Appendix G

Assumptions for Estimating Greenhouse Gas Emissions from Commercial Harbor Craft Operating in California

We used the methodology described in Appendix B of the staff report to estimate CO_2 emissions from commercial harbor craft operating in California. The same data needed for estimating NOx, PM and other emissions from harbor craft along with CO_2 emission factors were used to estimate CO_2 emissions. These data include:

- Base year vessel and engine population
- Future fleet growth and engine turn over
- Engine hours of operation and engine load
- Zero-hour (new engine) emission factor
- Engine deterioration and other adjustments
- Spatial allocation surrogate

A single CO_2 emission factor of 545.6 g/hp-hr was used for the entire harbor craft fleet. This emission factor represents a composite value which is based on the data in the New York private ferry fleet emission study and the Entec report. (NYSERDA, 2006) (ENTEK, 2002) It is consistent with the ARB OFFROAD Model used to estimate emissions from off-road equipment.

We understand that the fuel economy improvement of marine engines from mechanical control to electronic control may be offset by fuel penalty due to emission control technologies applied to these engines. Therefore, we assume the CO_2 emission factor remains constant throughout the period we forecasted. There is no data available for us to estimate CO_2 emission rate increases over time due to engine deterioration and we assume the CO_2 emission factor remains constant throughout the life of an engine.

We estimate harbor craft in California contribute about 3300 tons of CO_2 per day in 2004 and this number increases to about 3800 tons per day in 2025. Ferries, excursion vessels, tugs, and tows account for about 56% of these emissions in 2004 and this percentage is expected to increase to about 64% in 2025. Consequently, it is estimated that these vessel categories contribute about 0.7 million metric tons of CO_2 per year.

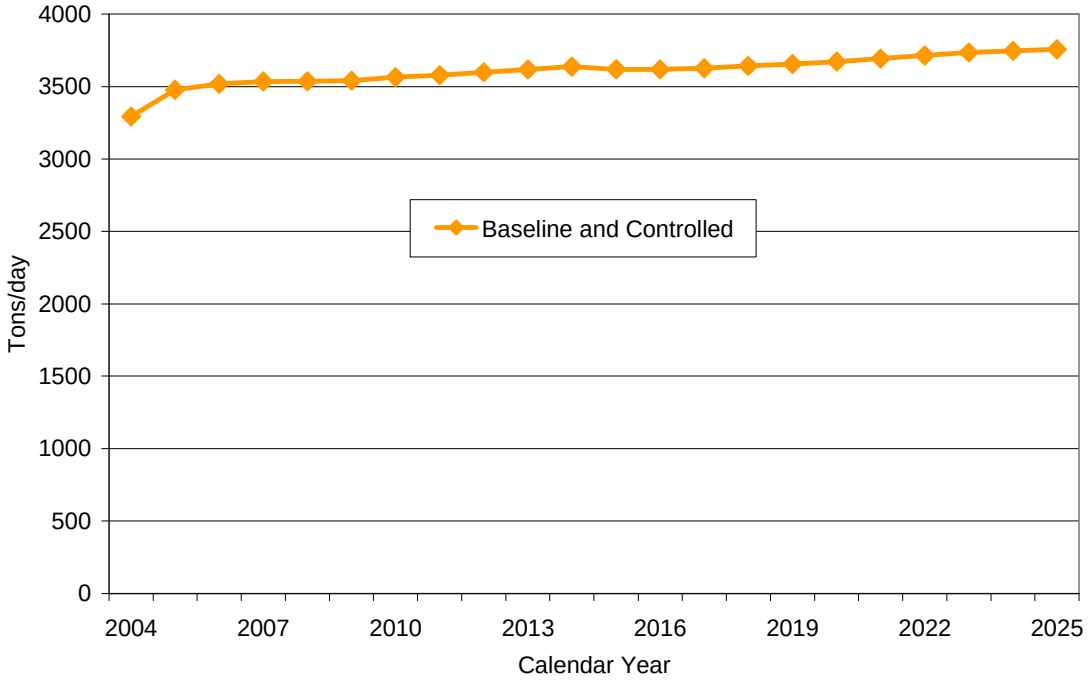

Figure G-1 CO_2 emissions from Commercial Harbor Craft in California

REFERENCES

(ENTEK, 2002) Commission of the European Communities and Entec UK Limited, *Quantification of Emissions from Ships Associated with Ship Movements between Ports in the European Community*. 2002, European Commission.

(NYSERDA, 2006) New York State Energy Research and Development Authority, *NYC Private Ferry Fleet Emissions Reduction Technology Study and Demonstration*. 2006.