Revised Estimates of Premature Death Associated with PM2.5 Exposures in California

May 22, 2008

Fresno, California

Air Resources Board

California Environmental Protection Agency

Overview

- Background on ARB's health impacts analysis
- Updated methodology
- New estimates of premature deaths
- Next steps

ARB's Health Impacts Analysis

- Estimate health impacts associated with public exposures to ambient levels of ozone and PM
- Estimate benefits associated with proposed diesel PM regulations to reduce emissions
- Board requested update in light of new studies emerging since 2002

Key Steps in ARB's Update of Estimates

Advisors

- Dr. Jonathan Levy, Harvard University
- Dr. Bart Ostro, Office of Environmental Health Hazard Assessment
- Dr. Arden Pope, Brigham Young University

Peer Review Evaluation

- Dr. Jeffrey R. Brook, Environment Canada
- Dr. Mark D. Eisner, UC San Francisco
- Dr. Richard C. Flagan, California Institute of Technology
- Dr. Alan E. Hubbard, UC Berkeley
- Dr. Joel D. Kaufman, University of Washington
- Dr. Joel D. Schwartz, Harvard University

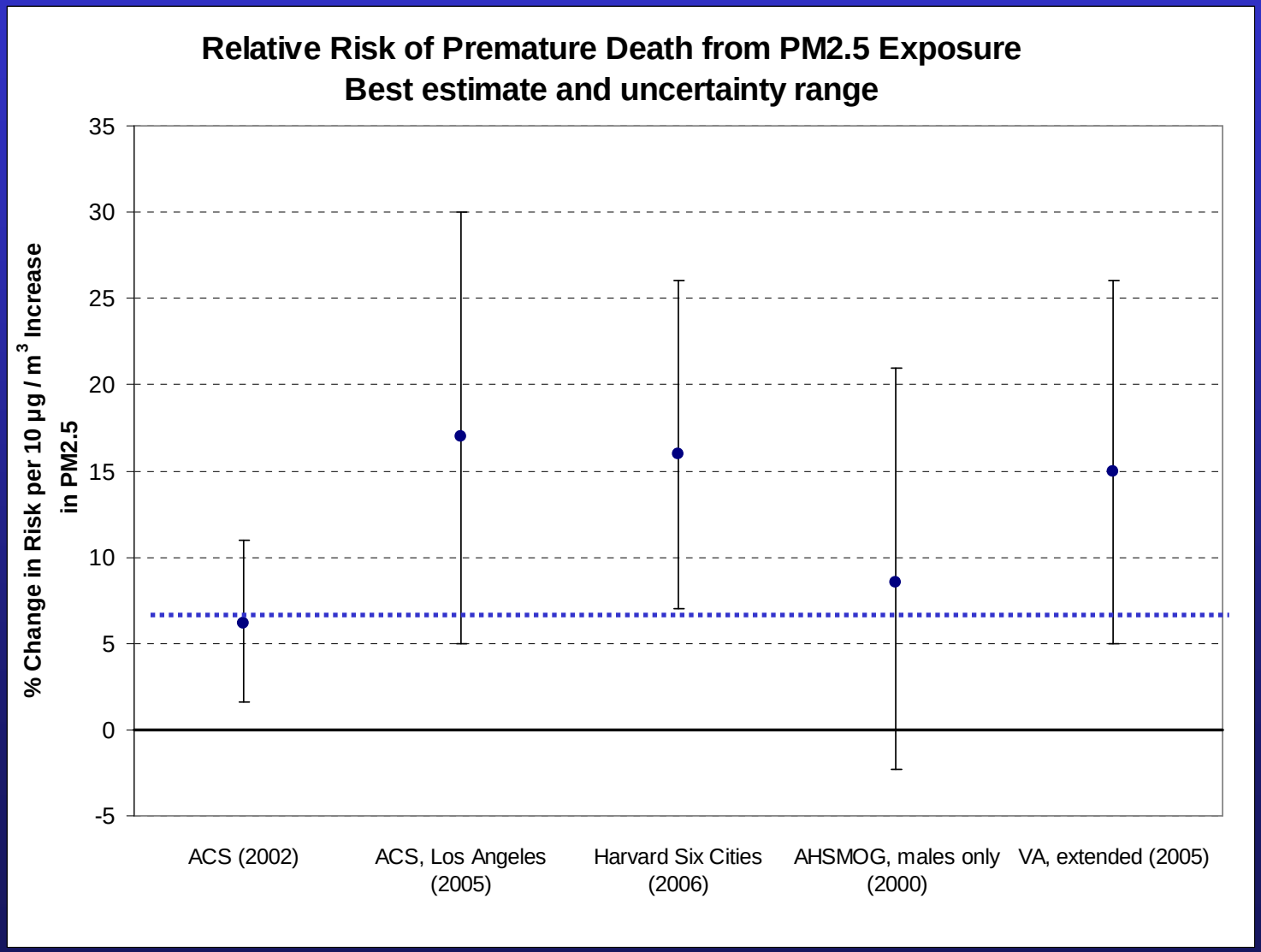
Proposed Revisions to the Methodology

- New estimate of PM2.5-premature death relationship
- Health impacts associated with exposures below the annual standard of 12 $\mu g/m^3$

Basis of Updated Methodology

- New information from major health studies
  - Harvard Six Cities (2006)
  - American Cancer Society (2005)
  - The Adventist Health Study of Smog (2005)
  - Women's Health Initiative (2004, 2007)
  - Veterans Administration (2003, 2006)
  - Eleven California Counties (2005)
  - Cystic Fibrosis Foundation (2004)
  - Studies outside of the U.S. (2004, 2005)
- U.S. EPA: experts' reviews and interpretations of literature

Summary of Results from Key Studies



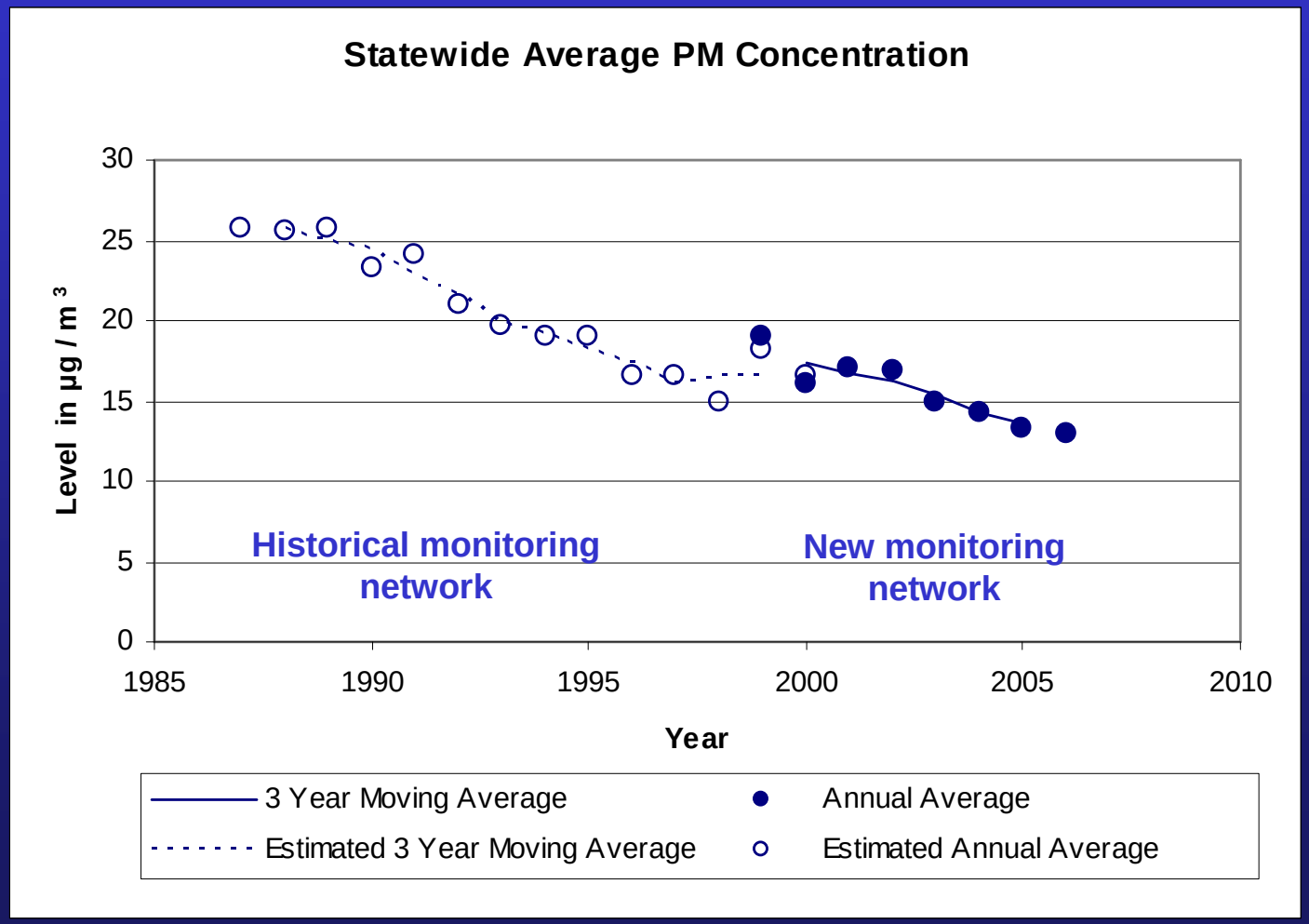
Revised Concentration-Response Relationship in Our Draft Report

- On average: 10% increased risk of premature death per 10 $\mu g/m^3$ increase in long-term PM2.5 exposures
  - Current estimate is 6%
- 90 percent uncertainty interval: 3% to 20%

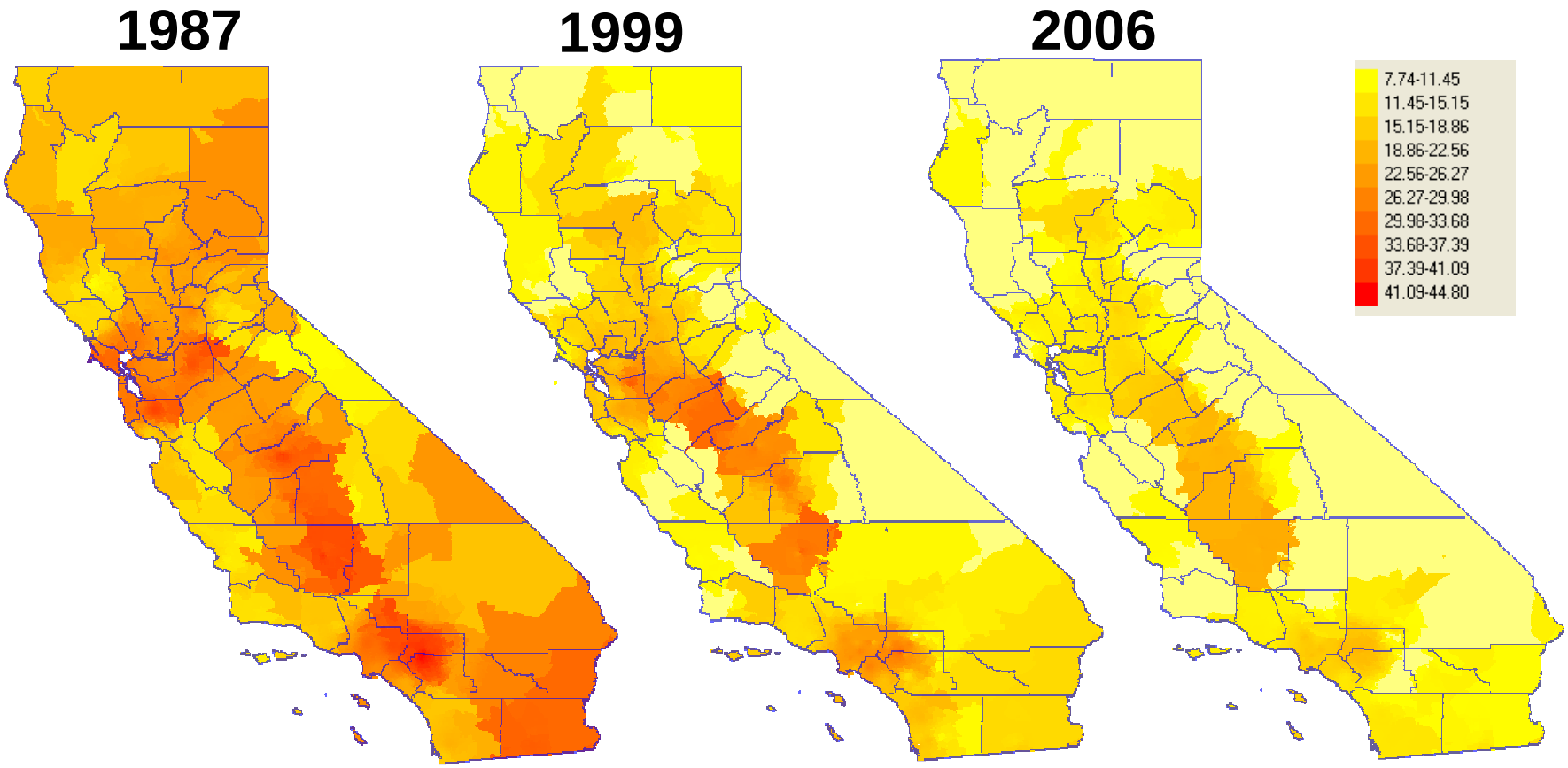
Other Analyses Consistent with Our Estimate of Increased Risk

- Results from U.S. EPA's reviews of literature statistically treated in various ways
- Results from actual major cohort studies
- European experts convened to survey interpretations of the literature

Statewide PM2.5 Exposures 1987-2006



PM2.5 Exposures 1987, 1999, and 2006



Premature Deaths Avoided Due to Ambient PM2.5 Reductions

- Since 1999, annual average PM2.5 levels decreased 30% statewide
- Deaths avoided due to year-to-year reduction in PM2.5 from 1999 to 2006: 14,000 deaths*

*Uncertainty interval: 4,300 to 25,000 deaths.

Proposed Revisions to the Methodology

- Update PM2.5-premature death relationship
- Use new estimate of ambient PM2.5 concentration based on 2004/05/06 monitoring data
- Estimate health impacts associated with exposures below the annual standard of 12 $\mu g/m^3$

Levels at Which the Risk for Premature Death Can Be Quantified

- Literature suggests increased premature death occurs at levels well below 12 $\mu g/m^3$
- New approach uses a range of levels
  - 7 $\mu g/m^3$: lowest level measured in American Cancer Society studies
  - 2.5 $\mu g/m^3$: background level in California

Revised Estimates of Premature Deaths Associated with Ambient PM2.5

- About 14,000 to 24,000* premature deaths annually are estimated to be associated with long-term exposures to PM2.5
- A majority of the impacts occur in
  - South Coast
  - San Joaquin Valley
  - San Francisco Bay

*Uncertainty interval: 4,300 to 41,000 deaths.

New Estimates of Premature Deaths Associated with Diesel PM

- Updated the methodology by considering the relation between ambient NO_X and diesel PM concentrations
- Based on new relationship, about 3,900* premature deaths were associated with primary diesel PM emissions in 2000
  - Previous estimate was 2,200 deaths

*Uncertainty interval: 1,200 to 7,100 deaths.

Summary of Proposed Revisions

	Current	*Proposed*
Increased Risk per 10 $\mu g/m^3$	6%	10%
Lowest level of effect	12 $\mu g/m^3$	Range of 7 to 2.5 $\mu g/m^3$
Air quality data	Year 1999/2000	Year 2004-06
Annual premature deaths (Ambient PM)	8,200	14,000 to 24,000
Premature deaths in 2000 (primary diesel PM)	2,200	3,900

Uses of New Methodology

- Use new findings for future health impacts analysis
- Consider this information in next review of ambient air quality standards

Timeline for Completion of Staff Report

May 22, 2008	Draft report* released at Board briefing
June 2008	Public workshop
July 2008	Public comment period ends
August 2008	Final staff report released

*Draft report available at:
http://www.arb.ca.gov/research/health/pm-mort/pm-mort.htm