Recreational Marine Engines

Nonroad Large SI Engines

Office of Transportation and Air Quality
January 2001
Recreational Marine
(Rulemaking will not include outboards/personal watercraft)
Marine--Regulatory History

- We proposed standards for all marine engines in 1994
  - 1996 final rule included standards only for outboard and personal watercraft
  - Sterndrive/Inboard excluded from 1996 rule
    » they appeared to be a clean alternative to outboards
    » technology for reducing emissions needed further investigation

- We finalized standards for commercial marine diesel engines in 1999
  - Recreational engines excluded for concern over small-business impacts and greater design challenge

- California ARB aiming for final sterndrive/inboard standards in Spring 2001
Marine--Product Overview

■ Annual sales mix
  – recreational marine diesel: 11,000
  – sterndrive/inboard gasoline: 110,000

■ Many recreational boats come with gasoline/diesel option
  – regulating both at same time maximizes ability to consider competitive issues

■ Engine manufacturing
  – Diesel: adjusted calibration is the only difference from commercial marine engines, which are also used in land-based applications
  – Gasoline: most manufacturers make dedicated marine engines by marinizing base automotive engines

■ Scope
  – Gasoline engines would also include jet boats and airboats
  – Need to refine personal watercraft definition to separate them from larger craft included in this proposal
Marine Diesel Issues

- **Standards**: data support proposing emission standards from the commercial marine diesel final rule
  - 7.2 to 7.5 g/kW-hr HC+NOx, 0.2 to 0.4 g/kW-hr PM

- **Lead time**: may need additional lead time beyond 2004, when standards start for most commercial marine diesel engines

- **Compliance program**: most provisions would match those for commercial marine diesel engines

- **Off-cycle**: requesting comment on not-to-exceed provisions

- **Useful life**: typical lifetime is 500 hours or more
Sterndrive/Inboard Issues

- **Emission standards**: requesting comment on standards with and without catalysts (5 to 10 g/kW-hr HC + NOx)
- **Lead time**: Requesting comment on implementing standards in 2005 or 2006 model year
- **Off-cycle**: requesting comment on not-to-exceed provisions
- **Useful life**: typical lifetime is 500 hours or more
- **Small business provisions**: most engine marinizers and boat builders qualify as small businesses
- **Evaporative emissions**: requesting comment on controlling gasoline vapor losses
Large SI
Large SI--Product Overview

- **Equipment types:**
  - Vehicles: forklifts, airport equipment, sweepers
  - Portable equipment: generators, pumps, compressors, saws

- **Engine types**
  - Most are derived from automotive engines
  - A few are air-cooled industrial engines--more challenging to control

- **Fuel types**
  - 70 percent of engines use LPG
  - Most of the rest are gasoline-fueled
  - Fuel conversions and dual-fuel engines are common
Large SI--Applications

Total annual sales = 100,000
California ARB adopted a final rule for Large SI engines in October 1998
- 4 g/kW-hr NOx+NMHC standard phases in from 2001 through 2004 (50 g/kW-hr CO)
- Standards were set to ensure feasibility based on limited deterioration data
- Projected technology includes electronic fuel systems with 3-way catalyst
- Compliance program includes production-line and in-use testing by manufacturers
Large SI Issues

- **Emission standards:**
  - Propose California ARB standards for 2004 model year
  - Data show engines can meet more stringent standards
  - Aiming to propose 1.5 to 2.5 g/kW-hr HC+NOx standard for 2007 model year

- **Test procedure:** developing transient duty cycle
  - Testing over normal forklift operation shows high emissions variability

- **Off-cycle:** potential not-to-exceed provisions would be tailored to Large SI technology/operation

- **Diagnostics:** pursue basic engine diagnostics to keep engines at stoichiometry

- **Evap:** explore possible steps to address evaporative emissions
  - Fuel boiling, diurnal losses, fuel permeation