APPENDIX C.

Air Quality Calculations

1303: Air Quality for MARS Cabled Observatory, Construction Phase Summary

Project Number: 1303/CSLC MBARI
Project Name: MARS Cabled Observatory EIR/EIS

SUMMARY CONSTRUCTION IMPACTS		Daily Summary					Total Duration of Construction				
		NOx	VOC	PM10	CO	SOx	NOx	VOC	PM10	CO	SOx
		(lb/day)	(lb/day)	(lb/day)	(lb/day)	(lb/day)	(ton)	(ton)	(ton)	(ton)	(ton)
Equipment Exhaust											
Non-road Equipment	Marine Vessels	5260.1	271.7	309.8	1065.4	1740.7	23.67	1.22	1.39	4.79	7.83
Non-road Equipment (*)	Drill Rig, etc	109.3	9.6	5.3	37.3	2.7	0.77	0.07	0.04	0.26	0.02
Off-Site, On-Highway Travel											
On-Highway Vehicles (*)	Deliveries, Workers	6.1	1.1	0.2	8.7	0.1	0.06	0.03	0.00	0.26	0.00
Fugitive Dust											
Fugitive and Road Dust	Staging/Landing (Avg per 2 mo)			7.9					0.16		
Project Total		**5375.5**	**282.4**	**323.2**	**1111.4**	**1743.4**	**24.5**	**1.3**	**1.6**	**5.3**	**7.9**
	MBUAPCD Significance Threshold:						**Federal General Conformity Rule Applicability:**				
		137	**137**	**82**	**550**	**150**	**100**	**100**	**None**	**None**	**None**

(*) These sources are included in the MBUAPCD planning inventory.
They are included in the Project Total although they do not count against the MBUAPCD Significance Thresholds.

1303: Air Quality for MARS Cabled Observatory, Vessel Emissions

Project Number: 1303/CSLC MBARI
Project Name: MARS Cabled Observatory EIR/EIS
Method of Analysis: Various U.S. EPA Marine Vessel Inventory Methods 2000-2003
Basis: Application Document E-4, Ile De Rey Specifications.

							Summary of Emission Factors, function of load	NOx	VOC	PM10	CO	SO2
							Cat 3 slow spd/full load (g/hp-hr) (Ref 1)	17.60	0.40	1.29	0.82	9.56
							Cat 3 slow spd/maneuvering (g/hp-hr) (Ref 1)	23.94	2.09	2.18	6.99	15.01
					all other engines (g/hp-hr) (Ref 2, 3)	100	load example	10.54	0.05	0.26	0.62	0.19
					Marine Engine							
Vessel Engines	**Engine Name and Rating**	**#**	**Rating / #**	**Speed**	**Category**		**Activity**		NOx	VOC	PM10	CO	SO2
(Ile De Re)			(kW)	(rpm)		Load	(hr/day)	(hp-hr)/day	(lb/day)	(lb/day)	(lb/day)	(lb/day)	(lb/day)
Main Engines	2x SKL/Magdeburg 12VDS48/42	2	5295	500	Cat 3	15	24	51124	2697.78	235.06	245.71	787.42	1691.65
Bow Thruster	2x Lips 1500 kW	2	1500		Cat 2	15	8	4828	128.36	9.11	3.52	44.33	2.82
Stern Truster	2x Lips 1500 kW	2	1500		Cat 2	15	8	4828	128.36	9.11	3.52	44.33	2.82
Aux Generator	2x Sulzer/Wartsila 9L26A	2	2925	1000	Cat 2	60	8	37655	884.18	8.88	21.96	86.44	16.84
Aux Generator	1x Sulzer/Wartsila 8L20 (main)	1	1440	1000	Cat 2	100	24	46345	1077.21	5.08	26.51	63.83	19.88
Aux Generator	1x Sulzer/Wartsila 8L20	1	1440	1000	Cat 2	60	8	9269	217.64	2.19	5.41	21.28	4.15
Emerg Generator	1x MAN D2866TF		150	1500	Cat 1								
					(Ref 1)	(Ref 2)							
Vessel Cable Equipment													
Cable Drum Engine	2x 25T Hydralift	2											
Linear Cable Engine	2x DOHB 6T Hydralift	2											
Linear Cable Engine	3x DOHB 2T Hydralift	3											
Tugger Winches	2x 10T	2											
Tugger Winches	1x 2T	1											
Modular Buoys	2x Buoys davit 10T	2											
Crane	1x 5T Hydralift	1											
									NOx	VOC	PM10	CO	SO2
Research Vessel			(kW)	(rpm)		Load	(hr/day)	(hp-hr)/day	(lb/day)	(lb/day)	(lb/day)	(lb/day)	(lb/day)
(R/V Point Lobos)	2x Detroit Diesel 16V92 (1200 shp)	2	450		Cat 2	35	8	3379	81.22	1.79	2.06	13.30	1.62
	2x Northern Lights gensets	2	150		Cat 1	60	8	1931	45.34	0.46	1.13	4.43	0.86
			science node deployment, in conjunction with ROV										
Support Vessels													
(ROV Ventana)	hydraulic and electrical systems on Point Lobos												
			post-lay inspection and burial										

	NOx	VOC	PM10	CO	SO2
	(lb/day)	(lb/day)	(lb/day)	(lb/day)	(lb/day)
Daily Summary	5260.09	271.69	309.82	1065.35	1740.65
	(ton)	(ton)	(ton)	(ton)	(ton)
Total Duration of Construction	23.67	1.22	1.39	4.79	7.83
9 days activity in 12-nm federal waters					

Ref 1: U.S. EPA. Final Regulatory Support Document: Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder. Tables 7.1-1 and 7.1-2. EPA420-R-03-004. January 2003.
Ref 2: U.S. EPA. Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data. Table 5-1. EPA420-R-00-002. February 2000.
Ref 3: 500 ppm sulfur content for non-Cat 3 diesel engines.

1303: Air Quality for MARS Cabled Observatory, On-land Emissions

		Non-Road Equipment					On-Highway Vehicles				
Parameter	**Units**	**Drill Rig 3406TA**	**Mud System 3408T**	**Excavator**	**Trencher**	**Cement Pump**	**Parameter**	**Units**	**Delivery/ Removal**	**Worker Trips**	
Fuel Type		Diesel	Diesel	Diesel	Diesel	Diesel	Round Trips	(#/day)	4	10	
Rated Output	(hp)	440.0	325.0	152.0	34.0	130.0	RT Distance	(mi)	50	30	
Load Factor	(%)	75	75	58	70	59					
Daily Use (apx 8 hr/day)	(hp-hr/day)	2,640	1,950	705	190	614	Daily Miles	(vmt/day)	200	300	
Duration	(day)	14	14	14	14	14	Duration	(day)	14	100	
Total Use	(hp-hr)	36,960	27,300	9,874	2,666	8,590	Total Miles	(vmt)	2,800	30,000	
Emission Factor							**Emission Factor**				
NOx	(g/hp-hr)	8.17	8.17	8.17	6.90	8.17	NOx	(lb/vmt)	0.028142	0.001634	
VOC	(g/hp-hr)	0.68	0.68	0.68	1.80	0.68	VOC	(lb/vmt)	0.002955	0.001626	
PM10	(g/hp-hr)	0.38	0.38	0.38	0.76	0.38	PM10	(lb/vmt)	0.000923	0.000113	
CO	(g/hp-hr)	2.70	2.70	2.70	5.00	2.70	CO	(lb/vmt)	0.020984	0.015165	
SOx	(g/hp-hr)	0.20	0.20	0.20	0.20	0.20	SOx	(lb/vmt)	0.000246	0.00001	
Daily Summary											**Daily (lb/day)**
NOx	(lb/day)	47.6	35.1	12.7	2.9	11.1	NOx	(lb/day)	5.6	0.5	115.4
ROCs	(lb/day)	4.0	2.9	1.1	0.8	0.9	ROCs	(lb/day)	0.6	0.5	10.7
PM10	(lb/day)	2.2	1.6	0.6	0.3	0.5	PM10	(lb/day)	0.2	0.0	5.5
CO	(lb/day)	15.7	11.6	4.2	2.1	3.7	CO	(lb/day)	4.2	4.5	46.0
SOx	(lb/day)	1.2	0.9	0.3	0.1	0.3	SOx	(lb/day)	0.0	0.0	2.7
Total Duration of Construction											**Total (tons)**
NOx	(ton)	0.333	0.246	0.089	0.020	0.077	NOx	(ton)	0.039	0.025	0.829
ROCs	(ton)	0.028	0.020	0.007	0.005	0.006	ROCs	(ton)	0.004	0.024	0.096
PM10	(ton)	0.015	0.011	0.004	0.002	0.004	PM10	(ton)	0.001	0.002	0.040
CO	(ton)	0.110	0.081	0.029	0.015	0.026	CO	(ton)	0.029	0.227	0.518
SOx	(ton)	0.008	0.006	0.002	0.001	0.002	SOx	(ton)	0.000	0.000	0.019

Assumptions:

Equipment Usage from combination of "Work Execution Plan for Ocean Bore", Schedule Draft 1A, 11/08/04 Response, and MBARI Application.

-- Plus CSLC and MBNMS assumption that cable installation could take 10-14 days.

References:

Non-road equipment rating and load factor from Tables A9-8-C and A9-8-D, SCAQMD CEQA Handbook 1993.

Off-Road: OFFROAD Model, Table 12, Mailout 99-32, California's Emission Inventory for Off-Road Large Compression-Ignited Engines (>25hp), January 2000.

On-Road: SCAQMD-ARB EMFAC2002, Spreadsheet for Model Year 2003 and beyond. Available at aqmd.gov, CEQA handbook. January 2003.

Fuel Consumption per Power Output: 0.066 gal Diesel/hp-hr output.

1303: Air Quality for MARS Cabled Observatory, Fugitive Dust

General Construction Activity

Emission Factor	Acres	Months	Mitigation	PM10 Emissions	
(ton/acre/month)	(acre/mo)	(mo)	(%)	(lb)	(ton)
0.110	2	2	75%	220	0.11

Note:

Emission Factor: 220 lb PM10/acre/month, Midwest Research Institute, 1995.

Acreage: max landing area less than 1 acre, plus staging and parking less than 1 acre

Equipment on Paved Roads

k	sL	W	E	vehicle miles traveled	PM10 Emissions
(lbs/vmt)	(g/m2)	(tons)	(lbs/vmt)	(vmt)	(ton)
0.016	0.40	10.00	0.034	1,800	0.03
0.016	0.40	1.00	0.001	30,000	0.02

Notes

Emission Factor: k(sL/2)^0.65 (W/3)^1.5

where: E = particulate emission factor (having units matching the units of k)

k = base emission factor (lb/vehicle miles traveled)

sL = road surface silt loading (grams per square meter) (g/m2)

W = fleet average weight (tons) of the heavy vehicles

Summary of Fugitive Dust Emissions

Units	General Activity	Paved Roads	**Totals**
PM10, total duration (ton)	0.11	0.05	0.16

Sources:

Sections 13.2.1 and 13.2.3 of USEPA Compilation of Air Pollutant Emission Factors (AP-42)