

Air Pollution and the Human Body

Group Activity

Once presenter has reviewed all power-point slides from “Air Pollution Basics,” the participants should be introduced to this group activity.

1. We will be dividing ourselves into 6 groups (count off by 6).
2. Each group will be assigned one of the 6 Criteria Pollutants
3. Each group will receive a factsheet of their pollutant, and a human body sheet, and a marker/crayon to match their pollutant color.
4. Each group will read through their factsheet together, then, mark the parts of the body that are impacted by the pollutant.
5. Once the group has marked their body, they will select 1 or 2 group members to report back to the larger group.
6. Each group should report back:
 - a. what is their pollutant
 - b. the local sources of the pollutant
 - c. the impact of the pollutant on the body
7. As the group reports, they will mark (with stickers or with markers) the areas impacted by their pollutant on a large poster-size image of a human body
8. Once the last group has ended, presenter should highlight the cumulative impacts of all the different pollutants on our body.

TIME:

Introduce activity & divide groups - 5 MIN

Group reads & marks their body sheet – 10 MIN

Groups report back & mark large poster – 14 MIN

Presenter wrap up of activity – 1 MIN

Total: 30MIN

CARBON MONOXIDE (CO)

Basic air pollutant fact sheet



The Wilmington neighborhood is next to the two largest ports in the United States. Drayage trucks picking up containers from the ports travel through Wilmington's streets.

Introduction

Carbon monoxide (CO) is a gas emitted from the combustion process. The burning of fuels, such as gasoline or diesel, natural gas, oil, coal or wood creates emissions. CO is a colorless and odorless gas whose exposure can lead to drastic health impacts, even death.

Vehicles are the single largest source of CO emissions. Breathing in concentrated CO levels can lead to reduced oxygen transport, cause headaches, increase risk of chest pain, and impair reaction time.

The US has made very significant strides toward reducing CO emissions from cars with policies and emission reduction

technology improvements, such the catalytic converter.

Carbon Monoxide Emissions

Mobile sources' combustion process is responsible for the largest portion of CO emissions. The heavy traffic in Los Angeles results in high levels of CO emissions. However, vehicles, such as trucks, trains, and ships are not the only sources of CO; industrial processes can also produce CO emissions.

Health Impacts of PM Exposure

Exposure to CO is harmful to your health. CO reduces the body's ability to carry oxygen. People who have cardiovascular diseases, such as heart disease, are more vulnerable to developing chest pains and other symptoms.

Exposure to high levels of CO can result in:

- slower reflexes, confusion, and drowsiness
- death in confined spaces (such as a room or garage)

Children, seniors, people with chronic illnesses and workers are especially vulnerable to CO.

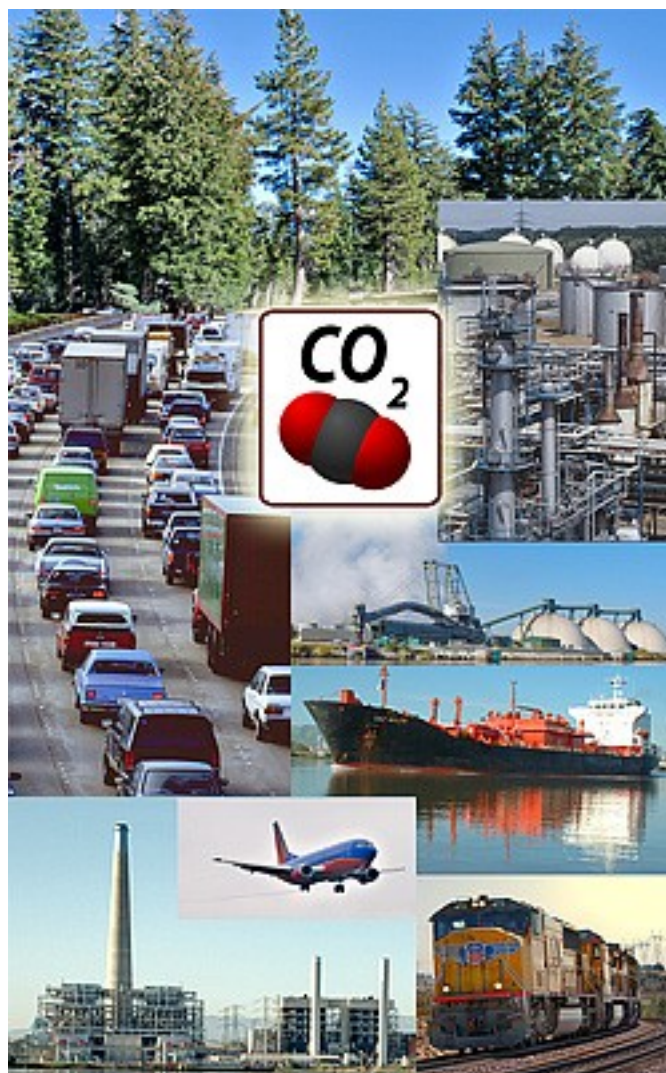
Local Sources of CO

The neighborhood of Wilmington is home to sources of pollution. The CO₂ graphic demonstrates some of the sources of CO emissions.

Due to the large level of activities, the twin Ports, the Port of Los Angeles and the Port of Long Beach are the largest single source of CO emissions. The container ships, cranes, tug boats, locomotives, and trucks that operate inside and around the Ports in combination with the emissions from the refineries, manufacturing facilities, and other industries create a toxic soup of CO emissions in Wilmington.

Aside from mobile sources, communities are also plagued by restaurant kitchens, lawn mowers, and barbecues.

CO is one of the six criteria pollutants regulated by the EPA through the Clean Air Act.



This graphic demonstrates a variety of CO emissions, from mobile to stationary.

LEAD - (PB)

Basic air pollutant fact sheet



While lead emissions have dramatically decreased since 1995 when lead was eliminated in the U.S., there are still industrial facilities that emit ambient lead.

Introduction

Lead (Pb) is a metal that is both formed naturally as well as through industrial processes. Historically, lead emissions have been a result of leaded gasoline combustion. Lead regulations focused on removing lead from fuels, which resulted in dramatic lead emission reductions in the early 1990s.

Lead emissions continue to be an important issue today, but most of the major sources are lead smelters.

Lead Emissions

Lead is everywhere. It can be found in the air, soil, water, and even inside homes. The majority of lead exposure happens due to human activities, ranging from industrial processes, automotive combustion, and is found in commercial products, such as

lead-based paint. Fortunately, leaded gasoline and lead-based paint have also been phased out, and are no longer available in the market. However, lead-based paint remains in houses and is especially prevalent in substandard housing.



Health Impacts of Lead

Lead exposure is very dangerous to your health. It is especially harmful to children because their bodies are growing and they absorb more lead than adults. Their brains and nervous systems are more sensitive to the damage of lead. Additionally, toddlers and infants are more likely to be exposed to lead because they often put their hands and other objects (window sills, pealed paint, etc.) into their mouths.

Adults and children are both susceptible to lead exposure by eating food or drinking water or using glasses/plates that contains lead. Living or working in areas with elevated lead levels in dust can also be a dangerous source of lead exposure. Pregnant women and their developing fetuses are also very vulnerable to lead.

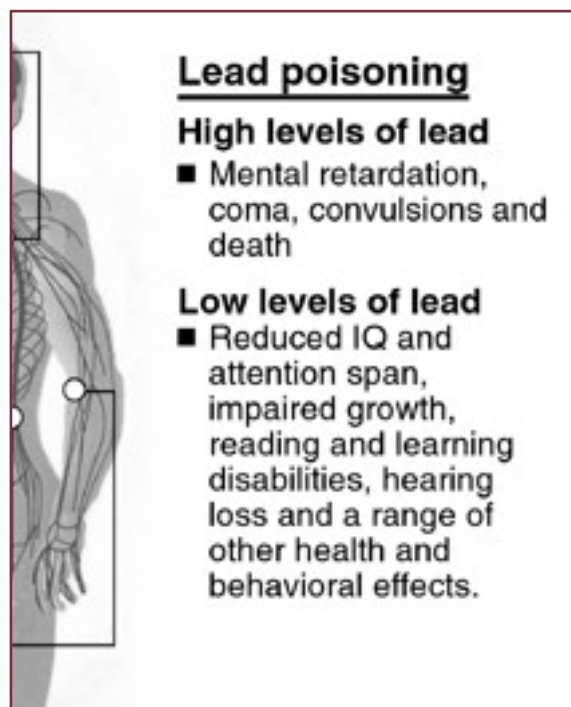
Lead exposure can impact almost any organ and system in your body. However, children six years and younger are the most vulnerable population to lead. Children with even low levels of lead in the blood can experience:

- Behavior and learning problems
- Lower IQ and hyperactivity
- Slowed growth
- Hearing problems
- Anemia

Pregnant women exposed to lead can reduce the growth of the fetus and premature birth.

Local Sources of Lead

Lead exposure in Wilmington happens both inside and outside of people's homes. In a special California Air Resources Board air monitoring study, the Wilmington school's monitor revealed several metals, including lead at much higher levels than their other study



Lead poisoning is very dangerous in both high levels and low levels.

sites in downtown Los Angeles and Long Beach. Sources of these metals for Wilmington include industrial and commercial operations as well as motor vehicles.

The metal scrapping facilities that surround the Port Complex of LA and Long Beach are a significant source of metal ambient emissions, including lead. Wilmington's older housing stock as compared to the city of Los Angeles is also a concern in regard to lead in paint.

People living in homes built before 1978 should wipe down flat surfaces, such as windows sills, mop smooth floors regularly, and vacuum carpets and upholstery to remove dust. Washing children's hands and toys can also help to reduce exposure.

NITROGEN DIOXIDE

Basic air pollutant fact sheet



Motor vehicles are huge sources of Nitrogen Dioxide (NO_x).

Introduction

Nitrogen dioxide (NO₂) is one of a group of toxic gases known as the “oxides of nitrogen.” We normally see this group of gases as NO_x.

For regulatory purposes, the Environmental Protection Agency (EPA) uses NO₂ as the indicator for the larger group of oxides of nitrogen.

NO_x forms quickly in the atmosphere and is linked to a number of drastic impacts on the respiratory system.

NO_x Emissions

NO_x emissions contaminate the air. The majority of NO_x exposure is due to human activities, some industrial processes, but mostly motor combustion. Cars, trucks, buses, airplanes, ships, trains, and any other motor vehicle are responsible for the majority of NO_x

Source: EPA Six Criteria Pollutants

emissions in urbanized areas, like Los Angeles.

Although according to EPA, all areas in the country meet the current (1971) NO₂ National Clean Air Act Quality Standard levels, NO_x pollution in Wilmington is of concern to local air quality agencies.

Health Impacts of NO_x

NO_x exposure can be dangerous to your health. It is especially harmful to children, seniors, the chronically ill, and people who are active outdoors or who work near NO_x sources, such as truck drivers or port workers.

Short term exposure to NO_x (30 minutes to 24 hours) can result in adverse health effects, including airway inflammation in healthy people and dire respiratory symptoms for people with asthma and other respiratory problems.

NO_x exposure has also been linked to increased visits to the emergency room and increased asthma attacks in children.

Because NO_x is a key ingredient in ozone formation, it also contributes to smog and the health impacts of ozone exposure.

Exposure to NO_x can cause:

- Burning eyes, throat, and irritated mucus membranes
- Shortness of breath, wheezing, coughing
- Asthma and other respiratory problems
- Chest pains and other cardiovascular problems
- Increased risk of heart attacks

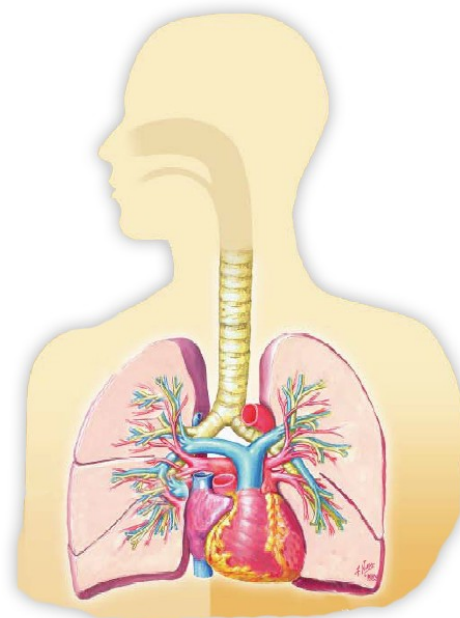
Pregnant women exposed to NO_x often are found to give birth to premature and low-birth weight babies.

Local Sources of NO_x

Wilmington's vicinity to the Port Complex and a number of major highways and local roads with tremendous truck traffic put the residents at a high risk of NO_x exposure.

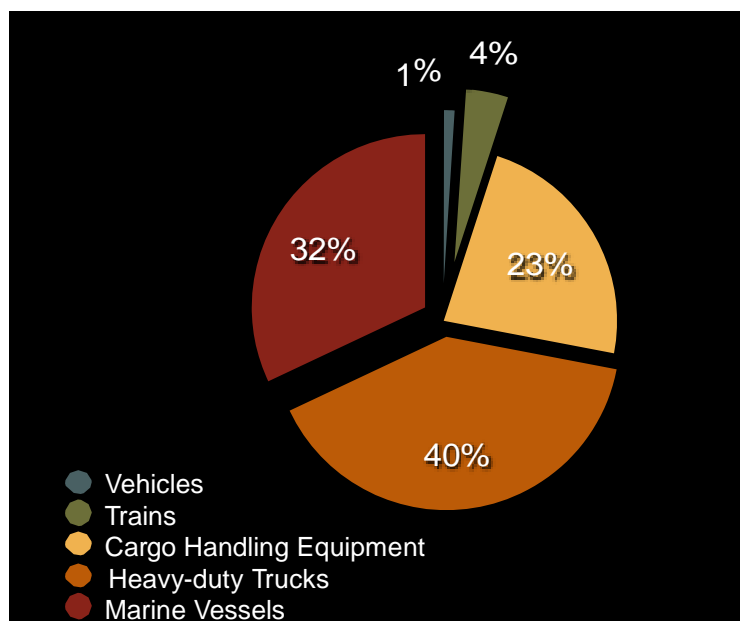
Individuals who work or live near major roadways are more heavily exposed to NO_x . According to the EPA, approximately 16% of U.S. housing units are located within 300 feet of a major highway, railroad, or airport.

The motor vehicles inside and outside of the Ports generate an alarming amount of NO_x pollution for the local community as well as for the region.



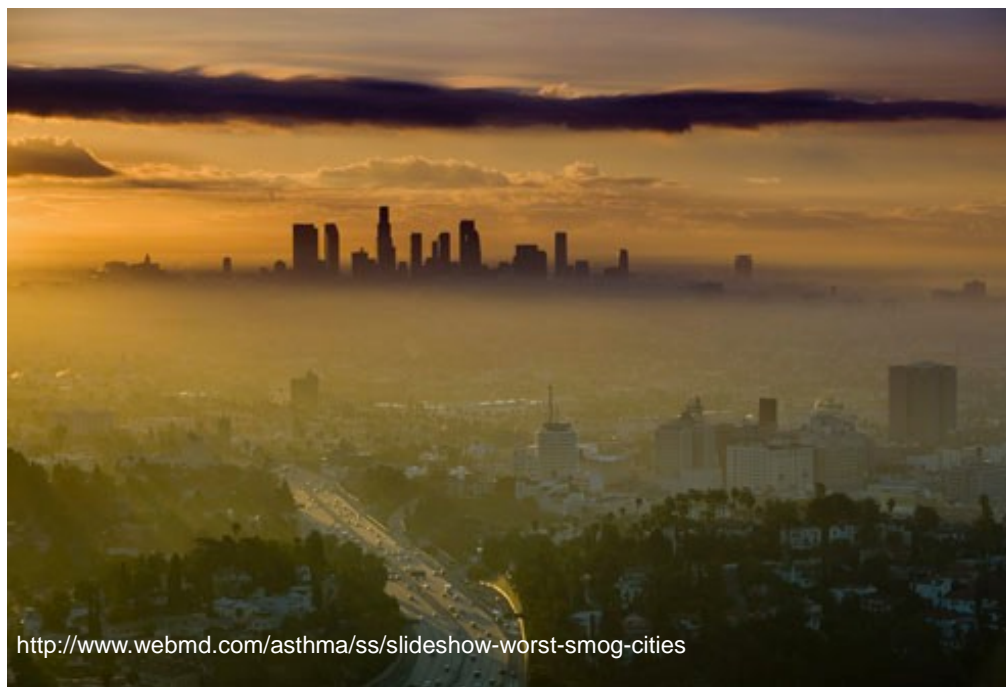
NO_x impacts both the respiratory and cardiovascular health of humans.

Below is a graph developed by the Natural Resources Defense Council to explain the average NO_x sources from Port-related activities in a container port. Heavy-duty diesel trucks are the largest single NO_x contributor.



OZONE - O₃

Basic air pollutant fact sheet



<http://www.webmd.com/asthma/ss/slideshow-worst-smog-cities>

The Los Angeles basin is home to a thick layer of ground level ozone. Thousands of factories, metal smelters, motor vehicles, and other industrial activities in the region in combination with the sun produce ozone, or what we call smog.

Introduction

Ozone (O₃) exists in two regions of Earth's atmosphere. Ozone beyond the stratosphere protects the earth from the sun's harmful UV rays. Ground level ozone is what we know as harmful smog.

Ground level ozone is formed by emissions (like NO_x) reacting in the presence of sunlight. The combination of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) exposed to sunlight creates ozone. Ozone exposure has drastic health impacts.

The Creation of Ozone

Industrial activities, such as manufacturing, electric utilities, vehicle exhaust, gasoline vapors, and chemical solvents emit both VOCs and NO_x¹. The ambient emissions of VOCs and NO_x in combination with sunlight create a photochemical reaction that produces ground level ozone.



emissions

+



sunlight

=



ozone layer

||

¹ Ozone Basic Information, EPA. (Accessed July 20, 2014) <http://www.epa.gov/airquality/ozonepollution/basic.html>

Health Impacts of Ozone Exposure

Exposure to ozone can be harmful to our health. Children are especially at risk from exposure to ozone. However, people with lung disease, seniors, and people who are active outdoors (athletes) are sensitive to ozone.

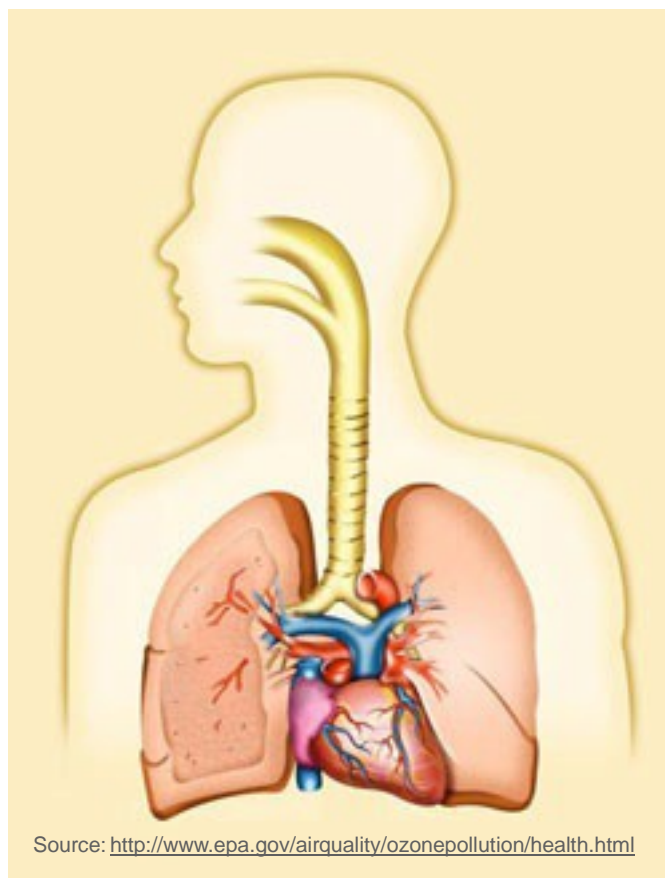
Ozone can also be harmful to sensitive vegetation and ecosystems, such as parks, forests, and other wilderness areas.

Breathing ozone can result in short-term impacts such as chest pain, coughing, throat irritation, and congestion.² Exposure can reduce lung function and inflame the linings of the lungs. Long term exposure can permanently scar lung tissue and damage airways. Additionally, it may increase the frequency of asthma attacks and make lungs more susceptible to infection.

Local Sources of Ozone

Locating exact sources of Ozone is difficult because it is actually created in the atmosphere by reactions of other pollutants. NO_x and VOCs are directly related to the level of ozone in the air.

In Wilmington, air pollution from the Ports of Los Angeles and Long Beach, the three refineries (Tesoro, Valero, and BP), and many other smaller industries are responsible for ozone pollution.



Source: <http://www.epa.gov/airquality/ozonepollution/health.html>

Ozone can irritate the air ways causing coughing, a burning sensation, wheezing and shortness of breath. It can also aggravate asthma and other lung diseases.

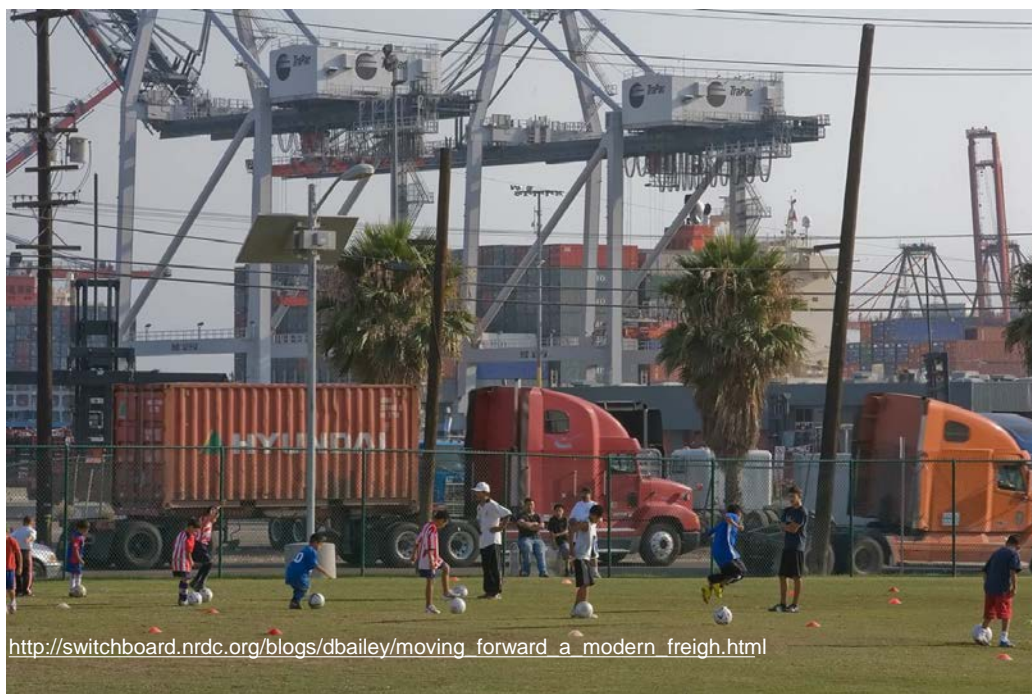
The high concentration of petroleum refineries in Wilmington make the local residents especially susceptible to ozone exposure. Refineries in and around Wilmington are responsible for nearly half of all VOC emissions in the Los Angeles area.³

² Health Effects of Ozone, EPA (Accessed July 20, 2014) <http://www.epa.gov/airquality/ozonepollution/health.html>

³ Dunn, Sylvia. "Can Residents of Wilmington Breathe their Air?" (January 16, 2011) <http://www.examiner.com/article/can-residents-of-wilmington-and-carson-breathe-their-air>

PARTICULATE MATTER- PM

Basic air pollutant fact sheet



The Wilmington neighborhood neighbors the two largest ports in the United States. Port and port-related activities in and around the Ports cause dramatic PM pollution for the local neighborhood and the southern California region.

Introduction

Particulate matter (PM) is a complex mixture of microscopic particles and liquid droplets that is created in the atmosphere. PM is composed of many parts, such as chemicals, metals, soil, and dust particles. The size of PM is indicative of its potential for causing harmful health effects. The Environmental Protection Agency (EPA) is primarily concerned with particles 10 micrometers in diameter or smaller because they are small enough to pass through the throat and nose on their way the lungs.

PM includes “inhalable coarse particles,” which are visible to the human eye. The dust that

lines window panes and the top of vehicles is visible particulate matter. Due to its toxic components, PM has adverse health impacts.

Particulate Matter Emissions

There is information about three different size distributions; PM 10 (particles that are between 10 and 2.5 micrometers in diameter), PM 2.5 (particles that are as big as PM 2.5), and ultra fine particles (microscopic particles that are too small to have mass). All three PM size categories are still very hard to see with the human eye.

Primary particles can come directly from combustion or smokestacks, while secondary particles form in the atmosphere from the combination of NO_x, dioxins and other chemicals emitted from power plants, industrial facilities, and motor vehicles (trucks, ships, and buses).

Health Impacts of PM Exposure

Exposure to PM is harmful to your health. The smaller the particle size, the greater its potential to negatively impact your health.

Ultrafine particles are especially dangerous because their microscopic size enables them to reach deep inside the lung tissue and travel through the bloodstream.

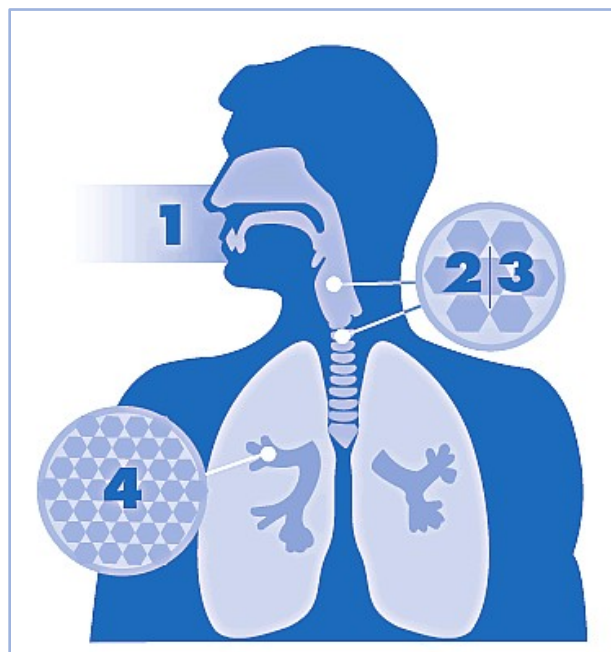
Breathing PM 10 can result in short-term impacts such as eye, throat, and nose irritation. However, long term exposure to PM 2.5 and ultrafine particles can lead to a variety of health problems, such as:

- decreased lung function
- aggravated asthma
- irregular heartbeat
- nonfatal heart attacks
- premature death
- increased respiratory problems

Children, seniors, people with chronic illnesses and workers are especially vulnerable to PM pollution.

Local Sources of PM

The neighborhood of Wilmington is home to sources of primary particles and its local atmosphere enables the creation of secondary particles through the toxic mixture of different chemicals and air contaminants.



1 PM enters respiratory system through nose and throat.

2|3 PM 10 is eliminated through body's defense (coughing, sneezing and swallowing)

4 PM 2.5 can penetrate deep into the lungs. Ultrafine particles can travel to the alveoli, causing lung and heart problems. This can lead to the development of cancer.

The largest sources primary particles in Wilmington are the twin Ports, the Port of Los Angeles and the Port of Long Beach. The international container ships, cranes, tug boats, locomotives, and trucks that operate inside and around the Ports are all fueled by diesel and all emit diesel particulate matter (diesel exhaust).

PM is one of the six criteria pollutants regulated by the EPA through the Clean Air Act.

SULFUR DIOXIDE

Basic air pollutant fact sheet



Sulfur dioxide in Wilmington comes primarily from the toxic emissions of the nearby petroleum refineries.

Introduction

Sulfur dioxide (SO_2) is one of a group of highly reactive and toxic gases known as “oxides of sulfur.” Sulfur dioxide is one of the six criteria pollutants that the Environmental Protection Agency regulates through the Clean Air Act.

It is a colorless gas at room temperature with a distinctive odor. It can also exist as a liquid.

The largest sources of SO_2 emission are power plants and other industrial facilities.

Sulfur Dioxide Emissions

In the U.S., power plants are the largest contributors to SO_2 emissions. Power plants and other utility production companies produce about 73%, while other industrial activities produce about 20% of all SO_2 emissions.

Trucks, ships, trucks, and cranes also emit SO_2 through the burning of high sulfur fossil fuels.

Petroleum refineries are also a significant source of SO_2 . In fact, the image below depicts a mountain of sulfur (a byproduct of the refining process) outside the Valero refinery in Wilmington.



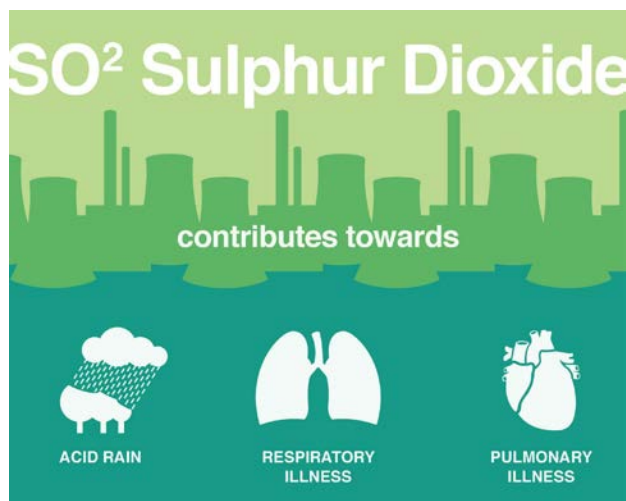
<http://articles.latimes.com/2010/nov/09/local/la-me-air->

Health Impacts of Sulfur Dioxide

SO₂ has both short-term and long-term health impacts, depending on the level of exposure. Scientific evidence reveals that exposure to SO₂ can result in respiratory problems, including bronchi-constriction, and increased asthma symptoms. People with asthma are particularly susceptible to SO₂.

Exposure to SO₂ has also been demonstrated to lead to hospital admissions for respiratory illnesses, especially for people with asthma.

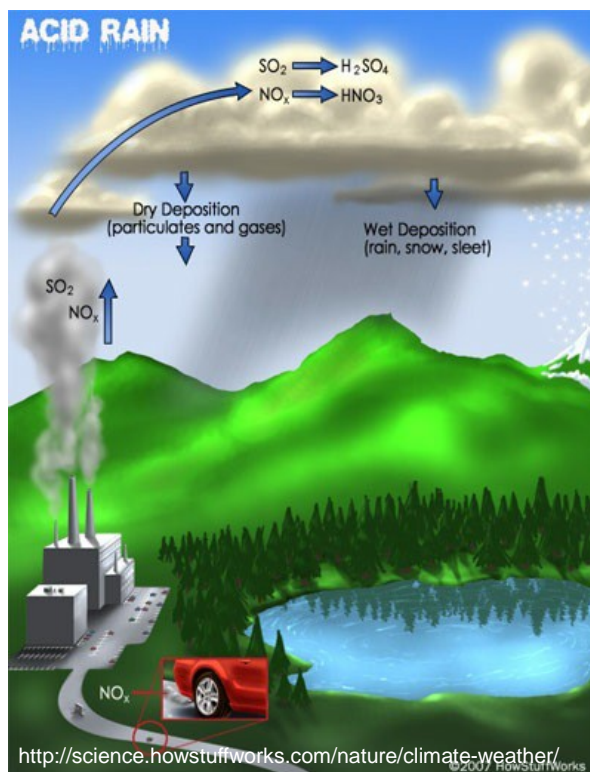
SO₂ can easily react with other compounds in the atmosphere and form small particles. These small particles can penetrate into lung tissues, which can lead to the development of cancer.



SO₂ is very harmful to the environment and human health, as it contributes to both acid rain and global warming, and it impacts the respiratory and cardiovascular system.

Local Sources of Sulfur Dioxide

Sulfur dioxide exposure in Wilmington is of concern because of the high number of potential sources. Wilmington is home to the region's highest amount of petroleum refineries, and it neighbors the Port Complex.



The combination of SO₂ and NO_x sources in Wilmington create a significant potential for acid rain. Acid rain refers to the mixture of wet and dry deposited material from the atmosphere that contains high levels of nitric and sulfuric acids. Acid rain occurs when the gases react in the atmosphere with water, oxygen and other chemicals, as the image above demonstrates.

