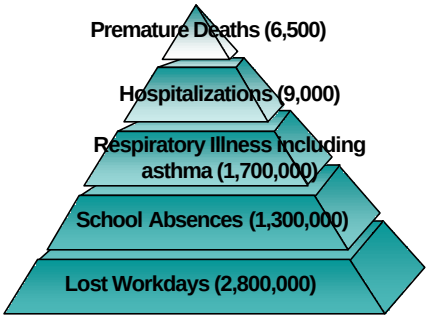
California Environmental Protection Agency
AIR RESOURCES BOARD

AMERICAN LUNG ASSOCIATION of California

Recent Research Findings:

Health Effects of Particulate Matter and Ozone Air Pollution, January 2004

Health Impacts of Air Pollution
(per year)



Although air pollution levels in California have improved significantly in the past few decades due to aggressive controls on vehicles and industry, many Californians still breathe the worst air in the nation. California's climate and geography are conducive to the formation and accumulation of air pollution (especially in Los Angeles and the Central Valley). These factors, combined with increasing population and economic growth, the dramatically increasing number of vehicle miles traveled, and other factors, make it difficult to reduce pollution levels. Higher and longer summer temperatures have also worsened smog problems. The concentrations of several pollutants not only exceed California's health-based standards, but are often measured at levels up to two or three times the standards.

Premature deaths linked to particulate matter or "PM" are now at levels comparable to deaths from traffic accidents and second-hand smoke (CARB 2002a). One of the most dangerous pollutants, fine particulate matter (e.g., from diesel exhaust and fireplace soot) not only bypasses the body's defense mechanisms and becomes embedded in the deepest recesses of the lung, but also can disrupt cellular processes. Population-based studies in hundreds of cities in the U.S. and around the world have demonstrated a strong link between elevated particulate levels and premature deaths, hospital admissions, emergency room visits, and asthma attacks. Groundbreaking long-term studies of children's health conducted in California have demonstrated that particle pollution may significantly reduce lung function growth in children (Peters et al. 1999, Avol et al. 2001, Gauderman et al. 2002).

Another dangerous pollutant is ozone. Ozone is a powerful oxidant that can damage the respiratory tract, causing inflammation and irritation, and induces symptoms such as coughing, chest tightness, shortness of breath, and worsening of asthma symptoms. Ozone in sufficient doses increases the permeability of lung cells, rendering them more susceptible to toxins and microorganisms. The greatest risk is to those who are more active outdoors during smoggy periods, such as children, athletes, and outdoor workers. Exposure to levels of ozone above the current ambient air quality standard leads to lung inflammation and lung tissue damage, and a reduction in the amount of air inhaled into the lungs. Recent evidence has, for the first time, linked the onset of asthma to exposure to elevated ozone levels in exercising children (McConnell 2002). These levels of ozone also reduce crop and timber yields, damage native plants, and damage materials such as rubber, paints, fabric, and plastics.

Scientific research is constantly uncovering new information on air pollution health effects and the mechanisms by which pollutants damage the heart and lungs and contribute to asthma attacks and premature death.

Air Pollution Causes Premature Death

Attaining the California PM standards would annually prevent about 6,500 premature deaths, or 3% of all deaths. These premature deaths shorten lives by an average of 14 years. This is roughly equivalent to the same number of deaths (4,200 – 7,400) linked to second-hand smoke in the year 2000. In comparison, motor vehicle crashes caused 3,200 deaths and homicides were responsible for 2,000 deaths (CARB 2002a, and CDHS 2000).

Air Pollution Leads to Hospitalizations and Emergency Room Visits

Attaining the California PM and ozone standards would annually prevent approximately (CARB 2003a):

- 4,000 hospital admissions for respiratory disease.
- 3,000 hospital admissions for cardiovascular disease.
- 2,000 asthma-related emergency room visits.

Air Pollution Contributes to Respiratory Illnesses and Cancer

Attaining the California PM and ozone standards would annually prevent about (CARB 2003a):

- 400,000 cases of lower respiratory symptoms (such as a cough) in children ages 7-14.

- 400,000 cases of upper respiratory symptoms (such as, runny nose, wet cough, and burning, itching, red eyes) in children ages 9-11.
- 8,000 cases of chronic bronchitis.
- 500,000 cases of respiratory illnesses (including colds and flus) in adults ages 18-65.
- 350,000 asthma attacks (all ages).

Although statistics are not available for cases of lung cancer caused by all air pollutants, it is estimated that exposure to diesel PM causes about 250 excess cancer cases per year in California (CARB 2000). A recent study provides evidence that exposure to particulate air pollution is associated with lung cancer (Pope et al. 2002). This study found that residents who live in an area that is severely impacted by particulate air pollution are at risk of lung cancer at a rate comparable to non-smokers exposed to second-hand smoke. Definitive lung cancer mortality numbers as a result of air pollution cannot yet be determined, but this study found an approximately 16 percent excess risk of dying from lung cancer due to fine particulate air pollution.

Air Pollution Contributes to Cardiac Illnesses

The hearts of sensitive individuals (for example, the elderly) may be affected when they breathe in fine particulate matter. One study shows that individuals with existing cardiac disease can be in a potentially life-threatening situation when exposed to high-levels of ultrafine air pollution (Peters et al. 2001). Fine particles can penetrate the lungs and may cause the heart to beat irregularly or can cause inflammation, which could lead to a heart attack. Understanding this link is extremely important in quantifying the detrimental health effects of air pollution.

Air Pollution Contributes to School Absences

On a statewide basis, 1.3 million school absence days would be avoided annually if the current levels of ozone were reduced to attain the established 1-hour state standard (CARB 2004).

Air Pollution is Costly

Air pollution can and does have a serious impact on the State's economy. Figures related to asthma costs and the valuation of air pollution exposure are significant and staggering. Analyses indicate that the benefits of California's air quality program exceeds the costs by a ratio of about 3 to 1 (CARB 2003c).

In 1998, it was estimated that asthma costs in California totaled $1.3 billion with hospitalizations and medications representing the largest direct expenditure (Asthma and Allergy Foundation of America 1998). Adult asthma patients spent an average of $5,000 annually on medical expenses, lost wages, transportation, asthma-control products, and other asthma related expenses (Cisteinas et al. 2003).

Furthermore, an annual value of over $3.5 billion is associated with hospitalizations and the treatment of major and minor illnesses, and about 2.8 million lost workdays each year, are all related to air pollution exposure in California. In addition, the value of premature deaths resulting from exposure to air pollution in excess of the State's PM2.5 standard is $43 billion (CARB 2003a, CARB 2003b, CARB 2002a, U.S. EPA. 1999).

Sensitive Groups Advised to Restrict Activities

Sensitive groups, including the elderly, people with heart or lung disease, children and infants, can be at increased risk of experiencing harmful effects from exposure to air pollution. Sensitive individuals are advised to restrict certain activities when pollution levels are elevated. Recently, the number of unhealthy days in some areas of California (based on California standards that are more health-protective than federal standards. (CARB 2003b) has been approximately one out of every three days for ozone (CARB 2002b).

Unhealthy Days in 2002		
	South Coast Air Basin	**San Joaquin Valley**
Days Above National 8-Hour Ozone Standard	96	125
Days Above State 1-Hour Ozone Standard	116	127

People in almost every area in California are exposed to PM levels over the current standards.

State's Population Living in Areas that Exceed PM2.5 Air Quality Standards*	
Annual National PM2.5 Standard	61%
Annual State PM2.5 Standard	89%

*Based on the proposed designations for PM2.5.

Summary of the Health Effects of Air Pollution

Particulate Matter Health Effects	Ground-level Ozone Health Effects
➢ Aggravated asthma ➢ Increased respiratory symptoms ➢ Chronic bronchitis ➢ Increased respiratory and cardiovascular hospitalizations ➢ Decreased lung function in children ➢ Lung cancer ➢ Premature deaths	➢ Aggravated asthma and possibly new cases of asthma ➢ Reduced lung capacity ➢ Increased susceptibility to respiratory illnesses ➢ Increased respiratory and cardiovascular hospitalizations

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