

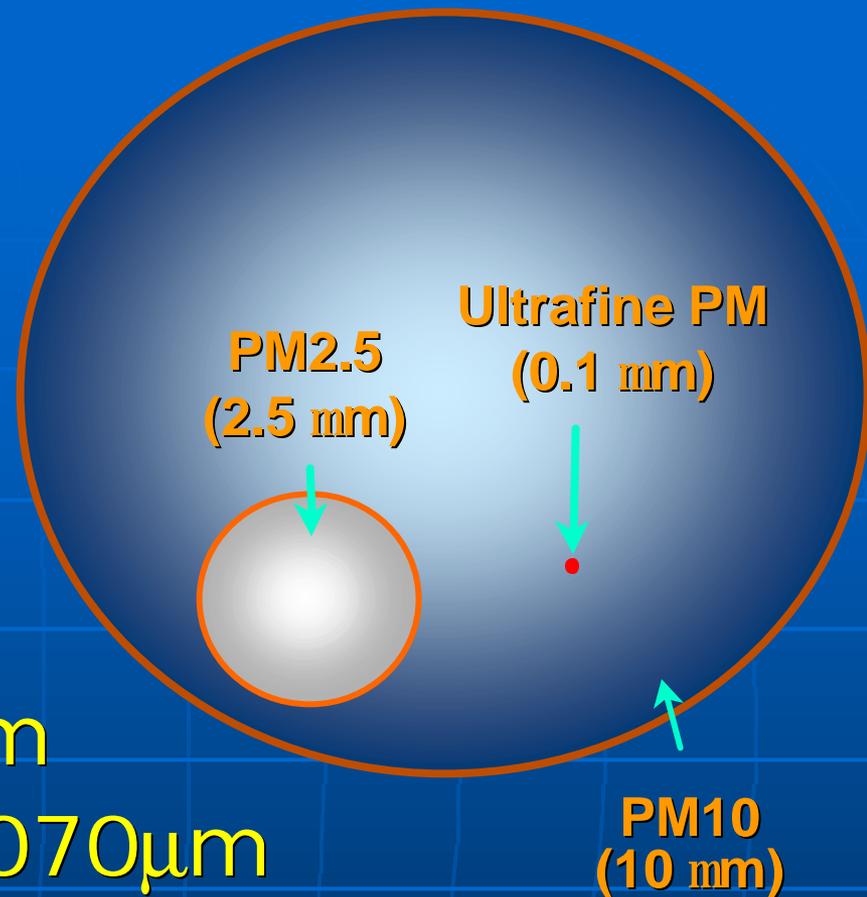
Current Issues in Ultrafine Particle Research: The ARB's Health and Exposure Research Program

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Air Resources Board
California Environmental Protection Agency

Relative particle size



- Ultrafine Particles: less than $0.1\mu\text{m}$
- Viruses: $0.002 - 0.070\mu\text{m}$
- Bacteria: $3 - 50\mu\text{m}$
- Red Blood Cell: $7.5\mu\text{m}$
- Human Hair: $60\mu\text{m}$

Why are we concerned about ultrafine particles?

Contain little mass, but:

- Possess a large surface area and high numbers
- Have a high deposition rate in the lung
- Can enter the circulatory system and move from the lungs to other organs
- Contain toxic components
- May initiate harmful oxidant injury

Health Effects

Recent Findings

- Ultrafine PM has been associated with premature death, cardiovascular disease, and respiratory illness
 - Detroit and Erfurt, Germany
 - Animal and cellular studies

Health Effects Research Issues

- How much of the health effects associated with PM_{2.5} are actually caused by ultrafine PM?
 - Cardiovascular effects in the elderly (UC Irvine)
 - Cardiovascular effects from on-road exposures (UCLA)
 - Role in atherosclerosis (UC Irvine)
- USEPA PM Centers at UCLA, Rochester, and Harvard focus on ultrafine particle research

Exposure

Recent Findings



- Exposure to ultrafine particles varies by location and time
 - Local sources can have a major impact
 - Ultrafine particle levels fall off rapidly near roadways
 - Much of your exposure occurs during daily commute

Exposure Research Issues

- What are community levels of ultrafine particles?
 - Ultrafine particles at LAX (UCLA)
 - Harbor Communities Monitoring Project
 - Community level monitoring (USC)
 - Mobile monitoring of spatial gradients (UCLA)

Indoor Exposure Recent Findings



- Indoor sources can be important to ultrafine particle exposures
 - Indoor combustion sources contribute to ultrafine particle exposures
 - Indoor Air Chemistry: Ultrafine particles and formaldehyde are produced by terpene – ozone reactions

Indoor Exposure Research Issues

- How much of the indoor exposure is due to indoor sources and how much to infiltration of outdoor particles?
 - Measurement of ultrafine particulate matter in classrooms and homes (UC Berkeley)
 - Emissions from office machines (UC Berkeley)

Emissions and Controls

Recent Findings

- Sources:
 - Combustion, condensation, photochemistry, indoor sources
- Findings: The internal combustion engine is a prominent source of ultrafine particles
 - Gasoline/CNG/Diesel/Jet engines/etc.

Emissions and Controls

Research Issues

- Characterization and quantification of mobile source emissions are still needed
 - Toxicity of emissions from heavy-duty and light-duty vehicles (USC)
 - Evaluation of the European Particle Measurement Program (PMP) protocol (UC Riverside)
 - Source apportionment (UC Davis)

Conclusion

- Ultrafine particles are a concern
- ARB is active in research into all aspects of ultrafine particles
- We will continue our research effort in the future