PARTICULATE AIR POLLUTION
AND INFANT MORTALITY

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Air Resources Board
California Environmental Protection Agency
PM10 = Coarse + Fine + Ultra-Fine
PM2.5 = Fine + Ultra-Fine
WHY ARE WE CONCERNED WITH PARTICLES?

- Attaining the State PM2.5 standard would prevent ~8,200 adult premature deaths annually in California.
- Substantial evidence that PM exposure is associated with cardiovascular deaths in adults.
- Evidence that PM exposure is associated with respiratory-related deaths in infants.
- Californians have a disproportionate share of PM exposure.
Less Known are the Effects of PM on Children Especially Infants

- **London, England 1952** - increase in infant death due to the “Great Fog”

- **Sao Paulo, Brazil** - 7% increased risk of respiratory death in children less than 5 years old due to PM10

- **Seoul, South Korea** - 102% increased risk of respiratory death in infants compared to 6.3% increased risk in those over 65 due to PM10

- **United States** - 20% increased risk of respiratory death among normal birth weight infants due to PM10

- Gaps in knowledge - Infant/Birth Outcome
  - The next two California studies help close the gap
“Air Pollution and Infant Death in Southern California, 1989–2000” by Ritz et al.

- South Coast Air Basin
- Postneonatal = infant between 28 days and 1 yr. old
- 1989 to 2000, birth and death certificates
  - 11 years of data and 19,664 deaths
- Zip codes within 16 km of a PM10 station
- PM10 averages of 2-weeks through a 6-month period
- Controlled for maternal confounding effects
RESULTS - PM10 & Infant Death

Preterm or Low Birth Weight - 2 month avg. PM10
- A 6% increased risk in all cause of death [1%–13%]
- A 26% increase risk in SIDS [6% – 50%]

Includes all infants regardless of weight - 2 week avg. PM10
- A 5% increase risk in respiratory-related death [1%–10%]

Death Associated Per 10 µg/m³ Increase in PM10

Methods - PM 2.5 & Infant Death

“Fine Particulate Matter (PM 2.5) Air Pollution and Selected Causes of Postneonatal Infant Mortality in California” by Woodruff et al.

- All of California
- Postneonatal = infant between 28 days and 1 yr. old
- 1999 to 2000, births & death certificates
  - 2 years of data and 1,606 deaths
- Maternal addresses within 5 miles of a PM2.5 monitor
- Life Exposure = PM2.5 average (birth to death)
- Controlled for maternal confounding factors
RESULTS - PM 2.5 & Infant Death

- A 213% increase risk for respiratory-related death [1.12 - 4.05]
- A 7% increase risk for all cause of death [0.93 - 1.24]
  (close but not significant)
- SIDS not significant [0.55 – 1.23]

Woodruff et al., “Fine Particulate Matter (PM2.5) Air Pollution and Selected Causes of Postneonatal Infant Mortality in California”, 2006
Ritz and Woodruff studies corroborate and add further evidence of a PM effect on infant death.

Not only adults but especially children and infants benefit from PM controls.

Better accounting of maternal tobacco smoke and of indoor exposure in future infant studies.

More studies are needed to fill the gap for the remaining unanswered questions.