SITE CONCEPTUAL MODEL UPDATE
FOURTH QUARTER 2005

Tesoro Station No. 67106
Former Beacon Station No. 3720
1088 Marina Boulevard
San Leandro, California
RDM Project No. 00-67106

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EXECUTIVE SUMMARY

This Site Conceptual Model (SCM) Update has been prepared by RDM Environmental, Inc. (RDM) and Haley & Aldrich, Inc. (Haley & Aldrich), on behalf of Tesoro Petroleum Companies, Inc. (Tesoro), for the former Tesoro Station No. 67106 located at 1088 Marina Boulevard, San Leandro, California. This report is submitted in fulfillment of the requirements for the California Regional Water Quality Control Board, San Francisco Bay Region (CRWQCBSFB), the Alameda County Health Care Agency – Department of Health and the City of San Leandro – Environmental Service Division. This report contains only updates to the Groundwater Monitoring and Remediation Systems Status Report dated November 10, 2005 (RDM). Standard background information previously submitted to the agency in hard copy is not included in this update report. This information can be found in hard copy by referring to the SCM report dated November 10, 2005, or electronically accessed on the Tesoro North Hollywood Sharepoint website (https://portal.haleyaldrich.com/sites/ext/San Leandro).

Currently, the groundwater flow is toward the southwest, which is generally consistent with recent monitoring events, and consistent with historical groundwater flow direction. Total Petroleum Hydrocarbons as gasoline (TPH-G) are currently detected in Wells MW-1, MW-2, MW-3, and MW-4 at concentrations greater than the screening level of 500 micrograms per liter (ug/L) for ground water that is not a current or potential drinking water resource (Table F-1b, *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater; Volume 2: Background Documentation for the Development of Tier I Environmental Screening Levels.* California Regional Water Quality Control Board, San Francisco Bay Region, Interim Final – 2005). Total Xylenes are currently detected in Well M-4 at a concentration greater than the Table F-1b screening criteria of 100 ug/L. All other on-site and off-site Wells are either non-detect (ND) or have concentrations below the screening criteria for TPH-G, BTEX, MTBE or other fuel oxygenates.

Significant concentration reductions have been observed since beginning this monitoring program: the highest MTBE concentration detected this quarter (15 ug/L, November 5, 2005 in Well MW-8) is less than one tenth of a percent of the historical maximum of 84,000 ug/L; the highest combined BTEX concentration detected this quarter (898 ug/L, November 5, 2005 in Well MW-4) is approximately one-tenth that of the historical maximum of 7,300 ug/L; and the highest TPH-G concentration detected this quarter 9,200 ug/L, November 5, 2005 in Well MW-1) is approximately one fourth that of the historical maximum of 35,000 ug/L. The remedial approach has slowed the migration of the gasoline plume and has substantially reduced contaminant concentrations in the aquifer.

Soil vapor extraction has reached the limit of its effectiveness as no measurable concentrations of VOCs or TPH-G were detected in the vapor stream during this quarter. We are proposing to temporarily suspend active remediation to allow an assessment of site rebound and equilibrium concentrations for a six month period. This assessment will be used to focus subsequent remedial action to the areas warranting further attention and facilitate a better understanding of which technology(ies) will be most appropriate to complete site restoration.

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1.0 INTRODUCTION

This Site Conceptual Model (SCM) Update Report has been prepared by RDM Environmental, Inc. (RDM) and Haley & Aldrich, Inc. (Haley & Aldrich), on behalf of Tesoro Petroleum Companies, Inc. (Tesoro) for the former Tesoro Station No. 67106 located at 1088 Marina Boulevard, San Leandro, California. This report contains only updates to the previously submitted documents. The most recently prepared project reports and standard project reference materials consistently contained in quarterly reports submitted to the CRWQCBSFB (e.g., site background, local groundwater use, site geology and hydrogeology, general field procedures, previous work, remedial system descriptions) are available in hard copy in any of the previous report submittals or electronically on the Tesoro North Hollywood Sharepoint website (https://portal.haleyaldrich.com/sites/ext/Tesoro/San Leandro), a project data portal and collaborative resource that is currently available to all members of the project team and interested stakeholders.

Total Petroleum Hydrocarbons as gasoline (TPH-G) and Total Xylenes remain the constituents of concern in groundwater beneath this site. The plume is contained within the site boundary with TPH-G concentrations in Wells MW-1 through MW-4 and MW-8 and total Xylenes concentrations from Well MW-4 at levels higher than the environmental screening criteria found in Table F-1b of *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater; Volume 2: Background Documentation for the Development of Tier I Environmental Screening Levels*, California Regional Water Quality Control Board, San Francisco Bay Region, Interim Final – 2005. The groundwater screening levels in Table F-1b are for groundwater that is not a current or potential drinking water resource. The final groundwater, contaminant specific, screening levels are based on the lowest of groundwater Ceiling Value, Indoor-Air Impact Goal and Aquatic Habitat Goal for protection of groundwater quality.

Soil vapor extraction (SVE) from Wells MW-2, MW-3, MW-8, MW-9, VW-1, ozone sparging in Wells MW-1, MW-4 and MW-5, coupled with air sparging in sparge points SP-1 through SP-6 have significantly reduced subsurface contaminant concentrations from beneath the site and have prevented off-site migration.

Significant concentration reductions have been observed since beginning this monitoring program: the highest MTBE concentration detected this quarter (15 micrograms per liter [ug/L], November 5, 2005 in Well MW-8) is less than one tenth of a percent of the historical maximum of 84,000 ug/L; the highest combined BTEX concentration detected this quarter (898 ug/L, November 5, 2005 in Well MW-4) is approximately one-tenth that of the historical maximum of 7,300 ug/L; and the highest TPH-G concentration detected this quarter (9,200 micrograms per liter [ug/L], November 5, 2005 in Well MW-1) is approximately one fourth that of the historical maximum of 35,000 ug/L. The remedial approach has slowed the migration of the gasoline plume and has substantially reduced contaminant concentrations in the aquifer.

2.0 SITE BACKGROUND

Site Description and Groundwater Use details are available in hard copy in any of the previous report submittals or electronically on the Tesoro North Hollywood Sharepoint website (https://portal.haleyaldrich.com/sites/ext/Tesoro/San Leandro).

3.0 ENVIRONMENTAL SETTING

Descriptions of the site geologic and hydrogeologic conditions are available in hard copy in any of the previous report submittals or electronically on the Tesoro North Hollywood Sharepoint website (https://portal.haleyaldrich.com/sites/ext/Tesoro/San Leandro). A site topographic map and site map are shown in Figures 1 and 2, respectively.

4.0 SITE ASSESSMENT ACTIVITIES

No supplemental site assessment activities were performed during the reporting period. A summary of previous work conducted at the site is available in hard copy in any of the previous report submittals or electronically on the Tesoro North Hollywood Sharepoint website (https://portal.haleyaldrich.com/sites/ext/Tesoro/San Leandro).

5.0 QUARTERLY GROUNDWATER MONITORING AND SAMPLING

5.1 GROUNDWATER MONITORING AND SAMPLING ACTIVITIES

On November 5, 2005, fluid levels in Monitoring Wells MW-1 through MW-9 were measured prior to well purging and sampling. No free product was observed in any of the groundwater monitoring wells and has not been observed in any project monitoring well since before March 1998. Groundwater monitoring data are presented in Table 1.

Data used to prepare the groundwater elevation contour maps were obtained from fluid level sensors deployed during the November 5, 2005 sampling event. Groundwater elevation data are summarized in Table 1. The groundwater elevation contour map, using data obtained during the November 5, 2005 sampling event, is shown in Figure 3 and indicated that groundwater direction is predominately to the southwest.

5.2 LABORATORY ANALYSIS

Groundwater samples collected during this sampling event were analyzed by a State-certified laboratory, for total petroleum hydrocarbons as gasoline (TPH-G) using the using the Department of Health Services Leaking Underground Fuel Tank (DHS LUFT) Method, and volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, total xylenes (BTEX), MTBE, and other fuel oxygenates using Environmental Protection Agency (EPA) Method 8260B.

Historical and quarterly results of laboratory analysis of groundwater samples (including Fourth Quarter 2005) are presented in Table 1. Dissolved-phase Benzene, TPH-G, MTBE and total Xylenes iso-concentration maps are shown on Figures 4, 5, 6, and 7, respectively. Copies of the official laboratory reports and chain of custody records for the 4th Quarter 2005 quarterly groundwater sampling event are included in Appendix B. In addition, field data sheets from the quarterly monitoring and sampling event are included in Appendix A.

5.3 FINDINGS

On November 5, 2005, groundwater was measured at depths between 11.92 feet and 14.79 feet bgs. Based on previous groundwater elevation data, the groundwater elevations have decreased approximately 0.5 feet in all wells, with the exception of MW-2 (1.35 ft increase) compared with the Third Quarter 2005 groundwater sampling event, but have not recovered to historical low water levels. Groundwater flow beneath the site is to the southwest under a hydraulic gradient less than 0.05 foot per foot.

Groundwater monitoring data are presented in Tables 1 and 2, and the groundwater elevation contour map is shown on Figure 3.

Results of laboratory analysis of groundwater samples collected on November 5, 2005, from Wells MW-1 through MW-9 are summarized in Table 1 and indicate the following:

- TPH-G was detected in groundwater samples collected from Wells MW-1, MW-3, MW-4, MW-5, MW-8, and MW-9 at concentrations of 9200, 2200, 3000, 110, 2300, and 150 ug/L, respectively. Results show no significant reduction in TPH-G concentrations from the Third Quarter 2005 analytical results.

- TPH-G, BTEX or MTBE concentrations were not detected in Well MW-2, but this likely represents a false negative result caused by station construction activities and silt blockage. The Well was cleared on November 21, 2005, using a vacuum truck, and a subsequent sample was collected on January 13, 2006, as part of the First Quarter 2006 sampling event. TPH-G, BTEX and MTBE results from the January 13, 2006 sample were consistent with Third Quarter 2005 analytical results.

- Benzene was detected in groundwater samples collected from Wells MW-3, MW-4, and MW-8 at concentrations of 7.1, 6.0, and 9.8 ug/L, respectively. Results are consistent with groundwater sample results from the Third Quarter 2005 and do not show a significant decrease in contaminant concentrations.

- Toluene was detected in groundwater samples collected from Wells MW-3 and MW-4 at concentrations of 1.0 and 91 ug/L, respectively. Results are consistent with groundwater sample results from the Third Quarter 2005 and do not show a significant decrease in contaminant concentrations.

- Ethylbenzene was detected in groundwater samples collected from Wells MW-1, MW-3, MW-4, MW-5, and MW-8 at concentrations of 92, 2.7, 95, 2.2, and 54 ug/L, respectively. Results are consistent with groundwater sample results from the Third Quarter 2005 and do not show a significant decrease in contaminant concentrations.

- Total Xylenes was detected in groundwater samples collected from Wells MW-1, MW-3, MW-4, MW-5, and MW-8 at concentrations of 38, 0.75, 630, 1.5, and 67 ug/L, respectively. Results are consistent with groundwater sample results from the Third Quarter 2005 and do not show a significant decrease in contaminant concentrations.

- MTBE was detected in groundwater samples collected from Wells MW-3, MW-4, MW-7, and MW-8 at concentrations of 3.6, 5.3, 0.76, and 15 ug/L, respectively. Results are consistent with groundwater sample results from the Third Quarter 2005 and do not show a significant decrease in contaminant concentrations, with the exception of Well MW-8 where the MTBE concentration was reduced from 27 to 15 ug/L (near 50% reduction).

6.0 SITE CONCEPTUAL MODEL OVERVIEW AND UPDATE

Currently, the groundwater flow is toward the southwest, which is generally consistent with recent monitoring events, and consistent with the previous SCM for the site. TPH-G, BTEX and MTBE were currently detected in onsite Wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-8 and MW-9. MTBE was present in off-site Well MW-7. Wells MW-1, MW-4 and MW-5 are currently connected to an ozone

sparging system and have shown significant decreases in BTEX and MTBE concentrations over the last year, with a leveling off during the past two quarters; no significant decrease in TPH-G concentration has have observed in the ozone sparge wells. An air sparging system is connected to sparge points SP-1 through SP-6, in an effort to stimulate aerobic biodegradation pathways. The current process flow diagram for all active remediation systems is shown on Figure 8.

In comparison to the Third Quarter 2005 sampling event, TPH-G, BTEX and MTBE concentrations for the Fourth Quarter 2005 have not significantly decreased in monitoring Wells throughout the site, indicating the current remedial measures may have reached the limit of their effectiveness. There was an average decrease in groundwater elevation of 0.5 feet compared to the Third Quarter of 2005.

Current groundwater monitoring results suggests that Final Groundwater Screening Levels have been met with the exception of total Xylenes in MW-2 and MW-4 and TPH-G in MW-1 through MW-4. Despite the application of ozone injection and based on current data, TPH concentrations in the vicinity of MW-1 through MW-4 and MW-8, along with BTEX constituents in MW-2 and MW-4, will require further remediation to achieve the specified groundwater screening criteria. Ozone sparging will not effectively address the TPH concentrations since ozone is not able to readily oxidize straight or branched chain alkanes typical of gasoline.

7.0 QUARTERLY REMEDIAL PROGRESS OF SOIL VAPOR EXTRACTION SYSTEM

7.1 OPERATIONS UPDATE

The SVE system is continuing to operate with extraction from Wells MW-2, MW-3, MW-8, MW-9 and VW-1. The effluent vapor from the SVE blower is abated using two 600-lb carbon vessels connected in series. During the Fourth Quarter 2005 no detectable concentrations of BTEX, MTBE, or TPH-G were identified in the SVE vapor stream (Table 2). It is estimated that less than 12 pounds of vapor equivalent gasoline were removed during the Fourth Quarter 2005 (Table 3), calculated using the analytical method reporting limit for each constituent as the vapor stream concentration. The cumulative vapor equivalent gasoline removed (Table 3), as of December 27, 2005, is estimated at 3,070 pounds (503 gallons).

7.2 CONCLUSIONS AND RECOMMENDATIONS

Based on no detectable concentrations of BTEX, MTBE and TPH-G in the SVE vapor stream for all samples collected during the Fourth Quarter 2005, it appears SVE has reached the limit of its effectiveness. We recommend that active SVE operations are temporarily suspended to allow an assessment of site rebound and equilibrium concentrations for a six month period.

8.0 QUARTERLY REMEDIAL PROGRESS OF GROUNDWATER TREATMENT SYSTEM

8.1 OPERATIONS UPDATE

Two 0.5 lb/hr ozone generators, connected in parallel, continuously sparge ozone in monitoring Wells MW-1, MW-4 and MW-5. Significant reductions in BTEX and MTBE concentrations have occurred over the past year, with a leveling off during the past two quarters. The application of ozone sparging has had little effect in decreasing TPH-G concentrations over the past two quarters. An air sparging system is connected to sparge points SP-1 through SP-6, in an effort to stimulate aerobic biodegradation pathways. The current process flow diagram for all active remediation systems is shown on Figure 7.

8.2 CONCLUSIONS AND RECOMMENDATIONS

Groundwater monitoring data shown in Table 1 suggests that Final Groundwater Screening Levels have been met with the exception of total Xylenes in MW-2 and MW-4 and TPH-G in MW-1 through MW-4. The results to date may not reflect actual aquifer conditions beyond the bore water of each ozone sparging well due to the small radius of influence resulting from the tight nature of the subsurface clay. Analytical results may also be biased low because many of the on-site monitoring wells are either vapor extraction or ozone injection points (ozone injection at MW-1, MW-4, and MW-5; SVE at MW-2, MW-3, MW-8, and MW-9).

Based on current data, TPH-G concentrations in the vicinity of MW-1 through MW-4 and MW-8, along with BTEX constituents in MW-2 and MW-4, will require further remediation to achieve the specified groundwater screening criteria. Continued ozone sparging will not effectively address the TPH-G concentrations based on ozone's inability to readily oxidize straight or branched chain alkanes typical of gasoline, and that benefits observed are likely limited to the well-bore water and an artifact of oxygen addition from ozone decomposition.

We therefore recommend that site conditions be reassessed under un-amended, equilibrium state conditions (i.e., after sufficient shutdown of current remediation systems). The assessment of un-amended site conditions will provide the data and insight necessary to support a preferred path to closure.

9.0 PROPOSED WORK ACTIVITIES

RDM, Haley & Aldrich, and Tesoro propose the following work activities for the First and Second Quarters of 2006:

- Shut-down of all active remediation (i.e., SVE, air sparging, and ozone injection), with immediate collection of TPH-G and VOC samples.

- Maintain remediation shut-down for a minimum 6-month period. We anticipate, based on experience at sites with similar subsurface conditions, that six months is sufficient time for the subsurface to reach equilibrium conditions.

- During the third month of remediation shutdown, collect TPH-G, VOC and MNA (e.g., dissolved oxygen, redox potential, pH, conductivity, ferrous iron, total iron, alkalinity, carbon dioxide, total organic carbon,) parameters from all wells using low flow sampling methods. This data will be reported in our next quarterly SCM update.

- At the end of the six month period sample each well for TPH-G, VOC, and MNA parameter analysis. We anticipate the analytical results will provide insight with respect to the following two concerns:
    - Whether subsurface conditions are appropriate for the current remedial approach.
    - The extent to which the current remedial approach has been effective.

- Regularly scheduled monitoring of water levels in key wells within the monitoring network to provide groundwater flow gradient and direction data.

- Continue quarterly groundwater compliance reporting under this new reporting format, including updates to the SCM as appropriate.

10.0 STATEMENT OF LIMITATIONS AND PROFESSIONAL CERTIFICATION

The conclusions presented herein are based solely upon the agreed upon scope of work outlined in this report. RDM makes no warranties or guarantees as to the accuracy or completeness of information provided or compiled by others. It is possible that information exists beyond the scope of this investigation. Additional information, which was not found or available to RDM at the time of writing this report, may result in modification of the conclusions presented. This report is not a legal opinion. The services performed by RDM have been conducted in a manner consistent with the level of care ordinarily exercised by members of our profession currently practicing under similar conditions. No other warranty, expressed or implied, is made.

This report was supervised or prepared by the licensed professional whose signature and license number appear below.

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11.0 REFERENCES

Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater; Volume 1: Summary Tier 1 Lookup Tables. California Regional Water Quality Control Board, San Francisco Bay Region, Interim Final – 2005.

Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater; Volume 2: Background Documentation for the Development of Tier I Environmental Screening Levels. California Regional Water Quality Control Board, San Francisco Bay Region, Interim Final – 2005.