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SITE ASSESSMENT REPORT AND CLOSURE REQUEST FOR

FORMER CHEVRON STATION NO. 9-1834

4175 Voltaire Street
San Diego, CA 92107

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1.0 INTRODUCTION

This report presents the results of site assessment activities conducted by SECOR International Incorporated (SECOR) for Chevron Environmental Management Company (Chevron) at Former Chevron Service Station No. 9-1834 (the Site), Unauthorized Release (UAR #H12455).

The Site is located at 4175 Voltaire Street, in San Diego, California (Figure 1). The scope of the assessment work was conducted in accordance with SECOR's *Work Plan for Confirmation Borings* (Work Plan), dated June 10, 2005. The assessment Work Plan was approved for UAR #H12455 by the County of San Diego Department of Environmental Health (DEH), Land and Water Quality Division, Site Assessment and Mitigation (SAM) Program in a letter dated July 7, 2005. Copies of the Work Plan and SAM approval letter are provided in Appendix A.

1.1 PURPOSE

The purpose of the site assessment was to assess the vertical extent of residual hydrocarbon impacts to the subsurface soil remaining at the Site, subsequent to the active remediation by soil vapor extraction (SVE) at the site.

1.2 SCOPE OF SERVICES

The following services were performed during the assessment:

- Obtained a soil boring construction permit from the DEH for the advancement of five soil borings;
- Notified Underground Service Alert (USA) to identify and clearly mark any subsurface utilities within the proposed soil boring locations;
- Prepared a site-specific Health and Safety Plan (HASP);
- Supervised the use of an air knife to clear subsurface utilities to a depth of 8 feet below ground surface (ft bgs) at five soil boring locations;
- Supervised the advancement of five soil borings (CB-1 through CB-5) to depths ranging from approximately 65-80 ft bgs
- Collected soil samples at varying depths during the advancement of each soil boring, performed lithologic logging of soils, and monitored the working area and headspace of retrieved soil samples with a Photoionization Detector (PID);
- Submitted subsurface soil samples to a California state-certified laboratory for analyses using U.S. Environmental Protection Agency (EPA) Method 8260B for: total petroleum hydrocarbons as gasoline (TPHg); benzene, toluene, ethylbenzene, and total xylenes (BTEX); methyl-tert-butyl ether (MTBE);
- Prepared a 60-day drilling report; and

- Prepared this report summarizing the site assessment procedures and findings, conclusions, and recommendations.

2.0 SITE BACKGROUND

2.1 SITE DESCRIPTION

The Site, located at 4175 Voltaire Street in San Diego, CA, is currently a vacant lot on the southern corner of the intersection between Voltaire Street and Catalina Boulevard. While in service, the station consisted of two pump islands under a canopy, one building with hydraulic lifts, four gasoline underground storage tanks (USTs) ranging in size from 3,000-gallon to 7,500-gallon, and one 550-gallon used oil UST (Figure 2).

Located in a mixed residential and commercial area, the Site is bound by Catalina Boulevard to the northwest, Voltaire Street to the northeast, an alley and apartment complex to the southwest, and a market and liquor store to the southeast. A 7-11 market is located across Catalina Boulevard and several commercial businesses are located across Voltaire Street.

The closest surface water is the San Diego River, which is located approximately 4,600 feet north of the Site. The Pacific Ocean is located approximately 1 mile west of the Site.

2.2 HISTORICAL SITE ASSESSMENT SUMMARY

The Site operated as a Chevron and/or Standard Oil Company fuel service station as early as 1955. In October 1996, DST Builders of Westminster, California exposed and removed five steel USTs and associated piping from the Site. Following UST removal, soil samples were collected from beneath the former piping and UST locations (Alton, October 1999).

Soil samples collected following the UST excavation had detectable levels of TPHg ranging in concentration from 4.5 to 15,000 milligrams per kilogram (mg/kg). Soil samples collected from beneath the former product piping had detectable levels of TPHg ranging in concentration from 95 to 13,000 mg/kg. Total recoverable petroleum hydrocarbon (TRPH) concentrations in soil collected from beneath the former USTs ranged in concentration from 12 to 1,500 mg/kg (Alton, October 1999).

Alton Geoscience (Alton) conducted an initial site assessment and soil vapor extraction (SVE) feasibility survey in February 1997, following the removal of the USTs and product piping. Sixteen soil borings (B-1 through B-16) were advanced during this assessment, with three of the borings converted to groundwater monitoring wells (MW-1 through MW-3), and three of the borings converted to nested vent wells (VW-1 through VW-3). In May 1997, six additional groundwater monitoring wells (MW-4 through MW-9) were installed at the Site (Alton, 1999a).

Soil samples collected during these drilling assessments ranged in TPHg concentrations from below laboratory reporting limits (LRLs) to 28,000 mg/kg. Benzene concentrations in soil samples collected ranged from below LRLs to 180 mg/kg, and MTBE concentrations ranged from below LRLs to 1.0 mg/kg.

In January of 1999, Alton supervised the installation of three offsite groundwater monitoring wells, of which two (MW-11 and MW-12) are located in the parking lot southeast of the Site and one (MW-10) is located in Voltaire Street to the northeast of the Site. TPHg, BTEX, and MTBE

concentrations in all soil samples collected during the installation of MW-10 through MW-12 were below LRLs.

In April 1997, Alton conducted two SVE step tests and concluded that for operational vacuums of 80 inches of water or less, SVE did not appear to be a feasible remediation alternative for the Site. They did conclude that for higher vacuums of 200 inches of water or more, SVE may be feasible for the shallow soils located at the Site (Alton, 1997b).

Alton conducted a risk assessment study in September 1997 by analyzing soil gas samples collected. Results of this study showed a less than 10^{-6} excess lifetime cancer risk (Alton, 1999).

Alton concluded from their initial site assessment that petroleum hydrocarbon-impacted soil and groundwater was present in the vicinity of the former UST cavity and the northeast portion of the Site (Alton, 1997a). Following the January 1999 assessment, Alton concluded the extent of petroleum hydrocarbons in both soil and groundwater had been adequately assessed (Alton, 1999).

Groundwater gauging and sampling for the monitoring wells referenced above has been conducted at the Site on a quarterly basis since March 1997, initially by BBC Environmental, Inc. (BBC), a Chevron contractor, and currently by SECOR.

Liquid phase hydrocarbons (LPH) have been identified in wells MW-1 and MW-9 as either a measurable thickness or sheen since September 1999. LPH have not been identified in any of the other monitoring wells (SECOR, 2005a).

2.3 HISTORICAL REMEDIATION SUMMARY

Alton conducted SVE testing activities in 1997 to assess the feasibility of using SVE for remediation at the Site. One SVE test was conducted in shallow subsurface soil (less than 25 feet bgs) using extraction well VW-1S. A second test was conducted in deeper soil (greater than 40 feet bgs) using well MW-1 as the extraction well. Numerous monitoring wells were used for observation throughout both tests. The results concluded that neither of the tests met Chevron's standard (at the time) for evaluating SVE tests, which compared the normalized vacuum measured in the observation wells to the normalized distances of the observation wells from the extraction wells. Alton interpreted the test results to indicate that the shallow soil beneath the Site was heterogeneous and of low permeability, but that high-vacuum SVE (greater than 200 inches of water) may provide effective remediation. Alton also concluded that typical SVE (80 inches of water or less) would possibly provide a feasible remediation alternative for the deeper soils in the vicinity of the water table. The SVE tests conducted on wells VW-1S and MW-1 removed approximately 5 pounds of hydrocarbons and 16 pounds of hydrocarbons, respectively, from the subsurface soil (Alton, 1997b).

In January 1999, Alton conducted a 10-hour high-vacuum dual-phase extraction (HVDPE) pilot test on well MW-1 utilizing numerous wells as observation wells. The test produced vapor flow rates of 13 to 15 cubic feet per minute (cfm) and groundwater extraction rates of approximately 105 gallons per hour at applied vacuums of 26 to 27 inches of mercury (Hg). Alton estimated the practical radius of influence to be approximately 30 to 35 feet from the extraction well.

Approximately 32 pounds of vapor-phase hydrocarbons and approximately 1,050 gallons of groundwater were extracted throughout the test. Alton concluded that dual-phase extraction appeared to be an effective method to remediate impacted soil in the vicinity of the water table (Alton, 1999b).

In April 2001, SECOR initiated the first of four interim remediation events utilizing a mobile remediation system (MRS) for HVDPE. The MRS provided for simultaneous removal of hydrocarbon mass from the vadose zone, capillary fringe, and saturated zones. This was accomplished by applying high vacuum to the wellhead while using a stinger within the well casing to extract groundwater. The stinger was used to draw down the water table, thereby exposing a greater thickness of the hydrocarbon-impacted "smear zone" (including portions of the upper saturated zone that had been below the water table) to intensive vapor extraction. The MRS was connected to wells MW-1 and MW-9 during the four MRS remediation events, which ranged in duration from 24 to 96 hours. Volatile fuel hydrocarbon (VFH) samples collected from the process vapor stream, which may have included additional dilution air, ranged between 530 parts per million by volume (ppmv) and 10,000 ppmv. A total mass of approximately 2,065 pounds of hydrocarbons were estimated to have been removed from the site and treated throughout the MRS remediation events. Approximately 75,600 gallons of groundwater were removed and disposed during the MRS events.

In October 2002, SECOR began operation of an on-site SVE remediation system under San Diego Air Pollution Control District (APCD) Permit #978165. The SVE system is connected to six SVE wells, three of which are nested dual-completion wells with shallow and deep screened sections (VW-1S/D, VW-2S/D, VW-3S/D, MW-1, MW-7, and MW-9). Vapors from the soil are extracted and treated by a catalytic oxidizer (catox) system. An estimated total of approximately 6,205 pounds of VFH were removed by the SVE system between October 2002 and December 2004. A Quarterly Remediation Progress Report (Fourth Quarter 2004) determined that the source VFH concentrations had reached asymptotically low levels, and that the mass of hydrocarbons removed by the SVE system during Fourth Quarter 2004 was minimal. The SVE system was subsequently shut down in February 2005. Process VFH concentrations and cumulative hydrocarbons removed by the SVE system since startup are presented in the SVE system performance graph in Figure 3. A summary of SVE system hydrocarbon mass removal is presented in Table 1, and a summary of the SVE system operation and maintenance parameters including source concentrations is presented in Table 2.

3.0 GEOLOGIC AND HYDROGEOLOGIC SETTING

3.1 GEOLOGIC SETTING

Regional Geologic Setting
The Site lies at the border of the Linda Vista Formation and the Bay Point Formation. The Linda Vista Formation is mostly comprised of moderate reddish-brown, interbedded sandstone and conglomerate. The Bay Point Formation is composed mainly of marine and nonmarine, poorly consolidated, pale brown, fine- and medium-grained fossilferous sandstone (Kennedy, 1975).

Local Geologic Setting
Based on a review of the 7.5-Minute La Jolla, California Quadrangle Topographic Map (US Geological Survey, 1967, Photorevised 1975), the Site is located at an elevation approximately 65 feet above mean sea level (MSL).

Soil lithologies observed during the drilling of CB-1 through CB-5 generally consisted of sandy silt to silty sand to approximately 80 ft bgs, the maximum depth of exploration. Soil lithologies and soil sample laboratory analytical results are displayed on geologic cross sections A-A' and B-B', presented on Figures 2, 4 and 5.

3.2 HYDROGEOLOGIC SETTING

The California Regional Water Quality Control Board, San Diego Region (CRWQCB) indicates in the 1994 Water Quality Control Plan, San Diego Basin (9) that the Site is located within the Mission San Diego Hydrologic Sub Area (HSA 7.11) of the Lower San Diego Hydrologic Area (HA 7.10) in the San Diego Hydrologic Unit (HU 7.00). Groundwater within this HSA is currently designated as beneficial for agricultural supply, industrial process, and industrial service supply uses. It is listed as having the potential for beneficial use for municipal and domestic supply. However, in the vicinity of the site location (west of interstate highway 5) these beneficial uses do not apply and the area is exempted from the sources of drinking water policy (CRWQCB, 1994). Beneficial uses for groundwater within the Mission San Diego Hydrologic Sub Area are displayed on Table 3.

Historic groundwater measurements indicate that static depth-to-water (DTW) has generally fluctuated between 50 to 54 ft bgs at the Site. On October 20 and 21, 2005, SECOR conducted groundwater monitoring activities at the Site. Static DTW measurements on October 20, 2005 ranged between 48.45 (in MW-5) and 52.03 (in MW-12) ft bgs. The direction of groundwater flow appears to be to the east with a hydraulic gradient of approximately 0.033 vertical foot per horizontal foot (ft/ft; SECOR, 2005a).

4.0 SITE ASSESSMENT METHODS

4.1 PRE-FIELD PREPARATION

SECOR prepared and submitted a Work Plan dated June 10, 2005 to the SAM for the advancement of five soil borings. The purpose was to assess the vertical extent of residual hydrocarbon impact to soil at the Site. A copy of the Work Plan and SAM work plan approval letter, dated July 7, 2005, is provided in Appendix A. Prior to field activities, a soil boring construction permit was submitted to the DEH for five soil borings. Pursuant to the requirements of the approved permit, the DEH was notified of SECOR's intent to drill at least 48 hours prior to the start of drilling. A copy of the approved well permit cover sheet (#LMON 103441, issued by the DEH on October 4, 2005 is included in Appendix B.

SECOR prepared a comprehensive site-specific HASP for this project, based on the scope of work and the potential hazards present. The HASP was used as the primary mechanism to assure employee, environmental, and public safety during field activities. All individuals working under the purview of SECOR were required to read and sign the HASP to acknowledge their understanding of the information contained in it. The HASP was reviewed by the project management team and then reviewed and approved by SECOR's Health and Safety Officer. The HASP was implemented and enforced on-site by the SECOR Site Safety and Health Officer.

SECOR contacted USA to mark utilities in the vicinity of the proposed soil borings. USA notified utility companies of the pending work so that the locations of buried utilities could be marked. Additionally, individual utility companies were contacted for utility locations by SECOR in an attempt to create a utility survey map. The information received from those companies that responded to the inquiries was used to create a utility survey map showing the approximate locations of local utilities (Figure 6). Additionally, a private geophysical company was contracted to help identify any subsurface utilities prior to drilling.

4.2 FIELD EXPLORATION

4.2.1 Drilling Operations

On October 17, 2005, a SECOR geologist, working under the direction of a California Professional Geologist, observed the utility clearance of five proposed soil boring locations, each to a depth of 8 ft bgs, using an air-vacuum extraction unit (e.g., air knife).

On October 18 and 19, 2005, following the completion of air knife activities, a SECOR geologist working under the direction of a California Professional Geologist, observed the advancement of five soil borings (CB-1 through CB-5) to depths ranging from approximately 65 to 80 ft bgs.

Soil borings CB-3 and CB-5 were advanced to depths of 70 ft bgs and soil borings CB-1, CB-2, and CB-4 were advanced to depths of 75 ft bgs, 65 ft bgs, and 80 ft bgs, respectively (Appendix C).

4.2.2 Subsurface Soil Sampling

Soil samples were collected from each boring at five foot depth intervals from 10 ft bgs to the maximum depth of exploration. Samples were collected using a split spoon sampler lined with three 6-inch brass sleeves. Upon collection, the bottom brass sleeve was removed from the sampler, sealed with Teflon™ sheets and plastic caps, properly labeled, and placed in an ice-chilled cooler for transport under chain-of-custody protocol to a state-certified laboratory for chemical analysis. The soil in one of the remaining brass sleeves was placed into a resealable plastic bag, and field-screened for volatile organic vapors using a PID. Soil in the third sample sleeve was visually classified in accordance with the Unified Soil Classification System (USCS), as prescribed in the American Society for Testing and Materials (ASTM) Standard D2488-93, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Soil color descriptions were referenced from the Geological Society of America's *Rock-Color Chart* published in 1995 (GSA, 1995).

All soil samples collected were analyzed for TPHg by EPA Method 8260B, and select samples collected, determined by PID readings observed in the field, were analyzed for BTEX and MTBE by EPA Method 8260B. A total of 67 samples were collected and analyzed, and the analytical results are summarized in Table 4.

4.2.3 Decontamination Procedures

To minimize the possibility of cross contamination, equipment used for drilling was properly decontaminated prior to use in the drilling of each soil boring and in the collection of subsurface soil samples from each soil boring. The down-hole drilling equipment was decontaminated prior to arrival at the Site using pressurized soapy water and steam.

4.2.4 Investigation-Derived Waste Handling Procedures

Drill cuttings and decontamination fluids generated during drilling activities were placed in U.S. Department of Transportation (DOT) approved 55-gallon steal drums with locking lids, properly labeled, and transported as non-hazardous waste by Phillips Services Corporation (PSC) of Carson, California to the TPS Technologies facility in Adelanto, California. A copy of the waste manifest is provided as Appendix D.

4.2.5 Groundwater Monitoring

All groundwater sampling activities were conducted according to SAM program guidelines (*2004 SAM Manual*). The Site was most recently sampled on October 20 and 21, 2005 using standard well purging techniques. Groundwater samples were collected from each of the 12 MWs using clean disposable bailers, and each sample was transferred into six labeled 40-mL VOA vials with HCl preservative. The samples were stored in an ice-chilled cooler and transported under chain-of-custody protocol to a state-certified laboratory for chemical analyses.

5.0 SUMMARY OF FINDINGS

Based on SECOR field observations and the results of laboratory analyses of soil and groundwater samples, SECOR presents the following summary of findings:

5.1 LOCAL HYDROSTRATIGRAPHIC CONDITIONS

The lithologies found during the advancement of soil borings CB-1 through CB-5 generally consisted of sandy silt and silty to coarse-grained sand from surface to 80 ft bgs, the maximum depth of exploration. The lithologies are described on the Borehole/Well Logs in Appendix C. Geologic cross sections are presented in Figures 4 and 5.

During groundwater gauging and sampling on October 20 and 21, 2005, the static DTW measurements ranged from 48.45 ft bgs in MW-5 to 52.03 ft bgs in MW-12. The relative groundwater elevations, calculated from the surveyed wellheads of the MWs, ranged from 18.01 feet above MSL in MW-10 to 19.62 feet above MSL in MW-8 and MW-12. Based on review of the groundwater gradient map (Figure 7) prepared from the calculated groundwater elevation data, the approximate groundwater flow direction beneath the Site is toward the east with a hydraulic gradient of 0.033 ft/ft (SECOR, 2005a).

5.2 ANALYTICAL RESULTS

5.2.1 Subsurface Soil

Hydrocarbon constituents were detected above LRLs in 12 of the 67 soil samples analyzed. TPHg was detected at concentrations of 1,100 mg/kg, 560 mg/kg, and 690 mg/kg in samples collected from boring CB-1 at depths of 60, 65, and 70 ft bgs, respectively. Soil samples collected from boring CB-3 at depths of 55 and 60 ft bgs had detectable levels of TPHg at concentrations of 5.2 mg/kg and 0.30 mg/kg, respectively. Five samples collected from boring CB-4 (at depths from 55 to 75 ft bgs) had detectable levels of TPHg, at concentrations ranging from 0.40 mg/kg (at 60 ft bgs) to 770 mg/kg (at 55 ft bgs). Boring CB-5 had two soil samples with detectable levels of TPHg, at concentrations of 1.2 mg/kg (at 20 ft bgs) and 0.16 mg/kg (at 45 ft bgs). No soil samples collected from boring CB-2 had TPHg concentration levels above the LRLs.

Of the 67 soil samples collected, 18 samples were analyzed for BTEX and MTBE. The remaining samples were not analyzed, but were available if Benzene or MTBE was detected in the first 18 samples. Benzene was detected above LRLs in 1 of the 18 samples analyzed, at a concentration of 0.26 mg/kg in the sample collected from boring CB-3 taken at 55 ft bgs. Ethylbenzene and Total Xylenes were detected above LRLs in 1 of the 18 samples analyzed, at respective concentrations of 8.2 mg/kg and 22 mg/kg in the sample collected from boring CB-4 at a depth of 55 ft bgs. MTBE was detected above LRLs in 2 of the 18 samples analyzed, at concentrations of 0.085 mg/kg and 0.01 mg/kg in the samples collected from boring CB-3 at 55 ft bgs and boring CB-4 at 65 ft bgs, respectively.

Analytical results for soil samples collected October 18 and 19, 2005 are summarized in Table 4. Figure 8 illustrates the historic distribution of petroleum hydrocarbons in soil samples

collected at the Site. A summary of historical soil analytical results is included in Table 5. A copy of the laboratory analytical report and chain-of-custody documentation is included in Appendix E. As illustrated in Figures 4 and 5, the full extent of the residual hydrocarbon impacts to soil and groundwater are limited and have been fully delineated vertically and horizontally.

5.2.2 Groundwater

On October 20 and 21, 2005, each of the 12 MWs at the Site was sampled following established purge sampling procedures, which are based on SAM guidelines (2004 SAM Manual). No measurable LPH were detected in any of the gauged wells during this sampling event; however, LPH sheen was observed in MW-9. TPHg was detected in samples collected from 4 of the 12 MWs, at concentrations ranging from 140 micrograms per liter (μg/L) (in sample MW-5) to 16,000 μg/L (in sample MW-9). Benzene was detected in samples collected from 3 of the 12 MWs, at concentrations of 51 μg/L, 510 μg/L, and 1,200 μg/L in wells MW-7, MW-9, and MW-1, respectively. Samples collected from MW-1, MW-7, and MW-9 had detectable levels of toluene at concentrations of 2,400 μg/L, 0.74 μg/L, and 2,900 μg/L, respectively. Samples taken from MW-1 and MW-9 had concentrations above the LRLs for ethyl-benzene, at 290 μg/L and 490 μg/L, respectively. Samples collected from 2 of the 12 MWs sampled had detectable levels of total xylenes, at concentrations of 1,400 μg/L (in MW-1) and 4,500 μg/L (in MW-9). MTBE was detected above LRLs in samples collected from 6 of the 12 MWs, ranging in concentration from 2.4 μg/L (in MW-8) to 130 μg/L (in MW-9). The LRL was <100 μg/L for TPHg, <0.50 μg/L for benzene, toluene, and ethyl-benzene, <1.5 μg/L for total xylenes, and <1.0 μg/L for MTBE. Di-isopropyl ether (DIPE) and tert-butanol (TBA) were detected in the sample taken from MW-5 at a concentration of 7.7 μg/L and 41 μg/L, respectively, and below LRLs in the remaining 11 wells. Ethyl tert-butyl ether (ETBE) and tert-amyl methyl ether (TAME) concentrations in all samples collected were below LRLs, which ranged from <5.0 μg/L to <120 μg/L (SECOR, 2005a).

A summary of historic groundwater levels and chemical analysis results is included in Table 6. Figure 9 illustrates the concentrations of dissolved MTBE, benzene, and TPHg in the groundwater beneath the Site on September 27, 2005. A copy of the laboratory analytical report and chain-of-custody documentation is included in Appendix E.

5.2.3 Estimated Distribution of Hydrocarbons in the Subsurface

Soil sample analytical data indicates elevated concentrations of TPHg in the vicinity of the former fuel USTs, located in the southern corner of the Site; in the vicinity of the former used oil UST, located in the central southern portion of the Site, and; in the vicinity of the former dispenser islands in the northeast corner of the Site. The maximum TPHg concentration detected in subsurface soil was in the sample collected from B-1/MW-1 in February 1997, reported as 28,000 mg/kg at a depth of 30 ft bgs. The maximum TPHg concentration detected during this assessment (CB-1 through CB-5) was reported in the sample taken from CB-1 at a depth of 60 ft bgs, reported as 1,100 mg/kg.

6.0 ESTIMATED TIME FOR GROUNDWATER TO REACH CLEANUP GOALS

This section provides an estimate of the time required for groundwater concentrations below the Site to reach State of California primary drinking water maximum contaminant levels (MCLs). It has already been demonstrated that the dissolved-phase hydrocarbon plume below the Site is stable (Section 3.0). Of the 12 groundwater monitoring wells at the Site, wells MW-2, MW-3, MW-4, MW-5, MW-6, MW-8, MW-10, MW-11, and MW-12 have been near or below the MCLs for dissolved-phase benzene and/or MTBE at the MCLs of 1.0 µg/L and 13 µg/L, respectively, for at least one year. Benzene and/or MTBE concentrations in wells MW-1, MW-7 and MW-9 have been above MCLs in the last year. Recent dissolved-phase benzene and MTBE concentrations in site wells are summarized in Table 6.

It has been observed that the attenuation of dissolved phase hydrocarbon concentrations at fuel hydrocarbon sites generally follows a first-order decay trend once the majority of hydrocarbon source material has been removed. The following equation has been used to describe the observed concentration decrease at a point (e.g. monitoring well) within a dissolved phase hydrocarbon plume:

$$C = C_o e^{-kt}$$

Where:
C = concentration at time t (µg/L)
C_o = peak concentration (µg/L)
k = overall attenuation rate constant ($days^{-1}$)
t = elapsed time after observation of peak concentration (days)

To estimate the time for remaining benzene and MTBE below the Site to attenuate to MCLs, SECOR used concentration trends in wells MW-1, MW-7, and MW-9 to estimate first-order attenuation rate constants for benzene and MTBE. The attenuation rate constant was estimated by utilizing the equation above with the peak concentration (C_o) for the given well and the concentration from the most recent groundwater sampling event. This calculated first-order degradation rate constant gives an approximate natural attenuation rate around a given well. The resulting rate constants were then used to extrapolate the estimated time to reach MCLs at the Site.

For benzene in well MW-1, a data set beginning with the maximum observed concentration of 18,000 µg/L on April 26, 1999 to 1,200 µg/L on October 20, 2005 was used for analysis. A semi-log plot of benzene concentration versus time for well MW-1 is presented as Figure 10. A least-squares statistical method was used to calculate the best-fit trend line through the data set. The best-fit trend line and equation are included on Figure 10. The slope of the best-fit line (0.0007 $days^{-1}$) is the estimated first-order attenuation rate constant for the data set. The first order decay equation and estimated rate constant are then used to estimate the time required for benzene concentrations to reach the MCL of 1 µg/L. This method estimated that benzene concentrations in the vicinity of well MW-1 will reach 1 µg/L in approximately 32 years. A summary of the trend analysis for well MW-1 is provided in Table 7.

This same approach was used to evaluate MTBE concentration data for well MW-1. A data set beginning with the maximum observed concentration of 1,800 µg/L on February 19, 1999 to 100

µg/L on October 20, 2005 was used for analysis. A semi-log plot of MTBE concentration versus time for well MW-1 and the resulting best-fit trend line and equation are presented as Figure 10. The slope of the best-fit line (0.0006 $days^{-1}$) is the estimated first-order attenuation rate constant for the data set. The equation for the best-fit line was then used to estimate the time required for MTBE concentrations to reach the MCL of 13 µg/L. This method estimated that MTBE concentrations in the vicinity of well MW-1 will reach 13 µg/L in approximately 16 years. A summary of the well MW-1 trend analysis is provided in Table 7.

For benzene in well MW-7, a data set beginning with the maximum observed concentration of 2,900 µg/L on January 22, 1998 to 51 µg/L on October 20, 2005 was used for analysis. A semi-log plot of benzene concentration versus time for well MW-7 is presented as Figure 11. A least-squares statistical method was used to calculate the best-fit trend line through the data set. The best-fit trend line and equation are included on Figure 11. The slope of the best-fit line (0.0013 $days^{-1}$) is the estimated first-order attenuation rate constant for the data set. The first order decay equation and estimated rate constant are then used to estimate the time required for benzene concentrations to reach the MCL of 1 µg/L. This method estimated that benzene concentrations in the vicinity of well MW-7 will reach 1 µg/L in approximately 9 years. A summary of the trend analysis for well MW-7 is provided in Table 7.

For MTBE in well MW-7, a data set beginning with the maximum observed concentration of 53 µg/L on March 31, 2000 to 7.2 µg/L on October 20, 2005 was used for analysis. A semi-log plot of benzene concentration versus time for well MW-7 is presented as Figure 11. A least-squares statistical method was used to calculate the best-fit trend line through the data set. The best-fit trend line and equation are included on Figure 11. The slope of the best-fit line (0.0001 $days^{-1}$) is the estimated first-order attenuation rate constant for the data set. MTBE concentrations in well MW-7 have been less than the MTBE MCL of 13 µg/L since September 2000, therefore no additional analysis of MTBE RNA is necessary. A summary of the trend analysis for well MW-7 is provided in Table 7.

For benzene in well MW-9, a data set beginning with the maximum observed concentration of 7,500 µg/L on August 27, 1998 to 510 µg/L on October 20, 2005 was used for analysis. A semi-log plot of benzene concentration versus time for well MW-9 is presented as Figure 12. A least-squares statistical method was used to calculate the best-fit trend line through the data set. The best-fit trend line and equation are included on Figure 12. The slope of the best-fit line (0.0008 $days^{-1}$) is the estimated first-order attenuation rate constant for the data set. The first order decay equation and estimated rate constant are then used to estimate the time required for benzene concentrations to reach the MCL of 1 µg/L. This method estimated that benzene concentrations in the vicinity of well MW-9 will reach 1 µg/L in approximately 23 years. A summary of the trend analysis for well MW-9 is provided in Table 7.

This same approach was used to evaluate MTBE concentration data for well MW-9. A data set beginning with the maximum observed concentration of 2,500 µg/L on August 27, 1998 to 130 µg/L on October 20, 2005 was used for analysis. A semi-log plot of MTBE concentration versus time for well MW-9 and the resulting best-fit trend line and equation are presented as Figure 12. The slope of the best-fit line (0.0007 $days^{-1}$) is the estimated first-order attenuation rate constant for the data set. The equation for the best-fit line was then used to estimate the time required for MTBE concentrations to reach the MCL of 13 µg/L. This method estimated that MTBE

concentrations in the vicinity of well MW-1 will reach 13 µg/L in approximately 13 years. A summary of the well MW-9 trend analysis is provided in Table 7.

Based on a review of the site data, the groundwater concentrations below the site should consistently reach MCLs within approximately 32 years. This estimate allows for a reasonable amount of uncertainty due to the possible presence of small pockets of residual hydrocarbons below the site that could result in future short-term rises in benzene and MTBE concentrations above MCLs and in wells with LPH. This estimate assumes that there are no additional releases at the Site.

7.0 SUMMARY OF FINDINGS AND CONCLUSIONS

7.1 SUMMARY OF FINDINGS

Based on the findings of the site assessment, SECOR makes the following summary of findings concerning the nature, extent, and severity of petroleum hydrocarbon impacts to subsurface soil, oil, gas, and groundwater at the Site and in the Site vicinity:

- The subject site is located within the Mission San Diego Hydrologic Sub Area (HSA 7.11) of the Lower San Diego Hydrologic Area (HA 7.10) in the San Diego Hydrologic Unit (7.00), as outlined in the California Regional Water Quality Control Board Basin Plan (CRWQCB, 1994). Groundwater within this HSA is currently designated as beneficial for agricultural supply, industrial process, and industrial service supply uses. It is listed as having the potential for beneficial use for municipal and domestic supply. However, in the vicinity of the site location, these beneficial uses do not apply and the area is exempted from the sources of drinking water policy. Groundwater measurements taken on October 20, 2005 indicate a range in static DTW from 18.01 (in MW-10) to 19.62 (in both MW-7 and MW-12) feet bgs.

- Soil lithologies encountered during the drilling of CB-1 through CB-5 generally consisted of sandy silt to silty sand to approximately 80 ft bgs, the maximum depth of exploration.

- Elevated concentrations of TPHg in subsurface soil appear to be limited to the vicinity of the former used oil and fuel USTs, located in the central to southern corner of the Site, and in the vicinity of the former dispenser islands in the northeast corner of the Site.

- Dissolved benzene and MTBE concentrations in groundwater have been relatively stable for at least two years and do not appear to be migrating further off-site, indicating plume stability.

- A sensitive receptor survey (SRS) was conducted by SECOR in March 2005 by evaluating public database records compiled by public agencies and database vendors and by conducting a field reconnaissance in the vicinity of the site. The SRS did not identify any domestic water wells or agriculture/irrigation wells within a one-mile radius of the site (SECOR, 2005b).

- The four high vacuum mobile remediation system events between April 2001 and November 2001 removed 2,065 pounds of hydrocarbons in the soil and groundwater. The SVE system which was in operation from October 2002 to February 2005 removed 6,205 lbs of VFH until the hydrocarbon mass removal rate was asymptotic.

- The remaining hydrocarbon concentrations in groundwater have been shown to be naturally attenuating.

7.2 CONCLUSIONS

Based on the findings of this and previous assessments at the Site, SECOR draws the following conclusions concerning the nature, extent, and severity of petroleum hydrocarbon impacts from UAR #H12455 on environmental media at the Site and in the Site vicinity:

- Residual hydrocarbon impact to subsurface soil on-site appears to be limited to the vicinity of the former used oil and fuel USTs, located in the central to southern section of the Site, and in the vicinity of the former dispenser islands in the northeast corner of the Site. Hydrocarbon impacts to the subsurface soil at the Site appear to be adequately defined.

- Dissolved phase hydrocarbon impact to groundwater appears to be adequately defined upgradient to the west of the Site, downgradient to the east of the Site, and crossgradient to the south of the Site. Hydrocarbon impact to groundwater is undefined crossgradient to the north of MW-5. The groundwater plume appears to be stable at the Site.

- The source area of the hydrocarbons in the soil and groundwater at the Site has been removed by active remediation to the extent feasible.

- The remaining residual hydrocarbon concentrations in soil and groundwater will remediate by natural attenuation within the next 32 years.

8.0 RECOMMENDATIONS

Based on the information presented in this report, SECOR recommends the following:

- The SVE system should be removed from the subject Site.
- The quarterly groundwater monitoring and sampling program at the Site should be discontinued and all the wells should be destroyed in accordance with SAM requirements.
- A "No Further Action Required" determination document should be issued by the OCHCA for UAR Case #H12455 associated with Former Chevron Station No. 9-1834.

9.0 STANDARD LIMITATIONS

The findings and conclusions in this report have been prepared for the specific application to this project and have been developed in a manner consistent with the level of care and skill normally exercised by members of the environmental scientific profession currently practicing under similar conditions in the area at the time this investigation was performed. No warranty, express or implied, is made. This report is for the exclusive use of Chevron and its representatives.

A potential always remains for the presence of unknown, unidentified, or unforeseen subsurface contamination. Further evidence against such potential site contamination would require additional subsurface exploration and testing.

If new information is discovered during future site work (which may include excavations, boreholes, or other studies), SECOR should be requested to re-evaluate the conclusions of this report and to provide amendments as required.

10.0 REFERENCES

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