

Category: Pleasure Craft

California's pleasure craft emissions inventory is an estimate of the amount and types of pollutants emitted from thousands of pieces of equipment used in recreational marine applications. There are six equipment types in the pleasure crafts category. These equipment types use both 2- and 4- stroke gasoline and diesel engines.

Equipment Type	Gasoline 2-Stroke	Gasoline 4-Stroke	Diesel
Personal Water Craft	X	X	
Vessels w/Outboard Engines	X	X	
Vessels w/Inboard Engines		X	X
Vessels w/Inboard Jet Engines		X	
Vessels w/Sterndrive Engines		X	
Sailboats w/Auxiliary Engines	X	X	X

Emissions Inventory:

As with other OFFROAD equipment types, the emissions inventory for the pleasure craft category is calculated as the product of the emission rate (grams per horsepower-hour), engine population, and activity (hours per year) in annual average use hours.

[Calculating Emissions Inventory \(PDF Format\)](#)

For the current emissions inventory for pleasure craft:

[Air Resources Board Almanac](#)

Input Data Sources:

The input factors used by the OFFROAD Model come from various data sources:

Input Factor	Source of Data
Emission rates <ul style="list-style-type: none">- Exhaust- Zero hour- Deterioration rate- Evaporative	ISO 8178-4 E4 recreational marine test cycle; 5-mode marine cycle Southwest Research Institute Testing (1999); Systems Applications International (1995) ARB vehicle testing Automotive Testing Laboratories, Inc (2003)
Activity <ul style="list-style-type: none">- Annual average activity- Activity by age	Systems Applications International (1995) Systems Applications International (1995)
Average horsepower <ul style="list-style-type: none">- Average horsepower- Model year specific avg hp	Power Systems Research (1996) Power Systems Research (1996)
Load factor	Systems Applications International (1995)
Population (base year 2000)	Department of Motor Vehicles (# of registered hulls) National Marine Manufacturers Association (engine sales)
Allocation factor	Systems Applications International (1995)
Growth factor	Department of Motor Vehicles registration data
Survival rate	Power Systems Research (1996-modified curve)

For the pleasure craft input factors used by the OFFROAD Model: [\(Document Link\)](#)

Adopted Regulations for Pleasure Craft:

1998: *(Reflected in OFFROAD Model)* Board approved emission reductions from outboard engines and personal watercraft by adopting exhaust emission standards for new engines. In 2001, all new outboards sold in California are required to meet the U.S. EPA 2006 emission levels. [\(Document Link\)](#)

2001: *(Reflected in OFFROAD Model)* Board approved regulatory proposal for spark-ignition inboard engines. In 2003, all inboard engines sold in California are required to meet exhaust emission standards (15.0 grams/kilowatt-hour HC+NOx), certification test procedures, and new engine and in-use compliance rules. In 2007, the catalyst-based standard (5.0 grams/kilowatt-hour HC+NOx) will be phased-in. [\(Document Link\)](#)

Additional detailed information for the above regulations are available at:

Outboard/PWC and Regulatory Emissions Inventory: [\(Document Link\)](#)

Inboard/Sterndrive: [\(Document Link\)](#)

Evaporative Emissions from Large Spark-Ignited Engines: [\(Document Link\)](#)

Future Improvements to the Pleasure Craft Category:

The emissions inventory from the OFFROAD Model strives to accurately represent the 'real-world' as accurately as possible. Therefore, the methodologies and data sources are constantly re-evaluated and updated where applicable. The following items are future improvements for the pleasure craft category:

- Modify the engine to boat ratio based on current NMMA data
- Update the age distribution from 2005 DMV registration data
- Revise growth factors using 2005 as base year
- Update survival curve to reflect current trends
- Analyze certification data for up-to-date 2-stroke/4-stroke population percentages
- Improve evaporative emission rates as more data becomes available
- Refine resolution for spatial allocation and differentiate between exhaust and evaporative emissions allocation
- Determine activity by age for other equipment types
- Reflect local regulations that ban 2-stroke pleasure craft