APPENDIX F

CALIFORNIA AIR RESOURCES BOARD
CALIFORNIA HARBORCRAFT EMISSIONS REDUCTIONS

Methodology to Calculate California Harborcraft Emissions Reductions

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Methodology to Calculate California Harborcraft Emissions Reductions Using the ARB 2003 Emissions Inventory

(Revised on September 20, 2004)

Assumptions:

- Emissions from ARB's 2003 Emissions Inventory (Appendix X)
- Emission reductions estimated based on 6% NOx and 14% PM reduction from switching from U.S. EPA on-road diesel to CARB diesel
- Proportion of U.S. EPA and CARB diesel fuels currently in use based on 2002 ARB Commercial Harbor Craft Survey. For recreational craft, CARB diesel is assumed to be used only in the North Coast

Sample Calculation:

5.8 Ton NOx/day x (16.8 million gallons EPA diesel/27 million gallons diesel total) x 6% emission reduction = **0.22 TPD**

Harbor Craft NOx Emission Reductions by Region*

Harbor Craft Type	Emissions (TPD)	Ratio of EPA to Total Diesel Fuel	Estimated Emission Reduction %	Reductions (TPD)
Commercial Harbor Craft				
S.F. Bay Area Air Basin	5.8	0.62	0.06	0.22
South Coast Air Basin	10.6	0.55	0.06	0.35
North Coast Air Basin	2.55	0	0.06	0
All Other Areas	5.0	0.61	0.06	0.18
Total	24.0			0.80
Recreational Craft				
S.F. Bay Area Air Basin	0.23	1	0.06	0.01
South Coast Air Basin	1.01	1	0.06	0.06
North Coast Air Basin	0.04	0	0.06	0
All Other Areas	1.51	1	0.06	0.09
Total	2.79		0.06	0.16
Grand Total	**26.8**			**1.0**

Harbor Craft PM Emission Reductions by Region*

Harbor Craft Type	Emissions (TPD)	Ratio of EPA to Total Diesel Fuel	Estimated Emission Reduction	Reductions (TPD)
Commercial Harbor Craft				
S.F. Bay Area Air Basin	0.34	0.62	0.14	0.03
South Coast Air Basin	0.23	0.55	0.14	0.02
North Coast Air Basin	0.27	0	0.14	0
All Other Areas	0.51	0.61	0.14	0.04
Total	1.35			0.09
Recreational Craft				
S.F. Bay Area Air Basin	0.01	1	0.14	<0.01
South Coast Air Basin	0.03	1	0.14	<0.01
North Coast Air Basin	0	0	0.14	0
All Other Areas	0.04	1	0.14	0.01
Total	0.08			0.01
Grand Total	**1.43**			**0.10**

Estimation of SOx related PM Reductions from Harbor Craft Using ARB 2003 Emissions Inventory

Assumptions:

- SOx emissions from ARB's 2003 Emissions Inventory
- SOx emission reductions proportional to reductions in fuel sulfur content (assuming EPA onroad diesel is 350 ppm and CARB diesel is 10 ppm)
- Conversion of SO_2 to SO_4 (as 50% ammonium sulfate and 50% ammonium bisulfate) in atmosphere is 12%
- Ratio of grams sulfate (as 50% ammonium sulfate and 50% ammonium bisulfate) to grams SO_2 is 1.92
- Overall conversion factor (SOx to PM) is 12% x 1.92 = 23%
- Proportion of U.S. EPA and CARB diesel fuels currently in use based on 2002 ARB Commercial Harbor Craft Survey.
- Diesel powered recreational craft SOx emissions and reductions are negligible

A. Sample Calculations

1. SOx related PM Reduction:

0.98 Ton SOx/day (S.F. Bay Area) x 96% (SOx reduction per calculation below) x 23% (SOx to PM conversion factor) = 0.22 TPD PM

2. SOx Reduction

Average sulfur before proposal = 350ppm x 0.62 + 10 ppm x 0.38 = 221 ppm
Average sulfur after proposed regulation = 10 ppm
Percent sulfur reduction = 221-10/221 = 95%

Harbor Craft SOx-Related PM Emission Reductions by Region*

Harbor Craft Type	SOx Emissions (TPD)	Ratio of EPA to Total Diesel Fuel	SOx Reduction from Proposal	SOX to PM conversion	PM Reductions (TPD)
Commercial Harbor Craft					
S.F. Bay Air Basin	0.98	0.62	95	23%	0.21
South Coast Air Basin	0.22	0.55	95%	23%	0.05
North Coast Air Basin	0.40	0	0%	--	0
All Other Areas	0.34	0.61	95%	23%	0.07
Total	**1.94**				**0.33**