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Research Article

# Challenges of Solid Waste Management and Policy Implications in the Indian Himalayan Region: A Scientific Review

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## ABSTRACT

According to Census of India (2011), total 377 million populations were residing in urban area which is 31% of the total population. During 1961-2011, the urban population was increased from 18 to 31.2% (Census of India, 2011b). India which is an agriculture-based economy is shifting towards service-oriented country as more of the population is shifting towards urban areas. Due to diverse geographical and climatic regions the people living here have different consumption and waste generation patterns. Towards sustainable urban development efficient municipal solid waste management is a vital constituent. Municipal solid waste management includes source segregation of waste, storage, collection, relocation, carry-age, processing, and disposal of solid waste for lessening its harmful impact on environment. Unplanned and short-term developmental plans increases industrialization and urbanization in the Indian Himalayan Region (IHR) and have led to tons of solid waste being sent to dump-yards and remained untreated. Due to this, solid waste management is becoming challenging issue in the IHR. In this review, various challenges and issues of solid waste management and probable solutions are suggested, particularly for the IHR.

**Keywords:** Indian himalayan region; Municipal solid waste; Solid waste management; Segregation; Policies

## INTRODUCTION

Growing urbanization and industrialization in developing countries, high population growth rates, rapidly varying waste characterization and generation patterns [1] are important factors for paying attention towards municipal solid waste management as more area will be required to accommodate waste [2]. Transmission of numerous ailments is caused by unmanaged municipal solid waste. Major problem in India regarding municipal solid waste management is non-segregation of waste and dumping of construction and demolition debris (C&D), plastic wastes, commercial and industrial re-fuses, and e-waste [3-5]. From street sweeping and from construction and demolition, about 12 million tons of inert waste is generated, which occupies one third of total municipal solid waste. Further, major concern of urban local bodies across the country is to implement Municipal Solid Waste Management (Management and Handling) Rules, 2016 rules.

## STATUS OF MUNICIPAL SOLID WASTE IN INDIA

In India, no effective steps have been taken to analyse regional and geographical specific waste generation patterns of urban towns till date. Due to lack of availability of primary data on per capita waste generation, waste characteristics and influence of informal sectors, the projections and values are different in different reports. These gaps in scientific data causes difficulty in assessing the appropriate treatment/disposal techniques as well land requirements. Study conducted by National Environmental Engineering Research Institute (NEERI) in 59 cities (35 Metro cities and 24 State Capitals) reveals that 39,031 tonnes per day (TPD) of municipal solid waste was generated from these cities/towns during the year 2004–2005. A study carried out by CIPET during 2009–2010 for CPCB for same 59 cities, it was seen that these cities are generating 50,592 TPD of waste (CPCB, 2013). According to CPCB, 2013 report it was revealed that during the year 2011, out of 1,27,486 TPD municipal solid waste generated from across the country, only 89,334 TPD (i.e. 70%) was collected and 15,881 TPD (i.e. 12.45%) was processed or treated (CPCB, 2013). During the last decade, solid waste generation has increased 2.44 times (CPCB, 2013). In another aspect of solid waste management, studies have been carried out to study the chief components of municipal solid waste in India. Joshi and Ahmed [6] carried out

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study for identifying composition and characteristics of municipal solid waste. Municipal solid waste includes biodegradable waste which includes food and kitchen waste, green waste and paper; recyclable material which included paper, glass, bottles, cans, metals, certain plastics, etc.; inert waste matter which comprised of C&D, dirt, debris, composite waste having waste clothing, tetra packs, waste plastics such as toys, domestic hazardous waste (also called "household hazardous waste"); and toxic waste such as waste medicine, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, and shoe polish. Total percentage of compostable waste is approximately 40–60%, 30–50% inert waste and 10% to 30% recyclable in municipal solid waste.

### STATUS OF MUNICIPAL SOLID WASTE IN THE INDIAN HIMALAYAN REGION (IHR)

Solid waste problem is at the heart of the Indian Himalayan Region (IHR) not because of its sheer quantity, but because of fragility of the ecosystem. Unplanned and short-term developmental agendas increases industrialization and urbanization in IHR and have led to tons of solid waste being sent to dump-yards and remained untreated (Figure 1). The growing buzz around waste in hill stations of India is due to rough terrain, scarce land, lack of resources and threat to exotic biodiversity and serenity of the Himalayas. As per the available data, 9 IHR states produced 22,320 MT of municipal solid waste (MSW) per day during 2009-2012 [7]. Almost every IHR state has passed by-laws in respective Urban Local Bodies (ULB), but these norms are heavily toyed. Total solid waste in 2016 was 3134 tons per year and would rise to 4685 tons per year in 2031. Current management practices, viz. collection, transportation, treatment/recycle and disposal, in almost every IHR states are similar and flawed [8]. As per estimated waste generation rate in Himachal Pradesh the amount of waste generation would rise from 304.3 TPD in 2011 to 550.9 TPD in 2031 [9]. These soaring amounts of waste generation in the IHR are partly due to increase in tourism activities and partly due to rise of consumerism.

## CHALLENGES AND ISSUES OF SOLID WASTE MANAGEMENT IN THE IHR

According to Deutsche Gesellschaftfür Internationale Zusammenarbeit (GIZ) report on specific challenges of hill states in Solid Waste Management [10], some of constrains for hilly areas regarding Solid Waste Management are as below:

**Figure 1:** Solid waste dumping site on Beas river bank at Rangri near Manali, Himachal Pradesh, India (February 2018).

### Tourism

Tourism in IHR is prime economic activity and generates huge employment for the local residents. In Manali, a popular hill station in Himachal Pradesh, as per the official data, the municipal solid waste generated during off-season is around 10-12 TPD whereas during on-season the MSW generation crosses 35 TPD. This much amount of waste in hills where it is difficult to find dump yards due to land constraints is an ecologically disastrous.

### Segregation

Although, Municipal Solid Waste (MSW) Rules 2016 has made at source segregation mandatory, absence of organized and scientifically planned segregation of municipal solid waste at source is widely prevalent. Segregation and collection of economically valuable waste material is largely undertaken by un-organized sector under unsafe and hazardous conditions. Due to lack of technical understanding and know-how in handling, transportation and disposal the segregated waste many-a-times got mixed up again (CPCB Report, 2013).

### Difficult Terrain

The issue of solid waste is aggravated in hill stations of IHR due to difficult terrain and poor infrastructure. Door to door collection in hilly states is a highly laborious task as no road connectivity is present.

### Land Issues

Land scarcity is a prime concern in several hilly states of IHR. Land is required for several purposes in solid waste management process viz. collection, treatment and disposal. It has been reported on several occasions that the local residents refuse to provide land in vicinity for such solid waste management facilities. This attitude of people is partly attributed to lack of concern of concerned local bodies in managing waste in proper manner after they acquire land. Existing landfill sites are already running beyond their earmarked capacities at several cities and towns in IHR.

### Technical Issues

Urban Local Bodies (ULB) in our country neither has technical expertise nor vision to achieve solid waste management. Majority of ULB in small towns and cities are only concerned with collection, transportation and open dumping of solid waste in their jurisdiction. Technological interventions for solving the solid waste menace are only limited to management of bio-degradable waste and no such intervention have come up for non-biodegradable waste. Public Private Partnership (PPP) is required to come up with new technological inventions with proper institutional support.

### Financial Issues

ULB spend much of their funds in managing solid waste but big chunk of these spending is done on collection and transportation; e. g. in Jammu & Kashmir collection and transportation cost of solid waste constitutes approximately 80-95% of the total budget of solid waste management. The scenario is same for most of the ULB in IHR viz. Kullu, Manali, Mandi, Hamirpur etc. The high cost

on the initial steps of waste management causes inadequate funds for subsequent processes treatment and proper disposal facilities causing open dumping and poorly managed dumping sites.

### Institutional Issues

It has also been acknowledged by the government the ULB cannot work in silos. A cluster approach has been proposed to make the projects technically and financially more feasible. The two identified clusters are: Dharamshala cluster - Dharamshala, Kangra, Palampur, Nagrota, Bagwan, JawalaJi and Dehra, and Sunder Nagar/Mandi cluster - Sunder Nagar, NerChowk, Mandi and Riwalsar[11].

### Failure of Waste-to-Energy Projects

In Shimla, the waste-to-energy (WTE) plant was setup in 2017 at a staggering cost of 42 crore but failure to achieve the stated targets has been a cause of backlash to the Shimla Municipal Corporation. This has also put a question mark on success of this sort of plants in hill states of IHR. Another WTE is coming up in Manali in 2019 but its success remains a major cause of concern for the state government of Himachal Pradesh. Its success may pave way for WTE in other hill states also.

### Involvement of Unorganized Sector

Recycling in our country is largely carried out by unorganized sector and that has not been incorporated into any formal SWM policies. The industry generates huge employment opportunity for rag pickers, garbage collectors and recyclers and any solid waste management policy should address them as well in order to work in a streamline manner. The waste-to-energy plants which has high demand for plastic bottles and other high calorific value waste is similar to the requirement of recycler which is the main cause of conflict among the two and is largely unaddressed by any existing policy.

## CURRENT POLICY AND MANAGEMENT PRACTICES

The existing Solid Waste Management Rules [8], shall apply to every domestic, institutional, commercial and any other non-residential solid waste producer except industrial waste, hazardous waste, bio-medical wastes, e-waste that are covered under their respective management rules framed under the Environment (Protection) Act, 1986. Responsibility to implement guidelines mentioned under Solid Waste Management (SWM) rules and provides all sorts of facilities and mechanism to manage the solid waste resides with the Urban Local Bodies (ULB). Urban Local Bodies can enact their own by-laws to ensure proper working of SWM rules and a review of SWM system in IHR reveals that most of the ULB has passed their by-laws to manage waste. According to the SWM Rules, 2016 the following are the responsibilities of state governments:

- Enforcement of these rules in cities.
- Forming guidelines for the ULBs to manage municipal solid waste.
- Reporting on the Service Level Benchmarks (SLBs) for solid waste management service by ULBs to the Ministry of Urban Development (MoUD).
- Allocating land to private players for construction of solid waste management facilities.
- Facilitate a regional sanitary landfill facility for a cluster of cities and to ensure professional and optimal management of such facility.
- Provide guidance to cities in managing grants for SWM activities.

In accordance with the above rules, Himachal Pradesh state government has also specified the roles and responsibilities of following institutions to ensure proper working of SWM Rules, 2000 [8]:

#### Municipal Authority

The implementation of MSW (Management and Handling) Rules, 2000, with in the territorial area of the municipality is the responsibility of the Municipal Authority. They are also responsible for infrastructure development for collection, storage, segregation, transportation and disposal of MSW. Recent initiative in door-to-door waste collection in Shimla is presently working successfully unlike other Indian cities largely due to the reason that the municipal authority could pass a by-law necessitating waste segregation, mandatory user fee collection and formed a society represented by different stakeholders, headed by Municipal Commissioner to look into issues associated with waste segregation at source.

#### State Government

The overall responsibility of provision of these rules is on the Secretary-in charge of the Department of Urban Development of the state. The District Magistrate or the Deputy Commissioner of the concerned district has the same responsibility with in the territorial limits [12,13].

#### State Pollution Control Board

SPCB will monitor the compliance of the standards, grant the authorization of waste processing and disposal facility and prepare and submit annual report to CPCB.

## CASE STUDY:ALAPPUZHA (KERALA) AND AIMA PANCHAYAT (HIMACHAL PRADESH)

Alappuzha one of the most successful model which has come up as a paradigm has gained wide recognition at international level through United Nations Environment Programme (UNEP). UNEP has recognized Alappuzha city in December 2017 as one of the world's best five cities which are limiting pollution, through sustainable solid waste management practices. Efforts are being made to replicate this model to the other parts of the country due to its immense success. This model can be well-thought-out for replication in IHR as well. In 2014 due to protest from local residents led to the closure of main landfill of Alappuzha a coastal city in Kerala. This caused piling of heaps of trash all over the city across roadsides and inside the canals. A threat was imposed on the health of the local residents due to havoc caused by disease causing flies and mosquitoes. The councillors, municipality authorities, party representatives, local residents and the local administration after several rounds of meetings and discussion came up with the idea of decentralized waste management to address this issue effectively. In this system segregation of biodegradable and non-biodegradable solid waste takes place at source. The separated biodegradable waste is treated in small composting plants providing

residents with biogas for cooking. For treating non-biodegradable waste, a collection facility is provided which is further separated according to the kind of waste to be disposed in it such as plastics, e-waste, etc [14-16].

Another successful example of management of solid waste at gram panchayat level has been set up by Aimapanchayat adjoining Palampur town of Kangra district in Himachal Pradesh. The model developed has been appreciated by honourable National Green Tribunal (NGT). Himachal Pradesh government has directed all the village panchayats of state to adopt this model for successful disposal of solid waste in an effective manner. AimaPanchayat was first Panchayat in Himachal Pradesh to promote door to door collection of the waste from households. Later for more efficient and eco-friendlier disposal of waste more feasible options using modern cleaner and greener techniques were adopted. The segregated waste from the households is brought to the garbage disposal plants where the plastic waste is converted into construction material while organic waste is converted into compost with help of composting machines. The treatment plant has been set up at a cost of Rs 15 lakh and panchayat is now earning Rs 1.20 lakh every month, which is utilized to meet operational cost of plant as well in the developmental activities of the area. The panchayat waste treatment plant is also catering to the needs of surrounding areas, hotels and Palampur Municipal council. Governmental officials from within the state as well as from other states of India are visiting this panchayat for studying the model and for its replication in their areas. Aimapanchayat has come up as a successful model especially at village level where by adopting modern eco-friendly techniques for efficient waste disposal.

These two models mentioned above are example of successful waste disposal mechanism which is resolving out the biggest problems of dumping site particularly in the IHR where due to hilly terrain dumping of waste in open spaces is not a viable option.

## PROBABLE SUGGESTED SOLUTIONS FOR SOLID WASTE MANAGEMENT IN THE IHR

- Cluster based approached as proposed by Government of Himachal Pradesh is a better idea for managing waste in a cost-effective manner.
- Recycling should be made compulsory for all ULB which would also generate the economy required to tackle the non-recyclable waste. This would also reduce the quantity of waste going to the dump yards.
- Bridging the gap between formal and informal sector i.e. between ULB and rag pickers, recyclers etc. is a must do thing in order to improve the current status of SWM and would lead to better understanding of informal recycling economy prevailing in hill states of the IHR.
- Environment friendly and ecologically sound waste treatment techniques such as bio-remediation, phyto-remediation, etc. should be adopted rather than going for technological interventions. This should be done after proper understanding of waste quantity, composition and characterization.
- In order to curtail the water and soil pollution due to solid waste, dump yards should be identified after studying the geo-morphology of the area, groundwater level, hydrology, flora, etc.
- Waste collection sur-charges should be made mandatory for every household for door-to-door collection as in case of water and electricity, this would encourage people not to throw waste in open spaces, khad/nallahs/rivers and would also stop open burning of waste. This will also generate appropriate funds for functioning of SWM chain.
- Enforcement and proper monitoring mechanism for Government policies and guidelines.

## CONCLUSION

There are several issues related to proper management of municipal solid waste especially in IHR. Efforts are being made all over India to address such kind of issues by the central and state governments. Some of the models developed are serving as a success story in the field of waste management in India as well as in the world. Treatment of waste in an eco-friendly manner at the source is a best method to address the problem of solid waste management. There is need of adopting and site specific changes in implementing solid waste management practices both at village and urban level. Community participation and management approach is required for successful implementation of policies and best practices at village and urban level for effective solid waste management.

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