Table D4. Emission Rates by Activity (Baseline)
Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***17.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***25.4***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	3.6	0.1	0.4	1.5	202.0
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***
CEMEX - Mining					
Tug	19.9	0.8	1.9	5.6	1628.8
Barge - Main	15.1	0.4	1.1	3.5	651.5
Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	**37.5**	**1.3**	**3.3**	**10.3**	**2423.0**
CEMEX - Cruising					
Tug	19.9	0.8	1.9	5.6	1628.8
Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	**22.4**	**0.9**	**2.2**	**6.7**	**1771.5**
CEMEX - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	**17.7**	**0.5**	**1.4**	**4.6**	**794.3**

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Table D5. Annual Emissions (Baseline) - Average Mined per Year 1998-2008

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	325	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	7.3	0.3	0.7	2.2	575.7
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	33.5	1.2	3.0	9.2	2,165.6
		Unloading	4	17.7	0.5	1.4	4.6	794.3	11.5	0.3	0.9	3.0	516.3
Hanson (DS-10)	324	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	5.4	0.2	0.5	1.7	412.5
		Mining	5.5	25.4	1.0	2.5	7.7	1,989.9	22.7	0.9	2.2	6.9	1,773.0
		Unloading	4	18.2	0.7	1.9	6.3	1,392.8	11.8	0.5	1.2	4.1	902.5
Suisun Associates (TS&G 230)	11	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	0.2	0.0	0.0	0.1	19.5
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	1.1	0.0	0.1	0.3	73.3
		Unloading	4	17.7	0.5	1.4	4.6	794.3	0.4	0.0	0.0	0.1	17.5
Suisun Associates (DS-10)	11	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	0.2	0.0	0.0	0.1	14.0
		Cruising	2	25.4	1.0	2.5	7.7	1,989.9	0.3	0.0	0.0	0.1	21.9
		Cruising	2	18.2	0.7	1.9	6.3	1,392.8	0.2	0.0	0.0	0.1	15.3
Suisun Associates (Jerico Barge)	30	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	21.5
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	14.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.1	18.9
Jerico	38	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	27.3
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	18.5
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.2	24.0
CEMEX	36	Cruising	2	22.4	0.9	2.2	6.7	1771.5	0.9	0.0	0.1	0.3	67.3
		Mining	5.5	37.5	1.3	3.3	10.3	2423.0	3.9	0.1	0.3	1.1	253.2
		Unloading	4	17.7	0.5	1.4	4.6	794.3	1.3	0.0	0.1	0.4	60.4
Total Emisisons (tons per year)									**102.0**	**3.7**	**9.5**	**30.1**	**7,012.8**

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Table D6. Emission Factors for Mining Equipment (2010) - Average Mined per Year 1998-2008

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
	Barge - Main Engine	1983	1,000	0.52	13.17	0.36	0.95	3.07	568.3	15.1	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	10.23	0.32	1.07	4.33	568.3	2.6	0.1	0.3	1.1	142.8
Hanson TS & G	Barge - Thruster (Aux)	1984	304	0.43	10.23	0.32	1.07	4.33	568.3	2.9	0.1	0.3	1.2	163.8
	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
Hanson DS-10	Barge - Generator (Aux)	1984	375	0.43	10.23	0.32	1.07	4.33	568.3	3.6	0.1	0.4	1.5	202.0
	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
Jerico Tug	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
	Barge Generator (Aux)	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
Jerico Barge	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007.

[c] Assumes all Jerico engines would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

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Table D7. Emission Rates by Activity (2010)
Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***37.5***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***22.4***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	15.1	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	2.6	0.1	0.3	1.1	142.8
Total	***17.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***25.4***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	3.6	0.1	0.4	1.5	202.0
Total	***16.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	3.6	0.1	0.4	1.5	202.0
Total	***18.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

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Table D8. Annual Emissions (2010) - Average Mined per Year 1998-2008

Barge	Mining Events	Activity	Hours	Emission Rates (lb/hr)					Annual Emissions (tons per year)				
				NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson (TS&G 230)	398	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	8.9	0.4	0.9	2.7	705.1
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	41.1	1.4	3.6	11.2	2,652.0
		Unloading	4	17.7	0.5	1.4	4.6	794.3	14.1	0.4	1.1	3.7	632.2
Hanson (DS-10)	398	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	6.6	0.3	0.7	2.1	506.8
		Mining	5.5	25.4	1.0	2.5	7.7	1,989.9	27.8	1.1	2.8	8.5	2,178.0
		Unloading	4	18.2	0.7	1.9	6.3	1,392.8	14.5	0.6	1.5	5.0	1,108.7
Suisun Associates (TS&G 230)	38	Cruising	2	22.4	0.9	2.2	6.7	1,771.5	0.9	0.0	0.1	0.3	67.3
		Mining	5.5	37.5	1.3	3.3	10.3	2,423.0	3.9	0.1	0.3	1.1	253.2
		Unloading	4	17.7	0.5	1.4	4.6	794.3	1.3	0.0	0.1	0.4	60.4
Suisun Associates (DS-10)	37	Cruising	2	16.7	0.7	1.7	5.3	1,273.3	0.6	0.0	0.1	0.2	47.1
		Cruising	2	25.4	1.0	2.5	7.7	1,989.9	0.9	0.0	0.1	0.3	73.6
		Cruising	2	18.2	0.7	1.9	6.3	1,392.8	0.7	0.0	0.1	0.2	51.5
Suisun Associates (Jerico Barge)	75	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.6	0.0	0.1	0.2	53.8
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.4	0.0	0.1	0.2	36.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.4	0.0	0.1	0.3	47.3
Jerico	32	Cruising	2	8.5	0.4	0.9	2.6	717.4	0.3	0.0	0.0	0.1	23.0
		Mining	5.5	1.9	0.1	0.3	0.9	177.2	0.2	0.0	0.0	0.1	15.6
		Unloading	12	0.9	0.0	0.1	0.7	105.1	0.2	0.0	0.0	0.1	20.2
Total Emisisons (tons per year)									**123.4**	**4.5**	**11.6**	**36.6**	**8,532.2**

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Table D9. Emission Factors for Mining Equipment (2011) - Average Mined per Year 1998-2008

Equipment Name	Type	Manufacture Year [a]	Horsepower [a]	Load Factor [b]	Emission Factor (g/bhp-hr) [c,d]					Emission Rate (lb/hr)				
					NOx	PM	ROG	CO	CO2	NOx	PM	ROG	CO	CO2
Hanson American River	Tug (2 engines)	2003	1,710	0.5	6.93	0.29	0.68	1.97	568.3	13.1	0.5	1.3	3.7	1,071.2
Hanson San Joaquin River	Tug (2 engines)	2001	2,600	0.5	6.93	0.29	0.68	1.97	568.3	19.9	0.8	1.9	5.6	1,628.8
Hanson TS & G	Barge - Main Engine	1983	1,000	0.52	4.85	0.36	0.95	3.07	568.3	5.6	0.4	1.1	3.5	651.5
	Barge - Generator (Aux)	1984	265	0.43	4.73	0.32	1.07	4.33	568.3	1.2	0.1	0.3	1.1	142.8
	Barge - Thruster (Aux)	1984	304	0.43	4.73	0.32	1.07	4.33	568.3	1.4	0.1	0.3	1.2	163.8
Hanson DS-10	Barge - Main Engine	2001	1,100	0.52	6.93	0.29	0.68	1.97	568.3	8.7	0.4	0.9	2.5	716.7
	Barge - Monitor Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Flood Pump (Aux)	2002	440	0.43	6.93	0.26	0.81	2.78	568.3	2.9	0.1	0.3	1.2	237.0
	Barge - Generator (Aux)	1984	375	0.43	4.73	0.32	1.07	4.33	568.3	1.7	0.1	0.4	1.5	202.0
Jerico Tug	Tug (2 engines)	2001	1,060	0.5	6.93	0.29	0.68	1.97	568.3	8.1	0.3	0.8	2.3	664.0
	Tug (generator)	2000	64	0.31	6.93	0.46	1.18	3.59	568.3	0.3	0.0	0.1	0.2	24.9
Jerico Barge	Barge Generator (Aux)	2004	99	0.43	4.62	0.46	1.18	3.59	568.3	0.4	0.0	0.1	0.3	53.3
	Barge Pump (Aux)	2001	230	0.43	6.93	0.26	0.81	2.78	568.3	1.5	0.1	0.2	0.6	123.9
Jerico Loader	Loader	2007	195	0.43	4.83	0.12	0.81	3.73	568.3	0.9	0.0	0.1	0.7	105.1

[a] Provided by Project Applicants.

[b] Based on information provided in Appendix B - Emissions Estimation Methodology for Commercial Harbor Craft Operating in California, from CARB's *Technical Support Document: Initial Statement of Reason for Proposed Rule Making, Proposed Regulation for Commercial Harbor Craft*, September 2007.

[c] Assumes all Hanson engines manufactured in or prior to 1985 would meet USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2011 adn that all Jerico engines met the USEPA Tier 2 NOx standard of 7.8 grams per kilowatt-hour (5.8 grams per brake-horsepower hour) by 2010.

[d] CO2 emission factors derived from OFFROAD2007. Represents CO2 emission factors for diesel fueled engines.

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Table D10. Emission Rates by Activity (2011)

Average Mined per Year 1998-2008

Equipment - Activity	Emission Rate (lb/hr-equipment)				
	NOx	PM	ROG	CO	CO2
Hanson TS&G 230 - Mining					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***26.6***	***1.3***	***3.3***	***10.3***	***2,423.0***
Hanson TS&G 230 - Cruising					
San Joaquin Tug	19.9	0.8	1.9	5.6	1,628.8
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***21.0***	***0.9***	***2.2***	***6.7***	***1,771.5***
Hanson TS&G 230 - Unloading					
TS&G - Barge - Main	5.6	0.4	1.1	3.5	651.5
TS&G - Barge - Gen - Aux	1.2	0.1	0.3	1.1	142.8
Total	***6.7***	***0.5***	***1.4***	***4.6***	***794.3***
Hanson DS-10 - Mining					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Main)	8.7	0.4	0.9	2.5	716.7
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***23.5***	***1.0***	***2.5***	***7.7***	***1,989.9***
Hanson DS-10 - Cruising					
American River Tug	13.1	0.5	1.3	3.7	1,071.2
DS-10 - Barge (Generator)	1.7	0.1	0.4	1.5	202.0
Total	***14.7***	***0.7***	***1.7***	***5.3***	***1,273.3***
Hanson DS-10 - Unloading					
Barge - Main	8.7	0.4	0.9	2.5	716.7
Barge - Monitor Pump - Aux	2.9	0.1	0.3	1.2	237.0
Barge - Flood Pump- Aux	2.9	0.1	0.3	1.2	237.0
Barge - Gen - Aux	1.7	0.1	0.4	1.5	202.0
Total	***16.2***	***0.7***	***1.9***	***6.3***	***1,392.8***
Jerico Barge - Mining					
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Jerico Barge - Monitor	1.5	0.1	0.2	0.6	123.9
Total	***1.9***	***0.1***	***0.3***	***0.9***	***177.2***
Jerico Barge - Cruising					
Jerico Tug - Main	8.1	0.3	0.8	2.3	664.0
Jerico Barge - Generator	0.4	0.0	0.1	0.3	53.3
Total	***8.5***	***0.4***	***0.9***	***2.6***	***717.4***
Jerico Unloading					
Loader	0.9	0.0	0.1	0.7	105.1
Total	***0.9***	***0.0***	***0.1***	***0.7***	***105.1***

10-62 cont.

TRC