FOURTH FIVE-YEAR REVIEW REPORT FOR PESTER REFINERY SUPERFUND SITE EL DORADO, BUTLER COUNTY, KANSAS

Prepared by

U.S. Environmental Protection Agency
Region 7
Lenexa, Kansas

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Cecilia Tapia, Division Director **Date** 3/12/14

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Attachments

LIST OF ABBREVIATIONS AND ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
KDHE	Kansas Department of Health and Environment
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
PPB	Parts per billion
PPM	Parts per million
PRP	Potentially Responsible Party
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TCLP	Toxic Characteristic Leaching Procedure
UG/KG	Micrograms per kilogram
UG/L	Micrograms per liter
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The fourth five year review of the Pester Refinery site, located north of the city of El Dorado, in Butler County, Kansas, has been completed, including a site inspection on October 23, 2013. The site includes two operable units, OU1, the soil and sludge operable unit, and OU2, the groundwater operable unit. The remedy for cleanup of OU1 was explained in a Record of Decision (ROD) signed on September 30, 1992, and included removal of the source of contamination, the sludge contained in an impoundment (burn pond), in-situ bioremediation and soil-flushing. The OU2 remedy for groundwater contamination on-site included quarterly groundwater monitoring and sediment monitoring which was described in a ROD dated September 29, 1998. The former refinery was located west of the site. The site boundary included only the burn pond, which was built by Fina Oil and Chemical Company (Fina) in 1958 in order to dispose of petroleum waste products generated by refinery operations. The pond (three inter-connected ponds) was used to store various refinery byproducts such as slop oil emulsion solids, API separator sludge and heat exchanger bundle cleaning sludge. A common practice for Fina was to ignite these wastes. An open interceptor trench was installed in the late 1950s or early 1950s to intercept seepage from the burn pond to the West Branch Walnut River. Although water was collected and pumped back to the pond, the trench occasionally overflowed or was inundated and carried contaminants into the river.

In 1977 Pester Refining Company (Pester) purchased the refinery from Fina and continued refinery operations until filing for bankruptcy in 1985. Following Pester's bankruptcy, Coastal Derby Refining Company purchased the refinery with the exception of the tract of land containing the burn pond which is still owned by Pester. In 1986, the Kansas Department of Health and Environment (KDHE) issue an Administrative Order requiring Pester to conduct a site investigation. The Pester Refinery site was placed on the National Priorities List (NPL) in 1989. A Consent Order was signed in 1990 between KDHE and responsible parties, Pester and Fina, to conduct a Remedial Investigation (RI) and Feasibility Study (FS). A subsurface interceptor trench was constructed during 1992 on the north and east sides of the burn pond to prevent the seepage of contamination from the burn pond into the river. In 1993, KDHE, Fina and Pester entered into a Consent Order for completion of the Remedial Design (RD) and Remedial Action (RA) for OU1. Fina and KDHE signed a Consent Order in 1993 for the RI/FS for OU2, the groundwater operable unit.

The RA for OU1 was initiated by Fina in 1994. In 1996, the open interceptor trench was replaced by Fina when KDHE approved the trench extension of the northwestern end of the subsurface interceptor trench. Water from the trench was treated by the water treatment system which consisted of oil/water separation and filtration and was discharged under a National Permit Discharge Elimination System (NPDES) permit.

To ensure protectiveness of the remedy, the maintenance of the site and the groundwater monitoring have been conducted by Atofina Petrochemicals, Inc. (formerly Fina), later known as Total Petrochemicals USA, Inc. and currently known as Total Petrochemicals and Refining USA, Inc.(Total). Although the bioremediation remedy demonstrated success in removing contaminants from the site, the 2001 bioremediation report indicated a decrease in the rate of contaminant removal and it was suggested by Atofina that cleanup levels might not be attainable with the bioremediation remedy. Atofina recommended an investigation for a new remedy. Atofina conducted a treatability study and pilot study and initiated the phase 2 treatability study for design admixtures for a proposed solidification remedy.

A ROD Amendment for the entire site incorporating the solidification remedy was completed June 20, 2005. Total and KDHE signed a Consent Agreement for the RD/RA of the solidification remedy on January 3, 2006. The remedial action for the solidification and soil cover was conducted and completed by Total in 2006. An inspection of the remedial action was conducted on December 5, 2006 by KDHE, the EPA and Total.

Groundwater and surface water sampling have been conducted by Total quarterly through 2006 and annually from 2007 through the present as required by the Long-Term Monitoring Plan. Site maintenance has been conducted by Total in accordance with the Operation & Maintenance Plan (O&M).

During 2007 and 2008 intermittent occurrences of phase-separated hydrocarbons (PSH) were observed on a portion of the gravel access road located at the base of the berm of the former Storm Pond and North Burn Pond in the area between piezometers P-10 and P-11. During September 2008 five observation wells, OW-1 through OW-5, were installed by Total along the berm in order to monitor fluid levels between the solidified soils within the former Storm and Burn Ponds and the interceptor trench. Total excavated the oil stained soils from the access road and placed additional gravel on the access road. A Special Waste Disposal Authorization was received for landfill disposal of the excavated soils.

A Five Year Review Report was completed by the EPA in June 2009 in which current protectiveness was deferred. An Addendum to the 2009 Five Year Review Report was issued by the EPA on February 19, 2010, to address the seepage of PSH by constructing an extension of the interceptor trench. The extension of the interceptor trench was constructed and the Interceptor Trench Modification Completion Report, January 2010, describes the work completed by Total.

The OU1 remedy at the Pester Refinery site currently protects human health and the environment. The original OU1 remedy of sludge removal and in-situ bioremediation and soil flushing was successful in remediating some of the source of the contamination. Groundwater monitoring is included in OU2 and is protective in the short term of human health and the environment. In order for OU2 to be protective in the long term, surface water and sediment samples should be collected. An Environmental Use Control (EUC) Agreement was recorded in Butler County by the Register of Deeds on November 30, 2007 and annual inspections are conducted by KDHE. Because OU1 is protective and OU2 is protective in the short term, the entire site is protective of human health and the environment in the short term.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Pester Refinery		
EPA ID: KSD000829846		
Region: 7	**State:** KS	**City/County:** El Dorado/Butler

SITE STATUS	
NPL Status: Final	
Multiple OUs? OU1, OU2	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): Catherine Barrett
Author affiliation: EPA
Review period: 6/25/2013 - 6/30/2014
Date of site inspection: 10/23/2013
Type of review: Statutory
Review number: 4
Triggering action date: 6/30/2009
Due date *(five years after triggering action date)*: 6/30/2014

Five-Year Review Summary Form (continued)

The table below is for the purpose of the summary form and associated data entry and does not replace the two tables required in Section VIII and IX by the FYR guidance. Instead, data entry in this section should match information in Section VII and IX of the FYR report.

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU2	**Issue Category:** Sampling			
	Issue: Monitor surface water and sediment			
	Recommendation: Monitor surface water and sediment			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	KDHE/EPA	N/A

To add additional issues/recommendations here, copy and paste the above table as many times as necessary to document all issues/recommendations identified in the FYR report.

Protectiveness Statement(s)

Include each individual OU protectiveness determination and statement. If you need to add more protectiveness determinations and statements for additional OUs, copy and paste the table below as many times as necessary to complete for each OU evaluated in the FYR report.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU1	Protective	
OU2	Protective in short term	

Protectiveness Statement:
OU1 is protective of human health and the environment.

Sitewide Protectiveness Statement (if applicable)

For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.

Protectiveness Determination: Protective in the short term

Addendum Due Date (if applicable):

Protectiveness Statement:
The entire site is protective of human health and the environment in the short term.

I Introduction

The Environmental Protection Agency (EPA) in cooperation with the Kansas Department of Health and Environment (KDHE) has conducted a five-year review of the Superfund remedial action implemented at the Pester Refinery site near the city of El Dorado, in Butler County, Kansas.

The five-year review report is completed pursuant to Section 121 (c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA); to Section 300.430 (f) (4) (ii) of the National Oil and Hazardous Substances Contingency Plan (NCP); and pursuant to EPA, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7 – 03B-P, Comprehensive Five-Year Review Guidance (June 2001).

The purpose of the five-year review is to ensure that the remedy at the site remains protective of human health and the environment. The five-year review report identifies any deficiencies found and provides recommendations.

This five-year review is required by statue and is implemented consistent with the CERCLA and the NCP. CERCLA Section 121 (c), as amended, states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedialaction no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP 40 CFR Part 300.430 (f) (4) (ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.*

For sites with multiple operable units, one five-year review is conducted for the combined operable units. The first five-year review for OU1 and OU2 was conducted five years from the initiation of the remedial action for OU1. The second five-year was conducted in 2004, and the third five-year review was completed in 2009. This is the fourth five-year review for the site. The triggering action for this review is the third five-year review. This five-year review addresses protectiveness for the remedies implemented at OU1 and OU2.

II Site Chronology

Table 1 Chronology of Site Events for OU1 and OU2

Event	Date
Preliminary Assessment	1980
Site Inspection	1981
Proposed to NPL	1988
Final Listing on NPL	1989
PRP Search	1989
Notice letters	1989
State Orders	1990,1993
PRP RI/FS for OU1	1992
ROD for OU1	1992
Explanation of Significant Differences (ESDs)	1993, 1998, 2000
State Consent Decree	1993
PRP RD	1994
PRP RA	1994
PRP RI/FS for OU2	1998
ROD for OU2	1998
Preliminary Close-Out Report	1998
First Five-Year Review Report	9/16/1999
Second Five-Year Review Report	9/15/2004
ROD Amendment	6/20/2005
Consent Order for RD/RA	1/3/2006
Remedial Action Report	10/2006
Remedial Action Site Inspection	12/5/2006
Operational and Functional	12/13/2006
Environmental Use Control Agreement	11/30/2007
Third Five-Year Review Report	6/30/2009
Addendum to Third Five-Year Review Report	2/10/2010
2012 and 2013 Groundwater Monitoring Reports	12/14/2012 12/18/2013
Rebound Monitoring Report and Request to Modify Groundwater Monitoring Program	12/14/2012
Well Plugging and Abandonment Work Plan	4/1/2013

III Background

Physical Characteristics

The Pester Refinery site is located on a 10-acre tract to the north and west of the city of El Dorado, in Butler County, Kansas. The site is located in the southwest quarter of Section 25, Township 25 South, Range 5 East in Butler County, Kansas. The site was originally comprised of a burn pond in which petroleum wastes were ignited as a common practice in the refinery operations. The refinery which was adjacent to and west of the site prior to its demolition was not within the site boundary. The pond was dewatered prior to initiating the remedial action for the 2006 solidification remedy. The West Branch Walnut River flows along the northern and eastern edge of the site. To the south of the burn pond is property owned by Kinder Morgan and formerly El Paso Energy Inc., previously named Coastal Refining and Marketing, Inc. (Coastal).

The site lies within the Osage Plains section, Flint Hills Upland subsection, of the Central Lowland Physiographic province. In general, the topography is characterized by flat-topped, steep-sided hills capped by chert-bearing limestone. The site is underlain by terrace and alluvial sediments of Recent Pleistocene age deposited by the West Branch Walnut River and Permian age units of the Barneston Limestone Formation. There are three aquifers beneath the site: (1) an alluvial aquifer ranging in thickness from 2 to 17 feet and consisting of clayey silts and fine sands with local gravel beds; (2) an upper bedrock limestone aquifer (Florence Limestone Member of the Barneston Limestone) consisting of thin to massively bedded fossiliferous limestone and clayey shale; and (3) a lower bedrock limestone aquifer (Florence Limestone Member of the Barnestone Limestone) consisting of limestone with interbedded chert. Calcareous shale (Oketo Shale Member) confines and separates the upper and lower bedrock aquifers.

Groundwater in the region is drawn primarily from the bedrock aquifers, the Fort Riley Limestone and Florence Limestone, with lesser amounts from the shallow alluvial aquifer because that aquifer is less commonly present. The bedrock aquifers are characterized by jointed and fractured limestone that may be confined.

The direction of groundwater flow in the alluvial aquifer at the site is generally northeast and east toward the river with the possibility of some radial flow to the south and southwest. Data suggest that the alluvial aquifer and the Fort Riley Limestone aquifer are hydraulically connected and were locally recharged by the ponds prior to the pond dewatering. Groundwater within the Fort Riley Limestone aquifer is interpreted to flow northeast and east from the former pond area with partial discharge into the West Branch Walnut River. Groundwater in the Florence Limestone aquifer is interpreted to flow eastward from the site.

Land and Resource Use

Industrial and agricultural lands surround the site. West of the site is land where the oil refinery had been located which is owned by El Paso Energy Inc. and a Santa Fe Railroad spur that serviced the refinery.

El Paso Energy Inc. currently operates a facility to the south of the site. The West Branch Walnut River fows east and south along the northern and eastern boundary of the site. Agricultural land lies to the north and east of the site across the river.

History of Contamination

The oil refinery which previously occupied the area west of the site was constructed in 1917, after the discovery of oil in El Dorado in 1915. The refinery and surrounding area were purchased by Fina Oil and Chemical Company (Fina) in 1938. The burn pond was built by Fina (later Petrochemicals, Inc. (Atofina) around the time of the refinery purchase. Fina disposed of petroleum waste products generated by normal refinery operations by running a pipe from the refinery to the burn pond. The pond was used to store various refinery byproducts such as slop oil emulsion solids, API separator sludge and heat exchanger bundle cleaning sludge. A general practice for Fina was to ignite the waste product, with the result that the waste which did not burn was discharged out of the pipe into the pond.

The site historically contained a burn pond, a stormwater pond and a smaller settling pond. The dike separating the burn pond and the larger stormwater pond was breached, resulting in an L-shaped pond. Eventually the dike between the stormwater pond and the settling pond also was breached, creating common water between all three ponds.

An open interceptor trench was installed in the late 1950s or early 1960s to intercept seepage from the burn pond to the West Branch Walnut River. The trench was excavated to the top of the weathered bedrock and sloped to the east where water was collected and pumped back to the ponds on site. Although typically effective, the trench occasionally overflowed or was inundated and carried contaminants into the river.

On January 1, 1977, Pester purchased the refinery from Fina and continued refinery operations. Pester filed for bankruptcy on February 25, 1985. Coastal Derby Refining Company (later known as Coastal Refining and Marketing, Inc.) purchased the refinery with the exception of the tract of land containing the burn pond. The tract previously occupied by the burn pond is still owned by Pester. Coastal became El Paso Merchant-Energy-Petroleum Company following the merger of El Paso Corporation and Coastal in January 2001.

Initial Response

In 1980, a preliminary assessment was performed to assess contaminants on-site and to determine if off-site migration of contaminants was occurring. It was determined that further monitoring would be warranted.

On February 28, 1986, the KDHE Administrative Order No. 86-E-16 was issued requiring Pester to conduct a site investigation of this surface impoundment, perform monitoring and submit a Burn Pond Closure Plan. Pester hired Mid West Environmental Consultants (MWEC) to conduct a site investigation which included installation of ten monitoring wells, pond sludge volume determination, soil sampling, sludge sampling and surface water sampling. The MWEC summarized their findings in a report in 1987.

The Pester Refinery site was placed on the NPL on March 31, 1989, by the EPA pursuant to the authority under CERCLA, as amended by SARA.

Following initial investigations, a Consent Order was signed with Pester, Fina and KDHE on April 19, 1990, for the responsible parties to conduct the Remedial Investigation (RI) to gather field data at the site and to conduct the Feasibility Study (FS) to evaluate alternatives for a cleanup of the site. The RI work was conducted in October 1990 including installation of five additional monitoring wells, verifying the volume of sludge, conducting a tracer test, and collection of sludge, soil, groundwater and surface water samples. The additional wells were installed in order to determine the chemical and hydraulic properties of the three aquifers beneath the site. The existing and new monitoring wells were measured for elevation and sampled for chemical parameters of volatiles, semi-volatiles and metals.

The major source of contamination at the site consisted of approximately 20,000 cubic yards of sludge in the burn pond. This material was classified as listed hazardous wastes K049, K050 and K051. The soil beneath the ponds contained most of the constituents found in the sludge at lower concentrations. The first 12 to 24 inches of soil under the ponds were oil stained as well as up to 5 feet of soil in the bottom of the alluvial aquifer between the eastern boundary of the burn pond and the river. The groundwater beneath the site was found to be impacted by the burn pond. The upper alluvial aquifer was found to contain volatile organics (including benzene, toluene and xylene) and metals. Benzene, toluene and xylene were found in the upper bedrock aquifer (Fort Riley Limestone). The lower bedrock aquifer (Florence Limestone) which is separated from the upper aquifer by a confining shale layer was not impacted by the burn pond sludge above levels of concern.

During late March 1992, a subsurface interceptor trench was constructed on the north and east sides of the burn pond between the pond and the West Branch Walnut River to prevent the seepage of contamination from the burn pond into the river in those areas. This trench extended east and south of the existing open interceptor trench. The subsurface interceptor trench was excavated into weathered bedrock and sloped to a central collection point. Appreciable thicknesses of oil that accumulated at the central collection point were periodically skimmed off of the water in the trench and disposed. Water extracted from the subsurface trench system was returned to the burn pond or discharged through the water treatment system (oil/water separation and filtration) under a National Pollutant Discharge Elimination System (NPDES) permit to the West Branch Walnut River. Since the ponds were dewatered, the water from the interceptor trench is discharged to the water treatment plant.

In December 1993, Fina and KDHE entered into a Consent Order to conduct RI/FS activities for the OU2. The Focused/Abbreviated RI for the OU2 was directed toward augmenting information on the nature and extent of groundwater contamination at the site collected during the original OU1 RI. The PRP, Fina, and their contractor, Sharp and Associates, identified the following goals for the OU2 RI: (1) to gain further understanding of the groundwater flow at the site; (2) to assess interaction between the aquifers; and (3) to define the extent of groundwater contamination. The field work for completion of the OU2 RI was conducted in June 1994. Three aquifers were defined for OU2: (1) the alluvial; (2) the upper bedrock, the Fort Riley Limestone; and (3) the lower bedrock, the Florence Limestone.

The alluvial aquifer is not considered a drinking water aquifer based on potential yield and inorganic quality. The alluvial aquifer extends from the northern edge of the site boundary east to the river and south to the site boundary. The subsurface interceptor trench constructed in 1992 serves as a barrier to groundwater contaminant migration to the river. The alluvial aquifer terminates at the river. The highest concentrations of volatile organic compounds (VOCs) were present in the alluvial aquifer. VOCs identified in the alluvial aquifer during the OU2 RI included benzene, ethylbenzene, toluene and total xylenes. Benzene was present at concentrations in excess of the maximum contaminant level (MCL). Semi-volatile organic compounds (SVOCs) identified in the alluvial aquifer included low concentrations of polycyclic aromatic hydrocarbons (PAHs), phenols, phthalates, naphthalene and methylnaphthalene. Arsenic, barium, chromium and lead were present above background concentrations in the alluvial aquifer. Separate-phase hydrocarbons were present in several wells during the OU2 RI sampling.

The upper bedrock aquifer, the Fort Riley Limestone, was locally recharged by the ponds on the site. Groundwater is interpreted as flowing north and east from the site and discharging to the West Branch Walnut River. Trace concentrations of benzene, toluene and total xylenes were detected in 1990 in a well completed in the upper bedrock aquifer upgradient of the site. No VOCs were detected in the sample collected from the upgradient well during the OU2 RI. A sample collected in 1990 from a well located downgradient of the burn pond and screened in the upper bedrock aquifer contained higher levels of benzene, toluene and total xylenes relative to the upgradient well and low levels of arsenic and barium. Subsequent downgradient samples have not contained elevated concentrations of metals or VOCs. Low concentrations of several SVOCs were detected in the upper bedrock aquifer during the 1994 OU2 RI.

The lower bedrock aquifer, the Florence Limestone, is separated from the upper bedrock aquifer by the Oketo Shale. A background sample collected in the lower bedrock aquifer in 1990 contained trace concentrations of toluene and total xylenes. No VOCs were detected above detection limits at this location during the OU2 RI. Samples collected from a well completed in the lower bedrock aquifer downgradient of the ponds contained no VOCs or SVOCs above detection limits. Arsenic and barium were detected at concentrations below the MCLs in 1994 and may reflect the naturally occurring background concentrations for these metals in the aquifer.

Surface water samples were collected from the West Branch Walnut River during the OU2 RI and analyzed for VOCs. No VOCs were present above detection limits.

Basis For Taking Action

The two main exposure pathways for the site were ingestion and direct (dermal) contact with the environmental media (groundwater, surface water, soil, sediment or sludge). As part of the OU1 RI, a risk assessment was completed in order to characterize the current and potential threats to human health and the environment that may be posed by contaminants migrating in sludge, surface soils, sediment, subsurface soils, groundwater and surface water.

Ten compounds were evaluated in the risk assessment as constituents of concern in the pond sludge at the site: xylenes, 2-methylnaphthalene, benzo(a)anthracene, chrysene, phenanthrene, pyrene, arsenic, barium, chromium and lead. Eleven constituents of concern were identified for the burn pond soils: ethylbenzene, toluene, xylenes, 2-methylnaphthalene, benzo(a)anthracene, chrysene, naphthalene, phenanthrene, phenol, pyrene and barium.

The risk characterization quantifies present and/or potential future risk to human health that may result from exposure to the contaminants of concern found at the site. The site-specific risk values are estimated by incorporating information from the toxicity and exposure assessments.

The risk assessment quantified the potential carcinogenic and noncarcinogenic risks to human health posed by contaminants of concern in several exposure media. Carcinogenic risk is presented as the incremental probability of an individual contracting some form of cancer over a lifetime as a result of exposure to the carcinogen. A risk of 1 X 10^{-6} would mean that one person in a million is in potential danger of developing cancer from the site contaminants.

In OU1 the carcinogenic risks exceeded the EPA acceptable risk range of 1 X 10^{-4} to 1 X 10^{-6} for ingestion of pond sludge by children in the residential exposure scenario. The carcinogenic risk levels associated with the incidental ingestion exposure (limited access exposure scenario) to the pond sludge and soil exceeded the departure point of 1 X 10^{-6} for multiple exposure pathways. Non-carcinogenic risks did not exceed the EPA criteria.

An ecological assessment was conducted as a part of the OU1 RI/FS for the purposes of determining possible effects from contamination to the site ecological system. The ecological assessment concluded that it is unlikely that the fisheries and the wildlife and the species foraging on these fish and wildlife species, would be affected by contamination at the site under the conditions at the time.

Based on all factors, the EPA made a finding that actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the OU1 ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

The OU2 risk assessment evaluated data from the alluvial, the upper bedrock and the lower bedrock aquifers. Unacceptable potential risk could be posed if contamination from the alluvial and upper bedrock aquifers were to impact the lower bedrock aquifer. As a drinking water aquifer, the relevant and appropriate water quality standards for the lower bedrock aquifer are MCLs. Primary remediation goals for OU2 are to monitor the lower bedrock aquifer for the OU2 chemicals of concern and to prevent future human exposure to contaminated groundwater within the upper bedrock and alluvial aquifers. Additional remedial goals include preventing separate-phase hydrocarbons from entering the West Branch Walnut River and preventing water with levels of contamination above the applicable water quality standards from discharging into the West Branch Walnut River.

IV Remedial Actions

Remedial Action Objectives (RAO)

The OU1 ROD identified the following RAOs for protection of human health specific to the Soil and Sludge Operable Unit, OU1:

- 1) Remove the sludges, listed wastes K050 and K051 from the site to prevent incidental contact and ingestion of those sludges. This RAO has been fully satisfied with removal of the sludge.
- 2) Remediate the contaminated soils to achieve the risk-based cleanup level of 13 mg/kg for carcinogenic PAHs that corresponds to a total excess cancer risk of greater than 1 X 10^{-6} via the ingestion pathway as determined by the baseline risk assessment. Despite the cleanup levels modified in the Evaluation of Significant

Differences (ESD) 3, this RAO was determined to not be fully achievable via implementation of the previously selected bioremediation remedy.

- 3) Remove the sludge and soil contamination as a source of groundwater contamination. This RAO was partially satisfied with removal of the sludge; however, given the inability to successfully complete bioremediation, residual contaminated soil remained in place as a potential source of groundwater contamination.

Solidification and containment of contaminants of concern (COCs) were proposed in the ROD Amendment as an additional remedial action to manage the risk associated with the COCs remaining in the contaminated soils. It is recognized that such risk-based, pathway elimination, containment strategies will not reduce the total concentration of PAHs and metals but would essentially prevent direct contact with them. RAOs state what the cleanup will accomplish in terms of what contamination will remain when restoration is complete. The RAOs confirm that either the contaminants will be removed or actions will be taken to protect human health and the environment from any risks posed by any contaminants that remain. For protection of human health and the environment revision of the RAOs for OU1 in the ROD Amendment is a follows:

- 1) Prevent direct contact with COCs by all affected exposure routes that would result in a total excess cancer risk of greater than $1X\ 10^{-5}$ for individual compounds, a total cumulative excess cancer risk of greater than $1\ X\ 10^{-4}$ and a total cumulative hazard index (HI) greater than 1.0.
- 2) Solidify and contain residual contaminated soils to prevent further degradation of groundwater in the alluvial and bedrock aquifers, thereby preventing adverse impact to other environmental media (i.e., sediment/surface water in the West Branch Walnut River).
- 3) Maintain the containment cover to prevent any exposure to contaminated soils, migration of contaminants to the surface and adverse impact to other environmental media.
- 4) Establish and implement a long-term monitoring plan and formal institutional controls for the site to verify the effectiveness of remedy implementation (i.e., on-going decline of COC concentrations in groundwater or other impacted environmental media) for as long as hazardous substances, pollutants or contaminants remain at the site.
- 5) Manage any waste residues (e.g., burn pond related separate-phase liquid waste) generated during solidification and pond closure activities in a manner consistent with ARARs.

Since mitigation of the risks posed to human health and the environment by the burn pond would only be achieved through successful remedy implementation of both OU1 and OU2, the OU2 RAOs were reestablished in the ROD Amendment as follows:

- 1) Reduce contamination in environmental media with completed exposure pathways such that the cumulative HI is less than 1 and the cumulative excess lifetime cancer risk is less than $1\ X\ 10^{-4}$.
- 2) Protect the Florence Limestone bedrock drinking water aquifer from becoming contaminated in excess of maximum contaminant levels (MCLs). As established by EPA, MCLs are the highest level of a contaminant that is allowed

in drinking water. For arsenic the standard is 0.010 milligrams per liter (mg/L).

- 3) Prevent separate-phase hydrocarbons from entering the West Branch Walnut River.
- 4) Prevent water with levels of contamination above the applicable water quality standards from discharging into the West Branch Walnut River. Applicable water quality standards were not clearly identified in the OU2 ROD. Since that time based upon existing regulation and pertinent guidance, a list of selected surface water quality standards has been developed for point of compliance assessment purposes.

The OU1 and OU2 RAOs are combined in the ROD Amendment. The OU2 RAOs were considered during development of the long-term monitoring plan and the institutional controls for the site. Implementation of the long-term monitoring plan will be the means by which it will be determined if those remedial actions taken remain protective of human health and the environment.

Remedy Selection

The OU1 ROD was issued on September 30, 1992. The remedy specified in the ROD for OU1 included excavation of sludge from the three interconnected ponds; dewatering of the sludge and shipment of the sludge to a permitted Resource Conservation and Recovery Act (RCRA) treatment, storage and disposal (TSD) facility; processing of sludge into petroleum product at an off-site refinery and in-situ flushing and bioremediation of the contaminated soils in the ponds.

After the ROD was finalized, it was determined that there were no available refineries at that time with a permit in compliance to accept off-site RCRA hazardous wastes for recycling, making the off-site transportation of sludge materials infeasible. An Explanation of Significant Differences (ESD) was written to identify changes to the ROD. The remedy was modified by the ESD to incorporate an alternative method of treating the sludge material. The modified remedy included three-phase separation of the pond sludge on site. The water phase was to be sent to the Coastal Derby wastewater treatment plant which operated under a NPDES permit. The oily phase was to be taken off-site to be recycled. The residual solids were to be further treated on-site to meet Best Demonstrated Available Technology standards to meet the land ban requirement for land disposal. The treated filter cake was then to be disposed at a RCRA-permitted TSD facility in compliance with the off-site policy. The OU1 ROD was supplemented by a second ESD completed in September 1998, which included modifications to the bioremediation system to optimize performance and cost-effectiveness. A third ESD in March 2000 modified the risk assessment to reflect the toxic equivalency factor (TEF) policy for individual carcinogenic toxicities for PAHs.

At the completion of the OU2 RI/FS, a ROD was issued September 29, 1998, for the OU2 remedy, which included groundwater monitoring and sediment monitoring. The groundwater constituents of concern as identified in the OU2 ROD include VOCs, benzene, toluene, ethylbenzene, carbon disulfide, and xylene, SVOCs, 2,4-dimethylphenol, 2-methylnaphalene, and metals, arsenic, chromium, barium and lead.

In order to achieve overall remedy permanence and site closure in a reasonable timeframe and to limit the ongoing potential for catastrophic release from the waste ponds, a ROD Amendment was signed June 20, 2005, for containment by in-situ solidification of residual contaminated soils followed by placement of a final soil cover.

Institutional controls are governed by the Environmental Use Control Agreement between the Pester Refining Company and KDHE and the Long-Term Agreement between Total Petrochemicals USA, Inc. and KDHE, which were recorded by the Butler County Register of Deeds on November 30, 2007.

Remedy Implementation

In compliance with a Consent Order, the responsible parties designed and implemented the remedial action for OU1 as set forth in the 1992 ROD and amended by the ESDs. KDHE, Fina and Pester entered into a Consent Order to complete a Remedial Design/Remedial Action (RD/RA) for OU1 in September 1993. The responsible party contractor removed and processed the sludge on site and the soil was treated by a process of in-situ soil flushing and bioremediation. A treatability study for the soil was completed in the fall of 1994. The pond sludge dredging and the removal and recycling of oil contained in the sludge began in December 1995 and continued through March 1996. The design document for the soil portion of OU1 established the organization and technical basis for the in-situ flushing and bioremediation of the pond soils. Following removal of the pond sludge, the ponds were filled with water. Any soil contaminants which were mobilized by the aqueous solution flowed to the interceptor trench for collection, treatment and reintroduction to the ponds. The subsurface interceptor trench was incorporated into the OU1 remedy to extract seepage from the ponds and maintain hydraulic control, preventing the discharge of separate-phase hydrocarbons and dissolved-phase contaminants into the adjacent river while simultaneously maintaining the water level in the aqueous bioremediation system. Treatment of the trench effluent prior to reintroduction of the effluent to the ponds also served to reduce the mass of contaminants in the ponds and seepage. The treatment process included initially pumping the water from below the oil/water interface in the interceptor trench to preclude the recirculation of separate-phase hydrocarbons, and mechanical filtration to remove suspended contaminants. After this treatment cycle, the water was discharged back into the pond cavities. Aeration of the stained soils/water mixture was provided in the northern half of the stormwater pond via surface aerators. The aeration augmented biodegradation of organic contaminants in the pond water.

Bioremediation and in-situ flushing of the pond soils were conducted in a phased approach. Phase 1 was completed and focused on remediating half of the stormwater pond while simultaneously gathering bioremediation performance data. Phase II focused on addressing the remainder of the stained soil in the ponds. Stained soils from the S1 pond and the southern half of the burn pond were dredged out and stockpiled in the southern half of the stormwater pond and the northern half of the burn pond and fed into the treatment area in the northern half of the stormwater pond to provide a continuous source of hydrocarbon material as food for microbes in the treatment area. Nutrients and other additives were added to optimize the efficiency of the biodegradation of hydrocarbon material. The aeration of the ponds, soil additions and nutrient additions, were suspended during the winter months when the temperature of the pond water precluded effective biodegradation.

The OU1 remedial action included monitoring designed to determine if the treatment process was effective. Monitoring has included collection and analysis of samples from the interceptor trench and the treated effluent to determine the effectiveness of the treatment system and the need for additional pretreatment prior to discharge back into the ponds. Soil monitoring was designed to detect the concentration levels of contaminants of concern in the soils to ensure performance standards of the system were attained. Groundwater monitoring and sediment monitoring were included in the Supplemental Remedial Action Plan in accordance with the OU2 ROD. The groundwater sampling and sediment sampling were conducted quarterly in accordance with the OU2 ROD.

In August 1996, Fina requested that KDHE allow the construction of an extension of the northwestern end of the subsurface interceptor trench at the site to replace the open interceptor trench. The open trench was subject to flooding by the West Branch Walnut River and overflowed on several occasions, releasing water into the river. KDHE approved the interim measure and the trench extension was completed.

Certain aspects of the OU1 remedy have contributed to the mitigation of groundwater contamination and have diminished the potential risk posed by that contamination. Exposure controls implemented as elements of the OU1 remedy include institutional controls in the form of a deed restriction (restrictive covenant) controlling development of the property, a fence to restrict site access, the removal of the material that served as the original source of groundwater contamination (sludge in the ponds), and the operation of the underground interceptor trench.

With the presence of the bioremediation system in the ponds and the recirculation of groundwater through the pond, alluvial aquifer and interceptor trench, it was anticipated that treatment and biodegradation and other natural attenuation processes would continue to reduce the concentration of chemicals of concern in the alluvial groundwater.

The shallow alluvial aquifer is the most significantly impacted water-bearing zone of the site, but is not used as a drinking water source in the area and does not yield sufficient water to serve as a domestic water supply. Given the maximum saturated thickness of approximately twenty feet for the combined saturated zones of the alluvial and upper bedrock aquifers that are in communication with each other, the projected maximum sustained yield of the aquifers would be insufficient to serve as a permitted domestic water supply in Kansas. In addition, the total dissolved solids content of water from the thin veneer of saturated alluvium at the upgradient edge of the site exceeds the Secondary Maximum Contaminant Limit for that parameter, suggesting that the water would be non-potable as a result of taste, odor, color or other non-aesthetic effects. The underlying upper bedrock aquifer, while significantly less impacted than the alluvial aquifer, has contained elevated concentrations of VOCs, arsenic and barium. Both the alluvial aquifer and the upper bedrock aquifer normally discharge to the West Branch Walnut River but are currently being captured by the underground interceptor trench. No chemicals of concern for the site have been detected at significant concentrations in the lower bedrock aquifer, a potential drinking water aquifer. The presence of the shale zone within the upper bedrock aquifer isolates the lower bedrock aquifer to some extent from the downward migration of contaminants present in the overlying aquifers.

The original subsurface interceptor trench was constructed during 1992 on the north and east sides of the burn pond between the pond and the West Branch Walnut River to prevent the seepage of contamination from the burn pond into the river in those areas. This trench extended east and south of the open interceptor trench. The subsurface interceptor trench was dug into weathered bedrock and sloped to a central collection point. Water extracted from the subsurface trench system at the collection point was treated by oil-water separation and mechanical filtration and discharged back to the burn pond. The open interceptor trench was replaced by Fina in August 1996 when KDHE approved the trench extension of the northwestern end of the subsurface interceptor trench. The process of extracting, treating and returning the water to the ponds for recirculation reduced the concentrations of contaminants in groundwater through oil-water separation, physical filtration, biodegradation and other natural attenuation processes.

The operation of the subsurface interceptor trench as a component of the OU1 remedy effectively prevented any off-site migration of contaminated water, and institutional controls restricted use of the site to industrial or commercial purposes prohibiting any use of the site for residential purposes. A restrictive covenant recorded and filed in Butler County runs with the land and has been binding upon Pester and its successors. The mitigative measures which are components of the OU1 remedy include institutional controls in the form of a deed restriction, a restrictive covenant controlling development of the property and a fence to restrict site access, the treatment and/or removal of the source material and the operation of the underground interceptor trench. The underground interceptor trench was constructed to prevent separate-phase hydrocarbon and dissolved-phase seeps from the ponds from reaching the river and to recirculate trench effluent to the ponds to maintain the aqueous bioremediation system.

On October 16, 1998, the aqueous bioremediation system in the northern half of the stormwater pond including eight 75-Hp surface aerators and one 20-Hp aspirating mixer used to mix the stained soils and provide oxygen for biodegradation, was shut down for the winter months. Prior to the system shut-down, the PRP contractor, Sharp and Associates, added dredged soils from the S1 pond and south burn pond to the bioremediation system.

On March 29, 1999, the bioremediation system was brought back on-line, and daily sampling of the bioremediation system was initiated on March 30, 1999. The data from the daily samples were evaluated to determine whether the system was operating efficiently. Daily parameters included heterotrophic plate count, total organic carbon, mixed liquor volatile suspended solids, nitrogen (kjeldahl), phosphorous, chemical oxygen demand, total suspended solids and on-site respirometry. The mist fence along the northern side of the stormwater pond was re-installed to intercept the mist that was generated by the surface aerators. The daily data indicated that the system efficiency began to increase during the month of May 1999. This was seen by the increase in the respirometry rate and mixed liquor volatile suspended solids. A five-day Biological Oxygen Demand analysis was conducted on some of the daily samples.

The groundwater interceptor trench continued to operate. The water from the trench was treated by the water treatment system which consisted of oil/water separation and filtration and was discharged to the West Branch Walnut River. The water treatment system began operation on February 16, 1999, and, during the months following, facilitated the dewatering of the southern half of the burn pond. During the month of July 1999, 580,150 gallons of treated water were discharged to the West Branch of the Walnut River under a NPDES permit.

The verification sampling and closure plan for the S1 pond and southern half of the burn pond was submitted by the PRP contractor, Sharp and Associates. The S1 pond and southern half of the burn pond were drained to allow for verification sampling and for the eventual site grading and final closure. Verification sampling was conducted during June 1999; however, based on the fact that the results of the analyses had shown that the concentrations of contaminants found still remained above cleanup goals, further remediation of the ponds stained soils were determined to be required.

During June 3-4, 1999, a site visit was conducted by KDHE in order to observe the verification sampling conducted by the PRP contractor, Sharp and Associates, and to collect split samples for the purpose of quality assurance/quality control oversight. Upon reviewing the analytical data, it was apparent that a good portion of the material sampled for verification testing collected from the south burn pond exceeded KDHE risk-based standards, and as a result, additional material from the south burn pond was transferred to the stormwater pond for further remediation. Sharp and Associated utilized a trackhoe with a 50-foot arm to transfer material from the south burn pond to the stormwater pond, where this material was subsequently transferred into the bioreactor. The depth of material that needed to be transferred varied over the different regions of the pond. In the locations where impacted materials were identified at subsurface depths ranging from 4 to 10 feet below grade surface, the soils overlaying these impacted materials were stockpiled on site. The stockpiled material was sampled before being used as fill material in the closure of the S1 and south burn pond.

The first five-year review report was completed in September 1999. The site was visited during October 1998 prior to the shut-down of the bioremediation system during the winter months. The temperature of 52 degrees had been the temperature at which the bioremediation system had been shown to remain active with microbes functioning as intended and providing the required level of treatment. In March 1999 a site visit was conducted at the time of re-activation of the bioremediation/soil flushing system.

In December 2002, Atofina submitted the Sediments Report which summarized the quarterly sediment sampling of the West Branch Walnut River required by the OU2 ROD and the Consent Order. The sediment samples were analyzed for VOCs, SVO Cs, arsenic, chromium and lead from October 2000 through November 2002 at upstream, adjacent and downstream locations. It was concluded by Atofina that after eight quarters of sediments sampling, there was no significant trend in metal or VOC concentrations across the site because the concentrations detected in upstream, adjacent, and downstream sediment samples over the quarterly sampling events showed fluctuations in the most contaminated to the least contaminated. Atofina determined that the site does not significantly impact the river and recommended that the sediments sampling be discontinued in 2003.

Five additional piezometers (P9 to P13) were installed around the stormwater and the north burn ponds during the second quarter 2003 sampling event. The data obtained from these additional piezometers confirmed previous interpretations. Groundwater is flowing northeast and east toward the West Branch Walnut River. In the vicinity of the river, the Florence Aquifer has a potentiometric head that is approximately 15 feet higher than either the alluvial aquifer or the Fort Riley Aquifer. During the third quarter 2003, in the vicinity of P9, W30D, and W07S (west of the site), an upward vertical gradient existed from the bedrock aquifers (Fort Riley Aquifer and Florence Aquifer) to the alluvial aquifer, The upward gradient from the Florence Aquifer in the vicinity of W30D was about two feet.

Monitoring well W39 was installed during the week of March 24, 2003, and sampled for the first time during the second quarter 2003. This well was installed on the west side of the storm pond in order to define groundwater quality upgradient of the site. Monitoring well W39 replaced upgradient well W30 which had been damaged and was abandoned.

During the weeks of April 5, 2004, and April 12, 2004, five additional monitoring wells were installed: W-39S, W-40, W-40S, W-40D, and W-41; and, W-05 was replaced with W-05R. These new wells were included in the sampling for second quarter 2004. The second quarter sampling was conducted during the week of April 19, 2004. The construction logs for the new wells were included in the second quarter 2004 monitoring report.

Sampling of the groundwater wells has been done using the EPA low-flow (minimum draw-down) groundwater sampling procedure in all of the wells. The water quality parameters pH, dissolved oxygen, conductivity, temperature, turbidity and oxidation-reduction potential (beginning in April 2004) were measured in all the wells.

The data collected during the OU1 remedy implementation indicated that the bioremediation component of the remedy was not expected to meet site remedial goals in a reasonable timeframe due to the nature of contamination and physical limitations posed by site conditions. In June 2004, Atofina collected the samples required by the phase 2 solidification treatability study investigation. The phase 2 solidification treatability study was completed. The EPA, Cincinnati, provided technical assistance with the treatability study data interpretation. The treatability study investigations confirmed the viability of the solidification/stabilization remedy for the Site.

A treatability study, a pilot study and a Phase II treatability study were conducted by the PRP, Total, in order to investigate modification of the remedy to incorporate the solidification and stabilization of soils. The previous RA involving bioremediation had reduced the mass of organic contaminants present in the soil; however, the destruction rate had decreased. Limitation of soil adsorptive capacity was identified as the primary cause of the slowing biodegradation rates. The organic contaminants remaining were tightly bound to the soils and less amenable to biological treatment. Solidification and containment of the remaining contaminated soils address residual risk posed by direct contact along with reduction in contaminant mobility. The viability of the solidification remedy was demonstrated with the treatability study of Site soils, Report on the Phase II Solidification Testing, October 2004.

A revised focused FS submitted by the PRP incorporated a remedial alternative for the solidification and stabilization of soils. A Proposed Plan was written and a ROD Amendment for the entire site was signed on June 30, 2005, including containment by in-situ solidification of residual contaminated soils followed by placement of a final soil cover. The RA work was completed in 2006 by Total. The RA Report describing the RA activities was completed in October 2006. An inspection of the site was conducted in December 2006 by Total, KDHE and the EPA.

System Operation/Operation & Maintenance (O&M)

The operation and maintenance (O&M) components of the site include groundwater and surface water monitoring and the maintenance of the site including the soil cover, the interceptor trench the water treatment system and the groundwater monitoring wells. The responsible parties are conducting the O&M activities for the site. The O&M Plan was finalized October 2, 2006. An Addendum to the O&M Plan completed in 2009 describes the modification for extension of the interceptor trench to address oil seeps along the access road.

The documents governing the monitoring are the Long-Term Monitoring Plan revised May 31, The documents governing the monitoring are the Long-Term Monitoring Plan revised May 31, 2006, and March 20, 2009, the Quality Assurance Project Plan, May 31, 2006, and the Surface Water Evaluation Plan, December 13, 2004.

The Long-Term Monitoring Plan summarizes the groundwater and surface water monitoring requirements at the site. Groundwater monitoring and surface water monitoring have been conducted by Total quarterly through 2006 and annually 2007 through the present.

MH-1, MH-2, MH-3, MH-4 and adjacent monitoring wells MW-05R, MW-31, MW-35, MW-36, P-11 and P-12 have been monitored for any measurable hydrocarbons. An oil skimmer was installed in MH-1 on July 13, 2006, to address removal of measurable hydrocarbons at that location. Two locations on the West Branch Walnut River are observed for noticeable sheen.

Residual hydrocarbons were observed in July 2007 in ruts along the access road upgradient of the trench near MH-1. The area was immediately contained and the residual hydrocarbons were removed with absorbent pads. Los Alamos Technical Associates, Inc. (LATA), the PRP contractor, was on site the week of August 20, 2007, to remove the visually impacted soils from the seep area. LATA excavated eight drums of visually impacted soil with a backhoe. The seep areas were excavated until all visually impacted soils were removed (mostly surface staining). The voids were backfilled with clean, imported gravel, approximately six inches of Quickrete concrete as a structural base for the access road, and approximately six inches of clean excavated soil. All containerized soil was stored in a contained area on site. A representative soil sample was sent to an off-site laboratory for analysis of reactivity, corrosivity, ignitability, TPH and Toxicity Characteristic Leaching Procedure. Analytical data received indicated that the containerized soil was nonhazardous. The drums were labeled with a nonhazardous waste label. A Special Waste Disposal Authorization was received for off-site landfill disposal of excavated soils. After the visually impacted soil was excavated and backfilled, Savage Construction graded the access road in order to prevent the formation of future ruts.

Residual hydrocarbons were observed at three of the monitoring well locations during the August 2008 monitoring event, which was generally consistent with observations over the previous several years. Residual hydrocarbons were observed in piezometer P-11 and groundwater monitoring well W-05R, both screened within the Alluvial/Eroded Fort Riley. Activities to address this area of the site included the installation of four observation wells in September 2008. An oil sheen was observed in upgradient monitoring well W-39S which is screened in the competent Fort Riley Limestone aquifer. This well was gauged on October 1, 2008 and a sheen was not detected at that time.

During the week of September 22, 2008, Total installed five observation wells to determine the extent of separate-phase hydrocarbons along the north and eastern berm of the solidified area. The primary objective achieved by installing the observation wells was the ability to monitor fluid levels between the solidified soils within the former storm and burn ponds and the interceptor trench. Observation well fluid level data indicated that mobile phase-separated hydrocarbons were not present at the groundwater table within the former berm. The source of the phase-separated hydrocarbons seeps observed on the access road may be either (1) residual hydrocarbons that were mobilized during the soil solidification activities conducted in 2005 and 2006, or (2) residual petroleum hydrocarbons associated with the historical presence of phase-separated hydrocarbons in the preexisting open trench that was located immediately downgradient of the seep. In addition, the occurrence of a seasonal high groundwater level due to precipitation may be a contributing factor.

Cap maintenance was conducted during the week of February 23, 2009, and work included erosion control at the northern swale near P-10, sod installation on the slope below the northern swale and slope restoration in the area of berm erosion with stockpiled soil and installed sod. Other maintenance activities included brush maintenance at observation points along the river, removal of tree limbs from the access road, removal of the site trailer and access road repair at the seep area with additional stone. The oil stained soils at the seep area were excavated prior to the placement of additional stone. Locks were installed and door repairs were made at the equipment buildings. Excavated soils were disposed in a landfill in accordance with a Special Waste Authorization.

The oil skimmer was operated on March 13, 2009, and 8 gallons of free product were removed. ARCADIS was on site on March 26, 2009 to plug and abandon observation well OW-4 (dry well) and install replacement observation well OW-4R intended to screen the water table. ARCADIS conducted cap maintenance activities on March 26, 2009 through March 31, 2009. Cap maintenance included mowing the cap and additional tree removal at the berm slope and fence line.

Annual system operations/O&M cost estimates received by KDHE from the PRP, Total, from their historical records are shown in the following table for the years 2009 through 2013. These costs include PSH collection/disposal, site maintenance and groundwater monitoring. Any other additional O&M type activity which increased the annual cost is noted.

Table 2 Annual System Operations/O&M Cost Estimates for 2009 through 2013

	2009	2010	2011	2012	2013
Cost Estimates	$37,000 (additional costs for extension trench)	$27,000	$31,000 (additional costs for treatment system and chemical removal)	$26,000	$23,000

V Progress Since the Last Five-Year Review

During the last five years the PRP, Total, has continued to maintain the site and conduct the groundwater and surface water monitoring and maintenance inspections. Annual groundwater and surface water monitoring has been conducted. Residual phase-separated hydrocarbons (PSH) have been gauged at several locations.

An area along the access road in the northwestern area of the site had shown some oil seepage and the PRP cleaned up the area and took actions to prevent seepage from re-occurring. Four observation wells were installed in September 2008 in order to monitor the area north of the solidification area. The O&M Plan was amended March 30, 2009, to include the extension of the existing subsurface interceptor trench to prevent oil seepage along the access road. The extension interceptor trench construction was completed in 2009 by Total. The Interceptor Trench Modification Completion Report was prepared by Total in January 2010.

The protectiveness statement was deferred in the June 30, 2009 Five Year Review Report until further information could be obtained. Further information was obtained by the installation by Total of the interceptor trench extension. Issue #1 in the 2009 Five Year Review Report, the PSH seepage occurring along the access road, was the reason for deferring the protectiveness determination until the extension of the interceptor trench could be completed. An Addendum to the June 30, 2009 Five-Year Review Report was issued by the EPA on February 19, 2010 incorporating the construction of the extension of the interceptor trench, completed by Total.

An extension of the existing interceptor trench was installed during the week of June 22, 2009 to address the presence of periodic surface seeps of PSH. The seeps were observed along the access road at the base of the berm between the stabilized burn pond and the interceptor trench. The trench extension is located along the south side of the access road, parallel to the interceptor trench, and immediately west of MH-01. The trench extension is keyed into the existing interceptor trench at manhole MH-05 and acts as a passive collection system. The trench extension provides for the collection of PSH in MH-06 prior to discharge of groundwater into the interceptor trench at MH-05. The installation was completed consistent with the Addendum to the Operation and Maintenance Plan – Trench Modification. The Interceptor Trench Modification Completion Report, January 2010, describes the work completed.

The trench elevation was excavated to the top of bedrock. Over the length of the trench extension, the bedrock surface is essentially flat, ranging in elevation from 1283.11 above mean sea level (amsl) at the collection point, MH-06, to an elevation of 1283.23 amsl at the west end of the trench extension.

The 180-foot long trench extension is installed along the PSH seep area, extending slightly beyond, both to the east and west. Stained soils were observed at the planned western extent of the trench extension so the trench was extended approximately 20 feet.

The trench extension was excavated to the top of bedrock, ranging in depth between approximately 4.3 feet below ground surface (BGS) at the collection point, MH-06 and approximately 6.5 feet bgs at the western end of the trench. The trench extension was backfilled with approximately 3 feet of permeable limestone gravel surrounding a 4-inch Schedule 40 polyvinylchloride (PVC) perforated pipe drain line.

A 36-inch diameter high density polyethylene (HDPE) collection sump, MH-06, was installed at the downgradient east end of the trench extension to recover PSH. The PSH collection sump drain line provides a hydraulic connection to the existing interceptor trench via the interceptor trench sump, MH-05, maintaining the water level in the collection sump, MH-06, at the base of the drain line (1,284.27 amsl).

Interceptor trench manhole, MH-05, is installed immediately west of MH-01. The interceptor trench was modified by removing the clay cover from above the permeable backfill and placing limestone gravel to an elevation of 1,284.52 feet amsl. A HDPE impermeable liner was placed on top of the permeable backfill and covered to ground surface with 2 feet of compacted clay. Care was taken during construction activities to leave the impermeable barrier, located on the downgradient side of the interceptor trench, in place and undamaged.

Stained soils excavated during installation of the extension trench were disposed of off-site. There were 147.37 tons of impacted soils which were excavated, staged on-site and then transported to Rolling Meadows Landfill, Topeka, Kansas. There soils were disposed as a non-hazardous waste in accordance with KDHE Special Waste Disposal Authorization.

The access road was repaired as required following installation of the interceptor trench extension. Disturbed areas were filled with soil, compacted and finished with crushed gravel.

Groundwater was observed entering MH-06 and flowing to MH-05 almost immediately after the interceptor trench extension construction completion. In July 2009, MH-05 and MH-06 were added to the weekly gauging program. Water levels at the trench extension have decreased by three feet since installation. Within the first several weeks, a sheen of PSH was detected. The first measurable accumulation of PSH was observed in MH-06 on August 6, 2009.

Removal of PSH began on August 25, 2009, when approximately 0.56 ft was measured in MH-06. A peristaltic pump was used to remove the PSH, which was containerized, and transferred to drums for on-site storage. Removal of PSH (10 to 30 gallons) was conducted through August 2009. On September 9, 2009, after a significant rainfall event, a thickness of 0.95 ft PSH was measured in MH-06, and 95 gallons of PSH were removed. A total of 415 gallons of PSH were recovered through November 24, 2009, when transport and off-site disposal occurred.

Interceptor trench manhole MH-01 continues to be monitored. PSH removal was conducted once at MH-01 on September 17, 2009 following modification of the interceptor trench. In addition, one gallon of PSH was removed from MH-05 on September 4, 2009. The PSH collected from MH-01 (prior to and since the interceptor trench modification) and MH-05 was consolidated and disposed with PSH collected from MH-06.

Disposal arrangements included shipping 415 gallons of PSH to Envirosolve in Tulsa, Oklahoma, then to PSC Environmental in Avalon, Texas. The PSH was shipped as a characteristic hazardous waste (D0004 and D018), and then used as an alternative fuel by PSC Environmental.

The extension trench will continue to operate passively, reducing local groundwater levels and collecting PSH as it accumulates. There have been no PSH seeps observed since the modification of the interceptor trench in June 2009. Weekly gauging will continue until PSH recovery has stabilized. At that time, a revised monitoring schedule will be considered. In addition, the O&M Plan will be revised to include trench extension maintenance requirements. At a minimum, the manual removal of PSH will be conducted when the measured thickness of PSH exceeds 0.10 ft.

Recovered PSH will continue to be containerized on-site until sufficient volumes for disposal are available. The PSH will be managed as a hazardous waste. The monthly/quarterly progress reports document PSH recovery and future disposal activities.

Annual cap mowing and maintenance was recommended in the 2009 Five Year Review Report. The mowing and maintenance of the cap has been conducted annually or more frequently by Total, during the last five years.

The 2009 Five Year Review Report questioned if any vapor intrusion was an issue downgradient from the groundwater plume. A monitoring well previously installed east of the West Branch Walnut River did not show any contamination. Residences are 2,000 to 3,000 feet downgradient and there is no contamination in the West Branch Walnut River. The institutional controls in place at the site restrict any encroachment on the site. The Environmental Use Control Ordinance was implemented in November 2007. Vapor intrusion is not an issue downgradient of the plume.

Groundwater quality has remained stable while the extension and interceptor trench system was in the non-pumping mode. This is based on the groundwater monitoring and confirmed with observation wells upgradient and side-gradient of the trench system.

When it was demonstrated that pumping groundwater from the interceptor trench was not required to remove PSH, the treatment system was dismantled in November 2011. A request to terminate the NPDES permit was submitted to KDHE in September 2012.

On December 14, 2012, Total submitted a request to modify the groundwater monitoring program as described in the existing Long-Term Monitoring Plan (LTMP). The KDHE letter of January 2, 2013 approved and provided comments on the request to modify the groundwater monitoring program. KDHE approved quarterly PSH monitoring and reporting of O&M and gauging occurrences, and continued operation of the interceptor trench in a non-pumping mode.

Well plugging and abandonment of groundwater wells were conducted by Total in accordance with the Well Plugging and Abandonment Work Plan. Plugged and abandoned wells and piezometers are: P-01, P-02, P-06, P-10, P-11, W-05R, W-30, W-33, W-39, W-07S, W-31S and W-30D. Transferred wells to Kinder Morgan (El Paso), the adjacent state-lead site, are: W-03, W-08, W-22, W-23, W-24, W-01S, W-29S, W-01D and W-29D. These monitoring wells are currently included in the monitoring program for the adjacent Kinder Morgan site. Confirmed destroyed or no longer existing are: P-03, P-04, P-05, P-07, P-08, and W-38. The well plugging and abandonment was conducted the week of April 22, 2013.

On April 4, 2013 the cap was seeded and fertilized. On April 30, 2013 tree trimming and brush removal were conducted. The access road was mowed on May 27, 2013, and the cap, berm and access road were mowed on June 24, 2013. On August 12, 2013 the access road and berm were mowed and on August 19, 2013 the south pond and west fence line near the railroad tracks were mowed. On September 9, 2013 the access road was mowed. The riverbank is inspected during the gauging events. There were no indications of sheen observed at the riverbank.

The extension trench and interceptor trench have been operated in a non-pumping mode consistent with the Rebound Monitoring Report. Quarterly gauging and collection of PSH, if present, are required to be conducted at MH-01, MH-05 and MH-06. Total is continuing to monitor the presence of PSH in the trench and at selected wells.

Pester has generator status due to the collection and disposal of PSH as a characteristic waste. Pester was classified as a Small Quantity Generator (SQG) through 2012. Weekly inspections are required for SQGs. Pester is considered a Kansas Small Quantity Generator if less than approximately 27.5 gallons of PSH is collected on a monthly basis.

VI Five-Year Review Process

Administrative Components

The Pester Refinery site five-year review process was conducted by Catherine Barrett, EPA Region 7 Remedial Project Manager and Charlotte Phillips, KDHE Project Manager, and supported by Catherine Wooster-Brown, EPA Region 7 Ecological Risk Assessor, Kelly Schumacher, EPA Region 7 Toxicologist, and Bill Pedicino, EPA Region 7 Hydrogeologist. Charlotte Phillips conducted the site inspection with Total, provided site photos and provided a review of the draft document.

This five-year review included the following activities: (1) a review of relevant documents; (2) discussions among representatives of EPA, KDHE and Total; and, (3) a site inspection on October 23, 2013.

Community Involvement

A newspaper notice will be placed in the El Dorado Times indicating the availability of the five-year review report for the public. The completed five-year review report will be available in the site information repository, the Bradford Memorial Library, 611 South Washington, El Dorado, Kansas 67042; in the EPA Superfund Division Records Center, 11201 Renner Blvd., Lenexa, Kansas 66219; and in the KDHE offices, 1000 S.W. Jackson Street, Topeka, Kansas 66612.

Document Review

The documents reviewed for the five-year review process are listed at the end of this report.

Data Review

Groundwater monitoring data and surface water monitoring data collected by the PRP, Total, over the last five years were reviewed. Historical data are included in tables at the end of this report.

The groundwater and surface water monitoring continues to be implemented by the PRP, Total. The Long-Term Monitoring Plan implemented in 2006 and revised in 2009 summarizes the plan for monitoring.

The groundwater flow patterns of the three aquifers have remained consistent with historical data. Groundwater is flowing toward the east. Groundwater in the alluvial aquifer is flowing toward the interceptor trench and the West Branch Walnut River. The lowest water levels occur in late fall and early winter, and the highest levels occur in spring and early summer. In the vicinity of the river as has been historically observed, there is an upward gradient from the Florence Limestone aquifer to the Fort Riley Limestone aquifer and upward from the Fort Riley Limestone aquifer to the alluvial aquifer and eroded top of the Fort Riley aquifer.

Groundwater sampling and surface water sampling in accordance with the Long-Term Monitoring Plan were conducted quarterly through 2006 and annually from 2007 through the present. Attachment B includes the historical groundwater monitoring data. The annual groundwater data for 2012 and 2013 are included in Attachment B.

2012 Sampling and Historic trends

Alluvial/Eroded Fort Riley

Benzene concentrations detected at 6 well locations (P-12, W-35, W-37, W-41, W-42 and W-44) exceeded the MCL/KDHE criterion (Tier 2 level) which is consistent with previous data. Concentrations of carbon disulfide, 2-4 dimethylphenol and 2-methylnaphthalene were below KDHE criteria at each of the sample locations. Arsenic concentrations detected in 8 well samples (P-12, W-35, W-36, W-39, W-40, W-41, W-42, and W-44) exceeded the MCL/ KDHE criterion.

Upgradient of the Solidified Pond

The concentrations of arsenic exceeded the MCL/KDHE criterion at wells W-39 and W-40.

Downgradient of the Solidified Pond

Benzene concentrations at P-12 and W-35 exceeded the MCL/KDHE Tier 2 criterion. Arsenic concentrations at P-12 and W-35 exceeded the MCL/KDHE Tier 2 criterion.

Side gradient of the Solidified Pond

Benzene concentrations at wells W-37 and W-41 exceeded the MCL/KDHE Tier 2 criterion. Arsenic concentrations at wells W-36 and W-41 exceeded the MCL/KDHE Tier 2 criterion.

Fort Riley Limestone Aquifer

Six monitoring wells, W-01S, W-07S, W-31S, W-36S, W-39S and W-40S, monitor the competent bedrock aquifer. No COCs were detected above limits in MW-36S, when sampled in October 2012.

Historically benzene concentrations in the 6 monitoring wells were either at the reporting limit or slightly above the reporting limit. Concentrations of carbon disulfide, 2,4-dimethylphenol and 2-methylhahphthalene were either at the reporting limit or slightly above the reporting limit.

Arsenic concentrations exceeded the MCL/KDHE criterion at W-40S in 2010.

Historic concentrations of arsenic, chromium and lead were either at the reporting limit or slightly above.

Florence Aquifer

Florence Aquifer MW-5D was sampled in October 2012 and there were no COCs detected above the reporting limits. Four monitoring wells, W-01D, W-05D, W-30D and W-40D are screened in the Florence aquifer. Arsenic concentrations exceeded the MCL at W-05D in 2010 and 2011.

2013 Sampling and Historic Trends

Alluvial/Eroded Fort Riley Unit

Benzene concentrations detected at five well locations (P-12, W-37, W-41, W-42, and W-44) exceeded the MCL/KDHE criterion (Tier 2 screening level), which is consistent with previous data. Concentrations of carbon disulfide, 2,4-dimethlyphenol and 2-methylnaphthalene were below KDHE criteria at each of the sample locations.

Arsenic concentrations detected in eight well samples (P-12, W-35, W-36, W-39, W-40, W-41, W-42, and W-44) exceeded the MCL/KDHE criterion.

Upgradient of the Solidified Pond

The concentrations of arsenic exceeded the MCL/KDHE Tier 2 criterion at well W-40. Benzene was detected at W-39 and W-40 but below the MCL/KDHE criterion.

Downgradient of the Solidified Pond

Benzene concentrations at P-12 exceeded the MCL/KDHE Tier 2 criterion. Arsenic concentrations at P-12 and W-35 exceeded the MCL/KDHE Tier 2 criterion.

Side gradient of the Solidified Pond

Benzene concentrations at wells W-42 and W-44 exceeded the MCL/KDHE Tier 2 criterion. Arsenic concentrations at wells W-42 and W-44 exceeded the MCL/KDHE criterion. Arsenic concentrations at wells W-42 and W-44 exceeded the MCL/KDHE Tier 2 criterion.

Downgradient of Interceptor Trench

Benzene concentrations at wells W-37 and W-41 exceeded the MCL/KDHE Tier 2 criterion. Arsenic concentrations at wells W-36, W-37 and W-41 exceeded the MCL/KDHE Tier 2 criterion. The groundwater quality has remained consistent following implementation of the remedy in 2006. Site-wide COC concentrations are generally stable or decreasing over time.

Fort Riley Limestone Aquifer

Arsenic concentrations at wells W-39S and W-40S exceeded the MCL/KDHE Tier 2 criterion.

Florence Aquifer

Arsenic was detected at concentrations below the MCL/KDHE criterion.

Groundwater analytical results from October 2013 were consistent with historical data. Concentrations of VOC constituents that exceed the KDHE criteria do not persist beyond the interceptor trench, with the exception of W-37 and W-41. Arsenic concentrations exceed the MCL/KDHE criterion at most sample locations. These constituents appear to be generally stable to decreasing and consistent with historical trends. Groundwater data for October 2012 and 2013 are shown in Attachment B.

Site Inspection

On October 23, 2013 a site inspection was conducted by Charlotte Phillips, KDHE Project Manager, and the PRP, Total. The purpose of the inspection was to assess the protectiveness of the remedy, including the maintenance of the site, the monitoring wells, the fence surrounding the site and the institutional controls. Site photos are included in Attachment C.

The cap showed good vegetative cover and monitoring wells and manholes were in good condition. Institutional controls (i.e., fence, signs, gates, locks) were intact. No seeps were evident north of the access road along the West Branch Walnut River. The river backwater area was filled with logs and branches from rising river water due to significant precipitation events in the area during the summer months. The Total contractor, ARCADIS, will include the spring near MH-2 and MW-2 in the regular monitoring plan to inspect for seeps, sheens or evidence of petroleum impacts to the river. KDHE recommended sampling of the water and surrounding soil and/or sediment in this area. The PRP contractor, ARCADIS, will re-grade portions of the south pond area due to low spots in the area. The north access road will be repaired near the gate because of erosion.

There has been no change in land use surrounding the site since the last five-year review. Residential development is not any nearer to the site. The refinery which occupied property to the west of the site has been demolished. The West Branch Walnut River flows along the north and east sides of the site, and agricultural land lies across the river to the east. The El Paso Energy, Inc. (El Paso), now Kinder Morgan owned facility occupies the property to the south, and public access is not allowed on this property.

VII Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

Yes.

Remedial Action Performance

The remedy of off-site removal of the source of site contamination, the pond sludge, and bioremediation and soil flushing which was selected in the OU1 ROD achieved some success in cleaning up the site. Reduction in contaminants achieved by the remedy continued over time, but the reduction in contaminants stabilized.

The PRP investigated incorporating the remedy of stabilization/solidification at the site. A phase 1 treatability study and a pilot study were completed by the PRP contractor followed by a phase 2 treatability study to investigate admixtures for the stabilization/solidification remedy. A ROD Amendment in June 2005 incorporated containment by in-situ solidification of residual contaminated soils followed by placement of a final soil cover. The PRP implemented the solidification remedy in 2006 and a site inspection was conducted in December, 2006 by Total, KDHE and the EPA. The solidification remedy has immobilized the residual soil contamination and the final soil cover will prohibit infiltration.

An area along the access road in the northwestern area of the site has shown some oil seepage and the PRP initiated plans to prevent seepage from occurring. Four observation wells were installed in September 2008 in order to monitor the area north of the solidification area. The O&M Plan was amended March 30, 2009 to include the extension of the existing subsurface interceptor trench to prevent oil seepage along the access road. The extension interceptor trench construction was completed in 2009. The Interceptor Trench Modification Completion Report was prepared by Total in January 2010.

Monitoring Activities

Groundwater monitoring and surface water monitoring have been conducted quarterly through 2006 and annually beginning in 2007 onward in accordance with the Long Term Monitoring Plan and the data are evaluated for system performance and effectiveness. The sampling and evaluation are performed by the PRP, Total. Based on the results of the groundwater monitoring, concentrations are decreasing. Groundwater and surface water monitoring should be conducted annually.

System Operations/Operation and Maintenance (O&M)

Total, is responsible for the O&M of the site. Total has maintained the site in accordance with the O&M Plan and the Long Term Monitoring Plan. An Addendum to the O&M Plan was prepared by Total which incorporated the extension of the existing subsurface interceptor trench. The extension of the interceptor trench will inhibit any further seepage of oil onto the access road and prevent any threat of movement to the adjacent West Branch Walnut River.

The O&M components of the site include the groundwater sampling and surface water sampling, gauging of the PSH, the maintenance of the cap, interceptor trench, interceptor trench extension, manholes and monitoring wells. Total has estimated the costs for O&M over the last five years as $37,000 for 2009, $27,000 for 2010, $31,000 for 2011, $26,000 for 2012 and $23,000 for 2013.

Opportunities for Optimization

System optimization is an ongoing process. Groundwater and surface water sampling frequency has been reduced from quarterly to annually. Annual groundwater sampling will continue. There were no opportunities for optimization identified as part of this five year review.

Implementation of Institutional Controls and Other Measures

The PRP, Total, continues to be responsible for the site, and there are no current or planned changes in land use at the site. A restrictive covenant was recorded and filed in Butler County on February 25, 1994, requiring that the site be used for industrial or commercial purposes and not be used or occupied for residential purposes. A new Environmental Use Control Agreement between the Pester Refining Company and KDHE has been developed, incorporating the Long Term Care Agreement between Total and KDHE. The Environmental Use Control Agreement was recorded by the Butler County Register of Deeds on November 30, 2007. The agreement restricts, prohibits or limits uses of the property. The property may not be used for residential purposes or agricultural purposes. Water wells are not allowed to be drilled, constructed or used on the property for any purpose which involves human consumption or human contact. There are to be no operations or uses on the property that will penetrate the surface cover or jeopardize the functional integrity of the protective cover. Public access is restricted.

Early Indicators of Potential Issues

Any on-site problems have been attended to in a timely manner by the PRP, Total. The interceptor trench extension was constructed as summarized in the Interceptor Trench Modification Completion Report prepared by Total in January 2010. Since this construction modification, there has not been any PSH seepage along the access road north of the solidified area.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of remedy selection still valid?

Yes.

Overview
1992 ROD

In the 1992 ROD for the Soil and Sludge Operable Unit 1 (OU1), the COCs identified in the pond sludge included xylenes, 2-methylnaphthalene, benzo(a)anthracene, chrysene, phenanthrene, pyrene, arsenic, barium, chromium and lead. The COCs identified in the soil included ethylbenzene, toluene, xylenes, 2-methylhaphthalene, benzo(a)anthracene, chrysene, naphthalene, phenanthrene, phenol, pyrene and barium. The selected remedy entailed 1) removal of the contaminated sludge from the burn ponds; 2) in-situ treatment of the contaminated soils by flushing and bioremediation; and 3) collection and treatment of oily seepage and water from the interceptor trench. The soils were to be treated until the total levels of the carcinogenic polycyclic aromatic hydrocarbons (PAHs) were reduced to 13 mg/kg.

1998 ROD

In the 1998 ROD for the Groundwater Operable Unit 2 (OU2), the chemicals of potential concern (COPCs) identified in the site groundwater included acenaphthene, arsenic barium, benzene, carbon disulfide, chromium, dibenzofuran, dimethyl phthalate, 2,4-dimethylphenol, ethylbenzene, fluorine, lead, 2-methylhaphthalene, naphthalene, phenanthrene, phenol, toluene and xylene. Three groundwater aquifers were examined, with higher levels of contaminants found in the alluvial aquifer, compared to lower levels in the two bedrock aquifers. The total excess lifetime cancer risk for future on-site workers exposed to contaminants in the alluvial aquifer via ingestion, dermal contact, and inhalation of volatiles during showering was 1×10^{-4}. The selected remedy was no action, other than mitigative measures previously implemented as part of the OU1 ROD. These measures included institutional controls in the form of a deed restriction and a fence. The 1998 ROD also required groundwater monitoring and sediment sampling. Finally, the 1998 ROD states that, although not required for the protection of human health and the environment, KDHE requested that the property owner amend the deed restriction to prevent installation of water wells for purposes other than remediation. This deed restriction can only be removed with the consent of KDHE.

2000 Explanation of Significant Differences (ESD) 3

In 2000, the risk-based cleanup goal of 13 mg/kg total PAHs was modified to include cleanup goals for each PAH based on the toxicity value for benzo(a)pyrene. Table 3 below indicates the cleanup goals specified in the 2000 ESD 3, as well as the current industrial soil screening levels for these compounds. These values are taken from the EPA Regional Screening Level Tables, and are based on an excess individual lifetime cancer risk of 1 X 10^{-6}. The cleanup goals provided in the ESD 3 were compared to the Regional Screening Levels to calculate the cancer risk using current toxicity and exposure values (see Table below).

Table 3 Soil Cleanup Goals for Carcinogenic PAHs

Contaminant	ESD 3 Cleanup Goal (mg/kg)	EPA Regional Industrial Soil Screening Level (mg/kg)	Cleanup Goal Cancer Risk
Benzo(a) pyrene	2.6	0.21	1.2E-05
Benzo(a)anthracene	26	2.1	1.2E-05
Benzo(b)fluoranthene	26	2.1	1.2E-05
Benzo(k)fluoranthene	260	21	1.2E-05
Chrysene	2600	210	1.2E-05
Dibenz(a,h)anthracene	2.6	0.21	1.2E-05
Indeno(1,2,3-cd)pyrene	26	2.1	1.2E-05

2005 Amendment to the ROD

Although in-situ bioremediation decreased the levels of contaminants in the soils, it was determined that this method was not expected to meet the risk-based cleanup goals. The levels of the PAHs, particularly benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and dibenz(a,h)anthracene, were not expected to reach the cleanup goals. Additionally, the concentrations of arsenic and lead in soils had increased above risk-based screening levels due to bioremediation-induced metals enrichment. Therefore, in the 2005 ROD Amendment, in-situ soil solidification followed by placement of a final soil cover was selected as the amended remedy. Because contaminated soils will remain on the site, institutional and engineering controls are to remain indefinitely. These include: 1) restriction of land use to industrial/commercial only; 2) formal deed restriction to prohibit any excavation activities; 3) formal deed restriction to prohibit installation of any wells for potable water use; 4) maintenance of the fence; 5) maintenance and care of the soil cover, and; 6) groundwater and surface water monitoring.

Changes in Standards and "To Be Considered" Requirements

- Have there been changes to risk-based cleanup levels or standards identified as Applicable or Relevant and Appropriate Requirements (ARARs) in the ROD that call into question the protectiveness of the remedy?

Human Health Risk

As stated in the overview above, the risk-based cleanup level of 13 mg/kg total PAHs identified in the 1992 ROD for the Soil and Sludge OU1 was modified in the 2000 ESD 3. New cleanup levels were developed for the individual PAHs for an excess individual lifetime cancer risk of 1 X 10^{-5}, based on the toxicity equivalence to benzo(a)pyrene. These new values are included above in the table. Since then, there have been several slight changes in exposure assumptions. Incorporating those changes results in the industrial soil screening levels presented in the table above, which were based on an excess individual lifetime cancer risk of 1 X 10^{-6}. Although age-dependent adjustment factors (ADAFs) are now used to assess cancer risk estimates to residential receptors, as specified in the EPA's 2005 "Guidelines for Carcinogen Risk Assessment" and the "Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens," we are only concerned with the industrial/commercial receptor at the Pester Burn Pond site. Based on current assumptions, the risk-based cleanup values identified in ESD 3 still fall within the EPA's target cancer risk range of 10^{-6} to 10^{-4}. Further, the amended remedy prevents contact with the PAHs in soil, so the remedy is protective of human health.

Eco-Risk

The EPA received an Ecological Assessment Report for the Pester Site in 1991. At that time, the EPA had limited ecological risk assessment guidance and limited ecological soil/sediment screening levels. In 1998, the EPA published Ecological Risk Assessment Guidance for Superfund. Further, the EPA now has final ecological screening level documents for some contaminants. However, after a thorough review of parts or all of the documents listed in Attachment 1, the EPA's ecological risk assessors agree with the 1991 Ecological Assessment Report which suggested the removal of the sludge ponds and solidification of contaminated soil would help prevent future exposure of wildlife to COCs. Both of these remedies were completed at the site by 2006. Although sediment and surface water data does not suggest a risk to aquatic life, there is still some concern that contaminated groundwater seeps may flow into the West Branch of the Walnut River. Since residual hydrocarbons were observed in July 2007 in ruts along the access road upgradient of the trench near MH-1, continued sediment collection at the same time and sites where surface water is collected (SW-1, SW-2, SW-3 and SW-4) is recommended.

- Are there newly promulgated standards that call into question the protectiveness of the remedy?

  There are no newly promulgated standards that call into question the protectiveness of the remedy currently in place.

- Have TBCs used in selecting cleanup levels at the site changed in a way that could affect the protectiveness of the remedy?

  For chemicals with no established EPA Maximum Contaminant Level (MCL), Kansas Tier 2 Groundwater Pathway values were used as TBCs to evaluate groundwater concentrations detected. Tables 2, 3 and 4 in Attachment B summarize the groundwater data. A MCL is not available for 2,4-dimethylphenol and the KDHE Tier 2 screening level is 1860 ug/L. The EPA tap water RSL for 2,4-dimethylphenol based on a non-cancer hazard quotient (HQ) of 1 is 270 ug/L. The highest concentration of 2,4-dimethylphenol that was detected in the alluvial aquifer exceeds the RSL as well as the KDHE screening level. A MCL is not available for 2-methylnaphalene and the KDHE Tier 2 screening level is 34.6 ug/L. The EPA tap water RSL based on a non-cancer HQ of 1 is 27 ug/L. The highest concentration of 2-methylnaphalene that was detected in the alluvial aquifer exceeds the RSL as well as the KDHE screening level. Because institutional controls prevent potable use of the alluvial groundwater on-site and the public water supply for the area is from a surface water body, we do not expect this to impact the protectiveness of the remedy.

Changes in Exposure Pathways

- Has land use or expected land use on or near the site changed (e.g., industrial to residential, commercial to residential)?

  Land use at the site is restricted to industrial/commercial, per the 2005 ROD Amendment, and we are not aware of any potential future land use changes.

- Have any human health or ecological routes of exposure or receptors changed or been newly identified (e.g., dermal contact where none previously existed, new populations or species identified on site or near the site) that could affect the protectiveness of the remedy?

  Subsurface vapor intrusion is a potential exposure pathway that has been considered for this site. According to the "OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils," assessment of the vapor intrusion pathway should be considered when buildings are located "100 feet laterally and vertically" from a subsurface vapor source. Although a few volatile compounds have been detected at concentrations slightly greater than tap water screening levels or MCLs in the groundwater monitoring wells immediately downgradient of the interceptor trench, we do not expect residential receptors to be impacted via vapor intrusion because the closest residences are located approximately 1000 to 2000 feet away from the site.

- Are there newly identified contaminants or contaminant sources?

  There are no new contaminants. Newly observed seeps were identified and were addressed with the extension of the interceptor trench.

- Are there unanticipated toxic byproducts of the remedy not previously addressed by the decision documents (e.g., byproducts not evaluated at the time of remedy selection)?

  There are no unanticipated toxic byproducts.

- Have physical site conditions or the understanding of these conditions changed in a way that could affect the protectiveness of the remedy?

  We are not aware of any other changes in physical site conditions.

Changes in Toxicity and Other Contaminant Characteristics

- Have toxicity factors for contaminants of concern at the site changed in a way that could affect the protectiveness of the remedy?

  Although the toxicity values for several of the site-related constituents have changed, they do not affect the protectiveness of the remedy.

- Have other contaminant characteristics changed in a way that could affect protectiveness of the remedy?

  Following implementation of the original remedy, concentrations of arsenic and lead in soils increased above risk-based screening levels due to bioremediation-induced metals enrichment. However, the amended remedy is protective of these changes.

Changes in Risk Assessment Methods

- Have standardized risk assessment methodologies changed in a way that could affect the protectiveness of the remedy?

  As previously stated, some of the exposure parameters used to determine cleanup goals have changed. These changes do not have a significant impact on the cleanup goals, and they do not affect the protectiveness of the remedy.

Remedial Action Objectives

The OU1 and OU2 RAOs have been combined in the 2005 ROD Amendment.

OU1

The OU1 RAOs have been partially completed as follows:

1) Removal of the sludges from the site to prevent incidental contact and ingestion of those sludges. This RAO has been completed.
2) Remediation of the contaminated soils to achieve the risk-based cleanup level of 13 mg/kg for carcinogenic PAHs that corresponds to a total excess cancer risk of greater than 1×10^{-6} via the ingestion pathway as determined by the baseline risk assessment. This RAO was determined to not be achievable by the bioremediation remedy. The cleanup levels for PAHs were modified in ESD3 to incorporate the toxic equivalency factors (TEFs).
3) Removal of the sludge and soil contamination as a source of groundwater contamination. This RAO has been addressed by the removal of sludge and the solidification and containment of contaminated soils. Some residual contaminated soil may still be a potential source of groundwater contamination.

The revision of the OU1 RAOs with the additional remedial action of solidification and containment to manage the risk associated with the COCs remaining in the contaminated soils is as follows:

1) Prevent direct contact with COCs by all affected exposure routes that would result in a total excess cancer risk of greater than 1×10^{-5} for individual compounds, a total cumulative excess cancer risk of greater than 1×10^{-4} and a total cumulative hazard index (HI) greater than 1.0.
2) Solidify and contain residual contaminated soils to prevent further degradation of groundwater in the alluvial and bedrock aquifers, thereby preventing adverse impact to other environmental media (i.e., sediment/surface water in the West Branch Walnut River).
3) Maintain the containment cover to prevent any exposure to contaminated soils, migration of contaminants to the surface and adverse impact to other environmental media.
4) Establish and implement a long-term monitoring plan and formal institutional controls for the site to verify the effectiveness of remedy implementation (i.e. on-going decline of COC concentrations in groundwater or other impacted environmental media) for as long as hazardous substances, pollutants or contaminants remain at the site.
5) Manage any waste residues (e.g., burn pond-related separate phase liquid waste)

generated during solidification and pond closure activities in a manner consistent with ARARs.

OU2

Since mitigation of the risks posed to human health and the environment by the burn pond would only be achieved through successful remedy implementation of both OU1 and OU2, the RAOs for OU2 were reestablished in the 2005 ROD Amendment as follows:

1) Reduce contamination in environmental media with completed exposure pathways such that the cumulative HI is less than 1 and the cumulative excess lifetime cancer risk is less than $1 X 10^{-4}$.
2) Protect the Florence Limestone bedrock drinking water aquifer from becoming contaminated in excess of MCLs. MCLs are the highest level of a contaminant that is allowed in drinking water. For arsenic, the standard is .010 milligrams per liter (mg/L).
3) Prevent PSH from entering the West Branch Walnut River.
4) Prevent water with levels of contamination above the applicable water quality standards from discharging into the West Branch Walnut River. Applicable water quality standards were not clearly identified in the OU2 ROD, but since that time based upon existing regulation and pertinent guidance, a list of selected surface water quality standards has been developed.

Residual Risk

The quantity of PAHs has been greatly reduced by source control, sludge removal and bioremediation activities. However, the concentrations of several PAHs in some of the contaminated soils were still too high (above the $1 X 10^{-5}$ carcinogenic risk level) to allow unrestricted contact with the soils. Due to bioremediation-induced metals enrichment, arsenic and lead were present in the contaminated soils at concentrations exceeding the established non-residential Tier 2 screening values, thereby warranting remedial action and ROD Amendment. COCs remaining in the contaminated soils have not affected the groundwater in the competent fort Riley Limestone and Florence Limestone aquifers above levels of concern. Furthermore, the presence of a vertical upward gradient from the Florence Limestone to the overlying alluvial and bedrock aquifers makes contamination of the Florence Limestone unlikely to occur via downward migration of COCs. Sediment samples have been collected to demonstrate that VOCs, SVOCs and metals from the site have not affected the sediments in the West Branch Walnut River to such a degree (do not exceed threshold effect concentrations) as to warrant remedial action. The subsurface interceptor trench and the extension trench have been effective in limiting migration of separate phase liquid waste from the alluvial and upper weathered Fort Riley Limestone to the West Branch Walnut River.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No.

- Have newly found ecological risks been found?
  No new ecological risks have been found.

An ecological assessment was completed as part of the RI/FS for the purposes of determining possible effects from contamination to the site ecological system. The ecological assessment concluded that it is unlikely that semi-aquatic or aquatic fisheries and wildlife, and species foraging on these species, would be affected by contamination at the site under the conditions at the time. Sediment sampling of the West Branch Walnut River was conducted as part of the OU2 remedy and it was concluded that contamination from the site was not contributing contamination to sediment in the river. With effective containment of soil and groundwater contamination under the in-situ solidification remedy as verified through long-term monitoring, it is anticipated that any risk of ecological exposure will be mitigated. Surface water and sediment samples should be collected to confirm this.

Natural Disaster Impacts

- Are there impacts from natural disasters (e.g., a 100-year flood)?
  We are not aware of any natural disasters that have occurred on this site.

Any Other Information That Could Call Into Question the Protectiveness of the Remedy

- Has any other information come to light which could affect the protectiveness of the remedy?
  We are not aware of any information that could call into question the protectiveness of the remedy.

Technical Assessment Summary

The physical conditions at the site have changed as the ponds have been eliminated and the remedial action for the containment and solidification of contaminated soils has been implemented. The phase 1 treatability study and the pilot study followed by the phase 2 treatability study completed by Total investigated methods for the incorporation of the solidification of soils on site. A focused FS was submitted by Total which included the proposed remedial alternative for the solidification of soils on site. A ROD Amendment for the entire site was issued in 2005 for containment by in-situ solidification of residual contaminated soils followed by placement of a final soil cover. Total completed the remedial action for the solidification of soils and placement of the soil cover during 2006. The extension of the subsurface interceptor trench completed by Total in 2009 is expected to prevent migration of PSH. The remedy of containment with in-situ solidification and soil cover is functioning to prevent exposure pathways to groundwater. Groundwater monitoring has continued to be conducted by Total annually. Institutional controls have been implemented in the form of an Environmental Use Control Agreement. The remedy protects human health and the environment.

VIII Issues

The PRP has remediated the area of PSH seepage along the access road north of the solidification remedy by excavating oil stained soils and backfilling with concrete as a structural base and clean soil and clean imported gravel. The interceptor trench extension was completed by Total in 2009. Continued monitoring for PSH has been conducted to prevent migration of PSH to the West Branch Walnut River.

The monitoring of PSH in selected manholes and monitoring wells should be continued by Total. Groundwater and surface water and sediment should continue to be monitored and the riverbank of the West Branch Walnut River should continue to be inspected for any noticeable oil sheen.

Table 4 Issues

Issue #	Issue	Affects Protectiveness Current	Affects Protectiveness Future
1	Sampling surface water and sediment	No	Yes

IX Recommendations and Follow-up Actions

- It is recommended that Total continue to sample surface water and sediment in order to monitor any seepage or migration of PSH to the West Branch Walnut River.

Table 5 Recommendations and Follow-up Actions

Issue #	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
1	Sampling surface water and sediment	PRP	KDHE/EPA	N/A

X Protectiveness Statement

The OU1 remedy included the removal of the source of contamination, the sludge in the burn pond from the site. The OU1 remedy of bioremediation and soil flushing successfully reduced some contamination at the site, but the rate of reduction of contaminants declined and it was not anticipated that the remedy would be able to meet cleanup levels in a reasonable time. Total completed a phase 1 treatability study and pilot study and a phase 2 treatability study to investigate the stabilization/solidification of the remaining contaminated soils on-site.
A ROD Amendment was written in June, 2005. Total implemented the in-situ solidification remedy and an inspection was conducted in December 2006. Groundwater and surface water monitoring continued as part of the remedy. When seepage of PSH occurred on the access road

north of the solidification remedy, Total excavated the stained soils from the access road and backfilled the area with concrete, clean soil and gravel. Observation wells OW-1 through OW-5 were installed by Total to monitor fluid levels between the solidified soils and the interceptor trench. An interceptor trench extension was constructed by Total in June 2009 to address the seepage of PSH. Institutional controls include the Environmental Use Control Agreement between the Pester Refining Company and KDHE, and the Long-Term Care Agreement between Total and KDHE. The Environmental Use Control Agreement was recorded by the Butler County Register of Deeds on November 30, 2007 and annual inspections are conducted by KDHE. The OU1 remedy is protective of human health and the environment. The OU2 remedy is protective of human health and the environment in the short term. The entire site is protective of human health and the environment in the short term. In order to be protective in the long term, surface water and sediment samples should be conducted.

XI Next Review

This is a statutory five-year review. The next five-year review for this Superfund site will be conducted in the year 2019.

Attachment A
Documents Reviewed

"Environmental Use Control Agreement" between Pester Refining Company (Grantor) and Kansas Department of Health and Environment (Grantee), Recorded November 30, 2007, Butler County, Register of Deeds, Book: 2008, Page: 6056.

"Long-Term Care Agreement Between Total Petrochemicals USA, Inc. and Kansas Department of Health and Environment," Recorded November 30, 2007, Butler County, Register of Deeds, Book: 2008, Page 6057.

"Operation & Maintenance Plan, Revised Addendum" , prepared by Total Petrochemicals USA, Inc. and ARCADIS, March 30, 2009.

"Third Five-Year Review Report, Pester Refinery, El Dorado, Kansas", prepared by EPA Region 7, June 30, 2009.

"Interceptor Trench Modification Completion Report, Pester Burn Pond Site, El Dorado, Kansas", prepared by Total Petrochemicals USA, Inc. and ARCADIS, January, 2010.

"Addendum to June 30, 2009 Five-Year Review Report, Pester Refinery, El Dorado, Kansas", prepared by EPA Region 7, February 10, 2010.

"Quarterly Progress Reports, 2012, 2013, Pester Burn Pond Site, El Dorado, Kansas", prepared by Total Petrochemicals USA, Inc. and ARCADIS and ra Ventures.

"Rebound Monitoring Report & Request to Modify Groundwater Monitoring Program, Pester Burn Pond Site, El Dorado, Kansas", prepared by Total Petrochemicals USA, Inc. and ARCADIS, December 14, 2012.

"2012 Groundwater Monitoring Report, Pester Burn Pond Site, El Dorado, Kansas", prepared by Total Petrochemicals and Refining USA, Inc. and ARCADIS, December 14, 2012.

"Well Plugging and Abandonment Work Plan, Pester Burn Pond Site, El Dorado, Kansas", prepared by Total Petrochemicals and Refining USA, Inc. and ARCADIS, April 1, 2013.

"2013 Groundwater Monitoring Report, Pester Burn Pond Site, El Dorado, Kansas", prepared by Total Petrochemicals and Refining USA, Inc. and ARCADIS, December 18, 2013.

Attachment B

Site Monitoring Data Summary Tables and Figures

Table 4. Summmary of Groundwater Analytical Data - October 2013
Pester Burn Pond Site, El Dorado, Kansas

Chemicals of Concern		Benzene	Carbon disulfide	2,4-dimethyl phenol	2-Methyl naphthalene	Dissolved Arsenic	Dissolved Chromium	Dissolved Lead
KDHE Tier 2 Screening Level		5	1660	1860	34.6	10	100	15
MCL		5	None	None	None	10	100	15
Result Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Aluvial Wells	**Sample Date**							
Upgradient Wells								
W-40	10/22/2013	3.1	<1.0	<1.9	<0.19	**16**	<5.0	<3.0
W-43	10/21/2013	1.8	<1.0	<1.9	<0.19	6.1J	2.2J	<3.0
DownGradient of Solidified Pond								
P-12	10/22/2013	**62**	15	850J	15J	**96**	<5.0	<3.0
W-31	10/23/2013	<1.0UB	3.5	0.75J	<0.19	6.7J	<5.0	<3.0
W-35	10/24/2013	1.3	<1.0	<1.9	<0.19	**49**	<5.0	<3.0
W-35 (DUP)	10/24/2013	1.5	<1.0	<1.9	<0.19	**47**	<5.0	<3.0
Side Gradient of Solidified Pond								
W-42	10/23/2013	**42**	58	1000	<4.8	**160**	3.1J	<3.0
W-44	10/22/2013	**20**	74	950J	<9.6UJ	**130**	<5.0	<3.0
Downgradient of Interceptor Trench								
W-36	10/24/2013	<1.0	<1.0	<1.9	<0.19	**17**	<5.0	<3.0
W-37	10/22/2013	**12**	<5.0	1.5J	12	**12**	<5.0	<3.0
W-41	10/23/2013	**19**	28	220	4	**42**	<5.0	<3.0
Fort Riley Limestone Aquifer								
W-36S	10/24/2013	<1.0	<1.0	<1.9	<0.19	<10	<5.0	<3.0
W-39S	10/21/2013	<1.0UB	0.17J	<1.9	<0.19	**23**	<5.0	<3.0
W-40S	10/21/2013	<1.0	<1.0	<1.9	<0.19	**50**	<5.0	<3.0
Florence Aquifer								
W-05D	10/23/2013	<1.0	0.14J	<1.9	<0.19	5.4J	<5.0	<3.0
W-40D	10/22/2013	<1.0	<1.0	<1.9	<0.19	5.9J	<5.0	<3.0

Table 4. Summmary of Groundwater Analytical Data - October 2012
Pester Burn Pond Site, El Dorado, Kansas

Chemicals of Concern		Benzene	Carbon Disulfide	2,4-Dimethyl phenol	2-Methyl naphthalene	Arsenic	Chromium	Lead
KDHE Tier 2 Screening Level		5	1660	1860	34.6	10	100	15
MCL	Sample Date	5	None	None	None	10	100	15
		(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)	(ug/L)
Alluvial Wells								
Upgradient Wells								
W-39	10/24/2012	< 1	0.15 J	< 1.9	< 0.19	**29**	< 5	1.9 J
W-40	10/24/2012	3.3	0.41 J	< 1.9	< 0.19	**12**	< 5	< 3
W-43	10/24/2012	2.4 J	< 4	< 3.8	< 0.38	6.4 J	< 5	< 3
Downgradient of Solidified Pond								
P-12	10/24/2012	**45**	33	990 J	13 J	**86**	< 5	< 3
W-31	10/25/2012	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3
W-35	10/24/2012	**16**	< 1	< 1.9	< 0.19	**32**	< 5	< 3
W-35 (DUP)	10/24/2012	**15**	< 1	< 1.9	< 0.19	**32**	< 5	< 3
Side Gradient of Solidified Pond								
W-42	10/23/2012	**25**	96	970 J	< 9.5 UJ	**130**	< 5	< 3
W-44	10/24/2012	**10**	28	480	3.7 J	**41**	< 5	< 3
Downgradient of Interceptor Trench								
W-36	10/25/2012	< 1	< 1	< 1.9	< 0.19	**18**	< 5	< 3
W-37	10/23/2012	**20**	< 2.5	< 7.8	15	9.0 J	< 5	< 3
W-41	10/23/2012	**23**	50	580	4.2	**72**	< 5	< 3
Fort Riley Limestone Aquifer								
W-36S	10/25/2012	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3
Florence Aquifer								
W-05D	10/25/2012	< 1	< 1	< 1.9	< 0.19	3.8 J	< 5	< 3

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\Aproject\TOTAL\OK0015572013\2013 CADD\2013 GWMR\20130729.PESTER F1 TOPO SURVEY AERIAL PHOTO.dwg LAYOUT: PB SAVED: 12/11/2013 4:11 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: — PLOTSTYLETABLE: — PLOTTED: 12/18/2013 1:03 PM BY: PERSCHNICK, KATHY

LEGEND

OW-*	OBSERVATION WELL LOCATION
MH-*	MANHOLE LOCATIONS
P-*	PIEZOMETER LOCATIONS
W-*	ALLUVIAL/TOP OF ERODED FT. RILEY MONITORING WELLS
W-*S	FT. RILEY MONITORING WELLS
W-*D	FLORENCE MONITORING WELLS
	SOIL BORING
	PLUGGED AND ABANDONED
SW-*	SURFACE WATER SAMPLE TRANSECT LOCATION
x	SW-* SURFACE WATER SAMPLE LOCATION STAKE
—·—·—	FENCE
——	INTERCEPTOR TRENCH

100 0 100
(FEET)

TOTAL PETROCHEMICALS
TOTAL PETROCHEMICALS USA, INC.

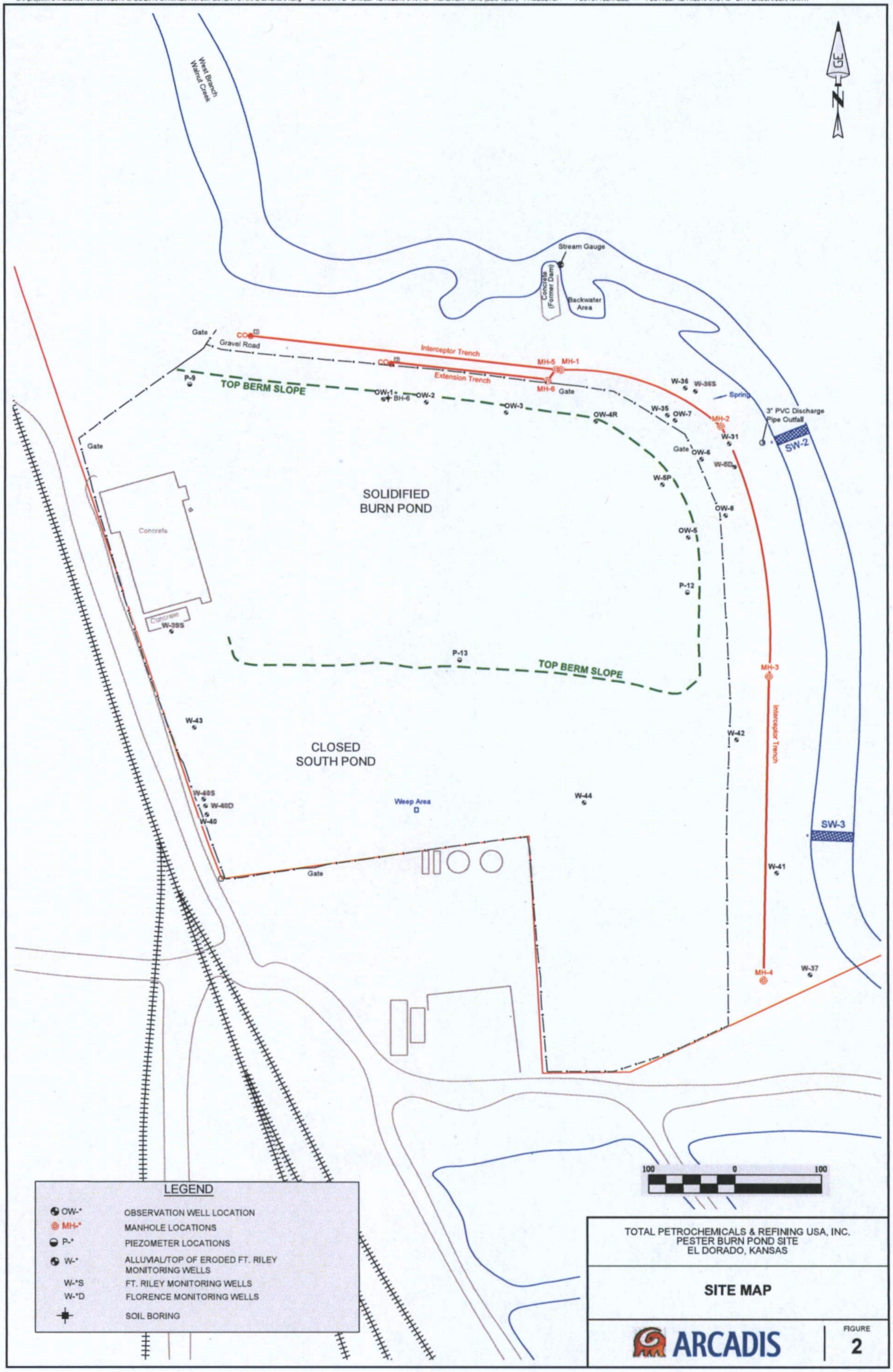
PESTER BURN POND SITE
EL DORADO, KANSAS

**TOPOGRAPHIC SURVEY
AERIAL PHOTO**

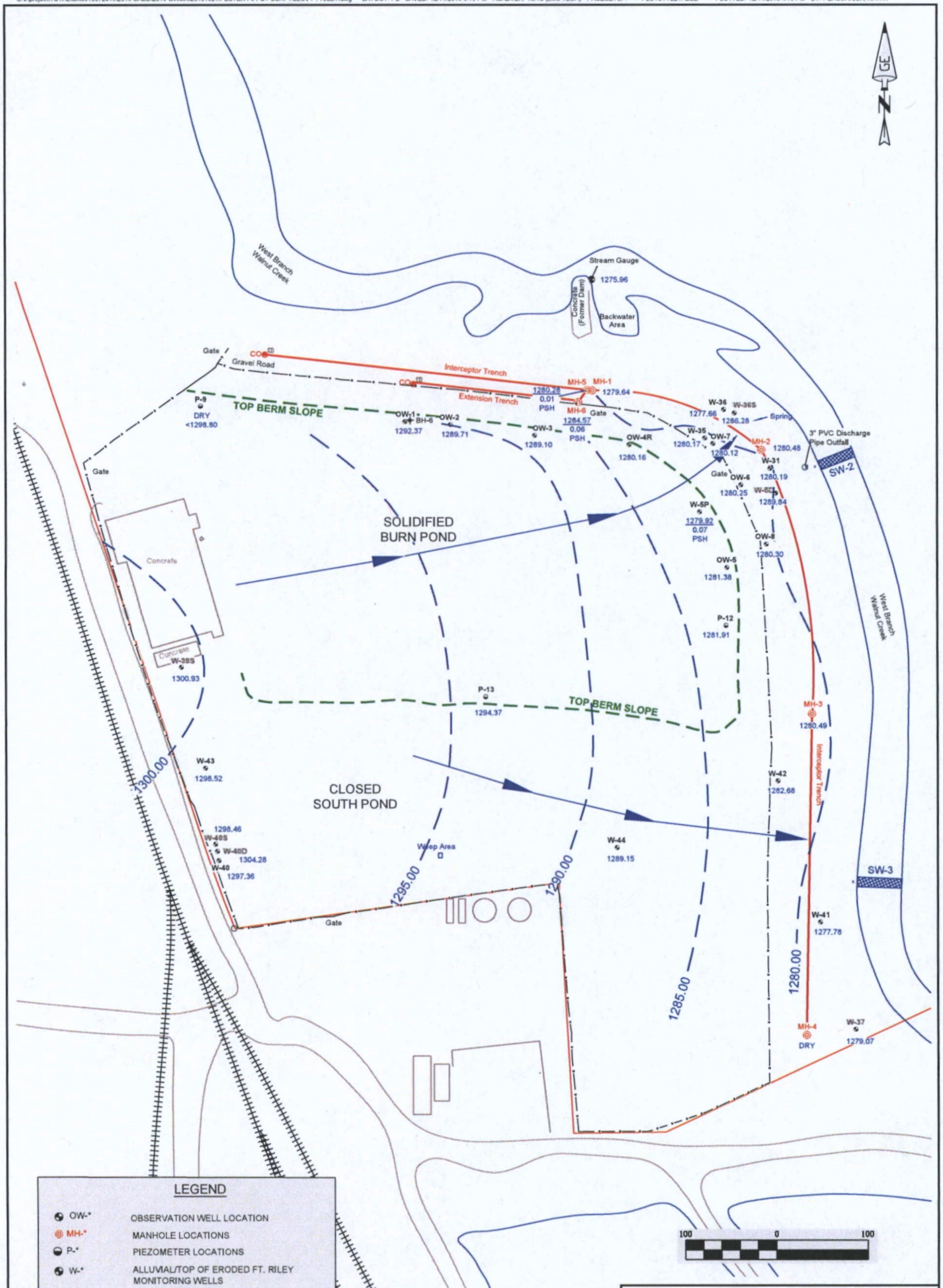
ARCADIS

FIGURE
1

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\Aproject\TOTAL\OK0015572013\2013 CADD\2013 GWMR\20130729.PESTER F2 FINAL SITE MAP.dwg LAYOUT: PB SAVED: 12/11/2013 3:19 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: — PLOTSTYLETABLE: — PLOTTED: 12/11/2013 4:12 PM BY: PERSCHNICK, KATHY



CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\Aproject\TOTAL\OK0015572013\2013 CADD\2013 GWMR\20131021.PESTER F3 POT SURF ALLUV FT RILEY.dwg LAYOUT: PB SAVED: 12/11/2013 3:19 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: — PLOTSTYLETABLE: — PLOTTED: 12/11/2013 4:13 PM BY: PERSCHNICK, KATHY

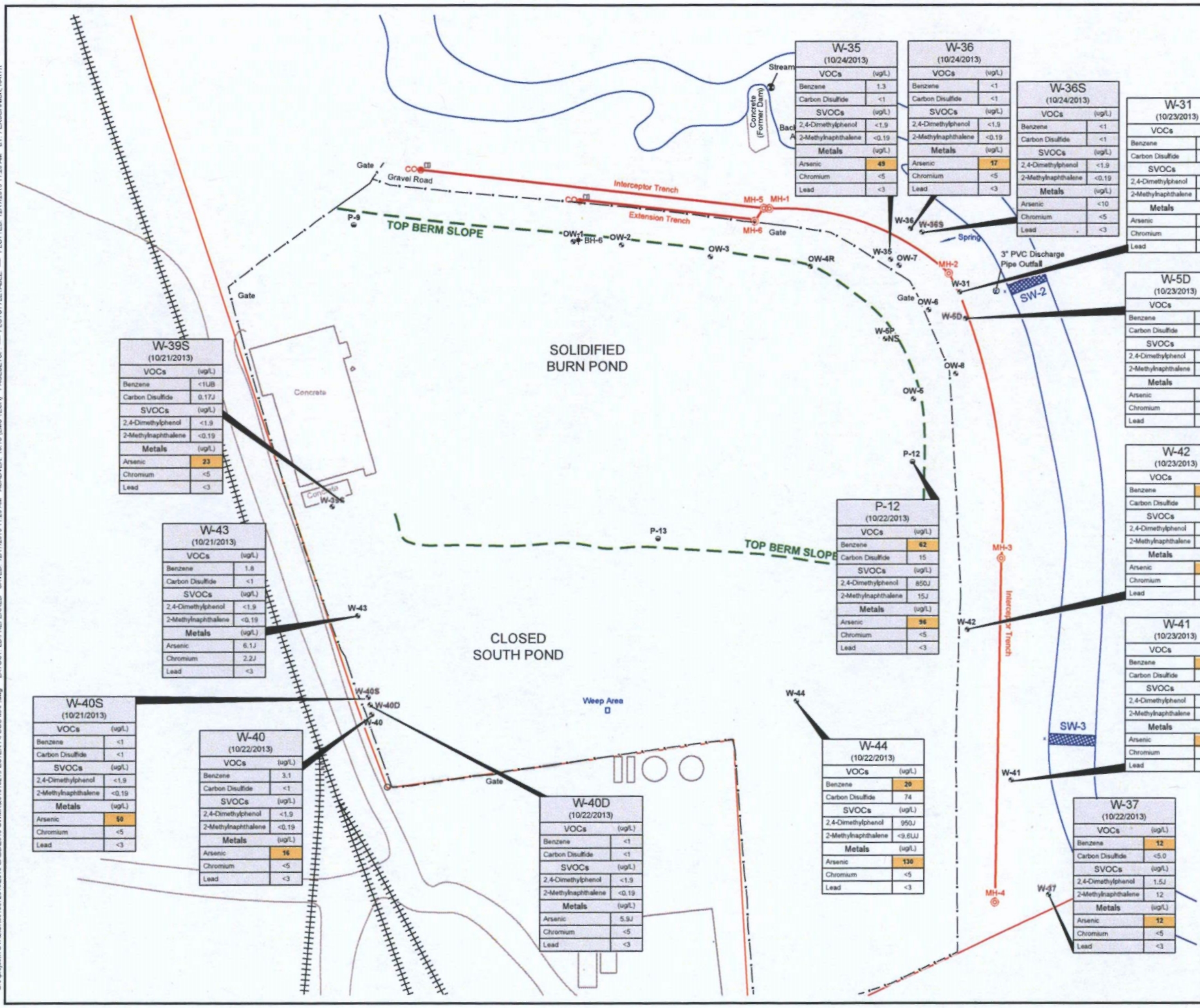


TOTAL PETROCHEMICALS & REFINING USA, INC.
PESTER BURN POND SITE
EL DORADO, KANSAS

POTENTIOMETRIC SURFACE
ALLUVIAL/ERODED FT. RILEY UNIT
OCTOBER, 21, 2013

ARCADIS

FIGURE
3



W-35 (10/24/2013)

VOCs	(ug/L)
Benzene	1.3
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	49
Chromium	<5
Lead	<3

W-36 (10/24/2013)

VOCs	(ug/L)
Benzene	<1
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	17
Chromium	<5
Lead	<3

W-36S (10/24/2013)

VOCs	(ug/L)
Benzene	<1
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	<10
Chromium	<5
Lead	<3

W-31 (10/23/2013)

VOCs	(ug/L)
Benzene	<1UB
Carbon Disulfide	3.5
SVOCs	(ug/L)
2,4-Dimethylphenol	0.75J
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	6.7J
Chromium	<5
Lead	<3

W-5D (10/23/2013)

VOCs	(ug/L)
Benzene	<1
Carbon Disulfide	0.14J
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	5.4J
Chromium	<5
Lead	<3

W-39S (10/21/2013)

VOCs	(ug/L)
Benzene	<1UB
Carbon Disulfide	0.17J
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	23
Chromium	<5
Lead	<3

P-12 (10/22/2013)

VOCs	(ug/L)
Benzene	62
Carbon Disulfide	15
SVOCs	(ug/L)
2,4-Dimethylphenol	850J
2-Methylnaphthalene	15J
Metals	(ug/L)
Arsenic	96
Chromium	<5
Lead	<3

W-42 (10/23/2013)

VOCs	(ug/L)
Benzene	42
Carbon Disulfide	58
SVOCs	(ug/L)
2,4-Dimethylphenol	1000
2-Methylnaphthalene	<4.8
Metals	(ug/L)
Arsenic	160
Chromium	3.1J
Lead	<3

W-43 (10/21/2013)

VOCs	(ug/L)
Benzene	1.8
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	6.1J
Chromium	2.2J
Lead	<3

W-41 (10/23/2013)

VOCs	(ug/L)
Benzene	19
Carbon Disulfide	28
SVOCs	(ug/L)
2,4-Dimethylphenol	220
2-Methylnaphthalene	4
Metals	(ug/L)
Arsenic	42
Chromium	<5
Lead	<3

W-40S (10/21/2013)

VOCs	(ug/L)
Benzene	<1
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	50
Chromium	<5
Lead	<3

W-40 (10/22/2013)

VOCs	(ug/L)
Benzene	3.1
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	16
Chromium	<5
Lead	<3

W-40D (10/22/2013)

VOCs	(ug/L)
Benzene	<1
Carbon Disulfide	<1
SVOCs	(ug/L)
2,4-Dimethylphenol	<1.9
2-Methylnaphthalene	<0.19
Metals	(ug/L)
Arsenic	5.9J
Chromium	<5
Lead	<3

W-44 (10/22/2013)

VOCs	(ug/L)
Benzene	20
Carbon Disulfide	74
SVOCs	(ug/L)
2,4-Dimethylphenol	950J
2-Methylnaphthalene	<9.6UJ
Metals	(ug/L)
Arsenic	130
Chromium	<5
Lead	<3

W-37 (10/22/2013)

VOCs	(ug/L)
Benzene	12
Carbon Disulfide	<5.0
SVOCs	(ug/L)
2,4-Dimethylphenol	1.5J
2-Methylnaphthalene	12
Metals	(ug/L)
Arsenic	12
Chromium	<5
Lead	<3

TOTAL PETROCHEMICALS
TOTAL PETROCHEMICALS USA, INC.
PESTER BURN POND SITE
EL DORADO, KANSAS

COC CONCENTRATIONS DETECTED IN GROUNDWATER - OCTOBER 2013

ARCADIS

FIGURE 4

CITY:(Reqd) DIV/GROUP:(Reqd) DB:(Reqd) LD:(Opt) PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\Aproject\TOTAL\OK001557\2013\2013 CADD\2013 GWMR\20131021 PESTER F4 COC MAP.dwg LAYOUT: LB-PREFERRED SAVED: 12/17/2013 11:25 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: — PLOTSTYLETABLE: — PLOTTED: 12/17/2013 11:26 AM BY: PERSCHNICK, KATHY

APPENDIX B

Table B-1 PSH Removal Log - 2013

Pester Burn Pond Site, El Dorado, Kansas.

Well ID	Top of Casing Elevation (datum)	Date	Time	Depth to Water (ft BTOC)	Depth to PSH[a] (ft BTOC)	PSH Thickness (ft)	Elevation of PSH[a] (datum)	Adjusted Depth to Water (ft BTOC)	Corrected Groundwater Elevation (datum)	Remarks	Estimated Gallons Removed	Removal Method
MH-06	Installed 6/22/09 as a PSH removal sump at east end of the extension trench (T.D. = 8.5 ft below top manhole). Water discharges to MH-05 via drain line (approx. 1284.30).											
	1289.32	1/3/13	--	5.95	5.10	0.85	1284.22	5.12	1284.20	Extremely cold	45	bucket, Tote #5
		1/3/13								Black colored emulsion	1.0	bucket, Tote #5
	1289.32	1/17/13	--	5.04	5.00	0.04	1284.32	5.00	1284.32			
	1289.32	2/5/13	--	5.04	5.00	0.04	1284.32	5.00	1284.32		1.5	bucket, Tote #4
	1289.32	3/5/13	--	5.04	5.00	0.04	1284.32	5.00	1284.32			
	1289.32	4/1/13	1340	5.12	5.00	0.12	1284.32	5.00	1284.32		25	bucket, Tote #4
	1289.32	4/1/13	1410	5.11	5.10	0.01	1284.22	5.10	1284.22	Tote #5 onsite with approx. 46 gals PSH		
	1289.32	4/3/13	1500	5.07	5.02	0.05	1284.30	5.02	1284.30	Stericycle picked up Tote #4		Disposed 160 Gal
	1289.32	4/4/13	1610	5.06	5.00	0.06	1284.32	5.00	1284.32	Bailed	0.5	W-5P, Tote #5
	1289.32	4/23/13		5.08	4.95	0.13	1284.37	4.95	1284.37	Gauge only		
	1289.32	4/29/13	1426	5.08	5.04	0.04	1284.28	5.04	1284.28	Bucket	20	bucket, Tote #5
	1289.32	4/29/13	1452	5.02	5.01	0.01	1284.31	5.01	1284.31	Bucket	15	bucket, Tote #5
	1289.32	4/29/13	1705	5.14	5.13	0.01	1284.19	5.13	1284.19		2.5	W-5P, Tote #5
	1289.32	5/14/13	1650	5.17	5.06	0.11	1284.26	5.06	1284.26	Bucket	30	bucket, Tote #5
	1289.32	5/14/13	1800	5.20	5.19	0.01	1284.13	5.19	1284.13	Gauge only		
	1289.32	5/15/13	800	5.21	5.18	0.03	1284.14	5.18	1284.14	Gauge only		
	1289.32	6/14/13	800	5.01	4.97	0.04	1284.35	4.97	1284.35	Bucket	20	bucket, Tote #5
	1289.32	6/14/13	1045	5.10	5.09	0.01	1284.23	5.09	1284.23	Gauge only		
	1289.32	6/20/13	1220	4.91	4.87	0.04	1284.45	4.87	1284.45	Gauge only		
	1289.32	7/12/13	925	5.08	4.98	0.10	1284.34	4.98	1284.34	Bucket	50	bucket, Tote #5
	1289.32	7/12/13	1030	5.13	5.11	0.02	1284.21	5.11	1284.21	Gauge only		
	1289.32	7/19/13		5.03	4.99	0.04	1284.33	4.99	1284.33	Bucket	23	bucket, Tote #5
	1289.32	7/19/13		5.07	5.06	0.01	1284.26	5.06	1284.26	Gauge only	2.0	MH-01, Tote #5
	1289.32	7/26/13		5.05	4.98	0.07	1284.34	4.98	1284.34	Bucket	25	bucket, Tote #5
	1289.32	7/26/13		5.05	5.04	0.01	1284.28	5.04	1284.28	Gauge only		
	1289.32	7/30/13	1130	3.09	3.03	0.06	1286.29	3.03	1286.29	Gauge only		High river elevation
	1289.32	8/9/13	1000	3.14	3.10	0.04	1286.22	3.10	1286.22	Gauge only		High river elevation
	1289.32	8/14/13	1200	5.00	4.96	0.04	1284.36	4.96	1284.36	Bucket	25	bucket, Tote #5
	1289.32	8/14/13	1345	4.97	4.96	0.01	1284.36	4.96	1284.36	Gauge only		
	1289.32	9/4/13	1345	4.97	4.96	0.01	1284.36	4.96	1284.36	Bucket	15	bucket, Tote #6
	1289.32	9/13/13	730	5.00	4.98	0.02	1284.34	4.98	1284.34	Gauge only		
	1289.32	9/17/13								Stericycle picked up Tote #5		Disposed 240 Gal
	1289.32	10/21/13		5.06	5.00	0.06	1284.32	5.00	1284.32	Bucket	27	bucket, Tote #6
	1289.32	11/8/13		5.02	4.98	0.04	1284.34	4.98	1284.34	Bucket	27	bucket, Tote #6
	1289.32	12/13/13		5.00	4.99	0.01	1284.33	4.99	1284.33	Gauge only		

		Volume	
Removed in 2013	Tote #4	26.5	Gals PSH
Removed in 2013	Tote #5	259.0	Gals PSH
Removed in 2013	Tote #6	69.0	Gals PSH
		354.5	**Gals PSH**
Recycled 4/3/2013	Tote #4	**160.0**	**Gals PSH**
Recycled 9/17/2013	Tote #5	**243.0**	**Gals PSH**

Volume PSH Removed MH-06	**347.0**	**Gallons**
Volume PSH Removed W-05P	**5.5**	**Gallons**
Volume PSH Removed MH-01	**2**	**Gallons**
Volume PSH Removed MH-05	**0**	**Gallons**
Volume PSH Removed 2013	**354.5**	**Gallons**
Volume PSH Removed 2012	**178.5**	**Gallons**
Volume PSH Removed 2011	**427.5**	**Gallons**
Volume PSH Removed 2010	**418**	**Gallons**
Volume PSH Removed 2009	**342**	**Gallons**
Volume PSH Removed MH-01 2009	**73**	**Gallons**
Cumulative Volume PSH Removed	**1794**	**Gallons**

Tote Capacity-Approx. 275 gallons (37.5" wide X 46" long)

1284.60 - Elevation bottom of drain pipe at MH-06

* pneumatic double diaphragm pump

G:\Aproject\TOTAL\OK0015572013\2013 GWM\REPORT\APPENDICES\[20131213.PESTER.APP B_TBL B1 PSH REMOVAL LOG 2013.xlsx]2013

Appendix C Table C-2.
Summary of Groundwater Analytical Data (2006 - 2013) Long Term Monitoring Program
Pester Burn Pond Site, El Dorado, Kansas

		VOCs Benzene	VOCs Carbon disulfide	SVOCs 2,4-dimethylphenol	SVOCs 2-Methylnaphthalene	Metals Arsenic	Metals Chromium	Metals Lead
KDHE Tier 2 Screening Level		5	1660	1860	34.6	10	100	15
MCL		5	None	None	None	10	100	15
	Sample Date	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Alluvial Wells								
Upgradient Wells								
W-24	1/25/2006	**130**	< 5	< 40	**62**	**15**	< 10	< 3
W-24	4/18/2006	**85**	< 5	< 20	**40**	**11**	< 10	< 3
W-24	7/13/2006	**230**	< 10	< 100	**200**	**18**	< 10	< 3
W-24	10/11/2006	**190**	< 11	9.7 J	**260**	**22**	< 10	< 3
W-24	7/18/2007	**100**	< 4	< 20	5.9 J	**21**	< 10	< 3
W-24	8/12/2008	**120**	< 6.7	< 40	**120**	**27.7**	< 5	< 3
W-24	8/27/2009	**130**	< 6.7	< 40	**160**	**42.5**	< 5	< 3
W-24	8/18/2010	**110**	< 3.3	< 10	**61**	**37**	< 5	< 3
W-24	8/3/2011	**200**	< 5	< 42	**140**	**32**	< 5	< 3
W-39	10/11/2006	< 10	< 10	< 25	< 25	**39**	1.9 B	**70 J**
W-39	7/17/2007	< 10	< 10	< 50 UJ	< 50 UJ	**52**	5.9 B	**150**
W-39	8/12/2008	< 20 UJ	< 20 UJ	< 40 UJ	.84 J	**55.9**	4 J	**80.5**
W-39	8/26/2009	< 1	.41 J	< 50	< 50	**33.9**	2.9 J	**51**
W-39	8/17/2010	1.4	< 1	< 10	< 10	**21.8**	2.3	**24.4**
W-39	8/3/2011	< 1	.18 J	< 43	< 43	**29**	2.9 J	12 B
W-39	10/24/2012	< 1	.15 J	< 1.9	< 0.19	**29**	< 5	1.9 J
W-40	1/24/2006	< 1.5	< 1	< 10	< 10	**16**	< 10	< 3
W-40	4/18/2006	1.2	< 1	< 10	< 10	9.7 B	< 10	< 3
W-40	8/17/2010	3.1	< 1	NA	NA	NA	NA	NA
W-40	8/3/2011	< 1	< 1	< 11	< 11	**13**	< 5	< 3
W-40	10/24/2012	3.3	.41 J	< 1.9	< 0.19	**12**	< 5	< 3
W-40	10/22/2013	3.1	<1	<1.9	<0.19	**16**	< 5	< 3
W-43	8/3/2011	**5.6**	< 1	< 48	< 48	8.3 J	< 5	< 3
W-43	10/24/2012	2.4 J	< 4	< 3.8	< 0.38	6.4 J	< 5	< 3
W-43	10/21/2013	1.8	< 1	< 1.9	<0.19	6.1 J	2.2J	< 3
Downgradient of Solidified Pond								
W-05R	1/26/2006	**99**	< 10	41 J	**38 J**	**50**	< 10	< 3
W-05R	4/20/2006	**91**	< 3.3	< 100	**40 J**	**52**	< 10	< 3
W-05R	7/12/2006	**88**	1.1 J	< 100	26 J	**49**	< 10	< 3
W-05R	10/10/2006	**98**	< 3.3	< 40	30 J	**58**	< 10	< 3
W-05R	7/18/2007	**65**	< 3.3	< 50	**41 J**	**60**	< 10	< 3
W-05R	8/13/2008	**42**	< 1.7	< 25 UJ	34	**55.7**	< 5	< 3
W-05R	8/26/2009	**38**	< 2	< 25	**42**	**58**	< 5	< 3
W-05R	8/18/2010	**49**	< 2	< 10	25	**55.1**	< 5	< 3
W-05P	8/4/2011	**29**	< 1	< 27	29	**70**	34	**38 B**
P-12	1/26/2006	**53**	**44**	**1900**	< 1300	**80**	1.7 B	< 3
P-12	4/20/2006	**51**	75	1600 J	< 2000	**99**	2.1 B	< 3
P-12	7/12/2006	**54**	68	1400 J	< 2000	**86**	< 10	< 3
P-12	10/10/2006	**50 J**	68 J	1200	< 1200	**89**	2.3 B	< 3
P-12	7/18/2007	**59**	87	1800 J	< 2000	**89**	2.2 B	< 3
P-12	8/13/2008	**43**	46	970	12 J	**70.6**	< 5	< 3
P-12	8/26/2009	**41**	26	800	17 J	**59**	2.6 J	< 3
P-12	8/18/2010	**60**	54	1100	10 J	**79**	< 5	< 3
P-12	8/4/2011	**47**	36	970	11 J	**74**	26	**16 B**
P-12	10/24/2012	**45**	33	990 J	13 J	**86**	< 5	< 3
P-12	10/22/2013	**62**	15	850 J	15 J	**96**	< 5	< 3
W-31	1/24/2006	**5.3**	.39 J	< 40	< 40	6.2 B	< 10	< 3
W-31	4/19/2006	**6.7**	.31 J	2.5 J	< 40	< 10	< 10	< 3
W-31	7/12/2006	**7.9**	.49 J	2.9 J	< 25	5.1 B	< 10	< 3
W-31	10/10/2006	**9.9**	.65 J	< 40	< 40	4.9 B	< 10	< 3
W-31	7/17/2007	3.4	< 1	< 25	< 25	7 B	< 10	< 3
W-31	8/12/2008	< 0.84 UB	< 1	< 10	< 10	7 J	< 5	< 3
W-31	8/26/2009	2.1	.51 J	< 10	< 10	3.5 J	< 5	< 3
W-31	8/17/2010	3.3	1.1	< 10	< 10	**16.6**	9.5	4.3
W-31	8/2/2011	2.1	.39 J	< 9.7	< 9.7	< 10	< 5	< 3
W-31	10/25/2012	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3
W-31	10/23/2013	< 1 UB	3.5	0.75J	<0.19	6.7J	< 5	< 3
W-35	1/25/2006	< 1.1	< 1	< 10	< 10	**39**	< 10	< 3
W-35	4/20/2006	**5.6**	< 1	< 40	< 40	**31**	< 10	< 3
W-35	7/12/2006	**8.8**	< 1	< 25	< 25	**40**	< 10	< 3

Appendix C Table C-2.
Summary of Groundwater Analytical Data (2006 - 2013) Long Term Monitoring Program
Pester Burn Pond Site, El Dorado, Kansas

		VOCs Benzene	VOCs Carbon disulfide	SVOCs 2,4-dimethylphenol	SVOCs 2-Methylnaphthalene	Metals Arsenic	Metals Chromium	Metals Lead
KDHE Tier 2 Screening Level		5	1660	1860	34.6	10	100	15
MCL		5	None	None	None	10	100	15
	Sample Date	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Downgradient of Solidified Pond continued								
W-35	10/10/2006	**8.1**	< 1	< 10	< 10	**36**	< 10	< 3
W-35	7/17/2007	.52 J	< 1	< 10 UJ	< 10 UJ	**41**	< 10	< 3
W-35	8/12/2008	**13**	< 1	< 10	< 10	**43.6**	< 5	< 3
W-35	8/27/2009	**47**	< 1.7	< 40	< 40	**35**	< 5	< 3
W-35	8/17/2010	**53**	< 2	< 10	< 10	**41.4**	< 5	< 3
W-35	8/2/2011	**19**	< 1	< 9.7	< 9.7	**34**	< 5	< 3
W-35 (DUP)	8/2/2011	**20**	< 1	< 9.5	< 9.5	**31**	< 5	< 3
W-35 (DUP)	10/24/2012	**15**	< 1	< 1.9	< 0.19	**32**	< 5	< 3
W-35	10/24/2012	**16**	< 1	< 1.9	< 0.19	**32**	< 5	< 3
W-35	10/24/2013	**1.3**	< 1	<1.9	<0.19	**49**	< 5	< 3
W-35 (DUP)	10/24/2013	**1.5**	< 1	<1.9	<0.19	**47**	< 5	< 3
Side Gradient of Solidified Pond								
W-42	8/2/2011	**29**	150	1100 J	< 480 UJ	**180**	35	9.3
W-42	10/23/2012	**25**	96	970 J	< 9.5 UJ	**130**	< 5	< 3
W-42	10/23/2013	**42**	58	1000	<4.8	**160**	3.1J	< 3
W-44	8/3/2011	**26**	84	750	5.4 J	**190**	17	< 7 UB
W-44	10/24/2012	**10**	28	480	3.7 J	**41**	< 5	< 3
W-44	10/22/2013	**20**	74	950 J	<9.6 UJ	**130**	< 5	< 3
Downgradient of Interceptor Trench								
W-36	1/24/2006	< 1	< 1	< 10	< 10	**18**	< 10	< 3
W-36	4/18/2006	< 1	< 1	< 10	< 10	**15**	< 10	< 3
W-36	7/11/2006	< 1	< 1	< 10	< 10	**16**	< 10	< 3
W-36	10/10/2006	< 1	< 1	< 10	< 10	**18**	< 10	< 3
W-36	7/17/2007	< 1 UJ	< 1 UJ	< 10 UJ	< 10 UJ	**17**	< 10	< 3
W-36 (DUP)	8/12/2008	< 1	< 1	< 10	< 10	**21.2**	< 5	< 3
W-36	8/12/2008	< 1	< 1	< 10	< 10	**18.9**	< 5	< 3
W-36	8/27/2009	< 1	< 1	< 10	< 10	**16.5**	< 5	< 3
W-36 (DUP)	8/27/2009	< 1	< 1	< 10	< 10	**16**	< 5	< 3
W-36	8/17/2010	0.25	< 1	< 10	< 10	**23.9**	< 5	< 3
W-36 (DUP)	8/17/2010	1.2	< 1	< 10	< 10	**22.9**	< 5	< 3
W-36 (DUP)	8/2/2011	< 0.23 UB	< 1	< 10	< 10	**16**	< 5	< 3
W-36	8/2/2011	< 0.25 UB	< 1	< 9.5	< 9.5	**21**	2.5 J	< 3
W-36	10/25/2012	< 1	< 1	< 1.9	< 0.19	**18**	< 5	< 3
W-36	10/24/2013	< 1	< 1	< 1.9	< 0.19	**17**	< 5	< 3
W-37	1/25/2006	**24**	< 3.3	3.5 J	**46**	5.5 B	< 10	< 3
W-37	4/19/2006	**13**	< 2.5	< 40	2.2 J	< 10	< 10	< 3
W-37	7/12/2006	**17**	< 2.5	1.6 J	22	< 10	< 10	< 3
W-37	10/11/2006	**22**	< 5.7	3.4 J	**85**	4.8 B	< 10	< 3
W-37	7/18/2007	**30**	< 8.3	5.4 J	25 J	**12**	< 10	< 3
W-37	8/13/2008	**17**	< 4	< 25 UJ	24 J	7 J	< 5	< 3
W-37	8/26/2009	**16**	< 6.7	< 25	**94**	**10.2**	< 5	2.8 J
W-37	8/17/2010	**26**	< 7.1	< 40	**72**	9	2.2	< 3
W-37	8/2/2011	**24**	< 6.7	< 25	**57**	4.9 J	< 5	< 3
W-37	10/23/2012	**20**	< 2.5	< 7.8	15	9 J	< 5	< 3
W-37	10/22/2013	**12**	<5.0	1.5J	12	**12**	< 5	< 3
W-41	1/25/2006	**23**	18	140 J	< 200	**45**	2.6 B	< 3
W-41	4/20/2006	**22**	14	42 J	< 100	**38**	1.7 B	< 3
W-41	7/13/2006	**24**	28	41	.96 J	**26**	< 10	< 3
W-41	10/12/2006	**20 J**	31	100	3.6 J	**67**	3.1 B	2.4 B
W-41	7/19/2007	**20**	49	540	< 500	**53**	6.7 B	5.7
W-41	8/13/2008	**18**	43	580	4 J	**65.3**	< 5	< 3
W-41	8/26/2009	**20**	29	560	< 200	**58.5**	< 5	< 3
W-41	8/17/2010	**27**	47	240	2.8	**59.7**	2.7	< 3
W-41	8/2/2011	**27**	19	170	3.3 J	**37**	< 5	< 3
W-41	10/23/2012	**23**	50	580	4.2	**72**	< 5	< 3
W-41	10/23/2013	**19**	28	220	4	**42**	< 5	< 3
Fort Riley Limestone Aquifer								
W-36S	7/17/2007	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-36S	8/27/2009	< 1	< 1	< 10	< 10	< 10	2.6 J	2.2 J
W-36S	8/17/2010	0.27	< 1	< 10	0.29	< 10	< 5	< 3
W-36S	8/2/2011	< 0.21 UB	< 1	< 9.5	< 9.5	< 10	< 5	< 3
W-36S	10/25/2012	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3
W-36S	10/24/2013	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3

Appendix C Table C-2.
Summary of Groundwater Analytical Data (2006 - 2013) Long Term Monitoring Program
Pester Burn Pond Site, El Dorado, Kansas

		VOCs Benzene	VOCs Carbon disulfide	SVOCs 2,4-dimethylphenol	SVOCs 2-Methylnaphthalene	Metals Arsenic	Metals Chromium	Metals Lead
KDHE Tier 2 Screening Level		5	1660	1860	34.6	10	100	15
MCL		5	None	None	None	10	100	15
	Sample Date	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Fort Riley Limestone Aquifer continued								
W-40S	4/18/2006	< 1	< 1	< 10	< 10	**27**	< 10	< 3
W-40S	8/17/2010	1	< 1	NA	NA	NA	NA	NA
W-40S	10/21/2013	<1	< 1	<1.9	<0.19	**50**	<5	<3
Florence Aquifer								
W-05D	1/26/2006	< 1.7	< 1	< 10	< 10	< 10	< 10	< 3
W-05D	4/19/2006	< 1	< 1	< 10	< 10	7.7 B	< 10	< 3
W-05D	7/17/2007	< 1	< 1	< 10	< 10	9.7 B	< 10	< 3
W-05D	8/26/2009	< 1	< 1	< 10	< 10	8 J	< 5	< 3
W-05D	8/17/2010	< 1	< 1	< 10	< 10	**18.8**	< 5	< 3
W-05D	8/2/2011	< 0.17 UB	.18 J	< 11	< 11	**23**	< 5	< 3
W-05D	10/25/2012	< 1	< 1	< 1.9	< 0.19	3.8 J	< 5	< 3
W-05D	10/23/2013	< 1	<0.14J	< 1.9	< 0.19	5.4J	< 5	< 3

Appendix C Table C-3.
Summary of Groundwater Analytical Data - Fort Riley Aquifer (1990 - 2013)
Pester Burn Pond Site, El Dorado, Kansas

		VOCs Benzene	VOCs Carbon disulfide	SVOCs 2,4-dimethylphenol	SVOCs 2-Methylnaphthalene	Metals Arsenic	Metals Chromium	Metals Lead
KDHE Tier 2 Screening Level		**5**	**1660**	**1860**	**34.6**	**10**	**100**	**15**
	Sample Date	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
South of Pester Site								
W-01S	11/11/1997	NA	NA	NA	NA	< 10	< 30	NA
Northwest of Pester Site								
W-07S	10/16/1990	2.1	NA	NA	NA	NA	NA	NA
W-07S	6/15/1994	< 5	NA	NA	NA	NA	NA	NA
W-07S	11/12/1997	< 5	NA	NA	NA	< 10	NA	NA
W-07S	10/24/2000	< 1	< 1	< 2	< 5	**44**	21	**179**
W-07S	1/9/2001	< 1	< 1	< 10	< 10	< 10	1.5 B	3.8
W-07S	3/20/2001	< 1	< 1	< 10	< 10	4.1 B	< 5	2.3 B
W-07S	6/19/2001	< 1	< 1	< 10	< 10	6.9 B	< 10	< 3
W-07S	10/17/2001	< 1	< 1	3.1 JB	< 10	< 10	< 10	< 3
W-07S	10/17/2001	< 1	< 1	4.2 JB	< 10	< 10	< 10	< 3
W-07S	1/22/2002	< 1	< 1	< 10	< 10	< 10	2.4 B	< 3
W-07S	4/30/2002	< 1	< 1	NA	NA	4.5 B	< 10	< 3
W-07S	4/30/2002	NA	NA	< 10 UR2	< 10 UR2	NA	NA	NA
W-07S	7/23/2002	< 1	< 1	< 10	< 10	4 J	< 10	< 3
W-07S	2/4/2003	< 1	< 1	< 10 UJR2	< 10 UJR2	8.1 B	1.5 B	< 3
W-07S	4/1/2003	< 1	< 1	< 10	< 10	4.9 B	< 10	< 3
W-07S	6/24/2003	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-07S	9/30/2003	< 1	< 1	< 10	< 10	7.6 B	< 10	< 3
W-07S	2/3/2004	< 1	< 1	< 10	< 10	4.1 B	< 10	< 3
W-07S	4/21/2004	< 1	< 1	< 10	< 10	3.5 B	< 10	< 3
W-07S	6/29/2004	< 1	< 0.28	< 0.23	< 0.02	5 B	< 1.9	< 1.7
W-07S	10/12/2004	< 1	< 1	< 10	< 10	8.4 B	< 10	< 3
W-07S	1/18/2005	< 1	< 1	< 10	< 10	4.8 B	< 10	< 3
W-07S	4/18/2005	.37 J	< 1	< 10	< 10	4.9 B	< 10	< 3
W-07S	7/11/2005	< 1.3	< 1	< 10	< 10	5.7 B	< 10	< 3
W-07S	12/5/2005	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-07S	4/18/2006	< 1	< 1	< 10	< 10	< 10	< 10	< 3
Downgradient of Solidified Pond								
W-31S	10/16/1990	**64**	NA	NA	NA	**27**	NA	NA
W-31S	6/15/1994	< 5	NA	NA	NA	NA	NA	NA
W-31S	11/11/1997	NA	NA	NA	NA	**15**	NA	NA
W-31S	10/25/2000	1.54	< 1	< 2	< 5	< 10	10	**78**
W-31S	1/10/2001	< 1	< 1	< 10	7.8 J	< 10	< 5	< 3
W-31S	3/21/2001	1	< 1	< 10	< 10	< 10	< 5	< 3
W-31S	6/20/2001	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-31S	10/18/2001	2.6	< 1	1.4 J	< 10	4.3 B	< 10	< 3
W-31S	1/23/2002	.64 J	< 1	< 10	< 10	**23**	< 10	< 3
W-31S	5/1/2002	.74 J	< 1	< 10	.99 J	< 10	< 10	< 3
W-31S	7/24/2002	< 1	< 1	NA	NA	< 10	< 10	< 3
W-31S	7/24/2002	NA	NA	< 10 UR2	< 10 UR2	NA	NA	NA
W-31S	2/5/2003	.46 J	< 1	< 10 UJR2	< 10 UJR2	< 10	< 10	< 3
W-31S	4/2/2003	.79 J	< 1	< 10	< 10	< 10	< 10	< 3
W-31S	6/25/2003	< 1	< 1	< 40	< 40	2.7 B	< 10	< 3
W-31S	6/25/2003	< 1	< 1	< 40	< 40	< 10	< 10	< 3
W-31S	10/1/2003	.36 J	< 1	< 40	< 40	< 10	< 10	< 3
W-31S	2/4/2004	< 1	< 1	< 10	2.2 NJ	3.6 B	1.1 B	< 3
W-31S	4/22/2004	.23 J	< 1	< 10	< 10	< 10	< 10	< 3
W-31S	6/30/2004	< 1	.3 J	NA	NA	< 2.6	< 1.9	< 1.7
W-31S	6/30/2004	NA	NA	< 0.23 UJ	< 0.02 UJ	NA	NA	NA
W-31S	10/13/2004	< 1	.28 J	< 10	< 10	< 10	< 10	< 3
W-31S	1/19/2005	< 1	< 1	NA	NA	< 10	< 10	< 3
W-31S	1/19/2005	NA	NA	< 10	< 10	NA	NA	NA
W-31S	4/19/2005	.26 J	< 1	< 10	< 10	< 10	< 10	< 3
W-31S	7/12/2005	.29 J	.65 J	< 10	< 10	< 10	< 10	< 3
W-31S	12/6/2005	< 1	< 1	NA	NA	< 10	< 10	< 3
W-31S	12/6/2005	NA	NA	< 10 UJ	< 10 UJ	NA	NA	NA
W-31S	4/19/2006	< 1	< 1	< 10	< 10	< 10	< 10	< 3

Appendix C Table C-3.
Summary of Groundwater Analytical Data - Fort Riley Aquifer (1990 - 2013)
Pester Burn Pond Site, El Dorado, Kansas

		VOCs Benzene	VOCs Carbon disulfide	SVOCs 2,4-dimethylphenol	SVOCs 2-Methylnaphthalene	Metals Arsenic	Metals Chromium	Metals Lead
KDHE Tier 2 Screening Level		**5**	**1660**	**1860**	**34.6**	**10**	**100**	**15**
	Sample Date	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
Downgradient of Interceptor Trench								
W-36S	11/11/1997	NA	NA	NA	NA	< 10	< 30	NA
W-36S	10/24/2000	< 1	< 1	< 2	< 5	< 10	**180**	**459**
W-36S	1/9/2001	< 1	< 1	< 10	< 10	< 10	8.9	< 3
W-36S	1/9/2001	< 1	< 1	< 10	< 10	< 10	11	< 3
W-36S	3/20/2001	< 1	< 1	< 10	< 10	< 10	1.9 B	< 3
W-36S	6/19/2001	< 1	< 1	< 10	< 10	< 10	2.2 B	< 3
W-36S	10/17/2001	< 1	< 1	3.8 JB	< 10	< 10	< 10	< 3
W-36S	1/22/2002	< 1	< 1	< 10	< 10	< 10	1.9 B	**16**
W-36S	4/30/2002	< 1	< 1	< 10	< 10	< 10	< 10	3.1
W-36S	7/23/2002	< 1	< 1	< 10	< 10	2.5 J	1.9 J	3.3
W-36S	2/4/2003	< 1	< 1	< 10 UJR2	< 10 UJR2	3.6 B	1.6 B	8.3
W-36S	4/1/2003	< 1	< 1	< 10	< 10	< 10	< 10	2.7 B
W-36S	6/24/2003	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-36S	9/30/2003	< 1	< 1	< 10	< 10	< 10	1.5 B	< 3
W-36S	2/3/2004	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-36S	4/20/2004	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-36S	6/29/2004	< 1	< 0.28	< 0.23	< 0.02	< 2.6	< 1.9	< 1.7
W-36S	10/12/2004	< 1	< 1	< 10	< 10	< 10	2.3 B	< 3
W-36S	7/12/2005	< 1	< 1	< 13	< 13	< 10	97	< 3
W-36S	7/17/2007	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-36S	8/27/2009	< 1	< 1	< 10	< 10	< 10	2.6 J	2.2 J
W-36S	8/17/2010	0.27	< 1	< 10	0.29	< 10	< 5	< 3
W-36S	8/2/2011	< 0.21 UB	< 1	< 9.5	< 9.5	< 10	< 5	< 3
W-36S	10/25/2012	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3
W-36S	10/24/2013	< 1	< 1	< 1.9	< 0.19	< 10	< 5	< 3
Upgradient Wells								
W-39S	4/20/2004	2.8 J	< 8	< 40	< 40	NA	NA	NA
W-39S	4/20/2004	NA	NA	NA	NA	**31**	< 10	< 3
W-39S	6/30/2004	< 1.5	< 1.9	NA	NA	NA	NA	NA
W-39S	6/30/2004	NA	NA	NA	NA	**27**	< 1.9	< 1.7
W-39S	6/30/2004	NA	NA	< 0.58	< 0.07	NA	NA	NA
W-39S	10/13/2004	< 4	< 4	NA	NA	NA	NA	NA
W-39S	10/13/2004	NA	NA	< 10	< 10	**25**	< 10	< 3
W-39S	1/19/2005	2 J	< 8	NA	NA	NA	NA	NA
W-39S	1/19/2005	NA	NA	NA	NA	**26**	< 10	< 3
W-39S	1/19/2005	NA	NA	< 40	< 40	NA	NA	NA
W-39S	4/19/2005	< 5	< 5	< 40	< 40	NA	NA	NA
W-39S	4/19/2005	NA	NA	NA	NA	**51**	< 10	< 3
W-39S	7/12/2005	< 5	< 5	< 40	< 40	NA	NA	NA
W-39S	7/12/2005	NA	NA	NA	NA	**32 J**	< 10 UJ	< 3 UJ
W-39S	4/19/2006	< 5	< 5	< 50	< 50	NA	NA	NA
W-39S	4/19/2006	NA	NA	NA	NA	**19**	< 10	< 3
W-39S	10/21/2013	<1 UB	0.17J	<1.9	<0.19	**23**	<5	< 3
W-40S	4/19/2004	.67 J	< 1.7	NA	NA	NA	NA	NA
W-40S	4/19/2004	NA	NA	< 10	4.1 J	**23**	< 10	< 3
W-40S	6/30/2004	< 1	.32 J	NA	NA	**37**	< 1.9	< 1.7
W-40S	6/30/2004	NA	NA	< 0.23 UJ	< 0.02 UJ	NA	NA	NA
W-40S	10/12/2004	1.1	2.1	< 10	.59 J	**32**	< 10	< 3
W-40S	1/18/2005	< 1	< 1	< 10	.77 J	**27**	< 10	< 3
W-40S	4/19/2005	< 1	< 1	NA	.66 J	**32**	< 10	< 3
W-40S	4/19/2005	NA	NA	< 10	NA	NA	NA	NA
W-40S	7/12/2005	< 1	< 1	< 10	1.1 J	**31**	< 10	< 3
W-40S	12/6/2005	1.2	< 1	< 10 UJ	1.7 J	**35**	< 10	< 3
W-40S	4/18/2006	< 1	< 1	< 10	< 10	**27**	< 10	< 3
W-40S	8/17/2010	1	< 1	NA	NA	NA	NA	NA
W-40S	10/21/2013	<1	<1	<1.9	<0.19	**50**	<5	<3

Appendix C Table C-4.
Summary of Groundwater Analytical Data - Florence Aquifer (1990 - 2013)
Pester Burn Pond Site, El Dorado, Kansas

		VOCs	VOCs	SVOCs	SVOCs	Metals	Metals	Metals
		Benzene	Carbon disulfide	2,4-dimethylphenol	2-Methylnaphthalene	Arsenic	Chromium	Lead
	MCL	**5**	**None**	**None**	**None**	**10**	**100**	**15**
	Sample Date	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
South of Pester Site								
W-01D	11/11/1997	NA	NA	NA	NA	< 10	< 30	NA
Downgradient of Solidified Pond								
W-05D	10/17/1990	NA	NA	NA	NA	< 5	NA	NA
W-05D	6/15/1994	NA	NA	NA	NA	4	NA	NA
W-05D	11/11/1997	NA	NA	NA	NA	**14**	NA	NA
W-05D	10/25/2000	1.59	< 1	< 2	< 5	< 10	15	**105**
W-05D	3/20/2001	< 1	< 1	< 10	< 10	**15**	< 5	< 3
W-05D	6/19/2001	< 1	< 1	< 10	< 10	**33**	< 10	< 3
W-05D	6/19/2001	< 1	< 1	< 10	< 10	**37**	< 10	< 3
W-05D	10/18/2001	.64 J	< 1	3.2 JB	< 10	5.3 B	4.1 B	< 3
W-05D	1/22/2002	.17 J	< 1	< 10	< 10	**32**	1.8 B	< 3
W-05D	4/30/2002	.23 J	< 1	NA	NA	6.2 B	< 10	< 3
W-05D	4/30/2002	NA	NA	< 10 UR2	< 10 UR2	NA	NA	NA
W-05D	7/23/2002	< 1	< 1	< 10	< 10	5.3 J	< 10	< 3
W-05D	2/4/2003	< 1	< 1	< 10 UJR2	< 10 UJR2	8.5 B	< 10	< 3
W-05D	4/1/2003	< 1	< 1	< 10	< 10	7 B	< 10	< 3
W-05D	6/24/2003	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-05D	9/30/2003	< 1	< 1	< 10	< 10	5.5 B	< 10	< 3
W-05D	4/21/2004	< 1	< 1	< 10	< 10	5.9 B	< 10	< 3
W-05D	6/29/2004	< 1	< 0.28	< 0.23	< 0.02	8.8 B	< 1.9	< 1.7
W-05D	10/12/2004	< 1	< 1	< 10	< 10	7.9 B	< 10	< 3
W-05D	4/19/2005	.3 J	< 1	< 10	< 10	9.4 B	< 10	< 3
W-05D	7/11/2005	< 1	< 1	< 10	< 10	11	< 10	< 3
W-05D	1/26/2006	< 1.7	< 1	< 10	< 10	< 10	< 10	< 3
W-05D	4/19/2006	< 1	< 1	< 10	< 10	7.7 B	< 10	< 3
W-05D	7/17/2007	< 1	< 1	< 10	< 10	9.7 B	< 10	< 3
W-05D	8/26/2009	< 1	< 1	< 10	< 10	8 J	< 5	< 3
W-05D	8/17/2010	< 1	< 1	< 10	< 10	**18.8**	< 5	< 3
W-05D	8/2/2011	< 0.17 UB	.18 J	< 11	< 11	**23**	< 5	< 3
W-05D	10/25/2012	< 1	< 1	< 1.9	< 0.19	3.8 J	< 5	< 3
Northwest of Pester Site								
W-30D	10/17/1990	NA	< 1	NA	NA	< 5	NA	NA
W-30D	6/15/1994	NA	6	NA	NA	< 3	NA	NA
W-30D	11/11/1997	NA	< 5	NA	NA	**47**	NA	NA
W-30D	10/25/2000	< 1	< 1	< 2	< 5	**41**	12	**264**
W-30D	1/9/2001	< 1	< 1	< 10	< 10	10	< 5	< 3
W-30D	3/20/2001	< 1	< 1	< 10	< 10	**16**	< 5	< 3
W-30D	6/19/2001	< 1	< 1	< 10	< 10	**22**	< 10	< 3
W-30D	10/18/2001	.55 J	< 1	3.3 JB	< 10	**11**	< 10	< 3
W-30D	1/22/2002	< 1	< 1	< 10	< 10	**12**	< 10	< 3
W-30D	1/22/2002	< 1	< 1	< 10	< 10	**12**	< 10	< 3
W-30D	4/30/2002	< 1	< 1	< 10	< 10	9.8 B	< 10	< 3
W-30D	7/23/2002	< 1	< 1	NA	NA	**18**	< 10	< 3
W-30D	7/23/2002	NA	NA	< 10 UJR2	< 10 UJR2	NA	NA	NA
W-30D	2/4/2003	< 1	< 1	< 10 UJR2	< 10 UJR2	**19**	< 10	< 3
W-30D	4/2/2003	< 1	< 1	< 10	< 10	5.6 B	< 10	< 3
W-30D	6/24/2003	< 1	< 1	< 10	< 10	**19**	< 10	< 3
W-30D	9/30/2003	< 1	< 1	< 10	< 10	**16**	< 10	< 3
W-30D	2/3/2004	< 1	< 1	< 25	< 25	**35**	< 10	< 3
W-30D	4/21/2004	.42 J	< 1	< 10	< 10	**17**	< 10	< 3
W-30D	6/29/2004	< 1	< 0.28	< 0.23	< 0.02	**24**	< 1.9	< 1.7
W-30D	10/12/2004	< 1	< 1	< 10	< 10	**14**	< 10	< 3
W-30D	1/18/2005	< 1	< 1	< 10	< 10	**15**	< 10	< 3
W-30D	4/20/2005	< 1	< 1	< 10	< 10	5.8 B	2.6 B	< 3
W-30D	7/12/2005	< 1	< 1	< 10	< 10	**18**	< 10	< 3
W-30D	12/5/2005	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-30D	4/18/2006	< 1	< 1	< 10	< 10	< 10	< 10	< 3
Upgradient Well								
W-40D	4/19/2004	.25 J	.33 J	< 10	< 10	3.3 B	< 10	< 3
W-40D	6/30/2004	< 1	1.6	NA	NA	5.3 B	< 1.9	4.9
W-40D	6/30/2004	NA	NA	< 0.23 UJ	< 0.02 UJ	NA	NA	NA
W-40D	10/12/2004	< 1	1	< 10	< 10	5.8 B	< 10	2.6 B
W-40D	10/12/2004	< 1	1.1	< 10	< 10	6 B	< 10	< 3
W-40D	1/20/2005	< 1	.7 J	< 10	< 10	8 B	< 10	< 3
W-40D	4/19/2005	< 1	.35 J	< 10	< 10	5.7 B	< 10	< 3
W-40D	7/12/2005	.24 J	.34 J	< 10	< 10	7.6 B	< 10	< 3
W-40D	4/19/2006	< 1	< 1	< 10	< 10	< 10	< 10	< 3
W-40D	10/22/2013	< 1	< 1	<1.9	<0.19	5.9J	<5	< 3

Attachment C

Site Photos

Cap over the Solidification Area

Access Road North of the Capped Area


West Branch Walnut River