

Update on the Review of the CA Ambient Air Quality Standards for Particulate Matter

June 28, 2001

California Environmental Protection Agency



Air Resources Board

WHY ARE WE CONCERNED ABOUT PARTICLES?

- ◆ Health effects are significant
- ◆ Body of evidence is substantial
- ◆ Premature death, cancer, and cardiorespiratory disease
- ◆ Reduced visibility

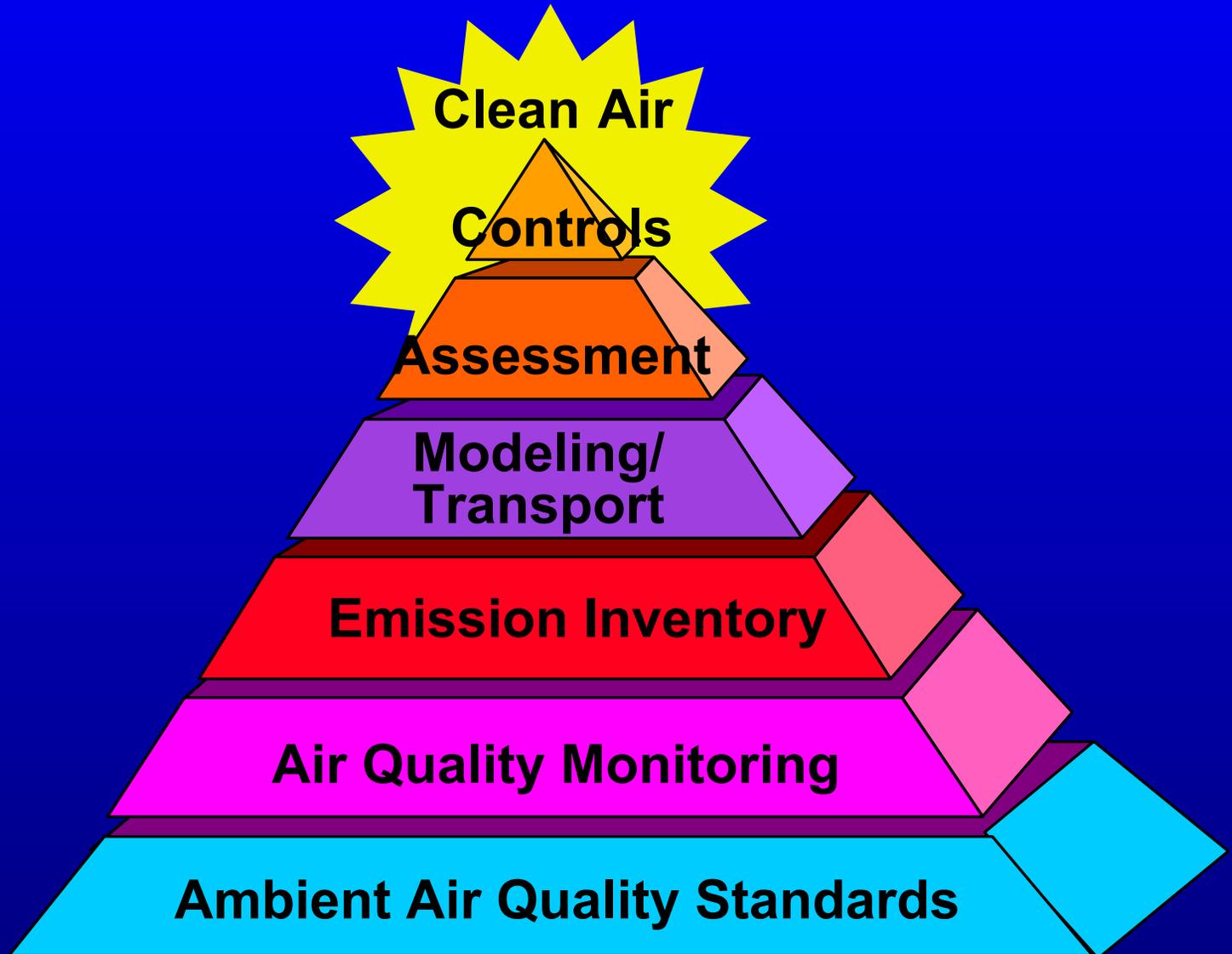
OVERVIEW

- ◆ **The standards setting process**
- ◆ **Properties of particulate matter**
- ◆ **Exposure to particulate matter**
- ◆ **Health effects of particulate matter**
- ◆ **Research on particulate matter**

WHAT IS AN AMBIENT AIR QUALITY STANDARD?

- ◆ Legal definition of clean air
- ◆ Health and welfare based
- ◆ Costs and feasibility are not factors

THE PATH TO CLEAN AIR



AUTHORITY AND HISTORY

- ◆ **Authority to set standards**
- ◆ **PM10 standard: 1982**
- ◆ **Sulfates standard: 1977**

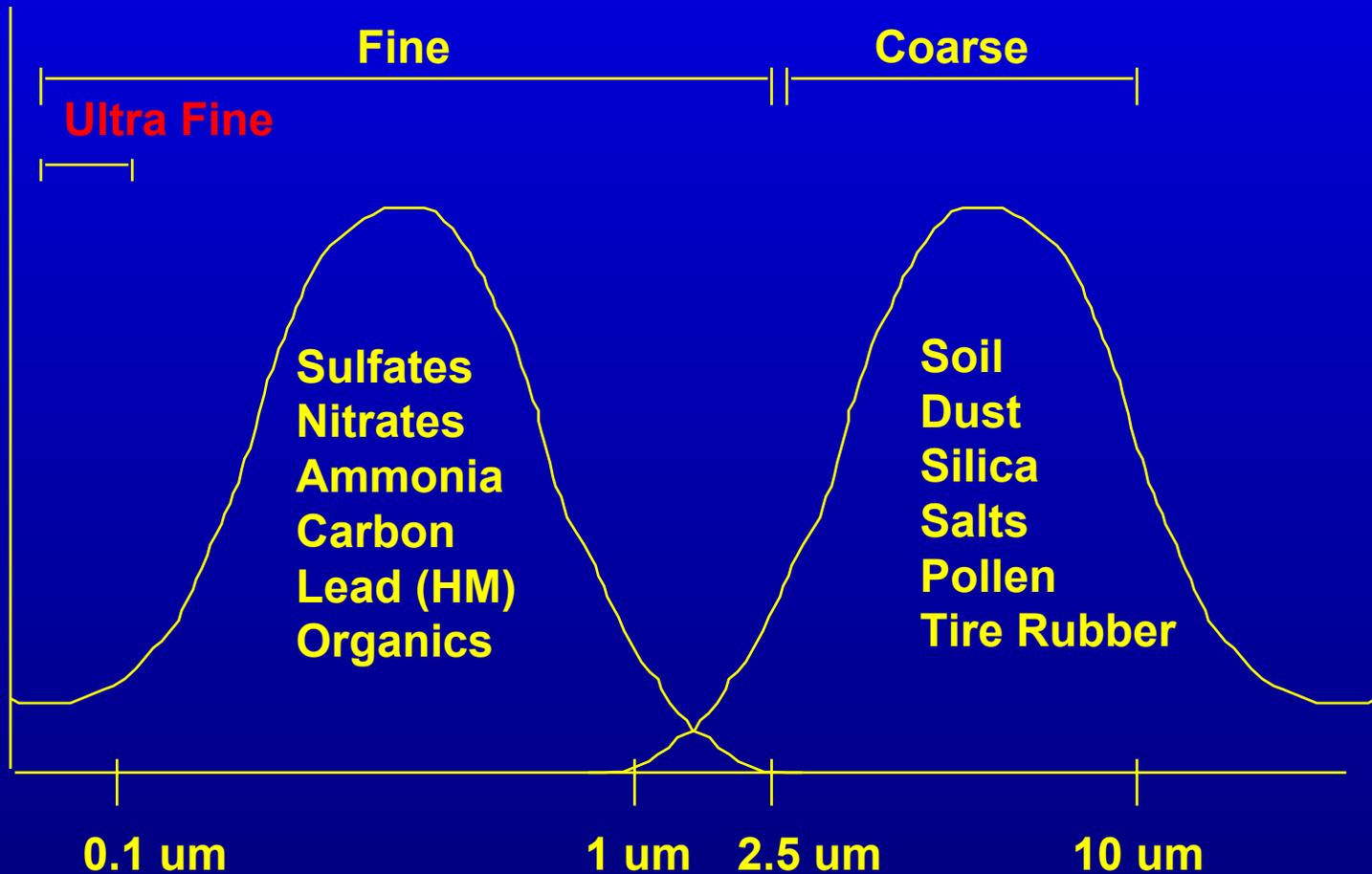
ELEMENTS OF AN AMBIENT AIR QUALITY STANDARD

- ◆ **Definition of the pollutant**
- ◆ **Averaging time**
- ◆ **Concentration**
- ◆ **Monitoring method**

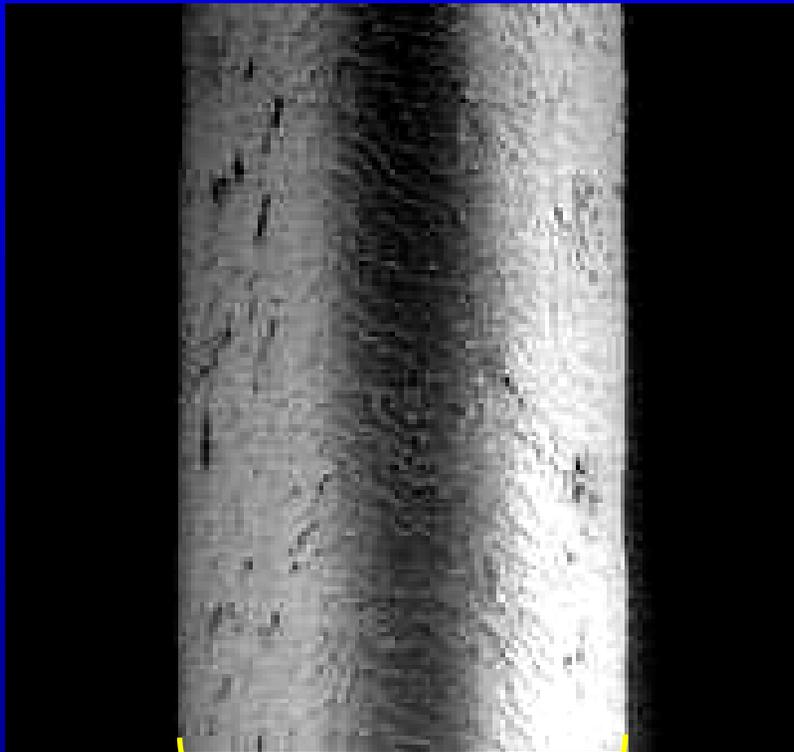
PROPERTIES OF PARTICULATE MATTER

- ◆ What is particulate matter?
- ◆ How small is particulate matter?
- ◆ Where does particulate matter come from?

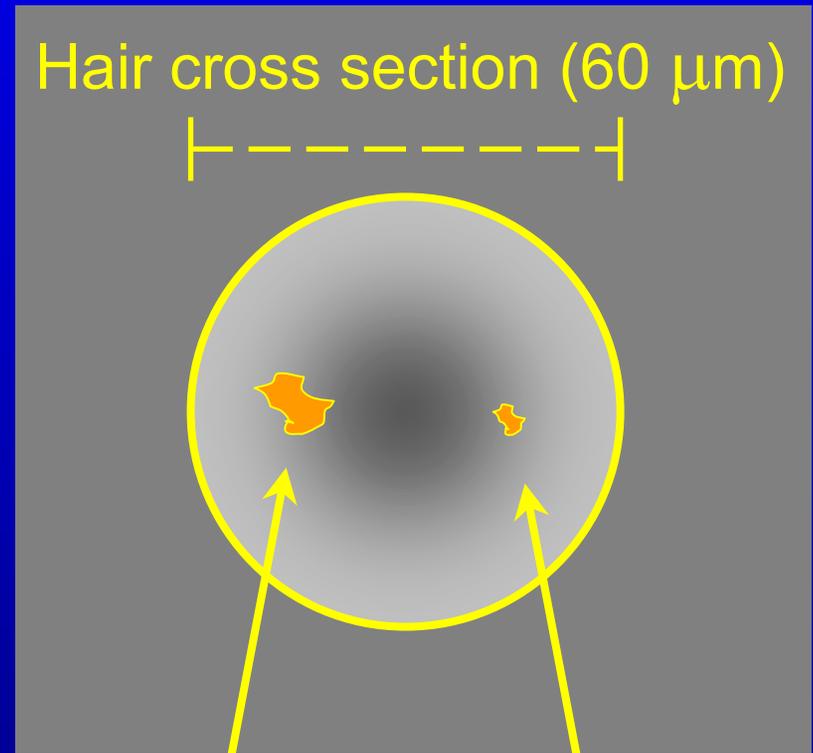
PM10 AIR POLLUTION SIZE AND COMPOSITION



HOW SMALL IS PM10?



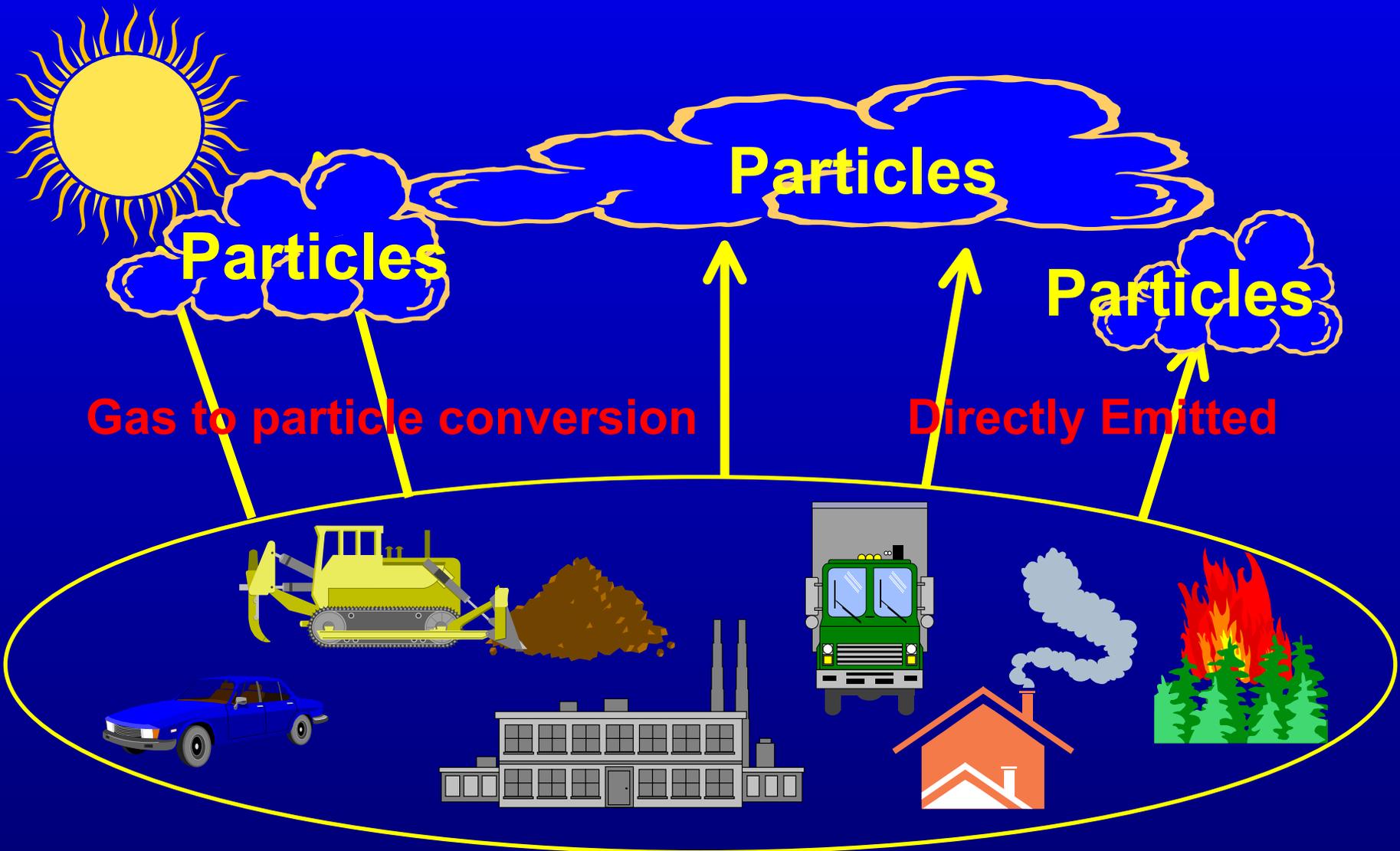
Human Hair
(60 μm diameter)



PM₁₀
(10 μm)

PM_{2.5}
(2.5 μm)

WHERE DO PARTICLES COME FROM?



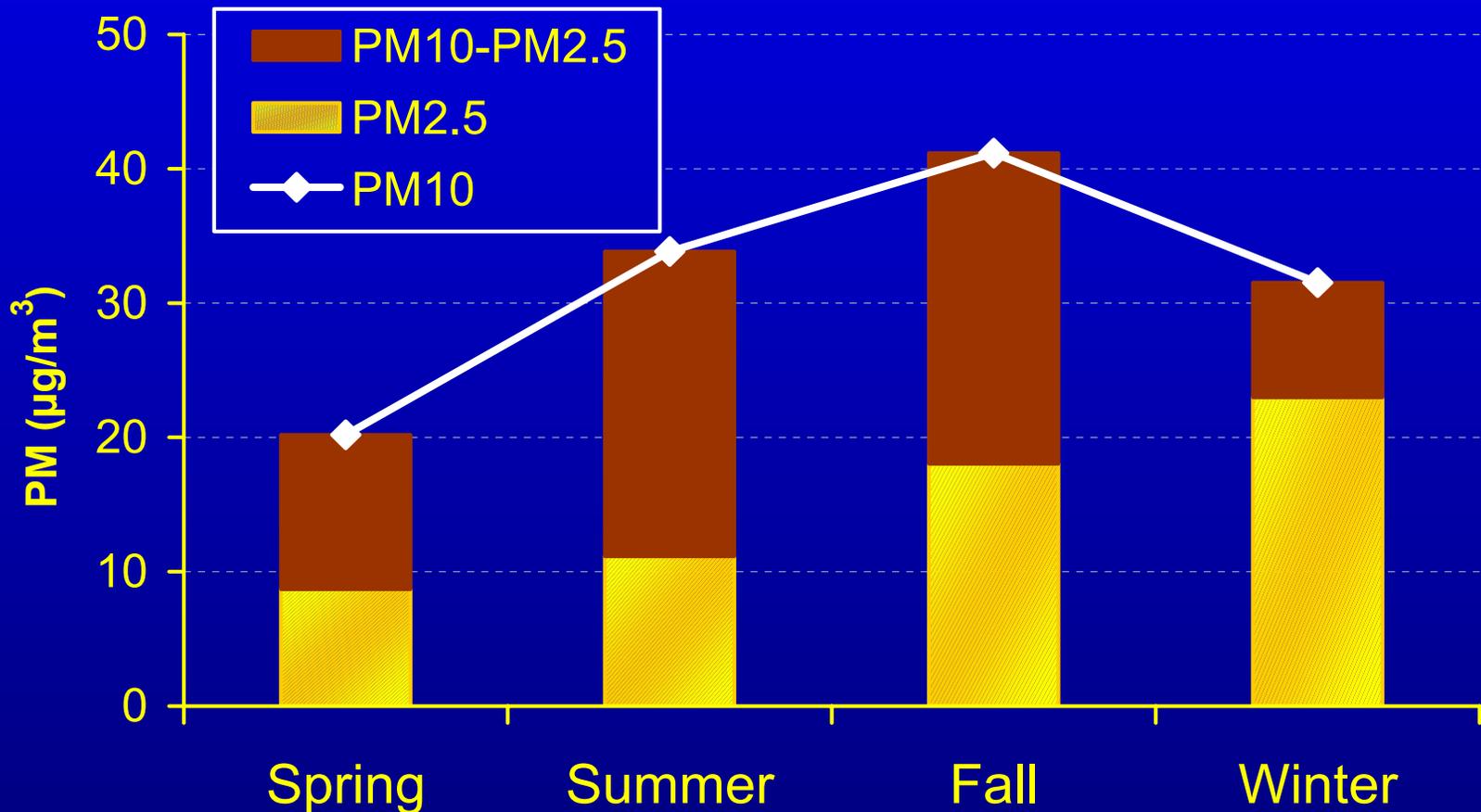
EXPOSURE TO PARTICULATE MATTER

CA PM10 Standard Attainment

-  Air Basin
-  County
-  Unclassified
-  Attainment
-  Nonattainment

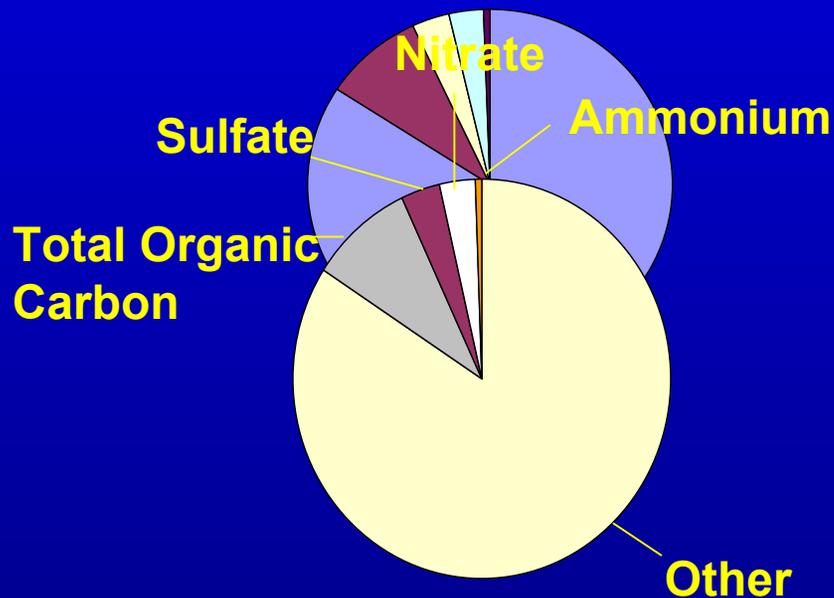


SAN JOAQUIN VALLEY AIR BASIN SEASONAL VARIATION IN PM10

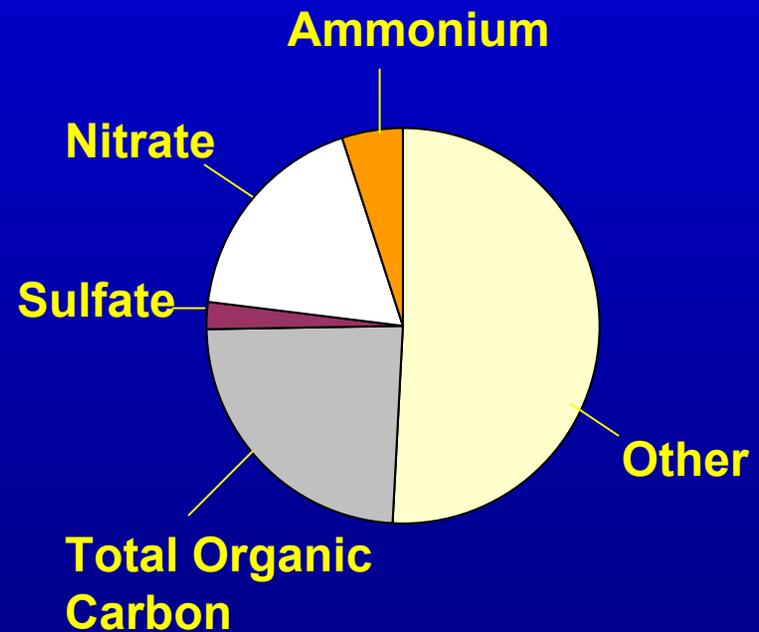


FALL AND WINTER PM10 COMPOSITION (FRESNO, CA, 1999)

Fall PM10 Composition



Winter PM10 Composition



DECISIONS

- ◆ **PM size**
- ◆ **Averaging time**
- ◆ **Concentration**
- ◆ **Monitoring method(s)**

STEPS TOWARD NEW PM STANDARDS

Sept. 2001	Public Draft Report released
Oct. 2001	Public workshops
Nov. 2001	Air Quality Advisory Committee meeting
March 2002	Final Draft Report released
April 2002	Board Hearing

HEALTH EFFECTS OF PARTICULATE MATER

BY

**Dr. Bart Ostro
from OEHHA**

KEY HEALTH FINDINGS -- PM

- ◆ **Associations between PM and**
 - **mortality**
 - **morbidity (illness)**
- ◆ **Observed effects**
 - **at current ambient concentrations**
 - **likely below current state standard**
 - **no apparent threshold**
- ◆ **Effects related to short- and long-term exposure**

OVERVIEW

- ◆ **Epidemiologic studies: advantages and disadvantages**
- ◆ **Acute exposure and mortality**
- ◆ **Chronic exposure and mortality**
- ◆ **Morbidity**
- ◆ **Conclusions**

USE OF EPIDEMIOLOGY FOR PM STUDIES

- ◆ Types of air pollution health effects studies:
 - toxicologic
 - controlled human exposure
 - epidemiologic
- ◆ Most PM health effects information comes from epidemiologic studies
- ◆ Collects data on humans under real-world conditions
- ◆ Recent animal studies support epidemiologic findings

EPIDEMIOLOGICAL STUDIES

- ◆ **No need to extrapolate across species or doses**
- ◆ **Allows examination of multiple exposures, outcomes and subgroups**
- ◆ **Imprecision in measurements**
- ◆ **Limited range of outcomes**

TYPES OF AIR POLLUTION EPIDEMIOLOGICAL STUDY DESIGNS

- ◆ **Time-series**
- ◆ **Prospective cohort**
- ◆ **Other (cross-sectional, panel)**

TIME-SERIES MORTALITY STUDIES

- ◆ Association between daily changes in pollution and daily counts of mortality in a specified area
- ◆ Controls for factors that change on a daily basis (e.g., weather, DOW)
- ◆ Factors such as smoking, alcohol use, occupational exposure not expected to change daily and be correlated with PM.
- ◆ Examines effects of relatively short-term exposure

RESULTS OF TIME SERIES MORTALITY STUDIES

- ◆ **Consistent association between PM and daily mortality**
- ◆ **Studies conducted throughout the US, in California, and elsewhere**
- ◆ **Associations even at very low concentrations**
- ◆ **No apparent threshold**
- ◆ **Sensitive groups: elderly, those with chronic heart or lung disease, and infants**

PROSPECTIVE COHORT STUDIES

- ◆ **Uses individual data**
- ◆ **Follows a specific group of people over time**
- ◆ **Examines impact of longer-term exposure**
- ◆ **Allows calculation of life-years lost**
- ◆ **Expensive, but very informative**

AMERICAN CANCER SOCIETY COHORT STUDY

- ◆ Followed 550,000 people from 151 cities for 7 years starting in 1982
- ◆ Controlled for potential confounders
- ◆ Mortality associated with fine particles and sulfates
- ◆ $10 \mu\text{g}/\text{m}^3$ change in PM10 \rightarrow 4% increase in mortality
- ◆ PM exposure associated with significant loss in life expectancy

RESULTS FROM OTHER COHORT STUDIES

- ◆ **Harvard Six-City Study**
- ◆ **Seventh Day Adventist Cohort**

MORBIDITY EFFECTS ASSOCIATED WITH PM

- ◆ **Hospitalization, emergency room and MD visits for cardiovascular or respiratory causes**
- ◆ **Cardiovascular outcomes**
- ◆ **Asthma exacerbation**
- ◆ **Acute and chronic bronchitis**
- ◆ **Respiratory symptoms**
- ◆ **Loss in lung function**
- ◆ **Work loss or restricted activity**

GENERAL FINDINGS

- ◆ **Mortality and morbidity results not likely due to confounders or chance**
- ◆ **Exposure associated with significant shortening of life**
- ◆ **No apparent threshold**
- ◆ **Effects associated with PM10, fine and coarse particles, and sulfates.**