



# 2004 SIP Summit

## Gasoline and Propane Engines

January 14, 2004

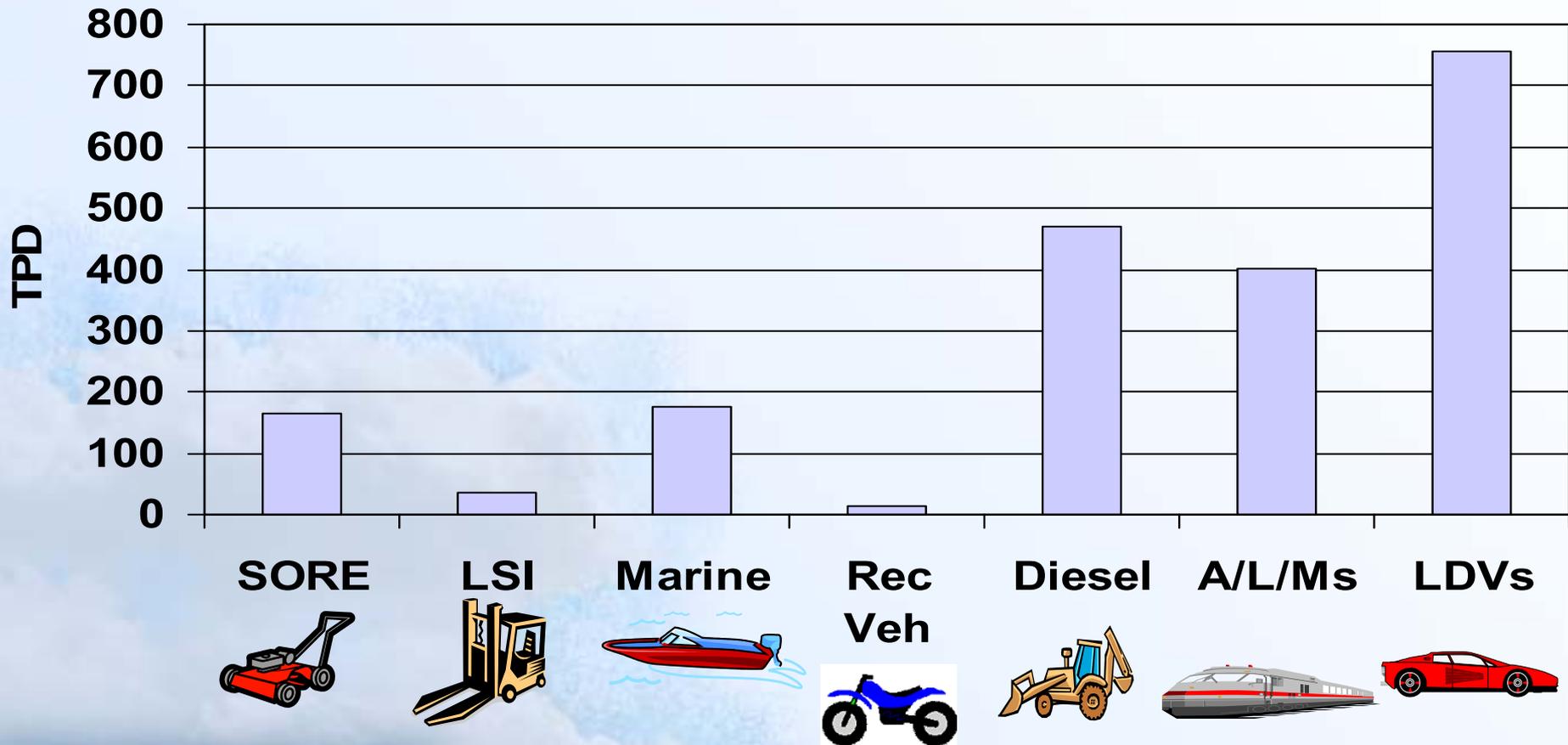
# How Are Off-Road Spark-Ignited Engines Categorized?

- Small Off-Road Engines (SORE)
- Large Spark-Ignited Engines (LSI)
- *Recreational Marine (Inboard, Outboard, Sterndrive, PWCs)*



# Emissions Inventory Comparison

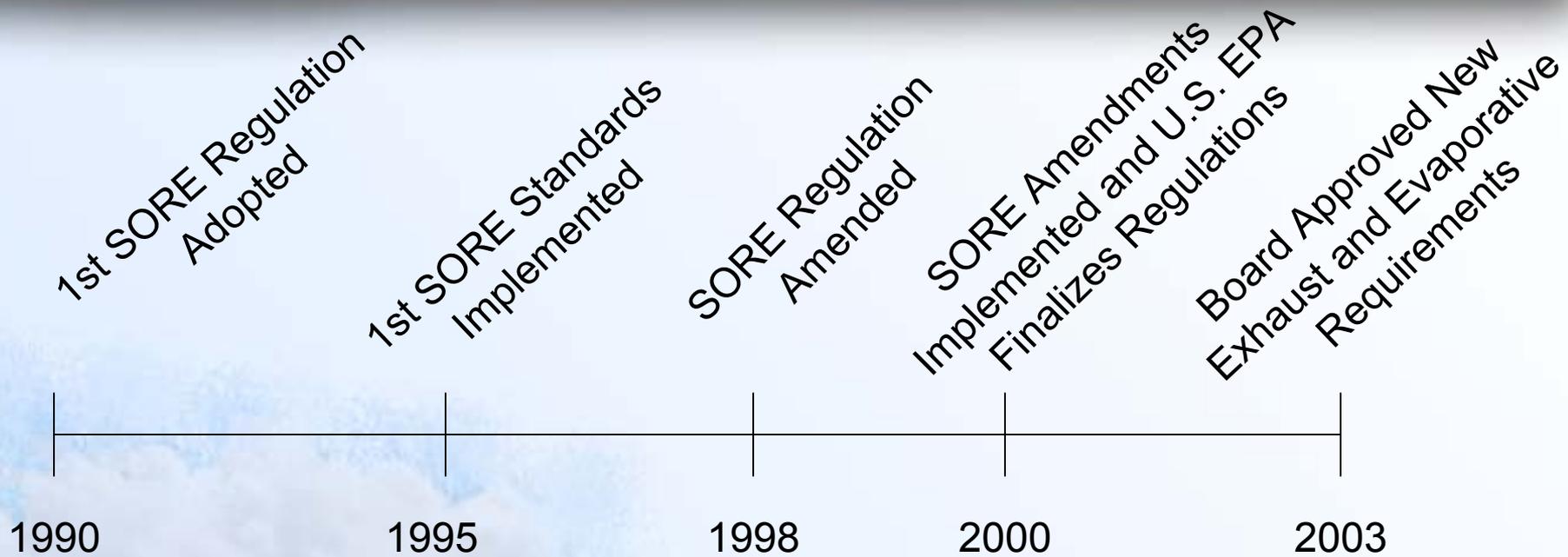
## 2010 HC+NOx Statewide



# Small Off-Road Engines and Equipment

- Engines < 25 hp
- Two and four-stroke engines
- Primarily lawn & garden & small industrial
- Handheld/Nonhandheld
- Residential/Commercial
- Short lifespan = 3 - 7 years

# History



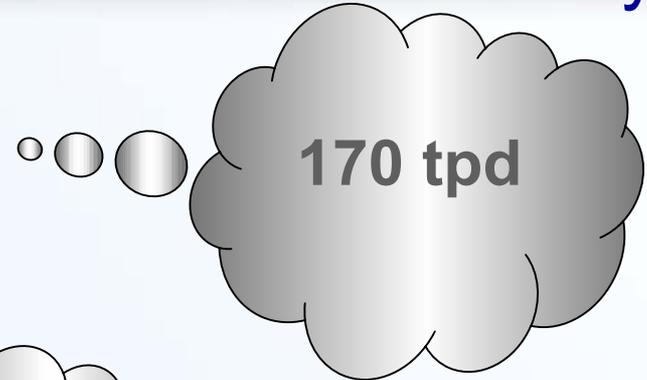
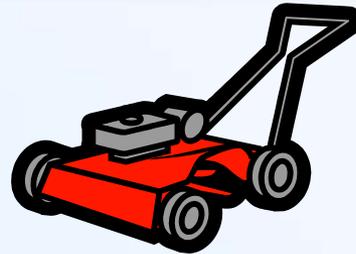
# How Important Are Evaporative Emissions?

- Current equipment have no evaporative emission limits
- Emissions arise from vented fuel caps, vented carbs, and permeation from fuel tank and lines
- Evaporative emissions are becoming a larger percentage of SORE emissions as exhaust emissions decrease

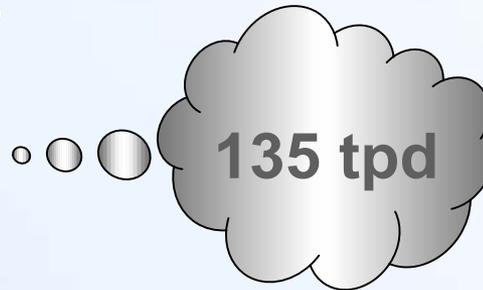
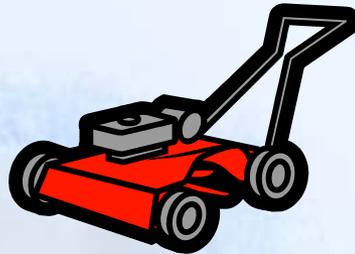
# How Important is Controlling SORE Emissions?

HC+NO<sub>x</sub> Statewide Evaporative + Exhaust Inventory

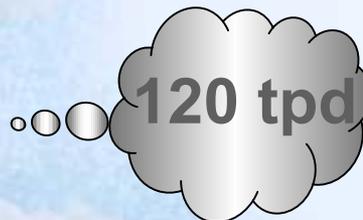
2005



2010



2020



# New SIP Commitments

- Includes two SORE measures
  - SMALL OFF-RD-1 (Handheld)
  - SMALL OFF-RD-2 (Nonhandheld)
- Regulations incorporating these measures approved by the Board on September 25, 2003

# New 2005 Model Handheld Standards SMALL OFF-RD-1

- 30% reduction from current standard for <50cc engines
- Technologies
  - Four-stroke
  - Two-stroke with a catalyst
  - Stratified scavenging
  - Two-stroke/four-stroke hybrids
  - Electric equipment
- Low evaporative permeation standards for fuel tanks



# New 2007/8 Model Nonhandheld Standards SMALL OFF-RD-2

- New evaporative standards
  - Low permeation fuel lines and tanks
  - Control of diurnal emissions
- New exhaust standards
  - Based on the use of a catalytic converter
  - 2007/2008 implementation



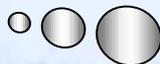
# Comparison of Controlled Emissions

## HC+NOx Statewide - Non-Preempt

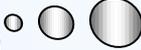
**Baseline**

**SIP Control**

**2010**



120 tpd



100 tpd

**2020**



130 tpd



80 tpd

# Other Possible Strategies

- Investigating increased use of electrics
  - Studying feasibility of electric requirement for residential equipment
  - Available equipment include trimmers, chainsaws, blowers, walk-behind mowers
- Incentives for scrap
  - Obtain funding to scrap older engines
  - Existing scrap programs are successful

# Conclusions

- Both SIP measures already adopted
  - Will reduce 20 TPD HC+NOx statewide in 2010
- Studying feasibility of electric requirement
- Evaluating future scrap programs

# Large Spark-Ignition (LSI) Engines

25 hp and Greater



# What are “LSI Engines”?

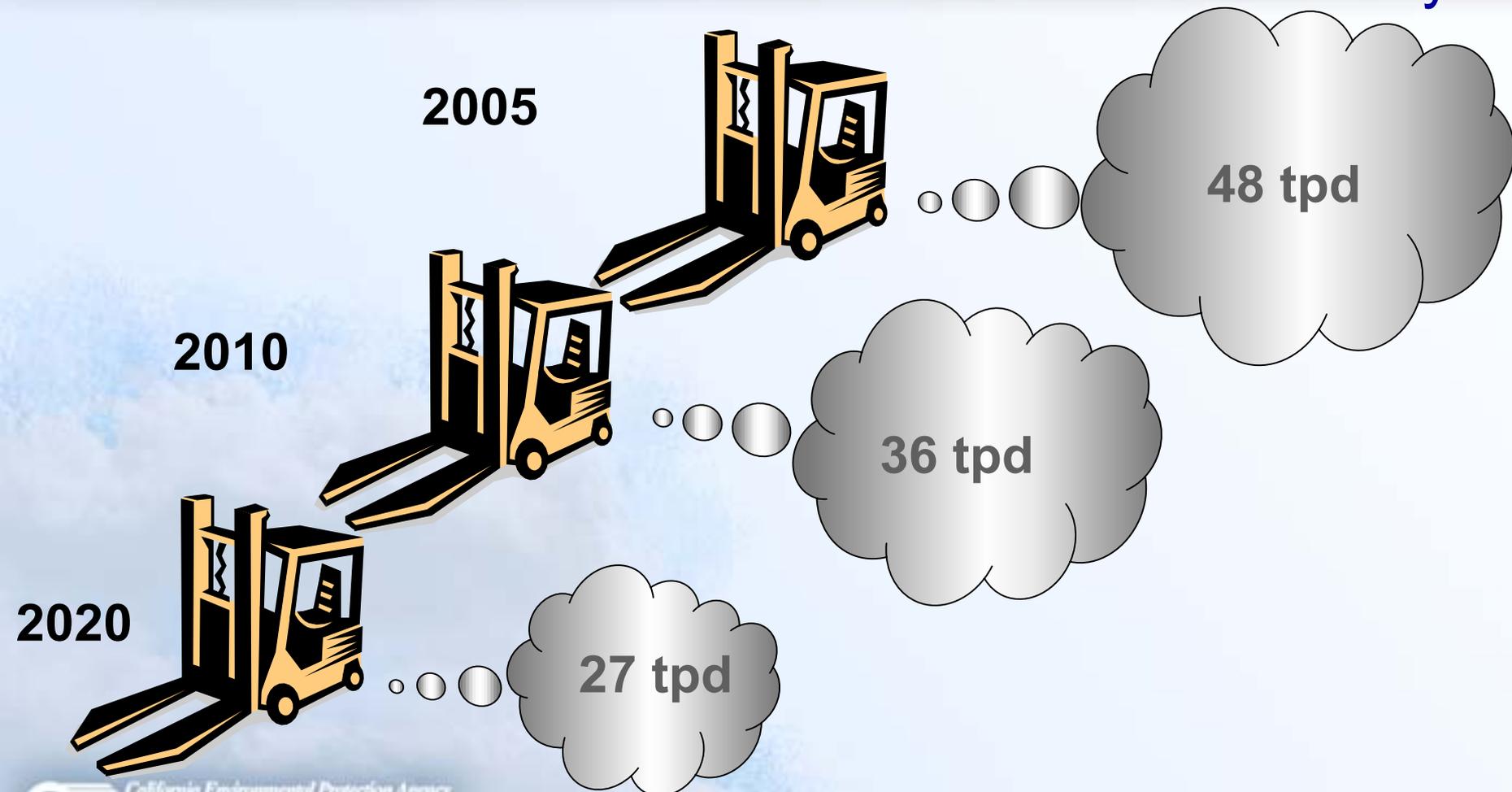
- Gasoline and LPG
- Mainly industrial equipment
- Typical life of 7-10 years
- Older car technology
- Federal preemption

# History



# How Important is Controlling LSI Emissions?

## HC+NOx Statewide Exhaust Emissions Inventory



# Forklifts Are Major Contributors to the LSI Inventory

Population

45%

Emissions

70%



# New SIP Commitments

- OFF-RD LSI-1
  - Lower Emission Standards for New Engines
- OFF-RD LSI-2
  - Clean Up Off-Road Gas Equipment Fleet Through Retrofit and New Emission Standards

# New Emission Standards: OFF-RD LSI-1

- More stringent HC+NO<sub>x</sub> standard beginning with 2007 MY
  - 1.0 - 2.0 g/bhp-hr HC+NO<sub>x</sub>
  - Similar to Federal 2007 standards
- Includes
  - Evaporative emission control
- Lower standards for <1 L engines
  - Consider SORE levels

# Retrofit/New Standards: OFF-RD LSI-2

- Retrofit existing uncontrolled equipment with catalysts where feasible
- Explore use of ZEV/PZEV technologies in place of current IC engines

# Comparison of Controlled Emissions

## HC+NOx Statewide

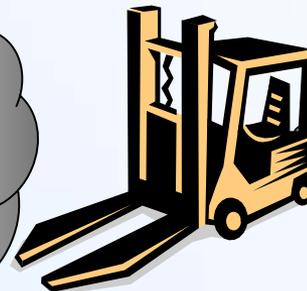
**Baseline**

**SIP Control**

**2010**



36 tpd



29 tpd

**2020**



27 tpd



19 tpd

# Other Possible Strategies

- Statewide registration program
  - Allows tracking of equipment
  - Enhances effectiveness of a retrofit program
- Obtain funding for incentive programs
  - Provide incentives for cleaner vehicles and equipment
  - Moyer Program

# Conclusions

- 2007 new engine standards
- Retrofit of existing equipment and zero/near-zero standards where feasible
- Equipment registration program
- Incentives for cleaner engines

