Health Update

SJVAPCD Citizens Advisory Committee Meeting

March 3, 2009

Assessment of the Hall et al. Report:

"The Benefits of Meeting Federal Clean Air Standards in the South Coast and San Joaquin Valley Air Basins"

(Published by California State University, Fullerton and Sonoma Technologies, Inc., November 2008.)

David Lighthall, Ph.D.
Health Science Advisor
San Joaquin Valley Air Pollution Control District

"Dirty Air Costs California Economy $28 Billion Annually"

Headline of the CSU Fullerton press release for the Hall et al. report: November 12, 2008.

South Coast Costs:	$21.63 billion
San Joaquin Valley Costs:	$5.73 billion

Purposes of the Presentation

1. Present and interpret Valley findings;
2. Discuss the study's methodology;
3. Discuss the Value of a Statistical Life:
    - Why is it so commonly misinterpreted?

Central Challenges facing Air Quality Agencies

How to find a justifiable balance between (1) the protection of public health, (2) the economic viability of the region, and (3) the rights of individuals?

How can we best harness scientific knowledge and advanced technology in striking this balance?

Background on the Report Methodology:

(The scientific marriage of epidemiology and GIS)

1. Epidemiology: "The study of factors affecting the health and illness of populations. It is the foundation and logic for interventions made in the interest of public health and preventive medicine."
2. Geographic information systems (GIS): "Tools that allow users to create interactive queries, analyze spatial information, edit data, maps, and present the results of all these operations."
3. Each is a critical element in computer models such as REHEX (used by Hall et al.) and BenMAP (used by the District and CARB): Why?

Air Quality Epidemiology

The case of PM 2.5, Morbidity, and Premature Mortality

1. 35 years of epi studies: A solid foundation for statistical inference;
2. Recent "best of the best":
   - Pope et al. (2002)
   - Jerrett et al. (2005)

Desirable Epidemiological Elements for Sound Inference

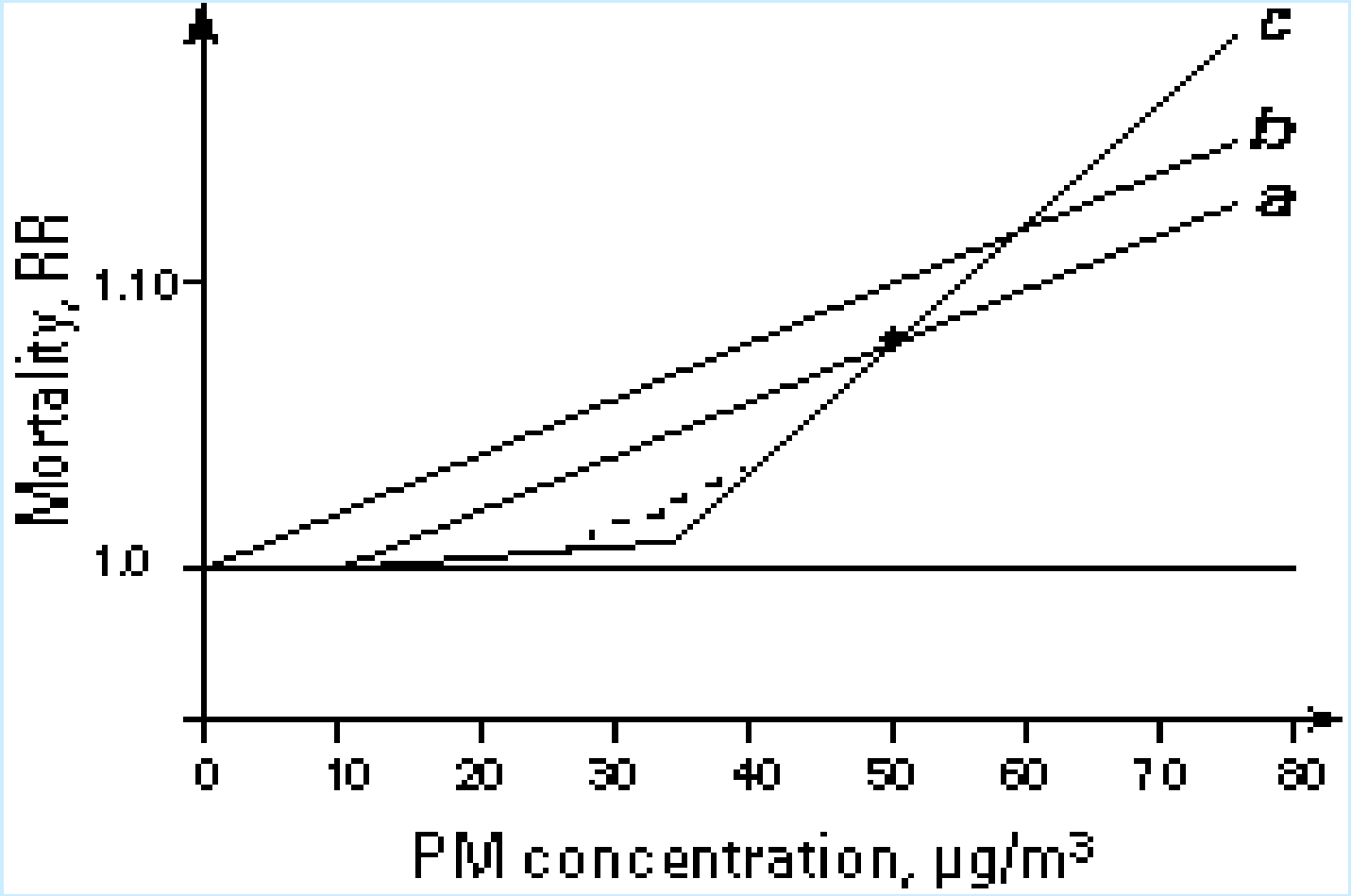
1. Large study populations (cohorts);
2. Good exposure data;
3. Controlling for confounding factors, e.g. smoking, education, income;
4. Similar geography and populations between study area and policy application.

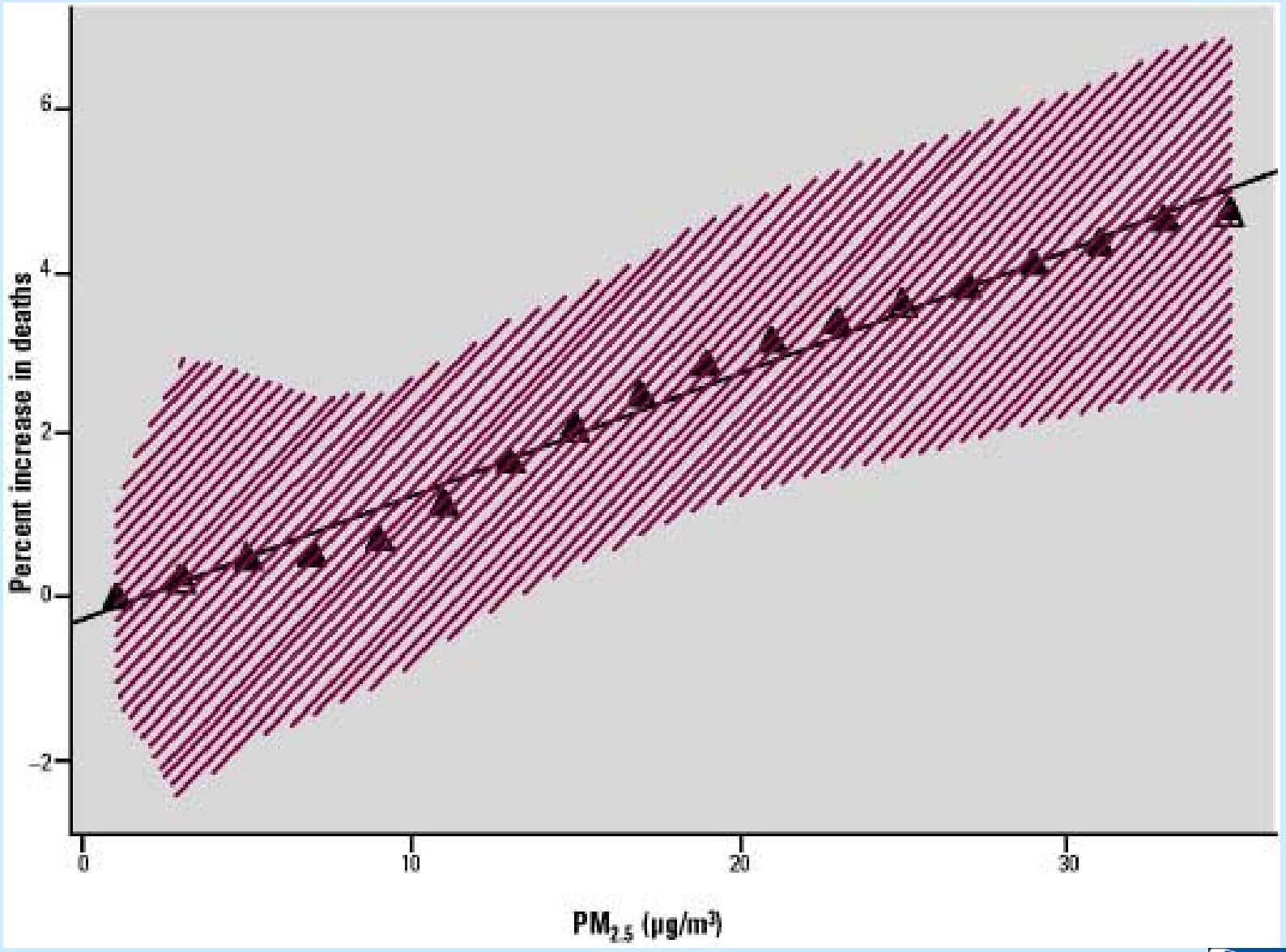
Scientific Consensus on PM 2.5

From Pope and Dockery (2008)

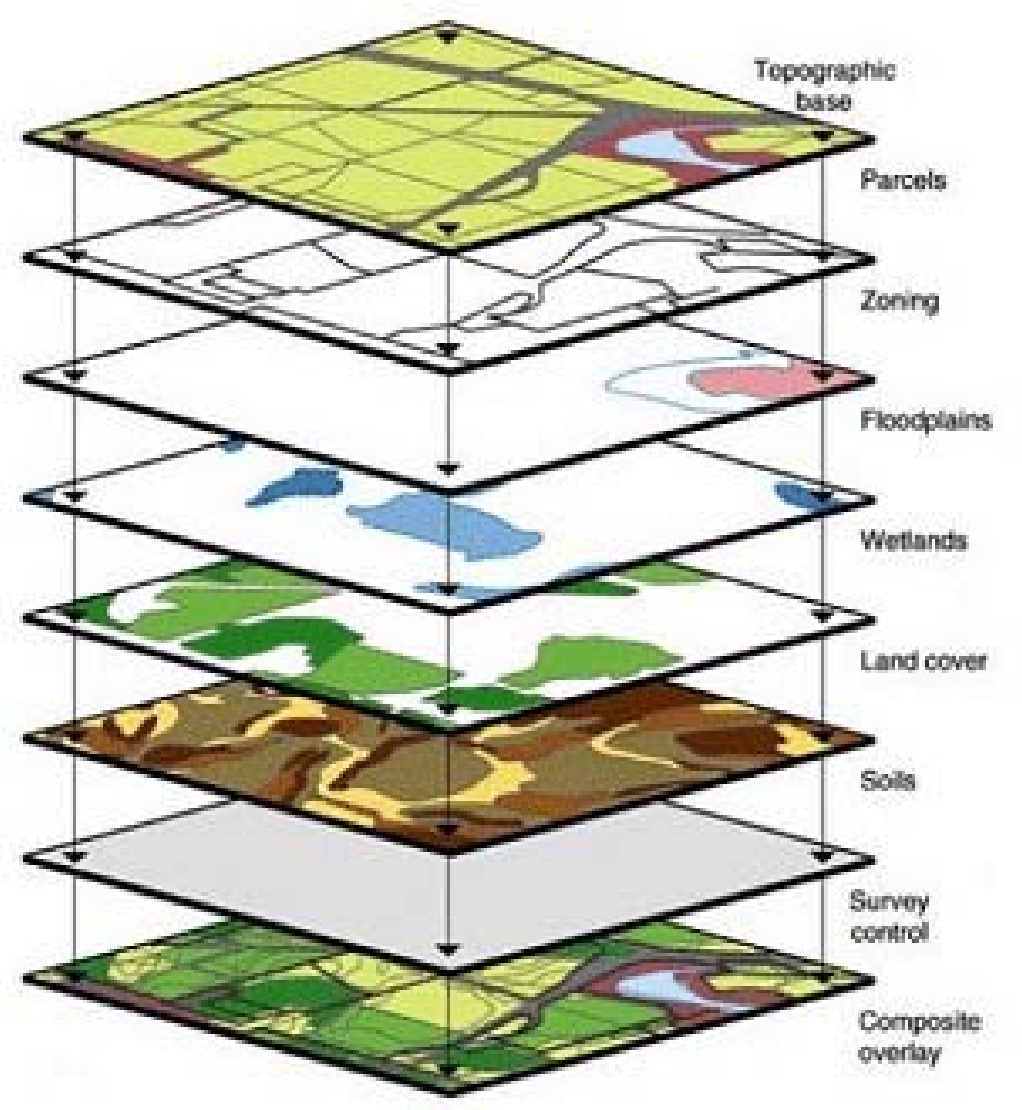
1. Effects seen in day to day variations in exposure at a given location;
2. Larger effects from place to place variations in annual exposure;
3. Multiple studies have led to concentration response functions for different health endpoints.

Concentration Response Function




Percent increase in deaths
6
4
2
0
−2
0
10
20
30
PM2.5 (µg/m3)

GIS Data Layers (Coverages or Grids)



How Do the REHEX and BenMAP Models Work?

Step 1: A population/settlement grid (coverage) based on US Census data and boundaries;

Step 2: A baseline air quality exposure grid (coverage) from monitor data;

Step 3: A baseline disease and mortality incidence grid based on baseline exposure and population data;

- Based on concentration response functions for health endpoints;

Step 4: A control air quality exposure grid based on a policy option;

- Rollback to a standard or % reduction option;

Step 5: New incidence rates assigned to the population based on the projected improvement in air quality;

Step 6: Calculate a dollar value for avoided cases of disease and pre-mature death.

Annual Valley Health Benefits of PM 2.5 Attainment

(Number of Avoided Cases per Health Endpoint)

Health Endpoint	Cases	Value (millions)
Minor Restricted Activity Days	386,340	$24.98
Premature Mortality (30+)	812	$5,380.00
Post-Neonatal Mortality (<1)	2	$13.25
Work Loss Days (18-64)	68,740	$10.55
Lower Respiratory Symptoms	18,260	$0.3873
Upper Respiratory Symptoms	362,340	$12.29
Acute Bronchitis (15-17)	3,600	$0.418
Chronic Bronchitis (27+)	364	$144.40
Childrens' Asthma ER Visits	440	$0.1563
Non-Fatal Heart Attacks	584	$40.94
Respiratory Hospital Admissions	119	$4.15
Cardio Hospital Admissions	170	$6.77
Total		**$5,638.29**

Annual Valley Health Benefits of Ozone Attainment
(Number of Avoided Cases per Health Endpoint)

Health Endpoint	Cases	Value (millions)
Minor Restricted Activity Days	153,750	$9.95
Premature Mortality (30+)	9	$59.63
Respiratory Hospital Admissions	163	$6.19
Asthma Attacks	20,400	$1.081
Minor Restricted Activity Days	153,750	$9.95
Days of School Absences (15-17)	151,510	$12.02
Emergency Room Visits	60	$0.02132
Total		**$88.89**

Valley Morbidity (Disease) vs. Mortality Costs

1. PM 2.5 Costs: Disease is 4.6% of total;
2. Ozone: Disease is 32.9% of costs;
3. PM 2.5 costs are 63.4 times the ozone costs;
4. Total mortality cost: $5.44 billion;
5. Total disease cost: $287.55 million;
6. Total cost: $5.73 billion;
7. 95% of Valley total is mortality cost, based on the value of a statistical life (VSL).

The Value of a Statistical Life: What does and doesn't it mean?

1. VSL is not:
   - Cost to taxpayers for premature death;
   - Health care costs or expenditures in general;
   - Lost income due to premature death.
2. VSL is:
   - An abstract value of a human life used to guide policy makers when making investments in public safety, health, etc.;
   - A social value expressed in economic terms ranging from $3.8 to $8.9 million per case;
   - Based on (1) salary premiums paid to workers in risky occupations or (2) surveys of willingness to pay for reduced risk from air pollution.

Discussion: Does the VSL make sense?

1. Is it helpful to you as policy makers?
2. Would it be sufficient to focus on the number of lives saved rather than the economic estimate?

Resources

- **Download the Hall Report: http://business.fullerton.edu/centers/iees/**
- **Find out about BenMAP: http://www.epa.gov/air/benmap/**
- **Read the Wood Rule (4901) evaluation: email David Lighthall (david.lighthall@valleyair.org**