

Key Studies



- Relevant studies ID'd and interpreted?
- Omissions?

Susceptible Populations

- Appropriately ID'd?
- Other populations that should be considered?
- Are data on infants and children appropriately considered?

Additional Information



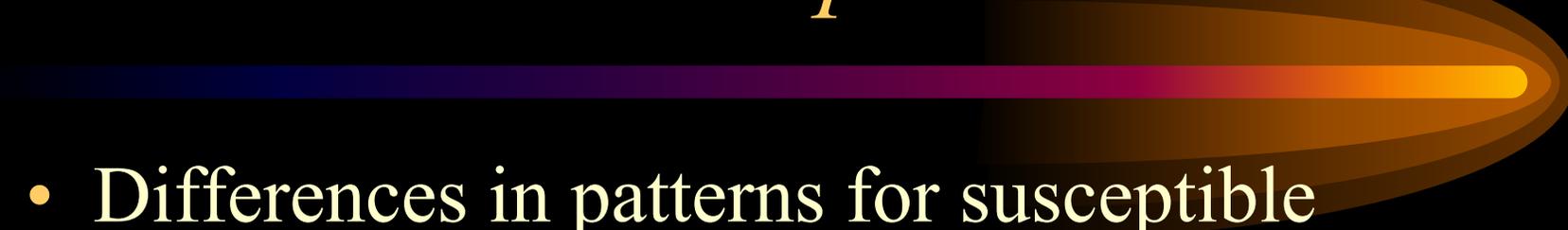
- Other critical information that should be considered?
 - Metrics
 - Averaging times

Uncertainties



- Adequate description?
- Adequate treatment?

Exposure Patterns



- Differences in patterns for susceptible populations?
 - Infants
 - Children
 - Others

Executive Summary

- Federal EPA will promulgate Pm_{coarse} NAAQS (Hopke).
- Evolution of PM standards.
 - Need to characterize specific components (acids, oxidants, biological activity, ultrafines)
- Include statement about importance of assessing relationship between outdoor and personal exposures.

Executive Summary



- Uncertainties in relationship between PM and personal exposure

Chapter 2 - Introduction

- Federal EPA will promulgate Pm_{coarse} NAAQS (Hopke).
- Evolution of PM standards.
 - Need to characterize specific components (acids, oxidants, biological activity, ultrafines)
 - Need for integrative approach in standard setting

Chapter 2 - Introduction

- Are Sulfate and PM2.5 standards overlapping?

Chapter 4 - Sources and Emissions

- More systematic speciation needed:
 - Improve assessment of source-receptor relationships.
 - Identify toxic components.
 - Provide data for development of mechanistic hypotheses.

Chapter 5 - Issues on Monitoring

- Adopt continuous PM monitors
 - $PM_{2.5}$ & PM_{Coarse}
- Quartz filters may adsorb organic vapors causing artifacts
 - Fluorocarbon filters?
- Continuous sulfate monitors
- SSI filter-based PM_{10} - $PM_{2.5}$ to estimate Pm_{coarse} may overestimate (loss of labile $PM_{2.5}$)

Chapter 5 - Issues on Monitoring



- Artifacts (e.g. SO_2 - H_2O_2 interactions) need to be better understood.

Chapter 6 - Exposure Assessment

- Spatial variability of PM mass (and components, e.g. PAH, metals) in CA strongly affects personal exposures.
 - Source vs. Receptors
 - Seasonal (photochemical changes)
 - Diurnal
 - Coastal vs. Inland
- Spatial variability also seen in particle size distributions

Chapter 6 - Exposure Assessment

- Outdoor contribution to personal PM can be estimated using $[\text{SO}_4]$
 - $\text{Pm}_{\text{out}} = ([\text{SO}_4]_{\text{pers}} / [\text{SO}_4]_{\text{out}}) \times \text{Pm}_{\text{out}}$
- Expand figure captions, presentation of size distributions, inclusion of mass in pie charts.

Chapter 7 - Health Effects

- Influence of chronic effects on acute mortality needs to be discussed more thoroughly.
- New measures of uncertainties for epidemiological outcomes (rather than confidence intervals) should be explored.
- The potential effects of short-term (hourly) excursions should be discussed.

Chapter 7 - Health Effects: Biological Mechanisms

- Explain more clearly how the mechanistic studies entered into the thinking on recommended standards.
- Document uncertainties in mechanistic studies (routes of exposure, doses, etc.), especially where those studies influenced possible standards.

Chapter 7 - Health Effects: Biological Mechanisms

- The point should be made that some particles accumulate in the lung (interstitial and plural deposition sites) and are retained for years.
- Retained particles that contain toxic components can influence health for extended periods of time.

Chapter 7 - Health Effects: Biological Mechanisms



- Data on 4 major potential mechanisms (lung injury, inflammation, increased blood coagulation, and cardiac arrhythmias) suggest important short term effects.

Overall Approach to Arriving at Recommendations



- Transparent
- Appropriate
- Air Quality Standards supported by scientific rationale?
 - Annual Average PM10
 - Annual Average PM2.5
 - 24-hr Average PM10
 - 24-hr Average Sulfate

PM_{2.5}

- Sufficient or insufficient evidence to develop 24-hr average (or other short-term standard)?
 - 24-hr PM₁₀ adequately protective?
 - Annual average PM_{2.5} adequately protective?

Chapter 7 - Health Effects (Recommendations for Standards)

- Not clear that the combination of 24-hr PM_{10} and low annual $PM_{2.5}$ standards afford equivalent protection as 24-hr $PM_{2.5}$.
- Strong support for inclusion of a $PM_{2.5}$ 24-hr standard.
- Support annual and 24-hr PM_{10}
- Support annual $PM_{2.5}$
- Need better justification of Sulfate standard

Chapter 7 - Health Effects (Recommendations for Standards

- Possible bases for short term PM_{2.5} standards:
 - 10 $\mu\text{g}/\text{m}^3$ above minimal annual average in areas where 10 $\mu\text{g}/\text{m}^3$ increments are shown to increase morbidity (mortality).
 - A level below the 98th percentile of highest 24 hr values in areas where the 24 hr peaks are shown to increase morbidity or mortality.

Other Research Issues



- 5 yr cycle?
- Gaps in knowledge base?
- Susceptible groups
- Sampling methods
- Coarse vs. Fine

Future Research

- Evaluate regional differences in relationships between PM and gaseous co-pollutants.
- Characterize short-term PM exposures.
- Speciate PM (metals, EC/OC, PAH's, NO₃).
- Characterize ultrafine exposures (I,O, personal)
 - speciate
 - new monitoring techniques

Future Research

- Panel studies to assess relationship between PM exposure (short-term, daily, personal) and health outcomes.
 - Regional differences
 - Seasonal differences
- Toxicological studies
 - dose-response and chronic studies (with superimposed acute peaks?)
 - CAPs
 - co-pollutants

Future Research

- Chronic toxicology studies using real-world aerosols
- Evolution of PM standards.
 - Need to characterize specific components (acids, oxidants, biological activity, ultrafines)
- Improved assessment of differences between children and adults.
 - Exposures
 - Responses