WASTE MANAGEMENT AND CONTROL

Waste (also known as rubbish, trash, refuse, garbage, junk, litter) is an unwanted material. In biology, waste is any of the many unwanted substances or toxins that are expelled from living organisms; such as urea, sweat or faeces. Litter is waste which has been disposed of improperly.

Waste is directly linked to human development, both technologically and socially. The compositions of different wastes have varied over time and location, with industrial development and innovation being directly linked to waste materials. An Example of this includes plastics and nuclear technology. Some components of waste have economical value and can be recycled once correctly recovered.

There are many waste types defined by modern systems of waste management, notably including: • Municipal Waste includes household waste, commercial waste, demolition waste • Hazardous Waste includes Industrial waste • Bio-medical Waste includes clinical waste • Special Hazardous waste includes radioactive waste, Explosives waste, E-waste

Sources of Waste

i) Domestic
ii) Industrial
iii) Commercial
iv) Agricultural
v) Construction
vi) Mining

Taxonomically, waste can be categorized in terms of state of matter i.e., solid, liquid and gaseous. Also, it can be toxic, hazardous or volatile. A typical solid domestic waste will consist of paper, glass, plastic, metals, textiles, woods, vegetables etc. liquid waste include grey water, kitchen sludges, oils, grease while gaseous include CH_4, CO_2, CO, aerosols.

Identification of waste source helps in giving proper nomenclature to waste. It also helps in identification of the required collection, storage, transportation and disposal.

Waste management

Waste management is the collection, transport, processing, recycling or disposal, managing 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. Waste management practices differ for developed and developing nations, for urban and

rural areas, and for residential and industrial producers. Management for non-hazardous waste residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generator.

Waste storage

Storage of waste takes place at the spot where the waste is generated. Domestic refuse is normally stored continually in a container or sack until collected. The daily production is usually stored inside until it is carried outside for collection. There can be 1 unit/household or per several households, or local communal collection points where garbage is emptied in a bin or container. In some developing countries, old oil barrels, concrete tubes and other improvised enclosures may be used for storage often without any systematized garbage collection taken place. Industry and business often have their own systems with relatively large storage units. Some factories run large refuse heaps on the factory's premises without any form of regular collection. Containers used as storage units are common for a great many industries and outside large market places.

Waste collection

Collection of waste generally take place by loading from the storage containers unto a vehicle e.g. hand-cart (simple), donkey-cart (complex), tractor with trailer (sophisticated), lorry or special garbage truck. The garbage is usually collected and emptied by the crew of the vehicle (garbage collectors) but in some cases, collectors make a sound signal in which members come and empty their garbage in the vehicle. Collection requires passable routes and the choice of technology must be adapted to the existing quality of roads, streets and settlement. A simple cart can often be more useful than a modern garbage truck and labor intensive method, more efficient than modern mechanized ones. The choice of technology should also be considered on the basis of available facilities for maintenance. In some places, tractors ordinarily used for agricultural purposes have proved useful for collection and transportation of waste. Moreover, in agricultural areas where tractors are sued, there is often a food infrastructure with garages available spare parts. Where there is systematic collection, small scale industries and businesses are usually included. Major manufacturing industries producing large amount of waste usually run their own system for collection and transport.

Collections of liquid waste (sludge) from waste water treatment plants require separate collection routes. Also, gaseous wastes are often collected through emission pipes (stacks) to be emitted into the atmosphere.

Waste transfer and transport

This is the process of shifting discarded resources from the point of generation or storage to the point of recovery or pre-disposal point by a pre-determined medium. The medium can be man, mechanical or nature. If the place of disposal is far away or if very small vehicles are used for

collection, it can be appropriate to load the garbage unto a larger transport vehicle. Transport is thereby rationalized in that it takes fewer vehicles and crews. Waste transfer can take place by the collection car emptying the garbage into a container for collection by a larger container car that transports it to a place of final disposal.

There are certain factors to be considered when designing waste transport system aspect of waste management. These include:

i) Location of disposal points
ii) Disposal facilities
iii) Available technology
iv) Prevailing climate
v) Route plans and road network and
vi) Waste quality and quantity

In the transportation of waste resources the following can be used:

i) Tippers
ii) Side loaders
iii) Skip vehicles and
iv) Roll over vehicle

Transportation of liquid waste may take place through networking in which the effluent passes into soil pipes (a channel) or through the channel to the final storage point and this is regulated through the use of gauge valve.

Methods of disposal

Open Dumps

It appears that in most developing countries, very little progress has been in upgrading waste disposable methods. Open dumps are consequently often used. Solid waste is usually accumulated in the open, where the refuse is piled up without being covered or otherwise protected. Dumps are located wherever land is available, without regard to safety, health hazards and aesthetic degradation.

Open dumps where the waste is unloaded in piles, make very uneconomical use of the available space, allow free access to waste pickers, animals and flies and often produce unpleasant and hazardous smoke from slow burning fires.

In industrialized nations, open dumps area is a thing of the past. In the U.S., thousands of open dumps have been closed and new ones banned. Common sites were mines and quarries where gravel and stones had been removed, natural low areas like swamps or flood plains, and hillside areas above or below towns. In some instances, the

refuse is ignited and allowed to burn, in some the refuse is leveled and compacted.
As a general cycle, open dumps create a nuisance by being unsightly, providing breeding grounds for pests creating health hazards, polluting the air and sometimes polluting ground water and surface water.

Landfills

Disposing of waste in a landfill involves burying the waste, and this remains a common practice in most countries. Landfills were often established in abandoned or unused quarries, mining voids or borrow pits. A properly designed and well-managed landfill can be a hygienic and relatively inexpensive method of disposing of waste materials. Older, poorly designed or poorly managed landfills can create a number of adverse environmental impacts such as wind-blown litter, attraction of vermin, and generation of liquid leachate. Another common byproduct of landfills is gas (mostly composed of methane and carbon dioxide), which is produced as organic waste breaks down anaerobically. This gas can create odour problems, kill surface vegetation, and is a greenhouse gas.

Design characteristics of a modern landfill include methods to contain leachate such as clay or plastic lining material. Deposited waste is normally compacted to increase its density and stability, and covered to prevent attracting vermin (such as mice or rats). Many landfills also have landfill gas extraction systems installed to extract the landfill gas. Gas is pumped out of the landfill using perforated pipes and flared off or burnt in a gas engine to generate electricity.

Incineration

Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 percent of the original volume. Incineration and other high temperature waste treatment systems are sometimes described as "thermal treatment". Incinerators convert waste materials into heat, gas, steam and ash. Besides reducing a large volume of waste to a much smaller volume of ash, incineration has another advantage in that the process can be used to supplement other fuels and generate electrical power. Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Incineration is common in countries such as Japan where land is more scarce, as these facilities generally do not require as much area as landfills. Waste-to-energy (WtE) or energy-from-waste (EfW) are broad terms for facilities that burn waste in a furnace or boiler to generate heat, steam or electricity. Combustion in an

incinerator is not always perfect and clean; there have been concerns about pollutants in gaseous emissions from incinerator stacks. Particular concern has focused on some very persistent organics such as dioxins (a carcinogenic toxin), furans, PAHs which may be created which may have serious environmental consequences. Smoke stacks from incinerators may emit oxides of nitrogen and sulphur that lead to acid rain after series of photochemical reactions in the atmosphere. Heavy metals such as Pb, Cd and Hg; and CO2 which hypothetically is related to global warming. In modern incinerator facilities, smoke stacks are filled with special devices to trap pollutants but the process of pollutant abatement is very expensive. Furthermore, the plant themselves are expensive to establish.

On-site disposal

A common on-site disposal method in urban areas in developed countries is mechanical grinding of kitchen food waste. Garbage disposal devices are installed in the waste water pipe system at the kitchen sink and the garbage is ground and flushed into the sewer system. Final material is transferred to sewage treatment plants, where solids remaining as sewage sludge still must be disposed off.

Sanitary landfill

Sanitary landfill is a site where solid wastes are placed are placed on or in the ground at a carefully selected location by means of engineering techniques that minimize pollution of air, water and soil, and other risks to man and animals. Aesthetic considerations are also taken into considerations are also taken into account. A sanitary landfill is designed to concentrate and contain refuse without creating a nuisance or hazard to public health or safety. The idea is to confine the waste to the smallest practical area, http://www.unaab.edu.ng reduce it to the smallest practical volume and cover it with a layer of soil at the end of each day of operation or more frequently if necessary. Covering the waste is what makes the landfill sanitary. The compacted layer restricts (but does not eliminate) continued access to the waste by insects, rodents and animals such as seagulls. It also isolates the refuse, minimizing the amount of surface water entering into and gas escaping from the waste.

RESOURCE RECOVERY

With increasing cost of raw materials, energy, transportation and land to reuse and recycle more resources will become financially feasible. Resource recovery means obtaining some economic benefits from materials that has been regarded as waste by someone.

It includes:

(i) Reduce: the objective here is to reduce the amount of urban and other types of wastes that must be disposed of in landfills, incinerators, or other waste management

facilities. Reducing waste can be facilitated by better packaging establishment of recycling programs and large-scale composting programs.

(ii) Reuse: this suggests using the same materials for the same purpose again, rather than disposing of it. An example of this is the refilling of soft drink bottles.

(iii) Conversion: this involves the processing of materials to make something different (such as producing padding for clothing and steeping bags from plastic bottles or producing compost from food waste)

(iv) Recycling: this involves processing materials so that it can be used again as the same material, such as the processing of waste paper to make pulp and then new ones. Recycling refers to the collection and reuse of waste materials such as empty beverage containers. The materials from which the items are made can be reprocessed into new products. Material for recycling may be collected separately from general waste using dedicated bins and collection vehicles, or sorted directly from mixed waste streams. The most common consumer products recycled include aluminum such as beverage cans, copper such as wire, steel food and aerosol cans, old steel furnishings or equipment , polyethylene and PET bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fiberboard boxes.

(v) Energy recovery (Waste-to-energy): The energy content of waste products can be harnessed directly by using them as a direct combustion fuel, or indirectly by processing them into another type of fuel. Recycling through thermal treatment ranges from using waste as a fuel source for cooking or heating, to anaerobic digestion and the use of the gas fuel (see above), to fuel for boilers to generate steam and electricity in a turbine. Pyrolysis and gasification are two related forms of thermal treatment where waste materials are heated to high temperatures with limited oxygen availability. The process usually occurs in a sealed vessel under high pressure. Pyrolysis of solid waste converts the material into solid, liquid and gas products. The liquid and gas can be burnt to produce energy or refined into other chemical products (chemical refinery). The solid residue (char) can be further refined into products such as activated carbon.

Composting

Composting is a biochemical process in which organic materials such as lawn clippings and kitchen scraps decompose to rich soil-like material. Waste materials that are organic in nature, such as plant material, food scraps, and paper products, can be recycled using biological composting and digestion processes to decompose the organic matter. The resulting organic material is then recycled as mulch or compost for agricultural or landscaping purposes. In addition, waste gas from the process (such as methane) can be captured and used for generating electricity and heat maximising efficiencies. The intention

of biological processing in waste management is to control and accelerate the natural process of decomposition of organic matter.

Waste minimization

An important method of waste management is the prevention of waste material being created, also known as waste reduction. Methods of avoidance include reuse of second-hand products, repairing broken items instead of buying new, designing products to be refillable or reusable (such as cotton instead of plastic shopping bags), encouraging consumers to avoid using disposable products (such as disposable cutlery), removing any food/liquid remains from cans, packaging, and designing products that use less material to achieve the same purpose (for example, lightweighting of beverage cans).

Environmental costs

Waste attracts rodents and insects which harbour gastrointestinal parasites, yellow fever, worms, the plague and other conditions for humans. Exposure to hazardous wastes, particularly when they are burned, can cause various other diseases including cancers. Waste can contaminate surface water, groundwater, soil, and air which causes more problems for humans, other species, and ecosystems. Waste treatment and disposal produces significant green house gas (GHG) emissions, notably methane, which are contributing significantly to global climate change.

ENVIRONMENTAL ASPECTS

1. Waste results in Slum: - Most of the wastes generated are in form of metal scraps, glass, cardboards, plastics, textiles. These are deposited in heaps on our settlements. Waste heaps are not often common in affluent environment because of regular collection. Therefore, the land that would have been useful in better ways has been designated during sites in most of the environment of developing countries.

2. Foul odours: Most of the waste environment often consists of organic matter e.g vegetable scraps and excrements from animal and humans. Such are areas are characterized by bad smell and large ant of files and rodents.

3. Impacts on soil: Leachates from the waste during sites percolate into the soil, this percolation continues in porous soil media or stop and accumulate in the non-porous impermeable soil media. This ways, the metal load of the soil is increased.

4. Impact on air: Waste gas normally contains heavy metals like Hg, Cd, Pb and Zn. Also, this includes gas flaming in the oil and gas industries. Waste gases also include fumes from chemical industries. The incineration process of waste normally lead to the increase of gases like Acid gas Hg, So, H2S and nitrous oxide.

5. Impacts on water: Water flowing from the waste can leach into the underground i.e aquifer, thereby polluting it. It can also get i.e through the drains out nearby rivers, especially the wastes deposited at the banks of the rivers and this leads to metal accumulation of the river and eutrophication.

6. Impacts on flora and fauna: Eutrophication resulting from leachates from the waste dumpsites will lead to deoxygenation and extermination of natural flora and fishes. The solubility of poisonous mineerals like Al and Cd from waste may increase and damage roots of plants thereby reducing their nutrients intake and uptake.

7. Impact on health aspect humans and animals: This is most felt in term of health problems.

a) Acid gases may in high concentration lead to health problems, cause damage to vegetation and corrode buildings and materials.

b) Acidification of water bodies through precipitation may poison and kill small faura and flora.

c) Waste may serve as an outbreak of diseases e.g. cholera typhoid etc.

d) Landfill gas may lead to suffocation among workers and there is also the possibility of health hazards due to toxic, carcinogenic and irritation organic that gases which are generated.

e) Exposure of waste scavengers/manual sorters to waste dust may lead to respiratory disorders.

f) Noise from waste processing plants may represent a health risk to refuse workers and people living nearby especially in the case of every large plant.