



MODULE FOUR

SURVEY OF TOXIC SUBSTANCES

Objectives

Upon completion of this module, you will be able to

- Identify and understand the different types of outdoor pollutants and their toxic effects
- Understand the toxic effects of various types of metals, pesticides, and other important chemicals
- Become familiar with ATSDR's ToxFAQs, Toxicological Profiles, and Fact Sheets

Main Outdoor Pollutants

- Carbon Monoxide
- Sulfur Oxides
- Ozone
- Nitrogen Oxides
- Particulates



Carbon Monoxide (CO)

- Colorless, odorless, and tasteless gas
- Lighter than air, dissolves in water
- Decreases the amount of oxygen available to cells



Carbon Monoxide (CO) (continued)

- Common Sources:

- Automobile exhaust
- Charcoal, wood, kerosene, or gas stoves
- Smoking Tobacco
- Foundries, coke ovens, and refineries



Carbon Monoxide (CO) (continued)

Health effects:

- Headache, nausea, irritability, increased respiration, chest pain, impaired judgment, and fainting.
- Damage to central nervous system (CNS), poor memory, and general mental decline

Sulfur Oxides

- Common Sources:
 - Automobile exhaust
 - Petroleum refineries
 - Paper manufacturing
 - Chemical industries
- Two Types:
 - Sulfur Dioxide (SO_2)
 - Sulfur Trioxide (SO_3)



Sulfur Oxides (continued)

Sulfur Dioxide (SO₂)

- Colorless gas with a bitter taste
- Under pressure it is a non-flammable liquid
- Biotransformed in the body
- Effects:
 - Lungs
 - Eyes
 - Skin

Ozone (O₃)



- Colorless gas, very light odor
- Major air pollutant in large industrialized cities
- Symptoms:
 - Eye, nose, throat, and lung irritation
 - Coughing and problems with breathing
 - Chest pain and pneumonia

Nitrogen Oxides

- Sources:
 - Combustion of coal and oil
 - Burning fuels in furnaces and internal combustion engines
 - Detonation of explosives and welding
 - Tobacco smoke
- Symptoms:
 - Coughing, heavy breathing, chest pain, irregular heartbeat, and eye irritation



Nitrogen Oxides (continued)

- Nitric Oxide (NO)
- Nitrogen Dioxide (NO₂)
- Nitrogen Trioxide (N₂O₃)
- Nitrogen Tetroxide (N₂O₄)
- Nitrogen Pentoxide (N₂O₅)/Nitrous Oxide (N₂O)

Particulates

- Sources:

- Automobile exhaust
- Smokestacks
- Blowing dust



- Size and Composition play a big role in determining health risk

- Small particles and heavy metals pose a threat to health

▪ Heavy Metals

- Arsenic
- Cadmium
- Lead
- Mercury



Arsenic

- One of the most toxic metals on earth
- Forms:
 - Trivalent
 - Pentavalent
- Routes of Exposure:
 - Ingestion
 - Inhalation



Arsenic (continued)

- Health Effects
 - Fever, anorexia, liver enlargement, death
 - Neurotoxicity of PNS and CNS, liver damage, gangrene of lower limbs
 - Skin cancer, lung cancer
 - Dermatitis, darkening of the skin, leukemia, kidney, and bladder cancers

Cadmium

- Non-corrosive and primary used for electroplating
- By-product of the mining and smelting of lead and zinc
- Found in:
 - Fertilizer
 - Cigarettes
 - Irrigation waters
 - Shellfish



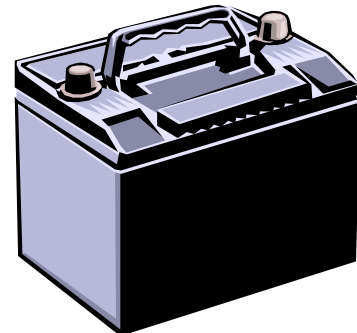
Cadmium (continued)

- Health effects
 - Nausea, vomiting, and abdominal pain
 - Chemically induced lung inflammation and fluid on the lung
 - Irritation of the nose and throat, coughing, dizziness, weakness, chills, fever, chest pains, and labored breathing
 - Metal fume fever
 - Obstructive pulmonary disease, emphysema, kidney disease

Lead



- Used in manufacture of batteries, plastics, china, ceramic glass, and paint products
- Routes of exposure
 - Ingestion of lead-contaminated glaze in pottery, paint chips, dust in older homes
- Deficiencies in nutrients can enhance lead absorption

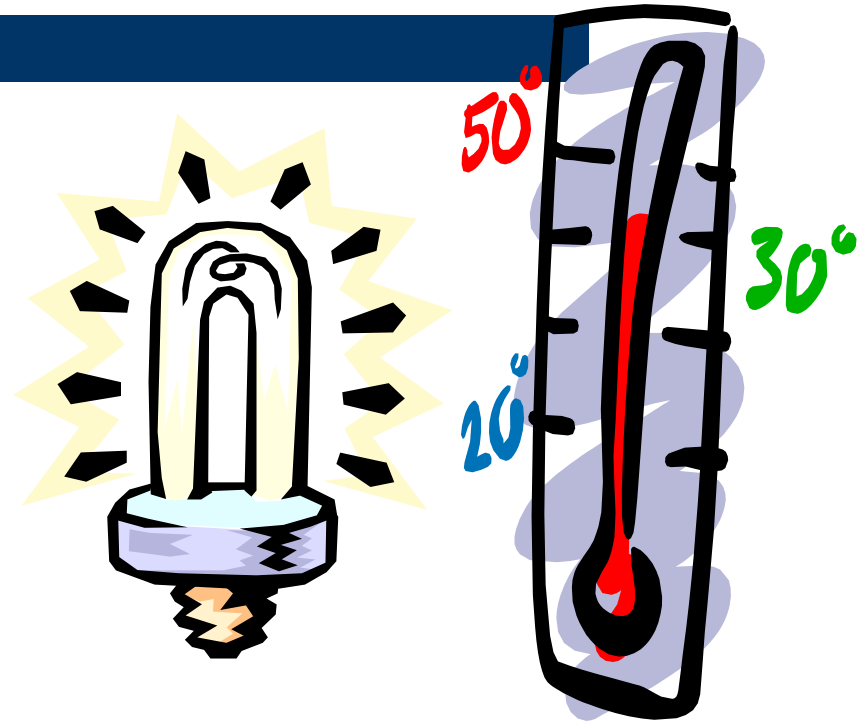


Lead (continued)

- Health effects
 - Lethargy, vomiting, irritability, loss of appetite, and dizziness
 - High blood pressure, lowered sperm count and sperm motility

Mercury

- Found in:
 - Vapor lamps
 - Fluorescent tubes
 - Thermometers
 - Electrical products



- Health effects:
 - Tremors, personality defects and disturbances
 - Permanent CNS damage

Benzene



Benzene



- Used as a solvent in rubber, ink, adhesives, and transformer fluids
- Route of exposure is through inhalation

Benzene (continued)

Health effects:

- Fatigue and anorexia
- Bone marrow damage resulting in anemia
- Leukemia
- Unconsciousness and death

Polychlorinated Biphenyls (PCBs)

- Used in plasticizers and adhesives
- Health effects:
 - Chloracne
 - Cancer

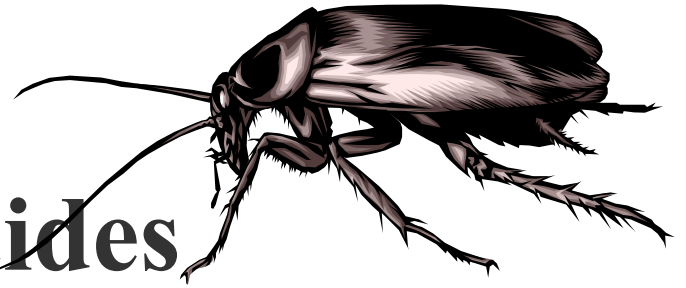


Pesticides

- Insecticides
- Herbicides
- Fungicides
- Fumigants
- Rodenticides

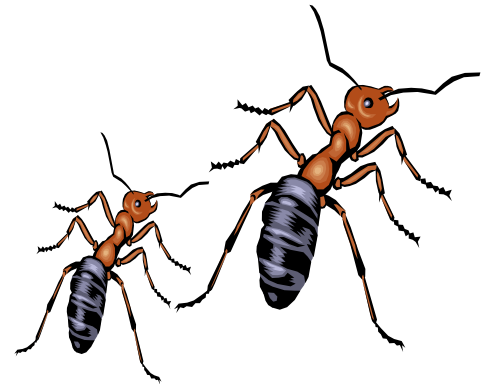


Insecticides



- Affect the nervous system

- Dermal absorption
- Inhalation
- Ingestion



- Health effects:

- Headache, anxiety, chest tightness, seizures, loss of consciousness, and liver dysfunction

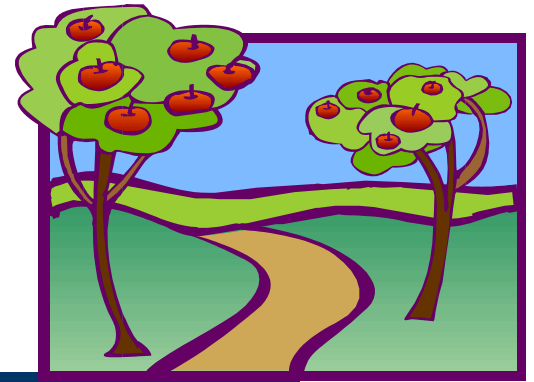
Herbicides

Health effects:

- Chloracne
- Liver disorders



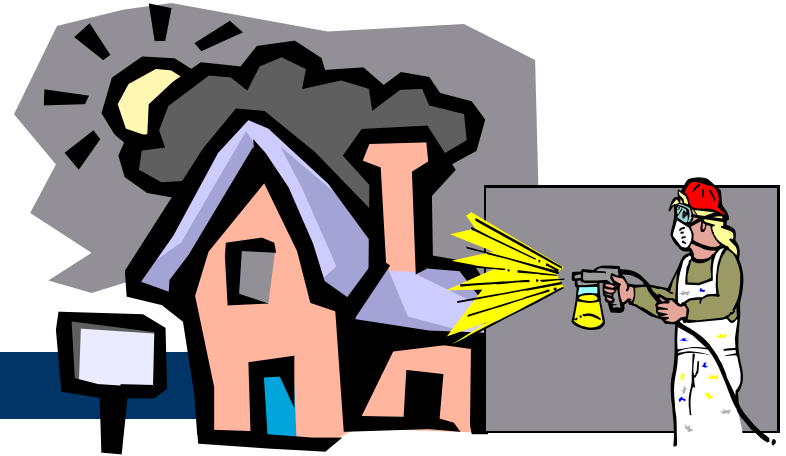
Fungicides



- Used in the treatment of plants such as fruit trees and vegetables
- Health effects:
 - Skin irritation, lethargy, dermatitis, headache, vomiting



Fumigants



- Used to eradicate insects, bacteria and rodents
- Health effects:
 - Nausea, vomiting, dizziness, dermatitis, headache, pulmonary irritation, and dementia

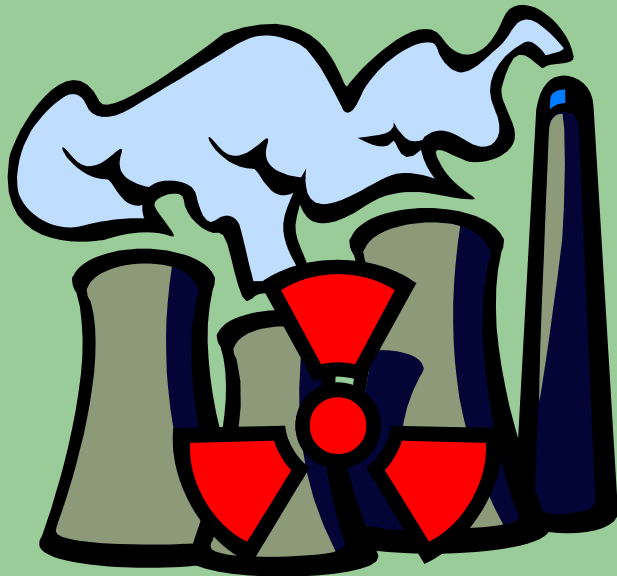
Rodenticides



- Used to eradicate rodents (mice, rats, rabbits, and gophers)
- Health effects
 - Inhibition of cell function
 - Anticoagulant activity
 - Neurotoxicity



Radiation and Radioactive Materials



- Ionizing radiation
- Non-Ionizing radiation

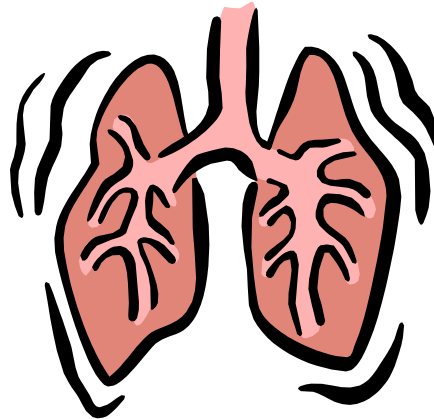


Ionizing Radiation

- Affects the bone marrow
- Health effects
 - Reddening of skin
 - Decreased red blood cell production
 - Gastrointestinal and reproductive effects
 - Cataracts, birth defects, respiratory illness

Non-Ionizing Radiation

Health effects on the skin, and thyroid, and causes lung cancer





Question and Answer Period