



पेयजल एवं स्वच्छता विभाग
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MINISTRY OF JAL SHAKTI
GOVERNMENT OF INDIA



Toolkit: Plastic Waste Management

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BACKGROUND

Plastic waste can be managed most effectively at the local level. Gram Panchayats (GPs) are best suited for creating awareness on the shunned use of plastic, especially the single use kind and undertake decentralized measures for effective Plastic Waste Management (PWM). Plastic products have become an integral part of our daily lives which has resulted in increased plastic consumption. Plastic waste has also emerged as an important environmental challenge in the rural parts of the country. Swachh Bharat Mission (Grameen) (SBM [G]) Phase-II strives to improve rural cleanliness through Solid and Liquid Waste Management (SLWM) activities. Plastic waste management has been made a critical criterion for declaring villages ODF Plus.



Swachh Bharat Mission supports Gram Panchayats to create awareness on curbing the use of single-use plastic and effective management of plastic waste. For management of plastic waste as per the 4 Rs, the following key steps are suggested – The first three Rs – Recover, Reduce and Reuse – which are the responsibility of the households. For the fourth R – Recycle – the recyclable plastic are to be handed over to scrap dealers for further recycling. Non-recyclable waste having shredded/separated combustible fraction should be recovered at a cement plant or used for road construction or in any other recovery method.





Key Objectives of SBM (G) Phase-II



Sustain the ODF status of villages



Improve the levels of cleanliness in rural areas through solid and liquid waste management activities, making villages ODF Plus

This includes



ODF sustainability



Solid waste management



Liquid waste management



Visual cleanliness

GPs as Leaders of Plastic Waste Management

The GPs will lead the implementation of PWM at the village level. GPs shall be responsible for developing a Village Action Plan (VAP) on plastic waste management in consultation with community and integrate that with Gram Panchayat Development Plan (GPDP). Following specific activities shall be undertaken for PWM in the GP:

- ▶ Create awareness on PWM
- ▶ Pass a community resolution about reducing the use of plastic, especially Single-Use Plastic (SUP)
- ▶ Ensure door-to-door collection of plastic waste along with other waste
- ▶ Ensure that plastic collected is segregated and stored at the common village shed constructed/ available in the village
- ▶ To encourage individual household for aggregation of their plastic waste and sell it directly to the Kabadiwalas
- ▶ Ensure periodic collection of plastic waste
- ▶ Contact details of all Kabadiwalas should be pasted in a prominent location for easy access to all households and institutions, for e.g., all village panchayat offices, village shed schools, anganwadi centres, health centres, market places, etc.
- ▶ Collaborate with district/block officials for shifting of plastic waste from the village segregation sheds to the Plastic Waste Management Units (PWMU)
- ▶ Support the block in processing of the plastic waste (shredding and baling) at the plastic waste management units and an establishing forward linkages.

Blocks and districts will support GPs in carrying out the above tasks.

Plastic Waste Management Rules, 2020 (GP reference)

As per the Plastic Waste Management Rules, 2020 every Gram Panchayat either on its own or by engaging an agency shall set up, operationalize and co-ordinate for waste management in the rural area under their control and for performing the associated functions, namely:



A detail list of all existing Kabadiwalas with contact details be prepared by district. This shall be made available to all the Gram Panchayats



Ensuring segregation, collection, storage, transportation, plastic waste and channelization of recyclable plastic waste fraction to recyclers having valid registration



Block to ensure the disposal of aggregated plastics preferably at household level. Plastic aggregated collected from public places, markets, etc. and kept in village shed should also be linked to Kabadiwalas



Ensuring that no damage is caused to the environment during this process



Creating awareness among all stakeholders about their responsibilities



Ensuring that open burning of plastic waste does not take place





PLANNING FOR PWM

Each village shall prepare a village action plan led by Sarpanch/Panchayat secretary and supported by Village Water and Sanitation Committee (VWSC) for implementation of SLWM. Plastic waste management shall be a distinct component of this plan. The following shall be done as part of the PWM planning:

- ▶ Assessment of waste (type and quantity) generated at various levels viz. household level, institutions, health care centres, commercial areas and market areas
- ▶ Identification of persons for door-to-door collection for solid waste (plastic)
- ▶ Identification of space in a common village shed where collected plastic waste shall be stored
- ▶ Segregation of waste in every household, commercial centres, institutions, etc.
- ▶ IEC activities to raise awareness regarding harmful impact of plastic waste and regarding roles and responsibilities of the stakeholders involved
- ▶ Identification of plastic scrap dealers /recyclers
- ▶ All forward linkages to be established for plastic recycling

This plan shall be presented and adopted in a Gram Sabha meeting for integration in GPDP.





IMPLEMENTATION OF PWM

The plan developed by GP shall form the basis for implementation of PWM in villages of the GP.

Step 1: Segregation at Source

Every household shall segregate waste at household level (biodegradable and non-biodegradable).

Segregate waste effectively at source in following ways:



Place different coloured bins in households/ commercial institutions



Develop IEC / IPC material on benefits and procedure of segregation



Initiate regular monitoring of percentage of segregation in each habitation/ ward





Step 2: Collection

The GP/village shall make arrangements for collection of segregated waste including plastic waste from households, commercial areas, restaurants, markets, etc. and its transportation to the village segregation shed.

For collection and transportation of plastic waste, the vehicles may be designed with partition of biodegradable and non-biodegradable waste.

Every GP shall provide protective equipment to collectors such as gloves and appropriate tools for ensuring their safety while handling waste.



Note — Village level waste collectors should not collect medical plastic waste generated in hospitals, because it needs to be treated as biomedical waste as per the norms set by the government of India.



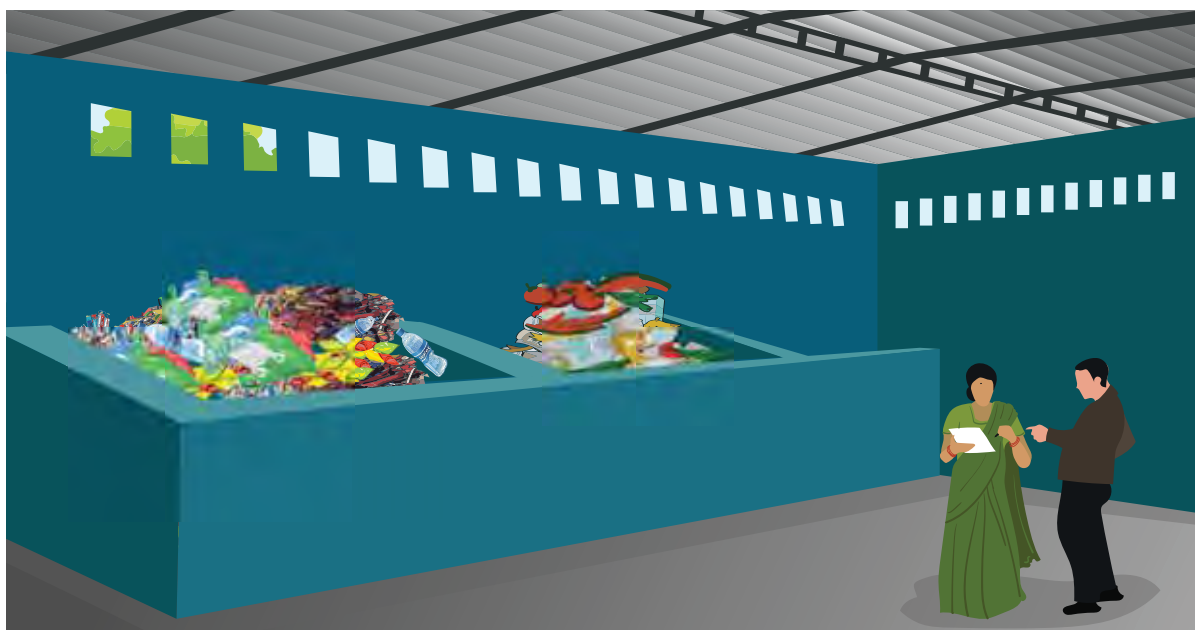
Step 3: Setting up a Village Level Shed

A common shed for bio degradable and non-biodegradable waste will be constructed in villages if one does not already exist. The village shed can be simple and can be made with locally available materials. This shed shall have dedicated space for storage of plastic waste.



Step 4: Secondary Segregation and Storage of Plastic Waste

The plastic waste collected from households, institutions, businesses and public places can be further segregated into various types of plastics for further processing and disposal. Different categories of recyclable plastic waste can be handed over to the appropriate authorized recycler.





Why Open Burning is Not a Good Idea!



Step 5: Transportation to Plastic Waste Management Unit

The GP shall coordinate with district/block officials to ensure timely transportation of the collected plastic waste from the village level shed to the plastic waste management unit.

Step 6: Setting up Plastic Waste Management Unit

A plastic waste management unit/materials recovery facility, materials reclamation facility, materials recycling facility or Multi Re-use Facility (MRF) is a specialized plant that receives and segregates recyclable materials which may be marketed to end-user manufacturers.

Plastic waste management unit shall ideally be set up at Block level and shall cater to all GPs within the block. District/block shall identify an appropriate location for setting up of PWMU and shall hire an agency for its Operation and Maintenance (O&M). The PWMU operating agency could be Self Help Group (SHG)/Non-Governmental Organisations (NGOs)/private enterprises. PWMU should have storage facilities of plastic received from GPs, the unit shall have a dust remover, a shredding machine and a bailing machine, among other necessary items.



Principle of Establishing Plastic Waste Management Unit

- ▶ **Clustering of GPs:** Clustering of GPs which will transport their plastic waste to the unit
- ▶ **Selection of appropriate site:** Site that is centrally located, closer to the cement factories if possible, away from drinking water sources, having uninterrupted electricity supply, etc.
- ▶ **Procurement of appropriate plastic dust remover/baler and shredder:** As per the applicable financial rules block/district shall procure the appropriate dust remover/baler/ shredder of required capacity based on the quantity of plastic waste to be processed and quality of processing required by the recovery units
- ▶ **Management of the collection and transportation process:** communication with concerned villages, listing and empanelment of transport facility providers, agreement/ contracts with them, scheduling the transportation process, managing its implementation
- ▶ **Empanelment of O&M agency/service provider:** empanelment of agency/ service provider for regular O&M of the unit through finalization of scope of work, empanelment process, entering into a formal contract, etc.
- ▶ Identification of recyclers for recyclable plastic
- ▶ **Regular monitoring of O&M:** District Water and Sanitation Mission/Committee (DWSM/DWSC) to do regular monitoring of O&M

Functions

- ▶ **Transportation —** PWMU will ensure transportation of collected plastic waste from all GPs
- ▶ **Baling —** The baling technology can 'press' material such as a plastic films or PET bottles into neat cube-like bundles — with ease — so that they can then be sent for recycling/recovery. With the help of this technology, waste is compacted and stored in a safe and clean manner. Research has also shown that compacted bales pose less of a fire risk

Plastic management unit in Kerala





- **Shredding** – It is an efficient and effective solution for turning scrap materials into valuable resources no matter the size and shape of plastic. Shredders are extremely useful when working with plastic products, vinyl materials and PVC pipes. Plastic in any unwanted form can be transformed into manageable and useful material that can be used for making various products.
- **Forward linkage** – Establishing linkage with recyclers, scrap dealers and for recovery at cement factories, road constructions and other
- **IEC** – Providing information on plastic waste management

Machines/Equipment Required at the Plastic Waste Management Unit

1. Dust remover machine

Plastic dust remover is very useful to remove dust and mud from the collected plastic waste and PET before recycling/recovery process.

Dust remover machine



2. Plastic shredder

A plastic shredder is a machine used for cutting the plastic in small pieces to make waste management easier. Shredded plastic can be used in road construction.

Plastic shredder





The internal mechanical process of shredders includes, grinding, cutting, hammering, compression and more. There are also shredders incorporating sorting and shaking mechanisms. Plastic shredders are designed for shredding a wide variety of plastics and so, they vary from low speed to moderate speed with high torque and come in varying specifications and blade sizes. Output plastic can be designed as per the final processing unit it can range from 1 inch up to 3 mm.

Available in different makes and models, plastic shredders typically range from single shaft machines to an advanced four-shaft mechanism that includes grinders, granulators, hammers and cutters along with sorting and shaking functionality.

Depending on the size and type of plastic scrap to be processed, different industrial shredders are available for plastic shredding. The internal mechanism of a plastic shredder typically travels in lateral, vertical or rotary directions and the speed also varies depending on the material.



Key considerations while selecting the appropriate shredding machine

- ▶ Quantity and characteristics of plastic waste to be processed
- ▶ Desired particle size and output requirement by the recovery facility
- ▶ Space needed for the machine set up and operations
- ▶ The life span of the equipment
- ▶ Easy to operate and maintain
- ▶ Manpower requirement
- ▶ Safety considerations
- ▶ Cost of the machine



3. Plastic baler

Balers are primarily used for compressing plastic materials into small and manageable blocks (bales) thereby reducing transportation and expenses incurred in storage of waste material. There are two major types of baler based on their motion – vertical and horizontal balers.

In the horizontal baling machine, the balers are larger machines loaded from the top of the conveyor belt, allowing large quantities of junk to be crushed. It can reach an output ranging 1 ton to 15 tons per hour. This automatic horizontal baling machine helps in dealing more efficiently from packing to transporting.



(From left to right) Plastic baler; plastic waste being baled, ready bales of plastic stacked



The vertical baler machines use the compressing force of the hydraulic cylinder to reduce the size of various waste materials and turn them into regular shape dense bales. The vertical baler machine can be loaded from the front. They are smaller and manually strapped and compressors from top to down.

Plastic balers can be operated manually or automatically. Many manufacturers offer a range of baler models and options which include mini balers, medium- to high-volume balers, etc. it is important to select the appropriate baler for specific requirements.





Step 7: Establishing Forward Linkages for Recovery

One of the important parts of the entire value chain of plastic waste management is to establish a proper forward linkage of the non-recyclable plastic collected baled and shredded plastics. As per the SBM (G) Phase-II guideline, the non-recyclable plastic which is processed in the plastic waste management unit will be further sent for road construction/ co-processing in cement industries or any other appropriate technology as per the norms.

The integration of mixed plastic waste for bitumen road is becoming an attractive and accessible option for authorities owing to the unsegregated nature of waste, improved quality of roads, and pothole filling. Co-processing of plastic in cement kilns offers a sound, environmentally viable mechanism to process non-recyclable, combustible plastic waste and simultaneously addresses the perennial challenge of waste management.

Use of plastics in road construction

Plastic roads mainly use non-biodegradable material such as carry-bags, disposable cups, etc. that are collected from various sources as an important ingredient of the road construction material. When mixed with hot aggregates plastics melt to form an oily coat over the aggregate and the mixture is laid on the road surface like a normal tar road.

There are four steps of using plastic in road construction:



Segregation: Plastic waste collected from various sources is separated from other waste



Cleaning: Segregated non-biodegradable plastic waste gets cleaned and dried



Shredding: Different types of plastic wastes are mixed which gets shredded or cut into small pieces



Collection and mixing: Plastic waste of size 2.36 mm is used for this process. This shredded plastic waste is added in equal proportion to the aggregate mix which forms a coat over the aggregate particles. After which bitumen is added to this mixture and this can be used for road laying process (Vasudevan, 2018)



The details of the process are given below:

Plastic waste being used in road construction



This innovative technology has not only strengthened the road construction but also increased the strength and performance of the road. It has also reduced the need for bitumen making it an eco-friendly process.

Government Order for the Use of Plastics in Road construction



The Ministry of Road Transport & Highways, Government of India has made it mandatory for road developers to use waste plastic along with bituminous mixes for road construction to overcome the problem of disposal of plastic waste.

Co-processing of plastic in cement kilns

Co-processing refers to the use of waste materials in industrial processes as Alternative Fuels or Raw Material (AFR) to recover energy and material from them. Due to the high temperature in cement kiln, different types of wastes can be effectively disposed without harmful emissions.

Usually, plastic wastes, that are contaminated with toxic components such as pesticides, etc., should be fed to the main burner to ensure its complete combustion in the high temperature and long retention time. For this, the plastics may need to be shredded to less than 20 mm size. The non-recyclable plastic wastes, that is not contaminated with toxic components, can be fed at the other feed points such as calciner, kiln inlet or mid kiln depending upon its size (CPCB, 2017).

Process flow diagram for co-processing of plastic waste in cement kilns along with the points of feeding of plastic waste is shown in the figure given below.



FUNDING PROVISIONS

Based on the concept of convergence a comprehensive plan for plastic waste management shall be prepared as a part of the GPDP. Available financial assistance for Solid Waste Management (SWM) under SBM (G) is as mentioned below:

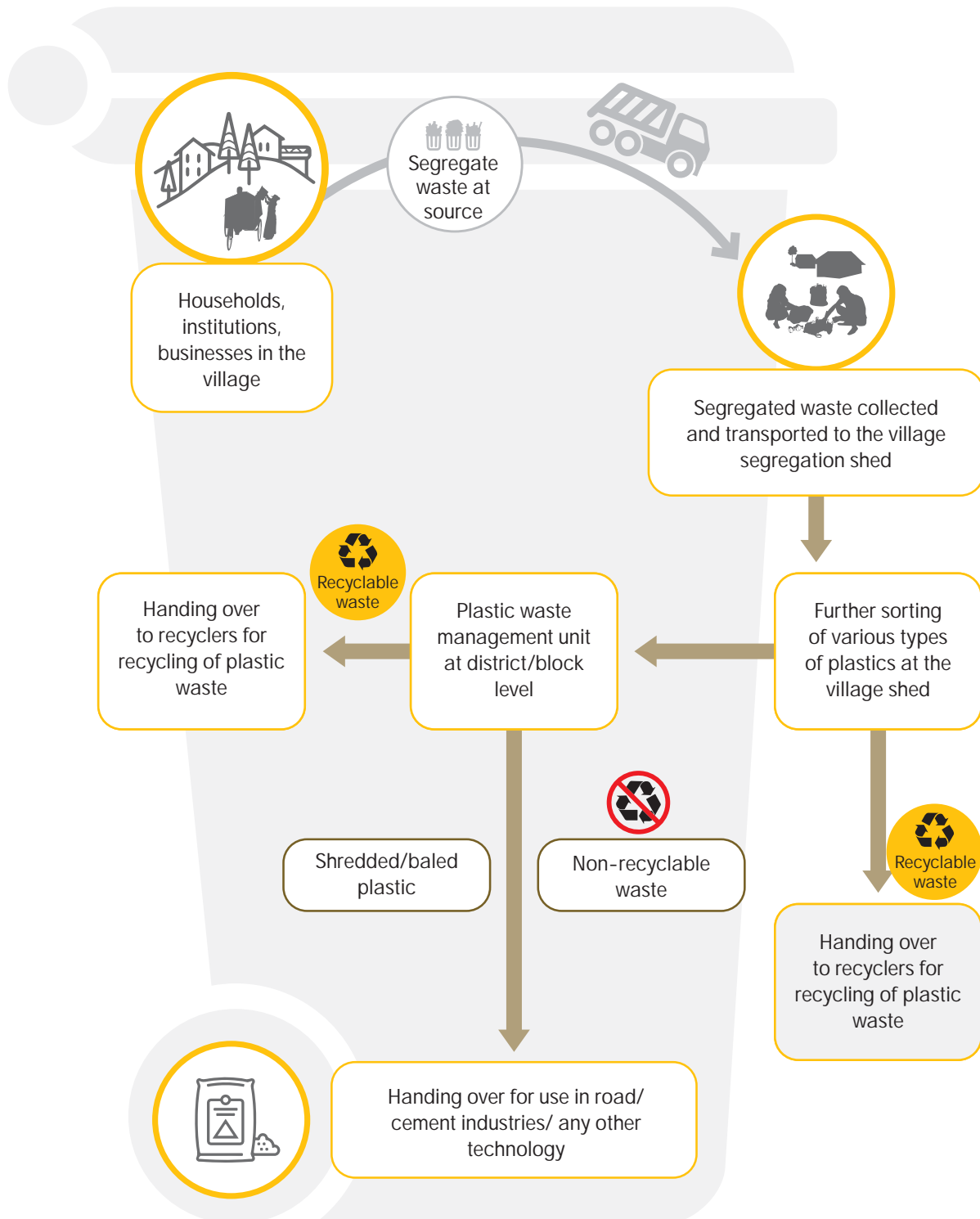
Population	Financial provision
Upto 5000 population	Solid waste management upto Rs. 60 per capita
Above 5000 population	Solid waste management upto Rs. 45 per capita
Note: ► 30 per cent of this amount will be borne by the GPs from their 15 th Finance Commission (FC) grants. Each village can utilize a minimum of total Rs. 1 Lakh based on their requirements for both solid waste and greywater management	
Plastic waste management unit (one in each block/district)	Upto Rs. 16 lakh per unit

GPs can source additional funds from other sources besides SBM (G) Phase-II such as 15th FC grants MPLAD/MLALAD/CSR funds or through convergence with MGNREGS or other schemes of the State or Central Government, etc.

Wages where needed to be paid for collection of waste from households can be sourced from the 15th FC and funds for construction of the shed may be obtained from SBM (G), 15th FC, SFC or other sources.



PLASTIC WASTE MANAGEMENT CYCLE



UNDERSTANDING DIFFERENT TYPES OF PLASTIC AND THEIR USES



PETE



Converted back to polymer and used for making apparel



HDPE



Converted to pellets and used to produce new HDPE



PVC



These are used to produce new PVC or as feed for other manufacturing processes or as fuel for energy recovery



LDPE



Converted to pellets and used to produce new LDPE



PP



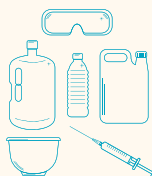
Converted to pellets and used to produce new PP



PS



Not recyclable



OTHERS



Not recyclable – However, multilayer packaging could be crushed and turned into sheets and boards for roofing, using adhesives



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