Lecture 8: Pollution

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Pollution

- An undesirable and unfavorable change in the physical, chemical and biological characteristics of land, air and water that negatively affects plant, animal and human life.

Environmental pollution

Addition of materials and substances into air, water or land that would alter their properties and make their use by man and other living organisms lethal or dangerous.

Environmental pollutants are solid, liquid and gaseous substances added to the environment in concentrations that can be injurious or lethal to living organisms.

Types of Pollutants

Biodegradable pollutants - can be rapidly decomposed by natural processes e.g. domestic sewage

Non-biodegradable pollutants – degrade very slowly in the natural environment e.g. plastic, aluminum cans, glass, DDT, mercuric salts

Examples of Pollutants

1. solid wastes (sewage, plastic, soot, dust, etc.)
2. gases (carbon dioxide, carbon monoxide, nitrogen dioxide, etc.)
3. industrial wastes (acids, alkalies)
4. agricultural pollutants (pesticides, herbicides)
5. metals (iron, zinc, mercury)
6. radioactive substances
7. oils

Types of Pollutants

Gaseous pollutants

- Carbon monoxide
- Nitrogen oxide
- Sulfur dioxide

Particulate substances

- Solid and liquid particles
- Large particles that easily settle down from the air (sand and water)
- Fine particles that float in the air for a long time (dust and mist)
- Finer particles that never settle and remain in the air (smoke, aerosol and fumes)

Mobile Combustion Sources

Automobiles are major sources of pollution with their exhaust containing carbon monoxide (77.2%), oxides of nitrogen (7.7%) and hydrocarbons (13.7%)

Photochemical reactions on oxides of nitrogen and hydrocarbons produce photochemical smog which contains peroxyacetylnitrate and ozone.

Tetra ethyl lead in petroleum produces various lead compounds.

Atmospheric Pollutants

Natural sources

- Volcanic eruptions
- Forest fires
- Decaying organic matter
- Sandstorms

Man-made pollutants

- Only 0.05% of total atmospheric pollutants is caused by the outputs of industries and automobiles

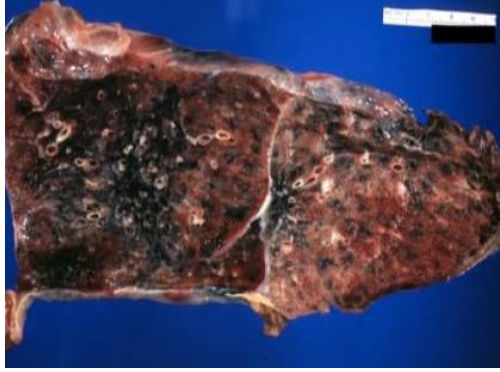
Industrial processing and other sources

Smoke emissions from factories

Compounds contain chlorine and fluorine used in propellants, refrigerants and in aerosol cans and can produce toxic products

Solvents in spray painting, dyeing, printing especially blasting, drilling, crushing, mixing, etc.

Health Effects of Pollution



NO_2 inflames the linings of the lungs; can reduce immunity to lung infections and can cause wheezing, coughing, colds, flu and bronchitis.

SO_2 irritates the skin and mucous membranes of the eyes, nose, throat and lungs; high concentrations can cause inflammation and irritation of the respiratory system especially during heavy physical activity.

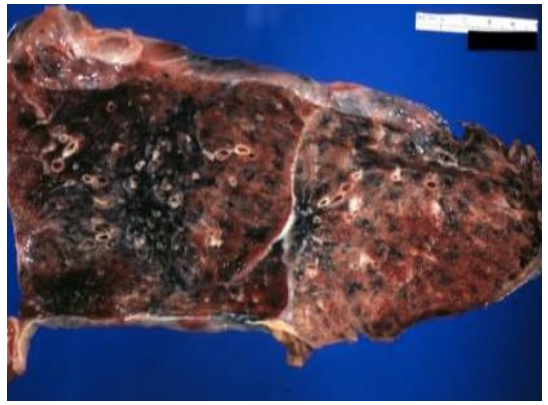
Hydrocarbons can cause serious problems like seizures, irregular heart rhythms, damage to kidneys or liver and worse coma. Sources include solvents used in paints and dry cleaning and household cleaning chemicals.

Health Effects of Pollution

Anthracosis (anthrac- meaning coal, carbon + -osis meaning condition) is defined as, “the asymptomatic, milder type of pneumoconiosis as caused by the accumulation of carbon in the lungs due to repeated exposure to air pollution or inhalation of smoke or coal dust particles”

Silicosis is a form of occupational lung disease caused by inhalation of crystalline silica dust. It is marked by inflammation and scarring in the form of nodular lesions in the upper lobes of the lungs.

Stress to animals



Environmental effects: damage to vegetation due to acid rain

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Water pollution

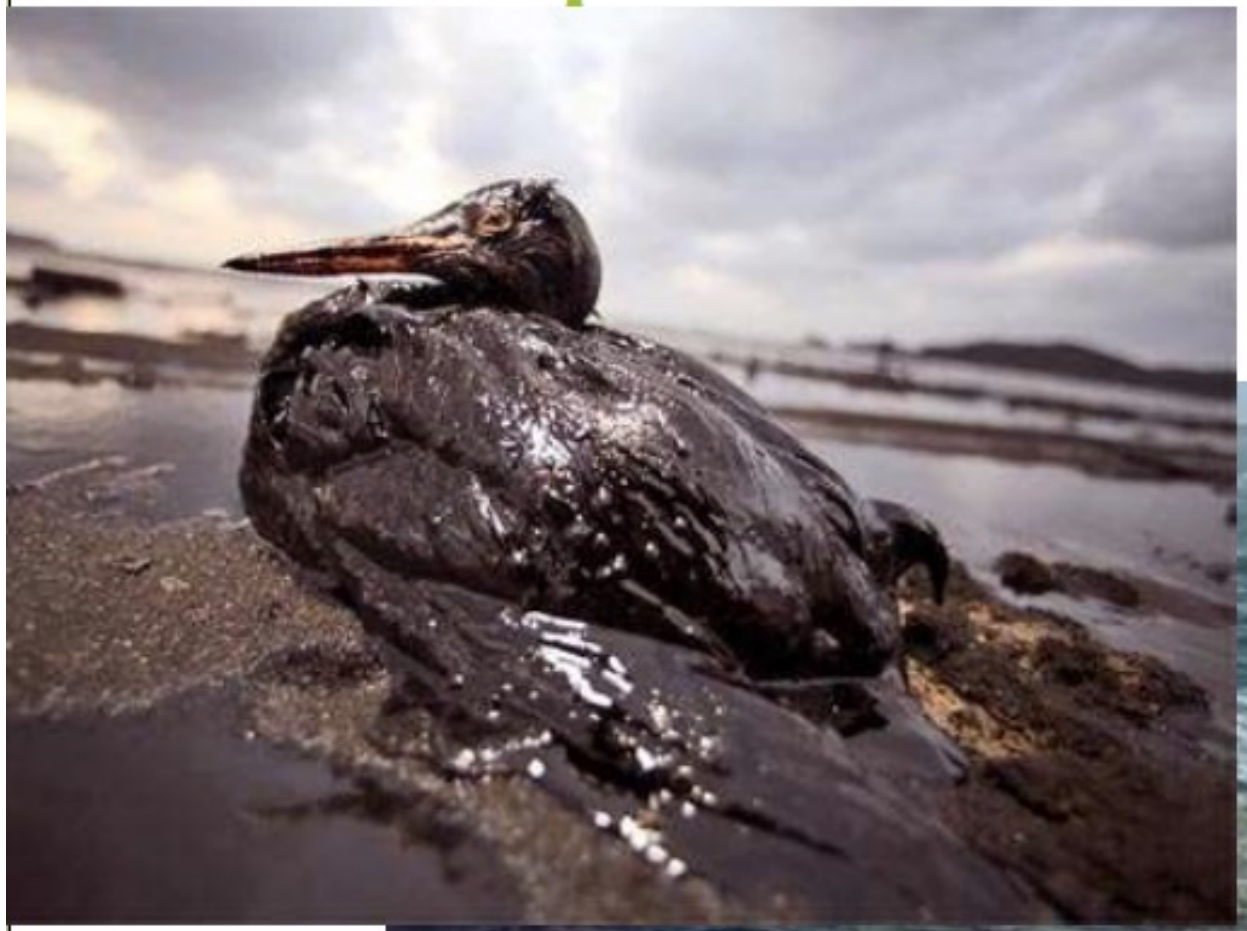
- Contamination of water by addition of undesirable organic and inorganic substances
- Natural sources can be soil erosion and minerals from weathering of rocks.
- Artificial sources include industrial effluents and domestic sewage.
- Destroys ecosystem through injurious effects on plants and animals
- Destroys marine organisms

Sources of Water Pollution	Community waste waters
	Industrial wastes
	Agricultural sources
	Thermal pollution
	Underground water pollution
	Marine pollution
	Oil spills

Effects of water pollution

- Heavy metal poisoning causes diseases in animals.
- Inorganic nitrates promote excessive plant growth in lakes and reservoirs.
- Pesticides are harmful to aquatic life.
- Organochlorines pass through food chains to animals and are harmful (biomagnification)
- Increased turbidity due to suspended particles
- Unpleasant odor and bad taste
- Soaps and alkalis cause foam formation
- Eutrophication provides rich growth of minute organisms that consume dissolved oxygen.
- Thermal pollution cause damage to aquatic life.

Oil Spills



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Control of water pollution

- Treatment of garbage and sewage
- Extraction of useful substances
- Chemical treatment
- Reduction of temperature of waste water
- Minimize the use of non-biodegradable pesticides.
- Proper implementation of anti-pollution laws of the government

Soil Pollution

Undesirable change in the physical, chemical or biological property which adversely affects its productivity

Caused by dumping of wastes and agrochemicals among others

Sources of soil pollution

- Domestic wastes
- Agricultural wastes
- Industrial wastes
- Human and animal excreta
- Salination

Control of soil pollution

- Proper disposal of industrial and agricultural wastes
- Recycling and recovery of materials
- Minimize the manufacture and use of chemical fertilizers
- Reduce the use of pesticides

Radioactive pollution

Pollution of air, water and soil caused by ionizing radiations of harmful nature emitted from disintegrating atomic nuclei

Natural sources include cosmic rays that reach the earth surface and radiations from radium 224, uranium 235, thorium 232, etc.

Man-Made Sources

- Nuclear weapons
- Reactors and nuclear fuel
- Wastewaters containing these wastes
- X-rays used in medical practice
- Ultraviolet rays present in solar radiations

Effects of Radioactive Pollution

Mutation

Cancer

Radioactive substances in food chain cause retarded growth and boen cancer

Increases infant mortality rate

Nuclear disasters

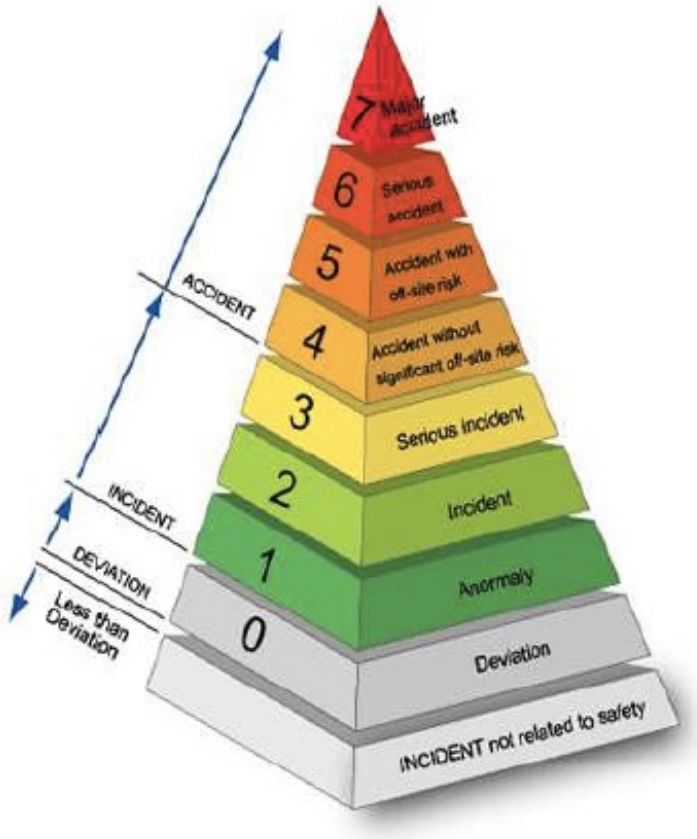
Nuclear energy is generated by the process of molecular fission, molecular fusion and molecular decay.

Uncontrolled formation of such energy leads to nuclear disasters.

These disasters affect the population and effects are observed for years.

Effects on Environment

- A single nuclear accident can cause loss of life, long term illness and destruction of property o a large scale.
- Radioactivity leads to cancer, genetic disorders and death in the affected area for decades.
- It thus affects all forms of life for generation to come.



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Examples of Nuclear Disasters

Serious **nuclear** power plant **accidents** include

- the Fukushima Daiichi **nuclear disaster** (2011)
- the Chernobyl **disaster** (1986)
- the **Three** Mile Island **accident** (1979)
- the SL-1 **accident** (1961).

Nuclear power **accidents** can involve loss of life and large monetary costs for remediation work.

Control Measures

- Prevention of leakage of radioactive elements from nuclear reactors
- Proper storage and disposal of nuclear wastes
- Regular monitoring
- Increasing the use of non-harmful energy sources

Thank you.