Air Quality in Utah
Problem and Opportunity

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March 4, 2013
London, December 1952
London
December 5-9, 1952
Air pollution events are associated with increased hospital admissions and emergency department visits.
Effects of Air Pollution on Children

- Incidence of asthma
- Acute asthma exacerbations
- Lung growth
- Lost IQ points
## Benefits of the Clean Air Act 1990-2020

<table>
<thead>
<tr>
<th>Case Description</th>
<th>Cases prevented (2020)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult mortality – particles</td>
<td>230,000</td>
</tr>
<tr>
<td>Infant mortality – particles</td>
<td>280</td>
</tr>
<tr>
<td>Mortality – ozone</td>
<td>7100</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>75,000</td>
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<tr>
<td>Acute myocardial infarction</td>
<td>200,000</td>
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<tr>
<td>Asthma exacerbation</td>
<td>2,400,000</td>
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<tr>
<td>Emergency room visits</td>
<td>120,000</td>
</tr>
<tr>
<td>Lost school days</td>
<td>5,400,000</td>
</tr>
<tr>
<td>Lost work days</td>
<td>17,000,000</td>
</tr>
</tbody>
</table>

Clean Air Act 40th anniversary celebration
“Criteria Pollutants” Defined in the Clean Air Act

- Particulate matter
- Ozone
- Lead
- Carbon monoxide
- Sulfur oxides
- Nitrogen dioxide
How Do We Investigate the Health Impact of Air Pollution?

- Cross sectional comparisons between populations exposed to different levels of pollutants
- Longitudinal epidemiological studies
- Human studies of responses in short term exposure-chamber experiments
- Animal studies looking at short term exposures to individual pollutants
Daily Average PM$_{2.5}$ Concentration at Hawthorne Monitor

December 15, 2012 to February 7, 2013

Days over PM2.5 standard for (preliminary data)

• Salt Lake County – 22
• Cache County – 20
• Utah County – 21
• Uintah Basin* – 13

Uintah Basin* – ozone levels also over standard on 13 days
PM$_{2.5}$ - The Key Aerodynamic Diameter to Reach the Gas Exchange Portion of The Lung
The Complex Equation of Particulate Air Pollution

Emissions

Air Quality Model

Modeled PM$_{2.5}$ Concentrations

Meteorology

Chemistry

1/3 primary particles
2/3 secondary particles, products of atmospheric chemistry
Average PM$_{2.5}$ Composition for Fifteen US Cities

Predominance of nitrates during PM2.5 events in Salt Lake City

Total Mass (µg/m$^3$) 24
Min. 6

Other
Sulfate
Nitrate
Elemental Carbon
Organic Carbon
Crustal

EPA Air Trends 2010
More Than Particulates

- Summertime ozone on the Wasatch front
- Wintertime ozone in the Uinta basin
Why Do We Need More Study of Air Pollution?

• We have only scratched the surface of the biological responses to air pollution
  – Mechanisms
  – Temporal relationships – cumulative effects vs. acute exposures vs. repeated exposures
  – Better understanding of specific diseases

• Why do individuals exposed to the same pollutants have different responses?

• What can be done to alleviate or interrupt these processes?
Why Do We Need More Study of Air Pollution?

- What are the contributions of specific components of air pollution?
- What are the key components/synergies?
  - Are the health effects of particulates related largely to size or chemical composition?
- Atmospheric chemistry - what are the limiting reactions?
- Geospatial relationships?
- Economic and behavioral aspects of the burden of air pollution?
Why Utah, Why Now?

- Important scientific questions
- Talented investigators from a broad array of disciplines
- Unique resources
  - UPDB
  - Monitoring
- Palpable sense of urgency

An ideal natural laboratory
Goals for the Program

• Catalyze growth of a Utah Center for Air Quality, Health and Society
• National prominence in air quality research
• Credible scientific resource concerning air pollution and human health
• Sustainable funding
  – Local partners and foundation grants
  – Federal Grants including Program Project Grants
  – NIEHS Center Grant
Roadmap for the Day

• Presentations and Panel Discussions
  – Engineering, Science and Atmospheric Sciences
  – Center for Public Policy and Administration
  – Health Sciences
  – Utah Population Database

• Keynote address – Arden Pope

• Breakout sessions
  – Organization
  – Goals – planning our next steps
Support for the Program

• Vivian Lee, Senior VP for Health Sciences
• Michael Hardman, Interim Senior VP for Academic Affairs
• Tom Parks, VP for Research
• Southwest Consortium for Environmental Research and Policy
• College of Engineering
• Department of Internal Medicine