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By Alameda County Environmental Health at 3:40 pm, Jun 21, 2013

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Results of DPE Test and SPH Removal
Former BP Service Station #11132
3201 35th Avenue
Oakland, California
ACEH Case #RO0000014

ENVIRONMENT

"I declare that to the best of my knowledge at the present time, that the information and/or recommendations contained in the attached document are true and correct."

Date:
June 12, 2013

Submitted by:

ARCADIS U.S., Inc

Hollis E. Phillips, PG
Project Manager

Contact:
Hollis E. Phillips

Phone:
415.432.6903

Email:
Hollis.phillips@arcadis-us.com

Our ref:
GP09BPNA.C112

Imagine the result

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ENVIRONMENT

Dilan Roe, P.E.
Hazardous Materials Specialist
Alameda County Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject:
Results of DPE Test and SPH Removal
Former BP Station #11132
3201 35th Avenue, Oakland, California
ACEH Case #RO0000014

Date:
June 12, 2013

Contact:
Hollis Phillips

Phone:
415.432.6903

Email:
Hollis.Phillips@arcadis-us.com

Our ref:
GP09BPNA.C112

Dear Ms. Roe:

ARCADIS U.S., Inc. (ARCADIS) has prepared this letter to provide a summary of recent field activities at the Former BP Station #11132 located at 3201 35th Avenue, in Oakland, California (Site). A dual-phase extraction (DPE) pilot test was conducted in November 2012 as proposed in the "*Site Remedial Strategy Update*," submitted on June 23, 2011 and in the "*Proposal for DPE"* letter submitted on July 6, 2012, to evaluate the potential effectiveness of DPE as a remedy at the Site during seasonal groundwater elevation lows. During baseline water level gauging prior to DPE startup separate phase hydrocarbon (SPH) was observed at well OW-1. The product was removed and the DPE pilot test was conducted. Following completion of the DPE pilot test ARCADIS conducted monthly SPH bail-down activities for three consecutive months to remove SPH and evaluate SPH mobility at monitoring wells OW-1 and MW-10, as described in the letter submitted on January 11, 2013 (ARCADIS 2013).

DPE Pilot Test Summary

On November 12, 2012, ARCADIS mobilized a trailer-mounted DPE unit to the Site with Mako Industries (Mako) to initiate field activities. Following review of health and safety procedures and site setup, ARCADIS conducted baseline depth-to-water (DTW) readings at all monitoring wells on-site and identified 0.99 feet of SPH in well OW-1. The presence of SPH was not anticipated at OW-1, as it is not routinely monitored as part of the semiannual groundwater monitoring program; therefore, system startup was temporarily postponed while SPH removal (bailing) was conducted. Approximately half a gallon of SPH/water mixture was bailed and stored

in a 55-gallon drum. Field notes from DPE field activities are included as **Attachment A**.

Following system setup and initial bailing activities, startup of the DPE system was further delayed until November 15, 2012 due to two malfunctioning/improperly sized submersible pumps intended to support dewatering. ARCADIS determined the use of a stinger would be sufficient to support dewatering and soil vapor extraction simultaneously. Baseline DTW and vacuum readings were collected from all wells on-site prior to startup. Monitoring wells MW-2 and MW-10 were initially selected as extraction locations; however, health and safety concerns and access restrictions at MW-10 due to placement within an active bus stop limited DPE to MW-2. During DPE activities, air and water were extracted from monitoring well MW-2 using a 1.5-inch diameter stinger and directed to a water knockout tank. Extracted vapors were treated by a thermal oxidizer prior to discharge to the atmosphere and extracted groundwater was transferred to an on-site holding tank pending analysis and off-site disposal. Approximately 16,100 gallons of water at an average flowrate of 2.2 gallons per minute (gpm) were extracted during the course of the DPE event, as shown in **Table 1**.

Throughout pilot test activities, pressure, air velocity, and total volatile organic compounds (VOC) measurements were collected at the oxidizer inlet to evaluate mass removal rate from MW-2. Results included in **Table 2** indicate that mass removal rates from MW-2 varied from 0.9 to 1.5 pounds of VOCs removed per day (lb/day). The concentration of VOCs extracted from MW-2 did not increase significantly over the course of the test, indicating that submerged source mass was not sufficiently exposed to increase VOC concentrations and mass removal rates.

The radius of influence (ROI) of DPE at the Site was measured by monitoring induced vacuum and DTW at selected response wells (VE-1, VM-2, AS-1, VM-1, OW-1, and RW-1) surrounding MW-2 at periodic intervals during the test. Field data included in **Table 3** indicate that vacuum response was observed in all wells, with exceptionally high vacuum response at VM-1 and VM-2. This is likely due to the fact that VM-1 and VM-2 are located approximately 7 and 16 feet from MW-2, respectively, and screened almost entirely in the vadose zone. The vacuum response observed at AS-1 and RW-1, which are located approximately 25 feet from MW-2 suggests that an ROI of at least 25 feet was obtained. DTW observations at the monitoring locations also indicated substantial influence. DTW measurements observed at AS-1 and RW-1 increased by 4 feet at each location, suggesting water table drawdown.

Review of mass removal rates and response well data collected during the 5-day DPE pilot test suggest that although the water table was lowered by approximately 4

feet and vacuum was induced as far as 25 feet from the extraction well, sufficient submerged source mass was not exposed to remove a significant amount of mass. Additionally, the average water extraction rate of 2.2 gpm does not make DPE a cost effective remedial strategy.

SPH Bail-down activities

Throughout DPE operations, DTW and depth-to-product (DTP) measurements were collected at OW-1 to monitor the SPH thickness during dewatering. As shown in **Table 3**, the SPH thickness remained constant between 0.35 and 0.43 feet throughout the duration of the test. SPH thickness did not increase as the water table was lowered, indicating that additional drainable SPH does not exist below the static water table near OW-1.

To further characterize SPH mobility, three bail-down events were conducted on a monthly basis during the first quarter of 2013. Field notes from SPH bail-down events are included as **Attachment B** and the data are summarized in **Table 4**. The SPH bailing events consisted of measuring initial thickness, removing SPH/water from the well until no measurable thickness is remaining, and measuring the final thickness of SPH immediately after bailing and again before leaving the site to determine if recharge occurred. Monitoring was conducted at locations MW-10 and OW-1, where both SPH and sheen have historically been observed. In the first event following DPE operations, conducted on January 17, 2013, the initial product thickness at OW-1 was observed to be 0.10 feet, approximately 2 months after the end of the DPE test. SPH was removed from OW-1 using a disposable bailer and the SPH/water mixture was placed in 55-gallon drum temporarily staged in the remediation compound on-site. Upon departure during the first bailing event, SPH was observed to have recharged to a thickness of 0.01 feet. During the second bailing event, conducted on February 20, 2013, SPH was observed in OW-1 at a thickness of 0.02 feet, indicating a recharge of approximately 0.01 feet over a one month period. SPH recharge was not observed upon departure during the second event. During the third bailing event, conducted on March 8, 2013, SPH was observed in OW-1 at a thickness of 0.01 feet indicating a recharge of approximately 0.01 feet over a one month period. Similar to the second event, SPH recharge was not observed upon departure. Additionally, during the February and March bailing events, the water table was nearly 3 feet lower than the January event. The lower water table exposed more smear zone soils and, therefore, would have increased the potential for drainable SPH to enter the well if it was present. As indicated in field forms in **Attachment B**, SPH was not observed at MW-10 during any of the bailing events. Following completion of the bailing events, the drum containing the SPH/water mixture was properly disposed of offsite.

Baseline and departure readings from each bailing event indicate that the rate of SPH recharge at OW-1 decreased with each successive event. The decreasing rate of recharge, minimal SPH thickness, and lower water table observed during the final two bailing events indicates that drainable SPH has been removed to the extent practicable.

Conclusions

Results from the DPE pilot test indicate that although DPE effectively lowered the water table and propagated a vacuum within the subsurface, sufficient submerged source mass was not exposed in order to achieve effective mass removal rates. Additionally, the average water extraction rate of 2.2 gpm does not make DPE a cost effective remedial strategy. Monitoring of SPH thickness during DPE activities and subsequent bail-down activities at OW-1 indicate that drainable SPH has been removed to the extent practicable at OW-1.

ARCADIS is currently compiling historical site data in order to complete the Low Threat Closure (LTC) checklists provided by ACEH on May 31, 2013. Based on the results of the LTC checklists, ARCADIS will present a revised site strategy. If you have any questions or comments regarding the contents of this letter, please contact Hollis Phillips of ARCADIS at 415.432.6903 or by e-mail at Hollis.Phillips@arcadis-us.com.

Sincerely,
ARCADIS

Hollis Phillips P.G.
Project Manager

Attachments

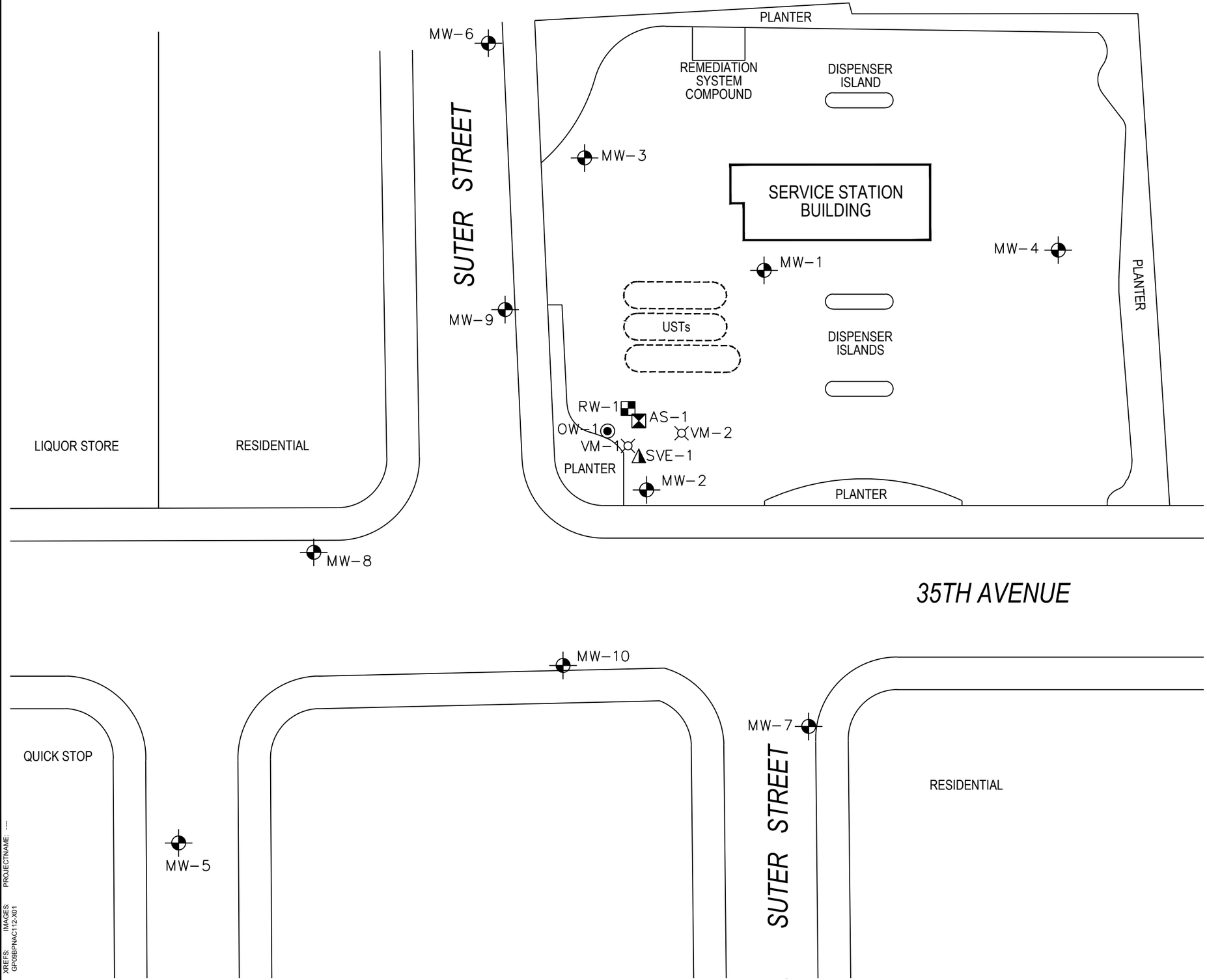
Figure 1	Site Plan
Table 1	Cumulative Water Removed
Table 2	System Data and Mass Removal Rates
Table 3	Response Well Data
Table 4	SPH Bail-down data at OW-1
Attachment A	Field Forms – DPE Pilot Test
Attachment B	Field Forms – SPH Bail-down

References:

ARCADIS US, Inc. 2011 (ARCADIS). *Site Remedial Strategy Update, Former BP Station #11132, 3201 35th Avenue, Oakland, California, ACEH Case #RO0000014*. June.

ARCADIS US, Inc. 2012 (ARCADIS). *Proposal for DPE, Former BP Station #11132, 3201 35th Avenue, Oakland, California, ACEH Case #RO0000014*. July.

ARCADIS US, Inc. 2013 (ARCADIS). *Proposed Additional Remedial Activities, Former BP Service Station No. 11132, 3201 35th Avenue, Oakland, California, ACEH Case #RO0000014*. January.



LEGEND

- MW-1 GROUNDWATER MONITORING WELL
- RW-1 GROUNDWATER RECOVERY WELL
- AS-1 AIR SPARGE WELL
- OW-1 OBSERVATION WELL
- SVE-1 SOIL VAPOR EXTRACTION WELL
- VM-1 SOIL VAPOR MONITORING WELL

NOTE:

BASE MAP PROVIDED BY BROADBENT & ASSOCIATES, INC., DATED 9/15/09, AT A SCALE OF 1"=50'.

0 30' 60'

GRAPHIC SCALE

FORMER BP STATION NO. 11132
3201 35TH AVENUE, OAKLAND, CALIFORNIA

WELL LOCATIONS

ARCADIS

FIGURE 1

Table 1
Cumulative Water Removed
Results of DPE Test and LNAPL Removal
Former BP Station No. 11132
3201 E 35th Avenue, Oakland, California

Date	Time	Totalizer	Cumulative Volume (gal)	Average Flowrate (gpm)	Notes
11/15/2012	10:00	257,171	---	---	Baseline
11/15/2012	12:00	257,419	248	2.1	
11/15/2012	17:00	258,084	913	2.2	
11/16/2012	9:00	260,055	2,884	2.1	
11/16/2012	15:30	260,996	3,825	2.4	
11/17/2012	9:25	263,208	6,037	2.1	
11/17/2012	16:19	264,085	6,914	2.1	
11/18/2012	9:30	266,234	9,063	2.1	
11/18/2012	15:45	267,076	9,905	2.2	
11/19/2012	9:15	269,347	12,176	2.2	
11/19/2012	15:00	270,125	12,954	2.3	
11/20/2012	8:30	272,439	15,268	2.2	
11/20/2012	15:00	273,280	16,109	2.2	

Notes:

gal	gallons
gpm	gallons per minute

Table 2
System Data and Mass Removal Rates
Results of DPE Test and LNAPL Removal
Former BP Station No. 11132
3201 E 35th Avenue, Oakland, California

		Blower Inlet Pipe flow diam (in): 3 Pipe Flow Area (ft^2): 0.049				Dilution Line Pipe flow diam (in): 2 Pipe Flow Area (ft^2): 0.022				Oxidizer Inlet Line Pipe flow diam (in): 3 Pipe Flow Area (ft^2): 0.049					
Date	**Time**	**Vacuum (in Hg)**	**Velocity (ft/min)**	**Flow Rate (ACFM)**	**Flow Rate (SCFM)**	**Vacuum (in Hg)**	**Velocity (ft/min)**	**Flow Rate (ACFM)**	**Flow Rate (SCFM)**	**Pressure (in H_2O)**	**Velocity (ft/min)**	**PID (ppm_v)**	**Flow Rate (ACFM)**	**Flow Rate (SCFM)**	**Mass Removal (lbs/day)**
11/15/2012	10:40	---	---	---	---	CLOSED				0.12	303	656	14.9	14.9	**0.9**
11/15/2012	11:50	---	---	---	---	CLOSED				0.12	460	728	22.6	22.6	**1.5**
11/15/2012	17:00	---	---	---	---	CLOSED				0.20	397	773	19.5	19.5	**1.4**
11/16/2012	9:00	---	---	---	---	CLOSED				0.20	393	743	19.3	19.3	**1.3**
11/16/2012	15:30	---	---	---	---	CLOSED				0.23	407	649	20.0	20.0	**1.2**
11/17/2012	9:25	---	---	---	---	CLOSED				0.21	451	604	22.1	22.1	**1.2**
11/17/2012	16:19	---	---	---	---	CLOSED				0.36	430	665	21.1	21.1	**1.3**
11/18/2012	9:30	---	---	---	---	CLOSED				0.35	410	658	20.1	20.1	**1.2**
11/18/2012	15:45	---	---	---	---	CLOSED				0.39	426	660	20.9	20.9	**1.2**
11/19/2012	9:15	---	---	---	---	CLOSED				0.32	420	612	20.6	20.6	**1.1**
11/19/2012	15:00	---	---	---	---	CLOSED				0.82	402	590	19.7	19.8	**1.0**
11/20/2012	8:30	---	---	---	---	CLOSED				0.80	430	600	21.1	21.1	**1.1**
11/20/2012	15:00	---	---	---	---	CLOSED				0.80	418	605	20.5	20.6	**1.1**

Notes:

---	not measured
ACFM	actual cubic feet per minute
in	inches
in Hg	inches of mercury
in H_2O	inches of water
ft^2	square feet
ft/min	feet per minute
lbs/day	pounds per day
ppm_v	parts per million by volume
SCFM	standard cubic feet per minute

Flow and Emission Equations

ACFM (ft^3/min) = Velocity (ft/min) X Flow Area (ft^2)

$$SCFM_{25C} = ACFM \left(\frac{P_{abs} + P_g}{P_{abs}}\right)\left(\frac{537}{460 + T}\right)$$

Mass Removal (lb/day) = SCFM (ft^3/min) x VOCs (ppmv) x 6.23x10-8 [(lb/ft^3)/(ppmv)] x 1440 (min/day)

where:

P_{abs} = *Atmospheric Pressure at Sea Level (1 atm = 406.8 in H_2O)*

P_g = *Guage/Line Pressure - equivalent to zero if atmospheric discharge*

T = *Airstream Temperature, degrees Farenheit (^oF)*

Table 3
Reponse Well Data
Results of DPE Test and LNAPL Removal
Former BP Station No. 11132
3201 E 35th Avenue, Oakland, California

Location ID:		VE-1		VM-2		AS-1		VM-1		RW-1		OW-1				
Date	Time	Vacuum (in H_2O)	DTW (ft bTOC)	Vacuum (in H_2O)	DTW (ft bTOC)	Vacuum (in H_2O)	DTW (ft bTOC)	Vacuum (in H_2O)	DTW (ft bTOC)	Vacuum (in H_2O)	DTW (ft bTOC)	Vacuum (in H_2O)	DTW (ft bTOC)	DTP (ft bTOC)	Product thickness (feet)	Notes
11/15/2012	1000	0.00	18.94	0.00	16.91	0.28	19.85	0.00	17.22	0.02	19.32	0.00	20.35	19.96	0.39	Baseline
11/15/2012	1100	0.07	18.94	5.60	17.29	6.71	22.07	0.15	17.22	0.43	19.99	0.00	22.22	21.83	0.39	
11/15/2012	1200	0.08	18.94	6.84	17.40	6.71	22.65	0.12	17.22	0.32	20.40	0.00	22.74	22.35	0.39	
11/15/2012	1700	0.17	18.96	8.17	17.50	6.25	23.28	0.23	17.26	0.06	21.85	0.00	23.41	23.03	0.38	
11/16/2012	900	0.24	19.05	11.58	17.77	5.80	24.05	0.43	17.30	0.12	22.98	0.00	24.21	23.82	0.39	
11/16/2012	1530	0.27	19.06	11.75	17.78	4.77	24.25	1.01	17.10	0.11	23.25	0.00	24.31	23.88	0.43	
11/17/2012	925	0.66	19.10	45.86	18.82	2.36	24.65	1.96	17.21	1.96	23.12	0.61	24.50	24.11	0.39	
11/17/2012	1619	0.73	19.15	34.77	18.42	4.51	24.40	14.65	17.93	2.76	23.22	0.02	24.52	24.14	0.38	
11/18/2012	930	0.87	19.19	43.39	18.80	5.37	24.36	33.17	18.72	0.00	23.40	1.24	24.41	24.05	0.36	
11/18/2012	1545	0.84	19.21	46.45	18.94	6.06	24.40	37.69	18.94	0.02	23.45	0.64	24.46	24.10	0.36	
11/19/2012	915	0.89	19.27	48.10	19.05	7.63	24.46	34.81	18.90	0.32	23.52	1.42	24.52	24.17	0.35	
11/19/2012	1500	0.84	19.30	48.74	19.05	6.49	24.42	31.78	18.81	0.04	23.55	1.78	24.52	24.14	0.38	
11/20/2012	830	0.84	19.38	45.64	19.12	4.60	24.45	30.28	19.52	0.04	23.55	2.78	24.53	24.20	0.33	
11/20/2012	1500	0.95	19.44	26.74	19.22	3.23	24.45	25.83	19.50	0.41	23.56	1.63	24.53	24.21	0.32	

Notes:

DTP	depth to product
DTW	depth to water
ft bTOC	measured from top of temporary riser pipe (~1 foot above top of well casing)
in H_2O	inches of water

Table 4
LNAPL Bail-down Data at OW-1
Results of DPE Test and LNAPL Removal
Former BP Station No. 11132
3201 E 35th Avenue, Oakland, California

Date	Time	Phase	DTW (ft bTOC)	DTP (ft bTOC)	Product thickness (feet)	Notes
1/17/2013	13:55	pre-bailing	15.00	14.90	0.10	
1/17/2013	14:10	post-bailing	14.10	--	--	
1/17/2013	14:35	departure	15.03	15.02	0.01	
2/20/2013	7:46	pre-bailing	17.79	17.77	0.02	
2/20/2013	7:55	post-bailing	18.59	--	--	
2/20/2013	8:25	departure	17.79	--	--	
3/8/2013	7:49	pre-bailing	17.98	17.97	0.01	
3/8/2013	8:04	post-bailing	18.4	--	--	
3/8/2013	8:22	departure	17.98	--	--	

Notes:

DTP	depth to product
DTW	depth to water
ft bTOC	measured from top of temporary riser pipe (~1 foot above top of well casi
gal	gallons

Site Visit Report

ARCADIS Project Number:	Dates of Site Visit:
60091BPNA.C176	11/12/12
ARCADIS Project Name:	**Location of Project:**
BP 11132	3291 35th Ave, Oakland, CA
ARCADIS Personnel Present:	**Other Persons Present:**
E Manter	Rob / Mario

Purpose of Site Visit:
DPE pilot

Date & Time:	Activities:
0730	Arrive on-site conduct H&S meeting
0800	Discuss with station attendant. Gas delivery thursday or friday 9-10 pm.
0815	Backup trailer + get positioned; set up cones
0820	Mob to equipco to pickup PID.
0950	Back on-site w/ equipment; propane delivery
1015	Tank; fencing + Fedex (pump) drop off.
1100	Background PID for air monitoring MW-2 = 2.5 ppm VM-2 = 417 ppm VE-1 = 490 ppm As-1: 0.0 ppm OW-1 = 250 ppm VM-1 = 50 ppm VOCs in breathing zone = 0.0 ppm @ VM-2 + VE-1
1120	E Manter off site to get traffic control
1215	Back on-site; propane fill truck on-site
1230	Baseline DTW; product at OW-1 ~~~ dark amber, very sticky 2' on tape
1400	Rob back on-site; put in down-hole piping VE-1 ≈ 19.3' of tubing VM-2 ≈ 19.5' of tubing VM-2 ≈ 19.4' of tubing As-1 ≈ 29.5'
1430	Mob to E-ville to get trailers
1500	Back on-site; Bail OW-1 Open remediation compound; LNAPL bailing drum on-site DTP: 19.06 DTW = 20.05' Bail ≈ 24" NAPL
1600	Post bailing: DTP = 19.30 DTW = 19.40'
1645	Stop work; Find RW-1; too late to start unit; postpone

Weather: Sunny 70's	Signature & Date:
	Eqpt Billing Log to Accounting Date: Initials:

1730 Mako offsite
1745 pickup chain & Locks for compound
1800 Security on-site
1840 Lock up / Demob

Casey: 916-223-8641

Site Visit Report

ARCADIS Project Number:	Dates of Site Visit:
G709BPNAC112.K000	11/13/12 / 11/14/12
ARCADIS Project Name:	**Location of Project:**
BP/11132	Oakland CA
ARCADIS Personnel Present:	**Other Persons Present:**
A. Shah	Rob from Mako

Purpose of Site Visit:
DPE Pilot

Date & Time:	Activities:
0900	Mako onsite to complete Setup
0945	AS onsite
	H&S tailgate
	Baseline at OW-1: DTW=19.82 (w/ riser) SPH=0.42 feet
1000	Start dewatering MW-2 w/ pump
1100	Determine pump is not capable of 3 GPM. Phone rental company to send replacement.
	Discuss w/ D. Evans & H. Phillips, decide to wait for new pump.
1130	Demob Equipment
1215	Leave Site, AS to Eville for shipments.
11/14/12	
0800	AS to pickup Equipment
0900	Mako on site. Tom Hess & Don Johnson onsite
0930	H&S Tailgate
	Site Setup
1000	Gas Delivery
1020	Begin Dewatering
1045	Gas Delivery Complete
1050	Begin VE
1000	Pump not providing sufficient flow Begin trouble-shooting
1200	Determine improper pump.
	Discuss w/ D. Evans. Says to shutdown & demob.
1300	Discuss w/ HEP & K. Houston. Decided to start tmrw w/ Stinger

Weather:	Mako offsite.	Signature & Date:
		Eqpt Billing Log to Accounting Date: Initials:

Site Visit Report

Date & Time:	Activities:
11/15/12.	
0830	AS onsite
0930	Mako onsite (Heavy traffic due to accident)
0945	OW-1 : DTP= 19.96, DTW=20.35 (no change in SPH from 11/13/12) (H(Baseline) Start Totalizer 25717
1010	Start system
	Set Stinger at 31 ft BTOC
1040	System Readings
1100	MW readings.
1115	Test float switch on KO tank & Storage tank
	Test Auto Dialer All functioning
1130	Confirm readings w/ KH. Thumbs up!!
1200	Round of Readings ~2.5 gpm.
1230	AS & Mako offsite
1700	AS onsite
	Round of Readings, ~2 gpm H_2O
1730	AS offsite
11/16/12	
0845	AS onsite, water pickup ~4 AM
	Round of Readings, ~2 gpm H_2O
0930	AS offsite.
1500	AS/MD onsite
1530	System Readings, ~2 gpm H_2O
1600	AS/MD offsite
11/17/12	0930 MD ON SITE - RAINING
	ROUND OF READINGS
	10:40 OFF SITE
	16:15 - MD ON-SITE
	ROUND OF READINGS.
	1700 - DEPARTED SITE

Site Visit Report

ARCADIS Project Number:	Dates of Site Visit:
60609BPNA-11132	
ARCADIS Project Name:	Location of Project:
ARCADIS Personnel Present:	Other Persons Present:
Purpose of Site Visit:	

Date & Time: Activities:

11-18-12/0920 MD ON SITE ~2GPM H2O
ROUND OF READINGS
NOTED INCREASE VAC READINGS ON VM-1 + VM2
10:10 - DEPARTED SITE

1610 MD ON SITE
ROUND OF READINGS
1645 MD OFF SITE

11-19-12
09:15 MD ON SITE
Round of readings.
~±2GPM N2O
10:00 MD OFF SITE

1500 MD ON SITE
Round of Readings
1530 MD OFF SITE

11-20-12
0830 MD ON SITE - ROUND OF READINGS
~2GPM N2O - PROBLEM @ 5070
0900 DEPARTED SITE.

Weather:	Signature & Date:
	Eqpt Billing Log to Accounting Date: Initials:

Site Visit Report

Date & Time:	Activities:
11-20-12	
1500	MD ON-SITE - Round of readings.
1530	MD DEPARTED SITE

DPE Pilot Test ield Data Forms

Supplemental Pilot Test Information (mark all that apply)

Yes / No — Is an AS pilot test being conducted concurrently?

Yes / No — Are baseline geochemistry data being collected?

Yes / No — Are air samples being collected?

TOTAL VOC EMISSION RATE (E):

E (lb/min) = SCFM (ft^3/min) x VOCs (ppmv) x 6.23x10-8 [(lb/ft^3)/(ppmv)]

E (lb/day) = SCFM (ft^3/min) x VOCs (ppmv) x 6.23x10-8 [(lb/ft^3)/(ppmv)] x 1440 (min/day)

Flow and Emission Equations

$$ACFM\ (ft^3/min) = Velocity\ (ft/min)\ X\ Flow\ Area\ (ft^2)$$

$$SCFM_{25C} = ACFM \times \left(\frac{P_{abs}+P_g}{P_{abs}}\right)\left(\frac{537}{460+T}\right)$$

where:

P_{abs} = *Atmospheric Pressure at Sea Level (1 atm = 406.8 in H_2O)*

P_g = *Guage/Line Pressure - equivalent to zero if atmospheric discharge*

T = *Airstream Temperature, degrees Farenheit (°F)*

Site Name/Location:

BP 11132

Field Team:

J. Shah

Rob from Mako

Site Elevation: _____ ft aMSL

P_{atm}: _____ in H_2O

CROSS SECTIONAL FLOW AREAS

Pipe Diam (inches)	Flow Area (in^2)	Flow Area (ft^2)
0.25	0.0491	0.0003
0.50	0.1963	0.0014
0.75	0.4418	0.0031
1.0	0.785	0.005
2.0	3.142	0.022
3.0	7.069	0.049
4.0	12.566	0.087
5.0	19.635	0.136

CONVERSION FACTORS

volume: 1 gal = 0.1337 ft^3

1 gal = 3.785 L

pressure: 1 atm = 14.7psi

1 atm = 29.921 in Hg

1 atm = 33.9 ft H2O

1 atm = 406.8 in H2O

1 in Hg = 13.6 in H2O

mass: 1 lb = 454 g

1 lb = 0.454 Kg

1 gal (H2O) = 8.34 lbs

power: 1 hp = 550 ft-lb/sec

1 hp = 0.746 kW

time: 1 day = 1440 min

1 day = 8640 sec

1 yr = 525600 min

temp: °F = 32° + [(9/5) x °C]

Extraction Well Information

Extraction Well ID:	MW-2				
Well Diameter:	2				inches
Water Level (static):					ft bTOC (before test)
Screen Dpth (top):	10				ft bTOC
Screen Dpth (bot):	35				ft bTOC
Well Depth:	31.4				ft bTOC

Monitoring Well Information

Monitoring Well ID:	VM-1	VM-2	OW-1	SVE-1	AS-1	RW-2				
Well Diameter:	2	2	2	2	2	6				inches
Water Level (static):				13.94						ft bTOC (before test) w/ riser
Screen Dpth (top):	10	10	10	10		20				ft bTOC
Screen Dpth (bot):	20	20	40	20		40				ft bTOC
Well Depth:										ft bTOC
Distance From MW-12:										feet

DPE Pilot Test Field Da) Forms-Extraction Wells

Staff: AS Site: 11132

Date: 11/15/12

Extraction Wellheads

Date: 11/13/12	Pipe Flow Diam (in): 3 Stinger @ 31 ft TOC				Pipe Flow Diam (in):				Pipe Flow Diam (in): 3				Pipe Flow Diam (in):			
Start Time 1000	Pipe Flow Area (ft²):				Pipe Flow Area (ft²):				Pipe Flow Area (ft²)				Pipe Flow Area (ft²):			
	Field Measurements				*Field Measurements*				*Field Measurements*				*Field Measurements*			
Time (hh:mm)	Casing Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Stinger ~~Depth~~ Vacuum (ft)	Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Stinger Depth (ft)	Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Stinger Depth (ft)	Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Stinger Depth (ft)
1000	Begin dewatering w/ pump							11/13/12 1500	16			18				
10/14/12 1020	Begin dewatering w/ Pump															
1055	Begin VE															
	Wrong Pump, Shutdown															
11/15/12 1040	Begin dewatering w/ stinger							11/20/12 0830	17			18				
	Stinger set at 31 ft BTOC							1500	17			18				
1040	10.5	Use oxidizer inlet	Use oxidizer inlet	14												
1140	11.5			16												
1700	12			17												
11/16/12 0900	13			17												
1530	12			16												
11/17/12 0925	17			17												
1619	16			19												
11-18-12 0930	16			18												
1545	16			18												
11-19-12	17			18												

DPE Pilot Test Field Da) Forms-Monitoring Wells

Staff: AC Site: 11132

Date: 11/15/12

Date: 11/15/12	System Inlet			Dilution Line			Oxidizer Inlet Line			Blower Outlet (Vent Stack)			Cumulative Liquid Volumes (gal)	
Start Time: 1010	Pipe Flow Diam (in):			Pipe Flow Diam (in):			Pipe Flow Diam (in): 3			Pipe Flow Diam (in):				
	Pipe Flow Area (ft^2):			Pipe Flow Area (ft^2):			Pipe Flow Area (ft^2):			Pipe Flow Area (ft^2):				
	Field Measurements			Field Measurements			Pressure Field Measurements			Field Measurements				
Time (hh:mm)	Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Vacuum, P_g ($in H_2O$)	Velocity (ft/min)	PID (ppmv)	Vacuum, P_g (in Hg)	Velocity (ft/min)	PID (ppmv)	Water	Totalizer LNAPL
	Same as EW			NO DILUTION					~~660~~			11/15/12 Totalizer		
1040							0.12	303	656			1000		257171
1150							0.12	460	728			1200		259419
1700							0.20	397	773			1700		258084
11/16/12												~~11/16/12~~ 11/16/12		
0900							0.20	393	743			0900		260055
1530							0.23	407	649			1530		260996
11/17/12														
0920							0.21	451	604					263208
1619							0.26	430	665					264085
11-18-12														
0930							0.35	410	658					026234
1610							0.39	426	660					267076
11-19-12														
0915							0.32	420	612					269347
1500							0.82	402	590					270125
11-20-12														
0830							0.80	430	600					272489
1500							0.80	418	605					273240

Total Operational Runtime: _____

Notes:

DPE Pilot Test Field Da Forms-Monitoring Wells

Staff: AS Site: 11132

Date: 11/15/12

Date: 11/15/12

Start Time: 1010

DTP = 19.96

ROI Monitoring Well Measurements

Time (hh:mm)	VE-1 Vacuum (in H_2O)	VE-1 DTW (ft bTOC)	VM-2 Vacuum (in H_2O)	VM-2 DTW (ft bTOC)	AS-1 Vacuum (in H_2O)	AS-1 DTW (ft bTOC)	VM-1 Vacuum (in H_2O)	VM-1 DTW (ft bTOC)	OW-1 Vacuum (in H_2O)	OW-1 DTW (ft bTOC)	RW-1 Vacuum (in H_2O)	RW-1 DTW (ft bTOC)	OW-1 Vacuum (in H_2O)	OW-1 DTW (ft bTOC)
1000	0	18.94	0	16.9 ~~17.65~~	-0.28	~~19.85~~ 19.84	0	17.22	0	20.35	0.02	19.32	19.96	
1100	0.07	18.94	5.60	17.29	-6.71	22.07	0.15	17.22	0.	22.22	0.43	19.99	21.83	
1200	0.08	18.94	6.84	17.40	6.71	22.65	0.12	17.22	0	22.74	0.32	20.40	22.35	
1700	0.17	18.96	8.17	17.50	6.25	23.28	0.23	17.26	0	23.41	0.06	21.85	23.03	
0900	0.24	19.05	11.58	17.77	5.80	24.05	0.43	17.30	0	24.21	0.12	22.98	23.82	
1530	0.27	19.06	11.15	17.78	4.77	24.25	1.00	17.40	0	24.38	0.11	23.25	~~24.27~~ 23.88	
									0					
11-17-12 05:20	0.66	19.10	-45.86	18.82	2.36	24.65	1.96	17.21	-0.61	24.50	1.96	22.12	24.11	
16:25	0.73	19.15	-34.77	18.42	-4.51	24.40	-14.65	17.93	-0.02	24.52	-2.76	22.22	24.14	
11-18-12														
09:42	0.87	19.19	-43.39	18.80	5.37	24.36	-32.17	18.72	-1.24	24.41	0	23.40	~~24.50~~	24.05
			DTB →	20.89			DTB	20.71						
1610	0.84	19.21	-44.45	18.94	6.06	24.40	-37.69	18.94	.84	24.46	0.02	23.45		24.10
11-19-12														
09:15	0.89	19.27	48.10	19.05	-7.63	24.46	-31.81	18.90	1.42	24.52	0.32	23.52		24.17
1500	0.84	19.30	48.74	19.05	-6.49	24.42	-31.78	18.81	1.78	24.52	0.04	23.52		24.14
11-20-12														
0810	.84	19.38	49.69	19.12	-4.60	24.45	-30.28	19.52	2.78	24.53	0.04	23.55		24.20
1500	0.45	19.44	-26.74	19.22	-3.23	24.45	-25.83	19.50	1.63	24.53	0.41	23.56		24.21

BROADBENT

GROUNDWATER MONITORING SITE SHEET

Project: Arcadis 11132 Project No.: 09-88-655 Date: 1/17/13

Field Representative: JR/AM Elevation: _____

Formation recharge rate is historically: High Low *(circle one)*

W. L. Indicator ID #: _____ Oil/Water Interface ID #: _____ *(List #s of all equip used.)*

WELL ID RECORD					WELL GAUGING RECORD					LAB ANALYSES					
Well ID	Well Sampling Order	As-Built Well Diameter (inches)	As-Built Well Screen Interval (ft)	Previous Depth to Water (ft)	Time (24:00)	Depth to LNAPL (ft)	Apparent LNAPL Thickness (ft)*	Depth to Water (ft)	Well Total Depth (ft)						
OW-1					1355	14.90	0.10	15.00							
MW-10					1424	–	–	15.31		NO SHEEN; BAILER IS STAINED FROM WELL WALLS					
Post Bailing															
OW-1					1410	–	–	15.39							
MW-10					–	–	–	–							
Departure															
OW-1					1435	15.02	0.01	15.03							
MW-10					1430	–	–	15.36							

* Device used to measure LNAPL thickness: Bailer (Oil/Water Interface Meter) *(circle one)*

If bailer used, note bailer dimensions (inches): Entry Diameter _____ Chamber Diameter _____

Signature: _____

BROADBENT

GROUNDWATER MONITORING SITE SHEET

Project: BP Arcadis 11132 Project No.: 09-88-655 Date: 2-20-13

Field Representative: JR Elevation: ____

Formation recharge rate is historically: High Low *(circle one)*

W. L. Indicator ID #: ____ Oil/Water Interface ID #: ____ *(List #s of all equip used.)*

WELL ID RECORD					WELL GAUGING RECORD					LAB ANALYSES					
Well ID	Well Sampling Order	As-Built Well Diameter (inches)	As-Built Well Screen Interval (ft)	Previous Depth to Water (ft)	Time (24:00)	Depth to LNAPL (ft)	Apparent LNAPL Thickness (ft)*	Depth to Water (ft)	Well Total Depth (ft)						
PRE															
OW-1					0746	17.77	0.02	17.79							
MW-10					0810	–	–	17.02							
POST															
OW-1					0755	–	–	18.59							
MW-10					–	–	–	–							
Departure															
OW-1					0825	–	–	17.79							
MW-10					–	–	–	–							

* Device used to measure LNAPL thickness: Bailer Oil/Water Interface Meter *(circle one)*

If bailer used, note bailer dimensions (inches): Entry Diameter ____ Chamber Diameter ____

Signature: ____

Revision: 1/24/2012

BROADBENT

DAILY REPORT

Page 1 of 1

Project: Arcadis 11132 Project No.: 09-88-655

Field Representative(s): Alex Martinez Day: Friday Date: 3/8/13

Time Onsite: From: 0730 To: 0830 ; From: _____ To: _____ ; From: _____ To: _____

x Signed HASP x Safety Glasses x Hard Hat x Steel Toe Boots x Safety Vest

x UST Emergency System Shut-off Switches Located x Proper Gloves

x Proper Level of Barricading ___ Other PPE (describe) _____

Weather: Sunny

Equipment In Use: Bailers

Visitors: None

TIME:	WORK DESCRIPTION:
0730	Arrived onsite
0750	Set up for product bailing & measurement
0830	Completed fieldwork & offsite

Signature: Alex Martinez

BROADBENT

GROUNDWATER MONITORING SITE SHEET

Project: Arcadis 11132 Project No.: 09-88-655 Date: 3/8/13

Field Representative: AM Elevation: –

Formation recharge rate is historically: High Low *(circle one)*

W. L. Indicator ID #: – Oil/Water Interface ID #: – *(List #s of all equip used.)*

WELL ID RECORD					WELL GAUGING RECORD					NOTES
Well ID	Well Sampling Order	As-Built Well Diameter (inches)	As-Built Well Screen Interval (ft)	Previous Depth to Water (ft)	Time (24:00)	Depth to LNAPL (ft)	Apparent LNAPL Thickness (ft)*	Depth to Water (ft)	Well Total Depth (ft)	
Pre										
OW-1					0749	17.97	0.01	17.98		Approximately ½ gallon purged
MW-10					0814	–	–	17.21		Strong HC/gasoline odor
Post										
OW-1					0804	–	–	18.40		
MW-10					–	–	–	–		
Departure										
OW-1					0822	–	–	17.98		
MW-10					–	–	–	–		

* Device used to measure LNAPL thickness: Bailer **Oil/Water Interface Meter** *(circle one)*

If bailer used, note bailer dimensions (inches): Entry Diameter _____ Chamber Diameter _____

Signature: Alex Martin

Revision: 8/19/11