

# Human Ecology

The Petroleum Industry & the Niger Delta  
The Ozone Layer, Green House Gases

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# The Niger Delta

- The Niger Delta region is situated at the apex of the Gulf of Guinea on the west coast of Africa and on Nigeria's South–South geopolitical zone
- The third largest wetland in the world and the largest in Africa
- It is home to some 31 million people, occupies a total area of about 75,000 km<sup>2</sup> and makes up 7.5% of Nigeria's land mass

# The Niger Delta (2)

- The region consists of 9 oil-producing states (Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Ondo, Imo and Rivers) and 185 local government areas
- Cuts across over 800 oil-producing communities with an extensive network of over 900 producing oil wells and several petroleum production-related facilities

# Oil activities in the Niger delta

- Oil was first discovered in commercial quantities in Nigeria in 1956 at Oloibiri, about 90km west of Port Harcourt in what is now Bayelsa State; other discoveries soon followed and exports began in 1958, although significant quantities only began to flow from 1965
- Oil production rose rapidly in the 70s and by 1974, oil revenues constituted over 80% of total federal revenues and over 90% of export earnings

# Oil activities in the Niger delta

- Nigeria is currently the largest oil producer in Africa, and the fifth largest in the Organization of Oil Producing Countries (OPEC).
- All of Nigeria's proven oil reserves are located in the coastal area of the Niger delta, in about 250 small (less than 50 million barrels) oil fields
- As a result, there is a need for a developed network of pipelines between the fields, and for constant exploration to augment existing oil reserves

# The Petroleum Industry

- The Petroleum industry is basically made up of 2 activities:
  - Oil exploration; and
  - Oil exploitation
- Both activities include several contaminating processes, but the extent of these polluting processes depends on the environmental practices and technology used by the oil companies
- In the Niger delta, these practices have repeatedly been questioned

# Oil Exploration activities

- Involves locating the oil several kilometres below the earth's surface
- Often begins with a 3-D seismic survey that requires a caravan of survey equipment, and the use of explosives like dynamites

# Oil Exploration activities

- These carry particular risks for plant habitat, wildlife and human communities, and have been noted to cause:
  - Deforestation
  - Destruction of farm lands
  - Exposure to infectious disease agents like jungle yellow fever
  - Access to explosives (dynamites)
  - Cultural clashes with local populations
  - Possibilities of industrial accidents

# Oil Exploitation Activities

- Once the oil is found in commercial quantity, oil exploitation begins with the drilling of oil wells
- This produces a large quantity of waste consisting of oil, drilling fluids and the byproducts of drilling, including water, drill cuttings and mud
- It is estimated that onshore oil production operations produce 60,000 to 300,000 gallons of cuttings and mud everyday, while offshore oil platforms use and discard nearly 400,000 gallons of water per day

# AN OIL WELL



# Environmental and Health Risks associated with Petroleum Exploration and Production

- Gas Flaring and Venting in the Niger Delta
- Petroleum Hydrocarbon Spills and Accidental Discharges in the Niger Delta
- Drilling Discharges and Petroleum–derived Chemical Wastes in the Niger Delta
- Petroleum Contamination of Soil, Sediment and Groundwater
- Human Health Risks – Long term Respiratory effects, mutagenicity, carcinogenicity and chromosomal damage

# The Ozone Layer

- Ozone is an allotrope of oxygen consisting of oxygen atoms ( $O_3$ )
- It occurs naturally in the atmosphere  $O + O_2 = O_3$
- The ozone layer is a region of Earth's stratosphere that absorbs most (97-99%) of the Sun's ultraviolet (UV) radiation which otherwise would potentially damage exposed life forms near the surface
- It contains high concentrations of ozone

# Ozone Depletion

- Is a decline in the total amount of ozone in the earth's stratosphere
- $O_3$  can be destroyed by certain free radical catalysts e.g.
- Hydroxyl radical (OH)
- Nitric oxide radical (NO)
- Chlorine atom (Cl)
- Bromine (Br)

# Occurrence of free radicals

These occur in natural forms e.g.

- i) Chloro-Fluoro-Carbons (CFC) as refrigerants
- ii)  $\text{CCl}_4$  as fire extinguishers, industrial solvent, agric fumigants, pesticide, in petroleum refining, pharmaceutical production
- iii) Methyl chloroform in cleaning metals
- iv) Halons as fire suppressants
- v) Methyl bromide as pesticide
- vi) CFC also contribute to Green House Gases in global warming

# Effects of Ozone Depletion

- Ozone layer protects the earth from the sun's UV rays and excessive heat
- Depletion thus leads to the following effects:
  - (a) On human health
    - (i) Melanoma , actinic keratoses
    - (ii) Premature ageing
    - (iii) Immune suppression
    - (iv) Eye problems

# Effects of Ozone Depletion (2)

## (b) Effects on plants

- (i) Plant diseases

- (ii) Reduced yield and decrease in food security

## (c) Aquatic Ecosystem

## (d) Global climate change and global warming

## (e) Socioeconomic effect e.g. damage to properties

# Protection from Ozone depletion

## (a) Personal Protection

- (i) Sunglasses
- (ii) Hat with wide brim
- (iii) Tightly woolen, loose fitting clothes
- (iv) Sunscreen cream

## (b) Controlling air pollution, elimination by substitution and change of process or process redesign

## (c) Policy and legislation

# Protection of the Ozone Layer

## (d) Conventions

- 1997- Kyoto protocol on ozone layer depletion;
- 1987- Montreal protocol on ozone layer depletion
- 1985- Vienna convention for the protection of ozone layer
- Helsinki Declaration

## (e) World ozone layer day;

- Ozone monitoring a necessity to socioeconomic development: 2007 theme;
- Protect the ozone layer, save life on earth; 2006 theme

# Greenhouse Gases

- Greenhouse chemicals are naturally occurring chemicals which permit incoming solar radiation to enter the earth's atmosphere and reach the earth's surface, but prevent re-radiated infrared energy from leaving earth's atmosphere
- Without these gases, the earth's temperature would have been  $-17^{\circ}\text{C}$  which is significantly lower than the observed mean global temperature of  $15^{\circ}\text{C}$

# Greenhouse Gases (2)

- Greenhouse effect is described “like the glass panes in a greenhouse”, certain gases in the earth’s atmosphere permit the sun’s radiation to heat the earth
- At the same time, these gases retard the escape into space of the infrared energy radiated back out of earth
- Normally greenhouse effect is a process that makes the earth habitable
- But the modern trend of increasing these gases into the atmosphere is threatening the very existence of earth because of their excessive release through anthropogenic sources from technology

# Greenhouse Gases (3)

- The major Greenhouse gases are
  - Carbon dioxide ( $\text{CO}_2$ )
  - Methane ( $\text{CH}_4$ )
  - Nitrous Oxide ( $\text{N}_2\text{O}$ )
  - Water Vapour ( $\text{H}_2\text{O}$ )
  - Chlorofluorocarbons (CFCs)
- Majority of them are from combustion sources while others are from biogenic activities

# CO<sub>2</sub> (Carbon Dioxide)

- >60% greenhouse effect
- 280 – 370 ppmv (31% increase since mid 19<sup>th</sup> Century)
- Sources
  - Fossil fuels (coal, oil, gas) combustion for transport, manufacturing, heating , cooling, generating energy
  - Biomass burning (firewood, bush burning, farm residues)
  - Land use changes (deforestation, desertification, farming, settlements etc)

# CH<sub>4</sub> (Methane)

- up to 20% greenhouse effect
- 700 – 1760 ppbv (151% increase since mid 19<sup>th</sup> C)
- Sources
  - Decaying organic matter, garbage
  - Wetlands, swamp rice
  - Livestock production
  - Fossil fuel production and combustion
  - Biomass burning
  - Waste water treatment

# N<sub>2</sub>O (Nitrous Oxide)

- 6% greenhouse effect
- 276 – 316 ppbv (175 increase since mid 19<sup>th</sup> Century)
- Sources
  - naturally from soils and the ocean
  - Soil cultivation; nitrogen fertilizers
  - Livestock production
  - Chemical industry; nylon manufacture
  - Fossil fuel and biomass burning

# Water vapour

- Water vapour is the most efficient greenhouse gas which is added to the atmosphere through Evapotranspiration processes
- Temperature governs its concentration in the atmosphere

# Chlorofluorocarbons (CFCs)

- These include Freon, Cl, F, Br, I compds, CFC I and CFC II
- They are of more recent origin (introduced in 1928)
- Their effects were not known before 1950s
- Up to 14% greenhouse effect
- They are 30,000 times more effective in absorbing radiation than CO<sub>2</sub>

# Chlorofluorocarbons (CFCs)

- They contribute to greenhouse effect as well as destruction of ozone layer
  - Sources
    - Exclusively Man-made and are widely used as;
    - propellants in aerosol cans,
    - manufacture of plastic foams, solvents, pesticides
    - Refrigerants

**Thank You**