



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

Particulate Matter in the SF Bay Area

March 13, 2013



Outline

- PM basics
- PM health & climate effects
- Progress in reducing PM
- Bay Area PM levels v. PM standards
- Why we need to continue reducing PM





What is PM?

- Diverse assortment of tiny airborne particles
- Particles differ in size, mass, chemistry, toxicity, behavior in air
 - Ultra-fine PM: less than 0.1 microns in diameter
 - PM2.5: fine PM less than 2.5 microns in diameter
 - PM10: particles less than 10 microns in diameter
- We inhale millions of particles we every breath we take
- Smaller particles penetrate deep into lungs, organs, cells





PM Impacts

- Public health
- Climate change
- Visibility / Haze
- Water pollution & ecosystems





PM & Health

PM is the **most harmful air pollutant** to public health in Bay Area

PM has adverse health impacts even at moderate levels

- **Respiratory effects:** asthma, bronchitis, impaired lung development
- **Cardiovascular effects:** arteries, strokes, heart attacks
- **Premature mortality:** PM accounts for ~ 90% of deaths related to air pollution in Bay Area

Other potential PM health effects under current study:

- Cognition
- Diabetes
- Autism





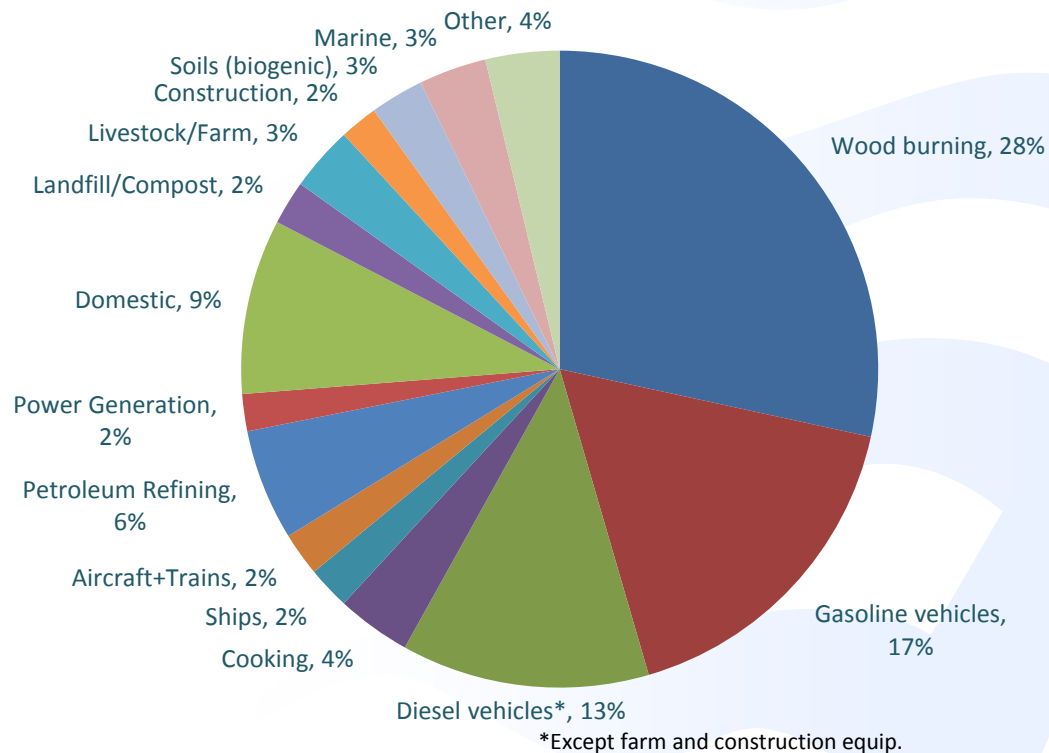
PM & Climate

- Effects of PM on climate are complex
- Different physical processes have both heating & cooling effects:
 - reflect or absorb sunlight
 - increase cloud formation
 - increase reflectivity of clouds
 - accelerate melting of snow & ice
- Overall impact depends on mix of particle types
- Black carbon (soot) is powerful climate heating agent
- Produced from biomass burning & fossil fuel combustion
- Reducing black carbon emissions can slow climate heating



PM Source Contributions

Estimated Source Contributions to Peak PM_{2.5} Concentrations





Progress in Reducing PM

Major progress in reducing Bay Area PM levels in recent years

- ARB regulations to reduce PM from motor vehicles
 - diesel vehicles & equipment
 - light-duty vehicles
- Grant programs to complement ARB regulations
- Winter Spare the Air to reduce residential wood-burning
- Regulations to reduce PM from stationary sources





PM Standards

National & state standards for PM₁₀ & PM_{2.5}

- 24-hour for acute effects (short-term exposure)
- Annual average for chronic effects (long-term exposure)

Currently no standards for ultrafine PM

Bay Area meets current national PM standards & is close to meeting state PM standards



Bay Area PM v. PM Standards

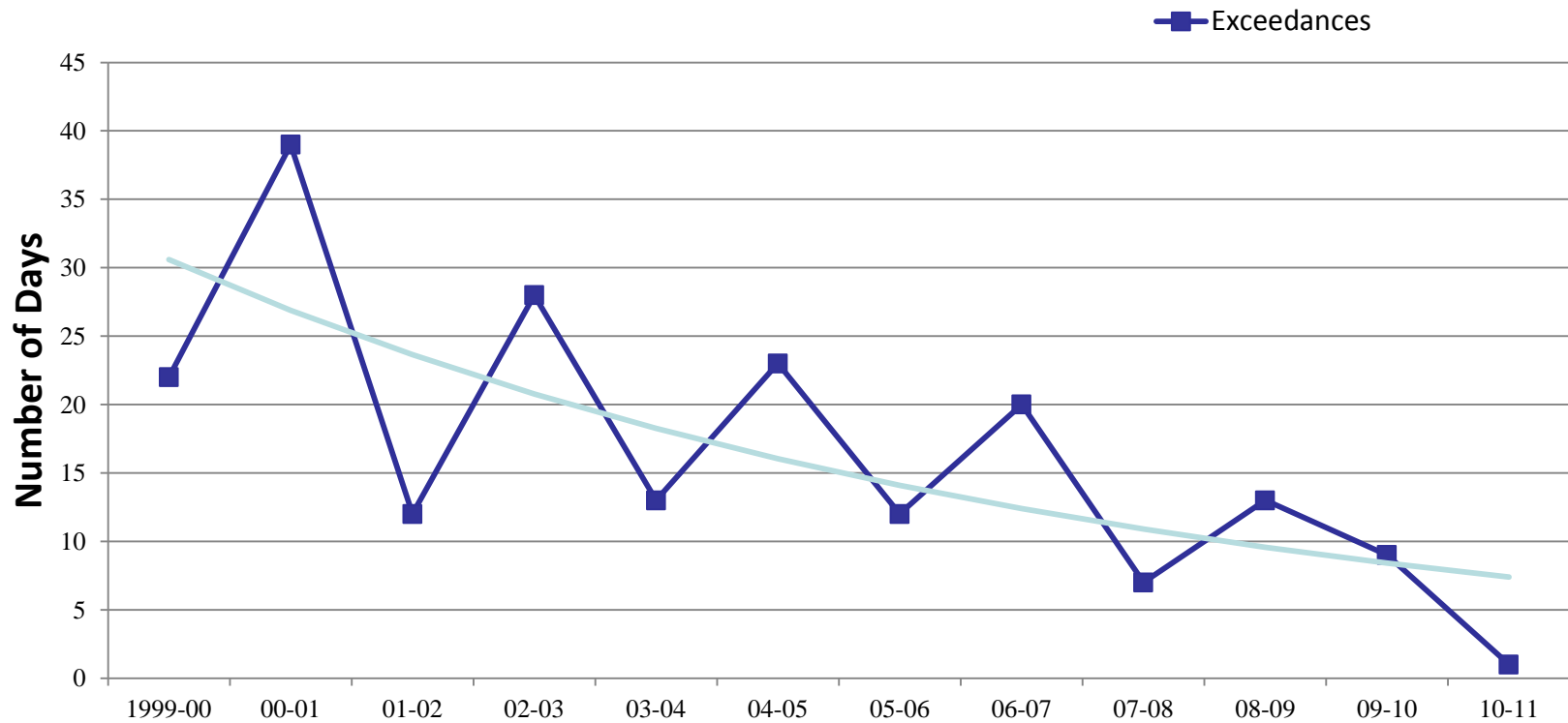
Current Design Values:

Pollutant	Averaging Time	National / California	Standard	Bay Area Design Value *	Bay Area Attainment Status
PM2.5 (2010-2012)	24-hour	National	35 µg/m ³	28 µg/m ³	Non-Attainment
	Annual	National	12 µg/m ³	9.4 µg/m ³	Unclassified
		California	12 µg/m ³	10.5 µg/m ³	Non-Attainment
PM10 (2009-2011)	24-hour	National	150 µg/m ³	70 µg/m ³	Unclassified
		California	50 µg/m ³	73 µg/m ³	Non-Attainment
	Annual	California	20 µg/m ³	20 µg/m ³	Non-Attainment

* Design Value is metric which describes a region's air quality relative to the standard.

Trends in PM2.5 Concentrations

Trend in # 24-hr PM2.5 Exceedances per Winter



Bay Area status: Annual Average PM_{2.5} standard

- In Dec 2012 US EPA reduced annual-avg PM_{2.5} standard from 15 µg/m³ (micrograms per cubic meter) to 12 µg/m³
- Final designations for new standard: Dec 2014
- Based on current monitoring data, Bay Area should be designated as attainment for the new annual standard



Bay Area status: 24-hr PM_{2.5} standard

- In 2006 US EPA reduced 24-hr PM_{2.5} standard from 65 µg/m³ (micrograms per cubic meter) to 35 µg/m³
- Although Bay Area barely exceeded the standard, we were designated **non-attainment** in Dec '09 based on monitoring data for years **2006-2008**
- But monitoring data for **2008-2010** & **2009-2011** shows that Bay Area attained the standard during both periods
- Current Bay Area design value (28-29 µg/m³) is well below the 35 µg/m³ standard





State Implementation Plans

- EPA requires preparation of State Implementation Plans (SIPs) for any area designated as non-attainment for national AQ standards
- Purpose of SIP:
 - Determine emissions reduction needed to attain the standard
 - Lay out a control strategy to attain the standard by target date (December 2014 for 24-hr PM_{2.5} standard)





“Clean Data” Finding

Recent Bay Area PM monitoring data submitted to EPA

EPA took final action to approve “clean data determination” for 24-hr PM_{2.5} standard for Bay Area on 1/9/13:

- Confirms that monitoring data shows Bay Area attains std
- Suspends most SIP planning requirements





SIP Options

EPA guidelines provide two options for regions with clean monitoring data:

1. Submit redesignation request & maintenance plan to show how region will continue to attain standard for 10 years
or
2. Submit an abbreviated “clean data” SIP





Option Chosen

- Premature for Bay Area to submit a redesignation request at this time:
 - PM levels can fluctuate due to year to year variation in (winter) weather patterns
 - Make sure that Bay Area continues to attain standard as economy recovers
- **Therefore, submit “clean data” SIP**





“Clean Data” SIP

EPA requirements for “clean data” SIP:

- Submit PM_{2.5} emissions inventory
- Amend New Source Review (NSR) rule to address PM_{2.5}:
 - NSR applies to new facilities & modified facilities

Air District Board took action to fulfill the SIP requirements in fall 2012.

District staff also prepared a comprehensive report re: PM to guide future efforts to reduce PM:

www.baaqmd.gov/Divisions/Planning-and-Research/Plans/PM-Planning.aspx



Current Status

- Bay Area will continue to be formally designated as **non-attainment** (until a redesignation request & maintenance plan are submitted & approved by EPA)
- The following SIP requirements are **suspended** as long as monitoring data continues to show attainment:
 - Attainment Demonstration / AQ Modeling for PM2.5
 - Reasonably Available Control Measures (RACM) Analysis
 - Reasonable Further Progress (*make steady progress*)
 - Mid-Course Review
 - Contingency Measures



Why We Need To Do More

- PM still damages public health
- Bay Area does not yet attain the more stringent State of California standards for PM_{2.5} & PM₁₀
- Health impacts occur at levels below current standards
- US EPA may tighten PM standards in future
- Some communities are exposed to higher PM levels
- Increasing concern about impacts of ultra-fine PM
- On-going research re: health & climate impacts of PM
- More work needed to understand PM & reduce its impacts





Key Points

Major progress in reducing Bay Area PM levels in recent years

- Attain current national PM standards
- Close to meeting state PM standards

PM reductions provide significant public health benefits

- Increase Bay Area average life expectancy by ~ 6 months over past 20 years

But PM is still most harmful air pollutant to public health in Bay Area

Need to continue reducing PM emissions & exposures

District prepared report to guide efforts to reduce PM:

www.baaqmd.gov/Divisions/Planning-and-Research/Plans/PM-Planning.aspx





Questions ?



PM Basics

Diverse & complex pollutant

Particles vary in size, mass, chemical composition, toxicity

Very dynamic in the atmosphere

Wide range of emissions sources

Primary PM: emitted directly from tailpipe, stack, etc.

Secondary PM: formed by interaction among precursor pollutants: ROG, NO_x, SO₂, NH₃ (ammonia)



PM health effects

- Bay Area 2010 Clean Air Plan analyzed health impacts of ozone, toxics & PM
 - Identified PM as most harmful air pollutant
- Exposure to PM is harmful to Bay Area residents
 - from both short-term & long-term exposure
 - children & elderly are most at risk
 - respiratory problems: asthma, bronchitis
 - cardiovascular problems: heart attacks
- PM accounts for ~ 90% of **premature mortality** related to air pollution in the Bay Area
- \$\$ value of PM health impacts ~ \$10-15 billion/year in Bay Area





New Source Review Rule Amendments

New Source Review rule amendments will address:

- New permit requirements for PM_{2.5} & greenhouse gases
- Obtaining EPA approval of “Prevention of Significant Deterioration” permit regulations
- Revisions to clarify regulatory language
- Proposed NSR amendments to Board of Directors:
October 2012





Beyond Federal Requirements

Air District prepared a document to guide our long-term efforts to reduce PM:

- Non-SIP doc to complement the “clean data” SIP
- Consider all types, sizes & sources of PM
- Synthesize current information re: PM
- Report will not propose a formal control strategy
- Title: *Understanding Particulate Matter: Protecting Public Health in the San Francisco Bay Area*



Purpose of the PM Report

- Summarize latest findings regarding PM health & climate impacts
- Highlight importance of reducing **population exposure & health impacts**
- Long-range program to enhance our technical capabilities:
 - Improvements to PM monitoring, including the consideration of technology to measure PM in real-time response to short-term PM episodes
 - PM emission inventory
 - PM photochemical modeling
 - PM population exposure
- Provide foundation for future technical enhancements and policy actions to reduce
- **PM report is not a SIP document and does not set forth a formal PM control strategy**





Section 2: PM

Technical Information

Basics: What is PM?

- Particles sizes; primary v. secondary; mechanisms
- PM dynamics / Results of PM_{2.5} modeling

Source contributions: speciation & CMB analysis

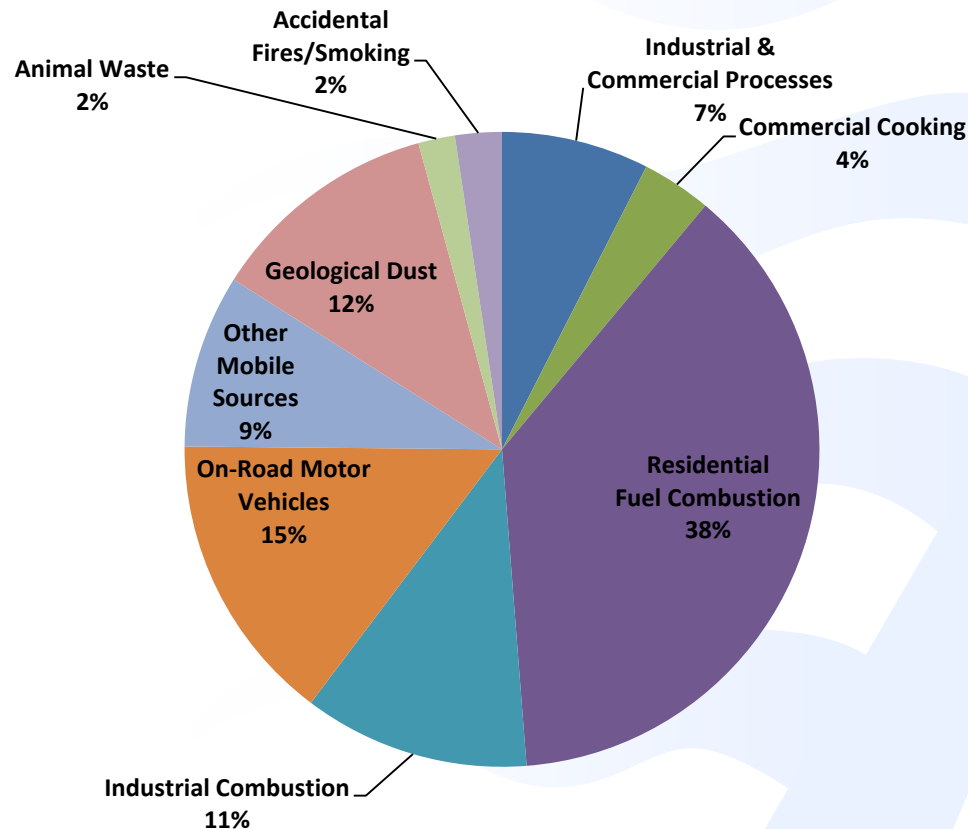
Emissions inventory:

- Primary PM_{2.5} & PM₁₀
- Primary PM_{2.5} Precursors: ROG, NO_x, SO₂, NH₃
- 2010 to 2030



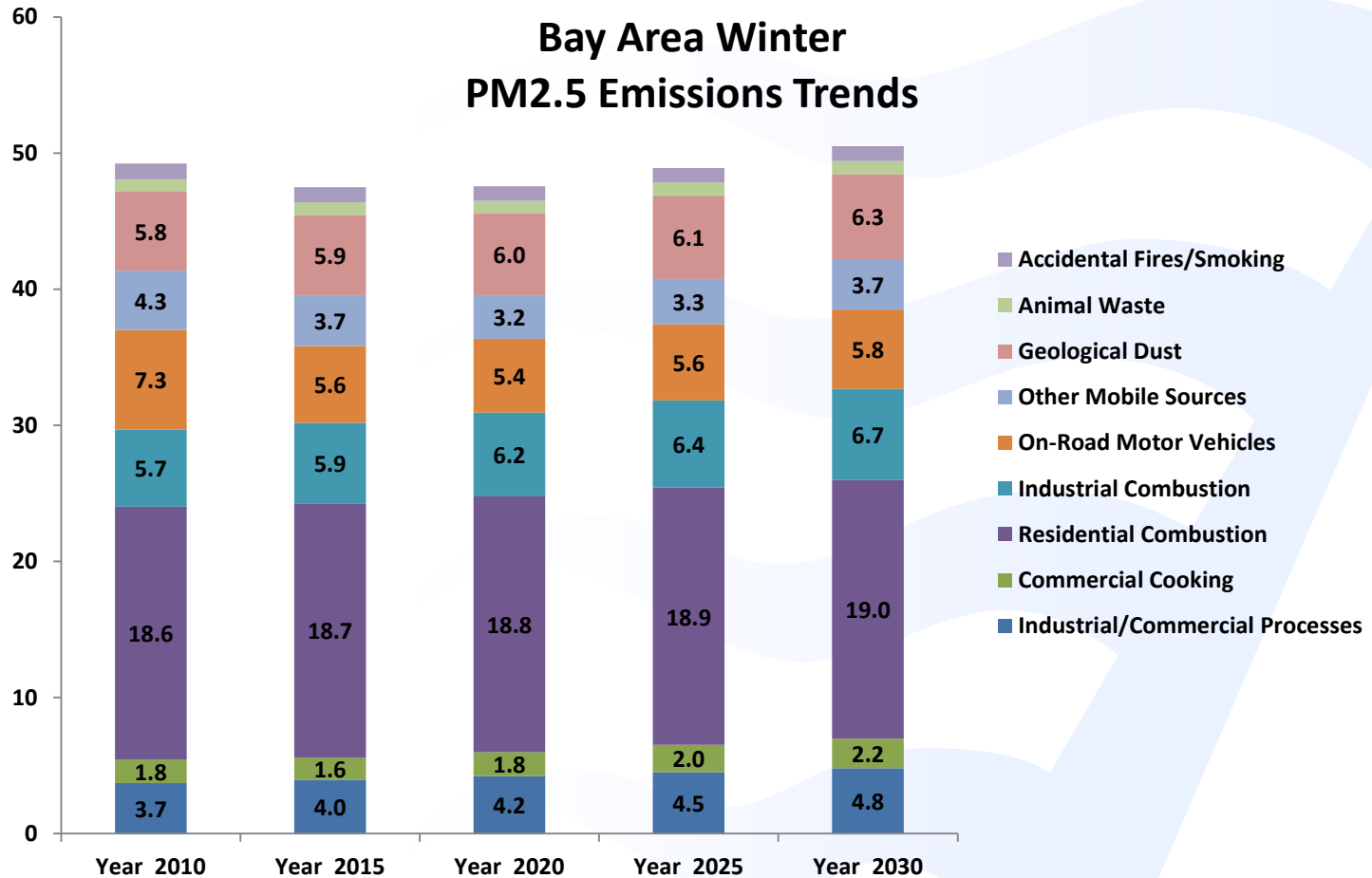
Source Contributions – 2010 Winter Primary Emissions PM2.5

2010 Winter Primary Emissions
Particulate Matter < 2.5 microns
49 tons/day





PM2.5 Projected to 2030





Summary of Progress

In recent years, major progress in reducing PM:

- Relative to both PM10 & PM2.5 State & federal standards
- On both annual average & 24-hr (peak) basis
- Total population exposure to PM
- Health effects due to PM exposure
- Reductions in premature mortality related to PM have contributed to longer life expectancy in Bay Area
- For additional info, see *Trends in Bay Area Ambient Particulates* report (Nov. 2011) on District website

But we still need to further reduce PM





For Additional Information

Reports on PM are available on Air District website re:

- Sources of PM_{2.5}
- Trends in PM concentrations
- PM_{2.5} modeling results
- PM health impact analysis
- Ultra-fine PM study plan
- Effectiveness of wood-burning rule

Visit: www.baaqmd.gov/Divisions/Planning-and-Research/Research-and-Modeling/Publications.aspx

