KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
FINAL CORRECTIVE ACTION DECISION
COASTAL DERBY SMITH BENTON PIPELINE SITE
Benton, Kansas

DECLARATION OF REMEDIAL ACTION SELECTION

SITE NAME AND LOCATION

Coastal Derby Smith Benton Pipeline Site
Benton, Butler County, Kansas

STATEMENT OF BASIS AND PURPOSE

This Final Corrective Action Decision (CAD) document presents the remedy selected to address contamination at the Coastal Derby Smith Benton Pipeline Site (Site) in Benton, Kansas. The Site is located in the southwest, northwest, and northeast quarters of Section 5, Township 26 South, Range 3 East, and the southeast quarter of Section 3, Township 25 South, Range 3 East, approximately two miles north of Benton, Kansas. This location is approximately one-half mile east of the intersection of 77th Street and NW Butler Road. Land in this area is used primarily for farming and ranching; one residence is located on the northeast portion of the Site. Pipelines owned by Texaco, Phillips, and Kansas Natural Gas transect the Site, and Whitewater Creek is located approximately 0.75 miles of the release area.

Since 1991, various investigations have identified benzene, ethylbenzene, and Total Petroleum Hydrocarbons – Low Range Hydrocarbons (TPH-LRH) in soil and groundwater at concentrations above the corresponding KDHE Tier 2 Levels or federal Maximum Contaminant Levels. In general, contaminant concentrations within the body of the contaminant plume have decreased over the period of record as the result of ongoing source abatement measures and natural processes.

The Corrective Action Study (CAS) focused on the evaluation of various remedial alternatives to address groundwater and soil contamination at the Site. The remedial action selected for the Site was based on the documents and information contained in the Administrative Record File for the Site.

DESCRIPTION OF THE SELECTED REMEDY

KDHE has determined that the selected remedy, described in the final CAD, satisfies or meets the criteria established for selection and will be protective of human health and the environment. The selected remedy includes Multi-Phase Extraction (MPE), Environmental Use Controls (EUCs), and contingencies based on the results of rebound testing. The main components of the selected remedy are summarized below:
- Multi-Phase Extraction (MPE) – the existing MPE system of two parallel trenches combining a replacement groundwater extraction system and a soil vapor extraction system will continue to operate for five years. The MPE system has, and continues to, reduce the size and concentration of the dissolved-phase plume, while also removing vapor phase naphtha. After five years, rebound testing, two years of monitoring and confirmation soil sampling will take place, and contingency actions will be required based on the results. The following possible contingencies are considered:
  
  o Contingency 1: MPE Restart – if the residual groundwater plume becomes unstable or migrates during the two-year study, resumption of hydraulic containment may be required.
  
  o Contingency 2: In-Trench Biosparge – if the groundwater plume remains stable, but groundwater concentrations still exceed cleanup goals, or additional EUCs are not obtained, additional treatment via in-trench sparge would be implemented. Biodegradation in the saturated zone would be enhanced by the addition of oxygen. Groundwater monitoring would continue, and after five years of operation, the rebound study would be repeated.
  
  o Contingency 3: Biostimulant Injection – liquid biostimulant would be injected into trench T-5 and T-6 to promote biodegradation of contaminants. Recovery wells would be replumbed as injection wells, and it is assumed that one year of injection performance monitoring would be required, followed by a two-year plume rebound study.
  
  o Contingency 4: Long-term Monitoring (LTM) – if the limited soil and/or groundwater exceedances remaining are stable, but EUCs are unobtainable, annual (or less frequent) monitoring of key wells would occur until remedial goals, or EUCs, are obtained.

- Environmental Use Controls (EUCs) – the existing EUC will remain in place, and additional EUCs will be obtained for the two remaining southern properties. This would clear any existing risk pathways and facilitate eventual site closure.

DECLARATION:

The selected remedy will be protective of human health and the environment and attain State, Federal and local requirements that are applicable or relevant and appropriate. The selected remedy also actively reduces the toxicity, mobility and volume of contamination identified at the Site. In selecting and declaring this remedy, KDHE believes implementation of this remedy will have a beneficial effect by reducing the toxicity, mobility, and volume of contaminants.
4-29-2020

Date

Lee A. Norman, M.D.
Secretary of Kansas Department of Health and Environment
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<th>Definition</th>
<th>Unit</th>
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<td>LNAPL</td>
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<tr>
<td>VOC</td>
<td>Volatile Organic Compound</td>
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Glossary

Administrative Record – The body of documents that form the basis for selection of a particular response at a site. Parts of the AR are available in an information repository near the site to permit interested individuals to review the documents and to allow meaningful participation in the remedy selection process.

Air Stripping – The process of forcing air through polluted water to remove harmful chemicals. The air causes the chemicals to change from a liquid to a gas. The gas is collected and treated if necessary.

Aquifer – An underground layer of rock, sand, or gravel capable of storing water within cracks and pore spaces or between grains. When water contained within an aquifer is of sufficient quantity and quality, it can be used for drinking or other purposes. The water contained in the aquifer is called groundwater.

Applicable or Relevant and Appropriate Requirements (ARARs) – The federal and state environmental laws that a remedy will meet. These requirements may vary among sites and alternatives.

Corrective Action Decision (CAD) – The decision document in which KDHE selects the remedy and explains the basis for selection for a site.

Corrective Action Study (CAS) – A study conducted to evaluate alternatives for cleanup of contamination.

Exposure – Contact made between a chemical, physical, or biological agent and the outer boundary of an organism. Exposure is quantified as the amount of an agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut).

Groundwater – Underground water that fills pores in soils or openings in rocks to the point of saturation. Groundwater is often used as a source of drinking water via municipal or domestic wells.

Hydraulic Containment – Use of pump and treat groundwater remediation systems to hydraulically control the movement of contaminated groundwater in order to prevent continued expansion of the contamination zone.

Maximum Contaminant Levels (MCLs) – The maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

Monitoring – Ongoing collection of information about the environment that helps gauge the effectiveness of a cleanup action. For example, monitoring wells drilled to different depths would be used to detect any migration of the plume.

Monitored Natural Attenuation – Allowing natural processes to remediate pollution in soil and groundwater while site conditions are routinely monitored.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP) – The federal regulations that guide the Superfund program. These regulations can be found at 40 Code of Federal Regulations, Part 300.

National Pollution Discharge Elimination System (NPDES) – As authorized by the Clean Water Act, the National Pollutant
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April 2020

Discharge Elimination System permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches.

**Operations and Maintenance (O&M)** – Activities conducted at a site after the construction phase to ensure that the cleanup continues to be effective.

**Plume** – A body of contaminated groundwater flowing from a specific source.

**Remedial Investigation (RI)** – A study of the source, nature and extent of contamination.

**Risk** – The probability of adverse health effects resulting from exposure to an environmental agent or mixture of agents.

**Tier 2 Level** – Calculated risk-based cleanup value for a specific contaminant. These values can be found in Appendix A of the *Risk-Based Standards for Kansas (RSK) Manual*.

**Threshold** – The dose or exposure below which no harmful effect is expected to occur.

**Toxicity** – A measure of degree to which a substance is harmful to human and animal life.

**Vapor Intrusion** – The migration of contaminants from the subsurface into overlying and/or adjacent buildings.

**Volatile Organic Compounds (VOCs)** – Carbon compounds, such as solvents, which readily volatilize at room temperature and atmospheric pressure. Most are not readily dissolved in water, but their solubility is above health-based standards for potable use. Some VOCs can cause cancer.
1. PURPOSE OF THE FINAL CORRECTIVE ACTION DECISION

The primary purposes of the Final Corrective Action Decision (CAD) for the Coastal Derby Smith/Benton Pipeline Site (Site) are to: 1) summarize information from the key site documents and Corrective Action Study (CAS) report; 2) briefly describe the alternatives for remediation detailed in the CAS report; 3) identify and describe the Kansas Department of Health and Environment’s (KDHE) preferred remedy for addressing contamination at the Site; and, 4) document comments and KDHE’s responses to the public comments received regarding the draft CAD. The public was encouraged to review and comment on the preferred remedy presented in the draft CAD during the public comment period from March 1 to March 15, 2020.

KDHE selected a final remedy for the Site after reviewing and considering all information submitted during the 15-day public comment period. MWH (now Stantec) performed a Supplemental Site Investigation and Rebound Plume Stability Study and Stantec wrote the CAS for the Coastal Derby Smith/Benton Site on behalf of the El Paso Merchant Energy-Petroleum Company, formerly Coastal Refining and Marketing, Inc., (Coastal) in general accord with the Consent Orders 91-E-15 dated April 17, 1991, and 91-E-101 dated October 7, 1992. The public was encouraged to review and comment on the technical information presented in the Site Investigation (SI) and CAS reports and other documents contained in the Administrative Record file. The Administrative Record file includes all pertinent documents and site information that form the basis and rationale for selecting the final remedy. The Administrative Record File was, and still is, available for public review during normal business hours at the locations shown in Highlight 1-1.

2. SITE BACKGROUND

On December 24, 1990, petroleum was being transported in a pipeline owned by Coastal under a pressure of 200 to 240 pounds per square inch. The pipeline failed and released approximately 10,600 barrels (450,000 gallons) of naphtha. Naphtha is a light-end and highly refined petroleum product that is most commonly used for blending or mixing with various final refinery products.

2.1. Site Location

The Site is located in the southwest, northwest, and northeast quarters of Section 5, Township 26 South, Range 3 East, and the southeast quarter of Section 3, Township 25 South, Range 3 East, approximately two miles north of Benton, Kansas. This location is approximately one-half mile east of the intersection of 77th street and NW Butler Road (Figure 1). Land in this area is used
primarily for farming and ranching. One residence is located on the northeast portion of the Site. Pipelines owned by Texaco, Phillips, and Kansas Natural Gas also transect the Site. Whitewater Creek is located approximately 0.75 miles south of the naphtha pipeline release area (Figure 2).

2.2. Site History
On December 25, 1990, Coastal discovered the pipeline rupture. On December 26, 1990, Coastal reported the spill to KDHE and indicated that naphtha had escaped into the surrounding soils. Residents potentially or actually impacted by the release were temporarily evacuated, and alternate water supplies were provided. Recovery trenches were excavated around the release area and a vacuum truck was used to recover approximately 94,000 gallons of product. The naphtha generally moved north or southeast from the spill area, where it intersected and flowed down a narrow dry streambed, covering an approximately 250 feet by 800 feet area (Figure 3).

3. REMEDIAL INVESTIGATIONS
In May 1991, the Revised Work Plan for the Naphtha Pipeline Remediation System Report outlined the emergency response and initial investigation. Actions included completing 29 soil borings and installing five trenches into which an 8-inch perforated polyvinyl chloride pipe was installed and teed into 4-inch riser pipes. Three to four feet of river gravel was then placed around the perforated pipe and backfilled with native soil. A slurry wall was installed, and a soil flushing and bioremediation pilot test was proposed. A monitoring program was also established.

In November 1994, an evaluation report provided the first detailed summary of the site lithology and included cross-section, bedrock, surface, and colluvium thickness maps. It included more complete groundwater quality data and further evaluated the competent shale contours and product migration paths in the subsurface.

The December 2002 Site Evaluation provided a conceptual site model (CSM) as well as a summary of the groundwater extraction and treatment system.

In March 2010 a Revised System Evaluation, Additional Remedial Investigation, Soil Vapor Extraction/Air Sparge (SVE/AS) Pilot Test and Dissolved Phase Rebound/Plume Stability Work Plan was presented which proposed further evaluation of the site soil impacts and evaluation of the potential applicability of an SVE/AS system. The groundwater extraction system was also shut down at this time due to equipment failure, so a dissolved phase rebound and plume stability study was included.

An Additional Remedial Investigation (RI) and a SVE/AS Pilot Test were performed in 2011. The resulting report outlined the installation of 23 borings, nine of which were completed as SVE/AS wells, five were completed as vapor monitoring points, and one was completed as an upgradient monitoring well. The information from this investigation was used to update the CSM and determined that further delineation of the contaminant mass was required to the southwest. Updated plume maps and cross sections were generated. The SVE/AS pilot tests indicated that air could be injected into or extracted from the subsurface, but that the radius of influence was limited.
A Supplemental Site Investigation and Rebound Plume Stability Study was completed in July 2012, which indicated that free product recoverability was low and hindered by pockets of product trapped by increased water elevations against the overlying clay. Data from the Rebound Plume Stability Study indicated some plume migration around the southwest side of the barrier wall. It was recommended that groundwater extraction resume and that the groundwater extraction and treatment system be replaced.

In 2013, 21 soil borings with temporary monitoring wells were installed to better delineate contamination south and southwest of Parallel Road. The results of the data collected were used to further define the remaining free product, soil and groundwater impacts.

The Final Interim Remedial Measures and Multi-Phase Extraction (MPE) System Design Study in 2014 included the installation of two new parallel trenches, one north and one south of Parallel Road. A replacement groundwater MPE system was recommended and installed (Figure 4).

Groundwater monitoring and system operations progress reports have been submitted over the lifetime of the project.

### 3.1. Hydrogeological Setting

The Site is located within the Flint Hills region of Kansas, which includes many perennial streams and rivers. The unnamed creek passing through the northeastern portion of the Site discharges into Whitewater Creek, which flows south of the Site from the southwest to the northeast. The unnamed creek is typically dry except for periods of precipitation. The principal aquifers in the region are in the Nolands, Winfield, and Barneston Limestone. There is no regional aquifer in this area, but small horizontally and vertically discontinuous, locally recharged, shallow aquifers are present. These aquifers are typically not used as a water source, as they contain elevated levels of sulfate and chloride. The United States Department of Agriculture notes that concentrations of dissolved solids, nitrate, sulfate, and chloride in most of the sampled groundwater of the Walnut River basin exceed recommended standards for drinking water. The groundwater in the vicinity of the Site is from the Wellington formation. The water of the Wellington formation is characterized as being high in calcium sulfate, calcium bicarbonate or calcium carbonate. Concentrations of dissolved solids range from less than 500 mg/L to greater than 2,000 mg/L. Water quality is marginal for use in irrigation or for livestock. The only petroleum impacted groundwater flow is through the primary shallow weathered limestone and shale. Groundwater flow is generally to the southeast towards Whitewater Creek, although based on historical contaminant impact, there appears to be a channel towards the southwest as well.

### 3.2. Summary of Remedial Investigation Results

The initial Site investigation indicated that naphtha saturated the overburden soils and was possibly pressure-injected into the weathered limestone/shale layer in the pipeline release area. Migration of the naphtha continued in this layer and was stopped vertically when it met a competent shale layer. Migration continued in the weathered layer above the competent shale. The competent layer also acts as a barrier to groundwater migration, resulting in a shallow groundwater layer across most of the Site. Groundwater levels fluctuate significantly throughout the Site through the year, effectively smearing the naphtha throughout the weathered limestone and shale layers. A
900-foot slurry wall was constructed on the southeastern side to prevent southeasterly migration of the plume.

Investigations revealed that soil impacts extend through shallower fractured limestone to the underlying shale layer. The MPE system trenches and recovery wells were designed to address the full vertical extent over which Light Non-Aqueous Phase Liquid (LNAPL) was historically present; however, the impact to the deeper shale layer presents an issue during the spring when increased precipitation raises site groundwater elevations by several feet, inundating the deeper, impacted soils and greatly reducing the effectiveness of the SVE systems.

The soil vapor phase now represents the bulk of the recoverable naphtha. The SVE system has recovered 5,800 gallons of liquid naphtha equivalent through the first nine months of SVE operation. The fact that concentrations of Volatile Organic Compounds (VOCs), and carbon dioxide remain elevated indicates that the vapor pathway exists for a greater distance than the expected 40 feet of influence. It is unknown how far the zone of influence is but could theoretically extend several hundred feet (Figure 5).

**4. SOURCE ABATEMENT AND INTERIM MEASURE IMPLEMENTATION**

Interim measures are actions or activities taken to quickly prevent, mitigate, or remedy unacceptable risk(s) posed to human health and/or the environment by an actual or potential release of a hazardous substance, pollutant, or contaminant.

The initial emergency response consisted of the installation of 29 soil borings and 5 trenches. By the end of 1991, collection trenches and an extraction system had been installed and were operating to recover free product and groundwater from the impacted area. A total of 2,172 barrels of free product were recovered by June 1992.

Pneumatically powered diaphragm pumps were used to pump groundwater and product into tanks. This water was then removed and treated at the Former Coastal Refinery in El Dorado, Kansas. Two coarse pore aerators were installed in October 1994 to treat groundwater. The treated groundwater was then discharged to Whitewater Creek under a National Pollutant Discharge Elimination System (NPDES) permit. Operation of this pump and treat system was discontinued in December 2009 after equipment failures resulted in difficulty maintaining consistent groundwater extraction and NPDES compliance.

An interim remedial measure MPE system of two parallel trenches combining a replacement groundwater extraction system and a soil vapor extraction system commenced operation in February 2016. Since implementation, over 7.2 million gallons of groundwater have been extracted and treated, resulting in reduction of the dissolved phase plume size and concentration. The vapor extraction phase of the system recovered over 34,000 pounds of vapor phase naphtha during the initial nine months of operation.
5. SITE RISKS

Naphtha is the Site contaminant. It was formerly present as free phase and is currently present in the sorbed and dissolved phases. Because naphtha is a highly refined product containing only a narrow range of petroleum chemicals, the constituents of concern (COCs) at this site are benzene, ethylbenzene and Total Petroleum Hydrocarbons – Low Range Hydrocarbons (TPH-LRH). The potential exposure pathways and associated risks at the site are:

**Contact or Ingestion of any Remaining Free Product.** The depth to groundwater and any remaining free product are greater than 11 feet below ground level. Most excavation depths are not typically this deep. The Vargas Property north of the road already has an Environmental Use Control (EUC) with an associated Soil Management Plan. While further free-phase migration is unlikely, the exposure risk remains.

**Contact or Ingestion of Impacted Soil and Groundwater.** The EUC on the Vargas property protects against contact with or ingestion of impacted soil or groundwater through limitations on groundwater use and soil management. The Orona and Johnson properties do not currently have EUCs. The plume must continue to be contained by mechanical or natural means to keep impacted groundwater from migrating along the southwest bedrock channel to the RW-29 area.

**Vapor Intrusion.** Within the zone of impacted soils as shown in Figure 6, there are currently no structures that would be impacted by vapor intrusion. Should a structure be built in this area prior to closure of the site, a potential complete vapor intrusion path could be present. The EUC on the Vargas property does not allow the building of a structure in this area; however, no such limitations exist on the Orona or Johnson properties.

**Surface Discharge.** There is no surface water discharge from the impacted aquifer within the groundwater plume migration distance. The only remaining risk is through pumping and discharge of contaminated groundwater.

6. REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are media-specific goals for protecting human health and the environment. RAOs are developed through evaluation of applicable and relevant and appropriate requirements (ARARs) and To Be Considered standards with consideration of the findings of the Comprehensive Investigation (CI). RAOs for the Coastal Derby Smith Benton Pipeline Site are the residential RSK levels for the COCs as outlined in Table 2.

7. SUMMARY OF REMEDIAL ALTERNATIVES EVALUATED

Through the CAS process, individual remedial action alternatives were first evaluated with respect to their ability to satisfy the following criteria as specified in the National Oil and Hazardous Substances Contingency Plan\(^1\) (NCP): protection of human health and the environment, compliance with ARARs; long-term effectiveness and permanence, reduction of toxicity mobility

\(^1\) National Oil and Hazardous Substances Contingency Plan, 40 CFR 300 et seq.
or volume through treatment; short-term effectiveness; implementability; and cost. The alternatives were then compared against one another to identify the preferred alternative (Table 3). A detailed description of the various remedial action alternatives and the individual and comparative analyses is presented in the CAS.

The NCP requires the evaluation of a No Action alternative to serve as a baseline for comparison to other remedial action alternatives evaluated.

7.1. Alternative 1 – No Action
For the purpose of the CAS, the No Action alternative assumes that the mechanisms currently in place are not required. The cost to implement this alternative is $0 because no additional action would be taken. An estimated $6,000,000 has been spent to date.

7.2. Alternative 2 – EUCs and Multi-Phase Extraction
Alternative 2 would continue the existing MPE system operation, maintenance and monitoring until the vapor phase mass removal no longer produces appreciable results. Confirmation soil sampling and a groundwater plume stability and a rebound study would then be completed in order to assess plume stability and dissolved phase concentrations. Alternative 2 also assumes that the existing EUC will remain in place and additional EUCs will be obtained for the two remaining southern properties. This would clear any existing risk pathways and facilitate eventual site closure.

This option assumes MPE operation for five years followed by two years of semiannual groundwater sampling for a plume rebound study and confirmation soil sampling. The present value cost of Alternative 2 is $1,300,000 in addition to the estimated $6,000,000 spent to date.

7.3. Alternative 3 – EUCs and MPE with Contingencies
Alternative 3 is identical to Alternative 2 with the exception that after five years of MPE extraction, rebound testing, and confirmation soil sampling, this alternative assumes that additional contingency action will be required. The Site would be reviewed annually to evaluate the appropriateness of the contingency with a recommendation provided in the semiannual report whether to continue, change to a different contingency, or to close the Site. The following possible contingencies are considered:

Contingency 1: MPE Restart. If the residual groundwater plume becomes unstable or migrates during the two-year study, resumption of hydraulic containment may be required. For costing purposes, it was assumed that an additional four years of operation would be required. Coupled with the associated groundwater monitoring, this contingency would cost an estimated $720,000.

Contingency 2: In-Trench Biosparge. If the groundwater plume remains stable and plume containment is not required to achieve site remediation goals, but groundwater concentrations still exceed cleanup goals or additional EUCs are not obtained, additional treatment would be warranted. This scenario assumes that the MPE system would not be restarted but that the blowers would be replaced and reversed to produce an in-trench sparge through the lower perforated pipe,
stripping VOCs as groundwater flows through the trench and creating a dissolved-oxygen plume downgradient of the trench. The in-trench bubbling would directly remove VOCs from the groundwater, but the primary purpose would be to enhance saturated zone biodegradation through the added oxygen. Groundwater monitoring would be continued to track COC concentration reduction over time. It is assumed that five years of operation would be required followed by repeating the two-year rebound study after system deactivation. The cost of this contingency is estimated to be $500,000.

Contingency 3: **Biostimulant Injection.** This contingency would introduce a liquid biostimulant into both trench T-5 and T-6 to promote biodegradation of contaminants. The optimal product would be selected at that time, but the objective would be to have an electron acceptor flow downgradient with groundwater which would enhance naturally occurring biodegradation processes in the residual plume. It is possible that multiple injection events could be required based on Site conditions. For costing estimation, it was assumed that one large event delivering 7,500 gallons of Nutrisulfate® mixed with 53,000 gallons of water would be required. Replumbing of the recovery wells to function as injection wells would be required. Injection rates are assumed to be moderate to high taking several days to complete if an offsite water source is used or longer if treated groundwater is used. For costing, it is assumed that one year of injection performance monitoring would be required and that a second two-year plume rebound study would be completed to permit site closure. The cost of this contingency is estimated to be $300,000.

Contingency 4: **Long-Term Monitoring (LTM).** LTM may be required if there are limited soil and/or groundwater exceedances remaining and the plume is stable, but EUCs were unobtainable on one or both of the southern properties. In this scenario, annual (or less frequent) monitoring of key wells is assumed. Half of the current number of wells in the current network were assumed to be required and the remaining wells would be properly abandoned. It is assumed that 10 years of LTM would be required to achieve remedial goals, or an EUC is obtained. The cost of this contingency is estimated to be $200,000.

It is currently unknown what the MPE performance, the residual contaminant mass quantity, and which contingency action will be required; however, for costing purposes it has been assumed that the initial five years of MPE operation would be followed by rebound testing and soil confirmation sampling, which would then be followed by Contingency 2 and then Contingency 4.

The present value cost of Alternative 3 is assumed to be the cost of Alternative 2 with the two assumed contingency actions for a total cost of $1,900,000 in addition to the $6,000,000 already spent.

### 8. **Description of the Preferred Remedy**

After evaluation of the individual remedial action alternatives, a comparative analysis of the various alternatives was performed with consideration of the threshold and balancing criteria specified in the NCP. The results of the comparative analysis support the preferred remedy to be Alternative 3 (EUCs, MPE, and Contingencies). The total present value cost of the preferred remedy is $1,900,000.
Alternative 3 encompasses the abatement of receptor risks, containment mass source reduction, and both short-term and long-term effectiveness, which should most rapidly achieve the remediation goals and risk management requirements. While the MPE system has performed well to this point, the contingencies provide measures that may be implemented under various scenarios while maintaining protection and/or instituting additional remediation as required (Table 4). The contingency actions provide flexibility for risk reduction and increased regulatory compliance while working toward the eventual goal of MPE shutdown and Site closure.

9. **Community Involvement**
A Public Relations Strategy was developed by KDHE. Public input and comment was encouraged by KDHE throughout the process. Public notice of the availability of the draft CAD was published in *The Wichita Eagle* on March 1, 2020. In addition, KDHE established a webpage dedicated to the Coastal Derby Smith Benton Pipeline Site, available online at [kdheks.gov/remedial/site_restoration/coastalderbysmithbenton.html](http://kdheks.gov/remedial/site_restoration/coastalderbysmithbenton.html).

10. **Responsiveness Summary**
The purpose of this section is to review and provide responses to comments received during the public comment period for the draft CAD. No comments were received during the public comment period.
Final Corrective Action Decision
Coastal Derby Smith Benton Pipeline Site, Benton, Kansas
April 2020

TABLES
Table 1 – Groundwater Analytical Results Summary Historical and Recent Maximums

<table>
<thead>
<tr>
<th>Compound</th>
<th>Well</th>
<th>Date</th>
<th>Historical Maximum Concentration μg/L</th>
<th>Well</th>
<th>Date</th>
<th>Recent Maximum Concentration μg/L</th>
<th>MCL or KDHE Tier 2 Level μg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>MW-37S</td>
<td>11/1/1993</td>
<td>40,000</td>
<td>RW-21</td>
<td>9/7/2017</td>
<td>1,100</td>
<td>5</td>
</tr>
<tr>
<td>Toluene</td>
<td>MW-33S</td>
<td>3/1/1995</td>
<td>730</td>
<td>RW-12R</td>
<td>6/15/2017</td>
<td>19</td>
<td>1,000</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>RW-21</td>
<td>9/25/2004</td>
<td>1,500</td>
<td>MW-37S</td>
<td>12/6/2017</td>
<td>590</td>
<td>700</td>
</tr>
<tr>
<td>Total Xylenes</td>
<td>RW-21</td>
<td>9/25/2004</td>
<td>1,100</td>
<td>RW-21</td>
<td>9/7/2017</td>
<td>180</td>
<td>10,000</td>
</tr>
<tr>
<td>TPH-GRO</td>
<td>MW-37S</td>
<td>7/18/2001</td>
<td>5,000,000</td>
<td>-</td>
<td>-</td>
<td>NA</td>
<td>500</td>
</tr>
<tr>
<td>TPH-LRH</td>
<td>RW-12R</td>
<td>6/8/2016</td>
<td>2,700</td>
<td>RW-21</td>
<td>9/7/2017</td>
<td>1,800</td>
<td>350</td>
</tr>
</tbody>
</table>

\(^{2}\)KDHE Tier 2 Levels default to MCLs where available. Tier 2 Level for groundwater provided from KDHE’s Risk Based Standards for Kansas (RSK) Manual, October 2010, Revised September 2015.

TPH-GRO replaced by TPH-LRH for TPH analysis (BER Policy # BER-041 September 2015 Revised May 2017).
# Table 2 – Cleanup Levels for Groundwater and Soil

<table>
<thead>
<tr>
<th>Compound</th>
<th>KDHE Tier 2 Level for Residential Groundwater mg/L</th>
<th>KDHE Tier 2 Level for Residential Soil mg/kg</th>
<th>KDHE Tier 2 Level for Residential Soil to Groundwater Pathway mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPH-LRH</td>
<td>0.350</td>
<td>550</td>
<td>50</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.005</td>
<td>15.9</td>
<td>0.168</td>
</tr>
<tr>
<td>Toluene</td>
<td>1</td>
<td>4320</td>
<td>51.2</td>
</tr>
<tr>
<td>Ethylbenzene</td>
<td>0.7</td>
<td>82</td>
<td>65.6</td>
</tr>
<tr>
<td>Total Xylenes</td>
<td>10</td>
<td>936</td>
<td>809</td>
</tr>
</tbody>
</table>

*KDHE Tier 2 Levels default to MCLs where available. Tier 2 Levels provided from KDHE’s Risk Based Standards for Kansas (RSK) Manual, October 2010 (Revised 2015).*
### Table 3 – Comparison of Remedial Alternatives

<table>
<thead>
<tr>
<th>Screening Criteria</th>
<th>Alternative 1 No Additional Action</th>
<th>Alternative 2 Environmental Use Controls (EUCs) and Multi-Phase Extraction (MPE)</th>
<th>Alternative 3 EUCs and MPE with Contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Protection of Health and the Environment</td>
<td>Moderately Low Exposure pathways remain and would be unprotected</td>
<td>Moderately High Exposure pathways likely broken, and migration controlled/prevented.</td>
<td>Very High Exposure pathways broken, and migration controlled/prevented.</td>
</tr>
<tr>
<td>Direct Contact/Soil Ingestion Protection</td>
<td>Moderate - Much work has been completed but exposure risks remain</td>
<td>Moderately High - Most contaminant mass will be removed and EUCs (if obtained) will protect receptors in any post-treatment area exceeding RBSLs.</td>
<td>High - Alt 2 and additional soil treatment through biodegradation</td>
</tr>
<tr>
<td>Groundwater Ingestion Existing/Future</td>
<td>Low - A chance of nearby drinking water well installation without EUCs</td>
<td>Very High - Alt 2 and contingencies add notable protection with or without EUCs</td>
<td>Very High - Human/ecological receptors protected &amp; plumes contained</td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>Moderate - If remediation were ceased now, plume migration may result</td>
<td>Very High - Human/ecological receptors protected &amp; plumes contained</td>
<td></td>
</tr>
<tr>
<td>Compliance with ARARs</td>
<td>Low Several ARARs may not be obtained. Free product not addressed</td>
<td>The groundwater plume would be contained, free product removed, &amp; soil-groundwater ARARs would eventually be achieved.</td>
<td>All ARARs will eventually be complied with, and short-term all will be with the possible exception of soil and groundwater chemical-specific ARARs.</td>
</tr>
<tr>
<td>Chemical-Specific Compliance</td>
<td>Low - Chemical-specific ARARs may not be achieved</td>
<td>High - Soil/groundwater would eventually meet RBSLs</td>
<td>High - With possible additional treatment, RBSLs will be achieved sooner than Alt 2</td>
</tr>
<tr>
<td>Action-Specific Compliance</td>
<td>No action-specific ARARs identified</td>
<td>High - No air permit required, and water is discharged in compliance with the NPDES</td>
<td>High - Same as Alt 2. Injection Permit should be easily attained</td>
</tr>
<tr>
<td>Location-Specific Compliance</td>
<td>No location-specific ARARs identified</td>
<td>No location-specific ARARs identified</td>
<td>No location-specific ARARs identified</td>
</tr>
<tr>
<td>Long-term Effectiveness and Permanence</td>
<td>Moderately Low Human health and ecological risks remain unabated (VI, soil, drinking water, etc.) and remaining contaminant mass and LNAPL are not addressed</td>
<td>High The majority of the contaminant mass would be permanently removed during MPE operation and the rest would biodegrade over time (permanent).</td>
<td>Very High Most of the contaminant mass would be permanently removed during MPE operation and biostimulant injection. The rest would biodegrade over time.</td>
</tr>
<tr>
<td>Magnitude Residual Risks are Reduced</td>
<td>Moderate risks remain without controls &amp; remediation</td>
<td>High - Treatment would reduce migration and exposure risks, with EUCs for residual contamination</td>
<td>Very High - EUCs and combined treatments abate human &amp; ecological risks</td>
</tr>
<tr>
<td>Adequacy and Reliability of Controls</td>
<td>Low - No controls</td>
<td>High - MPE has been highly effective and EUCs will be as long as they are obtained</td>
<td>Very High - Mass removal is permanent and EUCs are reliable</td>
</tr>
<tr>
<td>Reduction in Toxicity, Mobility, and Volume through Treatment</td>
<td>Moderately Low Slow, long-term reduction in toxicity, mobility, and volume through natural attenuation processes</td>
<td>High Active treatment processes would be in place to enhance previously completed work, removing and destroying contaminant mass.</td>
<td>Very High A very high reduction in the toxicity, mobility, and volume of contaminants is provided through treatment of the free phase, sorbed, &amp; dissolved-phase</td>
</tr>
<tr>
<td>Treatment Process</td>
<td>None other than already completed work</td>
<td>MPE processes of hydraulic recovery, volatilization, and biodegradation</td>
<td>All of the descriptions for these criteria are similar to Alternative 2, but they are rated as Very High for this alternative because of the additional treatment provided by the contingency measures. These include possible additional MPE operation or enhanced biodegradation through either biosparging or biostimulant (e.g. Nitrate/Potassium injection).</td>
</tr>
<tr>
<td>Amount Destroyed or Treated</td>
<td>Moderately Low - Some contaminant mass has been removed but much remains that would not be addressed</td>
<td>High - A large amount of contaminant mass has already been removed and is expected to continue. Remaining post-treatment mass would be treated over time</td>
<td></td>
</tr>
</tbody>
</table>

Final Corrective Action Decision
Coastal Derby Smith Benton Pipeline Site, Benton, Kansas
April 2020
### Table 3 continued

<table>
<thead>
<tr>
<th>Screening Criteria</th>
<th>Alternative 1 No Additional Action</th>
<th>Alternative 2 Environmental Use Controls (EUCs) and Multi-Phase Extraction (MPE)</th>
<th>Alternative 3 EUCs and MPE with Contingencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in Toxicity, Mobility, and Volume</td>
<td>Modestly Low - The IRM work reduced toxicity, mobility and volume, but contaminant mass remains and is mobile (dissolved phase)</td>
<td>High - Initial high mass removal rates followed by gradual and eventually near-complete reduction in toxicity, mobility, and volume over time</td>
<td>Very High - This alternative is highly effective during construction and implementation of the remedy, protecting the community, workers, and environment.</td>
</tr>
<tr>
<td>Short-term Effectiveness (During Construction and Implementation)</td>
<td>Moderate - No worker/community risks would occur from construction; however, numerous risks would not be effectively abated</td>
<td>High - Aggressive MPE treatment will reduce the time to achievement of CAGs, and the community, workers, and environment are being protected.</td>
<td>Very High - All of the descriptions for these criteria are similar to Alternative 2 but are rated as Very High for this alternative because of the additional protection and treatment provided by the contingency measures.</td>
</tr>
<tr>
<td>Community Protection</td>
<td>Low - South area residential exposure risks would remain without EUCs</td>
<td>High - EUCs and active communication with landowners prevent short-term exposure</td>
<td>Moderate</td>
</tr>
<tr>
<td>Worker Protection</td>
<td>Moderate - Could excavate (contact soil) and build (vapor intrusion) if sold</td>
<td>High - Site workers are well-trained and equipped with necessary safety equipment</td>
<td>High</td>
</tr>
<tr>
<td>Environmental Impacts</td>
<td>Moderate - Most risks abated, but modest plume migration may resume</td>
<td>High Effectiveness - Plume is contained and emitted vapors readily photo-degrade</td>
<td>Very High</td>
</tr>
<tr>
<td>Time Until CAGs achieved</td>
<td>None achieved within decades and many are indefinite</td>
<td>Most CAGs would be achieved within 5 years, although restoration of groundwater to its most beneficial use may require longer</td>
<td>Very High</td>
</tr>
<tr>
<td>Implementability</td>
<td>Moderate - Mix of high and low rankings below</td>
<td>High - Proven technology and methods. Readily implemented.</td>
<td>High - Proven technology and methods. Readily implemented.</td>
</tr>
<tr>
<td>Ability to Construct/Operate</td>
<td>Very High - IRM already implemented and nothing more to construct</td>
<td>High - All equipment installed and operating, but 2 EUCs remain uncertain</td>
<td>High - Same as Alt 2 and Bioinjection and LTM are readily implemented</td>
</tr>
<tr>
<td>Ease of Additional Action if Required</td>
<td>Very High - Nothing preventing additional remedial action</td>
<td>Very High - Trenches could be used for future biological treatment injections</td>
<td>High - Same as Alt 2 but some of those additional actions would be completed</td>
</tr>
<tr>
<td>Ability to Monitor Effectiveness</td>
<td>Very Low - No monitoring/LTM</td>
<td>Very High - Adequate monitoring network exists, including vapors</td>
<td>Very High - Better than Alt 2 because of assumed LTM after initial MPE</td>
</tr>
<tr>
<td>Ability to Obtain Approvals from Agencies</td>
<td>High - Nothing to approve, no permits required</td>
<td>Very High - Components and necessary permits are already in place.</td>
<td>High - Same as Alt 2 except readily obtained underground injection permit required</td>
</tr>
<tr>
<td>Availability of Equip., Material, &amp; Service</td>
<td>Very High - Nothing to construct</td>
<td>Very High - Equipment and materials are readily available</td>
<td>Very High - Equipment and materials are readily available</td>
</tr>
<tr>
<td>Community Acceptance</td>
<td>Moderate - Some remediation has been completed and landowners would welcome removal of wells and the system, but would be unlikely to accept remaining risks</td>
<td>Very High - Aggressive remediation has &amp; would continue to remove significant contaminant mass, progressing the Site to closure and well removal - desired by landowners</td>
<td>Very High</td>
</tr>
<tr>
<td>Cost</td>
<td>Moderate</td>
<td>High</td>
<td>Very High</td>
</tr>
<tr>
<td>Completed Interim Remedial Measures (IRM)</td>
<td>$6,000,000</td>
<td>$6,000,000</td>
<td>$6,000,000</td>
</tr>
<tr>
<td>Additional Capital + Annual O&amp;M</td>
<td>$0</td>
<td>$1,300,000</td>
<td>$1,900,000</td>
</tr>
</tbody>
</table>

Table from: Final Corrective Action Study (CAS) Coastal Derby Smith Benton Pipeline Site (C2-008-00500) Benton, Kansas. March 2, 2018 Stantec.
Table 4 – Preferred Alternative Contingencies

| Contingency 1 – Multi-phase Extraction Restart | This contingency assumes that the plume stability and rebound study determines the plume is stable hence plume containment (groundwater extraction) is not required to achieve CAGs, but either because of groundwater concentrations still notably exceed Cleanup Levels or because of lack of EUCs, this contingency assumes some additional treatment would be warranted. Groundwater extraction provides little contaminant mass removal, and the criteria for MPE system shutdown was that SVE mass removal rates had approached asymptotic limits; therefore, little benefit would be achieved from reactivating the system in this scenario. Hence this contingency assumes the MPE system would not be restarted but rather that the blowers would be replaced and reversed to in-trench sparge through the lower perforated pipe, stripping VOCs as groundwater flows through the trench and creating a dissolved-oxygen plume downgradient of each trench. (The shallow T5 lateral pipe would be sealed from the inside well prior to this.) The in-trench bubbling (air stripping) would directly remove VOCs from in-trench groundwater, but the primary purpose would be to enhance saturated zone biodegradation through the added oxygen. System performance monitoring would consist of continued groundwater monitoring to track concentrations over time. For the purposes of costing, it is assumed five years of operation would be required followed by a repeat two-year rebound study after the system is deactivated. With associated groundwater monitoring, the cost of this contingency is estimated to be $720,000.

| Contingency 2: In-Trench Biosparging | This contingency is similar to #2 but instead of air, a liquid biostimulant would be dosed into both trench T-5 and T-6, such as oxygen releasing calcium peroxide-based PermeOx®, Stimulox®, or Oxygen Release Compound ORC™) Advanced to promote aerobic biodegradation of contaminants. Similarly, sulfate releasing compounds such as Epsom salt, Nutrisulfate®, or Persulfate® could be used to promote growth of sulfate reducing bacteria (SRB) and associated petroleum degradation. In addition, several of these products contain a direct oxidation component. The optimal product would be selected at that time depending upon Site and market conditions, but regardless, the objective would be delivery of an electron acceptor flush that flows downgradient with groundwater, enhancing naturally occurring biodegradation processes across the residual groundwater plume. Multiple injection events could be completed if determined necessary to achieve CAGs, and actual product volumes would be determined at the time based on Site conditions, but for the purposes of costing, it is assumed one large event would be sufficient, delivering 7,500 gallons of Nutrisulfate® mixed with 53,000 gallons of water (a seven-fold dilution and two-trench volume) to T-5 or T-6 (or both) depending upon the location of the residual mass. Costing assumes the water would be potable from a nearby source delivered to the Site using a 2,000-gallon tanker truck. If this is implemented, it may be feasible to extract groundwater from the non-injection trench, and use the treated water for re-injection with the Nutrisulfate® added prior to re-injection. Depending on actual injection rates and treatment objectives at the time, the volume of dilution water could be reduced, relying primarily on transport with groundwater and downgradient treatment. The RW pumps would be removed and header piping re-plumbed to permit simultaneous injection into each RWs from the treatment building. The Nutrisulfate® would likely be delivered in totes and mixed into the water stream using a small diaphragm pump. Given the large trench cross-sectional area and permeability as indicated by historical SVE air flow rates, injection rates are assumed to be moderate to high, allowing completion of the event within several days if an off-site water source is used (longer if treated groundwater is used). RWs would be sealed, but each would be periodically gauged, and injection rates adjusted (if necessary) to prevent pressurization and possible surface loading of the solution. Given this is a saturated treatment process, it is likely injection would be timed for spring during high groundwater to maximize vertical distribution and treatment. For costing, it is assumed 1) one year of injection performance monitoring would be completed, 2) results would be favorable, and 3) then a second two-year plume rebound study would be completed permitting site closure. With associated groundwater monitoring, the cost of this contingency is estimated to be $300,000.

| Contingency 3: Biostimulant Injection | This contingency is identical to Alternative 2 with the exception that after five years of MPE operation (after it is assumed SVE mass removal asymptotic limits will be approached), rebound testing, and confirmation soil sampling, this alternative assumes additional contingency action will be required. Each of the following could be implemented and the Site would be reviewed annually to evaluate the appropriateness of the contingency with a recommendation provided in the semiannual report to continue, change to a different contingency, or close the Site.

| Contingency 4: Long-Term Monitoring (LTM) | LTM may be necessary if limited soil and/or groundwater Cleanup Level exceedances remain and the plume is stable but EUCs were not obtained on one or both southern properties. Under those conditions annual LTM (frequency could be reduced) of key wells is assumed to monitor groundwater concentrations and to provide periodic site inspection to ensure that no receptors at potential risk have been added. For the purposes of costing, it is assumed half the number of wells in the current monitoring program would require monitoring at that time given reduction of the plume size and concentration through prior active treatment. The actual number and specific wells would be selected at that time. All other wells would be properly abandoned. For the purposes of costing, it is assumed 10 years of LTM would be required before CAGs were achieved or an EUC is obtained. With associated groundwater monitoring, the cost of this contingency is estimated to be $200,000.

From Final Corrective Action Study (CAS) Coastal Derby Smith Benton Pipeline Site (C2-008-00500) Benton, Kansas. March 2, 2018 Stantec
FIGURES
Figure 1 – Site Location
Figure 2 – Monitoring Well Network
Figure 3 – LNAPL Release Extent
**Figure 4 – Multi-Phase Extraction (MPE) System**

Map from Final Corrective Action Study (CAS) Coastal Derby Smith Benton Pipeline Site Benton, Kansas (C2-008-00500) March 2, 2018 - (Stantec)

**Legend**
- **RECOVERY WELL**
- **EXISTING ML/SEW WEL**
- **EXISTING MONITORING WELL**
- **5' AND 7' IN RECOVERY TRENCH**
- **ORIGINAL SYSTEM RECOVERY TRENCH**
- **INDICATED CONCENTRATION CONTINUOUS (1/3-MAR-2017)**
- **BENZENE <5 µg/L**
- **METHANOL 5 to 1,200 µg/L**
- **BENZENE >2,000 µg/L**

**SITE:**
Coastal Derby Smith Benton Pipeline Site C2-008-00500
Benton, Kansas

**TITLE:** Multi-Phase Extraction System

**DRAWN BY:** CM 5/12/2019
**BASEMAP DATE:** 2018
**CHECKED BY:** CM 5/12/2019
Figure 5 – Soil Vapor Extraction Zone of Influence
Figure 6 – Soil ImpactExtent