Small Off-Road Engine Evaporative Emissions Regulation Amendments

Sacramento, California
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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

2008
U.S. EPA SORE evaporative emission regulations adopted

2009-2012
U.S. EPA evaporative emission standards implemented

**U.S. EPA**
Evaporative Emission Standards: Walk-Behind Mowers

Diurnal Emission Standard (g HC/day)

Year


Uncontrolled

SORE Rule Adopted

Passenger Cars

1.3 g day\(^{-1}\)

1.0 g day\(^{-1}\)

3×
Expected Benefit of SORE Regulations

Based on 2003 projections
Current Certification Pathways

Performance Certification

- Assemble unit
- Assume equipment meets diurnal emission standards
- Test assembled equipment

Select Components

Fuel line
Fuel tank
Carbon canister

Design Certification (Validation Needed)

Test separate components

- Assemble unit
- Assume equipment meets diurnal emission standards

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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
- Validation Study (2013-2015): 60% Failed

Compliance Rate

0%  50%  100%
Higher Emissions of Design-Certified Equipment

- **Diurnal Emissions/Emission Standard**
- **Performance**
  - **Certification Data**
  - **2013-2015 Validation Study**
  - **Assumption**
- **Design**
  - **2013-2015 Validation Study**

- **Higher Emissions of Design-Certified Equipment**
  - **8% Higher**
  - **117% 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

Ethanol Content

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

Phase III

ARB Certification Fuel

Regs adopted


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California Environmental Protection Agency
AIR RESOURCES BOARD
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

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

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

**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

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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)

[Graph showing ROG + NOx emissions from SORE and Light Duty Passenger Cars from 2016 to 2031]

- SORE\(^a\)
- Light Duty Passenger Cars\(^b\)

\(^a\) CEPAM
\(^b\) 2016 SIP Strategy

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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\textsubscript{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