

Solid Waste Management

A Step-by-Step Guide for Gram Panchayats

A Companion to
the Facilitators of Swachh Bharat Mission-G



National Institute of Rural Development & Panchayati Raj

Hyderabad - 500 030

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Foreword

When economies go after indiscriminate market-based growth and the people chase a consumerist culture, the apparent side effect is 'unmanageable waste generation.' There was a time when this was considered as a phenomenon of the West; and later of the cities of the fast emerging economies. Currently, it is prevalent everywhere, including the villages in India. The villages in general, and those on the periphery of cities and towns in particular, are at the frontline as far as indiscriminate and unmanageable waste generation is concerned. The concern is that at the end of the day, all the garbage ends up on the lap of the Gram Panchayat (GP) to clean it up.

'Sanitation and street cleaning' is one of the basic functions of a Gram Panchayat and they should make arrangements for attending to it. The Swachh Bharat Mission (SBM-Gramin) requires every Gram Panchayat to put in place a functional waste management system. Most of the State governments also encourage the GPs to chalk out plans for solid waste management (SWM) and practically start managing solid waste in a scientifically acceptable manner. We find that the GP functionaries as well as the SBM facilitators at the grassroots level are desirous of putting in place a waste management system at local level. But, not many successful units are around to get an exposure and learn from. And those which have taken off, with all the enthusiasm, have not fully got out of the turbulence to be able to communicate their experience confidently.

At the moment, there are a few SWM units in Tamil Nadu, Kerala, Andhra Pradesh, West Bengal, and in one or two GPs in Gujarat and Chhattisgarh that are considered to be managed successfully. These GPs have a lot of practical suggestions to share with other GPs and SBM facilitators who are earnest about creating a system to manage solid waste at the Gram Panchayat level. Dr. P SivaRam and Dr. R Ramesh from the Centre for Rural Infrastructure (CRI) of the NIRD&PR have observed the practices directly, held long interactions with the people behind the success in these places and also have documented their work.

This handbook is an outcome of a series of case studies done on SWM units that are managed admirably by GPs across States in India. For easy grasp of the SBM facilitators and GP functionaries, the authors have presented it as a systematic Step-by-Step Guide. It is my pleasure to recommend the SBM facilitators to draw ideas from this effort and customise them according to their respective contexts for successful enablement of a clean ecosystem for all.

August, 2018


Dr. W R Reddy, IAS
Director General

Preface

There is a great truth behind the saying: 'any big problem can be resolved if we can disaggregate and handle.' A corollary to this is: 'Problems get aggravated when it gets aggregated.' When domestic garbage of 100 households gets chucked on the street corner, it becomes a mammoth problem to handle. Pragmatically put, the best place to manage waste is at the 'household level.' This also goes with the principle: '*take responsibility for the waste you generate*'. Of course, there are certain types of waste (dry waste, especially) that becomes unfeasible for households to manage. Such waste must be managed by the local bodies - Gram Panchayat or Municipality as the case may be.

Community preparation activity for waste management should focus, first of all, on educating and equipping the community to 'take responsibility to manage the waste they generate at household level.' Conscious reduction of the amount of waste one generates could greatly bring down the burden of finding ways to manage. The Gram Panchayats (GPs) must be equipped to plan, organise, and implement waste management as a *regular practice* – and *not as a project* to place waste bins on street corners, and helplessly watch the garbage overflow on the streets. Without a functioning waste management system in place, it does not augur well blaming the households of being irresponsible.

This handbook is an outcome of a series of case studies conducted across States by the NIRD&PR, Hyderabad. The good practices observed from Gram Panchayats that are managing waste admirably well (some calling it as a 'resource') are presented here as a step-by-step guide for easy grasp and implementation. This handbook is intended to serve as a companion to the sanitation motivators and Gram Panchayat functionaries to move towards ODF-Plus.

One last word, before you get into reading this handbook. Waste generation is more a socio-psychological problem than a problem that technologies can solve. Our Social and Behaviour Change Communication strategies should aim at cultivating habits that favour waste prevention, waste reduction and waste segregation at household level. Our message to the communities should not mistakably put across: '*you generate waste; we are here to clean up.*' Suggestions for better practice are welcome.

R Ramesh | P SivaRam

August 2018

List of Abbreviations & Acronyms

| | |
|---------|-----------------------------------------------------------------|
| CRI | - Centre for Rural Infrastructure |
| DRDA | - District Rural Development Agency |
| Gol | - Government of India |
| GP | - Gram Panchayat (Village Panchayat) |
| HH | - Household |
| IEC | - Information, Education and Communication |
| IPC | - Interpersonal Communication |
| MDWS | - Ministry of Drinking Water and Sanitation |
| MoPR | - Ministry of Panchayati Raj |
| MoRD | - Ministry of Rural Development |
| MGNREGS | - Mahatma Gandhi National Rural Employment Guarantee Scheme |
| NIRD&PR | - National Institute of Rural Development and Panchayati Raj |
| ODF | - Open Defecation Free |
| ODF-S | - Sustainability of Open Defecation Free Status |
| ODF-Q | - Quality of Open Defecation Freeness |
| ODF+ | - Open Defecation Free – Plus (Solid & Liquid Waste Management) |
| SLWM | - Solid and Liquid Waste Management |
| SLRM | - Solid and Liquid Resource Management |
| SWM | - Solid Waste Management |
| VWSC | - Village Water and Sanitation Committee |

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Introduction

Background

The domestic waste generated in rural households of India is increasingly becoming an issue of serious concern. Though solid waste generated in rural areas is predominantly organic and biodegradable, it is becoming a major problem as the waste generated is not segregated *in-situ* and is of the order of 0.3 to 0.4 million metric tonnes per day, as reported by the Ministry of Drinking Water and Sanitation (MDWS), Government of India. Inconsiderate littering causes poor environmental sanitation resulting in unhealthy quality of living. Therefore, domestic-refuse should be handled responsibly. In order to manage waste in a desirable way, there should be a functional waste management system in place. Without a functional waste collection and disposal system at the Panchayat level, it is arbitrary to hold individual households responsible, or blame them of irresponsibility.



BACKGROUND

The Government of India (GoI) as well as many State governments is looking up to Gram Panchayats to come up with a working system to manage solid waste in rural areas. We must admit the fact that ‘some’ Gram Panchayats have been successful in managing solid waste, while ‘many others’ are in turbulence. The NIRD&PR took up the task of collecting and coming up with an array of practicable models of solid waste management, which GPs can choose from, and take up appropriately for implementation.

This handbook provides lessons from ‘good practices in solid waste management’, presented as a step-by-step guide. It will help formulate models and systems for solid waste management (SWM) that can serve as practicable system for Gram Panchayats to take up for implementation. The purpose of this handbook is not adding to the existing knowledge on SWM, but to provide practicable ideas for implementation.



SYSTEM

This handbook talks mostly about waste management models that are being implemented by Gram Panchayats. The reason is very obvious. Rural sanitation is one of the areas earmarked for

local government institutions under the Eleventh Schedule of the Constitution and the same is elaborated in the Constitution (Seventy-third Amendment) Act, 1992. Therefore, this handbook assumes that the Gram Panchayats in India are making attempts to arrange for solid waste management – either centralised or decentralised. That is Gram Panchayats come into play as the prime institution. There are waste generators as members of households, or institutional waste generators such as schools, anganwadis, health centres, shops and other establishments. This handbook is one of twins. The other handbook is: Simple Methods and Technologies For Solid Waste Management. This handbook is about management models and the other one is about SWM technologies for use.

Before We Take Step - 1



NOTE

Before we take step – 1, we provide here some basic understanding of solid waste management in rural areas. This helps understanding the steps better. Those of you, who think you can skip this and go straight to the steps, you can do so.

Gram Panchayats in India aspire to become clean, by putting in place a solid waste management system. It is not dumping or disposing – but managing. But what is meant by managing waste? It is said: manage waste 'systematically'. To do this, we need to first of all understand what types of wastes are generated in your Gram Panchayats (GP) and the category of waste generators. There needs to be a system in place – for waste collection, transport and treatment.

In a centralised arrangement, door-to-door collection, transport and appropriate treatment of waste takes place. The GP shall designate a place specifically for secondary segregation and for further treatment. Alternatively, promoting home-based composting of kitchen waste and the local body collecting only the dry wastes is also possible. This can be called partly decentralised waste collection system. Be it centralised or home-based system, the first task is weaning off from mixing up all types of wastes. That means to say that in setting up a system, the very first step is understanding the types of wastes generated; secondly, educating and enabling the waste generators to separate wet (kitchen) waste from other types of dry wastes.

Making the households segregate the waste is the most challenging and difficult task, especially when the initiative is not from within the community. If we are successful at this step, our likelihood of being successful in the subsequent steps is strong.

The next step is assessing the logistics requirements, arrangements for transport and treatment. When wastes are segregated by type

and kept as separate piles, it becomes easier to determine what treatment technology to apply. For instance, kitchen waste can be easily treated at village level applying simple windrow composting or vermicomposting. And other types of waste such as bottles and plastics can be sent to commercial recycling/resource recovery centres only. There are certain residual waste, which are not suitable for recycling or further processing, they can be incinerated (adopting one of the green incineration methods) or sent to a sanitary landfill.

In order to do all these, preparing the community mindset is significant. The community must understand that burning or burying waste is dangerous to human health as well as environment. Secondly, the Panchayat functionaries need to have a clear plan and it must be made clear to all sections of the waste generators. The plan must include cost of setting up; cost of operation; and contribution/services charges to be paid by the waste generator categories. Similarly, the technologies chosen must be prudent and suitable for the local conditions.



Subsidiarity Principle: Subsidiarity is an organising principle which is based on the understanding that matters should be handled at the lowest or least centralised stakeholder. This principle should be the driving force of Solid and Liquid Waste Management (SLWM) in rural areas. It implies that whatever can be done at the household level should be done at household level. If not possible at household level, then the possible association of multiple households (neighbours) could play a role at village level and so on up to cluster of Gram Panchayats level. When applied to rural SLWM, subsidiarity means that maximum efforts should be focused on the management of waste at the point of generation, e.g. a household, institution or marketplace.

By managing the waste as close to the source of generation as possible, it is possible to save time, money and labour. Only waste that cannot be managed at the household level should be part of the collective or public waste management system. In other words, the identification of solutions should start at household level, and then go upward like the rungs on a ladder. Whatever can be done at household level should be done at household level (ADB, 2014). We highly recommend kitchen waste be composted at household level. See *Annexure-6: Composting Kitchen Waste: FAQ*

Doing at the household level implies that households get trained in composting methods, and convert kitchen waste into compost for use in their garden. The dry wastes shall be collected and transported through a centralised arrangement and shall be sorted and passed onto the recyclers. Doing at the household level reduces considerable



work for the waste collectors/sanitation workers. This considerably reduces the costs incurred in waste collection arrangements. It is always wise to put in place a system where the households (waste generators) have a considerable role to play. In order to treat waste at the household level, all that is needed is a basic understanding of composting and an appropriate method of home-composting.

Six Reasons: Why should Gram Panchayat make arrangements for Waste Management?



LOOK UP

1. Rural sanitation is one of the areas earmarked for local bodies under the Eleventh Schedule of the Constitution and the same is elaborated in the Constitution (Seventy-third Amendment) Act, 1992.
2. Solid Waste Management Rules – 2016 clearly states that the rules mentioned under the SWM Rules – 2016 are applicable to Gram Panchayats also.
3. Gram Panchayats have the power to decide what kind of a waste management system shall be technically sound, economically non-intimidating and socially acceptable.
4. Because of the lifestyle changes and exposure people get through television and other media, waste generation in rural areas is increasingly becoming a medical emergency.
5. The Swachh Bharat Mission (SBM) campaigns have led most Indian villages to become Open Defecation Free (ODF). The next step big step is to move towards waste management, which has come to be known as ODF-Plus.
6. As local government institutions, Gram Panchayats should endeavour to provide all its residents a clean and livable environment.



ANNOUNCE

Step 1 Preparation

Preparatory Steps

In this chapter, we present the steps an aspiring GP can follow in order to take up solid waste management (SWM). It follows a step-by-step approach. It starts with preparatory arrangements required and goes up to monitoring the progress a given GP is making in SWM.

- 1) Panchayat functionaries meeting:** The panchayat president, vice-president, secretary, and other ward members should express their willingness and support and resolve to take up the cause of clean GP within certain time period (one year). Note: The best way to fix a target date is: By December 2019/ March 2020, etc. It tends to give an urgency of time ticking out. Instead, if we fix 'within one year', for instance, it will always show as if one year from the present moment. No urgency can be felt here.
- 2) Gram Sabha meeting:** Gram Sabha should discuss (and pass a resolution) what it means to be a clean village; in what way each household may have to cooperate, etc. This can include resolutions such as: (i) cloth bags to be used and avoid use of carry bags; (ii) tea stalls to use only stainless steel glasses and no use-and-throw cups; (iii) a by-law in this regard can be prepared and passed as well (see Model by-law in Section – 2).
- 3) Community Education:** Various segments of the community (waste generators) need to be educated. It must include the households, SHGs, shopkeepers, tea stalls, local restaurants, school children, health centre, marriage and community halls, etc. It is good to meet each group separately. Community education must essentially include: what are bio-degradable wastes; and what are non bio-degradable wastes? Which ones are recyclables; what hazardous wastes are; what is meant by primary segregation that the households are supposed to do?





IMPORTANT

- 4) **Identify infamous spots:** Generally street corners and empty land in between houses are vulnerable spots to become 'undeclared dump yards.' Every household quietly designates that spot for dumping household wastes. There are three things that need to be done about such places. (a) First of all, identify such infamous places/spots; (b) the garbage heap in such places must be moved to some existing landfills; and (c) fencing can be done to prevent future misuse, or if it is a common land, put some plants or tree saplings to grow. If funds are available put up a swing for children to play there. There are GPs that have converted such places as beautiful parks. Keep that place occupied, it should not be seen being empty.

Box – 1: What is a Sanitary Landfill?

A common misconception is people show a place being used as dumpsite, and they call it landfill area. Dumping is neither scientific nor sanitary. Landfill needs to be scientifically done without affecting the groundwater and the environment. There are certain types of non-biodegradable wastes that cannot be recycled. They may be sent to sanitary landfills. The main consideration while planning for a sanitary land fill is prevention of negative impacts on human health and environment. A low-lying site away from human settlement is selected. A gravel bed is made so as to prevent leaching, if any, not to contaminate the soil or water, nearby. After every filling or in periodical intervals a sand cap or clay cap is put on that, which prevents gases such as methane/carbon dioxide from causing air pollution. If we can reduce what ends up in the landfill to 10 per cent to 15 per cent through reduce, reuse, recycle process, it can be considered as a good management practice. Forty five per cent may go to gasification plant/composting; and 40 per cent may become recyclables.

- 5) **Community Preparation:** One way of doing this is, each household must be provided with three buckets – green, blue and a red one. (a) The green bucket is for disposing of kitchen refuse, leftover food and other wet waste; (b) The blue bucket is meant for keeping dry wastes; and (c) the red bucket is for keeping hazardous wastes like batteries; fused bulbs, etc. For an illustrative list of wet waste/dry waste/hazardous waste, see Box – 2 (Waste Category). The wet waste in the green buckets shall be collected daily morning (or morning and evening) as decided by the Gram Panchayat. Collecting two times a day (morning and evening) renders handling easy. That is when the waste is still fresh and has not started emitting smell, effective segregation becomes easier, than handling wastes that are stale and decayed. However, it involves double the work on a single day. The dry waste shall be collected separately. The hazardous waste such as used sanitary



TOOLS-TECH

napkins, children's diapers, etc., must be suitably wrapped with newspapers and kept in red bucket, and handed over to the sanitation workers (daily). Hazardous domestic wastes in villages are very minimal. They shall be collected once a month.

Box – 2: Waste Category (Bin it Right)

| Green | Blue | Red |
|-------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------|
| Vegetable peels | Soap covers/pockets/sachets | Mosquito repellent refill bottles/Mosquito repellent mats |
| Fruit peels | Empty shampoo bottles | Expired medicines |
| Rotten fruits and vegetables | Empty perfume bottles/containers of deodorants/shaving creams | Tablet covers/Syrup bottles |
| Leftover food | Milk covers | Any medical discard |
| Used tea/tea bags | Used doormats | Sanitary napkins |
| Used coffee ground | Used toothbrush | Children's diapers |
| Egg shells | Chocolate wrappers | Used condoms |
| Coconut shells (including tender coconut shell) | Butter wrappers | Used razor/razor blades |
| Mango kernel & any seed | Used mop cloth | Old batteries |
| Coconut fibre | Ghee/oil pockets/cans | Fused bulbs/tubes/electrical items |
| Used flowers/dry flowers | Package/polythene covers/Plastic covers | Broken glasses/ceramics |
| Spoiled spices | Newspapers/card boards | Empty cans of toilet cleaners |
| Floor sweeping dust | Cosmetics containers | Expired cosmetics |
| Meat & non-veg remains | Styrofoam | Cockroach killers/spray cans |
| Expired bread, biscuits and other food items | Broken stationery like used pens, pencil sharpener | Old printer cartridge/CDs |
| Hair | Empty cans of floor cleaners | Rusted iron pieces |
| Garden shrubs | Kurkure/Lays packets | Used odonil bottles |
| Floor sweeps | Unusable shoes | Old electronic items/parts |
| Road sweeps | Sachets (of shampoo, creams, etc.) | Pieces of wires, old chargers, old pen drives |
| | Bisleri kind of water bottles | Old paints/old household chemicals/cleaners |



IMPORTANT



TOOLS-TECH



| | | |
|--|------------------------------------------------------------|-----------------------------------------------|
| | Used toothpaste tubes, etc. | Insecticide sprays/ leftovers |
| | Broken household plastic items/toys | Toxic rejects |
| | Metal tins, and cans (e.g Pepsi, Coke cans) – Aerosol cans | Cotton/tissue papers used for medical purpose |
| | Small tubs like the ones used for yogurt, cheese, jam | Empty cans of lubricants used for car/bike |
| | Pieces of aluminum foils | Used needles and syringes |
| | Old brooms | |
| | Paper napkins, Tetra pockets | |
| | Destroyed old cushions | |
| | Leather, rexene, rubber | |
| | Iron pieces | |

Community Preparation through IEC

The waste generators (e.g. residents) hold the key for success in solid waste management. Human propensity to respond to a call for any change generally does not receive the same level of cooperation and support from all corners. First of all, it requires inscribing in the minds of the community that the GP is serious about it; secondly, it should be personally convincing for them to play their part and cooperate; and thirdly what they witness as manifested behaviour of GP functionaries should gradually strengthen their trust in waste management efforts. All these require a series of IEC campaign.



SBM facilitators, in association with Swachhagrahis and GP functionaries, need to plan for a series of IEC campaigns to educate the residents on how proper segregation at the household level eases the entire process of managing waste at subsequent stages. The responsibilities of the residents are spelt out clearly in pages 22-24 & 32-33. The community members/households should be clear about it at the outset. The suggestions that follow may be of help to conduct IEC campaigns for this purpose.

Ultimately, what is expected of the residents?

- Every household/resident should get habituated to properly segregating waste into three different categories (wet/dry/hazardous) before handing them over to waste collectors.

(This sounds very simple, but is not easy to make EVERYONE practice it. Thus, the need for IEC)

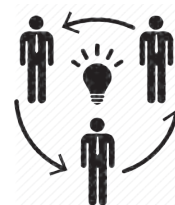
| Information | Education | Communication |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (Know what, why and how) Knowledge | (Self-regulation, Self-correction, Practice, Responsible well-being & civility) | The methods, tools and techniques (media) used to pass on information, and impact on practice so as to make one behave like an educated person. One can be illiterate but still be 'educated' |
| Awareness Ability (Making people aware) | (Triggering people to practice by undoing undesirable behaviour and adopting desirable/healthy behaviour) | |

Suggestive IEC Activities

- 1. Waste Bins Distribution with Handbills:** The GP shall arrange to supply three different colour bins to all the residents. Instead of three bins, it's possible to give one green bin for kitchen waste, and two big shoppers for dry wastes and hazardous wastes. [In this case, diapers and sanitary napkins must be kept separately and handed over to the waste collectors]. While distributing bins, we can use the opportunity to distribute also a handbill explaining the purpose of three different colour bins and seek residents' cooperation. Motivate them with your reasons: why is this important in a village?
- 2. Students Orientation:** The local school children are a wonderful source of enthusiastic human resource, the power of which can be tapped for this purpose. To do this, they need a brief orientation on SWM, and what is this SWM-Plan trying to achieve within a GP. Conduct orientations for them in separate groups, and plan with them how they can involve themselves in this IEC exercise. Generate ideas as well. They can be alternatively used in IEC, IPC activities depending upon their availability. School children also can prepare IEC materials on a competition held for them at school. They tend to own up such materials prepared by them and put them for effective use.
- 3. Cultural Evening:** Cultural evening with messages on waste management. Cultural evenings may be organised in the villages. In between the cultural programmes, we can take 15 minutes to sensitise the residents on waste segregation, waste reduction, etc. The cultural programme will continue, then again for 15 minutes solid waste management (SWM) plan shall be put across to the residents. At the end of the programme, the GP president shall sum up asking for the cooperation of residents for proper management of wastes, and not throw wastes in street corners.



SAMPLE LIST



DISCUSS

4. **IPC (Interpersonal Communication):** This helps in a face-to-face situation for the school children and sanitation motivators to demonstrate to the residents what are biodegradable wastes (wet)? and what are non-biodegradable (dry) wastes? What are recyclables; what hazardous wastes are? What is meant by primary segregation that the households are supposed to do? How this goes further into making gas, vermicompost, etc. The students can use their knowledge, creativity and innovation.
5. **SMS Alert:** An SMS alert may be arranged to nudge the errant households 'alerting them every morning with a message on 'waste segregation'. This should go on at least for 15 days at the launch of the programme; then once in three days; and then reduced to once a week.
6. **Educative Information:** The sanitation workers can also politely educate the residents when they find households mixing up waste (passing on wastes without segregating) especially because they are not clear as to how to segregate.
7. **Educative Inspection:** The Sanitation Inspector who goes for monitoring the works of the sanitation workers makes direct observation of how residents respond to the call. He can also use that opportunity to educate the residents who are unaware or are unwilling to spend time on segregating.
8. **Rangoli Competition:** Rangoli competitions can be announced at GP level. Prizes can be given to the biggest and the best rangoli. Prizes can be announced at three levels: (i) household level, (ii) street level and (iii) habitation level. People tend to clean up the streets in front of their houses, and their streets in their enthusiasm to bag prizes.
9. **Clean the Commons Campaign:** Cleaning up the schools, ICDS centres, backside of temples, churches, infamous spots where people usually chuck their waste. Such places can be cleaned up through a special campaign. Innovative ideas must be put to use so as to sustain the cleanliness of such places – by making vulnerable/infamous spots to be used as playground for kabbadi players/or local Sachin Tendulkars; or plant some trees and fence the area. If it is a bigger area, children's park can also be planned (like it has been done in Ibrahimpur GP in Telangana State).
10. **Announcing Prizes & Gifts:** As part of local festivals institute some awards such as 'Street of the Year Award' or 'Best Residential Locality Award'. It must be given every year so that people have some encouragement to keep clean and tend to question those who irresponsibly dump waste on street corners.



Step **2** Planning

1) **Area Survey:** Estimation of the nature, type and quantum of wastes generated by different categories of people, viz. households, tea stalls, restaurants, marriage halls, vegetable market, fish market, bus stand, temples and schools, etc., is necessary to be able to plan for collection, transport and manpower requirements. For households, average waste generated can be estimated. But, with regard to other stakeholders such as restaurants and markets, a site visit might be required to assess the waste they generate daily. The existing arrangement for waste disposal should also be studied. See Annexure 3 & 4 for further clarification on this point. How to do a 'waste survey' is given at the end of this module.



SURVEY

2) **Material Planning:** Tricycles or (solar) battery-operated vehicles for waste collection (one vehicle with two waste collectors for every 150 households, for instance), uniform and gears (jacket, gloves, cap, water bottle, first aid kit) for the workers, segregation shed, compost yard for wet waste, storeroom to lay in dry waste, tools and equipment. See Section - 3: Preparation of a Detailed Project Report for SWM.

3) **Manpower Planning:** SWM is a labour intensive work. We need minimum two workers per 150 households. It depends also on how sporadic or dense the settlement pattern is. That means with each garbage collection vehicle two workers can be deployed, who can help each other. They can together cover 150 households every day. They may cover 150 HH in the morning (7.00 – 10.30 am) and 150 HH in the evening (4.00 – 7.30 pm). One hour can be spent in secondary segregation at the shed. The experience in some places is that poor and destitute women are trained in this work. Those already involved in rag picking are also recruited and trained. Selection and training are important because wrong selection shall require frequent recruitment.



NOTE

4) **Technical Planning:** This is about processing and treatment of wastes collected. This guide does not suggest elaborate

treatment methods. See other useful materials on composting methods. We suggest you to go for simple windrow composting with wet waste, and if possible to go for vermicomposting. The dry waste can be segregated and what can be sold as recyclables may be sold to merchants who deal in scrap sales/waste recyclable items periodically. The rest may be sent to a sanitary landfill (See Box – 1). This is explained in detail in Step – IV and in Annexure - 4. See *Diagram-1 on Page 15*.

- 5) **Financial Planning:** This involves two types of costs. (a) Capital cost for setting up the facility and (b) Operational cost for meeting out the recurring expenses month after month. Capital cost pertains to point No. 2 above; and Operational cost pertains to points No. 3 & 4 above. See Box – 3 for details. The financial planning necessarily must involve a budgeting exercise too.



MEASURE

Budget is an estimated income and expenditure statement. In other words, this is a dry run of the expenditure to be incurred and the likely income to be accrued by the GP through the proposed SWM activity. It is more to know about what is likely to be the expenditure. This is a very essential exercise that Panchayat functionaries must do before actually venturing into 'real action'. This shall indicate the likely expenditure to be incurred and what are the sources of income available to cover the expenditure so that the venture becomes financially sustainable. A blank budget format is given below.

Box – 3: Income and Expenditure for a Solid Waste Management Project

(It is worked out assuming that this project is for 300 households)

| Items of Expenditure | Possible Income Sources |
|----------------------------------------------------|--------------------------|
| A. One-time Expenditure (Capital Cost) | 1. Service charge |
| 1. Baskets (900 numbers) - Green, Blue, Red | 2. Sale of compost items |
| 2. Tricycles - 2 | 3. Sales of recyclables |
| 3. Compost pit, segregation shed | 4. Fine and penalties |
| 4. Uniforms, gloves, caps, whistle | |
| 5. Tools & equipment | |
| B. Recurring Expenditure (Operational Cost) | |
| 1. Supervisor salary | |
| 2. Sanitary workers salary | |
| 3. Consumables/bleaching powder, etc. | |
| 4. Repair and maintenance | |

Note: This is the stage where GPs need to look into the feasibility of resource recovery from waste. Income generation through sale of products (such as vermicompost) from wastes is a source of income

in some Panchayats. Some GPs do SWM Project, on social enterprise mode only – meaning the expenditure is offset by another source of income to the GP. The income from sale of compost and service charge meet only a portion of the expenditure. Please visit SWM unit in Mudichur GP, Tamil Nadu (see a *brief case* at Annexure -1); and SLRM unit at Kurudampalayam GP, Coimbatore, Tamil Nadu (see a *brief case* at Annexure – 2) for firsthand experience on these aspects.

A Tentative Budget of Income and Expenditure for a Month

(Assume: 900 households/3600 population)

| Expenditure items | ₹ | Income Sources | ₹ |
|-----------------------------------------------------------------------------------------------------|------------------|---------------------------------------------------------|---|
| Sanitation workers salary (₹ 12000 x 6 workers cover 450 HH in the morning & 450 in the evening) | 72,000.00 | Service charge (900 HH x ₹ amount) | |
| Supervisor's salary (1 person) | 12,000.00 | Shops, restaurants, markets, marriage halls, etc. | |
| Consumables (bleaching powder, etc.) | 200.00 | Sale of compost | |
| Repair & maintenance of vehicles | 1000.00 | Sale of recyclables | |
| | | | |
| TOTAL | 85,200.00 | TOTAL | |



IMPORTANT

Note: It assumes that every household and every shop keepers pay service charge without fail. It's good to do this budgeting exercise before kickstarting the SWM implementation at ward level or GP level.

Step 3 Organising



NOTE

1) **Manpower:** Recruit the manpower as required by the plan. One experience is that very few local persons volunteer to work in dealing with garbage. It is good to recruit destitute women and those who are willing to take up such tasks. In some of the successful SWM projects, wherever the authors of this handbook have paid visits, we could notice destitute women from the neighbourhood villages and men outside the State working. Often they are recruited from faraway places. In such cases, they stay in a place given by the GP. There are places where actual rag pickers have been recruited and trained. They get orientation and trained so that they are ready to take up the task. While doing a training need assessment, it is advisable to go by 'task-based session plans'. Regarding compensation, each worker has to be paid at least ₹ 300 per day or the minimum wages as prescribed in MGNREGS.

2) **Materials & Facilities:**

The physical facilities required for setting up an SWM are as follows. We need to organise these things so as to commence work.

- Land to construct the segregation shed plus composting yard or the vermi-beds.
- Setting up a compost shed/segregation yard.
- Baskets/Containers for households – three per household.
- Green/Blue/Red Baskets (one for wet waste; other for dry waste and a third one for hazardous).
- Tricycles/Push cart for every 150 households – one.
- Sanitation workers (Janitors), two workers for every 150 households.
- Uniforms & gears (cap, gloves, whistle).
- Tools and equipment (broom sticks, bins, tin, sheets, etc.).



TOOLS-TECH

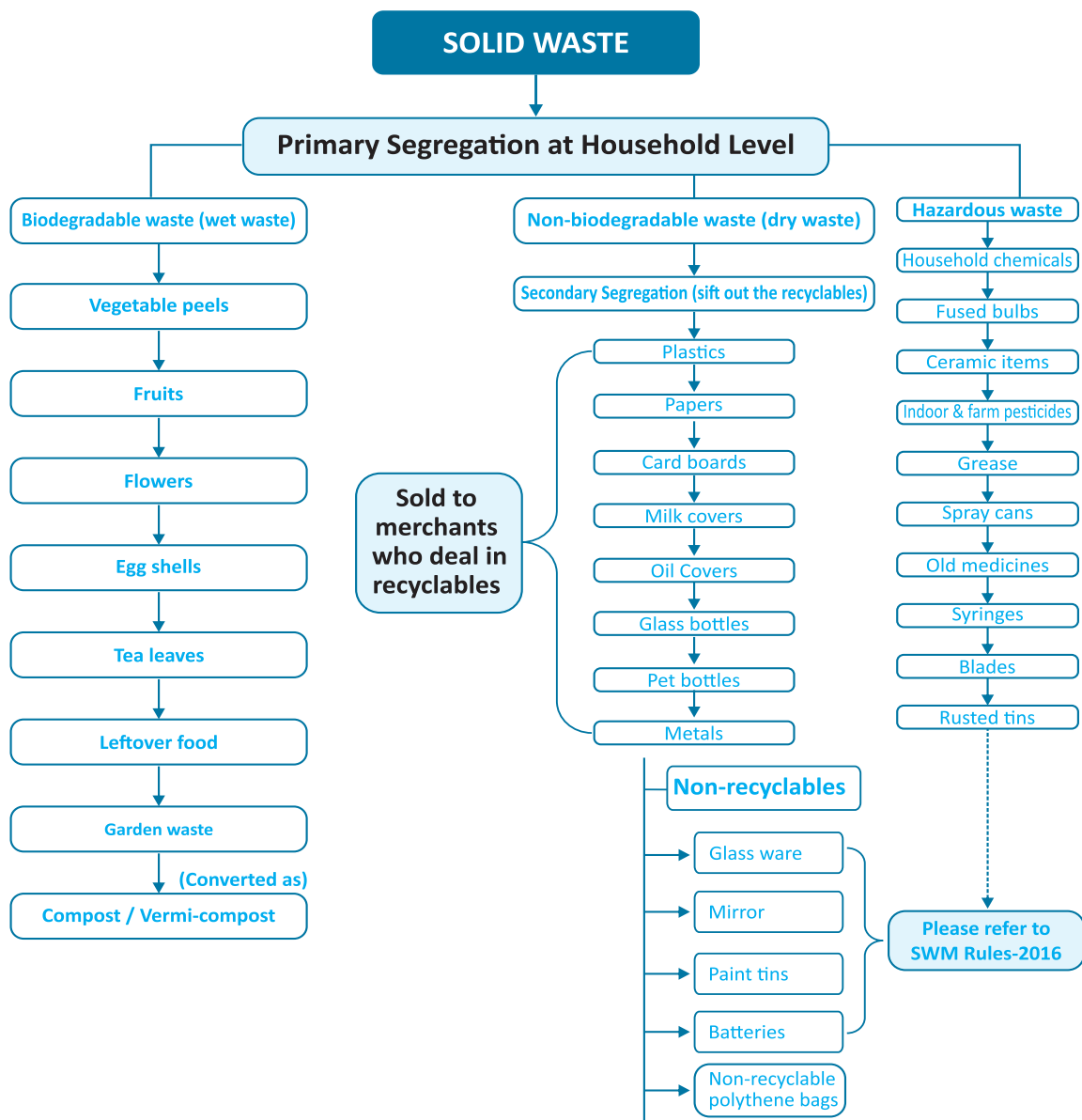


Diagram – 1: A Simple Solid Waste Management Model

- Technology:** This can include three things in the context of SWM. First, what vehicles are to be used in waste collection – are they simple tri-wheelers or battery-operated vehicles, etc.? Secondly, the technology to be used in treating the wet waste/biodegradable waste – are they going to be converted into simple compost or vermicompost? Thirdly, how the landfill is to be located and where it is going to be set up/how about an incinerator? Depending upon what technologies we choose, we need to organise materials and funds to procure such materials.
- Funds:** The State governments, through Centrally-sponsored schemes like Swachh Bharat Mission (Gramin), makes capital cost available for construction of facilities required for solid waste management. However, in the event of this fund being insufficient,



SYSTEM

GPs have approached CSR (for instance, Kurudampalayam GP, Coimbatore district, Tamil Nadu) and NGOs (for instance, Mudichur GP, Kancheepuram district, Tamil Nadu). There are also instances where the district administration and DRDA (Udupi district, Karnataka) have found other sources of funds to assist setting up solid waste management facilities. This is about initial investment. The real challenge is about covering the operational expenses (running cost) of the unit month after month, paying workers salary, maintaining collection vehicles, etc.

There are income sources in an SWM unit, viz. sale of compost and service charge collection, etc. One general complaint from GPs that are already involved in SWM is the irregularity in service charge payment - that the irregularity is up to 30 per cent. Therefore, the income from sale of compost and service charge cover only a portion of the expenditure. As mentioned elsewhere in this handbook, where GPs have taken up the task of SWM, they follow social enterprise model only – meaning the expenditure is offset by another confirmed source of income to the GP. For instance, in Mudichur GP in Tamil Nadu, they offset the loss incurred in SWM against the income they earn from sale of drinking water through RO Plant. See a case study in Annexure – 1 of SWM Unit in Mudichur GP in Tamil Nadu.



IMPORTANT

5. Coordination: Running an SWM unit is a time-consuming and long-drawn out task. Once started, it must go on and on. If left unattended for four days, things will fall back as bad as how it was earlier. Therefore, the GP must constantly keep in touch with the community and the sanitation workers. The GP must also watch out the supportive income sources that help compensate the loss incurred in SWM, etc. Poor coordination may result in ineffectuality, eventually resulting in unsustainability.

Implementation

1) **Segregation at Source:** The households must have sufficient knowledge of segregating biodegradable from non-biodegradable wastes. Since we have covered about preparing the community at Step – 1 itself, at this stage we assume that the community members know how they should participate and contribute. First of all, primary segregation takes place at the source, namely at the household itself. If this is done properly, it will considerably reduce the work in secondary segregation. Otherwise, it is an unpleasant task to lay hand in wet waste that is more than 8 to 12 hours old, which has already started decomposing/decaying. The households keep kitchen refuses in a green bin.



2) **Collection:** The sanitation workers indicate their arrival by ringing a bell. (It's better to avoid whistle for the worker may have to put it in his/her mouth with dirty hands). The green bin is emptied into the cabin meant for it in the tricycle. During the collection, the sanitation workers progressively perfect the community on what should be kept in the green bin, and what should go into the blue bin, and what are hazardous items and how they should be disposed safely.

3) **Secondary Segregation:** The tricycle reaches the segregation shed where the garbage undergoes a secondary segregation. In secondary segregation, the sanitation workers sift (pick and choose) the 'recyclables' from the lot received. The finally discarded ones (*i.e.* residual solid waste) are fit for nothing, reaches the 'sanitary landfill'. The hazardous wastes are treated appropriately. See *Diagram-1 on Page 15*.



4) **Facility for Treatment & Treatment of Waste:** This is an important step, where we have to have appropriate technology in place for treatment of, say for instance, kitchen waste. What method/technology to use is a matter of choice and convenience. Therefore, we present all the simple composting methods



LOOK UP

separately – as a supplementary/complementary resource to this handbook. The GP functionaries can pick and choose the method that most suits one's rural setting. To get to know about various methods of composting 'Government of India (2015), Technological Options for Solid and Liquid Waste Management in Rural Areas, published by MDWS, Swachh Bharat Mission (Gramin)' is also a good reference material.

The recyclables can be sifted and stored separately for sale to scrap dealers. When a considerable volume is accumulated, they can be sold. Arrangement may be made for scrap dealers to visit the site once in two months or so. The residual waste and hazardous waste such as napkins, if found suitable, can go into a 'closed incinerator'.

Box - 3: Informal Sector & Scrap Dealers

The kabadiwalas or scrap dealers, including the waste pickers play an important role in waste management. This system of using informal sector helps improve resource recovery and reduce the waste quantities, which otherwise, the Panchayat may have to handle. This can be done through SHGs, NGOs or Panchayats identifying and getting into an agreement with scrap dealers, who would visit the GP periodically and take away reusable scraps on terms agreed. Periodical sale of recyclable items can be a source of income to the GP.



COST

5) Service Charge Collection: Service charge collection from every household is very essential to cover the operational expenses. The Sanitation Supervisor (or Panchayat secretary) should take responsibility to sit in a designated cash counter at the GP Office, at least four hours daily to collect service charge from households (for household drinking water connections, for solid waste management, house tax, etc.). People get habituated to visiting the office and paying, once the system is established, and when the community members are sure that the GP Office is definitely open from morning to evening or at least at specified timings. If this is irregular, people tend to think poorly of the system and do not adhere to paying, citing 'closed GP office' as a reason for not paying.

Box - 4: Plastic Waste Management

Plastic Waste Management Rules, 2016 is applicable to Gram Panchayats also. With regard to the use of plastic carry bags, the PWM Rules – 2016 clarifies that (i) Plastic carry bags (made of virgin or recycled plastic) of less than 50 microns in thickness are banned; (ii) only the registered shopkeepers or street vendors shall be allowed to provide plastic carry bags (of more than 50 microns) for dispensing the commodities. They should get registered with the Gram Panchayat paying appropriate fees, which is not less than ₹ 48,000 per year. The idea is: pricing of plastic carry bags shall reduce the use of carry bags; secondly, plastics of above 50 microns are recyclable and therefore, waste pickers tend to collect them.

An eco-friendly product which is a complete substitute of the plastic has not been found yet. In the absence of a suitable alternative, it is impractical and undesirable to impose a blanket ban on the use of plastic all over the country. However, plastic bags of less than 50 microns shall be considered unapproved/illegal. Possibly, they are manufactured by unlicensed units operating in some nameless lane.

Those factories producing plastic carry bags and those using plastic carry bags shall register with the Gram Panchayat. The Gram Panchayat may charge ₹ 4,000 (monthly) for such shop-keepers as clean up charges. This will serve twin purposes: (i) the shopkeepers cannot afford to give away carry bags without a price; (ii) the money thus collected by the Gram Panchayats (₹ 48,000 per year) shall add to the own-source revenue of the Gram Panchayat to meet out a portion of expenditure incurred on waste management.



IMPORTANT

Monitoring and Correctives



- 1) **Household Adherence:** The households must adhere to segregating waste at source. They must be sufficiently educated. There might be initial hiccups. The sanitation workers must be sufficiently trained in order to educate the community members patiently and stop being intolerant on them. If primary segregation is properly done, a considerable work for the sanitation workers shall reduce. Ensure households adhere to proper segregation and cooperate.
- 2) **Feedback from Households:** The households must have the GP sanitation supervisor's/GP president's mobile number to offer suggestions on the system, or make complaints in the event of sanitation workers being irregular or behave irresponsibly.
- 3) **Feedback from Waste Collectors:** The GP president, GP secretary and the GP sanitation supervisor should talk to the sanitation workers/waste collectors on the response of, and the cooperation extended by the households. If their intervention is necessary to solve some of the problematic households or habitual delinquents, they must be attended to and dealt with appropriately.



- 4) **Physical Verification:** The GP sanitation supervisor should make visits when sanitation workers are on duty, collecting waste from households. It helps solve some of the problems. Similarly, the GP president should make visits whenever he has time. Initially, the GP president may have to visit the wards, often enough, so as to build confidence in the households. It communicates to the households how earnest the GP president is about the solid waste management system.
- 5) **Corrective Measures:** The GP functionaries should hold a discussion with the sanitation workers and representatives from households on corrective measures required to make the system more effective. The system can keep improving as months pass by, as the GP gains experience in managing solid waste.

Certain Assumptions and Imperatives

- Once started, there is no way waste collection can be halted – not even for one or two days. It must go on regularly ‘on time’. Even change of timings shall cause disruption. Garbage at households left unattended for two days, people tend to lose confidence in the system, and all the garbage shall get chucked on the streets.
- The GP must explore the availability of scrap dealers in the area/ vicinity and get in touch with them for the sale of recyclables.
- The community education (even at the doorsteps of households) must regularly take place wherever necessary in order to make them adhere to the new system. This must go on until 100 per cent of the households adhere to the system.
- A convenient service charge collection system must be put in place. Service charge must be collected month after month, without fail. If it is fixed as ₹ 50 per month, the GP may also let open the option of some households wanting to pay ₹ 150 once in three months. It is better to have it pre-paid, rather than post-paid. It is good to develop an SMS alert that shall remind about dues.
- Especially when it comes to treatment of wastes, do not get carried away by promises made by high-end technologies. Technology should be simple, facilitative and cost-effective.
- In the same vein, one can try to test the pragmatism behind the principle ‘waste-into-resource conversion.’ At the same time, we shall not lose sight of the fact that ‘simplicity is the hallmark of demonstrability’ and complexity is a drawback.



EDUCATION

Despite repeated education, some families do not segregate wastes properly and it happens in most communities. As a result, if the sanitation workers started dumping ‘all the wastes together’ in the collection cart, they are making way for a reverse journey. That’s an indication the system is gliding towards ‘failure’. The sanitation workers are as vital as the households are, to be able to spell success. To quote an incident, one sanitary worker in Kurudampalayam (see annex – 2) said to these authors: “many of the housewives in my village think, I am collecting wastes and garbage from them, I feel sorry that they hold an incorrect perspective of what I am doing. They lack an understanding that I am collecting resources from them to be converted as usable products.” And he really means it. It says, why Kurudampalayam is successful.



PRACTICE

Box - 5: Waste Collection: Models and Variants

There are many 'variants and models' Gram Panchayats in various States have tried



NOTE

Option – 1: Households segregate wet and dry wastes separately and keep them ready, including the hazardous ones. The GP cart collects the 'wet waste and dry wastes' regularly in the mornings (at designated timings), in the same cart/van where provision has been made for separate storage.

Option – 2: Households segregate wet and dry wastes separately, and keep them ready. The collection cart from GP collects only the wet waste. The dry wastes are collected twice a week - and not daily (for instance, on Mondays and Thursdays). This saves time and trips.

Option – 3: The households are trained in various methods of home composting. Households segregate wet waste and dry waste. The GP collects only the dry waste. The households do composting of wet waste at household level, and use it for the plants/in their garden. This further saves the time and trips because part of the problem (wet waste) is dealt with by households.

Actionable Agenda for Households

Your GP aspires to become clean and green within one year from now. We seek the cooperation of the residents by following certain simple steps in handling wastes at household level. Your adhering to this - with a little extra effort - shall help your GP to ground a scientific practice in waste management. It is in your interest; and it is in the interest of the community you live in.

Responsibilities of Households

The following are responsibilities of households/residents



ANNOUNCE

1. Each household shall segregate waste into wet waste (kitchen waste - GREEN) and dry waste (BLUE), and Hazardous Waste (RED) and put in the bin (or 'bag' as the case may be) given specifically for each purpose. This is called primary segregation, which will be the responsibility of the residents. The foundation for success or otherwise of this effort absolutely lies at this stage.

Box - 6: Waste Segregation

Wet Wastes (GREEN): Kitchen-refuse such as vegetable peels, fruits, flowers, egg shells, tea leaves, including leftover food, old bread, fish bones, leaves, garden shrubs and other easily degradable items.

Dry Wastes (BLUE): Plastics, papers, cardboards, shampoo bottles, empty cans/tins/toothpaste tube/worn out toothbrush/milk covers, oil covers, glass bottles, pet bottles, broken toys, caps of mineral water bottles, iron pieces, *etc.*

Hazardous Wastes (RED): Under this category, items frequently discarded are: (i) used-napkins, (ii) children's diapers, (and such items) (iii) used batteries. Other items under this category could include household chemicals/cleaners/fused bulbs/tubes, broken mirror and broken ceramic items, residual paint/indoor and farm pesticides, grease, spray cans, shoe polish, expired medicines and other pharmaceutical items/syringes, needles, sharps, blades, rusted tins, *etc.*

Note: It is courteous if we can securely wrap especially the items (i) and (ii) mentioned under RED waste above in an old newspaper, and stick a small RED colour cello tape (stamp-size enough!) so that it gets appropriate handling without any mess.



PRACTICE

2. Vegetable peels, fruit peels, egg shells, used tea leaves, leftover cooked vegetables/ food may be put in wet waste bin (Green). But never in a use-and throw cover; never knot it, please. Either give them as such or wrap it only with old newspaper.
3. It is always good to wash inside of a milk pocket with water. Washed milk cover renders it easy for the sanitation workers to deal with it. [Never throw empty milk covers on the street. The stray cows, buffalos and calves tend to chew up and eat them because of the milky smell on the cover. Accumulated polythene covers in their stomach prove deadly].
4. As far as possible leftover food items such as fish bones, mutton and chicken bones may be given to pet cats/dogs, if available at the households. This is an easy way to deal with leftover food at household level. If not, these items may be put under wet waste (GREEN waste), which after shredding (by a shredder machine) can be fed either into a gas plant or allow them to decompose along with the wet waste you convert as compost.
5. Certain items such as sanitary pads, children's nappies and condoms shall be wrapped in newspapers, or some papers available (put a red X [cross mark]) or stick a piece of RED cello tape, before it is handed to the sanitation workers. Such marking helps easy identification so that the sanitation worker shall handle it appropriately.



EDUCATION

6. The sanitation workers (in uniform & cap) shall visit every household with a cart/tricycle and ring a bell to let the residents in that area to get to know that the waste collection vehicle has arrived. It is the responsibility of each household to give the three baskets to the sanitation workers, who shall empty each basket in separate containers they bring/in partitioned vehicles.
7. The residents who repeatedly give mixed up waste (dry/wet/hazardous, etc., together) shall be dealt with firmly.
8. Complaints, if any, from the residents may be sent through SMS to the sanitation supervisor or to the GP president. The residents may also call up the GP president and inform complaints, if any.
9. Similarly, the sanitation workers shall also keep note of residents (house number) who do not cooperate and report to the VWSC or to the GP president for necessary action.



INVOLVE

Bigger GPs can also make plans to convert the waste collected from residents, after secondary segregation, into gas (gasification/bio-methanation) that can be used at the local school/ICDS kitchen, etc. Therefore, if an SWM plan got executed properly and became sustainable, the residents can really set an example to many GPs in the neighbourhood on how to handle household waste intelligibly.

Task Description for SWM Workers

1. The sanitation workers shall collect waste primarily segregated at the household level.
2. After reaching the segregation shed, the sanitation workers feed into the incinerator (combustion chamber) all the diapers, sanitary napkins and such items handed by households wrapped in old newspapers. This is about the RED bin.
3. Then they turn to handle wet waste: They shall do secondary segregation of the wet waste. During secondary segregation, their main job is ensuring that wet waste do not have any mix up of other types of wastes.
4. Before the wet waste goes into composting or into a gasification plant, the workers shall do the necessary chopping, shredding (using the shredder/chopping tool installed at the segregation shed) so as to make it fit for faster composting/easy gasification. This is the technical arrangement for treating wet waste. This is about the GREEN bin.
5. The workers then do segregation (tertiary segregation) of dry wastes. The main task here is sorting various materials like



LOOK UP

plastics, bottles, papers, cardboards, cosmetic containers and tins separately. This classification results in grouping items that can be sold for scrap dealers, and those items that must be sent to sanitary landfill. This will include other hazardous wastes, if any.

6. The items picked from the dry waste for sale to recyclers shall be kept in a store. This will be part of segregation shed. Incinerator will also be part of the segregation shed. This is the area where the waste collection vehicle is parked while not in use.
7. Periodically, it will also be a responsibility of the sanitation workers to take out the manure from compost yard/gas plant and keep them in sacks for sale.

Task Description for SWM Supervisor/Inspector

1. Educate and train the workers on collection and segregation.
2. Supply uniform, green caps and other protective gearings to the workers.
3. Introduce to the sanitation workers how to use the incinerator; how to use the segregation shed; how to use the chopper/crusher tools; how to use the gasification plant, if available.
4. Make periodical plans assigning workers for various tasks in waste management.
5. Make sure that the waste transported by trucks/trailers from one place to another is 'covered properly and transported'.
6. Oversee and educate workers on waste segregation until they become familiar with segregation methods. Arrange for exposure, if required.
7. Arrange segregation and sale of recyclable wastes.
8. Identify a suitable place to be used as landfill, and prepare – beware of dumping being called as landfill.
9. Oversee the type and form of waste fed into the composting/gasification plant, that the garbage are of acceptable type and in acceptable form.
10. Oversee the waste that come from markets and restaurants are in acceptable form before they are fed into the composting/gasification plant/incinerator.
11. Oversee the use of incinerator – how it is used and what goes in there?



SAMPLE LIST



MONITOR

12. Make sure that no dumping takes place anywhere in the GP by any sanitation worker or by residents. Nib such practices in bud, while the SWM project is on the runway.
13. Attend to the complaints brought about by the sanitation workers promptly.
14. Ensure the workers get their wages on time and recommend for incentives from the sale of recyclable items.
15. Ensure the health of the workers through periodical health check-up and if they use their protective gearings while at work.
16. The sanitation workers should not work overtime, nor should they be allowed to laze around. Calculate and deploy the right number of workers, and they should get one-day weekly off on rotation basis. Along with their monthly wages, they should be supplied toilette - two detergent soaps and two bath soaps.
17. They should associate their work with cleanliness and as part of preventive health. Their perception of their work should be that they are managing waste scientifically, which is an extremely serious problem world over; and that in the process, they are converting waste into recyclable products, energy, and usable manure, which is a wonderful thing. They should not feel small about what they are doing; and no one should be allowed to look down upon them.



NOTE

A Model By-law

A Model By-law for Solid Waste Management in Gram Panchayats

By-law for Gram Panchayat Panchayat Union
of District. Approved by Gram Sabha on / /
2018

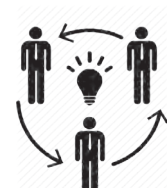
PART – I

General

1. The jurisdiction of the by-law is limited to solid waste management of the villages and hamlets within Village Panchayat.
2. These by-laws are prepared keeping in view the Solid Waste Management Rules – 2016 issued by the Ministry of Environment, Forest and Climate Change (notified in the Gazette of India on 8th April 2016).
3. These by-laws are prepared keeping in view the Constitution of India (Articles 243G, 243H, 243I and 280) and the guidelines of the Swachh Bharat Mission (G) for solid waste management in rural areas.
4. The Village Water and Sanitation Committee (VWSC) is hereby appointed the Executive Authority to plan, collect, treat and dispose kitchen wastes, and other domestic waste generated by households, shops and other establishments within the boundaries of the Panchayat.
5. The VWSC shall put in place a proper system for solid waste management for this GP. It shall fix terms and rates under which wastes generated by residents shall be collected and disposed in a manner that is healthy, and overall cleanliness of the village shall be maintained.
6. Solid waste generated by households, shops and establishments, and marriage halls within the GP shall be handled by a team of



IMPORTANT



DISCUSS



INVOLVE

sanitation workers trained and appointed by the VWSC with the approval of the GP on terms set out in this by-law (and related rules to be intimated when required).

7. Differential rates will be applicable to different categories of residents such as households, tea stalls, village restaurants and eateries, marriage halls, schools and offices if any, vegetable markets, mutton and chicken stalls, grocery shops, etc.
8. The rates set out in this by-law are hereby imposed on all category of waste generators in the village and the rates shall be levied and collected in accordance with a tariff fixed (See 2.5).
9. The rates shall be revised once a year to reflect changes in the cost incurred in solid waste management services.
10. Revenue collected for providing solid waste management (SWM) services shall be used only for the purpose of operation and maintenance of the said services including the workers' salary, employed additionally (or made to work for extra hours) for this purpose.
11. Any person who behaves in breach of this by-law shall be liable to a fine as stipulated in this by-law (See Point No. 2.5).

PART – II



NOTE

1. The GP shall do a survey and sort out residents under different categories (See User Category below). There will be a series of community education programmes conducted with the help of Block level staff of the government (or an NGO) involved in sanitation promotion (SBM) activities.
2. Residents, shops, etc., of the GP shall be intimated which category they fall under, for the purpose of payment of service charges for SWM – preferably monthly (or as agreed upon).
3. The unit considered as house for the purpose of house tax shall be considered as household in this case also.

2.1 User Category

- i. Households
- ii. Tea stalls
- iii. Village restaurants and eateries
- iv. Marriage halls
- v. Vegetable markets

- vi. Mutton and chicken stalls/Fish markets
- vii. Grocery shops
- viii. Schools and offices, if any
- ix. Temples, churches, mosques, etc. (unless they have their own waste disposal arrangement)
- x. Others

It is at the discretion of the VWSC, that a destitute woman or aged person running a small petty shop with an investment of less than ₹ 2,000 (two thousand only) may be exempted from paying, provided she/he already pays as a household. This is not applicable to others such as those who run a village eatery, vegetable vending, chicken/mutton and fish stall (with no proper arrangement for disposal of wastes), etc. Encourage (through IEC and IPC) for people to change to taking chicken, mutton, fish, etc., in stainless steel containers that they shall carry from home. They can avoid accepting use-and-throw carry bags given by the fish vendors and chicken vendors.



2.2 Technical Stipulations

1. The Panchayat shall pass a resolution banning the use of use-and-throw carry bags and use-and-throw tea cups, and seek the cooperation of community to carry reusable cloth bags, and insist on shopkeepers to use only biodegradable alternatives, in order to help the buyers who forget to bring cloth bags.
2. Every household shall be provided with two coloured baskets – one for WET WASTE, and the other for DRY WASTE. A third one can be given for hazardous waste (minus sanitary pads, and diapers for they have to be wrapped separately in newspapers and given). Households will be educated on which waste goes into which bin/basket and the intervals at which collection cart visits them.
3. Primary segregation shall take place at the source where waste is created (e.g. household level). Secondary segregation shall take place at SWM shed of the GP.
4. The responsibilities each category of SWM service users is provided separately.
5. Special arrangements shall be made for cleanliness during temple festivals and local festivals.



SAMPLE LIST

2.3 Inspection



1. Respective ward members of Panchayat along with the members of VWSC (or a supervisor appointed for this purpose) shall pay inspection visits to make sure that the community members, shopkeepers and others keep their surrounding clean.
2. They shall also personally visit in order to educate houses/shops that repeatedly mix up, or do not cooperate as reported by the sanitation workers.

2.4 Non-compliance

3. Where some households/shopkeepers are found not abiding by the Panchayat norms, and are chucking waste on the street corners or in some vacant place in residential areas shall be liable to pay penalty as decided by the GP.
4. In the event of some residents persistently not cooperating, the Panchayat may take the extreme step of denying other services by Gram Panchayat.

2.5 Payment for Services



The tariffs set for the SWM services with respect to different users are suggested below. However, the best way to do this is each GP can work out a budget (of likely expenditure to be incurred on SWM and accordingly work out the service charges [rates] for each category of service users, which should serve as income to be able to meet the expenditures). The following is a suggestive tariffs for different user categories.

1. The service charges for SWM shall be payable to the sanitation worker (or sanitation supervisor) at the door steps of service users before the 5th day of every month, unless otherwise specified. This is easier to collect and easier to pay. A receipt for the amount paid shall be insisted on by the residents who pay.
2. Alternatively, the service charges may be paid at GP Office before the 5th of every month in advance.
3. Payment for SWM service under the terms and conditions laid down in the by-law if not paid by the party concerned within the time stipulated shall be recoverable in the same manner as house tax.
4. Waste baskets given for SWM purpose shall not be put to any other use, causing SWM to suffer. In such an occurrence the

amount spent on the baskets shall be recovered at double the price.

5. Household not willing to involve themselves in primary segregation can do so, provided they are prepared to pay ₹ 150/pm, instead of the regular ₹ 50/pm.
6. However, those found chucking waste at the streets/street corners shall be liable to pay a penalty of ₹ 500 every time they err.



| S. No. | User Category | Service Charge (monthly) | Remarks |
|--------|-------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Households | ₹ 50 / ₹ 150 | Payable monthly (Type - A) (If a household does not want to spend time on primary segregation, they can opt to do so on additional payment of ₹ 100 every month. They shall be known as Type -B. |
| 2 | Tea stalls | ₹ 50 | Payable monthly |
| 3 | Village restaurants and eateries | ₹ 100 | Payable monthly |
| 4 | Marriage halls | ₹ 500 | Payable after every marriage |
| 5 | Vegetable markets | ₹ 50 | Payable monthly |
| 6 | Mutton & chicken stalls/ Fish markets | ₹ 200 | ₹ 50 Payable weekly |
| 7 | Grocery shops | ₹ 50 | Payable monthly |
| 8 | Schools and offices, if any | (as decided) | Payable monthly |
| 9 | Temples, churches, mosques, etc., (unless they have their own waste disposal arrangement) | (as decided) | Collected from the community along with the collection made for temple festivals/ local festivals. |
| 10 | Others (such as dispensaries) | | |

2.6 Penalty

1. Anyone wilfully or negligently throwing waste on the street shall be considered to have violated and shall be punished with a fine of ₹ 500 in the case of households and shops; and ₹ 2,000 in the case of marriage hall or as decided by the VWSC.
2. The GP/VWSC may also decide differential penalties in the case of one time violation, and repeated non-compliance/negligence.



3.1 Responsibilities of Households/Waste Generators

The following are responsibilities of households and others except marriage halls:



SAMPLE LIST

1. Each household shall segregate waste into wet waste (kitchen waste & food scraps) and dry waste (other waste) and put in the bin given specifically for each purpose. This is called primary segregation, which shall take place at the household/shopkeepers level. Those who do not want to segregate waste can do so on extra payment as prescribed by the GP. Those who repeatedly give mixed up (both dry waste and wet waste) shall be automatically classified under Type – B and charged accordingly.
2. As far as possible, leftover food items such as fish bones, mutton and chicken bones may be given to pet cats/dogs, if available at the households. This is a way to deal especially with leftover food at household level. Otherwise, they may be securely wrapped in a newspaper and handed to the sanitation workers (preferably with a green X [cross mark] on it). It helps easy identification of what is inside.
3. Vegetables peels, fruit peels, egg shells, used tea leaves, leftover cooked vegetables on the plate may be put in wet waste bin. But never knot it.



NOTE

4. It is always good to wash inside of a milk packet with water. That way, the milk in frozen form may find its way to your milk pan. Washed milk cover renders it easy for the sanitation workers to deal with it, as it does not smell. Moreover, just in case an unwashed milk cover ends up on the street, it happens that calves [small ones of a cow] tend to eat up the cover because of the milk smell, which over the years becomes dangerous for the animal.
5. Certain items such as used sanitary pads, children's nappies and condoms shall be securely wrapped in newspapers, or some papers available (put a red X [cross mark]) before it is handed to the sanitation workers, who shall take them to sanitary pad incinerator or bury in a landfill. Marking helps easy identification so that the sanitation worker shall not open it. It is good to use a third basket (red colour or black colour) to discard such items. This is part of hazardous waste generated as household level.
6. Putting kitchen waste (vegetable peels, etc.) in carry bags and knotting it should be avoided. Use torn newspapers/dry leaves

at the bottom of green basket, so as to avoid these things getting stuck, instead of using use-and-throw carry bags.

7. The sanitation workers (in uniform & cap) shall visit every household with a cart/tricycle and ring a bell to let the households/shops in that area get to know that the waste collection vehicle has arrived. It is the responsibility of each household to give the two baskets to the sanitation workers, who shall empty each basket in separate containers they bring/in partitioned vehicles.
8. No waste generator shall throw, burn or bury the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.
9. All waste generators shall pay such user fee for solid waste management, as specified in the by-laws of the local bodies.
10. No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organiser of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the Gram Panchayat.
11. Every street vendor and eateries, etc., shall keep suitable containers for storage of waste generated during the course of his activity such as food waste, disposable plates, cups, cans, wrappers, coconut shells, leftover food, vegetables, fruits, etc., and shall deposit such waste at waste storage depot or container or vehicle as notified by the Gram Panchayat.
12. All resident welfare and market associations shall, within one month 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 the waste collection arrangement made by the GP or to some authorised recyclers or waste pickers.
13. The complaints, if any, from the residents may be written in the complaints book available in the waste collection vehicle. The residents may also call up the mobile number available in the cash receipt that they received the previous month.
14. Similarly, the sanitation workers shall also keep note of households/shopkeepers who do not cooperate (not abide by the by-law) and report to the GP/VWSC.



NOTE



IMPORTANT

3.2 Responsibilities of Sanitation Workers

1. The sanitation workers shall collect waste primarily segregated at the household level, and after reaching the segregation shed allotted, shall involve in secondary segregation, where they segregate (different types of) recyclable items from the items that must go for composting, etc.
2. The system of households making direct payment of service charges at Panchayat office should be promoted. Where some shopkeepers feel uncomfortable, the sanitation workers shall collect service charges from such households and give account to the Panchayat secretary to keep accounts and follow up those who have not paid.



IMPORTANT

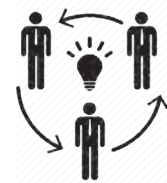
3.3 Responsibilities of VWSC/Gram Panchayat

1. Arrange for door-to-door collection of segregated solid waste from all households including slums and informal settlements, commercial, institutional and other non-residential premises and thus ensure hygienic conditions.
2. Collect separately waste from sweeping of streets, lanes and by-lanes daily, or on alternate days or twice a week depending on the density of population, commercial activity and local situation.
3. Transport segregated biodegradable waste to the processing facilities like compost plant, biomethanation plant or any such facility. Preference shall be given for on-site (home-based) processing of such waste.
4. Direct and educate the waste generators not to litter, i.e, throw or dispose of any waste and to segregate the waste at source as prescribed under these rules and hand over the segregated waste to waste pickers or waste collectors identified by the local body.
5. Arrange for composting of wet waste (type of composting as determined early on).
6. Set up Material Recovery Facilities or secondary storage facilities with sufficient space for sorting of recyclable materials to enable informal or authorised waste pickers and waste collectors to separate recyclables from the waste and provide easy access to waste pickers and recyclers for collection of segregated recyclable waste such as paper, plastic, metal, glass, textile from the source of generation or from material recovery facilities.



NOTE

7. Arrange segregation and sale of recyclable wastes.
8. Identify waste deposition centres for domestic hazardous waste and give direction for waste generators to deposit domestic hazardous wastes at this centre for its safe disposal.
9. Provide training on solid waste management to waste-pickers and waste collectors.
10. Involve communities in waste management and promotion of home composting, biogas generation, decentralised processing of waste at community level subject to control of odour and maintenance of hygienic conditions around the facility.
11. Phase out the use of chemical fertiliser in two years and use compost in all parks and gardens maintained by the local body and wherever possible in other places under its jurisdiction.
12. Make sure hardly 10–15 per cent of waste ends up in a sanitary landfill. And it should not be considered as a place for dumping. It should be a sanitary landfill.
13. Make sure the village streets, street corners and vacant places are clean, and everyone cooperates to maintain cleanliness. Frequently inspect vulnerable spots.
14. Facilitate construction, operation and maintenance of solid waste processing facilities and associated infrastructure on their own or with private sector participation or through any agency for optimum utilisation of various components of solid waste adopting suitable technology.
15. Prescribe from time to time user fee as deemed appropriate and collect the fee from the waste generators on its own or through authorised agency.
16. Promptly attend to community grievances so that their cooperation can be counted on.
17. Sustain the work, and make it a regular habit among the residents not to litter in open places/in drainage canals, etc.
18. Educate workers, including contract workers and supervisors for door-to-door collection of segregated waste and transporting the unmixed waste during primary and secondary transportation to processing or disposal facility.
19. Provide personal protection equipment including uniform, fluorescent jacket, hand gloves, raincoats, appropriate foot wear and masks to all workers handling solid waste and the same are used by the workforce.



DISCUSS



INVOLVE



TOOLS-TECH

20. Procurement of suitable sites for setting up solid waste processing facility and sanitary landfill facilities.



SAMPLE LIST

21. Levying of spot fine for households/persons who litters or fails to comply with the provisions of these rules and delegate powers to VWSC to levy spot fines as per the by- laws; and create public awareness through information, education and communication (IEC) campaign and educate the waste generators on the following; namely,

- Not to litter;
- Minimise generation of waste;
- Reuse the waste to the extent possible;
- Practice segregation of waste into biodegradable, non-biodegradable (recyclable and combustible), sanitary waste and domestic hazardous wastes at source;
- Practice home composting, vermicomposting, biogas generation or community level composting.

Preparation of a DPR

Preparation of a Detailed Project Report for SWM

A detailed plan is essential to have mental dry run of the project. This especially helps to understand the financial requirements for setting up and operating the unit. Thus, it helps to estimate the (i) manpower, (ii) equipment, (iii) technological and (iv) financial requirements. An outline of a DPR (Detailed Project Report) is presented below. This can help GPs to prepare a plan of their own.



IMPORTANT

- Name of the GP Block: District
- Population:
- Households:
- Number of wards or streets or hamlet: (provide anyone)
- Ward-wise/street-wise households/habitation: (use the following format to present the data)

| S. No. | Name of the Habitation/ Hamlet | No. of Households | No. of shops & other establishments | Approx. volume of solid waste generated | |
|--------|--------------------------------|-------------------|-------------------------------------|-----------------------------------------|-----------|
| | | | | Wet waste | Dry waste |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |



MEASURE

- List the waste generators (households, shops, tea stalls, market area, school, etc.)
- What type of wastes are generated (Aprox. How much wet – dry – hazardous?)

- What is the present arrangement for waste management?
- Do a transect walk, and identify also the vulnerable spots and those currently being used by the households and shopkeepers to dump waste.



SAMPLE LIST

PROPOSAL

- Describe what is proposed (provide a diagram how you are planning to manage waste?)
- What facilities are required? Land, Infrastructure, etc.
- What equipment are required? Justification for each equipment (e.g. tricycle).
- How do you plan to prepare the community/households?
- How do you plan to equip the GP (Institution) to take up this new task (SWM)?
- Mechanism of Operation (Technical Plan)
 - Additional Manpower Requirement
 - Collection Arrangement
 - Transport
 - Treatment
 - Disposal
- Financial Plan
 - Fixed (One-time) Investment Requirement (List the requirements with budget. e.g.)
 - Place for storing various types of wastes until they are sold to recyclers
 - Wet waste management place (e.g., compost bed or windrow bed area)
 - Collection Vehicle
 - Waste Bins
 - Segregation shed
 - How much does the monthly operation expenditure comes to?

- Budget

| S. No. | Items of Expenditure (Monthly) | ₹ | Items of Income (Monthly) | ₹ |
|--------|--------------------------------|---|---------------------------|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| | | | | |



What is the financial assistance requested?

Other requirements:

A note on the land where the facilities are to be set up (supporting papers):

What is the plan for sustainable Operation & Maintenance of the project?

Solid Waste Management System in Mudichur Gram Panchayat

(Kancheepuram District, Tamil Nadu)

Mudichur Village Panchayat in Kancheepuram district, Tamil Nadu implements an SWM model. It is functional for more than seven years now. What makes Mudichur click, while in many other Panchayats, such models fade away after a brief stint? And what lessons Mudichur can give for replicability in other parts of the country? Mudichur being very close to Chennai, the influence of city culture of keeping one's house clean and remaining unconcerned of the filth on the street in front was common. Litter anywhere irresponsibly and accuse the neighbours of their irresponsibility was the culture. A series of massive campaigns run by the State government to stop open defecation, made the Panchayat functionaries to work towards making the Panchayat open defecation free (ODF). In order to achieve the status of clean village, the GP president took leadership to put in place an SWM plan.

The lesson from Mudichur on SWM is that there is no dearth of technologies. What is required is a functional management system (model), which in Mudichur they have developed one. Mudichur Panchayat took Hand in Hand (NGO) and the DRDA into partnership to create a solid waste management system. They are implementing it meticulously that it has become regular, making us call it 'a system'. The Mudichur Panchayat president, with the help of a team of youth (and appointed Green Friends), is managing household waste admirably. Certainly, the role of Hand in Hand in making this system functional deserves to be appreciated as well. Mudichur model has several ideas and precautions for any Panchayat that wants to replicate.

In replication, the following points deserve to be emphatic.

- **Systemic Thinking:** Measures to be taken in advance to avert possible failures and to secure good results are an imperative in a solid waste management project. The normal way of thinking about solid waste management are placing dustbins at certain distance, and forget about it (Failure Model - 1). It overflows and takes a run-off extending the area under garbage; Collect, transport and dispose – dispose irresponsibly at the outskirts (Failure Model - 2). On the contrary, in Mudichur, they have created a system taking into account the logistic aspects, technological aspects, financial aspects and they have roped in the support of external support agencies where required. This systemic thinking makes the difference and this has made Mudichur Panchayat President stand tall amid a crowd.
- **System Sustainability:** The experience of Mudichur puts it fairly clearly that finding the sources of income for meeting out the 'operational expenses' (day-to-day running expenses) month after month, determines the real system sustainability.

Without a clear-cut idea of sources of income to meet the operational expenses, investing in non-recurrent expenses such as dustbins and tricycles do not augur well. Such a case shall help write only a failure story very soon. This is a caution, one should make note of.

- Social Enterprise Model: In order to meet the expenditure involved in managing the solid waste management system, the source of income from user fees collected plus sale of compost, etc., were found to be insufficient. This did not deter them. They have thought out of the box to come up with sensible solution, instead of being on the same sludge grumbling about the impossibility. The excess income earned out of RO Plant through sale of drinking water to the households is used to make up the loss incurred in running the solid waste management system for the same community. It is win-win in terms of both drinking water supply and environmental sanitation in a given community.
- Community Preparation: The GP, with the help of Hand in Hand (NGO) has spent sufficient time preparing and educating the community to adhere to and cooperate in the interest of everyone.

(Complete case study of SWM at Mudhichur is available on NIRD&PR wesbite)

Contact:

The Gram Panchayat President, Mudichur GP, Kancheepuram district (or)
Hand in Hand (NGO), Kancheepuram, Tamil Nadu

Solid Resource Management in Kurudampalayam Gram Panchayat, Tamil Nadu: A Classic Case that Transforms Waste into Resource

Kurudampalayam Gram Panchayat is located very close to Coimbatore city in Tamil Nadu. It has 14 wards, with a population of 33,000 that make into 11,360 households. There are marriage halls, restaurants, shops, schools and so on. The amount of waste generated is not less than 800 kg per day. The practice that existed before the introduction of solid resource management system in Kurudampalayam was 'discarding domestic refuse in street corners and in the open drains'. For the past three years, this GP has started viewing waste as a resource and it recovers usable resources from waste. Therefore, Kurudampalayam GP forbids the usage: 'solid waste management', and replaces it with 'solid resource management.' The Solid and Liquid Resource Management (SLRM) unit at Kurudampalayam, as it is locally known, has a lot to offer to other Gram Panchayats desirous of drawing ideas for managing solid wastes from households, institutions (schools), restaurants and marriage halls in rural areas.

The basic approach to solid waste management in Kurudampalayam is that there is almost nothing that can be called 'waste.' This is based on the premise that any waste can be converted into resource that can provide utilitarian value/as a useful commodity. It might require changing the form through certain amount of processing and presentation of the same, in a manner acceptable in the market. Any waste can be converted into a socially useful commodity. Hence, the usage 'Solid Resource Management' in Kurudampalayam and not 'Solid Waste Management' as it is addressed in most other places we have come across. Precisely, it is not about solid waste management in the minimalist sense; rather it is about scientific management of solid waste in its entirety. Besides this, tertiary (third level) segregation is something unique at Kurudampalayam which is done with the idea of recovering every usable resource from the waste collected. The resource recovery chain is really long and tedious. The unit is running since October, 2013.

Kurudampalayam SLRM unit is a must visit for Panchayat presidents to get an idea, on how to handle various types of wastes generated in rural areas. There are several good practices like solar battery operated tri-wheelers used for collecting wastes from households and restaurants; destitute women trained and deployed in waste collection and segregation. The painstaking third-level segregation that sort wastes of various recyclables in separate compartments are good practices to learn. It has all the potentials to emerge even as a training-cum-demonstration centre for solid waste management in Tamil Nadu.

(Complete case study of SWM at Kurudampalayam is available on NIRD&PR website)

Contact:

The Panchayat President, Kurudampalayam Gram Panchayat,
(Coimbatore district, Tamil Nadu) or DRDA, Coimbatore

What to Include in a Waste Survey?

- i. Source of waste (households, restaurants, marketplaces and streets, etc.)
- ii. Types of waste generated
- iii. Amount of waste generated type-wise (wet/dry and hazardous, etc.)
- iv. Identify vulnerable spots/infamous spots – dumping sites
- v. Existing disposal practice – at household level and at marketplaces
- vi. How do institutions like schools, ICDS, local clinics dispose waste?
- vii. What is the capacity of the GP to implement an SWM plan?
- viii. What does it take to build the capacity of the GP to manage an SWM unit?

Report from Waste Survey

Break-up details of Waste Generated in Gram Panchayat

| S. No. | Name of the area | Waste generated per day inGP | | | | Total (kgs) |
|--------|---------------------------|------------------------------------|-----------------|-----------------------|---------------------------|-------------|
| | | Wet waste (kgs) | Dry waste (kgs) | Hazardous waste (kgs) | Road sweeping waste (kgs) | |
| 1 | Ward - 1 | | | | | |
| 2 | Ward - n | | | | | |
| 3 | Main Streets | | | | | |
| 4 | Market area | | | | | |
| 5 | School/ICDS | | | | | |
| 6 | Ration shop | | | | | |
| 7 | Temple/church/mosque area | | | | | |
| 8 | Tea stalls/Restaurants | | | | | |
| 9 | Marriage halls, if | | | | | |
| | Total | | | | | |

- o Total Waste Generated per day
- o Average amount of waste by each household
- o Average amount of waste generated by other residents/shops & establishments/shandy
- o Understand the existing waste disposal system
- o Identify vulnerable/infamous spots
- o Nature of the community (in response to previous efforts of similar nature)
- o What kind of a plan is required at the GP level to take up SWM project?
- o Who should we involve in terms of support institutions and implementation partners?

Technical Management/Execution

The following are the stages involved. We present below how we intend to technically manage each stage of the SWM process. The technologies and tools proposed to be used are presented as well.

| Stage | Technology/Technique | Tools | Remarks |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------|
| Stage - 1 Collection | | | |
| 1.1 From households | Green Friends with collection vehicles shall collect as per the area assigned by the Sanitation Inspector | Three bins for every house (or two bins and a big shopper bag) | |
| 1.2 From shops | | Three bins | |
| 1.3 From market area | | Three bins | |
| 1.4 From ration shops | | Two bins | |
| 1.5 From tea stalls | | Two bins | |
| 1.6 From restaurants | | Two bins | |
| 1.7 From bus stop areas | | Two bins | |
| 1.8 From health centres/clinics | | Three bins (internal management will be health centre's) | |
| 1.9 From schools/ICDS centres | | Three bins (internal management will be school's) | |
| 1.10 From marriage halls | | Two | |
| Stage - 2 Secondary Segregation | Wet Waste Management: This is especially to ensure that wet waste that will go for vermicomposting or into the gasification plants does not have anything harmful/mix up of plastics, etc. | Pick anything that is not supposed to go into vermicomposting and put them in an aluminum vessels given (for sending to landfill) | |
| Stage - 3 Treatment of Wet Waste | Wet Waste Management: After ensuring that wet waste does not have any mix up, they are shredded/crushed as it may require, and fed into the gasification plant/vermicomposting bed | | |

| | | | |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--|
| Stage – 4 Tertiary Segregation | Dry Waste Management: This is to sift/sort materials that are recyclables and that which must go to landfill | Pick items (such as bottles, pet bottles, plastics, milk/oil covers, bottle caps, etc.) that are saleable/recyclable | |
| Stage – 5 Treatment of Dry Waste | Dry waste recyclable/saleable are kept in stores for sale to scrap dealers periodically, as decided | | |
| Stage – 6 Treatment of Hazardous Waste | <ul style="list-style-type: none"> • Hazardous wastes such as children’s diapers, sanitary napkins, medical bandage, band-aid and such items go into incinerator. • Other items such as old batteries, blades, fused bulbs/tubes, broken ceramic items, rusted tins, etc., go to landfill | | |

Composting Kitchen Waste: FAQ

(Basic Questions and Answers)

1. What is composting?

We have observed in our daily lives that decomposition of organic materials such as vegetables, fruits, leaves, plants, etc., is very natural. Composting is a technique to control and accelerate this natural process. There are many composting methods and techniques available now.

2. What is the basic understanding I need to have while getting down to composting?

We mentioned earlier that through composting we *control and accelerate the natural process of decomposition*. How do we do this? What happens during composting is microbes (e.g. microscopic living organisms such as *bacteria, fungi*—millions of them) feed on and breakdown organic materials. It is best to *keep their population high* so as to accelerate the composting process because they help faster decomposition.

3. I understand that microbes help faster decomposition. But we need to 'keep their population high'. What does it mean? How to keep their population high?

For instance, when we make coffee, we refer to a *specific blend of coffee and chicory* to get the best tasting coffee – 70:30 or 60:40 or 80:20, etc. That means 80 per cent coffee with 20 per cent chicory gives the best tasting coffee. Like we talk about *coffee and chicory* in making good coffee, we talk about *greens and browns* in composting. A specific blend of 'greens' and 'browns' in our composting bed is best for keeping the microbes population high, which gives us good quality compost in a short period of time. The rule of thumb for producing good compost is to blend 25 to 30 parts 'brown' materials to one part 'green' material. This is what they call C:N ratio = 25-30:1).

Brown materials are high in carbon (C), while green materials are high in nitrogen (N). We need to pay attention on a specific blend of carbon and nitrogen (C:N ratio) for a good composting to take place. Generally, in home-based composting, we keep accumulating greens (N) in our composting bin, and pay little attention to browns (C). This is one of the reasons it takes long for composting. This is lesson no. 1 in composting. There are a few other elements like aeration, moisture level in green, (which depends on what all constitute your greens); and again, what all constitute your browns, plus temperature in your place and so on. You shall learn as you go.

4. Can you give some more idea on what all you call greens; and what all you call browns?

By *greens* we mean the 'kitchen wastes'. By *brown* we mean dry leaves, dry grass, saw dust, shredded paper, etc. Let us try to list out 'greens' and 'browns' so that we understand our C:N ratio better. In other words, greens and browns ratio.

| | |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Discarded vegetables/vegetable peels | Dry leaves/garden shrubs gathered |
| Food waste/food scraps/leftover food | Corn stalks (broken) |
| Coffee and tea grounds, tea bags | Saw dust, wood chips |
| Stale bread, egg shells, left over salad, citrus | paddy straw, hay |
| Cut flowers | shredded paper, shredded card board, Newspaper |
| Prunings/fresh grass clippings | Twigs, and small pieces of barks |
| Houseplants | Paper napkins, tissue papers |
| Sewage sludge (no chemicals) | (Dry leaves/garden shrubs and newspaper pieces are easily available) |
| Cow manure, poultry manure, rabbit manure, horse manure and pig manure(NOT dog/cat's) | Soil can be added in compost because organic carbon is generally present in garden soil. |

The point is of the many elements required for microbial decomposition, C and N are the most critical.

5. How to ensure one part of greens (Nitrogen) and 25–30 parts of browns (Carbon) in my composting?

This is only a thumb rule. The moisture level, weight, and bulk density of the greens and browns you use in your composting might vary on different days. Therefore, you shall better keep 25-30:1 ratio as a thumb rule. There are formulas given on how to calculate each of this. That is beyond what is required for our purpose. Let us leave that puzzle to some biochemist. What you clearly need to bear in mind is that *browns you add must be much higher in quantity than the greens*. Greens as such, plus a few shredded paper or a handful of dry leaves does not help composting unless you *make sure your browns outweigh your greens*.

6. You mentioned about a few more elements such as aeration, moisture, temperature, etc. Can you elaborate a little more?

Composting is a microbial-driven process. Like other living creatures, microbes need right environment to survive and thrive. For compost to do well, microbes need nutritious 'food', which they get from suitable moisture, temperature, and aeration (oxygen).

Aeration: Oxygen is essential for respiration of aerobic microorganisms. Without sufficient oxygen, the process will become anaerobic and produce undesirable odours. Sometimes, you might get the rotten-egg smell of hydrogen sulfide gas too. Therefore, you need to maintain aerobic conditions. This is simple: mix and turn as frequently as necessary or at least once daily.

Moisture: A moisture content of 50-60 per cent is generally considered optimum for composting. (i) Too little moisture (say, less than 30 per cent) inhibits bacterial activity; and (ii) too much moisture (more than 65 per cent) results in slow decomposition, odour production and nutrient leaching. How to understand the moisture level? Squeeze a handful of well-mixed compost or raw material. If your hand becomes moist but without any drops of moisture forming, the moisture content is optimal. If water trickles out when compost is squeezed, it is too wet. It indicates that you need to add some garden soil or saw dust or shredded papers or fully dried leaves in order to bring it to the optimum level. If the compost crumbles, it is too dry. That means you need to sprinkle some water and enhance the moisture level.

Temperature: At certain temperatures certain microorganisms are most active. Generally, in a range of 50 to 65 degrees Celsius proper composting takes place. Actively working microbes can raise the pile's temperature by as much as 60–65 degrees Celsius. The temperature in your compost determines how much and how often aeration is required.

7. Why is high temperature required in composting, and how to do that?

Microbial decomposition during composting releases large amounts of energy as heat. The insulating qualities of the composting materials lead to an accumulation of heat, which raises the temperature. Exposed to high temperature (i) many of the microbes become either dormant or die away; (ii) high temperature kills undesirable pathogens, diseases, weed seeds and insect larvae. However, we cannot allow this tight insulation to remain for long, if our purpose is to get good quality composting. Therefore, after exposing to active phase of high temperature, we need to allow a curing phase. After a period of time, the nitrogen-rich material is depleted, the biological process slows and the hot compost begins to cool, we call this curing. Curing enables heat loss. This is done simply by turning and mixing with a garden fork/ small spade once a day or so.

8. Are there any techniques for faster composting?

In order to speed up composting or shorten the time taken for composting, there are artificial solutions, and powders commercially available in the market these days. The problem with them is none of them tell you that X amount of that powder reduces your composting time by Y amount. Again, it means money, whereas we suggest no-cost operation. Our set of suggestions is: (i) take care of your C:N ratio properly; (ii) the temperatures at desirable levels; (iii) make sure that the particle size of your greens and browns are small; and (iv) do not add too hard items such as bones, or oily and greasy items such as cheese. That will do.

Fruits and vegetable wastes tend to degrade fast because they contain mostly simple carbohydrates (sugar and starches). Similarly, twigs, sticks, wood chips, straw and hay take slightly longer to decompose, but they provide the pile a porous structure enabling air flow through the pile. Regular mixing and stirring the pile loosens the material and maintains proper aeration. If you are very much after speeding up,

you can sprinkle sugar or *gur* water, and sour butter milk. These can help speed up composting. However, beware that sugar can attract ants – just in case you have home-based composting, and if you don't like disturbances caused by ants. You can drive away ants by sprinkling turmeric powder (*haldi*), which is natural.

9. How about the odour (bad smell)?

We have mentioned elsewhere in this booklet that at lower ratios of C:N, N will be supplied in excess and will more likely to be lost as ammonia gas, causing undesirable odours. More greens, at excessive levels of moisture in your compost tend to produce undesirable odour. That means your C:N ratio require proper balancing. So, your composting as such does not create any smell or odour. Into your composting bin, you keep throwing all the kitchen waste and wasted food, and feel lazy to add browns or shredded paper the resultant outcome is not composting but bad odour only.

10. I have noticed some ants, bugs, worms and other insects during composting. It is natural that I need to deal with insects and worms also, during composting, right?

It's possible they might generate. It is actually called *food web of the compost pile*. In other words, during the process of composting, you shall see different organisms including some bugs, insects and worms. Actually, they feed on each other, and it is possible, they eat up some of the microbes also. Most of them, in fact, assist the process of decomposition by eating up bigger pieces of kitchen waste such as decomposing broccoli, cauliflower, etc. But make sure that they do not harm the earthworms, if you have introduced earthworms and garden soil along with your kitchen waste. For instance, red ants might harm earthworms. You can drive the red ants away by sprinkling turmeric powder. Some worms you notice might eat fungi, which is not a problem. They facilitate your composting. Yet, sometimes, it's possible we get centipedes also, which have poison claws. That's the reason it is good to stir and turn the compost pile with a garden fork or a compost turner rather than doing with bare hands. Once the curing phase starts, you shall find all these insects and bugs vanish. They have nothing left to feed on and survive.

11. How to spoil my composting?

It's possible you might spoil your composting – yes, unintentionally so. This happens when we take it easy and assume composting will take place if you just keep adding your kitchen waste day after day, but pay very little attention to other things such as: (i) proportion of greens and browns; (ii) add leftover meat and big pieces of bones, fish remains, etc., which can attract dogs, and even pigs; (iii) not preventing plastic carry bags and similar items from getting mixed up with kitchen waste in the composting bin. Good quality composting can become organic fertiliser for growing healthy vegetables in your kitchen garden. Poorly maintained compost can become a source of odour and futile work.

12. They say 'aerobic composting' and 'anaerobic composting' – what is it after all?

Respiration or 'aeration' is important for composting. 'Aerobic' means a condition where oxygen is present; and *anaerobic* means 'non-oxygen condition.' In aerobic conditions, the pile gets broken down into smaller particles with right amount of moisture.

Anaerobic composting is the slow decay of organic matter through fermentation. By definition, anaerobic composting means a controlled process involving microbial decomposition of organic matter in absence of oxygen. Unlike aerobic composting, the pile does not heat up, rather it ferments. The main by-product of anaerobic degradation is methane, which is harmful to the environment if let open from a landfill. But it is a useful alternative energy if properly used as fuel. Those planning to go for *biogas from kitchen waste and food scraps* plan for gasification plants using anaerobic method.

Box – 7: What do they mean by Zero Waste?

Zero Waste is a goal that is ethical, economical, efficient and visionary to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. (Waste, 2015)

Useful References & Websites

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