

Proposed Modifications to the Large Spark-Ignition (LSI) Engine Regulations



Board Hearing

November 21, 2008

Outline

- Background
- Proposed amendments
- Environmental benefits and economic impacts
- Conclusions

Background

Examples of LSI Equipment ≤ 1.0 L

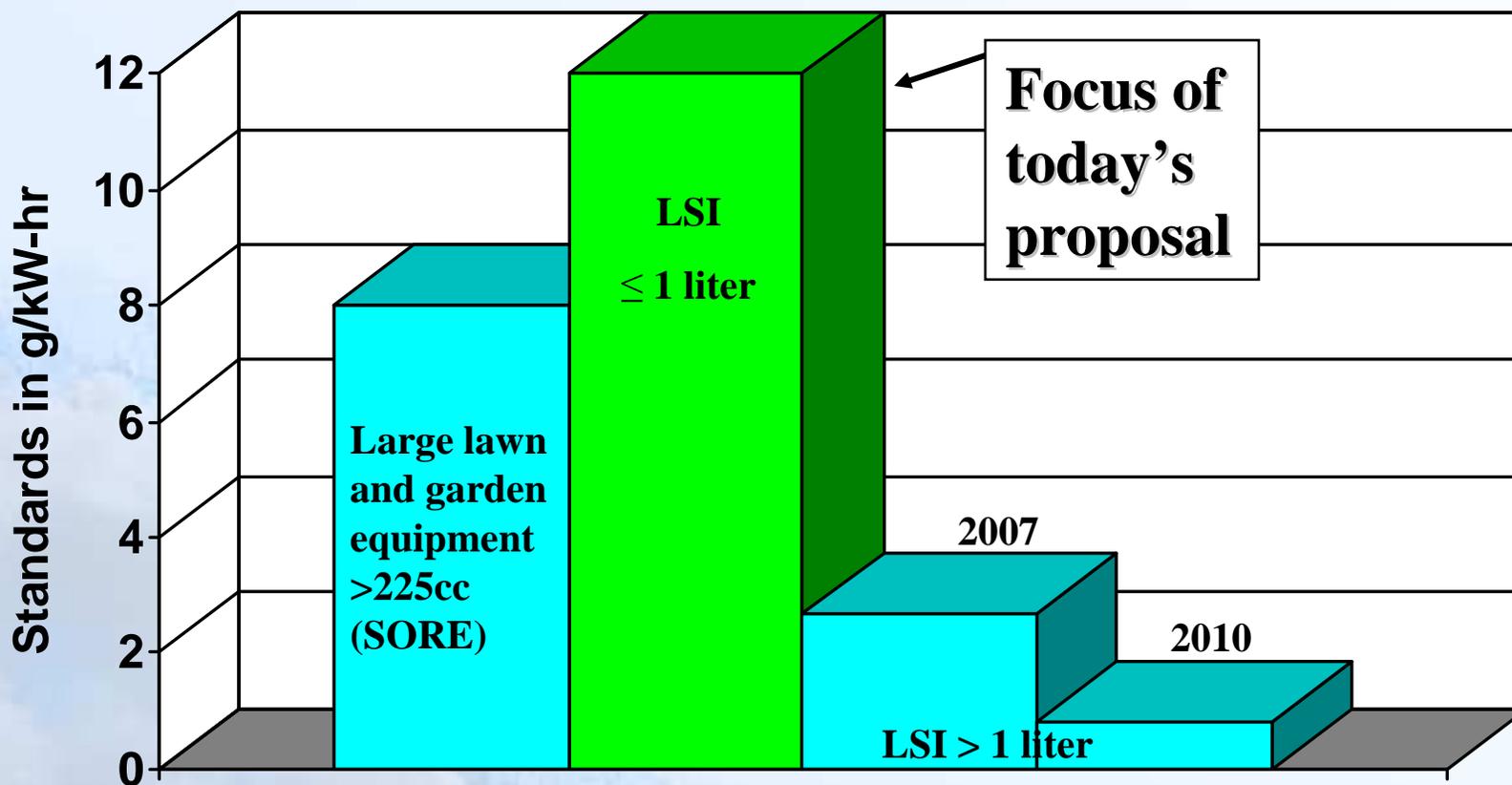
- Engines > 19 kW that run on gasoline or an alternative fuel such as LPG or CNG
- Includes
 - Portable generators
 - Large turf care equipment
 - Industrial equipment/material handling equipment
 - Scrubbers/sweepers
 - Airport ground support equipment



Background **LSI Engines**

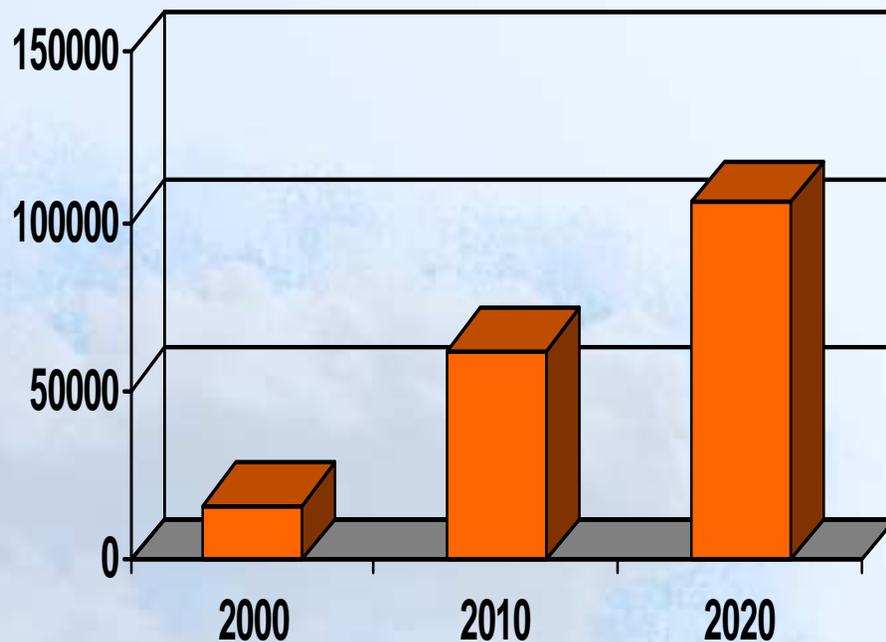
- 1998 - First regulated
- 2002 - First implemented
- 2006 - More stringent emission standards for LSI engines > 1.0 L adopted
 - No changes for LSI engines ≤ 1.0 L

Current Standards for LSI Engines ≤ 1.0 L Less Stringent Than Those for LSI Engines > 1.0 L and SORE ≥ 225 cc

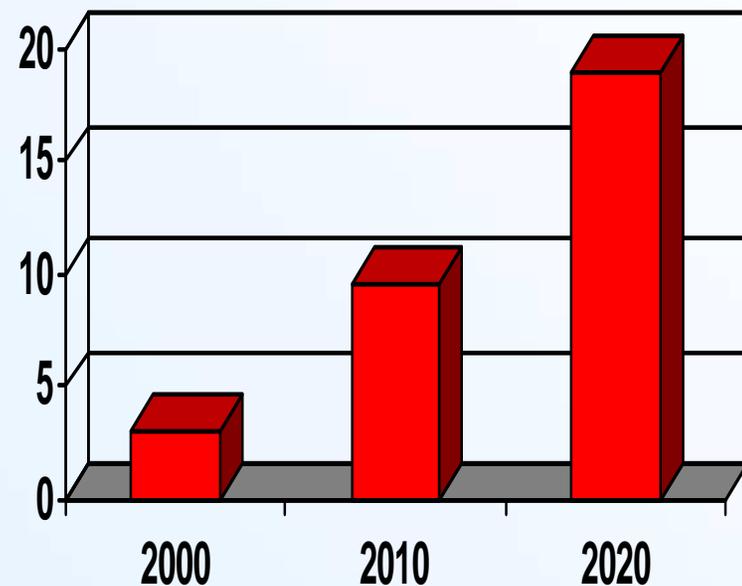


LSI Engines \leq 1.0 L Population Growth and Emissions Rise

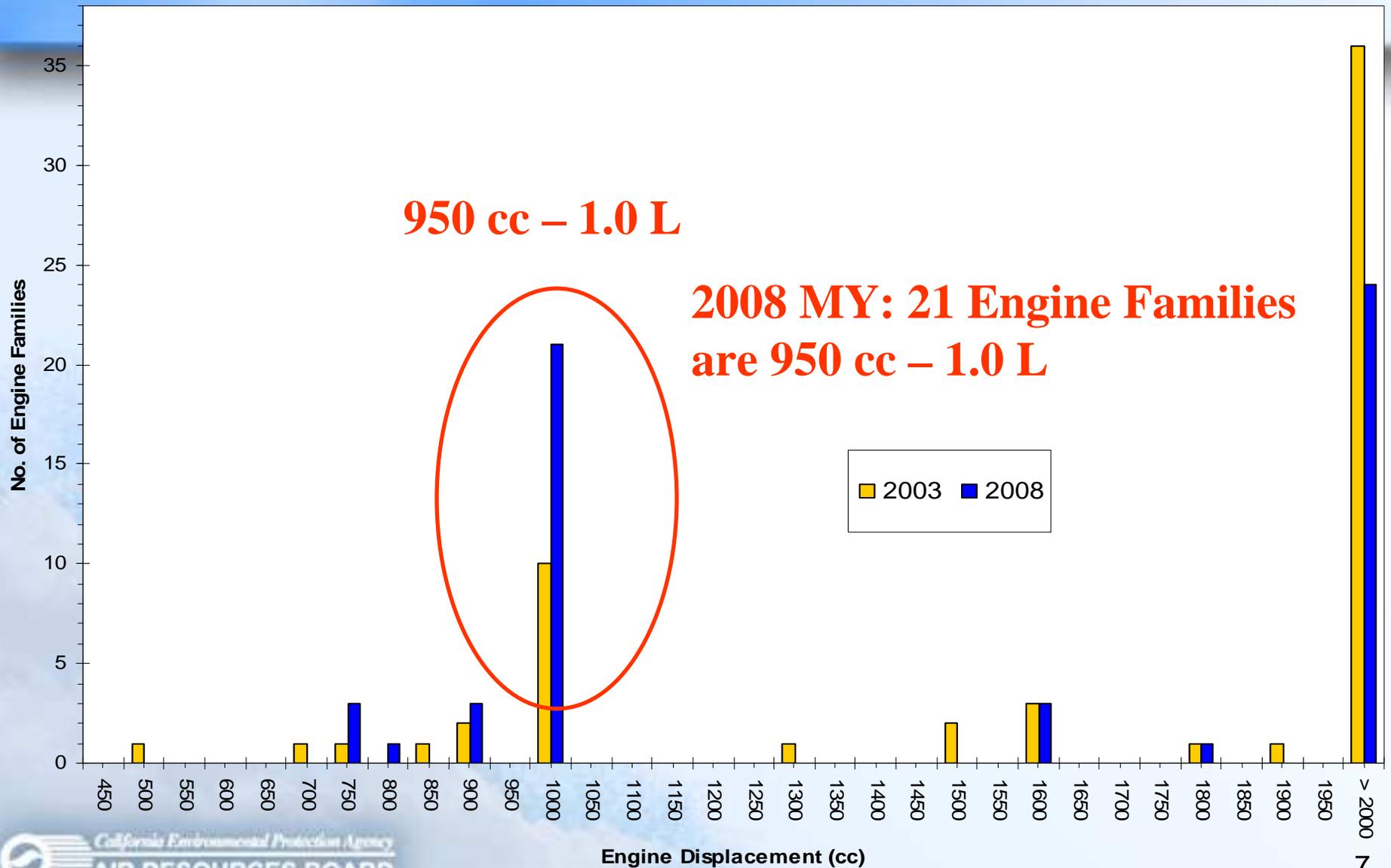
Statewide Population Growth



Statewide ROG+NOx Emissions



More Engines Being Sold in the Less Stringent Category



Proposed Amendments

LSI Engines \leq 1.0 Liter

- More stringent catalyst-based exhaust emission standards
- Evaporative emission standards and requirements
- Off-highway recreational vehicle (OHRV) test procedures for LSI engines used in OHRV-like applications

Current and Proposed Emission Standards for LSI Engines ≤ 1.0 L

Model Year	Engine Displacement	Durability Period	HC+NOx (g/kW-hr)	CO (g/kW-hr)
Current 2002 and subsequent	≤ 1.0 L	1,000 hours or 2 years	12.0	549
Proposed 2011 and subsequent	≤ 825 cc	1,000 hours or 2 years	8.0	549
Proposed 2011 - 2014	> 825 cc - ≤ 1.0 L	1,000 hours or 2 years	6.5	375
Proposed 2015 and subsequent	> 825 cc - ≤ 1.0 L	1,000 hours or 2 years	0.8	20.6

LSI Engines \leq 825 cc Will Be Treated Like SORE \geq 225 cc

- Low-cost
- Approximately 10% of LSI engines \leq 1.0 L in California
- Proposed emission standards equivalent to tier 3 exhaust emission standards for SORE \geq 225 cc

Are There Technical Roadblocks for the ≤ 825 cc Standards ?

No

- Engine modifications and Air/Fuel ratio changes
- Catalysts would not be necessary

Are There Technical Roadblocks for the Proposed 2011 Emission Standards for LSI Engines >825 cc - ≤ 1.0 L?

No

- Engine modifications and Air/Fuel ratio changes
- Possibly Catalyst
- Four non-catalyst equipped 2008 MY engine families meet the proposed 2011 standards

Are There Technical Roadblocks for the Proposed 2015 Emission Standards for LSI Engines > 825 cc - ≤ 1.0 L?

No

- Standards based on:
 - Water-cooled engines
 - Closed-loop electronic fuel injection with three-way catalysts
- Three engine families meet the proposed 2015 standards

So What is the Issue?

Cost

- 2011 Standards:
\$78 per unit
- 2015 Standards:
\$1,940 per unit
- Average Equipment cost
\$14,000

Cost-Effectiveness

LSI Engine Classes	Cost-Effectiveness (Cost per pound of ROG+NO _x reduced)
≤ 825 cc	\$0.02 - \$0.14
> 825 cc - ≤ 1.0 L	\$0.71 – \$6.40

Estimated Benefit of the Proposal Statewide Annual Average

Year	ROG + NO _x Emission reductions (tons per day)
2020	8.4
2030	15.4

- Unquantified possible CO₂ benefit

Conclusions

- Proposal would provide significant emission reductions
- Standards are attainable with existing technologies
- Proposed controls are cost-effective
- Staff recommends Board adoption