CHAPTER - 26

ENVIRONMENT ISSUES AND HEALTH EFFECTS

TOXICOLOGY EFFECTS

Eco-toxicology is "a study of the effects of released pollutants on the environment and on the biota that inhabit it.

Rem

It gives an indication of biological damage. It is an estimate of the amount of radiation of any type which produces the same biological injury in man as that resulting from the absorption of a given amount of X-ray radiation or gamma radiation.

Iodine - 131

Iodine - 131 produced by nuclear tests is passed to vegetation and then appears in milk of the cattle that consume the contaminated vegetation and is passed to humans. Iodine-131 causes serious damage to thyroid gland, especially among children.

About 99% of long-term radioactivity from either strontium or radium taken into the human body is found in the bones.

Lead

Lead is highly toxic to plants and animals including man. Lead generally affects children more severely than adults. Lead poisoning causes a variety of symptoms. These include liver and kidney damage, reduction in hemoglobin formulation, mental retardation and abnormality in fertility and pregnancy. Symptoms of chronic lead-poisoning are of three general types.

a. Gastrointestinal troubles - most common in industrial workers includes intestinal stress.

b. Neuromuscular effects - collectively called lead palsy, and impairment of muscle metabolism resulting into residual paralysis and muscular atrophy.

c. Central nervous system effects - CNS syndrome - a panoply of nervous system disorders, they may lead to delirium, convulsions coma and death.

Mercury

This is the most common and most toxic in water bodies. It occurs in water as monomethyl mercury. Most industrial effluents have mercury. Methyl mercury vapours cause fatal poisoning.

High levels of mercury in fish stocks have been found, mainly in coastal areas. Mumbai, Kolkata, Karwar (in Karnataka) and North Koel (in Bihar) are some of the severely affected areas.

The recent popularity of energy efficient compact to fluorescent lamps or CFLs has added another dimension to the controversy.

Toxicity of mercury is much greater than any other substance, about 1000 times more potent than colchicines.

Fluorine

It occurs in nature as fluoride, in air, soil and water. Fluorisis is a common problem in several states of the country due to intake of high fluoride content water. Fluorides cause dental fluorisis, stiffness of joints (particularly spinal cord) causing humped back. Pain in bones and joint and outward bending of legs from the knees is called Knock-Knee syndrome. In cattle, fluoride intake causes staining, mottling and abrasion of teeth, lameness and decrease in milk production.

DDT

Toxic pesticides as BHC, PCB, DDT etc., are not easily degraded and are long-lasting in the environment. Their concentration therefore goes on increasing in water and soil with successive applications.

DDT was sprayed for many years on marshes to control mosquitoes.

The DDT has bio-magnified from water to fish eating birds and humans. DDT is known to depress the activity of estrogen, the female sex hormone and testosterone, male sex hormone. Fish die due to

eating of DDT-killed insects; turtles die because of eating DDT-killed fish and so on. DDT deposited in butter fat of milk is a potential danger to infants.

The end result of DDT use is that whole population of predatory birds such as the fist hawk (osprey) and of detritus feeders as fiddler crab are wiped out. Birds are more vulnerable as DDT interferes with egg shell formation by causing a breakdown in steroid hormones which results in fragile eggs that break before the young can hatch.

LEAD IN PAINTS

- Modern houses are full of harmful chemicals. One of them is lead, present in paints.
- Though several countries have banned the use of this substance India is yet to do so, which is why paint makers use them.
- Inhaling lead dust like opening or closing windows is the most common source of lead poisoning.
- The human body is not designed to process lead. Young children are particularly vulnerable to lead as it can damage the central nervous system and the brain.
- If lead is so poisonous why do paint makers continue to use it? Using lead susbtitutes increases the cost and also reduces paint performance.

TRANSFAT

- Transfats are formed during the process of addition of hydrogen atoms to oils, a process which industry prefers as it keeps the oil from turning rancid and ensures a longer shelf life. (E.g trans-fatty acid in vanaspati).
- Transfats are associated with a host of serious health problems ranging from diabetes to heart disease to cancer.
- The health ministry in 2008 came out with a notification for labelling food including trans fats.
- Junk food high in transfats, salt and sugar, junk food gives no nutrition. In fact, getting addicted to it is making the young vulnerable to hypertension, heart diseases, diabetes and obesity.

HIGH CAFFEIENE IN ENERGY DRINKS

- Energy drinks are in controversy because of its high caffeine content. Most of these brands have upto 320 ppm of caffeine in them. These drinks are marketed as an instant source of energy.
- The manufacturers claim that it is the combination of caffeine, taurine, glucoronolactone, vitamins, herbal supplements, and sugar or sweeteners that gives the energy.
- According to study reports, it is the sugar that gives the energy rush, the caffeine only gives a 'feeling' of energy.
- Energy drinks fall under the category of 'Proprietary foods' in the Prevention of Food Adulteration (PFA) Act of 1954.
- An amendment in the PFA act 2009 ensured that caffeine in energy drinks should be capped at 145 ppm, the limit that was set for carbonated beverages.
- However, Red Bull managed to get a stay order on the amendment of the PFA act in 2010 and since then the energy drink market is expanding unregulated.
- The Food Safety and Standards Authority of India (FSSAI) is currently making regulations on energy drinks.

PESTICIDE IN HUMAN BLOOD

- Pesticides are commonly used in India but this comes at great cost to human health. It found that 15 different pesticides in the 20 blood samples tested from four villages in Punjab.

TESTING OF PESTICIDE TOXICITY

- All pesticides are tested to establish toxicity — a dose necessary to produce a measurable harmful effect, it is usually established through tests on mice, rats, rabbits and dogs.
- Results are then extrapolated on humans, and safe exposure levels predicted.
- The value commonly used to measure acute toxicity is LD 50 (a lethal dose in the short term; the subscript 50 indicates the dose is toxic enough to kill 50 per cent of lab animals exposed to the chemical). LD 50 values are measured zero onwards; the lower the LD 50 the more acutely toxic the pesticide.
- To illustrate, comparison of DDT — most used in India up to the early 1990s — with monocrotophos, currently most used.

- DDT' S LD 50 is 113 mg/kg; monocrotophos, 14 mg/kg. But never forget that lower LD 50 means higher acute toxicity.
- Pesticides once ingested, accumulate in the body fat or pass through. Organochlorine pesticides, for instance, accumulate in body fat and blood lipids. These fat-soluble chemicals persist in the body for many years.

DISEASES CAUSED BY ENVIRONMENTAL DEGRADATION

a) Minamata disease

- Minamata disease was first discovered in Minamata city in Kumamoto prefecture, Japan in 1956.
- It was caused by the release of methyl mercury in the industrial wastewater from the Chisso Corporation's chemical factory, which continued from 1932 to 1968.
- It is also referred to as Chisso-Minamata disease, is a neurological syndrome caused by severe mercury poisoning.
- Symptoms include ataxia, numbness in the hands and feet, general muscle weakness, narrowing of the field of vision and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms. A congenital form of the disease can also affect fetuses in the womb.
- This highly toxic chemical bioaccumulated in shellfish and fish in Minamata Bay and the Shiranui Sea, which when eaten by the local populace resulted in mercury poisoning. While cat, dog, pig, and human deaths continued over more than 30 years, the government and company did little to prevent the pollution.

b) Yokkaichi asthma

- Disease occurred in the city of Yokkaichi in Mie Prefecture, Japan between 1960 and 1972.
- The burning of petroleum and crude oil released large quantities of sulfur oxide that caused severe smog, resulting in severe cases of chronic obstructive pulmonary disease, chronic bronchitis, pulmonary emphysema, and bronchial asthma among the local inhabitants.

c) Itai-itai disease

- Itai-itai disease was the documented case of mass cadmium poisoning in Toyama Prefecture, Japan, starting around 1912.
- The cadmium poisoning caused softening of the bones and kidney failure.
- The cadmium was released into rivers by mining companies in the mountains. The mining companies were successfully sued for the damage

d) Blue baby syndrome

- It is believed to be caused by high nitrate contamination in ground water resulting in decreased oxygen carrying capacity of hemoglobin in babies leading to death.
- The groundwater is thought to be contaminated by leaching of nitrate generated from fertilizer used in agricultural lands and waste dumps.
- It may also be related to some pesticides (DDT, PCBs etc), which cause eco toxicological problems in the food chains of living organisms, increasing BOD, which kills aquatic animals.

e) Pneumoconiosis

- The coal miners are frequently caught by the black lung disease, which is also called as Pneumoconiosis
- Pneumoconiosis is caused due to the deposit of coal dust in the lungs of coal miners, leads to a serious lung disease called as Black Lung disease.

f) Asbestosis

- Workers working in the asbestos industry are caught by the serious lung disease called as asbestosis.

G) Silicosis

- It is caused due to the deposit of silica in the lungs of workers working in silica industries or at the sand blasting sites

h) Emphysema

- The breaking down of sensitive tissue of lungs due to air pollution and smoke of cigarette is called as Emphysema. Once this disease happens, the lungs cannot expand and contract properly

I) Sick Building Syndrome (SBS)

- Sick building syndrome (SBS) is a combination of ailments (a syndrome) associated with an individual's place of work or residence.
- Most of the sick building syndrome is related to poor indoor air quality.

- Sick building causes are frequently pinned down to flaws in the heating, ventilation, and air conditioning (HVAC) systems. Other causes have been attributed to contaminants produced by out gassing of some types of building materials, volatile organic compounds (VOC), molds, improper exhaust ventilation of ozone, light industrial chemicals used within, or lack of adequate fresh-air intake air filtration

MISCELLANEOUS TOPICS

CHIPKO MOVEMENT

- It is a social-ecological movement that practised the Gandhian methods of satyagraha and non-violent resistance, through the act of hugging trees to protect them from falling.
- The modern Chipko movement started in the early 1970s in the Garhwal Himalayas of Uttarakhand, with growing awareness towards rapid deforestation.
- The landmark event in this struggle took place on March 26, 1974, when a group of peasant women in Reni village, Hemwalghati, in Chamoli district, Uttarakhand, India, acted to prevent the cutting of trees and reclaim their traditional forest rights that were threatened by the contractor system of the state Forest Department.
- Their actions inspired hundreds of such actions at the grassroots level throughout the region.
- By the 1980s the movement had spread throughout India and led to formulation of people-sensitive forest policies, which put a stop to the open felling of trees in regions as far reaching as Vindhyas and the Western Ghats.
- The first recorded event of Chipko however, took place in village Khejarli, Jodhpur district, in 1730 AD, when 363 Bishnois, led by Amrita Devi sacrificed their lives while protecting green Khejri trees, considered sacred by the community, by hugging them, and braved the axes of loggers sent by the local ruler, today it is seen an inspiration and a precursor for Chipko movement of Garhwal.

APPIKO MOVEMENT

- Appiko movement was a revolutionary movement based on environmental conservation in India.
- The Chipko movement in Uttarakhand in the Himalayas inspired the villagers of the district of Karnataka province in southern India to launch a similar movement to save their forests.
- In September 1983, men, women and children of Salkani "hugged the trees" in Kalase forest. (The local term for "hugging" in Kannada is appiko.)
- Appiko movement gave birth to a new awareness all over southern India.

International Standards and Environment

- The ISO 14000 environmental management standards exist to help organizations
  a. Minimize how their operations (processes etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land)
  b. Comply with applicable laws, regulations, and other environmentally oriented requirements,
  c. Continually improve in the above.
- ISO 14000 is similar to ISO 9000 quality management in that both pertain to the process of how a product is produced, rather than to the product itself.
- As with ISO 9000, certification is performed by third-party organizations rather than being awarded by ISO directly.
- The ISO 19011 audit standard applies when auditing for both 9000 and 14000 compliance at once.
- List of ISO 14000 series standards
  i. ISO 14001 Environmental management systems—Requirements with guidance for use
  ii. ISO 14004 Environmental management systems—General guidelines on principles, systems and support techniques
  iii. ISO 14015 Environmental assessment of sites and organizations
  iv. ISO 14020 series (14020 to 14025) Environmental labels and declarations
  v. ISO 14030 discusses post production environmental assessment
  vi. ISO 14031 Environmental performance evaluation—Guidelines

vii. ISO 14040 series (14040 to 14049), Life Cycle Assessment, LCA, discusses pre-production planning and environment goal setting.

viii. ISO 14050 terms and definitions.

ix. ISO 14062 discusses making improvements to environmental impact goals.

x. ISO 14063 Environmental communication —Guidelines and examples

xi. ISO 14064 Measuring, quantifying, and reducing Greenhouse Gas emissions.

xii. ISO 19011 which specifies one audit protocol

The National Wastelands Development Board (NWDB)

- The National Wastelands Development Board (NWDB) was set up under the Ministry of Environment & Forests in 1985 with the objective of

i. to increase tree and other green cover on wastelands,

ii. to prevent good land from becoming wasteland, and

iii. to formulate within the overall nodal policy, perspective plans and programmes for the management and development of the wastelands in the country.

- In 1992, the Board was transferred to the Ministry of Rural Development, putting under a New Department of Wastelands Development under the charge of a Minister of State.

Bioassay

- Bioassay is a test in which organisms are used to detect the presence or the effects of any other physical factor, chemical factor, or any other type of ecological disturbance.
- Bioassays are very common in pollution studies. Bioassays can be conducted by using any type of organisms. However, the fish and insect bioassays are very common.
- The aim is to find out either lethal concentration or effective concentration causing mortality or other effects.
- Ultimately they are to be used for determination of safe concentration of a chemical or maximum acceptable toxicant concentration (MATC).
- The organism is exposed to different concentrations of a toxicant for a definite period and mortality, behavioral change or other signals of distress are noted periodically.
- Out of three types, static bioassay test is designed, where the organisms are exposed to the same toxicant solution for the whole experimental period. The other two are, renewal bioassay and flow-through bioassays.

Flagship species

- A flagship species is a species chosen to represent an environmental cause, such as an ecosystem in need of conservation. These species are chosen for their vulnerability, attractiveness or distinctiveness in order to engender support and acknowledgement from the public at large. Thus, the concept of a flagship species holds that, by giving publicity to a few key species, the support given to those species will successfully leverage conservation of entire ecosystems are all species contained therein.
- Example: Indian tiger, African elephant, giant panda of China, mountain gorilla of Central Africa, orangutan of Southeast Asia and the leatherback sea turtle.

Keystone species

- Keystone species is a species whose addition to or loss from an ecosystem leads to major changes in abundance or occurrence of at least one other species. Certain species in an ecosystem is considered more important in determining the presence of many other species in that ecosystem.
- All top predators (Tiger, Lion, Crocodile, Elephant) are considered as keystone species because it regulates all other animals' population indirectly. Hence top predators are given much consideration in conservation.
- Key stone species deserves special attention from the conservation point of view. Conservation of keystone species encourages conservation of all other relevant species associated with this.
- If keystone species is lost, it will result in the degradation of whole ecosystem. For example certain plant species (ebony tree, Indian-laurel) exclusively depends upon bats for its pollination. If the bat population is reduced then regeneration of particular plants becomes more difficult. This changes the vegetation structure which adversely influence on the dependant animals.

Indicator species

- Indicator species is a species whose presence indicates the presence of a set of other species and whose absence indicates the lack of that entire set of species.
- An indicator species is any biological species that defines a trait or characteristic of the environment. For example, a species may delineate an ecoregion or indicate an environmental condition such as a disease outbreak, pollution, species competition or climate change. Indicator species can be among the most sensitive species in a region, and sometimes act as an early warning to monitoring biologists.
- Many indicator species of the ocean systems are fish, invertebrates, periphyton, macrophytes and specific species of ocean birds (like the Atlantic Puffin). Amphibian indicates chemicals, global warming and air pollution. Lichens are indicators of air quality and are sensitive to sulfur dioxide.

Foundation species

- Foundation species is a dominant primary producer in an ecosystem both in terms of abundance and influence. Example: kelp in kelp forests and corals in coral reefs.

Charismatic megafauna

- These are large animal species with widespread popular appeal that environmental activists use to achieve conservation goals well beyond just those species. Examples include the Giant Panda, the Bengal Tiger, and the Blue Whale.

Umbrella species

- Umbrella species is a wide-ranging species whose requirements include those of many other species. The protection of umbrella species automatically extends protection to other species. These are species selected for making conservation related decisions, typically because protecting these species indirectly protects the many other species that make up the ecological community of its habitat.