Appendix L

Notification Plan for the Intertidal

To: Rik Williams, Chevron

From: Jennifer Holder, ERM

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Subject: Notification Plan for the Intertidal Area, Avila Tank Farm

Date: June 5, 2013

cc:

The objective of this memorandum is to present a plan for notifying the agencies when monitoring data collected in the intertidal area adjacent to the former Union Oil Avila Beach Tank Farm (Avila Tank Farm or the Site, see Figure 1) exceeds conservative screening levels (Notification Thresholds). Notification Thresholds were developed for compounds of potential concern (COPCs) detected in water, sediment and air in the intertidal area. This memorandum summarizes the Notification Plan for the intertidal area and the methodology and the sources used to develop the Notification Thresholds presented in Appendices 1 through 4.

1.0 BACKGROUND

The intertidal area south of the Avila Tank Farm is an active beach environment that responds dynamically to complex deposition and erosion processes due to wave energy, tides, and storm scour. Consequently, the undulating surface of the bedrock can be exposed, creating tide pools, or it can be buried with up to approximately 4 feet of beach deposits, including sands and gravels. Generally the area is at, or slightly above, sea level, and mostly covered by water unless there is a minus tide. Under normal tides, the area is difficult to access. During minus tides when bedrock is exposed, only tide pools (and tide pool water) are present. When the bedrock is covered, interstitial water or porewater flows through the beach deposits, but tidal pools are absent. In the absence of large positive tides or storm scour, it is expected that this area will typically be covered by beach deposits with outcropped bedrock and exposed bedrock where rock falls have occurred.

On May 8, 2012, a small amount of sheen was observed in an intertidal area located immediately south of former Tank No. 201104, below the cliff face of the Avila Tank Farm (Figure 1). In addition to the sheen, an intermittent petroleum hydrocarbon odor has been noted in the area. Analysis of water samples collected from the tidal pool where the sheen was observed indicated the presence of volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAH), and total petroleum hydrocarbons (TPH). Some water samples collected at the intertidal area have had fuel constituents in similar proportions to those

observed in groundwater samples collected from groundwater monitoring wells B-230 and B-231, suggesting that that release from former Tank No. 201104 is the source of the discharge at the intertidal area. In the absence of contrary evidence, Chevron is considering the release from former Tank No. 201104 as the source of the fuel-related impacts at the intertidal area.

Since May 8, 2012 Padre Associates, Inc. (Padre) has monitored the intertidal area in accordance with the *Revised Intertidal Zone Observation Monitoring Plan* dated June 29, 2012. Additionally, intertidal zone assessment activities were performed by Padre between June 2012 to March 2013 to assess the extent and recurrence of any potential impacts to intertidal zone air, water, and beach deposits. To aid in the interpretation of these monitoring or assessment data, the regulatory agencies (listed below in Section 2) involved in the Avila Tank Farm site investigation have requested the development of thresholds that can be used to easily and quickly screen the monitoring data from the intertidal area so that if detected concentrations exceed conservative thresholds the agencies will be notified.

Besides the monitoring in the intertidal area, Chevron implemented a vapor extraction pilot test using B-230 as an extraction well. The test was terminated due to vapor concentrations exceeding the design limit of the mobile remediation system. Active and passive LNAPL recovery has been performed at well B-230 since fall of 2012.

2.0 NOTIFICATION PLAN

The main component of the notification plan is the development of Notification Thresholds that will be used to screen the water, sediment and ambient air monitoring data. When a monitoring sample concentration is detected greater than the threshold, Chevron will notify the agencies that an exceedance has occurred.

2.1 IDENTIFICATION OF CONSTITUENTS OF POTENTIAL CONCERN

Notification thresholds for water and sediment were developed for COPCs, defined as the organic compounds and lead detected in either surface water or sediment in the tidal area, or in groundwater samples collected from monitoring wells B-230 and B-231. A summary of detected compounds is presented in Table 1. This summary is based on data collected up through March 2013. It is recognized that additional COPCs may need to have notification thresholds developed if new chemicals are detected during future sampling events. After each monitoring event, the list of detected chemicals will be compared to the Notification Threshold list. If new chemicals are detected in sediment or water, they will be defined as a COPC and a new threshold will be developed following the methodology laid out in the appendices of the Notification Plan.

The notification thresholds for ambient air VOCs focused on key petroleum-related chemicals that were found in concentrations greater than those in background air (see Appendix 4). Five separate sampling events were conducted through August 2, 2012, exceeding the four events originally proposed in the sampling plan. Air monitoring during intertidal area sampling events since August 2, 2012 has been conducted via a portable flame ionization detector (FID). Future ambient air sampling for VOCs will be

conducted on an as needed basis as directed by the San Luis Obispo County Air Pollution Control District and San Luis Obispo County Environmental Health Services.

The Notification Thresholds do not take into account exposure of ecological receptors to petroleum hydrocarbon sheen which has been intermittently observed in the tide pool water. Agencies consider exposure to petroleum sheen to cause adverse physical effects to birds and mammals, such as loss of water repellency or hypothermia. Sheen is being addressed as part of the Intertidal Zone Observation Monitoring Plan. Visual observations of the area are performed when the tides are low enough that it is safe to visit the area. If sheen is observed it is noted in the field log including the location, description of the sheen, and estimated surface area. Photo-documentation is also included. In addition, observation of sheen is reported to the agencies via email.

2.2 AGENCY-SPECIFIC THRESHOLDS

Four state and county agencies have requested a simple method to evaluate the significance of COPC concentrations from the monitoring data being collected in the intertidal area. Thresholds were developed independently for each agency, based on the specific media and receptors of interest for each agency. As a result, thresholds vary among the agencies. The specific thresholds for each agency are presented in Appendices 1 through 4 and are summarized below.

- Central Coast Regional Water Quality Control Board (CCRWQCB): Appendix 1 presents an overview of the thresholds identified by the CCRWQCB for this Site. These values represent a preliminary evaluation of water quality goals and were supplied to Chevron by the CCRWQCB. These generic benchmarks include concentrations based on: (1) taste and odor thresholds, (2) the California Ocean Plan, and (3) National Recommended Water Quality Criteria for the protection of saltwater life.

- California Department of Fish and Wildlife (CDFW): CDFW thresholds are for water and sediment and are protective of marine aquatic and benthic invertebrates, and fish. Appendix 2 presents the methodology used to develop the thresholds for the CDFW.

- San Luis Obispo County Environmental Health Services (SLO County EHS): Appendix 3 presents the methodology used to develop conservative threshold levels in water and sediment that are protective of potential human exposures.

- San Luis Obispo County Air Pollution Control District (APCD): Appendix 4 presents the process for evaluating ambient air data collected contemporaneously from the tidal area and a nearby background site, and the recommended threshold if contaminants in air collected from the intertidal area exceed background levels.[1]

[1] APCD thresholds are presented in the *Avila Tidal Area Air Sampling Work Plan* (McDaniel Lambert, June 5, 2012) and are described in the work plan as Action Levels (see Table 2 in Appendix 4).

2.3 DEVELOPMENT OF NOTIFICATION THRESHOLDS

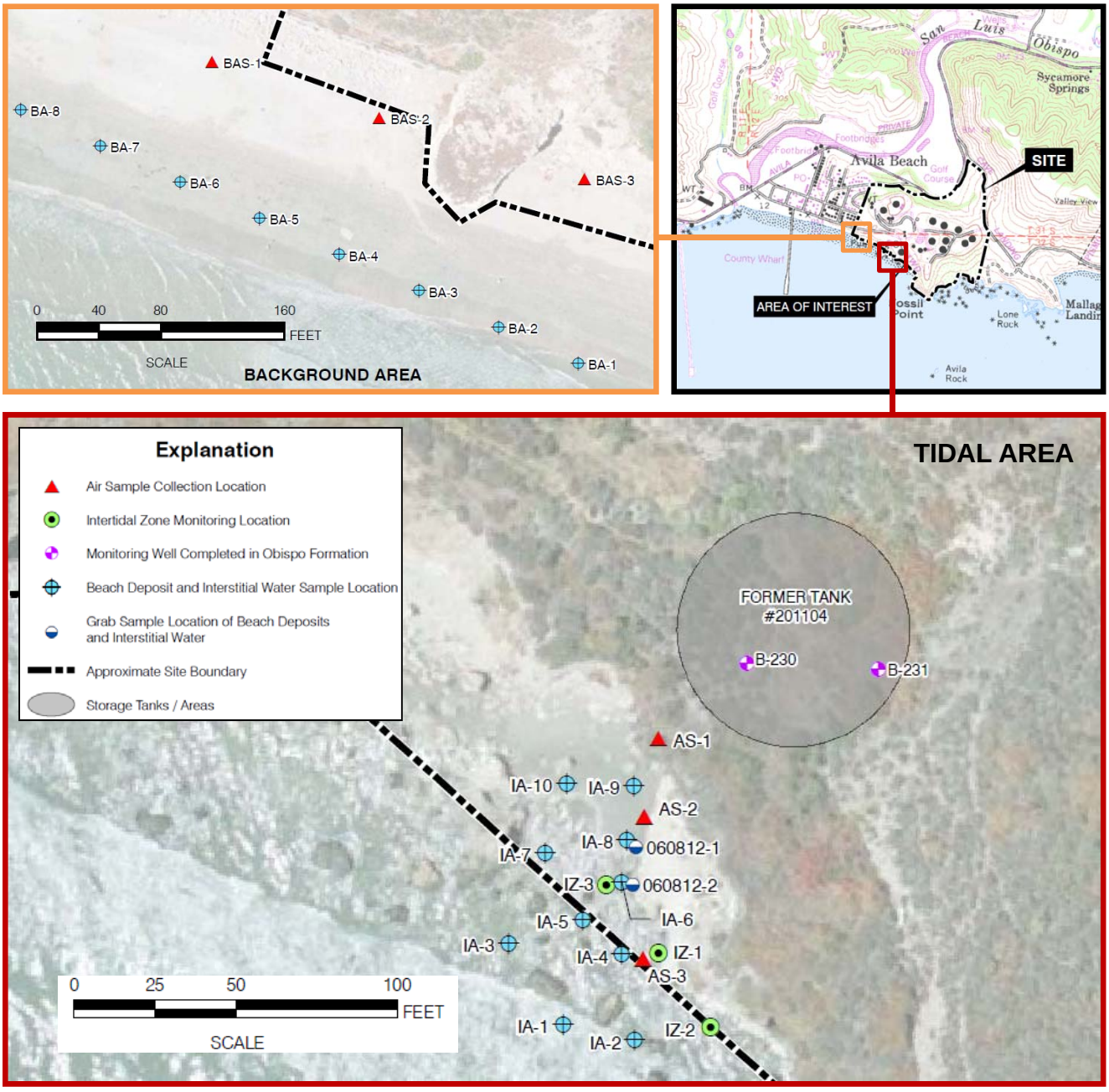
Once agency-specific thresholds were developed, they were pooled together and the lowest available benchmark for each COPC in each medium (independent of the receptor type) was then selected as the Notification Threshold for that medium. Tables 1 through 3 present the Notification Thresholds for water, sediment and air, respectively. As the Notification Threshold is the lowest of all the thresholds developed for a particular medium, it is possible that a specific sampling concentration might exceed the Notification Threshold, but not all of the specific agency's thresholds. Thus, each individual agency should review the data for those sampling events that have one or more COPCs that exceed Notification Thresholds to confirm whether their own thresholds have been exceeded.

2.4 OVERVIEW OF NOTIFICATION PROCESS

Figure 2 presents an overview of the notification process. Detected concentrations in samples of water or sediment collected in the intertidal area are compared to the appropriate Notification Threshold for that medium. If chemicals in ambient air collected from the intertidal area are above background levels, those intertidal air detections will be compared to the air Notification Thresholds. If all detected concentrations are less than the Notification Thresholds, then the concentrations are considered low enough that notification is not required. If one or more concentrations are greater than the Notification Thresholds, then all four agencies will be notified that an exceedance has occurred during that specific sampling event. As described above, the Notification Thresholds are, by design, the lowest of all benchmarks developed; therefore, each agency will need to evaluate the concentrations detected and determine if their respective thresholds are exceeded.

The Notification Thresholds are for screening purposes only. Due to their conservative nature, exceedances of these thresholds do not necessarily indicate unacceptable risks to human health and the environment. Notification Thresholds are specific to the intertidal zone and are not meant to replace the action levels developed for the cliff springs or to evaluate groundwater data. They are also not meant to be site-specific cleanup levels, or remediation goals. A site-specific assessment will be conducted if remediation goals or cleanup levels are required in the future.

Figures



Notes:

AREA OF INTEREST AND SAMPLE LOCATIONS

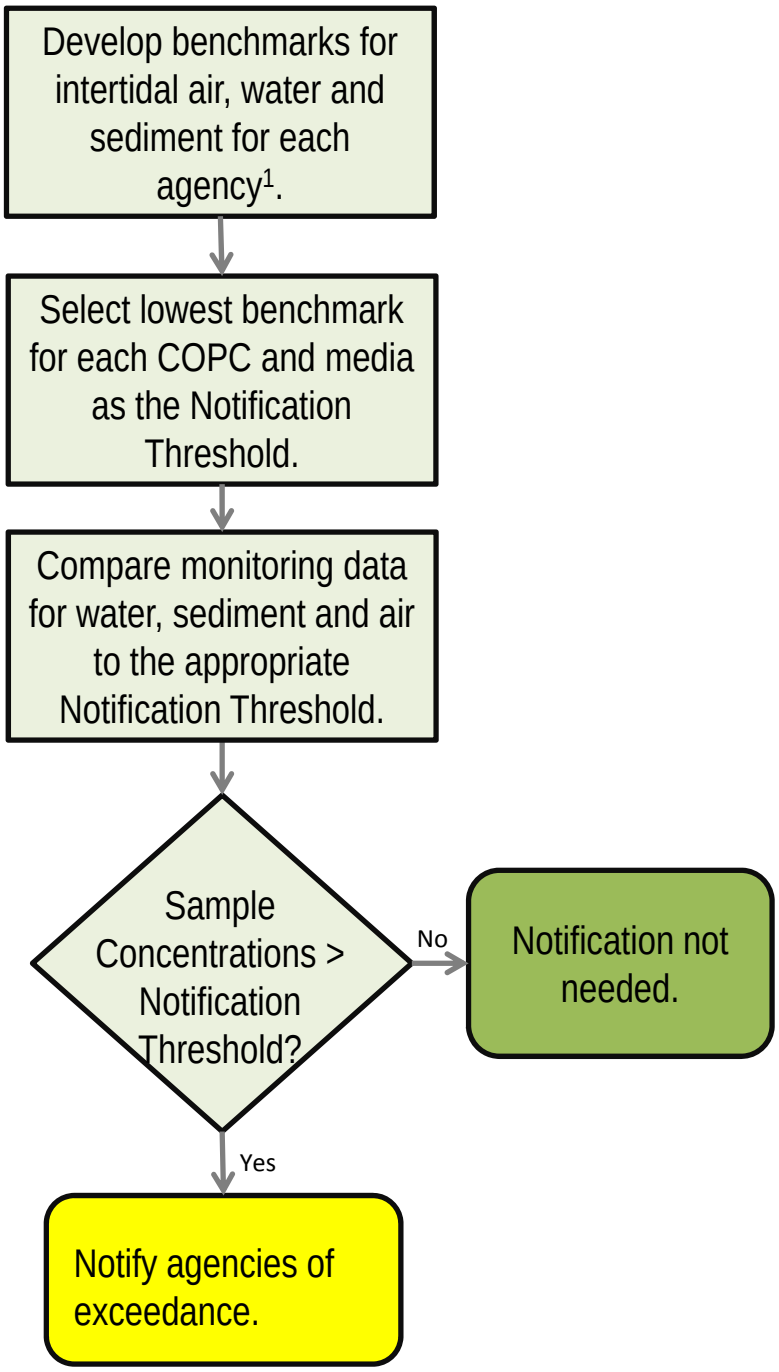
ERM

Avila Tidal Area
Avila Beach, CA

FIGURE 1

AGENCY-SPECIFIC BENCHMARKS[1]

- **CCRWQCB**: Water benchmarks are water quality goals based on preliminary evaluation supplied by the CCRWQCB.
- **CDFG**: Water and sediment benchmarks protective of water and sediment invertebrates and fish.
- **SLO EHS**: Benchmarks based on concentration in sediment and water protective of humans recreating in this area.
- **SLO APCD**: Air benchmarks are based on background ambient air concentrations and chronic RELs for key COPCs.



Notes:

NOTIFICATION PLAN FOR INTERTIDAL AREA ADJACENT TO FORMER AVILA TANK FARM

ERM

Avila Tidal Area
Avila Beach, CA

FIGURE 2

Tables

Table 1 - Summary of COPCs and Media in Which it had Been Detected
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

COPCs	Ground-water	Surface Water	Interstitial Water	Sediment
Lead (dissolved)	✓			
Lead		✓		✓
Organic Lead	✓			✓
Benzene	✓	✓	✓	✓
Bromoform		✓		
Dibromochloromethane		✓		
Ethanol		✓		
Ethylbenzene	✓	✓	✓	✓
Toluene	✓	✓	✓	
Xylenes (total)	✓	✓	✓	✓
t-Butyl alcohol	✓	✓	✓	✓
n-Butylbenzene	✓	✓	✓	
sec-Butylbenzene	✓	✓	✓	✓
tert-Butylbenzene	✓	✓	✓	
Chloroethane	✓	✓	✓	
Dibromomethane		✓		
1,2-Dibromoethane (EDB)	✓	✓	✓	
1,3-Dichlorobenzene			✓	
1,2-Dichloroethane	✓	✓	✓	
cis-1,2-Dichloroethene			✓	
1,2-Dichloropropane		✓	✓	
2,2-Dichloropropane			✓	
Isopropylbenzene	✓	✓	✓	✓
4-Isopropyl Toluene	✓	✓	✓	
Methylene chloride	✓			✓
n-Propylbenzene	✓	✓	✓	
t-Amyl Methyl Ether	✓			
Tetrachloroethene			✓	
1,2,4-Trimethylbenzene	✓	✓	✓	✓
1,3,5-Trimethylbenzene	✓	✓	✓	
Trichloroethene (TCE)			✓	
Acenaphthene	✓	✓	✓	
Acenaphthylene	✓			
Anthracene		✓		
Benz(a)anthracene		✓		
Benzo(g,h,i)perylene		✓		
Benzothiophene	✓	✓	✓	
C1-Benzothiophenes	✓	✓	✓	
C2-Benzothiophenes	✓	✓	✓	
C3-Benzothiophenes	✓	✓	✓	
C4-Benzothiophenes	✓			

Table 1 - Summary of COPCs and Media in Which it had Been Detected
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

COPCs	Ground-water	Surface Water	Interstitial Water	Sediment
C1-Dibenzothiophenes	✓	✓	✓	
C2-Dibenzothiophenes	✓	✓	✓	
C3-Dibenzothiophenes	✓	✓	✓	
C4-Dibenzothiophenes		✓	✓	
Biphenyl	✓			
Chrysene	✓	✓		
Dibenzofuran		✓	✓	
Dibenz(a,h)anthracene		✓		
Fluoranthene	✓	✓	✓	✓
Fluorene	✓	✓	✓	
C1-Fluorenes	✓	✓	✓	
C2-Fluorenes	✓			
C3-Fluorenes		✓	✓	
Indeno(1,2,3-c,d)pyrene		✓		
Naphthalene	✓	✓	✓	✓
1-Methylnaphthalene	✓	✓	✓	
2-Methylnaphthalene	✓	✓	✓	
C2-Naphthalenes	✓	✓	✓	
C3-Naphthalenes	✓	✓	✓	
C4-Naphthalenes	✓	✓	✓	
Phenanthrene	✓	✓	✓	
C1-Phenanthrenes/Anthracenes	✓	✓	✓	
C2-Phenanthrenes/Anthracenes	✓	✓	✓	✓
C3-Phenanthrenes/Anthracenes	✓	✓	✓	✓
C4-Phenanthrenes/Anthracenes		✓	✓	
Pyrene		✓	✓	
C1-Pyrenes/Fluoranthenes	✓	✓	✓	
C2-Pyrenes/Fluoranthenes		✓	✓	✓
C3-Pyrenes/Fluoranthenes		✓		
TPH Gasoline (C4-C10)	✓	✓	✓	
TPH Diesel (C10-C25)	✓	✓	✓	✓
TPH Oil Crude (C25-C40)	✓	✓		✓

Notes:
COPC = Constituent of Potential Concern

Table 2 - Notification Thresholds for Water
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Compound	RWQCB Threshold (ug/L)	SLO County EHS Threshold (ug/L)	CDFW Threshold[a] (ug/L)	Notification Threshold[b] (ug/L)
PAH*				
Acenaphthene	20	31,555	42	20
Acenaphthylene	0.0088	25,707	107	0.0088
Anthracene	- nv -	84,072	11	11
Benz(a)anthracene	- nv -	144	1.1	1.1
Benzo(g,h,i)perylene	- nv -	282,848	0.25	0.25
Benzothiophene	- nv -	- nv -	187	187
C1-Benzothiophenes	- nv -	- nv -	57	57
C2-Benzothiophenes	- nv -	- nv -	28	28
C3-Benzothiophenes	- nv -	- nv -	9.3	9.3
C4-Benzothiophenes	- nv -	- nv -	3.1	3.1
Biphenyl	- nv -	470	64	64
Chrysene	0.0088	1,442	0.99	0.0088
Dibenzofuran	- nv -	428	27	27
Dibenz(a,h)anthracene	- nv -	6.0	0.2	0.16
C1-Dibenzothiophenes	- nv -	- nv -	28	28
C2-Dibenzothiophenes	- nv -	- nv -	2.9	2.9
C3-Dibenzothiophenes	- nv -	- nv -	0.93	0.93
C4-Dibenzothiophenes	- nv -	- nv -	0.30	0.30
Indeno(1,2,3-c,d)pyrene	- nv -	144	0.2	0.16
Fluoranthene	15	377,131	3.2	3.2
Fluorene	0.0088	15,458	40	0.0088
C1-Fluorenes	- nv -	- nv -	7.8	7.8
C2-Fluorenes	- nv -	- nv -	3.0	3.0
C3-Fluorenes	- nv -	- nv -	1.1	1.1
Naphthalene	21	21,545	132	21
1-Methylnaphthalene	- nv -	141	47	47
2-Methylnaphthalene	- nv -	2,131	46	46
C2-Naphthalenes	- nv -	- nv -	17	17
C3-Naphthalenes	- nv -	- nv -	6.2	6.2
C4-Naphthalenes	- nv -	- nv -	2.3	2.3
Phenanthrene	0.0088	2,828,484	10	0.0088
C1-Phenanthrenes/Anthracenes	- nv -	- nv -	4.2	4.2
C2-Phenanthrenes/Anthracenes	- nv -	- nv -	1.8	1.8
C3-Phenanthrenes/Anthracenes	- nv -	- nv -	0.71	0.71
C4-Phenanthrenes/Anthracenes	- nv -	- nv -	0.30	0.30

Table 2 - Notification Thresholds for Water
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Compound	RWQCB Threshold (ug/L)	SLO County EHS Threshold (ug/L)	CDFW Threshold[a] (ug/L)	Notification Threshold[b] (ug/L)
Pyrene	- nv -	5,146	3.6	3.6
C1-Pyrenes/Fluoranthenes	- nv -	- nv -	2.8	2.8
C2-Pyrenes/Fluoranthenes	- nv -	- nv -	0.58	0.58
C3-Pyrenes/Fluoranthenes	- nv -	- nv -	0.36	0.36
VOC and MAH				
Benzene	5.9	230	130	5.9
Bromoform	- nv -	3,567	1,857	1,857
t-Butyl alcohol	- nv -	1,871,906	- nv -	1,871,906
tert-Butylbenzene	- nv -	18,090	38	38
n-Butylbenzene	- nv -	471,414	21	21
sec-Butylbenzene	- nv -	471,414	14	14
Chloroethane	16	46,536,790	- nv -	16
Dibromochloromethane	- nv -	433	2,307	433
cis-1,2-Dichloroethene	- nv -	7,299	590	590
Dibromomethane	- nv -	62,928	- nv -	62,928
1,2-Dibromoethane (EDB)	- nv -	12	- nv -	12
1,3-Dichlorobenzene	- nv -	26,785	71	71
1,2-Dichloroethane	28	967	910	28
1,2-Dichloropropane	- nv -	957	- nv -	957
2,2-Dichloropropane	- nv -	- nv -	424	424
Ethanol	- nv -	- nv -	- nv -	- nv -
Ethylbenzene	29	824	7	7.3
Isopropylbenzene	0.8	62,140	91	0.80
4-Isopropyl Toluene	- nv -	36,181	39	39
Methylene chloride	- nv -	3,575	2,200	2,200
n-Propylbenzene	- nv -	59,536	85	85
t-Amyl Methyl Ether	- nv -	- nv -	- nv -	- nv -
Tetrachloroethene	- nv -	17	98	17
Toluene	42	125,019	10	9.8
Trichloroethene (TCE)	- nv -	1,399	47	47
1,2,4-Trimethylbenzene	- nv -	1,297	97	97
1,3,5-Trimethylbenzene	15	8,720	153	15
Xylenes (total)	17	241,847	13	13
Total Petroleum Hydrocarbons**				
TPH Gasoline - aliphatic	5.0	4,736	- nv -	5.0
TPH Gasoline - aromatic	5.0	NA	- nv -	5.0
TPH Diesel - aliphatic	100	942,828	- nv -	100
TPH Diesel - aromatic	100	3,298	- nv -	100
TPH Motor Oil - aliphatic	25,000	18,856,560	- nv -	25,000
TPH Motor Oil - aromatic	- nv -	3,953	- nv -	3,953

Table 2 - Notification Thresholds for Water
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Compound	RWQCB Threshold (ug/L)	SLO County EHS Threshold (ug/L)	CDFW Threshold[a] (ug/L)	Notification Threshold[b] (ug/L)
Inorganics* **				
Lead	- nv -	NA	8.1	8.1

Notes:
PAH = Polycyclic Aromatic Hydrocarbon
MAH = Monocyclic Aromatic Hydrocarbon
VOC = Volatile Organic Compound
nv = No Value
NA = Not Applicable
kow < 2 = ecological benchmark can not be calculated for compounds with a kow < 2.

[a] The CDFW Threshold is the lowest of values presented in the CDFW appendix.

[b] The Notification Threshold is the lowest of agency-specific thresholds.

*SLO County EHS Thresholds were not calculated for PAHs analyzed for forensic purposes but not typically evaluated in human health risk assessments, including benzothiophene and alkylated PAHs (other than 1- and 2-methylnaphthalene).

**A SLO County EHS Threshold for TPH gasoline aromatic was not calculated as it is more appropriate to evaluate the individual constituents. CDFW Thresholds were not calculated for TPH as toxicity information on petroleum mixes is limited.

***For lead, notification thresholds were not calculated; intertidal water not a source of drinking water, therefore drinking water standards do not apply.

Table 3 - Notification Thresholds for Sediment
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Compound	SLO County EHS Threshold (ug/kg)	CDFW Threshold[a] (ug/kg)	Notification Threshold[b] (ug/kg)
PAH*			
Acenaphthene	11,115,223	821	821
Acenaphthylene	11,115,223	354	354
Anthracene	55,576,114	728	728
Benz(a)anthracene	2,833	918	918
Benzo(g,h,i)perylene	5,557,611	1,398	1,398
Benzothiophene	- nv -	490	490
C1-Benzothiophenes	- nv -	574	574
C2-Benzothiophenes	- nv -	652	652
C3-Benzothiophenes	- nv -	747	747
C4-Benzothiophenes	- nv -	850	850
Biphenyl	225,669	1,260	1,260
Chrysene	28,333	920	920
Dibenzofuran	231,456	678	678
Dibenz(a,h)anthracene	117	1,434	117
C1-Dibenzothiophenes	- nv -	652	652
C2-Dibenzothiophenes	- nv -	956	956
C3-Dibenzothiophenes	- nv -	1,073	1,073
C4-Dibenzothiophenes	- nv -	1,198	1,198
Indeno(1,2,3-c,d)pyrene	2,833	1,425	1,425
Fluoranthene	7,410,149	710	710
Fluorene	7,410,149	1,231	1,231
C1-Fluorenes	- nv -	770	770
C2-Fluorenes	- nv -	870	870
C3-Fluorenes	- nv -	976	976
Naphthalene	4,799,852	591	591
1-Methylnaphthalene	64,550	628	628
2-Methylnaphthalene	959,970	645	645
C2-Naphthalenes	- nv -	641	641
C3-Naphthalenes	- nv -	734	734
C4-Naphthalenes	- nv -	833	833
Phenanthrene	55,576,114	730	730
C1-Phenanthrenes/Anthracenes	- nv -	8,481	8,481
C2-Phenanthrenes/Anthracenes	- nv -	945	945
C3-Phenanthrenes/Anthracenes	- nv -	1,056	1,056
C4-Phenanthrenes/Anthracenes	- nv -	1,095	1,095

Table 3 - Notification Thresholds for Sediment
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Compound	SLO County EHS Threshold (ug/kg)	CDFW Threshold[a] (ug/kg)	Notification Threshold[b] (ug/kg)
Pyrene	5,557,611	514	514
C1-Pyrenes/Fluoranthenes	- nv -	975	975
C2-Pyrenes/Fluoranthenes	- nv -	1,114	1,114
C3-Pyrenes/Fluoranthenes	- nv -	1,209	1,209
VOC and MAH			
Benzene	18,054	36	36
Bromoform	164,123	853	853
t-Butyl alcohol	69,436,731	- nv -	69,436,731
tert-Butylbenzene	11,572,788	947	947
n-Butylbenzene	11,572,788	973	973
sec-Butylbenzene	11,572,788	991	991
Chloroethane	1,983,906,589	- nv -	1,983,906,589
Dibromochloromethane	19,206	690	690
cis-1,2-Dichloroethene	462,912	38	38
Dibromomethane	2,314,558	- nv -	2,314,558
1,2-Dibromoethane (EDB)	501	- nv -	501.487
1,3-Dichlorobenzene	6,943,673	472	472
1,2-Dichloroethane	38,412	58	58
1,2-Dichloropropane	50,149	- nv -	50,149
2,2-Dichloropropane	- nv -	709	708.7
Ethanol	- nv -	- nv -	- nv -
Ethylbenzene	164,123	20	20
Isopropylbenzene	23,145,577	812	812
4-Isopropyl Toluene	23,145,577	946	946
Methylene chloride	128,954	5	5
n-Propylbenzene	23,145,577	814	814
t-Amyl Methyl Ether	- nv -	- nv -	- nv -
Tetrachloroethene	3,343.25	31	31.37
Toluene	18,516,461	11	11
Trichloroethene (TCE)	101,997	7.6	8
1,2,4-Trimethylbenzene	462,912	809	809
1,3,5-Trimethylbenzene	2,314,558	793	793
Xylenes (total)	46,291,154	34	34
Total Petroleum Hydrocarbons**			
TPH Gasoline - aliphatic	9,258,231	- nv -	9,258,231
TPH Gasoline - aromatic	- nv -	- nv -	- nv -
TPH Diesel - aliphatic	23,145,577	- nv -	23,145,577
TPH Diesel - aromatic	6,943,673	- nv -	6,943,673
TPH Motor Oil - aliphatic	462,911,537	- nv -	462,911,537

Table 3 - Notification Thresholds for Sediment
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Compound	SLO County EHS Threshold (ug/kg)	CDFW Threshold[a] (ug/kg)	Notification Threshold[b] (ug/kg)
TPH Motor Oil - aromatic	6,943,673	- nv -	6,943,673
Inorganics			
Lead	80,000	46,700	46,700

Notes:
Units in ug/kg dry weight
PAH = Polycyclic Aromatic Hydrocarbon
MAH = Monocyclic Aromatic Hydrocarbon
VOC = Volatile Organic Compound
nv = No Value
NA = Not Applicable
kow < 2 = ecological benchmark can not be calculated for compounds with a kow < 2.

[a] The CDFW Threshold is the lowest of values presented in the CDFW appendix.

[b] The Notification Threshold is the lowest of agency-specific thresholds.

*SLO County EHS Thresholds were not calculated for PAHs analyzed for forensic purposes but not typically evaluated in human health risk assessments, including benzothiophene and alkylated PAHs (other than 1- and 2-methylnaphthalene).

**A SLO County EHS Threshold for TPH gasoline aromatic was not calculated as it is more appropriate to evaluate the individual constituents. CDFW Thresholds were not calculated for TPH as ecotoxicity information on petroleum mixes is limited.

Table 4 - Summary of Notification Thresholds for Air
Avila Tidal Area Notification Plan Memorandum
Avila Beach, CA

Key Petroleum-Related COPCs	Notification Threshold (ug/m^3)
Benzene	60
Toluene	300
Ethylbenzene	2000
Xylene (total)	700
Naphthalene	9
TPHv	7000

Notes:

Chemicals detected in ambient air collected from the intertidal area are only compared to the Air Notification Thresholds if detected above background concentrations.

Appendix 1- Regional Water Quality Control Board Thresholds

Regional Water Quality Control Board Thresholds

1. Overview

Thresholds specific to the Central Coast Regional Water Quality Control Board (RWQCB; Region 3) are presented in this appendix. The purpose of these benchmarks is to screen water samples collected in the Avila Tidal area. The RWQCB provided these thresholds to Chevron on September 25, 2012. These values are provided in Table 1, and are summarized below.

2. Taste and Odor Thresholds

"Taste and odor" thresholds are established to protect water resources against organoleptic impacts. Because the tidal area water is saline, odor is the primary organoleptic effect of concern. The taste and odor thresholds are presented in Table 1.

3. California Ocean Plan

The State Water Quality Control Board (SWQCB) issues ocean water quality benchmarks as part of the Water Quality Control Plan for Ocean Waters of California (SWQCB 2009). The Ocean Plan values are presented in Table 1

4. Saltwater Aquatic Life Protection

Various marine water benchmarks designed to be protective of aquatic life, or the consumption of aquatic life, were assembled by RWQCB into a single category called "Saltwater Aquatic Life Protection." These values are presented in Table 1.

5. Summary

The lowest value for each compound in Table 1 was selected as the RWQCB-specific threshold (see Table 1). The RWQCB Threshold was then compared with the other agency-specific thresholds (Appendices 2, 3 and 4) and the lowest threshold was selected as the Notification Threshold (see Table 1 in the memorandum). As discussed in the memorandum, if the Notification Threshold for a given analyte is exceeded, all agencies will be notified. However, it should be noted that the values provided in this appendix are considered screening level values, and are not necessarily indicative of hazardous impacts, potential human or ecological risk, or should be used as clean-up values.

6. References:

SWQCB. 2009. Water Quality Control Plan for Ocean Waters of California. California Environmental Protection Agency. March.

Table 1 - Water Quality Evaluation Benchmarks Provided by the Central Coast RWQCB*

Constituent of Concern	Taste and Order Threshold µg/L	California Ocean Plan µg/L[1]	Saltwater Aquatic Life Protection µg/L	RWQCB Threshold (Lowest Value) µg/L
Benzene	170	5.9	5100 (acute[2])/700[3]	5.9
Ethylbenzene	29	4100[4]	430 (acute[2])	29
Toluene	42	85000[4]	6300 (acute[2])/5000 (chronic[2])	42
Xylenes	17			17
tert-Butyl alcohol				
n-Butylbenzene				
sec-Butylbenzene				
tert-Butylbenzene				
Chloroethane	16			16
1,2-Dibromoethane				
1,2-Dichloroethane	7000	28	37[5]/113000 (acute[2])	28
Isopropylbenzene	0.8			
p-Isopropyltoluene				
n-Propylbenzene				
Tert-amyl methyl ether				
1,2,4-Trimethylbenzene				
1,3,5-Trimethylbenzene	15			15
Acenaphthene			990[5]/20[6]/970 (acute[2])/710 (chronic[2])/500[7]	20
Acenaphthylene		0.0088[8]	300[9] (acute)	0.0088
Chrysene		0.0088[8]	0.018[5]/300[9] (acute[2])	0.0088
Fluoranthene		15[4]	140[10]/40 (acute[2])/16 (chronic[2])	15
Fluorene		0.0088[8]	5300[10]/300[9]	0.0088
Naphthalene	21		2350 (acute[2])	21
Phenanthrene		0.0088[8]	300[9]	0.0088
TPH-Gasoline – aliphatic	5			5
TPH-Gasoline – aromatic	5			5
TPH-Diesel – aliphatic	100			100
TPH-Diesel – aromatic	100			100
TPH-Motor Oil – aliphatic		25000[4, 11, 12]/40000[4, 11, 13]/75000[4, 11, 14]		25000
TPH-Motor Oil – aromatic				

* Provided by Dan Niles of the CCRWQCB to Chevron on September 25, 2012
[1] Human Health Protection (30-day average; fish consumption only); carcinogen; limit based on cancer risk, unless otherwise noted.
[2] Toxicity information (Lowest Observed Effect Level).
[3] Other: Adverse effects on a fish species exposed for 168 days.
[4] Non-carcinogen.
[5] Fish consumption only; carcinogen; limit based on cancer risk.
[6] Taste and Order or Welfare.
[7] Other: Toxicity to algae occurs.
[8] For sum of acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluorene, indeno(1,2,3-c,d)pyrene, phenanthrene, and pyrene; Carcinogen; limit based on cancer risk.
[9] For polynuclear aromatic hydrocarbons.
[10] Fish consumption only.
[11] Effluent limitation for wastes discharged to waters.
[12] 30-day average.
[13] 7-day average.
[14] Instantaneous Maximum.

Appendix 2 – California Department of Fish and Wildlife Thresholds

California Department of Fish & Wildlife Agency-specific Thresholds

1. Overview

Risk-based thresholds specific to California Department of Fish and Wildlife (CDFW) were developed for ecological receptors potentially exposed to poly-aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and lead in water (intertidal and interstitial water) and sediment. For water exposure, thresholds protective of aquatic life were developed (e.g., fish or aquatic invertebrates, such as mussels or crabs). For sediment exposure, thresholds were developed that are protective of benthic invertebrates (e.g., clams and worms). Thresholds were not developed for birds or mammals as they are likely being exposed less than organisms directly residing in the affected media. Because in this case the risk to sessile aquatic and benthic organisms is considered to be greater than for mobile wildlife, the focus on aquatic and benthic organisms is considered conservative. The low and high thresholds are presented in Table A2-1.

Low and high thresholds were established for surface/interstitial water and sediment. Low thresholds are screening level benchmarks that are calculated using conservative assumptions. As such, it can be concluded, with a high degree of confidence, that sample results that do not exceed the low benchmarks do not represent potential ecological risk, and that agency notification is not required. Conversely, an exceedance of the high benchmark assumes that exposure to those sample concentrations represents a higher probability of adverse effects. A sample result that exceeds the low benchmark but does not exceed its respective high benchmarks presents a grey area, as there is uncertainty in the potential for unacceptable ecological risk.

The low CDFW-specific thresholds were incorporated with the other agency-specific thresholds to form the basis of the Notification Threshold. As discussed in the Notification Threshold memo, the lowest of the agency-specific thresholds was selected as the Notification Threshold. Thus, if a CDFW-specific threshold for a given compound, in a given media, was the lowest of the agency-specific thresholds for that compound in that media, it was selected as the Notification Threshold. The methodology used to derive the CDFW agency-specific threshold is presented in the next sections.

2. Development of Intertidal Water Thresholds

This section describes the derivation of thresholds for water (both surface and interstitial water). Different approaches were used for organic and inorganic compounds of potential concern (COPCs). The identification of COPCs is described in Section 2.1 of the Notification Plan Memorandum. If additional COPCs are identified in the future, new CDFW-specific thresholds will be developed following the methodology laid out in this appendix.

Organic Compounds

Peer reviewed literature and recent studies were evaluated to identify available benchmarks that would be relevant to the organic COPCs and exposures at the intertidal area of Avila. Of the information evaluated, the target lipid narcosis model (TLM) as presented in U.S. Environmental Protection Agency ([USEPA] 2003 and 2008) procedures was deemed relevant. The TLM relies on the theory that type I narcotic chemicals (PAHs and VOCs) have the same mode of toxicity in organisms and act by disrupting lipid structures in cell membranes. The relative magnitude of toxicity is governed by the hydrophobicity and lipid partitioning potential of the compound. This is quantified by its K_{ow} value. There is a preponderance of empirical evidence that supports the TLM model, as documented in USEPA (2003). The TLM method was used to develop both low and high thresholds as discussed in the following sections. Additionally, at the request of CDFW, Tier II conventional secondary chronic values (SCVs) for aquatic life (Suter & Tsao 1996) were included as potential threshold values for VOCs and monoaromatic hydrocarbons (MAHs). These screening values are based on diverse modes of toxicity. If a Tier II SCV was lower than the low TLM-based value, the Tier II SCV was selected as the low threshold.

Low TLM Thresholds

Based on a request from the CDFW, TLM benchmarks designed to be protective of 95 percent of test species (henceforth referred to as HC5s) were included as the low threshold. These benchmarks are based on the methodology presented in McGrath and Di Toro (2009), and serve as a more conservative form of TLM benchmark. HC5s are a variant of TLM-based benchmarks, and follow the same mode of toxicity. If a published value was available in McGrath and DiToro (2009) for a COPC, that value was taken directly from the source. For compounds that did not have HC5 benchmarks, low thresholds for water were calculated using the HC5 methodology described in McGrath and DiToro (2009). These calculations varied based on the type of aromatic hydrocarbon (PAH or monoaromatic [MAH]), both of which are shown below.

PAHs:

$$\log(HC5) = -0.936 \times \log(K_{ow}) + \log(52.9) - \log(3.83) - 2.3\sqrt{(0.000225 \times \log(K_{ow})^2) + 0.105 + 0.112}$$

MAHs:

$$\log(HC5) = -0.936 \times \log(K_{ow}) + \log(92.7) - \log(3.83) - 2.3\sqrt{(0.000225 \times \log(K_{ow})^2) + 0.105 + 0.112}$$

Where:

HC5 = hazard concentration to 5 percent of the tested species (millimoles per liter [mmole/L])
K_{ow} = Octanol-water partitioning coefficient (unitless; compound specific)

HC5s were then converted from molar concentrations to mass concentrations for use as risk-based thresholds using the following equation:

$$T_w = HC5 \times MW \times U_1 \times U_2$$

Where:

T_w = Risk-based threshold for aquatic life in water (micrograms per liter [µg /L])
HC5 = Hazard concentration to 5 percent of the tested species (mmole/L)
MW = Molecular weight of compound (gram/mole [g/mole])
U_1 = Units conversion factor (0.001 mole/mmole)
U_2 = Units conversion factor (10^6 micrograms per gram [µg/g])

In addition to the HC5s discussed above, Tier II SCVs were assembled for VOCs and MAHs. These SCVs were taken from Suter & Tsao (1996).

Table A2-2 presents the low thresholds for water.

High TLM Thresholds

High benchmarks were developed based on the narcosis model for chronic values (CV) with the lethal concentration at 50%mortality (LC50) and effects concentration at 50%effects (EC50; for survival, growth, or reproduction) as the endpoint. As CVs based on the LC50 are less conservative than thresholds based on the HC5, the CVs were chosen as the high thresholds. Water benchmarks were developed by the USEPA for the Deepwater Horizon (DWH) spill.[1] COPCs that had values available on the USEPA website were selected. For compounds that did not have DWH aquatic life benchmarks,

[1] http://www.epa.gov/bpspill/water-benchmarks.html

high thresholds for water were calculated using the CVs based on the narcosis model equations developed by DiToro et al (2000a and b) and presented in USEPA (2003 and 2008), as shown below.

PAHs:

$$\log(CV) = \log(2.24) - 0.945 \times \log(K_{ow})$$

VOCs:

$$\log(CV) = \log(6.94) - 0.945 \times \log(K_{ow})$$

Where:

CV = Chronic Value (mmole/L)
K_{ow} = Octanol-water partitioning coefficient (unitless; compound specific)

CVs were then converted from molar concentrations to mass concentrations for use as risk-based thresholds using the following equation:

$$T_w = CV \times MW \times U_1 \times U_2$$

Where:

T_w = Risk-based threshold for aquatic life in water (µg /L)
CV = Chronic Value for compound (mmole/L)
MW = Molecular weight of compound (g/mole)
U_1 = Units conversion factor (0.001 mole/mmole)
U_2 = Units conversion factor (10^6 µg/g)

The high water thresholds are presented in Table A2-3.

The water threshold calculations presented above (both the low and the high) required compound-specific values, specifically K_{ow} and MW. K_{ow} values were selected from the following hierarchy of sources based on availability: (1) McGrath and DiToro (2009); (2) EPA (2003; 2008), (3) extracted from USEPA's software "EPI Suite." The MW is the sum of the atomic weights of all the molecule's component atoms. The values used in calculating thresholds are presented in Tables A2-2 and A2-3. The TLM is not appropriate for calculating CVs for compounds that have low hydrophobicity (Log K_{ow} less than 2.0, USEPA 2003). As such, low and high thresholds were not calculated for ethanol; dibromomethane; t-butyl alcohol (TBA); chloroethane; cis-1,2-dichloroethene (cis-1,2-DCE); 1,2-dibromoethane (EDB); 1,2-dichloroethane (DCA); 1,2-dichloropropane; methylene chloride; t-amyl methyl ether (TAME) and trichloroethene (TCE). Additionally, the HC5 calculation methodology presented in McGrath and

DiToro (2009) is tailored for aromatic compounds. Thus, HC5s for non-aromatic compounds may have a higher degree of uncertainty associated with them; this is discussed further in the uncertainty section. These compounds included bromoform, dibromochloromethane; 2,2-Dichloropropane and TCE. Finally, total petroleum hydrocarbon (TPH) is a mixture of a wide range of hydrocarbons, with various carbon chain lengths and chemical structures. Thus, it is not appropriate to calculate a single low and high threshold to represent such a diverse mixture. The uncertainties associated with these model limitations are discussed further in the Section 4.

Inorganic Compounds

Lead was the only inorganic constituent of concern. Lead was included because it may be associated with the product (including gasoline and lead scavengers) stored in the tank assumed to be the source of intertidal zone releases. Lead is not hydrophobic nor is it a narcotic chemical, thus the TLM is not applicable. However, there is a promulgated ambient water quality criterion (AWQC) for lead.[2] As such, the low and high water thresholds are based on the marine chronic and acute AWQC for lead, respectively, and are presented in Table A2-1.

3. Development of Intertidal Sediment Thresholds

This section describes the derivation of thresholds for sediment. Different approaches were used for organic and inorganic compounds.

Organic Compounds

Sediment benchmarks were developed using the equilibrium partitioning (EqP) approach as presented in USEPA (2003 and 2008). The EqP approach is a means of converting water benchmarks into sediment benchmarks. The approach utilizes a compound's organic carbon (OC) partitioning potential (K_{oc}) to estimate what concentration in sediment OC is necessary to yield a water concentration equal to the water toxicity benchmark, after sediment-water contaminant equilibrium has been reached. The EqP approach was utilized by the USEPA to convert the TLM-based water benchmarks for the DWH oil spill into sediment screening level benchmarks.[3] The same approach was used to convert the HC5s from McGrath and DiToro (2009). The details on how EqP sediment benchmarks were calculated are presented below.

All low sediment thresholds required calculation using the EqP methodology, since McGrath and DiToro (2009) only presents HC5 water benchmarks. For the high sediment threshold, if a DWH benchmark was reported, or a value was reported in USEPA (2003 or 2008), this value was selected. Otherwise, high thresholds were

[2] http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
[3] http://www.epa.gov/bpspill/sediment-benchmarks.html

converted using the EqP methodology. Water threshold values were converted into sediment thresholds based on their K_{oc} using the following equation:

$$T_S = T_w \times K_{oc}$$

Where:

T_s = Risk-based threshold for aquatic life in sediment (micrograms per kilogram [µg/kg] OC)
T_w = Risk-based threshold for aquatic life in water (µg/L)
K_{oc} = Organic carbon partitioning coefficient (Liters per kilogram [L/kg] OC)

Log K_{oc} values were taken from EPA (2003 or 2008) if available, otherwise Log K_{oc} was estimated from K_{ow} using the relationship equation presented in USEPA (2003).:

$$\log K_{oc} = 0.00028 + 0.983 \times \log K_{ow}$$

Where:

K_{oc} = Organic carbon partitioning coefficient (L/kg OC)
K_{ow} = Octanol-water partitioning coefficient (unitless; compound specific)

The calculated K_{oc} values, along with the K_{ow} values used in calculating K_{oc}, are presented in Tables 2 and 3.

As a final step, sediment thresholds were OC-normalized using site-specific total organic carbon (TOC) data. The intertidal zone TOC sampling results have an arithmetic mean OC value of 0.23 percent (Table A2-4). This value was used to OC-normalize the sediment thresholds (Table A2-2 and 3), using the following equation:

$$T_s = T_{s'oc} \times 0.0023$$

Where:

T_s = Risk-based Threshold for aquatic life in sediment (mg/kg [dry weight])
$T_{s'oc}$ = Risk-based Threshold for aquatic life in sediment (mg/kg [OC])

Tier II SCV sediment benchmarks were also calculated from the aquatic Tier II SCV using the EqP approach described above. For a given compound, the lowest value between the HC5 and Tier II SCV was utilized as the low sediment threshold.

As with the water thresholds, TLM sediment thresholds were not calculated for compounds with a Log K_{ow} less than 2.0. These included ethanol; dibromomethane;

TBA; chloroethane; cis-1,2-DCE; EDB; 1,2-DCA; 1,2-dichloropropane; methylene chloride; TAME and TCE. Additionally, sediment thresholds based on HC5s non-PAH or -MAH compounds may have increased uncertainty associated with them, since the McGrath and DiToro HC5 (2009) methodology is tailored for aromatic compounds. These included bromoform; dibromochloromethane; 2,2-Dichloropropane; chloroethane; and TCE. As discussed in the previous section, TPH is a mix of hydrocarbons, and thus cannot have a single threshold calculated to represent it. These uncertainties are discussed further in the Section 4. The low and high sediment thresholds are presented in Tables A2-2 and A2-3, respectively.

Inorganic Compounds

As mentioned above, lead is the only inorganic constituent of concern in the tidal area. No promulgated sediment criteria are available for sediment; however, well accepted risk-based benchmarks are available in the literature. Thus, the low and high sediment thresholds for lead were based on the effects range low and effects range median values presented in (Long and MacDonald 1998). These sediment thresholds are presented in Table A2-1.

4. Uncertainties

There are some uncertainties associated with the assumptions and methodologies employed in the development of the CDFW agency-specific thresholds. These are presented below.

Exposure

The low and high aquatic life benchmarks are based on chronic exposure. Assuming that isolated exceedances from sample results are representative of chronic exposure to surface/interstitial water is a conservative assumption for two reasons. First, releases into the intertidal area are likely to be diluted rapidly by wave and tidal flushing. Second, given the highly dynamic sediment depositional conditions in the area, benthic or sessile organisms are unlikely to be chronically exposed to either a stable sediment bed or rocky intertidal substrate and associated water for prolonged periods of time. Nonetheless, it is assumed that exposure to any given sample result is "chronic." This likely over-estimated potential risk, but is considered protective.

K_{ow} Values and Use of Surrogates for Alkylated PAHs

The calculation of HC5 and CVs directly rely on K_{ow} values. It is the differentiating parameter between all calculated threshold values. K_{ow} values are typically based on empirical observation and reported in the literature or, if not reported in the literature, are estimated based on their chemical structure. Because K_{ow} values are based on

observation, there is no "established" value for a given compound. Instead there can be a range of available K_{ow} values for any given compound. This translates to a range of possible thresholds for that compound. The range of K_{ow} values for a given compound is not generally very large, but it does introduce uncertainty in the resulting calculated threshold value. This uncertainty could result in an over- or under-estimation of toxicity.

Alkylated PAHs (e.g., C2-napthalene) are common constituents of petroleum mixes. However, these classifications are not representative of a single PAH compound; rather, they represent a group of PAH compounds. For example C2-napthalene could represent dimethyl naphthalene or ethyl naphthalene. Additionally, the location of the methyl or ethyl functional groups can vary in where they are attached to the parent naphthalene molecule. These aspects of an alkylated PAH affect the K_{ow} value for the molecule. As discussed above, the K_{ow} value directly affects the resulting threshold calculation. Because a single K_{ow} value is required to calculate a threshold, the use of a single surrogate to represent the entire range of a given alkylated PAH group introduces uncertainty. Depending on the surrogate value that is chosen, this uncertainty may under- or over-estimate the toxicity of the alkylated PAH group as a whole.

Use of the MAH Formula to Calculate HC5 Thresholds for Non-aromatic VOCs

The MAH equation presented in McGrath and DiToro (2009) was used to calculate HC5s for VOCs for which there was not a value already presented in the paper. That equation is tailored for aromatic VOCs. Some of the VOCs that are COPCs in the intertidal area are not aromatics. In the absence of a non-aromatic HC5, the MAH equation was used rather than the PAH equation, as the K_{ow} values for non-aromatic VOCs tended to be more similar to MAH K_{ow} values than PAH values. This introduces uncertainty in the resulting values because it is unclear how accurate the MAH formula is at predicting narcotic toxicity from non-aromatic VOCs. Thus, the use of the MAH formula for non-aromatic VOCs may under- or over-estimate the potential toxicity of non-aromatic VOCs. In cases where a Tier II SCV was utilized for a non-MAH VOC, rather than an HC5, this uncertainty is abated.

TPH Toxicity

Low and high thresholds could not be calculated to screen analytical results for TPH mixes (e.g., gasoline-, diesel- or motor oil-range mixes), as a specific K_{ow} value is required to calculate an HC5 of TLM chronic value. The hydrocarbons captured in the TPH analyses are very diverse. This can create a wide range of K_{ow} values that is too broad to allow selection of a surrogate compound that is representative of the entire mix. The inability to screen TPH data introduces some uncertainty in the overall toxicity of water or sediment samples. However, many of the PAH and VOCs thought to

provide the greatest contributions of overall toxicity are analyzed for individually. These results will be screened against individual low and high thresholds. Thus, the uncertainty in not being able to screen TPH data is considered mitigated by screening individual PAHs and VOCs.

Individual Compound vs. Mixture Toxicity

The thresholds developed for the Avila tidal area generally only support benchmark comparisons on an individual basis. While thresholds based on the TLM can be utilized for mixture toxicity (i.e. the calculation of a hazard index [HI]), the inclusion of Tier II SCVs means the calculation of an HI for all detected organic compounds is inappropriate, as the modes of toxicity between TLM-based values and Tier II SCVs are diverse. This uncertainty is mitigated, however, by the conservatism inherent in the development of the low thresholds.

5. **Conclusion**

Surface water, interstitial water and sediment benchmarks were developed as thresholds for screening samples collected in the Avila tidal area. Low water thresholds consisted of HC5s developed based on the methods of McGrath and DiToro (2009). High benchmarks were based on the TLM method utilized by the USEPA for the DWH oil spill. The two sets of water benchmarks were converted into sediment low and high benchmarks using the EqP methods described in USEPA (2003 and 2008) and OC normalized using site-specific TOC data. The low thresholds for both water and sediment were compared to the agency-specific thresholds developed for the Central Coast Regional Water Quality Control Board and the San Luis Obispo County Environmental Health Services. The lowest of all the agency-specific thresholds was then selected as the Notification Threshold. If the concentration of one or more COPCs in water or sediment exceeds the Notification Threshold, then all the agencies will be notified. As the Notification Threshold represents the lowest of all the agency-specific concentrations, an exceedance of the Notification Threshold does not mean that the CDFW-specific low and high thresholds have been exceeded. For the CDFW thresholds developed herein, an exceedance of a low benchmark for intertidal water, interstitial water or sediment is not necessarily indicative of potential ecological risk. High threshold benchmarks were also developed to provide a screening method consistent with USEPA's current method for screening oil spill data, and provide a range of benchmarks to bracket the potential for risk.

6. References

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Table A2-1
Summary of CDFG Thresholds

Compound	CAS	Low Threshold*		High Threshold	
		Water (ug/L)	Sediment (ug/kg)	Water (ug/L)	Sediment (ug/kg)
PAH					
Acenaphthene	83-32-9	42	821	56	1,105
Acenaphthylene	208-96-8	107	354	307	1,017
Anthracene	83-32-9	11	728	21	1,337
Benz(a)anthracene	208-96-8	1.1	918	2.2	1,892
Benzo(g,h,i)perylene	191-24-2	0.25	1,398	0.44	2,453
Benzothiophene	95-15-8	187	490	339	889
Biphenyl	92-52-4	64	1,260	56	1,105
Chrysene	218-01-9	1.0	920	2.0	1,899
Dibenz(a,h)anthracene	193-39-5	0.16	1,434	0.28	2,527
Dibenzofuran	132-64-9	27	678	48	1,216
Fluoranthene	206-44-0	3.2	710	7.1	1,591
Fluorene	86-73-7	40	1,231	39	1,211
Indeno(1,2,3-c,d)pyrene	193-39-5	0.16	1,425	0.28	2,498
1-Methylnaphthalene	90-12-0	47	628	75	1,004
2-Methylnaphthalene	91-57-6	46	645	72	1,006
Naphthalene	91-20-3	132	591	193	866
Phenanthrene	85-01-8	10	730	19	1,341
Pyrene	129-00-0	3.6	514	10	1,568
C1-Benzothiophenes	--	57	574	104	1,034
C2-Benzothiophenes	--	28	652	51	1,169
C3-Benzothiophenes	--	9.3	747	17	1,333
C4-Benzothiophenes	--	3.1	850	5.4	1,510
C1-Dibenzothiophenes	--	28	652	51	1,169
C2-Dibenzothiophenes	--	2.9	956	5.1	1,697
C3-Dibenzothiophenes	--	0.93	1,073	1.6	1,898
C4-Dibenzothiophenes	--	0.30	1,198	0.54	2,113
C1-Fluorenes	--	7.8	770	14	1,375
C2-Fluorenes	--	3.0	870	5.3	1,544
C3-Fluorenes	--	1.1	976	1.9	1,730
C2-Naphthalenes	--	17	641	30	1,148
C3-Naphthalenes	--	6.2	734	11	1,307
C4-Naphthalenes	--	2.3	833	4.1	1,478
C1-Phenanthrenes/Anthracenes	--	4.2	8,481	7.4	1,508

Table A2-1
Summary of CDFG Thresholds

Compound	CAS	Low Threshold*		High Threshold	
		Water (ug/L)	Sediment (ug/kg)	Water (ug/L)	Sediment (ug/kg)
C2-Phenanthrenes/Anthracenes	--	1.8	945	3.2	1,679
C3-Phenanthrenes/Anthracenes	--	0.71	1,056	1.3	1,865
C4-Phenanthrenes/Anthracenes	--	0.30	1,095	0.56	2,052
C1-Pyrenes/Fluoranthenes	--	2.8	975	4.9	1,733
C2-Pyrenes/Fluoranthenes	--	0.58	1,114	1.0	1,969
C3-Pyrenes/Fluoranthenes	--	0.36	1,209	0.6	2,135
VOC/MAH					
t-Amyl Methyl Ether	994-05-8	- nv -	- nv -	- nv -	- nv -
Benzene	71-43-2	130	36	5,300	1,485
Bromoform	75-25-2	1,857	853	6,000	2,756
t-Butyl alcohol	75-65-0	- nv -	- nv -	- nv -	- nv -
n-Butylbenzene	104-51-8	21	973	67.6	3,077
sec-Butylbenzene	135-98-8	14	991	45	3,128
tert-Butylbenzene	98-06-6	38	947	122	3,005
Chloroethane	75-00-3	- nv -	- nv -	- nv -	- nv -
Dibromochloromethane	124-48-1	2,307	690	13,146	3,931
Dibromomethane	74-95-3	- nv -	- nv -	- nv -	- nv -
1,2-Dibromoethane (EDB)	106-93-4	- nv -	- nv -	- nv -	- nv -
1,3-Dichlorobenzene	541-73-1	71	472	471	3,128
1,2-Dichloroethane	107-06-2	910	58	- nv -	- nv -
cis-1,2-Dichloroethene	156-59-2	590	38	- nv -	- nv -
1,2-Dichloropropane	142-28-9	- nv -	- nv -	- nv -	- nv -
2,2-Dichloropropane	594-20-7	424	709	1,365	2,279
Ethanol	64-17-5	- nv -	- nv -	- nv -	- nv -
Ethylbenzene	100-41-4	7.3	20	790	2,183
Isopropylbenzene	98-82-8	91	812	290	2,587
4-Isopropyl Toluene	99-87-6	39	946	124	3,002
Methylene chloride	75-09-2	2200	5.0	- nv -	- nv -
n-Propylbenzene	103-65-1	85	814	272	2,594
Tetrachloroethene	79-34-5	98	31	9,925	3,177
Toluene	108-88-3	10	11	1,683	1,828
Trichloroethene (TCE)	79-01-6	47	7.6	- nv -	- nv -
1,2,4-Trimethylbenzene	95-63-6	97	809	310	2,580
1,3,5-Trimethylbenzene	108-67-8	153	793	489	2,533
Xylenes (total)	1330-20-7	13	34	830	2,179

Table A2-1
Summary of CDFG Thresholds

Compound	CAS	Low Threshold*		High Threshold	
		Water (ug/L)	Sediment (ug/kg)	Water (ug/L)	Sediment (ug/kg)
OTHER					
Lead	7439-92-1	8.1	46,700	210	218,000

Notes:

* The low thresholds in this table are used in conjunction with the other agency-specific thresholds to generate the final notification thresholds.

For PAHs and MAH/VOCs, low thresholds are based on the lower of the Tier II conventional SCV (Suter & Tsao 1996) or HC5 (McGrath and DiToro 2009). High Benchmarks are based on the target lipid model benchmarks from the Deep Water oil spill and/or EPA (2003 and 2008).

Lead water value is the ambient water quality criteria (AWQC), sediment is the Effects Range Low (ERL) from the NOAA Screening.

CV - Chronic value
DWH - Deep Water Horizon
EPA - Environmental Protection Agency
PAH - monocyclic aromatic hydrocarbon
PAH - polycyclic aromatic hydrocarbon
TLM - Target lipid model
VOC - volatile organic compound
ug/L - micrograms per liter
ug/kg - micrograms per kilogram dry weight

Table A2-2
Input Parameters for CDFG Low Thresholds

Compound	CAS	Chemical Properties[1]			Conventional SCV[2]		HC5 Values			Low Thresholds				Note
		MW	log K_{ow}	K_{oc}	Water (ug/L)	Sediment (ug/kg-OC)	Water (umole/L)	Water (ug/L)	Sediment (ug/kg-OC)	Water (ug/L)	Sediment (ug/kg-OC)	Sediment[3] (ug/kg)	Basis	
PAH														
Acenaphthene	83-32-9	154.2	3.88	8,790	--	--	0.27	42	364,794	42	364,794	821	a	
Acenaphthylene	208-96-8	152.2	3.44	1,472	--	--	0.70	107	157,537	107	157,537	354	a	
Anthracene	83-32-9	178.2	4.55	28,642	--	--	0.06	11	323,652	11	323,652	728	a	
Benz(a)anthracene	208-96-8	228.3	5.74	377,572	--	--	0.00	1.1	407,778	1.1	407,778	918	a	
Benzo(g,h,i)perylene	191-24-2	276.3	6.51	2,494,595	--	--	0.00	0.2	621,538	0.25	621,538	1,398	b	
Benzothiophene	95-15-8	134.2	3.12	1,167	--	--	1.4	187	217,832	187	217,832	490	b	
Biphenyl	92-52-4	154.2	3.94	8,752	--	--	0.24	64	560,131	64	560,131	1,260	a	
Chrysene	218-01-9	228.3	5.78	413,048	--	--	0.004	1.0	408,917	0.99	408,917	920	a	
Dibenz(a,h)anthracene	193-39-5	278.4	6.71	3,971,915	--	--	0.001	0.2	637,287	0.16	637,287	1,434	b	
Dibenzofuran	132-64-9	168.2	4.12	11,226	--	--	0.16	27	301,440	27	301,440	678	b	
Fluoranthene	206-44-0	202.3	5.19	99,541	--	--	0.02	3.2	315,544	3.2	315,544	710	a	
Fluorene	86-73-7	166.2	3.93	13,709	--	--	0.24	40	546,982	40	546,982	1,231	a	
Indeno(1,2,3-c,d)pyrene	193-39-5	276.3	6.72	4,055,085	--	--	0.00	0.2	633,406	0.16	633,406	1,425	b	
1-Methylnaphthalene	90-12-0	142.2	3.78	5,916	--	--	0.33	47	279,217	47	279,217	628	a	
2-Methylnaphthalene	91-57-6	142.2	3.79	6,194	--	--	0.33	46	286,801	46	286,801	645	a	
Naphthalene	91-20-3	128.2	3.26	1,991	--	--	1.0	132	262,769	132	262,769	591	a	
Phenanthrene	85-01-8	178.2	4.58	31,189	--	--	0.06	10	324,365	10	324,365	730	a	
Pyrene	129-00-0	202.3	5.13	62,708	--	--	0.02	3.6	228,256	3.6	228,256	514	a	
C1-Benzothiophenes	--	148.2	3.71	4,438	--	--	0.39	57	255,141	57	255,141	574	b	Kow and MW based on 2-methylbenzothiophene
C2-Benzothiophenes	--	162.3	4.08	10,255	--	--	0.17	28	289,641	28	289,641	652	b	Kow and MW based on dimethyldibenzothiophene
C3-Benzothiophenes	--	176.3	4.63	35,610	--	--	0.05	9.3	331,966	9.3	331,966	747	b	Kow and MW based on 2,5,7-trimethylbenzothiophene
C4-Benzothiophenes	--	190.3	5.18	123,657	--	--	0.02	3.1	377,782	3.1	377,782	850	b	Kow and MW based on 2,3,4,5-tetramethylbenzothiophene
C1-Dibenzothiophenes	--	162.3	4.08	10,255	--	--	0.17	28	289,641	28	289,641	652	b	Kow and MW based on 3,7-dimethylbenzothiophene
C2-Dibenzothiophenes	--	212.3	5.26	148,204	--	--	0.01	2.9	424,671	2.9	424,671	956	b	Kow and MW based on 4,6-dimethyldibenzothiophene
C3-Dibenzothiophenes	--	226.3	5.81	514,648	--	--	0.004	0.93	476,831	0.93	476,831	1,073	b	Kow and MW based on 2,4,8-trimethyldibenzothiophene
C4-Dibenzothiophenes	--	240.4	6.35	1,747,149	--	--	0.001	0.30	532,456	0.30	532,456	1,198	b	Kow and MW based on 3,4,6,7-tetramethyldibenzothiophene
C1-Fluorenes	--	180.3	4.72	43,652	--	--	0.04	7.8	342,368	7.8	342,368	770	b	
C2-Fluorenes	--	194.3	5.20	129,420	--	--	0.02	3.0	386,504	3.0	386,504	870	b	

Table A2-2
Input Parameters for CDFG Low Thresholds

Compound	CAS	Chemical Properties[1]			Conventional SCV[2]		HC5 Values			Low Thresholds				Note
		MW	log K_{ow}	K_{oc}	Water (ug/L)	Sediment (ug/kg-OC)	Water (umole/L)	Water (ug/L)	Sediment (ug/kg-OC)	Water (ug/L)	Sediment (ug/kg-OC)	Sediment[3] (ug/kg)	Basis	
C3-Fluorenes	--	208.3	5.70	400,867	--	--	0.01	1.1	433,944	1.1	433,944	976	b	
C2-Naphthalenes	--	156.3	4.30	16,866	--	--	0.11	17	284,884	17	284,884	641	b	
C3-Naphthalenes	--	170.3	4.80	52,360	--	--	0.04	6.2	326,161	6.2	326,161	734	b	
C4-Naphthalenes	--	184.3	5.30	162,248	--	--	0.01	2.3	370,006	2.3	370,006	833	b	
C1-Phenanthrenes/Anthracenes	--	192.3	5.04	901,571	--	--	0.02	4.2	3,769,407	4.2	3,769,407	8,481	b	
C2-Phenanthrenes/Anthracenes	--	206.3	5.46	232,809	--	--	0.01	1.8	420,075	1.8	420,075	945	b	
C3-Phenanthrenes/Anthracenes	--	220.3	5.92	660,693	--	--	0.003	0.71	469,335	0.71	469,335	1,056	b	
C4-Phenanthrenes/Anthracenes	--	220.3	6.32	1,633,052	--	--	0.001	0.30	486,872	0.3	486,872	1,095	b	
C1-Pyrenes/Fluoranthenes	--	216.3	5.29	157,398	--	--	0.01	2.8	433,322	2.8	433,322	975	b	
C2-Pyrenes/Fluoranthenes	--	230.3	6.03	846,779	--	--	0.003	0.58	495,262	0.58	495,262	1,114	b	Kow and MW based on 1,9-dimethylpyrene
C3-Pyrenes/Fluoranthenes	--	244.3	6.28	1,503,142	--	--	0.001	0.36	537,380	0.36	537,380	1,209	b	
VOC/MAH														
t-Amyl Methyl Ether	994-05-8	102.2	1.92	77	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
Benzene	71-43-2	78.1	1.94	124	130	16,144	31	2,413	299,659	130	16,144	36	c	Threshold value is not based on the TLM
Bromoform	75-25-2	252.7	2.35	204	- nv -	- nv -	7.3	1,857	379,171	1,857	379,171	853	b	
t-Butyl alcohol	75-65-0	74.1	0.35	2	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
n-Butylbenzene	104-51-8	134.2	4.38	20,222	- nv -	- nv -	0.16	21	432,399	21	432,399	973	b	
sec-Butylbenzene	135-98-8	134.2	4.57	31,088	- nv -	- nv -	0.11	14	440,370	14	440,370	991	b	
tert-Butylbenzene	98-06-6	134.2	4.11	10,975	- nv -	- nv -	0.29	38	421,106	38	421,106	947	b	
Chloroethane	75-00-3	64.5	1.43	25	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
Dibromochloromethane	124-48-1	208.3	2.16	133	- nv -	- nv -	11	2,307	306,691	2,307	306,691	690	b	
Dibromomethane	74-95-3	173.8	1.70	85	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
1,2-Dibromoethane (EDB)	106-93-4	187.9	1.96	85	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
1,3-Dichlorobenzene	541-73-1	147.0	3.53	2,953	71	209,666	1.0	148	435,586	71	209,666	472	c	Threshold value is not based on the TLM
1,2-Dichloroethane	107-06-2	99.0	1.48	29	910	25,951	- nv -	- nv -	- nv -	910	25,951	58	c	Threshold value is not based on the TLM
cis-1,2-Dichloroethene	156-59-2	98.6	1.48	29	590	16,826	- nv -	- nv -	- nv -	590	16,826	38	c	Threshold value is not based on the TLM
1,2-Dichloropropane	142-28-9	113.0	1.98	88	- nv -	- nv -	29	3,236	286,201	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
2,2-Dichloropropane	594-20-7	113.0	2.92	742	- nv -	- nv -	4	424	314,993	424	314,993	709	b	
Ethanol	64-17-5	46.1	-0.31	0.50	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
Ethylbenzene	100-41-4	106.2	3.01	1,222	7.3	8,917	3.1	330	403,101	7.3	8,917	20	c	Threshold value is not based on the TLM

Table A2-2
Input Parameters for CDFG Low Thresholds

Compound	CAS	Chemical Properties[1]			Conventional SCV[2]		HC5 Values			Low Thresholds				Note
		MW	log K_{ow}	K_{oc}	Water (ug/L)	Sediment (ug/kg-OC)	Water (umole/L)	Water (ug/L)	Sediment (ug/kg-OC)	Water (ug/L)	Sediment (ug/kg-OC)	Sediment[3] (ug/kg)	Basis	
Isopropylbenzene	98-82-8	120.2	3.66	3,963	- nv -	- nv -	0.76	91	360,761	91	360,761	812	b	
4-Isopropyl Toluene	99-87-6	134.2	4.10	10,730	- nv -	- nv -	0.29	39	420,663	39	420,663	946	b	
Methylene chloride	75-09-2	84.9	1.25	1.0	2,200	2,200	- nv -	- nv -	- nv -	2,200	2,200	5.0	c	Threshold value is not based on the TLM
n-Propylbenzene	103-65-1	120.2	3.69	4,242	- nv -	- nv -	0.71	85	361,863	85	361,863	814	b	
Tetrachloroethene	79-34-5	167.9	2.19	142	98	13,940	18	3,054	434,447	98	13,940	31	c	Threshold value is not based on the TLM
Toluene	108-88-3	92.1	2.73	483	9.8	4,733	5.7	522	251,984	10	4,733	11	c	Threshold value is not based on the TLM
Trichloroethene (TCE)	79-01-6	131.4	1.89	72	47	3,390	- nv -	- nv -	- nv -	47	3,390	7.6	c	Threshold value is not based on the TLM
1,2,4-Trimethylbenzene	95-63-6	120.2	3.63	3,703	110	407,345	0.81	97	359,691	97	359,691	809	b	
1,3,5-Trimethylbenzene	108-67-8	120.2	3.42	2,302	- nv -	- nv -	1.3	153	352,271	153	352,271	793	a	
Xylenes (total)	1330-20-7	106.2	3.12	1,167	13	15,177	2.4	259	301,963	13	15,177	34	c	Threshold value is not based on the TLM

Notes:

[1] Chemical properties were used to calculate HC_5 water and sediment values and TLM CVs when a reference was not available.

[2] Tier II SCVs were collected for VOCs and MAHs from Suter & Tsao (1996).

[3] EqP values were normalized using the average TOC from Site samples (0.23%; Table 4).

[a] An HC5 value was reported in McGrath and DiToro (2009) and was used.

[b] The HC5 value was calculated based on the methodology presented in McGrath and DiToro (2009).

[c] Tier II Conventional SCV is selected because it is lower than the HC5.

All sediment thresholds are calculated from the HC5 using the EqP methodology presented in EPA (2003 and 2008).

K_{ow} values were selected from the following hierarchy of sources based on availability:

(1) McGrath and DiToro (2009); (2) EPA (2003 or 2008), (3) extracted from USEPA's software "EPI Suite."

DWH - Deep Water Horizon

EPA - Environmental Protection Agency

EqP - Equilibrium partitioning-based sediment value

HC5 - TLM based chronic value protective of 95% of test species.

MAH - monocyclic aromatic hydrocarbon

PAH - polycyclic aromatic hydrocarbon

SCV - secondary chronic value

TLM - Target lipid model

VOC - volatile organic compound

nv - No value

umole/L - micromoles per liter

ug/L - micrograms per liter

ug/kg-OC - micrograms per kilogram organic carbon

ug/kg - micrograms per kilogram dry weight

Table A2-3
Input Parameters for CDFG High Thresholds

Compound	CAS	Chemical Properties[1]			High Thresholds				Basis	Note
		MW	log K_{ow}	K_{oc}	Water (mmole/L)	Water (ug/L)	Sediment (ug/kg-OC)	Sediment[2] (ug/kg)		
PAH										
Acenaphthene	83-32-9	--	--	--	--	56	491,000	1,105	a	
Acenaphthylene	208-96-8	--	--	--	--	307	452,000	1,017	a	
Anthracene	83-32-9	--	--	--	--	21	594,000	1,337	a	
Benz(a)anthracene	208-96-8	--	--	--	--	2.2	841,000	1,892	a	
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	0.44	1,090,000	2,453	a	
Benzothiophene	95-15-8	134.2	3.12	1,167	2.52	339	395,221	889	b	
Biphenyl	92-52-4	154.2	3.94	8,752	0.36	56	490,931	1,105	b	
Chrysene	218-01-9	--	--	--	--	2.0	844,000	1,899	a	
Dibenz(a,h)anthracene	193-39-5	--	--	--	--	0.28	1,123,000	2,527	a	
Dibenzofuran	132-64-9	168.2	4.12	11,226	0.29	48	540,647	1,216	b	
Fluoranthene	206-44-0	--	--	--	--	7.1	707,000	1,591	a	
Fluorene	86-73-7	--	--	--	--	39	538,000	1,211	a	
Indeno(1,2,3-c,d)pyrene	193-39-5	--	--	--	--	0.28	1,110,000	2,498	a	
1-Methylnaphthalene	90-12-0	--	--	--	--	75	446,000	1,004	a	
2-Methylnaphthalene	91-57-6	--	--	--	--	72	447,000	1,006	a	
Naphthalene	91-20-3	--	--	--	--	193	385,000	866	a	
Phenanthrene	85-01-8	--	--	--	--	19	596,000	1,341	a	
Pyrene	129-00-0	--	--	--	--	10	697,000	1,568	a	
C1-Benzothiophenes	--	148.2	3.71	4,438	0.70	104	459,637	1,034	b	Kow and MW based on 2-methylbenzothiophene
C2-Benzothiophenes	--	162.3	4.08	10,255	0.31	51	519,700	1,169	b	Kow and MW based on dimethyldibenzothiophene
C3-Benzothiophenes	--	176.3	4.63	35,610	0.09	17	592,476	1,333	b	Kow and MW based on 2,5,7-trimethylbenzothiophene
C4-Benzothiophenes	--	190.3	5.18	123,657	0.03	5.4	671,166	1,510	b	Kow and MW based on 2,3,4,5-tetramethylbenzothiophene
C1-Dibenzothiophenes	--	162.3	4.08	10,255	0.31	51	519,700	1,169	b	Kow and MW based on 3,7-dimethylbenzothiophene
C2-Dibenzothiophenes	--	212.3	5.26	148,204	0.02	5.1	754,012	1,697	b	Kow and MW based on 4,6-dimethyldibenzothiophene
C3-Dibenzothiophenes	--	226.3	5.81	514,648	0.01	1.6	843,469	1,898	b	Kow and MW based on 2,4,8-trimethyldibenzothiophene
C4-Dibenzothiophenes	--	240.4	6.35	1,747,149	0.002	0.54	939,092	2,113	b	Kow and MW based on 3,4,6,7-tetramethyldibenzothiophene
C1-Fluorenes	--	--	--	--	--	14	611,000	1,375	a	
C2-Fluorenes	--	--	--	--	--	5.3	686,000	1,544	a	
C3-Fluorenes	--	--	--	--	--	1.9	769,000	1,730	a	

Table A2-3
Input Parameters for CDFG High Thresholds

Compound	CAS	Chemical Properties[1]			High Thresholds				Basis	Note
		MW	log K_{ow}	K_{oc}	Water (mmole/L)	Water (ug/L)	Sediment (ug/kg-OC)	Sediment[2] (ug/kg)		
C2-Naphthalenes	--	--	--	--	--	30	510,000	1,148	a	
C3-Naphthalenes	--	--	--	--	--	11	581,000	1,307	a	
C4-Naphthalenes	--	--	--	--	--	4.1	657,000	1,478	a	
C1-Phenanthrenes/Anthracenes	--	--	--	--	--	7.4	670,000	1,508	a	
C2-Phenanthrenes/Anthracenes	--	--	--	--	--	3.2	746,000	1,679	a	
C3-Phenanthrenes/Anthracenes	--	--	--	--	--	1.3	829,000	1,865	a	
C4-Phenanthrenes/Anthracenes	--	--	--	--	--	0.56	912,000	2,052	a	
C1-Pyrenes/Fluoranthenes	--	--	--	--	--	4.9	770,000	1,733	a	
C2-Pyrenes/Fluoranthenes	--	230.3	6.03	846,779	0.004	1.0	874,945	1,969	b	Kow and MW based on 1,9-dimethylpyrene
C3-Pyrenes/Fluoranthenes	--	--	--	--	--	0.63	949,000	2,135	a	
VOC/MAH										
t-Amyl Methyl Ether	994-05-8	102.2	1.92	77	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
Benzene	71-43-2	--	--	--	--	5,300	660,000	1,485	a	
Bromoform	75-25-2	--	--	--	--	6,000	1,225,043	2,756	a	
t-Butyl alcohol	75-65-0	74.1	0.35	2	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
n-Butylbenzene	104-51-8	134.2	4.38	20,222	0.50	68	1,367,607	3,077	b	
sec-Butylbenzene	135-98-8	134.2	4.57	31,088	0.33	45	1,390,337	3,128	b	
tert-Butylbenzene	98-06-6	134.2	4.11	10,975	0.91	122	1,335,478	3,005	b	
Chloroethane	75-00-3	64.5	1.43	25	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
Dibromochloromethane	124-48-1	208.3	2.16	133	63.12	13,146	1,747,298	3,931	b	
Dibromomethane	74-95-3	173.8	1.70	85	- nv -	- nv -	- nv -	- nv -		
1,2-Dibromoethane (EDB)	106-93-4	187.9	1.96	85	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
1,3-Dichlorobenzene	541-73-1	147.0	3.53	2,953	3.20	471	1,390,262	3,128	b	
1,2-Dichloroethane	107-06-2	99.0	1.48	29	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
cis-1,2-Dichloroethene	156-59-2	98.6	1.48	29	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
1,2-Dichloropropane	142-28-9	113.0	1.98	88	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
2,2-Dichloropropane	594-20-7	113.0	2.92	742	12	1365	1013070	2279	b	
Ethanol	64-17-5	46.1	-0.31	0.50	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
Ethylbenzene	100-41-4	--	--	--	--	790	970,000	2,183	a	

Table A2-3
Input Parameters for CDFG High Thresholds

Compound	CAS	Chemical Properties[1]			High Thresholds				Basis	Note
		MW	log K_{ow}	K_{oc}	Water (mmole/L)	Water (ug/L)	Sediment (ug/kg-OC)	Sediment[2] (ug/kg)		
Isopropylbenzene	98-82-8	120.2	3.66	3,963	2.41	290	1,149,709	2,587	b	
4-Isopropyl Toluene	99-87-6	134.2	4.10	10,730	0.93	124	1,334,210	3,002	b	
Methylene chloride	75-09-2	84.9	1.25	1.0	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
n-Propylbenzene	103-65-1	120.2	3.69	4,242	2.26	272	1,152,826	2,594	b	
Tetrachloroethene	79-34-5	167.9	2.19	142	59	9,925	1,411,825	3,177	b	
Toluene	108-88-3	92.1	2.73	483	18.26	1,683	812,508	1,828	b	
Trichloroethene (TCE)	79-01-6	131.4	1.89	72	- nv -	- nv -	- nv -	- nv -		TLM not calculated (Kow < 2.0)
1,2,4-Trimethylbenzene	95-63-6	120.2	3.63	3,703	2.58	310	1,146,695	2,580	b	
1,3,5-Trimethylbenzene	108-67-8	120.2	3.42	2,302	4.07	489	1,125,817	2,533	b	
Xylenes (total)	1330-20-7	106.2	3.12	1,167	7.82	830	968,635	2,179	b	

Notes:

[1] Chemical properties were used to calculate HC_5 values and TLM CVs when a direct reference was not available.

K_{ow} values were selected base on the following hierarchy of sources: (1) McGrath and DiToro (2009); (2) EPA (2003; 2008), (3) extracted from USEPA's software EPI Suite.

K_{oc} values were taken from EPA (2003; 2008) if available, otherwise K_{oc} was estimatedfrom Kow using the relationship equation presented in USEPA (2003).

[2] EQP values were normalized using the average TOC from Site samples (0.23%; Table 3).

[a] A Deepwater Horizon CV and EqP benchmark was available and was used.

[b] Water CV and EqP sediment values were calculated using the methodology presented in EPA (2003 and 2008).

K_{oc} values were taken from EPA (2003 or 2008) if available, otherwise Koc was estimated from Kow using the relationship equation presented in USEPA (2003).

CV - Chronic value

DWH - Deep Water Horizon

EPA - Environmental Protection Agency

EqP - Equilibrium partitioning-based sediment value

HC_5 - TLM based chronic value protective of 95% of test species.

MAH - monocyclic aromatic hydrocarbon

PAH - polycyclic aromatic hydrocarbon

TLM - Target lipid model

Notes (cont.):

VOC - volatile organic compound

umole/L - micromoles per liter

ug/L - micrograms per liter

ug/kg-OC - micrograms per kilogram organic carbon

ug/kg - micrograms per kilogram dry weight

Table A2-4
Avila Tidal Area TOC Data

Sample	mg/kg
IA-1	2,600
IA-2	2,300
IA-3	2,700
IA-4	2,300
IA-5	1,900
IA-6	2,700
IA-7	2,500
IA-8	2,000
IA-9	1,900
IA-10	1,600
Average	2,250
TOC %	0.23%

Notes:
TOC - Total organic carbon
TOC % used to normalize sediment benchmarks
mg/kg - milligrams per kilogram dry weight

Appendix 3 – San Luis Obispo County Environmental Health Services Thresholds

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MEMORANDUM

TO: **Rik Williams, Chevron**

FROM: **Chuck Lambert**

DATE: **June 5, 2013**

RE: **Development of Risk-Based Recreational Thresholds for the Intertidal Area, Avila Tank Farm for San Luis Obispo County Environmental Health Services**

1.0 BACKGROUND

During routine sampling of the intertidal area on May 8, 2012, a small amount of sheen was observed in a tidal area immediately below the cliff face of the former Union Oil Avila Beach Tank Farm (the area of interest is shown in Figure 1). In addition, on a visit to the tidal area on May 24, 2012, the San Luis Obispo Air Pollution Control District (SLOAPCD) noted an intermittent "gasoline type odor", although no sheen was observed during this visit (SLOAPCD 2012a). Analysis of the water sample collected from the tidal pool where the sheen was observed (sample ID "IZ-3") indicated the presence of volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes (BTEX), naphthalene, and gasoline-range total petroleum hydrocarbons (TPHg). To date, the source(s) of the sheen and odor has not been determined, but additional monitoring of surface and interstitial water, sediment, and ambient air in the intertidal area is ongoing to better characterize the frequency that constituents are detected and the size of the area impacted (Padre 2012a). However, the VOCs detected in the May 8, 2012 IZ-3 tide pool water sample suggested it may be related to a source of petroleum detected in groundwater collected from monitoring wells B-230 and B-231 located at the top of the cliff at Avila Tank Farm in an area where tanks historically were located. In the absence of contrary evidence, Chevron is considering the release from former Tank No. 201104 as the source of the fuel-related impacts at the intertidal area. In addition to the ongoing monitoring in the intertidal area, Chevron has begun to implement interim remedial actions as outlined in Avocet Environmental, Inc.'s (Avocet) Work Plan for Cliff Area Interim Remedial Actions (Avocet 2012).

In June 2012, McDaniel Lambert, Inc. completed a screening Human Health Risk Assessment (sHHRA) based on the analytical results for the surface water grab samples collected on May 8, 2012 from the intertidal area below the cliff face (McDaniel Lambert, 2012a). The sHHRA

concluded that, based on maximum chemical concentrations detected during the May sampling event (in which chemicals were detected in only the sample collected from the tide pool where sheen was observed, IZ-3), there was no significant risk to beach users who might wade in the tidal pools.

In order to ensure the protection of ecological and human receptors that may be exposed to chemicals detected in the intertidal area, the California Central Coast Regional Water Quality Control Board (CCRWQCB) requested the development of notification thresholds for this area. These "Notification Thresholds" are conservative concentrations of chemicals that would result in the notification of the regulatory agencies (CCRWQCB, California Department of Fish and Game [CDFG], San Luis Obispo County Environmental Health Services [SLO County EHS], and SLOAPCD) of the potential for ecological or human health risks in the intertidal area. This memorandum identifies the surface water and sediment thresholds (i.e., screening levels) protective of recreational use of the intertidal area, prepared for SLO County EHS. As requested by SLO County EHS, this memorandum also summarizes the workplan developed by McDaniel Lambert to address the SLOAPCD request that air sampling be conducted in the intertidal area to determine the frequency and magnitude of any potential air impacts (McDaniel Lambert 2012b, included as Attachment 1). Five separate ambient air sampling events were conducted through August 2, 2012, exceeding the four events proposed in the sampling plan. Air monitoring during intertidal area sampling events since that time is conducted via a portable flame ionization detector (FID). Future ambient air sampling for individual VOCs will be conducted on an as needed basis as directed by SLOAPCD and SLO County EHS.

Generic human health recreational screening levels are not widely available. While the United States Environmental Protection Agency (USEPA), in conjunction with the United States Department of Health and Human Services, developed benchmarks to assess potential human health risks from exposure to oil-contaminated water in response to the British Petroleum/Deep Water Horizon (DWH) oil spill in the Gulf of Mexico (http://www.epa.gov/bpspill/health-benchmarks.html), these "Human Health Benchmarks for Chemicals in Water" apply to a limited exposure duration corresponding to a single summer (90 days). To be conservative, site-specific thresholds that address a longer exposure duration are required. Therefore, this memorandum describes the development of human health risk-based recreational thresholds for tidal pool surface water and sediment based on an exposure duration of up to 10 years, which corresponds to the most likely beach user, an adolescent wader (age 6 to 16 years). Given the planned remedial activity associated with the potential source area (former Tank No. 201104), the exposure duration of 10 years is believed to be conservative.

2.0 OBJECTIVE

The objective of this memorandum is to summarize the recreational use thresholds for petroleum-related chemicals of potential concern (COPCs) for surface water and sediment

against which ongoing data collected in the intertidal area can be compared. Exceedance(s) of these thresholds, or cumulative surface water, interstitial water, or sediment risks exceeding the risk management thresholds of $1x10^{-6}$ (cancer risk) or 1 (noncancer hazard), would require consultation with SLO County EHS to determine additional actions beyond those currently planned, which may include, a health risk assessment, beach signage, public notice, limitations on beach use, or other actions.

These recreational use thresholds are intended for screening purposes only; they are not regulatory standards, site-specific cleanup levels, or remediation goals. Per agreement with SLO County EHS, a site-specific, focused risk assessment will be conducted based on data collected during the initial year of sampling.

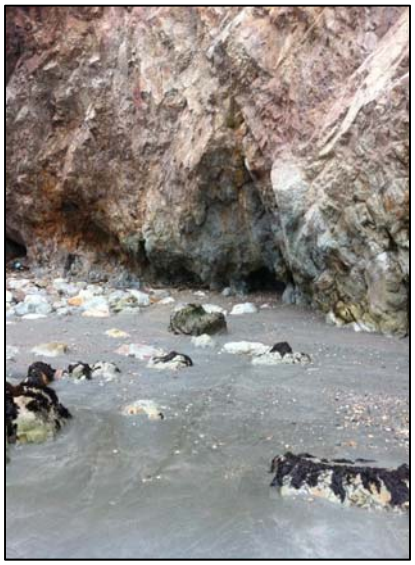
3.0 SLO COUNTY EHS SURFACE WATER AND SEDIMENT THRESHOLDS

The risk-based thresholds for potential recreational exposure to COPCs detected in surface water and/or sediment in the intertidal area summarized in Table 1 were derived using equations combining exposure assumptions with chemical-specific toxicity values. The equations follow those used by the USEPA in the development of the "Human Health Benchmarks for Chemicals in Water" (http://www.epa.gov/bpspill/health-benchmarks.html), as well as for the derivation of the USEPA's Regional Screening Levels ([RSLs]; USEPA 2012a). The intertidal area recreational thresholds are based on a hazard quotient (HQ) of 1 for noncarcinogens or a $1x10^{-6}$ lifetime cancer risk for carcinogens, consistent with USEPA and Cal/EPA practices for developing screening levels. The USEPA currently uses an incremental lifetime cancer risk of $1x10^{-6}$ to $1x10^{-4}$ as the range of acceptable risk (USEPA 1990, 1991) for risk management purposes. For any given site, the risk that is acceptable is very much dependent on site-specific characteristics that include: the number of people potentially exposed, the likelihood of exposure, the chemicals driving the risk, the future use(s) of the site, and the decisions of local risk managers. Moreover, the exceedance of a screening level does not indicate that a health risk exists or that risk management is necessary, but rather that additional evaluation is warranted. For the intertidal area, this could include the preparation of a multimedia human health risk assessment (HHRA). Thresholds for the consumption of biota (e.g., mussels) have not been developed because it is unclear if biota have been impacted and the extent to which local populations consume biota near the area of concern; as noted in Figure 2, any HHRA prepared for the site could include this potential exposure pathway.

3.1 Conceptual Exposure Model

The intertidal area is an active beach environment that responds dynamically to complex deposition and erosion processes due to wave energy, tides, and storm scour. Consequently, the undulating surface of the bedrock can be exposed, creating tide pools, or it can be buried with up to approximately four feet of beach deposits, including sands and gravels. When bedrock is

exposed, only the tide pools are present. When the bedrock is covered, interstitial water or porewater flows through the beach deposits. As shown in the photos below, in the absence of large positive tides or storm scour, it is expected that this area typically will be covered by beach deposits with outcropped bedrock and exposed bedrock where rock falls have occurred.



The thresholds for both tidal pool water and sediments are based upon direct contact with these media, specifically incidental ingestion and dermal contact. Direct contact with the type of sheen observed on May 8, 2012 is not anticipated to present a hazard beyond the potential exposure to chemicals detected in tide pool water or sediment; the sheen was very thin, and was not tacky or sticky like tar that is sometimes found on the beach. Because the intertidal area frequently is covered by beach deposits, many of the water samples collected from May through March 2013 were interstitial, as opposed to surface, water and the use of this data as a surrogate for standing surface water is highly conservative since prolonged dermal contact with (especially of body areas other than feet) or ingestion of interstitial water by beach goers is highly unlikely. Inhalation of volatile chemicals emanating from these media was addressed by the sampling of intertidal area and background ambient air, as summarized in Section 4, and on-going monitoring via the FID. As noted above, currently neither potential impacts to nor consumption of biota in the tide pools is clearly understood, and therefore thresholds for this medium have not been developed.

Consistent with the sHHRA that evaluated the initial analytical results for intertidal area water (McDaniel Lambert 2012a), thresholds were developed for adolescent (age 6 to 16 years) tide pool waders (beach users). It is anticipated that this adolescent wader is the beach visitor most likely to spend time in the intertidal area and is regarded as the key receptor for the development of recreational thresholds.

3.2 Chemicals of Potential Concern

Recreational use thresholds were developed for intertidal COPCs, which were defined as the organic compounds detected in surface water, interstitial water, or sediment samples collected from the intertidal area between May and March 2013, or in groundwater samples collected from

monitoring wells B-230 and B-231 in 2011 or 2012 (Padre 2012b and Intertidal Database provided by Padre), as summarized in Table 2 below.[1] Lead is associated with some petroleum products and has been detected in groundwater collected from both monitoring wells, and therefore also is included as a COPC.

3.3 Threshold Equations

The equations provided in Attachments 2 and 3 were used to calculate the intertidal area recreational thresholds, and follow those used in the derivation of the USEPA's RSLs (2012a). These equations include pathway-specific screening level equations for incidental ingestion of and dermal contact with carcinogens and noncarcinogens detected in tidal pool water and sediment samples. Because several mutagenic chemicals have been detected in intertidal water samples collected to date, specifically the carcinogenic PAHs benzo(a)anthracene and chrysene, as well as TCE, (chrysene and TCE at "J-values": estimated concentrations between the method detection limit and reporting limit), equations for the calculation of thresholds for mutagens are included in Attachment 2.

The adolescent wader cancer and noncancer thresholds for intertidal water and sediment are presented in Tables 3 and 4, respectively, with the receptor- and chemical-specific exposure parameters, as well as hierarchy for selecting toxicity factors, described in the subsequent sections.[2]

3.4 Exposure Parameters

The exposure parameters for the adolescent wader (Table 5) are consistent with those used in the tidal pool sHHRA (McDaniel Lambert 2012a), which generally followed the approach used in the ATCAT-ratified sHHRA for the Cliff Springs at the Former Avila Tank Farm and associated "action levels" (McDaniel Lambert 2007 and 2008). The tide pool area where the sheen was observed on May 8, 2012 is readily accessible only during negative low tide events. Based on tide charts, in 2012 there are 49 occurrences of tides greater than -0.75 feet; however, only 32 of these occurrences are within daylight hours (i.e., 7 am to 7 pm; http://www.centralcoastweather.net/AvilaBeach/GetMonthTides.asp). Based on these numbers, hypothetical waders were assumed to be exposed to water or sediment in the intertidal area below the cliff face for 35 days per year. The adolescent receptor cover ages 6 through <16, resulting in an exposure duration of 10 years.

[1]Table 2 excludes the detected polycyclic aromatic hydrocarbons (PAHs) analyzed for forensic purposes but not typically evaluated in human health risk assessments, including alkylated PAHs (other than 1- and 2-methylnaphthalene) and benzothiophene.

[2]For lead, notification thresholds were not calculated. Intertidal water is not a source of drinking water, therefore drinking water standards do not apply. The sediment threshold level is the California Human Health Screening Level (CHHSL) for residential soil (Cal/EPA 2009a).

Table 2. Summary of Chemicals Detected in Groundwater (B-230 and 231) and Intertidal Surface and Interstitial Water and Sediment

COPCs	Ground-water	Surface Water	Interstitial Water	Sediment
Lead (dissolved)	✓			
Organic Lead	✓			✓
Benzene	✓	✓	✓	✓
Ethylbenzene	✓	✓	✓	✓
Toluene	✓	✓	✓	
Xylenes (total)	✓	✓	✓	✓
Bromoform		✓		
t-Butyl alcohol	✓	✓	✓	✓
n-Butylbenzene	✓	✓	✓	
sec-Butylbenzene	✓	✓	✓	✓
tert-Butylbenzene	✓	✓	✓	
Chloroethane	✓	✓	✓	
Dibromochloromethane		✓		
1,2-Dibromoethane (EDB)	✓	✓	✓	
Dibromomethane		✓		
1,3-Dichlorobenzene			✓	
1,2-Dichloroethane	✓	✓	✓	
cis-1,2-Dichlorethene			✓	
1,2-Dichloropropane			✓	
2,2-Dichloropropane			✓	
Ethanol		✓		
Isopropylbenzene	✓	✓	✓	✓
p-Isopropyltoluene	✓	✓	✓	
Methylene Chloride	✓			
n-Propylbenzene	✓	✓	✓	
t-Amyl Methyl Ether	✓			
Tetrachloroethene			✓	
Trichloroethene		✓	✓	
1,2,4-Trimethylbenzene	✓	✓	✓	✓
1,3,5-Trimethylbenzene	✓	✓	✓	
Acenaphthene	✓	✓	✓	
Acenaphthylene	✓			
Anthracene		✓		
Benz(a)anthracene		✓		
Benzo(g,h,i)perylene		✓		
Biphenyl	✓			
Chrysene	✓	✓		
Dibenzo(ah)anthracene		✓		
Dibenzofuran			✓	
Fluoranthene	✓	✓	✓	✓

Table 2. Summary of Chemicals Detected in Groundwater (B-230 and 231) and Intertidal Surface and Interstitial Water and Sediment (continued)

COPCs	Ground-water	Surface Water	Interstitial Water	Sediment
Fluorene	✓	✓	✓	
Indeno(1,2,3-cd)pyrene		✓		
Naphthalene	✓	✓	✓	✓
1-Methylnaphthalene	✓	✓	✓	
2-Methylnaphthalene	✓	✓	✓	
Phenanthrene	✓	✓	✓	
Pyrene		✓	✓	
TPH Gasoline (C4-C10)	✓	✓	✓	
TPH Diesel (C10-C25)	✓	✓	✓	✓
TPH Oil Crude (C25-C40)	✓	✓		✓

Although the tidal pools, when present, are shallow and not actually swimmable, in order to be health protective, the ingestion rate for swimming (0.049 L/hour for child up to 18 years) was used (USEPA 2011). The exposure time for waders is one hour per day, a site-specific assumption based on best professional judgment. As in the Avila Tank Farm Cliff Springs evaluations (McDaniel Lambert 2007 and 2008), hypothetical waders are assumed to wear a short-sleeved shirt and shorts (no shoes), resulting in exposure of hands, forearms, lower legs, and feet. The surface areas for water and sediment exposures presented in Table 5 are the age-weighted averages for the corresponding age groups evaluated in the risk assessment, as recommended in guidance (USEPA 2011 and 2004).[3] The sediment ingestion rate is the USEPA default values for residential incidental ingestion of soil (USEPA 2002), and it is conservatively assumed that all ingested sediment comes from the contaminated area. The adherence factor for the adolescent is derived from data for children playing in tidal flats (USEPA 2011).[4] The body weight is based on the values recommended by USEPA, and was derived as the average of the corresponding age ranges (USEPA 2011). The life expectancy of 78 years (28,470 days) was used as the averaging time for exposure to carcinogenic contaminants (USEPA 2011). The averaging time for noncarcinogenic effects is equal to the exposure duration of 10 years (3,650 days). It is important to note that these exposure parameters assume ingestion of and prolonged dermal contact with the intertidal water, which is unlikely when standing water is not present. As a result, the recreational use surface water thresholds are very conservative relative to the actual potential for beach users exposure to COPCs detected in interstitial water in the intertidal area.

[3]The skin surface areas for the adolescent wader are the age-weighted averages of the exposed body parts for the corresponding age groups presented in Table 7-2 of USEPA 2011.

[4]The skin adherence factor for the child and adolescent waders was calculated as the weighted average for the exposed body parts using the adherence factors recommend by USEPA 2011 for playing in sediment (Table 7-4).

Chemical-specific parameters such as permeability coefficients (Kp), oral bioavailability factors (BF) and dermal absorption factors (ABS) are presented in Table 6. The Kps are based on values used in the USEPA's RSLs (USEPA 2012a), values recommended in the dermal exposure guidance (USEPA 2004), or are calculated following USEPA guidance (see Attachment 4). The oral BF accounts for the difference between absorption in the controlled dose-response study in the laboratory, upon which the toxicity criteria are mostly based, and the actual absorption likely to occur upon human exposure. Oral BFs are based on such considerations as the chemical form of the chemical, solubility, binding to soil, and weathering of organic materials (National Research Council [NRC] 2003). The only chemicals for which intertidal area thresholds were derived incorporating oral BFs are PAHs (Magee et al. 1996, NRC 2003). The 29 percent value for PAHs is the value used in the Avila Tank Farm Supplemental HHRA (McDaniel Lambert 2011). A health protective oral BF of 100 percent (1.0) was used for all other recreational use sediment thresholds, per USEPA guidance (1989). The ABS values are for soil and are those used by the California Environmental Protection Agency (Cal/EPA) in the derivation of the California Human Health Screening Levels (2005).

Table 6 also presents the additional parameters and variables (e.g., molecular weight, "B", "FA", etc.) required for the calculation of the dermal screening levels for organics in water. With the exception of the molecular weights, these parameters are either calculated following USEPA dermal exposure guidance (2004) as noted in Attachments 2 and 3, or are values obtained directly from that guidance (e.g., FA). It is noted that dermal surface water screening values were not calculated for several COPCs including n- and sec-butylbenzene, the PAHs benzo(a)anthracene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, and phenanthrene, and aliphatic TPH in the diesel and motor oil ranges (see Tables 2 and 3). This pathway was excluded because, for these chemicals, there is significant uncertainty regarding the ability to predict dermal absorption through the skin when exposed to water; that is to say, these chemicals have K_{ow} and molecular weights (MW) outside the "Effective Prediction Domain" (or EPD). Generally, chemicals with very large and very small K_{ow} values are outside of the EPD (USEPA 2004). The exclusion of the dermal pathway in the calculation of thresholds for these chemicals is consistent with both the absence of "Human Health Benchmarks for Chemicals in Water" for most PAHs (http://www.epa.gov/bpspill/health-benchmarks.html) and the USEPA's exclusion of this exposure pathway for chemicals outside the EPD in its derivation of the tap water RSLs (USEPA 2012a).

3.5 Dose-Response Assessment

The toxicity values used in the sHHRA are summarized in Table 7.[5] In accordance with Cal/EPA's suggested hierarchy of sources to identify dose-response values (Cal/EPA 2005), relevant carcinogenic and noncarcinogenic dose-response values were obtained from the following sources (in descending order of preference):

[5]Naphthalene has been identified as a carcinogen only via the inhalation pathway.

1. Office of Environmental Hazard Health Assessment (OEHHA) Toxicity Criteria Database (Cal/EPA 2012a),
2. Other Cal/EPA sources, such as OEHHA Table of Reference Exposure Levels (Cal/EPA 2012b),
3. USEPA Integrated Risk Information System database (USEPA 2012b),
4. USEPA RSLs (USEPA 2012a),
5. Department of Toxic Substance Control (DTSC) Interim Guidance for Evaluating Human Health Risks from Total Petroleum Hydrocarbons (TPH) – rescinded (Cal/EPA 2009b), and
6. The Toxicology Excellence for Risk Assessment (TERA) database.[6]

The benzo(a)pyrene (BaP) oral cancer slope factor (CSF) was used as the basis for the benzo(a)anthracene, chrysene, and indeno(1,2,3-c,d)pyrene CSFs presented in Table 7. These CSFs were calculated based on the "uncorrected" BaP potency value of 1.7 mg/kg-day^{-1} identified by Cal/EPA during development of the BaP public health goal for drinking water (Cal/EPA 2010) combined with the Cal/EPA potency equivalency factors (PEFs) of 0.10 for benzo(a)anthracene and indeno(1,2,3-c,d)pyrene, and 0.01 for chrysene (Cal/EPA 1993, 2002, and 2009c).[7] The "uncorrected" CSF is the appropriate value to use, given the inclusion of age-dependent adjustment factors in thresholds for COPCs identified as having a mutagenic mode of action. Specifically, the thresholds for mutagens include potency adjustments for childhood (early-life) exposures by applying a factor of 3 for exposures that occur from 2 years through 15 years of age (Cal/EPA 2009c).

Ideally, route-specific toxicity factors account for dosimetry information on the dose-response relationship for systemic effects from the absorbed dose. In the absence of dermal toxicity factors, USEPA has devised a method for making route-to-route (oral-to-dermal) extrapolations for systemic effects (USEPA 2004) – using absorption efficiency information from oral administration studies, toxicity factors are adjusted to represent the absorbed dose rather than the administered dose. For chemicals that do not have specific gastrointestinal absorption values, it is assumed that 100 percent of the administered oral dose is absorbed. In addition, route-to-route extrapolation between the inhalation and oral exposure pathways was utilized to develop noncancer thresholds for chemicals where no toxicity value was available for the oral route of exposure but an inhalation toxicity value was available. Although there is some uncertainty in extrapolating between exposure routes, the Cal/EPA specifically addresses this issue in its discussion of the revised RSL (Department of Toxic Substances Control, Office of Human and Ecological Risk [HERO] Note 3), and recommends extrapolating between these pathways

[6]Value for methyl-tert butyl ether, used as a surrogate for tert-butyl alcohol, available online: http://iter.ctcnet.net/publicurl/pub_level3.cfm?crn=1634%2D04%2D4&org=RIVM&type=NCO

[7]The oral cancer slope factor of 2.9 mg/kg-day^{-1} reported in the OEHHA toxicity criteria database was derived in the BaP public health goal document to correct for early life exposures based on lifetime exposure (70 years; Cal/EPA 2010).

"particularly for organic compounds in which systemic effects are known to occur and significant portal of entry effects are not anticipated" (Cal/EPA 2012c).

3.6 Evaluation of Samples with Multiple COPCs Detected

Risks posed by exposure to multiple COPCs with similar health effects are considered additive. Cal/EPA guidance recommends calculating cumulative risks if multiple chemicals with similar heath effects are present at a site (Cal/EPA 2005). The cumulative cancer risk associated with a sample can be calculated by summing the ratio of each chemical concentration divided by its respective carcinogenic threshold (CT) and multiplying this total by the target risk level of $1x10^{-6}$, as shown below.

$$Sample\ Cancer\ Risk = \left[\left(\frac{COPC_x}{CT_x}\right) + \left(\frac{COPC_y}{CT_y}\right) + \left(\frac{COPC_z}{CT_z}\right)\right] \times 10^{-6}$$

The cumulative noncancer hazard associated with a sample can be calculated by summing the ratio of each chemical concentration divided by its respective noncarcinogenic threshold (NCT), as shown below.

$$Sample\ Hazard\ Index = \left[\left(\frac{COPC_x}{NCT_x}\right) + \left(\frac{COPC_y}{NCT_y}\right) + \left(\frac{COPC_z}{CT_z}\right)\right]$$

These cumulative totals should be compared to the target cancer level of $1x10^{-6}$ and the hazard of 1. Exceedances of either of these risk management levels indicates that additional investigation is warranted, as discussed further in Section 5.0.

4.0 DEVELOPMENT AND USE OF AMBIENT AIR THRESHOLDS

Collection and assessment of air data related to the intertidal area was set forth in the June 2012 Avila Tidal Area Air Sampling Workplan (McDaniel Lambert 2012b), with samples collected five times through August 2, 2012, exceeding the four events proposed in the workplan. A brief synopsis of this workplan is provided below; for more details see Attachment 1. On-going monitoring of ambient air during intertidal sampling events is conducted using a portable FID. Additional ambient air monitoring for individual VOCs will be conducted on an as needed basis as directed by SLOAPCD and SLO County EHS.

4.1 Ambient Air Sample Locations

Concurrent intertidal area and background ambient air samples were collected. The three intertidal area sampling locations began near the tidal pool where sheen was observed (IZ-3) and extend west towards the location of former Tank No. 201104. The three background air samples were collected to the west of the intertidal area and cliff springs, along the beach area closer to the town of Avila Beach. All samples were collected at approximately 2 feet above the sand or ground surface.

4.2 Anticipated COPCs

Based on the chemicals detected in the tidal pool water sample where sheen was observed (IZ-3), the observation of odor consistent with gasoline, and the fact that no heavier types of petroleum have been detected in the area, the anticipated air COPCs were potentially petroleum-related VOCs including naphthalene. This focus on gasoline-range VOCs was consistent with analytical results from soil associated with a potential source, the nearby former Tank No. 201104. It is unlikely that hydrogen sulfide is present in the tide pool area – its odor has not been observed and it is typically associated with heavier sulfur-containing petroleum streams (e.g. crude oil). Additionally, extensive data collected over a two year period during remediation activities in the Town of Avila indicated that significant hydrogen sulfide was not present in any of the petroleum-impacted areas in Avila (see Attachment 1).

4.3 Sampling Frequency and Analyses

Ambient air sampling was conducted five times between June and August 2012, exceeding the minimum of four events specified in the workplan. On-going monitoring of ambient air during intertidal sampling events is conducted using a portable FID. Additional ambient air monitoring for individual VOCs will be conducted as directed by SLOAPCD and SLO County EHS.

Samples were analyzed for H&P, Inc.'s full list of analytes (82 chemicals) for the United States Environmental Protection Agency's TO-15/TO-15 SIM (selective ion monitoring) method, which includes chlorinated VOCs unlikely to be related to petroleum. The town of Avila Beach background values and H&P, Inc. reporting limited for select potentially petroleum-related COPCs are shown below in Table 8.

Table 8. Summary of Reporting Limits and Background Levels for Select Petroleum-Related Chemicals of Potential Concern

EPA Method TO-15 Modified Laboratory VOCs and TPH Compounds	Laboratory Reporting Limit ($\mu g/m^3$)	Avila Beach Background Values* ($\mu g/m^3$)
Benzene	0.16	0.42
Toluene	0.76	1.5
Ethylbenzene	0.44	0.40
m,p-Xylene	0.44	0.84 (o-Xylene)
o-Xylene	0.44	0.84
Naphthalene**	0.53 (0.068)	0.086

Notes

*From Applied Measurement Science (2001), see Attachment 1.

**The analytical reporting limit for naphthalene exceeds background value; results between the method detection limit (included in parentheses) and the reporting limit (estimated/J-values) will be reported by the laboratory.

4.4 Possible Actions Based on Initial Results

The flow chart below depicts possible risk management actions that could result following receipt and review of air sampling results, as specified in the workplan. This ambient air "action level" flow chart is similar to the process shown in Figure 2, but includes at step comparing the intertidal area and background air results. The air action levels (thresholds) identified in the June 2012 workplan are derived from the same source of action levels used for Project Avila (AMS 2001; see Attachment 1) – Cal/EPA's chronic Reference Exposure Levels (RELs; Cal/EPA 2012c). The air thresholds for key potentially petroleum-related COPCs are shown in Table 9.

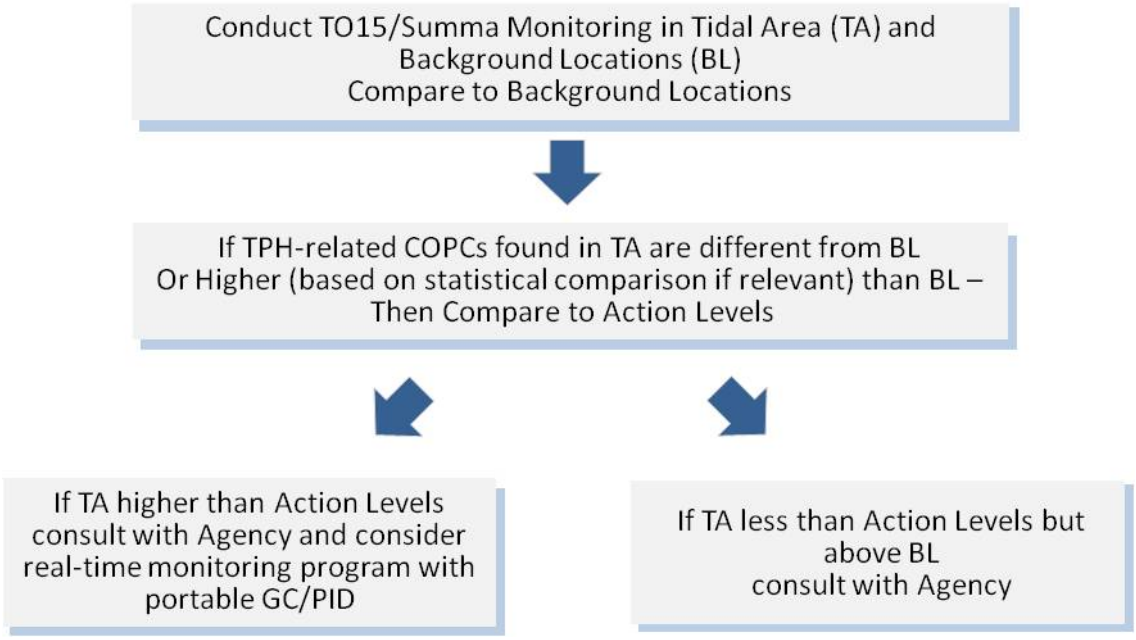


Table 9. Ambient Air Action/Thresholds

Key Petroleum-Related COPCs	Threshold (µg/m^3)*
Benzene	60
Toluene	300
Ethylbenzene	2000
Xylene (total)	700
Naphthalene	9
TPHv**	7000

*From Ca/EPA's chronic RELs (http://oehha.ca.gov/air/allrels.html)
** n-hexane chronic REL used as conservative surrogate for TPHv

5.0 USE OF RECREATIONAL THRESHOLDS

The recreational thresholds summarized in this memorandum provide an efficient risk-based screening tool to evaluate the recreational significance of detected concentrations of organic compounds in surface water (or interstitial water as a surrogate for surface water) and sediment collected in the intertidal area. Detected COPC concentrations in surface or interstitial water and

sediment easily can be compared to the appropriate recreational thresholds. Following Cal/EPA guidance, if multiple chemicals with similar heath effects are detected, the cumulative excess cancer risk and/or noncancer hazard index should be calculated (Cal/EPA 2005). If the sample total results in a target cancer level of less than $1x10^{-6}$ and/or a hazard of less than or equal to 1, it can be concluded that the risk posed by that sample is acceptable. As noted in Section 2, exceedance(s) of these thresholds and/or risk management levels will require consultation with the appropriate agencies to determine additional actions, beyond those currently planned, which may include, beach signage, public notice, limitations on beach use, preparation of a human health risk assessment, or other actions.

Surface or interstitial water and sediment samples have been collected from the intertidal area since May 2012, and will continue to be collected at least through mid 2013. Although these thresholds have been developed primarily to quickly screen "initial" data sets that have been subjected to no more than a cursory review of reporting limits and quality control sample results, it is anticipated that all of the data generated will be summarized in a data report that will include independent data validation. This more rigorous evaluation of the monitoring data should include the following minimum data validation and other requirements:

- Data collected from the intertidal area should be subjected to independent data validation, with 20% of the data subjected to level four validation and the remaining 80% to level two validation. Any validation issues should be discussed in the data report.
- All sediment data should be reported by the laboratory in terms of dry-weight.
- Any reports summarizing comparisons of validated data to recreational thresholds should include a data usability evaluation.
- Evaluations of the validated background air data will include the following summary statistics for detected COPCs – minimum, maximum, mean, and 95% upper confidence limit of the mean (95% UCL).
- Evaluations of validated intertidal data will include the following medium-specific summary statistics for detected COPCs – minimum, maximum, mean, and 95% UCLs.

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FIGURES

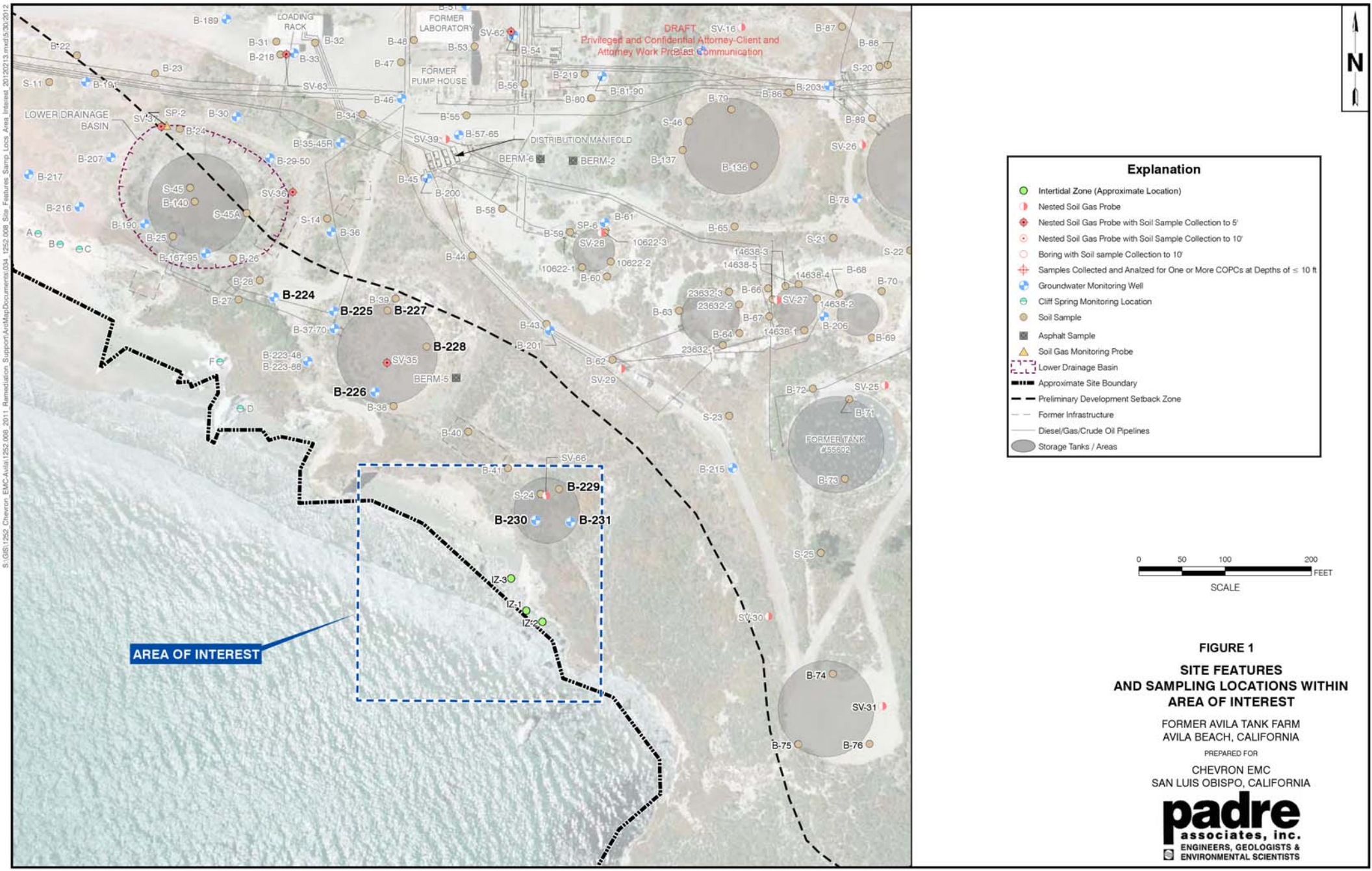


FIGURE 1

SITE FEATURES AND SAMPLING LOCATIONS WITHIN AREA OF INTEREST

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

Figure 2
Intertidal Area Human Health Decision Flowchart
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

RISK-BASED THRESHOLD LEVELS

- Site-specific values for air*, water, and sediment. Based on recreational exposure scenario relevant to the area and protective of direct exposure to air, water and sediment.

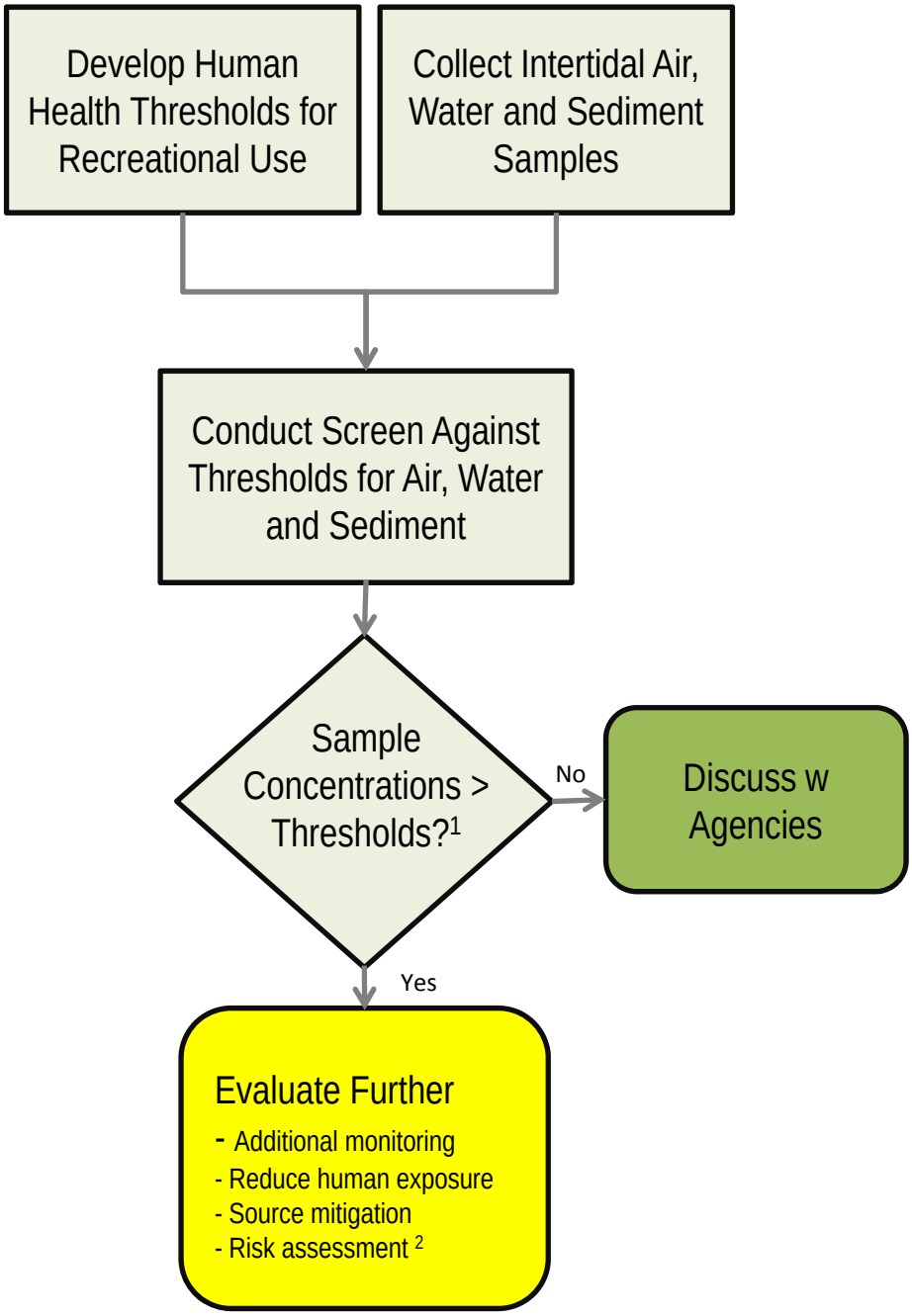
**Air screening process currently in use includes background comparison step and thresholds are chronic RELs for key COPCs.*

FOR THRESHOLD EXCEEDANCES

- Evaluate further: Could include additional monitoring, risk assessment[2], or mitigation etc.
- Take actions that would reduce human health exposure (e.g., signage).

[1] *Detected concentrations will be compared to thresholds independently. For samples where several COPCs with similar health effects are detected, a cumulative carcinogenic risk and/or hazard index will be calculated and compared to the acceptable risk management levels.*

[2] *Risk assessment could include indirect exposure pathways (such as consumption of marine biota), as needed.*



TABLES

Table 1
Recreational Use Thresholds - Adolescent Wader
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

CHEMICAL	Adolescent Wader			
	Surface Water (µg/L)		Sediment (mg/kg)	
Inorganics*				
Lead	NA		80	
BTEX				
Benzene	230	c	18	c
Ethylbenzene	824	c	164	c
Toluene	125,019	nc	18,516	nc
Xylenes (total)	241,847	nc	46,291	nc
VOCs				
Biphenyl	470	c	226	c
Bromoform	3,567	c	164	c
tert-Butylalcohol	1,871,906	nc	69,437	nc
n-Butylbenzene	471,414	nc	11,573	nc
sec-Butylbenzene	471,414	nc	11,573	nc
tert-Butylbenzene	18,090	nc	11,573	nc
Chloroethane	46,536,790	nc	1,983,907	nc
Dibromochloromethane	433	c	19	c
1,2-Dibromoethane	12	c	0.50	c
Dibromomethane	62,928	nc	2,315	nc
1,3-Dichlorobenzene	26,785	nc	6,944	nc
1,2-Dichloroethane	967	c	38	c
cis-1,2-Dichloroethene	7,299	nc	463	nc
1,2-Dichloropropane	957	c	50	c
2,2-Dichloropropane	NC		NC	
Ethanol	NC		NC	
Isopropylbenzene	62,140	nc	23,146	nc
p-Isopropyltoluene	36,181	nc	23,146	nc
Methylene chloride	3,575	c	129	c
n-Propylbenzene	59,536	nc	23,146	nc
Tetrachloroethene	17	c	3.3	c
Tert-amyl methyl ether	NC		NC	
Trichloroethene	1,399	c	102	c
1,2,4-Trimethylbenzene	1,297	nc	463	nc
1,3,5-Trimethylbenzene	8,720	nc	2,315	nc
PAHs**				
Acenaphthene	31,555	nc	11,115	nc
Acenaphthylene	25,707	nc	11,115	nc
Anthracene	84,072	nc	55,576	nc
Benz(a)anthracene	144	c	2.8	c
Benzo(g,h,i)perylene	282,848	nc	5,558	nc
Chrysene	1,442	c	28	c
Dibenz(a,h)anthracene	6.0	c	0.12	c
Dibenzofuran	428	nc	231	nc
Fluoranthene	377,131	nc	7,410	nc
Fluorene	15,458	nc	7,410	nc
Indeno(1,2,3-cd)pyrene	144	c	2.8	c
1-Methylnaphthalene	141	c	65	c
2-Methylnaphthalene	2,131	nc	960	nc
Naphthalene	21,545	nc	4,800	nc
Phenanthrene	2,828,484	nc	55,576	nc
Pyrene	5,146	nc	5,558	nc
Total Petroleum Hydrocarbons				
TPH Gasoline - aliphatic	4,736	nc	9,258	nc
TPH Gasoline - aromatic	NA		NA	
TPH Diesel - aliphatic	942,828	nc	23,146	nc
TPH Diesel - aromatic	3,298	nc	6,944	nc
TPH Motor Oil - aliphatic	18,856,560	nc	462,912	nc
TPH Motor Oil - aromatic	3,953	nc	6,944	nc

Notes:
"c" = carcingenic screening level; "nc" = noncancer screening level.
NC = No Criteria
NA = Not Applicable
*For lead, notification thresholds were not calculated; intertidal water not a source of drinking water, therefore drinking water standards do not apply. Sediment threshold is California Human Health Screening Level (CHHSL) for residential soil (Cal/EPA 2009a).
**Naphthalene has been identified as a carcinogen only via the inhalation pathway.

Table 3
Adolescent Wader Surface Water Thresholds
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

CHEMICAL	Adolescent Wader (mg/L)						Minimum Screening Level (µg/L)
	Cancer Screening Level			Noncancer Screening Level			
	Ing	Dermal	Total	Ing	Dermal	Total	
Inorganics							
Lead	NA	NA	NA	NA	NA	NA	NA
BTEX							
Benzene	7.35E-01	3.35E-01	2.30E-01	3.77E+01	1.72E+01	1.18E+01	230
Ethylbenzene	6.69E+00	9.40E-01	8.24E-01	9.43E+02	1.33E+02	1.16E+02	824
Toluene	NC	NC	NC	7.54E+02	1.50E+02	1.25E+02	125,019
Xylenes (total)	NC	NC	NC	1.89E+03	2.77E+02	2.42E+02	241,847
VOCs							
Biphenyl	9.19E+00	4.95E-01	4.70E-01	4.71E+02	2.54E+01	2.41E+01	470
Bromoform	6.69E+00	7.65E+00	3.57E+00	1.89E+02	2.16E+02	1.01E+02	3,567
tert-Butylalcohol	NC	NC	NC	2.83E+03	5.54E+03	1.87E+03	1,871,906
n-Butylbenzene	NC	NA	NC	4.71E+02	NA	4.71E+02	471,414
sec-Butylbenzene	NC	NA	NC	4.71E+02	NA	4.71E+02	471,414
tert-Butylbenzene	NC	NC	NC	4.71E+02	1.88E+01	1.81E+01	18,090
Chloroethane	NC	NC	NC	8.08E+04	1.10E+05	4.65E+04	46,536,790
Dibromochloromethane	7.82E-01	9.70E-01	4.33E-01	1.89E+02	2.34E+02	1.04E+02	433
1,2-Dibromoethane	2.04E-02	3.00E-02	1.22E-02	8.49E+01	1.25E+02	5.05E+01	12
Dibromomethane	NC	NC	NC	9.43E+01	1.89E+02	6.29E+01	62,928
1,3-Dichlorobenzene	NC	NC	NC	2.83E+02	2.96E+01	2.68E+01	26,785
1,2-Dichloroethane	1.56E+00	2.53E+00	9.67E-01	5.66E+01	9.16E+01	3.50E+01	967
cis-1,2-Dichloroethene	NC	NC	NC	1.89E+01	1.19E+01	7.30E+00	7,299
1,2-Dichloropropane	2.04E+00	1.80E+00	9.57E-01	8.49E+02	7.47E+02	3.97E+02	957
2,2-Dichloropropane	NC	NC	NC	NC	NC	NC	NC
Ethanol	NC	NC	NC	NC	NC	NC	NC
Isopropylbenzene	NC	NC	NC	9.43E+02	6.65E+01	6.21E+01	62,140
p-Isopropyltoluene	NC	NC	NC	9.43E+02	3.76E+01	3.62E+01	36,181
Methylene chloride	5.25E+00	1.12E+01	3.57E+00	5.66E+01	1.21E+02	3.85E+01	3,575
n-Propylbenzene	NC	NC	NC	9.43E+02	6.35E+01	5.95E+01	59,536
Tetrachloroethene	1.36E-01	1.92E-02	1.68E-02	5.66E+01	7.98E+00	7.00E+00	17
Tert-amyl methyl ether	NC	NC	NC	NC	NC	NC	NC
Trichloroethene	4.15E+00	2.11E+00	1.40E+00	4.71E+00	2.39E+00	1.59E+00	1,399
1,2,4-Trimethylbenzene	NC	NC	NC	1.89E+01	1.39E+00	1.30E+00	1,297
1,3,5-Trimethylbenzene	NC	NC	NC	9.43E+01	9.61E+00	8.72E+00	8,720
PAHs*							
Acenaphthene	NC	NC	NC	5.66E+02	3.34E+01	3.16E+01	31,555
Acenaphthylene	NC	NC	NC	5.66E+02	2.69E+01	2.57E+01	25,707
Anthracene	NC	NC	NC	2.83E+03	8.66E+01	8.41E+01	84,072
Benz(a)anthracene	1.44E-01	NA	1.44E-01	2.83E+03	NA	2.83E+03	144
Benzo(g,h,i)perylene	NC	NA	NC	2.83E+02	NA	2.83E+02	282,848
Chrysene	1.44E+00	NA	1.44E+00	2.83E+02	NA	2.83E+02	1,442
Dibenz(a,h)anthracene	5.98E-03	NA	5.98E-03	2.83E+03	NA	2.83E+03	6.0
Dibenzofuran	NC	NC	NC	9.43E+00	4.49E-01	4.28E-01	428
Fluoranthene	NC	NA	NC	3.77E+02	NA	3.77E+02	377,131
Fluorene	NC	NC	NC	3.77E+02	1.61E+01	1.55E+01	15,458
Indeno(1,2,3-cd)pyrene	1.44E-01	NA	1.44E-01	2.83E+02	NA	2.83E+02	144.20
1-Methylnaphthalene	2.54E+00	1.50E-01	1.41E-01	6.60E+02	3.89E+01	3.68E+01	141
2-Methylnaphthalene	NC	NC	NC	3.77E+01	2.26E+00	2.13E+00	2,131
Naphthalene	NC	NC	NC	1.89E+02	2.43E+01	2.15E+01	21,545
Phenanthrene	NC	NA	NC	2.83E+03	NA	2.83E+03	2,828,484
Pyrene	NC	NC	NC	2.83E+02	5.24E+00	5.15E+00	5,146
Total Petroleum Hydrocarbons							
TPH Gasoline - aliphatic	NC	NC	NC	3.77E+02	4.80E+00	4.74E+00	4,736
TPH Gasoline - aromatic	NC	NC	NC	NA	NA	NA	NC
TPH Diesel - aliphatic	NC	NA	NC	9.43E+02	NA	9.43E+02	942,828
TPH Diesel - aromatic	NC	NC	NC	2.83E+02	3.34E+00	3.30E+00	3,298
TPH Motor Oil - aliphatic	NC	NA	NC	1.89E+04	NA	1.89E+04	18,856,560
TPH Motor Oil - aromatic	NC	NC	NC	2.83E+02	4.01E+00	3.95E+00	3,953

Notes:
NA = Not Applicable:
For lead, notificaiton thresholds were not calcualted; intertidal water not a source of drinking water, therefore drinking water standards do not apply.
For organic dermal exposures, octanol-water partition coefficient and molecular weight are outside "Effective Prediction Domain" (EPD).
NC = No Criteria
*Naphthalene has been identified as a carcinogen only via the inhalation pathway.

Table 4
Adolescent Wader Sediment Thresholds
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

CHEMICAL	Adolescent Wader (mg/kg)						Minimum Screening Level (mg/kg)
	Cancer Screening Level			Noncancer Screening Level			
	Ing	Dermal	Total	Ing	Dermal	Total	
Inorganics							
Lead	NA	NA	NA	NA	NA	NA	80
BTEX							
Benzene	3.60E+02	1.90E+01	1.81E+01	1.85E+04	9.75E+02	9.26E+02	18
Ethylbenzene	3.28E+03	1.73E+02	1.64E+02	4.62E+05	2.44E+04	2.31E+04	164
Toluene	NC	NC	NC	3.70E+05	1.95E+04	1.85E+04	18,516
Xylenes (total)	NC	NC	NC	9.24E+05	4.87E+04	4.63E+04	46,291
VOCs							
Biphenyl	4.50E+03	2.38E+02	2.26E+02	2.31E+05	1.22E+04	1.16E+04	226
Bromoform	3.28E+03	1.73E+02	1.64E+02	9.24E+04	4.87E+03	4.63E+03	164
tert-Butylalcohol	NC	NC	NC	1.39E+06	7.31E+04	6.94E+04	69,437
n-Butylbenzene	NC	NC	NC	2.31E+05	1.22E+04	1.16E+04	11,573
sec-Butylbenzene	NC	NC	NC	2.31E+05	1.22E+04	1.16E+04	11,573
tert-Butylbenzene	NC	NC	NC	2.31E+05	1.22E+04	1.16E+04	11,573
Chloroethane	NC	NC	NC	3.96E+07	2.09E+06	1.98E+06	1,983,907
Dibromochloromethane	3.83E+02	2.02E+01	1.92E+01	9.24E+04	4.87E+03	4.63E+03	19
1,2-Dibromoethane	1.00E+01	5.28E-01	5.01E-01	4.16E+04	2.19E+03	2.08E+03	0.50
Dibromomethane	NC	NC	NC	4.62E+04	2.44E+03	2.31E+03	2,315
1,3-Dichlorobenzene	NC	NC	NC	1.39E+05	7.31E+03	6.94E+03	6,944
1,2-Dichloroethane	7.67E+02	4.04E+01	3.84E+01	2.77E+04	1.46E+03	1.39E+03	38
cis-1,2-Dichloroethene	NC	NC	NC	9.24E+03	4.87E+02	4.63E+02	463
1,2-Dichloropropane	1.00E+03	5.28E+01	5.01E+01	4.16E+05	2.19E+04	2.08E+04	50
2,2-Dichloropropane	NC	NC	NC	NC	NC	NC	NC
Ethanol	NC	NC	NC	NC	NC	NC	NC
Isopropylbenzene	NC	NC	NC	4.62E+05	2.44E+04	2.31E+04	23,146
p-Isopropyltoluene	NC	NC	NC	4.62E+05	2.44E+04	2.31E+04	23,146
Methylene chloride	2.57E+03	1.36E+02	1.29E+02	2.77E+04	1.46E+03	1.39E+03	129
n-Propylbenzene	NC	NC	NC	4.62E+05	2.44E+04	2.31E+04	23,146
Tetrachloroethene	6.67E+01	3.52E+00	3.34E+00	2.77E+04	1.46E+03	1.39E+03	3.3
Tert-amyl methyl ether	NC	NC	NC	NC	NC	NC	NC
Trichloroethene	2.04E+03	1.07E+02	1.02E+02	2.31E+03	1.22E+02	1.16E+02	102
1,2,4-Trimethylbenzene	NC	NC	NC	9.24E+03	4.87E+02	4.63E+02	463
1,3,5-Trimethylbenzene	NC	NC	NC	4.62E+04	2.44E+03	2.31E+03	2,315
PAHs*							
Acenaphthene	NC	NC	NC	9.56E+05	1.12E+04	1.11E+04	11,115
Acenaphthylene	NC	NC	NC	9.56E+05	1.12E+04	1.11E+04	11,115
Anthracene	NC	NC	NC	4.78E+06	5.62E+04	5.56E+04	55,576
Benz(a)anthracene	2.44E+02	2.87E+00	2.83E+00	4.78E+06	5.62E+04	5.56E+04	2.8
Benzo(g,h,i)perylene	NC	NC	NC	4.78E+05	5.62E+03	5.56E+03	5,558
Chrysene	2.44E+03	2.87E+01	2.83E+01	4.78E+05	5.62E+03	5.56E+03	28
Dibenz(a,h)anthracene	1.01E+01	1.19E-01	1.17E-01	4.78E+06	5.62E+04	5.56E+04	0.12
Dibenzofuran	NC	NC	NC	4.62E+03	2.44E+02	2.31E+02	231
Fluoranthene	NC	NC	NC	6.37E+05	7.50E+03	7.41E+03	7,410
Fluorene	NC	NC	NC	6.37E+05	7.50E+03	7.41E+03	7,410
Indeno(1,2,3-cd)pyrene	2.44E+02	2.87E+00	2.83E+00	4.78E+05	5.62E+03	5.56E+03	2.8
1-Methylnaphthalene	4.28E+03	6.55E+01	6.45E+01	1.12E+06	1.71E+04	1.68E+04	65
2-Methylnaphthalene	NC	NC	NC	6.37E+04	9.75E+02	9.60E+02	960
Naphthalene	NC	NC	NC	3.19E+05	4.87E+03	4.80E+03	4,800
Phenanthrene	NC	NC	NC	4.78E+06	5.62E+04	5.56E+04	55,576
Pyrene	NC	NC	NC	4.78E+05	5.62E+03	5.56E+03	5,558
Total Petroleum Hydrocarbons							
TPH Gasoline - aliphatic	NC	NC	NC	1.85E+05	9.75E+03	9.26E+03	9,258
TPH Gasoline - aromatic	NC	NC	NC	NA	NA	NA	NC
TPH Diesel - aliphatic	NC	NC	NC	4.62E+05	2.44E+04	2.31E+04	23,146
TPH Diesel - aromatic	NC	NC	NC	1.39E+05	7.31E+03	6.94E+03	6,944
TPH Motor Oil - aliphatic	NC	NC	NC	9.24E+06	4.87E+05	4.63E+05	462,912
TPH Motor Oil - aromatic	NC	NC	NC	1.39E+05	7.31E+03	6.94E+03	6,944

Notes:
NA = Not Applicable
Screening level for lead is California Human Health Screening Level (CHHSL) for residential soil (Cal/EPA 2009a).
NC = No Criteria
*Naphthalene has been identified as a carcinogen only via the inhalation pathway.

Table 5
Summary of Exposure Parameters
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

Parameter	Acronym	Units	Adolescent Wader	Source
Incidental Ingestion of Tidal Area Surface Water				
Surface Water Ingestion Rate	IngR-sw	L/hour	0.049	USEPA 2011
Exposure Time	ET	hr/day	1	Site specific
Exposure Frequency - Tidal Water	EF	days/year	35	Site specific
Exposure Duration - Tidal Water	ED	years	10	Site specific and USEPA 2002
Dermal Contact with Tidal Area Surface Water				
Surface Area - water	SA-w	cm^2	3950	USEPA 2011; See note a for specifics
Event Frequency	EV	events/day	1	Site specific
Apparent thickness of stratum corneum	l_{sc}	cm	0.001	USEPA 2004a; used to estimate dermal dose for organics
Incidental Ingestion of Tidal Area Sediment				
Sediment Ingestion rate	IngR-sd	mg/day	100	USEPA 2002 and 2011
Fraction Soil Contaminated	FI	unitless	1	Health protective assumption
Exposure Frequency - Tidal Sediment	EF	days/year	35	Site specific
Exposure Duration - Tidal Sediment	ED	years	10	Site specific and USEPA 2002
Dermal Contact with Tidal Area Sediment				
Surface Area - Tidal Sediment	SA-sd	cm^2/day	3950	Same as water surface area
Adeherence Factor	AF	mg/cm^2	4.8	USEPA 2004a and 2011 (see note b)
Common Parameters				
Body Weight	BW	kg	44	USEPA 2011
Averaging Time, Carcinogen	$AT_{carcinogens}$	days	28470	Based on life expectancy (78 years; USEPA 2011)
Averaging Time, Noncarcinogen	$AT_{nonarcinogens}$	days	3650	Based on exposure duration
Conversion Factors				
Conversion Factor-1	CF	L/cm^3	0.001	
Conversion Factor-2	CF	kg/mg	1.00E-06	

Notes:

[a]Surface areas assumes hands, forearms, lower legs and feet for all receptors. Surface areas for adolescent wader is the average of USEPA 2011 individual age group values corresponding to the 6 to <16 year age ranges.

[b]Adherence factor for adolescent wader based on USEPA 2011 values for children playing in sediment (geometric mean soil loadings of 9 children [ages 7 to 12 years] playing in tidal flats.

Sources:

USEPA 2002 - Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites
USEPA 2004a - RAGS Volume 1 Part E
USEPA 2011 - Exposure Factors Handbook

Table 6
Summary of Chemical Specific Parameters
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

	Chemical Specific Exposure Parameters										
	Water-related Parameters				Organic Chemcial Dermal Dose Paramters						
CHEMICAL	Dermal Permeability Constant, Kp (cm/hr)	Source	MW	Source	USEPA RAGS Part E Eq A1: "B" (unitless)	USEPA RAGS Part E Eq A3: Dsc/lsc	USEPA RAGS Part E Eq A4: Lag time per event (hr/event)	USEPA RAGS Part E Eq A.5-A.6: Time to Steady State (hr/event)	USEPA RAGS Part E Eq A.7: Correlation Coeff, b	USEPA RAGS Part E Eq A.8: Correlation Coeff, c	USEPA RAGS Part E: Fraction Absorbed (FA; unitless)
Inorganics											
Lead	1.00E-04	USEPA RSL (RAGSE)									
BTEX											
Benzene	1.49E-02	USEPA RSL (EPI)	78.11	USEPA RSL (EPI)	5.06E-02	5.71E-04	2.92E-01	7.01E-01	3.35E-01	3.68E-01	1.00E+00
Ethylbenzene	4.93E-02	USEPA RSL (EPI)	106.17	USEPA RSL (EPI)	1.95E-01	3.97E-04	4.19E-01	1.01E+00	4.35E-01	4.74E-01	1.00E+00
Toluene	3.11E-02	USEPA RSL (EPI)	92.14	USEPA RSL (EPI)	1.15E-01	4.76E-04	3.50E-01	8.40E-01	3.77E-01	4.14E-01	1.00E+00
Xylenes (total)	*4.71E-02*	*o-xylene (USEPA RSL, EPI)*	106.17	USEPA RSL (EPI)	1.87E-01	3.97E-04	4.19E-01	1.01E+00	4.29E-01	4.68E-01	1.00E+00
VOCs											
Biphenyl	9.43E-02	USEPA RSL (EPI)	154.21	USEPA RSL (EPI)	4.50E-01	2.14E-04	7.80E-01	1.87E+00	6.59E-01	6.80E-01	1.00E+00
Bromoform	2.35E-03	USEPA RSL (EPI)	252.73	USEPA RSL (EPI)	1.44E-02	5.98E-05	2.79E+00	6.69E+00	3.12E-01	3.43E-01	1.00E+00
tert-Butylalcohol	1.06E-03	Calculated	74.12	HSDB	3.52E-03	6.01E-04	2.77E-01	6.65E-01	3.05E-01	3.36E-01	1.00E+00
n-Butylbenzene	2.25E-01	USEPA RSL (EPI)	134.22	USEPA RSL (EPI)	1.00E+00	2.77E-04	6.03E-01	2.33E+00	1.38E+00	1.17E+00	1.00E+00
sec-Butylbenzene	2.91E-01	Calculated	134.22	USEPA Region IX	1.30E+00	2.77E-04	6.03E-01	2.37E+00	1.92E+00	1.44E+00	1.00E+00
tert-Butylbenzene	1.45E-01	Calculated	134.22	USEPA Region IX	6.46E-01	2.77E-04	6.03E-01	2.38E+00	8.76E-01	8.48E-01	1.00E+00
Chloroethane	6.07E-03	USEPA RSL (EPI)	64.52	USEPA RSL (EPI)	1.88E-02	6.81E-04	2.45E-01	5.88E-01	3.15E-01	3.46E-01	1.00E+00
Dibromochloromethane	2.89E-03	USEPA RSL (EPI)	208.28	USEPA RSL (EPI)	1.60E-02	1.06E-04	1.57E+00	3.77E+00	3.13E-01	3.44E-01	1.00E+00
1,2-Dibromoethane	2.78E-03	USEPA RSL (EPI)	187.86	USEPA RSL (EPI)	1.47E-02	1.38E-04	1.21E+00	2.89E+00	3.12E-01	3.43E-01	1.00E+00
Dibromomethane	2.23E-03	USEPA RSL (EPI)	173.84	USEPA RSL (EPI)	1.13E-02	1.66E-04	1.01E+00	2.41E+00	3.10E-01	3.41E-01	1.00E+00
1,3-Dichlorobenzene	5.09E-02	Calculated	147.00	USEPA Region IX	2.37E-01	2.34E-04	7.11E-01	1.71E+00	4.68E-01	5.07E-01	1.00E+00
1,2-Dichloroethane	4.20E-03	USEPA RSL (EPI)	98.96	USEPA RSL (EPI)	1.61E-02	4.36E-04	3.82E-01	9.17E-01	3.13E-01	3.44E-01	1.00E+00
cis-1,2-Dichloroethene	1.10E-02	USEPA RSL (EPI)	96.94	USEPA RSL (EPI)	4.17E-02	4.48E-04	3.72E-01	8.94E-01	3.29E-01	3.62E-01	1.00E+00
1,2-Dichloropropane	7.53E-03	USEPA RSL (EPI)	112.99	USEPA RSL (EPI)	3.08E-02	3.64E-04	4.58E-01	1.10E+00	3.22E-01	3.54E-01	1.00E+00
2,2-Dichloropropane	7.53E-03	1,2-Dichloropropane (USEPA RSL EPI)	112.99	HSDB	3.08E-02	3.64E-04	4.58E-01	1.10E+00	3.22E-01	3.54E-01	1.00E+00
Ethanol	5.46E-04	Calculated	46.07	HSDB	1.43E-03	8.64E-04	1.93E-01	4.63E-01	3.04E-01	3.34E-01	1.00E+00
Isopropylbenzene	8.97E-02	USEPA RSL (EPI)	120.20	USEPA RSL (EPI)	3.78E-01	3.31E-04	5.03E-01	1.21E+00	5.89E-01	6.20E-01	1.00E+00
p-Isopropyltoluene	1.45E-01	Calculated	134.22	HSDB	6.46E-01	2.77E-04	6.03E-01	2.38E+00	8.76E-01	8.48E-01	1.00E+00
Methylene chloride	3.54E-03	USEPA RSL (EPI)	84.93	USEPA RSL (EPI)	1.25E-02	5.23E-04	3.19E-01	7.65E-01	3.11E-01	3.42E-01	1.00E+00
n-Propylbenzene	9.39E-02	USEPA RSL (EPI)	120.20	USEPA RSL (EPI)	3.96E-01	3.31E-04	5.03E-01	1.21E+00	6.06E-01	6.35E-01	1.00E+00
Tetrachloroethene	3.34E-02	USEPA RSL (EPI)	165.83	USEPA RSL (EPI)	1.65E-01	1.84E-04	9.07E-01	2.18E+00	4.13E-01	4.51E-01	1.00E+00
Tert-amyl methyl ether	4.48E-03	Calculated	102.17	HSDB	1.74E-02	4.18E-04	3.98E-01	9.56E-01	3.14E-01	3.45E-01	1.00E+00
Trichloroethene	1.16E-02	USEPA RSL (EPI)	131.39	USEPA RSL (EPI)	5.11E-02	2.87E-04	5.81E-01	1.39E+00	3.35E-01	3.68E-01	1.00E+00
1,2,4-Trimethylbenzene	8.57E-02	USEPA RSL (EPI)	120.20	USEPA RSL (EPI)	3.61E-01	3.31E-04	5.03E-01	1.21E+00	5.74E-01	6.06E-01	1.00E+00
1,3,5-Trimethylbenzene	6.21E-02	USEPA RSL (EPI)	120.20	USEPA RSL (EPI)	2.62E-01	3.31E-04	5.03E-01	1.21E+00	4.88E-01	5.26E-01	1.00E+00
PAHs											
Acenaphthene	8.60E-02	USEPA RSL (EPI)	154.21	USEPA RSL (EPI)	4.11E-01	2.14E-04	7.80E-01	1.87E+00	6.20E-01	6.47E-01	1.00E+00
Acenaphthylene	1.08E-01	Calculated	152.20	HSDB	5.13E-01	2.19E-04	7.60E-01	1.82E+00	7.24E-01	7.33E-01	1.00E+00
Anthracene	1.42E-01	USEPA RSL (EPI)	178.24	USEPA RSL (EPI)	7.29E-01	1.57E-04	1.06E+00	4.12E+00	9.82E-01	9.22E-01	1.00E+00
Benz(a)anthracene	5.52E-01	USEPA RSL (EPI)	228.30	USEPA RSL (EPI)	3.21E+00	8.20E-05	2.03E+00	8.63E+00	7.99E+00	3.29E+00	1.00E+00
Benzo(g,h,i)perylene	1.07E+00	Calculated	276.34	HSDB	6.82E+00	4.41E-05	3.78E+00	1.69E+01	3.21E+01	6.87E+00	1.00E+00
Chrysene	5.96E-01	USEPA RSL (EPI)	228.30	USEPA RSL (EPI)	3.46E+00	8.20E-05	2.03E+00	8.69E+00	9.15E+00	3.54E+00	1.00E+00
Dibenz(a,h)anthracene	9.53E-01	USEPA RSL (EPI)	278.36	USEPA RSL (EPI)	6.12E+00	4.29E-05	3.88E+00	1.72E+01	2.61E+01	6.16E+00	6.00E-01
Dibenzofuran	9.75E-02	USEPA RSL (EPI)	168.20	USEPA RSL (EPI)	4.86E-01	1.78E-04	9.35E-01	2.24E+00	6.96E-01	7.11E-01	1.00E+00
Fluoranthene	3.08E-01	USEPA RSL (EPI)	202.26	USEPA RSL (EPI)	1.68E+00	1.15E-04	1.45E+00	5.83E+00	2.78E+00	1.81E+00	1.00E+00
Fluorene	1.10E-01	USEPA RSL (EPI)	166.22	USEPA RSL (EPI)	5.45E-01	1.83E-04	9.11E-01	2.19E+00	7.59E-01	7.61E-01	1.00E+00
Indeno(1,2,3-cd)pyrene	1.24E+00	USEPA RSL (USPEA RAGS E)	276.34	USEPA RSL (EPI)	7.93E+00	4.41E-05	3.78E+00	1.70E+01	4.28E+01	7.97E+00	6.00E-01
1-Methylnaphthalene	9.31E-02	*USEPA RSL (EPI)*	*142.20*	*USEPA RSL (EPI)*	*4.27E-01*	*2.49E-04*	*6.68E-01*	*1.60E+00*	*6.36E-01*	*6.61E-01*	*1.00E+00*
2-Methylnaphthalene	9.17E-02	*USEPA RSL (EPI)*	*142.20*	*USEPA RSL (EPI)*	*4.21E-01*	*2.49E-04*	*6.68E-01*	*1.60E+00*	*6.30E-01*	*6.55E-01*	*1.00E+00*
Naphthalene	4.66E-02	USEPA RSL (EPI)	128.18	USEPA RSL (EPI)	2.03E-01	2.99E-04	5.57E-01	1.34E+00	4.41E-01	4.80E-01	1.00E+00
Phenanthrene	1.44E-01	USEPA RAGS Part E	178.22	HSDB	7.39E-01	1.57E-04	1.06E+00	4.11E+00	9.95E-01	9.31E-01	1.00E+00
Pyrene	2.01E-01	USEPA RSL (EPI)	202.26	USEPA RSL (EPI)	1.10E+00	1.15E-04	1.45E+00	5.63E+00	1.55E+00	1.26E+00	1.00E+00

Table 6
Summary of Chemical Specific Parameters
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

	Chemical Specific Exposure Parameters										
	Water-related Parameters				Organic Chemcial Dermal Dose Paramters						
CHEMICAL	Dermal Permeability Constant, Kp (cm/hr)	Source	MW	Source	USEPA RAGS Part E Eq A1: "B" (unitless)	USEPA RAGS Part E Eq A3: Dsc/Isc	USEPA RAGS Part E Eq A4: Lag time per event (hr/event)	USEPA RAGS Part E Eq A.5-A.6: Time to Steady State (hr/event)	USEPA RAGS Part E Eq A.7: Correlation Coeff, b	USEPA RAGS Part E Eq A.8: Correlation Coeff, c	USEPA RAGS Part E: Fraction Absorbed (FA; unitless)
Total Petroleum Hydrocarbons											
TPH Gasoline - aliphatic	5.54E-01	Calculated	103.67	TPHCWG Vol 3 (Average C5-C10)	2.17E+00	4.10E-04	4.06E-01	1.67E+00	4.12E+00	2.27E+00	1.00E+00
TPH Gasoline - aromatic	6.20E-02	Calculated	96.67	TPHCWG Vol 3 (Average C5-C10)	2.35E-01	4.49E-04	3.71E-01	8.90E-01	4.66E-01	5.05E-01	1.00E+00
TPH Diesel - aliphatic	1.94E+01	Calculated	210.00	TPHCWG Vol 3 (Average C10-C21)	1.08E+02	1.04E-04	1.60E+00	7.53E+00	7.48E+03	1.08E+02	1.00E+00
TPH Diesel - aromatic	4.24E-01	Calculated	156.67	TPHCWG Vol 3 (Average C10-C21)	2.04E+00	2.07E-04	8.06E-01	3.29E+00	3.74E+00	2.15E+00	1.00E+00
TPH Motor Oil - aliphatic	2.38E+01	Calculated	210.00	TPH Diesel - aliphatic (TPHCWG Vol 3)	1.33E+02	1.04E-04	1.60E+00	7.54E+00	1.13E+04	1.33E+02	1.00E+00
TPH Motor Oil - aromatic	2.06E-01	Calculated	240.00	TPHCWG Vol 3 (C21-C35)	1.23E+00	7.05E-05	2.36E+00	9.24E+00	1.78E+00	1.38E+00	1.00E+00

Sources:
Calculated - See Attachment 2
HSDB = Hazardous Substances Data Bank (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB)
Magee et al. 1996 = Absorption adjustment factor (AAF) distributions for polycyclic aromatic hydrocarbons (PAHs)
OEHHA = Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (Cal/EPA 2005)
TPHCWG Vol 3 = Total Petroleum Hydrocarbon Criteria Working Group Volume 3 (TPHCWG 1997)
USEPA RSLs = USEPA Regional Screening Levels (USEPA 2012a)
EPI = Estimation Program Interface Suite
USEPA RAGS Part E = Risk Assessment Guidance for Superfund (RAGS), Vol. I, Part E (Supplemental Guidance for Dermal Risk Assessment; USEPA 2004a)
USEPA Region IX = Region IX PRGs (USEPA 2004b)

Table 6
Summary of Chemical Specific Parameters
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

CHEMICAL	Sediment-related Parameters			
	Ingestion Bioavailability Factor	Source	Dermal Absorbtion Coefficient	Source
Inorganics				
Lead	1	default	0.010	OEHHA
BTEX				
Benzene	1	default	0.10	OEHHA
Ethylbenzene	1	default	0.10	OEHHA
Toluene	1	default	0.10	OEHHA
Xylenes (total)	1	default	0.10	OEHHA
VOCs				
Biphenyl	1	default	0.1	Other VOCs (OEHHA)
Bromoform	1	default	*0.1*	*Other VOCs (OEHHA)*
tert-Butylalcohol	1	default	*0.10*	*Other VOCs (OEHHA)*
n-Butylbenzene	1	default	*0.10*	*Other VOCs (OEHHA)*
sec-Butylbenzene	1	default	*0.10*	*Other VOCs (OEHHA)*
tert-Butylbenzene	1	default	*0.10*	*Other VOCs (OEHHA)*
Chloroethane	1	default	*0.10*	*Other VOCs (OEHHA)*
Dibromochloromethane	1	default	*0.1*	*Other VOCs (OEHHA)*
1,2-Dibromoethane	1	default	0.10	Other VOCs (OEHHA)
Dibromomethane	1	default	0.1	Other VOCs (OEHHA)
1,3-Dichlorobenzene	1	default	*0.1*	*Other VOCs (OEHHA)*
1,2-Dichloroethane	1	default	0.10	OEHHA
cis-1,2-Dichloroethene	1	default	0.10	OEHHA
1,2-Dichloropropane	1	default	0.10	Other VOCs (OEHHA)
2,2-Dichloropropane	1	default	0.10	Other VOCs (OEHHA)
Ethanol	1	default	*0.1*	*Other VOCs (OEHHA)*
Isopropylbenzene	1	default	*0.10*	*Other VOCs (OEHHA)*
p-Isopropyltoluene	1	default	*0.10*	*Other VOCs (OEHHA)*
Methylene chloride	1	default	*0.10*	*Other VOCs (OEHHA)*
n-Propylbenzene	1	default	*0.10*	*Other VOCs (OEHHA)*
Tetrachloroethene	1	default	*0.10*	*OEHHA*
Tert-amyl methyl ether	1	default	0.10	Other VOCs (OEHHA)
Trichloroethene	1	default	0.10	OEHHA
1,2,4-Trimethylbenzene	1	default	0.10	Other VOCs (OEHHA)
1,3,5-Trimethylbenzene	1	default	*0.10*	*Other VOCs (OEHHA)*
PAHs				
Acenaphthene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Acenaphthylene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Anthracene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Benz(a)anthracene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Benzo(g,h,i)perylene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Chrysene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Dibenz(a,h)anthracene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Dibenzofuran	1	default	0.10	USEPA RAGS Part E (SVOCs)
Fluoranthene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Fluorene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Indeno(1,2,3-cd)pyrene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
1-Methylnaphthalene	0.29	Magee et al. 1996	*0.10*	*Naphth (OEHHA)*
2-Methylnaphthalene	0.29	Magee et al. 1996	*0.10*	*Naphth (OEHHA)*
Naphthalene	0.29	Magee et al. 1996	0.10	OEHHA
Phenanthrene	0.29	Magee et al. 1996	*0.13*	*BaP (OEHHA)*
Pyrene	0.29	Magee et al. 1996	0.13	*BaP (OEHHA)*

Table 6
Summary of Chemical Specific Parameters
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

CHEMICAL	Sediment-related Parameters			
	Ingestion Bioavailability Factor	Source	Dermal Absorbtion Coefficient	Source
Total Petroleum Hydrocarb				
TPH Gasoline - aliphatic	1	default	0.10	Other VOCs (OEHHA)
TPH Gasoline - aromatic	1	default	0.10	Other VOCs (OEHHA)
TPH Diesel - aliphatic	1	default	0.10	SVOCs (USEPA RAGS Part E)
TPH Diesel - aromatic	1	default	0.10	SVOCs (USEPA RAGS Part E)
TPH Motor Oil - aliphatic	1	default	0.10	SVOCs (USEPA RAGS Part E)
TPH Motor Oil - aromatic	1	default	0.10	SVOCs (USEPA RAGS Part E)

Table 7
Dose Response Values for Chemicals of Potential Concern
Intertidal Area Adjacent to Former Avila Tank Farm
Avila Beach, CA

	Cancer Slope Factors (CSF)				Noncancer Reference Doses (RfD)			
CHEMICAL	Oral CSF (mg/kg-day)$^{-1}$	Source	Dermal CSF (mg/kg-day)$^{-1}$	GIABS	Oral RfD (mg/kg-day)	Source	Dermal RfD (mg/kg-day)	GIABS
Inorganics								
Lead	NA		NA		NA		NA	
BTEX								
Benzene	1.00E-01	Cal/EPA	1.00E-01	1.0	4.00E-03	OEHHA* (IRIS)	4.00E-03	1.0
Ethylbenzene	1.10E-02	Cal/EPA	1.10E-02	1.0	1.00E-01	OEHHA (IRIS)	1.00E-01	1.0
Toluene	NC	IRIS	NC		8.00E-02	IRIS	8.00E-02	1.0
Xylenes (total)	NC	IRIS	NC		2.00E-01	IRIS	2.00E-01	1.0
VOCs								
Biphenyl	8.00E-03	USEPA RSL (PPRTV App)	8.00E-03	1.0	5.00E-02	IRIS	5.00E-02	1.0
Bromoform	1.10E-02	Cal/EPA	1.10E-02	1.0	2.00E-02	IRIS	2.00E-02	1.0
tert-Butylalcohol	NC		NC		*3.00E-01*	*(MTBE, TERA)*	*3.00E-01*	1.0
n-Butylbenzene	NC		NC		5.00E-02	USEPA RSL (PPRTV)	5.00E-02	1.0
sec-Butylbenzene	NC		NC		*5.00E-02*	*n-Butylbenzene (USEPA RSL, PPRTV)*	*5.00E-02*	1.0
tert-Butylbenzene	NC		NC		*5.00E-02*	*n-Butylbenzene (USEPA RSL, PPRTV)*	*5.00E-02*	1.0
Chloroethane	NC	Cal/EPA	NC		8.57E+00	r (converted; Cal/EPA)	8.57E+00	1.0
Dibromochloromethane	9.40E-02	Cal/EPA	9.40E-02	1.0	2.00E-02	IRIS	2.00E-02	1.0
1,2-Dibromoethane	3.60E+00	Cal/EPA	3.60E+00	1.0	9.00E-03	IRIS	9.00E-03	1.0
Dibromomethane	NC		NC		1.00E-02	USEPA RSL (HEAST)	1.00E-02	1.0
1,3-Dichlorobenzene	NC	IRIS	NC		3.00E-02	USEPA Region IX (NCEA) per HHRA Note 3	3.00E-02	1.0
1,2-Dichloroethane	4.70E-02	Cal/EPA	4.70E-02	1.0	6.00E-03	USEPA RSL (PPRTV App)	6.00E-03	1.0
cis-1,2-Dichloroethene	NC	IRIS	NC		2.00E-03	IRIS	2.00E-03	1.0
1,2-Dichloropropane	3.60E-02	Cal/EPA	3.60E-02	1.0	9.00E-02	USEPA RSL (ATSDR)	9.00E-02	1.0
2,2-Dichloropropane	NC		NC		NC		NC	
Ethanol	NC		NC		NC		NC	
Isopropylbenzene	NC	IRIS	NC		1.00E-01	IRIS	1.00E-01	1.0
p-Isopropyltoluene	NC		NC		1.00E-01	*Isopropylbenzene (IRIS)*	1.00E-01	1.0
Methylene chloride	1.40E-02	Cal/EPA	1.40E-02	1.0	6.00E-03	IRIS	6.00E-03	1.0
n-Propylbenzene	NC		NC		1.00E-01	USEPA RSL (PPRTV App)	1.00E-01	1.0
Tetrachloroethene	5.40E-01	Cal/EPA	5.40E-01	1.0	6.00E-03	OEHHA (IRIS)	6.00E-03	1.0
Tert-amyl methyl ether	NC		NC		NC		NC	
Trichloroethene	5.90E-03	Cal/EPA	5.90E-03	1.0	5.00E-04	IRIS	5.00E-04	1.0
1,2,4-Trimethylbenzene	NC		NC		2.00E-03	r (converted; USEPA RSL, PPRTV)	2.00E-03	1.0
1,3,5-Trimethylbenzene	NC		NC		1.00E-02	USEPA RSL (PPRTV App)	1.00E-02	1.0
PAHs								
Acenaphthene	NC	IRIS	NC		6.00E-02	IRIS	6.00E-02	1.0
Acenaphthylene	NC	IRIS	NC		*6.00E-02*	*Ace (IRIS)*	*6.00E-02*	1.0
Anthracene	NC	IRIS	NC		3.00E-01	IRIS	3.00E-01	1.0
Benz(a)anthracene	1.70E-01	BaP*PEF (Cal/EPA)	1.70E-01	1.0	*3.00E-01*	*Anth (IRIS)*	3.00E-01	1.0
Benzo(g,h,i)perylene	NC	IRIS	NC	1.0	*3.00E-02*	*Pyrene (IRIS)*	3.00E-02	1.0
Chrysene	1.70E-02	BaP*PEF (Cal/EPA)	1.70E-02	1.0	*3.00E-02*	*Pyrene (IRIS)*	*3.00E-02*	1.0
Dibenz(a,h)anthracene	4.10E+00	Cal/EPA	4.10E+00	1.0	*3.00E-01*	*Anth (IRIS)*	3.00E-01	1.0
Dibenzofuran	NC	IRIS	NC		1.00E-03	USEPA RSL (PPRTV App)	1.00E-03	1.0
Fluoranthene	NC	IRIS	NC		4.00E-02	IRIS	4.00E-02	1.0
Fluorene	NC	IRIS	NC		4.00E-02	IRIS	4.00E-02	1.0
Indeno(1,2,3-cd)pyrene	1.70E-01	BaP*PEF (Cal/EPA)	1.70E-01	1.0	*3.00E-02*	*Pyrene (IRIS)*	3.00E-02	1.0
1-Methylnaphthalene	2.90E-02	USEPA RSL (PPRTV)	2.90E-02	1.0	7.00E-02	*USEPA RSL (ATSDR)*	7.00E-02	1.0
2-Methylnaphthalene	NC	IRIS	NC		4.00E-03	IRIS	4.00E-03	1.0
Naphthalene	NC	Cal/EPA	NC		2.00E-02	OEHHA (IRIS)	2.00E-02	1.0
Phenanthrene	NC	IRIS	NC		*3.00E-01*	*Anth (IRIS)*	*3.00E-01*	1.0
Pyrene	NC	IRIS	NC		3.00E-02	IRIS	3.00E-02	1.0
Total Petroleum Hydrocarbons								
TPH Gasoline - aliphatic	NC	DTSC	NC	1.0	4.00E-02	DTSC	4.00E-02	1.0
TPH Gasoline - aromatic	NC	DTSC	NC	1.0	NA	DTSC - evaluate COPCs	NA	1.0
TPH Diesel - aliphatic	NC	DTSC	NC	1.0	1.00E-01	DTSC	1.00E-01	1.0
TPH Diesel - aromatic	NC	DTSC	NC	1.0	3.00E-02	DTSC - if naphthlenes evaluated individually	3.00E-02	1.0
TPH Motor Oil - aliphatic	NC	DTSC	NC	1.0	2.00E+00	DTSC	2.00E+00	1.0
TPH Motor Oil - aromatic	NC	DTSC	NC	1.0	3.00E-02	DTSC	3.00E-02	1.0

NC = No Criteria
*OEHHA (Cal/EPA 2005b) cites IRIS as the source of benzene oral reference dose - but reports 3E-03 instead of 4E-03

Sources:
Cal/EPA = California Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database (Cal/EPA 2012a)
OEHHA = Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil (Cal/EPA 2005)
DTSC = Evaluating Human Health Risks from Total Petroleum Hydrocarbons, Interim Guidance (Cal/EPA 2009a)
IRIS = USEPA's Integrated Risk Information System (USEPA 2012b)
USEPA RSLs = USEPA Regions 3, 6, and 9 Regional Screening Levels (USEPA 2012a)
PPRTV = Provisional Peer Reviewed Toxicity Value as cited by USEPA RSLs
PPRTV App = Appendix to the Provisional Peer Reviewed Toxicity Value as cited by USEPA RSLs
r = route extrapolation
HHRA Note 3 = DTSC Human Health Risk Assessment Note Number 3 (Cal/EPA 2012c)
USEPA Region IX (NCEA) per HHRA Note 3 = DTSC Human Health Risk Assessment Note Number 3 (Cal/EPA 2012c)
TERA = Toxicology Excellence for Risk Assessment database (http://iter.ctcnet.net/publicurl/pub_level3.cfm?crn=1634%2D04%2D4&org=RIVM&type=NCO)
Italics indicate criteria for surrogate compound applied.

ATTACHMENTS

ATTACHMENT 1

Avila Tidal Area Air Sampling Work Plan

McDaniel Lambert

1608 Pacific Avenue
Suite 201
Venice, CA 90291
www.mclam.com

June 5, 2012

Rik Williams
A&R Project Engineer and Manager
Chevron Environment Management Company
276 Tank Farm Road - San Luis Obispo CA 93401

Subject: ***Avila Tidal Area Air Sampling Work Plan***

Dear Rik,
Per your request, McDaniel Lambert has completed a DRAFT Air Sampling Work Plan for the tidal area below the cliff face of the former Union Oil Avila Beach Tank Farm where a sheen was observed in one tidal pool on May 8, 2012.

Background
On May 8, 2012, a small amount of sheen was observed in a tidal area immediately below the cliff face of the former Union Oil Avila Beach Tank Farm (Figure 1). The source of this sheen has not yet been identified. In addition to the sheen, a petroleum hydrocarbon odor was noted in the area. Analysis of water collected from the tidal pool where the sheen was observed (IZ-3 in Figure 2) indicated the presence of volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes (BTEX), naphthalene, and gasoline-range total petroleum hydrocarbons (TPHg), which are consistent with a light fuel material (McDaniel Lambert 2012). The tidal pools are exposed for approximately two to three hours during negative low tides greater than -1.00 feet, and for shorter periods in the days/nights preceding and following these peak negative tides (McDaniel Lambert 2012). On recent negative tides the tidal pools were covered in sand and no sheen was present (Louis Cappel, Padre - personal communication May 30, 2012). On a visit to the tidal area on May 24th, although no sheen was observed, the San Luis Obispo Air Pollution Control District (SLOAPCD) noted an intermittent "gasoline type odor" (SLOAPCD 2012a). After the visit the SLOAPCD proposed that area air sampling be undertaken and submitted a draft air sampling and analysis plan for further discussion (SLOAPCD 2012b).

The current work plan was developed at the request of Chevron Environmental Management Company (CEMC) to address the APCD request that air sampling be conducted in the tidal area to determine the frequency and magnitude of any potential air impacts.

Work Plan Objectives

1) Comply with APCD request to conduct air sampling at the tidal area below the Former Avila Tank Farm
2) Determine frequency and magnitude of any potential air impacts
3) Gather sufficient air data to make any necessary risk management decisions and determine if longer-term sampling is needed

Site Description

The former Union Oil Avila Tank Farm, acquired by Chevron Corporation in 2005, is located on the Central Coast of California, directly east of the community of Avila Beach, California, in an unincorporated portion of San Luis Obispo County. The site encompasses approximately 95 acres and is bordered by the community of Avila Beach to the west, the San Luis Creek and a golf course to the north, open space to the east, and the Pacific Ocean to the South. The site served as a petroleum storage and distribution facility, pump station, and crude oil refinery, with some operations continuing into the late 1990s. The last storage tanks were removed from operation in the late 1990s. Petroleum handled at the Avila facility entered or left through one of three pipeline corridors (eastern, northern, and Front Street corridors) or via trucks loading gasoline or diesel fuel for market at the truck loading rack. Though the source of the tidal pool sheen has not been identified, the tidal area in question is directly below former Tank No. 201104 (see Figure 2). A recently completed investigation indicated a localized, roughly circular area of fuel-related petroleum hydrocarbon impacted soil/bedrock approximately 90 feet in diameter beneath former Tank No. 201104. The petroleum hydrocarbons encountered in soil/bedrock in this area included elevated concentrations of TPH in the C4-C10 carbon range ("TPHg") and BTEX. The impacts to soil/bedrock identified in this area start at shallow depths of approximately 5 feet below ground surface (ft bgs) and extends to a maximum depth of approximately 45 ft bgs. Additionally, fuel-related impacts to groundwater (encountered at approximately 100 ft bgs) also have been identified at this location (Padre 2012).

Previous Avila Air Sampling and Human Health Risk Assessment Activities

Previous reports that have included air monitoring at either the town of Avila Beach and/or the former Tank Farm include:

1. *Avila Beach Health Study*
   Risk Science Associates (on behalf of San Luis Obispo County Environmental Health Services [SLO EHS]), April 22, 1998
2. *Human Health Risk Assessment Remediation Phase, Avila Beach, California*
   SOMA Corporation (on behalf of SLO EHS), October 12, 2000
3. *Avila Beach Remediation Community Monitoring Program Results*
   Applied Measurement Science (AMS), July 2001

Based on results of the town of Avila Beach health risk assessments identified above (Risk Science Associates 1998; SOMA 2000), the weight-of-the-evidence indicates that there were no significant health risks to the community of Avila from potentially-impacted air associated with

the former Tank Farm and/or the extensive soil contamination that existed in the town at the time of the assessments. Both the SOMA 2000 risk assessment and the comprehensive AMS 2001 Monitoring Report indicated that there were no significant concentrations of chemicals released into the air by the extensive remediation of this contaminated soil, and that the background air quality in the town of Avila Beach and at the Tank Farm was comparable to other small coastal towns (AMS 2001; SOMA 2000).

SOMA determined that most of the air risk associated with the remediation was associated with the use of diesel powered remediation equipment. Air quality at the Avila Tank Farm area was evaluated during two sampling events conducted prior to the start of the main Avila excavation project in 1999 as part of the air quality report for the Avila Beach excavation. The data collected in these studies showed that the air quality at the Avila Tank Farm was substantially unaffected by the emissions from developed areas in the region (AMS 2001; SOMA 2000).

Proposed Tidal Area Air Sampling Work Plan

Ambient Air Sample Locations

Concurrent tidal area and background location ambient air samples will be collected. The proposed initial sample locations are shown in Figure 3, and include three locations in the tidal area near the tidal pool where sheen was observed (IZ-3) and extending west towards the location of former Tank No. 201104. Three background samples will be collected to the west of the tidal area and cliff springs, along the beach area closer to the town of Avila Beach (see Figure 4). Samples will be collected at approximately 2 feet above the sand or ground surface.

Collection of Samples

Ambient air samples will be collected in individually 100% laboratory-certified 6-L Summa canisters provided by H&P, Inc. Air samples will be collected over an approximate 40 minute period. The fill time of each canister will be recorded by the sampling personnel on-site observing the summa canisters. The orifice included with the summa canister will be set to flow at a rate not faster than 150 mL/min (which will result in 6000 mL collected at 150 mL/min over the 40 minute sampling period). The SUMMA canister/flow regulator assembly will be set on a crate approximately 2 feet above the ground surface. The initial SUMMA vacuum reading (typically around -29 inches of mercury), canister serial numbers, and air sample ID will be recorded prior to opening the valve and initiating sample collection. The valve to the SUMMA canisters will be opened and sampling will continue until vacuum remaining in each SUMMA canister will approach approximately -2 inches of mercury. Upon completion of sampling, the valves to the SUMMA canister will be closed, the final vacuum and sample time will be recorded, and the SUMMA canister will be sealed, labeled, and secured for transportation. In addition to the six air samples collected during each sampling event, the following quality assurance/quality control (QA/QC) samples will be included: one duplicate sample and one trip blank sample. All SUMMA canisters will be submitted to H&P for analyses following standard chain of custody procedures.

The following details will be recorded for each sample:

- Sample location (including sketch, photograph, and GPS coordinates)
- Wind speed and direction
- Temperature
- Canister identification number
- Air sample ID
- Initial canister vacuum
- Time and date sample collection begins and ends
- Final canister vacuum

Chemicals of Potential Concern (COPCs)

Based on the chemicals detected in the tidal pool water sample where sheen was observed (IZ-3), the observation of odor consistent with gasoline, and the fact that no heavier types of petroleum have been detected in the area, the focus of this initial monitoring effort will be on the potentially petroleum-related VOCs including naphthalene. This gasoline-range VOC focus is consistent with soil data associated with a potential source, the nearby former Tank No. 201104. It is unlikely that hydrogen sulfide is present in the tide pool area – its odor has not been observed and it is typically associated with heavier sulfur-containing petroleum streams (e.g. crude oil). Additionally, extensive data collected over a two year period during remediation activities in the Town of Avila indicated that significant hydrogen sulfide was not present in any of the petroleum-impacted areas in Avila (AMS 2001). Naphthalene was the only semivolatile organic compound (SVOC) detected in the IZ-3 tidal pool water sample, and these chemicals are unlikely to be significant air contaminants (McDaniel Lambert 2012).[1]

Sample Analysis

The air samples will be analyzed for H&P, Inc.'s full list of analytes (82 chemicals) for the United States Environmental Protection Agency's TO-15/TO-15 SIM (selective ion monitoring) method, which includes chlorinated VOCs unlikely to be related to petroleum. The list of chemicals to be analyzed, as well as lowest reporting limits [RLs] achievable by H&P Inc., are included in Attachment 1. The town of Avila Beach background values and H&P, Inc. RLs for selected potentially petroleum-related COPCs are shown below in Table 1.

Sampling Frequency

Sampling will be conducted only during negative low tides greater than -0.50 feet, when it is safe for people to access the area. The first round of sampling will include no less than four separate sampling events in June, July, and August 2012, as the tides permit. The need for additional sampling will be assessed based on the initial results as well as any concerns regarding potential seasonal variability and/or conditions observed during the initial four events.

[1]Naphthalene is most commonly referred to as a VOC, but was reported (and detected in the IZ-3 tide pool water sample) in the analytical results for both the 8260 and 8270 SIM methods (see McDaniel Lambert 2012).

Table 1. Summary of Reporting Limits and Background Levels for Select Petroleum-Related Chemicals of Potential Concern

EPA Method TO-15 Modified Laboratory VOCs and TPH Compounds	Laboratory Reporting Limit ($\mu g/m^3$)	Avila Beach Background Values* ($\mu g/m^3$)
Benzene	0.16	0.42
Toluene	0.76	1.5
Ethylbenzene	0.44	0.40
m,p-Xylene	0.44	0.84 (o-Xylene)
o-Xylene	0.44	0.84
Naphthalene**	0.53 (0.068)	0.086

*From Applied Measurement Science (2001)

**For naphthalene the analytical reporting limit exceeds background value; results between the method detection limit (included in parentheses) and the RL (estimated/J-values) will be reported by the laboratory.

Odor Observations and Use of FID During Sampling Events

During each sampling event sampling personnel will be observant for odors at both the subject tidal area as well as the background area. Any odors will be documented as follows:

- Time and date
- Location (marked on map and GPS coordinates)
- Odor characteristic (e.g. petroleum-like, exhaust-like, sulfur-like)
- Odor strength (e.g. weak, medium, strong)
- Length of odor observation (e.g. intermittent or persistent)

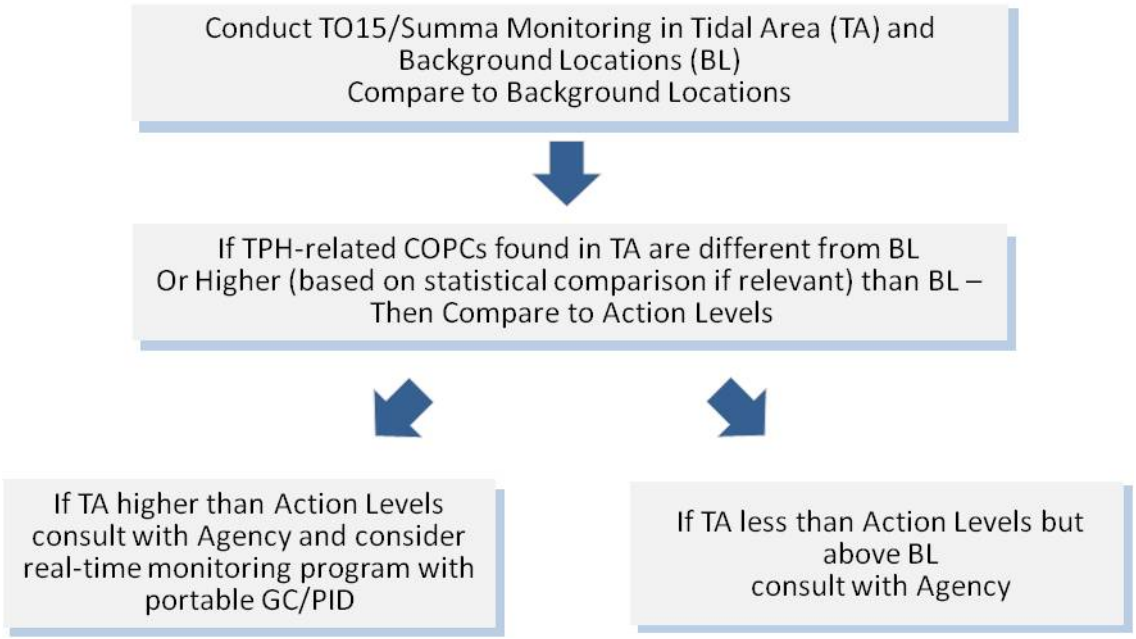
If an odor is observed a portable FID measurement will be made and noted. If a repeatable FID reading in the breathing zone exceeds of 50 parts per million (ppm) VOC (50 ppm is the California Occupational Safety and Health Administration Permissible Exposure Level (OSHA PEL) for n-hexane, a conservative surrogate for TPHv) is observed, sampling personnel will leave the area and additional consultation with SLOAPCD will occur.

Report Preparation

Upon completion of the four sampling events and receipt of laboratory reports, a report will be prepared and submitted to SLOAPCD, and other agencies as appropriate, documenting the field methodologies and results. The report will include data review and evaluation, tables of analytical data, field data sheets, and certified analytical reports.

Possible Actions Based on Initial Results

The following flow chart depicts possible risk management actions that may result after receiving results of initial sampling event(s):



The same source of action levels as used for Project Avila (AMS 2001) are proposed – the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) Chronic Reference Exposure Levels (RELs; Cal/EPA 2012), with key potentially petroleum-related COPC values shown in Table 2 below.

Table 2. COPCs and Action Levels

Key Petroleum-Related COPCs	Action Level ($\mu g/m^3$)*
Benzene	60
Toluene	300
Ethylbenzene	2000
Xylene (total)	700
Naphthalene	9
TPHv**	7000

*From OEHHA Acute, 8-hour, and Chronic Reference Exposure Levels (RELs); http://oehha.ca.gov/air/allrels.html

**Based on n-hexane chronic REL as conservative surrogate for TPHv

Sincerely,

Charles Lambert, PhD, DABT
Principal Toxicologist
McDaniel Lambert, Inc.

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SOMA Corporation. 2000. Human Health Risk Assessment Remediation Phase, Avila Beach, California. October.

FIGURES

S:\GIS\1252 Chevron EMC-Avila\1252.008 2011 Remediation Support\ArcMapDocuments\019 1252.008 Site Location Map.mxd\1/26/2012

0 1,000 2,000 4,000 FEET

SCALE

FIGURE 1

SITE LOCATION MAP

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

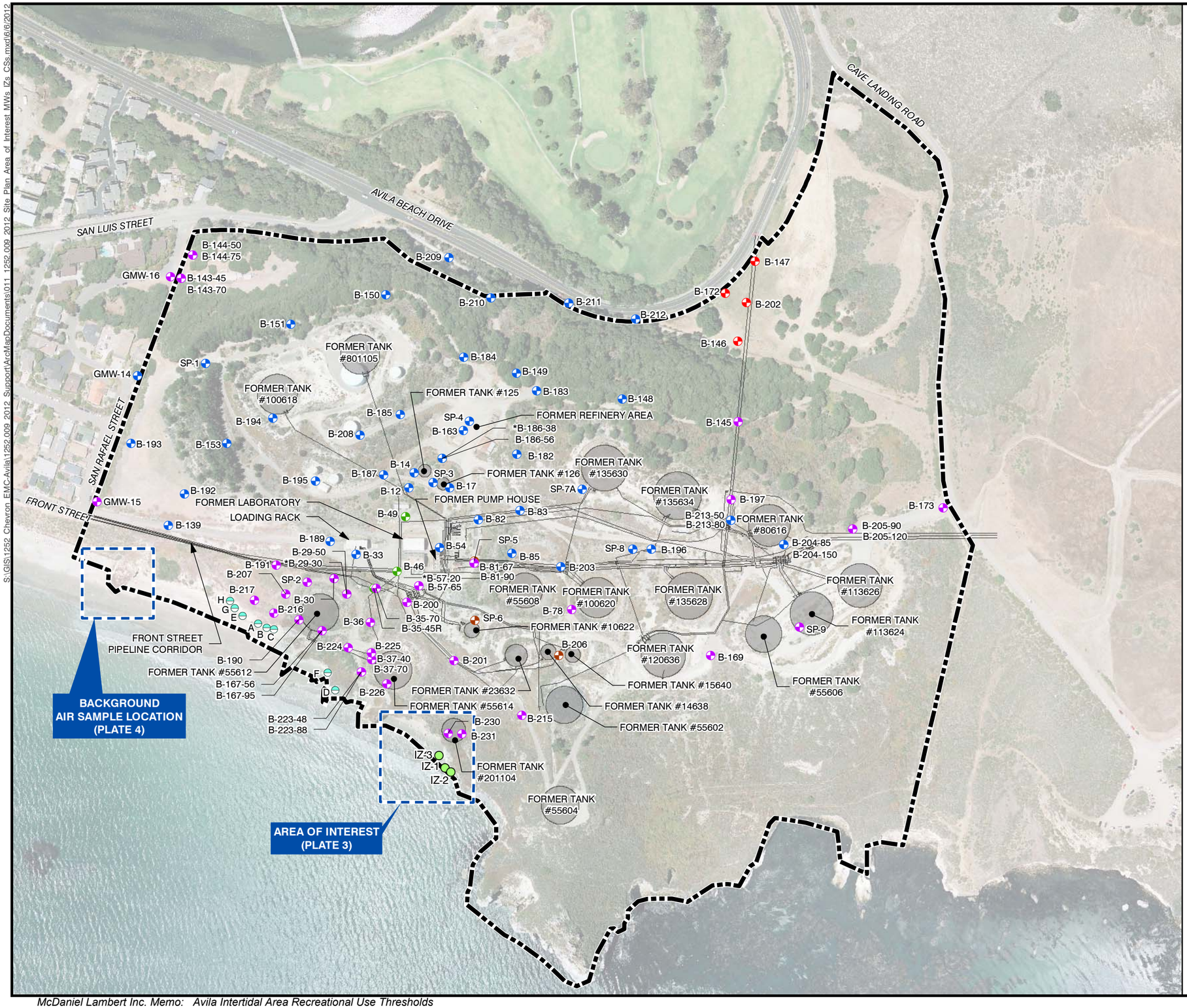
CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

REFERENCE:
7.5 MINUTE U.S.G.S. TOPOGRAPHIC MAP
OF PISMO BEACH, CALIFORNIA
DATED: 1965
PHOTOREVISED: 1975

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

McDaniel Lambert Inc. Memo: Avila Intertidal Area Recreational Use Thresholds 6/5/13

S:\GIS\1252 Chevron EMC-Avila\1252.009 2012 Support\ArcMapDocuments\011 1252.009 2012 Site Plan Area of Interest MWs IZs CSs.mxd 6/6/2012



Explanation

- Intertidal Zone (Approximate Location)
- Monitoring Well Completed in Unconsolidated Alluvium
- Monitoring Well Completed in Unconsolidated Colluvium
- Monitoring Well Completed in Pismo/Obispo Formation
- Monitoring Well Completed in Obispo Formation
- Monitoring Well Completed in Pismo Formation
- Cliff Spring Monitoring Location
- Approximate Site Boundary
- Diesel/Gas/Crude Oil Pipelines
- Storage Tanks / Areas

* = UPPER COMPLETION IN COLLUVIUM

N

0 150 300 600 FEET

SCALE

FIGURE 2

SITE PLAN

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

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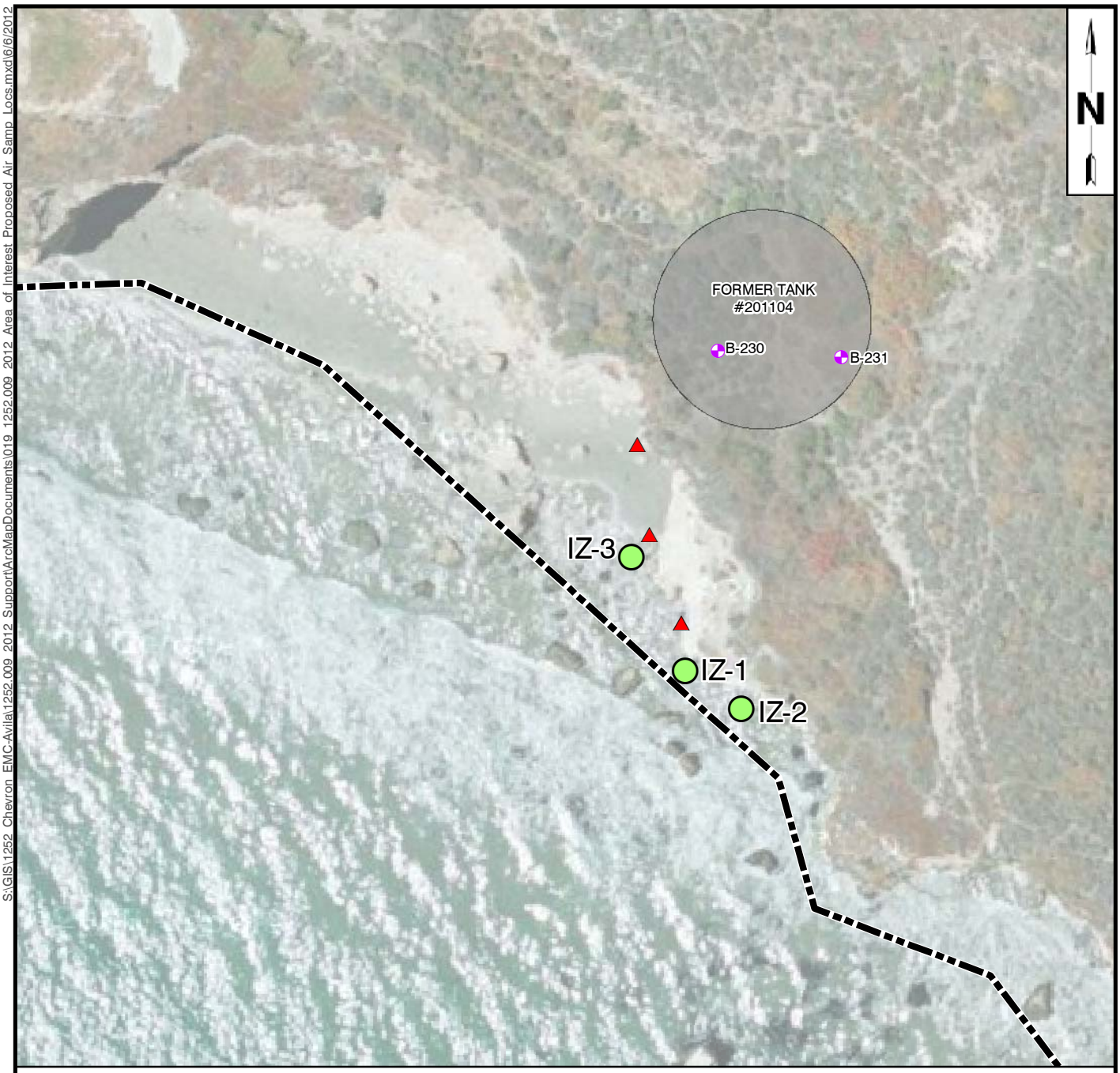

0 25 50 100
FEET
SCALE

Explanation

- Proposed Air Sample Location
- Intertidal Zone (Approximate Location)
- Monitoring Well Completed in Obispo Formation
- Approximate Site Boundary
- Storage Tanks / Areas

FIGURE 3

AREA OF INTEREST AND PROPOSED AIR SAMPLE LOCATIONS

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

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ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

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0 15 30 60
FEET

SCALE

Explanation

- Proposed Air Sample Location
- Approximate Site Boundary
- Storage Tanks / Areas

FIGURE 4

PROPOSED BACKGROUND AIR SAMPLE LOCATIONS

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

McDaniel Lambert Inc. Memo: Avila Intertidal Area Recreational Use Thresholds 6/5/13

ATTACHMENT 1

H&P, Inc. EPA Method TO-15 Full List VOCs Reporting Limits and Method Detection Limits

H&P Mobile Geochemistry, Inc. 2470 Impala Drive, Carlsbad, CA 92010
LA Field Office: 1855 Coronado Avenue, Signal Hill, CA 90755
Ph: 800-834-9888 www.handpmg.com

EPA Method TO-15
Full List VOCs
Padre - Avila Beach Ambient Air

	6L RLs	***6L MDL***	***6L RLs***	***6L MDL***
Compound	*Vapor (ppbv)*	*Vapor (ppbv)*	*Vapor (µg/m^3)*	*Vapor (µg/m^3)*
1,1,1,2-Tetrachloroethane	0.10	0.007	0.70	0.050
1,1,1-Trichloroethane	0.10	0.007	0.55	0.041
1,1,2,2-Tetrachloroethane	0.10	0.004	0.70	0.028
1,1,2-Trichloroethane	0.10	0.022	0.55	0.124
1,1,2-Trichlorotrifluoroethane (F113)	0.20	0.012	1.55	0.092
1,1-Dichloroethane	0.10	0.004	0.41	0.018
1,1-Dichloroethene	0.10	0.007	0.40	0.026
1,2,4-Trichlorobenzene	0.10	0.015	0.75	0.114
1,2,4-Trimethylbenzene	0.10	0.006	0.50	0.031
1,2-Dibromoethane (EDB)	0.10	0.005	0.78	0.039
1,2-Dichlorobenzene	0.10	0.008	0.61	0.048
1,2-Dichloroethane (EDC)	0.10	0.008	0.41	0.034
1,2-Dichloropropane	0.10	0.010	0.47	0.045
1,3,5-Trimethylbenzene	0.10	0.013	0.50	0.064
1,3-Dichlorobenzene	0.10	0.019	0.61	0.119
1,4-Dichlorobenzene	0.10	0.004	0.61	0.027
2-Butanone (MEK)	0.20	0.009	0.60	0.026
2-Hexanone (MBK)	0.20	0.004	0.82	0.015
4-Ethyltoluene	0.10	0.005	0.50	0.026
4-Methyl-2-pentanone (MIBK)	0.20	0.006	0.82	0.024
Acetone	0.50	0.023	1.21	0.056
Benzene	0.05	0.006	0.16	0.018
Bromodichloromethane	0.10	0.008	0.68	0.056
Bromoform	0.10	0.009	0.44	0.093
Bromomethane	0.10	0.011	0.40	0.043
Carbon disulfide	0.10	0.002	0.32	0.008
Carbon tetrachloride	0.05	0.006	0.32	0.038
Chlorobenzene	0.10	0.006	0.47	0.028
Chloroethane	0.10	0.014	0.27	0.039
Chloroform	0.05	0.006	0.25	0.028
Chloromethane	0.10	0.007	0.21	0.015
cis-1,2-Dichloroethene	0.10	0.007	0.40	0.029
cis-1,3-Dichloropropene	0.10	0.009	0.46	0.042
Dibromochloromethane	0.10	0.007	0.68	0.062
Dichlorodifluoromethane (F12)	0.20	0.056	1.01	0.279
Dichlorotetrafluoroethane (F114)	0.10	0.021	0.71	0.148
Ethylbenzene	0.10	0.003	0.44	0.015
Hexachlorobutadiene	0.20	0.010	2.15	0.110
m,p-Xylene	0.10	0.002	0.44	0.010
Methylene chloride (Dichloromethane)	0.10	0.004	0.35	0.016
o-Xylene	0.10	0.009	0.44	0.038
Styrene	0.10	0.007	0.43	0.032
Tetrachloroethene	0.10	0.006	0.69	0.039
Toluene	0.20	0.006	0.76	0.024
trans-1,2-Dichloroethene	0.10	0.011	0.40	0.043
trans-1,3-Dichloropropene	0.10	0.009	0.46	0.044

H&P Mobile Geochemistry, Inc. 2470 Impala Drive, Carlsbad, CA 92010
LA Field Office: 1855 Coronado Avenue, Signal Hill, CA 90755
Ph: 800-834-9888 www.handpmg.com

Trichloroethene	0.10	0.007	0.54	0.035
Trichlorofluoromethane (F11)	0.10	0.004	0.57	0.025
Vinyl chloride	0.05	0.007	0.13	0.018

Additional VOCs by TO-15	***6L RLs*** *Vapor (ppbv)*	***6L MDL*** *Vapor (ppbv)*	***6L RLs*** *Vapor (µg/m^3)*	***6L MDL*** *Vapor (µg/m^3)*
1,1-Dichloropropene	0.10	0.011	0.23	0.048
1,2,3-Trichlorobenzene	0.20	0.018	1.51	0.135
1,2,3-Trichloropropane	0.10	0.006	0.61	0.040
1,2-Dibromo-3-chloropropane	0.10	0.007	0.98	0.070
1,3-Butadiene	0.10	0.014	0.22	0.031
1,3-Dichloropropane	0.10	0.007	0.47	0.035
1,4-Dioxane	0.20	0.015	0.73	0.055
2,2,4-Trimethylpentane	0.10	0.004	0.47	0.017
2,2-Dichloropropane	0.10	0.005	0.47	0.025
2-Chlorotoluene	0.10	0.021	0.53	0.108
4-Chlorotoluene	0.10	0.026	0.53	0.136
Benzyl chloride	0.10	0.006	0.52	0.030
Bromobenzene	0.10	0.010	0.65	0.064
Cyclohexane	0.20	0.010	0.70	0.036
Dibromomethane	0.10	0.017	0.72	0.122
Ethyl acetate	0.20	0.020	0.73	0.074
Isopropylbenzene (Cumene)	0.10	0.003	0.50	0.013
n-Butylbenzene	0.10	0.005	0.56	0.029
n-Heptane	0.10	0.011	0.42	0.046
n-Hexane	0.10	0.008	0.36	0.030
n-Propylbenzene	0.10	0.005	0.50	0.023
p-Isopropyltoluene	0.10	0.008	0.56	0.043
Propene	0.10	0.013	0.17	0.022
sec-Butylbenzene	0.10	0.009	0.56	0.048
tert-Butylbenzene	0.10	0.009	0.56	0.050
Tetrahydrofuran	0.20	0.033	0.60	0.098
Vinyl acetate	0.10	0.029	0.36	0.105
TPH gas (C5-C11)			100	50*

*J-Flagging of TPH to the MDL of 50 ug/m3 must be confirmed in advance of sample analysis.

Oxygenates				
Diisopropyl ether (DIPE)	0.20	0.0068	0.85	0.029
Ethyl tertiary-butyl ether (ETBE)	0.20	0.0026	0.85	0.011
Methyl tertiary-butyl ether (MTBE)	0.20	0.0041	0.73	0.015
Tertiary-amyl methyl ether (TAME)	0.20	0.0040	0.85	0.017
Tertiary-butyl alcohol (TBA)	0.50	0.0079	1.54	0.024
Additional Compounds by TO-15				
Naphthalene	0.10	0.0128	0.53	0.068
Isopropyl Alcohol	0.50	0.00394	1.25	0.010
Ethanol	1.00	0.0260	1.90	0.050

ATTACHMENT 2

Screening Level Equations to Calculate Recreational Thresholds for Adolescent Waders

(A.1) Carcinogens detected in tidal pool water:

a. Adolescent wader incidental ingestion:

$$SL_{w-ing,c}(\mu g/L) = \frac{TR \times AT_c(days) \times BW(kg) \times \left(\frac{1000\ \mu g}{mg}\right)}{CSF_o([mg/kg-day]^{-1}) \times IRW(L/hour) \times ET(hour/day) \times EF(days/year) \times ED(years)}$$

Where:

$SL_{w\text{-}ing,c}$ = Carcinogenic screening level for ingestion of water (µg/L)
TR = Target risk (unitless, $1x10^{-6}$)
AT_c = Averaging time, carcinogens (days)
BW = Body weight for adolescent (kg)
CSF_o = Chronic oral slope factor $(mg/kg\text{-}day)^{-1}$
IRW = Intake rate water for adolescent (L/hour)
ET = Exposure time for adolescent (hours/day)
EF = Exposure frequency for adolescent (days/year)
ED = Exposure duration for adolescent (years)

b. Adolescent wader dermal contact with organics:

i. when the exposure time (ET, hours/event) is less than or equal to the time for a chemical to reach steady state (t^*, hours; chemical specific):

$$SL_{w-derm,c}(\mu g/L) = \frac{DA_{event}(\mu g/cm^2 - event) \times \left(\frac{1000\ cm^3}{L}\right)}{2 \times FA \times K_p(cm/hour)\sqrt{\frac{6 \times \tau_{event}(hours/event) \times ET(hours/event)}{\pi}}}$$

ii. when the exposure time (ET, hours/event) is greater than the time for a chemical to reach steady state (t^*, hours; chemical specific):

$$SL_{w-derm,c}(\mu g/L) = \frac{DA_{event}(\mu g/cm^2 - event) \times \left(\frac{1000\ cm^3}{L}\right)}{FA \times K_p(cm/hour)\left[\frac{ET(hours/event)}{1+B} + 2 \times \tau_{event}(hours/event) \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]}$$

Where:

$$DA_{event}(\mu g/cm^2 - event) = \frac{TR \times AT_c(days) \times BW(kg) \times \left(\frac{1000\ \mu g}{mg}\right)}{\left(\frac{CSF_o([mg/kg-day]^{-1})}{GIABS}\right) \times SA(cm^2) \times EV(events/day) \times EF_c(days/year) \times ED_c(years)}$$

And:

$SL_{w\text{-}derm,c}$ = Carcinogenic screening level for dermal contact with water (micrograms per liter [µg/L])
DA_{event} = Absorbed dose per event (microgram per square centimeter [µg/cm^2]-event)
FA = Fraction absorbed water (dimensionless; chemical-specific)
K_p = Dermal permeability coefficient (cm/hour; chemical-specific – see Attachments 3 and 4)
τ_{event} = Lag time per event (hours/event; chemical specific – see calculation in Attachment 3)
B = Ratio of the permeability coefficient (K_p) of a chemical through the stratum corneum relative to its permeability coefficient ($K_{p,ve}$) across the epidermis (dimensionless; chemical-specific – see calculation in Attachment 3)
TR = Target risk (unitless, 1x10^{-6})
AT_c = Averaging time, carcinogens (days)
BW = Body weight for adolescent (kg)
CSF_o = Chronic oral slope factor (mg/kg-day)$^{-1}$
GIABS = Gastrointestinal absorption (unitless)
SA = Exposed skin surface area for adolescent (cm^2)
EV = Event frequency for adolescent (events/day)
ET = Exposure time for adolescent (hours/event)
EF = Exposure frequency for adolescent (days/year)
ED = Exposure duration for adolescent (years)

c. Total carcinogenic direct contact with tidal pool water:

$$SL_{w-total,c} = \frac{1}{\frac{1}{SL_{w-ing,c}} + \frac{1}{SL_{w-derm,c}}}$$

Where:

$SL_{w\text{-}total,c}$ = Screening level for carcinogens in tidal pool water (µg/L)
$SL_{w\text{-}ing,c}$ = Carcinogenic screening level for ingestion of water (µg/L)
$SL_{w\text{-}derm,c}$ = Carcinogenic screening level for dermal contact with water (µg/L)

(A.2) Mutagens detected in tidal pool water:

a. Adolescent wader incidental ingestion:

$$SL_{w-ing,m}(\mu g/L) = \frac{TR \times AT_c(days) \times BW(kg) \times \left(\frac{1000\ \mu g}{mg}\right)}{CSF_o([mg/kg-day]^{-1}) \times IRW(L/hour) \times ET(hours/day) \times EF(days/year) \times ED(years) \times ADAF_{6-<16}}$$

Where:

$SL_{w\text{-}ing,m}$	= Mutagenic screening level for ingestion of water (µg/L)
TR	= Target risk (unitless, $1x10^{-6}$)
AT_c	= Averaging time, carcinogens (days)
BW	= Body weight for adolescent (kg)
CSF_o	= Chronic oral slope factor $(mg/kg\text{-}day)^{-1}$
IRW	= Intake rate water for adolescent (L/hour)
ET	= Exposure time for adolescent (hours/day)
EF	= Exposure frequency for adolescent (days/year)
ED	= Exposure duration for adolescent (years)
ADAF	= Age-dependent mutagenic adjustment factor (unitless; 3 for ages 6 to <16 years)

b. Adolescent wader dermal contact with organics:

i. when the exposure time (ET, hours/event) is less than or equal to the time for a chemical to reach steady state (t^*, hours; chemical specific):

$$SL_{w-derm,m}(\mu g/L) = \frac{DA_{event,m}(\mu g/cm^2-event) \times \left(\frac{1000\ cm^3}{L}\right)}{2 \times FA \times K_p(cm/hour)\sqrt{\frac{6 \times \tau_{event}(hours/event) \times ET(hours/event)}{\pi}}}$$

ii. when the exposure time (ET, hours/event) is greater than the time for a chemical to reach steady state (t^*, hours; chemical specific):

$$SL_{w-derm,m}(\mu g/L) = \frac{DA_{event,m}(\mu g/cm^2-event) \times \left(\frac{1000\ cm^3}{L}\right)}{FA \times K_p(cm/hour)\left[\frac{ET(hours/event)}{1+B} + 2 \times \tau_{event}(hours/event) \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]}$$

Where:

$$DA_{event,m}(\mu g/cm^2 - event) = \frac{TR \times AT_c(days) \times BW(kg) \times \left(\frac{1000\ \mu g}{mg}\right)}{\left(\frac{CSF_o([mg/kg-day]^{-1})}{GIABS}\right) \times SA(cm^2) \times EV(events/day) \times EF_c(days/year) \times ED_c(years) \times ADAF_{6-<16}}$$

And:

$SL_{w\text{-}derm,m}$ = Mutagenic screening level for dermal contact with water (micrograms per liter [µg/L])
$DA_{event,m}$ = Absorbed mutagenic dose per event (microgram per square centimeter [µg/cm^2]-event)
FA = Fraction absorbed water (dimensionless; chemical-specific)
K_p = Dermal permeability coefficient (cm/hour; chemical-specific – see Attachments 3 and 4)
τ_{event} = Lag time per event (hours/event; chemical specific – see calculation in Attachment 3)
B = Ratio of the permeability coefficient (K_p) of a chemical through the stratum corneum relative to its permeability coefficient ($K_{p,ve}$) across the epidermis (dimensionless; chemical-specific – see calculation in Attachment 3)
TR = Target risk (unitless, 1x10^{-6})
AT_c = Averaging time, carcinogens (days)
BW = Body weight for adolescent (kg)
CSF_o = Chronic oral slope factor (mg/kg-day)$^{-1}$
GIABS = Gastrointestinal absorption (unitless)
SA = Exposed skin surface area for adolescent (cm^2)
EV = Event frequency for adolescent (events/day)
ET = Exposure time for adolescent (hours/event)
EF = Exposure frequency for adolescent (days/year)
ED = Exposure duration for adolescent (years)
ADAF = Age-dependent mutagenic adjustment factor (unitless; 3 for ages 6 to <16 years)

c. Total mutagenic direct contact with tidal pool water:

$$SL_{w-total,m} = \frac{1}{\frac{1}{SL_{w-ing,m}} + \frac{1}{SL_{w-derm,m}}}$$

Where:

$SL_{w\text{-}total,m}$ = Screening level for mutagens in tidal pool water (µg/L)
$SL_{w\text{-}ing,m}$ = Mutagenic screening level for ingestion of water (µg/L)
$SL_{w\text{-}derm,m}$ = Mutagenic screening level for dermal contact with water (µg/L)

(A.3) Noncarcinogens detected in tidal pool water:

a. Adolescent water incidental ingestion:

$$SL_{w-ing,nc}(\mu g/L) = \frac{THQ \times AT_{nc}(days) \times BW_i(kg) \times \left(\frac{1000\ \mu g}{mg}\right)}{IRW_i(L/hour) \times ET_i(hours/day) \times EF_i(days/year) \times ED_i(years) \times \frac{1}{RFD_o(mg/kg-day)}}$$

Where:

$SL_{w\text{-}ing,nc}$ = Noncarcinogenic screening level for ingestion of water (µg/L)
THQ = Total hazard quotient (unitless, 1)
AT_{nc} = Averaging time, noncarcinogens (days)
BW_i = Body weight for adolescent (kg)
IRW_i = Intake rate water for adolescent (L/hour)
ET_i = Exposure time for adolescent (hours/day)
EF_i = Exposure frequency for adolescent (days/year)
ED_i = Exposure duration for adolescent (years)
RfD_o = Chronic oral reference dose (mg/kg-day)

b. Adolescent water dermal contact with organics:

i. when the exposure time (ET, hours/event) is less than or equal to the time for a chemical to reach steady state (t^*, hours; chemical specific):

$$SL_{w-derm,nc}(\mu g/L) = \frac{DA_{event}(\mu g/cm^2 - event) \times \left(\frac{1000\ cm^3}{L}\right)}{2 \times FA \times K_p(cm/hour)\sqrt{\frac{6 \times \tau_{event}(hours/event) \times ET(hours/event)}{\pi}}}$$

ii. when the exposure time (ET, hours/event) is greater than the time for a chemical to reach steady state (t^*, hours; chemical specific):

$$SL_{w-derm,nc}(\mu g/L) = \frac{DA_{event}(\mu g/cm^2 - event) \times \left(\frac{1000\ cm^3}{L}\right)}{FA \times K_p(cm/hour)\left[\frac{ET}{1+B} + 2 \times \tau_{event}(hours/event) \times \left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]}$$

Where:

$$DA_{event}(\mu g/cm^2 - event) = \frac{THQ \times AT_{nc}(days) \times BW_i(kg) \times \left(\frac{1000\ \mu g}{mg}\right)}{SA_i(cm^2) \times EV_i(events/day) \times EF_i(days/year) \times ED_i(years) \times \left(\frac{1}{RFD_o(mg/kg - day) \times GIABS}\right)}$$

And:

$SL_{w\text{-}derm,nc}$ = Noncarcinogenic screening level for dermal contact with water (µg/L)
DA_{event} = Absorbed dose per event (µg/cm^2-event)
FA = Fraction absorbed water (dimensionless; chemical-specific)
Kp = Dermal permeability coefficient (cm/hour; chemical-specific – see Attachments 3 and 4)
τ_{event} = Lag time per event (hours/event; chemical specific – see calculation in Attachment 3)
B = Ratio of the permeability coefficient (K_p) of a chemical through the stratum corneum relative to its permeability coefficient ($K_{p,ve}$) across the epidermis (dimensionless; chemical-specific – see calculation in Attachment 3)
THQ = Total hazard quotient (unitless, 1)
AT_{nc} = Averaging time, noncarcinogens (days)
BW_i = Body weight for adolescent (kg)
SA_i = Exposed skin surface area for adolescent (cm^2)
EV_i = Event frequency for adolescent (events/day)
ET_i = Exposure time for adolescent (hours/event)
EF_i = Exposure frequency for adolescent (days/year)
ED_i = Exposure duration for adolescent (years)
RfD_o = Chronic oral reference dose (mg/kg-day)
GIABS = Gastrointestinal absorption (unitless)

c. Total noncarcinogenic direct contact with tidal pool water:

$$SL_{w-total,nc} = \frac{1}{\frac{1}{SL_{w-ing,nc}} + \frac{1}{SL_{w-derm,nc}}}$$

Where:

$SL_{w\text{-}total,nc}$ = Screening level for noncarcinogens in tidal pool water (µg/L)
$SL_{w\text{-}ing,nc}$ = Noncarcinogenic screening level for ingestion of water (µg/L)
$SL_{w\text{-}derm,nc}$ = Noncarcinogenic screening level for dermal contact with water (µg/L)

(A.4) Carcinogens detected in tidal pool sediment:

a. Adolescent wader incidental ingestion:

$$SL_{s-ing,c}(mg/kg) = \frac{TR \times AT_c(days) \times BW(kg)}{CSF_o([mg/kg-day]^{-1}) \times IRS(mg/day) \times FI \times BF \times EF(days/year) \times ED(years) \times \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Where:

$SL_{s\text{-}ing,c}$	= Carcinogenic screening level for ingestion of sediment (mg/kg)
TR	= Target risk (unitless, $1x10^{-6}$)
AT_c	= Averaging time, carcinogens (days)
BW	= Body weight for adolescent (kg)
CSF_o	= Chronic oral slope factor $(mg/kg\text{-}day)^{-1}$
IRS	= Intake rate for sediment for adolescent (mg/day)
FI	= Fraction ingested from contaminated source for adolescent (unitless)
BF	= Bioavailability Factor (unitless, chemical-specific)
EF	= Exposure frequency for adolescent (days/year)
ED	= Exposure duration for adolescent (years)

b. Adolescent wader dermal contact:

$$SL_{s-derm,c}(mg/kg) = \frac{TR \times AT_c(days) \times BW(kg)}{\left(\frac{CSF_o([mg/kg-day]^{-1})}{GIABS}\right) \times SA(cm^2/day) \times ABS \times AF(mg/cm^2) \times EF(days/year) \times ED(years) \times \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Where:

$SL_{w\text{-}derm,c}$	= Carcinogenic screening level for dermal contact with sediment (mg/kg)
TR	= Target risk (unitless, $1x10^{-6}$)
AT_c	= Averaging time, carcinogens (days)
BW	= Body weight for adolescent (kg)
CSF_o	= Chronic oral slope factor $(mg/kg\text{-}day)^{-1}$
GIABS	= Gastrointestinal absorption (unitless)
ABS	= Absorption factor (unitless, chemical-specific)
SA	= Exposed skin surface area for adolescent (cm^2/day)
EV	= Events per day
AF	= Adherence factor for adolescent (mg/cm^2)

EF = Exposure frequency for adolescent (days/year)
ED = Exposure duration for adolescent (years)

c. Total carcinogenic direct contact with tidal pool sediment:

$$SL_{s-total,c} = \frac{1}{\frac{1}{SL_{s-ing,c}} + \frac{1}{SL_{s-derm,c}}}$$

Where:
$SL_{s\text{-}total,c}$ = Screening level for carcinogens in tidal pool sediment (mg/kg)
$SL_{s\text{-}ing,c}$ = Carcinogenic screening level for ingestion of sediment (mg/kg)
$SL_{s\text{-}derm,c}$ = Carcinogenic screening level for dermal contact with sediment (mg/kg)

(A.5) Mutagens detected in tidal pool sediment:

a. Adolescent wader incidental ingestion

$$SL_{s-ing,cm}(mg/kg) = \frac{TR \times AT_c(days) \times BW(kg)}{CSF_o([mg/kg-day]^{-1}) \times IRS(mg/day) \times FI \times BF \times EF(days/year) \times ED(years) \times \left(\frac{10^{-6}\ kg}{mg}\right) \times ADAF_{6-<16}}$$

Where:
$SL_{s\text{-}ing,m}$ = Mutagenic screening level for ingestion of sediment (mg/kg)
TR = Target risk (unitless, $1x10^{-6}$)
AT_c = Averaging time, carcinogens (days)
BW = Body weight for adolescent (kg)
CSF_o = Chronic oral slope factor $(mg/kg\text{-}day)^{-1}$
IRS = Intake rate for sediment for adolescent (mg/day)
FI = Fraction ingested from contaminated source for adolescent (unitless)
BF = Bioavailability Factor (unitless, chemical-specific)
EF = Exposure frequency for adolescent (days/year)
ED = Exposure duration for adolescent (years)
ADAF = Age-dependent mutagenic adjustment factor (unitless; 3 for ages 6 to <16 years)

b. Adolescent wader dermal contact:

$$SL_{s-derm,m}(mg/kg) = \frac{TR \times AT_c(days) \times BW(kg)}{\left(\frac{CSF_o([mg/kg-day]^{-1})}{GIABS}\right) \times SA(cm^2/day) \times ABS \times AF(mg/cm^2) \times EF(days/year) \times ED(years) \times \left(\frac{10^{-6}\ kg}{mg}\right) \times ADAF_{6-<16}}$$

Where:

$SL_{w\text{-}derm,m}$ = Mutagenic screening level for dermal contact with sediment (mg/kg)
TR = Target risk (unitless, $1x10^{-6}$)
AT_c = Averaging time, carcinogens (days)
BW = Body weight for adolescent (kg)
CSF_o = Chronic oral slope factor $(mg/kg\text{-}day)^{-1}$
GIABS = Gastrointestinal absorption (unitless)
ABS = Absorption factor (unitless, chemical-specific)
SA = Exposed skin surface area for adolescent (cm^2/day)
EV = Events per day
AF = Adherence factor for adolescent (mg/cm^2)
EF = Exposure frequency for adolescent (days/year)
ED = Exposure duration for adolescent (years)
ADAF = Age-dependent mutagenic adjustment factor (unitless; 3 for ages 6 to <16 years)

c. Total mutagenic direct contact with tidal pool sediment:

$$SL_{s-total,m} = \frac{1}{\frac{1}{SL_{s-ing,m}} + \frac{1}{SL_{s-derm,m}}}$$

Where:

$SL_{s\text{-}total,m}$ = Screening level for mutagens in tidal pool sediment (mg/kg)
$SL_{s\text{-}ing,m}$ = Mutagenic screening level for ingestion of sediment (mg/kg)
$SL_{s\text{-}derm,m}$ = Mutagenic screening level for dermal contact with sediment (mg/kg)

(A.6) Noncarcinogens detected in tidal pool sediment:

a. Adolescent wader incidental ingestion:

$$SL_{s-ing,nc}(mg/kg) = \frac{THQ \times AT_{nc}(days) \times BW_i(kg)}{IRS_i(mg/day) \times FI_i \times BF \times EF_i(days/year) \times ED_i(years) \times \frac{1}{RFD_o(mg/kg-day)} \times \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Where:

$SLs_{-ing,nc}$ = Noncarcinogenic screening level for ingestion of sediment (mg/kg)
THQ = Target hazard quotient (unitless, 1.0)
AT_{nc} = Averaging time, noncarcinogens (days)
BW_i = Body weight for adolescent (kg)
IRS_c = Intake rate for sediment for adolescent (mg/day)
FI_i = Fraction ingested from contaminated source (unitless)
BF = Bioavailability Factor (unitless, chemical-specific)
EF_i = Exposure frequency for adolescent (days)
ED_i = Exposure duration for adolescent (years)
RfD_o = Chronic oral reference dose (mg/kg-day)

b. Adolescent wader dermal contact:

$$SL_{s-derm,nc}(mg/kg) = \frac{THQ \times AT_{nc}(days) \times BW_i(kg)}{SA_i(cm^2/day) \times AF_i(mg/cm^2) \times ABS \times EF_i(days/year) \times ED_i(years) \times \frac{1}{(RFD_o[mg/kg-day] \times GIABS)} \times \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Where:

$SL_{c\text{-}derm,nc}$ = Noncarcinogenic screening level for dermal contact with sediment (mg/kg)
THQ = Target hazard quotient (unitless, 1.0)
AT_{nc} = Averaging time, noncarcinogens (days)
BW_i = Body weight for adolescent (kg)
SA_i = Exposed skin surface area for adolescent (c) (cm^2/day)
AF_c = Adherence factor for adolescent (c) (mg/cm^2)
ABS = Absorption factor (unitless, chemical-specific)
EF_i = Exposure frequency for adolescent (days/year)
ED_i = Exposure duration for adolescent (years)
RfD_o = Chronic oral reference dose (mg/kg-day)
GIABS = Gastrointestinal absorption (unitless)

c. Total noncarcinogenic direct contact with tidal pool sediment:

$$SL_{s-total,nc} = \frac{1}{\frac{1}{SL_{s-ing,nc}} + \frac{1}{SL_{s-derm,nc}}}$$

Where:

$SL_{s\text{-}total,nc}$ = Screening level for noncarcinogens in tidal pool sediment (mg/kg)
$SL_{s\text{-}ing,nc}$ = Noncarcinogenic screening level for ingestion of sediment (mg/kg)
$SL_{s\text{-}derm,nc}$ = Noncarcinogenic screening level for dermal contact with sediment (mg/kg)

ATTACHMENT 3

Additional Equations to Calculate Dermal Exposure to Organics in Water

The following additional equations, taken from USEPA 2004 Appendix A, are required to calculate screening levels for dermal exposure to organics in water (USEPA 2004a). The chemical specific results are summarized in Table 7.

(A.7) Dimensionless ratio of the permeability coefficient of a chemical through the stratum corneum relative to its permeability coefficient across the epidermis:

$$B = \frac{K_p}{K_{p,ve}} = \frac{\sqrt{MW}}{2.6} (as\ an\ approximation)$$

Where:

B = Ratio of the permeability coefficient (K_p) of a chemical through the stratum corneum relative to its permeability coefficient ($K_{p,ve}$) across the epidermis (dimensionless; chemical-specific)

K_p = Dermal permeability coefficient in water (cm/hr; chemical-specific – see also Attachment 4

$K_{p,ve}$ = Equilibrium partition coefficient between the epidermis and water for the absorbing chemical (cm/hr; chemical-specific)

MW = Molecular weight

(A.3) Ratio of effective diffusion coefficient for chemical transfer through the stratum corneum to the apparent thickness of stratum corneum

$$\frac{D_{sc}}{l_{sc}} = 10^{(-2.80-0.0056\times MW)}$$

Where:

D_{sc} = Effective diffusion coefficient for chemical transfer through the stratum corneum (cm^2/hr; chemical-specific)

l_{sc} = apparent thickness of stratum corneum (cm; default value of 0.001 cm)

MW = Molecular weight (g/mole; chemical specific)

(A.4) Lag time per event

$$\tau_{event} = \frac{l_{sc}}{6 \times D_{sc}} = 0.105 \times 10^{(0.0056\times MW)}$$

Where:

τ_{event} = Lag time per event (hr/event; chemical specific)

D_{sc} = Effective diffusion coefficient for chemical transfer through the stratum corneum (cm^2/hr)

l_{sc} = apparent thickness of stratum corneum (cm; default value of 0.001 cm)

(A.5-A.8) Time to reach steady state

(A.5) If B ≤ 0.6, then

$$t^* = 2.4 \times \tau_{event}$$

(A.6) If B > 0.6, then

$$t^* = 6 \times \tau_{event} \left(b - \sqrt{b^2 - c^2}\right)$$

Where:

(A.7)

$$b = \frac{2 \times (1 + B^2)}{\pi} - c$$

And:

(A.8)

$$c = \frac{(1 + 3B + 3B^2)}{3 \times (1 + B)}$$

And:

t^* = Time to reach steady state (hr; chemical-specific)

B = Ratio of the permeability coefficient (K_p) of a chemical through the stratum corneum relative to its permeability coefficient ($K_{p,ve}$) across the epidermis (dimensionless; chemical-specific)

τ_{event} = Lag time per event (hr/event; chemical specific)

b,c = Correlation coefficients fitted to the Flynn's in vitro experimental data set to give the equation describing the predictive correlation for permeability coefficient of organics based on the octanol-water partitioning coefficient and molecular weight (see Attachment 2; Equation 3.8 in USEPA 2004a)

ATTACHMENT 4

Dermal Permeability Constant Calculations

Calculated Dermal Permeability Constants

Carbon Group	Chemical/Surrogates	MW	log Kow	Source	Log Kp	Kp (cm/hr)
aliph C_{5-6}	hexane	86.17	3.90	HSDB	-0.708552	0.195635651
aliph $>C_{6-8}$	octane	114.23	5.18	HSDB	-0.020888	0.953041912
arom C_{5-7}	benzene	78.11	2.13	TPHCWG (Vol 3)/HSDB	-1.831616	0.014736149
arom $>C_{7-8}$	ethylbenzene	106.2	3.13	TPHCWG (Vol 3)/HSDB	-1.32892	0.046889975
aliph $>C_{8-10}$	decane	142.29	5.01	HSDB	-0.290224	0.512596929
arom$>C_{8-10}$	isobutylbenzene	134.22	4.01	TPHCWG (Vol 3)	-0.905032	0.124442292
aliph $>C_{10-12}$	dodecane	170.33	7.24	TPHCWG (Vol 3)	1.024552	10.58161607
arom$>C_{10-12}$	n-hexylbenzene	162.28	5.52	TPHCWG (Vol 3)	-0.065568	0.859868422
aliph $>C_{12-16}$	hexadecane	226.4	8.25	TPHCWG (Vol 3)	1.37716	23.8319731
arom$>C_{12-16}$	4-methylbiphenyl	168.24	4.63	TPHCWG (Vol 3)	-0.686344	0.205899836
aliph$>C_{16-35}$	n-hexadecane	226.4	8.25	TPHCWG (Vol 3)	1.37716	23.8319731
arom$>C_{16-35}$	4-methylbiphenyl	168.24	4.63	TPHCWG (Vol 3)	-0.686344	0.205899836
NA	Acenaphthylene	152.2	4.07	HSDB	-0.96612	0.108113518
NA	benzo(g,h,i)perylene	276.34	6.63	HSDB	0.028296	1.067323324
NA	TAME	102.17	1.55	HSDB	-2.349152	0.004475566
NA	tert-butyl alcohol	72.12	0.35	HSDB	-2.972872	0.001064457
NA	sec-butylbenzene	134.22	4.57	HSDB	-0.535432	0.291452644
NA	tert-butylbenzene	134.22	4.11	HSDB	-0.839032	0.144866511
NA	1,3-dichlorobenzene	147.00	3.53	HSDB	-1.2934	0.050886198
NA	2,2-dichloropropane	112.99	2.00	HSDB (1,2-dichloropropane)	-2.112744	0.00771358
NA	ethanol	46.07	-0.31	HSDB	-3.262592	0.000546271
NA	p-isopropyltouene	134.22	4.11	HSDB	-0.839032	0.144866511

Log Kp = -2.80 + 0.66 logKow - 0.0056*MW (USEPA 2004a, Equation 3.8)
Kp = permeability constant in centimeters per hour
HSDB = Hazardous Substances Data Bank (available online: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB)
TPHCWG = Vol 3 (1997), especially pp 33-38.

TPH Range	Permeability Constant (cm/hr)
TPH Gasoline - aliphatic	5.54E-01
TPH Gasoline - aromatic	6.20E-02
TPH Diesel - aliphatic	1.94E+01
TPH Diesel - aromatic	4.24E-01
TPH Motor Oil - aliphatic	2.38E+01
TPH Motor Oil - aromatic	2.06E-01

Aliphatic TPH-g Kp obtained by averaging Kp values for aliphatic C5-C10
Aromatic TPH-g Kp obtained by averaging Kp values for aromatic C5-C10
Aliphatic TPH-d Kp obtained by averaging Kp values for aliphatic >C10-C35
Aromatic TPH-d Kp obtained by averaging Kp values for aliphatic >C10-C35
Aliphatic TPH-mo Kp equal to >C16-C35 value
Aromatic TPH-mo Kp equal to >C16-C35 value

Appendix 4 – San Luis Obispo County Air Pollution Control Board Thresholds

McDaniel Lambert

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June 5, 2012

Rik Williams
A&R Project Engineer and Manager
Chevron Environment Management Company
276 Tank Farm Road - San Luis Obispo CA 93401

Subject: ***Avila Tidal Area Air Sampling Work Plan***

Dear Rik,
Per your request, McDaniel Lambert has completed a DRAFT Air Sampling Work Plan for the tidal area below the cliff face of the former Union Oil Avila Beach Tank Farm where a sheen was observed in one tidal pool on May 8, 2012.

Background
On May 8, 2012, a small amount of sheen was observed in a tidal area immediately below the cliff face of the former Union Oil Avila Beach Tank Farm (Figure 1). The source of this sheen has not yet been identified. In addition to the sheen, a petroleum hydrocarbon odor was noted in the area. Analysis of water collected from the tidal pool where the sheen was observed (IZ-3 in Figure 2) indicated the presence of volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes (BTEX), naphthalene, and gasoline-range total petroleum hydrocarbons (TPHg), which are consistent with a light fuel material (McDaniel Lambert 2012). The tidal pools are exposed for approximately two to three hours during negative low tides greater than -1.00 feet, and for shorter periods in the days/nights preceding and following these peak negative tides (McDaniel Lambert 2012). On recent negative tides the tidal pools were covered in sand and no sheen was present (Louis Cappel, Padre - personal communication May 30, 2012). On a visit to the tidal area on May 24th, although no sheen was observed, the San Luis Obispo Air Pollution Control District (SLOAPCD) noted an intermittent "gasoline type odor" (SLOAPCD 2012a). After the visit the SLOAPCD proposed that area air sampling be undertaken and submitted a draft air sampling and analysis plan for further discussion (SLOAPCD 2012b).

The current work plan was developed at the request of Chevron Environmental Management Company (CEMC) to address the APCD request that air sampling be conducted in the tidal area to determine the frequency and magnitude of any potential air impacts.

Work Plan Objectives

1) Comply with APCD request to conduct air sampling at the tidal area below the Former Avila Tank Farm
2) Determine frequency and magnitude of any potential air impacts
3) Gather sufficient air data to make any necessary risk management decisions and determine if longer-term sampling is needed

Site Description

The former Union Oil Avila Tank Farm, acquired by Chevron Corporation in 2005, is located on the Central Coast of California, directly east of the community of Avila Beach, California, in an unincorporated portion of San Luis Obispo County. The site encompasses approximately 95 acres and is bordered by the community of Avila Beach to the west, the San Luis Creek and a golf course to the north, open space to the east, and the Pacific Ocean to the South. The site served as a petroleum storage and distribution facility, pump station, and crude oil refinery, with some operations continuing into the late 1990s. The last storage tanks were removed from operation in the late 1990s. Petroleum handled at the Avila facility entered or left through one of three pipeline corridors (eastern, northern, and Front Street corridors) or via trucks loading gasoline or diesel fuel for market at the truck loading rack. Though the source of the tidal pool sheen has not been identified, the tidal area in question is directly below former Tank No. 201104 (see Figure 2). A recently completed investigation indicated a localized, roughly circular area of fuel-related petroleum hydrocarbon impacted soil/bedrock approximately 90 feet in diameter beneath former Tank No. 201104. The petroleum hydrocarbons encountered in soil/bedrock in this area included elevated concentrations of TPH in the C4-C10 carbon range ("TPHg") and BTEX. The impacts to soil/bedrock identified in this area start at shallow depths of approximately 5 feet below ground surface (ft bgs) and extends to a maximum depth of approximately 45 ft bgs. Additionally, fuel-related impacts to groundwater (encountered at approximately 100 ft bgs) also have been identified at this location (Padre 2012).

Previous Avila Air Sampling and Human Health Risk Assessment Activities

Previous reports that have included air monitoring at either the town of Avila Beach and/or the former Tank Farm include:

1. *Avila Beach Health Study*
   Risk Science Associates (on behalf of San Luis Obispo County Environmental Health Services [SLO EHS]), April 22, 1998
2. *Human Health Risk Assessment Remediation Phase, Avila Beach, California*
   SOMA Corporation (on behalf of SLO EHS), October 12, 2000
3. *Avila Beach Remediation Community Monitoring Program Results*
   Applied Measurement Science (AMS), July 2001

Based on results of the town of Avila Beach health risk assessments identified above (Risk Science Associates 1998; SOMA 2000), the weight-of-the-evidence indicates that there were no significant health risks to the community of Avila from potentially-impacted air associated with

the former Tank Farm and/or the extensive soil contamination that existed in the town at the time of the assessments. Both the SOMA 2000 risk assessment and the comprehensive AMS 2001 Monitoring Report indicated that there were no significant concentrations of chemicals released into the air by the extensive remediation of this contaminated soil, and that the background air quality in the town of Avila Beach and at the Tank Farm was comparable to other small coastal towns (AMS 2001; SOMA 2000).

SOMA determined that most of the air risk associated with the remediation was associated with the use of diesel powered remediation equipment. Air quality at the Avila Tank Farm area was evaluated during two sampling events conducted prior to the start of the main Avila excavation project in 1999 as part of the air quality report for the Avila Beach excavation. The data collected in these studies showed that the air quality at the Avila Tank Farm was substantially unaffected by the emissions from developed areas in the region (AMS 2001; SOMA 2000).

Proposed Tidal Area Air Sampling Work Plan

Ambient Air Sample Locations

Concurrent tidal area and background location ambient air samples will be collected. The proposed initial sample locations are shown in Figure 3, and include three locations in the tidal area near the tidal pool where sheen was observed (IZ-3) and extending west towards the location of former Tank No. 201104. Three background samples will be collected to the west of the tidal area and cliff springs, along the beach area closer to the town of Avila Beach (see Figure 4). Samples will be collected at approximately 2 feet above the sand or ground surface.

Collection of Samples

Ambient air samples will be collected in individually 100% laboratory-certified 6-L Summa canisters provided by H&P, Inc. Air samples will be collected over an approximate 40 minute period. The fill time of each canister will be recorded by the sampling personnel on-site observing the summa canisters. The orifice included with the summa canister will be set to flow at a rate not faster than 150 mL/min (which will result in 6000 mL collected at 150 mL/min over the 40 minute sampling period). The SUMMA canister/flow regulator assembly will be set on a crate approximately 2 feet above the ground surface. The initial SUMMA vacuum reading (typically around -29 inches of mercury), canister serial numbers, and air sample ID will be recorded prior to opening the valve and initiating sample collection. The valve to the SUMMA canisters will be opened and sampling will continue until vacuum remaining in each SUMMA canister will approach approximately -2 inches of mercury. Upon completion of sampling, the valves to the SUMMA canister will be closed, the final vacuum and sample time will be recorded, and the SUMMA canister will be sealed, labeled, and secured for transportation. In addition to the six air samples collected during each sampling event, the following quality assurance/quality control (QA/QC) samples will be included: one duplicate sample and one trip blank sample. All SUMMA canisters will be submitted to H&P for analyses following standard chain of custody procedures.

The following details will be recorded for each sample:

- Sample location (including sketch, photograph, and GPS coordinates)
- Wind speed and direction
- Temperature
- Canister identification number
- Air sample ID
- Initial canister vacuum
- Time and date sample collection begins and ends
- Final canister vacuum

Chemicals of Potential Concern (COPCs)

Based on the chemicals detected in the tidal pool water sample where sheen was observed (IZ-3), the observation of odor consistent with gasoline, and the fact that no heavier types of petroleum have been detected in the area, the focus of this initial monitoring effort will be on the potentially petroleum-related VOCs including naphthalene. This gasoline-range VOC focus is consistent with soil data associated with a potential source, the nearby former Tank No. 201104. It is unlikely that hydrogen sulfide is present in the tide pool area – its odor has not been observed and it is typically associated with heavier sulfur-containing petroleum streams (e.g. crude oil). Additionally, extensive data collected over a two year period during remediation activities in the Town of Avila indicated that significant hydrogen sulfide was not present in any of the petroleum-impacted areas in Avila (AMS 2001). Naphthalene was the only semivolatile organic compound (SVOC) detected in the IZ-3 tidal pool water sample, and these chemicals are unlikely to be significant air contaminants (McDaniel Lambert 2012).[1]

Sample Analysis

The air samples will be analyzed for H&P, Inc.'s full list of analytes (82 chemicals) for the United States Environmental Protection Agency's TO-15/TO-15 SIM (selective ion monitoring) method, which includes chlorinated VOCs unlikely to be related to petroleum. The list of chemicals to be analyzed, as well as lowest reporting limits [RLs] achievable by H&P Inc., are included in Attachment 1. The town of Avila Beach background values and H&P, Inc. RLs for selected potentially petroleum-related COPCs are shown below in Table 1.

Sampling Frequency

Sampling will be conducted only during negative low tides greater than -0.50 feet, when it is safe for people to access the area. The first round of sampling will include no less than four separate sampling events in June, July, and August 2012, as the tides permit. The need for additional sampling will be assessed based on the initial results as well as any concerns regarding potential seasonal variability and/or conditions observed during the initial four events.

[1]Naphthalene is most commonly referred to as a VOC, but was reported (and detected in the IZ-3 tide pool water sample) in the analytical results for both the 8260 and 8270 SIM methods (see McDaniel Lambert 2012).

Table 1. Summary of Reporting Limits and Background Levels for Select Petroleum-Related Chemicals of Potential Concern

EPA Method TO-15 Modified Laboratory VOCs and TPH Compounds	Laboratory Reporting Limit ($\mu g/m^3$)	Avila Beach Background Values* ($\mu g/m^3$)
Benzene	0.16	0.42
Toluene	0.76	1.5
Ethylbenzene	0.44	0.40
m,p-Xylene	0.44	0.84 (o-Xylene)
o-Xylene	0.44	0.84
Naphthalene**	0.53 (0.068)	0.086

*From Applied Measurement Science (2001)

**For naphthalene the analytical reporting limit exceeds background value; results between the method detection limit (included in parentheses) and the RL (estimated/J-values) will be reported by the laboratory.

Odor Observations and Use of FID During Sampling Events

During each sampling event sampling personnel will be observant for odors at both the subject tidal area as well as the background area. Any odors will be documented as follows:

- Time and date
- Location (marked on map and GPS coordinates)
- Odor characteristic (e.g. petroleum-like, exhaust-like, sulfur-like)
- Odor strength (e.g. weak, medium, strong)
- Length of odor observation (e.g. intermittent or persistent)

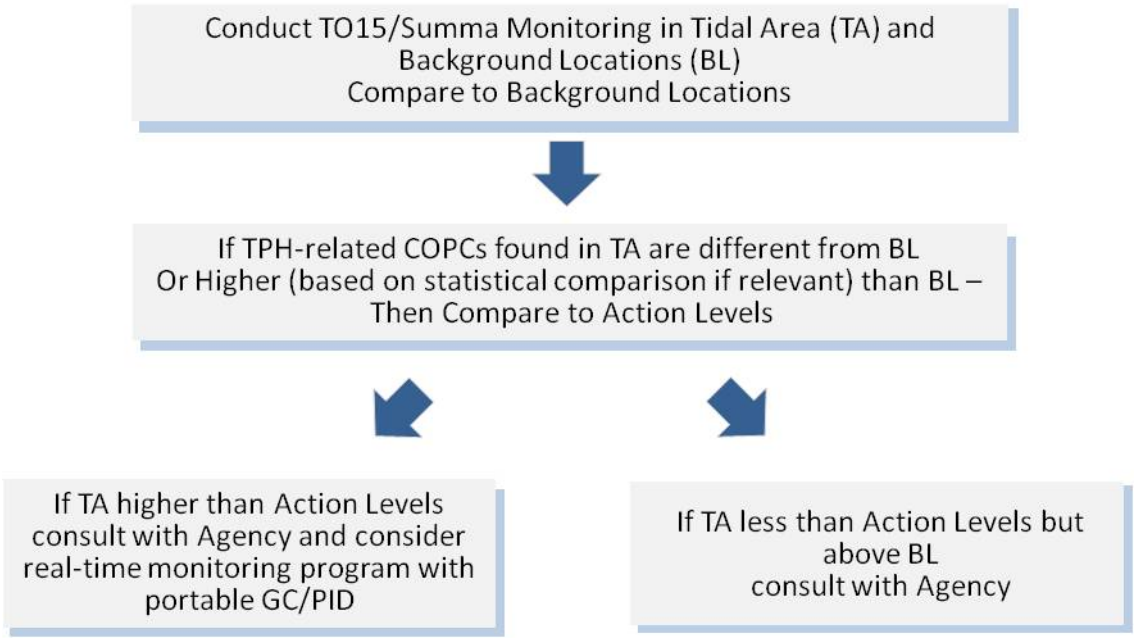
If an odor is observed a portable FID measurement will be made and noted. If a repeatable FID reading in the breathing zone exceeds of 50 parts per million (ppm) VOC (50 ppm is the California Occupational Safety and Health Administration Permissible Exposure Level (OSHA PEL) for n-hexane, a conservative surrogate for TPHv) is observed, sampling personnel will leave the area and additional consultation with SLOAPCD will occur.

Report Preparation

Upon completion of the four sampling events and receipt of laboratory reports, a report will be prepared and submitted to SLOAPCD, and other agencies as appropriate, documenting the field methodologies and results. The report will include data review and evaluation, tables of analytical data, field data sheets, and certified analytical reports.

Possible Actions Based on Initial Results

The following flow chart depicts possible risk management actions that may result after receiving results of initial sampling event(s):



The same source of action levels as used for Project Avila (AMS 2001) are proposed – the California Environmental Protection Agency Office of Environmental Health Hazard Assessment (Cal/EPA OEHHA) Chronic Reference Exposure Levels (RELs; Cal/EPA 2012), with key potentially petroleum-related COPC values shown in Table 2 below.

Table 2. COPCs and Action Levels

Key Petroleum-Related COPCs	Action Level (µg/m^3)*
Benzene	60
Toluene	300
Ethylbenzene	2000
Xylene (total)	700
Naphthalene	9
TPHv**	7000

*From OEHHA Acute, 8-hour, and Chronic Reference Exposure Levels (RELs); http://oehha.ca.gov/air/allrels.html

**Based on n-hexane chronic REL as conservative surrogate for TPHv

Sincerely,

Charles Lambert, PhD, DABT
Principal Toxicologist
McDaniel Lambert, Inc.

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FIGURES

S:\GIS\1252 Chevron EMC-Avila\1252.008 2011 Remediation Support\ArcMapDocuments\019 1252.008 Site Location Map.mxd\1/26/2012

0 1,000 2,000 4,000

FEET

SCALE

FIGURE 1

SITE LOCATION MAP

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

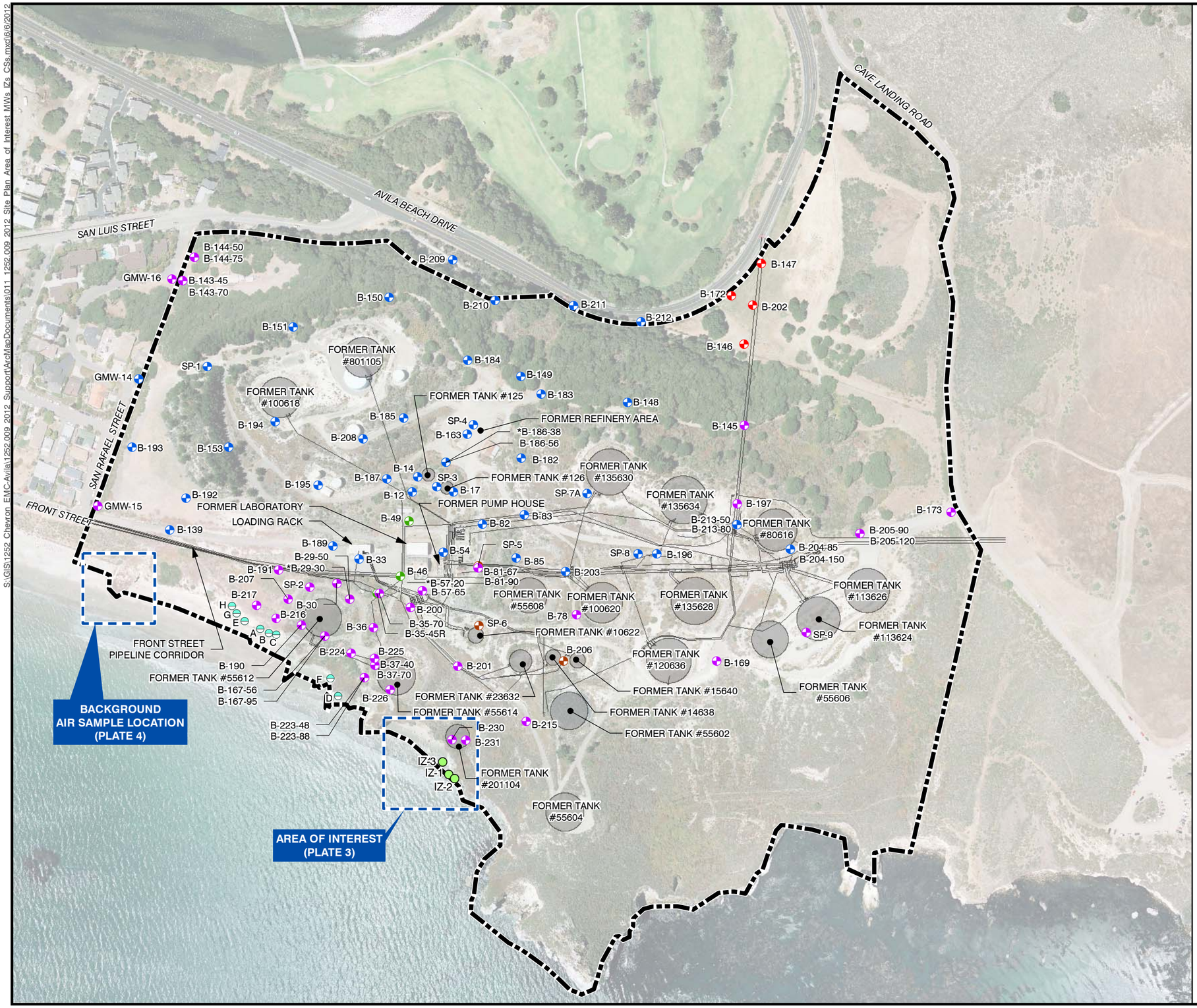
PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

REFERENCE:
7.5 MINUTE U.S.G.S. TOPOGRAPHIC MAP
OF PISMO BEACH, CALIFORNIA
DATED: 1965
PHOTOREVISED: 1975

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

S:\GIS\1252 Chevron EMC-Avila\1252.009 2012 Support\ArcMapDocuments\011 1252.009 2012 Site Plan Area of Interest MWs IZs CSs.mxd 6/6/2012



N

Explanation

- Intertidal Zone (Approximate Location)
- Monitoring Well Completed in Unconsolidated Alluvium
- Monitoring Well Completed in Unconsolidated Colluvium
- Monitoring Well Completed in Pismo/Obispo Formation
- Monitoring Well Completed in Obispo Formation
- Monitoring Well Completed in Pismo Formation
- Cliff Spring Monitoring Location
- Approximate Site Boundary
- Diesel/Gas/Crude Oil Pipelines
- Storage Tanks / Areas

* = UPPER COMPLETION IN COLLUVIUM

0 150 300 600 FEET

SCALE

FIGURE 2

SITE PLAN

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

padre associates, inc.
ENGINEERS, GEOLOGISTS & ENVIRONMENTAL SCIENTISTS

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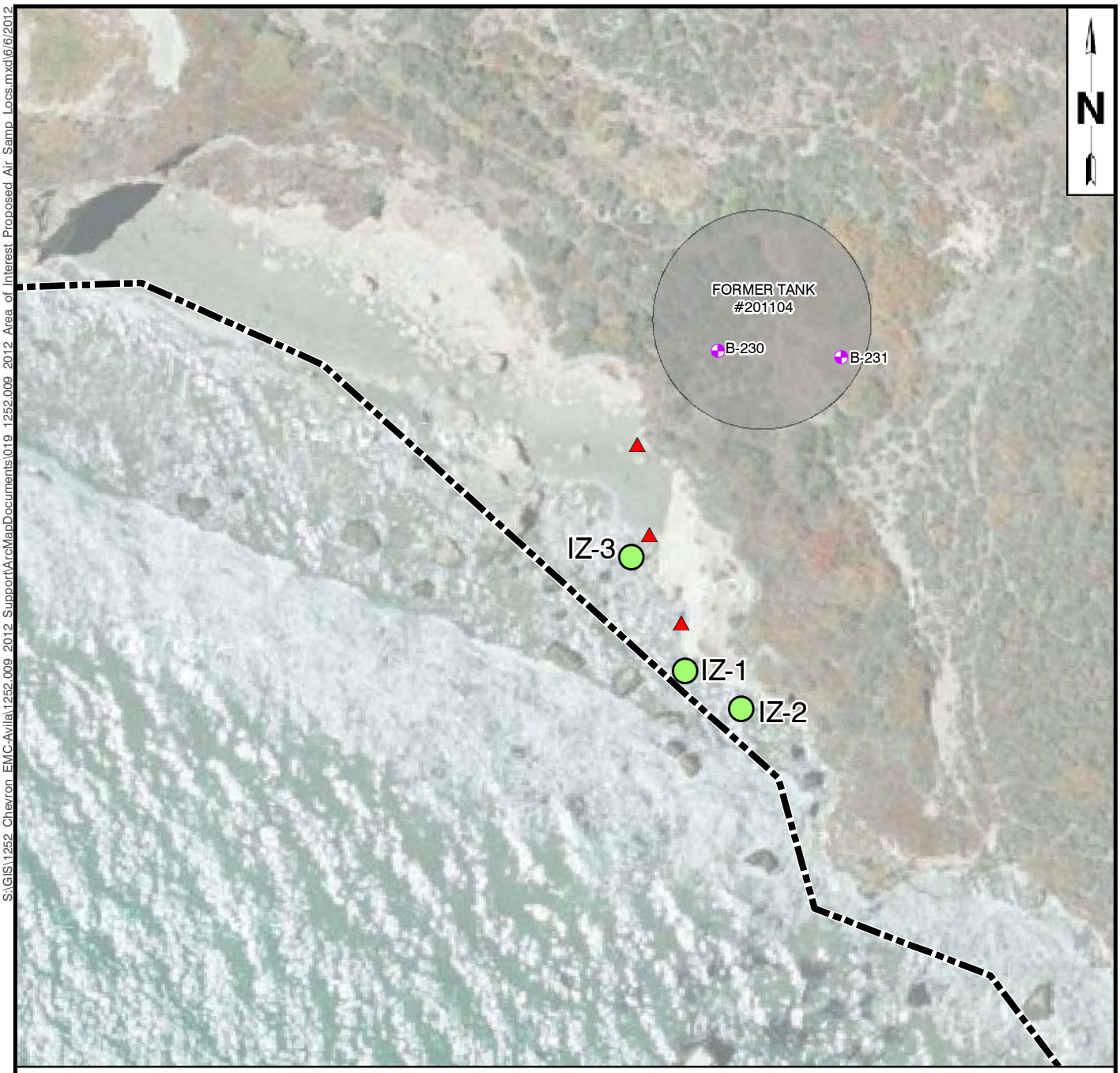

0 25 50 100 FEET

SCALE

Explanation

- Proposed Air Sample Location
- Intertidal Zone (Approximate Location)
- Monitoring Well Completed in Obispo Formation
- Approximate Site Boundary
- Storage Tanks / Areas

FIGURE 3

AREA OF INTEREST AND PROPOSED AIR SAMPLE LOCATIONS

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

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SAN LUIS OBISPO, CALIFORNIA

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0 15 30 60 FEET

SCALE

Explanation

- Proposed Air Sample Location
- Approximate Site Boundary
- Storage Tanks / Areas

FIGURE 4

PROPOSED BACKGROUND AIR SAMPLE LOCATIONS

FORMER AVILA TANK FARM
AVILA BEACH, CALIFORNIA

PREPARED FOR

CHEVRON EMC
SAN LUIS OBISPO, CALIFORNIA

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ATTACHMENT 1

H&P, Inc. EPA Method TO-15 Full List VOCs Reporting Limits and Method Detection Limits

H&P Mobile Geochemistry, Inc. 2470 Impala Drive, Carlsbad, CA 92010
LA Field Office: 1855 Coronado Avenue, Signal Hill, CA 90755
Ph: 800-834-9888 www.handpmg.com

EPA Method TO-15
Full List VOCs
Padre - Avila Beach Ambient Air

	6L RLs	***6L MDL***	***6L RLs***	***6L MDL***
Compound	*Vapor (ppbv)*	*Vapor (ppbv)*	*Vapor (µg/m^3)*	*Vapor (µg/m^3)*
1,1,1,2-Tetrachloroethane	0.10	0.007	0.70	0.050
1,1,1-Trichloroethane	0.10	0.007	0.55	0.041
1,1,2,2-Tetrachloroethane	0.10	0.004	0.70	0.028
1,1,2-Trichloroethane	0.10	0.022	0.55	0.124
1,1,2-Trichlorotrifluoroethane (F113)	0.20	0.012	1.55	0.092
1,1-Dichloroethane	0.10	0.004	0.41	0.018
1,1-Dichloroethene	0.10	0.007	0.40	0.026
1,2,4-Trichlorobenzene	0.10	0.015	0.75	0.114
1,2,4-Trimethylbenzene	0.10	0.006	0.50	0.031
1,2-Dibromoethane (EDB)	0.10	0.005	0.78	0.039
1,2-Dichlorobenzene	0.10	0.008	0.61	0.048
1,2-Dichloroethane (EDC)	0.10	0.008	0.41	0.034
1,2-Dichloropropane	0.10	0.010	0.47	0.045
1,3,5-Trimethylbenzene	0.10	0.013	0.50	0.064
1,3-Dichlorobenzene	0.10	0.019	0.61	0.119
1,4-Dichlorobenzene	0.10	0.004	0.61	0.027
2-Butanone (MEK)	0.20	0.009	0.60	0.026
2-Hexanone (MBK)	0.20	0.004	0.82	0.015
4-Ethyltoluene	0.10	0.005	0.50	0.026
4-Methyl-2-pentanone (MIBK)	0.20	0.006	0.82	0.024
Acetone	0.50	0.023	1.21	0.056
Benzene	0.05	0.006	0.16	0.018
Bromodichloromethane	0.10	0.008	0.68	0.056
Bromoform	0.10	0.009	0.44	0.093
Bromomethane	0.10	0.011	0.40	0.043
Carbon disulfide	0.10	0.002	0.32	0.008
Carbon tetrachloride	0.05	0.006	0.32	0.038
Chlorobenzene	0.10	0.006	0.47	0.028
Chloroethane	0.10	0.014	0.27	0.039
Chloroform	0.05	0.006	0.25	0.028
Chloromethane	0.10	0.007	0.21	0.015
cis-1,2-Dichloroethene	0.10	0.007	0.40	0.029
cis-1,3-Dichloropropene	0.10	0.009	0.46	0.042
Dibromochloromethane	0.10	0.007	0.68	0.062
Dichlorodifluoromethane (F12)	0.20	0.056	1.01	0.279
Dichlorotetrafluoroethane (F114)	0.10	0.021	0.71	0.148
Ethylbenzene	0.10	0.003	0.44	0.015
Hexachlorobutadiene	0.20	0.010	2.15	0.110
m,p-Xylene	0.10	0.002	0.44	0.010
Methylene chloride (Dichloromethane)	0.10	0.004	0.35	0.016
o-Xylene	0.10	0.009	0.44	0.038
Styrene	0.10	0.007	0.43	0.032
Tetrachloroethene	0.10	0.006	0.69	0.039
Toluene	0.20	0.006	0.76	0.024
trans-1,2-Dichloroethene	0.10	0.011	0.40	0.043
trans-1,3-Dichloropropene	0.10	0.009	0.46	0.044

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Trichloroethene	0.10	0.007	0.54	0.035
Trichlorofluoromethane (F11)	0.10	0.004	0.57	0.025
Vinyl chloride	0.05	0.007	0.13	0.018

Additional VOCs by TO-15	***6L RLs*** *Vapor (ppbv)*	***6L MDL*** *Vapor (ppbv)*	***6L RLs*** *Vapor (µg/m^3)*	***6L MDL*** *Vapor (µg/m^3)*
1,1-Dichloropropene	0.10	0.011	0.23	0.048
1,2,3-Trichlorobenzene	0.20	0.018	1.51	0.135
1,2,3-Trichloropropane	0.10	0.006	0.61	0.040
1,2-Dibromo-3-chloropropane	0.10	0.007	0.98	0.070
1,3-Butadiene	0.10	0.014	0.22	0.031
1,3-Dichloropropane	0.10	0.007	0.47	0.035
1,4-Dioxane	0.20	0.015	0.73	0.055
2,2,4-Trimethylpentane	0.10	0.004	0.47	0.017
2,2-Dichloropropane	0.10	0.005	0.47	0.025
2-Chlorotoluene	0.10	0.021	0.53	0.108
4-Chlorotoluene	0.10	0.026	0.53	0.136
Benzyl chloride	0.10	0.006	0.52	0.030
Bromobenzene	0.10	0.010	0.65	0.064
Cyclohexane	0.20	0.010	0.70	0.036
Dibromomethane	0.10	0.017	0.72	0.122
Ethyl acetate	0.20	0.020	0.73	0.074
Isopropylbenzene (Cumene)	0.10	0.003	0.50	0.013
n-Butylbenzene	0.10	0.005	0.56	0.029
n-Heptane	0.10	0.011	0.42	0.046
n-Hexane	0.10	0.008	0.36	0.030
n-Propylbenzene	0.10	0.005	0.50	0.023
p-Isopropyltoluene	0.10	0.008	0.56	0.043
Propene	0.10	0.013	0.17	0.022
sec-Butylbenzene	0.10	0.009	0.56	0.048
tert-Butylbenzene	0.10	0.009	0.56	0.050
Tetrahydrofuran	0.20	0.033	0.60	0.098
Vinyl acetate	0.10	0.029	0.36	0.105
TPH gas (C5-C11)			100	50*

*J-Flagging of TPH to the MDL of 50 ug/m3 must be confirmed in advance of sample analysis.

Oxygenates				
Diisopropyl ether (DIPE)	0.20	0.0068	0.85	0.029
Ethyl tertiary-butyl ether (ETBE)	0.20	0.0026	0.85	0.011
Methyl tertiary-butyl ether (MTBE)	0.20	0.0041	0.73	0.015
Tertiary-amyl methyl ether (TAME)	0.20	0.0040	0.85	0.017
Tertiary-butyl alcohol (TBA)	0.50	0.0079	1.54	0.024
Additional Compounds by TO-15				
Naphthalene	0.10	0.0128	0.53	0.068
Isopropyl Alcohol	0.50	0.00394	1.25	0.010
Ethanol	1.00	0.0260	1.90	0.050