

Ocean-Going Vessel Model Definitions

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**California Air Resources Board
Planning and Technical Support Division**

Ocean-Going Vessel - For the purposes of this inventory, an ocean-going vessel (OGV) is a commercial vessel greater than or equal to 400 feet in length or 10,000 gross tons; or propelled by a marine compression ignition engine with a displacement of greater than or equal to 30 liters per cylinder.

BASE YEAR

Base Year – The year from which the base population and activity is developed. This year is used as the basis for forecasting of future year populations.

Domain – This defines the shape of the area for which emissions are being estimated. The largest domain this model is capable of generating emissions for is the 200 nautical mile exclusive economic zone with a truncated southern border. GIS shape files have been provided to illustrate the domain options in the marine model, they can be found at <http://www.arb.ca.gov/ports/marinevess/marinevess.htm>. These GIS files are not necessary to run the model. However, in general the following definitions apply:

- **COABDIS100** – COABDIS stands for County, Air Basin, District; this is used internally by the Air Resources Board's emission inventory database system to define an area. These were primarily intended for land areas, not the ocean; they are for comparison only and do not imply that a given county or air pollution control district has jurisdiction over a particular part of the ocean. This zone extends 100 nautical miles due west from the California mainland shoreline, and was chosen to match a modeling surrogate developed for the ARB.
- **COABDIS24** – This zone corresponds to the 24 nautical mile regulatory zone defined in the 2008 low sulfur fuel rule.
- **COABDIS100-Bay**: The same as COABDIS100, except it includes the Bay Area.
- **POLA Study Area**: The same as COABDIS100, except it includes the Bay Area. This roughly corresponds to the Port of Los Angeles/Long Beach emission inventory study area.
- **ARB4kmGrid**: A grid used by the Air Resources Board for photochemical modeling purposes; grid squares are 4 kilometers on a side.

CONTROLS

Control Measures

- 1997 MARPOL Annex VI Emission Standards (IMO Tier 1)
- 2004 Los Angeles/Long Beach 20 nm Voluntary Speed Reduction Zone
- 2005 US EPA Category 3 Engine Standards (MARPOL Annex VI)
- 2005 Auxiliary Engine Regulation (not currently enforced)
- 2007 Shore Power Regulation
- 2008 Low Sulfur Fuel Regulation
- 2009 Los Angeles/Long Beach 40 nm Voluntary Speed Reduction Zone
- 2011 Low Sulfur Fuel Rule Revision
- 2012 North American Environmental Control Area

REPORT

Vessel Type	Description
Auto	Vessels designed to carry autos and trucks
Bulk Cargo	Bulk carriers are vessels used to transport bulk items such as mineral ore, fertilizer, wood chips, or grain.
Container	Container vessels are cargo vessels that carry standardized truck-sized containers.
General Cargo	Vessels designed to carry non-contaminated cargo such as steel, palletized goods, and heavy machinery.
Passenger	Passenger cruise vessels are passenger vessels used for pleasure voyages.
Reefers	Vessels used to transport perishable commodities which require temperature-controlled transportation, mostly fruits, meat, fish, vegetables, dairy products, and other foods.
Ro-Ro	A vessel designed to carry large wheeled cargo such as large off-road equipment, trailers or railway carriages. RORO is an acronym for "roll on/roll off".
Tankers	Vessels designed to transport liquids in bulk.

Mode - OGV emissions occur during three distinct operating modes: transit (emissions from vessel operations between ports), maneuvering (slow speed vessel operations while in-port areas), and hotelling (also known as berthing; in-port emissions while moored to a dock).

Engine Type - Two types of engines are found on OGVs, main engines and auxiliary engines. The main engine is a very large diesel engine used primarily to propel the vessel at sea. Main engines are used during the transit and maneuvering modes. Auxiliary engines on OGVs provide power for uses other than propulsion (except for diesel-electric vessels). Typically, an OGV will have

a single, large main engine used for propulsion, and several smaller auxiliary “generator-set” engines. Auxiliary engines are used during all three operating modes. An exception to this configuration is diesel-electric vessels where diesel engine generator sets provide power for both propulsion and auxiliary power needs.

In addition to the engines, most ships have auxiliary boilers to provide steam heat for a variety of uses, including fuel heating and hot water. Some crude oil tankers also use boilers for moving crude oil product on and off the ship. Boilers are used during slow speed vessel operations or in port; at cruise speed, most vessels are equipped with an “economizer” at cruise speeds which uses exhaust gas to provide heat. Below certain engine loads, however, there is not sufficient waste heat available from the exhaust, and boilers are activated. For the purposes of this inventory, it is assumed that boilers are operated during maneuvering, hotelling, and during anchorage.

Fuel Types - Heavy fuel oil (HFO) and marine distillate

EIC – Emission inventory code; used internally by the Air Resources Board to define a type of emissions source. The table def_EIC contains the definitions for the codes appropriate to this model. The EIC includes subcodes that define vessel type, emission mode, and fuel type.

Zone Flag – A set of yes/no fields that define what zone an emission occurs in. This is used internally by the model to determine which records are subject to the various emission controls.

Flag – Flag of vessel: A yes/no field that defines whether or not a particular ship has a US registry.

SUMMARY

This tab summarizes the options made on the other tabs of the Calculate form.

Overcompliance – This option enables the assumption that ships that use distillate fuels, either by choice or requirement, will use fuel with a sulfur content of 0.3%, even when regulations require 0.5% sulfur fuel. Recent surveys from the 2008 fuel regulation suggest that this is occurring.

MORE INFORMATION

- More information about the emissions inventory can be found here:

[2005 Auxiliary Engine Regulation](#) (not currently enforced)

[2007 Shore Power Regulation](#)

[2008 Low Sulfur Fuel Regulation](#)

[2011 Low Sulfur Fuel Rule Revision](#)