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Solid waste management: an action plan of the Rajasthan government

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Abstract
Waste as one of the major environmental issues in the current world can be seen scattered ubiquitously. There is a dire need to properly manage waste due to its negative effects on public and environmental health.
Rajasthan is one of the largest states of India in terms of area, with a population of 6.85 Crores. There are 33 districts, 193 Urban Local Bodies, 295 Panchayat Samitis, and 9,892 Gram Panchayats in Rajasthan State. The total solid waste generation in the state is about 6,500 TPD. With growing urbanization and changing lifestyles, the generation of waste and its appropriate disposal has become a challenge for the state. Hence, an effective and efficient Solid Waste Management (SWM) system is mandatory in Rajasthan. Management of solid waste is essential to maintain quality of life and for ensuring better standards of health and hygiene. plans which shall be prepared in the format prescribed in the SWM Rules, 2016, and The Rajasthan Solid Waste Management Policy and Strategy, 2017.

I. Introduction

This Policy acts as a key instrument in highlighting the vision and strategic goals of the State Government for the development of solid waste management in a sustainable manner. It lays down a detailed roadmap for the reduction, reuse, and recycling of waste through innovative technology, consumer service, and education for envisioning environmental, social, cultural, economic, technological, and public health concerns. Management of solid waste is a larger challenge not only because of its adverse health and environmental impacts but also due to the huge quantities of waste generated. Most Local Bodies lack the capability to handle such huge amounts of solid waste due to financial and institutional frailty. Local authorities struggle with insufficient funds, resources, infrastructure, and appropriate strategies to improve solid waste management. The proposed policy on Solid Waste Management in Rajasthan is in line with the SWM Rules, 2016, and provides a comprehensive vision for SWM, enabling frameworks and strategies to manage the challenges of SWM in Rajasthan. The policy provides a stimulus to the waste management economy and promotes environmental up-gradation.

SWM Plan is a valuable tool for the organization and decision-making process for solid waste management of the municipalities in the state. It is an instrument intended to evaluate the current solid waste management practices, evaluate the options and alternatives available for future solid waste management, and set forth the implementation steps for a 10-year planning period along with establishing projections of reduction in waste disposal over the 10-year plan. An overarching goal is to reduce the amount of solid waste destined for disposal by preventing its generation and increasing reuse, recycling, composting, and other organic materials recycling methods.

The policy is in line with the Central Government's vision to scientifically manage solid waste towards making India garbage free. The Government of Rajasthan intends to adopt the 5R approach (Reduce, Reuse, Recycle, Recover and Remove) by imparting thrust on collection, segregation, improving data and analytics, minimizing environmental impacts, creating a market for recyclable products, and aiming toward sustainable development.

There are three steps necessary to properly manage waste:

Waste is an unavoidable by-product of most human activity. Economic development and rising living standards in the Asian and Pacific Region have led to increases in the quantity and complexity of generated waste, whilst industrial diversification and the provision of expanded healthcare facilities have added substantial quantities of industrial hazardous waste and biomedical waste into the waste stream with potentially severe environmental and human health consequences. The steps are as follows:

- Identify Wastes
- Evaluate Waste
- Manage Wastes

1. Identify Wastes
The govt. provides safe, effective, and efficient waste management services for managing nonhazardous solid waste, recyclable waste, and hazardous waste. The members are responsible for identifying the type of waste produced and using the appropriate management system.

2. Evaluate Waste
The govt. the community must evaluate waste for its physical, chemical, and biological characteristics to determine how it is to be properly managed.
A waste may be:
- Recyclable material (e.g., paper, soda cans)
- Compostable organic waste (e.g. food, animal bedding, biodegradable plastics)
- Non-hazardous solid waste
- Hazardous radioactive waste: containing or contaminated with a radioactive isotope
- Hazardous biological waste: containing or contaminated with an infectious or potentially infectious agent, a biological toxin, animal carcasses, genetically modified organisms, recombinant DNA, etc.
- Hazardous chemical waste: waste chemicals, products that are chemical in nature (cleaning agents, paint, motor oil, and pharmaceutics), products that contain chemicals (fluorescent lamps, thermometers), or materials contaminated with chemicals (contaminated soil or rags)
- Otherwise Regulated Material: asbestos, car batteries, contaminated soil, and construction debris.

3. Manage Wastes
Once wastes have been identified and evaluated, the govt. the community must manage it according to waste management instructions. These waste management instructions have been developed to keep up with all applicable laws and regulations and to promote a safe and healthy workplace.

Types of Wastes
Throughout the region, the principal sources of solid waste are residential households and the agricultural, commercial, construction, industrial and institutional sectors. these sources are defined as giving rise to four major categories of waste.
municipal solid waste, industrial waste, agricultural waste, and hazardous waste. Each of these waste types is examined separately below.
1. Municipal Solid Waste (MSW) is generated from households, offices, hotels, shops, schools, and other institutions. The major components are food waste, paper, plastic, rags, metal, and glass, although demolition and construction debris is often included in collected waste, as are small quantities of hazardous waste, such as electric light bulbs, batteries, automotive parts, and discarded medicines and chemicals. Generation rates for MSW vary from city to city and from season to season and have a strong correlation with levels of economic development and activity.
2. Industrial Solid Waste Typically this range would include paper, packaging materials, waste from food processing, oils, solvents, resins, paints and sludges, glass, ceramics, stones, metals, plastics, rubber, leather, wood, cloth, straw, abrasives, etc. As with municipal solid waste, the absence of a regularly updated and systematic database on industrial solid waste ensures that the exact rates of generation are largely unknown. As the existing industrial solid waste collection, processing, and disposal systems are grossly inadequate, such incremental growth will pose very serious challenges.
3. Agricultural Waste and Residues Expanding agricultural production has naturally resulted in increased quantities of livestock waste, agricultural crop residues, and agro-industrial by-products.
4. Hazardous Waste With rapid development in agriculture, industry, commerce, hospital, and healthcare facilities, consuming significant quantities of toxic chemicals and producing a large amount of hazardous waste. Currently, there are about 110 000 types of toxic chemicals commercially available. Each year, another 1 000 new chemicals are added to the market for industrial and other uses.
Most hazardous waste is the by-product of a broad spectrum of industrial, agricultural, and manufacturing processes, nuclear establishments, hospitals, and healthcare facilities. Primarily, high-volume generators of industrial hazardous waste are the chemical, petrochemical, petroleum, metals, wood treatment, pulp and paper, leather, textiles, and energy production plants (coal-fired and nuclear power plants and petroleum production plants). Small- and medium-sized industries that generate hazardous waste include auto and equipment repair shops, electroplating and metal finishing shops, textile factories, hospital, and health-care centers, dry cleaners, and pesticide users, including waste solvents, chlorine-bearing waste and pesticides organophosphate-herbici de-urea-fungicide bearing waste. In particular, solvents are extensively used in the region and, as a consequence, large quantities of waste solvents are produced. The types, quantities, and sources of hazardous waste vary significantly from place to place and are influenced by the extent and diversity of industrial activity.

Waste Segregation
The SWM Rules, 2016 defines "segregation as sorting and separate storage of various components of solid waste namely biodegradable wastes including agriculture and dairy waste, non-biodegradable wastes including recyclable waste, non-recyclable combustible waste, sanitary waste, and non-recyclable inert waste, domestic hazardous wastes, and construction and demolition wastes".

Types of Waste to be segregate
1. Wet Waste: Wet waste is defined per the SWM Rules 2016 as "Organic waste usually generated by homes, and eateries and is heavy in weight due to high moisture content. It includes kitchen waste, fruits, flowers, leaves, meat waste, etc. The wet waste is biodegradable in nature and is decomposed aerobically or anaerobically into compost".
2. Dry Waste: Dry Waste is defined as "waste other than bio-degradable waste and inert street sweepings and includes recyclable and non-recyclable waste, combustible waste and sanitary napkin and diapers, etc".
3. Domestic Hazardous and other Wastes: "Domestic hazardous wastes are defined as discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines, broken mercury thermometers, used batteries, used needles and syringes, contaminated guage, etc. generated at the household level"

Benefits of Segregation
1. Waste segregation at the source ensures that waste does not get contaminated and can be collected and transported separately for further processing.
2. Segregation of waste optimizes waste processing and treatment technologies.
3. It results in a high proportion of segregated material that could be reused and recycled, leading to less consumption of virgin material.
4. Waste, if not segregated, can pose risks and constraints on the choice of operation of waste processing technologies. Plastic in waste if incinerated could lead to the release of dioxins that are toxic and causes severe health hazards. Household hazardous waste if not segregated (e.g. spent batteries, etc.) can result in contaminated compost.
5. Waste segregation leads to a reduction in waste transportation, correspondingly vehicular emissions reduction.
6. Due to the dumping of lesser quantities of waste, the life of the landfill increases.
7. As it is ensured through segregation that no organic or hazardous waste is dumped in the landfill, the risk to the ecosystem is reduced.
8. Segregated waste reduces health and safety-related risks to waste pickers.
9. Proper segregation of waste thus leads to a 'Circular Economy' creating green jobs, reducing consumption of virgin resources, and promoting investments and innovations.

Waste Processing and Treatment
Processing and treatment of solid waste shall be as per the schedules provided in Solid Waste Management Rules, 2016. Processing and treatment of solid waste and the adoption of processing technologies largely depend upon the quantity and characteristics of the total waste generated. It is essential to quantify and characterize the waste generated in the local body before adopting any processing and treatment technology. It is essential to adopt the Integrated Solid Waste Management (ISWM) approach to manage solid waste in a sustainable manner.

Achieving Excellence in Segregation of Waste
Segregating waste at source ensures that waste is less contaminated and can be collected and transported for further processing. Segregation of waste also optimizes waste processing and treatment technologies. It results in a high proportion of segregated material that could be reused and recycled, leading to less consumption of virgin material.

II. Conclusion

The SWM system should be considered in an integrated manner in order to cope with the reduction of the environmental footprint. SWM is considered a single stream disposed of in open dump sites. However, the implementation of future management plans requires the application of Adhoc collection and treatment solutions for each waste flow produced in municipal areas. Stakeholders and governments should know that SWM is a complex system that involves environmental, social, and economic issues, which should be evaluated. For improving the life cycle of waste, and reducing water, soil, and air contamination due to open burning and open dumping, practices are widespread in Rajasthan. The inclusion of the informal sector can be considered a viable way for improving the recycling rate and reducing the waste inflow into final disposal sites in developing countries, due to low technological requirements and economic investments. However, further investigations and efforts should be implemented for understanding the most appropriate strategy for its involvement.

remembering that informal recycling cannot be the only system in action; improving waste collection and selective collection coverage of municipal areas, introducing awareness and information campaigns, implementing appropriate treatment systems with regulations and control agencies, improving final disposal sites and their management, enhancing financial sustainability of the systems and introducing future management plans are all practices required for improving the integrated SWM system of Rajasthan.

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