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SOLID WASTE MANAGEMENT: AN INTEGRATED VIEWPOINT

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ABSTRACT

The population outburst and growth of civilization and sudo culture of show has prompted obsolesce of products and items in daily use to get in terms of wastes at very fast rate. This wastes in general and major proportion which is termed as Municipal Waste is posing multi affect to environment and ecology. One has to think and go for better waste management schemes and programs for protection of human life and provide a safe passage to human kind at least for coming generation. The new approach of Integrated Solid Waste Management (ISWM) is fast taking over. The growth, concept and benefits are need of hour to be discussed and dealt in public fora. Problems associated with poorly managed solid waste operation are to be discussed. Increased attention has been given by the government in recent years to handle this problem in a safe and hygienic manner. Most cities lack proper collection, reuse, recycle and disposal plans and ideas. The insufficient collection, inappropriate disposal and handling of solid wastes are contaminating the water sources which in turn are affecting the general hygiene. A new waste disposal, elimination, reduction and treatment in sustainable manner are to be thought of for longer terms affects.

Keywords—*ISWM, Environment, Ecology, Recycle, Reuse, Policies.*

1. INTRODUCTION

Urbanization and rapid gown of unplanned cities have given birth to local bodies and increased waste generation. The major concern of these are seen when we come across the Municipal bodies. The individuals see waste management as duty of public authority and see that they are only responsible for piling up in unscientific and unprecedented manner in the public places or at most in the remote areas where it is not visible to them. These wastes are often termed as Municipal Solid Wastes (MSW). These MSWs constitutes serious of problems in typical Third World cities. The municipal authorities are responsible for collection and disposal of such wastes by they seldom are equipped to carry out these. Facilities for proper are minimal and only fraction of wastes gets properly disposed. These insufficient waste disposal often turnout to land, water and air pollution which are deadly to human kind and nature. SWM may be described as discipline associated with overall monitoring and control of generation, intermittent storage, timely collection, transfer transport, processing, and proper disposal of solid wastes in prescribed and hygienic manner as per best principles of public health, economics, engineering, conservations, and acceptable to public attitudes and customs [1]. Depending on the regulating bodies enactments, legal sanctions, political commitment, inflow of wastes, socio economical conditions and traditions the operation of SWM varies from region to region, state to state or nation to nation. In the prevailing situation the management is in very poor shape and needs a radical consideration. This radical change may initiate from particular type identification, empanelment and giving responsibilities to individuals and bodies. Various national and international bodies like UNED have raised concerns and have directed the authorities to see that the minimum wastes are produced so that environmental and ecological balance is maintained, preserved and preservation of virgin raw materials can also be achieved. Waste can vary from the house hold, kitchen, construction debris, commercial, industrial, chemical or even agricultural and food wastes. [4]

2. MSW TYPES

- Broadly one can categorize the Solid Wastes into five categories , which can be enumerated as -
1. **Biodegradable waste:** Those wastes whose origin is from food, kitchen waste, green waste which may include vegetables, flowers, leaves, fruits, non recyclable paper of all categories.
 2. **Materials which can be Recycled:** Items including paper, glass, bottles, cans, metals, certain plastics, etc.
 3. **Inert waste:** These include civil construction and demolition waste, dirt, rocks, debris, flyash etc.
 4. **Composite wastes:** Clothing turned waste, tetra packs and waste plastics which are fit for recycling such as toys.

5. **Hazardous toxic Household & Consumer waste: The discarded** medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.
The wastes can come from Varsity of origins Broadly sources of waste, common waste generators & solid waste contents can be tabulated as bellow in Table-I.

Source	Waste Generators	SW Contents
Residential	Household	Kitchen wastes Cardboard, Textile, Wood , Glass, Batteries, other household hazards wastes
Industrial	Manufacturing, Fabrication, Chemical , Construction etc	Office Housekeeping wastes, Construction and demolition debris , Hazardous wastes from such origin
Consumer & Commercial Based	Restraints, hotels, Stores, Markets, office & Office establishment buildings, Etc.	Food Wastes, Paper, plastics, wood, glass, special wastes, metals Hazardous wastes.
Institutional	Schools, hospitals, prisons, Government centers.	Do
Municipal Wastes	Water and Wastewater treatment Plants. Street cleaning, Landscaping, parks, Beaches & other recreational Areas, Sewage and sewage plants	Street sweepings; landscape and tree Trimmings; general wastes from parks, Beaches, and Other recreational areas Sludge. Sewage collection, treatment and its associated wastes
Building Construction and Demolition, Road and associated construction.	New construction sites, Road repair, renovation Sites, demolition of Buildings	Construction materials, material waste, dust, Flyash, Debris, Wood, steel, concrete, dirt, Road debris, etc.
Agriculture	Farm, orchards, Crops, , vineyards, Dairies, feedlots, farms. Spoiled food wastes.	Agricultural Wastes, The unwanted degradable and non degradable wastes, hazardous wastes like Pesticides etc.
Industry/ Industrial Processes	Heavy Medium and light Manufacturing, Petroleum refineries, Chemical plants, Thermal and other types of power Plants, mineral processing , extraction and processing units.	Industrial process wastes, Scrap Materials, Off specification or waste products, Slag / Slay tailings

Table 1. Types of MSW



Figure 1 View of SW

3. GLOBALIZATION, GENERATION OF WASTES AND THEIR IMPACT ON HUMAN HEALTH AND THE ENVIRONMENT

The divide between developed, developing and under developed can be seen from the generation of waste itself. They have ones generated more waste and have fascination of keep on changing the holdings for many reasons and depleting the life of items. This is equally applicable to the different strata of social set up also. The unprecedented growth rate of population and tendency to match to the affluent by the larger middle income group is also main reason for waste generation. Globalization and technology transfer in name of help from developed countries to third world countries has paved another way of pushing their discarded out of date products to such nations which very soon turn to waste stream and increase the rate of generation of waste alarmingly. The generated wastes have many impacts and these impacts can be classified as herein under the different heads namely: [9]

3.1. Impact on Humans Health

The well known and observable effects of any environmental and ecological imbalance caused by unscientific waste management or disposal is seen on human kind only. The populations which are marginally affordable population residing in the vicinity of dump yards where wastes are disposed off are the most vulnerable group. The common effects noticeable and observed or termed as

3.1.1. Infections

- a. The toxicity and contamination of water by leaping in the ground water causes Skin and Blood Infections when individuals come in direct contact with waste.
- b. Direct or indirect contact to Eye and respiratory infections can result from exposure with infected dust during landfill or dumping operations.
- c. Typical vector borne diseases variety of diseases can result from
 - i. Flies breed which very effective vectors for spread of diseases in some constituents of solid wastes can result in some ailments.
 - ii. The dregs and drains in the slums gives rise to Mosquitoes breed can spread disease like malaria, dengue or similar types ones.
 - iii. Very often in the loose disposed wastes Rats find shelter and food which can spread different varieties of diseases and can damage electrical cables causing short circuits and other hazards.

3.1.2. Spreading of Typical Chronic diseases can result from these wastes. The few ones are as follows:

Hepatotoxicity

Hepatotoxicity which refers to chemical driven liver damage are caused by the wastes leaping in the water in the infected areas. The toxic constituent when inhaled or taken through water infects the liver and severely damages the liver function

Immunotoxicity

He contaminated environment causes loss in immunity and these results in Immunotoxicity which in turn can cause autoimmune disease, where an overactive immune system attacks the body's cells which may lead even to cancer. In case the heavy metals leachate and contaminates water source supply it can cause immunotoxicity. This can lead to impairment of human food chain..

Nephrotoxicity

Nephrotoxicity is bad effect of poisons, heavy metals, toxic chemicals and medication, on the kidney and results in malfunctioning of it. This can often be deadly and fatal on human beings.

Neurotoxicity

Every intake irrespective it is though inhalation or oral or environmental has effect on our neuro system. These natural or artificial toxic elements when gets into our body they affect our neuro system and this initiates malfunction because of neurotoxins and is termed as Neurotoxicity. The neurotoxins kills our neurocells or neurons and affects our nervous system which may be evident in terms of weakness in limbs, loss of memory, vision, headache, psychological problems resulting in sexual pattern, and behavioral problems [11]

Pulmonary toxicity

The inhalation or environmental changes which create troubles in breathing and lungs are normally bracketed under this. They caused by chemical and excessive dust particles in the air . .

4. DOS FOR COLLECTION AND STORAGE

- i. Project site Littering must be banned or restricted.
- ii. Measures for stopping of sewage and drainage should be taken.
- iii. Removal of debris, litter from ditch lines, drainage grates and trash racks should be ensured.
- iv. Prevision of Trash receptacles must be ensured at such places and points where wastes are collected and stored.
- v. Collection of Waste from work sites and placing in watertight dumpsters at least on weekly basis should be ensured. The consideration of source is meaningless here.
- vi. Sufficient nos and of size of Dumpsters may be arranged to contain MSW generated at the site of any project.
- vii. All filled in dumpsters may be regularly disposed of by concerned persons from the site and replaced by empty ones for collection.
- viii. Debris & waste from the site frequently on fixed basis depending on degradability or non degradability and collection rate.
- ix. Materials to be used in the work must be stacked in scientific and identifiable manner
- x. Provision for prevention form Storm water run-on on MSW with proper use of berms, dikes, temporary diversion structures or measures may be provisioned.
- xi. At least 15 mt or 50 ft distance from drainage facilities or wells for the storages of wastes must be maintained.
- xii. Wastes of typical types should be stored at different places and mixing of hazardous and non hazardous wastes must be avoided.
- xii. Liquid and deadly chemicals storage and collection in scientific manner must be ensured and special care for its non mixing with other wastes must be ensured.
- xiv. Care for covering of wastes must be ensured for avoiding its spreading due to storm and wind.

5. CURRENT PROBLEMS

In third world the problem of solid waste is multifold namely:

- Collection,
- Transportation
- Reuse and Recycling of wastes
- Extraction of useful and needful constituents
- Disposal through different scientific manner
- Availability of Proper regulatory mechanism
- Installation of disposal mechanism and
- Required Finance for this complete process in it.

Out of the total budget required for MSW is around 30 to 50 % of the total requirement. The different mechanisms available in advanced cities only 50 to 80 % wastes are being collected which is even higher compared to neighboring nations around. Normally 90 % of collected waste finds place in dumps. Located in the lesser refuse areas dwelling low income population in and around. The remaining wastes may get accumulated in the streets and cause environmental hazards and even blockage of drain once they get carried away by rain water to nearby nalas etc and other problems. Decomposing of organic materials produces methane

which is harmful for nearby persons, these even catch fire which may result in global warming. In summer the dry wastes catch fire and often lead to firefighting situation, in rainy seasons these wastes generate bad orders and cause many health related problems. [2].

6. WASTE REDUCTION:

Waste disposal is the last leg of waste handling. The genesis can be dealt by reduction itself. The organization of waste can be seen in two ways i.e. from generation point for disposal point of view as figure 2

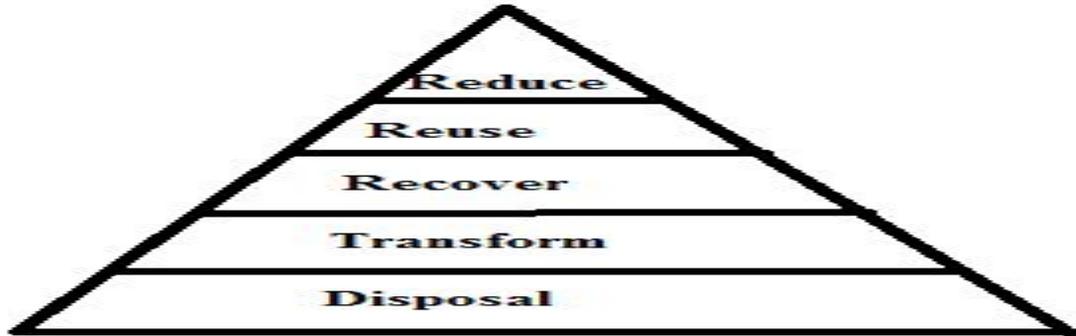


Figure 2

and from waste reduction for disposal point of view as figure 3.

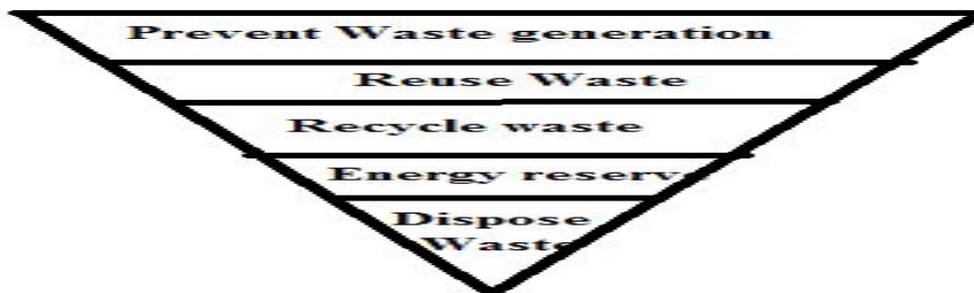


Figure 3

The waste disposal often requires land and dead areas which cannot be further used for any other purpose, which are depleting very fast these days. The cost and size of available land for disposal is day by day getting difficult to find irrespective of situation of nation. The available resources for migration may be solution for developed nations and optimal solution between available fund and resources left out may lead to have a compromise for third world nations. Transformation of waste into useful composts and useful energy requires finance so affordability is bit restricted for developing or underdeveloped nations.

Stress to every house hold irrespective of nation's condition should be to produce lesser waste and develop habit of using materials which reduce lesser wastes. In order to achieve this many approaches have been adopted across the globe and one among these is the Integrated Solid Waste Management (ISWM) scheme.

7. ISWM CONCEPT

Integrated solid waste management refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency. ISWM is a comprehensive waste prevention, recycling, composting, and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions. The major ISWM activities are waste prevention, recycling and composting, and combustion and disposal in properly designed, constructed, and managed landfills (Figure 4).

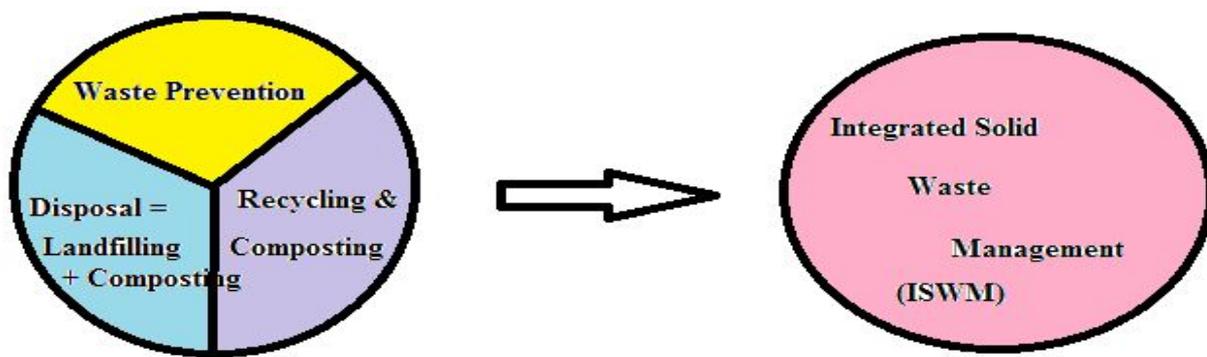


Figure 4

Each of these activities requires careful planning, financing, collection, and transport, all of which are discussed in this. ISWM is defined as the selection and application of appropriate techniques, technologies, and management programs to achieve specific waste management objectives and goals. Understanding the inter-relationships among various waste activities makes it possible to create an ISWM plan where individual components complement one another. The UNEP international environmental technology centre describes the importance of viewing Solid waste management from an integrated approach .[1]

In other words this ISWM approach is shown in the figure 5 which gives the paradigm shift of the meaning of WASTE in approaches as

Water	We	Wise
Air	Are	Approach to
Soil	Spoiling	Sustainability through
Triggers	The	Technological
Economy	Environment	Excellence

Figure 5

8. NEED FOR ISWM APPROACH

In order to handle growing volumes of wastes, the proper policies need to be enacted and implemented. In the developed world the approach to waste management regarded as the most compatible with an environmentally sustainable development is called “Integrated Waste Management.” This approach consists of a hierarchical and coordinated set of actions that reduces pollution, seeks to maximize recovery of reusable and recyclable materials, and protects human health and the environment. Integrated Waste Management aims to be socially desirable, economically viable and environmentally sound. The Integrated Waste Management approach, however, should be adapted to the local conditions when implemented in Third World cities.

The targets one can achieve is as follows

- Long-term strategy say for minimum next 25 years
- Decouple economic growth from environmental damage
- Recognizes that resource use has negative environmental impacts, these threaten health and economic prosperity
- Examine cradle to grave life cycle of resources
- Promotes Sustainable Waste Management
- Considers Life Cycle Thinking to implement Sustainable Waste Management
- Acceptance of fact there is a lack of data on waste generation and treatment
- Broadens national view from Municipal Solid Waste towards other hazardous and high volume waste streams particularly in construction & demolition, agriculture, etc
- Using a Life Cycle Assessment tool (computer model) to optimise waste generation, pattern and treatment
- Change consumption patterns

- It should be Environmentally effective
- Economically affordable
- Socially acceptable
- Takes an overall approach and manages waste in an environmentally effective and economically affordable way.
- Involves the use of a range of different treatment options at a local level.
- Considers the entire solid waste stream.
- Use existing waste management strategy as “Baseline”
- Compare the performance of different Waste Management strategies
- Choose optimum Waste Management strategy based on needs of local environment, economy and population
- Single criterion - where there is a single over-riding concern (e.g. lack of landfill space)
- Multiple criteria - where more than one issue is important (e.g. energy consumption and air emissions)
- “Less is better” approach where one option is lower in all categories
- Impact analysis for combined categories that contribute to same effect such as global warming. [1]

INTEGRATED WASTE MANAGEMENT STRUCTURE:

8.1. Waste Prevention

Waste prevention has highest priority It aims at reduction of the problem itself. Reduction requires fewer collection vehicles and a fewer refuse collectors; fewer and smaller waste handling facilities and would result in extension of life of the landfills. The popular ideas for lessening generation i.e. prevention of waste are

Enacting policies to discourage production, sale and consumption of products containing unnecessary packaging material

Enacting policies to discourage production, sale and consumption of disposable products

Adopting policies for encouragement of production, sale and consumption of reusable or recyclable products

Developing policies to encourage production, sale and consumption of larger life span products

Adopting policies to encourage consumption of large-size products.

Extending policies to encourage production, sale and consumption of repairable products

Minimizing weight of products.

Developing products on modular approach

Adoption of policies of Reuse

Adoption of policies of Recycling:

Adoption of Composting

Incineration:

Sanitary Land filling

8.2 Benefits of ISWM: The benefits can be listed as follows

Cleaner and safe neighborhoods

Higher resource use efficiency

Resource augmentation

Savings in waste management costs due to reduced levels of final waste for disposal

Better business opportunities and economic growth

Local ownership & responsibilities / participation

Turning vicious circle into virtuous circle

Very cost effective & easy to install and maintain the process.

9. CONCLUSION

Industrialization leads to excessive waste generation and this leads to environmental degradation and ecological imbalance. Every quarter and section is active in finding means and measures for prevention and cleaning of waste for improved environment and ecology. The worst effected side product is the contamination of water resource by the heavy metals which when ship in through the industrial waste SWM and municipal waste is the largest fraction of total waste demanding proper handling. The available regulating measures are far from satisfactory. Globally technology to tackle this menace is need of hour. The unscientific and unplanned considerable expenses has lead to excessive expenditure only without yielding fruitful and required results. Now we have come across a point where active consideration from all quarter is required using upcoming concepts

and approaches for better treatment can be viewed as new options. Proper planning from civil bodies and all regulating agencies is required and a concentrated efforts is required.

REFERENCES

- 1) *Integrated Solid Waste Management (Engineering Principles And Management Issues), McGraw-Hill, Inc. (1993)*
- 2) *Globalization, development, and municipal solid waste Management in third world cities MartinM et al.*
- 3) *State of Environment Report- Ministry of Environment & Forest 2009*
- 4) *Municipal Solid Waste (Management & Handling) Rule, 2000:*
- 5) *Solid Waste and Emergency Response May 2002*
- 6) *Storm water Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual,*
- 7) *The unep international environmental technology centre (1996)*
- 8) *Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.*
- 9) *<http://www.unep.org>*
- 10) *<http://edugreen.teri.res.in>*
- 11) *Health impacts of solid waste.mht*