Health Effects of Ambient Air Pollution

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General facts about outdoor air pollution

- Over ½ of US citizens live in areas which have unhealthy levels of either ozone or particle pollution.
- About 81 million Americans live in areas with unhealthful short-term levels of particle pollution and 66 million live in areas with chronically unhealthful levels of particle pollution.
- Air pollution increases the risk of premature death from lung cancer and heart disease as well as contributes to lung disease.

General facts about outdoor air pollution

- Asthma is a major cause of health care costs. There are an estimated 10 million lost school days and has an annual national cost of approximately $12.7 billion dollars. Asthma is made worse by air pollution and increased asthma episodes have been associated with air pollution
- Approximately 160 million Americans are exposed to unhealthy air. The most at risk groups for the health effects are children and the elderly. Of the 160 million, 29 million are children less than 14 years of age and 15 million are over the age of 65 years

The Environmental Protection Association has set standards for 6 pollutants

- Ozone
- Particulate matter
- Carbon monoxide
- Sulfur dioxide
- Nitrogen dioxide
- Lead

- Additionally, there are other pollutants

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State of the Air Report

- The American Lung Association publishes a State of the Air Report for the United States and for individual States
- In this report, each county and metropolitan area is given a grade from A to F per county for particulate matter and for ozone

State of the Air Report

- No Texas cities are in the top 25 cities for particulate material
- However, Texas cities rank 6th and 8th for cities with the worst ozone levels.

State of the Air Report – Texas Counties

Grade	Particulate Matter	Ozone
A	7	3
B	12	1
C	4	5
D	1	3
F	1	16

Air pollution effects on children

- Children are outdoors more than adults, especially in the summertime when ozone levels are the highest.
- Compared with adults, children do more strenuous outdoor activities including exercise. This causes increased air pollution exposure.
- Compared with adults, children have a faster respiratory rate when accounting for body weight. This causes higher amounts of pollution being delivered to their lungs. Most damage is related to the amount of pollution inhaled in relation to the body weight.

Air pollution effects on children (Cont)

- Compared with adults, children's airways are narrower. This results in a greater clinical effect of inflammation than is seen in adults with the same amount of inflammation. Thus, identical amounts of irritation or inflammation caused by air pollution may cause significantly increased symptoms in children compared with adults.
- During exercise, both adults and children mouth breathe bypassing the filtering effects of the nose, allowing air pollution to penetrate into the lungs.

Air pollution effects on children (Cont)

- Air pollution, including ozone, can blunt the immune defenses and may result in more frequent respiratory infections. Children with more frequent respiratory infections may be at greater risk of lower-than-normal lung function when they are adults.
- Compared with adults, children may not perceive significant drops in lung function well. They may not have the same amount of coughing, wheezing or shortness of breath, associated with ozone exposure as is seen in adults. Thus, children may not reduce their activities causing them to have greater exposure to air pollution.

Air pollution effects on children (Cont)

- Minority children are disproportionately represented in areas with high ozone levels. The following number of children live in areas that exceed the 0.08 ppm standard:
  - 61.3% of black children
  - 69.2% of Hispanic children
  - 67.7% of Asian-American children
  - 50.8% of white children live in such areas.

Air Pollution and Children

- When ozone levels are high, children should avoid calisthenics, soccer, running and other strenuous outdoor exercise. They should be encouraged to participate in less strenuous activities or indoor activities.

Ozone

- Ozone is a very reactive gas molecule composed of three oxygen atoms. Ozone is found in the air at ground level (troposphere) and in the upper atmosphere (stratosphere). Ozone in the stratosphere blocks ultraviolet light and is beneficial while ozone in the troposphere results in adverse health effects. All of this discussion is about ground level ozone rather than upper level ozone.

Ozone

- Ozone is formed when nitrogen oxides (NOx) and volatile organic compounds (VOCs), also called hydrocarbons, come into contact with both sunlight and heat. Texas has a lot of sunlight and heat, especially in the summer.

Ozone

- VOCs and NOx form when fossil fuels like gasoline or coal burn or when fossil fuel-based chemicals, like paints, evaporate. NOx is created from high-heat combustion such as power plants and motor vehicles as well as other sources. VOCs are released when organic compounds evaporate, such as gas stations, gas stations, paint and other sources

Health effects of ozone

- Ozone is a strong oxidizing chemical which results in an intense irritation or burning of the lining of the airways of the lung. This tissue is very delicate and the effects are similar to a burn of the lining of the lungs.
- Ozone blunts the immune defenses of the lungs, making individuals more prone to respiratory infections.

Health effects of ozone (Cont)

- Ozone causes significant worsening of the inflammation of asthma and asthma exacerbations correlate with ozone levels.
- In animal studies, long-term exposure to high levels of ozone can cause permanent structural changes to the lungs.

Health effects of ozone (Cont)

- Immediate effects of ozone:
  - shortness of breath
  - chest pain when inhaling deeply
  - wheezing and coughing
  - increased susceptibility to respiratory infections
  - inflammation of the lungs and airways
  - increased risk of asthma attacks
- Increased need for medical treatment and hospital admission for people with lung diseases, like asthma or chronic obstructive pulmonary disease (COPD)

Populations at risk for increased health effects of ozone

- Children
- Individuals with any chronic lung disease such as asthma, COPD (Chronic Obstructive Pulmonary Disease—emphysema or chronic bronchitis), or other lung diseases
- Senior citizens
- Healthy individuals who work or exercises outdoors
- Responders to ozone. s

Measures to protect individuals (esp children) from the effects of ozone

- Monitor the air pollution levels. If air quality is unhealthy, limit the amount of time children spend outdoors, especially with vigorous play.
- Plan the most strenuous outdoor activities for the early morning hours, before ozone levels climb.
- Minimize strenuous outdoor activities near roadways and other sources of pollution.

Measures to protect individuals (esp children) from the effects of ozone

- Avoid asthma triggers during days of increased ozone. Ozone can increase sensitivity to asthma triggers and thus react more strongly to their triggers than usual.
- Ensure coaches and camp directors know the health risks of air pollution and have have policies in place when air quality is unhealthy.
- Advocate on a local, state and national level to promote cleaner air.