APPENDIX 5.3. OIL-ON-WATER: SOURCES, BEHAVIOR, RESPONSE

The purpose of this Appendix is to provide the reader with information on the sources of petroleum hydrocarbons to the sea, to discuss activities which may cause these inputs that are discussed in the EIS and those sources considered in the cumulative analysis. Other topics addressed include, responses to oil spills, how oil changes when it is spilled on water, how various organizations respond to oil spills, and the tools they have available in the "response tool box".

SOURCES OF OIL

In 1985, the National Research Council's Steering Committee for the Petroleum in the Marine Environment Update, issued a book entitled, "Oil in the Sea: Inputs, Fates, and Effects (NRC, 1985). The NRC is updating this information but it is not available for direct citation until June, 2002; however, sources within the document were used. Data and information from Pacific OCS Region (POCSR) records were also used to ascertain the sources and amount of oil contributed to the sea.

OIL AND GAS EXPLORATION ACTIVITIES

Exploration activities include mobilization and operations on the drilling vessel and other associated activities as support vessels. Two general potential sources exist for spills during exploration activities:

- Spills during drilling operations due to loss of well control (blowouts), and
- Spills from other exploratory activities including those related to support vessels.

Minerals Management Service oil spill records do not differentiate between spills from development operations and from exploratory operations. In small part, this is due to the fact that few exploratory wells are drilled from fixed platforms. Mainly, however, it is because spills resulting from drilling on any facility has similar causes and risks. Exploratory drilling is subjected to more unknowns geologically, hence increasing the inherent risks. Recent technological innovations, however, that have greatly lessened the risk from this last eventuality include:

- Increased knowledge of nondrilled geology from such methods as 3-D seismic surveys and improved data processing;
- A better ability to control wells by intensive monitoring of a plethora of downhole data while drilling is occurring; and
- Intensive training and drills by facility workers, resulting in a readiness and an instant responsiveness to unexpected events.

Spills during drilling due to loss of well control

MMS investigates blowouts and provides reports describing the circumstances surrounding the incidents with the ultimate goal of prevention through the use of safety alerts and other regulatory means. Table 5.3-1 summarizes each of the blowouts for years 1992-present. This report is based on information contained in the MMS Technical Information Management System for the years 1995 through 2000, and in MMS files for the years prior to 1995. Some data details may not be available for 1999 through 2001 because investigations have not yet been completed. Most incidents involve everyday operations and duties. By providing brief descriptions of each blowout, MMS is trying to prevent similar incidents from occurring in the future. A total of 38 blowouts occurred in this 9 year period.

Of the 38 events summarized in table 5.3-1, 4 separate events resulted in a total spillage of 302 bbl of hydrocarbons. Twenty-six of the 38 events occurred during drilling, and 25 occurred during development (rather than exploration) operations. Only two events occurred in the POCSR, both as a result of workover operations; during one of these, in November 2000, approximately 1 gallon of oil was spilled.

Table 5.3-1. **Uncontrolled well (Blowout) information. Compiled from MMS's website:** ***http://www.mms.gov/stats/OCSincident.htm***

http://www.mms.gov/stats/OCSincident.htm

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Gulf of Mexico Region	3	3	0	1	4	5	6	5	8	1
Pacific Region	0	0	0	0	0	0	1	0	1	0
Total	3	3	0	1	4	5	7	5	9	1

Revised 3/13/01

Appendix 5.4 - Emission Data and Assumptions Tables

Table 5.4-1. Electromotive drilling requirements.

Electromotive Drilling Requirements										
			Duration (Days)[2]				Power Requirement (hp-hr)			
Drilling Phase	Engine Load (hp)[1]	Hours/Day	Bonito	Pt. Sal	Purisima Point	Gato Canyon	Bonito	Point Sal	Purisima Point	Gato Canyon
Movement	2765	24	2.75	2	2	1	182,490	132,720	132,720	66,360
Site Prep.	2050	24	2	1	1	3	98,400	49,200	49,200	147,600
Drilling	1785	24	23.5	29	23	21.5	1,006,740	1,242,360	985,320	921,060
Tripping	1730	24	4.75	4	4	6.5	197,220	166,080	166,080	269,880
Set Casing	1239	24	6.5	5	5	18	193,284	148,680	148,680	535,248
Recover Casing	1319	24	2.25	0	0	1	71,226	0	0	31,656
Logging	744	24	7.25	5	5	6	129,456	89,280	89,280	107,136
Testing	1049	24	27.5	21	21	30	692,340	528,696	528,696	755,280
Abandon Well	1240	24	3.5	5	5	4	104,160	148,800	148,800	119,040
Standby	983	24	10	2	2	4	235,920	47,184	47,184	94,368
Total			90	74	68	95	2,911,236	2,553,000	2,295,960	3,047,628
Equipment										
Cranes	600	2	60	60	60	60	72,000	72,000	72,000	72,000

1 - Assessment of NOx Control Measures for Diesal Engines on Offshore Exploratory Drilling Vessels and Rigs. Radian, 1982-

2.Provided in project description.

Table 5.4-2. Drilling phase emission factors.

Drilling Phase Emission Factors										
				Emission Factors						
Equipment	Hrs/day	Days	Load	NOx	CO	VOC	SO_2	PM_{10}	Units	Reference
Main Engines	24	*		7.10	0.95	0.04	0.16	0.31	g/bhp-hr	1990 SEDCO 712 Source test
Cranes	2	60	600	8.96	3.48	0.04	0.16	0.31	g/bhp-hr	
Flare	24	4	0.7mmcf/ day	100	35.0	6.4	4.1	5.0	lbs/mmcf	AP-42 (1.4-1)

*Variable

Table 5.4-3. Drilling phase emission estimates per Proposed Action.

Drilling Phase Emission Estimates															
	Hourly Emissions					Daily emissions					Total Emissions				
	(lbs/hr)					(lbs/day)					(tons)				
Drilling Operation	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Bonito															
Drilling Activities	21.10	2.82	0.12	0.48	0.92	506.31	67.75	2.85	11.41	22.11	22.78	3.05	0.13	0.51	0.99
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Total	35.87	8.44	0.36	0.81	2.39	600.01	101.46	7.44	14.7	28.26	23.63	3.38	0.14	0.53	1.08
Pt. Sal															
Drilling Activities	22.50	3.01	0.13	0.51	0.98	540.1	72.26	3.04	12.17	23.58	19.98	2.67	0.11	0.45	0.87
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Total	37.27	8.63	0.37	0.84	2.45	633.8	105.97	7.63	15.46	29.73	20.83	3.00	0.12	0.47	0.96
Purisima															
Drilling Activities	22.02	2.95	0.12	0.50	0.96	528.49	70.71	2.98	11.91	23.08	17.97	2.40	0.10	0.40	0.78
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Total	36.79	8.57	0.36	0.83	2.43	622.19	104.42	7.57	15.20	29.23	18.82	2.73	0.11	0.42	0.87
Gato															
Drilling Activities	20.92	2.80	0.12	0.47	0.91	502.14	67.19	2.83	11.32	21.92	23.85	3.19	0.13	0.54	1.04
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Total	35.69	8.42	0.36	0.80	2.38	595.84	100.90	7.42	14.61	28.07	24.70	3.52	0.14	0.56	1.13

Table 5.4-4. Purisima Point Mobile Source Emission Factors.

Purisima Point Mobile Source Emission Factors												
						Emission Factors						
Vessel	**Hrs/day**	**Days**	**Load**	**Fuel Rate (gal/mi)**	**Mileage (R/T)**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**Units**	**Reference**
Crew boat												
Idle	1	21		2.97		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		12		2.97	220	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Supply Boat												
Idle	1	18		8.24		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		18		8.24	220	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Tug Boats												
Small												
Idle	8	1	20	33.7 (gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	1	50	84.3 (gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Large												
Idle	8	3	20	56.2 (gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	3	50	140.5 (gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Helicopters												
LTO			80			3.02	13.54	6.78	0.44	0.40	Lbs/cycle	AP-42 (II-1-10)
Cruise			40 (hrs)			6.4	5.0	0.70	0.9	0.8	Lbs/mile	AP-42 (II-1-8)

Table 5.4-5. Purisima Point Mobile Source Emission Estimates.

Purisima Point Mobile Source Emissions															
	Hourly Emissions					Daily emissions					Total Emissions				
Vessel	(lbs/hr)					(lbs/day)					(tons)				
	NOx	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Crew boat															
Idle	1.12	0.53	0.71	0.03	0.14	1.12	0.53	0.71	0.03	0.14	0.01	0.01	0.01	0.00	0.00
Cruise	14.53	6.88	9.27	0.38	1.82	174.46	82.52	111.21	4.61	21.89	1.05	0.50	0.67	0.03	0.13
Supply Boat															
Idle	2.24	1.06	1.43	0.06	0.28	2.24	1.06	1.43	0.06	0.28	0.02	0.01	0.01	0.00	0.003
Cruise	40.33	19.08	25.71	1.06	5.06	484.02	228.96	308.54	12.78	60.73	4.36	2.06	2.78	0.11	0.55
Tug Boats															
Small (2)															
Idle	21.91	7.43	2.67	0.48	2.22	175.24	59.42	21.35	3.83	17.79	0.09	0.03	0.01	0.00	0.01
Manuever	59.01	16.37	4.97	1.20	5.56	944.16	261.94	79.58	19.15	89.02	0.47	0.13	0.04	0.01	0.04
Large (2)															
Idle	36.53	12.39	4.45	0.80	3.71	584.48	198.18	71.22	12.77	59.35	0.88	0.30	0.11	0.02	0.09
Manuever	98.35	27.29	8.29	1.99	9.27	786.8	218.28	66.32	15.96	74.18	1.18	0.33	0.10	0.02	0.11
Helicopters															
LTO	6.05	27.1	13.55	0.90	0.80	6.05	27.1	13.55	0.90	0.80	0.12	0.54	0.27	0.02	0.02
Cruise	6.40	5.00	0.70	0.90	0.80	6.40	5.00	0.70	0.90	0.80	0.13	0.10	0.01	0.02	0.02
Total															

Table 5.4-6. Point Sal Mobile Source Emission Factors.

Point Sal Mobile Source Emission Factors												
						Emission Factors						
Vessel	**Hrs/day**	**Days**	**Load**	**Fuel Rate (gal/mi)**	**Mileage (R/T)**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**Units**	**Reference**
Crew boat												
Idle	1	21		2.97		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		14		2.97	240	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Supply Boat												
Idle	1	18		8.24		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		22		8.24	240	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Tug Boats												
Small												
Idle	8	1	20	33.7(gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	1	50	84.3(gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Large												
Idle	8	3	20	56.2(gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	3	50	140.5(gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Helicopters												
LTO			100			3.02	13.54	6.78	0.44	0.40	Lbs/cycle	AP-42 (II-1-10)
Cruise			50 (hrs)			6.4	5.0	0.70	0.9	0.8	Lbs/mile	AP-42 (II-1-8)

Table 5.4-7. Point Sal Mobile Source Emission Estimates.

Point Sal Mobile Source Emissions															
	Hourly Emissions					Daily emissions					Total Emissions				
Vessel	(lbs/hr)					(lbs/day)					(tons)				
	NOx	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Crew boat															
Idle	1.12	0.53	0.71	0.03	0.14	1.12	0.53	0.71	0.03	0.14	0.01	0.01	0.01	0.00	0.00
Cruise	15.86	7.50	10.11	0.42	1.99	190.32	90.03	121.32	5.03	23.88	1.33	0.63	0.85	0.04	0.17
Supply Boat															
Idle	2.24	1.06	1.43	0.06	0.28	2.24	1.06	1.43	0.06	0.28	0.02	0.01	0.01	0.00	0.00
Cruise	44.00	20.81	28.05	1.16	5.52	528.02	249.77	336.59	13.94	66.25	5.81	2.75	3.70	0.15	0.73
Tug Boats															
Small															
Idle	21.91	7.43	2.67	0.48	2.22	175.24	59.42	21.35	3.83	17.79	0.09	0.03	0.01	0.00	0.01
Manuever	59.01	16.37	4.97	1.20	5.56	944.16	261.94	79.58	19.15	89.02	0.47	0.13	0.04	0.01	0.04
Large															
Idle	36.53	12.39	4.45	0.80	3.71	584.48	198.18	71.22	12.77	59.35	0.88	0.30	0.11	0.02	0.09
Manuever	98.35	27.29	8.29	1.99	9.27	786.8	218.28	66.32	15.96	74.18	1.18	0.33	0.10	0.02	0.11
Helicopters															
LTO	6.00	27.20	13.60	0.80	0.80	6.00	27.20	13.60	0.80	0.80	0.15	0.68	0.34	0.02	0.02
Cruise	6.40	5.20	0.80	0.80	0.80	6.40	5.20	0.80	0.80	0.80	0.16	0.13	0.02	0.02	0.02

Table 5.4-8. Bonito Mobile Source Emission Factors.

Bonito Mobile Source Emission Factors												
						Emission Factors						
Vessel	**Hrs/day**	**Days**	**Load**	**Fuel Rate (gal/mi)**	**Mileage (R/T)**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**Units**	**Reference**
Crew boat												
Idle	1	21		2.97		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		18		2.97	204	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Supply Boat												
Idle	1	18		8.24		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		23		8.24	204	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Tug Boats												
Small												
Idle	8	2	20	33.7 (gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	2	50	84.3 (gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Large												
Idle	8	4.75	20	56.2 (gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	4.75	50	140.5 (gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Helicopters												
LTO			180			3.02	13.54	6.78	0.44	0.40	Lbs/cycle	AP-42 (II-1-10)
Cruise			90 (hrs)			6.4	5.0	0.70	0.9	0.8	Lbs/mile	AP-42 (II-1-8)

Table 5.4-9. Bonito Mobile Source Emission Estimates.

Bonito Mobile Source Emissions															
	Hourly Emissions					Daily emissions					Total Emissions				
Vessel	(lbs/hr)					(lbs/day)					(tons)				
	NOx	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Crew boat															
Idle	1.12	0.53	0.71	0.03	0.14	1.12	0.53	0.71	0.03	0.14	0.01	0.01	0.01	0.00	0.00
Cruise	13.48	6.38	8.59	0.36	1.69	161.77	76.52	103.12	4.27	20.30	1.42	0.67	0.90	0.04	0.18
Supply Boat															
Idle	2.24	1.06	1.43	0.06	0.28	2.24	1.06	1.43	0.06	0.28	0.02	0.01	0.01	0.00	0.00
Cruise	37.40	17.69	23.84	0.99	4.69	448.82	212.31	286.10	11.85	56.31	5.05	2.39	3.22	0.13	0.63
Tug Boats															
Small															
Idle	21.91	7.43	2.67	0.48	2.22	175.24	59.42	21.35	3.83	17.79	0.18	0.06	0.02	0.00	0.02
Manuever	59.01	16.37	4.97	1.20	5.56	944.16	261.94	79.58	19.15	89.02	0.94	0.26	0.08	0.02	0.09
Large															
Idle	36.53	12.39	4.45	0.80	3.71	584.48	198.18	71.22	12.77	59.35	1.39	0.47	0.17	0.03	0.14
Manuever	98.35	27.29	8.29	1.99	9.27	786.8	218.28	66.32	15.96	74.18	1.87	0.52	0.16	0.04	0.18
Helicopters															
LTO	6.00	27.11	13.56	0.89	0.89	6.0	27.11	13.56	0.89	0.89	0.27	1.22	0.61	0.04	0.04
Cruise	6.44	5.11	0.66	0.89	0.89	6.44	5.11	0.66	0.89	0.89	0.29	0.23	0.03	0.04	0.04

Table 5.4-10. Gato Canyon Mobile Source Emission Factors.

Gato Canyon Mobile Source Emission Factors												
						Emission Factors						
Vessel	**Hrs/day**	**Days**	**Load**	**Fuel Rate (gal/mi)**	**Mileage (R/T)**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**Units**	**Reference**
Crew boat												
Idle	1	21		2.97		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		7		2.97	50	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Supply Boat												
Idle	1	18		8.24		267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Cruise		25		8.24	100	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
Tug Boats												
Small												
Idle	8	3	20	33.7(gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	3	50	84.3(gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Large												
Idle	8	4	20	56.2(gal/hr)		325	97.1	29.5	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Manuever	16	4	50	140.5(gal/hr)		350	110.2	39.6	7.1	33	lbs/1000 gal	AP-42 (II-3-3)
Helicopters												
LTO			168			3.02	13.54	6.78	0.44	0.40	Lbs/cycle	AP-42 (II-1-10)
Cruise			21 (hrs)			6.4	5.0	0.70	0.9	0.8	Lbs/mile	AP-42 (II-1-8)

Table 5.4-11. Gato Canyon Mobile Source Emissions.

Gato Canyon Mobile Source Emissions															
	Hourly Emissions					Daily emissions					Total Emissions				
Vessel	(lbs/hr)					(lbs/day)					(tons)				
	NOx	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Crew boat															
Idle	1.12	0.53	0.71	0.03	0.14	1.12	0.53	0.71	0.03	0.14	0.01	0.01	0.01	0.00	0.00
Cruise	3.30	1.56	2.11	0.09	0.41	39.65	18.76	25.27	1.05	4.97	0.14	0.07	0.09	0.00	0.02
Supply Boat															
Idle	2.24	1.06	1.43	0.06	0.28	2.24	1.06	1.43	0.06	0.28	0.02	0.01	0.01	0.00	0.00
Cruise	18.33	8.67	11.69	0.48	2.30	220.01	104.07	140.24	5.81	27.60	2.75	1.30	1.75	0.07	0.35
Tug Boats															
Small															
Idle	21.91	7.43	2.67	0.48	2.22	175.24	59.42	21.35	3.83	17.79	0.26	0.09	0.03	0.01	0.03
Manuever	59.01	16.37	4.97	1.20	5.56	944.16	261.94	79.58	19.15	89.02	1.42	0.39	0.12	0.03	0.13
Large															
Idle	36.53	12.39	4.45	0.80	3.71	584.48	198.18	71.22	12.77	59.35	1.17	0.40	0.14	0.03	0.12
Manuever	98.35	27.29	8.29	1.99	9.27	786.8	218.28	66.32	15.96	74.18	1.57	0.44	0.13	0.03	0.15
Helicopters															
LTO	5.95	27.14	13.57	0.95	0.71	5.95	27.14	13.57	0.95	0.71	0.25	1.14	0.57	0.04	0.03
Cruise	9.29	29.52	13.81	1.43	1.19	9.29	29.52	13.81	1.43	1.19	0.39	1.24	0.58	0.06	0.05

Table 5.4-12. Total emission estimates by unit.

Total Emission Estimates by Unit															
	Hourly Emissions (lbs/hr)					Daily emissions (lbs/day)					Total Emissions (tons)				
Drilling Operation	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Bonito															
Drilling	21.10	2.82	0.12	0.48	0.92	506.31	67.75	2.85	11.41	22.11	22.78	3.05	0.13	0.51	0.99
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Vessels	10.06	0.24	1.15	4.06	4.22	241.56	5.78	27.56	97.33	101.33	10.87	0.26	1.24	4.38	4.56
Helicopter	12.44	1.78	1.60	32.08	14.26	12.44	1.78	1.60	32.08	14.26	0.56	0.08	0.07	1.44	0.64
Total	58.37	10.46	3.11	36.95	20.87	854.01	109.02	36.6	144.11	143.85	35.06	3.72	1.45	6.35	6.28
Pt. Sal															
Drilling	22.50	3.01	0.13	0.51	0.98	540.1	72.26	3.04	12.17	23.58	19.98	2.67	0.11	0.45	0.87
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Vessels	11.02	0.27	1.30	4.71	5.44	264.59	6.49	31.08	112.97	130.54	9.79	0.24	1.15	4.18	4.83
Helicopter	12.44	1.78	1.60	32.08	14.26	12.44	1.78	1.60	32.08	14.26	0.31	0.04	0.04	0.80	0.36
Total	60.73	10.68	3.27	37.63	22.15	910.83	114.24	40.31	160.51	174.53	30.93	3.28	1.31	5.45	6.15
Purisima															
Drilling	22.02	2.95	0.12	0.50	0.96	528.49	70.71	2.98	11.91	23.08	17.97	2.40	0.10	0.40	0.78
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Vessels	9.87	0.25	1.15	4.12	4.56	236.76	5.88	27.64	98.82	109.41	8.05	0.20	0.94	3.36	3.72
Helicopter	12.44	1.78	1.60	32.08	14.26	12.44	1.78	1.60	32.08	14.26	0.25	0.04	0.03	0.64	0.29
Total	59.1	10.6	3.11	37.03	21.25	871.39	112.08	36.81	146.1	152.9	27.12	2.97	1.08	4.42	4.88
Gato															
Drilling	20.92	2.80	0.12	0.47	0.91	502.14	67.19	2.83	11.32	21.92	23.85	3.19	0.13	0.54	1.04
Cranes	11.85	4.60	0.05	0.21	1.32	23.70	9.21	0.11	0.42	2.65	0.71	0.28	0.00	0.01	0.08
Flare	2.92	1.02	0.19	0.12	0.15	70.00	24.50	4.48	2.87	3.50	0.14	0.05	0.01	0.01	0.01
Vessels	6.44	0.15	0.69	2.37	2.01	154.53	3.58	16.63	56.84	48.21	7.34	0.17	0.79	2.70	2.29
Helicopter	18.48	2.66	2.40	59.16	27.82	18.48	2.66	2.40	59.16	27.82	0.39	0.06	0.05	1.24	0.58
Total	60.61	11.23	3.45	62.33	32.21	768.85	107.14	26.45	130.61	104.1	24.70	3.52	0.14	0.56	1.13

Table 5.4-13. Estimated MODU peak hour emissions.

Estimated MODU Peak Hour Emissions					
Activity	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Site Preparation					
Main Engines	32.09	4.29	0.18	0.72	1.40
Small Tugboats	59.01	16.37	4.97	1.20	5.56
Large Tugboats	98.35	27.29	8.29	2.00	9.27
Total	189.45	47.95	13.44	3.92	16.23
Drilling Phase*					
Main Engines	27.94	3.74	0.16	0.63	1.22
Cranes	11.85	4.60	0.05	0.21	1.32
Crew (idle)	1.12	0.53	0.71	0.03	0.14
Supply (idle)	2.24	1.06	1.43	0.06	0.28
Total	43.15	9.93	2.35	0.93	2.96

*Representative of typical project emissions

Table 5.4-14. Cumulative Scenario - emission factors and assumptions.

Cumulative Scenario - Emission Factors and Assumptions												
						Emission Factors						
Activity	**Platforms**	**Pipeline (kms)**	**Days**	**Wells**	**Trips**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**Units**	**Reference**
Platform Installation	5					175.52	41.6	12.87	11.99	2.82	tons/platform	Jacobs (C-1.3)
Pipeline Installation		209.3				3.83	1.54	0.44	0.08	0.19	tons/km	Jacobs (C-2.2)
Power Cable Installation		177.1	249			1140	240	32	60	80	lbs/day	SBCAPCD (SYU ATC 1991)
Production Wells				181		3.56	1.69	0.49	0.53	0.52	tons/well	Jacobs (C-3.3)
Production	5					35.89	18.90	26.82	6.99	2.74	tons/platform (avg.)	SBCAPCD (1996 Inventory)
Vessels												
Crew					1,402	516.70	54.80	24.79	7.10	31.68	lbs/1000 gals	AP-42 (11-3-3)
Supply					2,978	550.00	54.80	24.79	7.10	31.68	lbs/1000 gals	AP-42 (11-3-3)
Helicopters												
LTO					4745	2.60	2.10	0.10	0.40	0.10	lbs/hr (5 min cycle)	Jacobs (5-23)
Cruise					4745	2.60	2.10	0.10	0.40	0.10	lbs/hr (1hr 20 min)	Jacobs (5-23)

Table 5.4-15. Cumulative Scenario - estimated emissions.

Cumulative Scenario - Estimated Emissions (tons per project life)					
Activity	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Platform Installation	877.6	208.0	64.35	59.95	14.10
Pipeline Installation	801.27	322.18	92.05	16.74	39.75
Power Cable Installation	141.93	29.88	3.98	7.47	9.96
Production Wells	644.36	305.89	88.69	95.93	94.12
Production	4,199.13	2,211.30	3,137.94	817.83	320.58
Spills	0	0	7.84	0	0
Vessels	0	0	0	0	0
Crew	27.38	2.90	1.31	0.38	1.68
Supply	124.335	12.39	5.60	1.60	7.16
Helicopters	0	0	0	0	0
LTO	12.85	10.38	0.49	1.98	0.49
Cruise	41.52	118.63	8.90	8.90	11.86
Total	6,870.375	3,221.55	3,411.15	1,010.78	499.7

Table 5.4-16.Peak year cumulative emissions.

Peak Year Cumulative Emissions With Development of 36 Leases (2008)										
	Peak Hour (lbs/hr)					**Peak Year (tons)**				
Activity	**NOx**	**CO**	**SOx**	**VOC**	**PM10**	**NOx**	**CO**	**SOx**	**VOC**	**PM10**
Platform Construct	113.54	26.92	7.76	8.33	8.37	497.3	117.9	34.0	36.5	36.7
Pipeline Install	148.26	59.54	3.11	17.03	14.70	649.4	260.8	13.6	74.6	64.4
Power Cable Install	20.11	4.25	1.07	0.57	1.42	88.1	18.6	4.7	2.5	6.2
Development Wells	4.89	2.31	0.73	0.66	0.71	21.4	10.1	3.2	2.9	3.1
Production	163.88	86.30	31.92	122.47	12.51	717.8	378.0	139.8	536.4	54.8
Spills	0	0	0	1.79	0	0	0	0	7.84	0
Service Vessels	1.39	0.14	0.02	0.06	0.08	6.07	0.61	0.08	0.28	0.35
Helicopters	0.50	1.18	0.10	0.09	0.11	2.18	5.16	0.44	0.38	0.49
Total	452.57	180.64	44.71	151	37.9	1,982.25	791.17	195.82	661.4	166.04

Table 5.4-17. Mud and Cuttings to Shore Alternative Emission Factors.

Muds and Cuttings to Shore Alternative - Emission Factors												
						Emission Factors						
Unit	**Vessel Trips**	**Vessel Mileage**	**Truck Trips**	**Truck Mileage**	**Vessel Fuel Rate (gal/mi)**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**	**Units**	**Reference**
Bonito												
1 well	12	204			8.24	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
			140	150		8.2	11.5	2.0	-	-	Gms/mile*	AP-42 (II-3-3)
2 wells	12	204			8.24	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
			140	150		8.2	11.5	2.0	-	-	Gms/mile	AP-42 (II-3-3)
Purisima	35	240			8.24	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
			410	150		8.2	11.5	2.0	-	-	Gms/mile	AP-42 (II-3-3)
Point Sal	35	240			8.24	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
			410	150		8.2	11.5	2.0	-	-	Gms/mile	AP-42 (II-3-3)
Gato	20	100			8.24	267	126.3	170.2	7.05	33.5	lbs/1000 gal	AP-42 (II-3-3)
			210	150		8.2	11.5	2.0	-	-	Gms/mile	AP-42 (II-3-3)

*assumes a 1995 model year tanker truck on 1/1/03

Table 5.4-18. Mud and Cuttings to Shore Alternative Estimated Emissions.

Muds and Cuttings to Shore Alternative - Estimated Emission Increases										
	Daily emissions					Total Emissions				
Unit	(lbs/day)					(tons)				
	NOx	**CO**	**VOC**	**SO_2**	**PM_{10}**	**NOx**	**CO**	**VOC**	**SO_2**	**PM_{10}**
Bonito										
Truck						0.19	0.27	0.05		
Vessel	448.8	212.3	286.1	11.9	56.3	2.69	1.27	1.72	0.07	0.34
Total						2.88	1.54	1.76	0.07	0.34
2 wells						5.76	3.08	3.52	0.14	0.68
Purisima										
Truck						0.56	0.78	0.14		
Vessel	528.0	249.8	336.6	13.9	66.2	9.24	4.37	5.89	0.24	1.16
Total						9.80	5.15	6.03	0.24	1.16
Point Sal										
Truck						0.56	0.78	0.14		
Vessel	528.0	249.8	336.6	13.9	66.2	9.24	4.37	5.89	0.24	1.16
Total						9.80	5.15	6.03	0.24	1.16
Gato										
Truck						0.28	0.40	0.07		
Vessel	220.0	104.1	140.2	5.8	27.6	2.20	1.04	1.40	0.06	0.28
Total						2.48	1.44	1.47	0.06	0.28