3.0 SUMMARY OF 1998 OFFSHORE ERA DATA COLLECTION

The following sections summarize the 1998 offshore data collected at NFD Point Molate. The rationale and methodology for sampling are summarized in Section 2.9. The complete package of validated data is included in Appendix F. Station IDs, specific sampling location coordinates in latitude and longitude and sampling location depths (mean low water) are given in Table F-1 in Appendix F. Sampling was conducted in both the north and south coves at NFD Point Molate (the boundary between the north and south coves is defined by the fuel pier at NFD Point Molate). The locations of the north cove and south cove sampling locations and the fuel pier are presented on Plate 2. The locations sampled to support this ERA are previously sampled locations which occur along transects running roughly perpendicular from shore from known sources towards the open bay. The general rationale for sample location selection is given in section 2.9. The detailed rationale for transect and associated sampling locations is given in the NFD Point Molate Offshore ERA Workplan (TtEMI, 1998b). Data collected in support of site characterization and ERA activities will be discussed in the following sections.

3.1 SUMMARY OF SITE CHARACTERIZATION DATA

Plate 2 graphically presents the results of the sum PAH and sum extractable petroleum hydrocarbons (EPH) collected at NFD Point Molate. Subtidal sampling location data (T10-2, P2-1, P3-1 and T3-2) were collected solely for site characterization purposes. Table 3-1 summarizes the PAH and EPH results for the subtidal stations at NFD Point Molate. Sum PAHs ranged from 1.511 to 3.691 mg/kg-dw, while sum EPH ranged from 31.00 to 95.00 mg/kg-dw. TPH data collected from vertical cores, as described in Section 2.9, are presented in Table 3-2. TPH concentrations ranged from 8 to 206 mg/kg. No general vertical trends in TPH concentration with depth were observed.

Organochlorine pesticide data were also collected in support of site characterization activities at sampling station T-2 due to potential upgradient on-shore sources of pesticides. Table 3-3 summarizes the pesticide results for sampling station T-2. Additionally, Table 3-3 summarizes pesticide data collected in support of the bioassays for the other intertidal sampling stations at NFD Point Molate and data from other relevant sampling events in San Francisco Bay (e.g., the RMP [RWQCB, 1994]). The only organochlorine pesticides detected at NFD Point Molate were DDT and its metabolites DDE and DDD. The detected concentration of DDT at T-2 fell within the range of detected DDT concentrations at other intertidal sampling stations at NFD Point Molate and at Point Pinole and Point Isabel, the closest RMP sampling stations. While the concentration at sampling station T-2 exceeded the ER-L, it was below the

ambient threshold criteria developed for San Francisco Bay. In general, all the DDT data collected from intertidal sampling stations at NFD Point Molate fell below ambient levels except for one outlier at T11A-1.

To evaluate the potential for bioaccumulation of organochlorine pesticides at station T-2, organochlorine pesticides were analyzed in bivalve tissue collected at T-2. As can be seen from Table 3-4, only DDT and its metabolites, DDD and DDE, were detected in bivalve tissue at station T-2. The total detected DDT concentration in the T-2 tissue sample was substantially lower than tissue data collected for the mussel watch program at the Emeryville Station, or for the RMP at Pinole Point.
Based on both the sediment and tissue data collected at station T-2, there is no indication that there has been significant contamination of the sediments with DDT which would require further evaluation.

3.2 SUMMARY OF DATA COLLECTED IN SUPPORT OF THE ERA

Plate 2 summarizes the sampling locations and sum PAH and sum EPH results collected in support of the offshore ERA for NFD Point Molate. Additionally, PAH and sum EPH data analyzed in sediments and PAH data analyzed in bivalve tissue are summarized in Table 3-5.

At bioassay locations, sediments were also analyzed for a full suite of chemicals, including metals, SVOCs, VOCs, PCBs, and organochlorine pesticides to evaluate potential sediment toxicity drivers other than the petroleum-related COPECs.

Sediment cores to be used in the bioassay evaluations were collected at all intertidal sampling stations as well as P1-1 and Paradise Cove. The bioassay results are discussed in more detail in Section 4.0 and in Appendix D. Benthos at each location were also collected, preserved, and archived for further evaluation if required.

As summarized in Table 3-5, tissue samples collected from north cove intertidal stations at NFD Point Molate contained sum PAH levels ranging from 0.142 to 0.178 mg/kg-dw (average 0.158 mg/kg-dw), with corresponding sediment sum PAH values of 1.255 to 4.753 mg/kg-dw (average 2.628 mg/kg-dw). Tissue samples collected at south cove stations contained sum PAH ranging from 0.176 to 0.313 mg/kg-dw (average 0.252 mg/kg-dw), with corresponding sediment sum PAH values of 0.428 to 2.947 mg/kg-dw (average 1.385 mg/kg-dw).

Sum PAH levels in three tissue samples collected from the reference area ranged from 0.107 to 0.113 mg/kg-dw (average 0.110 mg/kg-dw), and associated sediment sum PAH levels ranged from 1.322 to 5.103 mg/kg-dw (average 2.670 mg/kg-dw). As the data indicate, sediment sum PAH levels are much higher (generally by at least an order of magnitude) than sum PAH levels in bivalve tissue samples collected at the same station (Table 3-5).

Average sum PAH concentrations in tissues appeared highest in south cove samples and lowest in the reference area samples. In NFD Point Molate sediments, the lowest sum PAH concentrations were seen at stations T5 and T6 in the south cove, and the highest concentration was detected at station T11 in the north cove. However, the highest sediment sum PAH concentrations seen in this study were at the reference area. On average, sediment sum PAH levels appeared to be similar in the north cove, the pier, and the reference area, while the average sum PAH in the south cove area appeared lower than in the other areas.

TABLE 3-1

PAH AND SUM EPH (mg/kg-dw) IN SEDIMENTS FROM NFD POINT MOLATE SUBTIDAL STATIONS (SAMPLED FOR RISK CHARACTERIZATION PURPOSES)

PAH Results	T10-2	P1-1*	P2-1	P3-1	T3-2
Naphthalene	0.025	0.010	0.008	0.018	0.0 13
1-Methylnaphthalene	0.012	0.003	0.003	0.019	0.009
2-Methylnaphthalene	0.017	0.006	0.006	0.050	0.012
Acenaphthylene	0.024	0.013	0.008	0.017	0.011
Acenaphthene	0.024	0.011	0.015	0.140	0.007
Fluorene	0.032	0.013	0.009	0.110	0.015
Phenanthrene	0.230	0.130	0.110	0.590	0.110
Anthracene	0.120	0.048	0.033	0.110	0.042
Fluoranthene	0.290	0.600	0.200	0.580	0.170
Pyrene	0.350	0.430	0.290	0.560	0.290
Benz(a)anthracene	0.170	0.130	0.100	0.230	0.120
Chrysene	0.210	0.230	0.120	0.260	0.140
Benzo(b)fluoranthene	0.120	0.140	0.099	0.150	0.110
Benzo(k)fluoranthene	0.140	0.100	0.086	0.160	0.097
Benzo(a)pyrene	0.220	0.150	0.150	0.240	0.170
Indeno(1,2,3-cd)pyrene	0.210	0.140	0.140	0.240	0.180
Dibenz(a,h)anthracene	0.027	0.020	0.014	0.027	0.020
Benzo(g,h,i)perylene	0.170	0.110	0.120	0.190	0.150
Sum PAH	**2.391**	**2.284**	**1.511**	**3.691**	**1.666**
Sum EPH	**95.000**	**156.000**	**31.000**	**43.000**	**34.000**

* Station P1-1 was sampled for risk assessment purposes

PAH = Polycyclic aromatic hydrocarbons.
EPH = Extractable petroleum hydrocarbons.
Note: Stations are ordered north to south.

TABLE 3-2

VERTICAL CORE SAMPLING RESULTS

Core Depth (feet from surface)	TPH Concentration (mg/kg)					
	T2	T3	T5	T6	T11	DL1
0 - 1	40	--	--	--	--	--
1 - 2	39	46	18	--	181	186
2 - 3	37	20	23	22*	50	206
3 - 4	12	60	8		28	87

Notes:

-- = TPH was not detected in sample.
* Only one sample was collected for the depth from 2 to 4 feet at station T6.

TABLE 3-3

ORGANOCHLORINE PESTICIDE RESULTS (mg/kg-dw) FOR SEDIMENTS COLLECTED AT NFD POINT MOLATE AND RMP STATIONS

	NFD Point Molate Sampling Stations											RMP Stations			
	T2-1	T9-2	P1-1	T6-1	T3-1	T5-1	DL-1	T9-1	T10-1	T11-1	T11A-1	Point Isabel	Point Isabel	Pinole Point	
Matrix	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment	Sediment
Date Collected	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	mg/kg-dw	2/14/94	8/29/94	2/11/94	8/26/94
4,4'-DDE	<0.0004	0.001	0.001	0.001	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.002	0.0011	0.0009	0.0011	0.0018
4,4'-DDD	0.001	0.002	0.002	0.001	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.003	0.005	0.0052	0.0020	0.0015	0.003
4,4'-DDT	0.002	<0.0002	<0.0002	0.003	<0.0002	0.001	<0.0002	<0.0002	0.001	<0.0002	0.019	0.0003	ND	0.0007	ND
TOTAL DDTs	0.0029	0.0026	0.003	0.0046	0.0002	0.0013	N/A	N/A	0.0005	0.003	**0.026**	**0.0066**	0.0030	0.0034	0.0048

	ER-L	Ambient Threshold Criteria
Total DDTs	0.0016 ppm	0.007 ppm

* Only those pesticides detected at NFD Point Molate are included in this table. Additional pesticides were detected in RMP samples collected at Point Isabel and Pinole Point.
RMP = San Francisco Estuary Regional Monitoring Program (1994).
M. edulis = Mytilus edulis
U and UJ = Not detected based on data validation findings; value not included in total DDTs.
Total DDTs is considered as 4,4'-DDE + 4,4'-DDD + 4,4'-DDT.
Bold values exceed ambient threshold criteria; underlined values exceed the ERL.

TABLE 3-4

ORGANOCHLORINE PESTICIDE RESULTS[1] (mg/kg-dw) FOR TISSUE SAMPLES COLLECTED AT NFD POINT MOLATE, MUSSEL WATCH EMERYVILLE STATION, AND RMP STATION

	Point Molate	MW-SFEM	RMP
Location	T2	Emeryville	Pinole Point
Species	Potamocorbula	Mytilus Species (Mussel)	Mytilus Species (Mussle)
Matrix	Tissue	Tissue	Tissue
Sample Date	10/98	2/87 - 2/95	5/94 - 9/94
4,4'-DDE	0.005	0.032 - 0.200	0.026 - 0.055
4,4'-DDD	(2)	0.019 - 0.300	0.024 - 0.057
4,4'-DDT	0.002	0.006-0.313	0.002 - 0.004
TOTAL DDTs[3]	0.007	0.060 - 0.574	0.052 - 0.116

(1) Only those pesticides detected at NFD Point Molate are included for RMP stations in this table. Additional pesticides were detected in RMP samples collected at Point Isabel and Pinole Point.
(2) Not detected based on data validation findings; value not included in Total DDTs.
(3) Total DDTs = 4,4'-DDE + 4,4'-DDD + 4,4'-DDT

RMP = SFEI, 1994
MW-SFEM = Mussel Watch San Francisco Bay Emeryville Station, NOAA (1999)

TABLE 3-5

PAH SUM EPH (µg/kg-dw) IN CLAM TISSUES AND SEDIMENTS FROM POINT MOLATE INTERTIDAL STATIONS

	T11A				T11-1		T10-1-1		T9-1			
	North Cove				North Cove		North Cove		North Cove			
PAH Results	Tissue	Sed. T11A-1	Sed. T11A-2	Sed. T11A-3	Tissue	Sediment	Tissue	Sediment	Tissue	Sed. T9-1-1	Sed. T9-1-2	Sed. T9-1-3
Naphthalene	**0.2**	9	15	9	**0.2**	29	**0.2**	16	**0.2**	7	5	8
1-Methylnaphthalene	**0.2**	3	4	4	**0.2**	8	**0.2**	7	**0.2**	3	2	3
2-Methylnaphthalene	**0.3**	6	7	7	**0.3**	12	**0.3**	10	**0.3**	4	3	5
Acenaphthylene	0.5	20	23	19	0.5	42	0.5	35	0.5	12	7	15
Acenaphthene	1.0	12	14	10	1.0	24	0.9	22	1.0	3	3	8
Fluorene	2.0	18	18	14	1.0	33	1.0	34	2.0	12	5	14
Phenanthrene	12.0	210	210	170	8.0	380	8.0	460	10.0	96	61	140
Anthracene	3.0	93	90	72	2.0	180	2.0	130	3.0	40	24	58
Fluoranthene	33.0	400	380	340	28.0	660	27.0	730	28.0	190	140	260
Pyrene	26.0	440	470	370	30.0	750	23.0	720	22.0	200	200	240
Benz(a)anthracene	13.0	210	210	190	11.0	380	11.0	320	13.0	120	96	150
Chrysene	19.0	230	250	230	17.0	460	15.0	390	18.0	160	130	180
Benzo(b)fluoranthene	17.0	190	250	210	14.0	350	15.0	310	17.0	150	88	130
Benzo(k)fluoranthene	13.0	190	230	190	13.0	340	11.0	290	11.0	120	94	130
Benzo(a)pyrene	13.0	270	320	260	13.0	500	11.0	420	12.0	180	130	190
Indeno(1,2,3-cd)pyrene	12.0	170	190	160	10.0	330	9.0	200	14.0	180	140	170
Dibenz(a,h)anthracene	2.0	23	28	23	1.0	45	1.0	39	4.0	26	17	23
Benzo(g,h,i)perylene	11.0	120	130	110	9.0	230	8.0	210	11.0	130	110	130
Sum PAH	**178.1**	**2,614**	**2,839**	**2,388**	**159.1**	**4,753**	**144.0**	**4,343**	**167.1**	**1,633**	**1,255**	**1,854**
Sum EPH	**NA**	**149,000**	**248,000**	**137,000**	**NA**	**116,000**	**NA**	**106,000**	**NA**	**53,000**	**46,000**	**51,000**

PAH = Polycyclic aromatic hydrocarbons.
EPH = Extractable petroleum hydrocarbons.
A bolded number for an individual PAH represents half the detection limit for that PAH.
Stations are ordered north to south.

TABLE 3-5
(continued)

PAH SUM EPH (µg/kg-dw) IN CLAM TISSUES AND SEDIMENTS FROM NFD POINT MOLATE INTERTIDAL STATIONS

	T9-2		DL-1-1		T6		T5			
	North Cove		North Cove		South Cove		South Cove			
PAH Results	Tissue	Sediment	Tissue	Sediment	Tissue	Sediment	Tissue	Sed. T5-1	Sed. T5-2	Sed. T5-3
Naphthalene	**0.2**	8	**0.2**	8	8.0	4	**0.2**	3	3	2
1-Methylnaphthalene	**0.2**	2	**0.2**	3	7.0	2	**0.2**	0.9	1	0.9
2-Methylnaphthalene	**0.3**	4	**0.3**	5	0.2	4	**0.3**	2	**0.3**	2
Acenaphthylene	0.3	19	0.5	12	**0.1**	4	**0.1**	5	3	3
Acenaphthene	0.9	5	1.0	8	3.0	3	1.0	2	1	2
Fluorene	1.0	17	2.0	13	3.0	6	2.0	6	3	4
Phenanthrene	9.0	150	10.0	130	15.0	34	14.0	58	22	39
Anthracene	4.0	94	3.0	52	7.0	26	8.0	23	10	23
Fluoranthene	27.0	250	30.0	220	62.0	76	35.0	88	53	73
Pyrene	20.0	310	24.0	270	52.0	87	36.0	120	72	98
Benz(a)anthracene	11.0	230	11.0	160	27.0	48	21.0	51	33	43
Chrysene	16.0	350	16.0	190	39.0	86	29.0	73	48	60
Benzo(b)fluoranthene	14.0	260	16.0	150	24.0	64	18.0	53	34	45
Benzo(k)fluoranthene	8.0	210	12.0	140	21.0	49	16.0	56	31	41
Benzo(a)pyrene	10.0	310	11.0	200	18.0	67	16.0	74	39	52
Indeno(1,2,3-cd)pyrene	10.0	240	10.0	200	14.0	84	15.0	74	39	57
Dibenz(a,h)anthracene	1.0	34	2.0	30	**0.3**	12	**0.3**	12	6	9
Benzo(g,h,i)perylene	9.0	160	8.0	160	12.0	66	14.0	56	30	44
Sum PAH	**141.8**	**2,653**	**157.1**	**1,951**	**312.5**	**722**	**226.0**	**756.9**	**428.3**	**597.9**
Sum EPH	**NA**	**55,000**	**NA**	**69,000**	**NA**	**37,000**	**NA**	**26,000**	**24,000**	**27,000**

PAH = Polycyclic aromatic hydrocarbons.
EPH = Extractable petroleum hydrocarbons.
A bolded number for an individual PAH represents half the detection limit for that PAH.
Stations are ordered north to south.

TABLE 3-5
(continued)

PAH SUM EPH (µg/kg-dw) IN CLAM TISSUES AND SEDIMENTS FROM NFD POINT MOLATE INTERTIDAL STATIONS

	T3-1-1		T2				REF-1-1		REF-2-1		REF-3-1	
	South Cove		South Cove				Reference		Reference		Reference	
PAH Results	Tissue	Sediment	Tissue	Sed. T2-1	Sed. T2-2	Sed. T2-3	Tissue	Sediment	Tissue	Sediment	Tissue	Sediment
Naphthalene	**0.2**	6	**0.2**	10	18	6	**0.2**	9	**0.2**	10	**0.2**	12
1-Methylnaphthalene	**0.2**	2	**0.2**	5	11	3	**0.2**	2	**0.2**	3	**0.2**	2
2-Methylnaphthalene	**0.3**	**0.3**	**0.3**	8	17	5	**0.3**	6	**0.3**	7	**0.3**	5
Acenaphthylene	**0.1**	8	**0.1**	21	25	15	0.5	8	0.6	18	**0.1**	9
Acenaphthene	0.8	4	1.0	9	13	4	0.7	6	0.7	9	0.7	4
Fluorene	1.0	11	2.0	21	36	12	1.0	8	1.0	14	1.0	**0.3**
Phenanthrene	12.0	100	22.0	220	320	160	10.0	71	8.0	200	8.0	64
Anthracene	5.0	30	4.0	49	50	34	3.0	21	4.0	70	2.0	22
Fluoranthene	34.0	190	58.0	290	430	250	21.0	160	16.0	1,200	16.0	170
Pyrene	28.0	210	48.0	340	480	280	16.0	210	17.0	1,100	17.0	240
Benz(a)anthracene	17.0	100	33.0	180	200	130	9.0	86	8.0	380	7.0	98
Chrysene	24.0	160	43.0	330	300	200	10.0	97	9.0	480	9.0	130
Benzo(b)fluoranthene	13.0	110	22.0	190	180	130	7.0	88	8.0	290	8.0	120
Benzo(k)fluoranthene	12.0	100	21.0	180	180	130	6.0	84	6.0	350	6.0	120
Benzo(a)pyrene	10.0	120	14.0	210	230	150	9.0	140	9.0	370	9.0	190
Indeno(1,2,3-cd)pyrene	9.0	130	13.0	200	240	160	9.0	170	10.0	330	11.0	210
Dibenz(a,h)anthracene	**0.3**	20	**0.3**	31	37	25	1.0	16	1.0	42	**0.3**	18
Benzo(g,h,i)perylene	9.0	95	10.0	130	180	110	9.0	140	10.0	230	11.0	170
Sum PAH	**175.8**	**1,396.3**	**292.0**	**2,424**	**2,947**	**1,804**	**112.8**	**1,322**	**108.9**	**5,103**	**106.7**	**1,584.3**
Sum EPH	**NA**	**45,000**	**NA**	**38,000**	**38,000**	**38,000**	**NA**	**33,000**	**NA**	**40,000**	**NA**	**33,000**

PAH = Polycyclic aromatic hydrocarbons.
EPH = Extractable petroleum hydrocarbons.
A bolded number for an individual PAH represents half the detection limit for that PAH.
Stations are ordered north to south.