

Traffic-Related Pollution and Health

Policy Issues

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My role

- ◆ Faculty member
 - Department of Preventive Medicine
 - Keck School of Medicine
 - University of Southern California
 - Los Angeles

- ◆ Director, Community Outreach and Education Program:
 - Southern California Environmental Health Sciences Center
 - ◆ USC/UCLA scientists
 - ◆ Funded by National Institute of Environmental Health Sciences (NIEHS)
 - Children’s Environmental Health Center
 - ◆ Funded by NIEHS and U.S. EPA

Centers

- ◆ Goal
 - to improve health by
 - ◆ investigating environmental exposures
 - ◆ studying who might be most susceptible
 - ◆ linking research with the communities we serve
- ◆ Center scientists study
 - respiratory disease, cancer and adverse reproductive outcomes
 - and develop new methods for designing studies and evaluating exposures
- ◆ Major focus
 - health impacts of air pollution

The USC Children's Health Study

◆ **Primary Funders**

- California Air Resources Board
- NIEHS

◆ **Other Important Funders:**

- U.S. EPA
- NHLBI
- South Coast AQMD
- Hastings Foundation

12 CHS Communities



12 Communities Studied

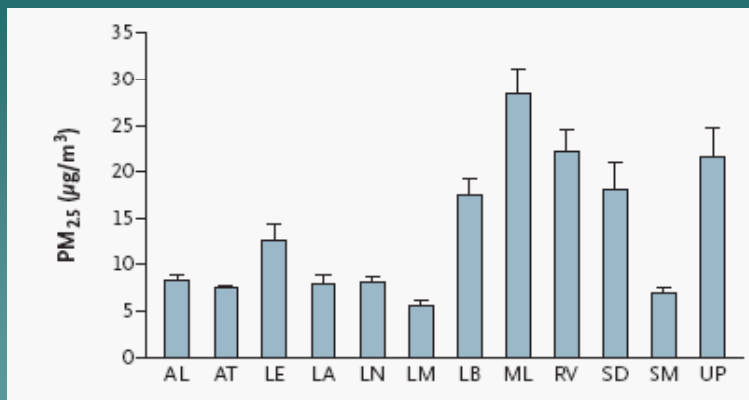
- ◆ Studied “regional pollution”
- ◆ Pollution measured by central site monitors in communities
 - Placed in locations that are not expected to be heavily impacted by a local source, like a refinery or a busy road

Regional Pollution

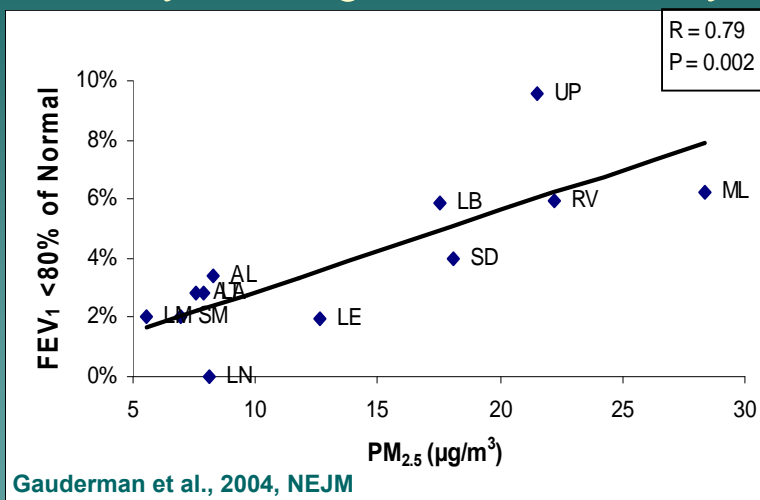


Photo Credit to W. Zamore

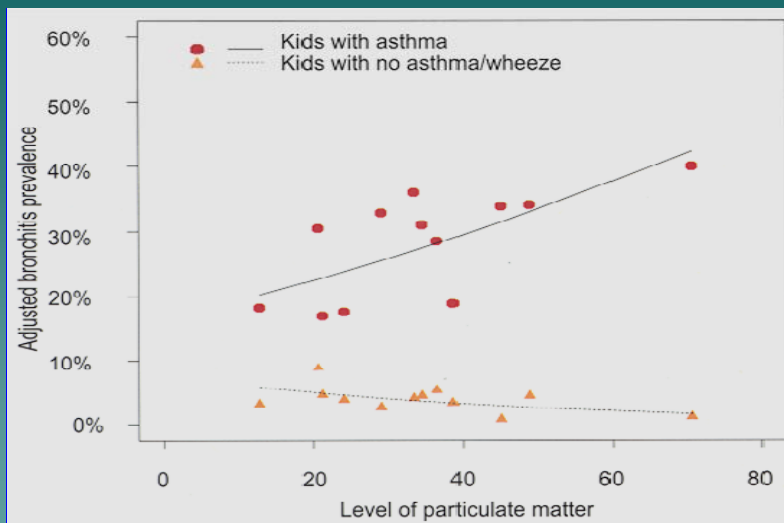
Mean PM_{2.5} levels, 1994-2000



Higher Percentage of Children with Abnormally Low Lung Function More Likely in a High PM Community



Asthma is Worse in a High PM Community



(McConnell, et al., 1999; see also McConnell et al., 2003)

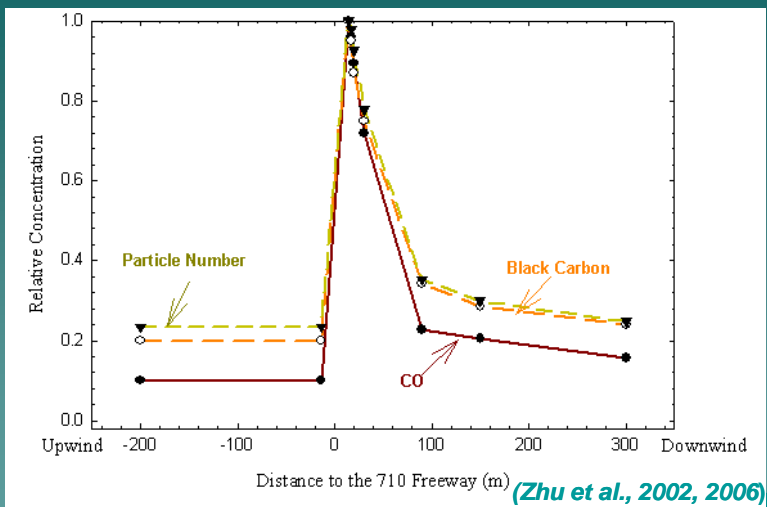
What About Local Exposures?



- ◆ Many places we don't know the levels –air pollution regulatory monitors are currently not placed near busy roads and freeways
- ◆ Thus, “localized exposures” are not regulated or routinely measured

◆ BUT.....

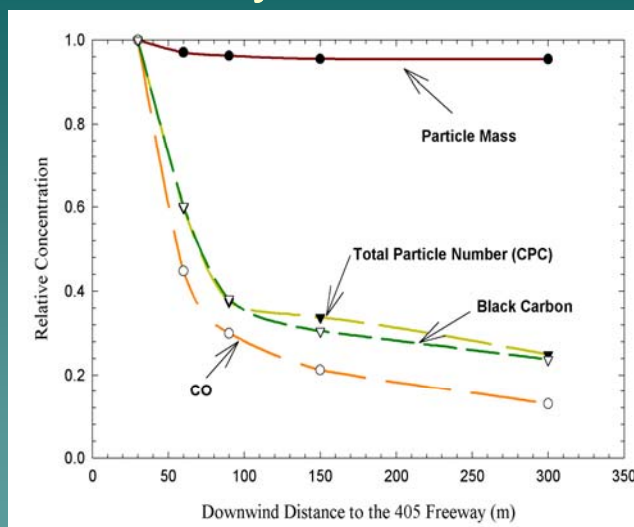
Air Quality is Worse Near a Freeway

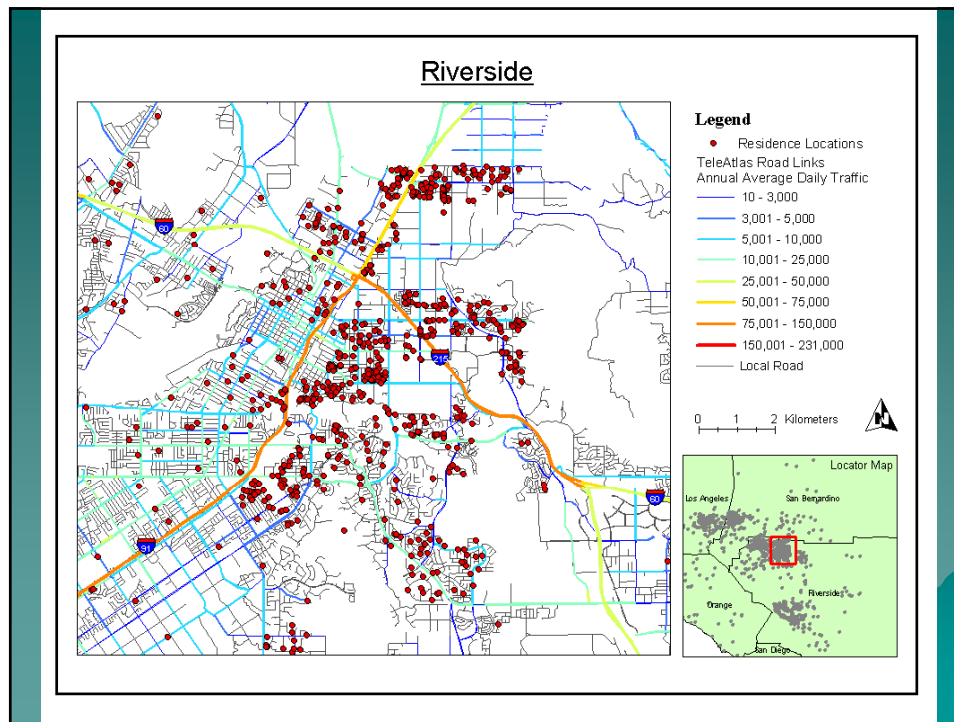


Black carbon (diesel); CO; ultrafine particle numbers. Other pollutants are also high near freeways (e.g. NO₂)

PM Dynamics

- ◆ Fine particles, CO, and roadside distance
- ◆ We measure PM mass, and not particle number





Traffic and Children's Health

Living close to traffic associated with:

- ◆ Increased risk of asthma
(Gauderman et al, 2005; McConnell et al., 2006)
- ◆ Increased respiratory symptoms
(Kim et al., 2004; multiple European and U.S. studies)

Does traffic affect lung development?



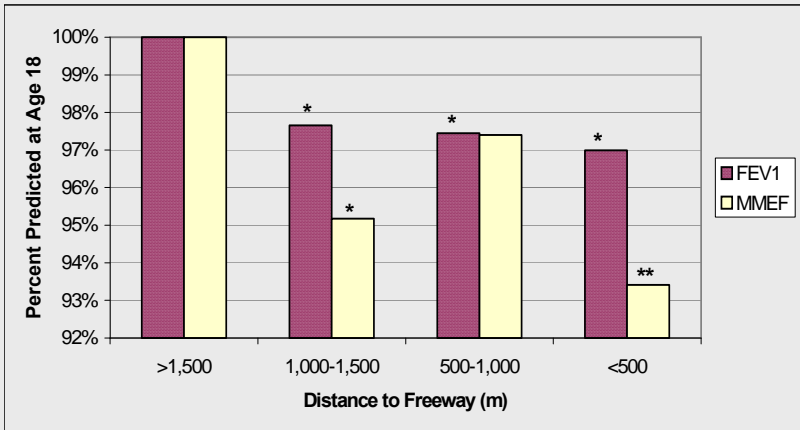
Annual lung function testing

- 3,677 4th grade children
- Annual tests through 12th grade

Lung function measures:

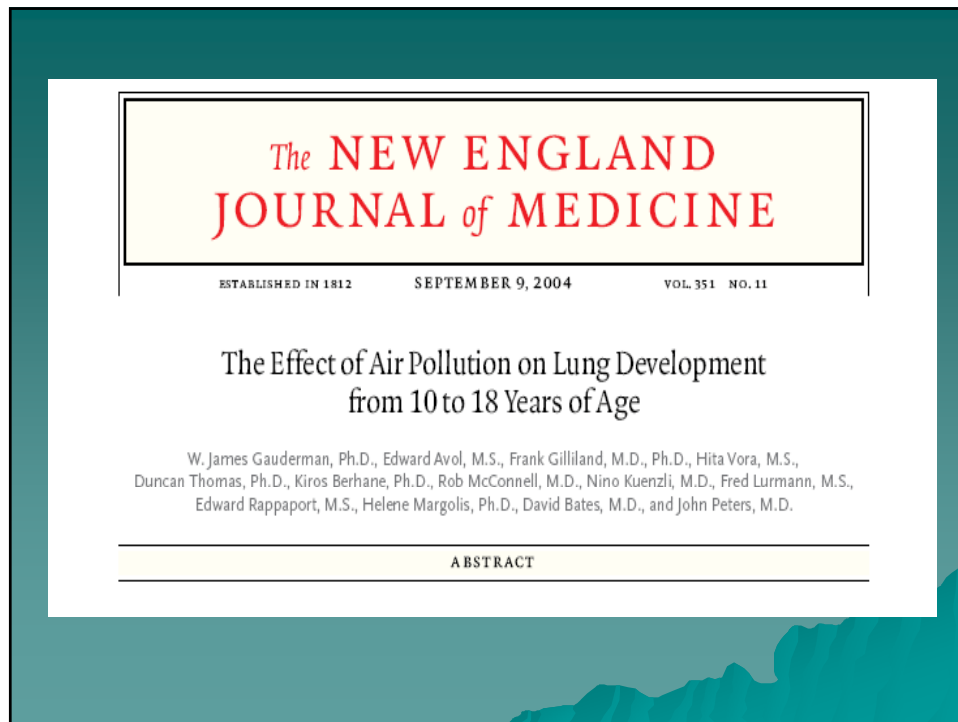
FEV₁: Overall lung health
MMEF: Small airways health

Lung Function at Age 18 is 3% – 7% Lower than Expected for Children Living within 500 Meters of a Freeway



* p<0.05; ** p<0.01

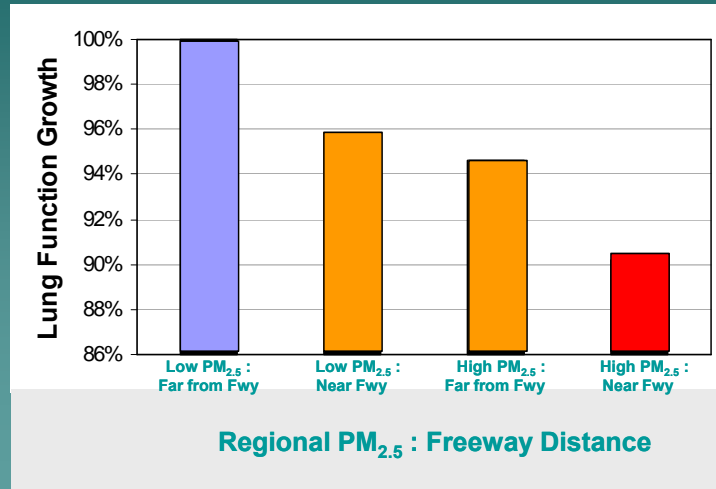
Gauderman et al., Lancet, 2007



Why is reduced lung function important?

- ◆ Lung function believed to be a predictor of long term respiratory and cardiovascular health

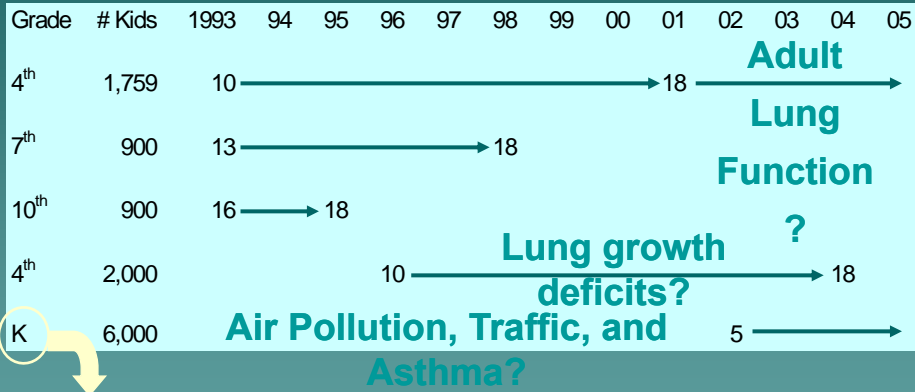
Regional AND Local Air Pollution Affect Adolescent Lung Function Growth



CHS: Ongoing Studies (Funding: NIEHS, NHLBI, EPA)

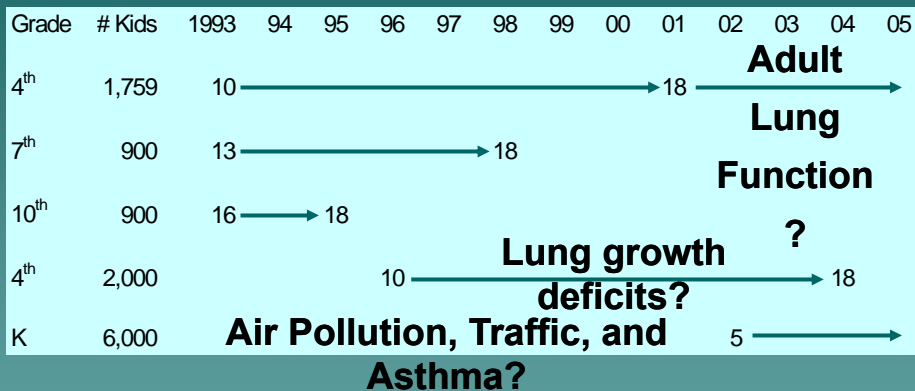
Grade	# Kids	1993	94	95	96	97	98	99	00	01	02	03	04	05	
4 th	1,759	10	→ 18										Adult Lung Function		
7 th	900	13	→ 18												
10 th	900	16	→ 18												
4 th	2,000	10	→ 18										Lung growth deficits?		

CHS: Ongoing Studies (Funding: NIEHS, NHLBI, EPA)



New cohort of kindergarten children

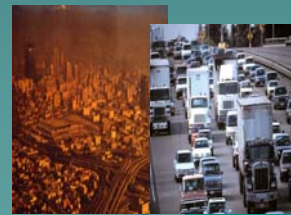
CHS: Ongoing Studies (Funding: NIEHS, NHLBI, EPA)



Genetics: Do genes affect above relationships?

Summary

- ◆ Air pollution has long-term health effects in children
- ◆ Both regional and local effects
- ◆ Regulations
 - Regional pollution regulated (criteria pollutants and mobile source air toxics)
 - Localized pollution not regulated



Other Effects of Living Near Busy Roads and Highways

- ◆ Many other studies now
- ◆ Developmental effects:
 - Mothers who live near busy roads when pregnant are more likely to have low birth weight or premature babies (Ritz et al, 2002)
 - ◆ Biggest risk within 750 feet for premature babies (Wilhelm, 2006)

Heart Disease

- ◆ Exposure to higher particle levels are associated with heart attacks and deaths
- ◆ New study (*July 2008, NIEHS journal Environmental Health Perspectives*)
 - Higher long-term exposure to traffic is associated with development of cardiovascular heart disease in ostensibly healthy middle-aged persons
 - ◆ First study to show *new cases of heart disease* in association with traffic-related pollution
 - Kan et al., 2008

Studies of Diesel

- ◆ Diesel particulate matter associated with cancer in workers
 - 30 occupational health studies of railroad workers and truck drivers
- ◆ New study (*Hart, 2008*)
 - Exposure to diesel exhaust in railroad workers linked to COPD
 - ◆ Chronic obstructive pulmonary disease
 - E.g., bronchitis and emphysema

Summary about Traffic

- ◆ Contributes to overall mix of regional pollution that makes people sick
- ◆ Causes local pollution – near busy roads and other hubs – that makes people sick
- ◆ Not only where you live:
 - Pollution penetrates into our homes, but also into our cars, & our schools



Issues - Siting

- ◆ Today, we don't know a "safe" distance between a sensitive receptor (school, home, daycare center, hospital) & a heavily trafficked-road
 - Some studies indicate that a buffer of even 1500 feet is still a problem
 - Many think in terms of 500 feet – that you don't want to sites homes or schools closer than 500 feet to a busy road

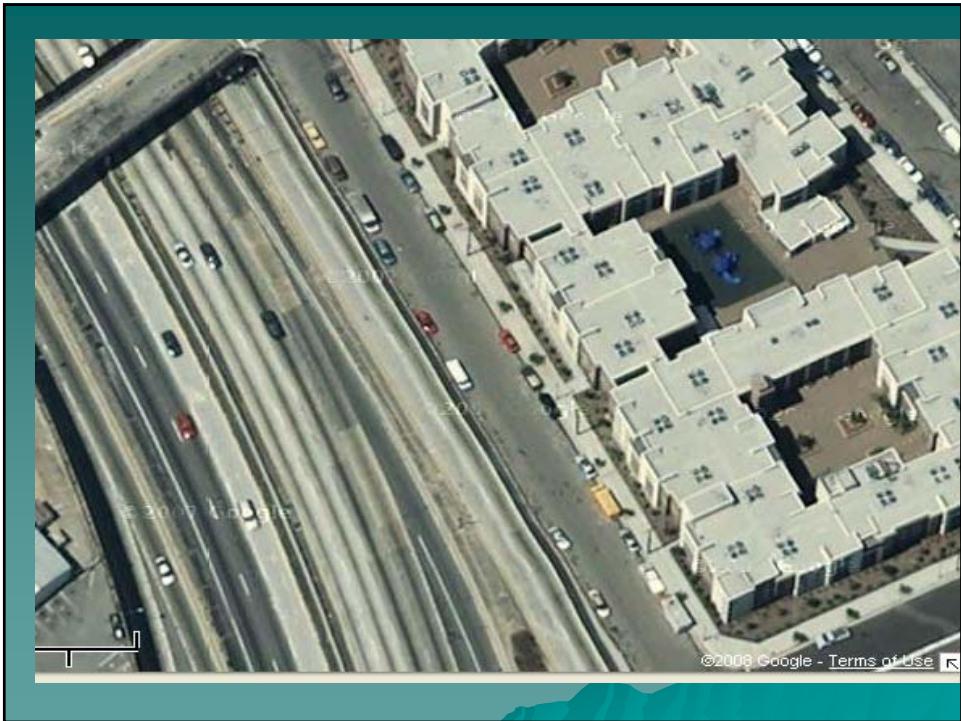
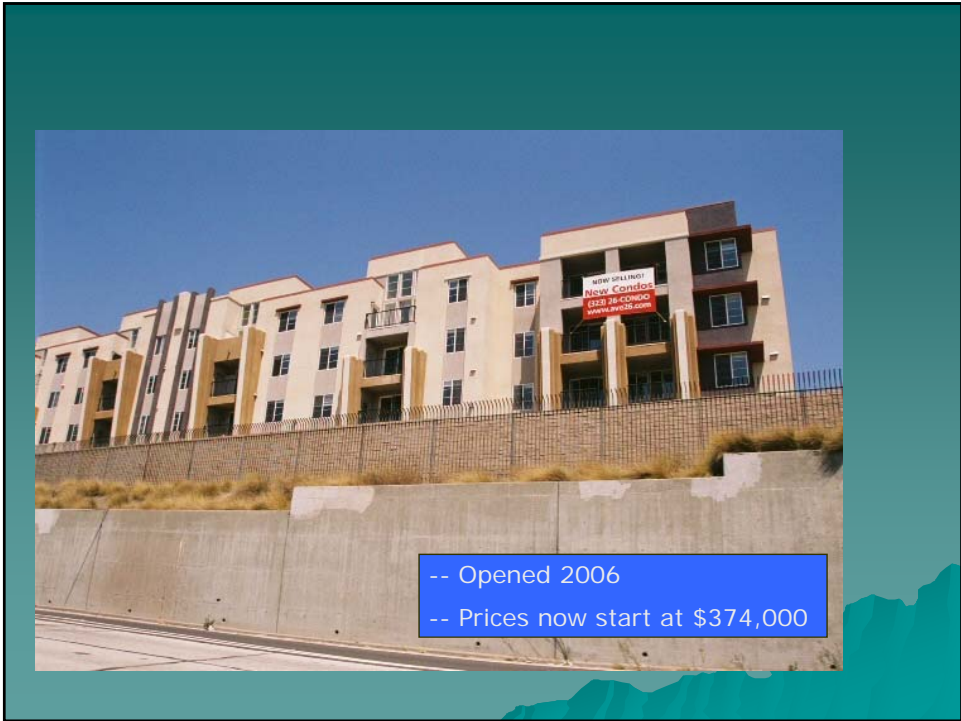
A large problem ...

- ◆ 13% of U.S. housing units are located within 300 feet of a major transportation source
 - U.S. Census Housing Survey, 2003

Example #1

Housing

Puerto del Sol Condominiums
Los Angeles, CA



Immediately adjacent to the I-5 Freeway



One could say....

- ◆ That's a bad idea
 - We should not site new homes or schools within 500 feet of a busy road

- ◆ But what about the “flipside”
 - a new infrastructure project that proposes to expand a road or highway within 500 feet of schools or homes?

Married students' housing next to I-405-Freeway, Los Angeles



I-405 Freeway was widened 20 years after housing units were built

Possible Housing Solutions When Expanding Infrastructure

- ◆ Consider a separation between traffic and people
 - Buffers
 - Air Filters in homes – recommended for some freeway projects
 - ◆ Remove larger particles effectively
 - ◆ Do not remove volatile organics
 - ◆ Need more tests on efficiency/effectiveness for capturing ultrafine particles, if in fact they can do that

Possible Solutions Besides Buffers and Filters

- ◆ Better community design and fewer vehicles on the road
 - Mass transit, bikes, carpools, reduce commuting, smart growth, fees? etc.
- ◆ No emission – or lower emission – vehicles
- ◆ Mass transit
- ◆ Wiser land use decisions

Housing and Traffic Environmental Justice Considerations

- ◆ Children of color 3x more likely to live near high traffic density in California
 - *RS Green et al, Environ Health Perspect 2004 Jan; 112(1)61-6)*

Example #2:

Schools near freeways

Schools

- ◆ National study*
 - More than 30% are located within 400 meters of a major roadway
 - ◆ 10% within 100 meters



**University of Cincinnati researchers, funded by NIEHS
(Apatova et al, 2008)*

What if regional transportation planners wanted to expand the freeway over this school?



Example #3

Expanding freight rail &
expanding railyards near
homes and schools

Hudson School
Long Beach, CA





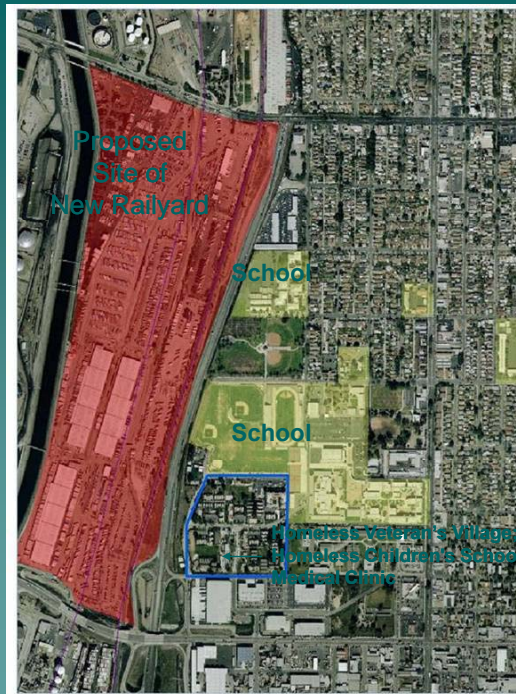


Current proposals to boost use of freight rail for accommodating more international trade containers

- ◆ Argue that freight rail is cleaner than moving containers by trucks



- ◆ BUT most railyards are sited in communities, near homes and schools
- ◆ Not just a practice of the past...
 - New proposal in southern California to site a new railyard right next to two schools



- ◆ Ports are expanding, even during economic downturn
 - High construction activity areas
 - ◆ L.A./Long Beach
 - ◆ Charleston, SC
 - ◆ Savannah, GA
 - ◆ Jacksonville, FL
- ◆ Expansion of ports often means
 - Expansion of freeway infrastructure
 - Expansion of rail movements

- ◆ Railyards are very polluting
 - Can create high diesel cancer risks
 - Studies by CA Air Resources Board of 18 yards





Example #4: Long Beach (I-710) Freeway



Schools

- ◆ 80 within one mile
- ◆ 12 within $\frac{1}{4}$ mile of the freeway

To Improve Public Health....

To Improve Public Health ...

- ◆ When expanding freeways, need to ensure that air pollution will actually be reduced
 - Consider requiring monitors along new or expanded highways when homes are in close proximity
 - No glib assumptions that simply assert that “new infrastructure will reduce idling, increase speed and reduce air pollution”
 - ◆ Models must consider how quickly highways become congested again
 - When congested, the “benefits” are lost

- ◆ If expanding freeways, need to do appropriate Mobile Source Air Toxic “hot spot” analysis
 - Federal Highway Administration does not “accept” the health research findings
 - If expanding near a school, highway developer (e.g., state DOT or FHWA) could pay to move playground away from the traffic
 - ◆ At least one settlement has demanded that

- ◆ If using filters as a mitigation measure, must ensure that the ones selected are evaluated
 - ensure they remove ultrafine particles
 - & ensure money for maintenance

- ◆ When engaging in any new infrastructure project, immediately involve the public and those who live near the proposed project or expansion
 - I-710 planners did not do that in CA
 - Residents were angry
 - Set back the process several years

- ◆ When urging more freight rail, consider where the railyards will be
 - They should not be sited close to homes and schools
 - If freight rail is encouraged nationally, locomotive emissions need better controls



- ◆ If expanding freeways and roads, or railyards, need to consider Environmental Justice issues



Research Needs

- ◆ More chronic disease studies
- ◆ More exposure assessment studies
 - E.g., there are no studies of actual exposures at or near railyards
- ◆ More toxicology studies
 - Need to know constituents that are causing harm
- ◆ U.S. Department of Transportation
 - Urge them to partner with U.S. EPA and federal research agencies like NIEHS to better understand the health impacts of transportation



The Benefits of Meeting Federal Clean Air Standards in California

Jane V. Hall and Victor Brajer
The Institute for Economic and Environmental Studies
California State University, Fullerton

Frederick W. Lurmann
Sonoma Technology, Inc.

November 2008

Scope of the Results

- ◆ Looked at economic value gained from fewer adverse effects if
 - we reduced exposures
 - ◆ by attaining the federal 8- hour ozone, and the daily and annual average PM_{2.5} standards

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Health Endpoints from Ozone Considered

- ◆ Ozone-related:
 - Respiratory hospital admissions
 - Emergency room visits
 - School absences
 - Asthma attacks
 - Days of restricted activity
 - Premature mortality

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Health Endpoints from PM_{2.5} Considered

- ◆ PM_{2.5}-related:
 - Premature death
 - Acute bronchitis, children
 - Chronic bronchitis, adults
 - Work loss days
 - Days of restricted activity
 - Respiratory symptoms, children
 - Non-fatal heart attacks
 - Respiratory and cardio hospital admissions
 - Children's asthma ER-related visits
 - Post neonatal mortality

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Economic Values Calculated

◆ New case of chronic bronchitis	\$400,000
◆ Hospitalization	\$ 40,000
◆ Work loss day	\$138-188
◆ School absence	\$ 98-165
◆ Acute bronchitis	\$ 117
◆ Asthma attack	\$ 53
◆ Emergency room visit	\$ 358
◆ Non-fatal heart attack	\$ 70,000

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Total Economic Value of Cleaning the Air

South Coast Air Basin

- \$21.62 billion *each year*
- \$1,250 per resident each year

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Implications

- Nearly all residents in the L.A. Air Basin face significant risks from air pollution
- There is no “clean” season (ozone in summer and PM_{2.5} in winter)
- As science advances, known risks grow
- Impacts of air pollution are not distributed evenly
- More exposures than average for Latinos and blacks

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Thank you

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