

About the Institute:-

The Institute of Management, Public Administration and Rural Development is an apex training institute in the State of Jammu & Kashmir. The Institute was established in the year 1982 as a Govt. Dept. and was subsequently registered as a society under the Societies Act VI of S-1998. The objectives postulated for the Institute are as follows;

- * To create an awareness of the application of Management in all sectors of national life;
- * To develop and lay down standards of proficiency in Management and Administration;
- * To develop and lay down standards of proficiency in Management and Administration:
- * To determinate knowledge on Management through Seminars, Workshop, Journals & other Publications.
- *To impart knowledge and skills to the practicing managers and administrators through teaching and training;
- * To assist in the application of management concepts and techniques through consultancy and extension services;
- *To foster and assist in the development of the profession of management and make it a genuine instrument for economic development and social change;
- To provide for and promote the study and deal with relevant fields and factors contributing to the improvement of enconomic development and social well being of the people with special reference to those of rural areas.



J&K Institute of Management, Public Administration & Rural Development (J&K IMPARD)



Moulana Azad Road, Srinagar, Kashmir
190001

Tel.: 0194- 2479616

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Training Course on Solid Waste Management & Disposal

(September 20-22, 2021)



Organized by:
Centre for ID & UA

*J&K Institute of Management, Public
Administration and Rural Development
(J&K IMPARD)*

Need of the Training Course-

One of the major problems we face today is the "management" of solid wastes arising out of domestic, commercial and industrial activities. Due to the increase in packaging of consumer / commercial products and explosion of industrial growth, besides an enhanced tourism & healthcare facilities, the local authorities, though committed, are unable to cope with their waste disposal. The process is generally undertaken to reduce the materials produced by human activity e.g. in tourism and healthcare organizations and their effects on health, environment or aesthetics.

In order to contain the menace of increasing solid wastes in households, hotels and hospitals; and to develop more and more sanitized areas in the cities & enhance the health of the public, it is an exigency to train the stakeholders, especially the tourism personnel, hoteliers & the medical personnel for the same.

Objectives of the Course-

To enable the participants to:

1. study the loopholes in the present obsolete systems of solid waste management;
2. explore new, advanced & sustainable methods of effective solid waste management & disposal;
3. devise effective methods of resource recovery from the solid wastes; &
4. explore the possibilities of waste minimization.

Course Content Areas-

1. Solid Wastes & its Management Scenario in J&K
2. Contemporary Innovative Waste Management Technologies.
3. Management of Bio-medical & Hospitality-related wastes.
4. Policies & Rules for Solid Waste Management
5. Waste Minimization.
6. Sustainable Methods of Waste Disposal
7. Ecological Sanitation Solutions
8. Hazardous Waste Management

Participants' Profile-

Senior and middle level officers from various Government Departments like SDA, ULB, SMC, LAWDA, Pollution Control Board, Tourism & J&K TDC.

Methodology

The course shall follow the following methods:

1. Brainstorming.
2. Lecture sessions
3. Interaction & discussions
4. Films / Videos
5. Feedback/ Evaluation.

Field Visit-

To the Achchan Landfill Site

Faculty -

The lecture sessions and discussions shall be carried out by the Coordinator and the experts, who shall share their ideas, experiences and knowledge with the trainees.

Duration & Venue-

The training course shall be conducted for three days at the Institute of Management, Public Administration and Rural Development (J&K IMPA) premises, Main Campus, M.A. Road, Srinagar.

Course Coordinator

The training shall be conducted by

Dr. Humera Yaqoob, Assistant Professor,
Centre for ID & UA, J&K IMPARD

For further details about the training, she may be contacted at the following address:

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J&K IMPARD, Main Campus, M.A. Road, Sgr.



J&K IMPARD

J&K Institute of Management, Public Administration & Rural Development

Training Course
on
Solid Waste Management & Disposal
September 20-22, 2021

Venue: IMPA, Main Campus, Srinagar

Dr. Humera Yaqoob
(Course Coordinator)

Programme Schedule

Day 1	20 September, 2021		
	10:00 am to 10: 30 am	Registration of the Participants	Programme Staff
	10:30 am to 11:15 am	Inaugural Session & Course Briefing	Dr. Humera Yaqoob Course Coordinator
	11:15 am to 11:30 am	Tea Break	
	11:30 am to 12:30 pm	Session – 1 Experience Sharing: Interaction with the participants	Dr. Humera Yaqoob
	12:30 pm to 02:00 pm	Session – II Solid Wastes & its Management Scenario in J&K	Dr. Humera Yaqoob
	02:00 pm to 03:00 pm	Lunch Break	
	03:00 pm to 04:30 pm	Session – III Innovative Solid Waste Management Techniques	Dr. Humera Yaqoob
Day 2	21 September, 2021		
	10:00 am to 10: 30 am	Recap	Dr. Humera Yaqoob
	10:30 am to 11:45 am	Session – 1 Waste Minimization: A Sustainable Solution	Dr. G. R. Gani Former Comm./Sec, H&UDD
	11:45 am to 12:00 pm	Tea Break	
	12:00 pm to 01:00 pm	Session continued.....	Dr. G. R. Gani Former Comm./Sec, H&UDD

	01:00 pm to 02:00 pm	Lunch Break	
	02:00 pm to 03:30 pm	Session – II Behavioural Changes for Kitchen Waste Management	Dr. Samia Jabeen Faculty, J&K IMPARD
	03:30 pm to 04:30 pm	Session – III Conscious Hospitality: Hotel Waste Management	Dr. Humera Yaqoob
Day 3	22 September, 2021		
	10:00 am to 10: 30 am	Recap	Dr. Humera Yaqoob
	10:30 am to 11:30 am	Session I Bio-medical Waste Management	Dr. Humera Yaqoob
	11:30 am to 11:45 am	Tea Break	
	11:45 am to 01:00 pm	Session - II Films & Videos 1.Satayamev Jayate: Don't Waste Your Garbage 2.How a Modern Landfill Works 3.Waste Management in Healthcare & Hospitality: Case Studies 4. Solid & Liquid Waste Management 5. Bio-medical Waste Management	Dr. Humera Yaqoob
	01:00 pm to 02:00 pm	Lunch Break	
	02:00 pm to 03:00 pm	Session - III Towards Greener & Cleaner Cities: J&K Perspective	Mr. Aamer Athar Khan Commissioner, SMC
	03:00 pm to 03:30 pm	Session - IV Discussions & Strategy Building	Dr. Humera Yaqoob
	03:30 pm to 04:00 pm	Course Evaluation	Dr. Humera Yaqoob
	04:00 pm to 04:30 pm	Valediction & Distribution of Certificates	Mr. Aamer Athar Khan Commissioner, SMC & Dr. Humera Yaqoob

Course Coordinator

- **In charge Head, ID & UA**

- **Director Trainings**



J&K IMPARD

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Course Coordinator

Training Course
on
Solid Waste
Management & Disposal
Concept Paper



Dr. Humera Yaqoob
Course Coordinator
J&K IMPARD, Srinagar

Organized by:
Centre for Infrastructure Development And Urban Affairs

Jammu & Kashmir
Institute of Management, Public Administration & Rural Development
Main Campus, M. A. Road, Srinagar-190 001
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Solid Waste Management

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. Daily life in industrialized nations can generate several pounds of solid waste per consumer, not only directly in the home, but indirectly in factories that manufacture goods purchased by consumers

Types & Sources of Solid Wastes:

Basically solid waste can be classified into different types depending on their source:

<i>Source</i>	<i>Typical waste generators</i>	<i>Types of solid wastes</i>
Residential	Single and multifamily dwellings.	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g., bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes.).
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants.	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes.
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes.
Institutional	Schools, hospitals, prisons, government centers.	Same as commercial.
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings.	Wood, steel, concrete, dirt, etc.
Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants.	Street sweepings; landscape and tree trimmings; general wastes from parks, beaches, and other recreational areas; sludge.
Process (manufacturing, etc.)	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing.	Industrial process wastes, scrap materials, off-specification products, slay, tailings.
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms.	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g., pesticides).

Effects of Solid Waste Pollution:

Municipal solid wastes heap up on the roads due to improper disposal system. People clean their own houses and litter their immediate surroundings which affects the community including themselves.

This type of dumping allows biodegradable materials to decompose under uncontrolled and unhygienic conditions. This produces foul smell and breeds various types of insects and infectious organisms besides spoiling the aesthetics of the site. Industrial solid wastes are sources of toxic metals and hazardous wastes, which may spread on land and can cause changes in physicochemical and biological characteristics thereby affecting productivity of soils.

Toxic substances may leach or percolate to contaminate the ground water. In refuse mixing, the hazardous wastes are mixed with garbage and other combustible wastes. This makes segregation and disposal all the more difficult and risky.

Various types of wastes like cans, pesticides, cleaning solvents, batteries (zinc, lead or mercury), radioactive materials, plastics and e-waste are mixed up with paper, scraps and other non-toxic materials which could be recycled. Burning of some of these materials produces dioxins, furans and polychlorinated biphenyls, which have the potential to cause various types of ailments including cancer.

Waste Management

Americans alone are responsible for producing a whopping 220 million tons of waste a year. This number is far more than any other nation in the world. Because of this fact both the government and environmental associations have developed numerous methods of dealing with the problem. 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.

Waste management is the process of treating solid wastes and offers variety of solutions for recycling items that don't belong to trash. 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.

According to Wikipedia, "*Waste management is the "generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes". There are various types of solid waste including municipal (residential, institutional, commercial), agricultural, and special (health care, household hazardous wastes, sewage sludge).*"

It is the collection, transport, processing or disposal, managing and monitoring of waste materials. The term usually relates to materials produced by human activity, and the process is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is a distinct practice from resource recovery which focuses on delaying the rate of consumption of natural resources. All waste materials, whether they are solid, liquid, gaseous or radioactive fall within the remit of waste management.

Waste management practices can differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. Management of 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 subject to local, national or international authorities.

Sustainability

The management of waste is a key component in a business' ability to maintaining ISO14001 accreditation. Companies are encouraged to improve their environmental efficiencies each year by eliminating waste through resource recovery practices, which are sustainability-related activities. One way to do this is by shifting away from waste management to resource recovery practices like recycling materials such as glass, food scraps, paper and cardboard, plastic bottles and metal.

Methods of Solid Wastes Disposal:

- i. Sanitary Landfill
- ii. Incineration
- iii. Composting
- iv. Pyrolysis

i. Sanitary Land Filling:

The Landfill is the most popularly used method of waste disposal used today. This process of waste disposal focuses attention on burying the waste in the land. Landfills are found in all areas. 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.

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:

- i. Should be above the water table, to minimize interaction with groundwater.
- ii. Preferably located in clay or silt.
- iii. Do not want to place in a rock quarry, as water can leech through the cracks inherent in rocks into a water fracture system.
- iv. 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.
- v. 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:

- i. Fatal accidents (e.g., scavengers buried under waste piles).
- ii. Infrastructure damage (e.g., damage to access roads by heavy vehicles).
- iii. Pollution of the local environment (such as contamination of groundwater and/or aquifers by leakage and residual soil contamination during landfill usage, as well as after landfill closure).
- iv. 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).
- v. Harboring of disease vectors such as rats and flies, particularly from improperly operated landfills.

ii. Incineration:

Incineration or combustion is a type disposal method in which municipal solid wastes are burned at high temperatures so as to convert them into residue and gaseous products. The biggest advantage of this type of method is that it can reduce the volume of solid waste to 20 to 30 percent of the original volume, decreases the space they take up and reduce the stress on landfills. This process is also known as thermal treatment where solid waste materials are converted by Incinerators into heat, gas, steam and ash. Incineration is something that is very in countries where landfill space is no longer available, which includes Japan.

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.

Incineration and other high temperature waste treatment systems are sometimes described as “thermal treatment”. 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.

iii. Composting:

Composting is an easy and natural bio-degradation process that takes organic wastes i.e. remains of plants and garden and kitchen waste and turns into nutrient rich food for your plants. 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.

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.

Organic matter constitutes 35%-40% of the municipal solid waste generated in India. 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 increases the soil's ability to hold water and makes the soil easier to cultivate. 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. Composting: some benefits

- i. Compost allows the soil to retain more plant nutrients over a longer period.
- ii. It supplies part of the 16 essential elements needed by the plants.
- iii. It helps reduce the adverse effects of excessive alkalinity, acidity, or the excessive use of chemical fertilizer.
- iv. It makes soil easier to cultivate.
- v. It helps keep the soil cool in summer and warm in winter.
- vi. It aids in preventing soil erosion by keeping the soil covered.
- vii. It helps in controlling the growth of weeds in the garden.

iv. Pyrolysis:

Pyrolysis is a form of incineration that chemically decomposes organic materials by heat in the absence of oxygen. Pyrolysis typically occurs under pressure and at operating temperatures above 430 °C (800 °F).

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.

v. Recovery and Recycling

Resource recovery is the process of taking useful discarded items for a specific next 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 is the process of converting waste products into new products to prevent energy usage and consumption of fresh raw materials. Recycling is the third component of Reduce, Reuse and Recycle waste hierarchy. 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.

vi. Plasma gasification

Plasma gasification is another form of waste management. Plasma is a primarily an electrically charged or a highly ionized gas. Lighting is one type of plasma which produces temperatures that exceed 12,600 °F. With this method 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 bonds are broken down as result of the intense heat in the vessels and the elemental components. 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.

Limitations and Concerns:

- i. The technology requires drying of soil prior to treatment.
- ii. 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.
- iii. 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.
- iv. Pyrolysis is not effective in either destroying or physically separating inorganics from the contaminated medium. 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.
- v. When the off-gases are cooled, liquids condense, producing an oil/tar residue and contaminated water. These oils and tars may be hazardous wastes, requiring proper treatment, storage, and disposal.

Waste to Energy (Recover Energy)

Waste to energy (WtE) process involves converting of non-recyclable waste items 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 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.

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. Thermal treatment ranges from using waste as a fuel source for cooking or heating 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. Gasification and advanced Plasma arc gasification are used to convert organic materials directly into a synthetic gas (syngas) composed of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam. An alternative to pyrolysis is high temperature and pressure supercritical water decomposition (hydrothermal monophasic oxidation).

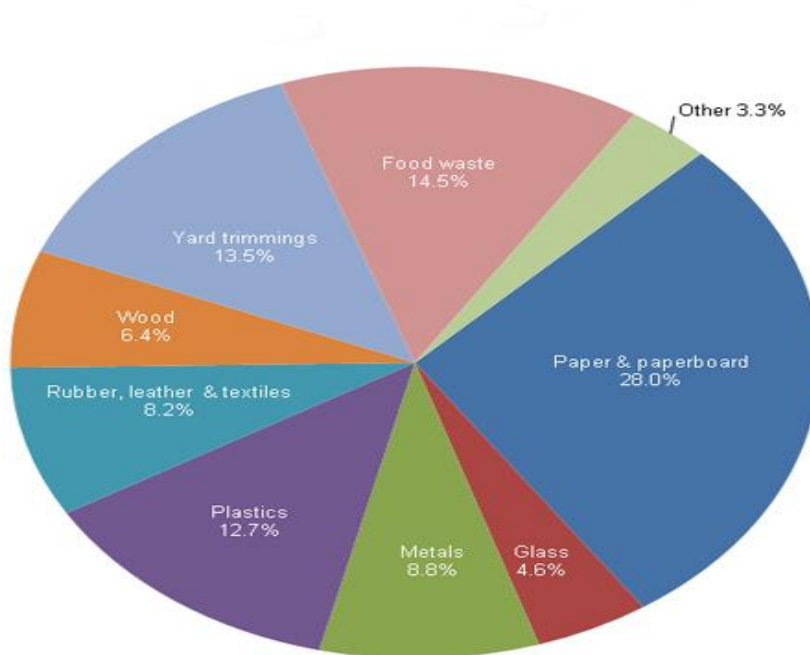
Resource Recovery

Resource recovery (as opposed to waste management) uses LCA (life cycle analysis) attempts to offer alternatives to waste management. For mixed MSW (Municipal Solid Waste) a number of broad studies have indicated that administration, source separation and collection followed by reuse and recycling of the non-organic fraction and energy and compost/fertilizer production of the organic material via anaerobic digestion to be the favoured path.

Resource Conservation

Recycling and composting prevented 86.9 million tons of material away from being disposed in 2011, up from 15 million tons in 1980. This prevented the release of approximately 183 million metric tons of carbon dioxide equivalent into the air in 2011—equivalent to taking 34 million cars off the road for a year. Learn more about how common wastes and materials, including food and yard wastes, paper, metals, and electronics, contribute to MSW generation and how they can be recycled.

Energy Recovery from Waste



*Total MSW Generation (by Material), 2011
250 Million Tons (before recycling)*

Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolysis, anaerobic digestion, and landfill gas (LFG) recovery. This process is often called Waste-to-energy (WTE).

Energy recovery from waste is part of the non-hazardous waste management hierarchy. Converting non-recyclable waste materials into electricity and heat generates a renewable energy source and reduces carbon emissions by offsetting the need for energy from fossil sources and reduces methane generation from landfills.

There is separated yard waste or food waste, including recycled cooking and trap grease, and other materials. Final regulations allow separated municipal solid waste (after all recyclable materials have been removed) to qualify as "separated yard or food waste."

Currently there are 86 facilities in the United States for combustion of municipal solid waste (MSW), with energy recovery. These facilities are located in 25 states, mainly in the Northeast. No new plants have been built in the US since 1995, but some plants have expanded to handle additional waste and create more energy. The 86 facilities have the capacity to produce 2,720 megawatts of power per year by processing more than 28 million tons of waste per year. According to *Municipal Solid Waste in the US: Facts and Figures*, in 2011 we combusted about 29 million tons of MSW (about 12 percent) for energy recovery. After energy is recovered, approximately ten percent of the volume remains as ash. This ash is generally sent to a landfill.

Waste management concepts

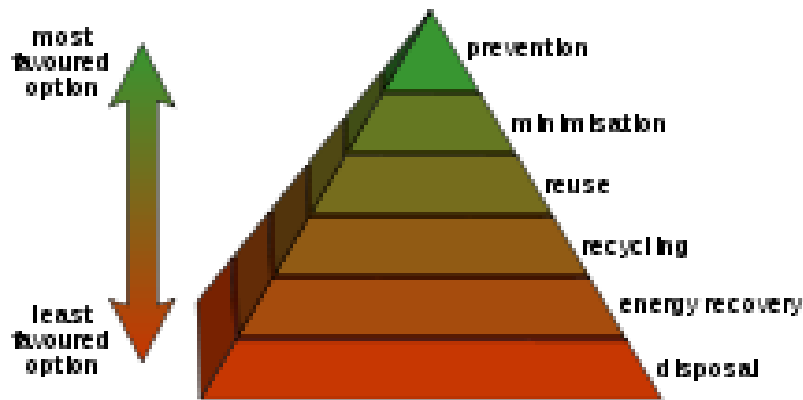


Diagram of the waste hierarchy

There are a number of concepts about waste management which vary in their usage between countries or regions. Some of the most general, widely used concepts include:

Waste hierarchy - The waste hierarchy refers to the "3 Rs" reduce, reuse and recycle, which classify waste management strategies according to their desirability in terms of waste minimization. The waste hierarchy remains the cornerstone of most waste minimization strategies. The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste see: resource recovery.

Polluter pays principle - the Polluter Pays Principle is a principle where the polluting party pays for the impact caused to 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.

Avoidance / 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, light-weighting of beverage cans).

The most easier method of waste management is to reduce creation of waste materials thereby 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 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.

Source Reduction and Reuse

Source reduction, also known as waste prevention, means reducing waste at the source. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. Source reduction also is important in manufacturing. Light weighting of packaging, reuse, and remanufacturing are all becoming more popular business trends. Purchasing products that incorporate these features supports source reduction.

Source reduction can:

- Save natural resources;
- Conserve energy;
- Reduce pollution;
- Reduce the toxicity of our waste; and
- Save money for consumers and businesses alike.

There are certain waste types that 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 is 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 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.

Composition and Characteristics of Solid Waste:

The composition and characteristics of municipal solid wastes vary throughout the world. Even in the same country it changes from place to place as it depends on number of factors such as social customs, standard of living, geographical location, climate etc. MSW is heterogeneous in nature and consists of a number of different materials derived from various types of activities. Waste composition also varies with socio-economic status within a particular community, since income determines life-style – consumption and cultural behaviour.

Waste can be segregated into the following streams:

1. Biodegradable Wastes:

Biodegradable waste includes organic waste, e.g. kitchen waste, vegetables, fruits, flowers, leaves from the garden, and paper.

2. Non-biodegradable Wastes:

Non-biodegradable waste can be further segregated into:

- (a) Recyclable waste – plastics, paper, glass, metal, etc.
- (b) Toxic waste – old medicines, paints, chemicals, bulbs, spray cans, fertilizer and pesticide containers, batteries, shoe polish.
- (c) Soiled – hospital waste such as cloth soiled with blood and other body fluids. Toxic and soiled waste must be disposed of with utmost care.

Certain items are not biodegradable but can be reused or recycled. In fact, it is believed that a larger portion can be recycled, a part of it can be converted to compost, and only a smaller portion of it is real waste that has no use and has to be discarded. According to the Municipal Solid Wastes (Management and Handling) Rules, 2000, wastes must be segregated into three categories i.e. Organic, Recyclables and others.

Solid Waste Management & Disposal in J&K

The collection and dumping of the solid waste in urban areas is one of the basic facility being provided by the Department of Urban Development. However, the Dept. feels handicapped in absence of the proper/latest machinery and equipment for collection and disposal of the waste. In order to overcome this difficulty the Dept. introduced a scheme in the Annual Plan 2010-11 with the expression of Solid Waste Management and an allocation of 50.00 lacs were earmarked during 2011-12 for 6 SWM projects for the districts of Reasi (Katra), Udhampur, Kthar(Jammu), Budgam, Pulwama and Kulgam.

The SWM is an ever increasing challenge due to continual migration of people towards towns/cities and inadequate allocations for the same. There are several issues which have to be addressed and answered before venturing into a solution for handling tons of garbage viz.:-

- i. Latest technology to be explored and adopted;
- ii. Cost effectiveness of the projects to be analysed;
- iii. Financing of the projects to be ensured; &
- iv. Public Private Partnerships to be initiated.

There are Municipal Solid Waste (Managing & Handling) Rules 2000 which make Municipal Authorities responsible for collection, segregation, storage, transportation, processing and disposal of Solid Waste. As per reports made public by Ministry of Forest & Environment, Government of India 62 million tons of waste including plastic & bio- medical waste is generated annually out of which about 70 % gets collected and about 25% of that is processed and treated. A lot needs to be done and the involvement of students is very important for wide awareness amongst the people and making authorities accountable. On an average Jammu and Kashmir generates 3134 tonne solid waste per day. In the face of “low level of services” this causes threat to the public health in particular and environment quality in general, as per the draft action plan for municipal solid waste management 2018. The waste generation is increasing with each passing year

Since 2012, the waste generation in the state has increased by over 18 per cent. In 2012, the total waste generated was recorded at 2568 TPD (tonne per day) which went up to 2704 TDP in 2013, 2844 TPD in 2014 and 2987 TDP in 2015. The policy document attributes the increase to the growing population.

However, the policy highlights the failure of the urban local bodies and municipal bodies to “tackle the waste disposal on scientific basis” despite the municipal agencies spending 5-25 percent of their annual budget on these activities.

Collection and transportation activities constitute approximately 80-95 percent of the total budget of SWM. Hence, it formulates a key component in determining the “economics of the entire SWM system”.

On the contrary, disposal and treatment of waste is an underinvested area and open dumping, uncontrolled and poorly managed landfills are a common feature across most Indian cities and towns. The policy has been drafted as per the National Green Tribunal order dated

15.01.2015 whereby all the states and UTS were directed to prepare an action plan at the state level.

According to a notification issued by the department, the state government has prepared the draft action plan for municipal solid waste management J&K-2018 in pursuance to solid waste management rules, 2016 (Rule-15).

Solid waste management mismanaged in Srinagar

With Srinagar city generating nearly 450 metric tonne solid waste daily, the authorities have failed to address the menace notwithstanding the financial assistance available from the union government for implementation of much-needed solid waste management rules. The waste is stored at Achan, the only dumping site in the Srinagar city.

However, the Srinagar Municipal Corporation (SMC) has failed to implement the ‘Solid Waste Management Rules’ (SWMR) aimed to dispose of the bio-degradable and non-biodegradable waste on scientific lines.

Under SWMR, segregation of waste at source has been declared important process as it solves half the city’s problem of waste management.

SMC has also failed to procure adequate men and machinery for scientific disposal of solid waste through segregation, collection, treatment and disposal of waste. SMC has just around 120 hoppers against the need of round 600 to collect and transport segregated waste from municipal wards.

Each municipal ward must have at least two hoppers, one to transport degradable waste and another for non-biodegradable.

In 2017, a pilot project was started in few municipal wards and people were educated about segregation of waste at source.

They were also provided with two colour coated dustbins, one each for biodegradable and non-biodegradable waste. However, SMC officials mix the segregated waste by throwing it in same hopper for transportation.

Similarly, services of some NGOs were hired as information, education and communication partners to spread awareness among masses in municipal wards about the waste and its issues. Later, within after few months, the campaign was suspended in most of the wards.

Waste-to-energy plant

The authorities have even failed to give J&K its first waste-to-energy plant so far. According to sources a contract in this regard has been awarded to a consortium of contractors that is supposed to build the ambitious Rs.120 crore waste-to-energy project.

The project would see the city’s 450 metric ton solid waste converted into low-cost electricity and also facilitate productive disposal of the harmful waste.

Directions for the same were issued on 12 December 2017 by National Green Tribunal, asking the state government to complete the project within 18 months. One year has passed and the work on this project is yet to begin.

Swachh Bharat Mission

On 3 December 2018, Jammu and Kashmir High Court sought compliance report from the Commissioner SMC, on the implementation of various schemes besides a report indicating the amount spent and the steps taken for the public awareness on Swachh Bharat Mission.

An affidavit dated 14 May 2018 submitted before the HC by the State Government reveals that out of Rs.12.11 crores received from Central government for the purpose, only Rs.1.22 crores have been utilized.

Scenario in J&K State

The Swachh Bharat Mission (Urban) has a special mention about preparation of Detailed Project Reports (DPRs) for management of solid waste across cities and towns of India. According to a survey done in the recent past, except Srinagar Municipal Corporation (SMC) and Jammu Municipal Corporation (JMC), most of the local bodies that include Municipal Councils and Municipal Committees/Town Area Committees (TAC) have not prepared proper DPRs as per Solid Waste Management Rules 2016. This has added to the problems of managing solid waste in towns across J&K. In almost all the towns of J&K state, local municipalities have failed to scientifically treat the waste. The waste is either thrown into water-bodies, hill-sides or forest areas. A report submitted before National Green Tribunal (NGT) only a few years back had revealed that J&K state has 100 percent open dumping of Municipal Solid Waste by SMC, JMC and all the Municipal Councils and Municipal Committees which are 90 plus in number. The NGT report had given 31st rank to J&K State with regard to Solid Waste Management policy. Goa, Kerala and Tamil Nadu have been ranked as 1, 2 and 3 respectively keeping in view the scientific management of solid waste.

Recently JMC and SMC have started a pilot activity in some areas to undertake door to door collection of garbage and segregation at source. JMC in association with a private solid waste management organization is executing this pilot project in Jammu town. For this purpose coloured dustbins have been provided to the households. They have been advised to put biodegradable waste in green dustbin and non-biodegradable waste in blue dustbin. The waste is collected by the workers of JMC on daily basis in hand driven trolleys/load carriers for further shifting to the dumping sites. In an environmentally fragile state of Jammu and Kashmir composting units do not exist (except one in Budgam district).

The most important core function of the Corporation is to provide better and efficient sanitation. It includes Waste collection system. The man & machinery used by the Corporation for the purpose does sweeping and collection of waste/garbage within municipal limits at Ward level under the overall supervision of the Ward Officer in each administrative ward, which comprises of the elect wards represented by the Councillor. Each Ward Officer is assisted by the Sanitary Inspector and Supervisors for supervision of the processes. The

Health Officer, Chief Sanitation Officer and Sanitation officer are supervising the overall workability and planning processes at Central level. The existing strength is not sufficient to cater the requirements for 100% collection of waste on door-to-door basis and sweep the city roads which consist of 174 running K.M. main roads and 860 running K.M. other roads. This shortage obviously affects the overall waste collection and road sweeping performance of the Srinagar Municipal Corporation. More than 380 metric tons of refuse and garbage are generated per day in Srinagar City. The Corporation is providing better sanitation and is trying its best to arrive at the public expectations. At present 60% of total waste generated is being collected and this is as per national standards comparing the infrastructure and manpower available with SMC for this purpose. For collection & lifting of the city waste from interiors at ward level, hand carts, raidees etc. are being used to collect the waste and take it to a the specific collection points.

As against requirement of 3600 Safai-karamcharies the Srinagar Municipal Corporation is presently having only 2108 Safai-karamcharies, 1765 on regular basis and 343 on consolidated bases.

The process of the transportation of waste from the collection points on daily basis is being looked after and supervised by the transport officers assisted by the full-fledged transport yard staff & accordingly, 60% of the waste is being taken to dumping site on daily basis. For collection of the city waste from the Srinagar City which is spread over an area of 279 Sq. K.M., having 575 Temporary Collection Points, the existing garbage transportation fleet, which is inadequate, old and unscientific is being used for transportation.

Details of Solid Waste Collection Equipment and Vehicles:

Sr. No	Type of Vehicle	Existing Number	Actually Required
(i).	Mini Truck.	05	05
(ii).	Truck-Tipper.	24	34
(iii).	Hook Trailer (transfer station)	--	08
(iv).	1. Refuse Collector	01	10
	2. Refuse Collector Bins (Kerb side bins).	20	400
(v).	1. Dumper Placer vehicle.	12	25
	2. Dumper Bins.	110	400

(vii).	Tricycle	20	500
(viii).	Hand Carts	500	500
(ix)	Wheel Barrows	1000	150
(x).	Containerized handcarts	--	2000
(Xi).	Front-End-Loader	20	20
(xii).	TATA ACE for door-to-door collection of waste	-	20
(xiii).	Road Sweeping Machines	--	04
(xiv).	Compactors for dumping site.	01	03
(xv).	Snow clearance Dozer (Mini Dozer compatible to clear snow in lanes and by lanes).	--	04

- For augmentation of the Municipal Transport Fleet the Corporation has to purchase modern garbage handling machinery and equipment and liquid waste handling equipment.
- Under ADB funding a number of garbage and liquid collection vehicles are being provided by the J&K Economic Reconstruction Agency and matter has been taken up with concerned authorities.
- Besides, Housing and Urban Development Department has been requested to release the funds, so that some of the machinery/equipment required for collection and transportation of garbage is purchased and Solid Waste System is improved.

The Srinagar Municipal Corporation has at present only one Dumping Site at Syedpora, Achan, which comprises of 540 Kanals of land, where the waste is being spread over and is further being covered with clay and use of disinfectants are also being made. The existing Dumping site is being improved and modernized in a scientific Engineered Landfill site through the financial and technical guidance of Asian Development Bank. A detailed action plan/project report on this score has been prepared. In fact some of the works have been taken up for execution by the J&K Economic Reconstruction Agency against the money released by the Asian Development Bank. All the environmental and other related issues will be redressed under the modernization plan. The modernization of existing open dumping site into a scientific Sanitary Landfill site will be taken up for execution by the J&K ERA in a couple of months against the estimated cost of Rs.22.00 Crores that will take care of all the pollutants including that of air quality, ground water quality and aesthetic look and

landscaping of the interior of Landfill site as per guidelines of J&K SPCB. Besides this there will be a permanent facility for regular monitoring of these components in future. The following are salient features of proposed modernization of Landfill site:

- I. Construction of new 7m wide access road from Ali Jan road directly into the Landfill site thus avoiding the congested population of Saidapora village.
- II. Construction of internal roads for free movement of garbage vehicles, shouldering and construction of drains for disposal of storm water.
- III. Landscaping and plantation around the Landfill site (within SMC land) to improve aesthetic view of the site.
- IV. Administration offices with sanitation and rest facilities and environmental monitoring facility.
- V. Weighing bridge.
- VI. Lined sanitary cell development.
- VII. Equipment, workshop and garage building.
- VIII. Waste transport equipment and washing facilities.
- IX. Leachate collection and disposal facilities.
- X. Compound walling around the Landfill site.

There is no door to door collection except in only few areas / towns, viz., Municipal Committee Reasi, Cantonment Board, Jammu and few wards in Jammu city. Reasi Municipal Committee is worth to mention here because it is the only local body to practice 100% door to door collection. There is no processing facility in the State except small scale vermicomposting being carried out at MC, Bhaderwah, Doda and MC, Sunder.

The management of municipal solid waste is one of the main functions of all Urban Local Bodies (ULBs) in the country. All ULBs are required to meticulously plan, implement and monitor all systems of urban service delivery especially that of municipal solid waste. With limited financial resources, technical capacities and land availability, urban local bodies are constantly striving to meet this challenge.

Solid waste means and includes solid or semi-solid domestic waste, sanitary waste, commercial waste, institutional waste, catering and market waste and other non-residential wastes, street sweepings, silt removed or collected from the surface drains, horticulture waste, agriculture and dairy waste, treated bio-medical waste excluding industrial waste, bio-medical waste and e-waste, battery waste, radio-active waste generated in the area under the local authorities and other entities (SWM Rules, 2016).

With the launch of the flagship programme by the Government of India, Swachh Bharat Mission in 2014, there is a focus on quality and sustainability of the sanitary service provision as well as emphasizes the commitment on every stakeholder to bring about a visible change in society.

Important Highlights of SWM Rules, 2016

Solid Waste Management Rules, 2016 came in supersession of MSW Rules, 2000 keeping in view the need to integrate all sections of society to achieve desired zero waste target with provisions laid down for the first time for waste generators. Under the new rules, carrying

certain dos and don'ts for manufacturers, distributors, municipal bodies and panchayats, and directing every local authority and village Panchayat to:

1. Facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure with maximum utilisation of all components of solid waste and preference given to decentralized processing such as Bio-methanation plants, composting, waste to energy processes including RDF.
2. To organise awareness programmes for segregation of wastes and promote recycling or reuse of segregated materials with objective of “Zero waste” going to landfills.

Growing challenge with no management in place can lead to disastrous impacts on environment and health

Special Provisions for Hilly Areas as per SWM Rules, 2016

- a. Construction of landfill on hill shall be avoided.
- b. Convey the provisions of solid waste management under the bye-laws to all tourists visiting the hilly areas at the entry point in the town as well as through the hotels, guest houses or like where they stay and by putting suitable hoardings at tourist destinations.
- c. May levy solid waste management charges from the tourist at the entry point to make the solid waste management services sustainable.

The State Government has banned the manufacturing of plastic bags of below 50 microns as thinner bags currently pose a major threat to environment due to its non-disposability

To sum it up, one of the major problems we face today is the "management" of solid wastes arising out of domestic, commercial and industrial activities. Due to the increase in packaging of consumer / commercial products and explosion of industrial growth, besides an enhanced tourism & healthcare facilities, the local authorities, though committed, are unable to cope with their waste disposal. The process is generally undertaken to reduce the materials produced by human activity e.g. in tourism and healthcare organizations and their effects on health, environment or aesthetics.

In order to contain the menace of increasing solid wastes in households, hotels and hospitals; and to develop more and more sanitized areas in the cities & enhance the health of the public, it is an exigency to train the stakeholders, especially the tourism personnel, hoteliers & the medical personnel for the same.