REPORT

First Quarter 2016 Remediation Progress Report SFPP Norwalk Pump Station Norwalk, California

Prepared for

Kinder Morgan Energy Partners, L.P.

April 15, 2016

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The material and data presented in this report were prepared consistent with current and generally accepted consulting principles and practices. This work was supervised by the following CH2M licensed professional.

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Acronyms and Abbreviations

µg/L	micrograms per liter
1,2-DCA	1,2-dichloroethane
Air Tech	Air Technology Laboratories
ASTM	ASTM International (formerly American Society for Testing and Materials)
ATL	Advanced Technology Laboratories
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CH2M	CH2M HILL Engineers, Inc.
EPA	U.S. Environmental Protection Agency
GWE	groundwater extraction
GWTS	groundwater treatment system
LGAC	liquid-phase granular activated carbon
MTBE	methyl tertiary butyl ether
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
OWS	oil-water separator
PID	photoionization detector
RAB	Restoration Advisory Board
RWQCB	California Regional Water Quality Control Board, Los Angeles Region
SCAQMD	South Coast Air Quality Management District
scfm	standard cubic feet per minute
SF6	sulfur hexafluoride
SFPP	SFPP, L.P., an operating partnership of Kinder Morgan Energy Partners, L.P.
SVE	soil vapor extraction
TBA	tertiary butyl alcohol
TFE	total fluids extraction
TPH	total petroleum hydrocarbons
TPH-d	total petroleum hydrocarbons quantified as diesel
TPH-g	total petroleum hydrocarbons quantified as gasoline
TPH-o	total petroleum hydrocarbons quantified as oil
TPH-total	total petroleum hydrocarbons quantified as gasoline, diesel, and oil
VOC	volatile organic compound
WSB	West Side Barrier

SECTION 1

Introduction

CH2M HILL Engineers, Inc. (CH2M) has prepared this report on behalf of SFPP, L.P. (SFPP), an operating partnership of Kinder Morgan Energy Partners, L.P., to summarize remediation activities performed at the former SFPP Norwalk Pump Station located within the Defense Fuel Support Point Norwalk, located at 15306 Norwalk Boulevard, Norwalk, California (the site; Figure 1) during the first quarter 2016 reporting period.

This progress report is submitted pursuant to a request from the California Regional Water Quality Control Board, Los Angeles Region (RWQCB) in its letter dated October 25, 2006 (RWQCB, 2006). Additional site background information can be found in the report titled, *Conceptual Site Model and Proposed Alternate Interim Remedy for Soil, Groundwater, and LNAPL* (CH2M, 2013a), and in previously submitted semiannual groundwater monitoring reports.

This report summarizes the remediation systems present at the site and describes remediation activities for the period of January through March 2016 with documentation of the following tasks:

- Operations and maintenance (O&M) of remediation systems performed by SFPP field personnel
- Remediation system evaluation

The remediation activities performed during January through March 2016 and the progress achieved through those activities are summarized in the following sections.

SECTION 2

Remediation Systems

SFPP currently operates remediation systems consisting of soil vapor extraction (SVE), total fluids extraction (TFE) of free product and/or groundwater using top-loading pumps, and treatment of extracted soil vapors and groundwater to address two specific areas at and near the site: the south-central area and the southeastern area. Operation of the West Side Barrier (WSB) groundwater extraction (GWE) system (WSB system) for remediation of the western offsite area was discontinued in August 2008. SFPP also operates a horizontal biosparge system to enhance mass removal of free-phase and dissolved-phase hydrocarbon constituents in the south-central area of the site. Further discussion of this system is provided below.

Remediation in the south-central and southeastern areas consists of SVE and TFE. At several well locations, SVE is coupled with TFE in a process referred to as dual-phase extraction. SVE is performed using a blower to remove soil vapors from the south-central and southeastern areas. The extracted vapors are conveyed to a knock-out tank that separates entrained moisture from the soil vapors. Accumulated moisture in the knock-out tank is treated by the main groundwater treatment system (GWTS) described below. The soil vapors are then treated in a thermal oxidizer where volatile organic compounds (VOCs) are converted to carbon dioxide and water prior to being discharged to the atmosphere. Operation of the GWTS and SVE system is conducted in accordance with Permits to Construct (Application Nos. 569588 and 567723, respectively; ID 110835) issued by the South Coast Air Quality Management District (SCAQMD).

The main GWTS processes free product and groundwater recovered from the south-central and southeastern parts of the site. Free product and groundwater recovered by pneumatically operated top-loading total fluids pumps are piped to an oil-water separator (OWS). Free product from the OWS is collected in a storage tank and recycled at an offsite location. Water from the OWS is treated using liquid-phase granular activated carbon (LGAC). Treated water is routed through an onsite 3,000-gallon equalization tank. Two fluidized bed bioreactors installed downstream of the equalization tank treat fuel oxygenates such as tertiary butyl alcohol (TBA) and methyl tertiary butyl ether (MTBE) that are not treated in the LGAC. The treated groundwater then passes through polishing LGAC units prior to discharge in accordance with a National Pollutant Discharge Elimination System (NPDES) permit (NPDES No. CA0063509, CI No. 7497).

SFPP recently completed installation of a horizontal biosparge system in the south-central area of the site. Construction of the biosparge well is documented in the report titled, *Horizontal Biosparge Well and Soil Vapor Monitoring Probe Completion Report* (CH2M, 2015). The biosparge system injects ambient air into the horizontal biosparge well, BS-01, via a rotary screw air compressor, at a maximum design rate of approximately 500 standard cubic feet per minute (scfm). SFPP’s SVE system has an interlock that ensures the biosparge system cannot operate unless the SVE system is operating. Operation of the SVE system reduces the potential for off-gassing of VOCs during biosparge operations. Pilot testing commenced on January 6, 2016, and is anticipated to continue for approximately 1 year in order to evaluate the feasibility of system expansion. Soil vapor and groundwater data collected as part of the pilot testing will be submitted to the RWQCB and Restoration Advisory Board (RAB) under separate cover. A summary of remediation wells in the south-central, southeastern, and WSB areas is presented in Table 1. Table 1 includes well identifications, well construction details, well use, and operational status at the end of the first quarter 2016. The remediation system layout is presented in Figure 2.

SECTION 3

Operations and Maintenance

During the first quarter 2016 reporting period, O&M of the remediation systems included the following tasks:

- Performed weekly maintenance and monitoring of the south-central and southeastern SVE and TFE wells, the SVE system and GWTS (collectively referred to as remediation systems), and the horizontal biosparge system.
- Performed cleanout of the OWS, sump, equalization tank, and transfer tank.
- Performed carbon changeout of the LGAC vessels.
- Performed carbon changeout of the vapor-phase granular activated carbon vessels used to treat off-gas from the product tank and OWS.
- Installed new conveyance piping to existing well MW-SF-17 and connected to the SVE system.

The remediation systems operated during the first quarter 2016 with the following exceptions:

- The GWTS was turned off on February 11, 2016, to facilitate collection of groundwater samples as part of a sulfur hexafluoride (SF6) tracer gas study for the biosparge pilot test. The system remained offline until March 16, 2016, for maintenance of the fluidized bed bioreactors.
- There were two biosparge system shut downs on February 16, 2016. First, due to a high temperature alarm in the compressor and, secondly, for replacement of the SF6 tracer gas canister during tracer gas testing. The system was restarted the same day.
- The SVE system shut down on February 29, 2016. No alarms were noted upon arrival. The system was restarted the same day. The biosparge system was offline during this period.
- The SVE system was turned off on March 10, 2016, to troubleshoot the destruction efficiency influent VOCs. After troubleshooting the system and collection of vapor compliance samples on March 23, 2016, the system was restarted on March 28, 2016. The biosparge system was offline during this period.

During this reporting period, remediation system inspections were performed on a weekly basis. For these inspections, volumes of extracted groundwater, hours of operation, and other system parameters were recorded during system operation.

Overall, during the first quarter 2016, the SVE system was operational 78 percent of the time (93 percent of the time excluding planned shutdowns), and the GWTS operated 70 percent of the time (96 percent of the time excluding planned shutdowns). The biosparge system operated 74 percent of the time since startup on January 6, 2016 (93 percent of the time excluding planned shutdowns). Table 2 presents the SVE system operations summary. Extracted vapor photoionization detector (PID) measurements at the end of the first quarter 2016 are summarized in Table 3. Extracted vapor analytical results for the first quarter 2016 are summarized in Table 4. The groundwater remediation system operation activities for the first quarter 2016 are summarized in Table 5. The extracted groundwater analytical results for the first quarter 2016 are summarized in Table 6. Table 7 presents the biosparge system operations summary. Historical (post-2007) gauging results of select TFE and SVE wells are provided in Table 8. Pre-2007 data can be found in previous semiannual groundwater monitoring reports.

Vapor samples from the SVE system influent and water samples from the GWTS influent were collected during the first quarter 2016 when the systems were in operation. During the first quarter 2016, influent vapor samples were collected on January 4, February 4, and March 3, 2016. Influent water samples were collected on January 21 and February 2, 2016, when the GWTS was operating. The water samples were delivered to Advanced Technology Laboratories (ATL) of Las Vegas, Nevada, for analysis. ATL is certified by the California Department of Public Health Environmental Laboratory Accreditation Program. The vapor samples were delivered to Air Technology Laboratories (Air Tech) of City of Industry, California, for analysis.

Air Tech analyzed the vapor samples for the following:

- Fixed gases (methane, carbon dioxide, oxygen, and argon) using ASTM International (ASTM) D1946
- VOCs using U.S. Environmental Protection Agency (EPA) Method TO-15
- Total VOCs using EPA Method TO-3

ATL analyzed the water samples for the following:

- Total petroleum hydrocarbons (TPH) quantified as gasoline (TPH-g), TPH quantified as diesel (TPH-d), and TPH quantified as oil (TPH-o) (collectively referred to as TPH-total) using EPA Method 8015(M)
- VOCs using EPA Method 8260B

The laboratory analytical reports and chain-of-custody documents for these samples are included in Appendix A.

Summary of Remediation Progress

Based on weekly monitoring of the influent vapor concentration, vapor extraction flow rate, and hours of operation, the total mass of VOCs removed by SVE was 74,148 pounds during the first quarter 2016. This represents a significant increase in mass removal since fourth quarter 2015, when the mass removed was 46,061 pounds. The increase is due to higher influent concentrations resulting from operation of the horizontal biosparge system. Since SVE implementation in September 1995, the cumulative mass removed was 3,394,610 pounds (Table 2). The cumulative mass removed by SVE does not include the mass removed by naturally occurring in situ biodegradation.

A total of 767,657 gallons of groundwater was extracted during the first quarter 2016 (Table 5). No water was extracted from the WSB area during the first quarter 2016. Approximately 96.5 million gallons of groundwater has been extracted from the south-central, southeastern, and WSB areas since GWTS operations first began in 1996.

GWE was discontinued in the WSB region during the third quarter 2008 based on the reduced lateral extent and low concentrations of MTBE and 1,2-dichloroethane (1,2-DCA) west of the site. 1,2-DCA, MTBE, and TBA concentrations in the western area during the fourth quarter 2015 did not warrant restarting the WSB system in the first quarter 2016.

The amount of free product that accumulated in the product holding tank of the GWTS was estimated to be 194 gallons during the first quarter 2016. Since 1995, a total of 14,020 gallons of product has been removed by TFE, vacuum truck, or manual bailing operations. The estimated mass removal (pounds) of hydrocarbons by the GWTS is shown in Table 5. Mass removal estimates between 1996 and 2005 are based on benzene, toluene, ethylbenzene, and total xylene (BTEX) and MTBE concentrations in the groundwater influent (TPH data were not available) and total volume of extracted groundwater. Mass removal estimates between 2006 and 2011 are based on groundwater influent concentrations of TPH-g and TPH quantified as fuel product, and the total volume of extracted groundwater. Mass removal estimates between 2012 and 2016 are based on groundwater influent TPH-total concentrations (TPH-total includes TPH-g, TPH-d, and TPH-o) and the total volume of extracted groundwater. Since GWE first began in 1996, hydrocarbon mass removed by the GWTS is estimated to be 19,104 pounds. During the first quarter 2016, the mass removal of hydrocarbons was estimated to be 4,203 pounds. Since the first quarter 2014 there has been significantly more hydrocarbon removal than previous quarters. The increase in mass removal during the first quarter 2016, and since the first quarter 2014, is attributed to the higher TPH-total concentrations in the groundwater influent. The maximum TPH-total concentration in the first quarter 2016 was 2,685,000 micrograms per liter (µg/L) (Table 6). The higher concentrations of TPH-total are attributed to the free product that is emulsified in the groundwater influent during TFE operations.

The biosparge system operated for 1,524 hours in the first quarter 2016 (Table 7). During January and February 2016, biosparge system flow (air injection) rates were gradually increased to approximately 500 scfm, the maximum design rate. Injection rates were decreased in March 2016 in order to optimize destruction efficiency of influent VOCs in the SVE system.

System Evaluation and Optimization

On March 11, 2016, the SVE system was shut down to troubleshoot the reduced destruction efficiency of the SVE. As part of this effort, additional air samples were collected on March 23, 2016, at the post-dilution and effluent sampling points and analyzed for total VOCs. Samples were collected under different operational conditions including flow rate and vacuum. Data indicate that SVE destruction efficiency was improved by decreasing the process flow rate, which increased residence time in the combustion chamber. These conditions were achieved by throttling all SVE wells to 50 percent open. During future SVE operation, all offsite wells will remain fully open to ensure maximum vapor extraction from the offsite area; onsite wells will be 50 percent open to decrease the process flow rate and increase residence time.

The TFE system currently consists of three wells operated for product recovery and hydraulic control in the south-central part of the site, and three wells equipped with TFE pumps operated for product recovery and hydraulic control in the southeastern part of the site (Table 1). TFE operations from these wells will continue and pump inlets will be adjusted, as needed, to optimize GWE and product recovery.

The second semiannual 2015 groundwater monitoring event in the WSB region occurred during the fourth quarter 2015. Monitoring results support the continued shutdown of GWE in the WSB region. 1,2-DCA, MTBE, and TBA concentrations in the western area will continue to be monitored during routine semiannual groundwater monitoring events; the WSB system will be restarted if necessary. The first semiannual 2016 groundwater monitoring event is scheduled for April 2016.

As shown in Table 7, measurable free product was observed in 21 remediation wells during the previous semiannual groundwater monitoring event (conducted during the fourth quarter of 2015). Of these, 2 wells in the southeastern area had measureable product, and the remaining 18 wells with measurable product are located in the south-central area. Up to 11.27 feet of measurable product was observed in offsite well GMW-O-12 on October 30, 2015. It is believed that increased product thicknesses, previously observed, are indicative of declining water levels across the site (Figure 3). However, during recent groundwater monitoring conducted in March 2016 (for pilot test data collection), measurable free product was observed in only eight remediation wells in the south-central area. The product thicknesses ranged from 0.02 foot in MW-SF-6 to 2.12 feet in GMW-22. Only 0.8 foot of measureable product was observed in GMW-O-12, where up to approximately 11 feet of product had been observed in October 2015. The substantial decline in measurable product in the south-central area is directly attributed to biosparge system operations. Biosparge system operations will continue during the second quarter 2016. Air injection rates will be optimized to ensure adequate destruction efficiency of extracted vapors by the SVE system.

Planned Second Quarter 2016 Activities

During the second quarter 2016, SFPP plans to continue to focus remedial efforts on the south-central and southeastern areas. The following maintenance and other activities are planned to be completed during the second quarter 2016:

- Continue weekly maintenance and monitoring of the south-central and southeastern SVE and TFE/GWE treatment systems, and horizontal biosparge system.
- Measure individual well vapor concentrations.
- Collect and analyze system influent vapor and groundwater samples.
- Perform as-needed carbon changeouts of the LGAC vessels.
- Remove, inspect, and repair existing TFE/GWE pumps and associated discharge lines.
- Install pumps and associated equipment necessary for TFE at select wells with measurable free product.
- Continue to remove free product from wells without TFE pumps using manual bailing methods.
- Install the new OWS and associated pad to allow more efficient removal of free product from the influent stream.
- Place order and begin planning for installation of a new regenerative thermal oxidizer vapor extraction and treatment system.
- Continue biosparge pilot testing, as outlined in the *Horizontal Biosparge System Construction and Pilot Test Work Plan* submitted to the RWQCB on November 18, 2013 (CH2M, 2013b). Soil vapor and groundwater data collected as part of the pilot testing will be submitted to the RWQCB and RAB under separate cover.

The TFE, GWE, and SVE systems for the south-central and southeastern areas will continue to operate. Operation of the TFE system in the southeastern area will be monitored closely, and adjustments will be made to improve fluid recovery. System inspections will continue on a weekly basis; system evaluation parameters will be collected as needed. The remediation activities and progress for the second quarter 2016 will be described in the Second Quarter 2016 Remediation Progress Report, to be submitted by July 15, 2016.

Pilot testing of the horizontal biosparge system in the south-central area will continue in the second quarter 2016. Testing will be performed for a period of approximately 1 year in order to evaluate the feasibility of system expansion. Progress reports on the pilot testing activities will be submitted to the RWQCB under separate cover until completion of the pilot test, as requested in the RWQCB's work plan approval letter (RWQCB, 2014).

SECTION 7

References

California Regional Water Quality Control Board, Los Angeles Region (RWQCB). 2006. Letter to Mr. Kola Olowu, Defense Energy Support Center, Los Angeles, and Mr. Michael Pitta, Kinder Morgan Energy Partners; Conditional Approval of Revised Remedial Action Plan and Second Addendum to Remedial Action Plan for the Defense Fuel Support Point Norwalk, 15306 Norwalk Boulevard, Norwalk (SLIC No. 0286A, DOD No. 16638). October 25.

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Tables

Figures

Appendix A
Laboratory Analytical Reports