Small Off-Road Engine Evaporative Emissions Regulation Amendments

Sacramento, California
November 17, 2016
Need for Regulatory Action

• Low compliance rate with existing emission standards

• ARB can not effectively take enforcement action

• Certification fuel doesn’t represent real-world fuel

• Different ARB and U.S. EPA fuel tank testing requirements impose extra costs
Proposed Amendments

• Require all SORE to meet emission standards
• Strengthen enforcement provisions
• Require E10 certification fuel
• Provide optional streamlined fuel tank test procedure
What Are Small Off-Road Engines?

Lawn and garden equipment

Other utility equipment and specialty vehicles

Federally regulated equipment

(> 45 cc)
Sources of SORE Emissions

During operation
- Exhaust
- Evaporative running loss

After operation
- Evaporative
  - Hot soak
  - Diurnal

- Fuel hoses
- Fuel tank
- Carbon canister
- Carburetor
- Connections, etc.
SORE Evaporative Emissions Regulatory History

**ARB**

- **2003**
  - ARB SORE evaporative emission regulations adopted

- **2006-2013**
  - ARB evaporative emission standards implemented

**U.S. EPA**

- **2008**
  - U.S. EPA SORE evaporative emission regulations adopted

- **2009-2012**
  - U.S. EPA evaporative emission standards implemented
Evaporative Emission Standards: Walk-Behind Mowers

- **Uncontrolled**
  - SORE Rule Adopted
  - Passenger Cars
  - Diurnal Emission Standard (g HC/day)
  - Year

- **SORE Rule Adopted**
  - 1.3 g day\(^{-1}\)
  - 1.0 g day\(^{-1}\)
  - 3x

- Date: 11/17/2016

California Environmental Protection Agency
AIR RESOURCES BOARD
Expected Benefit of SORE Regulations

Evaporative Emissions (ROG, tons per day)

Based on 2003 projections

2003 Rule Adopted

2006 Begin Rule Implementation

Uncontrolled

Controlled

Expected benefits
Current Certification Pathways

Performance Certification

- Test assembled equipment

Select Components

Fuel line
Fuel tank
Carbon canister

Design Certification (Validation Needed)

- Assemble unit
- Assume equipment meets diurnal emission standards

Test separate components
SORE Validation Studies

- Defined in 2003 regulations
- Conducted from 2008-2015
- Joint ARB/industry testing program
- 49 design, 10 performance-certified units
- Are we getting expected emissions reductions?
Low Compliance Rates

- Certification Data
- 2013-2015 Validation Study: 60% Failed
- Assumption: 50% Failed
- 2013-2015 Validation Study

Compliance Rate: 0%, 50%, 100%
Higher Emissions of Design-Certified Equipment

Diurnal Emissions/Emission Standard

Performance

Design

Certification Data

2013-2015 Validation Study

Assumption

2013-2015 Validation Study

117% Higher

8% Higher

Emissions = Standard

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Potential Changes to Certification Pathways

1. Eliminate design certification

2. Retain design certification but add accountability (staff recommendation)

3. No changes to current regulations
Challenges in Addressing Non-Compliance

• Diurnal emission standards are not enforceable for design-certified engines

• Compliance testing requires five engines

• Emissions can be up to 50% above standard before failure
Certification Fuel Does Not Represent Real-World Fuel

California Reformulated Gasoline

Phase I

Phase II

Phase III

Cert fuel does not represent real-world fuel
Different State and Federal Fuel Tank Testing Requirements

• Requires separate tests for ARB and U.S. EPA
• Increases the cost for manufacturers

1-3 fuel tanks with fuel caps
• Precondition at 28 ± 5 °C or 43 ± 5 °C
• 10 percent ethanol and 9 RVP fuel
• 4 Durability tests

5 fuel tanks
• Precondition at 30 ± 10 °C or elevated temperature
• 0 percent ethanol and 7 RVP fuel
• Different slosh and pressure test requirements
Proposed Amendments

• Require all SORE to meet emission standards

• Strengthen enforcement provisions

• Require E10 certification test fuel

• Provide optional streamlined fuel tank test procedure
Require All SORE to Meet Emission Standards

• Retain both performance and design certification
• Maintain existing diurnal emission standards
• Require bonds to cover enforcement liability
Strengthen Enforcement Provisions

• Compliance testing in SHED for all SORE > 80 cc

• Expedite compliance testing
  • Test one engine instead of five
  • Retest if emissions exceed standard by < 5%

• Omit preconditioning
Minimize Impact for Compliant Manufacturers

• ~50% of manufacturers produce compliant equipment

• Amendments minimize additional testing costs for these manufacturers

• Continued choice of either design or performance certification pathway

• Carryover of emissions data for certification applications
Require E10 Certification Test Fuel

- California Reformulated Gasoline
- Phase I
- Phase II
- ARB Certification Fuel
- Phase III
- Regs adopted

Timeline:
- 2000
- 2005
- 2010
- 2015
- 2020
- 2025

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Feasibility of Meeting Standards Using E10 Fuel

- ARB staff assessed feasibility of E10 as cert fuel
- Testing conducted from 2015-2016
- 17 units tested for diurnal emissions
- 13 units met diurnal emission standards
- Suggests requirements and phase-in are reasonable
Provide Optional Streamlined Fuel Tank Test Procedure

**Testing Pathways**

**Existing**
- 5 fuel tanks
- Precondition at 30 ± 10 °C or elevated T
- 0 percent ethanol and 7 RVP fuel
- Different durability requirements

**Optional Streamlined**
- 5 fuel tanks
- Precondition at ≥ 38 °C
- Test with or without fuel cap
- 10 percent ethanol and 9 RVP fuel
- 4 durability tests

- 1-3 fuel tanks
- Precondition at 28 ± 5 °C or 43 ± 5 °C
- 10 percent ethanol and 9 RVP fuel
- 4 Durability tests

- 5 fuel tanks
- Precondition at ≥ 38 °C
- Test with or without fuel cap
- 10 percent ethanol and 9 RVP fuel
- 4 durability tests
Proposed Regulations Costs and Benefits

• Direct costs for testing and certification

• Maximum retail price increase of $3.68 per unit
  • Includes 75% markup on manufacturers’ costs

• Typical retail price $70 – $5,000
  • Potential 0.1 – 5.3% increase in retail price

• Environmental and health benefits from increased compliance
Rulemaking Process

• Workshops, working group, manufacturer meetings

• Numerous changes based on industry concerns

• Some remaining industry concerns

• Staff proposes 15-day changes

• Accountability critical for further reductions
Proposed 15-Day Changes

• Received 46 suggested changes during 45-day comment period

• Changes/clarification based on 40 of 46 suggestions
  • Fuel cap, fuel line, canister purging requirements
  • Editorial changes and clarification

• Changes to reporting requirements
  • Quarterly zero-emission equipment sales
  • Quarterly sales by engine family and fuel tank volume (spark-ignited)
  • Manufacturers’ QA/QC plans
Need for Additional Emissions Reductions
ARB’s Mobile Source Strategy

- 80% reduction of HC + NO\textsubscript{x} emissions from mobile sources by 2031
- 40% reduction of greenhouse gas emissions by 2030
SORE vs. Cars
(South Coast Air Basin)

- SORE\textsuperscript{a}
- Light Duty Passenger Cars\textsuperscript{b}

\begin{itemize}
\item \textsuperscript{a} CEPAM
\item \textsuperscript{b} 2016 SIP Strategy
\end{itemize}

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Near-Term Compliance Actions

• Current compliance testing (six evap families)
• Active screening program
• Streamlined compliance testing
2018 Informational Update

- Zero-emissions technology assessment
- Build on 2004 assessment
- Evaluate availability, cost, and performance
- Review effectiveness of incentives and exchange programs

Mean Green 60” Commercial Riding Mower
GreenWorks 21” Commercial Walk-Behind Mower
Echo Professional Grade 14-16” String Trimmer
2020 Rulemaking

- 80% reduction in HC and NO$_x$ emissions by 2031
- 40% reduction in GHG emissions by 2030 (SB 32)
- Develop new exhaust and evaporative emission standards
- Significant zero-emission equipment requirement
Summary and Recommendation

• Proposed amendments will increase accountability
• Additional ARB testing will improve compliance rate
• Certification test fuel will reflect gasoline in California
• Potential cost savings to manufacturers from streamlined fuel tank test procedure
• Costs are modest
• Staff recommends adoption of proposed amendments with 15-day changes