

## Chapter 1 : pulpandpaper-technology

*Waste management is the process of treating solid wastes and offers variety of solutions for recycling items that don't belong to trash. Waste management disposes of the products and substances that you have use in a safe and efficient manner.*

Principles of waste management[ edit ] Diagram of the waste hierarchy Waste hierarchy[ edit ] The waste hierarchy refers to the "3 Rs" reduce , reuse and recycle , which classifies waste management strategies according to their desirability in terms of waste minimisation. The waste hierarchy is the cornerstone of most waste minimisation strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of end waste; see: The next step or preferred action is to seek alternative uses for the waste that has been generated i. The next is recycling which includes composting. Following this step is material recovery and waste-to-energy. The final action is disposal, in landfills or through incineration without energy recovery. This last step is the final resort for waste which has not been prevented, diverted or recovered. The hierarchy represents the latter parts of the life-cycle for each product. Each stage in the life-cycle offers opportunities for policy intervention, to rethink the need for the product, to redesign to minimize waste potential, to extend its use. Resource efficiency[ edit ] Resource efficiency reflects the understanding that global economic growth and development can not be sustained at current production and consumption patterns. Globally, humanity extracts more resources to produce goods than the planet can replenish. This process of resource efficiency can address sustainability. Polluter-pays principle[ edit ] The polluter-pays principle mandates that the polluting party pays for the impact on the environment. With respect to waste management, this generally refers to the requirement for a waste generator to pay for appropriate disposal of the unrecoverable material. History of waste management Throughout most of history, the amount of waste generated by humans was insignificant due to low population density and low societal levels of the exploitation of natural resources. Common waste produced during pre-modern times was mainly ashes and human biodegradable waste , and these were released back into the ground locally, with minimum environmental impact. Tools made out of wood or metal were generally reused or passed down through the generations. However, some civilizations do seem to have been more profligate in their waste output than others. In particular, the Maya of Central America had a fixed monthly ritual, in which the people of the village would gather together and burn their rubbish in large dumps. Following the onset of industrialisation and the sustained urban growth of large population centres in England , the buildup of waste in the cities caused a rapid deterioration in levels of sanitation and the general quality of urban life. The streets became choked with filth due to the lack of waste clearance regulations. In the UK, the Nuisance Removal and Disease Prevention Act of began what was to be a steadily evolving process of the provision of regulated waste management in London. The Metropolitan Board of Works was the first citywide authority that centralized sanitation regulation for the rapidly expanding city and the Public Health Act made it compulsory for every household to deposit their weekly waste in "moveable receptacles: The use of incinerators for waste disposal became popular in the late 19th century. The dramatic increase in waste for disposal led to the creation of the first incineration plants, or, as they were then called, "destructors". In , New York City became the first U. They became motorized in the early part of the 20th century and the first closed body trucks to eliminate odours with a dumping lever mechanism were introduced in the s in Britain. The Garwood Load Packer was the first truck in , to incorporate a hydraulic compactor. Waste handling and transport[ edit ] Main articles: Waste collection vehicle , Dustbin , and Waste sorting Molded plastic, wheeled waste bin in Berkshire , England Waste collection methods vary widely among different countries and regions. Domestic waste collection services are often provided by local government authorities, or by private companies for industrial and commercial waste. Some areas, especially those in less developed countries, do not have formal waste-collection systems. Waste handling practices[ edit ] Curbside collection is the most common method of disposal in most European countries, Canada , New Zealand and many other parts of the developed world in which waste is collected at regular intervals by specialised trucks. This is often associated with curb-side

waste segregation. In rural areas waste may need to be taken to a transfer station. Waste collected is then transported to an appropriate disposal facility. In some areas, vacuum collection is used in which waste is transported from the home or commercial premises by vacuum along small bore tubes. Systems are in use in Europe and North America. Automated vacuum collection In some jurisdictions unsegregated waste is collected at the curb-side or from waste transfer stations and then sorted into recyclables and unusable waste. Such systems are capable of sorting large volumes of solid waste, salvaging recyclables, and turning the rest into bio-gas and soil conditioner. In San Francisco , the local government established its Mandatory Recycling and Composting Ordinance in support of its goal of "Zero waste by ", requiring everyone in the city to keep recyclables and compostables out of the landfill. Financial models[ edit ] In most developed countries, domestic waste disposal is funded from a national or local tax which may be related to income, or property values. Commercial and industrial waste disposal is typically charged for as a commercial service, often as an integrated charge which includes disposal costs. This practice may encourage disposal contractors to opt for the cheapest disposal option such as landfill rather than the environmentally best solution such as re-use and recycling. In some areas such as Taipei , the city government charges its households and industries for the volume of rubbish they produce. Waste is collected by the city council only if it is put in government issued rubbish bags. This policy has successfully reduced the amount of waste the city produces and increased the recycling rate.

**Chapter 2 : What is Waste Management and Methods of Waste Disposal? - Conserve Energy Future**

*Methods of Solid Waste Disposal and Management Methods of solid waste disposal and management are as below:  
Open burning Dumping into the sea Sanitary.*

You may also consider contacting a compostable waste hauler about designing your compost plan. Obtaining the right nutrient mix requires experimentation and patience. It is part of the art and science of composting. Particle Size Grinding, chipping, and shredding materials increases the surface area on which microorganisms can feed. Smaller particles also produce a more homogeneous compost mixture and improve pile insulation to help maintain optimum temperatures see below. If the particles are too small, however, they might prevent air from flowing freely through the pile. Moisture Content Microorganisms living in a compost pile need enough moisture to survive. Water is the key element that helps transports substances within the compost pile and makes the nutrients in organic material accessible to the microbes. Organic material contains some moisture in varying amounts, but moisture also might come in the form of rainfall or intentional watering. Oxygen Flow Turning the pile, placing the pile on a series of pipes, or including bulking agents such as wood chips and shredded newspaper all help aerate the pile. Aerating the pile allows decomposition to occur at a faster rate than anaerobic conditions. Care must be taken, however, not to provide too much oxygen, which can dry out the pile and impede the composting process. Temperature Microorganisms require a certain temperature range for optimal activity. Certain temperatures promote rapid composting and destroy pathogens and weed seeds. If the temperature does not increase, anaerobic conditions i. Controlling the previous four factors can bring about the proper temperature. Top of Page Onsite Composting Organizations that are going to compost small amounts of wasted food can compost onsite. Composting can significantly reduce the amount of wasted food that is thrown away. Yard trimmings and small quantities of food scraps can be composted onsite. Animal products and large quantities of food scraps are not appropriate for onsite composting. Learn how to create your own compost pile Things to Think About The climate and seasons changes will not have a big effect on onsite composting. Small adjustments can be made when changes happen such as when the rainy season approaches. Onsite composting takes very little time or equipment. Education is the key. Local communities might hold composting demonstrations and seminars to encourage homeowners or businesses to compost on their own properties. Creating compost can take up to two years, but manual turning can speed up the process to between three to six months. Compost, however, should not be used as potting soil for houseplants because of the presence of weed and grass seeds. Top of Page Vermicomposting Red worms in bins feed on food scraps, yard trimmings, and other organic matter to create compost. The worms break down this material into high quality compost called castings. Worm bins are easy to construct and are also available for purchase. One pound of mature worms approximately , worms can eat up to half a pound of organic material per day. The bins can be sized to match the volume of food scraps that will be turned into castings. It typically takes three to four months to produce usable castings. The castings can be used as potting soil. Note Night-crawlers and field worms found in gardens are not appropriate for vermiculture. What Can Be Composted - Vermiculture? Food scraps Yard trimmings such as grass and plants Things to Think About Ideal for apartment dwellers or small offices. Schools can use vermiculture to teach children conservation and recycling. It is important to keep the worms alive and healthy by providing the proper conditions and sufficient food. Prepare bedding, bury garbage, and separate worms from their castings. Worms are sensitive to changes in climate. Extreme temperatures and direct sunlight are not healthy for the worms. In hot, arid areas, the bin should be placed under the shade. Vermicomposting indoors can avoid many of these problems. Top of Page Aerated Turned Windrow Composting Aerated or turned windrow composting is suited for large volumes such as that generated by entire communities and collected by local governments, and high volume food-processing businesses e. It will yield significant amounts of compost, which might require assistance to market the end-product. Local governments may want to make the compost available to residents for a low or no cost. The ideal pile height is between four and eight feet with a width of 14 to 16 feet. This size pile is large enough to generate enough heat and maintain temperatures. Large volumes of diverse wastes such as yard trimmings,

grease, liquids, and animal byproducts such as fish and poultry wastes can be composted through this method. Things to Think About Windrow composting often requires large tracts of land, sturdy equipment, a continual supply of labor to maintain and operate the facility, and patience to experiment with various materials mixtures and turning frequencies. In a warm, arid climate, windrows are sometimes covered or placed under a shelter to prevent water from evaporating. In rainy seasons, the shapes of the pile can be adjusted so that water runs off the top of the pile rather than being absorbed into the pile. Windrow composting can work in cold climates. Leachate is liquid released during the composting process. This can contaminate local ground water and surface-water supplies. It should be collected and treated. Windrow composting is a large-scale operation and might be subject to regulatory enforcement, zoning, and siting requirements. Compost should be tested in a laboratory for bacterial and heavy metal content. Odors also need to be controlled. The public should be informed of the operation and have a method to address any complaints about animals or bad odors. Top of Page Aerated Static Pile Composting Aerated static pile composting produces compost relatively quickly within three to six months. It is suitable for a relatively homogenous mix of organic waste and work well for larger quantity generators of yard trimmings and compostable municipal solid waste e. This method, however, does not work well for composting animal byproducts or grease from food processing industries. In aerated static pile composting, organic waste mixed in a large pile. To aerate the pile, layers of loosely piled bulking agents e. The piles also can be placed over a network of pipes that deliver air into or draw air out of the pile. Air blowers might be activated by a timer or a temperature sensors. Things to Think about In a warm, arid climate, it may be necessary to cover the pile or place it under a shelter to prevent water from evaporating. In the cold, the core of the pile will retain its warm temperature. Aeration might be more difficult because passive air flowing is used rather than active turning. Placing the aerated static piles indoors with proper ventilation is also sometimes an option. Since there is no physical turning, this method requires careful monitoring to ensure that the outside of the pile heats up as much as the core. Applying a thick layer of finished compost over the pile may help alleviate any odors. If the air blower draws air out of the pile, filtering the air through a biofilter made from finished compost will also reduce any of the odors. This method may require significant cost and technical assistance to purchase, install, and maintain equipment such as blowers, pipes, sensors, and fans. Having a controlled supply of air allows construction of large piles, which require less land than the windrow method. Top of Page In-Vessel Composting In-vessel composting can process large amounts of waste without taking up as much space as the windrow method and it can accommodate virtually any type of organic waste e. This method involves feeding organic materials into a drum, silo, concrete-lined trench, or similar equipment. This allows good control of the environmental conditions such as temperature, moisture, and airflow. The material is mechanically turned or mixed to make sure the material is aerated. The size of the vessel can vary in size and capacity. This method produces compost in just a few weeks. It takes a few more weeks or months until it is ready to use because the microbial activity needs to balance and the pile needs to cool. Things to Think About Some are small enough to fit in a school or restaurant kitchen. Some are very large, similar to the size of school bus. Large food processing plants often use these. Careful control, often electronically, of the climate allows year-round use of this method. Use in extremely cold weather is possible with insulation or indoor use. Very little odor or leachate is produced. This method is expensive and may require technical expertise to operate it properly. Uses much less land and manual labor than windrow composting. Contact Us to ask a question, provide feedback, or report a problem. Sustainable Management of Food.

## Chapter 3 : Hazardous Waste | US EPA

*Separating different types of waste components is an important step in the handling and storage of solid waste at the source. The types of means and facilities that are now used for the recovery of waste materials that have been separated at the source include curbside collection, drop off and buy back centers.*

**Water Scarcity** Types of waste Generally, waste could be liquid or solid waste. Both of them could be hazardous. Liquid and solid waste types can also be grouped into organic, re-usable and recyclable waste. Let us see some details below: Waste can come in non-solid form. Some solid waste can also be converted to a liquid waste form for disposal. It includes point source and non-point source discharges such as storm water and wastewater. Examples of liquid waste include wash water from homes, liquids used for cleaning in industries and waste detergents. Solid waste predominantly, is any garbage, refuse or rubbish that we make in our homes and other places. These include old car tires, old newspapers, broken furniture and even food waste. They may include any waste that is non-liquid. Hazardous or harmful waste are those that potentially threaten public health or the environment. Such waste could be inflammable can easily catch fire , reactive can easily explode , corrosive can easily eat through metal or toxic poisonous to human and animals. In many countries, it is required by law to involve the appropriate authority to supervise the disposal of such hazardous waste. Examples include fire extinguishers, old propane tanks, pesticides, mercury-containing equipment e. More on hazardous waste here

**Organic type:** Organic waste comes from plants or animals sources. Commonly, they include food waste, fruit and vegetable peels, flower trimmings and even dog poop can be classified as organic waste. They are biodegradable this means they are easily broken down by other organisms over time and turned into manure. Many people turn their organic waste into compost and use them in their gardens.

**Recycling** is processing used materials waste into new, useful products. This is done to reduce the use of raw materials that would have been used. Waste that can be potentially recycled is termed "Recyclable waste". Aluminum products like soda, milk and tomato cans , Plastics grocery shopping bags, plastic bottles , Glass products like wine and beer bottles, broken glass , Paper products used envelopes, newspapers and magazines, cardboard boxes can be recycled and fall into this category.

**Chapter 4 : List of solid waste treatment technologies - Wikipedia**

*Solid waste management is a polite term for garbage management. As long as humans have been living in settled communities, solid waste, or garbage, has been an issue, and modern societies generate far more solid waste than early humans ever did.*

Americans alone are responsible for producing a whopping million tons of waste a year. This number is far more than any other nation in the world. Waste management is that solution, a rather complex issue that encompasses more than 20 different industries. Waste management is collection, transportation, and disposal of garbage, sewage and other waste products. It is about how garbage can be used as a valuable resource. Waste management is something that each and every household and business owner in the world needs. Waste management disposes of the products and substances that you have use in a safe and efficient manner. This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation. It also encompasses the legal and regulatory framework that relates to waste management encompassing guidance on recycling etc. Those groups include source reduction and reuse, animal feeding, recycling, composting, fermentation, landfills, incineration and land application. Various Methods of Waste Disposal Although there are many methods available to dispose off waste. This process of waste disposal focuses attention on burying the waste in the land. Landfills are commonly found in developing countries. There is a process used that eliminates the odors and dangers of waste before it is placed into the ground. While it is true this is the most popular form of waste disposal, it is certainly far from the only procedure and one that may also bring with it an assortment of space. This method is becoming less these days although, thanks to the lack of space available and the strong presence of methane and other landfill gases, both of which can cause numerous contamination problems. Many areas are reconsidering the use of landfills. Incineration is something that is very in countries where landfill space is no longer available, which includes Japan. Recovery and Recycling Resource recovery is the process of taking useful discarded items for a specific next use. Recycling is the process of converting waste products into new products to prevent energy usage and consumption of fresh raw materials. The idea behind 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 another form of waste management. Plasma is a primarily an electrically charged or a highly ionized gas. Thanks to this process, destruction of waste and dangerous materials is found. This form of waste disposal provides renewable energy and an assortment of other fantastic benefits. Composting Composting is a easy and natural bio-degradation process that takes organic wastes i. Composting, normally used for organic farming, occurs by allowing organic materials to sit in one place for months until microbes decompose it. Composting is one of the best method of waste disposal as it can turn unsafe organic products into safe compost. On the other side, it is slow process and takes lot of space. It can also help to reduce carbon emissions by offsetting the need for energy from fossil sources. Waste-to-Energy, also widely recognized by its acronym WtE is the generation of energy in the form of heat or electricity from waste. 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 a couple of the best 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 widely used around the world, with plastic, paper and metal leading the list of the most recyclable items. Most material recycled is reused for its original purpose. The Bottom Line There are certain waste types that are considered as hazardous and cannot be disposed of without special handling which will prevent contamination from occurring. Biomedical waste is one example of such. This is found in health care facilities and similar institutions. The special waste disposal system for this unit in place to dispose of this type of waste. As you can see there are plenty of important things that you should know about waste management and disposal in order to ensure that you are safe, as well as that you are keeping the environment safe. It is your

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choices as to how you will dispose of waste, however it is always in your best interest to take a look at all of the options that you have available before making the choice.

**Chapter 5 : Types of solid waste**

*Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes.*

In the waste management process, the wastes are collected from the different sources and are disposed of. This process includes transportation, analysis, legal procedures, along with monitoring and enforcing regulations. The image above shows waste management strategies according to their maximum effect on waste minimization. Discarded solid material from industrial, municipal and agricultural activities. Household material consisting of everyday garbage, food and yard waste. Includes construction waste, biomedical waste, electronic waste or e-waste or even sewage sludge as part of different industries. The flowchart below illustrates the functional elements of waste management in a simple way. Waste handling and disposal practices vary in different demographics. Hazardous solid waste is industry generated which need special disposal techniques. Solid waste management is an integral part of the environmental domain of any region. Inefficient waste disposal systems lead to environmental pollution along with presenting severe health hazards. As shown in the diagram above, solid waste management generally includes a collection of waste, transporting waste, processing and recycling it, and finally disposal of waste. Today, the most general method of waste disposal is by using landfills. Olden landfills are being covered and the present day sanitary landfills are not just dumped sites. They are designed and customized pertaining to the region, type of waste and other environmental factors. The primary purpose of this is to dispose of waste effectively without causing health risks or contributing to environmental pollution. A foul smell is produced and also spoils the aesthetic value of the area. The solid wastes collected from different industries include toxic metals, chemicals, and other hazardous wastes. Practise This Question R: A is true but R is false. A is false but R is true.

*Solid waste disposal management is usually referred to the process of collecting and treating solid wastes. It provides solutions for recycling items that do not belong to garbage or trash. Solid waste management can be described as how solid waste can be changed and used as a valuable resource.*

In a sanitary landfill, garbage is spread out in thin layers, compacted and covered with clay or plastic foam. In the modern landfills the bottom is covered with an impermeable liner, usually several layers of clay, thick plastic and sand. The liner protects the ground water from being contaminated due to percolation of leachate. Leachate from bottom is pumped and sent for treatment. When landfill is full it is covered with clay, sand, gravel and top soil to prevent seepage of water. Several wells are drilled near the landfill site to monitor if any leakage is contaminating ground water. Methane produced by anaerobic decomposition is collected and burnt to produce electricity or heat. Sanitary Landfills Site Selection: Should be above the water table, to minimize interaction with groundwater. Preferably located in clay or silt. Do not want to place in a rock quarry, as water can leech through the cracks inherent in rocks into a water fracture system. Do not want to locate in sand or gravel pits, as these have high leeching. Unfortunately, most of Long Island is sand or gravel, and many landfills are located in gravel pits, after they were no longer being used. Do not want to locate in a flood plain. Most garbage tends to be less dense than water, so if the area of the landfill floods, the garbage will float to the top and wash away downstream. A large number of adverse impacts may occur from landfill operations. These impacts can vary: Off gassing of methane generated by decaying organic wastes methane is a greenhouse gas many times more potent than carbon dioxide, and can itself be a danger to inhabitants of an area. Harboring of disease vectors such as rats and flies, particularly from improperly operated landfills. The term incinerates means to burn something until nothing is left but ashes. An incinerator is a unit or facility used to burn trash and other types of waste until it is reduced to ash. An incinerator is constructed of heavy, well-insulated materials, so that it does not give off extreme amounts of external heat. The high levels of heat are kept inside the furnace or unit so that the waste is burned quickly and efficiently. If the heat were allowed to escape, the waste would not burn as completely or as rapidly. 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 per cent of the original volume. Incinerators convert waste materials into heat, gas, steam and ash. 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. Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants. Due to shortage of space for landfill in bigger cities, the biodegradable yard waste kept separate from the municipal waste is allowed to degrade or decompose in a medium. A good quality nutrient rich and environmental friendly manure is formed which improves the soil conditions and fertility. This waste can be recycled by the method of composting, one of the oldest forms of disposal. It is the natural process of decomposition of organic waste that yields manure or compost, which is very rich in nutrients. Composting is a biological process in which micro-organisms, mainly fungi and bacteria, convert degradable organic waste into humus like substance. This finished product, which looks like soil, is high in carbon and nitrogen and is an excellent medium for growing plants. The process of composting ensures the waste that is produced in the kitchens is not carelessly thrown and left to rot. It recycles the nutrients and returns them to the soil as nutrients. Apart from being clean, cheap, and safe, composting can significantly reduce the amount of disposable garbage. The organic fertilizer can be used instead of chemical fertilizers and is better specially when used for vegetables. It helped the soil retain more of the plant nutrients. Vermi-composting has become very popular in the last few years. In this method, worms are added to the compost. These help to break the waste and the added excreta of the worms makes the compost very rich in nutrients. In the activity section of this web site you can learn how to make a compost pit or a vermi-compost pit in your school or in the garden at home. To make a compost pit, you have to select a

cool, shaded corner of the garden or the school compound and dig a pit, which ideally should be 3 feet deep. This depth is convenient for aerobic composting as the compost has to be turned at regular intervals in this process. Preferably the pit should be lined with granite or brick to prevent nitrite pollution of the subsoil water, which is known to be highly toxic. Each time organic matter is added to the pit it should be covered with a layer of dried leaves or a thin layer of soil which allows air to enter the pit thereby preventing bad odour. At the end of 45 days, the rich pure organic matter is ready to be used. Compost allows the soil to retain more plant nutrients over a longer period. It supplies part of the 16 essential elements needed by the plants. It helps reduce the adverse effects of excessive alkalinity, acidity, or the excessive use of chemical fertilizer. It makes soil easier to cultivate. It helps keep the soil cool in summer and warm in winter. It aids in preventing soil erosion by keeping the soil covered. It helps in controlling the growth of weeds in the garden. Pyrolysis is a form of incineration that chemically decomposes organic materials by heat in the absence of oxygen. In practice, it is not possible to achieve a completely oxygen-free atmosphere. Because some oxygen is present in any pyrolysis system, a small amount of oxidation occurs. If volatile or semi-volatile materials are present in the waste, thermal desorption will also occur. Organic materials are transformed into gases, small quantities of liquid, and a solid residue containing carbon and ash. The off-gases may also be treated in a secondary thermal oxidation unit. Particulate removal equipment is also required. Several types of pyrolysis units are available, including the rotary kiln, rotary hearth furnace, and fluidized bed furnace. These units are similar to incinerators except that they operate at lower temperatures and with less air supply. The technology requires drying of soil prior to treatment. Limited performance data are available for systems treating hazardous wastes containing polychlorinated biphenyls PCBs, dioxins, and other organics. There is concern that systems that destroy chlorinated organic molecules by heat have the potential to create products of incomplete combustion, including dioxins and furans. These compounds are extremely toxic in the parts per trillion ranges. The MSO process reportedly does not produce dioxins and furans. The molten salt is usually recycled in the reactor chamber. However, depending on the waste treated especially inorganics and the amount of ash, spent molten salt may be hazardous and require special care in disposal. Volatile metals may be removed as a result of the higher temperatures associated with the process, but they are not destroyed. By-products containing heavy metals may require stabilization before final disposal. These oils and tars may be hazardous wastes, requiring proper treatment, storage, and disposal.

**Chapter 7 : Solid Waste Management: Types, Sources, Effects and Methods of Solid Waste Management**

*The term solid waste management mainly refers to the complete process of collecting, treating and disposing of the solid wastes. In the waste management process, the wastes are collected from the different sources and are disposed of.*

The country has over 5, cities and towns, which generate about 40 million tonnes of MSW per year today. The municipal solid waste industry has four components: Waste generation encompasses activities in which materials are identified as no longer being of value and are either thrown out or gathered together for disposal. The functional element of Collection includes not only the gathering of solid waste and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material processing facility, a transfer station or a landfill disposal site. Waste handling and separation involves activities associated with waste management until the waste is placed in storage containers for collection. Handling also encompasses the movement of loaded containers to the point of collection. Separating different types of waste components is an important step in the handling and storage of solid waste at the source. The types of means and facilities that are now used for the recovery of waste materials that have been separated at the source include curbside collection, drop off and buy back centers. Transfer and transport involves two main steps. First, the waste is transferred from a smaller collection vehicle to larger transport equipment. The waste is then transported, usually over long distances, to a processing or disposal site. Today the disposal of wastes by land filling or land spreading is the ultimate fate of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual materials from materials recovery facilities MRFs, residue from the combustion of solid waste, compost or other substances from various solid waste processing facilities. A modern sanitary landfill is not a dump; it is an engineered facility used for disposing of solid wastes on land without creating nuisances or hazards to public health or safety, such as the breeding of insects and the contamination of ground water. Municipal solid waste can be used to generate energy. Several technologies have been developed that make the processing of MSW for energy generation cleaner and more economical than ever before, including landfill gas capture, combustion, pyrolysis, gasification, and plasma arc gasification. While older waste incineration plants emitted high levels of pollutants, recent regulatory changes and new technologies have significantly reduced this concern. In USA, EPA regulations in and under the Clean Air Act have succeeded in reducing emissions of dioxins from waste-to-energy facilities by more than 99 percent below levels, while mercury emissions have been by over 90 percent. Municipal solid waste management is more of an administrative and institutional mechanism failure problem rather than a technological one. Until now, MSW management has been considered to be almost the sole responsibility of urban governments, without the participation of citizens and other stakeholders. The Centre and the Supreme Court, however, have urged that this issue be addressed with multiple stakeholder participation. Hazardous wastes are those that can cause harm to human and the environment. Characteristics of Hazardous Wastes: Wastes are classified as hazardous if they exhibit any of four primary characteristics based on physical or chemical properties of toxicity, reactivity ignitability and corrosively. Toxic wastes are those that are poisonous in small or trace amounts. Some may have acute or immediate effect on human or animals. Carcinogenic or mutagenic causing biological changes in the children of exposed people and animals. Reactive wastes are those that have a tendency to react vigorously with air or water are unstable to shock or heat, generate toxic gases or explode during routine management. Gun powder, nitro glycerin. Gasoline, paint thinners and alcohol. Are those that destroy materials and living tissues by chemical reactions? Included human tissue from surgery, used bandages and hypoderm needles hospital wastes. Sources of Hazardous Wastes: Chemical manufacturing companies, petroleum refineries, paper mills, smelters and other industries. Plastic industries thousand of chemicals are used in industries every year. When used incorrectly or inappropriately they can become health hazards. PCBs Polychlorinated biphenyls are resistant to fire and do not conduct electricity very well, which makes them excellent materials for several industrial purposes. Rainwater can wash PCBs out of disposal areas in dumps and landfills thus contaminating the water. PCBs do not break open very rapidly in the environment and thus retain their toxic characteristics.

They cause long-term exposure problems to both human and wildlife. Many household chemicals can be quite toxic to humans as well as wildlife. Most of the dangerous substances in our homes are found in various kinds of cleaners, solvents and products used in automotive care. When these products are used incorrectly they have the potential to be harmful. Effects of Hazardous Wastes: As most of the hazardous wastes are disposed off or in land, the most serious environmental effect is contaminated ground water. Once ground water is polluted with hazardous wastes, it is very often not possible to reverse the damage. Pesticides form residues in the soil that are washed into streams which then carry them forward. The residues may persist in PCBs poly chlorinated biphenyls are concentrated in the kidneys and liver and cause damage; they cause reproductive failure in birds and mammals. The soil or in the bottom of lakes and rivers. Exposure can occur through ingestion, inhalation and skin contact, resulting acute or chronic poisoning. Lead, mercury and arsenic are hazardous substances which can often refer to as heavy metals. Most of the lead absorbed by people is stored in the bones. Lead can affect red blood cells by reducing their ability to carry oxygen and shortening their life span. Lead may also damage nervous tissue, resulting in brain disease. Mercury is used in production of chlorine and as a catalyst in the production of some plastics. Mercury build up in body over long period of time is known to cause brain damage. Minamata disease occurs due to mercury poisoning. Vinyl chloride is a chemical that is widely used in plastic manufacture. A long continuous exposure in humans it can cause deafness, vision problem circulation disorders and bone deformities. Control of Hazardous Wastes: Common methods for disposing of hazardous wastes are land disposal and incineration Industries need to be encouraged to generate less hazardous waste in the manufacturing process. Although toxic wastes cannot be entirely eliminated, technologies are available for minimizing recycling and treating the wastes. Integrated pest management practices IPM reduce the usage of pesticides. Substitute the use of PCBs and vinyl chloride with chemicals that are less toxic. Polyvinyl chloride use can be lowered by reducing the use of plastics. These contain more of toxic and require special treatment. Source of Industrial Wastes: During processing, scrap materials, tailings, acids etc. Effects of Industrial Wastes: Most common observation is that the health of the people living in the neighborhood of dumping sites is severely affected. The exposure may cause disorders of nervous system, genetic defects, skin diseases and even cancer. The liquid effluents discharged by the industries contain inorganic and organic pollutants and they enter into water bodies causing destruction of fish, formation of sediments, and pollution of ground water and release of foul odours. Control of Industrial Wastes: Waste minimization technologies have to be developed. Source reduction recycling and reuse of materials need to be practiced on a large scale. Hazardous waste should not mix up with general waste. Source reduction involves altering the design, manufacture or use of products and materials to reduce the amount and toxicity of materials that get thrown away. Local communities and voluntary organizations should educate the industrialists as well as the public about dangers of pollution and the need to keep the environment clean. Land filling, incineration and composting technologies to be followed. Biogas is obtained from solid waste treatment of industrial and mining waste is done for the recovery of useful products. Sources of Agricultural Wastes: The waste generated by agriculture includes waste from crops and live stock. In developing countries, this waste does not pose a serious problem as most of it is used e. Some agro-based industries produce waste e. Agricultural wastes are rice husk, degasses, ground nut shell, maize cobs, straw of cereals etc. Effects of Agricultural Wastes: N ratio wastes like paddy husk or straw may cause immobilization of nutrients if applied on the fields. It occupies to large land areas if not properly disposed. Management of Agricultural Wastes: It is the process in which chemical decomposition of biomass takes place in the presence of controlled amounts of oxygen, producing a gas. This gas is cleaned and used in an internal combustion engine to produce electric power. Without clean up also, the gas can be used in boilers to produce electric power. This technology is highly suited to generate electric power from agricultural wastes like rice husks, groundnut shells etc. It is similar to gasification except that the chemical decomposition of biomass wastes takes place in the absence or reduced presence of O<sub>2</sub> at high temp. Mixtures of gases result from decomposition including H<sub>2</sub>, NH<sub>4</sub> Co, CO<sub>2</sub> depending on the organic nature of waste matter. This gas used for power generation. Animal wastes, food processing wastes and other organic matter are decomposed anaerobically to produce a gas called biogas. It contains methane and CO<sub>2</sub>. The methane can provides gas for domestic use.

**Chapter 8 : Waste management - Wikipedia**

*For example, treatment techniques act to reduce the volume and toxicity of solid waste. These steps can transform it into a more convenient form for disposal. Waste treatment and disposal methods are selected and used based on the form, composition, and quantity of waste materials.*

Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot of good things and bad things as well. One of the negative effects of industrialization is the creation of solid waste. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. This waste comes from homes, offices, industries and various other agricultural related activities. These landfill sites produce foul smell if waste is not stored and treated properly. It can pollute the surrounding air and can seriously affect the health of humans, wildlife and our environment. The following are major sources of solid waste: Residential Residences and homes where people live are some of the major sources of solid waste. Garbage from these places include food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like bulky household items like electronics, tires, batteries, old mattresses and used oil. Most homes have garbage bins where they can throw away their solid wastes in and later the bin is emptied by a garbage collecting firm or person for treatment. Industrial Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants. These industries produce solid waste in form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes. Commercial Commercial facilities and buildings are yet another source of solid waste today. Commercial buildings and facilities in this case refer to hotels, markets, restaurants, go downs, stores and office buildings. Some of the solid wastes generated from these places include plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and other hazardous wastes. Institutional The institutional centers like schools, colleges, prisons, military barracks and other government centers also produce solid waste. Some of the common solid wastes obtained from these places include glass, rubber waste, plastics, food wastes, wood, paper, metals, cardboard materials, electronics as well as various hazardous wastes. Construction and Demolition Areas Construction sites and demolition sites also contribute to the solid waste problem. Construction sites include new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites. Some of the solid wastes produced in these places include steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass. Municipal services The urban centers also contribute immensely to the solid waste crisis in most countries today. Some of the solid waste brought about by the municipal services include, street cleaning, wastes from parks and beaches, wastewater treatment plants, landscaping wastes and wastes from recreational areas including sludge. Treatment Plants and Sites Heavy and light manufacturing plants also produce solid waste. They include refineries, power plants, processing plants, mineral extraction plants and chemicals plants. Among the wastes produced by these plants include, industrial process wastes, unwanted specification products, plastics, metal parts just to mention but a few. Agriculture Crop farms, orchards, dairies, vineyards and feedlots are also sources of solid wastes. Among the wastes they produce include agricultural wastes, spoiled food, pesticide containers and other hazardous materials. Biomedical This refers to hospitals and biomedical equipment and chemical manufacturing firms. In hospitals there are different types of solid wastes produced. Some of these solid wastes include syringes, bandages, used gloves, drugs, paper, plastics, food wastes and chemicals. All these require proper disposal or else they will cause a huge problem to the environment and the people in these facilities. Effects of Poor Solid

Waste Management Due to improper waste disposal systems particularly by municipal waste management teams, wastes heap up and become a problem. People clean their homes and places of work and litter their surroundings which affects the environment and the community. This type of dumping of waste materials forces biodegradable materials to rot and decompose under improper, unhygienic and uncontrolled conditions. After a few days of decomposition, a foul smell is produced and it becomes a breeding ground for different types of disease causing insects as well as infectious organisms. On top of that, it also spoils the aesthetic value of the area. Solid wastes from industries are a source of toxic metals, hazardous wastes, and chemicals. When released to the environment, the solid wastes can cause biological and physicochemical problems to the environment and may affect or alter the productivity of the soils in that particular area. Toxic materials and chemicals may seep into the soil and pollute the ground water. During the process of collecting solid waste, the hazardous wastes usually mix with ordinary garbage and other flammable wastes making the disposal process even harder and risky. When hazardous wastes like pesticides, batteries containing lead, mercury or zinc, cleaning solvents, radioactive materials, e-waste and plastics are mixed up with paper and other scraps are burned they produce dioxins and gasses. These toxic gases have a potential of causing various diseases including cancer.

**Methods of Solid Waste Management** There are different methods of solid waste management. The following are some of the recognized methods:

**Sanitary Landfill** This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam. Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand. This liner protects the ground water from being contaminated because of leaching or percolation. When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

**Incineration** This method involves burning of solid wastes at high temperatures until the wastes are turned into ashes. Incinerators are made in such a way that they do not give off extreme amounts of heat when burning solid wastes. This method of solid waste management can be done by individuals, municipalities and even institutions.

**Recovery and Recycling** Recycling or recovery of resources is the process of taking useful but discarded items for next use. Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills.

**Composting** Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting. Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes.

**Pyrolysis** This is method of solid waste management whereby solid wastes are chemically decomposed by heat without presence of oxygen. This usually occurs under pressure and at temperatures of up to degrees Celsius. The solid wastes are changed into gasses, solid residue and small quantities of liquid. In summary, proper solid waste management is an integral part of environmental conservation that should be observed by individuals and companies globally. This will keep the environment clean and reduce health and settlement problems.

**Chapter 9 : Types of Landfills - Waste management alternatives**

*Waste can take any form that is solid, liquid, or gas and each have different methods of disposal and management. Waste management normally deals with all types of waste whether it was created in forms that are industrial, biological, household, and special cases where it may pose a threat to human health. [2].*

Modern waste disposal methods give you several different options for getting rid of your waste. This process generates heat, which is then used for energy. Incineration also creates byproducts, including various gases and inert ash. The incinerator design and the waste material being burned dictates how much pollution this method creates. Filters can minimize the pollution. Incineration reduces waste volume by up to 90 percent of the original amount. If organic waste is incinerated, the resulting ash can provide nutrients for hydroponic solutions. Incineration is the preferred method for disposing of toxic chemicals and hazardous wastes.

Recycling Materials you put into your recycling bin get a new purpose after being processed and turned into new or similar products. The most common recyclable items are plastic, paper, glass and aluminum. Recycling bins are available for home, office or public use to collect recyclables before being taken to recycling centers. Many communities also offer curbside pickup of recyclables to make this option easier. The downside of recycling is that only certain items can be recycled, and processing plants are expensive to operate and maintain.

Composting Composting is a natural process where organic wastes break down into nutrient-rich compost perfect for your garden plants. Microbes decompose the organic materials as they sit in a compost pile or bin for months. Composting preserves more nutrients than incineration and is the preferred method for organic waste disposal. The main drawback is the amount of time it takes for the organic materials to break down into compost. This method also requires you to have enough space to make a large compost pile, which is challenging if you live in a multi-family dwelling or have a small yard. You may have the option of curbside pickup for your compostable materials. Separate trucks pick up those materials and take them to facilities that process them into compost. A protective lining beneath the waste helps to prevent harmful chemicals from leaking into the groundwater and polluting drinking water. A layer of earth goes over the compacted waste. Soil with low permeability is preferred for landfills to cut down on the potential for leakage. Some landfills use hardening materials such as cement or asphalt to seal each layer of waste. Landfills are usually located in areas without flooding or high groundwater levels.