CountryMark.

Countrymark Refining and Logistics, LLC
1200 Refinery Road
Mt. Vernon, IN 47620
Tel (800) 832-5490
www.countrymark.com

February 14, 2013

Michelle Kaysen
Project Manager
United States Environmental Protection Agency
Region 5, Mail Code LU-9J
77 West Jackson Boulevard
Chicago, IL 60604-3507

RE: In the Matter of CountryMark Refining and Logistics, LLC
Proceeding under Section 3008(h) of RCRA
Docket No. RCRA-05-01-2014-0001

Dear Ms. Kaysen:

Pursuant to Paragraph 11.a of the Administrative Order on Consent for the above-referenced matter, attached please find a disk which contains a Current Conditions Report, which includes a Conceptual Site Model, and a Corrective Action Master Plan. This information has also been loaded onto the web portal available for this case, and has been filed with the local library. Please contact me at your convenience if you have any questions.

Sincerely,

David Hertzing

David Hertzing

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Current Conditions Report and Initial Master Plan

February 2014

Prepared for:

Countrymark Refining and Logistics, LLC
1200 Refinery Road
Mt. Vernon, Indiana
EPA ID No. IND 044908663

Environmental Resources Management, Inc.
11350 N. Meridian, Suite 320
Carmel, IN 46032

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Countrymark Refining and Logistics, LLC

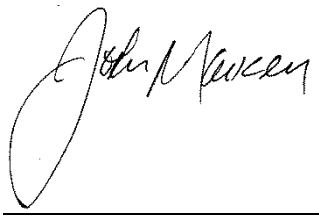
Current Conditions Report and Initial Master Plan

Countrymark Refining and Logistics, LLC
1200 Refinery Road
Mt. Vernon, Indiana

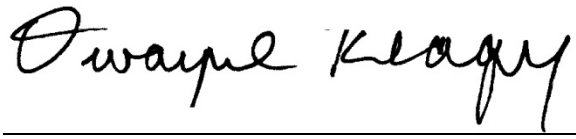
EPA ID No. IND 044908663

February 2014

ERM Project No. 0217333



John Markey, *Partner*



Dwayne Keagy, *L.*P.G., *Project Manager*

Elsie Millano, *Ph.D., P.E., Technical Director*

Environmental Resources Management
11350 N. Meridian, Suite 320
Carmel, IN 46032
www.erm.com

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EXECUTIVE SUMMARY

Environmental Resources Management, Inc. (ERM) has prepared this Current Conditions Report (CCR) for the Countrymark Refining and Logistics, LLC (CountryMark) facility located at 1200 Refinery Road, Mt. Vernon, Indiana 47620 (the "Site"). This CCR has been prepared in accordance with the requirements of the Administrative Order on Consent (the "Order") between CountryMark and the United States Environmental Protection Agency (USEPA) Region 5 ("EPA Region 5"), Docket No. RCRA-05-2014-0001, effective August 2, 2013. The CountryMark facility's EPA ID No. is IND 044908663. The intent of the CCR is to identify potential contaminant sources at the Site. In addition, EPA requested a conceptual site model (CSM) which is to describe source identification, migration pathways, and potential complete exposure pathways to human and ecological receptors, both on- and off-site.

The Site consists of a petroleum refinery that produces liquefied petroleum gases, gasoline, kerosene, distillate fuel oils, and liquid asphaltic materials. The Site is almost completely developed for refinery activities or related structures, including eight ponds used for wastewater treatment, storm water retention and/or treatment, and fire suppression water storage. CountryMark also owns and operates a private golf course for its employees and their families on the northeast portion of the Site. A former Land Treatment Area (LTA) located in the northwest portion of the Site is legally restricted to only commercial/industrial (C/I) development; it and the rest of the CountryMark property is zoned heavy industrial.

The central portion of the Site was originally developed in approximately 1940 by Indiana Farm Bureau Cooperative, precursor to CountryMark. Additional parcels were added to the facility in 2005, 2006, and 2013. Prior to its use as a refinery, the area was likely utilized for agricultural purposes. The Site receives crude oil via pipelines and tanker trucks. The crude oil is stored in above-ground storage tanks and then transferred via underground pipelines to the process unit area where it is refined into finished products. Finished products are shipped off-site via pipeline or truck transport.

Based on available information, no residents or susceptible human or ecological populations are expected to be impacted by the constituents of potential concern (COPCs) detected in the soil or groundwater at the Site to date. No ecologically susceptible areas (ESAs) were found within eight miles of the Site.

The refinery processing equipment is at least 1,000 feet from the nearest residential areas and there is a buffer of at least 300 feet between the nearest storage tanks and the residential area to the east and of at least 150 feet between the nearest pond and the residential area to the south. Other surrounding areas

include industrial and commercial buildings and agricultural land. The Site and surrounding area are not located within a wellhead protection area. There are no active water or other wells currently located on the Site and potable water is supplied by the Mt. Vernon Water & Sewer Utility and process water is obtained from an intake on the Ohio River. While active water supply wells exist within one mile of the Site, the first usable groundwater in the area appears to occur at approximately 90 feet below ground surface, which is well below the depth at which COPCs have been detected.

Storm water flow is generally directed south via an unnamed tributary of Mill Creek that traverses the Site, north to south. There are two additional creeks that feed the unnamed tributary on-site. The unnamed tributary flows approximately 620 feet south of the Site before it discharges to Mill Creek. Northwest portions of the Site also drain west to Mill Creek via roadside ditches. Mill Creek flows southeast along the southwest side of the Site boundary, through Mt. Vernon, and enters the Ohio River approximately 3,700 feet south-southeast of the Site. The unnamed tributary to Mill Creek is part of the refinery's storm water management system and is subject to the conditions of the Site's National Pollutant Discharge Elimination System (NPDES) permit that requires periodic sampling of seven permitted outfalls to prevent contamination of Mill Creek.

Surficial soils at the Site generally consist of silty clay and clay with occasional thin seams of fine gravel, sand, or silt that have a low susceptibility to surface contamination. Depth to groundwater measured in monitoring wells installed for various site investigations ranged from 0.5 to 11.9 feet below ground surface. Monitoring wells have produced little water, and several went dry during purging, indicating a low-permeability unit that would not provide sufficient yield for potable water use.

The determination of the current conditions at the Site was performed via a review of CountryMark and Indiana Department of Environmental Management (IDEM) records, public databases, and aerial photographs, and conducting site interviews and inspections. Several areas, including the LTA, have already been investigated or found to be of no concern. An evaluation of soil and groundwater data collected from the LTA, during the 2010 investigation, and for one additional area in 2005 is presented in the report. Five of these areas may need further delineation for Indiana human health screening levels (HHSLs) for arsenic, benzene, and/or 1,2-dichloroethane in groundwater and for arsenic in soil at one of the areas. Regarding ecological screening levels (Eco-SLs), vanadium and zinc were detected at concentrations above the Eco-SLs in most of the samples collected at the Site, including the four background locations investigated in 2010. However, the 95% upper confidence level of the background concentrations indicated that only a few of the vanadium and zinc concentrations were above the 95% Upper Confidence Level (UCL), and all

concentrations fell within the range of detections used by the United States Geological Survey (USGS) to derive an arithmetic average for Eastern United States soils. Therefore, delineation of those compounds is considered to be within acceptable ranges and is complete in all areas at the Site. The comparison showed some exceedances of the ecological screening levels for surface water. However, the calculations are based on the assumption that the groundwater will discharge to surface water at the same concentration found in the monitoring wells which is highly conservative and unlikely.

A CSM was prepared in accordance with EPA requirements to have a generic picture of the possible exposure pathways for all potential on- and off-site receptors and conservatively evaluate whether the pathways can be complete. Based on that conservatism, and given the Site setting, further evaluation will likely cause many pathways of concern to drop off the list. In any event, the concentrations detected to date are unlikely to affect receptors in areas other than the immediate area of where the samples were collected.

1.0 INTRODUCTION

Environmental Resources Management, Inc. (ERM) has developed this Current Conditions Report (CCR) on behalf of Countrymark Refining and Logistics, LLC (CountryMark), in accordance with the requirements of the Administrative Order on Consent (the "Order") between CountryMark and the United States Environmental Protection Agency (USEPA) Region 5 ("EPA Region 5"), Docket No. RCRA-05-2014-0001, effective August 2, 2013, for the CountryMark facility located at 1200 Refinery Road, Mt. Vernon, Indiana 47620 (the "Site"). The CountryMark facility's EPA ID No. is IND 044908663.

The CCR follows the model CCR outline in Chapter III, Section 1 of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan in EPA's RCRA Corrective Action Plan, OSWER Directive 9902.3-2A, May 1994, with the addition of a Conceptual Site Model (CSM) and a Corrective Action Facility Master Plan (Master Plan), as required in the Order. Specific information provided includes:

- Section 1.0: Introduction,
- Section 2.0: Site background,
- Section 3.0: Identification of locations to be evaluated,
- Section 4.0: Preliminary degree and extent of contamination,
- Section 5.0: Conceptual Site Model,
- Section 6.0: Implementation of interim/stabilization measures, and
- Section 7.0: Corrective Action Facility Master Plan.

2.0 SITE BACKGROUND

The following sections provide a general description of the Facilities location, uses, geology and hydrology.

2.1 GEOGRAPHICAL LOCATION

The approximately 213-acre Site (comprised of 11 separate parcels) is located at 1200 Refinery Road, Mt. Vernon, Posey County, Indiana in Sections 5 and 6 in Township 7 South, Range 13 West on the United States Geological Survey (USGS) 7.5 minute topographic quadrangle map for Mt. Vernon, Indiana - Kentucky. **Figure 2-1** illustrates the general location and physical setting of the Facility west of Lower New Harmony Road, south of Givens Road to the east, north and south of Givens Road to the west, east of Smith Road, north of ODonnel Road to the west, and north of 8th Street to the east. In addition, there are railroad tracks that traverse the center of the Facility from north to south and east to west.

The Site is located in an area zoned Heavy Industrial and Agricultural, and is bordered by the following properties:

- North: Givens Road is located immediately north of the eastern portion of the Facility, and traverses the western portion of the Facility. The adjoining property to the north of the Facility, west of the railroad tracks, is utilized by GAF Manufacturing for the production of asphalt roof shingles. An area of commercial properties is adjoining to the north of the Facility, east of the railroad tracks. These commercial properties include Posey Lanes (bowling alley), Bradly Truck Repair, an electrical sub-station owned by Southern Indiana Gas and Electric, and warehouses. Northwest of the Facility is agricultural land (i.e. row crops).

- South: An area of residential homes is adjoining to the south of the eastern portions of the Facility. The Posey County Jail is adjoining to the south of the central portion of the Facility and Brittle Bank Park is located southwest of the southern-most portion of the Site.

- East: Lower New Harmony Road is located immediately east of the Facility. An area of residential homes is adjoining to the east of the central portion of the Facility, across Lower New Harmony Road.

- West: Smith Road is located immediately west of the southern portion of the Facility. Residential homes are adjoining to the west of the southern portion of the Facility. The adjoining property to the west of the northern portion of the Facility is utilized for agricultural purposes (i.e. row crops).

2.2 *LAND USE*

The Site is in an area zoned Heavy Industrial (M-2). The Site is an active petroleum refinery subject to the requirements of a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of its wastewater and storm water. With the exception of the Land Treatment Area (LTA), the Site is not currently legally restricted to only commercial/industrial (C/I) development; however, that is how the Site is currently zoned and used. Total closure of the LTA was completed with conditions, including access restrictions, an environmental restrictive covenant (ERC) to prevent the former LTA area from being used for non-industrial purposes, and maintenance of vegetative cover.

There are residential areas directly east and southeast of the Site (**Figure 2-2**). However, the refinery processing equipment is at least 1,000 feet from the nearest residential areas and there is a buffer of at least 300 feet between the nearest storage tanks and the residential area to the east and of at least 150 feet between the nearest pond and the residential area to the south. Other surrounding areas include industrial and commercial buildings and agricultural land (**Figure 2-2**). **Section 2.1** provides more information on the other surrounding areas.

The property is almost completely developed for refinery activities or related structures, including the ponds used for wastewater and/or storm water storage and/or treatment. On the northeast portion of the property, CountryMark owns and operates a private golf course for its employees and their families. Access to the refinery and golf course is controlled by a fence and an entrance check point. Therefore, non-CountryMark recreational users are not exposed to the on-Site soil and groundwater impacts.

2.3 *DEMOGRAPHY AND SUSCEPTIBLE HUMAN POPULATIONS*

The following information is from the Mt. Vernon web page at http://www.mountvernon.in.gov/category/subcategory.php?categoryid=23.

> *As of the census of 2000, there were 7,478 people, 3,027 households, and 2,058 families residing in the city. The population density was 3,036.0 people per square mile (1,173.7/km2). There were 3,312 housing units at an average density of 1,344.7 per square mile (519.8/km2). The racial makeup of the city was 95.85% White, 2.65% African American, 0.16% Native American, 0.23% Asian, 0.25% from other races, and 0.86% from two or more races. Hispanic or Latina of any race were 0.56% of the population.*
>
> *There were 3,027 households out of which 33.4% had children under the age of 18 living with them, 52.4% were married couples living together, 12.0% had a*

female householder with no husband present, and 32.0% were nonfamilies. 28.5% of all households were made up of individuals and 13.5% had someone living alone who was 65 years of age or older. The average household size was 2.43 and the average family size was 2.97.

In the city the population was spread out with 26.1% under the age of 18, 8.0% from 18 to 24, 27.9% from 25 to 44, 23.1% from 45 to 64, and 14.8% who were 65 years of age or older. The median age was 38 years. For every 100 females there were 91.6 males. For every 100 females age 18 and over, there were 88.0 males.

The nearest susceptible human population centers and their location are summarized in the following table:

Susceptible Human Population Facility	Name and Address	Approximate Location with Respect to the Site (distance and direction)
School	West Elementary School (1415 Country Club Rd, Mt Vernon, IN)	0.3 mile, south
Day Care Center	Children's White House Center (431 College Ave, Mt Vernon, IN)	0.4 mile, south
Nursing Home	Mount Vernon Nursing & Rehab Center (1415 Country Club Rd, Mt Vernon, IN)	0.6 mile, south
Senior Center	Posey County Council on Aging (611 W. 8th Street, Mt. Vernon, IN)	Adjacent to the southwestern-most corner, near SMWU 7S
Park	Brittle Bank Park, ODonnel and Smith Roads	Adjacent to the southwestern-most corner, near SMWU 7S
Recreation Center	Brittle Bank Park Swimming Pool (1200 ODonnel Road, Mt. Vernon, IN)	Adjacent to the southwestern-most corner, near SMWU 7S
Hospital	Deaconess Hospital (600 Mary St, Evansville, IN	18.3 miles, southeast
Care Center	St. Mary's Convenient Care Center (5320 Weston Rd, Evansville, IN)	14.5 miles, east

Appendix A has the information used to develop the above table. No residents or susceptible populations are expected to be impacted by the concentrations of chemicals detected in the soil or groundwater to date. Details regarding chemicals of concern, their concentrations and detected locations are discussed in **Sections 3.0, 4.0 and 5.0** below.

2.4 CLIMATE

Climate data for the site vicinity, as summarized in this section, is based on tables and information developed for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina. **Table 2-1** provides a summary of air temperature and precipitation data recorded at Mt. Vernon for the period 1951 to 1974. The average annual precipitation for that period of

record was 43 inches. The 25-year 24-hour rainfall for the area is estimated to be 5.45 inches, based on information in National Oceanic and Atmospheric Administration (NOAA) Technical Paper 40. The pH of the precipitation ranges from 6.9 to 7.4 based on sampling from 1982 to 1992.

Approximately 23 inches (53% of total annual precipitation) usually falls during the period April through September, the growing season for most vegetation. In 2 years out of 10, the rainfall from April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 5.13 inches at Mt. Vernon on 21 January 1957.

Average seasonal snowfall is 12 inches. The greatest snow depth at any one time during the period of record was 12 inches. On the average, 7 days per year have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

In winter, the average temperature is 34 °F, and the average daily minimum temperature is 25 °F. The lowest temperature during the period of record (–13 °F) occurred at Mt. Vernon on 23 January 1963. In summer, the average temperature is 76 °F, and the average daily maximum temperature is 88 °F. The highest temperature during the period of record (107 °F) occurred on 2 September 1953. **Table 2-2** shows probable dates of the first freeze in fall and the last freeze in spring. **Table 2-3** provides data on length of the growing season.

The average relative humidity in mid-afternoon is approximately 60%. The percentage of possible sunshine averages 75% during the summer and 45% during the winter. The prevailing wind direction is from the south-southwest. Average wind speed is highest, at 10 miles per hour, in March.

2.5 VEGETATION

Of the approximately 213 acres covered by the Site, approximately 10% is impervious and 90% is pervious. The following table summarizes the percentages for different types of covers. Areas with vegetation or undeveloped include up to 77.7% of the property.

Type of Cover	Surficial Area (ft2)	Approximate % Coverage
Impervious	Tanks	2.4%
	Pavement	5.4%
	Buildings	2.4%
	Total Impervious	*10.2%*
Pervious	Gravel	8.0%
	Grass, tank dikes, or undeveloped	68.3%
	Brush/Trees	8.8%
	Heavy Vegetation, Waterways, or Ditches	0.6%
	Ponds	4.1%
	Total Pervious	*89.8%*
	Total All Covers	**100.0%**

2.6 DRINKING WATER SOURCE

The facility's potable water is supplied by the Mt. Vernon Water & Sewer Utility, from the Ohio River, and process water is obtained from an intake on the Ohio River. For information on water and oil and/or gas production wells formerly located on-Site see **Sections 2.7 and 4.1.14.13** below.

2.7 WATER WELL SURVEY

A search of Indiana Department of Natural Resources (IDNR) water well records and Indiana Department of Environmental Management (IDEM) Office of Water Quality records on wellhead protection areas for wells within 1 mile of the Site boundaries and high capacity wells within 2 miles of the Site boundaries was performed, as required by Section 3.11 of the Indiana Remediation Closure Guide (RCG) (see **Appendix B**).

The results of the search indicate that the Site and surrounding area are not located within a wellhead protection area. However, the logs for four water wells located on the Site (313369, 233533, 313367, and 233552) were found during the search. The log for 233533 noted a completion date of February 1940; the completion dates of the other three wells is unknown. There is no record that these wells were utilized for potable and/or process water, nor are there any records of abandonment for these wells. It is believed that these wells were properly abandoned, and no evidence of an on-site potable/process well was observed by ERM during the 2013 Site reconnaissance. However, as stated in **Section 4.1.14.13** below, there is a former oil production well which was plugged and abandoned to a depth of 127 feet below ground surface. This well was reportedly left open to be utilized as a water supply well for Indiana Farm Bureau Cooperative, Inc. (IFBC), the predecessor of CountryMark. Based on information from Mr. David Hertzing, there are currently no active process or

potable water supply wells on the Site, and the well that remains available for use will be properly abandoned in the near future.

Two off-site privately owned wells (329563 and 233488) were found at distances of 3,100 feet and 4,200 feet southeast, the likely downgradient direction, from the Site, as shown on the area map in **Appendix B**. The total depths of these wells are 150 feet below ground surface (ft-bgs) for well 329563 and 90 ft-bgs for well 233488. No screened interval is provided in the well records, but the search of IDNR and IDEM Office of Water Quality records indicated that there are no wellhead protection areas in Mt. Vernon. These wells are unlikely to be affected by the low concentrations of constituents of potential concern (COPCs) detected at the Site.

There are approximately 21 additional privately-owned wells within 1 mile of the Site. With the exception of the four wells on the Site and the two wells southeast (downgradient) of the Site, all other wells are either upgradient or sidegradient of the Site. There is one high capacity well located within 1 mile of the Site, and two high capacity wells located within 2 miles of the Site. These wells are also located sidegradient of the Site.

2.8 ECOLOGICALLY SUSCEPTIBLE AREAS

An evaluation of ecologically susceptible areas (ESAs) as defined by the State of Indiana in the RCG (i.e., karst terrain; wetlands; parks, preserves, and other protected areas; and habitats used by endangered or threatened species, or species of special concern) was performed for the Site area. No ESAs were found close enough to the Site to be susceptible to impacts from the concentrations detected in samples of the on-Site soil or groundwater.

The Site is an active petroleum refinery, with open spaces for a private golf course owned by CountryMark and used by its employees and their families and for retention and/or treatment ponds used as part of the refinery's wastewater and storm water management system. A letter dated December 4, 2012 from the IDNR states that the Indiana Natural Heritage Data Center has no records of endangered, threatened, or rare species, high quality natural communities or natural areas within 0.5 miles of the Site (**Appendix C**).

A search of the IDNR webpage for ESAs indicated that there are three nature preserves, one fish & wildlife area, and a state park in Posey County, all of which are located more than approximately 8 miles from the Site (see maps in **Appendix C**). Two of the nature preserves (Section Six Southern Flatwoods Site and Wabash Lowland) are adjacent to the Wabash River on the southwestern state boundary, and the third (Twin Swamps/Styrax Site) is located more than 2 miles north of the Ohio River near the southwestern edge of Posey County. The fish & wildlife area (Hovey Lake) is located on the southern tip of Posey County.

Harmonie State Park is located northwest of the Site. The Indiana Atlas indicates two Special Designated Areas, Goose Pond Cypress Slough (approximately 4 miles southeast of the refinery) and Cypress Slough (approximately 2 miles southeast of the refinery). Copies of the IDNR and Indiana Atlas information for these ESAs and a map of the Indiana Atlas areas are included in **Appendix C**.

Based on the distances to these sites and the location of the five ESAs, a release from the Site to soils or groundwater would not be expected to affect them.

A comparison of 2010 groundwater sample results from on-site areas adjacent an unnamed tributary of Mill Creek that traverses north-south through the Site to Region 5 ecological screening levels is presented in **Section 4.3**.

2.9 TOPOGRAPHY AND HYDROLOGY

The Site is located at an elevation of between approximately 390 and 430 feet above mean sea level. The refinery is not located in a 100-year flood plain. The 100-year flood plain area is elevation 372.0 feet above sea level. All refinery property is located above this elevation, 1-mile north of the Ohio River. See **Figure 2-3** from the Federal Emergency Management Agency (FEMA) Map Service Center for floodplain information.

The topography at the Site is relatively flat with occasional rolling hills. Surface flow in the process area, wastewater treatment area, and crude oil tank farm is generally directed south via an unnamed tributary of Mill Creek that traverses the refinery property, north-south.

The unnamed tributary to Mill Creek begins north of the Site and traverses the central portion of the Site from north to south, leaving the Site at the south property boundary between Pond #2 and Pond #3. There are two additional creeks that feed the unnamed tributary on-Site. The north creek enters the Site beneath Givens Road, north of Tank #44 and joins the unnamed tributary south of the equalization basin. The south creek begins as the outfall of Pond #3 (Outfall 002S) and joins the unnamed tributary as it crosses the southern property boundary. **Sheet 2-1** illustrates these creeks and tributary.

The unnamed tributary to Mill Creek travels approximately 620 feet beyond the south border of the Site before it discharges to Mill Creek. The remaining tank farm areas to the north and west of the process area drain to Mill Creek via roadway ditches. Mill Creek flows southeast along the southwest side of the Site boundary and enters the Ohio River approximately 3,700 feet south-southeast of the Site. No information is available as to the flow rate or the hardness of the unnamed tributary of Mill Creek or any other of the on-site creeks that discharge to the unnamed tributary or directly to Mill Creek.

The Site also has eight ponds for wastewater treatment, storm water retention and fire suppression water storage. The uses of the ponds are as follows:

- Pond #1: treated wastewater aeration basin (overflows to Pond #2);
- Pond #2: Fire Water Reserve (treated wastewater, discharges via a pipeline to the Ohio River, NPDES Outfall 001);
- Pond #3: Storm water retention pond equipped with underflow discharge piping, NPDES Outfall 002;
- North Fire Water Pond;
- Golf Course Fire Pond;
- Wastewater Equalization Basin;
- Two small golf course ponds.

Sheet 2-1 shows the topography of the Site with a contour interval of 2 feet and a scale of 1 inch = 200 feet.

2.10 GEOLOGY AND HYDROGEOLOGY

The June 2011 *Investigation Report* by ERM indicates that the Site is located in the Wabash Lowland physiographic province of Indiana, characterized by broad aggraded valleys and rounded hills. The Site resides over alluvial, lacustrine, and backwater deposits derived from Pleistocene-age glaciation. According to the IDNR publication, *Unconsolidated Aquifer Systems of Posey County Indiana* (Unterreiner 2006), "The alluvial, Lacustrine, and Backwater Deposits Aquifer System in Posey County is marked by thick deposits of soft silt and clay that have a low susceptibility to surface contamination." The aquifer system consists of two sources of sediments: (1) glaciolacustrine sediments ("slackwater clay") that had collected in bodies of still water, and (2) alluvium and colluvium which were derived from stream-suspended sediments. Wells installed in the unit typically yield anywhere from 1 to 10 gallons per minute.

According to the March 2005 *Closure Plan for Land Treatment Area* by ERM, the surficial geology of Posey County reflects a post-glacial depositional environment, typical of southern Indiana. The surface soils at the Site are silt loams of the Alford, Evansville, Reevesville, and Uniontown series derived from loess and lacustrine plains and terraces. The near-surface sediments beneath the Site are those of the Atherton Formation of Pleistocene Age. The Atherton Formation consists of coarse-to-fine-grained sediments deposited by glacial melt water and the associated eolian (wind-blown) and lacustrine (lake) deposits.

These unconsolidated glacial sediments are underlain by bedrock at a depth of approximately 40 to 60 feet. This bedrock is believed to be the Bond Formation, the middle unit of the Pennsylvanian Age McLeansboro Group, consisting of alternating layers of shale, sandstone, limestone, and thin coal seams, but predominantly of shale and sandstone.

Additional stratigraphic information was obtained through a search of the IDNR online Water Well Database, where the logs of four wells drilled on the Site (313369, 233533, 313367, and 233552) were found (see **Appendix B** and **Section 2.7** for more details). The logs for wells 313369 and 233533, respectively, noted clay from grade to 29 and 34 ft-bgs, sand from 29 and 34 ft-bgs to 38 and 43 ft-bgs, and clay from 38 and 43 ft-bgs to shale bedrock at 41 and 47 ft-bgs. The log for well 313367 noted shale bedrock encountered at 28 ft-bgs. The log for well 233533 also noted alternating sequences of shale, sandy shale, sandstone, and coal from 47 ft-bgs to a total depth of 283 ft-bgs. Well 233552 was an oil/gas well drilled to a depth 2,460 ft-bgs and its log only noted sandstone and water at a depth of 104 ft-bgs. None of these on-site wells are currently in use.

Based on boring logs for the above-mentioned on-site water wells, the upper clay unit extends to 29 or 34 ft-bgs where it overlies a 9-foot unit of sand on top of another 3- to 4-foot thick clay unit in contact with the shale bedrock. However, the depth appears to vary depending on the location within the Site, because the sand unit was encountered at depths of 28 to 55 ft-bgs at the LTA and extended to bedrock, which was found at 45 to 55 ft-bgs.

Additional bedrock stratigraphy was also obtained from a review of IDNR online oil and gas well records provided in **Appendix D**. This search found that there were ten oil production wells located on the Site. These logs showed shale bedrock at depths ranging from 40-120 ft-bgs. Deeper bedrock stratigraphy consists of alternating layers of limestones, sandstones and shales. Units of interest to oil production listed in sequence include the Kinkaid Limestone, the Clore Sandstone, the Menard Limestone, the Waltersburg Sandstone, the Vienna Limestone, the Tar Springs Sandstone, the Glen Dean and Barlow Limestones, the Middle Cyprus and Benoist Sandstones, the Renault Limestones, the St. Genevieve Limestone and the St. Louis Formation. This stratigraphic section is described as beginning at a depths ranging from 1,740 to 1,800 ft-bgs, with the deepest logged unit, the St. Louis Formation, found at a depth of 3,070 ft-bgs. The primary oil bearing unit is the Tar Springs Sandstone, found at a depth from 2,275 to 2,300 ft-bgs.

Surficial soils encountered at most of the 81 soil borings drilled for a 2010 soil and groundwater investigation of select EPA-identified Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) discussed in **Section 4.0** below generally consisted of silty clay and clay with occasional thin seams of fine gravel, sand, or silt. The maximum boring depth for that

investigation was 32 ft-bgs for monitoring well MW-4 at SWMU 5. Silty clay was predominant even at four background borings, with only slight variations to clayey silt and sandy clay in select intervals. Significant exceptions to the above soil stratigraphy were noted in the following nine borings, listed by AOC, SWMU, or Other areas:

AOC/SWMU #	Boring/Well #	Description
SWMU 5	EN-3	Silt was encountered from 16 ft-bgs to the boring's maximum depth of 20 ft-bgs
	ES-2	Fine sand was encountered from 1 to 1.5 ft-bgs
	MW-8 and MW-11	Sandy clay was encountered from 19 ft-bgs to the boring's maximum depth of 20 ft-bgs
	MW-9 and MW-10	While advancing the soil borings for these two wells using a 7720 DT Geoprobe rig, refusal was encountered in a hard, dry clay layer at 11 and 16 ft-bgs, respectively
SWMU 7S	MW-5	Clayey silt was encountered from 12 to 16 ft-bgs
Other	#3	Medium sand was encountered from 2 to 2.5 ft-bgs
	MW-2	Gravel was encountered from 4-8 ft-bgs

ERM measured groundwater elevations on December 2, 2010 and July 20, 2012 from 36 permanent monitoring wells installed for the 2010 soil and groundwater investigation discussed in **Section 4.0** below. Depth to groundwater in these wells ranged from 0.5 to 11.9 ft-bgs for the two dates. Shallow groundwater flow at each of the SWMUs and AOCs investigated was generally toward the unnamed tributary of Mill Creek. The aforementioned 36 wells are identified along with groundwater flow direction and elevation measurements in **Table 2-4** and on **Figures 2-4 through 2-9**. The following describes the depth to groundwater and groundwater flow direction encountered for each investigation area.

Area	Depth to Groundwater (feet bgs)		Direction of Groundwater Flow
	Range	Average	
AOC 2	3.83-5.63	4.47	South
Other	0.5-5.25	3.42	Northeast
SWMU 5	2.45-8.58	5.55	East
SWMU 6	2.62-7.32	4.88	Southeast
SWMU 7N	4.10-6.38	5.55	Southwest
SWMU 7S	5.65-11.91	7.99	Southeast

Wells installed in the shallow saturated unit in 2010 produced little water, and several went dry during purging. This indicates a low-permeability unit likely consisting of perched water that would not provide sufficient yield for private potable water use. Based on the depth of the nearest private water wells listed in **Section 2.7**, the first usable groundwater appears to occur at 90 ft-bgs.

Groundwater flows toward the unnamed tributary to Mill Creek in all of the areas sampled in 2010, except for AOC 2, where groundwater flow direction was towards the north creek located immediately southeast of AOC 2 that discharges to the unnamed tributary of Mill Creek. Depending on the location of the areas investigated and their proximity to nearby creeks, groundwater flow towards the on-site creeks may be in a northeast, east, southeast, or southwest direction.

According to the February 2005 *Closure Plan for Land Treatment Area*, by ERM, five wells (BR-3 to BR-7) and two piezometers (BR-1 and BR-2) were completed around the LTA at depths greater than 34.5 ft-bgs, considered to be within the uppermost usable aquifer. Groundwater flow direction at these wells and piezometers was variable, with the predominant direction being to the northwest and the secondary direction being to the southeast (or opposite direction). The last three quarters of sampling reported a south-southeast groundwater flow direction (See **Section 4.2.1** for information on the LTA). Four wells were completed in the shallow saturated unit (screened to a depth of 12.5 ft-bgs) around a staging area within the LTA before August 2005. Depth-to-groundwater measurements on August 23, 2005, indicated a flow direction slightly to the southwest. Depth to groundwater at the LTA ranged from 5.96 to 7.34 ft-bgs. Slug testing indicated a geometric average hydraulic conductivity of 4.02×10^{-4} cm/sec. The *Groundwater Investigation Report* dated October 4, 2005 and submitted on October 20, 2005 by August Mack (IDEM virtual file cabinet [VFC] document # 27462248) contains more details. Slug testing was not conduced on the 2010 investigation wells.

Groundwater pH was measured during sampling as part of the well purging efforts for the 2010 investigation. As shown in Appendix A of the June 2011 Investigation Report, pH of the stabilized groundwater ranged between 6.43 at Other MW-1 and 7.38 at SWMU 5 MW-1. No data on the fraction of organic carbon or cation-exchange capacity for the Site soils have been found. However, on-site soils, shallower than 20 ft-bgs, from four background borings (BB NE, BB NW, BB SE, and BB SG) and three investigation area well borings (Other MW-4, SWMU 6 MW-1, and SWMU 6 MW-2) conducted in 2010 were analyzed for total organic carbon; results ranged from 1,270 to 4,940 mg/kg in the background borings and 4,270 to 57,800 mg/kg in the investigation borings. Also, the May 24, 2006 Closure Certification Report indicates the following: *"Analytical results have shown that the upper soils have a high cation capacity and slightly basic pH that aided in the immobilization of inorganic constituents."* This was confirmed by the analytical results of soil pore liquid samples collected during closure of the LTA.

2.11 LAYOUT AND PAST/CURRENT USES

The central portion of the Site was originally developed in approximately 1940, and was owned/operated by IIFBC. Prior to its use for oil production and as a

refinery the area was likely utilized for agricultural purposes. The parcel located north of Givens Road was acquired in 2005, the southeastern most parcel was acquired in 2006, and the two southwestern most parcels of vacant land were acquired in February 2013. The following substantial expansions were completed during the years indicated:

Year	Type of expansion completed
1940	Skimming unit startup
1948	Crude Unit expansion from 2,000 barrels per day (BPD) to 10,000 BPD
1950	New Fluid Catayltic Cracking Unit
1953	New Finished Products Pipe Line
1956	New Platforming Unit (Catalytic Reformer) New Unifining Unit (Catalytic Hydrotreating)
1957	Crude Unit expansion to 12,500 BPD
1966	New Alkylation Unit
1971	New Gas Concentration Unit
1976	Crude Unit Expansion to 24,000 BPD
1986	New Isomerization Unit
1991	New CCR Platformer (Catalytic Reformer)
2006	New Hydrotreater, Sulfur Recovery Unit, Amine Unit and Tail Gas Treatment Unit
2008	Crude Unit Revamp – expanded to 27,000 BPD
2009	Low Sulfur Gasoline Unit

Currently the Site consists of a 27,000-BPD petroleum refinery (SIC No. 2911) that produces liquefied petroleum gases, gasoline, kerosene, distillate fuel oils, and liquid asphaltic materials. **Table 2-5** lists the size and contents of the aboveground storage tanks as well as other miscellaneous chemicals stored on the Site, and **Sheet 2-1** shows the locations of tanks on the Site.

The Site receives crude oil via pipelines and tanker trucks. The crude oil is stored in above-ground storage tanks (ASTs) located on the east-central portion of the Site. From there the crude oil is transferred via underground pipeline to the process unit area where it is refined into finished products. This area includes desalinization, sulfur recovery, catalytic hydrotreating, alkylation, gas concentration, tail gas treatment, and related refinery processes. The process unit area is located in the central portion of the Site. Finished and intermediary products are primarily stored in the tank farm located in the northwestern portion of the Site. Finished products are shipped off-site via pipeline or truck transport. The pipeline terminal is located in the northwestern portion of the Site, between Tank #41 and #42. There are two truck loading racks: one located in the southern portion of the Site and one located east of the process unit area in the central portion of the Site. The southern truck rack is utilized to transfer finished products via underground piping to tanker trucks for transport off-site (see **Section 4.1.14.14**). The central truck rack is utilized for fueling CountryMark vehicles and equipment (see **Section 4.1.14.1**). **Figure 2-10** shows the refinery process flow.

The remaining portions of the Site are occupied by the following:

- Wastewater treatment unit (WWTU) located in the central portion of the Site, adjacent to the process unit area, and immediately north of SWMU 5. **Figure 2-11** shows the Facility wastewater management process.

- Offices are located in the south and north central portions of the Site as well as the northeast portion of the Site.

- The former LTA is located in the northern most portion of the Site, north of Givens Road. A complete description of the former land treatment area is included in **Section 3.2**, below.

- A private golf course for CountryMark employees is located in the northeast portion of the Site.

There are no process or potable water supply wells on the Site. Process water is obtained from an intake on the Ohio River. The Site's potable water is supplied by the Mt. Vernon Water & Sewer Utility, from the Ohio River. Electricity and natural gas (for the purposes of building heating) is provided by Vectren Energy. Sanitary wastewater from offices/restrooms is discharged to the on-site septic system located in the eastern portion of the Site, near the intersection of Lower New Harmony Road and Grant Street. Gray water (i.e., wash-water other than water from toilets) flows to the City of Mt. Vernon municipal wastewater treatment facility.

From late 1976 to November 1, 1988, the facility land treated its American Petroleum Institute (API) oil/water separator sludge (hazardous code K051 and primary dissolved flotation (DAF) float residue (hazardous waste code K048) in a land treatment area. Both wastes were listed for hexavalent chromium and lead, and prohibited from land disposal effective November 8, 1990. Dewatered API Separator sludge, DAF sludge, fill dirt, and building foundation materials were reportedly landfilled in the area now designated as the rail yard and employee parking (SWMU 5: Landfill 2A).

After 1 November 1988, the K051 and K048 wastes have been dewatered and transported off-site by a licensed waste hauler to an approved treatment, storage, and disposal facility (currently ESSROC in Logansport, Indiana). The Site is a RCRA Large Quantity Generator, with the ID # IND044908663. The wastes remain on-site for less than 90 days.

Crude oil well development sludges were landfilled in the area of the aeration and retention ponds (SWMU 6: Landfill 2B), adjacent to the unnamed tributary of Mill Creek approximately 50 years ago. These types of sludges are no longer generated or handled at the facility. More information about these three areas is provided in **Sections 3.2 and 4.1**.

In addition, the following wastes and recyclable materials are generated at the Site and disposed of at the listed locations:

Waste/Recyclable Material	Disposal/Recycling Location
Wastewater Collection and Treatment Residuals – Sludge, Filter Cake, Liquids, Oils	ESSROC – Logansport, Indiana (2012, 2013)
Heat exchanger bundle cleaning sludge	Clean Harbors – El Dorado, Arkansas Green America Recycling, Hannibal, Missouri
No. 6 Fuel Oil storage tank cleanout (2011*)	ESSROC – Logansport, Indiana
Crude oil storage tank cleanout (2012*)	ESSROC – Logansport, Indiana Lonestar – Cape Girardeau, Missouri Greencastle WDF (Buzzi Unicem), Greencastle, IN
Spent Hydrotreating Catalyst	Catalyst Recovery of Louisiana, Lafayette, Louisiana US Ecology – Robstown, Texas
Waste Monoethanolamine Solution	Safety-Kleen - Dolton, Illinois AES Environmental – Calvert City, Kentucky
Lead additive system removal (2000)	M&M Chemical
Spent platformer catalyst	Heraeus Metal Processing, Wartburg, Tennessee
Miscellaneous - Labpack of unusable lab chemicals, waste paint, waste kerosene, waste xylenes	Safety-Kleen – Smithfield, KY Veolia, East St. Louis, IL Veolia, Menominee Falls, WI
Universal waste lamps, batteries, polychlorinated biphenyl (PCB) capacitors	Safety-Kleen – Dolton, Illinois
Non-hazardous	
Spent Alumina Oxide Catalyst	
Slop oil/Used oil	ESSROC – Logansport, Indiana Lonestar – Cape Girardeau, Missouri Bodin Oil Recovery – Abbeville, Louisiana Apollos Water – Lafayette, Indiana Greencastle WDF (Buzzi Unicem) – Greencastle, Indiana
Scrap Metal	
Petroleum Naphtha	Safety-Kleen – Evansville, Indiana

* Tank cleaning is done only when the tank needs to be emptied for inspection, which occurs approximately every 10 to 15 years, or for repair or change in service.

2.12 REGULATORY ISSUES

The following sections summarize permits applied for and/or received, any enforcement actions and their subsequent responses, and a list of documents and studies prepared for the facility.

2.12.1 Permits

2.12.1.1. List of Permits

The Facility currently holds the following permits:

- Title V Air Permit Number T129-25424-00003, issued July 1, 2010, expiration July 1, 2015.
- NNPDES Permit Number IN0002470, issued April 1, 2012 and effective through March 31, 2017.
- The Facility is registered as a Large Quantity Generator of hazardous wastes with the USEPA and has been assigned identification number IND044908663.

The only permit relevant to the Order is the NPDES permit, which regulates the use of the Site ponds for wastewater treatment and storm water retention for the process area storm water. This permit is described below.

In addition, the LTA was authorized Interim Status as a Treatment, Storage, and Disposal Facility (TSDF) by the USEPA on June 14, 1982. The LTA underwent a RCRA closure (beginning with submittal of a closure plan) between November 1, 1988, when operations ceased, and November 9, 2006, when the LTA closure was approved by IDEM. More information regarding the LTA is provided in **Sections 3.2 and 4.1.2** below.

2.12.1.2. NPDES Permit

The unnamed tributary to Mill Creek is part of the refinery's storm water management system and is subject to the conditions of the Site's NPDES permit that requires periodic sampling of the different outfalls and specific conditions to prevent contamination of Mill Creek. The Site has seven permitted outfalls, three of which are located within the area investigated in 2010, as described below. **Sheet 2-1** shows the approximate locations of the outfalls, the south creek, the unnamed tributary to Mill Creek and Mill Creek.

Outfall 001

Receiving water is the Ohio River. Permitted streams, after on-site treatment, include process, non-process, and treated sanitary wastewater and boiler and cooling tower blowdown; hydrostatic test water, and storm water. A 6-inch diameter, approximately 7,500 feet long pipeline carries this water to the Ohio River.

Outfall 002

The receiving water is the south creek which feeds into an unnamed tributary to Mill Creek, with compliance determined at a point close to but upstream of Mill Creek. Discharge is limited to intermittent discharges of storm water from Pond #3 (SWMU 7S in **Section 3.3**). Pond #3 is primarily a storm water retention pond, and can also be used for emergency overflow events if commingled storm water and process water overflows from the API oil/water separator during storm water events. This pond was designed to hold a 100-year flood event. Pond #3 was designed to operate such that, under normal conditions, the accumulated pond water is pumped to the head of the wastewater treatment plant and treated in the wastewater treatment system. If the pond overfills, an underflow siphon dam system releases the overflow into the south creek which discharges to the unnamed tributary that discharges to Mill Creek.

Outfalls 003/003S, 004/004S, 005/005S, 006/006S, and 007/007S

Discharge to the unnamed tributary of Mill Creek, with compliance determined at a point close to but upstream of Mill Creek. Discharge is limited to hydrostatic test waters. There is no difference between these outfalls and those designated with an "S" at the end, other than the timing of sampling and the parameters sampled for compliance.

The locations of Outfalls 003 to 007 are as follows:

- Outfall 003/003S is located at the north end of the process unit area of the refinery approximately 350 feet south of Givens Road. The outfall enters the unnamed tributary of Mill Creek that runs north to south through the refinery.

- Outfall 004/004S is at the point the unnamed tributary to Mill Creek leaves the refinery property in the south, and is located between the #2 fire water reserve pond and the #3 storm water pond. Water discharged at Outfall 003/003S is ultimately discharged at Outfall 004/004S.

- Outfall 005/005S is located at the outlet of the northwest tank farm near Givens Road and Smith Road.

- Outfall 006/006S is rarely used, but is to the unnamed tributary to Mill Creek where it enters the Site in the north. The drainage from the tank dikes in this area is routed via pipe to the wastewater treatment plant. If water is discharged at Outfall 006/006S it is ultimately discharged at Outfall 004/004S.

- Outfall 007/007S is located southeast of Tank 22A and flows southeast along the east-west railroad tracks for a short distance before passing under the

railroad tracks and proceeding to the north-south railroad ditch that meets Mill Creek approximately 1900 feet south of the refinery area.

2.12.2 Enforcement Actions or EPA-Requested Activities

CountryMark entered into a Consent Decree regarding several air emission issues, Case Number 3:13-cv-00030-RLY-WGH, on April 22, 2013.

As indicated in **Section 3.3**, after an exchange of letters with CountryMark, EPA Region 5 requested an investigation of three SWMUs (SWMUs # 5, 6, and 7 north and south) and one AOC (AOC #2). The entire refinery is now subject to the Order (Docket No. RCRA-05-2014-0001), under the RCRA corrective action program. This CCR was prepared as the first deliverable to the Order.

2.12.3 List of Documents and Studies

The reports that document site conditions, sampling performed at the Site, or EPA's previous evaluations of the site include, in chronological order:

- 1986 July 23 EPA Region 5 *Preliminary Review RCRA Assessment Report/Visual Site Inspection.*
- 1992 November 17 CountryMark *Underground Storage Tank (UST) Registration*
- 1992 November 30 CountryMark *Verification of Tank Removal*
- 1999 January 21 CountryMark *Clean-up Status Report IDEM Incident 9704036*
- 2002 IDEM Fire Drill Approval
- 2003 IDEM Fire Drill Approval
- 2005 February 17 ERM *Groundwater Investigation Work Plan*
- 2005 March 17 ERM *Modified Closure Plan*
- 2005 May 16 ERM *Modified Groundwater Investigation Work Plan*
- 2005 September 30 August Mack *Subsurface Investigation Report IDEM Incident 2005-07-152*
- 2005 October 20 August Mack *Groundwater Investigation Report*
- 2006 June 19 CountryMark *Incident 2005-07-152 Status Update*
- 2006 September 15 IDEM *Compliance Confirmation Incident 2005-07-152*
- 2006 May August Mack *Closure Certification Report – Land Treatment Area*

- 2007 May 14 CountryMark *RCRA Response Report*
- 2008 IDEM Fire Drill Approval
- 2009 January 12 CountryMark *RCRA Response Report*
- 2009 April 27 CountryMark *Spill Report IDEM Incident 2009-04-190*
- 2010 February 12 CountryMark *Response to EPA RCRA Facility Assessment Response Update Report*
- 2010 March 06 IDEM *Spill Report IDEM Incident 2010-03-041*
- 2010 May 12 IDEM *Spill Report IDEM Incident 2010-05-112*
- 2010 June 7 CountryMark 2010 *Response to EPA Comments Dated May 7, 2010*
- 2011 IDEM Fire Drill Approval
- 2011 June ERM *Investigation Report*
- 2011 August 11 IDEM *Spill Report IDEM Incident 23869*
- 2011 November 15 IDEM *Spill Report IDEM Incident 25715*

Copies of these documents are included in **Appendix E**.

3.0 IDENTIFICATION OF LOCATIONS TO BE EVALUATED

The locations to be evaluated for determining the need for additional investigation were based on a review of existing documents described in the next subsections. All SWMUs, AOCs, and any other areas identified as relevant to this report are shown on **Sheet 3-1**.

3.1 PRELIMINARY REVIEW RCRA ASSESSMENT REPORT/VISUAL SITE INSPECTION

3.1.1 1986 Preliminary Review RCRA Assessment Report/Visual Site Inspection

A RCRA facility assessment and visual site inspection was conducted by the EPA Region 5 on July 23, 1986. The assessment identified nine SWMUs including:

- SWMU #1 Tank Storage Area – Tanks 11A and 11B utilized for the storage of sludge from the API oil/water separator and the DAF unit of the WWTU;
- SWMU #2 LLTA – Investigations and RCRA Closure detailed in Section 3.2 below;
- SWMU #3 Surface Impoundment Area – Located within the LTA;
- SWMU #4 Leaded Tank Bottom Tank – Located within the LTA;
- SWMU #5 Landfill 2A – Used for the disposal of dewatered API separator and DAF sludge as well as other solid waste (fill dirt, building foundation materials, etc.) from 1959-1977;
- SWMU #6 Landfill 2B – Utilized for the disposal of crude oil well development sludge; and
- SWMU #7 – The equalization basin pond, referred to as SWMU #7N (North), and the stormwater drain/wastewater treatment unit overflow retention pond, referred to as SWMU #7S (South). EPA Region 5 observed that both had waste oil film covering the stones and sparse vegetation surrounding them, but concluded that there was no evidence of a release from either of them.

Among other things, the assessment concluded that "There are no obvious releases from the SWMUs that would require the facility to begin any immediate corrective or remedial action".

3.1.2 RCRA Response Report and Correspondence

Closure activities were undertaken in the LTA from 1988 through 2006. Details regarding the closure of the LTA are provided in **Section 3.2** below. On April 4, 2007, IDEM and EPA Region 5 issued a letter to CountryMark indicating that the Site was included in the US EPA 2020 Corrective Action Universe Program and corrective action would be required for the facility.

On April 4, 2007 EPA Region 5 issued a letter requesting updated information regarding RCRA remediation activities in response to the Preliminary Review RCRA Facility Assessment conducted in July 1986. On May 14, 2007 Countrymark provided a report discussing the status of the SWMUs previously identified at the site and identifying the following AOCs:

- AOC #1: Former caustic storage tanks,
- AOC #2: Underground process pipeline break/spill, and
- AOC #3: Former proposed injection well.

On January 12, 2009, during a phone conversation between CountryMark and EPA Region 5 representatives, EPA Region 5 requested another update regarding the AOCs at CountryMark. CountryMark provided a response the same day updating the information regarding the SWMUs and AOCs previously identified at the Site. This update concluded that all areas of concern identified were addressed and resolved with the exception of Pond #3 (SWMU 7S) and the equalization basin (SWMU 7N). .

Between December 2009 and June 2010, EPA Region 5 and CountryMark exchanged correspondence that led to extensive sampling in the fall of 2010 at the Site. As part of that correspondence, EPA Region 5 approved a separate Sampling and Analysis Plan (SAP) for each area and a Quality Assurance Project Plan (QAPP) for all areas submitted by CountryMark after the final areas to be sampled were established. The final list of areas to be investigated included SWMUs 5, 6, 7 North (7N), and 7 South (7S); AOC 2; the "Other Transformer" area; and the "Other" area. Details regarding investigative work conducted in these areas are provided below.

3.1.3 2010 Site Investigation

Soil and groundwater sampling was conducted in accordance with the SAPs and the QAPP in the fall of 2010. The investigation included the following activities:

- Four background soil borings with two samples collected per boring,
- Drilling of 73 soil borings and collection of 252 soil samples,

- Installation of 36 monitoring wells and collection of one round of samples from each well,

- Surveying of the 77 soil boring and 36 monitoring well locations and elevations and,

- A round of water level measurements and evaluation of the presence of non-aqueous phase liquids (NAPL) was performed on December 2, 2010.

A second round of water level measurements and evaluation of the presence of NAPL was performed on July 20, 2012.

Samples were analyzed for the 1997 EPA Region 5 constituents of concern (COCs) for Wastes from Petroleum Processes ("Skinner List"), except for the soil samples collected from the Other Transformer area, which were only analyzed for PCBs, and select other samples which were also analyzed for total organic carbon and oil and grease in addition to the Skinner List COCs. Further details of the sample results are presented in **Section 4.0**. The *Investigation Report* submitted to USEPA, dated June 2011, describes the work performed and the sampling results.

3.2 LAND TREATMENT AREA INVESTIGATION AND CLOSURE

As required by the Order, the following assessment of the LTA is included in the CCR, along with an assessment of the need for additional sample collection in **Sections 4.4.1 and 4.5.1**.

According to the May 2006 *Closure Certification Report for the LTA*, during the refinement processes, the WWTU produces listed hazardous waste, specifically API oil/water separator sludge (hazardous waste code K051) and primary DAF float residue (hazardous waste code K048). The API separator unit removes oils/oil-water emulsions in the refinery waste water stream by skimming and gravity separation. These removed materials can be recycled or further processed (for oil recovery) up to the point where they are sent through a vacuum filter drum. The resultant filter drum sludge is then classified as a hazardous waste by listing as K051. The DAF Unit receives influent that is downstream from the API Separator and uses dissolved air to float solids that are then skimmed off. The DAF float is stored in a tank prior to dewatering in a vacuum filter drum. The DAF material is classified as a hazardous waste by listing as K048.

The former LTA was used for the land treatment via surface application of the K051 and K048 wastes in four separate land treatment cells. Approval for the LTA operation was granted by the State of Indiana Stream Pollution Control Board in a letter dated August 31, 1976 (Appendix A of the May 24, 2006 *Closure*

Certification Report – Land Treatment Area Report). At the time of operation of the LTA, the facility was owned by Indiana Farm Bureau Co-Op Association, Inc. (IFB). IFB began operation of the LTA in late 1976, depositing approximately 5,000 gallons per day of K051 and K048 wastes into the former LTA, where it was tilled and fertilized to improve biodegradation, until operations ceased in November 1988.

CountryMark performed closure of the LTA, including the Staging Area (i.e., SWMU 3, the surface impoundment) used to store the wastes prior to placement in the cells, in accordance with the approved *Closure Plan* dated June 2004, along with text revisions dated March 17, 2005. These closure activities included removal of the wastes remaining in the surface impoundment and their tilling into the treatment cells; installation of a vegetative cover over the treatment cells; and groundwater, soil, and soil pore liquid investigations and monitoring as required by IDEM. Detailed descriptions and results of investigation and monitoring activities are provided in the approved *Closure Plan*, the *Groundwater Investigation Work Plan for the Shallow Saturated Unit – Land Treatment Area* dated February 17, 2005, and the *Groundwater Investigation Report* dated October 4, 2005.

Analytical data from the uppermost usable aquifer and the shallow saturated zone collected during previous investigations indicated that none of the hazardous constituents of concern were reported at concentrations exceeding IDEM Risk-Integrated System of Closure (RISC) Industrial Default Closure Levels (IDCLs), effective at the time of closure. Between October 2005 and January 2006, CountryMark submitted the *Groundwater Investigation Report* and *Groundwater Investigation Report Addendum* to satisfy IDEM requirements for closure. In a letter dated March 7, 2006, IDEM determined that the groundwater investigation was complete and requested that a *Closure Certification Report* be submitted for the former LTA. The requested *Closure Certification Report* was submitted on May 24, 2006.

The IDEM issued a closure letter on November 9, 2006 stating that total closure of the LTA was completed with conditions, including access restrictions, an ERC to prevent the former LTA area from being used for non-industrial purposes, and maintenance of vegetative cover.

An assessment of whether additional investigation is required in this area is presented in **Section 4.1.2**, below.

3.3 2013 COUNTRYMARK EVALUATION

The following subsections describe activities conducted and documents reviewed in 2013 for this CCR. **Table 3-1** provides a list of Findings for the Facility, including Environmental Data Resources, Inc. (EDR) database ID

numbers, spill database information, and referenced documents. All documents can be found in their respective sections of **Appendix E**.

3.3.1 External Records Review

3.3.1.1. Public Database Search

A database search for federal and state agency records was obtained from EDR to determine whether there are any agency files describing sources of contamination which have impacted or could potentially impact the Facility. A copy of the database search report is provided in **Appendix F**.

There are 63 listings for the facility address (1200 Refinery Road) in the databases searched by EDR. There are several databases that have multiple listings for the Facility, and several listings are duplicate listings. The databases applicable to corrective action include the following, and applicable listings are included in **Table 3-1**:

- 2020 Corrective Action Program List,
- Comprehensive Environmental Response, Compensation and Liability Information system – No Further Remedial Action Planned (CERCLIS-NFRAP),
- Emergency Response Notification System (ERNS) – 11 listings,
- Institutional Control,
- Leaking Underground Storage Tank (LUST),
- Material Licensing Tracking System (MLTS),
- NPDES,
- Office of Indiana State Chemist Database (OISC),
- RCRA-TSDF,
- Spill incidents – 23 listings,
- UUST – 4 listings.

Based on the database search results, additional records were reviewed, as described in **Section 3.3.1.3**. The Institutional Control listing is in reference to the ERC in place for the LTA. Additional information regarding this can be found in **Section 4.1.2**, below. The MLTS listing is in reference to radioactive materials in instruments and gages at the Site. The Site has a registered safety

officer responsible for the proper maintenance and disposal (when necessary) of these materials. The OISC listing is in reference to pesticides/herbicides used in the maintenance of the on-Site golf course. **Table 2-5** includes a list of chemicals commonly utilized in that area.

3.3.1.2. Aerial Photograph Review

ERM reviewed aerial photographs, obtained from EDR, dated 1950, 1958, 1971, 1993, 1998, 2006, 2007, 2008, 2010, and 2012. Copies of the aerial photographs reviewed are included in **Appendix G**. Due to small scale and poor quality of the early photographs, limited information is available. Pertinent observations obtained from the aerial photographs are as follows:

- 1950: The central portion of the Site appears to be utilized as a refinery. The above ground tanks appear to be limited to the west central portion of the Site, west and north of the railroad tracks that bisect the Site. The northern portion of the facility (north of Givens Road), southern portion of the Site (southwest of the railroad tracks), and the adjoining properties to the north, south, east and west appear to be utilized for agricultural purposes.

- 1958: The Site and surrounding properties appear essentially as observed in the 1950 aerial photograph, with the following exceptions. There are ASTs on the eastern portion of the Site (northeast of the railroad tracks). The adjoining properties to the east of the Site, east of Lower New Harmony Road, appear to be utilized for residential purposes.

- 1971: The Site and surrounding properties appear essentially as observed in the 1958 aerial photograph, with the following exceptions. Tank #50 is present on the northern portion of the Site, north of Givens Road. Tanks #44, 45, 46, 48, and 49 and pond # 5 are present on the eastern portion of the Site. The northeastern portion of the Site appears to be utilized as a golf course. Additional residential/commercial development is present on the adjoining properties to the south and east.

- 1993: The Site and surrounding properties appear essentially as observed in the 1971 aerial photograph, with the following exceptions. Tanks 51 and 52 are present on the northern portion of the Site, north of Givens Road, and Tank 47 is present on the eastern portion of the Site. Pond #2 is present on the southeastern portion of the Site. The adjoining properties to the north of the facility appear to be utilized for C/I purposes.

- 1998: The Site appears essentially as observed in the 1993 aerial photograph with the following exceptions. The #1 and 3 ponds are present on the southeastern portion of the Site, as well as of office buildings adjacent to the ponds. The subsurface impoundment is present on the northern portion of

the Site. The adjoining properties appear essentially as observed at the time of the site reconnaissance, and as described in this report.

- 2006: The Site and surrounding properties appear essentially as observed in the 1998 aerial photograph with the following exceptions. There appear to be earthmoving activities and materials stored in the northernmost portion of the Site. The north fire water pond is present in the northernmost portion of the Site.

- 2007, 2008, and 2010: The Site and surrounding properties appear essentially as observed in the 2006 aerial photograph.

- 2012: The Site and surrounding properties appear essentially as observed in the 2006 aerial photograph, as observed at the time of the site reconnaissance, and as described in this report.

The historical information obtained from the aerial photography review is consistent with historical information obtained from other sources.

3.3.1.3. IDEM Records Review

Two sources of on-line IDEM records were reviewed: the Emergency Response Spill Data was reviewed in December 2013 and the VVFC was reviewed between November 2013 and January 2014.

The spill database includes information regarding spill response actions from persons experiencing spills to soil, water and air. Several of the listings were for releases to air and were not reviewed further. **Table 3-1** shows the spill listings which were confirmed to be within the Site, and the relevant information provided in the on-line Spill Data table.

The VFC had 634 documents for the Site, some of which are contained in duplicate. These documents are from the Emergency Response, Hazardous Waste Site, and Underground Storage Tank programs, as well as the Office of Air Quality and the Office of Water Quality. Documents related to air issues (permits and releases) were not reviewed in detail. IDEM assigns a unique document number to each document in the VFC; however, some of the numbered documents consist of more than one unrelated documents. **Table 3-1** shows the titles and dates for documents which were found to be applicable to this report, as well as the issues identified in those documents. **Section 4.0** describes each of the issues in detail.

3.3.2 Site Interviews

ERM interviewed Mr. David Hertzing, Manager of Regulatory Compliance, of CountryMark to determine the status of, and obtain any commonly known or reasonably ascertainable information regarding previously identified SWMUs,

AOCs, and "Other" areas, as well as any information regarding other historic spills. Relevant information obtained during the Site interview is contained in applicable sections of this report.

3.3.3 Site Records Review

Applicable records obtained from CountryMark are discussed in **Section 4.0** below.

3.3.4 Site Walkout

Mr. David Hertzing, Manager of Regulatory Compliance, of CountryMark provided a guided tour of the Site on October 2, 2013. The tour included all previously identified SWMUs, AOCs, and "Other" areas, as well as sites identified during the records review, described above. Photographs depicting the current facility conditions are presented in **Appendix H**.

3.3.5 Summary of Potential Investigation Locations

Table 3-1 has a list of all locations for which further evaluation was determined to be necessary, and the information source that provided the locations. The evaluation of those locations is described in **Section 4.0**.

4.0 PRELIMINARY DEGREE AND EXTENT OF CONTAMINATION

This section presents, for each of the areas and issues identified in **Section 3.0**, the information available; a comparison of the data collected, if any, to human health screening levels (HHSLs) and ecological screening levels (Eco-SLs); a summary of the preliminary evaluation of the degree and extent of contamination; and the need for additional delineation where necessary.

Section 4.1 presents each area identified during the 2013 evaluation as described in **Section 3.3** above. Section 4.2 describes the free product measurements conducted at the Site. **Section 4.3** discusses the calculation of the Site-specific background concentrations for select metals. **Section 4.4** presents the results of the comparison to the HHSLs of the data collected from (1) SWMU 2 (the LTA treatment cells and Staging Area); (2) SWMUs 5, 6, 7N, and 7S, AOC 2, "Other Transformer", and "Other" areas; and (3) Tank #44 spill. The corresponding comparisons to the Eco-SLs are discussed in **Section 4.45**.

4.1 INFORMATION AVAILABLE FOR EACH AREA

A description of each area and the information available for each one is presented in this section.

4.1.1 SWMU 1: Tank Storage Area

The hazardous waste sludge generated in the WWTU (K048 and K051, see **Section 3.2**) is stored adjacent the Site's WWTU in tanks 11A, 11B, and 12. Historically, the tanks were emptied and sludge was taken by vacuum truck to the Staging Area (i.e., the SWMU 3, the surface impoundment) in the LTA for temporary storage until it was transferred to one of the LTA treatment cells. Currently, SWMU 1 is on a concrete slab with concrete secondary containment. The surrounding area is highly compacted gravel on dirt or asphalt paved with no visible staining. The waste stored in these tanks is pumped into a vacuum drum press, de-watered and disposed of at Clean Harbors of Canada. The 1986 and 2010 EPA Region 5 site inspections, as well as the 2013 site reconnaissance did not report any evidence of leaks or releases. No further action has been warranted or conducted for this SWMU.

4.1.2 SWMU 2: Land Treatment Area

Section 3.2 describes the LTA and the RCRA closure process it underwent. This SWMU 2 includes the LTA treatment cells. The area continues to meet its closure conditions, i.e., has a vegetative cover and a fence surrounding the treatment cells. No additional remediation was warranted after completion of closure and no further sampling has been performed. However, soil removed

from the desulfurization unit construction was placed in Cell 4 of the LTA in 2006. The soil was not visually impacted and was placed as ground cover and seeded in the LTA.

In accordance with the Order, an evaluation of the data against current HHSLs and Eco-SLs has been provided in **Sections 4.4.1 and 4.5.1** respectively. Data collected for the closure include surface and subsurface soil and soil pore liquid from the four treatment cells as well as groundwater samples from a five-well monitoring well network screened in the uppermost usable aquifer (completed at variable depths ranging from 28-55 ft-bgs, in the sand unit) established around the LTA. In addition to these five monitoring wells, two piezometers were installed to obtain groundwater elevation data. **Figure 2** in **Appendix I** presents the locations of these wells. Piezometer BR-1 is an upgradient well installed to the top of the bedrock (to a depth of approximately 54 feet). Piezometer BR-2 and well BR-4 are downgradient wells, also installed to the top of the bedrock (to depth of approximately 44 to 46 feet). Well BR-3 is a crossgradient well, installed to the top of the bedrock (to a depth of approximately 46 feet). Wells BR-5 (upgradient), BR-6 (downgradient), and BR-7 (downgradient) are screened in the middle of the sand aquifer.

A total of 68 surface soil samples (0 to 0.5 feet) and 32 subsurface soil samples (3 to 7 feet) were collected from the LTA treatment cells in 1988 and 1998 from both the treatment cells and background locations. Soil samples were collected from each cell for analysis of:

- Surficial Soil (0-0.5'): Oil and grease, hexavalent chromium, total chromium and lead in surficial soil; and

- Subsurface Soil (3-7'): Oil and grease, volatile organic compounds (VOCs), semi-VOCs (SVOCs), 13 metals, and extraction procedure toxicity (EP-Tox) for hexavalent chromium, total chromium, and lead.

In addition, at the request of IDEM, composite surficial soil samples were collected in 2003 for analysis of hexavalent chromium. Soil pore liquid samples were obtained in 1988 and 1998 for analysis of the Skinner list and, at the request of IDEM, in 2004 for analysis of antimony.

Monitoring wells BR-3 through BR-7 were sampled annually for parameters establishing groundwater quality (chloride, iron, manganese, phenols, sodium, and sulfate) and semi-annually for analysis of parameters establishing groundwater quality (chromium and lead) and for indicator parameters (pH, specific conductance, total organic carbon, and total organic halogens). This monitoring was performed from 1988 to 1998. Samples from the same wells were collected for analysis of a modified Skinner list in 1998.

At the request of IDEM, additional quarterly groundwater samples were obtained for one year, between June 2003 and March 2004, from wells BR-3 through BR-7 for analysis of antimony, arsenic, chromium, lead, nickel, and vanadium. The data collected between 1988 and 2005 are evaluated in **Sections 4.4.1.1 and 4.5.1.1**.

4.1.3 SWMU 3: Former Surface Impoundment

The surface impoundment was the Staging Area for the sludges to be treated in the LTA cells, and it was located within Cell #3 of the LTA. Sludge was transferred via vacuum truck from the tanks adjacent to the WWTU to the Staging Area. From there the material was periodically applied to the land treatment area treatment cells. In 2004, after soil sampling demonstrated that no remediation of the Staging Area was required as part of the LTA closure sampling activities, the facility expanded the Staging Area to hold fire water; the area is now called the "North Fire Water Pond" (see **Section 3.2**). The current 85 foot by 115 foot impoundment has no liner because the compacted soil used in construction had a low permeability.

This area was included in the closure of the LTA, discussed in **Section 3.2**. No further action has been warranted or conducted for this SWMU.

In accordance with the Order, samples from the Staging Area have been compared to current HHSLs and Eco-SLs; the comparison is presented in **Sections 4.4.1.2 and 4.5.1.2**. The following samples were collected between 2003 and 2005 as part of the LTA's closure: 19 soil samples, two rounds of groundwater samples from monitoring well SI-1 in 2004 and 2005, and one round of groundwater samples from three monitoring wells (MW-1 through MW-3) installed in 2005 and completed within the shallow saturated zone in silty-clay soils (less than 20 ft-bgs) and surrounding the Staging Area. All samples were analyzed for the modified Skinner list parameters.

4.1.4 SWMU 4: Leaded Tank-Bottoms Tank

This "drying tank" was located within Cell #4 of the land treatment area. It was a 9-foot by 21-foot covered concrete enclosure. As leaded product storage tanks were emptied and cleaned, the leaded waste (primarily rust) was transported to the tank and stored. As of the date of the *Preliminary Review RCRA Facility Assessment and Visual Site Inspection* conducted by the EPA Region 5 on July 23, 1986, the tank had never been emptied.

In 1989, subsequent to EPA's ban on leaded gasoline, the leaded tank bottoms were removed and the tank was cleaned out. The tank was then utilized to store oily water from non-leaded tank clean-outs. Solids and heavy oils settled to the bottom of the concrete tank and non-hazardous liquid hydrocarbon and non-hazardous water floated to the top and were periodically drawn off over the

years for re-processing. The solids and heavy hydrocarbons were left in the concrete tank until it was put out of service and removed in December 2008.

At the time the concrete enclosure was removed, the floor and walls were power washed. Solids from the clean-out were placed in roll-off boxes and disposed of off-site. The concrete walls were removed and used as clean fill in a low point at the site, north of the railroad tracks and east of Pond #2. The floor was left in place. No indication of a release from the containment area was identified at the time it was removed.

Being located within the boundary of the LTA, this SWMU has been closed. No further action has been warranted or conducted for this SWMU.

4.1.5 SWMU 5: Landfill 2A

Reportedly, dewatered API Separator sludge, DAF sludge, fill dirt and building foundation materials were landfilled in the area now designated as the rail yard and employee parking from 1959 to 1977. No records are available to verify if this occurred or, if so, the amount of solid waste disposed. In 2007 a wash pad was installed in this area. Excavation for the wash pad and conduit installation did not indicate the presence of fill material. In addition, visual and olfactory inspection did not indicate potential soil impacts.

During the 2010 site investigation, a total of 102 soil samples (including four duplicates) were collected from 31 borings and 12 groundwater samples (including one duplicate), one from each well, were collected from SWMU #5. The 2010 data are evaluated in **Sections 4.4.2.1 and 4.5.2.1**.

4.1.6 SWMU 6: Landfill 2B

Approximately 50 years ago, crude oil well development sludges were landfilled in the area of the aeration and retention ponds and adjacent to the unnamed tributary traversing the Site. No records are available for the amount of waste disposed. This area was over-excavated in September 1988. According to CountryMark records, approximately 509 tons of impacted soil was removed. The soil was taken to the LTA and incorporated into the natural attenuation processes that were being conducted at the time.

During the 2010 site investigation, 50 soil samples (including two duplicates) were collected from 14 soil borings and seven groundwater samples, one from each monitoring well, were collected from SWMU #6. The 2010 data are evaluated in **Sections 4.4.2.2 and 4.5.2.2**.

4.1.7 SWMU 7: Waste Water Treatment

The Site waste water treatment ponds, SWMU 7, are divided into two separate areas, SWMU 7 North and SWMU 7 South. Each area is addressed separately below.

4.1.7.1. SWMU 7N: Equalization Pond

The equalization pond is located in the area of the waste water treatment unit across from the unnamed tributary traversing the Site. It is stone lined with an impermeable clay bottom.

During the 2010 site investigation, 18 soil samples were collected from four borings and four groundwater samples were collected, one from each well, from around SWMU 7N. The 2010 data are evaluated in **Sections 4.4.2.3 and 4.5.2.3**.

4.1.7.2. SWMU 7S: Storm Water Retention/Overflow Pond

The storm water retention/overflow pond (Pond #3) is an unlined pond with an impermeable clay bottom. The pond is used to retain storm water/overflow water from the WWTU. Under varying conditions the contents are pumped back to the WWTU for treatment. This action is authorized in CountryMark's NPDES permit. The pond is located south of the WWTU, north of the Site's south property boundary, and west of the unnamed tributary to Mill Creek that traverses the Site.

During the 2010 site investigation, 17 soil samples (including two duplicates) were collected from five borings and five groundwater samples, one from each well, were collected from around SWMU 7S. The 2010 data are evaluated in **Sections 4.4.2.4 and 4.5.2.4**.

4.1.8 AOC 1: Former Caustic Storage Tanks

The January 2009 CountryMark RCRA response states that the spent caustic storage tank was associated with the injection well and was closed out when the injection well was closed. However, the February 2010 CountryMark *RCRA Facility Assessment Response Update Report* states that CountryMark continues to use the tank referenced. Based on information from Mr. David Hertzing, the tank associated with the injection well was closed and removed from the Site when the injection well was closed. A new spent caustic tank was placed into service approximately 10-12 years ago. No spills from the historic tank or the current tank have been identified, and the new tank will be replaced, as necessary, based on tank inspection data to ensure no spills occur in the future.

During the 2013 site reconnaissance, one tank was observed at this location, Tank #720 T14. The tank, which is currently used to store spent caustic, is located within concrete secondary containment. The surrounding area is highly

compacted gravel on dirt with no visible staining. The tank and the secondary containment area appeared to be in good condition with no evidence of leaks or releases. No further action has been warranted or conducted for this AOC.

4.1.9 AOC 2: Underground Process Pipeline Break and Spill

AOC 2 is located within a fairway of the CountryMark golf course. This spill occurred on February 22, 1977. According to the 1986 *Preliminary Review RCRA Facility Assessment and Visual Site Inspection*, 164 barrels of crude oil spilled and was cleaned up under the guidance of Indiana State Board of Health Department. No records regarding clean-up or confirmation samples could be found.

During the 2010 site investigation activities, 36 soil samples from seven borings and five groundwater samples one from each monitoring well installed were collected. The 2010 data are evaluated in **Sections 4.4.2.5 and 4.5.2.5**.

4.1.10 AOC 3: Former Underground Injection Well

Records indicate that an oil well was drilled on the facility property in 1950. In 1955 the well was converted to a waste or saltwater disposal well. It was CountryMark's (formerly IFBC) intention to utilize this well as a deep injection well to dispose of spent caustics (See AOC 1, above). The permit to operate the oil well as an injection well was denied. The well was closed and capped in 1985. A certificate of compliance was issued upon plugging. The Affidavit of well plugging states that the total depth of the well was 2,460 feet and was plugged in the following manner: open pipe 2,460 ft-bgs to 2,145 ft-bgs, cast iron plug 2,145 ft-bgs to 2,143 ft-bgs, cement 2,143 ft-bgs to 1,927 ft-bgs, pipe and mud 1,927 ft-bgs to 1,096 ft-bgs, open hole and mud 1,096 ft-bgs to 531 ft-bgs, and cement 531 ft-bgs and 3 ft-bgs.

Following well closure, the sulfur recovery unit was constructed on the area that once contained the oil well. Actual location of the well is undeterminable at this time. No further action has been warranted or conducted for this AOC.

4.1.11 Other: Transformer Area

Two transformers are located at the Site. One of the transformers is owned by Vectren and is not under the control of CountryMark; this transformer was placed in service in 1991 and is known to not contain PCBs. The second transformer, which is owned by CountryMark, had PCB oils removed and disposed of during 2000 as part of an upgrade. No leaks or releases are known to have occurred from this transformer.

Ten soil samples (including one duplicate) were collected from this area during the 2010 investigation for analysis of PCBs only. The 2010 data are evaluated in **Section 4.4.2.6**.

4.1.12 Other: Possible Historic Disposal Area

An additional area was identified by CountryMark in 2010 as having potentially been used for disposal. This area is described as having similar characteristics and historic disposal practices as SWMU 5. This area is located north of SWMU 5 (Landfill 2A) and west/northwest of SWMU 7N.

During the 2010 investigation, 27 soil samples (including two duplicate samples) from seven borings and four groundwater samples, one from each monitoring well installed, were obtained from the Other area. The 2010 data are evaluated in **Sections 4.4.2.7 and 4.5.2.6**.

4.1.13 Unnamed Tributary to Mill Creek

The unnamed tributary to Mill Creek has received spills in the past, based on the documents reviewed, but spills have always been cleaned up to remove any visible impacts in accordance with the refinery's Facility Response Plan, Storm Water Pollution Prevention Plan, and Spill Pollution Control and Countermeasure Plan. In some cases, based on the type of material released, confirmatory sampling and even soil treatment were involved in the cleanup of spills. **Section 4.5.4** presents the comparison of the most downgradient groundwater data nearest to the unnamed tributary to Mill Creek to the Eco-SLs.

4.1.14 Other Areas of Known Spills or Releases Identified in 2013

Information presented in this section was obtained from conversations with CountryMark personnel, review of CountryMark records, and/or review of the EDR report and IDEM VFC records.

4.1.14.1. Former USTs

The Site was identified on the EDR report as having had seven USTs previously located on it. Documentation found on the IDEM VFC indicated that there were seven USTs located at the Site, ranging in size from 200 gallons to 10,000 gallons. However, two letters from CountryMark, dated November 1992, indicate that the USTs were removed from the ground in August 1988. Based on information from Mr. David Hertzing, the USTs were likely located in the central portion of the Site in the area of the current filling station and electrical substation. No other information regarding the location or contents of the USTs could be found.

4.1.14.2. Fire Drills

Fire drills were identified in in the IDEM Spills database and VFC records. Fire drills are routinely conducted at the Site. These fire drills are conducted using fuel oil with burn pans and a fire circle or training prop with LP, as permitted by IDEM. Because these fire drills are approved and permitted by IDEM they are identified in the IDEM Spills database. Records approving the fire drills were available on the IDEM VFC dating back to 2002. Based on information from Mr. David Hertzing, Manager of Regulatory Compliance, CountryMark has historically conducted fire drills only in this manner. CountryMark has not burned a fuel source on exposed pavement. Based on this information, additional investigation is not warranted.

4.1.14.3. Spill of Virgin Distillate to Mill Creek

A spill of virgin distillate to Mill Creek from the Site was identified on the IDEM Spills database as well as in the EDR report. Based on information in the IDEM Spills database, the spill occurred in January 1996, but no information is provided as to its location. Based on the Spills database, an unknown quantity of virgin distillate was released, affecting a 0.75 mile section of Mill Creek. No other records regarding this release could be found.

4.1.14.4. Unleaded Gasoline Spill

A 24,000-gallon unleaded gasoline spill was identified on the IDEM Spills database as well as in the EDR report. The spill occurred in May 1994 and is indicated in the IDEM Spills database record as having been contained within a tank's dike, but the tank number and information about its location on the Site were not provided. No other records regarding this release could be found.

4.1.14.5. Tank #48 Spill

This spill was identified in the IDEM Spills database, EDR report, and VFC documentation. On April 7, 1997, Tank #48 (90,000 barrel [bbl] capacity) experienced a bottom seam leak. This tank is located in the eastern portion of the Site. This leak resulted in the discharge of approximately 50,000 gallons of crude oil into the earthen secondary containment surrounding the tank over the course of approximately 18 hours. The spill was reported to the IDEM and was assigned IDEM incident #9704036. Upon discovery of the leak, tank contents were transferred to another tank. Recovery efforts resulted in the recovery of all but 2,000 gallons of crude oil. The loss estimate includes vaporization, water and oil emulsion, water entrainment and amounts within the soil matrix. Water washing of the dike interior was extensive and used to recover additional crude oil. This process was conducted to remove oil in the surface soil and to clean the grass within the dike. Recovered crude oil and contaminated waters were

processed through the refinery via standard processing, or in the case of water was treated via the on-site NPDES WWTU.

Following the water washing of the dike, migration of oil into the soil was limited and averaged 2 inches, as confirmed via sampling. The limited migration was due to the clay soil, standing water in the dike from previous rainfall, and the short duration of the leak itself. After liquid recovery efforts were completed soils around the tank were recontoured to allow for better drainage and protection of the tank. The impacted area was fertilized and tilled to a depth of approximately 6 to 8 inches on a periodic basis during the remainder of 1997, and a ground cover of grass was established in 1998.

In the fall of 1998, nine soil borings were completed, in accordance with the IDEM-approved sampling plan, to confirm soil remediation was complete. Each boring location was sampled at the 1 foot depth interval, four locations within areas of highest head pressure during the leak were also sampled at the 3 foot depth interval, and two locations were also sampled at the 6 foot depth interval. All samples were analyzed for total petroleum hydrocarbons (TPH) diesel range organics (DRO) or waste oil range organics. Based on the analytical results, two small areas were found to require additional remediation (results of 140 milligrams per kilogram (mg/kg) and 460 mg/kg for TPH-waste oil range organics).

No further information was available regarding additional remediation. Although IDEM's TPH limit at the time was 100 mg/kg, the most recently used IDEM TPH limit of 5,800 mg/kg would indicate no need for additional remediation. Subsequent to IDEM policy announcements in the summer of 2010, IDEM withdrew all TPH-related closure/screening levels, and on December 9, 2013 IDEM officially announced it will no longer include TPH soil and groundwater criteria in its screening level tables.

4.1.14.6. Tank #44 Spill

This spill was identified in the IDEM Spills database and VFC records. In July 2005, Tank #44 experienced a release of natural gas condensate via a hole in the bottom of the tank. Tank #44 is located in the northeastern portion of the Site, and approximately 300 feet east of the north creek which discharges to the unnamed tributary of Mill Creek. The spill was reported to the IDEM and was assigned incident number 2005-07-152. Upon discovery of the release, the tank was emptied and the hole was repaired to eliminate potential for further releases.

CountryMark dug several test pits to determine the area impacted by the release and installed a trench and sump system to collect product that accumulated on the shallow perched water table north of the tank. Water and product was pumped from the sumps on a daily basis using a vacuum tanker. The volume of

product removed diminished greatly over time indicating that the recovery effort was effective.

August Mack Environmental conducted an investigation in July 2005 to determine and document the extent of impacts from the release. The investigation included advancing 19 soil borings and digging seven test pits. A shallow saturated zone was identified between the depths of approximately 3 to 10 ft-bgs at the Site. A stiff dry clayey material was present beneath this saturated zone. Therefore, this shallow saturated zone is believed to contain perched water and not to be in communication with the deeper aquifer. Thirty-eight soil and eleven groundwater samples were collected from the borings for laboratory analysis of VOCs, TPH-gasoline range organics (GRO), carcinogenic polynuclear aromatic hydrocarbons (cPAHs), and four soil samples were analyzed for RCRA metals. Of the 19 soil samples collected from depths greater than eight feet, beneath the shallow perched water interval, only one sample (collected adjacent to the tank) contained a TPH concentration above 100 mg/kg.

The groundwater results indicated that benzene (at 2.94 milligrams per liter [mg/L]) was the only contaminant present in the shallow saturated zone groundwater above the RISC IDCLs in effect at that time. Groundwater samples collected from the uppermost usable aquifer (which is approximately 20 to 30 ft deeper than the bottom of the shallow saturated zone) did not contain detectable concentrations of VOCs or cPAHs. Based on this information, groundwater impacts were determined to be confined within the shallow saturated zone, and well within the property boundaries.

A status update letter dated June 19, 2006 states that groundwater samples collected in May 2006 from the shallow water-bearing zone showed all levels of contaminants of concern below detection limits. A no further action letter was received from the IDEM Emergency Response Section on September 15, 2006. A comparison of these data to the HHSLs and Eco-SLs is presented in **Sections 4.4.3 and 4.5.3**, respectively.

4.1.14.7. Diesel Fuel Spill

A spill of diesel fuel to storm drains and Mill Creek from the Site was identified on the IDEM Spills database as well as in the EDR report. Based on information in the IDEM Spills database, the spill occurred in October 2006. No other records regarding this release could be found.

4.1.14.8. Sulfuric Acid Spill

This spill was identified on both the IDEM Spills database and in the EDR report. A release of approximately 125-150 gallons of sulfuric acid from a 3,366 pound tote occurred in April 2009 near Cooling Tower #3, located in the central portion of the Site, adjacent to the west of the unnamed tributary to Mill Creek.

The spill was reported to the IDEM and assigned incident #2009-04-190. The release occurred when the tote was placed on top of a plastic spill container within a concrete secondary containment area via fork truck and the plastic spill container collapsed causing the tote to fall and spill. Due to soft ground conditions in the area of the secondary containment the tote could not be immediately righted. CountryMark was eventually able to reposition the tote to stop the spill, but the acid that had spilled did reach the unnamed tributary to Mill Creek.

At the time of the spill, CountryMark dusted the entire ditch with soda ash, and bags of soda ash within burlap bags were positioned at four strategic points between the siphon dam and the south CountryMark property boundary to neutralize the water prior to discharge from the Site. In addition, the water was monitored with a pH probe to ensure the effectiveness of the soda ash. The pH of the water in the ditch was maintained at a safe level (assumed to be within 6 to 9 pH units) prior to discharge from the Site.

As a result of this incident, the area of the secondary containment was modified with a concrete pad to improve fork truck access to the area.

4.1.14.9. Tank #26 Spill

This spill was identified on both the IDEM Spills database and the EDR report. On March 6, 2010 approximately 16,000 gallons of unleaded gasoline was released from Tank #26 into the earthen dike surrounding the tank. Tank #26 is located in the north central portion of the Site. The spill was reported to IDEM and assigned incident #2010-03-041. The spill resulted from an accidental overfill of Tank #26 during product transfer from Tank #50. Gasoline was observed coming from the east and west flow vents of Tank #26. The transfer pump was shut down, the Sheriff's Department was contacted to stop traffic on Givens Road, and the Site's WWTU was notified of the release. Dike valves were properly positioned to prevent run-off to public ditches. According to the spill report, CountryMark began the process of "applying water to the pools of gasoline for recovery at the waste water treatment facility" (most likely meaning that the gasoline was moved with water to the drain connected to the wastewater treatment plant), and continued this process for approximately two hours. The tank dike was ultimately water-washed two additional times after the gasoline had been recovered.

On April 3, 2010, approximately 14 cubic yards of visually impacted soil was removed and disposed of off-site. One composite sample of the removed soil was collected and analyzed for benzene, toluene, ethylbenzene, and total xylene (BTEX) for disposal purposes. Confirmation sampling records could not be found.

4.1.14.10. Crude Oil Spill

This spill was identified on both the IDEM Spills database and the EDR report. In May 2010, approximately 5 gallons of crude oil was released from the underground slop oil pipeline directly north of the WWTU to the unnamed tributary to Mill Creek located on the Site. The spill was assigned incident #2010-05-112. The incident report submitted to the IDEM states that the underground slop oil line had developed a leak. The line was immediately shut off and pads/booms were deployed as well as vacuum trucks. The above ground area immediately around the leak was approximately 36 square feet by 1 foot deep. This area was covered with absorbent pads and was excavated.

During the leak, material reached the nearby unnamed tributary to Mill Creek. The tributary contained water at the time of the release, and a sheen was observed on the water surface up to the syphon dam located on the south end of the property, at Pond #3 (SWMU 7S). Emergency response activities for the unnamed tributary included boom deployment and use of a vacuum truck to collect the sheen-impacted water. The impacted water was introduced back into the Site's WWTU. Secondary activities included excavation of the leaking pipeline, replacement of the leaking pipeline, and removal/disposal of impacted soils. Confirmation sampling records could not be found.

4.1.14.11. API Oil/Water Separators Spill

This spill was identified in the IDEM Spills database. On August 10, 2011 a release from the Site's API oil/water separators was reported by CountryMark. The spill was assigned incident #23869. The spill report submitted to IDEM states that CountryMark indicated that a storm caused the oil/water separators at the Site to overflow. This caused release of oily water into the storm drain system at the Site. According to the spill report the release was contained within the Site boundaries and did not reach surface waters. Adsorbent booms were placed at the nearest storm water (Outfall 003/003S based on the location of the API oil/water separators) as a precautionary measure.

4.1.14.12. Kerosene Spill

This spill was identified in the IDEM Spills database and the VFC. In November 2011, oil was discovered coming out of a valve on the kerosene line inside the Tank #17 earthen dike. Tank #17 is located in the central portion of the Site near the process area. The valve was immediately closed, a spill notification was made, and cleanup procedures initiated. This spill was identified in the IDEM VFC. The spill was reported to the IDEM and assigned incident #25712. It was assumed that the spill had been contained within the Tank #17 dike; however, an open valve allowed oil to flow into the DHT sump undetected. Heavy rainfall during the two days following the release caused the contents of the sump to be pumped to the Tank #42 dike, which drained into the Tank #43 dike.

This oily storm water left the Site via the Tank #43 dike drain and the #005/005S outfall.

Upon discovery of this release absorbent booms were placed at Outfall 005/005S, at the bridge over Mill Creek approximately ¼ mile downstream, and at the outfall of Mill Creek to the Ohio River. River flow and wind pushed the spill along the north bank of the Ohio River near the CountryMark river terminal. Vacuum tucks and manual labor were also used at these locations to recover the product. All free product and adsorbent materials were disposed of or returned to the refinery system. The final estimated volume released was 150 gallons of product.

4.1.14.13. Historic Oil Production Wells

A review of the IDNR online oil and gas well records indicates that there were ten oil production wells located on the Site. **Figure 1** in **Appendix D** shows the approximate locations of the former production wells. One of the wells (Well ID 8474) was previously identified, and is discussed in **Section 4.1.10**, above. At least two of the wells (Well ID 14351 and 54154) were dry or utilized only for geotechnical/structural testing. All of the wells were listed as having been properly plugged and abandoned with the exception of Well ID 8335, which was left open from 127 ft-bgs to be utilized as a water supply well for Indiana Farm Bureau Cooperative, Inc., the predecessor of CountryMark. Based on information from Mr. David Hertzing, this well is not utilized by CountryMark, and has likely been abandoned; however, the open casing is still present. CountryMark plans to properly abandon this well in the near future. The following information was obtained from IDNR records for each well:

IDNR Well ID	Approximate Location	Total Depth (ft-bgs)	Data Installed	Date Abandoned
8335	Adjacent to east of Tank #44	2,461	03/11/1950	07/16/1955
8396	Southwest undeveloped area	2,455	03/29/1950	10/28/1983
8399	Northwest of Pond #3	2,669	04/07/1950	11/19/1966
8474	South of process area	2,460	04/23/1950	09/20/1985
14351	Adjacent to southeast of Tank #45	2,438	04/18/1950	11/22/1966
16676	Adjacent to east of equalization basin	2,437	03/09/1950	11/29/1966
25460	Central portion of property	3,032	12/04/1949	09/24/1985
27382	Southwest undeveloped area	2,288	10/15/1963	10/05/1974
54154	Southwest undeveloped area	3,378	06/23/2010	09/22/2010
113052	Southwest undeveloped area	1,040	Unknown	Unknown

4.1.14.14. South Truck Rack

There is a truck filling rack located in the southernmost portion of the facility, adjacent and west of SWMU 7S/Pond #3. The area of the truck rack is concrete

paved; however, the surrounding area north and east of the truck rack is gravel or grass covered. This truck rack transfers finished products to tanker trucks via underground piping. Incidental surface spills can occur in this area during product transfers (i.e. during connecting/disconnecting of hoses to tanker trucks). Surface flow in the area of the loading rack is generally directed northeast to Pond #3.

In addition, there is a sump located northeast of the truck rack, adjacent to the edge of Pond #3. Based on information from Mr. David Hertzing, this sump is constructed of a steel tank and is utilized for collecting incidental spills from the truck rack as well as drains from the laboratory located in the nearby southern office building. This sump is periodically pumped to the slop oil tanks so the materials can be recycled via the crude oil unit.

4.2 PRESENCE OF FREE PRODUCT

The presence of free product in monitoring wells was evaluated in two separate events, on December 2, 2010 and on July 20, 2012. As shown in Table 2-1, none of the 36 wells installed had measurable free product. However, either a sheen, oily smearing on the interface probe, or detectable free product at thicknesses not measurable with the interface probe (i.e., less than 0.01 foot thick) were detected.

Results were different between the two measurements. On December 2, 2010, during the preliminary characterization, three wells (AOC 2 MW-1, AOC 2 MW-4, and Other MW-4) had a visible sheen on the water surface and one well (SWMU 5 MW-8) had detectable (but not measurable with the interface probe) free product, with less than 0.01 foot of free product. The purpose of the July 20, 2012 free product evaluation was to determine the presence of free product in the 36 wells during a different season. ERM's field personnel noted a thick, black, oily substance adhering to the interface probe after being lowered to the bottom of one well (SWMU 5 MW-2). This oily substance was not noted in December 2010 in this well. None of the other wells had any evidence of free product in July 2012. As described in Section 4.3, only two of the 36 wells sampled had one petroleum product above the groundwater residential HHSL: Other MW-2 and SWMU 7S MW-5 had benzene detected at 0.014 mg/L. No free product was noted in either of these two wells the two times it was evaluated.

A comparison of the water elevations detected during the sampling events indicated that the groundwater elevations at SWMU 5 MW-8 and Other MW-4 were 4 and 5 inches higher, respectively, in July 2012 than in December 2010, whereas the groundwater elevations at AOC 2 MW-2 and AOC 2 MW-4 were approximately 3 feet and 1.7 feet lower, respectively, in July 2012 than in December 2010. Therefore, the discrepancy in the presence of free product was

apparently not related to differences in groundwater elevations, as some wells had higher groundwater elevations in July 2012 than in December 2010 and others had lower groundwater elevations.

4.3 PRO UCL CALCULATIONS OF BACKGROUND VALUES FOR ARSENIC, COBALT, VANADIUM, AND ZINC

The U.S. EPA software ProUCL was used to calculate site-specific background concentrations for arsenic, cobalt, vanadium, and zinc. Out of 258 soil samples collected during the 2010 investigation, discussed in **Section 3.1.1** above, 165 and 200 had arsenic and cobalt, respectively, above the corresponding HHSLs for soil migration to groundwater of 5.9 milligrams per kilogram (mg/kg) and 4.3 mg/kg. In addition, all of the soil samples collected in 2010 had concentrations of vanadium and 119 had concentrations of zinc above their Eco-SLs of 7.8 mg/kg and 46 mg/kg respectively. Similar issues were noted in the LTA soil samples. Given the ubiquitous presence of arsenic cobalt, vanadium, and zinc in the soil samples, an evaluation of the site-specific, regional, and/or county-wide background soil concentrations was performed. The data obtained for each AOC/SWMU/Other areas were compared to the background concentrations obtained to assess the potential presence of Site-related contamination. The following bullets describe the results of the background evaluation:

- ProUCL was used to calculate 95% upper confidence levels (UCLs) for arsenic, cobalt, vanadium, and zinc using the analytical results of the eight samples collected from four background borings installed in 2010 at non-impacted, nonproduction areas on the Site (BB-1 through BB-4) (see **Sheet 2-1**). Arsenic, cobalt, and vanadium were detected in each of the eight samples analyzed. Zinc was detected in each sample at a concentration below the reporting limit, but above the method detection limit, and as such the values are considered to be estimated. No outliers were identified by ProUCL. The 95% UCLs recommended by ProUCL are as follows (see **Appendix J**):
    - Arsenic 13.57 mg/kg
    - Cobalt 19.28 mg/kg
    - Vanadium 25.61 mg/kg
    - Zinc 48.68 mg/kg.
- The USGS's National Geochemical Survey database of background metal concentrations in soil in the U.S. has an average background arsenic concentration in Posey County, Indiana, of 14.564 mg/kg, with a standard deviation of 9.998 mg/kg (i.e., a range of 4.565 to 24.562 mg/kg) (http://tin.er.usgs.gov/geochem/doc/home.htm). The samples used to

calculate these average background concentration were obtained from non-impacted areas.

- No data for cobalt, vanadium, or zinc are provided in the above database, but the USGS's *Element Concentrations in Soil and Other Surficial Materials in the Conterminous United States* (1984), has arithmetic average concentrations in Eastern U.S. soils (east of the 96th Meridian, an area that covers Indiana) of:
    - Cobalt: 9.2 mg/kg, with a range of < 0.3 to 70 mg/kg;
    - Vanadium: 66 mg/kg, with a range of < 7 to 300 mg/kg; and
    - Zinc: 52 mg/kg, with a range of < 5 to 2,900 mg/kg.

4.4 COMPARISON OF AVAILABLE ANALYTICAL DATA TO HUMAN HEALTH SCREENING LEVELS

HHSLs used for this evaluation included the residential, C/I worker, and excavation worker soil direct contact, soil migration to residential groundwater, residential groundwater use, and groundwater vapor exposure for residents and C/I workers SLs in Appendix A of IDEM's RCG as updated on March 1, 2013 and July 9, 2013. Comparison to the residential HHSLs is required by USEPA to show if the entire Site requires a C/I use restriction. It should be noted that IDEM's RCG provides groundwater SLs only for residential use of groundwater as a potable water source. In fact, Mt. Vernon provides water to the residents and C/I facilities (including the Site) from the Ohio River. Because the Site is zoned Heavy Industrial and will continue to be used as a petroleum refinery for the foreseeable future, this section presents a comparison of the data to the C/I properties HHSLs, except for the soil migration to groundwater and groundwater use exposure routes, which are based on residential use in the RCG. The need for either additional delineation or resampling, where necessary, is also presented below only for the exceedances of the C/I worker direct contact SLs.

4.4.1 Land Treatment Area (SWMU 2)

Tables 4-2 to 4-11 show the comparison of the LTA analytical data to the HHSLs. **T**he sampling locations are shown in the figures included in **Appendix I**.

4.4.1.1. Treatment Cells

Soil

The maximum concentrations of four metals in soil samples collected in 1998 were above the soil migration to groundwater HHSLs, as follows: (1) Cell #1: antimony, arsenic and cobalt; (2) Cell #2: antimony, cadmium and cobalt; and (3) Cells #3 and #4: arsenic and cobalt. **Table 4-2** presents this information. These exceedances are not of concern because none of the metals was detected in the groundwater samples above the HHSLs. No hexavalent chromium was detected in the soil samples collected in 2003 (**Table 4-3**).

Soil Pore Liquid

As shown on **Tables 4-4 and 4-5**, none of the soil pore liquid samples had detections above the HHSLs.

Uppermost Usable Groundwater

Only one SVOC (bis[2-ethylhexyl]phthalate) was detected in the 1998 LTA groundwater samples from the uppermost usable aquifer above the HHSLs for groundwater use (**Tables 4-6 and 4-7**). This compound is a common laboratory contaminant and was detected at a maximum concentration only slightly above the SL (0.00795 mg/L vs. the SL of 0.006 mg/L); therefore, further evaluation of this exceedance is not necessary.

4.4.1.2. Staging Area

Soil

Arsenic and cobalt were the only COPCs detected above the current HHSLs for soil migration to groundwater in one and 10 samples, respectively, both at concentrations below the calculated site-specific background levels; therefore, further evaluation is not necessary for these two metals. No VOC or SVOC HHSLs were exceeded. **Tables 4-8 through 4-10** present the data and the comparison to the HHSLs.

Shallow Saturated Groundwater

Cobalt was the only analyte detected above the HHSL for groundwater use at a concentration slightly above the HHSL (0.0093 mg/L vs. the current HHSL of 0.0047 mg/L). **Table 4-11 shows the data**. Because the Staging Area groundwater samples were collected from the shallow saturated zone, which is not usable based on its low conductivity, further evaluation is not necessary.

4.4.2 2010 Investigation Areas

The results of the comparison of the 2010 samples analytical data are presented below by area investigated. **Tables 4-12 through 4-17** and **Figures 4-1 to 4-7** summarize the comparison.

4.4.2.1. SWMU 5

A total of 102 soil samples (including four duplicates) and 12 groundwater samples (including one duplicate) were collected from SWMU #5 (**Figure 4-1**). The subsections that follow summarize the comparison of the data to the applicable HHSLs.

Soil

The analytical results of the soil samples collected from SWMU 5 are listed in **Tables 4-12 through 4-14** for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. Of the 102 soil samples analyzed for VOCs, seven samples of those shallower than 15 ft-bgs had VOC concentrations above the HHSLs applicable to the Site: SWMU 5 EN #7 (MW-1) (4-6), SWMU 5 EN #15 (4-6), SWMU 5 ES #8 (MW-2) (4-6), SWMU 5 MW-9 (4-6), SWMU 5 W #2 (12-14), and SWMU 5 W #5 (2-4) and (4-6). Benzene was detected at a concentration above its migration to residential groundwater HHSL in each of these soil samples, with the exception of SWMU 5 W#2 (12-14). However, benzene was not detected in any of the groundwater samples collected from the monitoring wells in SWMU #5. Based on this information, benzene is not migrating to groundwater; therefore, further evaluation is not necessary.

The exceedance at sample SWMU 5 W#2 (12-14) was for 1,2-dichloroethane (DCA), which was detected at a concentration above its migration to residential groundwater HHSLs. However, this sample was likely collected at or below the water table; therefore, the migration to residential groundwater pathway does not apply to this sample and the evaluation should be performed based on groundwater samples. 1,2-DCA was detected in the groundwater samples collected from SWMU 5 MW-6 and SWMU 5 MW-9 at concentrations above its HHSLs for residential groundwater use and for C/I vapor exposure.

Naphthalene was the only SVOC detected above the HHSLs in the soil samples from SWMU 5. Seven of the samples had a detection of naphthalene above its migration to residential groundwater HHSL: SWMU 5 EN #7 (MW-1) (4-6), SWMU 5 EN #10 (2-4), SWMU 5 EN #15 (4-6), SWMU 5 ES #8 (MW-2) (4-6), SWMU 5 MW-10 (2-4), and SWMU 5 W #5 (2-4) and (4-6). However, naphthalene was not detected in any of the groundwater samples collected from the area. Based on this information, naphthalene is not migrating to the groundwater; therefore, further evaluation is not necessary.

Arsenic and cobalt were detected above the HHSL for the migration to residential groundwater pathway in 56 and 67 soil samples shallower than 15 ft-bgs (including three and four duplicates), respectively. Thirty-eight of the arsenic exceedances of the HHSL for the migration to residential groundwater pathway occurred in samples obtained from the saturated zone. Of the remaining 18, only three were detected at concentrations above the site-specific background concentration of 13.57 mg/kg [i.e., SWMU 5 EN #8 (4-6), SWMU 5 EN #12 (2-4), and SWMU 5 MW-4 (4-6)], and none above the upper USGS background range of 24.562 mg/kg for Posey County. As discussed in Section 4.5.2, arsenic was detected in the groundwater samples collected from SWMU 5 MW3, MW-4, and MW-7. Further evaluation of the soil arsenic exceedances is unnecessary because the concentrations detected were lower than the background concentrations. An assessment of the delineation of arsenic in groundwater from this area is presented in the groundwater section below.

Sixty-seven soil samples shallower than 15 ft-bgs had cobalt at concentrations above the migration to residential groundwater pathway HHSL, of which 20 were vadose-zone samples. Cobalt was detected in all 20 vadose-zone soil samples at concentrations above the HHSL for the migration to residential groundwater pathway, with a maximum level of 15 mg/kg. This concentration is below the calculated site-specific background 95% UCL of 19.28 mg/kg and, as presented in the groundwater section below, cobalt was not detected in the groundwater samples collected at SWMU 5. Based on this information, cobalt is not migrating to the groundwater; therefore, further evaluation is not necessary.

Hexavalent chromium was detected in soil samples SWMU 5 MW-4 (30-32) and SWMU 5 MW-6 (2-4) Dup 7 and (14-16) above its migration to residential groundwater HHSLs. As indicated in the groundwater section below, hexavalent chromium was not detected in any of the groundwater samples collected from SWMU 5. Based on this information, hexavalent chromium is not migrating to the groundwater; therefore, further evaluation is not necessary. .

Groundwater

Tables 4-15 through 4-17 present the analytical results of the groundwater samples collected from SWMU 5 for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. As indicated above, 1,2-DCA was detected in the groundwater sample SWMU 5 MW-6 above its residential groundwater HHSL and in SWMU 5 MW-9 above both its residential groundwater use and C/I vapor exposure HHSLs. No VOCs were detected above applicable HHSLs in the remaining nine groundwater samples collected from SWMU 5. Sample SWMU 5 MW-9 is located more than 120 feet away from the nearest buildings and, thus, is not an issue for vapor intrusion. Delineation of groundwater 1,2-DCA concentrations for the residential groundwater use will also delineate the C/I vapor exposure pathway, which has a much higher HHSL.

Delineation of residential groundwater use 1,2-DCA impacts is required to the northwest and south. Delineation is provided in the other directions as follows: (1) to the northwest of SWMU 5 MW-6 by samples SWMU 5 MW-10 and SWMU 5 MW-11; to the southeast of SWMU 5 MW-9 and SWMU 5 MW-6 by samples SWMU 5 MW-3, MW-5, and MW-7; and to the northeast by samples SWMU 5 MW-2, MW-1 and MW-11.

None of the 12 groundwater samples collected from SWMU 5 (including a duplicate) had concentrations of SVOCs above their respective HHSLs. No further evaluation of these results is necessary.

Total lead was detected above its HHSL in SWMU 5 MW-11 but, because dissolved lead was not detected, no further evaluation of total lead is necessary. Arsenic was detected above its residential groundwater SL in monitoring wells SWMU 5 MW3, SWMU 5 MW-4, and SWMU 5 MW-7. Delineation of arsenic in groundwater is required east of SWMU 5 MW-4 and SWMU 5 MW-7 and south of SWMU 5 MW-3 and SWMU 5 MW-7. Delineation is provided to the north and west by MW-2, MW-1, MW-6, MW-8, and MW-11 and to the southwest of SWMU 5 MW-3 by SWMU 5 MW-5.

Hexavalent chromium was detected above its residential groundwater HHSL in monitoring well SWMU 5 MW-11. Delineation for hexavalent chromium is incomplete in the north and east/southeast directions. Wells SWMU 5 MW-10, MW-8, MW-1, and MW-4 delineate hexavalent chromium to the west, south, and southeast of SWMU 5 MW-11.

Delineation Summary

Groundwater delineation is insufficient for 1,2-DCA to the northwest and southwest, for arsenic to the east and south, and for hexavalent chromium to the north and east/southeast to define the area with concentrations above the residential groundwater use HHSLs (**Figure 4-1**). Delineation of 1,2-DCA to its residential groundwater use HHSLs will also delineate the area that has 1,2-DCA concentrations above the C/I vapor exposure HHSL, which is much higher than the residential groundwater use HHSL for 1,2-DCA.

4.4.2.2. SWMU 6

Fifty soil samples (including two duplicates) and seven groundwater samples were collected from SWMU #6 (**Figure 4-2**). The subsections that follow summarize the comparison of the data to the applicable HHSLs.

Soil

Tables 4-12 through 4-14 present the analytical results of the samples collected from SWMU 6 for analysis of VOCs; SVOCs; and metals, cyanide, DRO, GRO,

total organic carbon (TOC), and oil and grease, respectively. Of the 50 soil samples analyzed for VOCs, one had a VOC concentration above the HHSLs applicable to the Site: SWMU 6 MW-2 (6-8), which had benzene at a concentration above its migration to residential groundwater HHSL. Because this sample was within or below the smear zone, the migration to residential groundwater pathway does not apply to it and the groundwater data should be evaluated to assess this pathway. As indicated in Section 4.6.2, benzene was not detected in SWMU 6 MW-2 or any other well installed in the area of SWMU #6. Based on this information, benzene is not migrating to groundwater; therefore, further evaluation is not necessary.

Sample SWMU 6 #8 (MW-7) (8-10) is the only soil sample that had detections of SVOCs above their respective HHSLs, including benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. These three SVOCs were detected at concentrations above their respective migration to residential groundwater HHSLs. This sample was also collected at or below the water table; therefore, the migration to residential groundwater pathway does not apply to this sample and the groundwater samples should be used to evaluate the residential groundwater use pathway. As discussed in the groundwater section below, no SVOCs were detected in any of the groundwater samples collected from SWMU #6 above their respective applicable HHSLs. Based on this information, the SVOCs detected in soil are not migrating to groundwater; therefore, further evaluation is not necessary.

Of the 50 soil samples (including two duplicates) analyzed for metals, all 34 samples collected at less than 15 ft-bgs had arsenic concentrations above its migration to residential groundwater HHSL and one sample also had arsenic above the C/I worker direct contact HHSL [SWMU 6 #5 (6-8)]. This sample was obtained at or below the smear zone, and neither the migration to groundwater or C/I worker direct contact pathways HHSLs apply to them. Fifteen of the 34 samples were collected above the smear zone and all of them had arsenic concentrations greater than the migration to residential groundwater HHSL. The HHSL for the migration to groundwater pathway does not apply to the other 19 samples, including the one that had an arsenic concentration above the C/I worker direct contact HHSL, for which the C/I worker direct contact HHSL also does not apply.

The concentrations of arsenic in 10 of the 34 samples where it was detected above the HHSLs were above the site-specific background concentration of 13.5 mg/kg, but none of the samples had concentrations greater than the USGS upper limit of the range of background concentrations in Posey County or 24.562 mg/kg. Based on this information, arsenic is within expected background ranges; therefore, further evaluation is not necessary.

The residential groundwater use should be assessed by evaluating the groundwater samples instead of the saturated-zone soil samples. As indicated in the groundwater section below, one groundwater sample (SWMU 6 MW-2) had total and dissolved arsenic at concentrations above the HHSLs for the residential groundwater use pathway.

Thirty-five soil samples had cobalt above the migration to residential groundwater HHSL, of which 16 were obtained at or below the smear zone, where the migration to residential groundwater HHSL does not apply. Therefore, an evaluation of the groundwater cobalt concentrations was performed to assess this pathway. One groundwater sample, SWMU 6 MW-2, had cobalt at a concentration greater than the HHSL for groundwater. The groundwater section, below, evaluates the results to determine if further delineation is required. None of the soil samples obtained from SWMU 6 had cobalt at concentrations greater than the site-specific background concentration of 19.28 mg/kg. Based on this information, cobalt is within expected background ranges; therefore, further evaluation is not necessary.

Soil sample SWMU 6 MW-2 (2-4) had hexavalent chromium and SWMU 6 MW-2 (6-8) had antimony above their respective migration to residential groundwater HHSLs. As discussed in the groundwater section below, hexavalent chromium and antimony were not detected in any of the groundwater samples collected from SWMU #6. Based on this information, these compounds are not migrating to groundwater; therefore, further evaluation is not necessary.

Groundwater

Tables 4-15 through 4-17 summarize the analytical results of the groundwater samples collected from SWMU 6 for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. No VOCs were detected in any of the groundwater samples collected from SWMU #6 and no SVOCs were detected above their respective HHSLs. Further evaluation of these results is not necessary.

Of the seven samples collected from SWMU 6, one sample (SWMU 6 MW-2) had total and dissolved arsenic and total and dissolved cobalt at concentrations above their respective HHSL for the residential groundwater use pathway. Delineation of the arsenic detected at SWMU 6 MW-2 is required to the east/southeast, beyond the creek, and to the southwest. Delineation to the northwest is provided by SWMU 6 MW-3, MW-5, and MW-6; and to the south by SWMU 6 MW-1.

Delineation Summary

Delineation of the arsenic detected in groundwater sample SWMU 6 MW-2 is incomplete to the east and southeast (beyond the unnamed tributary of Mill Creek), and to the southwest (**Figure 4-2**). No delineation is required for any

other parameter detected in the groundwater samples or for the soil samples, which are defined by samples collected at other locations within SWMU 6.

4.4.2.3. SWMU 7N

Eighteen soil samples and four groundwater samples were collected from SWMU 7N (**Figure 4-3**). The subsections that follow summarize the comparison of the data to the applicable HHSLs.

Soil

The analytical results of the soil samples collected at SWMU 7N are shown on **Tables 4-12 through 4-14** for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. Of the 18 soil samples analyzed, none had VOC concentrations above the HHSLs applicable to the Site and none had SVOCs detected. Further evaluation of these results is not necessary.

Nine soil samples collected at depths shallower than 15 ft-bgs had arsenic detected at concentrations above the migration to residential groundwater HHSL, including six samples obtained at or below the smear zone. The three vadose-zone soil samples were SWMU 7N #1 (MW-2) (Surface), SWMU 7N #2 (MW-3) (Surface), and SWMU 7N #5 (MW-4) (Surface). Two samples, both collected at or below the smear zone, exceeded the arsenic HHSL for the C/I worker direct contact pathway: SWMU 7N #5 (MW-4) (8-10) and SWMU 7N #6 (MW-1) (6-8). Neither of these pathways applies to saturated soil samples; in addition, the migration to residential groundwater pathway is better evaluated via the groundwater concentrations. The groundwater section below evaluates the groundwater result to determine if additional arsenic delineation is required. One of the four wells installed at SWMU 7N [for sample SWMU 7N MW-3 and its duplicate] had arsenic at a concentration slightly above the residential groundwater use HHSL (0.011 mg/L and 0.013 mg/L vs. the HHSL of 0.01 mg/L). Given that the direction of groundwater flow is towards the creek, in a southwest direction, the delineation of this area is complete for arsenic. The source of the arsenic is presumed to be the pond, so delineation upgradient of SWMU 7N is unnecessary. Further, only two of the arsenic concentrations were above the site-specific background of 13.5 mg/kg, and none was above the USGS upper range background concentration of 24.562 mg/kg. Based on this information, arsenic is within expected background ranges; therefore, further evaluation is not necessary.

Eleven of the 18 soil samples were collected at depths shallower than 15-ft bgs. Of these 11, eight had cobalt at concentrations above the migration to groundwater HHSLs, including five collected at or below the smear zone. Neither of these samples had cobalt above the site-specific background of 19.28 mg/kg, with the highest concentration detected being 9.4 mg/kg in sample SWMU 7N #5 (MW-4) (8-10), and the groundwater samples from SWMU 7N did

not have cobalt at concentrations above the HHSL. Based on this information, cobalt is within expected background ranges and is not migrating to groundwater; therefore, further evaluation is not necessary.

Note that the soil sample that had the highest cobalt concentration (161 mg/L) in all areas investigated at the Site was collected from the 26-28 ft-bgs interval [SWMU 7N #2 (MW-3) (26-28)], and three of the samples collected above it had concentrations lower than the HHSLs. Further, the same soil sample had (1) barium at a concentration (10,600 J mg/kg) above one order of magnitude greater than any other Site barium soil concentration, and (2) selenium at a concentration (37 mg/kg) almost an order of magnitude greater than the few concentrations detected in the rest of the Site soil samples. The three shallower samples at SWMU 7N #2 (MW-3) also had much lower concentrations of both barium and selenium. These analytical results must have been a result of laboratory error, because the groundwater sample from the same location had no cobalt or selenium detected, and barium at only 0.25 mg/L (vs. the HHSL of 2 mg/L), and the area outside the pond has not been previously excavated or re-graded to that depth.

Groundwater

Tables 4-15 through 4-17 list the analytical results for the groundwater samples for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. VOCs and SVOCs were not detected in any of the five samples (including one duplicate) collected from this area.

Arsenic was detected above its residential groundwater HHSL in monitoring well SMWU 7N MW-3 and its duplicate, at concentrations slightly above the HHSL (0.011 mg/L and 0.013 mg/L vs. 0.010 mg/L). The delineation in this area is complete because the groundwater flow direction is to the southwest, towards SWMU 7N MW-1, which had no arsenic. Samples to the northeast and south of SWMU 7N MW-3 also had no arsenic reported.

Delineation Summary

Delineation for SWMU 7N is complete. No additional investigation work is necessary in this area.

4.4.2.4. SWMU 7S

Seventeen soil samples (including two duplicates) and five groundwater samples were collected from SWMU 7S (**Figure 4-4**). The subsections that follow summarize the comparison of the data to the applicable HHSLs.

Soil

Tables 4-12 through 4-14 present the analytical results of the samples collected from SWMU 7S for analysis of VOCs; SVOCs; and metals, cyanide, GRO, and DRO, respectively. Only one of the 17 soil samples collected had VOC concentrations above the HHSLs applicable to the Site: SWMU 7S #5 (MW-5) (6-8), which had benzene and toluene detected at concentrations greater than their respective migration to residential groundwater HHSLs. However, this sample was collected from the saturated zone; therefore, the migration to residential groundwater pathway does not apply and the impacts should be evaluated by using the groundwater samples collected. As described in the groundwater section below, toluene was not detected above the residential groundwater use HHSL in any of the groundwater samples. However, benzene was detected above the HHSL for the residential groundwater use pathway in the groundwater sample collected from the same location that had the soil exceedances, SWMU 7S MW-5.

The same soil sample that had the only exceedances of benzene and toluene also was the only soil sample that had any SVOC (naphthalene) at a concentration above the migration to residential groundwater HHSL. However, this sample was collected from the saturated zone; therefore, the migration to residential groundwater pathway does not apply and the groundwater samples should be used to evaluate the pathway. As discussed in the groundwater section below, naphthalene was not detected in any of the groundwater samples collected from SWMU 7S. Based on this information, it does not appear that naphthalene is migrating to the groundwater in SWMU 7S; therefore, further evaluation of naphthalene detections is not necessary.

Of the 14 soil samples (including two duplicates) collected at depths shallower than 15 ft-bgs, 11 soil samples (including the two duplicates) had arsenic concentrations above its migration to residential groundwater HHSL. Nine of these samples, including SWMU 7S #5 (MW-5) (6-8), were collected from the saturated zone; therefore, the migration to residential groundwater pathway does not apply to those samples. Instead, the groundwater data should be checked. As described in the groundwater section below, arsenic was not detected in any of the groundwater samples collected from SWMU 7S, and requires no further evaluation for the migration to residential groundwater pathway. SWMU 7S #5 (6-8) had the highest arsenic concentration detected in the soil samples from SWMU 7S and was the only sample that had arsenic at a concentration greater than its site-specific background concentration of 13.5 mg/kg, but below the USGS upper range concentration for background soils in Posey County of 24.562 mg/kg. Based on this information, arsenic is within expected background ranges and is not migrating to groundwater; therefore, further evaluation is not necessary.

Cobalt was also detected in 11 soil samples (including two duplicates) of the 14 collected at depths shallower than 15 ft-bgs at concentrations above the

migration to residential groundwater HHSL. None of the concentrations detected was greater than the site-specific background concentration of 19.28 mg/kg. Further, although total cobalt was detected in the groundwater sample from SWMU 7S MW-1, dissolved cobalt was not detected. Based on this information, cobalt is within expected background ranges and is not migrating to groundwater; therefore, further evaluation is not necessary.

Groundwater

Tables 4-15 through 4-17 present the analytical results of the groundwater samples from SWMU 7S for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. Benzene was the only VOC detected at a concentration above its residential groundwater HHSL, at SWMU 7S MW-5. Delineation of benzene is required for SWMU 7S MW-5 south of SWMU 7S, because the pond may have affected the groundwater south of the pond and that groundwater would leave the property before it reaches the unnamed tributary of Mill Creek. The benzene exceedance of the HHSL for the residential groundwater use in sample SWMU 7S MW-5 is delineated to the north and east by samples SWMU 7S MW-1, MW-2, MW-3, and MW-4 (see **Figure 4-4**).

The only metal detected above the residential groundwater HHSL was cobalt, in an unfiltered sample; the analysis of a filtered sample for dissolved cobalt did not detect cobalt. Therefore, further evaluation of cobalt is not necessary.

Delineation Summary

The only location that requires delineation (and only for benzene), is SWMU 7S MW-5 (**Figure 4-4**), because the Pond #3 (SWMU 7S) may have affected the groundwater to the south in the same way it affected SWMU 7S MW-5.

4.4.2.5. AOC 2

Thirty-six soil samples from seven borings and five groundwater samples, one from each monitoring well installed, were collected from AOC 2 (shown on **Figure 4-5**). The subsections that follow summarize the comparison of the data to the applicable HHSLs.

Soil

The analytical results of the soil samples collected from AOC 2 are listed in **Tables 4-12 through 4-14** for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. VOCs, SVOCs, and cyanide were not detected above their respective HHSLs in any of the 36 soil samples collected. Further evaluation of these results is not necessary.

Nineteen and 23 of the 36 soil samples analyzed for metals had arsenic and cobalt concentrations, respectively, above their specific HHSL for the migration

to residential groundwater pathway. In addition, hexavalent chromium was detected in one soil sample (AOC 2 MW-1 [4-6]) above its migration to residential groundwater pathway. Except for seven samples collected from the surface, all other samples with metals exceedances were obtained from the saturated zone including AOC 2 MW-4 (4-6) and AOC 2 MW-1 (4-6). The migration to residential groundwater and the C/I direct contact HHSLs do not apply to soil samples collected from saturated zones. None of the seven surficial soil samples had either arsenic or cobalt above the site-specific 95% UCLs calculated for arsenic and cobalt using ProUCL. In addition, as discussed below, the groundwater samples from AOC 2 did not have arsenic, cobalt, or hexavalent chromium detected above their respective HHSLs. Based on this information, these metals were within expected background ranges and/or are not migrating to groundwater; therefore, further evaluation is not necessary.

Hexavalent chromium was also detected above the migration to groundwater HHSL in a sample collected at or below the smear zone [AOC 2 MW-1 (4-6)]. Compounds detected at or below the smear zone should be evaluated via the groundwater samples. As stated in the groundwater section below, no hexavalent chromium was detected in the ground water sample collected from the same location. In fact, one of the background soil samples [BB NE (6-8)] had a detection of hexavalent chromium at a similar concentration (5.8 mg/kg vs. 6.3 mg/kg), indicating a potential laboratory error, as the background soil samples had no organics and both detections of hexavalent chromium were only slightly above the reporting limit of 5 mg/kg. Based on this information, hexavalent chromium is not migrating to groundwater; therefore, further evaluation is not necessary.

Groundwater

As shown in **Tables 4-15 through 4-17**, none of the groundwater samples had any detection above the HHSLs. Therefore, further evaluation of the groundwater at AOC 2 is not necessary.

Delineation Summary

The delineation is considered complete in AOC 2 because (1) the soil samples obtained with concentrations above the HHSLs were either at or below the smear zone; (2) the chemicals detected had concentrations that were below the HHSLs or background concentrations; and/or (3) the chemicals detected above the HHSLs for the migration to residential groundwater were not found in the groundwater samples collected in AOC 2.

4.4.2.6. Other Transformers

Ten soil samples (including one duplicate) were collected from this area for analysis of PCBs only (**Figure 4-6**). As shown in **Table 4-14**, no PCBs were

detected in any of the samples. Therefore, further investigation or evaluation of this area is not necessary.

4.4.2.7. Other

Twenty-seven soil samples (including a duplicate) from seven borings and four groundwater samples, one from each monitoring well installed, were obtained from the Other area (**Figure 4-7**). The subsections that follow summarize the comparison of the data to the applicable HHSLs.

Soil

Tables 4-12 through 4-14 present the analytical results for the soil samples collected from this area for VOCs; SVOCs; and metals, cyanide, and TPH, respectively. Of the 27 soil samples analyzed for VOCs, two had VOC concentrations above the HHSLs applicable to the Site: Other MW-1 (4-6) and Other MW-2 (2-4). At vadose-zone soil sample Other MW-2 (2-4), benzene was detected at a concentration above its migration to residential groundwater HHSL. As discussed in the groundwater discussion below, benzene was detected in the groundwater sample from Other MW-2 above its residential groundwater use HHSL.

The exceedances at sample Other MW-1 (4-6) were for benzene and chloroform, which were detected at a concentration above their respective migration to residential groundwater HHSLs. However, sample Other MW-1 (4-6) was likely collected at or below the water table; therefore, the migration to residential groundwater pathway does not apply to this sample and the potential for exceedance of the groundwater HHSLs should be evaluated using the groundwater samples collected from the same boring. Because the groundwater sample from Other MW-1 did not have any VOCs detected above the HHSLs (discussed in the groundwater section, below), further evaluation of this soil exceedance is not necessary.

Of the 27 soil samples analyzed for SVOCs, naphthalene was detected in one of the samples [Other #4N (2-4)] at a concentration above its HHSL for the migration to residential groundwater HHSL. However, naphthalene was not detected in any of the four groundwater samples collected from the area. Based on this information, SVOCs are not migrating to the groundwater; therefore, further evaluation is not necessary.

Twenty and 25 of the 27 soil samples had arsenic and cobalt, respectively, above their respective migration to residential groundwater pathway HHSL. In addition, the following six samples less than 15 ft-bgs had concentrations of arsenic above its C/I direct contact HHSL: Other #3 (4-6), Other #4N (2-4), Other #4 (14-16), Other MW-2 (2-4), Other MW-3 (4-6), and Other MW-4 (14-16).

Only two of the 27 soil samples collected in this area were obtained from the vadose zone: Other #4 N (2-4) and Other MW-2 (2-4).

Both Other #4 N (2-4) and Other MW-2 (2-4), as well as Other #3 (4-6), had arsenic concentrations greater than the site-specific background concentration of 13.57 mg/kg and above the USGS upper range of arsenic in background soils in Posey County of 24.562 mg/kg. These three arsenic samples were collected from areas between railroad tracks. Railroad track ballast material is known for having arsenic at elevated concentrations; as such, they are not considered to be CountryMark-specific impacts. Delineation of these samples is only required to the west, because the soil samples from the following locations had no arsenic above the background concentrations: (1) to the north, Other MW-1 and Other #2; (2) to the south, SWMU 5 MW-10, SWMU 5 MW-11, and SWMU 5 W #4; and (3) to the east and northeast, Other MW-3 and Other MW-4.

The migration to groundwater pathway does not apply to samples from saturated zones, which will not be evaluated further except via the groundwater samples. As discussed in the groundwater section below, cobalt was not detected in groundwater samples collected from the Other area; therefore, further evaluation of the cobalt soil exceedances is not necessary. However, arsenic was detected in the groundwater samples collected from Other MW-2 and Other MW-4. These concentrations and the need for delineation are assessed in the groundwater section below.

Lead, mercury, and cyanide were detected in one soil sample (Other MW-2 [2-4]) and mercury was detected in a second soil sample [Other #4N (2-4)] above their respective migration to residential groundwater HHSLs. Lead and mercury were not detected in any of the groundwater samples collected from the Other area and cyanide was detected below the residential groundwater use HHSL (groundwater section below). Based on this information, lead, mercury, and cyanide are not migrating to groundwater; therefore, further evaluation of these exceedances is not necessary.

Groundwater

Tables 4-15 through 4-17 present the analytical results for the groundwater samples collected from the Other area for VOCs; SVOCs; and metals, cyanide, DRO, and GRO, respectively. Only benzene was detected in groundwater sample Other MW-2 at a concentration above its residential groundwater HHSL. No VOCs were detected in the remaining three groundwater samples collected from the Other area. No delineation to the north or east is required for this sample because the benzene was not detected in groundwater samples from Other MW-1, Other MW-3, and Other MW-4. To the south and southeast, SWMU 5 MW-10 and SWMU 5 MW-11 had no benzene detected.

Arsenic was detected above its residential groundwater HHSL in monitoring wells Other MW-2 (total arsenic) and Other MW-4 (total and dissolved arsenic). No other metals were detected above the HHSLs. Based on the lack of detection of arsenic, delineation for the arsenic detected in Other MW-2 and Other MW-4 is provided by the indicated groundwater samples in the following directions: (1) to the north and northeast, samples Other MW-1 and Other MW-3; (2) to the south and southeast, SWMU 5 MW-10 and SWMU 5 MW-11; and (3) to the east, by SWMU 7N MW-1 and SWMU 7N MW-2. Delineation to the west is not required because the concentration detected is only slightly higher than the HHSL (0.053 mg/L vs. 0.010 mg/L). The arsenic concentrations detected in Other MW-2 and Other MW-4 are less than the applicable surface water Eco-SLs, as discussed in **Section 4.5.2.6**, thus requiring no sampling for arsenic analysis of the unnamed tributary to Mill Creek related to this area.

Delineation Summary

Delineation of arsenic in soil to the west of samples Other #4 and Other MW-2 beyond the railroad track ballast material is insufficient. Arsenic soil delineation to the north, east and west is provided by samples from the Other and SWMU 5 areas (**Figure 4-7**). Groundwater delineation is provided by samples from the Other area to the north, samples from SWMU 5 to the south, and samples from SWMU 7N to the east, beyond the unnamed tributary to Mill Creek.

4.4.3 Tank #44

Tables 4-18 and 4-19 present the soil and groundwater analytical results for the samples collected during the investigation conducted to determine the extent of impacts immediately following the Tank #44 release.

Soil

As shown on **Table 4-18**, 14 of the 38 soil samples collected exceed the soil migration to residential groundwater HHSL for benzene, and one soil sample, B-13 (10-12 ft-bgs) exceeded the soil migration to groundwater HHSL for 1,2,4-trimethylbenzene. However, several of the samples were collected from the saturated zone; therefore, the migration to residential groundwater pathway does not apply and the impacts should be evaluated by using the groundwater samples collected, described below.

Groundwater

As shown on **Table 4-19**, seven of the groundwater samples collected exceeded the residential groundwater HHSL and the residential and C/I groundwater vapor exposure HHSLs for benzene. In addition, one groundwater sample also exceeded the residential groundwater HHSL for toluene, and three groundwater samples exceeded the residential groundwater HHSL for naphthalene.

These groundwater samples were obtained from the shallow perched water interval in 2005, but the uppermost usable aquifer (approximately 20 to 30 feet deeper than the shallow saturated zone) was not impacted, based on samples collected. In addition, the 2006 groundwater samples collected from the shallow saturated zone had no exceedances; therefore, no further evaluation is necessary.

4.5 COMPARISON OF AVAILABLE ANALYTICAL DATA TO ECOLOGICAL SCREENING LEVELS

This section presents a comparison of the data collected to-date to the Eco-SLs listed in the 2005 Region 5 RCRA Ecological Screening Levels and the USEPA Ecological Soil Screening Levels (Eco-SSLs), in accordance with EPA Region 5 instructions provided during a conference call on November 7, 2013 with USEPA's project manager, Michelle Kaysen, and other USEPA technical staff. The full list of Eco-SLs is presented in **Table 4-**1. In accordance with USEPA Region 5 direction, the Eco-SLs for soil are the EPA Eco-SSLs if available or the EPA Region 5 ESLs otherwise. These Eco-SLs are conservative values and some of them (those for arsenic, cobalt, lead, vanadium, and zinc) were even exceeded in the background soil samples. Although exceedances of these values were found, as discussed below, no ecological impacts were observed by ERM at the time of the Site reconnaissance. The relevance of these results and the need for additional delineation will be determined once the specific media, areas, and populations of interest are defined.

The groundwater data was compared to the Eco-SLs for surface water, assuming that the groundwater would discharge to surface water at the same concentration found in the monitoring wells. This comparison is considered very conservative because it ignores the natural attenuation of the COPCs in the groundwater as the groundwater moves towards the creek.

As discussed in **Section 4.2** all of the soil samples collected during the 2010 investigation had vanadium, and 119 had zinc at concentrations above their Eco-SLs of 7.8 and 46 mg/kg, respectively. In addition, several of the soil samples collected from the LTA contained vanadium and/or zinc at concentrations above their respective Eco-SLs. Given the ubiquitous presence of vanadium, and zinc in the soil samples, an evaluation of the site-specific, regional, and/or county-wide background soil concentrations was performed. The background concentrations for vanadium and zinc were found to be 25.61 and 48.68 mg/kg, respectively, as described in **Section 4.3**.

Several soil samples had concentrations of vanadium above the calculated site-specific background concentration; however none of the sample concentrations were greater than the USGS arithmetic average concentration for United States eastern soils of 66 mg/kg. Based on this information, vanadium concentrations

are within expected background ranges; therefore, further evaluation is not necessary.

Several of the soil sample analytical results for zinc were below the analytical reporting limit but above the analytical method detection limit; therefore these values are estimated concentrations. Several soil samples had concentrations, either detections or estimated values, of zinc above the calculated site-specific background concentration. A majority of these concentrations were less than the USGS arithmetic average concentration for US eastern soils of 52 mg/kg, and all of the concentrations were within the range of background concentrations from 0 to 2,900 mg/kg. Based on this information, zinc concentrations at the Site are within expected background ranges; therefore further evaluation is not necessary.

4.5.1 Land Treatment Area (SWMU 2)

Tables 4-20 through 4-27 show the comparison of the LTA analytical data to the Eco-SLs.

4.5.1.1. Treatment Cells

Soil

One VOC (carbon disulfide) was found above the ESL in one cell and one SVOC (di-n-butylphthalate) was found above the ESL in all four cells (**Table 4-20**). Eco-SLs exceedances were found in surficial soils from all Cells for total chromium and lead. Subsurface soil samples had concentrations above the Eco-SLs for cadmium, total chromium, lead, and nickel in one cell each, and three other metals (antimony, selenium, and vanadium) were found in the subsurface soil samples above Eco-SLs concentrations in at least two of the four cells. As stated in **Section 4.5** above, the vanadium detections are related to background levels; therefore, no further evaluation of the vanadium exceedances is necessary.

Soil Pore Liquid

As shown on **Table 4-21**, the following metals were detected at concentrations above the Eco-SLs in the soil pore liquid samples: (1) antimony, barium, lead, and mercury in one of the three cells sampled; (2) vanadium in two of the three cells sampled; and (3) cadmium in all three cells sampled. Resampling of Cell #2 for antimony resulted in no detections in either of the two samples collected (**Table 4-5**). These exceedances should be evaluated based on the groundwater concentrations, described below.

LTA Groundwater

One metal (lead) was detected at concentrations greater than the Eco-SLs in all wells, with the two highest concentrations detected in the crossgradient well BR-3, indicating that the lead results were related to background concentrations (**Table 4-22**). However, lead was not detected in the samples collected between June 2003 and March 2004 (see **Table 4-23**) and, therefore, does not present a risk to ecological populations.

Mercury was detected in one of the downgradient samples (BR-4) at a concentration above the Eco-SL (Table 4-22). Additionally, an SVOC [bis(2-ethylhexyl)phthalate] had a concentration greater than the Eco-SL. These exceedances are not of concern because the samples represent groundwater located at depths of least 28 ft-bgs, which is not accessible to ecological populations.

4.5.1.2. Staging Area

Soil

Lead in one sample, zinc in two samples, and vanadium in all 16 samples analyzed were detected at concentrations above the Eco-ESLs (**Tables 4-24 to 4-26**). As indicated in **Section 4.4.1.2** for soil, vanadium and zinc concentrations appear to be related to background and not to site operations; therefore, no further evaluation of vanadium and zinc is necessary. Lead exceeded in shallow samples (0-2') and may pose a risk to ecological populations.

Shallow Saturated Zone Groundwater

Only cadmium was detected at concentrations above its Eco-SL in the April 21, 2004, but not in the August 23, 2005 sampling event (**Table 4-27**). No further evaluation is necessary.

4.5.2 2010 Investigation Areas

Tables **4-28 through 4-33** present the comparison of the analytical data collected in 2010 to the Eco-SLs.

As shown on **Table 4-30,** vanadium was above the Eco-SL for all samples collected from all investigation areas from depths ranging from "surface" to 28 ft-bgs. As stated in **Section 4.5** above, the vanadium detections are related to background levels; therefore, no further evaluation is necessary.

4.5.2.1. SWMU 5

Soil

As shown in **Table 4-28**, seven samples collected from SWMU 5 had benzene, naphthalene, and/or pyrene at concentrations greater than the Eco-SL. Four of these samples were collected within the vadose zone: SWMU 5 #7 (MW-1), SWMU 5 EN #10, SWMU 5 EN #15, and SWMU 5 ES #8 (MW-2).

With respect to the inorganics, vanadium was again detected above the Eco-SLs in all samples collected from SMWU 5. Zinc was the next metal detected more frequently, with 50 of the 102 samples collected with concentrations above the Eco-SL. As stated in **Section 4.5** above, the vanadium and zinc detections are related to background levels; therefore, no further evaluation for these two metals is necessary.

The following additional inorganics were detected at concentrations above the Eco-SLs in one to 34 samples: antimony, arsenic, total chromium, cobalt, lead, mercury, nickel, selenium, and cyanide. Of those 34 samples, only 10 of these samples were collected from the vadose zone. Samples SWMU 5 EN #15 (2-4 ft-bgs) and SWMU 5 MW-4(4-6 ft-bgs) contained the greatest number of exceedances detected in this area as well as the highest concentrations of total chromium (416 mg/kg and 493 mg/kg respectively).

Shallow Saturated Zone Groundwater

As shown on **Table 4-31**, no VOCs were detected in groundwater at concentrations above the Eco-SLs at SWMU 5. Four groundwater samples exceeded the Eco-SL for anthracene. In addition, one of these samples (SWMU 5 MW-10) exceed the Eco-SL for benzo(a)pyrene.

With respect to inorganics, total barium, total lead, total zinc, dissolved cadmium, dissolved zinc, and cyanide were detected above the Eco-SLs in one to six groundwater samples collected from SWMU 5. Dissolved barium and dissolved lead concentrations were either below the Eco-SLs or not detected; therefore, further evaluation of total barium and total lead is not necessary.

4.5.2.2. SWMU 6

Soil

As shown on **Table 4-28**, no VOCs were detected in soils at concentrations above the Eco-SLs at SWMU 6. One sample collected at a depth of 8-10 ft-bgs and below the smear zone had eight SVOCs detected at concentrations above their respective Eco-SLs. None of these exceedances are of concern for ecological populations because the sample was collected from the saturated zone.

With respect to the inorganics, vanadium was again detected above the Eco-SLs in all samples collected from SMWU 6. Zinc was the next metal detected more frequently above the Eco-SLs. As stated in **Section 4.5** above, the vanadium and zinc detections are related to background levels; therefore, no further evaluation for these two metals is necessary.

The following additional inorganics were detected in concentrations above the Eco-SLs in one to 21 samples: antimony, arsenic, total chromium, lead, mercury, and cyanide. Only 10 of these samples were collected from the vadose zone. Soil sample SWMU 6 MW-2 collected from 6-8 ft-bgs contained the second highest concentration of total chromium detected at the Site; however, this exceedance is not of concern for ecological populations because it is from the saturated zone.

Shallow Saturated Zone Groundwater

As shown on **Table 4-31**, no VOCs were detected in groundwater at SWMU 6. One groundwater sample (SWMU 6 MW-2) exceeded the Eco-SLs for anthracene, total barium, and total selenium. Because dissolved barium and dissolved selenium were not detected above the Eco-SLs in this sample, further evaluation of these exceedances is not necessary.

4.5.2.3. SWMU 7N

Soil

As shown on **Tables 4-28 and 4-29**, no VOCs or SVOCs were detected in SWMU 7N. In addition to vanadium, of the 18 samples collected from SWMU 7N, nine contained one or more of the following inorganic compounds at concentrations greater than their respective Eco-SLs: arsenic, barium, total chromium, cobalt, lead, selenium, zinc, and/or cyanide. Only three of these samples were collected from the vadose zone.

Shallow Saturated Zone Groundwater

As shown on **Tables 4-31 and 4-32**, no VOCs or SVOCs were detected in groundwater at SWMU 7N. With the exception of MW-2 all of the groundwater samples collected from SWMU 7N contained total barium at concentrations greater than its Eco-SL. In addition, cyanide was detected in MW-3 at a concentration greater than its Eco-SL.

4.5.2.4. SWMU 7S

Soil

As shown in **Table 4-28** one sample, and it's duplicate, collected below the smear zone had benzene, ethylbenzene, toluene, xylene, and naphthalene at concentrations greater than the Eco-SL (SWMU 7S #5 [MW-5]).

In addition to vanadium detected in all samples collected from the Site (below background concentrations, as stated in **Section 4.5**), one sample contained lead and a second sample contained lead and arsenic at concentrations above their respective Eco-SLs. Neither of these two exceedances are of concern for ecological populations because they were deep samples from the saturated zone. Zinc was also detected above its Eco-SL in six samples collected from SWMU 7S. Only one of these samples was collected from the vadose zone (SWMU 7S #4 (MW-4).

Shallow Saturated Zone Groundwater

As shown on **Table 4-32**, no SVOCs were detected in groundwater at SWMU 7S. One groundwater sample collected from SWMU 7S (MW-5) contained xylene (total) at a concentration greater than its Eco-SL. Groundwater sample SWMU 7 MW-1 contained total lead and dissolved nickel at concentrations greater than their respective Eco-SLs. Dissolved lead was not detected; therefore, further evaluation of the total lead exceedance is not necessary.

4.5.2.5. AOC 2

Soil

No VOCs or SVOCs were detected in AOC 2 (**Tables 4-28 and 4-29**). One sample collected at a depth of 18-20 ft-bgs and one collected at a depth of 4-6 ft-bgs, both from below the smear zone, had cobalt and arsenic, respectively, at a concentration slightly above the Eco-SL. Neither of these two exceedances are of concern for ecological populations because they were too deep and/or from the saturated zone. Lead was detected slightly above the Eco-SL in all surface soil samples collected from AOC 2, with the highest detected concentration at 14.7 mg/kg vs. the Eco-SL of 11 mg/kg.

Shallow Saturated Zone Groundwater

There were no detections of VOCs or SVOCs in the AOC 2 samples. Two samples exceeded the Eco-SLs for total barium.

4.5.2.6. Other

Soil

As shown on **Table 4-28**, one soil sample collected below the smear zone had benzene at a concentration greater than the Eco-SL [Other MW-1 (4-6)]. Sample Other MW-2 (2-4), collected within the vadose zone, had both benzene and total xylene concentrations above the Eco-SLs. Sample Other #4 N (2-4), collected within the vadose zone, had chrysene, naphthalene, and pyrene above their respective Eco-SLs (**Table 4-29**).

With respect to the inorganics, vanadium was again detected above the Eco-SLs in all samples collected from the Other area. Zinc was the next metal detected more frequently above the Eco-SLs. The following additional inorganics were detected at concentrations above the Eco-SLs in one to five samples: arsenic, barium, cadmium, total chromium, cobalt, mercury, nickel, selenium, and cyanide. Several of these exceedances occurred in samples collected below the smear zone. The three samples with the highest arsenic concentrations [Other #3 (4-6), Other #4 N (2-4), and Other MW-2 (2-4)], also had the highest concentrations of barium, cadmium [Other #4 N (2-4) only], total chromium, cobalt, lead, mercury, nickel, selenium, vanadium, zinc, and cyanide detected in this area. All three of these samples were collected between railroad tracks; the ballast placed below the railroad ties is believed to be the source of these metals, as the soil samples collected in this area had the highest concentrations detected in 2010.

Shallow Saturated Zone Groundwater

None of the VOC Eco-SLs was exceeded in any of the four samples collected from the Other area (**Table 4-31**). Two of the four samples collected had one SVOC (anthracene) above the Eco-SLs (**Table 4-32**). As shown in **Table 4-33**, total arsenic, barium (total and dissolved), total zinc, and cyanide were detected in one to three samples at concentrations above the Eco-SLs.

4.5.3 Tank #44

Tables 4-34 and 4-35 present the comparison of the analytical data collected immediately following the Tank #44 release to the Eco-SLs.

Soil

As shown on **Table 4-34**, eleven of the soil samples collected contained benzene at concentrations greater than its Eco-SL. In addition, toluene, lead, and selenium were detected in one to six soil samples collected at concentrations greater than their respective Eco-SLs.

Shallow Saturated Zone Groundwater

As shown on **Table 4-35**, eight of the 11 groundwater samples collected had one or more of the following compounds detected at concentrations greater than their respective Eco-SLs: benzene, ethylbenzene, toluene, total xylenes, naphthalene, and total barium.

4.5.4 Evaluation of Potential for Ecological Impacts in the Unnamed Tributary to Mill Creek

Several of the groundwater samples collected adjacent to the unnamed tributary of Mill Creek during the 2010 site investigation had compounds detected above the HHSLs. Therefore, an evaluation of the potential impact of the groundwater concentrations on surface waters was performed via a comparison of the detected groundwater concentrations in wells adjacent to the creek to the Eco-SLs for groundwater (**Table 4-36**). As previously indicated, this comparison is considered very conservative because it ignores the natural attenuation of the COPCs in the groundwater as the groundwater moves towards the creek. The maximum concentrations detected in the following wells were used for the comparison:

- SWMU 5: MW-4, MW-7, and MW-11;
- SWMU 6: MW-2, MW-3, and MW-7;
- SWMU 7N: MW-1, MW-2, and MW-4;
- SWMU 7S: MW-1, MW-2, MW-4, and MW-5;
- AOC 2: MW-2, MW-3, and MW-5; and
- Other: MW-4.

As indicated in **Table 4-36,** anthracene, total and dissolved barium, dissolved cadmium, and dissolved nickel were detected above the Eco-SLs for groundwater samples collected from wells MW-2 in SWMU 6, MW-4 in Other, MW-4 in SWMU 5, and MW-1 in SWMU 7S. Further delineation of these analytes and wells towards the unnamed tributary of Mill Creek will provide the information necessary to determine if the unnamed tributary to Mill Creek may have been affected by the concentrations detected in groundwater from these areas.

4.6 SUMMARY OF PRELIMINARY DEGREE AND EXTENT OF CONTAMINATION

Based on the data evaluation presented in **Sections 4.1 to 4.3**, the following areas are of potential concern for human health: Other, SWMU 5, SWMU 6, SWMU 7N, and SWMU 7S. Delineation of concentrations above the HHSLs is required for the following compounds:

- Other: Arsenic in soil,
- SWMU 5: 1,2-Dichloroethane, arsenic, hexavalent chromium, and dissolved cadmium in groundwater.
- SWMU 6: Arsenic in groundwater.
- SWMU 7S: Benzene in groundwater.

Delineation of the Eco-Sls exceedances will be performed, if needed, once the media, areas, and populations of interest are defined.

According to the Site history presented in **Sections 2.0 and 3.0**, the property has been used for petroleum refining operations for over 64 years. PCBs were historically used in electrical transformers, but all PCB oil was removed from the transformers in 2000, as indicated in **Section 4.1.11**. Samples from the Other Transformers area did not have PCBs. There are no records of manufacture of pesticides or herbicides at the Site; however, as stated in **Section 3.3.1**, pesticides and herbicides are used at the Site for the maintenance of the golf course. A general list of herbicides is included in **Table 2-5**.

5.0 CONCEPTUAL SITE MODEL

Figure 5-1 shows the Site's CSM for both on- and off-site human and ecological populations under unrestricted conditions, i.e., except for the LTA (see **Section 3.2**), the Site may be used for residential development in the future.

The CSM was developed in accordance with the following documents:

- The Order.
- EPA's "RCRA Corrective Action Plan", May 1994.
- EPA's "Effective Use of the Project Life Cycle Conceptual Site Models", July 2011 (EPA 542-F-11-011).

As requested by EPA Region 5, the CSM was prepared to have a generic picture of the possible exposure pathways for all potential on- and off-site receptors and conservatively evaluate whether the pathways can be complete. Based on that conservatism, and given the site setting, a number of potentially complete exposure pathways were identified that will be further evaluated, some of which would likely drop off the list of pathways of concern as the investigation at the Site progresses. The CSM is a living document, and will be refined as new data are collected.

5.1 PRIMARY SOURCES AND RELEASE MECHANISMS

Section 4.0 discusses the potential sources of contamination and the results of sampling conducted to date. Based on the information presented in that section, the currently defined potential sources of impacts are as follows:

- Process and Storage Areas: Former USTs, Fire Drills, Spill of virgin distillate to Mill Creek, Unleaded gasoline spill, Tank #48, Tank #44, Diesel Spill, Sulfuric Acid Spill, Tank #26, Crude Oil Spill, Oil/Water Separator Spill, Kerosene Spill, and Historic Oil Production Wells;
- Solid Waste Disposal Areas: SWMU 5 SWMU 6, and Other; and
- Wastewater Treatment Ponds: SWMU 7N and SWMU 7S.

No data are available for some of the other areas of known spills and releases identified in 2013. Theoretical, potential release mechanisms include spills and releases from the process and storage areas, releases from surficial and buried waste in the solid waste disposal areas, and discharge to surface water from the wastewater treatment ponds. This latter release mechanism is regulated by the

State of Indiana under an NPDES permit, as described in **Section 2.12.1.2**. Most of these potential release mechanisms are not continuous (i.e., spills) or have been discontinued for several years (i.e., the LTA). Further, the concentration of COPCs from the releases investigated to date are relatively minor.

5.2 CONSTITUENTS OF POTENTIAL CONCERN

The COPCs identified to date, based on the sampling performed in 2010, the data collected between 1988 and 2005 for the LTA, and the Tank #44 data, are listed in **Table 5-1.** The list of COPCs was developed via comparison of the concentrations detected in samples of soil and groundwater to the 2013 HHSLs. **Table 5-1** also shows the physical/chemical properties of the COPCs, including molecular weight, solubility, dimensionless Henry's law constant (H'), organic carbon-water partition coefficient (Koc), diffusivity in air and water, permeability coefficient, and density, if readily available.

See **Section 4.0** for information on the distribution of the COPCs in the areas sampled. The effects of these COPS are related to their concentration, their physical-chemical properties, their potential for migration in the environment, the availability of an exposure route, and the presence of a receptor. See **Section 5.7** for a qualitative evaluation of the data collected.

5.3 AFFECTED ENVIRONMENTAL MEDIA AND SECONDARY SOURCES

Secondary sources associated with the Site (i.e., the areas that may receive the releases from the primary sources and that may impact other areas) include surface soil, subsurface soil, groundwater, and surface water, which may have been impacted by COPCs released from the primary sources via the following pathways:

- Spills or releases from the process and storage areas may have impacted surficial soils or waterways.
- Releases from surficial, subsurface, or buried wastes may have impacted subsurface soils and/or groundwater via infiltration. This includes releases from the bottom of the ponds and the Other area.
- Sporadic piped discharges from the storm water retention pond (SWMU #7S) may have impacted the unnamed tributary to Mill Creek.
- Spills identified in Section 4.1.14 may have impacted the unnamed tributary to Mill Creek as well as other waterways in the property.

5.4 MIGRATION PATHWAYS

Potential migration pathways include the following:

- Infiltration of COPCs from surficial soils to subsurface soil and from subsurface soil to groundwater. This pathway may be limited for organics by the clayey, low permeability soils found at the Site.

- Runoff to the unnamed tributary of Mill Creek or other drainage ways that reach Mill Creek. This would only apply to spills or impacted areas that do not drain to one of the Site ponds.

- Dust emissions from surficial soil. This migration pathway applies only to uncovered areas, but the areas where surficial soil impacts were detected are covered by either gravel or vegetation.

- Volatilization from surface and subsurface soils, groundwater, and surface water. Only five VOCs have been detected above the HHSLs on site, of which only one exceeds the groundwater vapor exposure HHSLs for C/I workers.

- Migration in groundwater. This is not expected to affect the on-site populations or off-site downgradient residents because (1) the city supplies the drinking water at the Site and in the area, and (2) the concentrations detected are relatively low and would likely attenuate before leaving the Site.

- Groundwater discharge to the unnamed tributary to Mill Creek and other drainage ways. This pathway may be occurring, but additional investigation between the downgradient area of some of the sampled areas and the unnamed tributary to Mill Creek is needed to assess its impacts.

- Migration in surface water from the unnamed tributary to Mill Creek and from Mill Creek to the Ohio River. No data are available to even evaluate whether the unnamed tributary to Mill Creek is impacted. Natural attenuation may reduce the concentrations with distance to levels below the Eco-SLs.

- Deposition of particulates and COPCs with high affinity for organic compounds to sediments. This migration pathway depends on the type of COPCs reaching the waterways.

The polynuclear aromatic hydrocarbons (PAHs), and some of the VOCs to a lesser extent, have a high affinity for organic carbon and would adsorb to particulates as they infiltrate into the soil, migrate in groundwater, or are transported in surface water, resulting in attenuation with distance. The VOCs detected above the HHSLs could volatilize into ambient air or indoor air from

soil, groundwater, or surface water, however, because these concentrations are low, they would likely dissipate fast in outdoor air and would not reach off-Site receptors. The heavier PAHs would tend to adsorb to soil or sediments depending on the organic carbon content of these media, thus not migrating significantly beyond the releases.

Given the low concentrations detected in the groundwater samples collected in 2010 from the investigated area closest to the south property boundary (SWMU 7S), it is unlikely that the COPCs detected in the on-site groundwater would have migrated off site. Impacted soils are located away from the property boundaries and have clean topsoil, vegetation, gravel, or pavement cover that would prevent the dispersion of COPCs in soil via wind erosion. Migration of COPCs to the different waterways on site may have occurred via runoff, direct discharge, or migration in groundwater.

5.5 EXPOSURE ROUTES

As shown on **Figure 5-1**, potential exposure routes for human populations include (1) ingestion of and dermal contact with soil, groundwater, surface water, or sediments; and (2) inhalation of COPCs volatilized from soil, groundwater, or surface water in outdoor and indoor air.

Exposure routes for ecological populations include (1) ingestion of particulates and water; (2) direct contact and absorption; (3) inhalation of COPCs volatilized from soil within burrows; and (4) terrestrial and aquatic food chain exposure.

As previously indicated, exposure only occurs if the COPCs migrate to the receptors of if there is a receptor at the location of the impacts. For example, a soil sample that has an exceedance of the residential direct contact HHSL is not a concern if there are no residents in the specific area where it was detected. This evaluation has not been completed.

5.6 RECEPTORS

5.6.1 On-Site Receptors

The Site is an operational refinery and will continue to be so in the foreseeable future. However, because there is no legal instrument to prevent construction of residences on site in the future, residents were also included in the CSM, as required by EPA. Potential on-site human receptors under current conditions include industrial workers, construction workers, and, to a lesser extent, site visitors (e.g., delivery or repair people). Relatives of plant personnel may play in the on-site golf course occasionally, but there are no soil or groundwater impacts in that area that would be a cause for concern.

Potential ecological receptors include both terrestrial and aquatic life, given the Site setup and its size.

5.6.2 Off-Site Receptors

Potential off-site human receptors include residents, susceptible populations, industrial workers, construction workers, and, to a lesser extent, site visitors (e.g., delivery or repair people). The closest susceptible population are residents immediately southeast and east of the Site, and children who may use the swimming pool and other park facilities at Brittle Bank Park, located just southwest of the southwestern-most corner of the Site, near the area where SWMU 7S is located. Because no soil impacts were found around SWMU 7S and the groundwater flow direction is to the southeast, towards the unnamed tributary to Mill Creek, it is unlikely that the COPCs detected in the groundwater in this area will affect susceptible populations in Brittle Bank Park or the residents located east of Lower New Harmony Road or southeast of SWMU-7S.

Potential ecological receptors are the same as for the on-site receptors.

5.7 POTENTIAL COMPLETE EXPOSURE PATHWAYS

This section lists the potential exposure pathways for the COPCs detected at the Site. Given the low concentrations detected to date, effects to on- and off-site human populations are expected to be low. A site visit to assess the presence of ecological populations of concern has not been performed to date, but the state records indicate that there are no susceptible ecological receptors at the Site.

5.7.1 On-Site Exposure Pathways

For purposes of performing Site data evaluation and any additional investigations under EPA Region 5's corrective action requirements, potential complete exposure pathways for on-site human population exposure may include:

- On-Site Industrial Workers: Ingestion of and dermal contact with soil, groundwater, surface water, or sediment; outdoor inhalation of air contaminated as a result of the volatilization of VOCs from soil, groundwater, or surface water or of dust emissions of COPCs; inhalation of VOCs volatilized from groundwater during potable use; and indoor inhalation of VOCs via vapor intrusion from soil and surficial groundwater.

- On-Site Future Residents under unrestricted conditions: Ingestion of and dermal contact with soil, groundwater, surface water, or sediment; outdoor inhalation of air contaminated as a result of the volatilization of VOCs from

soil, groundwater, or surface water or of dust emissions of COPCs; inhalation of VOCs volatilized from groundwater during potable use; and indoor inhalation of VOCs via vapor intrusion from soil and surficial groundwater. Given that the Site is zoned Heavy Industrial and CountryMark plans to continue using the property as a petroleum refinery, these pathways are not likely to occur, even in the future.

- On-Site Construction Workers: Incidental ingestion of and dermal contact with COPCs found in soil and in groundwater, surface water, or sediment encountered during excavation activities; and inhalation of VOCs volatilized from the soils and surficial groundwater exposed during excavation activities or from dust emissions of COPCs.

- On-Site Recreational (Golf Course) Users: Outdoor inhalation of air contaminated as a result of the volatilization of VOCs from soil, groundwater, or surface water or of dust emissions of COPCs. Given the low concentrations of COPCs detected to date, this pathway is unlikely to be of concern.

Similarly, potential complete exposure pathways for on-site ecological population exposure (both terrestrial and aquatic) may include:

- Ingestion of particulates and water containing COPCs,

- Direct contact and absorption of COPCs,

- Inhalation of COPCs volatilized from soil within burrows (terrestrial populations only), and

- Terrestrial and aquatic food chain exposure.

5.7.2 Off-Site Exposure Pathways

Potential complete exposure pathways for off-site human population exposure may include:

- Off-Site C/I Workers: Ingestion of and dermal contact with COPCs in groundwater used as a source of potable water, and inhalation during use and via vapor intrusion of VOCs present in surficial groundwater.

- Off-Site Construction Workers: Incidental ingestion of and dermal contact with COPCs in groundwater or surface water and sediments, and inhalation of VOCs volatilized from surficial groundwater during excavation activities or in surface water during construction work.

- Off-Site Residents: Ingestion of and dermal contact with COPCs during groundwater use, inhalation during groundwater use, and inhalation via vapor intrusion of VOCs volatilized from surficial groundwater.

Neither of these pathways appears to be of concern because of the low concentrations detected at the Site to date and the fact that potable water is sourced from the Ohio River.

Potential complete exposure pathways for off-site ecological population exposure (both terrestrial and aquatic) may include exposure to sediments and surface water via:

- Ingestion of particulates and water containing COPCs,
- Direct contact and absorption of COPCs, and
- Terrestrial and aquatic food chain exposure.

6.0 IMPLEMENTATION OF INTERIM/STABILIZATION MEASURES

Interim or stabilization measures have not been found to be necessary at the Site, because the concentrations of hazardous constituents detected to–date do not pose an imminent threat to human populations.

7.0 CORRECTIVE ACTION FACILITY MASTER PLAN

ERM developed a Draft Master Plan for the Site in accordance with Section VI.11.a. of the Order and the description of the expected contents of the Master Plan provided by Ms. Michelle Kaysen, EPA Region 5' s project manager, during the kick-off conference call on November 7, 2013. The Draft Master Plan is attached as **Table 7-1**.

The schedules established in the Order, as adjusted between the EPA and CountryMark and confirmed via e-mails dated December 12 and 16, 2013 from Ms. Kaysen, are listed for each activity related to the investigation, selection and implementation of corrective measures, and submittal of the Completion Report. The schedule shown in **Table 7-1**:

- Deadlines indicated as "days" in the Order are "working days" and as "years" are "calendar years",
- Collection of groundwater and soil gas samples for two quarters, and
- Delineation of the extent of contamination during the mobilization for the first quarter of groundwater and soil gas sampling.

Given that the RFI Work Plan has not been submitted or approved, the duration of the tasks past the RFI Work Plan are estimates that will likely be modified during preparation of the RFI Work Plan. As required in the Order, the Draft Master Plan will be updated quarterly upon approval by EPA Region 5.