METROPOLITAN
TRANSPORTATION
COMMISSION

Joseph P. Bort MetroCenter
101 Eighth Street
Oakland, CA 94607-4700
TEL 510.817.5700
TDD/TTY 510.817.5769
FAX 510.817.5848
E-MAIL info@mtc.ca.gov
WEB www.mtc.ca.gov

Memorandum

TO: Air Quality Conformity Task Force DATE: February 9, 2012

FR: Brenda Dix W. I.

RE: Update on Bay Area Air Quality Management District's PM Monitoring

Based on the Bay Area PM2.5 monitoring data for years 2008-2010, on December 8, 2011 the California Air Resources Board (ARB) submitted a "clean data finding" request to US EPA on behalf of the Bay Area. If the clean data finding request is approved, then EPA guidelines provide that the region can fulfill federal PM2.5 SIP requirements either by preparing:

- a redesignation request and a PM2.5 maintenance plan, or
- a "clean data" SIP submittal

Because peak PM2.5 levels can vary from year to year based on natural short-term changes in weather conditions, the Air District believes that it would be premature to submit a redesignation request and PM2.5 maintenance plan at this time. Therefore, the Air District will prepare a "clean data" SIP to address the required elements, including:

- An emission inventory for primary PM2.5, as well as precursors to secondary PM formation; and
- Amendments to the Air District's New Source Review (NSR) regulation to address PM2.5.

The Air District is committed to reducing the impacts of PM on public health and the climate. Therefore, in addition to preparing a "clean data" SIP to fulfill EPA requirements, Air District staff will develop a comprehensive PM research agenda to guide their long-term efforts to reduce this important air pollutant. This (non-SIP) PM research agenda will complement the "clean data" PM2.5 SIP. Air District staff is working to develop both the "clean data" PM2.5 SIP and the companion PM research agenda by summer 2012.

In September 2010, the Air District adopted the Bay Area 2010 Clean Air Plan which defines an integrated, multi-pollutant air quality control strategy. The Air District is working to implement the 55 control measures in the 2010 Plan; many of these measures will reduce will reduce direct emissions of PM, precursors that contribute to formation of ozone and secondary PM, toxic air contaminants, and greenhouse gases.

BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

Public Workshop / Webcast: Reducing Particulate Matter in the SF Bay Area

February 6, 2012

Henry Hilken, Director of Planning & Research

David Vintze, Air Quality Planning Manager

David Burch, Principal Planner

Andrea Gordon, Senior Planner

Jackie Winkel, AQ Planner

To participate on-line

1. Please sign-in by sending email with name & affiliation to: **PMplanning@baaqmd.gov**

2. Send questions via email to:

   PMplanning@baaqmd.gov

Overview of Presentation

Part 1: Background & context

- Particulate Matter (PM) basics
- PM impacts on health & climate

Break for questions & comments on Part 1

Part 2: Current PM control program

Break for questions & comments on Part 2

Overview of Presentation

Part 3: Upcoming PM planning

- Trends in reducing PM2.5 in Bay Area
- PM standards & Bay Area attainment status
- Federal PM planning requirements
- PM research agenda
- Schedule

Questions & comments on Part 3

Acronyms Used

ARB - Air Resources Board

CAP – Bay Area 2010 Clean Air Plan

CARE – Community Air Risk Evaluation program

CEQA – California Environmental Quality Act

EPA - U.S. Environmental Protection Agency

NOx - Oxides of nitrogen (precursor to ozone & PM)

NH3 – Ammonia

PM - Particulate Matter

SIP – State Implementation Plan (Federal air quality plan)

SOx – Sulfur oxides

VOC – Volatile organic compound (precursor to ozone & PM)

PM Planning Tools

Key tools in PM planning include:

- **PM monitoring data:**
  - PM concentrations: PM mass by particle size category
  - Breakdown by chemical species
- **PM emissions inventory:**
  - detailed estimates of emissions by source category
  - for both direct PM emissions & chemical precursors
- **Photochemical modeling** to simulate PM formation & dynamics

Key Concepts

PM Emissions: direct PM & precursors

(*meterorology*)

Ambient Concentrations (AQ standards)

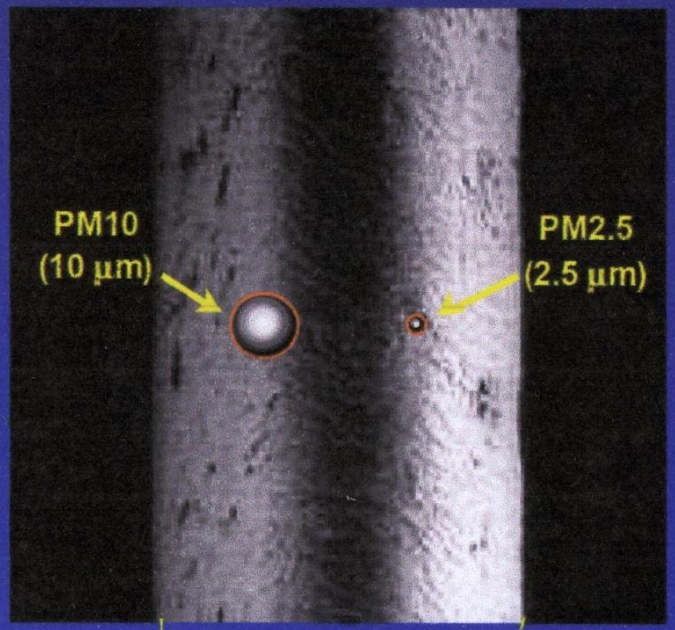
Population Exposure (sensitive populations)

Health effects: respiratory, cardiovascular

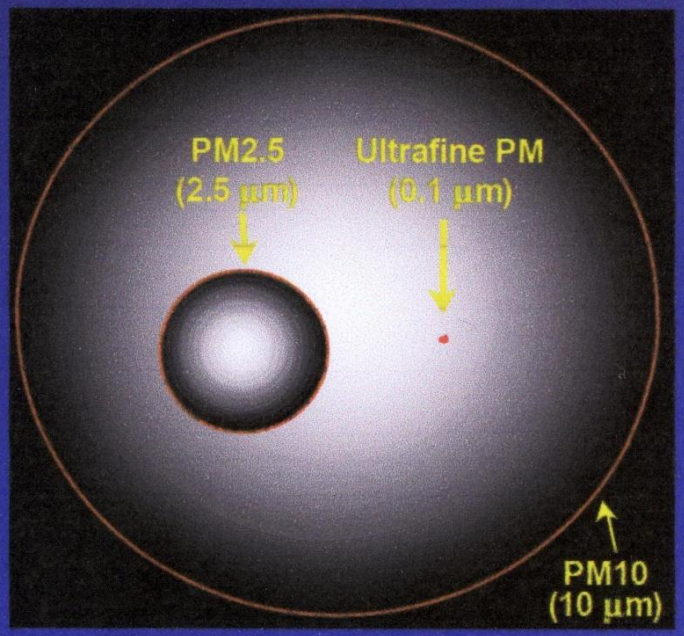
What is PM?

- Diverse assortment of tiny airborne particles
- Particles differ in size, mass, chemical properties, toxicity, and length of time they remain suspended:
  - PM10: particles less than 10 microns in diameter
  - PM2.5: fine PM less than 2.5 microns in diameter
  - Ultra-fine PM: less than 0.1 microns in diameter
- Larger particles dominate in terms of mass (weight)
- Smaller particles dominate in number & surface area
- Smaller particles penetrate deeper into lungs; can enter bloodstream & organs

Comparison of PM10, PM2.5, and Ultrafine PM



Human Hair
(60 µm diameter)



Relative size of particles

PM Formation

- **Primary PM**
  - Emitted directly from a tailpipe, smokestack or factory
- **Secondary PM**

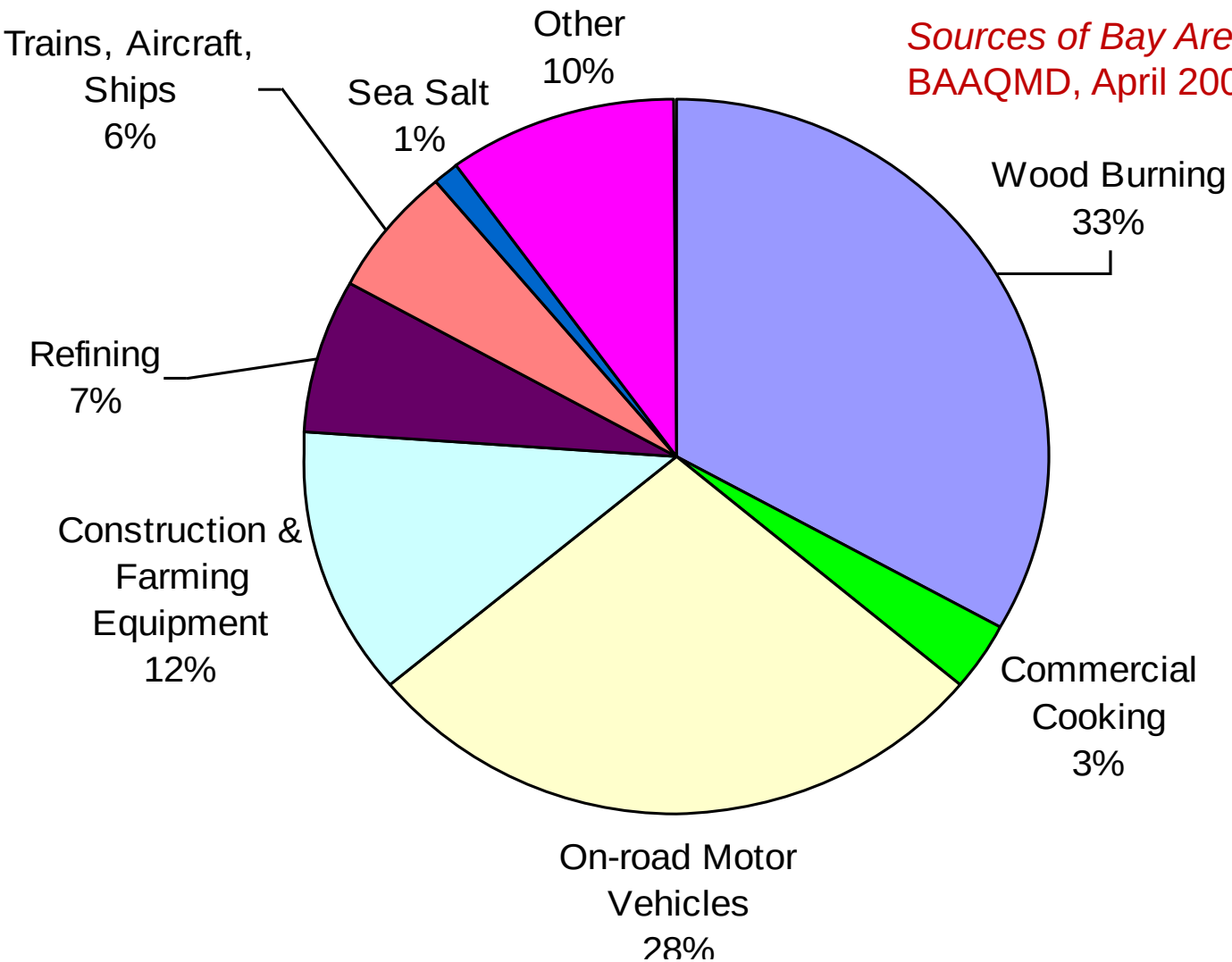
  Formed in atmosphere by reactions among precursors:
  - NOx, SOx, VOC, NH3 (ammonia)
  - NOx + NH3 = ammonium nitrate
  - SOx + NH3 = ammonium sulfate
- Highest PM levels in Bay Area during winter months

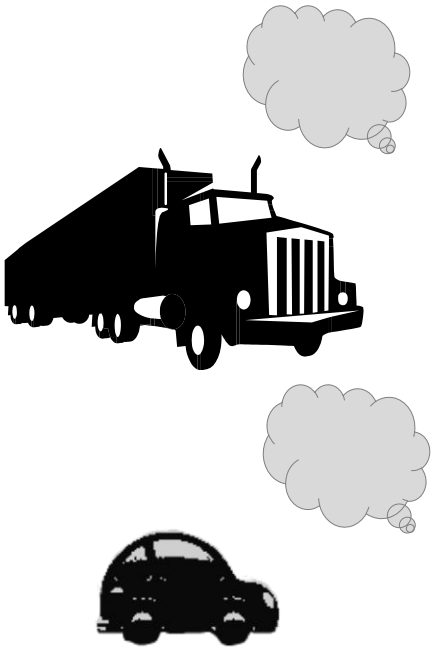
PM Sources

- Both natural & man-made sources of PM
- Natural PM: primarily geologic dust & sea salt
- Man-made PM emitted by stationary & mobile sources:
  - Fossil fuel combustion: gasoline, diesel, coal, natural gas
  - Wood burning
  - Industrial processes
- Both outdoor sources & indoor sources:
  - Indoor sources include cooking, fireplaces, printers, cigarettes

Bay Area PM2.5 Sources: Peak (Winter) Season

Sources of Bay Area Fine Particles, BAAQMD, April 2008





PM from Motor Vehicles

- Direct PM from tailpipe:
  - mostly ultra-fine & fine PM
  - diesel PM classified as air toxic
- Particles from brake & tire wear:
  - both fine & coarse, toxic metals
- NOx emissions from tailpipe:
  - secondary PM (ammonium nitrate)
- Re-entrained road dust:
  - primarily coarse PM

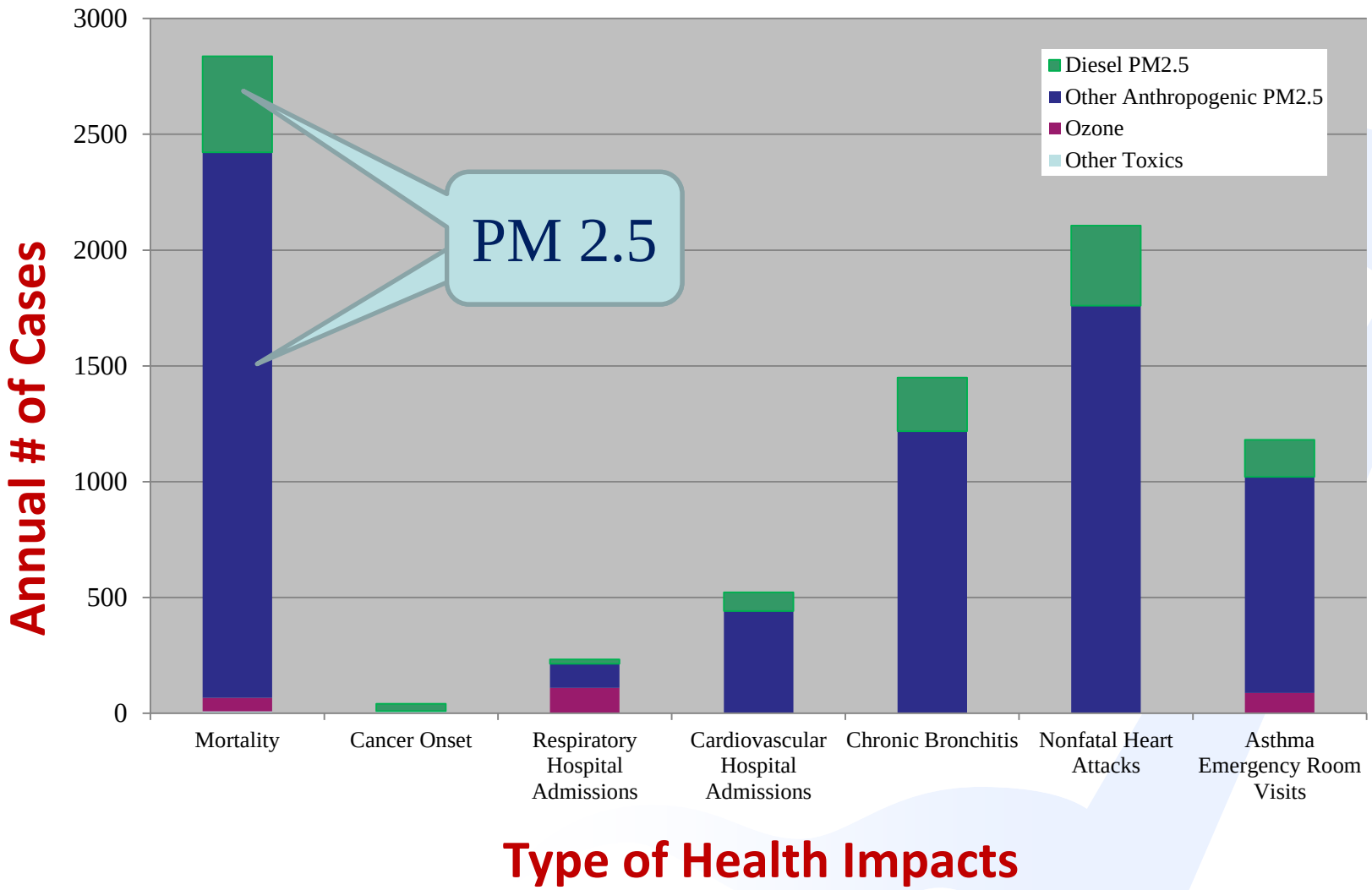
PM Impacts

- **Public health**: Huge body of evidence shows causal effects of PM on public health
- **Climate change**: Particle types have different impacts
  - Aerosols generally scatter light, reduce heat
  - But black carbon (soot) is an important warming agent
  - Overall PM impact on climate is difficult to assess
- **Visibility / haze**: PM is major cause of regional haze
- **Soil & water**: Deposition of PM can have negative effects on terrestrial & aquatic ecosystems

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

Estimated PM Health Impacts in Bay Area (2008)



Source: Health Burden Analysis, Bay Area 2010 Clean Air Plan, Appendix A

Questions & Comments on Part 1

Send questions & comments via email to:

PMplanning@baaqmd.gov

Part 2: PM Control Program

- Air Resources Board program
- BAAQMD program

Questions & Comments on Part 2

ARB PM Control Program

- ARB identified diesel PM as toxic air contaminant in 1998
- ARB Diesel Risk Reduction Program includes:

Cleaner fuels:

– Ultra-low sulfur diesel / cleaner fuel for ships

Regulations to reduce PM from heavy-duty diesel engines:

– Transit buses
– On-road trucks
– Cargo-handling equipment & drayage trucks at ports
– Construction equipment
– Locomotives & rail yards

ARB PM Control Program (con't)

Restrictions on Use:

- Idling restrictions on buses & trucks near schools
- Shore-power for ships in port

Grant & Incentives Programs:

- Carl Moyer Program: to accelerate compliance with ARB regulations
- Low Emission School Bus Program
- Programs are administered by BAAQMD in Bay Area

Existing BAAQMD PM Control Program

- **Grant & Incentives Programs:**
  - Carl Moyer Program & Low Emissions School bus Program
  - Transportation Fund for Clean Air (TFCA)
- **Regulations on stationary sources:**
  - Open-burning (Regulation 5; 1st adopted late 1950's)
  - General PM limitation (Regulation 6-1; 1st adopted 1960)
  - Charbroiling rule (Regulation 6-2; December '07)
  - Wood smoke rule (Regulation 6-3; July '08)
- **Permitting for stationary sources (focus on PM10)**
- **Public education: Winter Spare the Air program**

Existing BAAQMD PM Control Program

Reducing population exposure to PM:

- PM risk & hazard CEQA threshold
- CARE program: identify communities impacted by PM & toxics and implement strategies to reduce exposure
- Community Risk Reductions Plans to reduce PM & toxics in impacted communities: pilot efforts underway in San Francisco & San Jose
- Mobile Source Compliance Plan: BAAQMD enforcement staff working to enforce ARB diesel regulations

Bay Area 2010 Clean Air Plan

- First-ever Bay Area **multi-pollutant control strategy** to reduce ozone, PM, air toxics, and greenhouse gases
- Emphasized PM reductions in developing the control strategy in the 2010 Clean Air Plan
- Prioritized stationary source control measures that reduce PM for early action in rule development schedule

New PM Control Measures in 2010 CAP

Stationary Source Measures (SSM) under development:

- SSM 1: **Metal-Melting Facilities**: New draft Regulation 12-13 to reduce PM & other emissions from foundries
- SSM 6: **General PM**: Amend Regulation 6-1 to reduce allowable PM emissions rate from all sources
- SSM 7: **Open Burning**: Amend Regulation 5 to limit amount that can be burned on permitted burn days
- SSM 9: **Cement Kilns**: Reduce NOx & SOx
- SSM 16: **New Source Review** amendments for PM2.5
- SSMs 10, 11, 12, 13, 14 will reduce NOx; SSM 8 targets SOx

PM Control Measures in 2010 CAP

Also reductions in direct PM & PM precursors from:

- **Mobile Sources Measures**: 10 measures to reduce emissions by promoting clean fuels & technologies
- **Transportation Control Measures**: 17 measures to reduce motor vehicle emissions by promoting transit, biking, walking, ridesharing, etc.
- **Land Use & Local Impacts Measures**: 6 measures to protect communities most impacted by air pollution

Questions & Comments on Part 2

Send questions & comments via email to:

PMplanning@baaqmd.gov

Part 3: Upcoming PM Planning

- Trends in reducing PM2.5 in Bay Area
- PM standards & Bay Area attainment status
- Federal PM2.5 planning requirements
- PM research agenda to guide future efforts
- Process & Schedule

Questions & Comments on Part 3

PM Control Program is working

- PM emissions & ambient concentrations have declined significantly in response to existing ARB & Air District control programs
- PM emissions will continue to decrease in future as:
  - ARB diesel PM regulations are fully implemented
  - Air District control measures in 2010 Clean Air Plan are implemented
  - Turnover in motor vehicle fleet reduces emissions

Progress in Reducing PM2.5

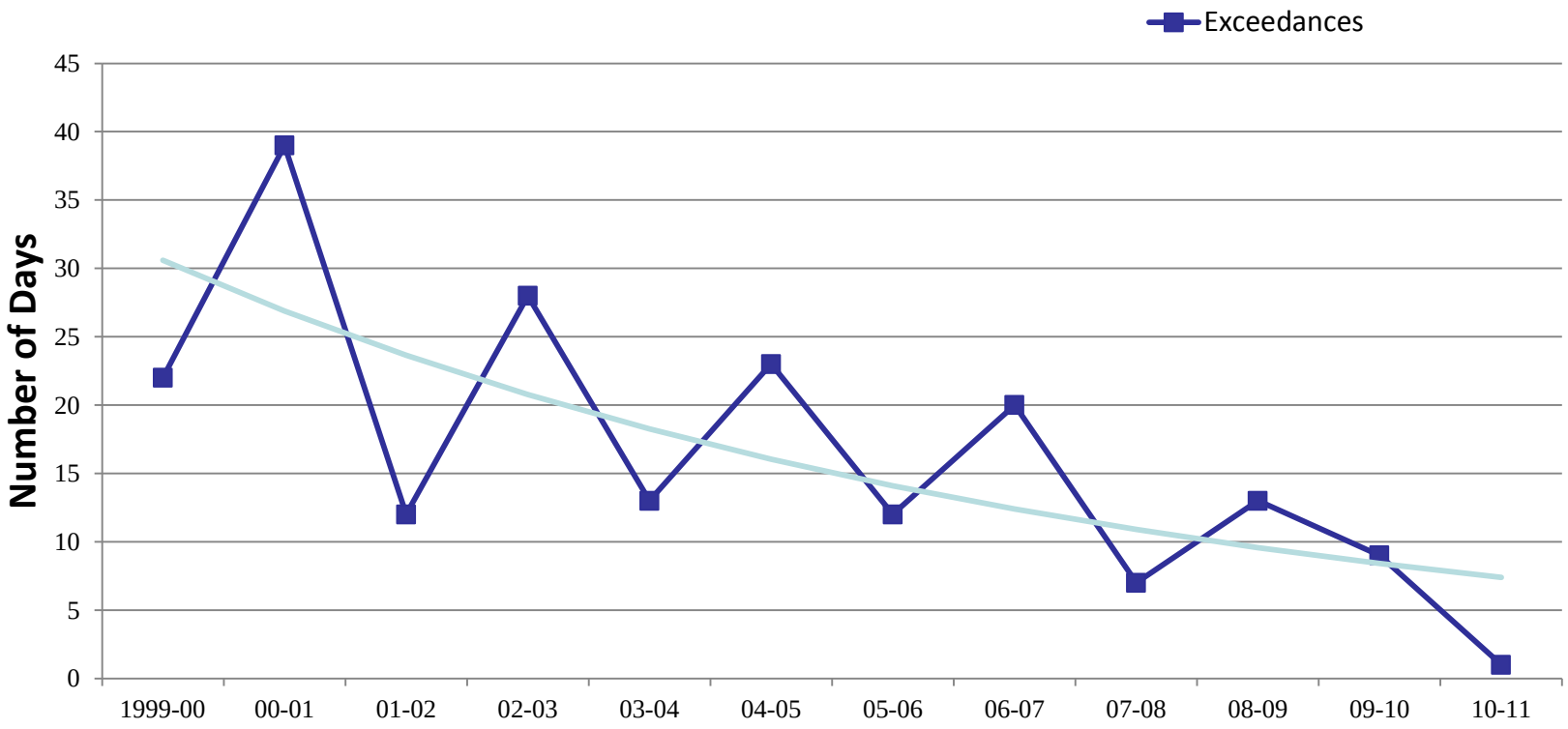
PM2.5 levels measured at monitoring sites have been decreasing throughout the Bay Area

Type of Standard	Design Value 1999-2001*	Design Value 2008-2010*	% Reduced	Standard
National Annual Average PM2.5	14.2 $\mu g/m^3$	10.2 $\mu g/m^3$	28%	15 $\mu g/m^3$
National 24-hour PM2.5	57 $\mu g/m^3$	31 $\mu g/m^3$	45%	35 $\mu g/m^3$

* *Design Value is metric which describes a region's air quality relative to the standard. Design Value is based on the "form of the standard" – in this case, the 98th percentile reading at monitoring station with highest PM levels, calculated for 3-year average.*

Progress in Reducing PM2.5

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



Bay Area status: 24-hr PM2.5 standard

- In 2006 US EPA reduced 24-hr PM2.5 standard from 65 $\mu g/m^3$ (micrograms per cubic meter) to 35 $\mu g/m^3$
- 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 shows that Bay Area attained the standard during this period
- Design value for 2008-2010 was 31 $\mu g/m^3$, below the 35 $\mu g/m^3$ standard

Summary of Progress

In recent years, major progress in reducing PM:

- Relative to both PM10 & PM2.5 State & nat'l 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 add'l info, see *Trends in Bay Area Ambient Particulates* report (Nov. 2011) on District website

But we still need to further reduce PM

Federal Planning Requirements

- US EPA requires preparation of State Implementation Plans (SIPs) for any area designated as non-attainment for national air quality 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 PM2.5 standard)

“Clean Data” SIP Options

- But some regions, including Bay Area, have attained 24-hr PM2.5 standard since 2009
- EPA guidelines provide two options:
  1. Submit redesignation request & maintenance plan to show how region will continue to attain standard for 10 years

     or
  2. Submit “clean data finding” based on quality-assured monitoring data showing attainment for the most recent 3-year period

Proposed Course of Action

- 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, pursue "clean data finding"**
  - ARB submitted request to EPA Region 9 on behalf of Bay Area in December 2011
  - EPA plans to issue "clean data determination" by mid-2012

What This Means

If EPA approves "clean data finding":

- Bay Area would continue to be designated as **non-attainment** (until a redesignation request & maintenance plan are submitted & approved by EPA)
- The following SIP requirements would be **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

Remaining Federal Requirements

Federal PM2.5 requirements that still apply if "clean data finding" is approved:

- Submit emissions inventory for direct PM2.5 & PM2.5 precursors using ARB's new EMFAC 2011 emission factors
- Amend New Source Review (NSR) rule to address PM2.5:
  - NSR applies to new facilities & modified facilities

New Source Review Rule Amendments

New Source Review rule amendments will address:

- New permit requirements for PM2.5 & greenhouse gases
- Obtaining EPA approval of "Prevention of Significant Deterioration" permit regulations
- Revisions to clarify regulatory language
- Upcoming workshop on draft NSR rule amendments:

  February 22: 9:30 to Noon
  BAAQMD Board Room (also webcast)
  www.baaqmd.gov/pln/ruledev/workshops.htm

- Proposed NSR amendments to Board of Directors: June

Why We Need To Do More

Despite major progress in reducing PM levels:

- PM still damages public health
- Bay Area does not yet attain the more stringent State of California standards for PM2.5 & 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

Beyond Federal Requirements

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

- Working title: ***PM Research Agenda***
- Non-SIP document designed to complement the "clean data" SIP
- Consider all types, sizes & sources of PM

Purpose of PM Research Agenda

- Emphasize importance of reducing PM
- Summarize latest findings re: PM health & climate impacts
- Focus on reducing population exposure & health impacts
- Long-range program to enhance our technical capabilities:
  - PM monitoring
  - PM emission inventory
  - PM photochemical modeling
  - PM population exposure
- Describe progress on PM measures in 2010 Clean Air Plan
- Analyze Further Study Measures in 2010 Clean Air Plan
- Inform development of future PM control measures

Draft Schedule

Initial public workshop / webinar	February 6
Issue draft PM2.5 SIP & PM research agenda	April
Workshops on draft PM SIP & research agenda	May
Informational presentations to MTC & Joint Policy Committee	June
Bring to Air District Board for public hearing	July
Submit “clean data” PM2.5 SIP to Air Resources Board	September
ARB submits SIP to US EPA	by Dec 2012

Recap of key points

- PM is a complex pollutant
- Exposure to PM can cause serious health effects
- Add'l research needed to better understand PM
- Major progress in reducing PM levels in Bay Area
- We are committed to further reducing PM levels & health impacts
- Air District will prepare two complementary documents:
  - "Clean data" SIP to fulfill federal PM2.5 SIP requirements
  - PM research agenda to guide long-term effort to further reduce PM

For Additional Information

Reports on PM are available on Air District website re:

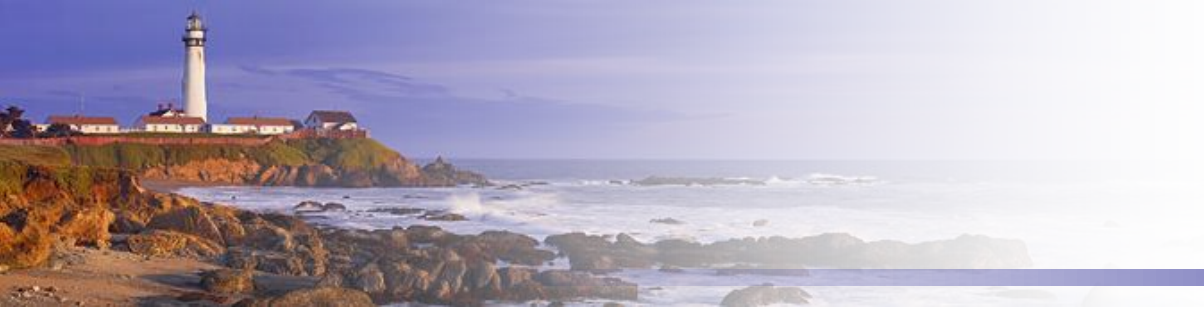
- Sources of PM2.5
- Trends in PM concentrations
- PM2.5 modeling results
- PM health impact analysis
- Ultra-fine PM study plan
- Effectiveness of wood-burning rule

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

Providing Your Input

- We welcome your input & suggestions
- Please complete survey on today's workshop / webcast on PM Planning webpage: www.baaqmd.gov/Divisions/Planning-and-Research/Plans/PM-Planning.aspx
- Staff will post summary of comments received on PM Planning webpage: www.baaqmd.gov/Divisions/Planning-and-Research/Plans/PM-Planning.aspx
- Please submit written comments by **February 27** to:

  PMplanning@baaqmd.gov



End of presentation

Questions & Comments on Part 3

Send questions & comments via email to:

PMplanning@baaqmd.gov

Bay Area PM Monitoring Network

- Air District operates network of 10 PM2.5 monitoring sites
- PM2.5 monitoring network complies with & exceeds State & Federal requirements
- District also operates four separate PM2.5 monitors used to analyze the chemical make-up of PM2.5

PM standards

- PM standards are based on mass:
  - expressed as micro-grams per cubic meter (µg/m^3)

	24-hour	National	Bay Area Status	State	Bay Area Status
PM10	24-hour	150 µg/m^3	Attainment	50 µg/m^3	Non-attainment
	Annual avg	No std		20 µg/m^3	Non-attainment
PM2.5	24-hour	35 µg/m^3	Non-attainment	No std	
	Annual avg	15 µg/m^3	Attainment	12 µg/m^3	Non-attainment

- No standards for ultra-fine PM as yet