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February 10, 2015

Mr. Jerry Wickham
Alameda County Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502-6577

RECEIVED

By Alameda County Environmental Health at 4:02 pm, Feb 13, 2015

RE: Remediation Performance Evaluation and Monitoring Plan
800, 726, and 706 Harrison Street, Oakland, California 94607
Fuel Leak Case No.: RO0000231, RO0000321, and RO0000484
Comingled Plume Claim No. 6678

Dear Mr. Wickham,

I declare under penalty of perjury that to the best of my knowledge the information and/or recommendations contained in the attached report is/are true and correct.

If you have any questions or need additional information, please contact me at (925) 790-6912.

Sincerely,

Nicole Arceneaux
Union Oil of California – Project Manager

Attachment
Remediation Performance Evaluation and Monitoring Plan

Chevron Environmental
Management Company

Remediation Performance Evaluation and Monitoring Plan

706/726/800 Harrison Street
Oakland, California
ACEH Case #RO0000231/321/484

February 10, 2015

ARCADIS

Remediation Performance Evaluation and Monitoring Plan

706/726/800 Harrison Street
Oakland, California
ACEH Case
#RO0000231/321/484

Tyler Sale
Environmental Engineer II

PROFESSIONAL GEOLOGIST
KATHERINE BRANDT
No 9132
Expires
3/31/2016
STATE OF CALIFORNIA

Katherine Brandt

Katherine Brandt, P.G.
Geologist/Certified Project Manager

Prepared for:

Chevron Environmental
Management Company

Prepared by:

ARCADIS
2000 Powell Street
Suite 700
Emeryville
California 94608
Tel 510.596.9675
Fax 510.652.4906

Our Ref.:

B0047339.2014

Date:

February 10, 2015

Tables

Figures

Appendices

1. Introduction

On behalf of Chevron Environmental Management Company, for itself and as Attorney-in-Fact for Union Oil Company of California, ARCADIS U.S., Inc. (ARCADIS) prepared this Remediation Performance Evaluation and Monitoring Plan (monitoring plan). This monitoring plan describes air sparge (AS)/soil vapor extraction (SVE) system monitoring throughout operation to address the petroleum-hydrocarbon-impacted groundwater in the co-mingled plume at 706, 726, and 800 Harrison Street in Oakland, California (site). Figure 1 illustrates the general area of the site and Figure 2 presents a layout of the three properties. This monitoring plan was prepared according to the Alameda County Department of Environmental Health's (ACEH's) requirements presented in a letter dated July 14, 2014 (Appendix A).

1.1 Purpose/Remedial Action Objectives

The purpose of this monitoring plan is to communicate the system performance monitoring, system optimization, operations and maintenance, performance monitoring and groundwater monitoring.

1.2 Monitoring Plan Organization

The remaining sections of this work plan are presented as follows:

- Section 2 provides the system details and system startup procedures.
- Section 3 discusses the system performance monitoring.
- Section 4 presents system remediation performance monitoring and shutdown criteria.
- Section 5 discusses reporting.
- Section 6 lists references.

2. AS/SVE System

The proposed AS/SVE remediation system consists of 16 AS wells (13 new wells and three existing wells) and six SVE wells (two new wells and four existing wells). A Busch 1502 rotary claw blower capable of extraction air flows of 300 standard cubic feet per minute (scfm) at a vacuum of 7.87 inches of mercury (in. Hg) will be used for the SVE system. A Busch model 1102 BP rotary claw compressor system capable of delivering approximately 70 scfm of injection air at a discharge pressure of 23.5 pounds per square inch (psi) will be used onsite. The oxidizer will be an electric catalytic oxidizer with a maximum air flow capacity of 300 scfm. A detailed description of the AS/SVE system was provided in the *Remedial Action Plan* submitted on April 18, 2014 (ARCADIS, 2014).

2.1 Soil Vapor Probe Installation

Three soil borings (SV-1 through SV-3) will be advanced near the existing building at 726 Harrison Street. Soil borings will be advanced using a hand auger from the ground surface to a total depth of 5.0 feet bgs. The soil borings will be logged in accordance with the Unified Soil Classification System (USCS). Selected soil samples will be placed into sealed Ziploc bags and screened for volatile organic compounds (VOCs) using a photoionization detector (PID). The PID readings will be recorded on the field boring logs. Soil samples that are retained for laboratory analysis will be collected and preserved in an Encore® sampler per United States Environmental Protection Agency (USEPA) Method 5035. Site work will be performed under the supervision of an ARCADIS geologist.

After the boring has been advanced to the target depth, the soil vapor probes will be constructed with a 6-inch long, 0.375-inch outer diameter stainless steel screen centered within a one-foot interval of sand pack placed from 4.0 to 5.5 feet bgs, allowing approximately three-inches of sand above and below the screens. Teflon tubing (or equivalent) will be connected to the soil vapor screen and capped with a vapor-tight, 2-way valve or cap at the surface to eliminate the potential for barometric pressure fluctuations to induce vapor transport between the subsurface and the atmosphere. The 2-way valve will be installed in the closed position to allow equilibration of soil vapor concentrations to commence immediately after installation.

A one-foot interval of dry, granular bentonite will be placed above the sand pack followed by hydrated granular bentonite to a depth of 0.5 feet bgs above the probe. Dry granular bentonite is used to ensure that the hydrated bentonite does not infiltrate the sand pack, seal the vapor probe screen and inhibit the collection of soil vapor. A flush-mounted well box will be set in concrete at the surface to secure the soil vapor probes.

PID readings will be collected from the soil vapor probes during each operation, monitoring, and maintenance (OM&M) event to monitor potential vapor intrusion in the existing building onsite. System OM&M is discussed in detail in Section 3.

2.2 AS/SVE System Startup

Following system and soil vapor probe installation, and the completion of electrical upgrades, the AS/SVE system will be inspected, started up, and tested to verify the operation meets or exceeds performance design criteria as presented in the *Remedial Action Plan* (ARCADIS, 2014), including equipment operating performance, system control functionality, measurement accuracy, compliance with applicable permits, and safety.

2.2.1 SVE System Startup

Vacuum will be applied to the SVE well network prior to starting air sparge operation. Individual SVE wells will be optimized and balanced at a target wellhead vacuum ranging from 100 to 120 inches of water column vacuum to achieve an operation flow of approximately 20 to 40 standard cubic feet per minute (SCFM). The SVE well network will consist of new SVE wells and existing SVE wells at 706 Harrison Street. This SVE well network provides the most effective capture of any residual soil contaminant mass remaining and recovery of volatile organic hydrocarbons from the vapor phase via air sparging operations. If photo-ionization detector (PID) readings during performance monitoring indicate that a higher extraction vacuum and flow rate would be beneficial to capture volatilized hydrocarbons, the VFD settings on the SVE system can be adjusted to accommodate higher vacuum and flow from the SVE network. SVE system performance operating parameters are provided in Table 1.

Air sparge operation will begin following SVE system startup and optimization. Vacuum, flow, and extracted vapor volatile organic compound (VOC) concentrations will be measured periodically throughout startup testing activities. Data from each well will be used to assess individual wellhead extraction characteristics and to identify areas of the site with higher mass removal rates. The relative distribution of mass removal rates will factor into future AS/SVE optimization efforts. System SVE data will also be collected and monitored to estimate emission attenuation rates.

2.2.2 AS System Startup

The AS system will operate in a pulsed configuration with air injected into a clustered subset of AS wells in an area for a period of time and then injection will be rotated, in sequence, to other well clusters. The AS cluster injection time period will be determined and optimized by performing an AS mounding test during initial operation. The proposed air sparge remediation well network targets dissolved phase source mass, centralized near the northern boundary of 706 Harrison Street and the southern boundary of 726 Harrison Street.

AS system startup will entail balancing of individual well pressures and flows during their respective zoned operation. Sustaining target wellhead pressures over the duration of the pulse interval will be critical in order to achieve air break-through in the formation and to deliver injected air distribution over the estimated AS radius of influence (ROI). Air sparge pressures will typically range from 8 to 16 pounds per square inch (psi) and will be adjusted based upon a measurable flow. Target pressure ranges should result in a target flow rate of at least 10 SCFM per well. AS system performance operating parameters are provided in Table 1.

Collectively, data from all AS and SVE wells will be used to develop system performance curves. Information gathered during startup will also be used to establish a baseline for subsequent treatment system performance evaluations.

3. System Performance Monitoring

System performance monitoring is conducted in order to evaluate system operating characteristics and identify treatment optimization opportunities. Performance monitoring will include observing and documenting the following:

- individual well extraction and injection flow rates;
- separator liquid collection rates;
- system-wide extraction vacuum and temperature;
- system-wide injection pressure and temperature;
- individual well vapor concentrations; and
- total system emissions.

The SVE and AS system performance monitoring schedule and required parameters are summarized on Tables 2 and 3, respectively. If injection rates fall below targets in individual wells, the well will be cleaned out to restore injectivity. Air samples will be collected for laboratory analysis to track VOC air emission discharge rates. Air samples will be collected monthly for the first quarter and quarterly thereafter. The treatment system will also be inspected to ensure reliable operation and performance in accordance with performance-based design specifications. Following the first quarter of system operations, performance monitoring will be expanded to a quarterly basis. Additional performance monitoring objectives, locations, and schedule are further detailed in Section 6. Standard operating procedures (SOP) for system operation are provided as Appendix B.

3.1 Operations and Maintenance

System operations and maintenance events will be conducted weekly for the first month of operation and monthly thereafter. ARCADIS will prepare an operations and maintenance (O&M) manual for all AS/SVE treatment equipment. In addition to detailing system operating instructions, the O&M manual will detail equipment maintenance requirements. The level of detail will be sufficient for ensuring proper and efficient treatment throughout the life of the project. The O&M manual will include a system maintenance schedule, detailing manufacturer recommended mechanical and electrical maintenance requirements based on equipment hours-of-operation, and will also document equipment make, model, troubleshooting, and manufacturer contact information for all treatment system components. Operation and maintenance data collection forms are provided as Appendix C.

3.2 AS/SVE System Optimization

System data will be used to verify system performance. Data collected quarterly will be evaluated and used to optimize system operational parameters during subsequent operation, maintenance, and monitoring (OM&M) events to maintain optimal system performance. Individual well operational parameters (vacuum/pressure and flow) and PID readings will be used to determine if the system is operating at optimal mass removal rates. A comprehensive system performance evaluation will be performed semi-annually in order to assess treatment progress towards meeting cleanup objectives. This semi-annual evaluation will consider all data collected to date, estimate total mass of petroleum hydrocarbons removed, and will ultimately determine if AS/SVE is achieving cleanup objectives in a timely and cost-effective manner. Analytical samples may be collected from each individual SVE well to provide additional information for the optimization process.

4. Remediation Performance Monitoring and Shutdown Criteria

A network of existing groundwater monitoring wells will be monitored to evaluate AS/SVE system performance. In addition to the routine semi-annual site groundwater sampling events, three monitoring wells located on 706 Harrison Street (MW-1, MW-2 and MW-4) and three monitoring wells located on 726 Harrison Street (MW-1, MW-5 and MW-6) will be sampled quarterly for additional performance monitoring. The analytical data and field parameter results from these wells will be used to assess the effectiveness of the AS operation and to evaluate potential optimization to achieve remedial cleanup goals.

A groundwater monitoring event will be performed before system startup to establish baseline conditions prior to full scale system operation. A remedial system groundwater performance monitoring program will be implemented thereafter for the purpose of monitoring aqueous phase hydrocarbon concentrations in the context of active soil and groundwater remediation and evaluating opportunities for treatment system optimization. A groundwater remedial performance monitoring schedule is provided in Table 4.

The system will continue to operate until observed groundwater concentrations satisfy the groundwater-specific criteria of the State Water Resources Control Board (SWRCB) Low-Threat Underground Storage Tank Closure Policy (LTCP) (SWRCB 2012). System operations will cease when groundwater concentrations are in accordance with groundwater-specific Criteria 2d. All ground-water specific criteria under Scenario 2 of the Low-Threat Policy are presented below:

- *(a) The contaminant plume that exceeds water quality objectives is less than 250 feet in length.*
- *(b) There is no free product*
- *(c) The nearest existing water supply well or surface water body is greater than 1,000 feet from the defined plume boundary.*
- *(d) The dissolved concentration of benzene is less than 3,000 micrograms per liter (µg/l), and the dissolved concentration of MTBE is less than 1,000 µg/l.*

The system will be shutdown and a rebound assessment will be conducted once all of the above criteria are met by groundwater concentrations at the site. Four consecutive quarters of groundwater monitoring will be performed following system shutdown to confirm groundwater concentrations remain stable.

The system may be shutdown prior to achieving LTCP criteria if it has been sufficiently optimized to operate to the full extent practicable and asymptotic VOC mass removal rates are observed. De minimis influent vapor concentrations may indicate that the system has reached its practical limits of dissolved-phase source mass destruction. Practical limits of system operation will be demonstrated by a sequential series of operational and shutdown periods. System operation will cease if groundwater concentrations in successive rebound events exhibit minimal progress in stable declining concentrations.

5. Reporting

A Remediation System Startup Report will be prepared to document system installation, startup, and optimization activities. This report will include at a minimum the following:

- A scaled site plan illustrating the AS and SVE well locations, AS/SVE system as-built drawings and other relevant site features

- Documentation of field activities
- Geologic boring logs
- System startup operational data

6. References

ARCADIS U.S., Inc. 2014. Remedial Action Plan for 800, 726, and 706 Harrison Street. April 18.

State Water Quality Control Board, 2012, Low-Threat Underground Storage Tank Closure Policy. August 17, 2012.

Tables

Table 1
System Performance Operating Parameters
Chevron Facility No. 351646
706, 726, and 800 Harrison Street, Oakland, California

Monitoring Locations	Vacuum (inches of H_2O)	Flow (scfm)
SVE Well Heads	≈ 100 - 120	---
SVE Well Laterals	≈ 100 - 120	≈ 20 - 40
SVE Manifold	≈ 100 - 120	≈ 120 - 240
SVE Inlet	≈ 100 - 140	≈ 120 - 240
SVE Outlet	---	≈ 120 - 240
SVE Bleed *	---	---

Monitoring Locations	Pressure (psi)	Flow (cfm)
AS Well Heads	≈ 8 - 16	---
AS Well Laterals	≈ 8.5 - 19.5	≈ 10 - 15
AS Manifold	≈ 8.5 - 19.5	≈ 60 - 90
AS Compressor Outlet	---	≈ 60 - 90

Notes:

SVE: Soil Vapor Extraction

AS: Air Sparge

scfm: Standard Cubic Feet per Minute

psi: Pounds per Square Inch

*: Bleed air flow will vary on VFD motor reduction capacity

Table 2
SVE System Performance Monitoring Parameters
Chevron Facility No. 351646
706, 726, and 800 Harrison Street, Oakland, California

Monitoring Locations	Performance Monitoring Parameters
SVE Well Heads	V_g
SVE Well Laterals	Q_{air}, V_g VOCs
SVE-Manifold	$T_{air,}$ V_g $Q_{air,}$ VOCs
SVE-Bleed	$T_{air,}$ V_g $Q_{air,}$ VOCs
SVE- Blower Inlet	$T_{air,}$ V_g $Q_{air,}$ VOCs
SVE-Blower Outlet	$T_{air,}$ V_g $Q_{air,}$ VOCs

Notes:

SVE: Soil Vapor Extraction

V_g: Vacuum at Gauge

P_{air}: Air Pressure

Q_{air}: Air Flow

VOCs: Volatile Organic Compounds

T_{air}: Air Temperature

SVE Wells:

VE-3
VE-4
VE-5
VW-3
VW-4
VW-5

Table 3
AS System Performance Monitoring Parameters
Chevron Facility No. 351646
706, 726, and 800 Harrison Street, Oakland, California

Monitoring Locations	Performance Monitoring Parameters
AS Well Heads	P_{air}
AS Well Laterals	$Q_{air,}$ P_{air}
AS Manifold	$Q_{air, Pair}$ T_{air}
AS Compressor Outlet	$Q_{air, Pair}$ T_{air}

Notes:

AS: Air Sparge

P_{air}: Air Pressure

Q_{air}: Air Flow

T_{air}: Air Temperature

AS Wells:

Zone 1	Zone 2	Zone 3	Zone 4
AS-1	AS-6	AS-10	AS-13
AS-2	AS-7	AS-11	AS-14
AS-3	AS-8	AS-12	SP-4
AS-4	AS-9	SP-3	SP-5
AS-5			

Table 4

Remedial System Groundwater Performance Monitoring Schedule

Chevron Facility No. 351646

706, 726, and 800 Harrison Street, Oakland, California

Monitoring Locations	Quarterly									Semi-Annually								
	Standard Parameters			MNA Parameters			Analytical Parameters			Standard Parameters			MNA Parameters			Analytical Parameters		
	Depth to Water	Water Temp.	pH	SC	DO	ORP	BTEX	TPH-g	MTBE	Depth to Water	Water Temp.	pH	SC	DO	ORP	BTEX	TPH-g	MTBE
706 Harrison Street																		
MW-1*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-2*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-3																		
MW-4*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-5										X	X	X	X	X	X	X	X	X
MW-6										X	X	X	X	X	X	X	X	X
MW-7										X	X	X	X	X	X	X	X	X
726 Harrison Street																		
MW-1*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-2										X	X	X	X	X	X	X	X	X
MW-3																		
MW-4										X	X	X	X	X	X	X	X	X
MW-5*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-6*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
800 Harrison Street																		
MW-1										X	X	X	X	X	X	X	X	X
MW-2										X	X	X	X	X	X	X	X	X
MW-3										X	X	X	X	X	X	X	X	X
MW-4										X	X	X	X	X	X	X	X	X
MW-5										X	X	X	X	X	X	X	X	X
MW-6										X	X	X	X	X	X	X	X	X
MW-7																		
MW-8										X	X	X	X	X	X	X	X	X

Notes:

SC: Specific Conductance

DO: Dissolved Oxygen

ORP: Oxidation Reduction Potential

BTEX: Benzene, Toluene, Ethylbenzene, and Total Xylenes

TPH-g: Total Petroleum Hydrocarbons as Gasoline

MTBE: Methyl tert-butyl ether

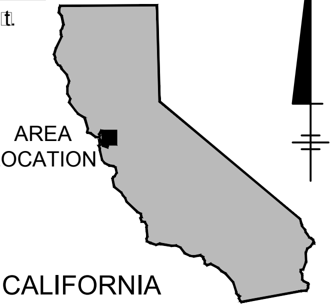
* : Groundwater monitoring will follow existing sampling and analysis plan

Figures

REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., OAKLAND WEST, CALIFORNIA, 1993.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.



UNION OIL OF CALIFORNIA
STATION NO. 0752/YEE/GIN COMMINGLED
706/726/800 HARRISON STREET
OAKLAND, CALIFORNIA

SITE LOCATION MAP

ARCADIS

FIGURE
1

CITY: PETALUMA, CA DIV/GROUP: ENV DB: J. HARRIS LAYOUT: 1 SAVED: 3/9/2012 1:32 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: SETUP1 PLOTSTYLETABLE: ARCADIS.CTB PLOTTED: 3/9/2012 1:32 PM BY: HARRIS, JESSICA
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XREFS: IMAGES: Oakland West.jpg PROJECTNAME: ----

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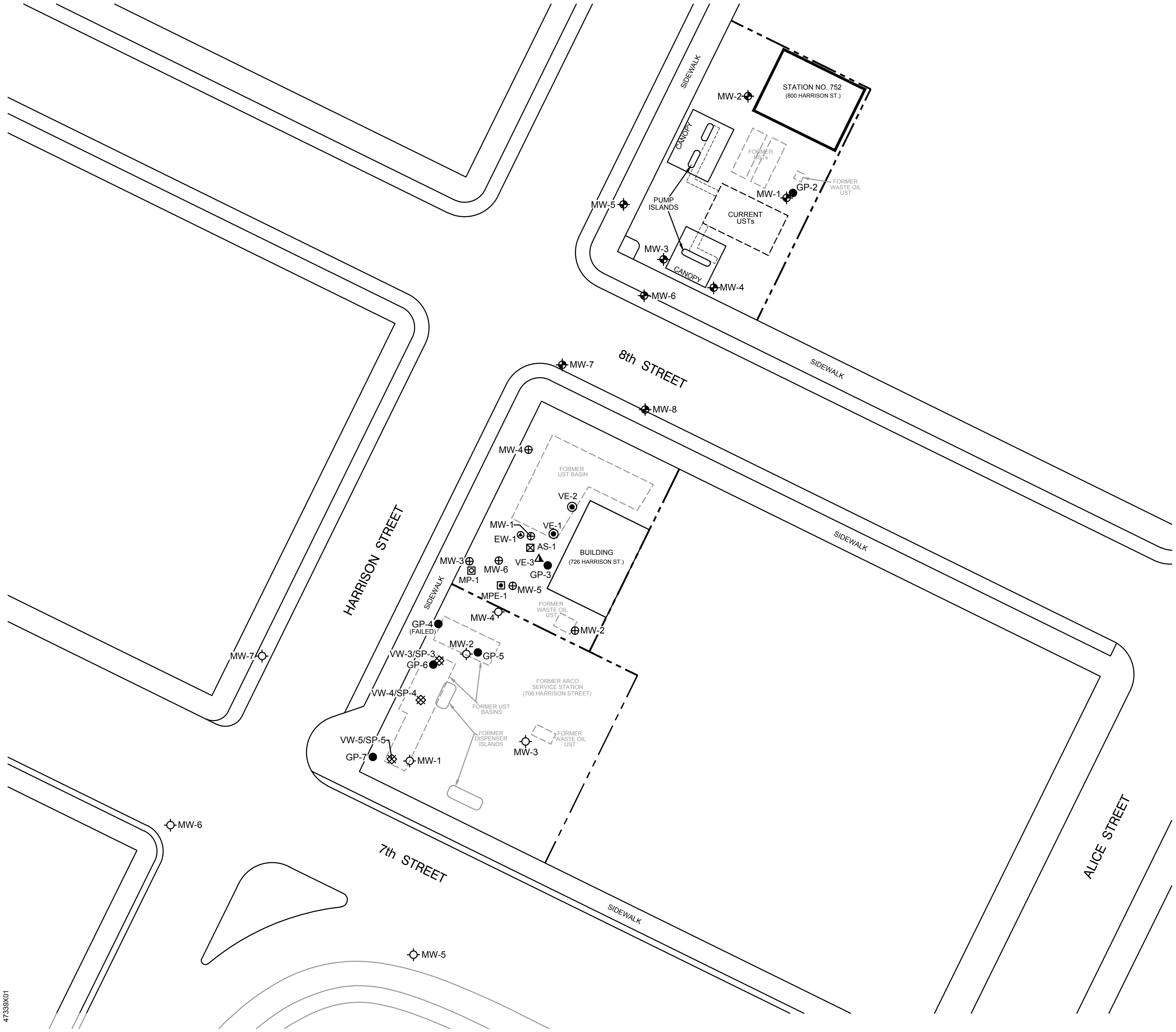
XREFS: 47339X01 IMAGES: PROJECTNAME: ----



LEGEND

— · — ·		PROPERTY BOUNDARY
- - - - -		PRODUCT PIPING
MW-1	⨁	GROUNDWATER MONITORING WELL (UNOCAL)
MW-1	⌖	GROUNDWATER MONITORING WELL (GIN)
VW-3/SP-3	▩	SOIL VAPOR/SPARGE WELL (UNABLE TO LOCATE) (GIN)
MW-1	⊕	GROUNDWATER MONITORING WELL (YEE)
AS-1	⊠	AIR SPARGE WELL (YEE)
EW-1	◬	EXTRACTION WELL (YEE)
GP-2	●	GEOPROBE™ (JUNE 2011)
MPE-1	▣	MULTI-PHASE EXTRACTION PILOT TEST WELL (PZ-1 IS LOCATED IN THE SAME BOREHOLE)
MP-1	⧇	PILOT TEST MONITORING POINT
VE-1	◉	VAPOR EXTRACTION WELL
VE-3	△	PILOT TEST VAPOR EXTRACTION WELL

NOTE:

1. BASE MAP PROVIDED BY MID COAST ENGINEERS, DATED 06/29/11, AT A SCALE OF 1"=50'. ADDITIONAL SITE FEATURES PROVIDED BY STANTEC, INC., DATED 03/05/10, AT A SCALE OF 1"=50'.
2. COORDINATES ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE III, NAD 83.

0 50' 100'
GRAPHIC SCALE

UNION OIL OF CALIFORNIA
STATION NO. 0752/YEE/GIN COMMINGLED
706/726/800 HARRISON STREET
OAKLAND, CALIFORNIA

SITE PLAN

ARCADIS

FIGURE
2

CITY: PETALUMA, CA DIV/GROUP: ENV DB: J. HARRIS
G:\ENVCAD\Lakewood-CO\ACT\B0047339\Design\20140205 from roseville\47339B30.dwg LAYOUT: 3 SAVED: 12/16/2014 8:40 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS-DEN.CTB PLOTTED: 12/16/2014 8:58 AM BY: HOEFER, MATTHEW
XREFS: 47339X01 IMAGES: PROJECTNAME: ---

LEGEND

— - - —	PROPERTY BOUNDARY
- - - - - -	PRODUCT PIPING
MW-1 ⌖	GROUNDWATER MONITORING WELL (UNOCAL)
MW-1 ⌖	GROUNDWATER MONITORING WELL (GIN)
VW-3/SP-3 ▩	SOIL VAPOR/SPARGE WELL (GIN)
MW-1 ⊕	GROUNDWATER MONITORING WELL (YEE)
AS-1 ☒	AIR SPARGE WELL (YEE)
EW-1 ◉	EXTRACTION WELL (YEE)
MPE-1 ▣	MULTI-PHASE EXTRACTION PILOT TEST WELL (PZ-1 IS LOCATED IN THE SAME BOREHOLE)
MP-1 ▣	PILOT TEST MONITORING POINT
VE-1 ◉	VAPOR EXTRACTION WELL (DESTROYED)
VE-3 ▲	PILOT TEST VAPOR EXTRACTION WELL
AS-2 ☒	PROPOSED AIR SPARGE WELL
VE-4 ▲	PROPOSED VAPOR EXTRACTION WELL
▨	PROPOSED SYSTEM TRENCHING
—W—	WATER UTILITY LINE
—E—	ELECTRICAL UTILITY LINE

NOTE:

1. BASE MAP PROVIDED BY MID COAST ENGINEERS, DATED 06/29/11, AT A SCALE OF 1"=50'. ADDITIONAL SITE FEATURES PROVIDED BY STANTEC, INC., DATED 03/05/10, AT A SCALE OF 1"=50'.
2. COORDINATES ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM, ZONE III, NAD 83.

0 30' 60'
SCALE 1"=30'

UNION OIL OF CALIFORNIA
STATION NO. 0752/YEE/GIN COMMINGLED
706/726/800 HARRISON STREET
OAKLAND, CALIFORNIA

SITE PLAN WITH PROPOSED REMEDIATION SYSTEM

ARCADIS

FIGURE
3

Appendix **A**

Correspondence

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
ALEX BRISCOE, Director

ENVIRONMENTAL HEALTH SERVICES
ENVIRONMENTAL PROTECTION
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577
(510) 567-6700
FAX (510) 337-9335

July 14, 2014

RO0000231 Responsible Parties:

Timothy Bishop
Chevron Environmental Management Company
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San Ramon, CA 94583
(*Sent via E-mail to:*
TimBishop@Chevron.com)

Ed Ralston
Phillips 66 Company
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Sacramento, CA 95818
(*Sent via E-mail to: Ed.C.Ralston@p66.com*)

Muhammad Usman
800 Harrison Street
Oakland, CA 94607

Mahmood M Ali
Armsco, Inc.
P.O. Box 5427
Novato, CA 94948-5427

RO0000321 Responsible Parties:

Peter Yee
1000 San Antonio Avenue
Alameda, CA 94501

Kin Chan
4328 Edgewood Avenue
Oakland, CA 94602-1316

RO0000484 Responsible Parties:

Bo Gin
342 Lester Avenue
Oakland, CA 94606-1317

Subject: Conditional Work Plan Approval for Remedial Action Plan for Commingled Plume Assessment for Fuel Leak Case No. RO0000231 (GeoTracker Global ID T0600101486), Unocal #0752, 800 Harrison Street, Oakland, CA 94607; Fuel Leak Case No. RO0000321 (GeoTracker Global ID T0600102122), Chan's Service Station/Shell, 726 Harrison Street, Oakland, CA 94607; and Fuel Leak Case No. RO0000484 (GeoTracker Global ID T0600100985), Oakland Auto Parts, 706 Harrison Street, Oakland, CA 94607

Dear Responsible Parties:

Alameda County Environmental Health (ACEH) staff has reviewed the case file for the above-referenced site including the most recent document entitled, "*Remedial Action Plan Addendum, 800, 726, and 706 Harrison Street, Oakland*," dated July 1, 2014 (RAP Addendum). The RAP Addendum, which was prepared on behalf of Chevron Environmental Management Company by ARCADIS, is an addendum to a "*Remedial Action Plan,*" dated April 18, 2014 and presents responses to two technical comments on the RAP in ACEH correspondence dated May 13, 2014. A public comment period for the RAP extended from May 13, 2014 to July 13, 2014. No comments were received from the public during the comment period.

As described in the Technical Comments below, the proposed scope of work in the RAP Addendum is conditionally approved and may be implemented provided that the revision in Technical Comment 2 below is incorporated during remedial implementation. Submittal of a revised RAP or RAP Addendum is not required unless an alternate scope of work outside that described in the RAP and technical comments below is proposed. We request that you address the following technical comments, perform the proposed work, and send us the reports described below.

TECHNICAL COMMENTS

1. **Recovery of VOC Vapors.** The RAP Addendum appears to adequately address Technical Comment No. 1 in our April 18, 2014 correspondence regarding recovery of vapors at 726 Harrison Street.

2. **SVE and Air Sparge Well Configuration for 706 Harrison.** The RAP Addendum indicates that if existing well VW-5/SP-5 is not usable, a replacement well will be installed at the location of VW-5/SP-5 to capture vapors from wells AS-13 and AS-14 at the downgradient edge of the site. The RAP Addendum also indicates that a replacement sparge well (AS-15) will be installed if existing well VW-4/SP-4 is not usable. However, no soil vapor extraction well is proposed in the area of the replacement sparge well AS-15. Well VW-5/SP-5 is approximately 60 feet south of the nearest proposed vapor extraction well (VE-5). It appears that this spacing may not be adequate to assure capture of vapors in the southern portion of 706 Harrison Street. If existing well VW-4/SP-4 is not usable for vapor extraction, we request that an additional vapor extraction well be located in the area of replacement sparge well AS-15. Alternately, the replacement vapor extraction well for VW-5/SP-5 may be moved to a location between sparge wells AS-13 and AS-15 provided that the replacement vapor extraction well will achieve capture of vapors from sparge wells in the southern portion of 706 Harrison Street.

3. **Remedial Performance Evaluation and Monitoring Plan.** Please submit a Remediation Performance Evaluation and Monitoring Plan by September 19, 2014 that describes how the remedial system performance will be monitored and evaluated.

4. **Groundwater Monitoring.** Groundwater monitoring is to be continued on a semi-annual basis during the first and third quarters. Please present the results in the reports requested below.

TECHNICAL REPORT REQUEST

Please upload technical reports to the ACEH ftp site (Attention: Jerry Wickham), and to the State Water Resources Control Board's GeoTracker website according to the following schedule and file-naming convention:

- **October 29, 2014** – Semi-annual Groundwater Monitoring Report – Third Quarter 2014
  File to be named: GWM_R_yyyy-mm-dd RO231

- **September 19, 2014** – Remediation Performance Evaluation and Monitoring Plan
  File to be named: RDIP_R_yyyy-mm-dd RO231

- **December 8, 2014** – Remediation Start-up Report
  File to be named: REM_R_yyyy-mm-dd RO231

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the responsibilities of a responsible party in response to an unauthorized release from a petroleum ST system, and require your compliance with this request.

If you have any questions, please call me at (510) 567-6791 or send me an electronic mail message at jerry.wickham@acgov.org. Online case files are available for review at the following website: http://www.acgov.org/aceh/index.htm.

Sincerely,

Jerry Wickham, California PG 3766, CEG 1177, and CHG 297
Senior Hazardous Materials Specialist

Attachment: Responsible Party(ies) Legal Requirements/Obligations

Enclosure: ACEH Electronic Report Upload (ftp) Instructions

cc: Leroy Griffin, Oakland Fire Department, 250 Frank H. Ogawa Plaza, Ste. 3341, Oakland, CA 94612-2032 (*Sent via E-mail to: lgriffin@oaklandnet.com*)

Katherine Brandt, ARCADIS, 1900 Powell Street, 11th Floor, Emeryville, CA 94608 (*Sent via E-mail to: Katherine.Brandt@arcadis-us.com*)

Robert Foss, Conestoga-Rovers & Associates, 5900 Hollis Street, Suite A, Emeryville, CA 94608 2032 (*Sent via E-mail to: bfoss@craworld.com)*

Robert Kitay, Aqua Science Engineers, Inc., 55 Oak Ct., Suite 220, Danville, CA 94526 (*Sent via E-mail to: rkitay@aquascienceengineers.com*)

Jerry Wickham, ACEH (*Sent via E-mail to: jerry.wickham@acgov.org*)

GeoTracker, eFile

Attachment 1

Responsible Party(ies) Legal Requirements / Obligations

REPORT REQUESTS

These reports are being requested pursuant to California Health and Safety Code Section 25296.10. 23 CCR Sections 2652 through 2654, and 2721 through 2728 outline the responsibilities of a responsible party in response to an unauthorized release from a petroleum UST system, and require your compliance with this request.

ELECTRONIC SUBMITTAL OF REPORTS

ACEH's Environmental Cleanup Oversight Programs (LOP and SLIC) require submission of reports in electronic form. The electronic copy replaces paper copies and is expected to be used for all public information requests, regulatory review, and compliance/enforcement activities. Instructions for submission of electronic documents to the Alameda County Environmental Cleanup Oversight Program FTP site are provided on the attached "Electronic Report Upload Instructions." Submission of reports to the Alameda County FTP site is an addition to existing requirements for electronic submittal of information to the State Water Resources Control Board (SWRCB) GeoTracker website. In September 2004, the SWRCB adopted regulations that require electronic submittal of information for all groundwater cleanup programs. For several years, responsible parties for cleanup of leaks from underground storage tanks (USTs) have been required to submit groundwater analytical data, surveyed locations of monitoring wells, and other data to the GeoTracker database over the Internet. Beginning July 1, 2005, these same reporting requirements were added to Spills, Leaks, Investigations, and Cleanup (SLIC) sites. Beginning July 1, 2005, electronic submittal of a complete copy of all reports for all sites is required in GeoTracker (in PDF format). Please visit the SWRCB website for more information on these requirements (http://www.waterboards.ca.gov/water_issues/programs/ust/electronic_submittal/).

PERJURY STATEMENT

All work plans, technical reports, or technical documents submitted to ACEH must be accompanied by a cover letter from the responsible party that states, at a minimum, the following: "I declare, under penalty of perjury, that the information and/or recommendations contained in the attached document or report is true and correct to the best of my knowledge." This letter must be signed by an officer or legally authorized representative of your company. Please include a cover letter satisfying these requirements with all future reports and technical documents submitted for this fuel leak case.

PROFESSIONAL CERTIFICATION & CONCLUSIONS/RECOMMENDATIONS

The California Business and Professions Code (Sections 6735, 6835, and 7835.1) requires that work plans and technical or implementation reports containing geologic or engineering evaluations and/or judgments be performed under the direction of an appropriately registered or certified professional. For your submittal to be considered a valid technical report, you are to present site specific data, data interpretations, and recommendations prepared by an appropriately licensed professional and include the professional registration stamp, signature, and statement of professional certification. Please ensure all that all technical reports submitted for this fuel leak case meet this requirement.

UNDERGROUND STORAGE TANK CLEANUP FUND

Please note that delays in investigation, later reports, or enforcement actions may result in your becoming ineligible to receive grant money from the state's Underground Storage Tank Cleanup Fund (Senate Bill 2004) to reimburse you for the cost of cleanup.

AGENCY OVERSIGHT

If it appears as though significant delays are occurring or reports are not submitted as requested, we will consider referring your case to the Regional Board or other appropriate agency, including the County District Attorney, for possible enforcement actions. California Health and Safety Code, Section 25299.76 authorizes enforcement including administrative action or monetary penalties of up to $10,000 per day for each day of violation.

Alameda County Environmental Cleanup Oversight Programs (LOP and SLIC)	**REVISION DATE:** May 15, 2014
	ISSUE DATE: July 5, 2005
	PREVIOUS REVISIONS: October 31, 2005; December 16, 2005; March 27, 2009; July 8, 2010, July 25, 2010
SECTION: Miscellaneous Administrative Topics & Procedures	**SUBJECT:** Electronic Report Upload (ftp) Instructions

The Alameda County Environmental Cleanup Oversight Programs (LOP and SLIC) require submission of all reports in electronic form to the county's ftp site. Paper copies of reports will no longer be accepted. The electronic copy replaces the paper copy and will be used for all public information requests, regulatory review, and compliance/enforcement activities.

REQUIREMENTS

- **Please do not submit reports as attachments to electronic mail.**
- Entire report including cover letter must be submitted to the ftp site as **a single portable document format (PDF) with no password protection**.
- It is **preferable** that reports be converted to PDF format from their original format, (e.g., Microsoft Word) rather than scanned.
- **Signature pages and perjury statements must be included and have either original or electronic signature.**
- **Do not password protect the document**. Once indexed and inserted into the correct electronic case file, the document will be secured in compliance with the County's current security standards and a password. **Documents with password protection will not be accepted**.
- Each page in the PDF document should be rotated in the direction that will make it easiest to read on a computer monitor.
- Reports must be named and saved using the following naming convention:

  RO#_Report Name_Year-Month-Date (e.g., RO#5555_WorkPlan_2005-06-14)

Submission Instructions

1) Obtain User Name and Password
   a) Contact the Alameda County Environmental Health Department to obtain a User Name and Password to upload files to the ftp site.
      i) Send an e-mail to deh.loptoxic@acgov.org
   b) In the subject line of your request, be sure to include **"ftp PASSWORD REQUEST"** and in the body of your request, include the **Contact Information, Site Addresses**, and the **Case Numbers (RO# available in Geotracker) you will be posting for**.

2) Upload Files to the ftp Site
   a) Using Internet Explorer (IE4+), go to ftp://alcoftp1.acgov.org
      (i) Note: Netscape, Safari, and Firefox browsers will not open the FTP site as they are NOT being supported at this time.
   b) Click on Page located on the Command bar on upper right side of window, and then scroll down to Open FTP Site in Windows Explorer.
   c) Enter your User Name and Password. (Note: Both are Case Sensitive.)
   d) Open "My Computer" on your computer and navigate to the file(s) you wish to upload to the ftp site.
   e) With both "My Computer" and the ftp site open in separate windows, drag and drop the file(s) from "My Computer" to the ftp window.

3) Send E-mail Notifications to the Environmental Cleanup Oversight Programs
   a) Send email to deh.loptoxic@acgov.org notify us that you have placed a report on our ftp site.
   b) Copy your Caseworker on the e-mail. Your Caseworker's e-mail address is the entire first name then a period and entire last name @acgov.org. (e.g., firstname.lastname@acgov.org)
   c) The subject line of the e-mail must start with the RO# followed by **Report Upload**. (e.g., Subject: RO1234 Report Upload) If site is a new case without an RO#, use the street address instead.
   d) If your document meets the above requirements and you follow the submission instructions, you will receive a notification by email indicating that your document was successfully uploaded to the ftp site.

Appendix **B**

ARCADIS Standard Operating Procedures

ARCADIS
Infrastructure, environment, facilities

Imagine the result

Photoionization Detector Air Monitoring and Field Screening

Rev. #: 1

Rev Date: November 8, 2009

Approval Signatures

Prepared by: (the late) Maureen Geisser Date: July 28, 2003

Christopher C Lutes

Reviewed/revised by: Christopher C. Lutes Date: November 8, 2009
(Technical Expert)

I. Scope and Application

Field screening with a photoionization detector (PID), such as an HNu™, Photovac™, MicroTIP™, or MiniRAE™, is a procedure to measure relative concentrations of volatile organic compounds (VOCs) and other compounds. Characteristics of the PID are presented in Attachment 1 and the compounds a PID can detect are presented in Attachment 2. Field screening will frequently be conducted on the following:

- Work area air to assess exposure to on-site workers of air contaminants via the air pathway;
- Well headspaces as a precautionary measure each time the well cover is opened; and
- Headspace of soil samples to assess the relative concentration of volatile organics in the sample or to select particular intervals for off-site analysis for VOCs.

II. Personnel Qualifications

Personnel performing this method should be familiar with the basic principles of quantiative analytical chemistry (such as calibration) and familiar with the particular operation of the instrument to be used.

III. Equipment List

The following materials, as required, shall be available while performing PID field screening:

- personal protective equipment (PPE), as required by the site Health and Safety Plan (HASP);
- PID and operating manual;
- PID extra battery pack and battery charger;
- calibration canisters for the PID;
- sample jars;
- Q-tips;

- aluminum foil;
- field calibration log (attached); and
- field notebook.

IV. Cautions

PIDs are sensitive to moisture and may not function under high humidity. PIDs cannot be used to indicate oxygen deficiency or combustible gases.

V. Health and Safety Considerations

Since the PIDs cannot detect all of the chemicals that may be present at a sample location, a zero reading on either instrument does not necessarily signify the absence of air contaminants. PIDs cannot be used as an indicator for oxygen deficiency.

VI. Procedure (*Note these procedures were written particular to one specific instrument model, therefore please also refer to your owners manual.Hhowever the general principles – such as always measuring both a zero and span gas after an instrument adjustment/at the beginning of the analytical day, after four hours of testing and again at the end of an analytical day can be applied to all instruments.)*

PID Calibration

PID field instruments will be calibrated and operated to yield “total organic vapor” in parts per million (ppm) (v/v) relative to benzene or isobutylene (or equivalent). Operation, maintenance, and calibration shall be performed in accordance with the manufacturer’s instructions and entered on the PID calibration and maintenance log (Attachment 3).

1. Don PPE, as required by the HASP.

2. Perform a BATTERY CHECK. Turn the FUNCTION switch to the BATTERY CHECK position. Check that the indicator is within or beyond the green battery arc. If battery is low, the battery must be charged before calibration.

3. Allow the instrument to warm up, then calibrate the PID. If equipped, turn the FUNCTION switch to the STANDBY position and rotate the ZERO

POTENTIOMETER until the meter reads zero with the instrument sampling clean air. Wait 15 to 20 seconds to confirm the adjustment. If unstable, readjust. If equipped, check to see that the SPAN POTENTIOMETER is adjusted for the probe being used (e.g., 9.8 for 10.2 electron volts [eV]). Set the FUNCTION switch to the desired ppm range (0-20, 0-200, or 0-2,000). A violet glow from the ultraviolet (UV) source should be visible at the sample inlet of the probe/sensor unit.

4. Listen for the fan operation to verify fan function.

5. Connect one end of the sampling hose to the calibration canister regulator outlet and the other end to the sampling probe of the PID. Crack the regulator valve and take a reading after 5 to 10 seconds. Adjust the span potentiometer to produce the concentration listed on the span gas cylinder. Record appropriate information on a PID Calibration and Maintenance Log (Attachment 3, or equivalent).

6. If so equipped, set the alarm at desired level.

7. Recheck the zero with fresh/clean air

8. Always recheck both zero and span after making any instrment adjustment, after four hours of screenign work and again after sample analysis.

Work Area Air Monitoring

1. Measure and record the background PID reading.

2. Measure and record the breathing space reading.

Well Headspace Screening

1. Measure and record the background PID reading.

2. Unlock and open the well cover while standing upwind of the well.

3. Remove the well cap.

4. Place the PID probe approximately 6 inches above the top of the casing.

5. Record all PID readings and proceed in accordance with the HASP.

Field Screening Procedures

Soil samples will be field screened upon collection with the PID for a relative measure of the total volatile organic concentration. The following steps define the PID field screening procedures.

1. Half-fill two clean glass jars with the sample (if sufficient quantities of soil are available) to be analyzed. Quickly cover each open top with one or two sheets of clean aluminum foil and subsequently apply screw caps to tightly seal the jars. Sixteen-ounce (approximately 500 mL) soil or “mason” type jars are preferred; jars less than 8 ounces (approximately 250 mL) total capacity may not be used.

2. Allow headspace development for at least 10 minutes. Vigorously shake jars for 15 seconds at both the beginning and end of the headspace development period. Where ambient temperatures are below 32°F (0°C), headspace development should be within a heated building.

3. Subsequent to headspace development, remove screw lid to expose the foil seal. Quickly puncture foil seal with instrument sampling probe, to a point about one-half of the headspace depth. Exercise care to avoid contact with water droplets or soil particulates.

4. Following probe insertion through foil seal, record the highest meter response for each sample as the jar headspace concentration. Using the foil seal/probe insertion method, maximum response should occur between 2 and 5 seconds. Erratic meter response may occur at high organic vapor concentrations or conditions of elevated headspace moisture, in which case headspace data should be recorded and erratic meter response noted.

5. The headspace screening data from both jar samples should be recorded and compared; generally, replicate values should be consistent to plus or minus 20%. It should be noted that in some cases (e.g., 6-inch increment soil borings), sufficient sample quantities may not be available to perform duplicate screenings. One screening will be considered sufficient for this case.

6. PID field instruments will be operated and calibrated to yield “total organic vapors” in ppm (v/v) as benzene. PID instruments must be operated with at least a 10.0 eV (+) lamp source. Operation, maintenance, and calibration will be performed in accordance with the manufacturer’s specifications presented in Attachment 12-1. For jar headspace analysis, instrument calibration will be checked/adjusted at least twice per day, at the beginning and end of each day

of use. Calibration will exceed twice per day if conditions and/or manufacturer's specifications dictate.

7. Instrumentation with digital (LED/LCD) displays may not be able to discern maximum headspace response unless equipped with a "maximum hold" feature or strip-chart recorder.

VII. Waste Management

Do not dispose canisters of compressed gas, if there is still compressed gas in the canister. Return the canister to the manufactuer for proper disposal.

VIII. Data Recording and Management

Measurements will be record in the field notebook or boring logs at the time of measurement with notation of date, time, location, depth (if applicable), and item monitored. If a data memory is available, readings will be downloaded from the unit upon access to a computer with software to retrieve the data.

IX. Quality Assurance

After each use, the readout unit should be wiped down with a clean cloth or paper towel.

For a HNu, the UV light source window and ionization chamber should be cleaned once a month in the following manner:

1. With the PID off, disconnect the sensor/probe from the unit.

2. Remove the exhaust screw, grasp the end cap in one hand and the probe shell in the other, and pull apart.

3. Loosen the screws on top of the end cap and separate the end cap and ion chamber from the lamp and lamp housing.

4. Tilt the lamp housing with one hand over the opening so that the lamp slides out into your hand.

5. Clean the lamp with lens paper and HNu cleaning compound (except 11.7 eV). For the 11.7 eV lamp, use a chlorinated organic solvent.

6. Clean the ion chamber using methanol on a Q-tip and then dry gently at 50ºC to 60ºC for 30 minutes.

7. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place ion chamber on top of the housing, making sure the contacts are properly aligned.

8. Place the end cap on top of the ion chamber and replace the two screws (tighten the screws only enough to seal the o-ring).

9. Line up the pins on the base of the lamp housing with pins inside the probe shell and slide the housing assembly into the shell.

X. References

Denahan, S.A. et. all *"*Relationships Between Chemical Screening Methodologies for Petroleum Contaminated Soils: Theory and Pracice" *Chapter 5 In Principles and Practices for Petroleum Contaminated Soils,* E.J. Calabrese and P.T. Kostecki Eds., Lewis Publishers 1993.

Fitzgerald, J. "Onsite Analytical Screening of Gasoline Contaminated Media Using a Jar Headspace Procedure" Chapter 4 *in Principles and Practices for Petroleum Contaminated Soils,* E.J. Calabrese and P.T. Kostecki Eds., Lewis Publishers 1993.

ATTACHMENT 1

Characteristics of the Photoionization Detector (PID)

I. Introduction

PIDs are used in the field to detect a variety of compounds in air. PIDs can be used to detect leaks of volatile substances in drums and tanks, to determine the presence of volatile compounds in soil and water, and to make ambient air surveys. If personnel are thoroughly trained to operate the instrument and interpret the data, these PID instruments can be a valuable tool. Its use can help in deciding the level of protection to be worn, assist in determining the implementation of other safety procedures, and in determining subsequent monitoring or sampling locations.

Portable PIDs detect the concentration of organic gases, as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to UV radiation, which ionizes molecules that have an ionization potential (IP) less than or equal to that rated for the UV source. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, thus yielding a positively charged ion and the free electron. These ions are attracted to an oppositely charged electrode, causing a current and an electric signal to the LED display. Compounds are measured on a ppm volume basis.

II. HNu PI-101 / MiniRAE or Equivalent PID

The PIDs detect the concentration of organic gases, as well as a few inorganic gases. The basis for detection is the ionization of gaseous species. The incoming gas molecules are subjected to UV radiation, which is energetic enough to ionize many gaseous compounds. Each molecule is transformed into charged ion pairs, creating a current between two electrodes. Every molecule has a characteristic IP, which is the energy required to remove an electron from the molecule, yielding a positively charged ion and the free electron.

Three probes, each containing a different UV light source, are available for use with the PID. Probe energies are typically 9.5, 10.2, and 11.7 eV, respectively. All three probes detect many aromatic and large-molecule hydrocarbons. In addition, the 10.2 eV and 11.7 eV probes detect some smaller organic molecules and some halogenated hydrocarbons. The 10.2 eV probe is the most useful for environmental response work, as it is more durable than the 11.7 eV probe and detects more compounds than the 9.5 eV probe. A listing of molecules and compounds that the HNu can detect is presented in Attachment 2.

The primary PID calibration gas is either benzene or isobutylene. The span potentiometer knob is turned to 9.8 for benzene calibration. A knob setting of zero increases the sensitivity to benzene approximately 10-fold. Its lower detection limit is in the low ppm range. Additionally, response time is rapid; the dot matrix liquid crystal displays 90% of the indicated concentration within 3 seconds.

III. Limitations

The PID instrument can monitor several vapors and gases in air. Many non-volatile liquids, toxic solids, particulates, and other toxic gases and vapors, however, cannot be detected with PIDs (such as methane). Since the PIDs cannot detect all of the chemicals that may be present at a sample location, a zero reading on either instrument does not necessarily signify the absence of air contaminants.

The PID instrument is generally not specific and their response to different compounds is relative to the calibration gases. Instrument readings may be higher or lower than the true concentration. This effect can be observed when monitoring total contaminant concentrations if several different compounds are being detected at once. In addition, the response of these instruments is not linear over the entire detection range. Therefore, care must be taken when interpreting the data. Concentrations should be reported in terms of the calibration gas and probe type.

PIDs are small, portable instruments and may not yield results as accurate as laboratory instruments. PIDs were originally designed for specific industrial applications. They are relatively easy to use and interpret when detecting total concentrations of known contaminants in air, but interpretation becomes more difficult when trying to identify the individual components of a mixture. PIDs cannot be used as an indicator for combustible gases or oxygen deficiency.

ATTACHMENT 2

Molecules and Compounds Detected by a PID

Some Atoms and Simple Molecules

	IP(eV)		IP(eV)
H	13.595	I_2	9.28
C	11.264	HF	15.77
N	14.54	HCl	12.74
O	13.614	HBr	11.62
Si	8.149	HI	10.38
S	10.357	SO_2	12.34
F	17.42	CO_2	13.79
Cl	13.01	COS	11.18
Br	11.84	CS_2	10.08
I	10.48	N_2O	12.90
H_2	15.426	NO_2	9.78
N_2	15.580	O_3	12.80
O_2	12.075	H_2O	12.59
CO	14.01	H_2S	10.46
CN	15.13	H_2Se	9.88
NO	9.25	H_2Te	9.14
CH	11.1	HCN	3.91
OH	13.18	C_2N_2	13.8
F_2	15.7	NH_3	10.15
Cl_2	11.48	CH_3	9.840
Br_2	10.55	CH_4	12.98

Paraffins and Cycloparaffins

Molecule	IP(eV)
methane	12.98
ethane	11.65
propane	11.07
n-butane	10.63
i-butane	10.57
n-pentane	10.35
i-pentane	10.32
2,2-dimethylpropane	10.35
n-hexane	10.18
2-methlypentane	10.12
3-methlypentane	10.08
2,2-dimethlybutane	10.06
2,3-dimethlybutane	10.02
n-heptane	10.08
2,2,4-trimethlypentane	9.86
cyclopropane	10.06
cyclopentane	10.53
cyclohexane	9.88
methlycyclohexane	9.8

Alkyl Halides

IP(eV)	IP(eV)
HCl	12.74
Cl_2	11.48
CH_4	12.98
methyl chloride	11.28
dichloroemethane	11.35
trichloromethane	11.42
tetrachloromethane	11.47
ethyl chloride	10.98
1,2-dichloroethane	11.12
1-chloropropane	10.82
2-chloropropane	10.78
1,2-dichloropropane	10.87
1,3-dichloropropane	10.85
1-chlorobutane	10.67
2-chlorobutane	10.65
1-chloro-2-methylpropane	10.66
2-chloro-2-methylpropane	10.61
HBr	11.62
Br_2	10.55
methyl bromide	10.53
dibromomethane	10.49
tribromomethane	10.51
CH_2BrCl	10.77
$CHBr_2Cl$	10.59
ethyl bromide	10.29
1,1-dibromoethane	10.19
1-bromo-2-chloroethane	10.63
1-bromopropane	10.18
2-bromopropane	10.075
1,3-dibromopropane	10.07
1-bromobutane	10.13
2-bromobutane	9.98
1-bromo-2-methylpropane	10.09
2-bromo-2-methylpropane	9.89
1-bromopentane	10.10
HI	10.38
I_2	9.28

Alkyl Halides

Molecule	IP(eV)
methyl iodide	9.54
diiodomethane	9.34
ethyl iodide	9.33
1-iodopropane	9.26
2-iodopropane	9.17
1-iodobutane	9.21
2-iodobutane	9.09
1-iodo-2-methylpropane	9.18
2-iodo-2-methylpropane	9.02
1-iodopentane	9.19
F_2	15.7
HF	15.77
$CFCl_3$ (Freon 11)	11.77
CF_2Cl_2 (Freon 12)	12.31
CF_3Cl (Freon 13)	12.91
$CHClF_2$ (Freon 22)	12.45
$CFBR_3$	10.67
CF_2Br_2	11.07
CH_3CF_2Cl (Genetron 101)	11.98
$CFCl_2CF_2Cl$	11.99
CF_3CCl_3 (Freon 113)	11.78
$CFHBrCH_2Cr$	10.75
CF_2BrCH_2Br	10.83
CF_3CH_2I	10.00
n-C_3F_7I	10.36
n-$C_3F_7CH_2Cl$	11.84
n-$C_3F_7CH_2I$	9.96

Aliphatic Alcohol, Ether, Thiol, and Sulfides

Molecule	IP(eV)
H_2O	12.59
methyl alcohol	10.85
ethyl alcohol	10.48
n-propyl alcohol	10.20
i-propyl alcohol	10.16
n-butyl alcohol	10.04
dimethyl ether	10.00
diethyl ether	9.53
n-propyl ether	9.27
i-propyl ether	9.20
H_2S	10.46
methanethiol	9.440
ethanethiol	9.285
1-propanethiol	9.195
1-butanethiol	9.14
dimethyl sulfide	8.685
ethyl methyl sulfide	8.55
diethyl sulfide	8.430
di-n-propyl sulfide	8.30

Aliphatic Aldehydes and Ketones

Molecule	IP(eV)
CO_2	13.79
formaldehyde	10.87
acetaldehyde	10.21
propionaldehyde	9.98
n-butyraldehyde	9.86
isobutyraldehyde	9.74
n-valeraldehyde	9.82
isovaleraldehyde	9.71
acrolein	10.10
crotonaldehyde	9.73
benzaldehyde	9.53
acetone	9.69
methyl ethyl ketone	9.53
methyl n-propyl ketone	9.39
methyl i-propyl ketone	9.32
diethyl ketone	9.32
methyl n-butyl ketone	9.34
methyl i-butyl ketone	9.30
3,3-dimethyl butanone	9.17
2-heptanone	9.33
cyclopentanone	9.26
cyclohexanone	9.14
2,3-butanedione	9.23
2,4-pentanedione	8.87

Aliphatic Acids and Esters

Molecule	IP(eV)
CO_2	13.79
formic acid	11.05
acetic acid	10.37
propionic acid	10.24
n-butyric acid	10.16
isobutyric acid	10.02
n-valeric acid	10.12
methyl formate	10.815
ethyl formate	10.61
n-propyl formate	10.54
n-butyl formate	10.50
isobutyl formate	10.46
methyl acetate	10.27
ethyl acetate	10.11
n-propyl acetate	10.04
isopropyl acetate	9.99
n-butyl acetate	10.01
isobutyl acetate	9.97
sec-butyl acetate	9.91
methyl propionate	10.15
ethyl propionate	10.00
methyl n-butyrate	10.07
methyl isobutyrate	9.98

Aliphatic Amines and Amides

Molecule	IP(eV)
NH_3	10.15
methyl amine	8.97
ethyl amine	8.86
n-propyl amine	8.78
i-propyl amine	8.72
n-butyl amine	8.71
i-butyl amine	8.70
s-butyl amine	8.70
t-butyl amine	8.64
dimethyl amine	8.24
diethyl amine	8.01
di-n-propyl amine	7.84
di-i-propyl amine	7.73
di-n-butyl amine	7.69
trimethyl amine	7.82
triethyl amine	7.50
tri-n-propyl amine	7.23
formamide	10.25
acetamide	9.77
N-methyl acetamide	8.90
N,N-dimethyl formamide	9.12
N,N-dimethyl acetamide	8.81
N,N-diethyl formamide	8.89
N,N-diethyl acetamide	8.60

Other Aliphatic Molecules with N Atom

Molecule	IP(eV)
nitromethane	11.08
nitroethane	10.88
1-nitropropane	10.81
2-nitropropane	10.71
HCN	13.91
acetonitrile	12.22
propionitrile	11.84
n-butyronitrile	11.67
acrylonitrile	10.91
3-butene-nitrile	10.39
ethyl nitrate	11.22
n-propyl nitrate	
methyl thiocyanate	10.065
ethyl thiocyanate	9.89
methyl isothiocyanate	9.25
ethyl isothiocyanate	9.14

Olefins, Cyclo-ofefins, Acetylenes

Molecule	**IP(eV)**
ethylene	10.515
propylene	9.73
1-butene	9.58
2-methylpropene	9.23
trans-2-butene	9.13
cis-2-butene	9.13
1-pentene	9.50
2-methyl-1-butene	9.12
3-methyl-1-butene	9.51
3-methyl-2-butene	8.67
1-hexene	9.46
1,3-butadiene	9.07
isoprene	8.845
cyclopentene	9.01
cyclohexene	8.945
4-methylcyclohexene	8.91
4-cinylcylohexene	8.93
cyclo-octatetraene	7.99
acetylene	11.41
propyne	10.36
1-butyne	10.18

Some Derivatives of Olefins

Molecule	**IP(eV)**
vinyl chloride	9.995
cis-dichloroethylene	9.65
trans-dichloroethylene	9.66
trichloroethylene	9.45
tetrachloroethylene	9.32
vinyl bromide	9.80
1,2-dibromoethylene	9.45
tribromoethylene	9.27
3-chloropropene	10.04
2,3-dichloropropene	9.82
1-bromopropene	9.30
3-bromopropene	9.7
$CF_3CCl=CClCF_3$	10.36
n-$C_5F_{11}CF=CF_2$	10.48
acrolein	10.10
crotonaldehyde	9.73
mesityl oxide	9.08
vinyl methyl ether	8.93
allyl alcohol	9.67
vinyl acetate	9.19

Aromatic Compounds

Molecule	IP(eV)
benzene	9.245
toluene	8.82
ethyl benzene	8.76
n-propyl benzene	8.72
i-propyl benzene	8.69
n-butyl benzene	8.69
s-butyl benzene	8.68
t-butyl benzene	8.68
o-xylene	8.56
m-xylene	8.56
p-xylene	8.445
mesitylene	8.40
durene	8.025
styrene	8.47
alpha-methyl styrene	8.35
ethynylbenzene	8.815
naphthalene	8.12
1-methylnapthalene	7.69
2-methylnapthalene	7.955
biphenyl	8.27
phenol	8.50
anisole	8.22
phenetole	8.13
benzaldehyde	9.53
acetophenone	9.27
benzenethiol	8.33
phenyl isocyanate	8.77

Aromatic Compounds

Molecule	IP(eV)
phenyl isothiocyanate	8.520
benzonitrile	9.705
nitrobenzene	9.92
aniline	7.70
fluoro-benzene	9.195
chloro-benzene	9.07
bromo-benzene	8.98
iodo-benzene	8.73
o-dichlorobenzene	9.07
m-dichlorobenzene	9.12
p-dichlorobenzene	8.94
1-chloro-2-fluorobenzene	9.155
1-chloro-3-fluorobenzene	9.21
1-chloro-4-fluorobenzene	8.99
o-fluorotoluene	8.915
m-fluorotoluene	8.915
p-fluorotoluene	8.785
o-chlorotoluene	8.83
m-chlorotoluene	8.83
p-chlorotoluene	8.70
o-bromotoluene	8.79
m-bromotoluene	8.81
p-bromotoluene	8.67
o-iodotoluene	8.62
m-iodotoluene	8.61
p-iodotoluene	8.50
benzotrifluoride	9.68
o-fluorophenol	8.66

Heterocyclic Molecules

Molecule	IP(eV)
furan	8.89
2-methyl furan	8.39
2-furaldehyde	9.21
tetrahydrofuran	9.54
dihydropyran	8.34
tetrahydropyran	9.26
thiophene	8.860
2-chlorothiophene	8.68
2-bromothiophene	8.63
pyrrole	8.20
pyridine	9.32
2-picoline	9.02
3-picoline	9.04
4-picoline	9.04
2,3-lutidine	8.85
2,4-lutidine	8.85
2,6-lutidine	8.85

Miscellaneous Molecules

Molecule	IP(eV)
ethylene oxide	10.565
propylene oxide	10.22
p-dioxane	9.13
dimethoxymethane	10.00
diethoxymethane	9.70
1,1-dimethoxyethane	9.65
propiolactone	9.70
methyl disulfide	8.46
ethyl disulfide	8.27
diethyl sulfite	9.68
thiolacetic acid	10.00
acetyl chloride	11.02
acetyl bromide	10.55
cyclo-$C_6H_{11}CF_3$	10.46
$(n\text{-}C_3F_7)(CH_3)C=O$	10.58
trichlorovinylsilane	10.79
$(C_2F_5)_3N$	11.7
isoprene	9.08
phosgene	11.77

Notes:

Reference: HNu Systems, Inc., 1985
IP = Ionization Potential

ATTACHMENT 3

PID CALIBRATION AND MAINTENANCE LOG

Instrument Model Number

Instrument Serial Number

Calibration Gas **ppm**

Date/Time	Initials	Battery Check	Calibration			
			Background Value	True Gas Value	Measured Gas Value	Adjust

COMMENTS:

ARCADIS
Infrastructure, environment, facilities

Imagine the result

SOP: Soil Vapor Extraction and Treatment System Sampling

Rev. #: 1

Rev Date: February 19, 2010

Approval Signatures

Brian Millage
Prepared by: ______________________ Date: February 19, 2010
Brian Millage
Staff Scientist

Christopher C Lutes
Reviewed by: ______________________ Date: February 19, 2010
Chris Lutes
Technical Review

Reviewed by: ______________________ Date: February 19, 2010
Quentin Moore
Project Engineer/ Certified Project Manager

I. Scope and Application

This standard operating procedure (SOP) describes the procedures to collect treatment system air samples using a 6-liter, stainless steel SUMMA® canister. The presence of volatile organic compounds (VOCs) will be analyzed by United States Environmental Protection Agency (USEPA) Method TO-14A (TO-14A) and USEPA Method 25C (25C) for total gaseous non-methane organic compounds (TGNMO) to satisfy permit conditions and provide baseline data for destruction efficiency calculations. In addition, all vapor samples collected quarterly will be submitted to the laboratory for the analysis of oxygen, carbon monoxide, carbon dioxide and methane in accordance with the American Society for Testing and Materials (ASTM) method D1946.

Sample collection discussed in this SOP is consistent with the standard TO-14A collection method. Both the TO-14A and 25C analysis will be performed from the same canister. The following sections list the necessary equipment and detailed instructions for collecting the treatment system samples.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, DOT/IATA Hazardous Materials training, site supervisor training, site-specific training, first aid, and cardiopulmonary resuscitation (CPR), as needed. ARCADIS field sampling personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to successfully complete the desired field work. ARCADIS personnel responsible for leading treatment system air sample collection activities must have previous treatment system air sampling experience or be cross-trained by experienced personnel.

III. Equipment List

The equipment required for ambient air sample collection is presented below:

- 6-liter, stainless steel SUMMA® canisters (LAB SUPPLIED - order at least one extra if feasible);
- ¼” stainless steel Swagelok^{TM} fittings for canisters
- Vacuum gauge capable of -30” Hg;
- ¼” Teflon tubing, tees and 3-way valves to purge sample train

- Peristaltic purge pump with required silicon tubing;
- MultiRAE^{TM} Plus PID or equivalent (calibrated);
- Non fixed-open-blade-knife (FOBK) cutting tool for tubing;
- Appropriate-sized open-end wrench and kneeling pad;
- Chain-of-custody (COC) form and sample label tags;
- Field notebook, pens and camera;
- Sample collection log;
- Table or adequate surface to place and secure canisters
- Safety gear including eye, hand and heat protective PPE

IV. Cautions

Care must be taken to minimize the potential for introducing interferences during the sampling event such as any source pollutants or biological debris. Care must also be taken to keep the canister secured in place while collecting the sample. Sampling personnel should not handle hazardous substances (such as gasoline), permanent marking pens, wear/apply fragrances, or smoke cigarettes/cigars before and/or during the sampling event.

Sample integrity is maintained if some vacuum is present in the canister, but sample integrity can be compromised if the event is extended to the point that the canister reaches atmospheric pressure. The treatment system will be operational for a minimum of one hour before the collection of any treatment system samples.

A Shipping Determination must be performed, by DOT-trained personnel, for all environmental and geotechnical samples that are to be shipped, as well as some types of environmental equipment/supplies that are transported. Use laboratory courier to transport samples if there is any doubt regarding shipping methods.

V. Health and Safety Considerations

Field sampling equipment must be carefully handled to minimize the potential for injury and the spread of hazardous substances. Plan safe access routes if sampling points are near powered, heated or elevated equipment. Use a spotter when necessary.

VI. Sampling Procedure

SUMMA® Canister Sampling Train Setup

- The canister valve assembly can be directly leak tested by connecting the pressure gauge and sampling valve directly to the sample tank. Remove the brass dust cap from the SUMMA® canister. Check that the vacuum gauge is zeroed properly. Connect the vacuum gauge, open canister valve slightly and observe vacuum. The vacuum should be the same as the reported value supplied by the laboratory, approximately -29” Hg. Verify canister Identification, record results and allow the canister to sit for one minute. The leak check for the tank is acceptable if no vacuum change is noted. If the canister leaks, notify the laboratory and remove the canister from use.

- Prepare sampling equipment and sample train assembly on plastic sheeting or table to limit potential debris from entering the sample train or equipment.

- To incorporate the canister as part of the sample train, remove vacuum gauge and install a barb to the SUMMA® canister with the appropriate wrench. Tighten with fingers first, then gently with the wrench.

- Using Teflon tubing, place a 3-way valve in line from the sample port (source gas) to the canister and tubing from the remaining barb to a peristaltic purge pump. Install a tee downstream of the purge pump for PID screening and attach a length of tubing to the remaining barb open to the atmosphere for discharge gas. For safety, keep this length of tubing away from the breathing zone or from powered equipment.

- With the sample train now in place, evacuate using the peristaltic pump with the three-way valve initially open and purge an adequate length of time to assure source vapors fill the sample train. Log the PID readings. Note the condition of the gas stream for the presence of moisture or other matter. (Note: At no time should droplets be permitted to enter the sample canister).

- Once adequate purge has been achieved, close the three-way valve and stop the purge pump. The three-way valve should now be closed to the peristaltic pump and open towards the SUMMA® canister for sample collection.

Sample Collection

- With the sample port valve still open, and 3-way valve properly aligned, gently open the SUMMA® canister valve. Record in the field notebook the time sampling began and note conditions.

- Take photographs of the SUMMA® canister, sample location and surrounding area, as appropriate.

- Close the canister valve when the canister vacuum reaches approximately 5 inches of Hg (leaving some vacuum in the canister provides a way to verify if the canister leaks before it reaches the laboratory) or when the desired sample collection time has elapsed. Verify end vacuum reading and record on the appropriate form.

- Close the sample port valve and carefully disconnect the sample train assembly and purge PID of residual source gas.

VII. Sample Handling, Packing and Shipping

- Record the date and local time (24-hour basis) of valve closing in the field notebook, sample collection log, and COC form.

- Complete the appropriate forms and sample labels as directed by the laboratory (e.g., affix card with string), complete COC forms and place requisite copies in shipping container.

- Package the canister (and flow controller if supplied by the laboratory) in the shipping container for return shipment to the laboratory. The SUMMA® canister does not require any preservation methods for shipment.

- Seal shipping container by affixing custody seal to container closure. Keep trip blank with collected samples until laboratory courier arrives. Keep all samples away from objects that may impact results (i.e. car exhaust, contaminated media).

VIII. Waste Management

No specific waste management procedures are required. Properly dispose of used materials in a sealed plastic bag managed as Non-hazardous waste.

IX. Data Recording and Management

Measurements will be recorded in the field notebook at the time of measurement, with notations of project name, sample date, sample start and finish times, sample location (e.g., GPS coordinates if available), canister serial number and initial and final vacuum reading. Field sampling logs and COC records will be transmitted to the Project Manager.

X. Quality Assurance

Soil gas vapor sample analysis will be performed using USEPA Method TO-14A and USEPA Method 25C. The TO-14A method uses a quadrupole or ion-trap GC/MS with a capillary column to provide optimum detection limits. The GC/MS system requires a 1-liter gas sample (which can easily be recovered from a 6-liter canister) to provide a 0.5 ppbv detection limit. The 6-liter canister also provides several additional 1-liter samples in case subsequent re-analyses or dilutions are required. This system also offers the advantage of the GC/MS detector, which confirms the identity of detected compounds by evaluating their mass spectra in either the SCAN or SIM mode.

The Method 25C analysis for total non-methane organic compounds requires less than 1-liter volume for analysis. Both the TO-14A and 25C analysis can be performed from the same canister. Oxygen, carbon monoxide, carbon dioxide and methane fixed gases are analyzed in accordance with the American Society for Testing and Materials (ASTM) method D1946.

XI. Limitations

Please reference the documentation specific to the job site, including the permit conditions, to assure that the method testing is suitable for testing requirements and project target goals.

XII. References

Center for Environmental Research Information Office of Research and Development, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second Edition, Compendium Method TO-14A Determination of Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters with Subsequent Analysis By Gas Chromatography*, U.S. Environmental Protection Agency, Cincinnati, OH 45268. January 1999.

Chain-of-Custody, Handling, Packing and Shipping

Rev. #: 2

Rev Date: March 6, 2009

Approval Signatures

Prepared by: Caron Koll Date: 3/6/09
Caron Koll

Reviewed by: Date: 3/6/09
Jane Kennedy(Technical Expert)

I. Scope and Application

This Standard Operating Procedure (SOP) describes the chain-of-custody, handling, packing, and shipping procedures for the management of samples to decrease the potential for cross-contamination, tampering, mis-identification, and breakage, and to insure that samples are maintained in a controlled environment from the time of collection until receipt by the analytical laboratory.

II. Personnel Qualifications

ARCADIS field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, Department of Transportation (DOT) training, site supervisor training, and site-specific training, as needed. In addition, ARCADIS field sampling personnel will be versed in the relevant SOPs and possess the skills and experience necessary to successfully complete the desired field work.

III. Equipment List

The following list provides materials that may be required for each project. Project documents and sample collection requirements should be reviewed prior to initiating field operations:

- indelible ink pens (black or blue);
- polyethylene bags (resealable-type);
- clear packing tape, strapping tape, duct tape;
- chain of custody
- DOT shipping forms, as applicable
- custody seals or tape;
- appropriate sample containers and labels,;
- insulated coolers of adequate size for samples and sufficient ice to maintain 4°C during collection and transfer of samples;
- wet ice;
- cushioning and absorbent material (i.e., bubble wrap or bags);

- temperature blank
- sample return shipping papers and addresses; and
- field notebook.

IV. Cautions

Review project requirements and select appropriate supplies prior to field mobilization.

Insure that appropriate sample containers with applicable preservatives, coolers, and packing material have been supplied by the laboratory.

Understand the offsite transfer requirements for the facility at which samples are collected.

If overnight courier service is required schedule pick-up or know where the drop-off service center is located and the hours of operation. Prior to using air transportation, confirm air shipment is acceptable under DOT and International Air Transport Association (IATA) regulation

Schedule pick-up time for laboratory courier or know location of laboratory/service center and hours of operation.

Understand DOT and IATA shipping requirements and evaluate dangerous goods shipping regulations relative to the samples being collected (i.e. complete an ARCADIS shipping determination). Review the ARCADIS SOPs for shipping, packaging and labeling of dangerous goods. Potential samples requiring compliance with this DOT regulation include:

- Methanol preservation for Volatile Organic Compounds in soil samples
- Non-aqueous phase liquids (NAPL)

V. Health and Safety Considerations

Follow health and safety procedures outlined in the project/site Health and Safety Plan (HASP).

Use caution and appropriate cut resistant gloves when tightening lids to 40 mL vials. These vials can break while tightening and can lacerate hand. Amber vials (thinner glass) are more prone to breakage.

Some sample containers contain preservatives.

- The preservatives must be retained in the sample container and should in no instance be rinsed out.

- Preservatives may be corrosive and standard care should be exercised to reduce potential contact to personnel skin or clothing. Follow project safety procedures if spillage is observed.

- If sample container caps are broken discard the bottle. Do not use for sample collection.

VI. Procedure

Chain-of-Custody Procedures

1. Prior to collecting samples, complete the chain-of-custody record header information by filling in the project number, project name, and the name(s) of the sampling technician(s) and other relevant project information. Attachment 1 provides an example chain-o- custody record

2. Chain-of-custody information MUST be printed legibly using indelible ink (black or blue).

3. After sample collection, enter the individual sample information on the chain-of-custody:

    a. Sample Identification indicates the well number or soil location that the sample was collected from. Appropriate values for this field include well locations, grid points, or soil boring identification numbers (e.g., MW-3, X-20, SB-30). When the depth interval is included, the complete sample ID would be “SB-30 (0.5-1.0) where the depth interval is in feet. Please note it is very important that the use of hyphens in sample names and depth units (i.e., feet or inches) remain consistent for all samples entered on the chain-of-custody form. DO NOT use the apostrophe or quotes in the sample ID. Sample names may also use the abbreviations “FB,” “TB,” and “DUP” as prefixes or suffixes to indicate that the sample is a field blank, trip blank, or field duplicate, respectively. NOTE: The sample nomenclature may be dictated by the project database and require unique identification for each sample collected for the project. Consult the project data management plan for additional information regarding sample identification.

b. List the date of sample collection. The date format to be followed should be mm/dd/yy (e.g., 03/07/09) or mm/dd/yyyy (e.g. 03/07/2009).

c. List the time that the sample was collected. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

d. The composite field should be checked if the sample is a composite over a period of time or from several different locations and mixed prior to placing in sample containers.

e. The “Grab”. field should be marked with an “X” if the sample was collected as an individual grab sample. (e.g. monitoring well sample or soil interval).

f. Any sample preservation should be noted.

g. The analytical parameters that the samples are being analyzed for should be written legibly on the diagonal lines. As much detail as possible should be presented to allow the analytical laboratory to properly analyze the samples. For example, polychlorinated biphenyl (PCB) analyses may be represented by entering “PCBs” or “Method 8082.” Multiple methods and/or analytical parameters may be combined for each column (e.g., PCBs/VOCs/SVOCs or 8082/8260/8270). These columns should also be used to present project-specific parameter lists (e.g., Appendix IX+3 target analyte list. Each sample that requires a particular parameter analysis will be identified by placing the number of containers in the appropriate analytical parameter column. For metals in particular, indicate which metals are required.

h. Number of containers for each method requested. This information may be included under the parameter or as a total for the sample based on the chain of custody form used.

i. Note which samples should be used for site specific matrix spikes.

j. Indicate any special project requirements.

- k. Indicate turnaround time required.
- l. Provide contact name and phone number in the event that problems are encountered when samples are received at the laboratory.
- m. If available attach the Laboratory Task Order or Work Authorization forms
- n. The remarks field should be used to communicate special analytical requirements to the laboratory. These requirements may be on a per sample basis such as "extract and hold sample until notified," or may be used to inform the laboratory of special reporting requirements for the entire sample delivery group (SDG). Reporting requirements that should be specified in the remarks column include: 1) turnaround time; 2) contact and address where data reports should be sent; 3) name of laboratory project manager; and 4) type of sample preservation used.
- o. The "Relinquished By" field should contain the signature of the sampling technician who relinquished custody of the samples to the shipping courier or the analytical laboratory.
- p. The "Date" field following the signature block indicates the date the samples were relinquished. The date format should be mm/dd/yyyy (e.g., 03/07/2005).
- q. The "Time" field following the signature block indicates the time that the samples were relinquished. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.
- r. The "Received By" section is signed by sample courier or laboratory representative who received the samples from the sampling technician or it is signed upon laboratory receipt from the overnight courier service.

3. Complete as many chain-of-custody forms as necessary to properly document the collection and transfer of the samples to the analytical laboratory.

4. Upon completing the chain-of-custody forms, forward two copies to the analytical laboratory and retain one copy for the field records.

5. If electronic chain-of-custody forms are utilized, sign the form and make 1 copy for ARCADIS internal records and forward the original with the samples to the laboratory.

Handling Procedures

1. After completing the sample collection procedures, record the following information in the field notebook with indelible ink:

   - project number and site name;
   - sample identification code and other sample identification information, if appropriate;
   - sampling method;
   - date;
   - name of sampler(s);
   - time;
   - location (project reference);
   - location of field duplicates and both sample identifications;
   - locations that field QC samples were collected including equipment blanks, field blanks and additional sample volume for matrix spikes; and
   - any comments.

2. Complete the sample label with the following information in indelible ink:

   - sample type (e.g., surface water);
   - sample identification code and other sample identification information, if applicable;
   - analysis required;
   - date;
   - time sampled; and
   - initials of sampling personnel;

- sample matrix; and
- preservative added, if applicable.

3. Cover the label with clear packing tape to secure the label onto the container and to protect the label from liquid.

4. Confirm that all caps on the sample containers are secure and tightly closed.

5. In some instances it may be necessary to wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. For some projects individual custody seals may be required. Custody seal evidence tape may be placed on the shipping container or they may be placed on each sample container such that the cooler or cap cannot be opened without breaking the custody seal. The custody seal should be initialed and dated prior to relinquishing the samples.

Packing Procedures

Following collection, samples must be placed on wet ice to initiate cooling to 4°C immediately. Retain samples on ice until ready to pack for shipment to the laboratory.

1. Secure the outside and inside of the drain plug at the bottom of the cooler being used for sample transport with “Duct” tape.

2. Place a new large heavy duty plastic garbage bag inside each cooler

3. Place each sample bottle wrapped in bubble wrap inside the garbage bag. VOC vials may be grouped by sample in individual resealable plastic bags). If a cooler temperature blank is supplied by the laboratory, it should be packaged following the same procedures as the samples. If the laboratory did not include a temperature blank, do not add one. Place 1 to 2 inches of cushioning material (i.e., vermiculite) at the bottom of the cooler.

4. Place the sealed sample containers upright in the cooler.

5. Package ice in large resealable plastic bags and place inside the large garbage bag in the cooler. Samples placed on ice will be cooled to and maintained at a temperature of approximately 4°C.

6. Fill the remaining space in the cooler with cushioning material such as bubble wrap. The cooler must be securely packed and cushioned in an upright position and be surrounded (Note: to comply with 49 CFR 173.4, filled cooler must not exceed 64 pounds).

7. Place the completed chain-of-custody record(s) in a large resealable bag and tape the bag to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with packing tape.

9. Wrap strapping tape around both ends of the cooler.

10. Mark the cooler on the outside with the following information: shipping address, return address, "Fragile, Handle with Care" labels on the top and on one side, and arrows indicating "This Side Up" on two adjacent sides.

11. Place custody seal evidence tape over front right and back left of the cooler lid, initial and date, then cover with clear plastic tape.

Note: Procedure numbers 2, 3, 5, and 6 may be modified in cases where laboratories provide customized shipping coolers. These cooler types are designed so the sample bottles and ice packs fit snugly within preformed styrofoam cushioning and insulating packing material.

Shipping Procedures

1. All samples will be delivered by an express carrier within 48 hours of sample collection. Alternatively, samples may be delivered directly to the laboratory or laboratory service center or a laboratory courier may be used for sample pickup.

2. If parameters with short holding times are required (e.g., VOCs [EnCore™ Sampler], nitrate, nitrite, ortho-phosphate and BOD), sampling personnel will take precautions to ship or deliver samples to the laboratory so that the holding times will not be exceeded.

3. Samples must be maintained at 4°C±2°C until shipment and through receipt at the laboratory

4. All shipments must be in accordance with DOT regulations and ARCADIS dangerous goods shipping SOPs.

5. When the samples are received by the laboratory, laboratory personnel will complete the chain-of-custody by recording the date and time of receipt of samples, measuring and recording the internal temperature of the shipping container, and checking the sample identification numbers on the containers to ensure they correspond with the chain-of-custody forms.

Any deviations between the chain-of-custody and the sample containers, broken containers, or temperature excursions will be communicated to ARCADIS immediately by the laboratory.

VII. Waste Management

Not applicable

VIII. Data Recording and Management

Chain-of-custody records will be transmitted to the ARCADIS PM or designee at the end of each day unless otherwise directed by the ARCADIS PM. The sampling team leader retains copies of the chain-of-custody forms for filing in . the project file. Record retention shall be in accordance with project requirements.

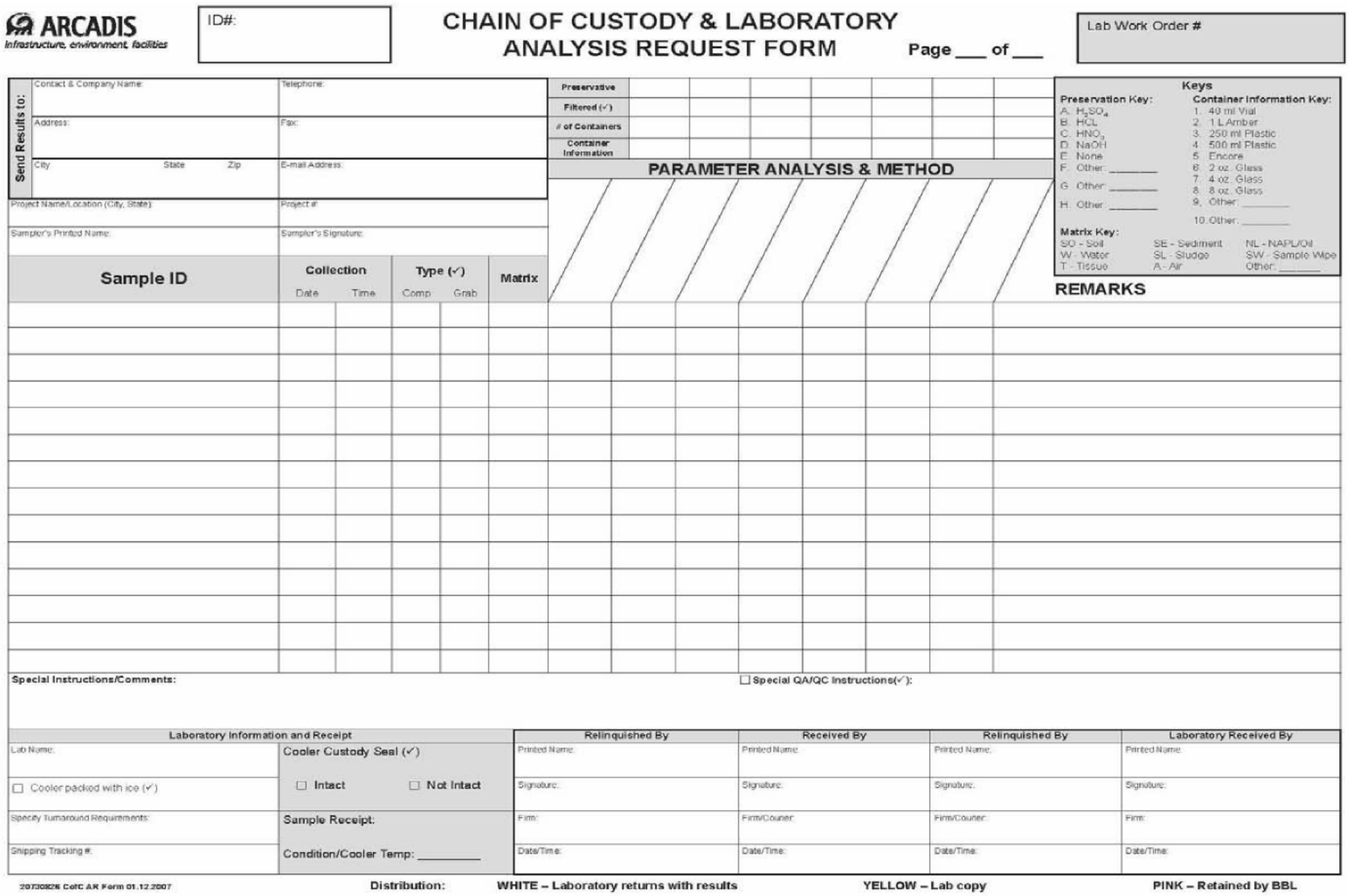
IX. Quality Assurance

Chain-of-custody forms will be legibly completed in accordance with the applicable project documents such as Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), Work Plan, or other project guidance documents. A copy of the completed chain-of-custody form will be sent to the ARCADIS Project Manager or designee for review.

X. References

Not Applicable

Attachment 1



ARCADIS
Infrastructure, environment, facilities

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:

Contact & Company Name:
Telephone:
Address:
Fax:
City State Zip
E-mail Address:
Project Name/Location (City, State):
Project #:
Sampler's Printed Name:
Sampler's Signature:

Preservative
Filtered (✓)
# of Containers
Container Information

PARAMETER ANALYSIS & METHOD

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: ________
G. Other: ________
H. Other: ________

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other: ________
10. Other: ________

Matrix Key:
SO - Soil
W - Water
T - Tissue
SE - Sediment
SL - Sludge
A - Air
NL - NAPL/Oil
SW - Sample Wipe
Other: ________

Sample ID	Collection		Type (✓)		Matrix								REMARKS
	Date	Time	Comp	Grab									

Special Instructions/Comments:

☐ **Special QA/QC Instructions(✓):**

Laboratory Information and Receipt

Lab Name:
☐ Cooler packed with ice (✓)
Specify Turnaround Requirements:
Shipping Tracking #:

Cooler Custody Seal (✓)
☐ Intact ☐ Not Intact

Sample Receipt:
Condition/Cooler Temp: ________

Relinquished By	Received By	Relinquished By	Laboratory Received By
Printed Name:	Printed Name:	Printed Name:	Printed Name:
Signature:	Signature:	Signature:	Signature:
Firm:	Firm/Courier:	Firm/Courier:	Firm:
Date/Time:	Date/Time:	Date/Time:	Date/Time:

20730826 CofC AR Form 01.12.2007

Distribution: **WHITE – Laboratory returns with results** **YELLOW – Lab copy** **PINK – Retained by BBL**

Appendix **C**

Operation & Maintenance Forms

Soil Vapor Extraction System Data Monitoring Form

Chevron Facility 351646

706/726/800 Harrison Street

Oakland, California

Record #	Initials	Date (mm/dd/yy)	Time (24-hr Format)	Operational Zones	Arrival (On/Off)	Departure (On/Off)	System Hours	Ambient Temp. (°F)	Process Temp. (°F)	Influent Conc. (ppmv)	Effluent Conc. (ppmv)	System Flowrate (acfm)	System Vacuum (in. Hg)	Dilution Valve (% Open)
1														
2														
3														
4														
5														
6														

Additional Notes:

Soil Vapor Extraction System
SVE Well Data Monitoring Form
Chevron Facility 351646
706/726/800 Harrison Street
Oakland, California

Date: ______________________
Personnel: ______________________
Weather: ______________________

SVE Wells		**Time:**		
Well ID	Vacuum (in. H_2O)		Flow (SCFM)	PID (ppm)
	Manifold	Wellhead		
VE-3				
VE-4				
VE-5				
VE-6				

Total Flow: ☐ SCFM

Total Vacuum: ☐ in. H_2O

Wells with Faulty Monitoring Equipment
(valves, flow meters, gauges, etc.)

____
____
____
____

Additional Notes:

____
____
____
____
____
____

Air Sparge System Data Monitoring Form

Chevron Facility 351646

706/726/800 Harrison Street

Oakland, California

Record #	Initials	Date (mm/dd/yy)	Time (24-hr Format)	Operational Zones	Arrival (On/Off)	Departure (On/Off)	System Hours	Ambient Temp. (°F)	Process Temp. Before Heat-X (°F)	Process Temp. After Heat-X (°F)	Air Flow (acfm)	Air Pressure (psig)
1												
2												
3												
4												
5												
6												

Additional Notes:

____

____

____

____

Air Sparge System

AS Well Data Monitoring Form

Chevron Facility 351646
706/726/800 Harrison Street
Oakland, California

Date: ____________________

Personnel ____________________

Weather ____________________

AS Well Operation		
Zone 1	**Zone 2**	**Zone 3**
Total Flow: ☐ SCFM	Total Flow: ☐ SCFM	Total Flow: ☐ SCFM
Total Pressure ☐ psi	Total Pressure ☐ psi	Total Pressure ☐ psi
Temperature: ☐ °F	Temperature: ☐ °F	Temperature: ☐ °F

Zone 1 Wells		Time:	
Well ID	**Manifold Pressure (psi)**	**Manifold Flow (SCFM)**	**Wellhead Pressure (psi)**
AS-1			
AS-6			
AS-9			
AS-12			
AS-13			

Zone 2 Wells		Time:	
Well ID	**Manifold Pressure (psi)**	**Manifold Flow (SCFM)**	**Wellhead Pressure (psi)**
AS-2			
AS-4			
AS-8			
AS-11			
AS-14			
SP-3			

Zone 3 Wells		Time:	
Well ID	**Manifold Pressure (psi)**	**Manifold Flow (SCFM)**	**Wellhead Pressure (psi)**
AS-3			
AS-6			
AS-10			
SP-4			
SP-5			

Wells with Faulty Monitoring Equipment (gauges, flow meters, valves, etc.)

Additional Notes: