Health Impacts and Mitigation of Air Pollution

Alan C. Lloyd, Ph.D.
Chairman
California Air Resources Board
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California Air Quality Trend
(1-hour Peak Indicator)

California PM10 Air Quality Trend
(Maximum Annual Average of Quarters)

Children and Air Pollution
- Children are sensitive to air pollution
  - growing and developing
  - more time outdoors
  - more active and greater exposures
Long-term Effects Unknown

- Little was known about chronic effects of air pollution on children
- Most previous studies based on short-term exposures to adults

Children Health Study
Southern California

- 10+ year study of air pollution impact on lung health and growth
- Over 5,500 children studied
  - 12 communities with different pollution profiles
  - Increased community monitoring
  - Lung function testing and questionnaires

Annual Lung Function Testing
Children Health Study Findings

- Short-term respiratory effects
- Long-term respiratory effects
- Lung function growth reduced
- Asthma effects
- Greatest impact of lung function decrements may be in adulthood

Lung Function Growth

- 1% per year deficits in lung function associated with mix of pollutants
  - PM, NO₂, acids
- 2nd group study replicated results of first (plus effects from elemental carbon and ozone)


Lung Function at Age 18

- Reduced lung function growth from age 10-18
- Children in high air pollution areas had significantly lower values on lung function tests at age 18
- Associated with mix of pollutants
  - (PM₂.₅, NO₂, acids, elemental carbon)
- Motor vehicle link to pollutants


Lung Function at Age 18 Implications

- 18 year olds are nearing the end of their lung development
- Likely that changes are permanent
- Long-term health implications
- Greatest effect may occur later in life (reduced lung function - a risk factor for adult respiratory illness and death)
**Lung Function Growth**

"The Solution"

- 2001 Study on Relocation
  - relocation to lower PM10 areas associated with increase in lung function growth
  - air quality improvements can affect children’s health


**Asthma**

- Asthma causation related to high ozone and exercise


**Bronchitis In Asthmatics**

- Bronchitic symptoms related to air pollution only in asthmatics
- Association with PM10, PM2.5, organic carbon, NO2, and ozone


**School Absenteeism**

- School absenteeism associated with ozone increases
- Upper and lower respiratory symptoms and illness

Air Quality and Health

Conclusions

- Air pollution associated with:
  - short- & long-term respiratory effects in children
  - reduced lung function growth
  - asthma causation
- Greatest impact of lung function deficits may be in adulthood
- Air quality improvement leads to better lung function in children (and adults)

California Regulatory Actions (1) (Past two years)

- Prohibit idling of school buses near schools (2/02)
- Require PM retrofit and upgrade to low emission trash truck engines (9/03)
- Impose more stringent exhaust (catalyst-forcing) and new evaporative emission limits for new lawn and garden equipment (9/03)
- Require retrofit of stationary diesel engines with PM controls (11/03)
- Require upgrade to low emission diesel transportation refrigeration unit engines (12/03)

California Regulatory Actions (2) (Past two years)

- Require PM retrofit or upgrade to low emission diesel engines for portable power equipment (2/04)
- Require reflash of 1993-98 diesel truck engines that had high cruise NOx emissions (3/04)
- Require diagnostics (OBD) for 2007+ new diesel truck engines (5/04)
- Limit idling for diesel trucks to 5 minutes (7/04)
- Impose GHG limits for new passenger vehicles, beginning with 2009 models (9/04)

Ambient AQ Standards Review 2004-2005

- Nitrogen dioxide Ambient Air Quality Standard
- Ozone Ambient Air Quality Standard
**Carl Moyer Program**

- **1999-2004**
  - $150 million total funded for 6 years
- **Beyond 2004**
  - $141 million continued funding per year
  - Expand program for new source types:
    - (agricultural, light-duty scrap and repair, school buses, and fleet modernization)
  - More grants to reduce NOx, PM, or ROG emissions

**Proposed Future Agenda Items (1)**

- **2005**
  - Amendments to Revise Clean Fuels Program Regulation
  - Marine Auxiliary Engine Measures
  - ATCM for Harbor Craft Retrofit Component

**Proposed Future Agenda items (2)**

- **2005**
  - Fleet Rule for Transit Agencies: Non-Urban Buses
  - Diesel PM Control Measure for Publicly Owned or Operated Fleets
  - HDD Truck Idling (New Trucks)
  - Revisions to Aftermarket Parts/Catalyst Rulemaking
  - OBD II Biennial Review for LDVs
  - Parts Replacement Program
  - On-Road/Off-Road Private Fleets

**Current Issues & Future Challenges**

- **Reducing exposure to PM**
  - New diesel engine clean-up on schedule
    - 95%+ PM reduction for new on- and off-road engines
  - Clean-up of existing diesel engines still in infancy
    - Success with fleets such as buses and trash trucks
    - Private fleets next: Issue is high cost of filters/re-engine
    - Agricultural engines last: few retrofit devices; high cost
  - Special focus on goods movement needed
    - Container trade and related emissions growing
    - Rail/ship emissions poorly controlled
Current Issues & Future Challenges
Reducing greenhouse gas emissions

- Phase-in 2009-16 -- 30% less CO$_2$eq
- For cars ~ equal to EU voluntary standards (cars)
- Compliance using existing technologies
  - Combustion, transmission
  - Hybrid models expanding, significant demand
  - Diesel: Could meet LEV III by ~2008
- Legal challenge expected
- Opposition from US EPA possible - waiver
- NAS study -- challenge to CA authority to regulate

Current Issues & Future Challenges
Integrating air quality and energy policy

- Reduce transportation petroleum use
  - National CAFÉ; Fischer Tropsch diesel blend; increased use of alternatives e.g. H$_2$
  - Goal: Reduce use to 15% below 2003 by 2020
- Longer term goal -- increase use of hydrogen
  - Fuel Cell Partnership - vehicle demonstrations
  - Hydrogen Highway Network - initial fueling network