6) Appropriate steps should be taken against occupational exposure; and
7) Safety measures should be strengthened against nuclear accidents

3.2 SOLID WASTE MANAGEMENT

Solid wastes are the material that arises from various human and economic activities. It is being produced since the beginning of civilization. Ever increasing population growth, urbanization and industrialization are contributing to the generation of solid waste in huge quantities.

Waste is enviable; waste is by product of human activity which has lack of use. The term waste refers to the useless material generated from different sources such as household, public places, hospital, commercial centre construction sites and production of waste from industries.

Waste can be classified through various methods on the basis of physical state (solid, liquid and gaseous) and then within solid waste (according to its original use packaging waste, food waste etc.) material (glass, paper etc.) physical properties, domestic, commercial, biodegradable, non-biodegradable etc. Solid wastes have prevailing characteristics which sets them apart from the liquid and gaseous wastes.

The characteristics are that the waste remains highly visible in the environment. Liquid wastes are quickly relegated to sewer and are out of sight and gaseous wastes disperse in to the atmosphere. Accumulation of large quantities of solid wastes is having an adverse impact on the environment.

There are many waste types defined by modern systems of waste management, notably including:

- municipal solid waste (MSW)
- construction waste and demolition waste (C&D)
- institutional waste, commercial waste, and industrial waste (IC&I)
- medical waste (also known as clinical waste)
- hazardous waste, radioactive waste, and electronic waste
- biodegradable waste

Waste management is the collection, transport, processing, recycling or disposal, and monitoring of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each.

Effects

a) Health Hazard

If solid wastes are not collected and allowed to accumulate, they may create unsanitary conditions. This may lead to epidemic outbreaks. Many diseases like cholera, diarrhea, dysentery, plague, jaundice, or gastro-intestinal diseases may spread and cause loss of human

lives. In addition, improper handling of the solid wastes is a health hazard for the workers who come in direct contact with the waste.

b)Environmental Impact

If the solid wastes are not treated properly, decomposition and putrefaction may take place, causing land and water pollution when the waste products percolate down into the underground water resources. The organic solid waste during decomposition may generate obnoxious odors. Stray dogs and birds may sometimes invade garbage heaps and may spread it over the neighborhood causing unhygienic and unhealthy surroundings.

Control measures

An integrated waste management strategy includes three main components

1. Source reduction

2. Recycling

3. Disposal

Source reduction is one of the fundamental ways to reduce waste. This can be done by using less material when making a product, reuse of products on site, designing products or packaging to reduce their quantity. On an individual level we can reduce the use of unnecessary items while shopping, buy items with minimal packaging, avoid buying disposable items and also avoid asking for plastic carry bags.

Recycling is reusing some components of the waste that may have some economic value. Recycling has readily visible benefits such as conservation of resources reduction in energy used during manufacture and reducing pollution levels. Some materials such as aluminum and steel can be recycled many times. Metal, paper, glass and plastics are recyclable. Mining of new aluminum is expensive and hence recycled aluminum has a strong market and plays a significant role in the aluminum industry. Paper recycling can also help preserve forests as it takes about 17 trees to make one ton of paper. Crushed glass (cullet) reduces the energy required to manufacture new glass by 50 percent. Cullet lowers the temperature requirement of the glassmaking process thus conserving energy and reducing air pollution.

However even if recycling is a viable alternative, it presents several problems. The problems associated with recycling are either technical or economical. Plastics are difficult to recycle because of the different types of polymer resins used in their production. Since each type has its own chemical makeup different plastics cannot be recycled together. Thus separation of different plastics before recycling is necessary. Similarly in recycled paper the fibers are weakened and it is difficult to control the colour of the recycled product. Recycled paper is banned for use in food containers to prevent the possibility of contamination. It very often costs less to transport raw paper pulp than scrap paper. Collection, sorting and transport account for about 90 percent of the cost of paper recycling.

The processes of pulping, deinking and screening wastepaper are generally more expensive than making paper from virgin wood or cellulose fibers. Very often thus recycled paper is more expensive than virgin paper. However as technology improves the cost will come down.

Disposal of solid waste is done most commonly through a sanitary landfill or through incineration. A modern sanitary landfill is a depression in an impermeable soil layer that is lined with an impermeable membrane. The three key characteristics of a municipal sanitary landfill that distinguish it from an open dump are:

• Solid waste is placed in a suitably selected and prepared landfill site in a carefully prescribed manner.

• The waste material is spread out and compacted with appropriate heavy machinery.

• The waste is covered each day with a layer of compacted soil. The problems with older landfills are associated with groundwater pollution. Pollutants seeping out from the bottom of a sanitary landfill (leachates) very often percolate down to the groundwater aquifer no matter how thick the underlying soil layer. Today it is essential to have suitable bottom liners and leachate collection systems along with the installation of monitoring systems to detect groundwater pollution.

The organic material in the buried solid waste will decompose due to the action of microorganisms. At first the waste decomposes aerobically until the oxygen that was present in the freshly placed fill is used up by the aerobic microorganisms. The anerobes take over producing methane which is poisonous and highly explosive when mixed with air in concentrations between 5 and 15 percent. The movement of gas can be controlled by providing impermeable barriers in the landfill. A venting system to collect the blocked gas and vent it to the surface where it can be safely diluted and dispersed into the atmosphere is thus a necessary component of the design of sanitary landfills.

Even though land filling is an economic alternative for solid waste disposal, it has become increasingly difficult to find suitable land filling sites that are within economic hauling distance and very often citizens do not want landfills in their vicinity. Another reason is that no matter how well engineered the design and operation may be, there is always the danger of some environmental damage in the form of leakage of leachates. Incineration is the process of burning municipal solid waste in a properly designed furnace under suitable temperature and operating conditions. Incineration is a chemical process in which the combustible portion of the waste is combined with oxygen forming carbon dioxide and water, which are released into the atmosphere.

This chemical reaction called oxidation results in the release of heat. For complete oxidation the waste must be mixed with appropriate volumes of air at a temperature of about 815o C for about one hour.

Incineration can reduce the municipal solid waste by about 90 percent in volume and 75 percent in weight. The risks of incineration however involve airquality problems and toxicity and disposal of the fly and bottom ash produced during the incineration process. Fly ash consists of finely divided particulate matter, including cinders, mineral dust and soot. Most of the incinerator ash is bottom ash while the remainder is fly ash. The possible presence of heavy metals in incinerator ash can be harmful. Thus toxic products and materials containing heavy metals (for example batteries and plastics) should be segregated.

Thus extensive air pollution control equipment and high-level technical supervision and skilled employees for proper operation and maintenance is required. Thus while sanitary landfills and incinerators have their own advantages and disadvantages, the most effective method of solid waste management is source reduction and recycling.

Vermi – Composting

Nature has perfect solutions for managing the waste it creates, if left undisturbed. The biogeochemical cycles are designed to clear the waste material produced by animals and plants. We can mimic the same methods that are present in nature. All dead and dry leaves and twigs decompose and are broken down by organisms such as worms and insects, and is finally broken down by bacteria and fungi, to form a dark rich soil-like material called compost.

These organisms in the soil use the organic material as food, which provides them with nutrients for their growth and activities. These nutrients are returned to the soil to be used again by trees and other plants. This process recycles nutrients in nature. This soil can be used as a manure for farms and gardens.

3.2.1 ROLE OF INDIVIDUALS IN PREVENTION OF POLLUTION

The role of an individual in maintaining a pollution free, pure and congenial environment and in preserving its resources is actually the need of the hour. Individuals can, however, play an important role in abatement of air, water, soil or noise pollution in the following simple manners:

1) Use low-phosphate, phosphate-free or biodegradable dishwashing liquid, laundry detergent, and shampoo.
2) Don't use water fresheners in toilets.
3) Use manure or compost instead of commercial inorganic fertilizers to fertilize gardens and yard plant.
4) Use biological methods or integrated pest management to control garden, yard, and household pests.
5) Don't pour pesticides, paints, solvents, oils, or other products containing harmful chemicals down drain or on the ground. Contact the authorities responsible for their disposal.
6) Recycle old motor oil and antifreeze at an auto service center that has an oil recycling program

7) If you get water from a private well or suspect that municipal water is contaminated, have tested by an EPA certified laboratory for lead, nitrates, trihalomethanes, radon, volatile, organic compounds and pesticides.

8) Run water from taps for several minutes every morning before using the water for drinking or cooking. Save it and use it to water plants.

If you have a septic tank, monitor it yearly and have it cleaned out every three to five years by a reputable contractor so that it won't contribute to groundwater pollution. Do not use Septic tank cleaner, which contain toxic chemicals that can kill bacteria important to sewage Decomposition and that can contaminate groundwater if systems malfunction.

9) Support ecological land-use planning in your community.

10) Get to know your local water bodies and form watchdog groups to help monitor, protect, and restore them.

3.3 DISASTER MANAGEMENT

Disaster means a terrible event that causes a great damage / loss to the human beings. It is a situation arising from natural forces where large scale disruption of infrastructure, services etc. occurs. It causes a serious impact on human life, economy and environment. Natural disasters are always severe and sudden.

Some disasters are:

(A) Geological: in nature like the earthquakes;

(B) Landslides (rocks slides down from the side of a hill); Volcanic eruptions etc..

(C) Climatic disasters / Natural calamities: These are of different types affect nations all over the world. Because of the large geographical size of the country, India often faces natural calamities like floods, cyclones and drought occurring frequently in different parts of the country.

Natural calamities are of two types:

1. Major calamities: eg: earthquakes; droughts; floods, tsunamis; cyclones etc
2. Minor calamities: eg: hailstorms; avalanches; fire accidents

(D) Man induced disasters include wars, battles, riots, rail/road accidents, nuclear explosions.

The disaster Management: The natural disaster management involves the following steps:
Relief measures: it include rescue tools; communication equipments; heavy machines to remove debris; water pumps; technicians; drugs, doctors, ambulances..

Disaster predictions: The predictions of natural hazards may be made on the basis of past history of the area with regular monitoring of the environmental changes caused by human activities to assess the genesis of natural disasters.

Education: Disaster education plays a significant role in disaster education. It create awareness and improve the standards to prevent from the disasters.

Geographic Information Systems: (GIS): GIS is a system that captures, stores, analyzes , manages and presents data with reference to geographic location of the area. In simple terms, GIS is the merging of cartography, statistical analysis and database technology. GIS may be used in Archaeology, Geography, Remote Sensing, Land surveying; Natural Resource Management;

Urban Planning etc. GIS programs help by means of maps available data of the problem areas, to predict the severity of the disaster.

Floods

Floods are high stream flow that overflows the natural banks of the rivers and most of the times become calamitous. India is the most flood affected nation after Bangladesh. Out of total deaths by Floods in the world, (1/5) are from India. The main causes of floods are excessive rains in river catchments, poor natural drainage, Change of river course, Landslide restricting river flow, cyclone and very intense rainfall. Over that past few years the rise in population is forcing large settlements along the river banks, making the country highly vulnerable to Floods. The most vulnerable states of India are Uttar Pradesh, Bihar, Assam, West Bengal, Gujarat, Orissa, Andhra Pradesh, Madhya Pradesh, Maharashtra, and PunjabandJammu&Kashmir. In 1994, a major flood killed 147 people in Kerala, 138 in Gujarat and marooned 10000 in Madhya Pradesh. In 1995, the states of Uttar Pradesh, Haryana and Arunachal Pradesh were severely hit by flood causing huge casualties. In the year 1996, a fierce flood literally paralyzed India, Thousands of people died, got homeless, were marooned in the states of Rajasthan, Andhra Pradesh, Jammu & Kashmir also affecting many other parts of the country. In short, nearly every year one or the other part of the country is severely hit by Floods and creating a shameful history for India. It is high time that the policies and measures for various preventions and disaster management activities are properly implemented. Development of flood risk maps, flash flood run off modeling, water logging problems, systems for monitoring and management of flood using remote sensing and GIS.

Earth-quakes Earthquakes occur due to the sudden movements in the earth crust. The earth's crust has several tectonic plates of solid rocks which slowly move along their boundaries. When friction prevents these plates from slipping, stress builds up and results in the sudden fractures which occur along their boundaries of the plates or fault lines (planes of weakness) within the plates. This causes earthquakes, the violent, short term vibrations in the earth. The point on a fault at which the first movement occurs during an earth quake is called the epicenter. The severity of an earthquake is generally measured by its magnitude on RichterScale.

Richter scale	**Severity of earthquake**
Less than 4	Insignificant
4-4.9	Minor
5-5.9	Damaging
6-6.9	Destructive
7-7.9	Major
8-8.9	Great

Damage to property and life can be prevented by monitoring of buildings and structures under Strong Earth Motion, experimental and analytical investigations on structures to predict their behavior under earthquake conditions, strengthening through retrofits, development of

earthquake resistant design methodologies, better materials, risk assessment, preparation of seismic codes, seismic zonation and development of risk specific designs

Landslides

Landslides are mass movement of rocks and debris that usually follow a cyclone, volcano or earthquake. In the hilly areas of India, the sliding of huge masses of land has been a common natural disaster causing havoc to life and property. One of the worst and most disastrous landslides has been recorded in the year 1998 in the state of Uttarakhand, when nearly 380 people were killed. As a measure of concern many committees and other measures have been taken to protect from this natural havoc in India. In India, the regions of Himalayas and the Western ghats are the most vulnerable to these land-slides. The main causes of landslides are weak, weathered materials, physical property variation, Ground Uplift, erosion, Earthquake, Volcanic eruptions etc. The general and simple mitigation that are adopted or should be adopted are drainage correction, proper land-utilization, reforestation and spreading of awareness.

Cyclones

Cyclone refers to a whirl in the atmosphere with very strong winds circulating around it in anti-clockwise direction in the Northern Hemisphere and clockwise in the Southern Hemisphere. Cyclones are intense low pressure areas with pressure increasing outwards. Cyclones can be hazardous as Cyclones are normally associated with strong winds. A storm surge is an abnormal rise of sea level near the coast caused by a severe tropical cyclone; as a result, sea water inundates low lying areas of coastal regions drowning human beings and lives- stock, eroding beaches and embankments, destroying vegetation and reducing soil fertility. Apart from strong winds, cyclones can result in heavy rains causing floods. However, the most destructive factor associated with the cyclones is the storm surge. The worst and the oldest cyclone in India were in 1737, in Calcutta that took 300000 lives respectively. For cyclone forecast and advance warning, the Government has strengthened the Meteorological Department, by providing Cyclone Surveillance Radars at Calcutta, Paradeep, Visakhapatnam, Machilipatnam, Madras and Karaikal in the east coast and at Cochin, Goa, Bombay and Bhuj in the west coast. As India has a vast coastline it is extremely vulnerable to cyclone.

3.3.1 E-WASTE

Front panel of CRTs	Barium (Ba)	Short term exposure causes: • Muscle weakness; • Damage to heart, liver and spleen.
Motherboard	Beryllium (Be)	• Carcinogenic (lung cancer) • Inhalation of fumes and dust. Causes chronic beryllium disease or beryllicosis. • Skin diseases such as warts.