California Case Study: Source Categories, Sources, and Control Strategies

WESTAR-WRAP

Regional Haze Webinar Series #5

November 16, 2017

Proposed Guidance Focuses on Large Emitters

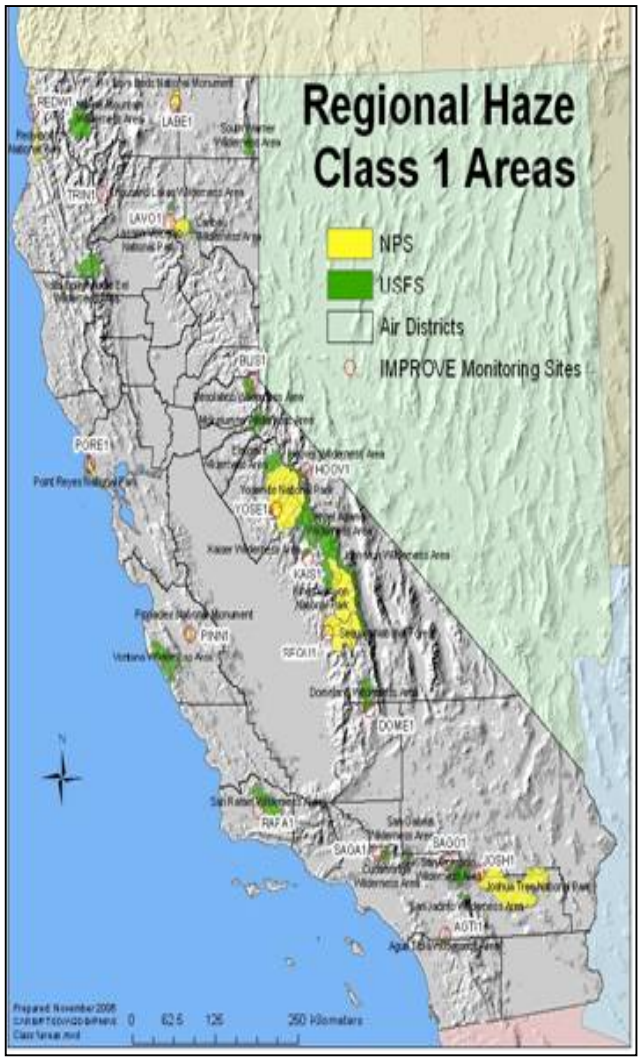
- Rank “Top 80%” of non-Mobile Anthropogenic State Inventory
- List Potential Control Technologies for Sources
- Apply Four-Factor Analyses to top 80%
- Model Scenarios to get RPG
- Explain RPG Relationship to Glide Path

Does this Work in the West for Screening Potential Haze Sources?

Consider Regional Context of Class I Areas

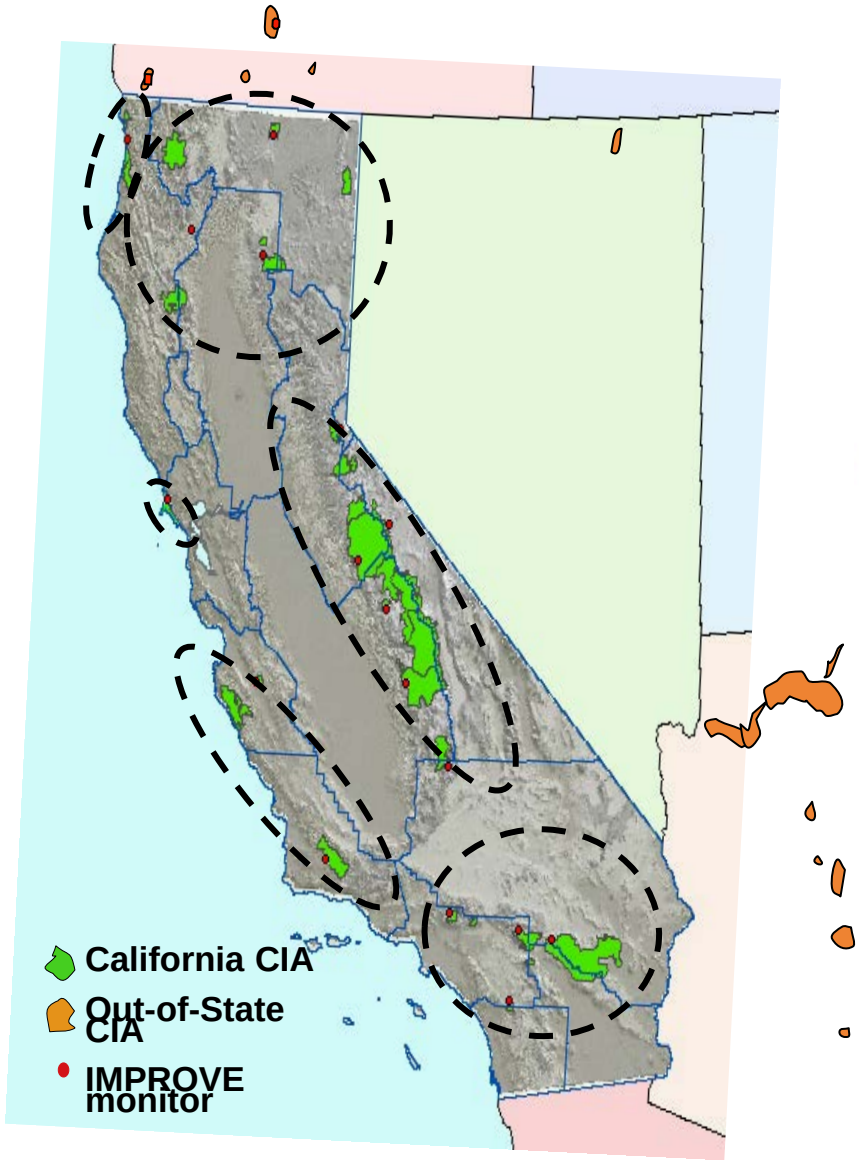
- **What is local Geography and Meteorology?**
  - Unique and Relevant Topography
  - River Valleys and Intermountain Basins
  - Proximity to influence of Out-of-State Sources
  - Shared Geologic Features (desert, mountain pass)
  - Wind patterns (foehns, haboobs, fogs, Santa Anas etc.)

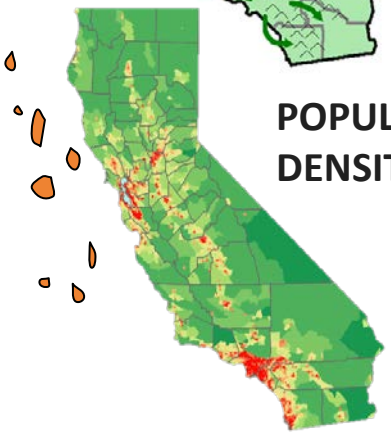
- **Are "Uncontrollable" Sources Significant Contribution?**
  - Mobile Sources (roads, airports, railroads, shipping lanes)
  - Biogenic Emissions
  - Geogenic Emissions
  - Regularly-Occurring Natural Extreme Episodic Events
  - Federal Facilities



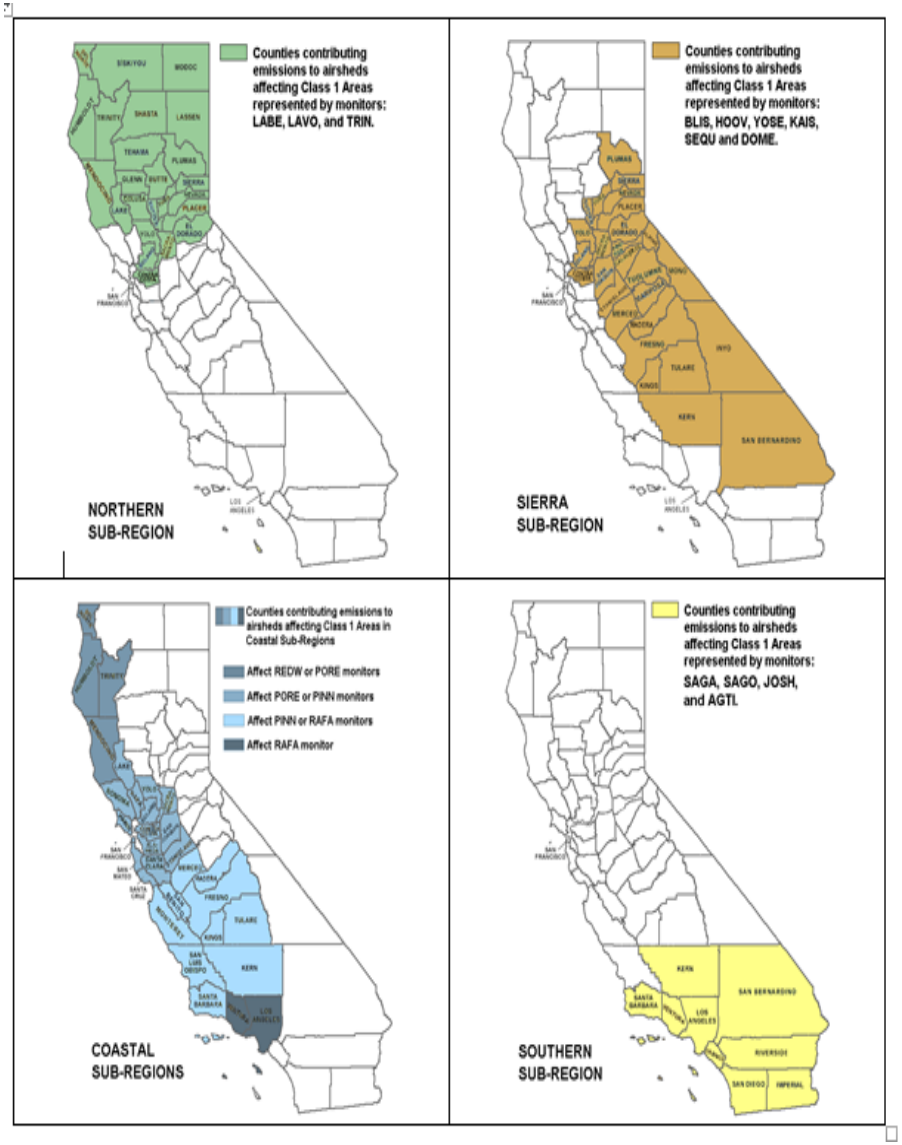
Statewide vs. Regional Inventory

- **Emissions Locations, Seasonality, Meteorology, Air Basin**
  - Are potential impacting sources seasonal?
  - Are some sources too distant or rarely upwind?
  - Are large population centers nearby?
  - What is nearby mobile network?



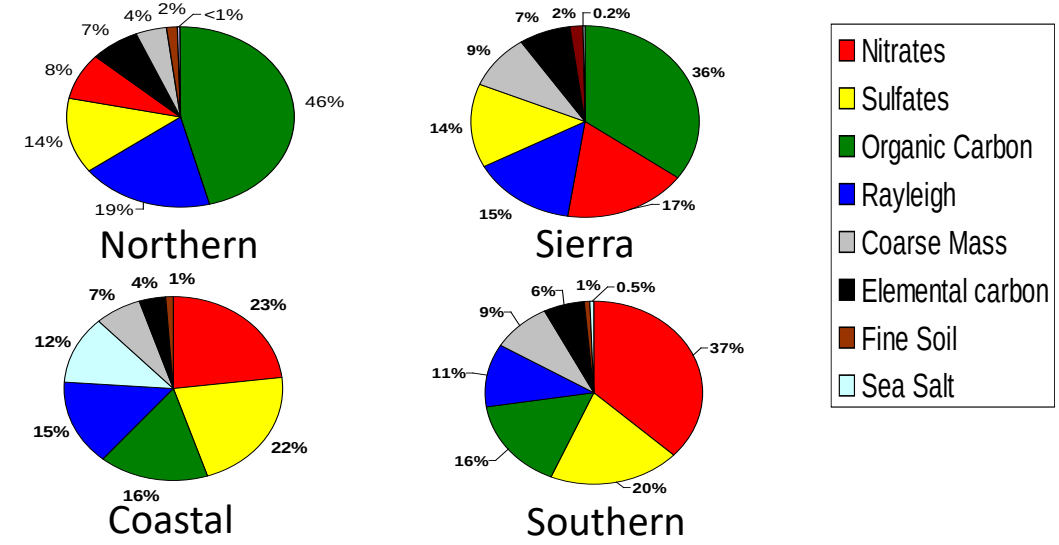


Compare Sub-Regional Inventory with Impairment at Monitors

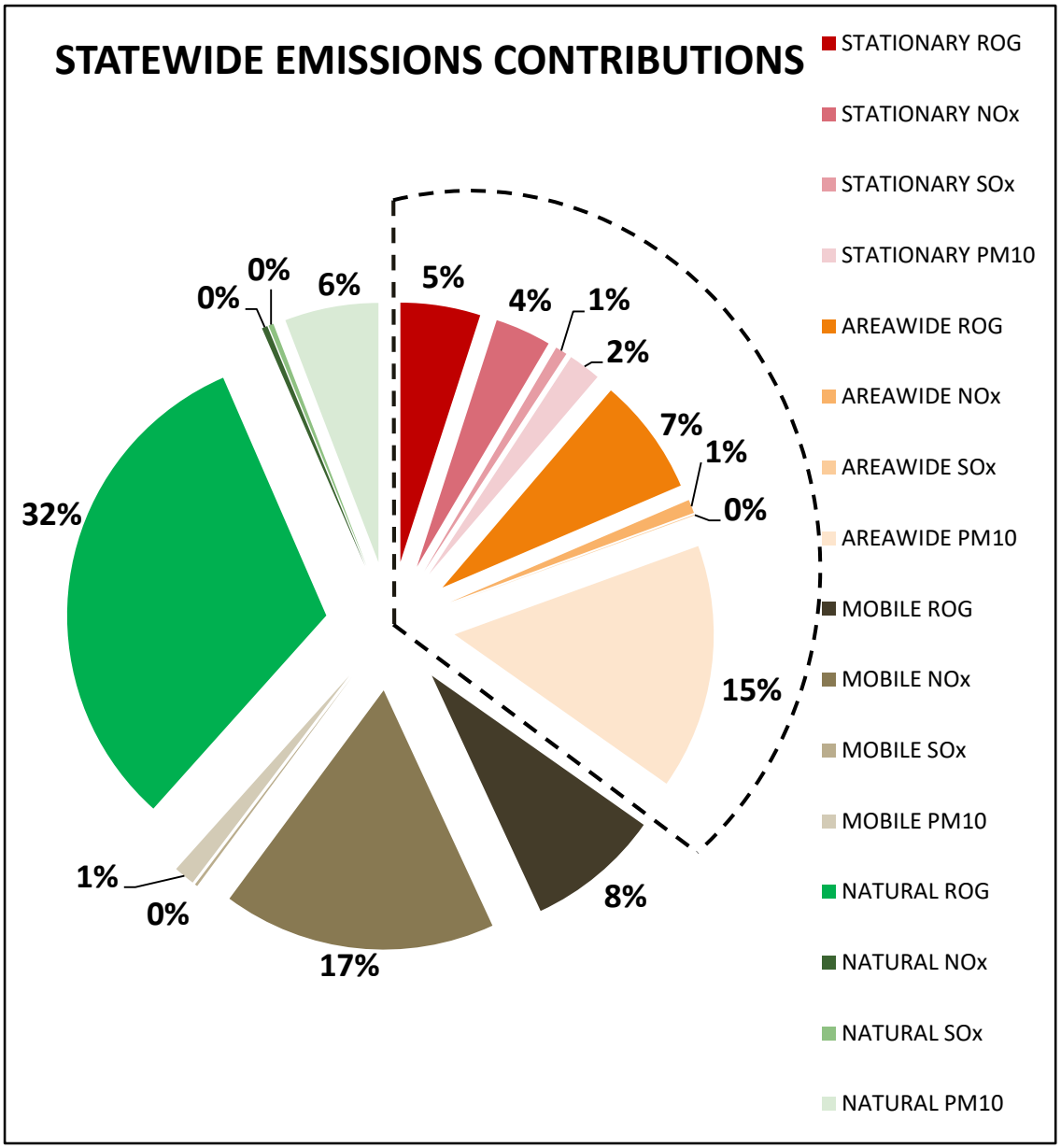


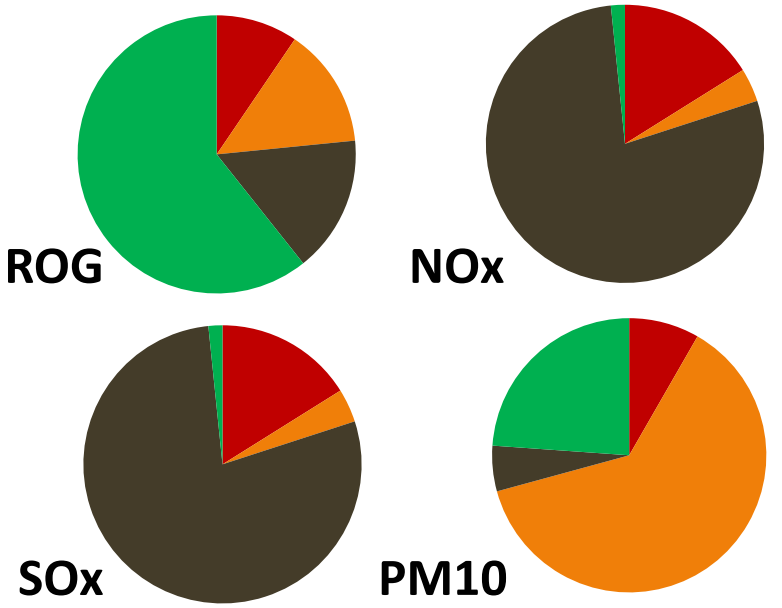
- Target in-state sources of precursors with greatest likelihood of reducing impairment in the region, if the resulting haze species are reduced at the monitor
- Use tracer modeling tools to determine Anthropogenic Contributions by Species “driving” impairment
- Selected NOx reduction strategy for first planning period

Sub-Region Worst Days - Baseline

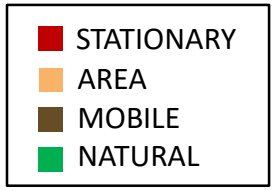


California Statewide Inventory: 2014





- **Key Anthropogenic Precursors (35%)**
  - ROG 12% non-Mobile
  - NOx 5% non-Mobile
  - SOx 1% non-Mobile
  - PM10 17% non-Mobile



- **26% Mobile Anthropogenic**
- **38% Natural**

Ranking 2015 Statewide Non-Mobile Anthropogenic Sources (by Category)

ROG CATEGORY	TOP 81%	TYPE
CONSUMER PRODUCTS	20%	AREA
FARMING OPERATIONS	15%	AREA
PETROLEUM MARKETING	8%	Stationary
ARCHITECTURAL COATINGS AND RELATED PROCESS SOLVENTS	7%	AREA
COATINGS AND RELATED PROCESS SOLVENTS	6%	Stationary
RESIDENTIAL FUEL COMBUSTION	6%	AREA
MANAGED BURNING AND DISPOSAL	4%	AREA
PESTICIDES AND FERTILIZERS	4%	AREA
DEGREASING	4%	Stationary
OIL AND GAS PRODUCTION	3%	Stationary
ASPHALT PAVING AND ROOFING	3%	AREA
ROG SUM	**820**	**Tons Per Day**

NOx CATEGORY	TOP 80%	TYPE
MANUFACTURING AND INDUSTRIAL	18%	Stationary
RESIDENTIAL FUEL COMBUSTION	16%	AREA
MINERAL PROCESSES	16%	Stationary
SERVICE AND COMMERCIAL	13%	Stationary
ELECTRIC UTILITIES	7%	Stationary
PETROLEUM REFINING (COMBUSTION)	5%	Stationary
COGENERATION	5%	Stationary
NOx SUM	**290**	**Tons Per Day**

SOx CATEGORY	TOP 83%	TYPE
MINERAL PROCESSES	22%	Stationary
PETROLEUM REFINING (COMBUSTION)	15%	Stationary
MANUFACTURING AND INDUSTRIAL	14%	Stationary
ELECTRIC UTILITIES	9%	Stationary
PETROLEUM REFINING	8%	Stationary
MANAGED BURNING AND DISPOSAL	6%	AREA
SERVICE AND COMMERCIAL	5%	Stationary
RESIDENTIAL FUEL COMBUSTION	4%	AREA
SOx SUM	**50**	**Tons Per Day**

PM 10 CATEGORY	Top 84%	TYPE
FUGITIVE WINDBLOWN DUST	23%	AREA
UNPAVED ROAD DUST	20%	AREA
CONSTRUCTION AND DEMOLITION	13%	AREA
PAVED ROAD DUST	12%	AREA
FARMING OPERATIONS	11%	AREA
MINERAL PROCESSES	5%	Stationary
PM10 SUM	**1149**	**Tons Per Day**

Source: *https://www.arb.ca.gov/app/emsinv/fcemssumcat/fcemssumcat2016.php*

Somewhat Informative – < 30% of Precursor Inventory – Need Additional Considerations

- Where are sources located?
- Relative impact of organic aerosols, nitrates, sulfates, coarse mass and fine soil?
- Are sources already sufficiently controlled?

Ranking Statewide Anthropogenic Sources (Individual "Facilities")

Top ROG Emitters

- 80% of emissions from about 750 facilities out of ~12, 570 ROG emitters
- Refineries, landfills & waste management, airports, federal defense facilities, wineries & breweries, offshore oil production, chemical manufacturing, cement plants, food production, general manufacturing, farms, hospitals
- Southern, Coastal, Bay Area, and Central Valley locations predominate
- 80% ~ 27,500 Tons Per Year

Top NOx Emitters

- 80% of emissions from about 170 facilities out of ~12,400 NOx emitters
- Airports, refineries, cement plants, utilities (power & waste treatment), glass plants, federal defense facilities, chemical plants, mineral processing, landfills, biomass plants
- Most in Southern California and the San Francisco Bay Area; individual plants in Central Valley, foothills, and near the coast
- 80% ~46,000 Tons Per Year

Top SOx Emitters

- 80% of emissions from about 45 facilities out of ~11,450 SOx emitters
- Refineries, cements, airports, glass plants, chemical plants, wastewater treatment, minerals processing, a power plant, a cogen, a federal defense facility, oil & gas plants, metals manufacturing, waste management, landfill
- Predominately Bay Area, Southern California, the coast, and Central Valley
- 80% ~ 11,400 Tons Per Year

Top PM 10 Emitters

- 80% of emissions from about 200 facilities out of ~ 14,050 PM10 emitters
- Federal defense facilities, cement plants, landfills, mineral processes, refineries, glass plants, asphalt plant, power plants, forest products, food processing, waste management, an airport, marine ship repair
- Southern California, Bay Area, the coast, and Central Valley, few in mountains
- 80% ~31,600 Tons Per Year

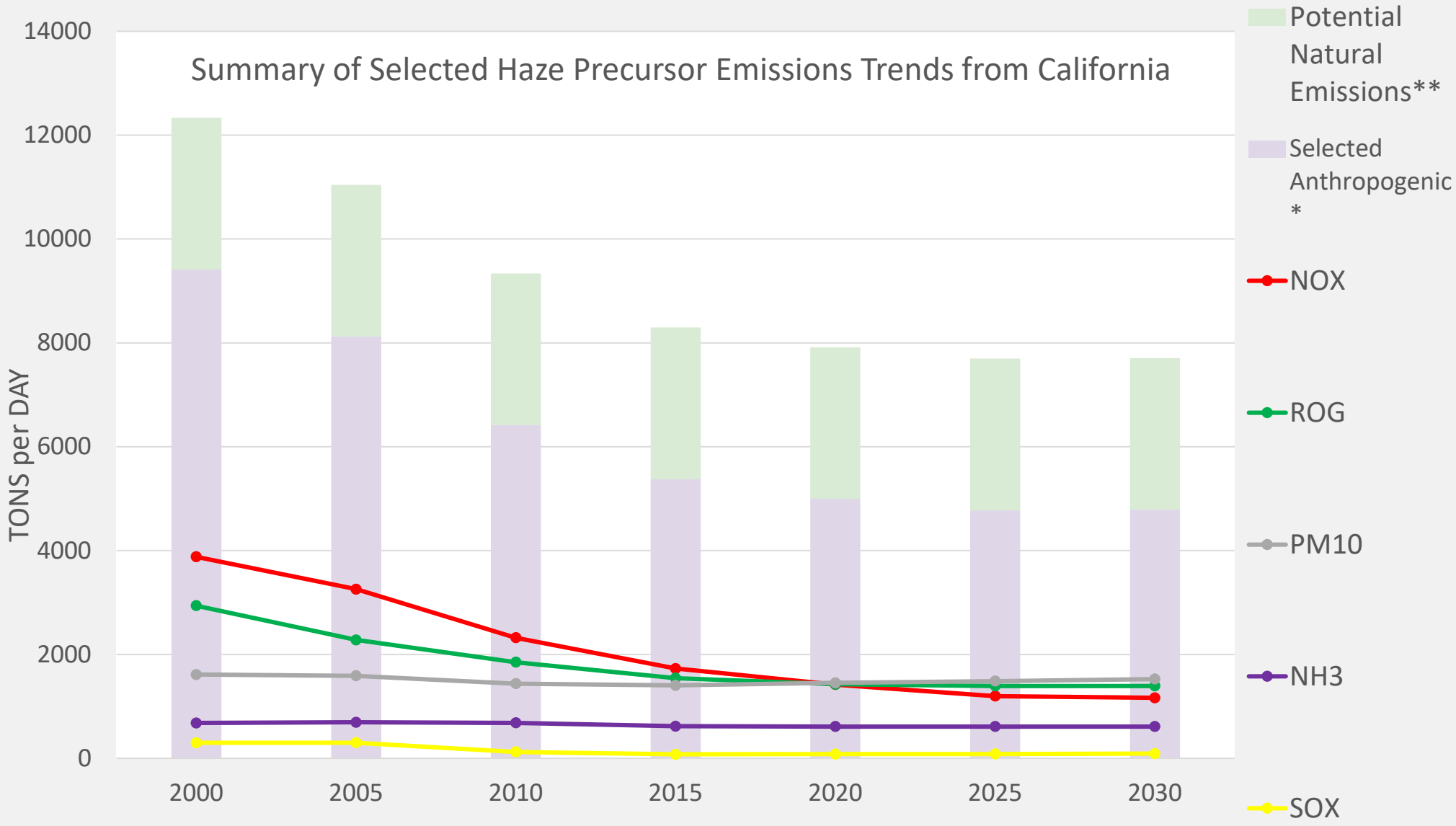
Source: https://www.arb.ca.gov/app/emsinv/facinfo/facinfo.php

CONTROL MEASURES CLEARINGHOUSE

- State & Federal BACT Clearinghouse (CARB & CAPCOA)
- California Senate Bill 656 List of PM Controls Measures
- Federal CTGs for Volatile Organic Emissions
- RACT level controls
- MACT and Toxics Controls
- State Greenhouse Gas Measures
- Incentive Programs
- Voluntary Programs

Cost per Ton will vary with local economy and attainment status.
Expect visibility co-benefit from implementing other required programs.

Inventory Forecast for Rules on the Books



Base Year 2012

* Sum of Selected Anthropogenic Precursor Emissions

Source: https://www.arb.ca.gov/app/emsinv/2017/emssumcat.php

**Potential Based on 2000-2010 Annual Average; Large Variations Each Year