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Original Research Article

A comparative study of general waste management practices in a campus of a medical university located in the purview of a municipal corporation of a South Indian state

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ABSTRACT

Background: General waste is the waste that does not pose an immediate hazard or threat to health or to the environment. Waste management activities include collection, transportation, treatment and disposal of wastes. Academic institutions produce wastes, which are not disposed of effectively or economically. The result is littering and accumulation of garbage, which cause pollution. The objective of the current study is to examine and compare the general waste management practices of an university with current waste management rules in force.
Methods: The current observational and comparative study was carried in an autonomous medical university located in South India. Waste is managed by Campus Maintenance Committee and Swachh Bharath committee under supportive supervision of Department of Community Medicine. The authors have observed the practices per se, talked with all the stakeholders of waste management in the institute, and presented their observations. The observations were compared with the standard practices of waste management to be adhered by academic institutions as per the rules of waste management.
Results: Everyday 200-250 Kg of solid waste is generated in the university campus. General waste generated from different sources is grouped into black bags and sent to the dumpsite of campus. The corporation workers separate dry waste from wet waste and transport to the corporation dumpsite in separate blue and green drums separately.
Conclusions: The steps taken by the university authorities like division of campus into areas with group leaders to facilitate ownership and accountability and formation of committees and regular meetings to facilitate coordination have shown results.

Keywords: General waste, Management, Swachh Bharat, University

INTRODUCTION

According to the Basel convention, "Wastes are substances or objects which are disposed or are intended to be disposed or are required to be disposed of by the provisions of national laws". The United Nations Statistics Division (UNSD) describes wastes are materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the

extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities.[1]

Waste comes in many different forms and may be categorized in a variety of ways. These categories are not necessarily exclusive and there may be considerable overlap so that one waste entity may fall into one to many types. Waste is divided into two classes based on the risk it poses - general waste and hazardous waste. "General waste" means waste that does not pose an immediate hazard or threat to health or to the environment, and includes non-hazardous substances, materials or objects within the business, domestic, inert or building and demolition wastes. "hazardous waste" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within the business waste, residue deposits and residue stockpiles.[2]

United nations statistics division characterises waste management as activities which not only include collection, transportation, treatment and disposal of wastes but also controlling, monitoring and regulation of production, collection, transport, treatment and disposal of waste along with prevention of waste through modification, reuse and recycling.[1]

In India, there have been many institutional frameworks at central, state and organizational level. Legal frameworks, environmental norms, policy initiatives, key government programmes have been governing the waste management scenario in India. Many technologies and practices besides traditional technologies were used in key projects and key Initiatives implemented in various states and cities.[3]

As per solid waste management rules, “bulk waste generator” means and includes buildings occupied by the Central government departments or undertakings, State government departments or undertakings, local bodies, public sector undertakings or private companies, hospitals, nursing homes, schools, colleges, universities, other educational institutions, hostels, hotels, commercial establishments, markets, places of worship, stadia and sports complexes having an average waste generation rate exceeding 100 kg per day.[4]

Institutional waste can be one of the most complex forms of waste to manage, due to its diversity of waste materials, and the number, variety and size of institutional organizations that create it. It is noted that there are indeed advantages in managing solid waste at institutional level because of the institutions’ unique characteristics that also influence their waste management needs. Academic institutions produce wastes, which are not disposed of effectively or economically. The result is littering and accumulation of garbage, which cause pollution. The same goes for institutions where tons of solid wastes are being generated.

Effective and sustainable waste management is important as the amount and complexity of waste are increasing globally because of industrialization and urbanization. Waste, when not managed properly, not only increase financial burden in a form of disposal charges but can pose serious health hazards as well as affect the climate through the emission of greenhouse gases.[5]

Studies by Lehmann et al, Velazquez et al, Zilahy and Husingh have revealed the key roles that universities can play when promoting sustainable programs in society.[6-8] Academic institutions have the capacity of putting into practice strategies for sustainable development, which could be incorporated into their academic programs, outreach and facilities operation. Large institutions, by their very nature, produce more waste due to their large population sizes and they are also single decision-making entities. In decision-making, planners may be able to identify and organize groups of individuals, waste stream producers or reduction/reuse opportunities to a greater extent.[5]

In South India, studies which have examined the waste management practices in educational institutes or University campus are few and there is need to understand and improve these practices. Such studies may also pave way to develop uniform waste management policies at the level of institutional and universities in India.

The objective of the current study is to examine the general waste management practices of an autonomous Medical university located in south India and compare its practices with the waste management guidelines to be followed by academic institutions as per the current waste management rules in force.

METHODS

The higher academic institute chosen for this study is an autonomous medical university located in Tirupati Municipal Corporation of Andhra Pradesh state. It has various super speciality and broad speciality departments along with medical, nursing and physiotherapy colleges. This is a qualitative observational study. The study was conducted during the period from January to September 2018. Existing and changing practices in waste management in the Institute were discussed with the view to strengthen the existing practices in this observational study. The department where the authors of this study work does the overall supervision of waste management. The authors have observed the practices per se, talked with all the stakeholders of waste management in the institute, and presented their observations. The observations made were compared with the standard practices of waste management to be adhered by

academic institutions as per the rules of waste management in force in the state and country in which the university is located.

Traditionally the assembly, collection and disposal of this waste was done by sanitation workers who are monitored by supervisors under the sanitation department headed by senior health inspector. Initially the waste generated from various sources was collected by sanitation workers and dumped into the dumpsite. From the dumpsite, the municipal corporation would pick up the waste through its vehicles. A senior sanitary health Inspector with supervisors used to supervise the whole operations.

Every Friday of the week was observed as Swachh Bharat day and all the employees and students of the University on rotation basis would clean the campus. Initially the program was successful but the motivation, commitment and sustainability could not be maintained for longer periods. To maintain the motivation and commitment the Director of the University constituted two main committees named "Campus Maintenance Committee" and "Swachh Bharat Committee". Senior professors and HOD'S headed these committees. Administrators, professors and faculty were members of these committees. Overall supervision of the campus maintenance was given to Department of Community Medicine.

Campus maintenance committee conducted regular monthly meetings. In these meetings, issues regarding campus maintenance and waste management would be kept before the members. The members of the committee would take decisions on these issues. These decisions will be implemented by Director, through the Department of Community medicine with the support of Swachh Bharat committee, engineering section, sanitation department, employees and students of the university. The issues were classified into majorly two types - ones with immediate or short-term solutions and the others with permanent or long-term solution. Issues with immediate solutions were implemented at the level of the committees. Issues needing permanent solutions on a long term were taken to the notice of the administrators. As long term or permanent solutions needed lot of resources and involvement of many other stakeholders, some short-term measures were drawn for these issues.

Swachh Bharat committee would specifically look after the Swachh Bharat program observed on every Friday of the week. College employees and students would clean their respective surroundings. Hospital employees would take care their surroundings. Employees, residents and students residing in the campus will take care of the residential areas. All the employees and students were divided into batches and would work on rotation basis on alternate Fridays. Because of different people, working on different Fridays there was communication gap between the batches and continuity and owner ship of the tasks was not there.

To improve commitment and assign owner ship the entire campus was divided into areas. Each team with a team leader was assigned an allotted area. The team leader along with his team is responsible for the waste management in their respective areas. The team leader has to report to the campus maintenance committee regarding the issues in his allotted area. The committee would collect issues from team leaders and draws up solutions at their regular monthly meetings. These solutions are communicated to the team leaders who will implement them through his teammates and with the help of sanitation department. Our experience has shown that classification of the campus into areas and giving responsibility to leaders and teams of respective areas has facilitated ownership and accountability and has improved the quality of campus maintenance.

RESULTS

The major categories of waste generated in the university campus could be classified into biomedical waste and non-biomedical waste or general waste. Biomedical waste is the result of the hospital activities, which forms a major part of the university activities. There are specific guidelines and regulations for management of biomedical waste. The biomedical waste generated in the campus is being managed as per bio-medical waste management guidelines of India.[9] The non-biomedical waste generated could be broadly classified as solid waste and waste water.

Solid waste management

Everyday 200-250 kg of solid waste is generated in the University campus. Fifteen Sanitation workers in the morning, four in the afternoon and two in the night shift working continuously in three shifts are engaged in the solid waste management. One supervisor in each shift monitors these workers. The sources and the types of solid waste generated in the university campus is shown in the Table 1.

Table 1: Sources and types of solid wastes from different sources in the institution.

Source	Type of waste
Colleges	Paper, food leftovers, tins, bottles, plastics, fruit leftovers and stationary waste
Canteens	food leftovers, food preparation waste, tins, bottles, paper, fruit leftovers
Residential areas	Food leftovers, food preparation waste, papers, vegetables, clothes, plastics
Hospital	Paper, food leftovers, tins, bottles, plastics, fruit leftovers, clothes and stationary waste
Open areas	Dry leaves, dry sticks, fruits and seeds, paper, plastic, cement and concrete, stones and bricks

In colleges of the university, dustbins are provided in every room of every department, office rooms and lecture galleries. Waste generated by every individual is discarded into the dustbins voluntarily. The sanitation workers allotted to the colleges will ensure all the waste that does not reach the dustbin or falls out of the dustbin is collected back into the bins. Once in a day all the waste generated in the colleges is segregated at a place, which in turn is collected and transported to the main dumpsite of the university by general sanitation workers.

The canteens run in the campus are contracted to outsiders. As part of the contract, it is the sole responsibility of the canteen contractor to manage the waste generated by them. The food left overs are collected and reused as animal feed. Other wastes are managed with the help of private waste management company.

Every house or room in the residential area has separate bins for discarding the waste generated throughout the day. If the capacity of these bins is not sufficient then the residents can dump the waste directly into the nearest common bin located in the residential area. Every day Individual bins are emptied into common bins located at specific points in residential area by the sanitation workers allotted to residential areas. The waste from the common bins is collected and transported to the dumpsite of the campus by general sanitation workers.

In the hospital, the non-biomedical or general waste generated is discarded into the black coloured bins located in every room and department. The sanitation workers regularly clean the surfaces of waste. Once the bin is full, the sanitation worker collects and packs the waste in the black bag. These bags are transported to the common waste collection point of the hospital. From there it is transported to the common dumpsite of the campus. The open areas are cleaned at least once in a day by the sanitation workers allotted to specific areas.

Wastewater management

The liquid waste generated in the campus is from colleges, canteens, residential areas and hospital. The waste coming from these sources can be broadly categorised into sullage and sewage. Sullage from all the sources enters the drainage system present in the campus. The sewage water before entering the drainage enters in to the septic tanks. The supernatant fluid free of faecal matter in the septic tank enters the drainage system. The solid faecal matter settles down to the base of septic tank. The faecal matter in the septic tank undergoes anaerobic oxidation and becomes inert.

Students of medical college, college of nursing, college of physiotherapy and college of allied health sciences of the university participated in Swachh Bharat every week. For their innovative planning and implementation of the Swachh Bharat program in the campus, the university won the award from Swachh Andhra Clean and Green Program from the district administration. As part of Swachh Bharat, program students and employees of medical college have initiated the task of preparing a playground in their campus. The district administration along with the municipal corporation came forward, took up the task further, and sanctioned a playground where the students have started their work. The work of preparing the ground is in progress.

DISCUSSION

As per the solid waste management rules, 2016 (henceforth these rules will be mentioned as "rules" in the present discussion) the institution falls under the category of "bulk generator". As per these rules every waste generator shall segregate and store the waste generated by them in three separate streams namely bio-degradable, non-biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time. The institution is not segregating and storing the waste under specified categories but collecting the entire waste into one category called general waste and handing over it to the municipal corporation. Municipal Corporation is further classifying the waste into only two categories i.e. biodegradable or wet waste and non-biodegradable or dry waste. A third category of waste called the domestic hazardous waste is not being identified or segregated or managed separately.

As per the rules the institute has to wrap securely the used sanitary waste like diapers, sanitary pads etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as instructed by the local authorities and shall place the same in the bin meant for dry waste or non- bio-degradable waste. As there is exclusive women's medical college and majority of nursing, physiotherapy and paramedical students are women, there are huge number of women students in the campus. The issue of disposal of sanitary pads has taken many turns. Earlier the sanitary pads were flushed in to the toilet or thrown out in to the open. Because of this clogging of toilets and unsightly view of pads in open space was an issue. Later separate bins were provided near the washrooms for disposal of pads. In spite of that, some instances of flushing in the toilet and disposal in open space are noticed. Proper student education is needed for them to stick to the norms.

As per the rules, the institute has to store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the construction and demolition waste management rules, 2016. As per construction and demolition waste management rules, 2016, Every waste generator shall keep the construction and demolition waste within the premise or get the waste deposited at collection centre so

made by the local body or handover it to the authorised processing facilities of construction and demolition waste; and ensure that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains. The institute does not has a separate mechanism for management of this type of waste. The construction and demolition works are outsourced to the contractors. As per the contract, it is the responsibility of the contractor to dispose the waste generated. The contractor would keep all these waste with in the campus until the work period. After the work is completed, he will dump the entire waste in the natural or artificial pits already in existence with in or out of the municipal corporation limits. There are no specific collection centres or authorized processing facilities for management of construction and demolition waste in the municipal corporation.

As per the rules, the generator has to store horticulture waste and garden waste generated from his premises separately in his own premises and dispose of as per the directions of the local body from time to time. The institute gardens are maintained by a different organization on voluntary basis. The garden waste is piled up at specific places. When the waste is dried up, it would be burnt. A great opportunity in the form of converting the garden waste into manure is missed.

As per the rules, All gated communities and institutions with more than 5,000 sqm area shall, within one year from the date of notification of these rules and in partnership with the local body, ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorized recyclers. The biodegradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body. The current institute falls under the category of institutions with more than 5000 sqm area. Even after two years of the notification of these rules, the institute is not collecting and segregating waste in separate streams. No effort has been made to manage the biodegradable waste as per rules within the premises. Very recently, the municipal corporation is showing its interest in implementing these rules in this institute.

As per the rules, all hotels and restaurants shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The biodegradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body. The canteens run with in the premises are outsourced to contractors and as per the terms of the contract, it is the sole responsibility of the contractor to dispose the waste generated. These canteens are segregating the waste at source and handing over to the authorised waste pickers. They are not interested to manage biodegradable waste as per rules within the premises as they do not have any obligation as per the terms of contract.

Presently there are no separate regulations or guidelines for safe handling, transport and disposal of wastewater in the country.[10] As per water (Prevention & Control of Pollution) Act, 1974 all urban local bodies shall treat sewage generated in that area to the prescribed standards.[11] As per this Act it is the responsibility of the Municipal Corporation to manage the waste water let out by the university. A sewage treatment plant (STP) of 50 MLD capacity is available for the Municipal Corporation under which this University Falls. The Urban sewage generation in Andhra Pradesh is ten times the current capacity available for sewage treatment.[12] As the capacity of STP is not sufficient for the municipal corporation under which the university under study comes, a new STP has been sanctioned which is likely to come near the university premises. This new STP is likely to cater for the wastewater management needs of the university in the near future.

CONCLUSION

From this study, it can be concluded that the university can be considered a bulk generator as per waste management rules as it produces 200-250 kg of general waste per day. The steps taken by the university authorities like division of campus into areas with group leaders to facilitate ownership and accountability and formation of committees and regular meetings to facilitate coordination have shown results. The university won the award from Swachh Andhra Clean and Green Program from the district administration for successful implementation of Swachh Bharat program. Medical colleges student's participation in Swachh Bharat has earned them a playground from Municipal Corporation and District Administration. There is no segregation of dry and wet waste at the level of generation of waste. Domestic hazardous waste is not being identified or segregated or managed separately. Sanitary waste is majorly managed as per guidelines except for few aberrations. There are no specific collection centres or authorized processing facilities for management of construction and demolition waste in the municipal corporation. A great opportunity in the form of converting the garden waste into manure is missed due to outsourcing. The canteens in the university campus are adhering to the waste management rules. There are plans in the near future to process, treat and dispose off biodegradable waste through composting or bio-methanation within the premises as far as possible. The

steps taken by the university administration, employees and students can be easily reproducible in other academic institutes also. The methods applied do not require much resources and can be replicated with available resources.

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