Spark-Ignition Marine Engine and Boat Regulations

BOARD HEARING

Staff Presentation
Air Resources Board
July 24, 2008

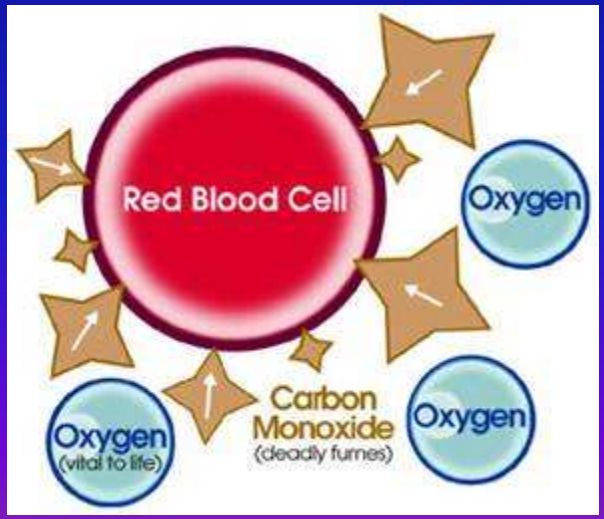
California Environmental Protection Agency
Air Resources Board

Regulatory Timeline

1998	Outboard/Personal Watercraft (OB/PWC) hydrocarbon and oxides of nitrogen ($HC+NO_x$) standards adopted
2001	Sterndrive/Inboard (SD/I) $HC+NO_x$ standards adopted
2005	Optional standards for SD/I 5 g/kW-hr $HC+NO_x$ standard adopted
2007 / 2008	SD/I engines ≤ 373 kW comply with the 5 g/kW-hr standard
2009	High performance SD/I engines > 373 kW will be subject to the 5 g/kW-hr $HC+NO_x$ standard

Reasons for Action

- Provide relief to the small volume manufacturers of high performance sterndrive/inboard engines
- Reduce the risk of carbon monoxide poisoning from all spark-ignition marine engines
- Streamline the regulations



High Performance Engines (> 373 kW)

Few in Number, High Performance Engines Are Significant Polluters

HIGH PERFORMANCE HC+NO_x EMISSIONS 2020 Statewide Summer Weekend Estimates		
Annual Sales	Uncontrolled Inventory [tons per day]	Projected Benefit from the 5 g/kW-hr Exhaust Standard [tons per day]
150 - 250	4.22	2.03

Catalysts aren't the Answer for High Performance Engines

- The technological solution we envisioned when we adopted the 5 g/kW-hr HC+NO_x standard did not materialize:
  - Existing catalyst technology is not durable at sustained wide open throttle operation
  - Limited economies of scale do not support the development of a proprietary technology for only 200 engine sales per year

Proposed High Performance HC+NO_x Standards

MODEL YEAR	POWER CATEGORY *[kilowatts]*	HC+NO_x STANDARD *[grams per kilowatt-hour]*	
		Small Volume or Non-Qualifying Intermediate Volume Manufacturer	Large Volume or Qualifying Intermediate Volume Manufacturer
pre 2009	kW > 373	Uncontrolled	
2009 - 2010	373 < kW ≤ 485	16.0	5.0
	kW > 485	25.0	
2011 and later	373 < kW ≤ 485	16.0	5.0
	kW > 485	22.0	

An intermediate volume manufacturer certifies between 75 and 500 combined high and standard performance engines per year in California

Qualifying intermediate volume manufacturers certify at least 12 times as many standard performance engines as high performance engines

Proposed High Performance Evaporative Design Specifications

PERMEATION SPECIFICATIONS *[grams per square meter per day]*		DIURNAL SPECIFICATIONS *[grams per gallon per day]*
Hose	Tank	
15.0	1.5	0.16 / 0.40

Emissions Neutral Solution

2020 Statewide Summer Weekend HC+NO_X Benefits

Emissions Benefit from Existing 5 g/kW-hr Exhaust Standard for All High Performance Manufacturers		**2.03** *[tons per day]*
PROPOSED REQUIREMENTS	**INCREMENTAL BENEFIT** *[tons per day]*	**CUMULATIVE BENEFIT** *[tons per day]*
Existing 5 g/kW-hr Standard for Large Volume Manufacturers	1.42	1.42
Proposed 16/25 g/kW-hr Standard for Small Volume Manufacturers	0.20	1.62
Proposed Evaporative Controls (Canister, Tanks, Hoses)	0.41	2.03

Proposal Allows Alternative Means of Compliance for Large Volume Manufacturers

- Use more carbon canisters on standard performance boats to offset emissions
- Other manufacturer-specific measures approved by the Executive Officer (e.g., voluntary lower standards)

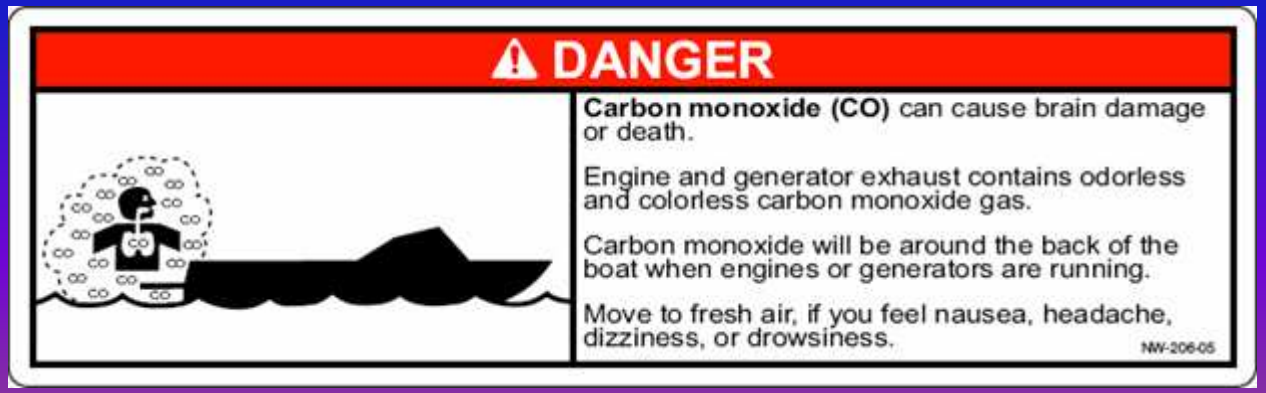
Carbon Monoxide is Deadly to Boaters

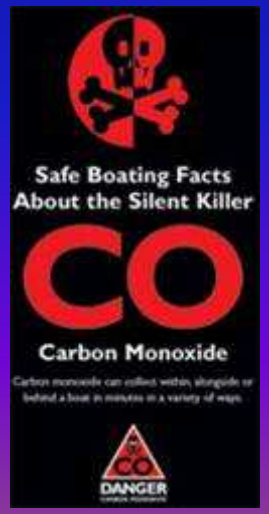
- 43 cases of carbon monoxide poisoning were reported in California between 1990 and 2004
- 10 deaths occurred in California between 2001 and 2006
- All marine engines can be dangerous sources of carbon monoxide to vessel occupants and to occupants of other nearby vessels or swimmers

http://www.dbw.ca.gov/BoaterInfo/CODanger.aspx
http://info.sen.ca.gov/pub/03-04/bill/asm/ab_2201-2250/ab_2222_bill_20040917_chaptered.pdf

Proposed Carbon Monoxide Standards

ENGINE CATEGORY	MODEL YEAR	MAXIMUM POWER [kilowatts]	CO STANDARD [grams per kilowatt-hour]	TYPE
OB/PWC (outboard / personal watercraft)	2010 and later	kW ≤ 40	500 - 5 x P	Fixed
		kW > 40	300.0	Fixed
SD/I (sterndrive / inboard)		kW ≤ 373	75.0	Fixed
		kW > 373	350.0	Fixed





Jet Boats

Jet Boats Should be Treated Like Sterndrives

- Jet boats are commonly marketed as competitors to boats with sterndrive engines
- Jet boats have transoms and are used in tow sports
- Proposed federal definition for “sterndrive/inboard engines” encompasses jet boat engines

Proposed Jet Boat Requirements

- Jet boat engines will be reclassified as SD/I engines
- New jet boat engines must comply with the SD/I standards in 2010 (unless replacing an engine of equal or lesser stringency)
- Existing jet boat engines may continue to be certified to the OB/PWC standards until 2012

Voluntary Standards

5 STAR Voluntary Standards

$HC+NO_x$ STANDARD *[grams per kilowatt-hour]*	**CO STANDARD** *[grams per kilowatt-hour]*	**PERMEATION STANDARDS** *[grams per square meter per day]*		**DIURNAL STANDARD** *[grams per gallon per day]*
		Hose	**Tank**	
2.50	50.0	15.0	1.5	0.4

Highlights of Other Proposed Action

- Simplified certification procedures
- Methane-inclusive hydrocarbon standards
- Not-To-Exceed (NTE) limits
- Hardship relief provisions
- Updated on-board diagnostics requirements
- Updated replacement engine provisions
- Standardized rebuilding practices
- Hang-Tag durability provisions

Proposed 15 Day Changes

- Authorize the Executive Officer to approve manufacturer specific alternatives for complying with high performance requirements
- Create intermediate volume category for high performance engine manufacturers
- Change the commencement date for carbon monoxide standards to 2010
- Permit replacement jet boat engines to comply with the OB/PWC standards until 2012

Conclusions

The Proposed Amendments:

- Facilitate Compliance
  - Relief for small businesses
  - Greater flexibility
- Reduce Carbon Monoxide Exposure
- Preserve Emission Benefits
  - 2.03 tons per day reduction of $HC+NO_x$ in 2020 from high performance engines