The sources of anthropogenic environmental change fall into two broad categories:

* Changes associated with the land use
* Changes induced by emissions

Public Policy

Environmental policies thus shape the development of technology in directions that reflects the goals and preferences of society.

Sources of Environmental Impacts

* Material selection
* Manufacturing processes
* Energy use

Life cycle assessment:

1-Material extraction 2-Material processing 3-Manufacturing 4-Use 5-Waste management

Industrial Ecology is the means by which humanity can deliberately and rationally approach and maintain a desirable carrying capacity, given continued economic, cultural, and technological evolution.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Chapter 2

Human health Effect:

Acute causes an immediate response in human body. Ex: carbon monoxide can cause short breath or dizziness

Chronic causes long term response in human body. Ex: exacerbation to the symptoms of asthma

Carcinogenic causes cancer

Criteria air pollutants are **particulate matter (PM), Sulfur dioxide (SO2), Carbon monoxide (CO), Nitrogen dioxide (NO2), and ground-level ozone (O3) and Lead (Pb)**

Standards that are specified on an hourly or daily basis are designed to protect against acute health effects, while annual average standards are related to chronic health effects. Most of the secondary standards protect against effects on materials or vegetation.

SO2 source is from combustion of coal and oil and metal smelting. Causes respiratory/breathing illness.

CO source is from non-complete combustion of fossil-fuel. Causes short breath and dizziness.

NO2 is a reddish-brown gas that is toxic in very high concentrations. The source of NO2 is from fuel combustion. NO2 can irritate the lung system and causes bronchitis.

Ozone found at ground level is formed by complex chemicals reaction in the atmosphere involving nitrogen oxide (NOx) and hydrocarbon gases know as Volatile Organic Compound (VOC). Can be controlled by reduction in NOx and VOCs.

Lead is a toxic metal that can cause neurological damage and adverse effect on organs such as the liver and kidneys. The most important source is the automobiles using leaded gasoline. In the US the major source is lead smelting and manufacturing process. Damages paints, fabrics, plastic, rubbers, and plants

Air toxics

Hazardous air pollutants (HAPs) also known as air toxics. By 1990 Clean Air Act Amendments there are 189 chemicals as hazardous air pollutants. Any industrial process emitting more than 10 tpy of any one these substances or more than 25 of any combination of HAPs must use maximum available control technology (MACT) to reduce the air toxic emissions.

Acid deposition

Commonly known as acid rain, refer to the fallout of acidic particles or any type of precipitation than is more acidic than normal. In North America the source of SO2 was from coal fired power plants of mid-west of US. Most of SO2 was released from tall chimneys which caused long distance transport of air pollutants. The cap of SO2 emissions is 9 million tons per year.

Stratosphere Ozone

Is depleted by chlorofluorocarbons (CFCs);

Greenhouse Gases

Greenhouse gases cause the rise in temperature and this will eventually lead to rising the sea level and flooding of low lying regions; increased precipitation and severity of storm events; increased drought and climate change. Other gases such as Methane (CH4), nitrous Oxide (N2O), and halocarbons which include CFCs contribute to greenhouse gases.

Water pollutants

Pathogens: disease causing agents such as bacteria.

Organic Wastes: the main source of oxygen depleting.

Nutrients

Toxic Organic Chemicals

Toxic Metals: mercury, lead, arsenic, cobalt, iron, chromium, manganese and molybdenum.

Sediments and suspended solids

Acidity

Salts

Heat: the primary source is from the waste heat from electric power plants.

Solid and Hazardous Wastes

Ignitability: an ability to burn easily or cause or enhance fires.

Corrosivity: strong acids and bases, or substances able to corrode metal.

Reactivity: an ability to react violently or cause explosions, including reactions with water.

Toxicity: an ability to threaten water supplies and health.

Radioactive Wastes

* Its harmful effects on living organisms are induced by radiation rather than by chemical mechanisms.
* Radioactive wastes remain dangerous up to hundreds and thousands of years.

The most dangerous waste is called high-level waste. This includes the spent fuel from nuclear reactors, as well as the highly radioactive liquids and solids produced by any reprocessing of spent fuel to manufacture plutonium and uranium. The danger arise when uranium and it’s daughter products break apart (fission). They can destroy living tissues and cause cancer.

Any waste that is not high level waste (HLW) is categorized as low level waste (LLW).

Human use and consumption of the earth’s natural resources are generally for

* Source of food
* Source of energy
* Source of raw materials for structures, devices, and other human endeavors.

**Ecological impacts**

Biodiversity

Loss of habitat

Marine ecosystems

**Land use practices**

People use land for housing, transportation, commercial activities and recreation.

Chapter 12

CO2 has increased more than 30% in the past 150 years

Process of global warming

Emissions of greenhouse gases🡺 increase in atmospheric concentration🡺 increase in radiative forcing🡺 increase in average temperature🡺 change in global climate

Qmax=σAT

Sigma is a constant, A is the area of the body, and T is temperature in kelvin (C°+273), and Q is the rate of emission of heat

Q/A is heat flux is the radiative energy in terms of the rate per unit of surface area🡺 q=Q/A

So=342 W/m2

Rate of solar energy absorbed (W/m2) = So(1 – a)

Solving for T🡺 The real avg temperature for earth is 15