

UNIT 139 – UPSC - Waste Management

Waste management is multidisciplinary activities that involve in engineering principles, economic, urban and regional planning, management techniques and social sciences to minimize the overall wastivity of the system under consideration. A systematic approach of waste management encompassing the waste of all kinds of resources at all stages should be adopted. However the material constitutes the major fraction of the total production cost, material wasted are of critical importance (Arora, 2004).

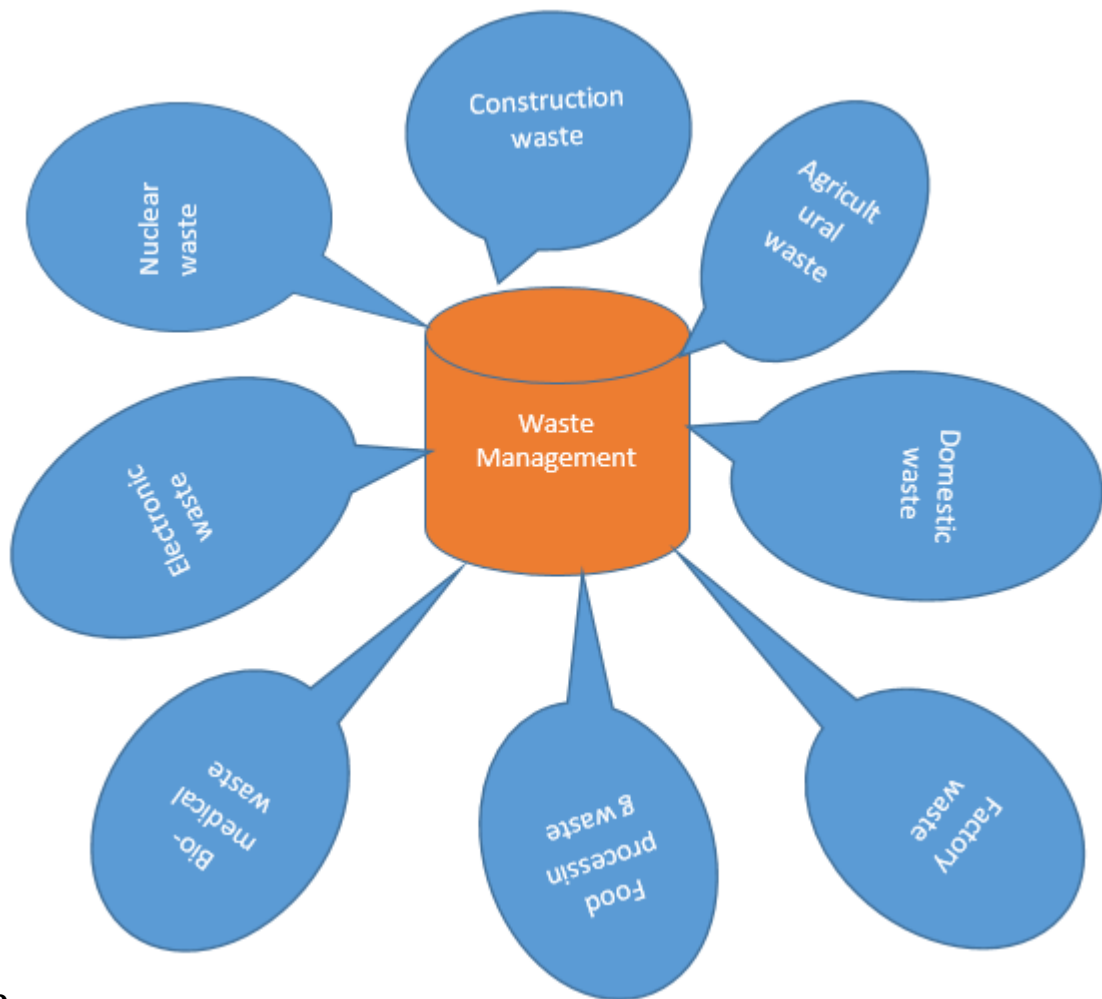


Waste is explained as most unwanted materials according to the Environmental Protection Act 1990. Waste includes any scrap material, effluent or unwanted extra substance or article that needs disposal because it is broken, worn out, contaminated or otherwise polluted. Wastes are 'those substances or objects which fall out of the business cycle or chain of utility' such as glass bottles that are returned or reused in their original form are not waste, whereas glass bottles banked by the public and dispatched for remoulding are waste 'until they have been recovered'. The Department of the Environment recognized four broad categories of potential waste. First is worn but functioning substances or objects that are still useable (albeit after repair) for the purpose they were made. Secondly, substances or objects that can be put to immediate use otherwise than by a specialised waste recovery establishment or undertaking for example ash from a power station used as a raw material in building blocks. Third category is degenerated substances or objects that can be put to use only by establishments or undertakings specialised in waste recovery. These are always wastes even if transferred for recovery for value for example polluted solvents or scrap. Such substances only cease to be waste when they have been recovered. Fourth are the substances which the holder does not want and which he has to pay to have taken away.

Speedy economic development has increased the living standard of the populace around the globe. This has directly converted into more material utilization and more waste production. Solid waste material, generated particularly in the urban areas is as follows.

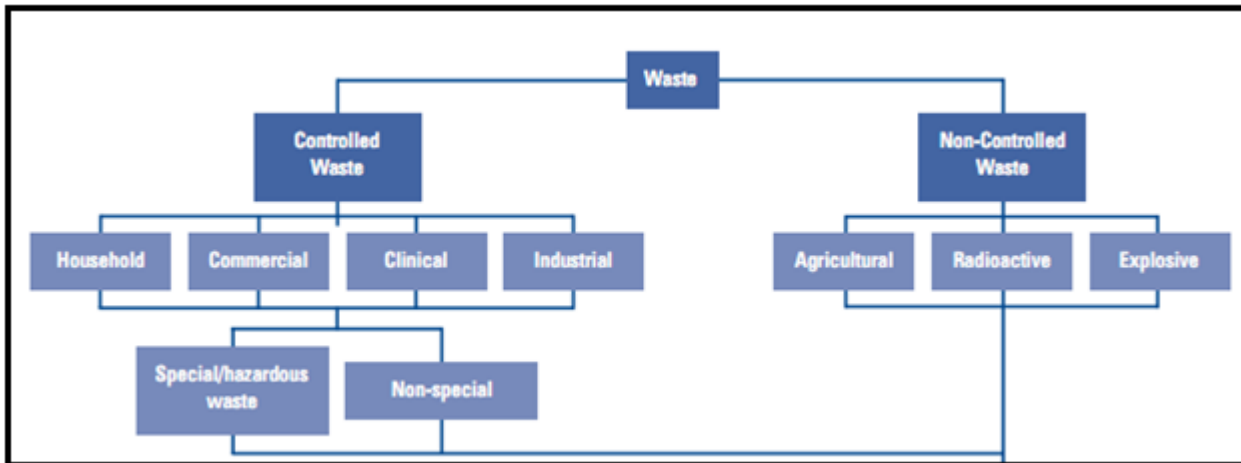
1. Organic waste
2. Plastic waste
3. Metal waste material

4. Glass waste material
5. Paper waste material, and
6. Electronic waste
7. Others (Ash, Sand, Grit, etc.)

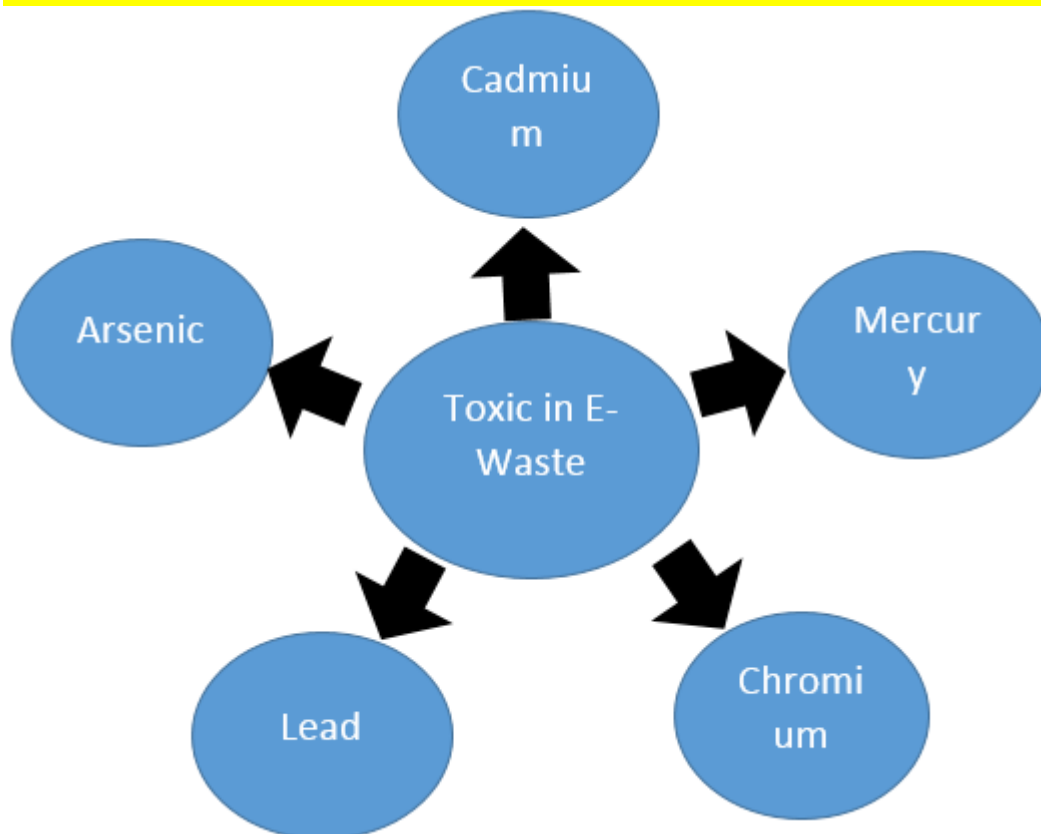


Types of Waste

Organisations may discard items of considerable residual value, from production scrap materials to outmoded plant and equipment, which may be considered as waste in legal terms. Certain wastes are categorized as hazardous. There is wide range of substances that may have variable levels of risk. For example, toxic substances that may cause cancer are considered as dangerous. Fluorescent tubes or cathode ray tubes in televisions are also hazardous and pose little immediate threat but may cause long term damage over a period of time. The Environment Agency recognizes waste as any substance or object that has been unused, is required to be discarded or is intended to be discarded.

Waste Classification Framework (source: EAUC)

Electronic waste: It is a term that refers to outdated material or irreparable electronic devices such as mobile phones, television, printers and computers. Toxics in electronic waste are shown in below figure:



Characteristics of

waste generation:

Source of waste	Micro components –waste generators
Residential	Organic/Inorganic waste from the single or multifamily houses, colonies, apartments, etc.
Industrial	Construction, Manufacturing, Fabrications, Power plants, Chemical Plants
Commercial	Eateries, Restaurants, Stores, Hotels, Offices, etc
Institutional	Hospitals, Large institutions , Schools, Jails, etc
Construction and demolition	New construction sites, Roads, etc.
Municipal services	Various cleaning services, Parks, Community places, waste water treatment plants, Beaches, etc.
Process	Manufacturing facilities , Oil Refineries, Chemical plants, Power plants, Natural Resources like minerals etc processing
Agriculture	Crops residue, Fertilizers and pesticides remaining

Process of Waste management is the collection, transport, processing, recycling or disposal of waste materials. The notion generally associated with materials produced by human activity, and is generally undertaken to lessen their effect on health, the environment. Waste management is also done to recuperate resources from it. Waste management can involve solid, liquid, gaseous or radioactive substances, with different methods and fields of expertise for each. It has been shown in reports that Waste management practices vary for developed and developing nations, for urban and rural areas, and for residential and industrial, producers. Management for non-hazardous

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

An efficient waste management system can assist in proper operation of the many interconnected systems on which a unit depends for waste containment, leachate management, and other important functions. If the constituents of an overall waste management system are not frequently examined, maintained, improved, and evaluated for effectiveness, even the best designed unit might not operate resourcefully. Good execution of waste management system can also decrease long and short term costs, shield workers and local communities, and maintain good community relations. Successful waste management system also requires that procedures be in place to observe performance and determine improvement towards clearly articulated and well understood environmental goals.

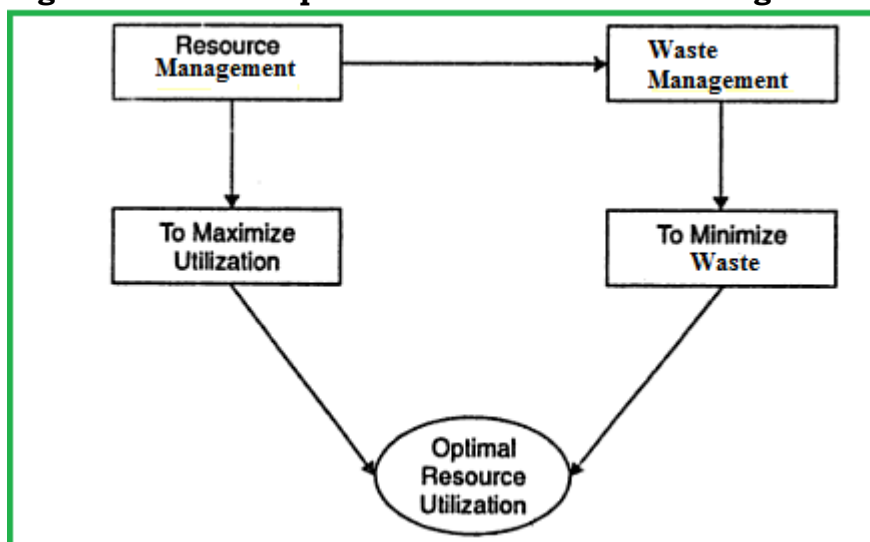
Major objective of waste management is to lessen the waste thus aiming at the ideal system. While the resource management intends to maximize the utilization of the resources. The goal of waste and resource management is same that is optimal utilization of available resources for increased efficiency and growth of the system but the approaches are different (Arora, 2004).

In order to attain this objective, it is imperative to:

1. Avoid the generation of waste
2. Promote reuse of waste
3. Promote biological recovery of waste and recycling of materials
4. Promote energy use of waste not suited for recycling
5. Ensure that the treatment and disposal of waste does not cause any harmful impacts

It is established in management literature that resource and waste management are complementary to each other.

Figure: Relationship of resource and waste management (Source: Arora, 2004). :



In waste management area, new concept of wastivity is proposed. It can serve as an adequate measure of performance of any system. Wastivity of any system is defined as ratio of waste to input.

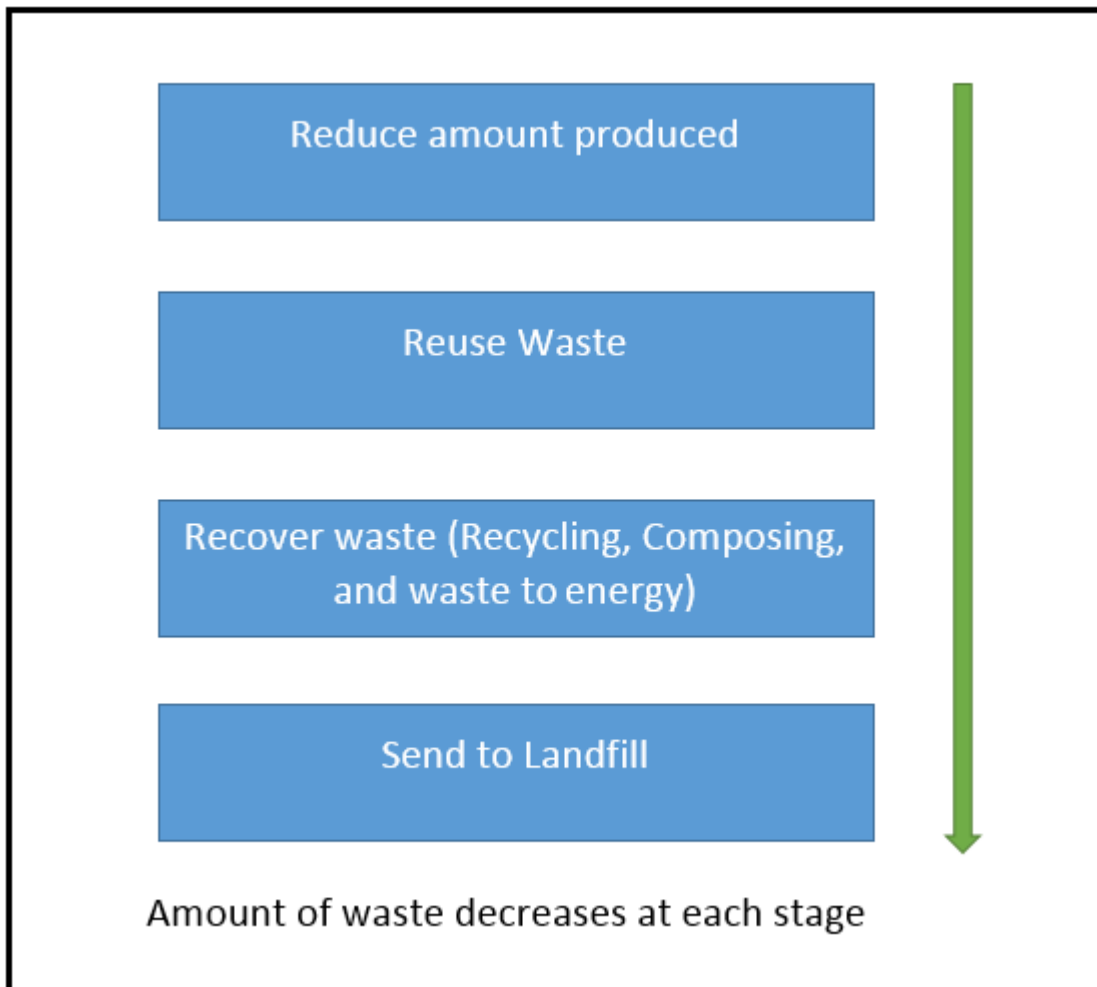
$$\text{Wastivity} = \frac{\text{Waste}}{\text{Input}}$$

Depending upon the level of consideration, wastivity may be categorized as gross wastivity and net wastivity. Many studies have indicated that waste can indirectly serve as measure of productivity (Arora, 2004).

Waste management has become a multifaceted area of legal, technical and commercial ground. Only few organisations can rely on the waste collection services provided through local authorities as a solution to their waste management obligations. Thus many firms need to identify and contract one or more reputable, licensed, specialist companies for the disposal of their waste, or discharging their legal obligations. Main development in the field of waste management is to concentrate on preventing the production of waste through waste minimisation and the re-use of waste materials through recycling. This links directly to procurement issues, where careful selection of materials, suppliers, process redesign for disassembly and reverse logistics can all reduce the amount of wastes produced or facilitate recycling and re-use. It is necessary that companies must adopt effective waste management procedure to get good financial returns. The efficient waste management comprises of quick identification of waste generated, economic reduction, efficient collection and handling, optimal sense and recycling, effective disposal of waste that do not create environmental problems. Waste management can be grouped in to five elements that include generation, reduction, collection, recycling and disposal (Arora, 2004).

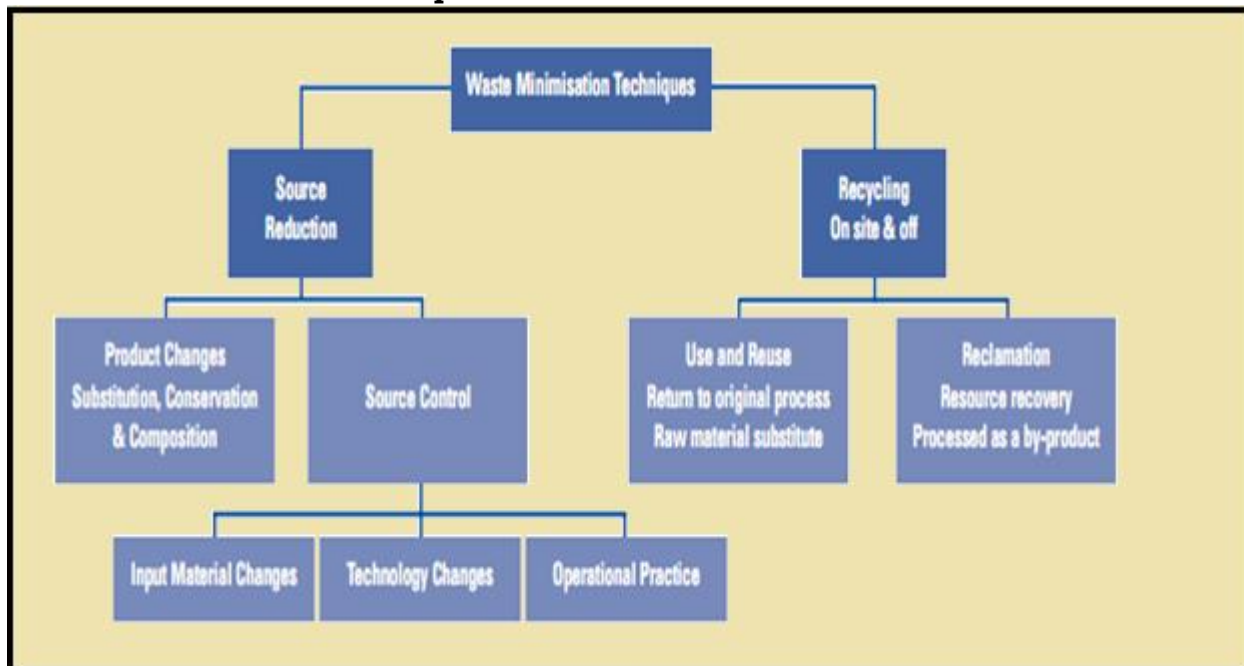
Hierarchy of waste management emphasizes the need to decrease the amount of waste created, then re-use wastes, then recover (via recycling, composting or waste-to-energy facilities) and at last, as a last resort to dispose of waste to landfill.

The Waste Management Hierarchy



Waste minimization techniques: An efficient way to manage waste is not to produce it in the first place and this is the driving force behind the proposal of waste minimisation

Waste Minimisation Techniques



Types of waste disposal: There are eight major groups of waste management methods.

Landfill: The Landfill is an effective procedure of waste disposal in present time. This process of waste removal focuses attention on burying the waste in the land. Landfills are found in all areas. There is a process used that reduces the odours and hazards of waste before it is placed into the ground. While this is the most popular way of waste disposal, it is surely far from the only procedure and one that may also bring with it an assortment of space. In the operation of landfill, the garbage collection trucks are weighed at entrance and their load is checked for wastes. Then, these vehicles drop their load. After loads are dumped, compactors or dozers spread and compress the waste on the operational field. This flattened waste is enclosed with soil every day.

Incineration: Incineration or it is also called combustion is also an important waste disposal procedure in which municipal solid wastes are burned at high temperatures so as to convert them into remains and gaseous products. Major benefit of this type of method is that it can reduce the volume of solid waste to 20 to 30 percent of the original volume, reduces the space they take up and reduce the stress on landfills. This process is also recognized as thermal treatment where solid waste materials are converted by Incinerators into heat, gas, steam and ash.

Recovery: Resource recovery is the method of collecting useful leftover items for further use. These discarded items are then processed to extract or recover materials and resources or convert them to energy in the form of useable heat, electricity or fuel.

Recycling: Recycling is also effectual process of managing waste. It is the collection and use of materials that would otherwise have been unwanted as the raw materials in the production of new products. It is the process of converting waste products into new products to avoid energy usage and utilization of fresh raw materials. Recycling is the third component of Reduce, Reuse and Recycle waste hierarchy. Main principle of recycling is to reduce energy usage, reduce volume of landfills, reduce air and water pollution, reduce greenhouse gas emissions and preserve natural resources for future use.

Plasma gasification: Plasma gasification is one of the types of waste management. Plasma is mainly an electrically charged or a highly ionized gas. In Plasma Gasification Process the matter gasified in an oxygen-starved environment to decompose waste material into its basic molecular structure. It does not combust the waste as in the incinerators. Electricity is fed to a torch, which has two electrodes, creating an arc. A constant flow of electricity through the plasma maintains a field of extremely intense energy powerful enough to disintegrate the garbage into its component elements. Lighting is one type of plasma which produces temperatures that exceed 12,600°F. In this procedure of waste disposal, a vessel uses characteristic plasma torches operating at +10,000 °F which is creating a gasification zone till 3,000 °F for the conversion of solid or liquid wastes into a syngas. During the treatment solid waste by plasma gasification, the waste's molecular forms. This form of waste disposal provides renewable energy and beneficial for human beings. Municipal solid waste is considered as a source of renewable energy, and plasma gasification technology is one of the leading-edge technologies available to harness this energy (Pourali, 2010). The Municipal solid waste is a never lasting source and increasing rapidly in Indian States such as Madhya Pradesh, India and therefore Plasma Gasification may be effectual as a sustainable source of energy and environmentally secure solution for MSW disposal in the State.

Composting: Composting is a natural procedure to handle waste in this method, food scraps, yard trimmings, and other organic materials are collected and allowed to decompose under controlled conditions into a rich, soil-like substance called compost. Composting is an easy and natural bio-degradation method that takes organic wastes that is remains of plants and garden and kitchen waste and turns into nutrient rich food for plants. Composting, normally used for organic farming, occurs by allowing organic materials to sit in one place for months until microbes decompose it. It is considered best procedure waste removal as it can turn dangerous organic products into safe compost.

Waste to Energy (Recover Energy): In Waste to energy method, non-recyclable waste items are converted into useable heat, electricity, or fuel through a variety of processes. This type of source of energy is a renewable energy source as non-recyclable waste can be used over and over again to create energy. It can also assist to decrease carbon emissions by offsetting the need for energy from fossil sources.

Avoidance/Waste Minimization: The simple procedure to manage waste is to reduce creation of waste materials thus reducing the amount of waste going to landfills. Waste reduction can be done through recycling old materials like jar, bags, repairing broken items instead of buying new one, avoiding use of disposable products like plastic bags, reusing second hand items, and buying items that uses less designing.

Recycling and composting are considered as effective methods of waste management. Composting is so far only possible on a small scale, either by private individuals or in areas where waste can be mixed with farming soil or used for landscaping purposes. Recycling is extensively used at global level.

Biological reprocessing: Common consumer products that are recycled include aluminium beverage cans, steel food and aerosol cans, HDPE and PET bottles, glass bottles and jars, paperboard cartons, newspapers, magazines, and cardboard. Other types of plastic (PVC, LDPE, PP, and PS) are also recyclable, although these are not as usually collected. These items are generally composed of a single type of material, making them relatively easy to recycle into new products. The recycling of complex products (such as computers and electronic equipment) is more complex, due to the additional dismantling and separation required. There are numerous composting and digestion methods and technologies varying in complexity from simple home compost heaps, to industrial-scale enclosed-vessel digestion of mixed domestic waste. Methods of biological decomposition are differentiated as being aerobic or an aerobic methods, though hybrids of the two methods also exist.

The Bottom Line: In waste category, some items or wastes that cannot be disposed of without special handling which will prevent contamination from occurring. Biomedical waste is the example. This is found in health care facilities and similar institutions.

Waste management in Indian perspective: India is considered as second most populous country in the world, India constantly keeps on accumulating waste material in its physical boundaries. In densely populated urban areas, land for proper waste treatment, disposal and overall management is limited. Recent and sustained economic growth increasing living standards of the people, increased manufacturing and production activities has led to increase in the waste generation rate. Statistical reports indicated that India produces approximate 42 Million tons of

solid waste annually. In India, main issue of waste management is the absence of systematic assessment of quality and pollution potential of waste. Initial data has been collected by Ministry of environment and forest, pollution control board and institution such as NEERI and National productivity counsel. These data indicated that disposal procedure practices for waste management are not compatible (Arora, 2004).

Benefits of Waste Management: There are so many benefits of waste management both to the environment and to the people.

Waste disposal has evolved into a business and it has numerous functions including removal of waste. The organic waste is separated from non-recyclable and inorganic waste. This has allowed metropolis to make use of organic waste to create compost for public areas. There are even some cities that package and sell the compost to make money. These items can be reprocessed and recycled and will be used in producing new products. This technique assists to decrease further consumption of natural resources and at the same time lowers the ultimate needs for waste disposal.

Another advantage of waste management is that it is beneficial to health. Previously, burning waste in the landfill or in the backyard was a general practice. But health agencies put pressure to local authorities that this type of practice is harmful. When garbage and plastics are being burned, they generate particulate matter that are solid compounds and are suspended in the air. Exposure to this can increase the risks of developing heart disease, respiratory disease, asthma and emphysema. Therefore, it is necessary for proper disposal of waste or waste management relocates waste to areas where they can be left, burned up or disposed of in a protected manner. Removing waste from public areas helps lessen risks to overall health, decreases exposure to biohazards and reduces plague of pest.

It can be established that Waste reduction can help reduce expenditures on raw materials, office supplies, equipment, and other purchases. Streamlining operations to decrease waste often can increase overall competence and productivity as well. Furthermore, waste diminution measures can help demonstrate concern for the environment, increasing customer loyalty. Numerous companies plan for waste reduction strategies for long-term business success. Waste reduction slows the reduction of natural resources, helps reduce contamination associated with the extraction of raw materials and the manufacture of products, and preserves valuable landfill space. Some waste reduction efforts also serve to decrease dangerous constituents in solid waste.

To summarize, Waste management is the procedure to treat solid wastes and proposes numerous solutions for recycling items that do not belong to scrap. It is about how garbage can be used as a valuable resource. Waste management process must be adopted by business owner in the world. Waste management disposes of the products and substances that company have use in a safe and efficient manner. Waste management is vital to decrease organisation's impact upon the environment. It is also a primary requirement to accomplish efficient cost savings and a better financial return for trade. For environmental concern, pioneering companies are incorporating waste reduction standards into their everyday operations. Waste reduction includes all actions taken to reduce the amount and/or toxicity of waste requiring disposal. It comprises of waste prevention, recycling, composting, and the purchase and manufacture of goods that have recycled content or produce less waste.