

# Public Workshop

## Proposed RACT/BARCT Determination for Stationary Spark-Ignited Internal Combustion Engines

August 29, 2000

California Environmental Protection Agency

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Air Resources Board

# Purpose of Workshop

- Provide overview of proposed RACT/BARCT determination
- Open Discussion / Document Comments

# Why a Determination?

- California Clean Air Act, adopted in 1988, requires nonattainment areas to apply RACT or BARCT controls to stationary sources
- BARCT also required for districts located within an area of origin of transported air pollutants
- HSC 40916 requires the ARB to provide technical assistance to districts

# What is a Determination?

- Cooperative effort between ARB and CAPCOA
- Designed to provide districts with guidance in the development of a rule to control emissions
- Is NOT a rule
- Since 1991, final determinations have been released for 18 source categories

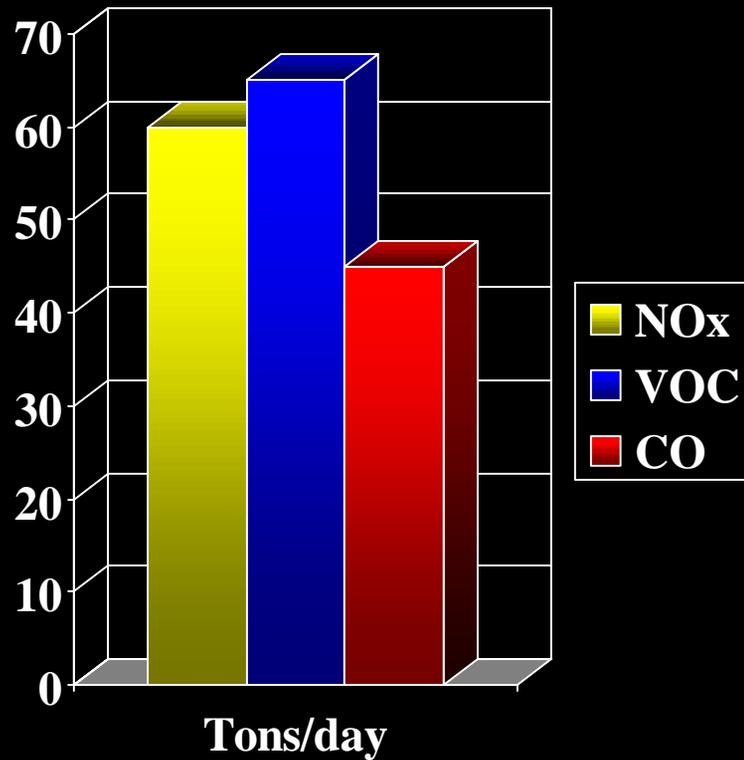
# Overview

- Background
- Inventory
- Schedule
- Emission Limits/Control Technology
- Exemptions
- Administrative Requirements
- Test Methods
- Issues

# Background

- Previous version released December 1997 and included diesel-fueled engines
- Workshops held in January 1998
- Meetings with District Workgroup
- Diesel-Fueled engines will be addressed as part of Diesel Risk Reduction Plan
- Applicability to all existing spark-ignited engines with rating of 50 bhp or greater

# Inventory



- Based on 1996 Point Source Inventory
  - 60 tons/day NO<sub>x</sub>
  - 65 tons/day VOC
  - 45 tons/day CO

# Spark-Ignited IC Engines by Fuel Type

<u>Fuel Type</u>	<u>%</u>
Natural Gas	77
Gasoline	14
Propane	7
Landfill/Digester Gas	2

- Based on 1996 Point Source Inventory

# Schedule

- Workshop on August 29
- Written comments requested by Sept.18
- Final Determination to be presented to CAPCOA Engineering Managers in late September

# How was the Proposed Determination Developed?

- Review of existing district rules
- Discussions with owners/operators of engines
- Discussions with district representatives
- Discussions with representatives of various control technology providers and engine manufacturers

# Factors Considered in Determining Emissions Limits

- Capacity factors (i.e., annual fuel consumption)
- Rich Burn vs. Lean Burn
- Type of fuel (waste gas vs. natural gas)
- Control Technologies

# Proposed RACT Standards Stationary Spark-Ignited Internal Combustion Engines

<u>Engine Type</u>	<u>% Control</u>	<u>ppmv at 15% O<sub>2</sub></u>		
		NO <sub>x</sub>	VOC	CO
Spark-Ignited Engines				
- Low Fuel Consumption	---	350	750	4500
- High Fuel Consumption				
Rich-Burn, All Fuels	90	50	250	4500
Lean-Burn, All Fuels	80	125	750	4500

# Proposed BARCT Standards Stationary Spark-Ignited Internal Combustion Engines

<u>Engine Type</u>	<u>% Control</u>	<u>ppmv at 15% O<sub>2</sub></u>		
		NO <sub>x</sub>	VOC	CO
Spark-Ignited Engines				
- Low Fuel Consumption	---	350	750	4500
- High Fuel Consumption				
Rich-Burn, Waste Gas Fueled	90	50	250	4500
Rich-Burn, All Other Fuels	96	25	250	4500
Lean-Burn, All Fuels	90	65	750	4500

# Low/High Fuel Consumption

- For Spark-Ignited Engines, dividing line is 180 million BTUs/year
  - 50 horsepower engine operating about 300-400 hours per year
  - Based on meeting the cost-effectiveness threshold of \$12 per pound of NO<sub>x</sub> with the installation of NSCR on a 50 horsepower spark-ignited engine

# Expected Controls

## -RACT-

<u>Spark-Ignited Engine Type</u>	<u>Control</u>	<u>NOx Limit</u>
Low Fuel Consumption	Leaning air/fuel ratio	350 ppmv
High Fuel Consumption		
- Rich Burn	Catalyst (NSCR) Prestratified Charge Leaning air/fuel ratio	50 ppmv/90% reduction
- Lean Burn	Leaning air/fuel ratio Clean Burn Controls	125 ppmv/80% reduction

# Expected Controls

## -BARCT-

<u>Spark-Ignited Engine Type</u>	<u>Control</u>	<u>NOx Limit</u>
Low Fuel Consumption	Leaning air/fuel ratio	350 ppmv
High Fuel Consumption, - Rich Burn, Waste Gas	Prestratified Charge	50 ppmv/90% reduction
- Rich Burn, Other Fuels	Catalyst (NSCR)	25 ppmv/96% reduction
- Lean Burn	Clean Burn Controls Catalyst (SCR)	65 ppmv/90% reduction

# Exemptions

- Engines operated during emergencies or disasters
- Engines used in agricultural operations
- Portable Engines
- Nonroad Engines (mobile application)

# Exemptions - Continued

- Engines operated less than 100 hours per year (except engines used for generation of electricity)
- Emergency standby engines: (1) operated less than 100 hours per year for testing and maintenance; (2) operated during unscheduled power outages; and (3) not operated for any other purpose

# Administrative Requirements

- Emission control plan
- Documentation required for exemptions
- Inspection and monitoring plan
- System to continuously monitor NO<sub>x</sub> and O<sub>2</sub> (applies only to engines > 1,000 bhp and permitted to operate > 2,000 hours per year)

# Administrative Requirements - Continued

- Maintain records of inspections and continuous monitoring for two years
- Source test required every two years or 8,760 hours of operation, whichever comes first for all engines
- Maintain operating log, showing hours of operation and fuel consumption for each engine on a monthly basis

# Emissions Test Methods

NO<sub>x</sub>, VOCs, CO, & O<sub>2</sub>:

- ARB Method 100 or Equivalent EPA Method
- Additional Methods Being Researched

# Estimates of Costs and Cost-Effectiveness

<u>Engine Type</u>	<u>HP Range</u>	<u>Control Type</u>	<u>Capital Cost, \$</u>	<u>\$/Ton NO<sub>x</sub> removed (\$/lb.)</u>	
Rich-Burn	501-1,000	Prestratified	36,000	300	(0.15)
Rich-Burn	151-300	NSCR catalyst	16,000	1,100	(0.55)
Lean-Burn	50-150	Clean Burn	14,000	1,100	(0.55)
Lean-Burn	301-500	SCR catalyst	120,000	2,500	(1.25)

# Issues

- Cyclically-Loaded Beam-balanced and Crank-balanced IC engines
- Ag Engines

# **NO<sub>x</sub> Emissions from Engines Used in Agricultural Operations in the San Joaquin Valley**

- Includes both spark-ignited and diesel-fueled engines
- For IC Engines under Permit
  - 20 Tons/day, annual basis
- Estimated for Agricultural Engines
  - 32 Tons/day, average for the year
- 1996 Report by Sonoma Technology

# Summary

- This is a guidance document
- This proposed determination sets emissions limits for RACT and BARCT
- Potentially Significant Emission Reductions
- Control Technologies Cost Effective
- New technologies being developed