Follow-up to the Harvard Six-Cities Study: 
Health Benefits of Reductions in Fine Particulate Matter Air Pollution

June 22, 2006
Harvard Six-Cities Study: 1993 and 2006

- First study on long-term effects of exposure to low-to-moderate PM levels

- Dockery et al. (1993)* found an association between PM and premature death

- Over 8,000 adults in 6 cities in eastern U.S. followed for about 15 years

- Laden et al. (2006)** extended the follow-up for an additional 8 years (1990-1998)


Methodology Used and Trends Observed

- PM2.5 concentrations estimated based on visibility data and monitored PM10 data
  - Error of estimate not determined

- Study controlled for smoking, education, body mass index, sex and age

- PM2.5 decreased substantially between the two study periods
  - Correspondingly, death rates decreased in each city
Key Finding #1

- 16% increase in risk of overall premature death for each 10-µg/m³ increase in PM2.5 over entire follow-up period
  - Uncertainty range is 7% to 26%

- Results significant for deaths due heart-related disease, but of borderline significance for deaths due lung cancer

- Results are consistent with other chronic exposure studies
  - American Cancer Society (national and Los Angeles data)
Key Finding #2

- Between 2 periods, 27% lower risk of overall premature death for each 10-μg/m³ decrease in mean PM2.5
  - Uncertainty range is 5% to 43%

- Risk for deaths due to heart and lung disease decreased consistently as PM decreased, but not for lung cancer
  - Mortality effects of long-term PM pollution may be reversible

- Results are consistent with other evidence of air pollution reductions and health improvement
  - Ban of coal sales in Dublin, Ireland
  - Closure of steel mill in Utah Valley, Utah
  - Children’s Health Study in southern California
Implications

- Supports association between PM exposure and premature death due to heart-related disease

- PM2.5-associated deaths decreased in periods of decreased PM concentrations

- Supports need for reductions in PM exposure