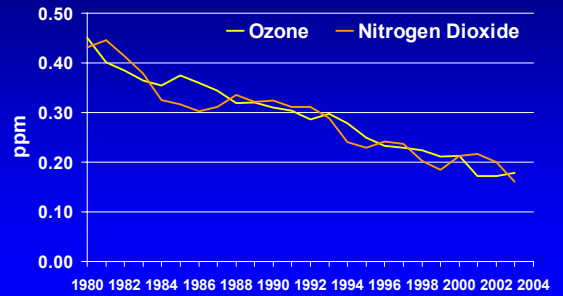


Health Impacts and Mitigation of Air Pollution

Alan C. Lloyd, Ph.D.
Chairman
California Air Resources Board
October 20, 2004

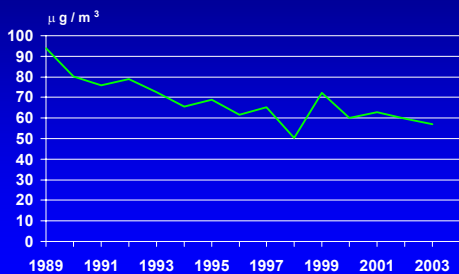
International Council on Clean Transportation
Bellagio, Italy

California Air Quality Trend (1-hour Peak Indicator)



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



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Children and Air Pollution

- Children are sensitive to air pollution
 - growing and developing
 - more time outdoors
 - more active and greater exposures



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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

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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

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Annual Lung Function Testing



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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

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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)

Gauderman WG et al. 2000. Association between air pollution and lung function growth in southern California Children. Am J Respir Crit Care Med 162:1383-1390.

Gauderman WG et al. 2002. Association between air pollution and lung function growth in southern California Children: Results from a second Cohort. Am J Respir Crit Care Med 166:76-84.

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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

Gauderman WG et al. 2004. The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age. N Engl J Med 351:1-11.

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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)

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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

Avol EL et al. 2001. Respiratory effects of relocating to areas of differing air pollution levels. *Am J Respir Crit Care Med* 164:2067-2072.

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Asthma

- Asthma causation related to high ozone and exercise

McConnell R, et al. 2002. Asthma in exercising children exposed to ozone: a cohort study. *Lancet*. 359:386-91

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Bronchitis In Asthmatics

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

McConnell R, et al. 1999. Air pollution and bronchitic symptoms in southern California children with asthma. *Environ Health Perspec* 107:757-760.

McConnell R, et al. 2003. Prospective study of air pollution and bronchitic symptoms in children with asthma. *Am J Respir Crit Care Med* 168:790-797.

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School Absenteeism

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

Gilliland FD, et al. 2001. The effects of ambient air pollution on school absenteeism due to respiratory illnesses. *Epidemiology* 12:43-54.

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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)

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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)

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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)

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Ambient AQ Standards Review 2004-2005

- Nitrogen dioxide Ambient Air Quality Standard
- Ozone Ambient Air Quality Standard

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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 NO_x, PM, or ROG emissions

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Proposed Future Agenda Items (1) 2005

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

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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

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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

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Current Issues & Future Challenges

Reducing greenhouse gas emissions

- Phase-in 2009-16 -- 30% less CO_{2eq}
- For cars ~ equal to EU voluntary standards (cars)
- Compliance using existing technologies
 - Combustion, transmission
 - Hybrid models expanding, significant demand
 - Diesel: Could meet LEV II by ~2008
- Legal challenge expected
- Opposition from US EPA possible - waiver
- NAS study -- challenge to CA authority to regulate

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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. H₂
 - 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



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