## VI: Pollution

1. Air pollution
    a. Any release of chemical, physical, biological, or radioactive contaminants into the atmosphere
    b. Primary pollutants vs. secondary pollutants
    c. Fugitive emissions – those which escape accidentally from their sources into the atmosphere
    d. $SO_2$ – leads to acid rain ($H_2SO_4$)
    e. CO – incomplete combustion
    f. PM – 10 and 2.5
    g. NOx – NO initially formed, which further oxidizes in the atmosphere to form nitrogen dioxide (responsible for giving photochemical smog it's reddish brown color)
    h. Lead – problem mostly of the past (leaded gasoline phased out in developed world)

2. Temperature inversions
    a. Warm air above cold air mass trapped in location
3. Heat islands (urban)
4. Indoor air pollutants – typically 2-5 times higher indoors than outdoors
    a. Smoking – most significant indoor pollutant in the US. Causes approximately 20% of all deaths in the US
    b. Formaldehyde
    c. Radon
5. Noise pollution*
    a. Permanent damage in humans after 8 hours exposure to 85 dB or greater
6. Water pollution
    a. Types:
        i. Infectious agents – bacteria, viruses, etc.
        ii. Oxygen demanding wastes – "dead zones"
        iii. Inorganics – acids, metals, etc.
        iv. Organics – oil, pesticides, etc.
        v. Plant nutrients - eutrophication
        vi. Sediment
        vii. Heat (thermal) – lowers DO
    b. Nonpoint vs. Point
        i. Originating from specific, identifiable locations (point)
    c. Groundwater pollution – 50% of US depends on aquifers for drinking water
        i. Example: Methyl tertiary butyl ether (MTBE) is a gas additive to help in air pollution. It is a carcinogen. It leaks from underground storage tanks
7. Water treatment
    a. Septic systems
        i. Utilizes natural processes in areas with small population densities
    b. Municipal sewage treatment
        i. Primary treatment
        ii. Secondary treatment – activated sludge
        iii. Tertiary treatment – removes any residuals from secondary treatment

**VII: Global Change**

1. Stratospheric ozone
    a. $O_3$ formed from sun splitting $O_2$ up, which then reacts with other $O_2$ to form the $O_3$
        i. Takes place more readily from the Sun, so higher concentrations are found at equator (spread globally by wind circulations)
    b. Depletion
        i. Chlorine is the main culprit, originating from CFCs
        ii. Bromine, used extensively in fire retardants, is even worse than chlorine, but not used as much
    c. Montreal Protocol (1987) phased out all use of CFCs in 81 developed nations and set up fund to assist others in doing the same
        i. Studies show that levels will return to normal around 2040
2. Global Warming
    a. Keeling curve
        i. Seasonal fluctuations due to carbon sequestration and release during specific seasons (Charles Keeling)
    b. "Hockey Stick"
        i. classic temperature and $CO_2$ graph