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Southern California Environmental Health Sciences Center

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Community Outreach and Education Program

Air Pollution and Children's Health

[COEP Home](#)Chapter excerpt from the [Health Atlas of Southern California](#)[Members](#)**Andrea Hricko, Kim Preston, Hays Witt & John Peters**[Community Partners](#)[COEP Focus Areas](#)[Community Involvement](#)[Town Meeting 2005 on Goods Movement and the Ports](#)[Photo Gallery](#)[Resources](#)

Location of 12 Communities Included in the USC Children's Health Study



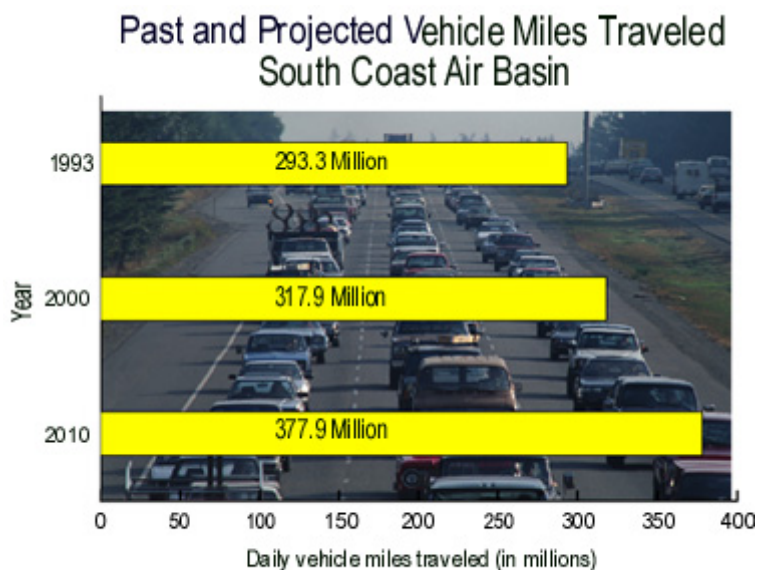
Figure 1

Controlling air pollution in the Los Angeles basin presents a challenge unrivaled anywhere in the United States. Local topography and weather conditions are ideally suited to the generation of air pollution. Angeles' cherished, yet pollutant-trapping, ring of mountains set stage for a dilemma long before millions of cars and trucks filled freeways. Indeed, lore has it that early inhabitants referred to the Gabriel Valley as the "Valley of Smokes" - and on many days that name still seems apt.



Figure 2

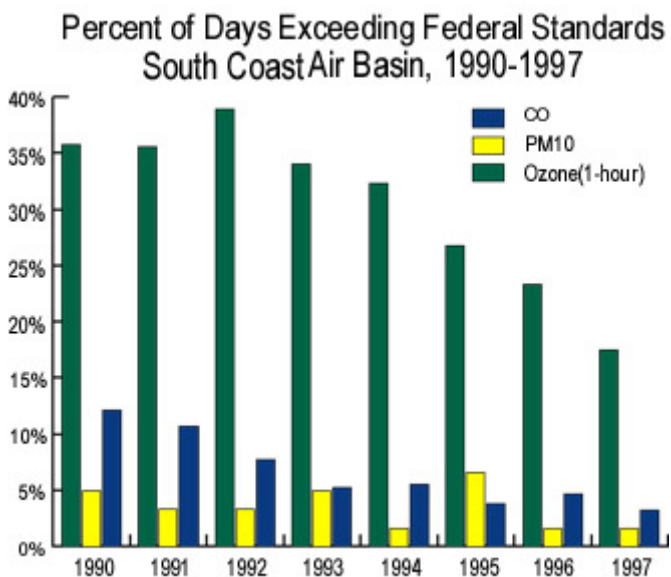
Despite extensive emission control efforts that significantly improved L Angeles' air quality over the last 30 years, views of thick haze obscuring downtown skylines remain a familiar sight. The South Coast Air Basin including all or parts of Los Angeles, Orange, Riverside and San Bernardino Counties (See **Figure 1**), maintains the unfortunate distinction of having the worst air quality in the country, for both particulate matter (PM10) and ozone (O3) (See **Figure 2**).



Source: 1997AQMD

Figure 3

Industry, an ever-growing population, and more than 12 million vehicles pose a formidable challenge for regulatory agencies trying to achieve and maintain air quality standards designed to protect human health (See **Figure 3**).



Source: 1997 AQMD???

Figure 4

Air Pollution Trends

Six major air pollutants, referred to as "criteria pollutants" - ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead - are routinely monitored for compliance with air pollution standards. The South Coast Air Basin remains in violation of the ozone, particulate matter, and carbon monoxide standards. Ozone and particulate matter are considered the most critical to human health.

Some progress has been made in reducing levels of particulate matter since 1990; more significant reductions have been achieved in reducing ambient ozone (See **Figure 4**).

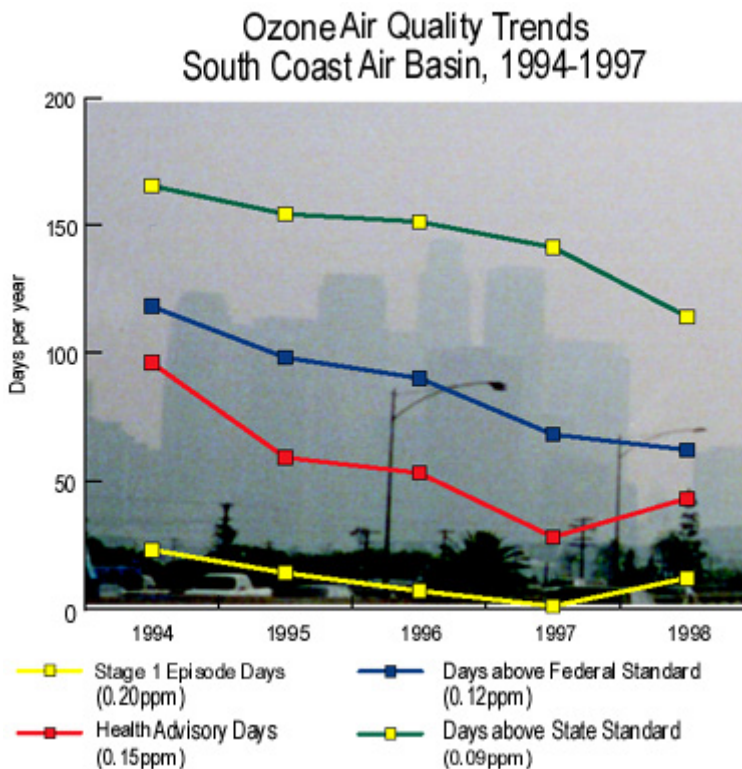
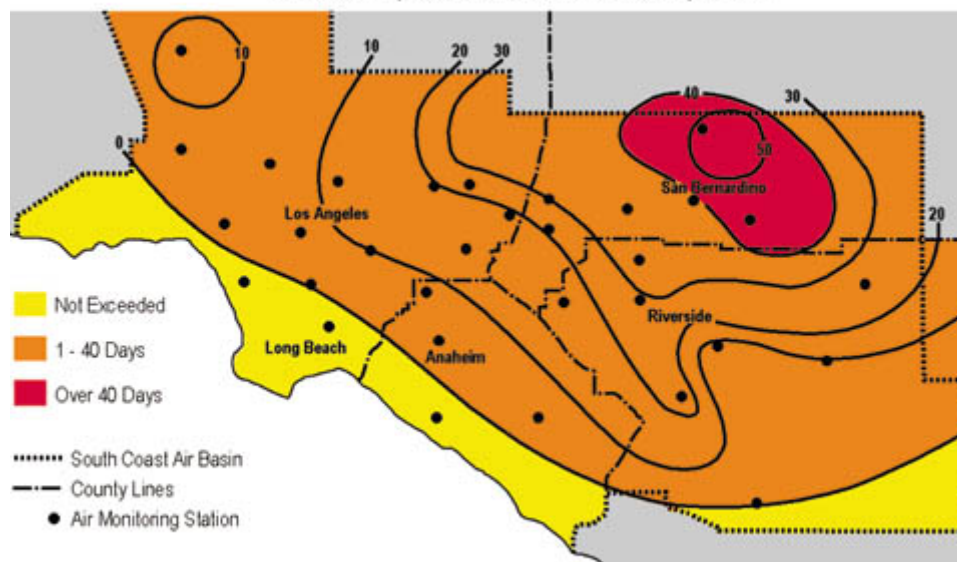


Figure 5

In 1976, there were a staggering 102 Stage 1 smog episodes in South Coast Air Basin; in 1998, there were only 12 such episodes. St...

1 episode is defined as the level where air pollution is considered to "very unhealthy" (ozone above 200 parts per billion). Despite the sharp reductions, 1998 ozone levels violated the federal standard (120 ppb) 62 days, and the state standard (90 ppb) on 114 separate days (See **Figure 5**). With these levels, the 80 ppb standard for ozone proposed by the United States Environmental Protection Agency (EPA) to protect children would be violated more than three out of 10 days in the So Coast Air Basin.

Number of Days Exceeding the Federal Standard (1 hour average > 0.12 ppb for Ozone, South Coast Air Basin, 1998



Figure

Along with the downward trend in concentrations of some pollutants over the past decade, another change is occurring. The worst ozone used to be in the eastern San Gabriel Valley; today the highest observed ozone concentrations are in the Central San Bernardino mountains (See **Figure 6**).

A 1999 Air Quality Management District (AQMD) study finds an important reason for the geographic shift: better emission controls and new fuel formulations are reducing volatile pollutants (such as vehicle exhaust and paint fumes) and causing them to react more slowly in intense sun. As a result, when pollutants build up in the traffic-congested western edge of the air basin, it takes longer to turn them into smog. By the time the chemical reaction occurs, the sea breezes have blown the smog all the way out toward the mountains.

Children's Special Vulnerability

Children are believed to be especially vulnerable due to higher relative doses of air pollution and increased susceptibility as their lungs develop and their bodies grow (See **Box 1**).

Why Children Might Be More Affected by Air Pollution than Adults

- *Higher relative doses – they breathe more air per unit of body weight
- *Smaller diameter airways
- *More time outdoors
- *More active, especially in the afternoon
- *Closer to the ground level and sources of vehicle exhaust

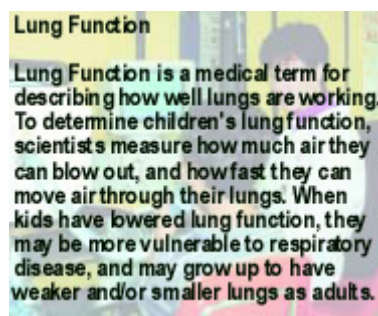
Box

Acute Effects of Air Pollution

In the past, rare severe air pollution episodes have been associated with increases in both child and adult mortality rates. Acute or short-term effects of air pollution are also well-documented at levels of pollution similar to those that children breathe on a smoggy Southern California day. Air pollution is linked to multiple adverse health effects in children, including increased respiratory symptoms and hospitalizations, respiratory illnesses, increased or more severe asthma episodes, decreases in lung function, and longer-lasting lung infections. High levels of ozone and fine particulates are specifically linked to aggravation of children's asthma. Exposure to particulate matter is associated with increased lung irritation and respiratory symptoms in children, together with decrements in lung function.

Longterm (Chronic) Effects of Air Pollution in Children

In an attempt to clarify the relationship between air pollution and chronic respiratory health effects in children, researchers at the USC Keck School of Medicine are measuring pollutant levels in 12 Southern California communities, and tracking the respiratory health of more than 3,600 students. The study is supported by the California Air Resources Board (ARB), along with



Box

funding from the National Institute of Environmental Health Sciences, the US EPA, and the Hastings Foundation.

By comparing children's health in communities with different pollutant profiles for four major air contaminants (ozone, particulates, nitrogen dioxides, and acids), researchers hope to pinpoint which pollutants are linked to specific health problems. Particulate matter and nitrogen dioxide appear to be the most strongly associated with the development of chronic lower respiratory symptoms in asthmatic children. Initial results indicate that exposure to pollutants retards the growth of lung function in children. Nitrogen dioxide (perhaps as an indicator of exposure to traffic exhaust) appears to be most highly associated with this effect in young children (See **Box 2**).

Also, results show that children who spend more time outdoors have stronger associations between air pollution and reduced breath capacity.

Asthma and Air Pollution

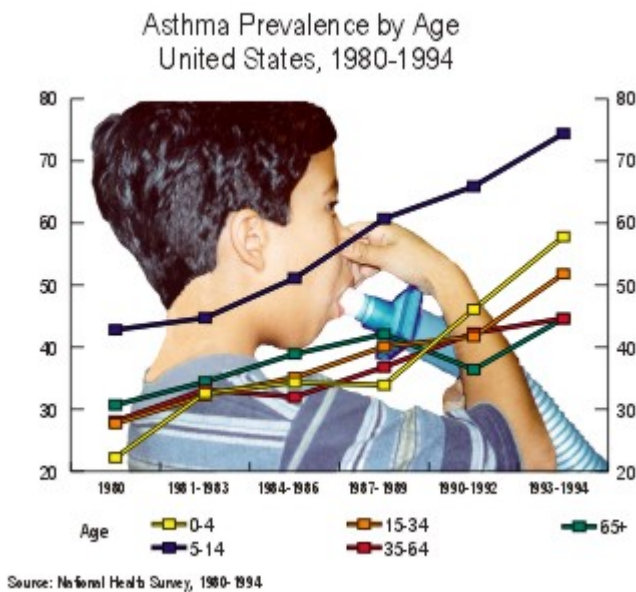


Figure 7

Although most studies show that air pollution does not appear to cause asthma directly, children's asthma is known to be exacerbated by pollution. There is no tracking system for asthma in California, so exact figures on how many children have the illness is unknown. The prevalence of self-reported asthma, especially among children, has risen dramatically in the United States over the past 20 years (See **Figure 7**

The Impact of Particulate Matter on Bronchitis Prevalence Among Children with Asthma, Southern California, 1993

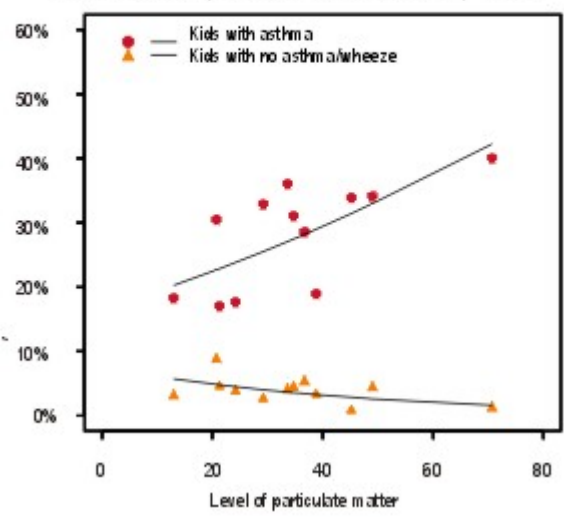


Figure 8

The USC Children's Health Study showed that children with asthma develop more symptoms of bronchitis (cough and phlegm) as levels of particulate air pollution increase (See **Figure 8**).

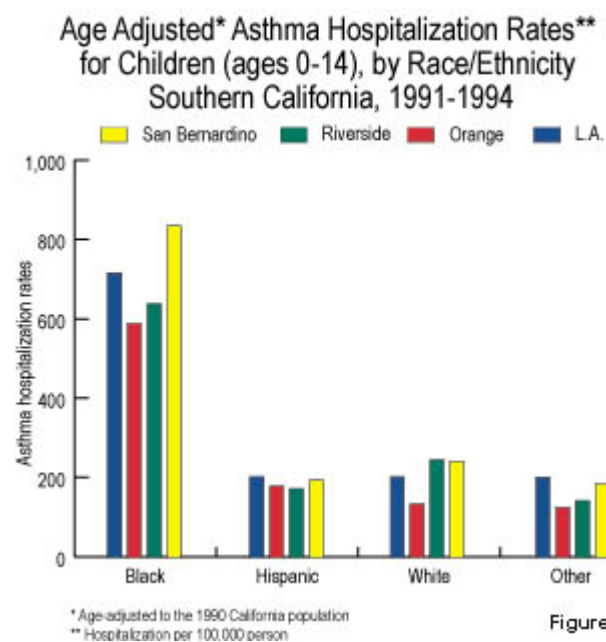


Figure 9 Figure 9

Nationwide, the highest increases in asthma are found in urban areas : among African-Americans and Latinos. Although prevalence figures asthma are not available for Southern California, the asthma hospitalization rates for African-American children in Southland counties are two to four times higher than for other ethnic or racial groups (Figure 9). The increased rates may be due to genetic or environmental factors, lack of access to quality health care, poverty or poor quality housing, or a combination of these factors.

Indoor air pollution is known to play a role in the increase in children's asthma. Environmental tobacco smoke, allergens from dogs, cats, cockroaches and dust mites, as well as mold and mildew are implicated. The initial results of the Children's Health Study show an increase in respiratory illness among children who live in homes with pets, household pests, dampness, and smokers.

Emerging Concerns

Air Toxics - Thousands of chemicals are in the air we breathe every day. The six "criteria pollutants" typically monitored to assess air pollution, such as ozone and particulates, are not the only air pollutants that threaten children's health. Levels of "air toxics" in Southern California are of increasing health concern. Air toxics are pollutants that are linked to cancer, neurological damage, genetic mutations, birth defects, and other chronic illnesses.

Diesel Emissions - Diesel emissions account for a significant portion of the country's emissions of nitrogen oxides and fine particulate matter. The particles in diesel exhaust are small enough to be inhaled deeply into the lungs, and studies show that workers exposed to higher levels of diesel emissions are more likely to develop lung cancer. In August 1994, the California Air Resources Board declared that these particles, termed "diesel particulate matter," are toxic air contaminants and must be further controlled to protect the health of Californians.

There is also growing evidence that children with allergies have an enhanced allergic response when they are also exposed to diesel exhaust. Particulate air pollution from diesel vehicles may be related to an increase in asthma and allergic rhinitis (runny nose).

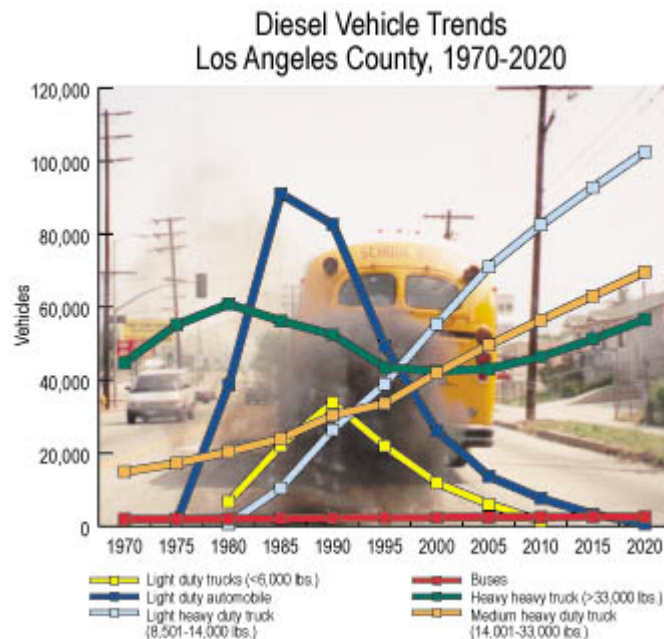


Figure 10

There has been a marked increase in the number of heavy duty die trucks on Los Angeles County highways since 1980, with projections for continuing increase in volume. (See **Figure 10**). (Note that regulatory standards in the 1990s, limiting particulate matter or soot from diesel automobiles and light duty trucks, resulted in a sharp decline in sales vehicles in those categories.)

The EPA projects that by 2010, diesel engines will account for more than half the mobile source emissions of nitrogen oxides, and nearly 70% the mobile source particulate matter (PM) emissions nationwide. Automobile manufacturers are also considering converting some of their increasingly popular sport utility vehicles from gasoline to diesel engines because they consume less fuel and emit fewer greenhouse gases linked to global warming. Such a switch, however, is expected to be significantly harder in California due to recent stricter emission controls.

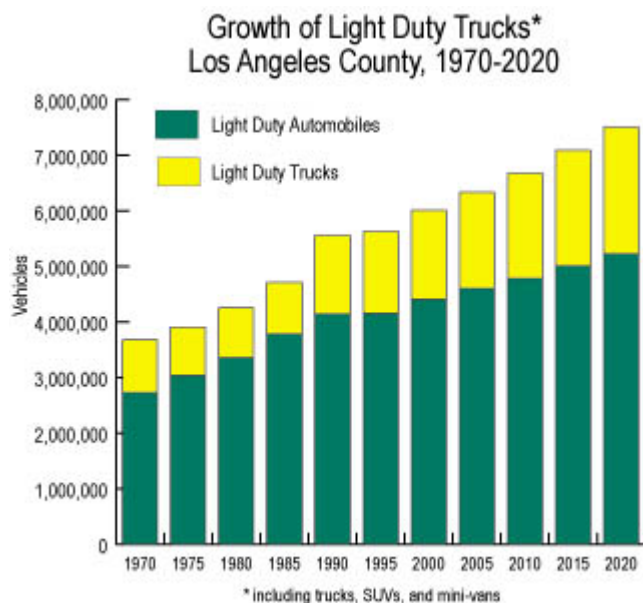


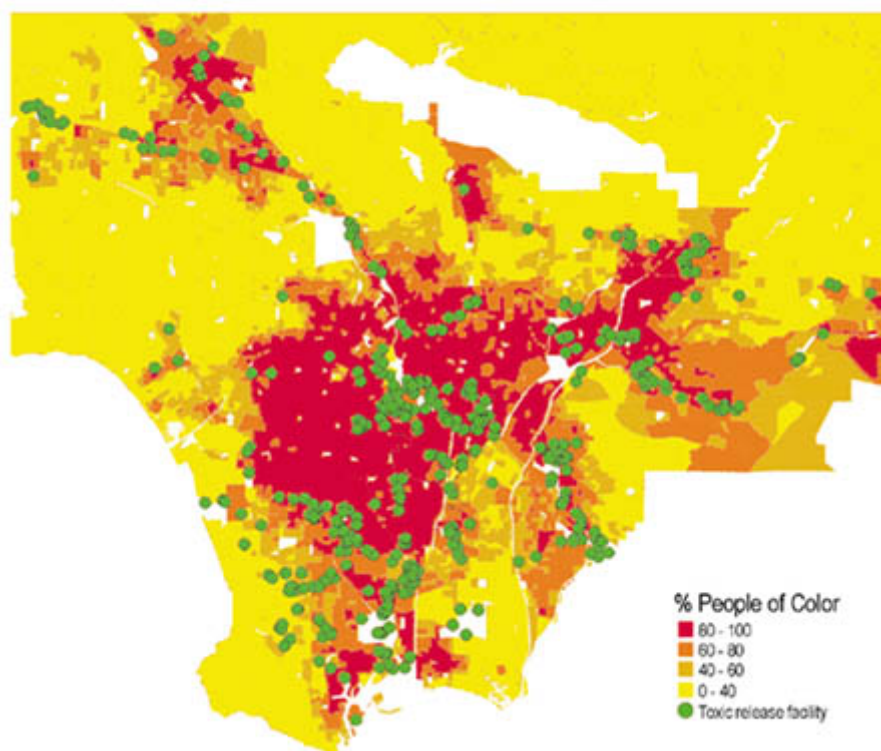
Figure 11

Sport Utility Vehicles - More and more Americans are buying sport utility vehicles (SUVs). As of November 1998, SUVs (which are in a class that includes sport utility vehicles, minivans and light trucks) now account for more than 50% of the U.S. passenger sales for new vehicles. Source: U.S. Department of Transportation, Bureau of Economic Analysis.

sales in California at an all-time high (See **Figure 11**). With some sport utility vehicles emitting 2-3 times as much air pollution as a regular car, the growing number of SUVs on our freeways threatens costly and hard-won gains in air quality. In an attempt to prevent an erosion of air quality, earlier this year California regulators announced tighter pollutant standards for SUVs and light pickup trucks - the first state to do so.

Traffic Density - Although air pollution from vehicles on South California freeways is recognized as a health hazard, few studies have considered what happens to the health of children who live or attend school near roads with heavy traffic. Recent studies in the Netherlands show decreased lung function and increased respiratory illness in children living near major roadways, particularly related to diesel particles. Dutch researchers find that asthma is more often reported in children living within 100 meters of a freeway.

Toxic Release Facilities Relative to Racial/Ethnic Composition of Neighborhoods, Los Angeles, 1996



Reproduced with permission from Communities for a Better Environment, "Holding Our Breath", 1996.

Fig

Environmental Justice - The mixed-use nature of many lower-income Southern California neighborhoods, with homes adjacent to industrial operations, is leading to demands for "environmental justice" by residents and community groups concerned about the threat of exposure to toxics (See **Figure 12**). The South Coast Air Quality Management District is studying the levels of air toxics in neighborhoods near industrial facilities to evaluate disproportionate impacts on poor and minority neighborhoods.

Recommendations

Southern California's population — and the number of vehicles on roads — continues to grow, and it is an ongoing battle to ensure that Southern California's air quality improves rather than deteriorates. Stricter controls on all petroleum-fueled vehicles will be needed, especially on the increasing numbers of sport utility vehicles, which

produce higher emissions than regular cars. Traffic density and proximity of homes and schools to busy freeways and roads constitute an important public health concern.

Issues of environmental justice and disproportionate impact on low income and minority neighborhoods are increasingly raised. Indoors a broad-based campaign is needed to focus on reducing all sources of indoor pollution (e.g., household pests, mold, mildew, and environmental tobacco smoke) which exacerbate asthma.

The number of children particularly susceptible to air pollution, children with asthma or other respiratory problems is growing. It is essential to identify the role of diet (e.g., low fruit and vegetable intake), level of exercise, genetics and other factors that could render certain children more susceptible to the chronic effects of air pollution.

Without innovative and aggressive control strategies, dramatic improvements in the internal combustion engine, much stricter control of diesel emissions, or a change to zero-emission or near-zero emission vehicles, the gains in improving Southern California's air quality will be threatened, with the predictable consequence of impairment of children's health.

Southern California Environmental
Health Sciences Center

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