APPENDIX F

Water Quality Sampling and Analysis Plan

Water Quality Sampling and Analysis Plan

ConocoPhillips Los Angeles Refinery
Carson Plant

In Partial Fulfillment of
RWQCB Cleanup and Abatement Order No. 94-139

Prepared for

ConocoPhillips Company

Prepared by
TRC
21 Technology Drive
Irvine, CA 92618

Revised April 2006

This Water Quality Sampling and Analysis Plan was prepared under the supervision of a Registered Geologist.

Gil Fry
California Registered Geologist, No. 5678

Contents

Number **Page**

Contents (Continued)

Tables

Number **Page**

Tables

Number **Page**

Figure

Number **Page**

Section 1
Introduction

This site-specific Water Quality Sampling and Analysis Plan (SAP) describes the field and analytical activities performed as part of the ground water monitoring program being conducted in compliance with Cleanup and Abatement Order (CAO) 94-139 issued to Union Oil Company of California, dba Unocal (Unocal), for the Unocal (now ConocoPhillips) Los Angeles Refinery (LAR), by the Regional Water Quality Control Board, Los Angeles Region (RWQCB) on December 22, 1995. This Water Quality Sampling and Analysis Plan has been revised to reflect the recommendations in the "Groundwater Operation and Maintenance Inspection Report" by the Department of Toxic Substances Control (DTSC), dated January 5, 2004 and the recommendations of the United States Environmental Protection Agency (USEPA) to the RWQCB for Initial Phased Field Investigation (correspondence from G. Lovato to P. Cho, dated August 19, 2003).

The LAR consists of two facilities, the Carson Plant and the Wilmington Plant. This SAP specifically addresses the ground water monitoring program for the Carson Plant, which is located at 1520 East Sepulveda Blvd. in Carson, California. In compliance with the CAO, ground water monitoring at the Carson Plant is conducted on a semiannual basis. During each event all monitoring wells are gauged to determine water levels and free-product petroleum hydrocarbon (if present) levels. In addition, ground water from 15 selected monitoring wells and the Plant's two water supply wells are sampled for dissolved constituents. Starting with the Fall 2003 semi-annual groundwater monitoring event, all onsite wells that do not contain free product, including monitoring wells and recovery wells, are sampled for the constituents identified in Table 2-2.

Site-wide ground water monitoring was conducted on a quarterly basis from 1985 through 1993. During that time no marked seasonal variations in water levels were observed. In 1994, the RWQCB agreed to change ground water monitoring from a quarterly to a semiannual schedule. Monitoring is conducted each Spring and Fall with results reported July 30 and January 30, respectively. A monitoring well will not be sampled if it is found to contain free product, unless lead is specified, in which case the lead will be sampled for even if the well is found to contain free product. For one sampling crew, it is estimated that sampling and gauging for one semiannual monitoring event will require about 4 days, which includes about 1 day for gauging and 3 days for purging and sampling.

This SAP was developed in accordance with the State of California Water Resources Control Board LUFT Manual (1989) and in reference to EPA's guidance in preparation of a field sampling plan (1992). Prior to a gauging and sampling event, each member of the field team must sign a document stating that each member has read and understands the current version of the SAP (Appendix A). Following each sampling event, each member of the field team must sign a document that details any deviations from the SAP that were necessitated by field conditions (Appendix B). The document also states that, with the exceptions noted above, all

field measurements and samples were collected in accordance with the procedures described in the SAP. Both signed documents will be included with a copy of the SAP in an appendix of the semiannual monitoring report.

1.1 Ground Water Monitoring Program Objectives

This ground water monitoring program was developed for the Carson Plant to monitor water levels, ground water flow rate and direction, and ground water quality. Ground water quality is monitored specifically for separate and dissolved phase petroleum hydrocarbon constituents, dissolved halogenated hydrocarbons, and dissolved lead. Specific analyses are described in Section 2.4. Ground water quality, water level, and free-product levels will continue to be integrated into a database on an ongoing basis for preparation of semiannual reports. The monitoring network for the Carson Plant consists of the following:

- 52 monitoring wells
- 2 water supply wells

Monitoring wells on the adjacent former Shell Oil Company (Shell) properties (Shell Fee Property) are not addressed under this SAP.

1.2 Purpose of the Sampling and Analysis Plan

The purpose of this SAP is to provide guidance for the established semiannual ground water monitoring program at the Carson Plant. This sampling program has been established in compliance with CAO 94-139 issued by the RWQCB on December 22, 1994. The monitoring program consists of gauging all the monitoring and sampling select wells for ground water quality.

Included in this SAP are the following:

- Number of ground water samples to be collected at the facility
- Description of field procedures used to gauge and sample monitoring wells
- Types of analyses performed on ground water samples

Also presented in this document are the analytical methodology and quality control procedures.

Section 2
Sampling Locations and Laboratory Analyses

This section outlines the sampling program for ground water monitoring at the ConocoPhillips Carson facility. Table 2-1 presents a list of monitoring wells and the rationale for sampling each well, including the rationale for collecting quality control samples. Figure 2-1 is a plan view map of the facility showing the location of the monitoring wells.

2.1 Sampling Objectives

The objective of the ground water sampling program at the Carson Plant is to monitor for the presence of LNAPL, dissolved petroleum hydrocarbon constituents, dissolved halogenated hydrocarbon constituents, and dissolved lead in the ground water. In addition, designated Point of Compliance (POC) wells for the closed Process Water Pond (PWP) will be monitored for CCR 66264 Appendix IX constituents on an annual basis for a minimum of 4 years until baseline water quality has been established. Data collected from the Carson site will also be provided to the Carson Regional Groundwater Group (CRGG) for inclusion into their annual report.

2.2 Sampling Locations

Fourteen selected monitoring wells will be sampled for chemical analysis at the Carson Plant. In addition to the 14 sampled monitoring wells, the water supply wells (WW-2 and WW-4) for the Carson Plant will be sampled for water quality. All 14 monitoring wells and the two water supply wells will be sampled in the Spring, and 11 of the 15 monitoring wells and the two water supply wells will be sampled in the Fall. Tables 2-2A and 2-2B specify the wells and chemical analyses to be performed on samples collected during the Spring and Fall semiannual events. A total of 52 monitoring wells and 69 product recovery wells will be gauged for ground water elevations and thickness of LNAPL (if present). All onsite wells that do not contain free product will be sampled for the constituents shown in Table 2-2A. Designated POC wells for the PWP (wells 2, 17, 38 and 59) will be analyzed for Appendix IX constituents, regardless of whether LNAPL is present, until baseline conditions have been established (Table 2-2B). It is anticipated that four rounds of annual monitoring will be sufficient to establish baseline water quality, at which point ConocoPhillips will streamline the Appendix IX program to eliminate nondetect and/or exotic constituents not associated with former PWP operations. Monitoring well locations are presented in Figure 2-1.

Table 2-1
Summary of Rationale for Ground Water and QA/QC Samples
ConocoPhillips Carson Plant

Sample Type	Well Site	Well Type	Rationale
Ground Water Samples	Carson Plant	Monitoring Well	Evaluate background water quality (MW-2, MW-31, MW-32), downgradient water quality (MW-17, MW-35, MW-46, MW-50), vertical migration (WD-1, WD-2, WD-3, WW-2, WW-4), plume migration (MW-29), northern property boundary (MW-54), and offsite to onsite plume migration (MW-3, MW-5, MW-50, MW-35, MW-2, and MW-29). Assist with management of contamination at the facility and assist with establishment of aerial limits of contamination.
Ground Water Samples	Carson Plant	Monitoring Well	MW-29 and MW-46 to monitor impact to ground water associated with Inactive Disposal Site 1 (IDS-1).
Ground Water Samples	Carson Plant	Point of Compliance (POC) Monitoring Well for PWP	Evaluate Appendix IX constituents in PWP POC wells 2, 17, 38, and 59.
QA/QC Samples			
Duplicate Ground Water Samples	TBD [1]	TBD	Duplicate samples will be collected to check on laboratory and field procedures. One duplicate sample will be taken at minimum frequency of 10 percent for each parameter.
MS/MSD [2]	TBD	TBD	Evaluate the precision and accuracy of laboratory analyses. One MS/MSD sample will be taken at a minimum frequency of 5 percent for all parameters.
Field Blank [3, 4]	NA	NA	Evaluate the presence of external contaminants that may have been introduced into ground water samples during sampling. One field blank per semiannual event will be collected for all parameters except VOCs. One VOC field blank will be collected for each day of sampling for VOCs.

(1) TBD = To be determined.
(2) MS/MSD = Matrix spike/matrix spike duplicate.
(3) Blank samples will be prepared using analytically-certified organic-free (HPLC-grade) water for organic parameters and metal-free (deionized-distilled water) for inorganic parameters.
(4) At least one blank sample (equipment, trip, or field) will be collected per day.

Table 2-2A
Sampling Requirements for CAO Semiannual Ground Water Monitoring
ConocoPhillips Carson Plant

Hydraulic Zone	Monitoring Well	Semiannual Monitoring Event [1,2,7]									
		Spring Only					Spring and Fall				
		Dissolved Petroleum Hydrocarbons									
		Total Recoverable Petroleum Hydrocarbons (1664)	Total Petroleum Hydrocarbon as Gas (8015M)	Carbon Chain Identification (8015M)	Volatile Aromatic Hydrocarbons & Oxygenates[4] (8260B)	Total Phenols (420.2)	Semi-volatile Organic Compounds (8270)	Metals (Including Cr^{+6}) (6010)	Field Parameters [3] (field)	Volatile Halogenated Hydrocarbons and Oxygenates (8260B)	DIPE, TBA and MTBE[5,6] (8260)
Bellflower Aquitard	MW-2	■	■	■	■	■	■	■	■	■	
	MW-3	■	■	■	■	■	■	■	■	■	
	MW-5	■	■	■	■	■	■	■	■	■	
	MW-17							■	■		
	MW-29	■	■	■	■	■	■	■	■		
	MW-31							■	■		
	MW-32	■	■	■	■	■	■	■	■	■	
	MW-35	■	■	■	■	■	■	■	■	■	
	MW-46	■	■	■	■	■	■	■	■		
	MW-50	■	■	■	■	■	■	■	■	■	
	MW-54	■	■	■	■	■	■	■	■	■	
Gage Aquifer	WD-1	■	■	■	■	■	■	■	■	■	
	WD-2	■	■	■	■	■	■	■	■	■	
	WD-3	■	■	■	■	■	■	■	■	■	
Silverado Aquifer	WW-2	■	■	■	■	■	■	■	■	■	
	WW-4	■	■	■	■	■	■	■	■	■	
All Other Wells[5]											■

Notes:

1. Gauging will be performed for all monitoring wells at the Plant.
2. Wells containing free product will be sampled for lead only.
3. Field parameters are pH, specific conductance (or electrical conductivity), temperature, and turbidity.
4. Oxygenates include t-butyl alcohol (TBA), methyl t-butyl ether (MTBE), tert-amyl methyl ether (TAME), ethyl tert-butyl ether (ETBE) and diisopropyl ether (DIPE).
5. All onsite wells that do not contain free product will be sampled for TBA, DIPE and MTBE.
6. Samples obtained from Point of Compliance wells for the RCRA-regulated PWP unit will be analyzed for selected oxygenates as well as Appendix IX constituents on an annual basis, beginning with the Fall 2004 event (see Table 2-2B). The Point of Compliance wells are MW-2, MW-17, MW-38, and MW-59.
7. If equivalent or improved laboratory EPA methods are available, the samples may be analyzed by the equivalent or improved method.

Table 2-2B

Sampling Requirements for Annual Appendix IX Monitoring for PWP Point of Compliance Wells

ConocoPhillips Carson Plant

Hydraulic Zone	POC Monitoring Well	Fall Only	
		Dissolved Petroleum Hydrocarbons	
		Appendix IX Constituents[1] (CCR 66264)	DIPE, TBA, MTBE[1] (8260)
Bellflower Aquitard	MW-2	■	■
	MW-17	■	■
	MW-38	■	■
	MW-59	■	■

[1] Appendix IX constituents and oxygenates to be analyzed minimum of four annual events, to establish baseline conditions beginning with Fall 2004. The Appendix IX analytical program will then be reduced as appropriate to eliminate nondetect and/or exotic constituents not associated with former PWP operations.

2.3 Field and QA/QC Analyses

This section presents the field and QA/QC analyses that will be used during ground water sampling at the Carson Plant. All field activities will be conducted in modified Level D personal protective equipment (PPE) as detailed in the site-specific Health and Safety Plan (HSP).

2.3.1 Field Analyses

During purging of monitoring wells, water quality parameters will be monitored. Parameters to be monitored include pH, temperature, turbidity, and electrical conductivity. The frequencies for taking these measurements are described in Section 3.4, Measuring Field Parameters. Final field values for these parameters will be recorded and reported.

During collection of ground water samples and well gauging activities, the breathing zone will be monitored for potential hazards to the health of personnel performing these activities. This work will consist of monitoring the breathing zone for contaminants through the use of a photoionization detector (PID). Monitoring activities will be performed at the beginning of each task and at intervals as specified in the site-specific HSP. Action levels will be identified in the site-specific HSP provided by the contractor.

2.3.2 QA/QC Analysis

The following types of field QA/QC samples will be collected:

- Field duplicate ground water sample
- Field blank sample
- Laboratory QA/QC sample

These QA/QC samples are identified in Table 2-1 and described below.

Field duplicate ground water samples will be collected to check on laboratory and field procedures. One duplicate ground water sample will be taken at a minimum frequency of 10 percent for each parameter.

Field blank samples will be collected to evaluate the presence of external contaminants that may have been introduced into ground water samples during sampling. One field blank per semiannual event will be collected for all parameters except volatile organic compounds (VOCs). For VOCs, one field blank will be collected for each day of sampling. Blank samples will be prepared using analytically-certified organic free (HPLC-grade) water for organic parameters and metal-free (deionized or distilled) water for inorganic parameters.

Laboratory QA/QC samples will be prepared by the laboratory in the form of matrix spike/matrix spike duplicate (MS/MSDs) samples. One MS/MSD sample will be taken at a minimum frequency of 5 percent for all parameters, with a minimum of one MS/MSD sample collected for each semiannual monitoring event.

Table 2-3
Analytical Parameters, Methods, and Detection Limits for Ground Water and QA/QC Sample Analyses
ConocoPhillips Carson Plant

Parameter	Method	Target Detection Limit
Laboratory Parameters		
Halogenated Volatile Organics	EPA 8260[a]	Method Detection Limit[b]
Aromatic Volatile Organics	EPA 8260[a]	Method Detection Limit[b]
Carbon Chain Identification	8015M	Method Detection Limit
Total Petroleum Hydrocarbons as Gasoline	EPA 8015M[a]	Method Detection Limit
Total Recoverable Petroleum Hydrocarbons	EPA 1664[a]	Method Detection Limit
Total Phenol	EPA 8270[a]	Method Detection Limit[b]
Total Dissolved Lead	EPA 6010[a]	1.0 µg/L[c]
Field Parameters		
pH	Field/manual	N/A
Turbidity	Field/manual	N/A
Electrical Conductivity	Field/manual	N/A
Temperature	Field/manual	N/A

[a] U.S. Environmental Protection Agency, 1979. *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-020, revised March 1983.
[b] Values using purge-and-trap method.
[c] Value expected when using a 20-µL injection and normal gas flow.
[d] If equivalent or improved laboratory EPA methods are available, the samples may be analyzed by the equivalent or improved method.

2.4 Request for Analysis

The following paragraphs outline the specific analyses requested for the Carson Plant. Table 2-1 summarizes the required QA/QC samples. Table 2-2 summarizes the wells to be sampled and the required analyses for each well according to the Spring and Fall sampling events. Wells having free product will not be sampled for dissolved petroleum hydrocarbon constituents. Wells having LNAPL, however, will still be sampled for total dissolved lead if lead is specified. Table 2-3 summarizes the required analytical parameters, methods, and detection limits for the ground water analyses. Table 2-4 presents the required analytical methods, holding times, number and types of containers, and preservatives for the required ground water analyses. All monitoring wells at the Carson Plant will be gauged for water and free product levels, if present. The Carson Plant sampling and gauging is estimated to take 4 days, which includes 1 day for gauging and 3 days for sampling.

As shown in Table 2-2, 14 selected monitoring wells will be sampled during the Spring semiannual event, and 10 selected monitoring wells will be sampled during the Fall semiannual event. Included in the group of 14 monitoring wells is the following breakdown of well screen sampling zones: 11 monitoring wells are screened in the Bellflower Aquitard (MW-2, MW-3, MW-5, MW-17, MW-29, MW-31, MW-32, MW-35, MW-46, MW-50, and MW-54); and 3 monitoring wells are screened in the Gage Aquifer (WD-1, WD-2, and WD-3). The facility water supply wells, screened in the Silverado Aquifer (WW-2 and WW-4), are also sampled in the Spring and Fall events. An equipment blank will be collected if a submersible pump is used to collect samples from the Gage aquifer monitor wells.

The Spring monitoring event consists of sampling 14 monitoring wells and the two water supply wells, including MW-2, MW-3, MW-5, MW-17, MW-29, MW-31, MW-32, MW-35, MW-46, MW-50, MW-54, WD-1, WD-2, and WD-3; and the water supply wells WW-2 and WW-4. The ground water samples collected during the Spring semiannual event will be analyzed for the following constituents:

- Halogenated volatile organics using EPA Method 8260B (14 wells, excluding MW-17 and MW-31).
- Aromatic volatile organics EPA Method 8260B (14 wells, excluding MW-17 and MW-31).
- Total recoverable petroleum hydrocarbon (TRPH) using EPA Method 1664 (14 wells, excluding MW-17 and MW-31).
- Total petroleum hydrocarbon-gas (TPH-gas) using EPA Method 8015M (14 wells, excluding MW-17 and MW-31).
- Carbon chain identification using EPA Method 8015M (14 wells, excluding MW-17 and MW-31)

- Metals using EPA Method 6010 (all 16 wells).
- Semi-volatile organic compounds (SVOCs) using EPA Method 8270 (all 16 wells).
- Phenolic compounds using EPA Method 420.2 (14 wells, excluding MW-17 and MW-31).
- Field parameters, including electrical conductivity, pH, temperature, and turbidity (all 16 wells).

The Fall monitoring event consists of sampling 10 monitoring wells including MW-2, MW-3, MW-5, MW-32, MW-35, MW-50, MW-54, WD-1, WD-2, WD-3; and the water supply wells WW-2 and WW-4. The ground water samples collected during the Fall semiannual event will be analyzed for the following constituents:

- Halogenated volatile organic using EPA Method 8260B (all 12 wells).
- Field parameters, including electrical conductivity, pH, temperature, and turbidity (all 12 wells).
- Metals using EPA Method 6010 (all 12 wells).
- Semi-volatile organic compounds (SVOCs) using EPA Method 8270 (all 12 wells).

Additionally, all onsite wells that do not contain product will be sampled for t-butyl alcohol (TBA), methyl t-butyl ether (MTBE) and diisopropyl ether (DIPE).

Table 2-4

Analytical Holding Time, Sample Container, and Preservative Requirements for Groundwater and QA/QC Samples
ConocoPhillips Carson Plant

Analytical Parameter	Analytical Method	Analytical Holding Time	Minimum Number and Type of Containers	Preservative
Volatile Aromatic Hydrocarbons	EPA 8260B	7 days w/o HCl 14 days w/ HCl	3 x 40 ml glass vial-TLC (no headspace)	Cool to 4°C, HCl to pH<2
Volatile Halogenated Hydrocarbons	EPA 8260B	7 days w/o HCl 14 days w/ HCl		
TPH as Gasoline	EPA 8015M	7 days w/o HCl 14 days w/ HCl		
Carbon Chain Identification, C_8 through C_{44+}	EPA 8015M	14 days	1 x 1-liter amber glass bottle-TLC	Cool to 4°C
TRPH	EPA 1664	14 days	1 x 1-liter amber glass bottle (no headspace)	Cool to 4°C, HCl
Total Phenol	EPA 420.2	28 days	1 x 500-ml amber glass bottle	Cool to 4°C, H_2SO_4 to pH<2
Semi-Volatile Organic Compounds	EPA 8270	14 days	2 x 500-ml amber glass bottle	Cool to 4°C
Metals (Total and Dissolved)	EPA 6010	6 months (Hexavalent Chromium has a 24-hour holding time)	1 x 500-ml polyethylene bottle (filtered) 1 x 500-ml polyethylene bottle (unfiltered)	If filtering in laboratory: cool to 4°C in field, transport to laboratory, filter with 0.45 micron filter and preserve with HNO_3
				If filtering in field: filter sample with 0.45 micron filter under positive pressure, place into sample container preserved with HNO_3 so that pH<2, cool to 4°C, transport to laboratory.

Notes:
TPH = Total Petroleum Hydrocarbon
TRPH = Total Recoverable Petroleum Hydrocarbons
EPA = Environmental Protection Agency
TLC = Teflon Lined Cap

Section 3
Field Activities and Ground Water Monitoring Procedures

This section presents the procedures to be followed during gauging, purging, and sample collection of ground water monitoring wells at the Carson Plant. In addition, the following are also outlined in this Section: proper maintenance and calibration of field equipment, decontamination procedures, field parameter measurement procedures, sample container and preservation requirements, sample packaging and shipping, collection of quality control samples, and managing investigation-derived waste.

Field gauging and ground water sample collection activities will consist of the following tasks: (1) measuring water levels and free-product (if any) levels in all monitoring wells; and (2) purging ground water from selected monitoring wells for which field water quality parameters will be measured and ground water samples will be collected into containers for laboratory analysis. Water levels will be measured in the shortest possible time and will be measured in all monitoring wells before any well is purged. The order in which wells will be gauged and sampled will be evaluated prior to each event utilizing information obtained in the previous events. In general, gauging and sampling will proceed in sequence from clean wells to progressively more contaminated wells to minimize the potential for cross contamination. Monitoring wells with a history of containing LNAPL will be gauged and sampled last. However, in every case the deep aquifer wells will be gauged and sampled prior to the shallow aquifer wells. A monitoring well will not be sampled if it is found to contain free-product, unless an analysis for lead is specified, in which case the lead will be sampled even if the well is found to contain free-product.

Prior to gauging a well, the field team member will assess well-head conditions including the state of well casing, well locks, and markings, and will note those well-head conditions when appropriate in the comment section of the ground water monitoring log. Minor items such as replacing well locks and removing standing water from within the wellhead protective casing will be reported on the ground water monitoring log. Major problems such as missing or damaged wells will be noted on the ground water monitoring log, voiced to appropriate ConocoPhillips personnel within 24 hours of discovery, scheduled for maintenance/repair and then followed up in writing within two weeks of completing the field work.

3.1 Field Equipment

Field instruments will be calibrated using the methods described by the manufacturer's instructions and then checked and adjusted at specific, predetermined intervals. At a minimum the equipment will be calibrated at the beginning and end of each day. Field equipment found to be out of calibration will be recalibrated in accordance with the manufacture's specifications. When test equipment is found to be out of calibration or

damaged, an evaluation will be made to ascertain the validity of previous inspection or test results and the acceptability of data generated since the last calibration check. When it is necessary to assure the acceptability of suspect items, the originally required inspections and/or tests will be repeated using properly calibrated equipment. Evidence of suspect data will be reported to the Field or Project Manager. Test equipment consistently found to be out of calibration will be repaired or replaced. All instrument calibration activities will be documented in the field logbooks or the ground water monitoring log.

The field instruments such as oil-water interface probes, water level indicators, pH meters, conductivity bridges, organic vapor monitor (OVM), and organic vapor analyzer (OVA) screening equipment will be set up and operated in strict adherence to the manufacturer's instructions. When the operation of these instruments needs modifications because of specific site or sample conditions, such modifications will be documented in the instrument logs and field notebooks.

Buffer solutions will be labeled with their expiration dates to ensure accuracy in calibration of the pH meter. When buffer solutions are transferred to smaller containers for field use, the expiration date of the calibration fluid will be noted on the smaller containers. The expiration dates for the buffer solutions will be noted on the ground water monitoring logs. Calibration gases will be available in labeled containers.

3.2 Monitor Well Gauging

The water level in all the monitoring wells at the Carson Plant will be gauged during each event. An intrinsically safe, dedicated, clean, ORS portable oil-water interface probe (or comparable model) capable of obtaining reliable measurements to +/- 0.01 foot with an LNAPL hydrocarbon detection limit of 0.01 feet will be used for gauging the wells completed in the shallow aquifer. Water levels in wells completed in the deep aquifer will be measured with a SOLINST water level probe (or comparable model) capable of obtaining reliable measurements to +/- 0.01 foot. The depth to water in all the wells will be measured with reference to a point that has been highlighted in black at the top of the well casing and has been surveyed by a licensed surveyor. After sounding each well, the probe tip and the length of tape plus two feet that came into contact with water or LNAPL will be cleaned using Alconox solution, and then rinsed with deionized water. This decontamination procedure is described in greater detail in Section 3.6.

Well total depths (TD) will be measured and reported on a site wide basis during the Fall event every five years. Well depths were last measured site wide in Fall 2000. The next event during which well depths will be measured site wide will be Fall 2005. More frequent measurements will be made as needed if it is suspected that the well casing has been damaged or if there is evidence of excessive sediment build up in the well casing. The TD of the well will be measured by lowering the portable oil-water interface probe in the wells completed in the shallow aquifer and the portable water level probe in the wells completed in the deeper aquifer until the probe meets resistance. The depth to this point will then be measured from the marked reference point on the well head casing. The current TD of the

well will be recorded on the ground water log collection sheet and reported in the subsequent monitoring report.

Well gauging will be performed as follows:

- Instruments will be calibrated according to manufacturers' instructions.
- The well number, site, date, and condition will be recorded in the field logbook or the ground water monitoring logs.
- The well is unlocked and opened.
- Breathing zone and headspace will be monitored with proper health and safety equipment and observations will be recorded in the logbook. Action levels and additional field procedures will be presented in the HSP provided by the contractor.
- Depth to air-water, or air-oil, and oil-water interfaces will be measured and recorded on the ground water monitoring log and reported in the subsequent monitoring report.

3.3 Well Purging

To ensure that representative ground water samples will be collected, the well will be purged prior to sampling for analysis. A vacuum truck and operator specialized for and experienced in monitoring at hazardous waste sites may be used to purge monitoring wells having depths to ground water of approximately 100 feet or less. Dedicated stingers may be used for well purging at the plant. For wells not suited to vacuum truck purging, a development rig with a bailer may be used. Alternatively, a submersible pump may be used. It is anticipated that the recharge rate for several wells will be slow, thus requiring multiple visits to these wells. In this case, sampling will be conducted within 24 hours of the initiation of purging.

Purge water will be contained within a vacuum truck. Wells not suited for vacuum truck purging will be hand bailed or will be purged using a pump, and then their purged water will be placed in drums for temporary storage. Each drum will be labeled excluded recyclable material "Purge Water." After the purging of a well is complete, the drums containing purge water will be emptied onsite by a vacuum truck. The empty drums will be removed from the site at the close of each day. The vacuum truck will transport the purged water to the Plant's Oil Recovery Unit for processing.

Well purging will be performed as follows:

- For each well to be sampled, information on well location, diameter(s), and depth will be recorded on the ground water monitoring log.
- Either a vacuum truck, bailer or pump is selected to purge the well. A bailer or pump is used when the water depth is greater than approximately 100 feet bgs.

- The well number, date, and condition will be recorded on the ground water monitoring log.

- Pump hoses will be marked at 10-foot intervals with fasteners or other equivalent devices to be used to set the pump at a consistent depth of 5 feet below the top of water.

- A tarp or drop cloth will be placed around the well to avoid the dripping of water or free-product from wells known to contain free product and, if a bailer is used, to avoid having the bailer cord contact the soil.

- The breathing zone and headspace will be monitored with proper health and safety equipment and observations will be recorded in the logbook or ground water monitoring log.

- All field measurements of pH, specific conductance, temperature, and turbidity will be recorded on the ground water monitoring log forms or in the field logbook.

- The volume of water (gallons) in a well casing (i.e., well volume) is calculated as follows:

  $(\Pi r^2 h)\ 7.48 = \text{gallons}$

  where: $\Pi = 3.142$
  r = Radius of the well pipe in feet
  h = Linear feet of water column in well
  7.48 = Gallons per cubic foot of water

- Representative well volumes for select casing diameters will be as follows:

  2-inch-diameter well:
  0.163 gal./ft x __ (linear ft of water) = ___gal.

  4-inch-diameter well:
  0.653 gal./ft x __ (linear ft of water) = ___gal.

  6-inch-diameter well:
  1.47 gal./ft x __ (linear ft of water)= ___gal.

- During purging, field parameters will be measured at least once during each well volume. This is done by diverting vacuum water into a bucket or instrument water reservoir for measurement of the parameter. A sample for laboratory analysis is taken when three well volumes have been purged and field parameter readings have stabilized over three successive readings.

- Unless the well is purged to dryness, well purging will continue until a minimum of three well volumes are removed and the field parameters measured during purging

have stabilized. Field parameters will be considered stabilized when three consecutive measurements agree as follows: (1) pH measurements agree within 0.1 units, (2) temperature measurements agree within 1°C, (3) and specific conductance measurements are within 10 percent. One turbidity reading will be taken prior to sampling. Purge volumes will be measured using calibrated containers or measuring devices. In the case when the calculated purge volume is greater than 100 gallons, the criterion of 3 well volumes will be relaxed and purging will be stopped when field parameters have stabilized. A minimum of 100 gallons will be purged in these cases.

- After purging, a typical well will be allowed to recharge to at least 80 percent of its original water level prior to sampling. The wells will be sampled within 24 hours of purging, even if the water level has not recovered to at least 80 percent of its original water level.

- The maximum purge rate for each well will be three gallons a minute. The objective is to avoid purging a well to dryness. In the case of slow recharging wells, i.e., when recharge time for water levels to return to 80 percent of its original level is greater than 2 hours, sampling will occur when field parameters stabilize.

- For wells that will be bailed, a well will be considered to have been purged until "dry" if less than 10 % of the original volume of water remains in the well after purging. In the case where a well is bailed "dry" it will be sampled after it has reached 80 percent of its original water level. However, the well will be sampled within 24 hours after purging is complete if the well has not yet reached 80 percent of its original water level within this time.

3.4 Measuring Field Parameters

The field parameters, temperature, pH, EC, and turbidity, will be measured and recorded at intervals described above, throughout the purging of each well. The frequency of measurement will be at least once per purged well volume and immediately before sampling to confirm parameter stabilization. A minimum of a quarter of a well volume will be purged in between readings. A Hydac Water Quality Meter (or equivalent) will be used to measure pH, conductivity and temperature. Turbidity will be measured using a LaMotte turbidimeter or equivalent. These meters will be maintained and calibrated according to manufacturer specifications and as specified in section 3.1. At a minimum, instruments will be calibrated twice a day, once in the morning and again at the completion of the day's sample collection. Calibration and any observed "drift" will be recorded in the field log book or on the ground water collection logs along with the equipment serial number. The equipment serial numbers will be recorded in the field logbook at the beginning of the sampling events. Buffer solutions will show expiration dates. Turbidity measurements will be taken in standard units prior to sample collection.

3.5 Sample Collection

Samples will be collected into the appropriate sample container pretreated with preservative (if needed) as summarized in Table 2-4.

A new disposable bailer constructed of inert materials will be used for each well during water sampling. Before handling the bailer and filling the sample containers, new clean, powderless disposable nitrile surgical gloves will be donned to minimize potential cross contamination. The bailer will be connected to a new disposable nylon bailer cord. The bailer will be lowered into the well in a controlled manner to minimize ground water disturbance. The bailer will then be raised slowly to minimize agitation. The bailer cord will be wrapped in a coil and held or placed on a tarp to avoid contact with the ground. The ground water will be collected in the appropriate containers using a new disposable bottom-emptying device for each well. The sample containers will be filled through the bottom emptying devices. The sample containers for VOC analysis (Methods 8015M, 8260) will be slightly overfilled prior to affixing the lid, and the lid will be attached carefully and containers visually checked to verify that there is no headspace. Additional sample containers requiring preservation will have the appropriate preservative added to the containers by the laboratory prior to sampling. Sample containers not intended for VOC analysis will not be over filled to avoid loss of preservative.

Samples requiring filtering will be collected in one of the following methods depending on whether the samples are filtered in the field or filtered in the lab:

- **Field Filtering.** Samples to be filtered in the field will be placed into an appropriately preserved sample container(s) immediately after field-filtering. The filtering will occur in the field under positive pressure using a 0.45 micron filter. The filled sample container will immediately be chilled for transport to the laboratory.

- **Laboratory Filtering.** Samples to be filtered in the laboratory will be placed into preservative-free sample container(s) and submitted to the laboratory where filtering and sample preservation will occur on the same day the samples are collected. The filled sample containers will immediately be chilled for transport to the laboratory. The samples will be filtered by the laboratory immediately upon receipt from the field with a 0.45 micron filter under positive pressure. Immediately after filtering the sample in the laboratory, the appropriate preservatives will be added to the samples.

Field duplicates, field blanks, and laboratory QA/QC samples will be collected to ensure QA/QC as discussed in Section 3.9.

3.6 Decontamination Procedures

Equipment will be decontaminated after use with each well to prevent the introduction of contaminants into other wells or samples of ground water. The water level probe and the portable oil-water interface probe, and the portion of the cord attached to either probe plus

two feet that comes into contact with liquids in a well will be decontaminated before being used in the next well by the following method:

- Scrub the cord in an Alconox (or equivalent) solution wash
- Double rinse the cord with potable tap water
- Rinse with organic-free or deionized

Water sampling, water level and oil-water measuring, and sample preparation equipment that comes onsite will be cleaned prior to and after each use. Decontamination will consist of combinations of steam cleaning or detergent (Alconox or equivalent) wash, water rinse, and distilled water rinse.

During cleaning and decontamination operations, the substitution of a higher grade water for tap water is permitted and does not have to be noted as a variation.

All decontamination operations will be conducted by personnel wearing Level D personal protective equipment, as defined in the Health and Safety Plan.

Equipment shall not be used if visual signs, such as discoloration, indicate that decontamination was insufficient.

3.7 Sample Containers and Preservation

Sample container requirements and preservation methods for each analysis are summarized in Table 2-4. Sample containers will be obtained through a certified vendor. If required, chemical preservatives will be added to the appropriate sample containers by the laboratory that supplies the containers and does the analyses. In the event that samples will be collected outside the normal scope of the program, EPA guidelines for sample collection, preservation, and holding times will be followed. All samples will be placed on ice in a cooler and maintained at 4°C immediately following sample collection.

3.8 Sample Packaging and Shipment

After collection, ground water samples must be packaged and shipped to the laboratory. To ensure integrity of the samples arriving at the laboratory, the coolers must be properly prepared, packed, and closed. These procedures will be described below.

Preparation of Sample Coolers

- Remove all previous labels used on the cooler.
- Seal all drain plugs with tape (inside and outside).
- Line the cooler with a large plastic bag to contain samples.

- Double-bag all ice in plastic bags and seal.

Packing Samples in Coolers

- Place the COC form in the zip-type closure bag.
- Place samples in an upright position in the cooler.
- Fill the void space between samples with recyclable cornstarch popcorn, double-bagged ice, or bubble wrap.
- Place ice on top of and between the samples.
- Fill the remaining voids with recyclable cornstarch popcorn or double-bagged ice.
- Custody-seal large plastic bag containing samples and packing material.

Closing and Shipping of Cooler

If shipping is required, coolers will be packed with packing material surrounding the bottles to prevent breakage during transport. Ice will be sealed in plastic bags to prevent melting ice from soaking the packing material. Sample documentation will be enclosed in sealed plastic bags taped to the underside of the cooler lid. Coolers will be secured with packing tape and custody seals as described below.

- Tape the cooler lid with strapping tape, encircling the cooler several times.
- Place COC seals on two sides of the lid (one in front, and one on the side).
-

The coolers will then be delivered to the appropriate laboratory by the sampling team or by overnight courier the day of sample collection. For Friday shipments, the laboratory must be contacted prior to 12 noon to coordinate with sample shipments on Saturday. Samples will only be shipped on Friday if the laboratory provides assurance that analytical holding times will not be exceeded.

The following information will be written on each sample container label with a permanent marker:

- Sample location number
- Type of analysis requested
- Preservative used
- Date and time collected

Immediately following sample collection, the filled sample containers with completed labels will be sealed with custody seals, placed in plastic zip-type closure bags, and placed in a cooler containing ice. The three volatile organic analysis (VOA) vials collected for each well

will be placed into labeled plastic zip-type closure bags or placed in the wrapper from the bailer. All other glass bottles will be bubble-wrapped and placed into labeled plastic zip-type closure bags.

3.9 Quality Control Samples

QA/QC samples will be collected or prepared to assist in determining data reliability. These QA/QC samples include field duplicates, field blanks, and additional volume samples for laboratory QA/QC analysis (for matrix spike [MS] and matrix spike duplicates [MSDs]. QA/QC samples will be normally collected from locations that will be suspected to be of moderate contamination. QA/QC samples will be collected immediately following collection and using the same procedures as the collection of the target sample.

Field Duplicates. The field duplicate is an independent ground water sample collected as close as possible to the original sample from the same source and is used to document sampling precision. They will be labeled and packaged in the same manner as other samples so that the laboratory cannot distinguish between samples and duplicates. Field duplicates will be collected by alternately filling sample and sample duplicate containers at a location of known or suspected contamination. Each duplicate will be taken using the same sampling and preservation method as the samples. One field duplicate will be taken at a minimum frequency of 10 percent for each parameter.

Field Blanks. The field blanks will be collected to verify that contamination is not introduced to samples during collection, handling, or shipping of the samples. They will be prepared by pouring blank water directly into the sample bottles. Commercially prepared high pressure liquid chromatography (HPLC) water will be used for organic analyses and reagent-grade deionized or distilled water for inorganic analyses using the same preservation methods and packaging and sealing procedures used during collection of ground water samples. Field blanks will be prepared and labeled in the same manner as the field samples and sent "blind" to the laboratory. One field blank per semiannual event will be collected for all parameters except VOCs. For VOCs, one field blank will be collected for each day of sampling.

Laboratory QA/QC Samples. Laboratory QA/QC samples will be prepared by the laboratory to perform MS and MSD analyses. An MS is an aliquot of a sample spiked with a known concentration of target analyte(s) and provides a measure of the method accuracy. The MSD is a laboratory split sample of the MS and is used to determine the precision of the method. One MS/MSD sample will be analyzed at a minimum frequency of 5 percent for all parameters, with a minimum of one MS/MSD sample analyzed for each semiannual monitoring event.

3.10 Investigative-Derived Waste

It is anticipated that the following type of investigation-derived waste (IDW) will be generated during sampling activities.

- Decontamination water
- Monitoring well purge water
- Disposable sampling equipment (paper towels, tubing, and bailers)
- Disposable personal protective equipment (Tyvek, if necessary, and disposable gloves)

Investigation-derived wastes generated during ground water sampling will consist primarily of purge water from monitoring wells. Purged well water will be contained in a vacuum truck or other container and will be appropriately disposed of at the refinery or at an approved recycling facility. Labeled drums may be used for temporary storage and removed from the site at the end of each workday. Disposable PPE that becomes contaminated will be properly stored and disposed offsite in compliance with applicable regulatory requirements by the field contractor.

Section 4
Data Quality Management

This section addresses the procedures required to provide data of known and appropriate quality to assist with the assessment of potential contamination in the ground water at the facilities.

4.1 Sample Chain-of-Custody Procedures

A sample consists of physical material (i.e., soil and water) that is collected from a hazardous waste site, from the immediate environment, or from another source associated with the hazardous waste site. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples will be collected until they will be analyzed. This is especially critical if they will be introduced as evidence in the event of enforcement proceedings.

Chain-of-custody procedures will be used to maintain and document sample possession for reporting integrity as well as enforcement purposes. The principal documents used to identify samples and to document possession may include:

- Packing lists
- COC records
- Air bills (e.g., Federal Express, Purolator)
- Field notebooks
- Photographs

Sample custody and COCs will be maintained by the field team until pickup by a representative from the contract laboratory. Sample shipping information from each day will be maintained by the Task Manager and relayed to the contracted laboratory as soon as possible after sample pickup. These documents may be introduced as evidence should a site investigation result in legal action. To document sample possession, COC procedures will be followed.

Definition of Custody. A sample is under custody if one or more of the following criteria will be met:

- It is in your possession.
- It is in your view, after being in your possession.
- It was in your possession and then you locked it up to prevent tampering.
- It is in a designated secure area.

Field Custody. In collecting samples for evidence, collect only enough to provide a good representation of the media being sampled. To the extent possible, the quantity and types of samples and sample locations will be determined before the actual field work. As few people as possible should handle samples.

4.2 Sample Labels

From the time of sampling until the analytical data will be released from the laboratory, the integrity of samples and the resolution of questions regarding analytical data will be critical to the enforceability of data. The sampling location identification, sample labeling, handling, and shipping must be performed using standardized and well-documented procedures, so that a sample can be tracked to its point of origination.

A sample numbering system must be used that provides a tracking mechanism to allow retrieval of sample information including sampling locations, date, time, and analytical parameters requested. The following information is included on the sample label:

- Laboratory
- Project name (and number where appropriate)
- Sample ID
- Station ID
- Preservation
- Analysis
- Sampler's initials, date, and time

Sample containers must be labeled prior to being filled.

4.3 Chain-of-Custody Record

Samples will be accompanied by a COC record, which will contain the information described below. When transferring samples, the individuals relinquishing and receiving the samples sign, date, and note the time on the COC record. This record documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

4.3.1 Field Chain-of-Custody Procedures

Samples will be packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate COC record accompanying each shipping container (one for each field laboratory and one for samples driven to the laboratory). Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier name(s), and other pertinent information, will be entered in the "Received by," section of the COC record.

Whenever samples will be split with a facility owner or agency, it is noted in the Remarks section of the COC record. The note indicates with whom the samples will be split and is

signed by both the sampler and recipient. If the split is refused, this will be noted and signed by both parties. If a representative is unavailable or refuses to sign, this is noted in the Remarks section of the COC record. When appropriate, as in the case where the representative is unavailable, the COC record should contain a statement that the samples were delivered to the designated location at the designated time.

All shipments will be accompanied by the COC record identifying its contents. The original record and yellow copy accompanies the shipment to the laboratory, and the pink copy is sent to be retained by the field team leader.

4.3.2 Laboratory Chain-of-Custody Procedures

When samples will be shipped to the laboratory by other than the laboratory courier, they must be placed in containers sealed with custody seals. One or more custody seals must be placed on each side of the shipping container (cooler). A designated sample custodian will accept custody of the shipped samples following the procedure outlined below.

When sample analyses and necessary QA checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. Sample containers and remaining samples will be disposed of in compliance with all federal, state, and local regulatory requirements.

A designated sample custodian accepts custody of the shipped samples and verifies that the packing list sample numbers match those on the COC records. The laboratory custodian uses the sample identification number or assigns a special laboratory number to each sample, and is responsible for seeing that all samples will be transferred to the proper analyst or stored in the appropriate secure area.

The custodian distributes samples to the appropriate analysts. Laboratory personnel will be responsible for the care and custody of samples from the time they will be received until the sample is exhausted or returned to the custodian. The data from sample analyses will be recorded on the laboratory report form.

4.4 Documentation Procedures

Field documentation for activities at the ConocoPhillips Carson Plant will consist of one or more of the following: site-specific field logbooks, field forms, sample logs/labels, and/or equipment calibration logs.

4.4.1 Sample Identification

Each analytical sample is assigned a special number by the field data manager, using a sample tracking program. This number is an alpha-numeric code that identifies the project, site, specific sampling location, and matrix sampled. These numbers will be used to track the

sample from collection, through laboratory analysis, and into the final reports. The sample number is cross referenced with the site name and sample location on the COC.

4.4.2 Field Notes

Field Notes will consist of all associated field logbooks and ground water monitoring forms. Information required on the cover of the site logbook also must be provided on the cover of each field logbook. Entries in the field logbook must be continuous through the day. Field logbook pages as well as the logbooks themselves will be numbered consecutively. The following information should be included in field logbooks and/or forms:

- Date, time of specific activities, and physical location
- Weather conditions
- Names, titles, and organization of personnel onsite; names and titles of visitors, and times of visits
- Field observations, including specific details on sampling activities (including type of sampling, time of sampling, and sample numbers), a description of any field tests and their results.
- Detailed documentation of samples collected and any splits, duplicates, matrix spikes, or blanks that were prepared. A list of sample identification numbers, packaging numbers, and COC form numbers pertinent to each sample or referenced to the appropriate documentation should be noted.
- Specific problems, including equipment malfunctions and their resolutions
- A list of times, equipment types, and decontamination procedures followed (if different from the project work plan) or a reference to the appropriate documentation

Additional information may be recorded at the discretion of the technician. Information to be recorded may include the following:

- Identification of well
- Static water level, depth, and measurement technique
- Presence of immiscible layers and detection methods
- Collection method for immiscible layers and sample identification numbers
- Total depth of well
- Well yield
- Purge volume and pumping rate
- Well purging times and volumes
- Sample withdrawal procedure
- Date and time of collection
- Well sampling sequence

- Types of sample containers and sample identification numbers
- Preservatives used
- Laboratory analyses requested
- Field analysis data and methods
- Sample distribution and transporter

4.4.3 Corrections to Documentation

All original handwritten data recorded in field notebooks, sample identification tags, COC records, and receipts-for-sample forms will be written with ink. Corrections must be marked with a single line, dated, and initialed.

If an error is made on an accountable document assigned to one team, the team leader may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

APPENDIX A

Form Acknowledging Review and Understanding of the Ground Water SAP

SAMPLING AND ANALYSIS PLAN FOR THE
CONOCOPHILLIPS LOS ANGELES REFINERY CARSON PLANT
CARSON, CALIFORNIA

I,_____, have received a copy of the current version of the sampling and analysis plan for the semiannual ground water monitoring program for the ConocoPhillips Los Angeles Refinery, Carson Plant. I have reviewed the plan and understand the procedures outlined for collecting field information, measurements, and water quality samples.

SIGNED: _____ **DATE:** _____

COMPANY: _____ **POSITION:**_____

SIGNED: _____ **DATE:** _____
TEAM LEADER

APPENDIX B

Form Acknowledging Deviations from the SAP During Ground Water Sampling

DEVIATIONS FROM THE
SAMPLING AND ANALYSIS PLAN FOR THE
CONOCOPHILLIPS LOS ANGELES REFINERY CARSON PLANT
CARSON, CALIFORNIA

I,_____, have completed the _____ ground water monitoring event. The following deviations from the current version of the sampling and analysis plan for the ConocoPhillips Los Angeles Refinery, Carson Plant were necessitated by the noted field conditions (e.g., equipment failure, wells that could not be sampled, etc.):

Deviation:	Field Condition:

With the exceptions noted above, field measurements and samples were collected in accordance with the procedures described in the sampling and analysis plan for the ConocoPhillips Los Angeles Refinery, Carson Plant.

SIGNED: _____ **DATE:** _____

COMPANY: _____ **POSITION:**_____

SIGNED: _____ **DATE:** _____
TEAM LEADER

APPENDIX C

PID Calibration Form