



Industrial Smog

- Industrial smog is a mixture of sulfur dioxide, droplets of sulfuric acid, and a variety of suspended solid particles emitted mostly by burning coal.

Southern California

mp.com



Sunlight plus Cars Equals Photochemical Smog

VOCs + NO_x + heat + sunlight →

- ground level ozone (O₃)
- + other photochemical oxidants
- + aldehydes
- + other secondary air pollutants

- o Photochemical smog is a mixture of air pollutants formed by the reaction of nitrogen oxides and **volatile organic compounds** under the influence of **sunlight** and **heat**.

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Sunlight plus Cars Equals Photochemical Smog



Atlanta, GA:
taken from
high point
near campus
of Emory

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ACID DEPOSITION



- Sulfur dioxides, nitrogen oxides, and particulates can react in the atmosphere to produce acidic chemicals that can travel long distances before returning to the earth's surface.
- Tall smokestacks reduce local air pollution but can increase regional air pollution.

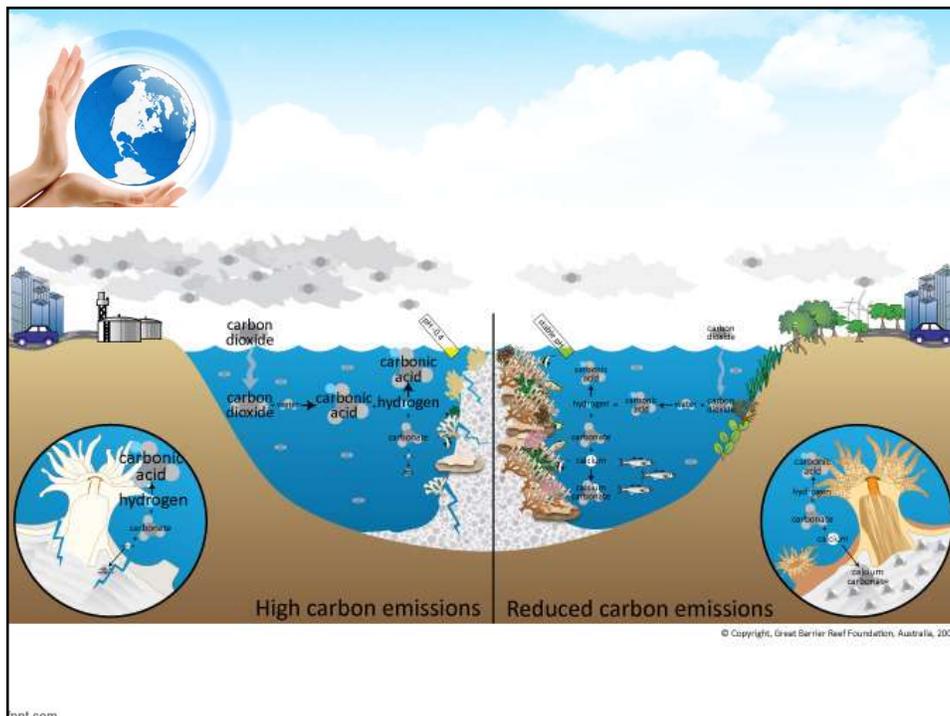


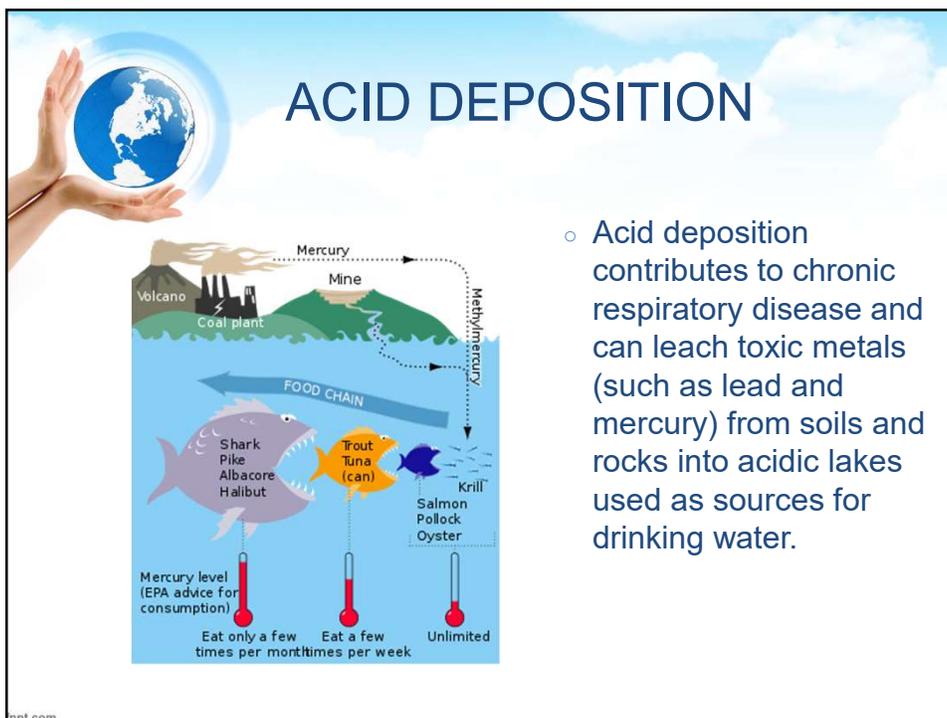
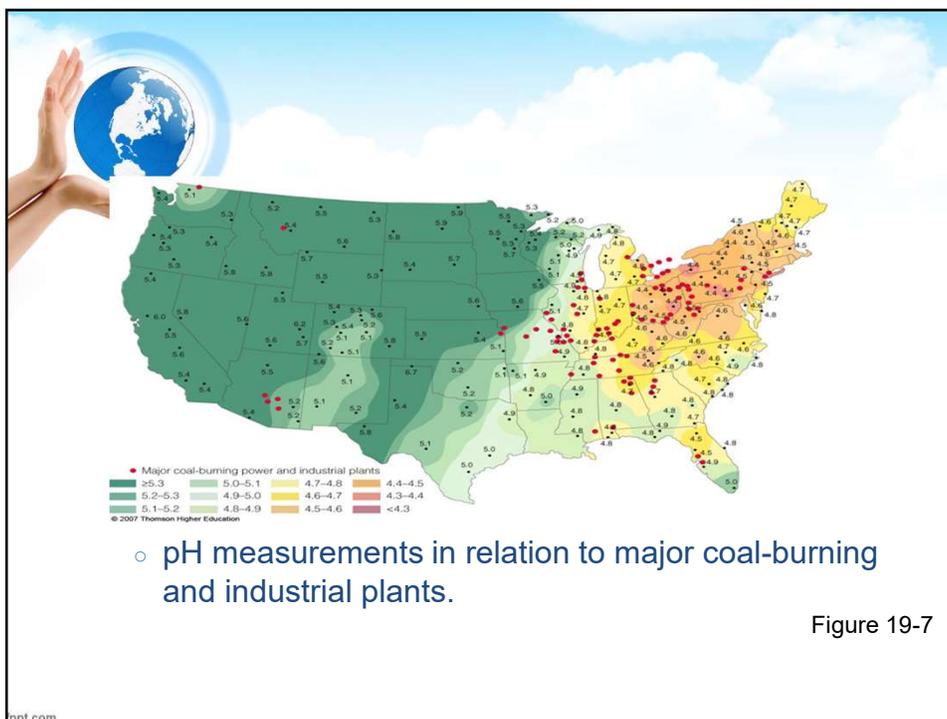
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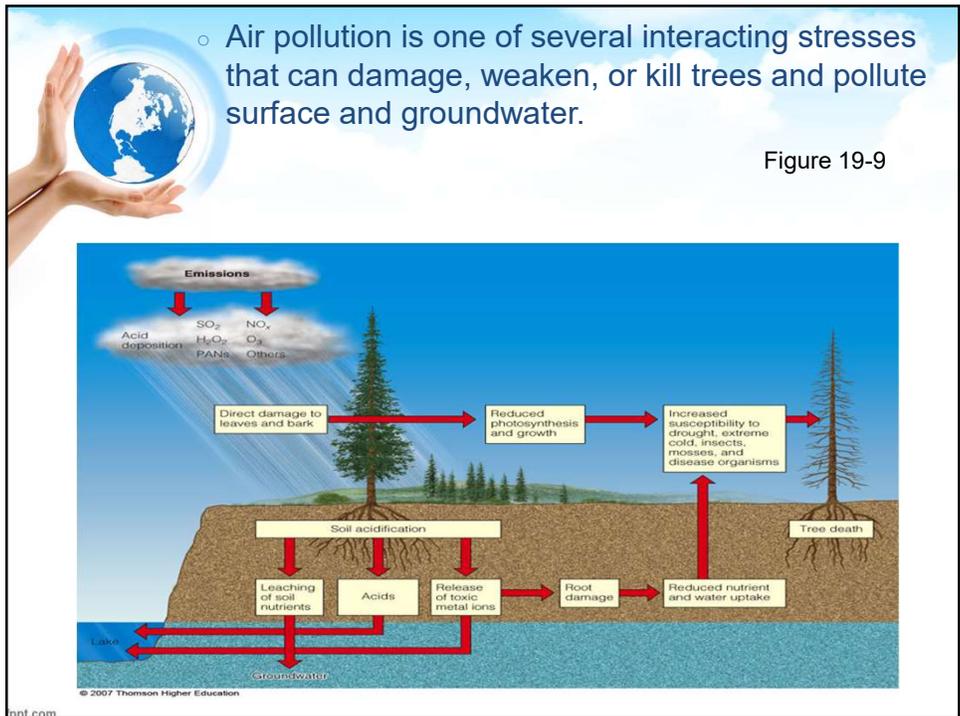
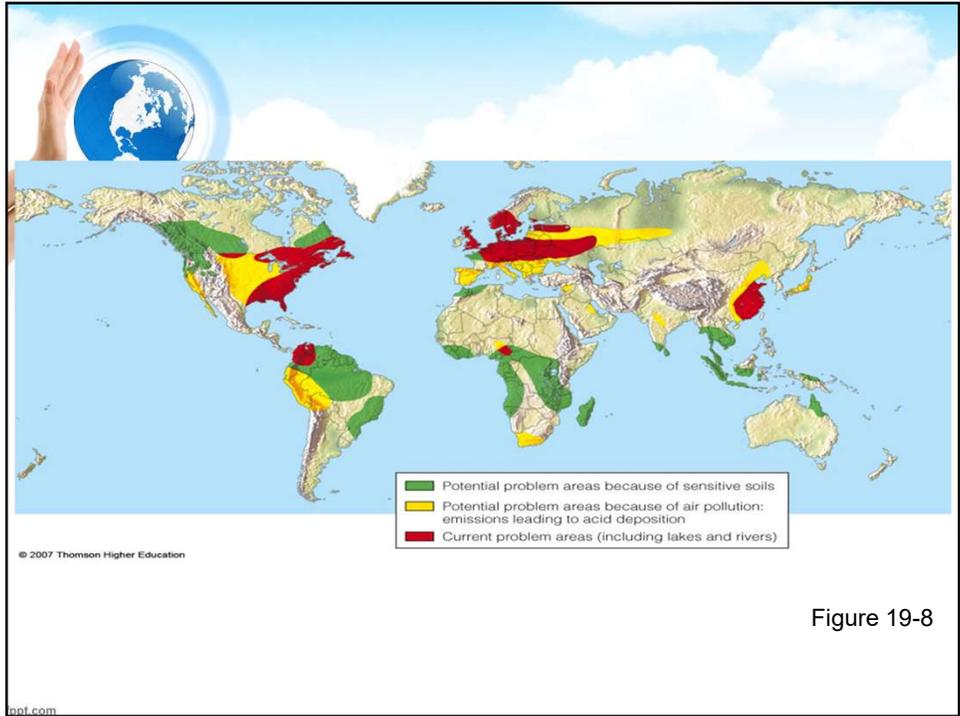


2010

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Air Quality is better in US; EPA estimates since 1970

- Particulate Matter (PM)- down 78%
- Carbon Dioxide (CO₂)- down 23%
- Nitrogen Dioxide (NO_x)- **up 14%**
- Lead (Pb)- down 98%
- Sulfur Dioxide (SO₂)- down 32%

Air quality is worse in developing countries:
Mexico City & Beijing: air exceeds WHO standards 350 days/year

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Factors Influencing Levels of Outdoor Air Pollution

- Outdoor air pollution can be reduced by:
 - settling out, precipitation, sea spray, winds, and chemical reactions.
- Outdoor air pollution can be increased by:
 - urban buildings (slow wind dispersal of pollutants), mountains (promote temperature inversions), and high temperatures (promote photochemical reactions).

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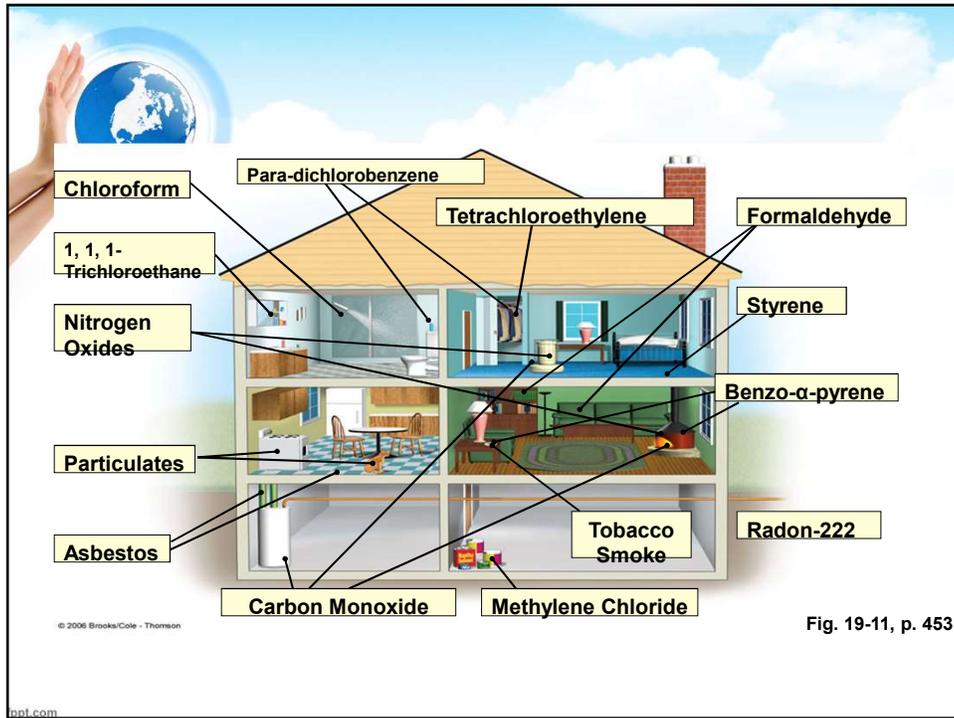
Temperature Inversions

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- Cold, cloudy weather in a valley surrounded by mountains can trap air pollutants (left).
- Areas with sunny climate, light winds, mountains on three sides and an ocean on the other (right) are susceptible to inversions.

INDOOR AIR POLLUTION

- Indoor air pollution usually is a greater threat to human health than outdoor air pollution.
- According to the EPA, the four most dangerous indoor air pollutants in developed countries are:
 - Tobacco smoke.
 - Formaldehyde.
 - Radioactive radon-222 gas.
 - Very small fine and ultrafine particles.



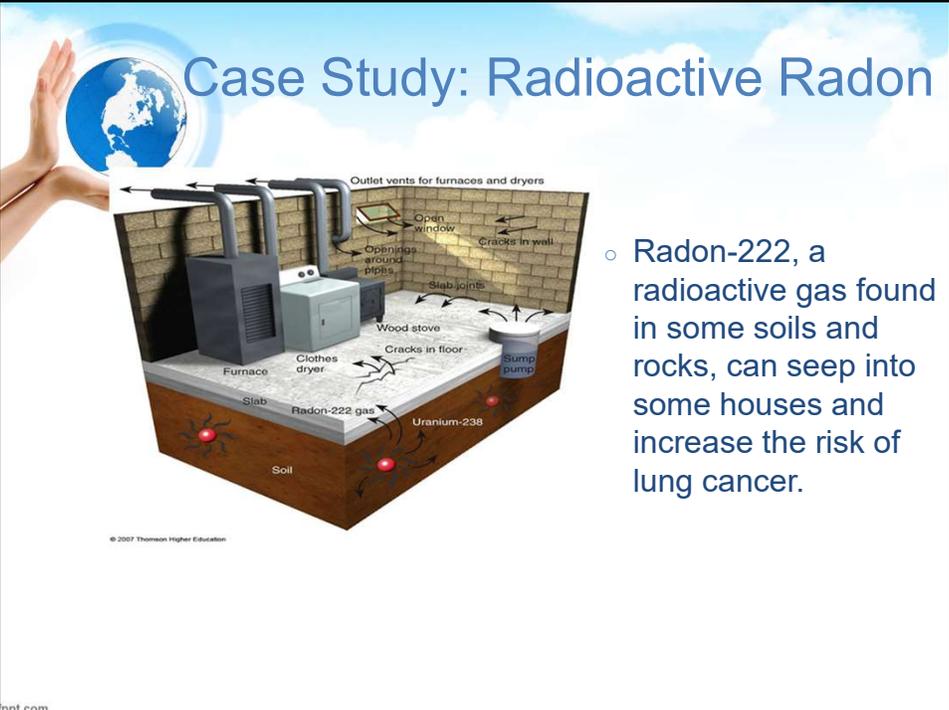
INDOOR AIR POLLUTION



- Household dust mites that feed on human skin and dust, live in materials such as bedding and furniture fabrics.
- Can cause asthma attacks and allergic reactions in some people.

Figure 19-12

Case Study: Radioactive Radon



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The diagram illustrates radon entry into a house. It shows a cross-section of a house with a basement. Radon-222 gas is shown entering from the soil through various points: cracks in the floor, cracks in the walls, and gaps around pipes. The diagram also shows radon-222 gas entering from the soil through a sump pump. The diagram includes labels for various household items: Furnace, Clothes dryer, Wood stove, Slab, Radon-222 gas, Uranium-238, Soil, Outlet vents for furnaces and dryers, Open window, Cracks in wall, Slab joint, and Cracks in floor. A hand is shown holding a globe of the Earth in the top left corner.

- Radon-222, a radioactive gas found in some soils and rocks, can seep into some houses and increase the risk of lung cancer.