

Chapter - 4

Environmental Impact of Energy Sources

Nuclear Hazards.

Risk or danger to human health or the environment posed by radiation emanating from the atomic nuclei of a given substance, or the possibility of an ~~uncontrolled~~ uncontrolled explosion originating from a fusion or fission reaction of atomic nuclei is called nuclear Hazards.

Fusion

A nuclear reaction in which atomic nuclei of low atomic number fuse to form a heavier nucleus with the release of energy is called fusion.

Fission

A nuclear reaction in which a heavy nucleus splits spontaneously or on impact with another particle, with the release of energy.

Source of Nuclear Radiations.

Natural Sources

- Cosmic rays from outer space
- Radioactive radon- 222
- Soil, rocks, air, water and food.

Anthropogenic sources

- Nuclear power plants
- Nuclear accidents
- X-rays
- Diagnostic kits
- Test laboratories

Physiological effects.

① White blood cell count drops.

② Mild radiation sickness.

- Nausea & Vomiting.
- Headache
- Fatigue
- Weakness

③ Moderate radiation sickness.

- Fever
- Hair-loss.
- Vomiting blood
- bloody stool
- Poor wound healing.

④ Severe radiation sickness.

- Diarrhea
- High fever.
- 50% fatality.

⑤ Very severe - radiation sickness.

- Dizziness
- Disorientation
- low blood - pressure.
- > 50% fatality.

⑥ Long term or chronic radiation effects.

- Genetic mutations.
- tumors
- cancer
- birth defects
- cataracts etc.

Control of radio-active pollution.

① Protection against radiation exposure.

② Distance from the source.

③ Time of exposure.

④ Shielding.

⑤ Using lab hoods, air filter, eliminating dry sweeping.

⑥ Use of ionizer.

4.L Emission Hazards

Automotive pollution

1. Local

- Direct Toxins:

* CO, Nitric Oxide, Ozone, Benzene, Toluene etc.

2. Regional

- Atmospheric Formation

* smog, Haze, Ozone, Nitric acid.

3. Global

- Ozone layer depletion, Global warming,
Global cooling.

- CO₂, CH₄, Sulphates, CFC's

Local pollution is simply the direct exposure to evaporated fuel and tail pipe pollution which has direct toxic effects on people. CO is poisonous, Ozone and ~~no~~ no damage lungs, benzene is carcinogenic.

Regional pollution is the result of many cars operating in a region and ~~the~~ their overall pollution level building up enough that air chemistry reactions between those pollutants produce new pollutants.

Global pollution is mostly concerned with global warming and ozone layer depletion. To reduce global warming, you mostly want to make processes more efficient and use less C in your fuel.

Evaporative & Refueling Emissions.

- Durnal (Breathing) losses
- Running losses
- Hot start
- Refueling

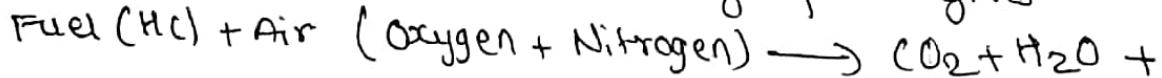
Health Impacts of common pollutants.

1. Carbon monoxide (CO) affects especially persons with heart disease and fetuses
2. Unburned hydrocarbon (HC) has serious health problems ~~to~~ and suffers from lungs diseases, asthma or emphysema.
3. Nitrogen oxides (NO_x) is linked to a wide range of respiratory problems; cough, runny nose and sore throat.
4. Ozone can cause chest pain, coughing and shortness of breath.
5. Lead exposure will lead to a decrease in intelligence.
6. Particulate matter (PM) can cause respiratory and cardiovascular disease etc.

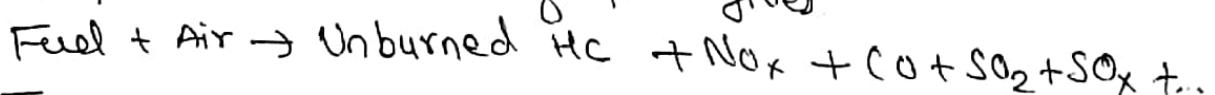
Internal Combustion Engine (ICE)

It is a heat engine where the combustion of fuel occurs with an oxidizer in a high temperature and high pressure gases produced by combustion applied direct force to some component of engine.

~~Completion~~. Complete Combustion of fuel gives



Incomplete combustion of fuel gives $\text{Unaffected nitrogen}$.



Types

- ① Reciprocating
- ② Rotory

Causes of Motor Vehicle Pollution

- 1) Improper Maintenance
- Low quality parts
 - No culture of preventive maintenance.
 - Lack of skills, equipments

2. Poor transport infrastructure & road conditions
3. Fraud and corruption.
4. Driving habits
5. Tampering (poor performance).

Vehicular emission control strategies.

1. Appropriate vehicle emission standard for new and in-use vehicles.
2. Set stringent emission standards for registration of new vehicles.
3. Require use of cleaner fuel.
4. Require mandatory periodic inspection.
5. Take stringent enforcement actions.

Roadworthiness requirements for vehicles.

Vehicle safety and reliability

1. Steering system.
2. Break system
3. wheels and tyres
4. lighting system
5. Gear and transmission system
6. chassis and body.

Vehicle environment protection.

1. Exhaust emission (I/M)
2. Oil loss reduction
3. Noise emission.

Engine characteristics

1. Engine type.
2. Engine technology.
3. Exhaust after treatment.

Fuel characteristics

1. Fuel properties
2. Fuel quality.

Vehicle emission - control technologies

1. Engine emission control

- Crank case emission control.
- Combustion control
- Exhaust after-treatment.

2. Evaporative emission control

3. Onroad diagnostic system.

4. Improvement in fuel quality.

Fuel parameters Affective pollutant Emission

1. Gasoline

- lead Content
- ~~Volatility~~
- Benzene & other Aromatic HCs.

Duel - Fuel Engines

Natural gas can be burned in diesel engine by mixing it with intake air. The injected diesel fuel in the combustion chamber serves to ignite the natural gas. About 30-40% of total energy is supplied by diesel and rest is being supplied by natural gas.

Advantage: NO_x and PM are reduced.

Disadvantage: High-cost.

Electric Vehicles

An electric vehicle (EV) also referred to as an electric drive vehicle, uses one or more electric motors or traction motors for propulsion. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels or a generator to convert fuel to electricity. EVs include road and rail vehicles, surface and underground vehicles, electric aircraft and

Advantages

- No tailpipe emissions.

Disadvantages

- Substantial electrical energy cost.
- High initial cost.
- Batteries are heavy and occupy a lot of room.
- Acceleration is poor.

Hybrid Vehicles

A hybrid vehicles uses two or more distinct types of power, such as internal combustion engine plus electric motor.

Eg: Diesel-electric trains.

Advantages

- Very low emissions
- Greater range
- Better acceleration.

Fuel Cell Vehicles

A fuel cell vehicles (FCV) is a type of electric vehicle which uses a fuel cell, instead of battery, or in combination with a battery or superconductor, to power its on-board electric motor.

Advantage

No vehicle emission.

Dis-advantage

Very expensive.

* Causes of smoky diesel vehicles

Improper air-fuel ratio

Incorrect fuel injector-timing

Inadequate intake air

Battery Hazards

There are main four hazards associated with batteries.

- a) Battery acid.
- b) Flammable gases.
- c) Electrical shock
- d) Weight.

Protection:

- a) Goggles.
- b) Face shield.
- c) Rubber gloves.
- d) Rubber apron.
- e) Recharge in ~~same~~ safe location.