A Handbook on

# Waste Management in Rural Tourism Areas

## - a Zero Waste Approach




Shibu K Nair
C Jayakumar

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**A Handbook for Waste Management in Rural Tourism Areas**
**- A Zero Waste Approach**

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# Contents

# Gratitude

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We have been working with UNDP to help the partner NGOs implementing Rural Tourism projects in developing Zero Waste plans to address the waste issues in their destinations. We traveled and met government officials and village development councils and NGOs in the Endogenous Tourism Project sites and this book is a result of these travels and conversations. We thank all of the partners, people and officials in the ETP sites for their valuable support.

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**Shibu K. Nair**
**C. Jayakumar**
***Thanal***

# Preface

*"Willful waste brings woeful want."*

- Thomas Fuller

Each of us create and also contribute to manage waste in our everyday life. Fifty years back the largest man made structure on planet earth was the great wall of China, but today it would be the New York waste dump. Over the last sixty years in addition to the growth in quantum of waste, the concept of waste has also changed, primarily because we have changed the materials we use. Consequently it has also resulted in changing the way we manage waste. Travel and travelers also generate waste of different nature and often change the composition of the waste in a rural area. There is growing concern about waste related to tourism as it is growing at a fast pace. There have been many conflicts centered around waste all over the world especially in tourism hotspots.

The Global Civil Society Forum urged the UNEP to "Recognize the impact of tourism on the mandates of various United Nations agencies, such as the United Nations Development Programme's Poverty Alleviation Programmes, and call for greater coherence and coordination between organizations and agencies within the United Nations system regarding issues related to tourism. In this respect we believe that tourism can play a positive role in promoting zero-waste strategies, reduce energy consumption, especially for travel, and other sustainable development benefits."

UNDP is implementing the Endogenous Tourism Project (ETP) in selected villages spread over 20 states across the country, in collaboration with Government of India. The objective of this project is to provide sustainable livelihoods to communities in rural areas through tourism based on art, craft, and natural endowment. The project is being implemented in the field through grassroots NGOs and Panchayaths. One of the major challenges faced by the project is waste management in these villages, which is not only a desirable feature for the success of tourism but also essential for enhancing the quality of life of inhabitants in terms of sanitation and public health.

This hand book is being published to help NGOs and Local Governments to assist communities to manage discards in the ETP sites. The hand book will also help develop a sustainable plan in these sites to deal with waste so that it will not distract visitors or deny them the special experiences of the unique sites in rural India. The Handbook has the limitation of language as we are dealing with diverse languages and diverse cultures.

The attempt is to start with a few models in different parts of India so that these institutions/people will be able to develop and work with others in the region and become a movement to safeguard the environment. THANAL has been working with six partners with the guidance of UNDP Endogenous Tourism Project office for ten months and is committed to work for another one year to help the partner NGOs to realize their dreams and plans. Work on Tourism discards is an ongoing project and in two years we hope to see the pilot project partners reach the level of expertise to become leaders in this endeavour.

There is significant work to be done in raising awareness, capacity building, institution building and technology for waste/discard management. The Handbook is designed to provide basic inputs on all these topics. We also plan to provide web based support for all interested groups/ organizations, therefore we encourage interested readers to get in touch with us. The authors will be more than happy to work with each one of you to build a network of ETP sites working to solve discard issues and eventually become waste free.

The experiences across the globe on waste/discard management in the past few decades have resulted in a progressive movement to newer concepts and the world has identified new ways and means to deal with discards. Being part of the global network (GAIA) and participating in its meetings and conferences we have understood the problem better. We hope to share these lessons from many places as part of our work. We have learned that tourism waste issue can be easily addressed by changes in behaviour, better planning and communication. Appropriate hardware, software and good communication can help the destinations become waste free. This Handbook has some terms and names that may be new and unfamiliar to many readers however we have tried our level best to keep it to a minimum. However if you experience any difficulty with the material the authors will be willing to reach out and help you in your efforts to understand it. The lessons learned from different ETP sites will be of immense use to other sites across continent especially the principles that can be replicated. Thus we hope the handbook will be the starting point for thoughts and actions .

**Shibu K. Nair**
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Chapter-1

# Waste – Issues and Perceptions

## 1. Introduction

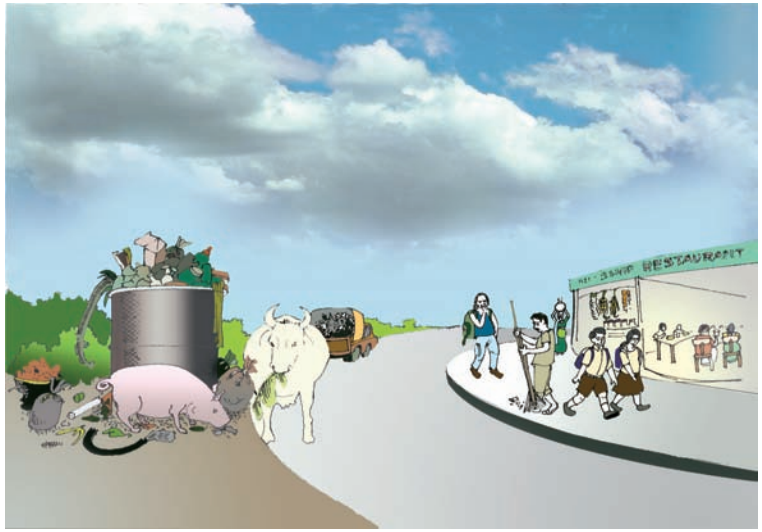
Waste is getting wider attention for its magnitude and dimensions of threat it poses to nature and mankind. The conventional approach to waste management is also being challenged for its lack of objectivity, sustainability and safety. Till recently, concerns over waste were on the grounds of public health, environment, public expenditure and politics. But now, waste as an issue has grown into another dimension because of its direct relation to climate change.

The issue grows every minute and is complicating all other processes including livelihoods of people. Rapid urbanisation is leaving behind piles of waste that is being dumped on communities in the rural landscape - a clear case of social injustice and environmental racism.

## 2. Aspects of Waste Issue

Solid and liquid waste always had adverse effects on the environment. The presence of waste materials in the essential elements – air, water and soil – depletes the ecosystems and its members. The toxic elements pass through the channels in the ecosystem affecting each and every element within. The presence of pollutants in essential elements create an unsafe environment, which impairs public health and leads to acute and chronic diseases. Waste dumps form breeding grounds for flies, mosquitoes, rats and other scavenging creatures, which are not only an eye-sore but also pose a threat to public health.

Generally, municipal solid waste instead of being safely disposed off is being shifted from one place to another. Most of the time the waste ends up in places inhabited



by marginalised communities and/or people with less bargaining power. The general trend in India is that villages are becoming the dumping grounds for cities. The foul smell, proliferation of vector animals and diseases, poor quality of water and air, low standard of living, reduced livelihood options etc., are some of the problems with the centralised waste management facilities operating in the villages. This forces people to stay away from the affected villages and also results in social stigma and discrimination.

Waste is considered as the shadow of an economy. It is the visible form of inefficiency. What we often throw out as useless is actually 'used less'. It means that every discarded material has some amount of energy, labour and capital in it. We are also wasting land and capital for disposing such discards. Nowadays waste disposal is a costly affair and is eating away a good amount of public money which could otherwise have been utilized for public welfare. Economics says that if less waste is created then it is efficient, which in turn results in saving money, materials, energy and creation of jobs. Most importantly, it is not ethical to waste since the resources which we utilize now are borrowed from the future.

Failure in perceiving the issue of waste has led us into a wrong direction. Most of the time we asked 'how to manage waste' and forgot to ask the fundamental question 'Why waste happens ?' This is a serious error in the way discards are handled further contributing to the waste crisis. Let us learn how these fundamental errors are manifested in the current waste management practices.

# 3. Current Waste Management practices

Normally people end up asking the question "What to do with our Waste?" A wrong question always yields a wrong answer. The general trend across the world related to waste management is transferring the problem from one person to another or converting the problem from one form to another. The premier practices can be classified as follows:

## 3.1 Dumping

This is the easiest way through which individuals, institutions and Governments manage their waste. It starts at the individual level where waste generally gets thrown into someones yard/house. At a larger level, cities also

follow this and dump their waste into neighbouring villages. If we climb another step up this ladder we see states within the country which dump waste in another state. One step ahead, at the global level, waste is flowing from economically developed countries to less developed countries especially, Asian and African countries. Meanwhile, even where there is a "proper" collection system, we see the waste thrown into a dustbin go to a larger bin placed in the street and from there it goes to villages or places where marginalised or less privileged people live. In a way it is transferring of one's problem to somebody or some other region without managing it. Dumping is hence an attitude which we cannot afford in a civilized society.

## 3.2 Burning

It is the traditional way of waste handling where people believe in *Agnisudhi* (meaning "cleansing with fire"). In our country it can be seen at the household, institutional and Government level. People normally burn their waste to make it disappear. Institutions like hospitals use the same method with or without the help of an incinerator (sometimes just a barrel with a pipe). Governments, burn their waste in open dumps, or in incinerators. It is the most dangerous method of waste disposal as a result of which people and environment are exposed to toxic substances like heavy metals, toxic fumes and ashes. It is found that dioxins and furans are emitted from burning of municipal waste. These burning machines appear in several forms – incinerator, pyrolator, plasma arc, pelletisation (Refuse Derived Fuel- and is often termed Waste to Energy Plants) – but the process is the same, conversion of waste into toxic fumes and ashes. This process depletes the environment and challenges life on earth by contaminating the basic elements.

# Health hazards of Incineration or waste burning

**Dioxins and Furans:** Dioxins and Furans are extremely persistent toxic substances that produce a remarkable variety of adverse effects in humans and animals at extremely low doses. They are a family of 210 compounds and are produced when burning halogenated substances. They are persistent in the environment and accumulate in magnified concentrations as they move up the food chain, concentrating in fat, notably breast milk. Dioxins can cause cancer and act as an endocrine disruptor with adverse effects on reproduction, development and the immune system.

**Heavy Metals :** These are present in many waste streams and cannot be destroyed by incineration. They end up in ash or are released as air emissions. Typical heavy metals emitted by incinerators include mercury, which causes birth defects, immune system damage, and nervous disorders; lead, which is known to cause nervous disorders; and cadmium, which causes kidney failure, hypertension, and genetic damage. Other heavy metals include arsenic which damages many tissues including nerves, stomach, intestines and skin, causes decreased production of red and white blood cells and abnormal heart rhythm. Chromium damages nose, lungs and stomach and beryllium causes chronic lung problems. Incinerators are significant sources of these forms of air pollutants. Worldwide, incinerators are the source of 21 percent of air emissions of manganese and lead, 19 percent of antimony, 15 percent of tin, and 11 percent of selenium.

## 3.3 Burying/Landfill

This is a product of 'out of sight out of mind' attitude. We hide our waste in deep pits or in sanitary landfills. Nowadays in urban areas solid waste filling is being used to reclaim wetlands or swamps . Economies which can afford money follow sophisticated ways of burying waste called sanitary landfills. Time has proven that landfilling is not a viable solution for waste disposal. Landfilling only leads to postponing a problem to a future date so that some one else takes the responsibility of solving it. Otherwise it is the relocation of a problem. Landfilling of unsorted municipal waste leads to a variety of problems, much of it associated with the organic material. The organic material decomposes, producing acids. These acids mix with rainwater, dissolve heavy metals and other toxics from the waste, and then percolate down through the landfill. If not stopped by a liner, this leachate will eventually contaminate groundwater or surface water supplies. If a liner and leachate collection system is in place, leachate treatment becomes an additional problem and expense. However, even with a liner, all landfills eventually leak. The decomposition of organic material under anaerobic (without oxygen) conditions produces large quantities of methane. Methane is a contributor to the "greenhouse effect," which is driving global climate change. Methane is also highly flammable, and landfill fires are common and difficult to put out. The uncontrolled burning of wastes in a landfill is likely to result in air emissions similar to those from incinerators. Besides this landfills emit a cocktail of toxic gases and liquids, which have to be managed on a day to day basis even after the closure of the landfill.

## 3.4 Centralised Mixed Waste composting

This is the result of perceiving waste as a technical problem. The basic assumptions behind this system are; People are inefficient, segregation at source is impossible, decentralised waste management is not economically feasible or practical, machines play a vital role in composting, non-biodegradable can be completely separated by composting unsegregated waste, composting is a hi-tech business which need expertise and so on. Common sense and experience shows that these perceptions are the cause of furthering the problem of waste.

Composting is a natural process and it is the microbes that do the work for us. Being a tropical region, our climatic conditions and characteristics of our organic waste are conducive for efficient composting. But when municipal solid waste is mixed and is centralised to form a huge bulk, the process of composting becomes problematic. There come machines, separators and vehicles to aerate, sieve and move the mixed waste mounds. The experience in India shows that this method is very inefficient and eventually fails, for various reasons.

These facilities are very capital intensive, demanding more money and space, but have low efficiency. Moreover the mixed composting process converts the valuable organic material into toxics. Presence of batteries, tube lights, household chemical containers and a variety of chemicals and toxics in our mixed municipal solid waste contaminates the compost. Tests have proved that such compost contains high levels of heavy metals and other toxic substances which are harmful to plant and animal life.

Generally speaking these processes are not scientific and sustainable. And they cause irreversible impact on public health and environment.

# 4. Tourism and Waste

Tourism is an industry whose capital is the environment and culture of a region. The industry is very sensitive to issues which affect its capital and waste is one of the critical issues. Aesthetics play a vital role in this industry and in addition it is also measured at each level by its consumers with yardsticks of social justice, protection of

environment and so on. A photograph of a waste heap may ruin a couple of tourist seasons leaving behind all those people who are dependent on this suddenly stranded.

A tourist region is a hub and meeting place for many cultures and lifestyles. Each culture and lifestyle is demarcated with the nature and type of the material they consume. Tourists introduce many ideas and products to a region. Local communities, who are not able to comprehend the pros and cons fall into the trap and get exposed to the impacts. Same is the case with waste left behind by the tourist about which many times communities have no clue. Many times the communities or their governments may not be in a position to handle these giant foot prints. All these accumulate adding to the pollution of the environment and contaminating the culture of the region. Approaches and systems to address these impending issues should be a pre requisite for each tourist destination. In short, rural tourism promoters have to initiate steps to avoid ruining rural tourism sites when tourism extends to rural India.

Emerging rural tourism is an opportunity to set up and showcase standard procedures and models of appropriate resource management to avoid waste. Let us make an attempt.

Behaviour change coupled with adequate systems and mechanisms are needed for addressing this issue of waste. The nature and magnitude varies from place to place reflecting the diversity of this country. No shortcuts, no standard formulae exist as a solution. A process-based approach is needed to evolve solutions for local issues related to waste. It has to be participatory, involving each and every member of the society at every stage of intervention. People have the wisdom and spirit. Motivation and facilitation is all that is needed to pool the ideas for evolving an effective and sustainable process to conserve local resources and to avoid waste.

World over a paradigm shift has taken place where in Zero Waste as an ideal goal for management of discards in the long run has found acceptance by many communities and countries. This helps in developing a strategy that avoids all unsustainable end-of-the-pipe solutions such as incinerators and eventually eliminates landfills. Zero Waste requires a mind shift in the community since waste is a human problem and waste from any source and of any quantity is a nuisance. Zero Waste campaign has taken root in India since 2000 and projects were undertaken at various locations in India which were successful. Achieving Zero Waste or even getting close is not going to be easy. However, it transforms the task from getting rid of waste to saving the resources. Hard work, perseverance and creativity by officials and public can make it happen.

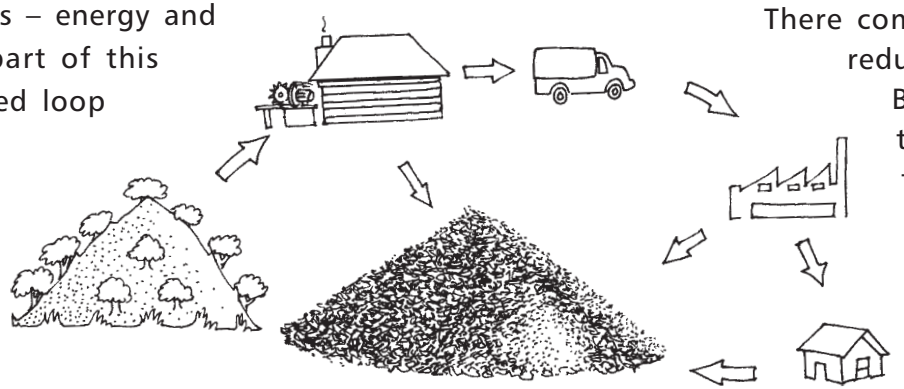
The fundamental question that we need to keep asking is “Why waste”?

Chapter 2

# Zero Waste Principles and Systems

## 1. Zero Waste – Principles and Systems

The mounting waste is a symbol of inefficiency and failure of a mankind that does not conserve and share the resources on earth with other living beings. Life on earth through millenniums has been made possible due to the natural cycles – energy and elements. We are all part of this unending cycles or closed loop systems.



**"Take - Make - Waste"**

Unfortunately we, human beings negate these cycles and interrupt it. We convert them into linear process which nature cannot afford. Look at the extraction, production, transportation, consumption and wasting processes which we follow? How much of the energy or material which we use is ploughed back to nature to form a closed loop system? Are we doing anything to replenish the natural resources so that our activities are sustainable over a long period of time? No, we follow linear systems and it cuts the cycles and causes resource depletion on one end and exponential increase of toxic waste on the other end. The 'take, make and waste' mentality that has guided our economy for decades must be replaced by the desirable and visionary goal of zero waste. Our human economy is undeniably dependant on nature's economy.

We all know that resources are limited. There comes the importance of reduce, reuse and recycle. But is it enough to handle the danger we all are facing now? If you attempt to answer the question "Why waste?" then probably you will find that this 3Rs are not enough. Perhaps we have to address waste not at end of the pipe, but up-stream. The idea of Zero Waste is a result of exploration in this thought process. It tries to understand natural systems and it functions so as to device processes and mechanisms to build closed loop systems.

*'Zero waste is a logical planning approach incorporating principles of effective human and material resource utilization to avoid the conversion of discards into waste – an inefficient form – in a manner that revitalizes the local economy.'* (Zero Waste Alliance, www.Zero Waste.org)

Zero Waste requires a mind shift. We have to change the task from getting rid of waste, to one of ensuring sustainable material practices at the front end of the manufacturing process. Communities faced with discarded materials and objects they cannot reuse, recycle or compost have to demand that industry stops producing them. Total recycling is not approachable without industry's help. Thus, Zero Waste consciously links 'community responsibility' to 'industrial responsibility' and eventually to responsible policies and governance.

Zero Waste combines community practices such as reuse, repair, recycling, toxic removal and composting, with industrial practices such as eliminating toxics and re-designing packaging and products for the key demands of the twenty first century: the need to develop sustainable communities and sustainable production systems.

Zero Waste combines ethical practice with a solid economic vision, both for local communities and major corporations. On the one hand, it creates local jobs and businesses, which collect and process secondary materials into new products, and on the other, it offers corporations a way of increasing their efficiency, thereby reducing their demands on virgin materials as well as their waste disposal costs.

# 2. Principles

The fundamental principles of Zero Waste are; Ethics, Efficiency and Economics or in short the 3Es

3Es propose a paradigm shift in terms of resource conservation and management in a Zero Waste Society. It calls for ethical and efficient material use patterns and consumption patterns to bring in economy for the community. It does not allow misinterpretations since the parameters are very clear.

## 2.1 Ethics

It denotes an approach with consideration to mankind as well as nature; it also denotes fundamentals of equity and justice; it reminds mankind of its responsibilities to society and nature. For example ethical use of water at home saves water so that more people can use it.

## 2.2 Efficiency

Efficiency is optimum benefit from minimum resource. It is applicable for services as well as materials. For example efficient use of energy in any form at home will protect our last forests.

## 2.3 Economics

Economics denotes not just private profit; collective benefit to a society as a whole which will help the economy to move forward ensuring welfare of all members and preserving the environment for future generations. For example purchasing products available locally will eliminate packaging waste as well as create economic opportunity locally.

# 3. Components of Zero Waste

Zero Waste is a growing science. Broadly identified components of zero waste systems are:

## 3.1 Building Relations

Waste is also a symbol of broken relations in our society. It also reveals lack of trust. Community development and community building is possible only through better personal and societal relationships. For example lack of trust in our local baker, tempts us to buy branded, plastic packed snacks treated with preservatives for longer shelf life. At the same time local baker who suffers from reduced sales may start using cheaper quality materials to compensate his loss. This will eventually lead to closure of his business. So here we lost one livelihood and added more plastic waste. In another example, in Kovalam in Kerala, some of the hotels gave technical support in terms of standards for production to local women group to produce pickles and other ready to eat food. This in turn saved them lots of plastic packaging waste since the women group supplied them products in safe reusable containers which they used to take back. Social conflicts due to outsourcing of products and services in tourism industry are quite common. To get the components of rural tourism viable and sustainable, this outsourcing has to be stopped so that it will support the local economy. Rebuilding relations and trust in the society to enhance circular flow of materials will prevent waste and create more economic opportunities. Zero Waste provides a space for greater interaction between individuals, communities and institutions.


**Community Consultation - Pranpur, Madhya Pradesh**

## 3.2 Policy/Law

There are international and national policy frameworks and laws. They provide guiding principles within which we should draw our own policies at government and institutional level to address the waste issues we face in our region. Policies such as promotion of durable and reusable goods against disposable goods, incentives for resource conservation etc. need to be incorporated into the policy. We have to consider extending the scope of globally accepted policy of Extended Producer Responsibility to more materials and products for which we don't have solutions. 'Malinya Muktha Keralam' is the policy of Government of Kerala launched in 2007 to solve the waste issues in the State. This policy is based on zero waste where Government supports source segregation of waste, decentralised waste management, resource recovery and participation.

### Participation-an example

There could be better bargains and regular markets if one can network with needs of another player in the market. Akshara, the NGO working on the Endogenous Tourism Project facilitated for a contract between the community of Pochampally and ITC. The deal is for recovering paper waste generated in the village. The people segregate and keep paper which is bought by ITC at the rate of Rs.5/kg irrespective of type and nature of paper. The rural setting where paper are often dumped or burnt has a new way of ensuring that every paper goes back for recycling and ITC sends them for recycling at *Bhadrachalam Paper boards*. We see this as a good example for partnerships of community with private sector to keep destination clean and recycling resources.

## 3.3 Participation

The key element of zero waste is participation. Each and everyone in the society should have a space and role in a zero waste community for resource conservation and resource recovery. For example in Kovalam, women, children, hoteliers, merchants, tourism department and Panchayath came together to address the waste issue by identifying their own roles, duties and space. In Kerala, the panchayaths prepared their waste management plans with the involvement of gramasabhas at the ward level and with the support of voluntary organisations and individuals. Zero Waste is a creative and positive process. Involvement of people should be ensured from planning to implementation. If a person decides to use cloth bags instead of plastic bags, imagine the amount of money he is saving for his Government in terms of waste management?

## 3.4 Resource Recovery

It is the sum total of thoughts, systems and practices designed for efficient recovery of resources to close the loop of resource flow. It includes segregation at source, recycling, re-using, repairing, reconstructing, refurnishing....and composting. Just look at your local scrap dealer and


**'Balloons for hair' -
A scene from Pranpur**

## Resource Recovery some experiences from ETP sites

Pochampally, a village in the state of Andhra Pradesh is famous for its silk sarees. Pochampally is also a rural tourism site where it showcases the tradition of weaving, dying and art. They have an interesting way of resource recovery. The People keep the scrap metals and plastics in homes and later exchange their scrap metals and plastic discards for onions! The hawkers who do this business visit the village on regular intervals to collect scrap metals and plastics. This trade is an example of resource recovery, happening with out institutional support or thought we could find many such examples in Indian Villages and with bit more creativity and planning these could be better linked with waste/ discard management and save valuable resources without wasting them in addition to keeping the place clean.

When we look around for solving waste/ discard problems we may have several good working examples in other villages that we can emulate. Cut human hair is dumped in all the rural areas openly as waste and some communities may burry them. Pranpur, a village in Madhya Pradesh famous for traditional weaving of silk and metal works has a solution to share with rest of Indian villages. In this small village, children collects cut hair waste and wait for the trader in the bicycle. He visits the area and the colorful balloons are given to the children who can give him the cut hair. The place is clean and children happily play with the balloons they earned by managing a discard.

The Girls in Kovalam realized that the cloth discards dumped by the tailors as waste has potential as raw material they provide sacks to the tailor shops and pick the waste at regular intervals. They found that there is good diversity of cloths as there is many types of cloths stitched and there are also exotic cloths often brought by Tourists. With training from the Zero Waste Kovalam initiative they formed a woman collective "Vismaya Patch working Women's Lives" the group now makes over 50 different cloth products and have specialized in cloth banners. All use tailor discard as raw material. The six member group makes more than 1.25 lakh worth products every year and has good domestic buyers and people who appreciate their creativity of waste to art.

find out what all materials he is trading in! You will be surprised to see the classifications he has for the materials which we consider as waste!

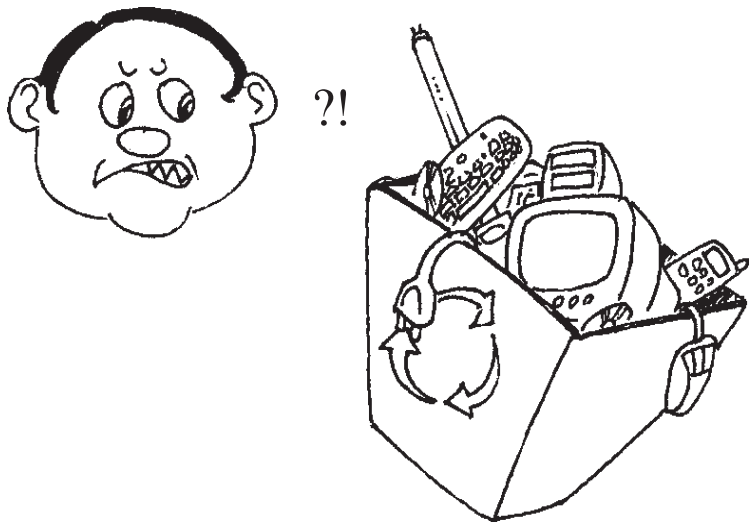
Resource Recovery Facilities have to be created for sorting, cleaning, storing and streamlining of the discarded materials so that resources flow back to the production process. Incorporation of people of unorganized sectors like rag pickers (kabaadi walahs) into this system will make it efficient, smooth and just.

## 3.5 Material Substitution

It is a globally accepted principle which has been adopted in the Stockholm Convention (2001). It aims at substituting the toxic and unsustainable materials with locally available and eco-friendly sustainable materials. For example we replaced our good old glass tumblers with disposable plastic cups and now we have a problem of plastic waste! It is still possible us to go back to reusable cups. Materials like plastics and other unsustainable materials can be replaced with cloth, jute, paper, clay, leaves, and metals and so on. Capacity building at community level is needed for better ideas, products and material use practices. Capacity building at Government level is needed for making policies to promote better materials and services.

## 3.6 Extended Producer Responsibility

It is the principle that producers bear a degree of responsibility for any environmental impact of their products. This includes upstream impacts arising from the choice of materials and from the manufacturing process and downstream impacts from the use and disposal of products. Producers accept their responsibility when they accept legal, physical, and/or economic responsibility for the environmental impacts that cannot be eliminated by design. As each day goes by lots of materials and products are being dumped, in our rural environment especially in rural tourism sites, for which we don't have a solution. The most economic way of dealing with them is to send them back with the person who brought them. Don't you think that the producers of batteries, tube lights, and various plastic products should be held liable for their products before they reach the waste stream?




## 3.7 Clean Production

Clean production is a way of designing products and manufacturing processes in harmony with natural ecological cycles. It aims to eliminate toxic waste and inputs and ultimately promotes the judicious use of renewable energy and materials. Clean production is a growing subject and science. Globally experiments and explorations are on for clean production methods and materials. Clean production is possible in farming by following organic farming.

Zero Waste is a goal, a science, an approach, a system, a process and most importantly a way of life which is not new to Indian civilization. It was there in our cultural heritage. Let us revive it for conserving our nature and culture.

Zero waste provides for infinite and creative ideas rooted in ecology. Exploring them challenges creativity and when creativity emerges waste disappears to zero. From mere resource management zero waste takes us to lifestyle, culture, building relationships and linking everyone to this earth and its life supporting systems.


*Photo: Shibu K. Nair*

Chapter 3

# Procedure for setting up a Zero Waste System

The essential elements to be followed while preparing a road map to set up a practical discard handling system based on zero waste principles is described below. These procedures can be modified to suit local conditions.

## 1. Preliminary Preparation

Remember that setting up a zero waste system is not just building physical infrastructure, it is also a process of social engineering to create qualitative change in behaviour of people. It is a very creative and challenging job which needs patience, perseverance and persistence. This can be taken up by a group of self motivated, committed people with fire in their hearts for a social change.

### 1.1 Core Team

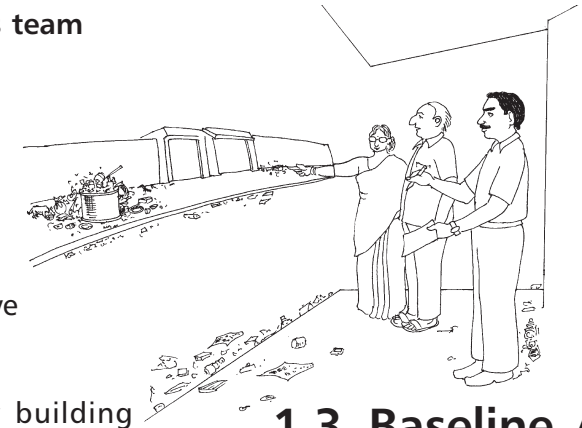
The first step is to form a core team (Village Development Committee or Grama Panchayath can identify people or entrust it to a voluntary organisation to form a core team) and start deliberations and discussions to ignite the process of setting up the zero waste system. Ideally the core team should include the following expertise:

- Knowledge about social work and social dynamics
- Knowledge about the people and issues of the locality
- Ability to organise training programmes on capacity building
- Knowledge about social research, analysis and interpretation tools (basic statistics)
- Sound public relations with different sections of the society.

This core team can act as the Technical Advisory Group (TAG) who defines the broader framework and directions for the process. In most of the places it will be a team of like minded people or a voluntary organisation.

**The major functions expected from this team are:**

- Creating a framework for the system
- Organising data collection and studies
- Preparation of Approach paper to solve the local waste issue
- Facilitating/Coordinating capacity building programmes
- Preparation of a campaign plan and designing education programmes
- Facilitation, motivation and coordination of planning and implementing process.
- Monitoring, Evaluation and Trouble shooting



## 1.2 Approach Paper

The core team has to do a field visit to prepare an approach paper. The approach paper may contain a description of the local physical and political geography, demography, social background and major occupations/activities/trade etc. to give an overview of the region. A general observation report on major waste dumps, waste generation points, existing waste disposal mechanisms, and people involved, institutional mechanisms-strengths and weakness etc. will be helpful for planning. Also it will be good to have information about the opportunities, expertise, materials and systems that exist in the locality. For example, the number of waste traders and the materials they trade on, number of farmers, artists or artisans in the locality, materials that can be used for material substitution, sustainable livelihood options etc.

This approach paper has to be presented before the community for discussion and inputs should be considered.

## 1.3 Baseline Assessment

Based on this approach paper detailed studies have to be commissioned to do a baseline assessment of:

1. Source, nature and quantity of waste generated
2. Level of awareness, attitude and behaviour of people in handling waste
3. Opportunities and potential in terms of material, expertise and institutions

Analysis of these studies will determine the direction of the process to reach Zero Waste in your locality. This is a very important phase and needs more people on the ground to carry out the study. The core team has to develop a resource team or local volunteers from the locality. The Resource Team has to do primary data collection and reporting to the Core Team. This resource team will graduate themselves as social animators or campaigners along with the progress of zero waste programmes. People with basic education/ communication skill, self motivation and commitment

may form the resource team. Core Team has to conduct an orientation session and training for the Resource Team to get them ready for coordinated action.

# 2. Understanding the Issue

It is very important to have a clear perception about waste and local waste issues. Even though the general issues and concerns about waste are the same everywhere, the gravity varies from place to place. Remember that consolidation or generalisation of waste will not help to find a way out. Because waste occurs in a decentralised manner, any effort to centralise it is likely to aggravate the problem and lead to failure. The process which will give a fairly clear idea about the waste in any locality is described below.

## 2.1 Data Collection

Information on quantity and quality of discards generated in a particular area along with demographic information is necessary to develop a sound zero waste plan. In some places, there will be information readily available. It can be found from census reports, project reports prepared by Local Self Governments or any other institutions, academic research conducted by educational institutions, social research reports of voluntary organisations, books of accounts related to waste management, press reports, annual reports etc. In order to supplement this information, primary data collection can be carried out.

### 2.1.1 Socio Economic Surveys

Demographic information such as population, number of families, age group of people etc. and information regarding number of commercial establishments and other institutions, quantity of waste generated, types of waste generated, the way waste get disposed, people's attitude and their level of understanding etc. are the minimum information expected from a socio economic survey for setting up a discard management system.

The questionnaire prepared should be able to extract the above details. It should be simple, straight and unbiased. The interviewer should not impose his/ her idea or answers to the interviewee. The survey process should be a friendly one which does not need much probing. A model questionnaire that can be adapted to local conditions is given in *Annexure - 1*.

Utmost care is needed in surveys since the information generated is going to be the baseline data for all future programmes to manage discards and resources. There are many instances when such assessments arrived at the quantity of waste generated, and later when the systems were built for these high quantities, there was not enough waste to feed the system, leading to technical failures and financial losses. Scientifically, any statistical survey needs minimum 20% reliable response of the total population for the analysis. Hence the survey should be able to generate data sheets with clear and complete answers from at least 20% of the population. It will increase the reliability of the data and will help to identify the trend. Moreover, the data collection should cover all the different sections of the society and all geographic areas. It is suggested that the interviewer visit the interviewee at his/her place and collect data directly. It is always good to avoid asking the interviewee to fill up the questionnaire by themselves. The questionnaires should have a serial number and identification mark of the interviewer. Never argue with the interviewee while doing the interview. Be very polite and unbiased while collecting the information. It is advisable to send a team of 2 to 3 people to collect information rather than one person alone.

### 2.1.2 Mapping

Make a map of the area and plot the places where people dump, burn, or bury waste. This map can also have a pictorial representation of the present flow of waste. It will give a visual sense of waste accumulation and flow of materials. Along with it, plot public amenities and institutions like public taps, parks, schools etc. in the map. This can be developed through Participatory Research methods also. The maps can also be used later to demonstrate the changes as the project proceeds.

### 2.1.3 Observation/ Interview reports

Observation reports are meant to create a better understanding of the issue pertaining to a specific sector. For example, an observation report on farmers, farming process, the problems they face, a study on scrap dealers and seconds market/the status of micro enterprise units and other service sector business in the locality, etc. will help in understanding the use of resources and will eventually help design a good action plan for discard management.

Observation reports can be made on following topics:

#### a. Farming

Number of people involved, number of crops and their status, main problems, demand for farming inputs like manure, scope of organic farming, institutions in place to support farming and marketing.

#### b. Scrap Market

Number of rag pickers in the locality, number of small scale and large scale scrap dealers, the scraps they are dealing with, classification of scrap materials,

price list, regularity of collection, average income generated,the quantity of materials traded.

### c. Micro Enterprise

The status of micro enterprises, the products and services they provide, scope for new products and or services, economical viability, the problems faced by the existing units.

### d. Natural Resources and Human resources

The natural materials available in the locality (for example, screw pine, bamboo, clay, waste cloth, paper etc.), the skilled people in the locality, people who are interested in developing skills and livelihoods, kind of training programmes needed.

### e. Markets

The existing market for organic products, scope, problems, the existing market for non agricultural products and services. Re-use, recycling status of households and institutions

### f. Technology

Explore about the institutions/people who can be approached for technical support and technology for discard handling.

## 2.1.4 Clean-up drive

Clean-up drives help in generating data on discards at public places. At the same time, this activity can be a tool for public awareness. It's a great motivating tool where people from all walks of life, especially the organised sectors like school children, workers, unions, traders etc. can be involved. In many places a clean-up programme ends up with a huge pile of mixed waste, management of which is a big problem. As segregating collected mixed waste is next to impossible, it is recommendable to assign groups that would collect specific materials during clean up. For example, divide the people who volunteered for clean up drive into groups. Each group should have minimum 2 people. Assign an area for each group and ask them to pick only a selected type of discard. The paper group for example, has to pick only dried paper; the glass people have to pick only glass bottles or pieces, the plastic carry bag


**Clean-up at Lachen, Sikkim**

group have to pick only carry bags and sachets. In this way creating specialist groups will make the work easier and give clear cut information regarding the quality and quantity of discards in the public domain. Moreover, the resultant waste is easy to sell to recyclers since it is segregated.

## 3. Data analysis and interpretation

Reading the relevant information from the data collected is very important. For this, data has to be processed and interpreted logically. Care has to be taken to prevent losing the information value of data collected while processing. Also prepare priority lists in terms of issues and activities. Besides statistical tools, mapping and power analysis can be used for analysing the situation. The data analysis should be able to provide information regarding:

a. Number of households, commercial establishments, markets, institutions

b. Number of places and location of waste dumping

c. Major source of waste

d. Characteristics of waste (content, quantity, nature etc.)

e. Quantity of waste generated per day in households, institutions, markets and public places

f. Quantity of biodegradable discards generated

g. Quantity of non-biodegradable discards generated

h. Attitude of people

i. Present way of waste disposal followed

j. Number of ragpickers and scrap dealers in the region

Besides these statistical information, information about social structure, institutions, power structure etc. have to be derived from data analysis.

## 4. Policy formulation

Based on the data analysis a broad policy frame work has to be developed for the locality which will support the realisation of Zero Waste. A Zero Waste policy has to be drafted incorporating all the components of Zero Waste philosophy suitable to the locality focussing on material use, waste reduction, source segregation and decentralised disposal/recovery options. Suggested components for a zero waste policy is given in *Annexure - 2*

## 5. Draft Action Plan

A draft action plan has to be prepared along with a realistic timeline and budget. Logical Frame Work Approach can be used as a tool for making this plan where goal, objectives, outputs and activities are listed in a

logical sequence along with measurable indices of change. A draft action plan will have hardware and software components. Hardware is the physical infrastructure to be created in the community for achieving zero waste. Software is the programmes and processes which will create a behavioural change in people and enable them to optimum utilisation of hardware facilities created, therefore the software needs more thrust. A model Logical Frame Work and action plan is given in *Annexure - 3 and 4.*

## 6. Community Consultation

The study reports and its findings, policy, strategies and draft action plan have to be presented back to the community to get their consent. The sectoral plans have to be incorporated in the draft plan only after its discussion in the concerned interest groups. For example, farmers, students, teachers, political parties, commercial establishments and traders, government officials etc. should be consulted before incorporating plans concerning their interest. This process will help to get the community to take the ownership of the programme and make it sustainable. The comments, suggestions, criticisms and inputs from these consultations have to be incorporated to make the draft action plan a complete one. It is always good to get the approval of Local Self Government to get their support in terms of finance and administration.

## 7. Fund raising or identifying resources

A close examination of the action plan, budget and timeline will help to estimate the quantum of money, human resource and material needed to implement a zero waste programme. Wise utilisation of available funds and encouragement for voluntary contribution in terms of labour, material and money will solve the problem of resources. Integration and coordination of identified activities with programmes or projects or activities of other departments, agencies or institutions will avoid overlapping of activities and thus saves money. For example, household level composting activity can be linked with agriculture programmes to avail financial and technical support. Socio economic surveys and door to door campaigns can be carried out through community

service programmes of schools and colleges nearby. Salary of Parisara Sevikas (Sevaks) can be raised through sponsorship of a tour operators and or hotels.

# 8. Implementation

Now it is time for implementation since action plan is ready and funds are available. Implementation need not be a sequential activity, several actions can happen in parallel. Following a timely logical sequence will be wise and it depends upon the local situation and wisdom of people who are implementing the program. Let us look at the steps in implementation.

## 8.1 Building capacity

It is the process of getting people ready for a change in behaviour or practices. It is an important and sensitive process. The logical sequence for this will be creating awareness through dissemination of information; transforming the awareness into behaviour change; and equipping people to adapt to a changed situation. Altogether it is a kind of capacity building. It will be in different form and intensity at different levels of the community. Remember that each and every infrastructure/ hardware/practice that we want to establish in the community should be supplemented with adequate and timely software components. This should lead to a determined and self motivated community wanting to engage in various elements of the action plan to achieve Zero Waste.

To begin with the community should be informed about the programme, targets and milestones. It can be done through organising a public meeting or programme to launch zero waste action plan. To sustain the message in the community different activities have to be planned and strategically positioned. Some of the activities can be as follows:

### 8.1.1 Leadership Training

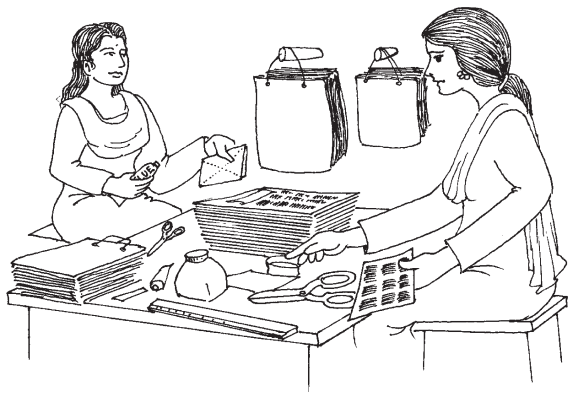
Identify interested people from the locality as local environment leaders or animators. Organise training programmes to give them an overview of Zero Waste and insight into the issue of waste in their locality. Motivate them to take the leadership in mobilising and sensitising their neighbours and facilitate learning processes in their neighborhood. Women play a great role in this and they have to be involved. The local leaders or animators should help in door to door campaigns and interventions in local specific issues. These people will form the catalysts to sustain the message of zero waste and they will provide

the continuity for the programme. Leadership training programmes can be organised for students, trade union members, farmers, traders, house wives, voluntary organisations, clubs, youth etc.

## 8.1.2 Vocational Training

It is very important to change the perspective of people about waste. Vocational training programme is one of the best tools for this. Traditional Products and practices which are economically and ecologically sustainable and generate less waste should be encouraged . New uses for such produce can be found and training programmes, design workshops etc. can be organised for this. These have to be linked with the waste reduction or material substitution programmes of zero waste. People should be assisted to revive or develop skills to produce such products. For example, most of the plastic products can be avoided by replacing them with products made of leaves, paper, cloth, jute, clay, metal and so on.

Organise regular training workshops and skill sharing sessions so that people can use these skills to make a livelihood. Promotion of organic farming, handloom and such traditional practices and repositioning them with their ecological importance is critical. Intensive training programmes can be organised for selected people on vermi composting, composting and biogas installation so that they can become the local service providers for resource recovery in the locality.



Moreover, these training workshops will give visibility to zero waste initiatives and help to increase its acceptance in the community.

## 8.1.3 Enterprise Development

Vocational skills alone will not be enough to survive especially in the new competitive markets. It has to be supplemented with enterprise skills for effective marketing. Training programmes organised to develop skills in communication, correspondence, basic book keeping and accounting, pricing, business organisation, banking, computing, marketing etc. will enable the people to cope up with new systems. Enterprise development does not end with a training session. It needs a handholding process where professionals or volunteers need to interact on and off with the people running small scale business. Zero Waste Programmes should provide for such opportunities. Now it is relatively easy to get volunteers since many management students want to work in the rural business sector as part of their program or out of personal interest. These opportunities should be created by liaisoning with Education and Training institutions.

## 8.1.4 Planning and Project Management

It is also very important for the officials, elected representatives and other people engaged in policy formulation, project planning and implementation to get updated or refreshed on planning, budgeting and project management skills. Such training programmes will be a motivation for them to support Zero Waste programmes and will result in effective implementation .

## 8.1.5 Campaign


A Campaign has to be launched to bring the necessary change in the approach of the people. The campaign should address the local issues well and should be strong enough to retain the messages for a long period of time. The vehicle for a campaign has to be selected very carefully after considering the culture, religion, social set up etc. of the locality. A team of people should take the responsibility of the campaign. They have to decide the messages, tools to be used, programmes to be organised etc. in the campaign. People from voluntary organisations, teachers, artists, people with technical as well as scientific background etc. can help in this. They have to sit with the resource team to design a campaign strategy for the locality.

The possible campaign tools are as follows:

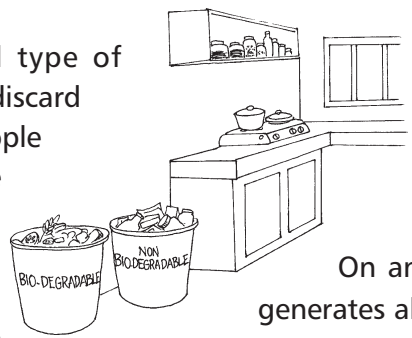

Posters , Brochures, Notices, Public meetings, Door to door visits, Clean up programmes, Cultural events, Drama/street plays, Processions, News paper/TV reports/ programmes, Exhibitions, Competitions, Film shows, Public announcements/radio announcements, Ticker in local cable TVs etc.Campaigns are an useful tool for bringing in desired changes in community behaviour. Specific themes or issues can be identified as the focus of the campaign and continuous activities have to be planned for reaching it to the public. Strategically placed messages, icons, images and even sounds will sustain the focus of the community on the specific issue. For example, a campaign to reduce the use of plastics can be through dissemination of information about impacts of plastics on our health, environment and livelihood.

### 8.1.6 Organising and sensitization

There will be a silent section in the community living in the margins - Rag pickers, small scale scrap dealers, house maids, sweepers, and so on. They have to be brought into the main stream to utilise their skills and valuable services to enable the flow of materials to avoid wasting. Rag pickers can be mobilized to avail their services in linking discard materials to the recyclers. These rag pickers should be respected for their services. Providing them identity cards as local environment managers (Parisara Sevika/Sevaks) will boost their morale and enhance their standard of living. Adequate programmes like insurance schemes have to be organised to protect their livelihood, health and education. They can be involved in additional activities like gardening, management of compost operations etc.

## 8.2 Designing systems

The next step is designing the size and type of infrastructure or hardware components for discard handling. This is a danger zone where people always get trapped. In many places, waste management programme starts with purchase of dust bins, transportation vehicles, and other equipments. This is an absolutely wrong thing to do. We have to decide the flow of discards in our community, before taking decisions on infrastructure. There are a lot of questions to be asked about waste.




- What it is ?
- How much?
- Where it is?
- Is there a need for storing? If yes how much and where?
- Where is it going? And by how?
- Who takes it? And what is his/her capacity?
- How it is being utilized/disposed?
- Who all are taking responsibility throughout the line?

After this only we can decide whether we need dustbins on street corners or houses. Only after this thought process is complete we should choose the transportation mechanism, technology etc. Hence it is very important to ask these questions repeatedly to get clarity. There are no uniform designs which can be replicated just as it is. Local specific, community specific designs have to be developed for discard handling. Let us look at different sectors.

### 8.2.1 Household level

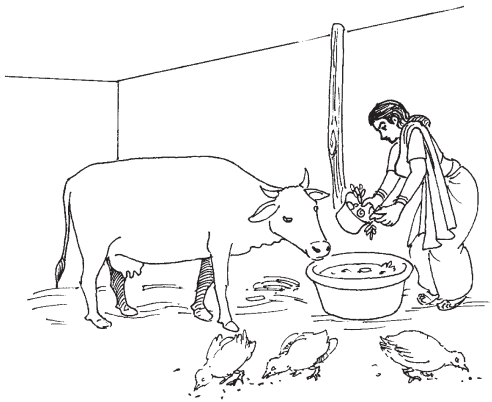
On an average, a family consisting of 4 members generates about 1000gms to 1500gms of waste per day. 60-70% of it is biodegradable. So it is very easy to address the issue at household level. Motivate the maximum number of households to have source segregation and disposal of biodegradable discards at source. This is the

simplest thing that households can do, but it is always difficult to motivate them to do this. It needs continuous monitoring and campaign. Ask every household to do two bin segregation - biodegradable discards and non-biodegradable discards. This will avoid placing dust bins on the streets.

Motivate maximum households to dispose off biodegradable discards at their premises through the following ways:

a. Feeding it to animals – Most biodegradable discards can be fed to domestic animals and cattle. It is the most efficient way of disposing food leftover, raw vegetables etc. Make sure that they are not rotten nor contaminated by dirt or soil.

b. Composting/biogas – simple pit/drum composting, vermi composting or biogas generation. (See *Annexure – 5*)

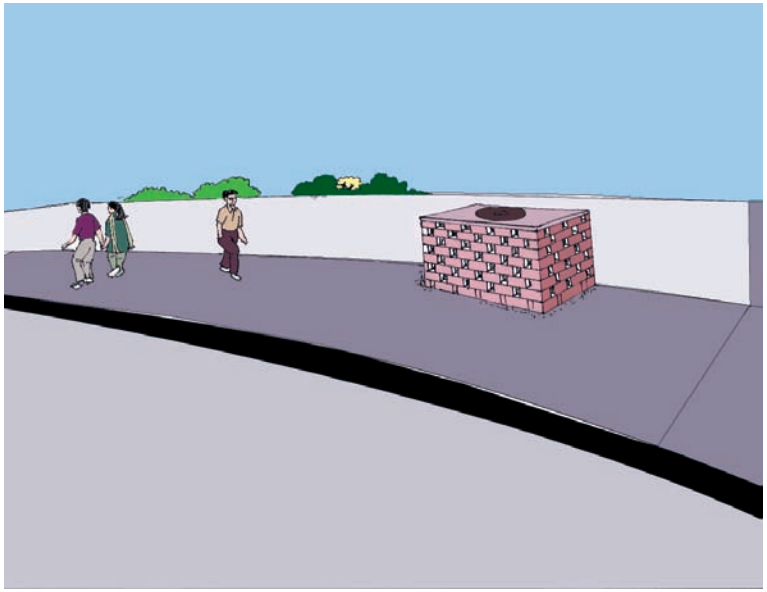


Non-biodegradable discards have to be segregated, cleaned, and stored separately in a safe place. Three or four old sacks/bags/plastic covers/cartons are enough to do this. Keep them in the back yard shed or just behind the house. One bag/box is exclusively for plastics, the other is exclusively for paper, the third for metal and glass. Hazardous materials have to be stored in a safe place out of reach of children. Once in a month it can be emptied to the community collection system or can be sold to the scrap dealer. Hazardous things should be deposited to the Local Self Governments' containment facility.

## 8.2.2 Community level

Still there are some households that may not have space for disposing biodegradable discards at home. In thickly populated areas, multi-storied apartments, slums, colonies etc., it is not practical to run composting or biogas plants to handle biodegradable discards. Such places can go for cluster systems/neighborhood systems for 10 to 100 households and or commercial establishments.

A monitoring committee has to be formed by the residents to liaison with LSG for support and to monitor the operation and maintenance of community level discards collection – transportation and disposal system.



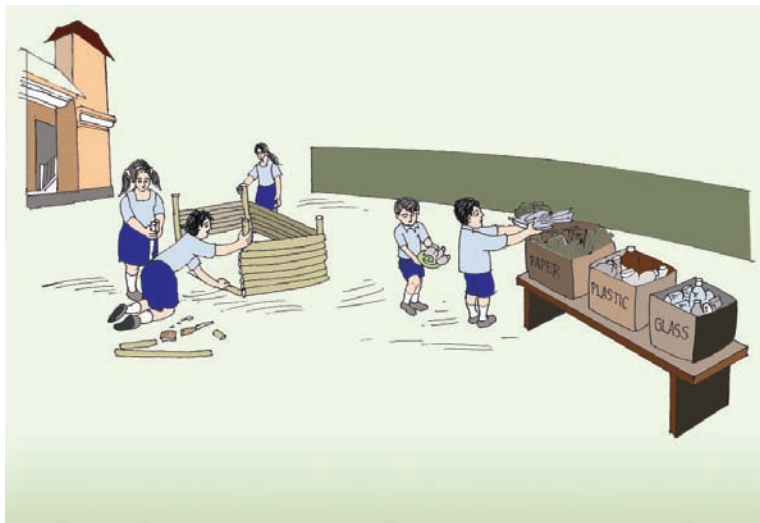
A community level facility can be run with the help of Parisara Sevaks/Parisara Sevika (PS), who will monitor household level segregation process and will run a community level compost/vermi compost or biogas plant for the community. PS will do door-to-door collection of biodegradable discards on a daily basis, which will be disposed in the local facility daily. The non-biodegradable discards will be collected once in a week and will be routed to the local scrap dealer and or common facility.The members of such cluster facilities should be motivated to take up the ownership of the system, operation and monitoring. Otherwise it will not survive. Each and every member has to take the responsibility to ensure that the segregation, collection, transportation and disposal process is running smoothly. The members also have to contribute money as user fee to sustain the service of PS.

Community projects will be viable only with voluntary support from the community. Ensure maximum voluntary support from the community to minimize the cost of operation and subscription fee. The subscription fee should be decided in consultation with the community members.

Ensure cooperation of local self Government for handling hazardous as well as inert discards in the common facility.

## 8.2.3 Institution level

Institutions – commercial/government/educational – should be encouraged to have own facilities to handle the discards generated by them. Community halls, marriage halls, hotels, restaurants, shopping complexes, government offices, schools, colleges, hospitals etc. can have their own facilities. The head of the institution/ owner has to take ownership and depute a member of



staff/workers/student committees to run the mini resource recovery facilities or alternately they can avail the service of the Parisara Sevika/Sevaks in the locality. Source segregation is mandatory as in the case of community level facility. They can establish a complete resource recovery facility or an interim storage space so that discards can be handed over to the common discards collection system.

Showcasing model resource recovery facilities in institutions, especially educational institutions play a vital role in motivating the society and also provide for hands on experience. Concepts like Zero Waste School, Zero Waste offices etc. should be the target for institutions so that they can be the role model for the society.

### 8.2.4 Common Resource Recovery Park

Every Local Self Government should have a common facility called Resource Recovery Park (RRP) which will address the discards generated in the public places and places where space is not available for disposal of waste. Individual households, institutions, multi family systems like flats, residents associations, community facilities etc. can utilize common facility for depositing the unmanageable discards in their disposal facilities. Resource recovery park is the new trend in discard management. Based on functions and concepts there are many types of resource recovery facilities. It is in use in different parts of the world. The basic elements of a resource recovery park is as follows:

a) **Office:** An office space for administration of the Resource Recovery Park.

b) **Shop:** It will be the trading hub for second hand products and scrap materials.

c) **Rest room and tools room:** A toilet and changing room for the workers should be a part of the RRF: There should be a separate room for storing implements and tools.

d) **Storing facility:** Cleaned and sorted non-biodegradable discards and processed compost will be stored in this facility.

e) **Containment:** Hazardous materials will be stored safely in this facility.

f) **Composting Plant:** Slow decaying materials are composted aerobically in this facility.

g) **Vermi composting Plant:** This is to supplement biogas and aerobic composting facilities.

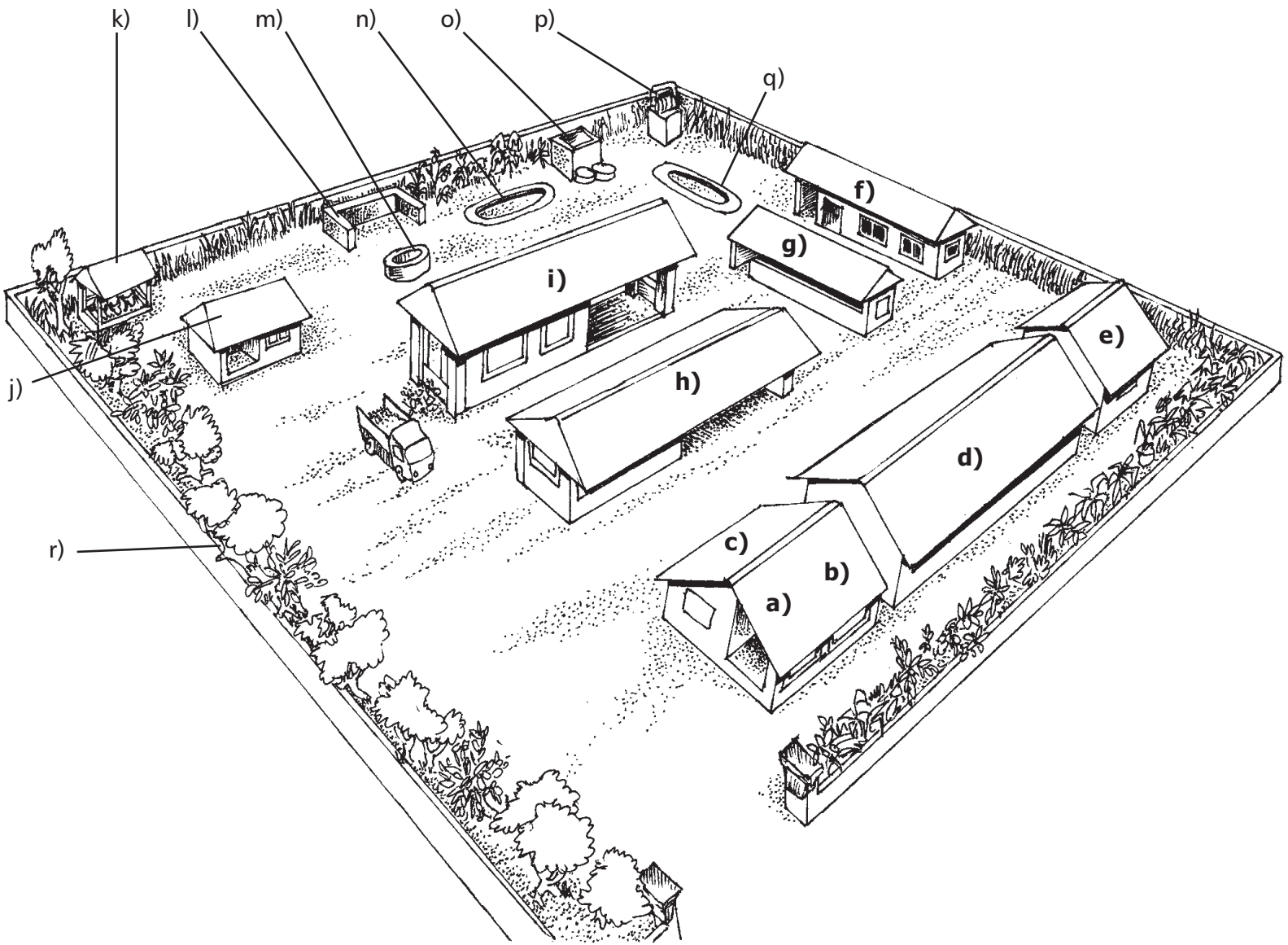
h) **Sorting and cleaning facility:** Non-biodegradable discards will be cleaned and sorted here. They will be dried in the sun.

i) **Transfer station:** Here segregated discards will be unloaded for processing. All biodegradable discards will be sent to animal feed/biogas plant/compost unit.

j) **Interpretation Centre:** A Classroom for Training, orientation and awareness programmes.

k) **Animal shed:** For keeping the animals which can

# Lay out plan of a Common Resource Recovery Plant with suggested components



feed on vegetation grown in the facility and can provide dung to be used in biogas and composting plant.

l) **Inert store:** Space for stocking inert materials like, construction debris, sand and grit.

m) **Water source:** Open well/Borewell/piped water connection to provide water for the facility

n) **Rain Water Harvesting Facility:** Tank for storing rainwater

o) **Biogas Plant:** This is for managing fast decaying materials like, food discards and meat.

p) **Energy conversion:** This is for converting energy from burning of methane produced in the biogas plant. It can be a stove, water heater or electricity generator.

q) **Grey Water Recycling unit:** This is for recycling and treating the water discharged from the Resource recovery park

r) **Vegetable garden/green belt:** This is to utilize a part of compost and to prevent foul smell, if any.

The space requirement will vary from 10 cents to 2 acres for handling 100 kg to 3,000 kg of waste. If it is very difficult to find enough space as a single plot, the components of RRF can be further decentralised and can be spread over the LSG. For example, the biogas plant can go to the market or slaughterhouse, composting facilities can be distributed throughout the LSGs, in school/office campuses, public places etc. LSGs can externalise the cost of recovery of non-biodegradable discards by providing assistance to the local scrap dealer to modify his facility to take in non-biodegradable discards from the collection system of the LSG.

The Resource Recovery Park has to be managed by a team of Parisara Sevikas/Sevaks. Sales of scrap materials and vegetable will form a part of their income. They must be sustained with monetory support from the Local Self Government.

Even though the RRP is under the ownership and close supervision of the local self government, it always good to form a committee consisting of representatives from different walks of life to monitor and evaluate the functions.

### 8.2.5 Collection – Transportation – Recovery

In every community, there is need for a collection and transportation system for discards. The need for such a system is mainly to address the issue of non-biodegradable discards, that have almost no on-site disposal facility. In some places collection and transportation is needed for both biodegradable and non-biodegradable discards since there is no space for storing or disposing discards. The collection and transportation mechanism need not be a centralised one. Each community facilities can have their own collection transportation systems which will reduce the cost. Collection and transportation system may require in the

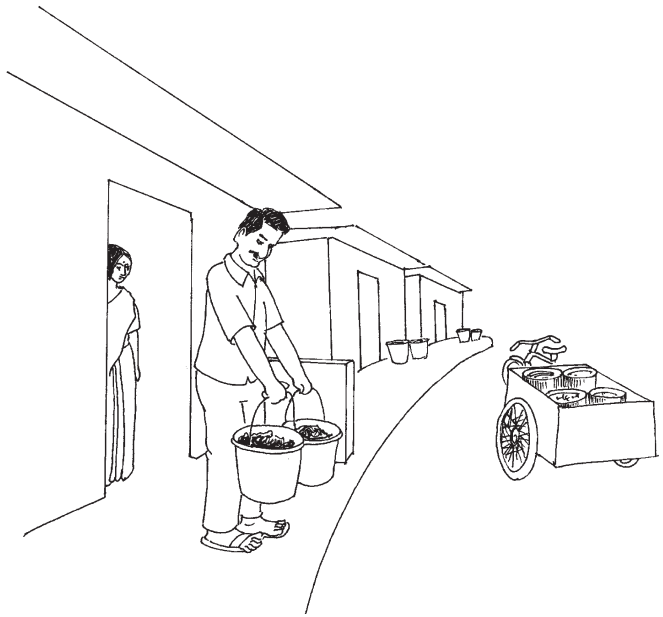
following modes.

a. **Direct Local:** Discards (non-biodegradable and or biodegradable) from point of generation have to be collected and then transported to a community facility nearby for disposal. Headload, wheel carts or tricycles can be used for this system.

b. **Direct Central:** Discards (non-biodegradable and or biodegradable) from point of generation have to be collected and transported to a central Common facility for disposal. Tricycles, wheel carts, animal driven carts, tipper auto rickshaws, jeeps, trucks etc. are the option.

c. **Indirect Central:** Discards (non-biodegradable and or biodegradable) from interim storage (Resource Recovery Facilities at local level) or community facilities will be collected and transported to the common facility. Larger fuelled vehicles may be used for this.

Placing of common dustbins in public places should be discouraged. In unavoidable situations, place enough bins for segregated collection. Ensure that the beneficiary committee or a person takes the ownership for such bins for its optimum utilisation. Otherwise they will end up as another waste dump site.




**Door to door collection - Pochampally**

### 8.2.6 Planning Zero Waste Events

Waste reduction has to be the main focus and all opportunities to show case that should be used. Public meetings, seminars, fairs, marriages, parties etc. are opportunities for intervention for waste reduction. Use of disposable plastic products, synthetic and plastic decorative material, plastic stationery etc. should be discouraged. Local specific code of conduct or material use policy can be developed to plan and implement social and community events in a zero waste compliant manner.

## 8.3 Facilitation and Integration

Zero Waste is very much about optimum utilisation of resources to avoid waste. Zero Waste is not a stand alone project or activity. It has to be made as an inner spirit or element in each and every human activity. Hence the zero waste concept has a vast scope for integration with other activities like agriculture, education, trade, industrial activities and so on. The core team has to facilitate the planning and implementation of such projects or activities to incorporate elements of zero waste to reduce waste and to support the systems planned for discard. For example, promotion of organic farming will lead to demand for organic manure or compost which will compel people to continue composting biodegradable discards. Extension of subsidies associated with soil conservation or water conservation to soak pits will encourage people to dispose their waste water in soak pits. Such integration will reduce cost of implementation of zero waste discard handling system as well as improve its efficiency and sustainability.

## 8.4 Follow – up

The core team has to motivate public to follow up the implementation of zero waste programmes. In the long run lack of interest on the part of community will demotivate the facilitators. To prevent this continuous reporting at various levels has to be put in place. To ensure proper follow up we have to ensure the following

### 8.4.1 Building Institutional Mechanism

An institutional mechanism has to be framed for the smooth management of the discard management programme. It can be formal or informal. But it is always good to strengthen the existing formal system by supporting it with informal mechanisms. For example, technical input from a voluntary organisation will strengthen the village extension officer, who is in charge of developing micro-enterprise units. Advise or suggestions from the farmers club will help the Agriculture officer to finalise a project. To make this process smooth ensure that modifications made in the system are not affecting the existing system drastically by adding or reducing more power and/or responsibility. Try to understand the gaps in the existing system and supplement it with work arrangements or voluntary support.

The activities or processes have to be institutionalised for their sustainability. Try to make systems within the formal

## Plastics ... Plastics... How do I manage it ?

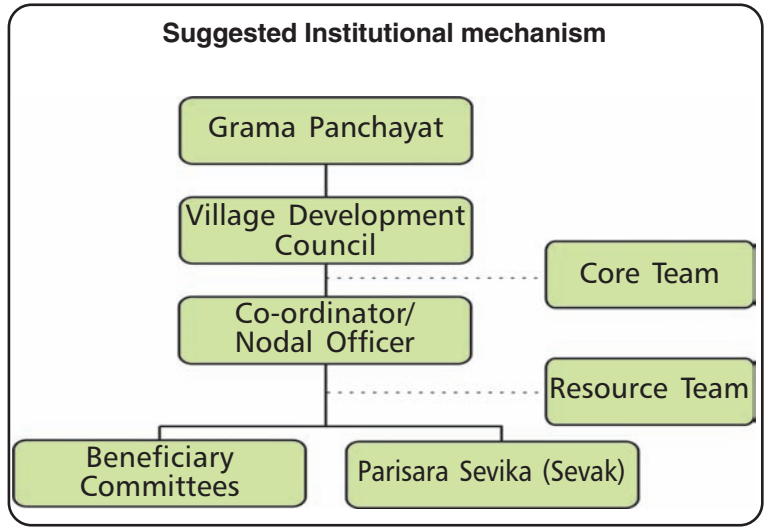
Presence of plastics in waste stream worsens the waste scenario. Management of carry bags, disposable cups, plates, straws, styrofoams, thin plastic sachets and covers found in municipal waste is a challenge for every community. Till date there is no convincing, safe and economically viable option for disposing plastic waste.

Burning or burying of plastics will complicate the situation with toxicity. Recycling of plastics still remains a myth, since most of the plastics are down cycled. Every single plastic product is made of a cocktail of chemicals and inerts. The complexity of structure of plastic products makes it difficult for recycling like glass or metals. Glass can be recycled many times without loosing much of its quality. But in case of plastics every recycling stage will result in inferior products and cannot be recycled again and again even with high energy inputs at subsidized rates. It ends up in the waste stream after 2 or 3 cycles.

Plastics are light weighted and its scrap value is comparatively cheaper. Some types of plastic waste have higher prices but most of the plastics especially, thin plastics such as carry bags, disposable cups/plates, styrofoams have very low price at factory gate. Ragpickers or scrap dealers are not interested in collecting this type of plastic waste for recycling since it is not economically viable. Collecting scattered plastic materials is a laborious job. Even though plastics are light weighted the volume is high which requires more space for storage.

The best way to manage plastics is Prevention. Reducing the use of plastics – especially disposable plastic products and packaging materials is the only viable solution for it. Substituting plastic products with locally available materials or services will be the best option.

But still we will find plastics in our premises. Encourage people to store them cleaned at source (households, commercial establishments or institutions) instead of dumping it along with other type of wastes. Once in a year when it becomes a manageable quantity it can be sent to recyclers nearby for down cycling. Local self Government may have to subsidize the collection and transportation cost for these materials to recyclers. Work with your governments to come up with policies for extended producer responsibility and prevention of such wastes in future.




organisational frame work for periodical reporting, evaluation and reviews. For a super check, community institutions can be formed e.g. beneficiary committees, local area monitoring committees, institutional committees etc.

### 8.4.2 Reporting and Monitoring

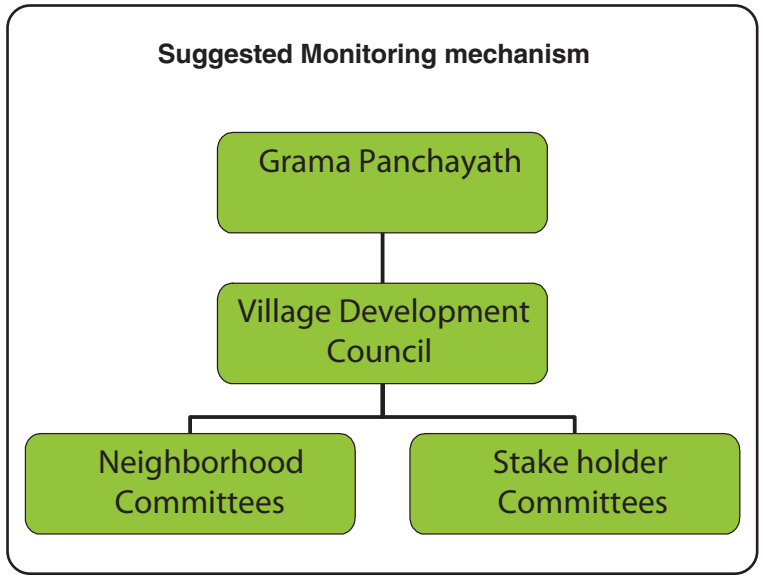
A good reporting system should be instituted to strengthen the process and to get a clear idea of what is going right and what is not. Several reporting formats can be used. However, a reporting system with minimum paper work is ideal. Reporting can be as follows:

The process has to be monitored and audited to check the reports coming from the field. This is vital to give

relevant and timely feed back to the people who are reporting. Monitoring and auditing can be done at two different levels which are parallel.

**Executive level:** Where the executives report to their superiors at a regular interval in a standard format. All such formal reporting will start from the people at the bottom and will reach the Secretary of the Local Self Government.

**Community level:** Here the community constitutes committees with volunteers to cross check the process and its progress. It will ensure community participation and ownership. All such reporting will start at local level monitoring committees and will reach the top level in the Local Self Government.




| # | Reporting level | Things to be reported |
|---|---|---|
| 1 | Process level reporting | Functioning of composting, segregation, quantification and qualification of discards etc. |
| 2 | Programme level reporting | Reporting of programmes, its participation, impact etc. |
| 3 | Personnel level reporting | Reporting the change in capacity of individuals |

# Conclusion

Across the world there are many communities, groups and individuals who are exploring sustainability. They are trying to harmonize the ways of nature with human activities to realise ecology of economics.

Their experiments and experiences shows that what is ecologically viable is also always economically viable in the long run. This reality is motivating many people to follow sustainable models even in these times of fast track consumerism.

In India, our life style was defined by our cultural as well as biological diversity. The lifestyles and practices were tuned to what we call today as 'Zero Waste'. Of course they were zero waste communities having intelligence to utilize the resources very efficiently. Colonization, Westernisation, liberalisation and finally globalisation has pushed us to a point of no return in terms of sustainability. We have to unwind and learn from the wisdom which still prevails in our villages –to conserve our precious natural resources for our current needs as well as for generations to come.

Zero Waste is a theory which can be practised in our daily lives, in every word and deed. It is a new school of thought in Management, both Government and business. The very spirit of zero waste is participation and involvement of people. It needs involvement and insights from people with a positive attitude. Zero waste is a comprehensive approach to resource conservation and protection of environment for economical and ecological sustainability.

We hope that this handbook will inspire people to explore and delve more into zero waste and thus broaden the canvas with more ideas. From our past experience, both academic and practical, we have understood that to realise the goal of zero waste needs immense energy from people especially voluntary support from all walks of life.

Exploration is a never ending process. We will be grateful to those who will take this hand book forward by adding new dimensions to it.

*Photo: Shibu K. Nair*

# Annexure 1

## Survey on waste generation and disposal in homes in Pochampally Village

Date: Serial No.

1. House No. Street. Ward
2. Name: Occupation:

3. No. of members
4. Quantity of Waste generated

| | Male | Female | Total |
|---|---|---|---|
| Adult members | | | |
| Children | | | |
| Total | | | |

5. Mode of disposal -Biodegradable
Burning/Burying/Dumping/Animal feed/Composting/ biogas/Others.

| | Biodegradable | Non-biodegradable | Total |
|---|---|---|---|
| Quantity generated per day (in grams) | | | |

6. Mode of disposal – Non-biodegradable

| | Burning | Burying | Dumping | Selling to recyclers | Others |
|---|---|---|---|---|---|
| Paper | | | | | |
| Metal | | | | | |
| Glass | | | | | |
| Cloth | | | | | |
| Wood | | | | | |
| Plastics | | | | | |
| Others | | | | | |

7. Do you feel that waste is a problem in your area? Yes/No.
8. Do you know the problems of burning/burying of waste? Yes/No.
9. Are you interested in composting/vermicomposting/biogas?
10. Do you have any suggestions for waste management?
11. How will you involve in the process of waste management?
12. What kind of personal expertise which you can contribute for this?

## Socio Economic survey on waste generation and handling in commercial establishments – Pranpur Village

Date: Serial No.

1. Name of the establishment
2. Name of the owner
3. Type of ownership Own/ Rent / Lease / Others
4. Classification of establishment (Provision store / vegetable shop / textiles / tailoring / hair saloon.)
5. Quantity of Waste generated

| | Biodegradable | Non-biodegradable | Total |
|---|---|---|---|
| Quantity generated per day (in grams) | | | |

6. Mode of disposal-Bio degradable
Burning/Burying/Dumping/Animal feed/Composting/ biogas/ Others.
7. Mode of disposal – Non bio-degradable

| | Burning | Burying | Dumping | Selling to recyclers | Others |
|---|---|---|---|---|---|
| Paper | | | | | |
| Metal | | | | | |
| Glass | | | | | |
| Cloth | | | | | |
| Wood | | | | | |
| Plastics | | | | | |
| Others | | | | | |

8. Do you know that burning / burying / dumping of waste is a problem? Yes / No.
9. How will you involve in the process of waste management?
10. What kind of personal expertise which you can contribute for this?
11. Whom do you think responsible for waste management in your region?
12. Your suggestions for waste management.

# Annexure 2

Suggested components for a Zero Waste Policy

1. Background and current status

   The information from approach paper can be used here.

2. Goal – Goal of the village is to progress as Zero Waste village by (2020)

3. Strategy

   a. Waste Reduction

   b. Decentralised Resource Recovery

   c. Capacity building

   d. Material Substitution

   e. Public Participation and public consultation

   f. Stakeholder monitoring

4. Mile stones

   a. 100% Source segregation by 2010

   b. 0% burning/open dumping by 2010

   c. Waste reduction by 40% by 2012

   d. 100% sanitation (2010)

   e. 100% prevention of littering in public places 2012

   f. 100% recovery of biodegradable discards by 2012

   g. 100 % recovery of metals and glass by 2014

   h. 50% substitution of problem materials and products 2010

   i. 80 % recovery of other materials

   j. Periodical social audit of the project by 2010

Add more...

Annexure 3

## Model Logical Framework Analysis for Zero Waste Rural Tourism project

| | | Performance Indicators | Means of Verification |
|---|---|---|---|
| **Goal** | **A Zero Waste Village** | | |
| Purpose | Mobilizing and sensitising people and building capacity in them to practice better resource use models and systems to reduce and recover waste both solid and liquid | | |
| Objective 1. | People sensitised on Waste Management | Behaviour change in handling waste | Citizen surveys, reduced dumping and burning of waste in the public place |
| Output 1.1 | Formation of Resource Team | Training programmes, | Training report, list of volunteers |
| Output 1.2 | Education materials are developed | Posters, Brochures, videos etc. | Physical verification |
| Output 1.3 | Clean up programmes done | Clean streets, water ways | Programme report, news cuttings |
| Output 1.4 | Door to Door campaigns | Awareness in households | Direct inspection, interviews, education materials passed on to them |
| Output 1.5 | Local Environment Leadership training programmes | Training programmes, | List of Local environment leaders, their meeting minutes |
| Output 1.6 | Public events organised | Participation of people and coverage | Number of people registered in the programme, news reports |
| Objective 2. | Model decentralised discard handling system established | Vermicompost pits, soak pits, biogas plants | Physical verification |
| Output 2.1 | Household doing source segregation and composting | 100% segregation, 100% composting | Field reports, inspection |
| Output 2.2 | Neighborhood level resource recovery facility to collect, clean and store non biodegradable discards | People send non biodegradable discards to the facility | Physical verification |
| Output 2.3 | Construction of sanitary toilets/complex | Community member use the toilets | Physical verification & minimize the ope defecation |
| Output 2.4 | People trained in vermicomposting, composting and biogas operations | Experts are available in the village to help in composting and biogas plants | List of local experts |
| Output 2.5 | Developing Plan and estimate to implement drainage water management. | Action plan | Physical verification, minutes of meetings |
| Output 2.6 | Basic study to develop a Resource Recovery Facility | Study papers | Physical verification, minutes of meetings |
| Output 2.7 | Developing detailed Plan and estimate implement common resource recovery facility | Action plan | Physical verification, minutes of meetings |
| Objective 3. | Livelihoods generated to support Zero Waste | 50 jobs created | Number of people working |
| Output 3.1 | Exhibition of alternate products | Participation of people and coverage | programme report, news cuttings |
| Output 3.2 | Vocational Training Programmes organised | Training programmes, | List of trained people |
| Output 3.3 | Entrepreneurship training programmes organised | Training programmes, | List of trained people |
| Objective 4. | People's institution developed to monitor and implement ZW programmes | Participation in public meetings and discussions | Meeting minutes and programme reports |
| Output 4.1 | Neighborhood level committees are formed for monitoring the programmes | Neighborhood committees | Meeting minutes of Neighborhood committees |
| Output 4.2 | Stakeholder level committees are formed | Stakeholder level committees | Meeting minutes of stakeholder level committees |
| Objective 5 | Destination profile documented and published | Promotional materials | Physical verification |
| Output 5.1 | Calendar of events developed | Calendar of events | Physical verification and news coverage |
| Output 5.2 | Profile document and brochure | Profile document and Brochure | Physical verification |

## Guidelines for Budgeting a Zero Waste Rural Tourism Village

| | | Outputs | Budget | | |
|---|---|---|---|---|---|
| | | | Total | Installments | |
| **Awareness and Education Programmes** | Output 1.1 | Resource Team Training Programme | | | |
| | Output 1.2 | Posters, brochures, signboards, reading materials, stickers etc. | | | |
| | Output 1.3 | Village level clean up drive | | | |
| | Output 1.4 | Door to door campaign on Zero Waste | | | |
| | Output 1.5 | Local Environment Leadership Training Programme | | | |
| | Output 1.6 | Public meetings, rallies, etc. | | | |
| | Output 2.1 | Training for households to do segregation and composting 5 models in each ward | | | |
| | Output 3.1 | Exhibition of alternate products | | | |
| | Output 5.1 | Preparation of Calendar of Events | | | |
| | Output 5.2 | Preparation of destination profile document/brochures | | | |
| **Hardware components** | Output 2.2 | Neighborhood level Resource Recovery Sheds | | | |
| | Output 2.3 | Construction of sanitory toilets/complex | | | |
| | Output 2.5 | Developing Plan and estimate to implement drainage water management. | | | |
| | Output 2.6 | Basic study to develop a Resource Recovery Facility | | | |
| | Output 2.7 | Developing detailed plan and estimate implement common resource recovery facility | | | |
| **Vocational Training and Capacity Building** | Output 2.4 | Intensive training programmes for vermi composting, composting and biogas operation | | | |
| | Output 3.2 | Vocational Training programmes | | | |
| | Output 3.3 | Entrepreneurship development programme | | | |
| | Output 4.1 | Formation of Neighborhood level committee | | | |
| | Output 4.2 | Formation of Stakeholder level committee | | | |
| | | **Total** | | | |

# Annexure 3 contd.

## Model Timeline for Zero Waste Rural Tourism Programme

| S.No. | Activities | TIME LINE | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Y1M1 | Y1M2 | Y1M3 | Y1M4 | Y1M5 | Y1M6 | Y1M7 | Y1M8 | Y1M9 | Y1M10 | Y1M11 | Y1M12 | Y2M1 | Y2M2 | Y2M3 | Y2M4 | Y2M5 | Y2M6 | Y2M7 | Y2M8 | Y2M9 | Y2M10 | Y2M11 | Y2M12 | Y3M1 | Y3M2 | Y3M3 | Y3M4 | Y3M5 | Y3M6 | Y3M7 | Y3M8 | Y3M9 | Y3M10 | Y3M11 | Y3M12 |
| Output 1.1 | Formation of Resource team | X | X | | | | | | | | | | | X | | | | | | | | | | | | X | | | | | | | | | | | |
| Output 1.2 | Education materials are developed | X | X | X | | | | | | | | | | X | X | | | | | | | | | | | X | | | | | | | | | | | |
| Output 1.3 | Clean up programmes done | | | | | | X | | | | | X | | | | | X | | | | | X | | | | | X | | | | | X | | | | | |
| Output 1.4 | Door to door campaigns | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | | X | |
| Output 1.5 | Local Environment Leadership training programmes | X | | | | | X | | | | | X | X | X | | | | | X | | | | | X | X | X | | | | | X | | | | | | X |
| Output 1.6 | Public events organised | | | X | | | | X | | | | X | | | | X | | | | X | | | | X | | | | X | | | | X | | | | X | |
| Output 2.1 | Household doing source segregation and composting | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Output 2.2 | Neighborhood level resource recovery facility to collect, clean and store non biodegradable discards | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Output 2.3 | Construction of sanitory toilets/complex | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Output 2.4 | People trained in wormi composting, composting and biogas operations | | | X | X | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Output 2.5 | Developing Plan and estimate to implement drainage water management. | | | | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Output 2.6 | Basic study to develop a Resource Recovery Facility | | | | | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Output 2.7 | Developing detailed Plan and estimate implement common resource recovery facility | | | | | | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Output 3.1 | Exhibition of alternate products | | | | | | X | | | | | | | | | | | | X | | | | | | | | | | | X | | | | | | |
| Output 3.2 | Vocational Training Programmes organised | | | | | | | X | X | | | | | | | | | | | X | X | | | | | | | | | | | X | X | | | | |
| Output 3.3 | 3 entrepreneurship training programmes organised | | | | | | | | | | | | | | | | | | | | | X | X | | | | | | | | | | | X | | | |
| Output 4.1 | Neighborhood level committees are formed for monitoring the programmes | | | | X | X | X | | | | | | | X | X | X | | | | | | | | | | | | | X | X | X | | | | | | |
| Output 4.2 | Stakeholder level committees are formed | | | | X | X | X | | | | | | | X | X | X | | | | | | | | | | | | | X | X | X | | | | | | |
| Output 5.1 | Calendar of Events established | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Output 5.2 | Profile document and brochures developed | | | | | | | | | | | X | X | | | | | | | | | | | X | X | | | | | | | X | X | X | X | X | X |

# Annexure 4

## LFA of Pochampally waste plan-2008-2013

| | Project Description | Indicator/Outcome | Means of Verification | Assumptions |
|---|---|---|---|---|
| **Goal** | To contribute to Promotion of Pochampally as the first zero-waste model rural tourism destination in Andhra Pradesh | Increase in tourist arrivals | Impact assessment<br>Tourist arrival data maintained by the interpretation centre | There is no change in policy of GOI related to Tourism specially Endogenous Tourism Project<br>Current trend of consumer spending on tourism does not change |
| **Purpose** | To establish working community involved sustainable zero-waste management system that supports rural Tourism in Pochampally | Litter<br>Percentage of disposable plastics in the total waste Increased percentage of waste recovered No. of livelihoods created CBOs involvement in various stages of the project | Litter index<br>Business records of the plastics in the waste Records of waste processing Impact assessment Meeting minutes of the project and CBO | A movement for waste reduction builds up in the broader environment, which (a) facilitates and sustains convergence at district/state level (b) helps in scale-up and maintain the facilities. |
| **Objectives 1** | To motivate the Gram Panchayath/District administration to dialogue with the community and adopt and implement the plans and related systems for waste management | Plans have been adopted and some of the plans were implemented<br><br>Representation of CBOs in project planning and review meetings increases | Project meeting minutes/ Draft plans<br><br>Project meeting minutes | Availability of sufficient and timely budgets at District Administration/ Gram Panchayath<br>Political consensus realting to various place of facilities emerges |
| **2** | To campaign waste management practices towards Zero waste | Community is aware of the issues and systems related to waste management<br><br>Resource Recovery Facility is established<br>100% segregation of waste at source adopted<br>Improved green cover, that uses waste<br><br>Artificial wet land system exists<br><br>Waste water is recycled<br>Activities taken up by the CBOs | Citizen card interview<br><br>Records of Gram Panchayat<br>Karyakartha report<br>Direct observation compared with baseline; density of trees<br>Direct observation compared with baseline survey<br>Karyakartha report<br>Karyakartha report | Funds are available for designing and printing the IEC material, and use of mass media<br>Existing rapport with the community facilitates processes |
| **3** | To demonstrate the reduction, recovery and disposal systems/models at household and neighbourhood level | Safe sanitation practices (like avoidance of open defecation) are adopted by the community<br>Community uses reusable material<br><br>All households have soak pits.<br><br>Others are more ready to finance the efforts related to waste management, based on the initiative demonstrated by the community.<br>100% households (with feasibility) adopt kitchen gardens<br>200 households have compost pits<br>200 households have wormi-compost units<br>100 households have bio-gas plants<br>10 neighbourhood wormi-compost units and RRFs | Direct observation compared with baseline survey<br><br>Citizen card interview<br>Focus group discussion with service providers<br>Records of waste water treatment plants<br><br>Karyakartha report<br><br>Karyakartha report | |

# Annexure 4 contd.

| Indicative Budget sheet for Pochampally Zero Waste 2008-20013 | | | |
|---|---|---|---|
| | **S. No.** | **Project activity** | **Budget** |
| | | | **Total** |
| **Output** | **1.1** | Plan for Model Resource Recovery Facility comprising of vermi compost, windrow compost and bio-gas, with provision for sorting, cleaning and storing non-biodegradables and containment of hazardous substances, approved by the community, exists | |
| **Activity** | **1.1.1** | Engagement with technical experts | |
| | **1.1.2** | Orientation to community and Gram Panchayath on resource recovery processes | |
| | **1.1.3** | Evaluation of alternative technologies suited for the site and preparation of plan | |
| **Output** | **1.2** | Plan for Artificial Wet Land System to treat the drainage water at tail end exists | |
| | **1.2.1** | As in 1.1.1., 1.1.2 and 1.1.3 above | |
| **Output** | **1.3** | Plan for collection, treatment and disposal of dye water | |
| | **1.3.1** | As in 1.1.1., 1.1.2 and 1.1.3 above | |
| **Output** | **1.4** | Community managed systems developed and supported for waste reduction, recovery and disposal including<br>Committee of Self Help Group leaders<br>Network of Community Based Organisations<br>Volunteers<br>Entrepreneurs<br>Karyakartas | |
| | **1.4.1** | Orientation of leaders | |
| | **1.4.2** | Promotion of Committee of Self Help Group leaders | |
| | **1.4.3** | Promotion of opportunities for Self Help Group leaders to participate in decision making processes | |
| | **1.4.4** | Identification of Community Based Organisations | |
| | **1.4.5** | Orientation of Community Based Organisations | |
| | **1.4.6** | Promotion of network | |
| | **1.4.7** | 5 community facilitators (Karyakarthas) are identified and trained to provide need-based services including during demonstration | |
| | **1.4.8** | Remuneration to the karyakartas | |
| | **1.4.9** | One coordinator to anchor the program | |
| **Output** | **1.5** | 20 persons are engaged in providing alternative materials | |
| | **1.5.1** | Market scoping & demand assessment | |
| | **1.5.2** | Training & hand-holding support | |
| | **1.5.3** | Linking with sources of credit/marketing | |
| | | **Sub-total** | |

# Annexure 4 contd.

| | | | |
|---|---|---|---|
| **Output** | **2.1** | Localized Infromation Education Campaign material for campaign | |
| | **2.1.1** | Develop Information Education Campaign plan (themes) | |
| | **2.1.2** | Design of Information Education Campaign material as per the plan | |
| | **2.1.3** | Print Information Education Campaign material | |
| **Output** | **2.2** | Community, service providers and Gram Panchayath are aware of<br>- hazards due to disposable plastics<br>- importance of using reusable & alternate materials<br>- the need for reduced generation of waste | |
| | **2.2.1** | Campaign using Information Education Campaign material & events(kalajatha) | |
| | **2.2.2** | Installations | |
| **Output** | **2.3** | Community, service providers and Gram Panchayath are sensitive to/aware of importance of<br>- Waste management<br>- Safe sanitation practices<br>- Segregation at source<br>- Improved green cover/kitchen gardens<br>- Participation of community in waste management | |
| | **2.3.1** | Campaign using Information Education Campaign material & events(door to door) | |
| | **3.2.2** | Liaise between households/GP and line departments for toilet (individual & community), kitchen garden seeds, saplings, drainage | |
| **Output** | **2.4** | 30 green volunteers work for campaigning about waste management | |
| | **2.4.1** | Identification of green volunteers and orienting them to various components of waste management | |
| **Output** | **2.5** | Community is aware about the role played by soak pits in recycling water | |
| | **2.5.1** | Demonstration of soak pits in 10 households | |
| | **2.5.2** | Campaign using Information Education Campaign material & events | |
| **Output** | **2.6** | Process documentation and prgress/dissemination reports exist | |
| | **2.6.1** | Documenting early successes/ profiling processes | |
| | | **Sub-total** | |
| **Output** | **3.1** | Demonstrtion units exists and people gain exposure to these unts | |
| | **3.1.1** | Demonstration of 10 wormi-compost, 20 composting units, and 1 bio-gas plant at household level | |
| | **3.1.2** | Demonstration of 1 wormi-compost unit at neighbourhood level. | |
| | **3.1.3** | Piloting source segregation in 300 households | |
| | **3.1.4** | Demonstration of 100 household level kitchen gardens | |
| | **3.1.5** | Demonstration of soak pits in 10 households | |
| | **3.1.6** | Arranging exposure visit to these units | |
| | **3.1.7** | Demonstration of 1 RRF at neighbourhood level. | |
| | **3.1.8** | Liaise with Gram Panchayath, Agriculture Dept., NEDCAP, ANERT, Energy Mission | |
| | | **Sub-total** | |
| | | **Total** | |

# Annexure 5

## Technology Options

### 1 Solid Waste Management

Composting (aerobic or windrow), vermicomposting and bio methanation of organic materials are the popular biological method of discard handling. Of this, which composting is very popular especially among farmers. Municipal Solid Waste (Management and Handling) Rules 2000 specifies that biodegradable/organic materials have to be composted/vermi composted or biomethanised.

### 1.1 Composting

Composting is an environmental – friendly way of disposing of waste. It involves the mixing of biodegradable waste with soil, water, air and additives or activators (optional). It is a the best method to turn your fruit, vegetable and yard trimmings into a very useful soil conditioner.

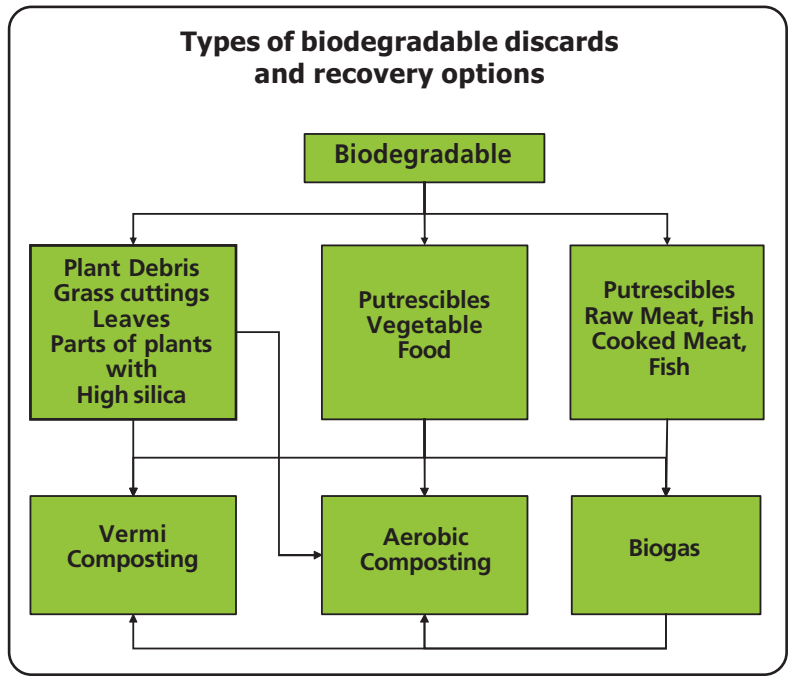
The process of composting is completed through 3 phases, and all this without any involvement from our part. We only need to setup the right system for composting to happen naturally. The following explains the whole composting process.

a. In the initial phase simple structured materials are rapidly decomposed by the action of mesophelic bacteria. The temperature rises to 20 – 30 degree celcius. As the heat increases the activity of mesophelic bacteria decreases.

b. Thermophelic bacteria takes over from this point to decompose complex materials such as proteins, fats, carbohydrates, cellulose and hemi cellulose at higher temperatures. The heat goes up to be 55 – 60 degree celcius in which pathogens are destroyed. As the food available for these bacteria decreases, the temperature goes down.

c. At this stage mesophelic bacteria come back to decompose left over materials. When it is over compost again cools down and get stabilized to the atmospheric temperature. Now what you have compost which is ready for plants to take in.

Composting needs air, sun and moisture. Composting can be done in pits, tanks, drums, bags or even in piles. If



**Troubleshooting - Aerobic Composting**

| Symptoms | Problems | Solutions |
|---|---|---|
| Pile not composting | Too dry<br>Too much brown matter | Add water until slightly damp & turn (mix)<br>Add fresh green matter or organic nitrogen fertilizer & turn |
| Pile smells rotten/ attracts files | Too wet/too many food scraps or lawn clippings<br>Food scraps exposed<br>Non- compostables | Turn & add browns(dry, woody materials ) or dry soil<br>Bury & mix food scraps into pile<br>Remove meat, dairy, grease, etc. & turn |
| Rodents in pile | Food scraps in open bin/holes larger than ¼ inch/ non-compostables | Use traps or baits, rodent-proof bin, remove meat, grease, etc.& turn |

it is done in tanks or pits below surface, the depth should not be more than 1 meter and width should not be more than 1.5 meters. There is no limit for length. Above 1 meter depth, there won't be enough aeration for composting. Above 1.5 meters width, it will be difficult for a person to access the middle portion of compost with hands. The volume of the space required for composting is equal to twice the weight of total biodegradable discards. In smaller units (below 500kg) it will take 30 – 40 days and in larger units it will take 60 to 90 days for complete composting.

### 1.1.1 Composting in pits

It is the conventional way of composting that exist in our country. 2 pit system is efficient. In this system two pits will be made on the ground with 2 ft X 2ft X 2ft dimension and 2 feet apart. Composting will start with one pit where small twigs, dried leaves and grass will be spread at the bottom and a layer of biodegradable discards will be added to it on a daily basis, once a week a layer of dried leaves, twigs will be placed to ensure good aeration. This will repeat till the pit fills to the brim. Then the pit will be closed with sand and left for sleeping. At this time the second pit will be in action. By the time the second pit get filled, the first pit can be emptied where composting have been completed. This method is suitable only where, low rain fall, not much scavenging animals and enough space is available.

### 1.1.2 Composting in pots/drums

At household level, composting can be done in earthen pots or metal/plastic drums which are easily available. The method is same as in composting in pits, but instead of covering it with sand, a lid can be used for covering the pot or drum. Small holes have to be made in pots or drums to ensure aeration. The pots/drums have to be placed slightly elevated. Bricks or metal stand can be used for this. This is to avoid rats and other creatures finding their way into the compost.

### 1.1.3 Windrow composting

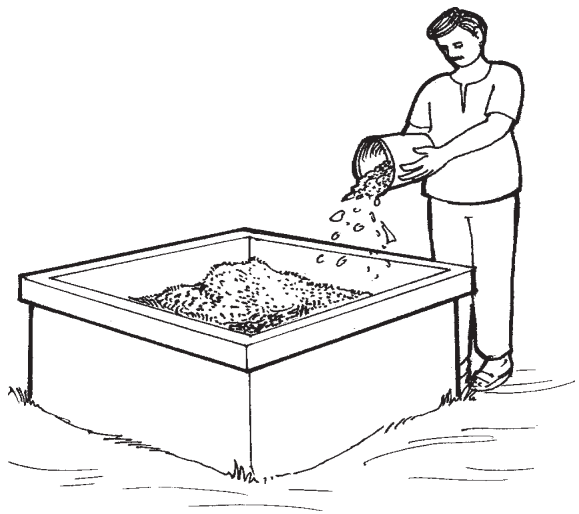
It is one of the sophisticated ways of composting where composting is done above surface and in open. It is used for large scale composting. It is done by making heaps of biodegradable discards on a platform where the height of heap will be 2 meters. Length and breadth varies from place to place. The heap will be turned mechanically or manually on a regular interval. This is to speed up the process of composting.

### 1.1.4 Composting in tanks

Honey comb brick work tanks above surface can be used for composting. It is ideal for composting yard trimmings, street sweepings, vegetable discards etc. at community level. This tanks can be made on the road sides, or in markets for composting. It may require a lid to prevent water going in and a soak pit for handling liquid oozing from it.

### Suitability

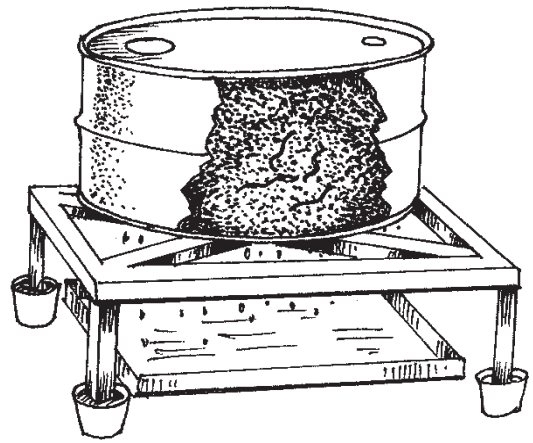
It is suitable for almost all kinds of biodegradable discards. But generally large scale (more than 50 kg per day) composting of fish/meat/slaughter house waste is discouraged in our climatic and geographical condition. It will become a public nuisance and threat to public health if there is a lack in care. In households in rural area where land is available, it is the easiest way of composting.



## 1.2 Vermi composting

The waste that is segregated can be subjected to biological activity through microbes and earth worms. Just as microbes are primary decomposers earth worms form one of the major group of organisms included under secondary decomposers. They feed upon any partially decomposed organic matter with minimum of 80% moisture. The advantage of using earth worms for waste management lies in minimizing the time of composting and composting of any substance to degrade organic waste. Mixing up of secretions of earth worms with the composted material enhances the water holding capacity of the compost apart from having stimulatory effect on plant growth.

When earth worms feed on partially degraded organic



**Vermi Compost Tank**

**Troubleshooting - Vermicomposting**

| Symptoms | Problems | Solutions |
|---|---|---|
| Worms are dying | Food and bedding all eaten<br>Too dry<br>Extreme Temperatures | Harvest compost, add fresh bedding & food<br>Add water until thoroughly moistened<br>Move bin so temp. is between 40-80 degreeF |
| Bin attracts flies and/ or smells bad | Food exposed/ over feeding<br>Non compostables present | Add 4"-6" layer of bedding & stop feeding for 2-3 weeks<br>Remove meat, pet feces, etc. |
| Sowbugs, beetles in bin | These are good for your vermi compost! | |

waste, they draw into their mouth fine bits of food particles. This material undergoes further chemical breakdown by the enzymatic activity in their gut and finally the mucus coated excreta (vermi cast) is ejected from the body. Thus organic waste exposed to earth worm activity undergoes physical and chemical breakdown. The earth worms identify to work on organic waste is a boom for solid waste management.

The load on the organic manure and chemical fertilizer application is almost reduced by 25-50% on application of vermi compost. Vermi compost has stimulatory effect on seedling establishment and in vegetative propagation of plants. Vermi composting of urban organic solid waste, apart from curbing the organic pollution caused by putrefying organic waste helps in minimizing the use of chemicals in agriculture.

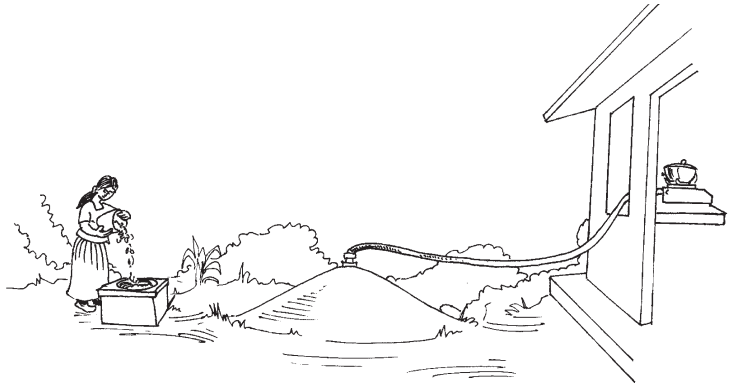
Vermi composting can be done at household level, in pots, drums and tanks. To introduce worms a bedding has to be prepared first. It can be made of semi decomposed biodegradable discards or fresh cow dung with 80% moisture. Release adequate number of worms into this bedding inside the bin, pot or tank for composting. Give one week time for worms to get acclimatized and multiplied. Then start feeding them biodegradable discards on a daily basis. Ensure that the tank/pot/bin is not deeper than 60 cm. since worms do not like to go deeper. Do not put too much salt, chillie, oil etc. since worms may get killed. Do not put any chemicals, deodourants or disinfectants into vermi compost.

Vermicomposting is scalable to suit community or centralised facilities. Series of tanks can be used for handling large volume of biodegradable discards.

Vermi compost facilities have to be protected from scavenging animals, especially rodents and ants, using nets above and water channels around the tank.

## Suitability

It is suitable for almost all kinds of biodegradable discards. But generally large scale (more than 50 kg per day) composting of fish/meat/slaughter house waste is discouraged in our climatic and geographical condition. It will become a public nuisance and threat to public health if there is a lack in care. Worms helps to breakdown the complex compounds in the discards and thereby helps to reduce toxicity. It is suitable at household level, community level and common facility level if adequate supervision and care can be ensured



**Deenabandhu Model Bio-gas Plant**

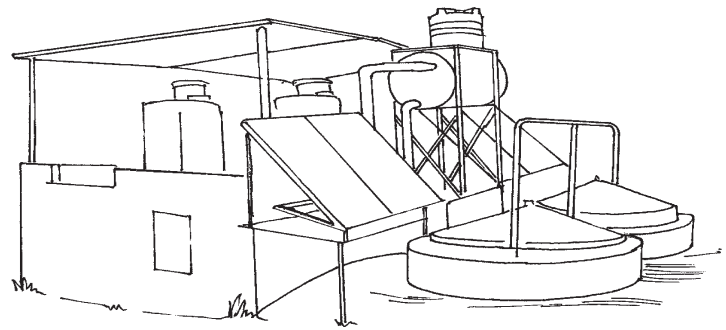
## 1.3 Anaerobic Digestion

Anaerobic digestion (AD) is the process of micro-organisms breaking down organic materials in the absence of oxygen in an enclosed vessel. Anaerobic digestion produces biogas (consisting primarily of methane and carbon dioxide). Depending on the system design, biogas can be combusted to run a generator producing electricity and heat, or it can be burned as a fuel in a boiler or other burner.

### *Methanogenesis*

Methanogenesis is a microbial process, involving many complex, and differently interacting species, but most notably, the methane-producing bacteria.

The process takes place through 4 stages. In the first stage carbohydrates, fats and proteins present in the biodegradable discard is being converted into simpler forms such as sugars, fatty acids and amino acids. This stage is called hydrolysis. In the second stage these simpler components are further converted into carbonic acid, alcohol, hydrogen, carbon dioxide and ammonia. This stage is called Acidogenesis. In the third stage these are mainly converted into acetic acid, carbon dioxide and hydrogen. This stage is called acetogenesis. In the final stage these elements are converted into methane. This stage is called methanogenesis. The resulting biogas, sometimes referred to as 'gobar' gas, consists of methane and carbon dioxide, and some traces of other gases, notably hydrogen sulphide ($H_2S$). Its exact composition will vary, according to the materials used in the methanogenesis process. When cattle dung is used, the resulting gas will be between 55-66% methane, 40-45% Carbon dioxide, plus a negligible amount of Hydrogen sulphide and Hydrogen.



**Nisargruna Bio-gas Plant (BARC Model)**

## Different types of biogas plant recognised by MNES (Ministry of Non-Conventional Energy Sources).

1. Floating-drum plant with a cylinder digester (KVIC model).
2. Fixed-dome plant with a brick reinforced, moulded dome (Janata model).
3. Floating-drum plant with a hemisphere digester (Pragati model).
4. Fixed-dome plant with a hemisphere digester (Deenbandhu model).
5. Floating-drum plant made of angular steel and plastic foil (Ganesh model).
6. Floating-drum plant made of pre-fabricated reinforced concrete compound units.
7. Floating-drum plant made of fibreglass reinforced polyester.

## Precautions

- The plant must be tested to make sure it is water-tight and gas-tight.
- Enough fresh material must be added before it is used every day.
- There must be a water source to provide enough water to clean the livestock pens regularly, to provide fresh material for the fermentation chamber system. (Each litre of manure needs 1 - 3 litres of water).
- The plant must be equipped with a safety valve or U-shaped barometer.
- Chemicals such as detergents or pesticides must not be put into the fermentation chamber.
- After fresh manure and water is added to the fermentation chamber, the valve should be opened so the gas can escape. At this stage, the gas is mainly carbon dioxide. This should be done once or twice, before the biogas plant comes into use for biogas production.

## Suitability

Anaerobic digestion is suitable for disposing human excreta, in places where water table is high and septic tanks are impossible. Anaerobic digesters are designed for cattle excreta and is often termed as 'gobar gas plants'. It is suitable for handling meat, fish or slaughter house discards at large scale. It is not advised to feed biodegradable discards which have more fibre and silica content, such as banana leaves, garden trimmings, banana stem, coconut leaves, coconut husk, coconut shells etc. This may lead to clogging of the plant and will cause shut down of the plant.

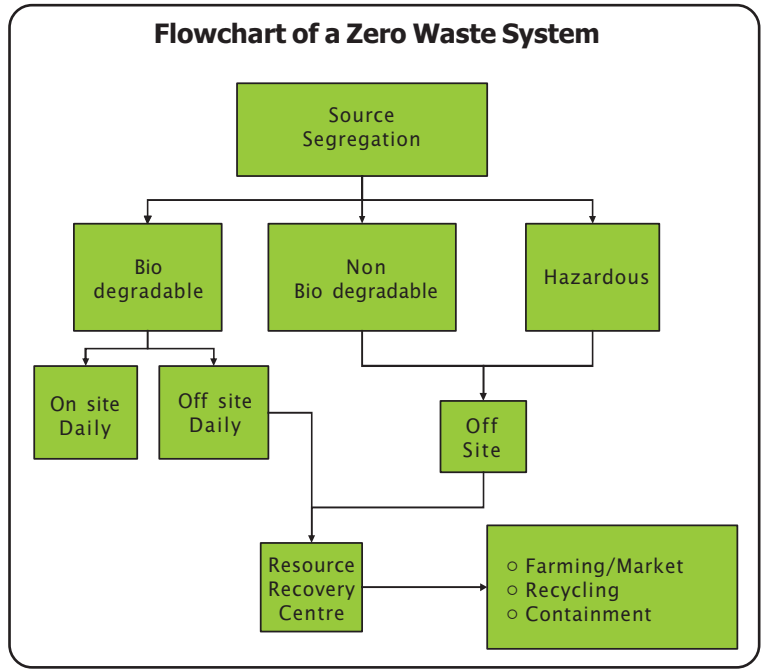
It is advised to have pre-treatment and post treatment facilities in large scale (above 10 cu.m.) anaerobic digesters. Pre-treatment includes pre conditioning where the particle size of the discards are reduced by chopping, crushing or by pulverising; pre digesting where the discards are kept for aerobic composting and temperature standardisation. Post treatment includes conversion of slurry into manure by mixing with any composting process

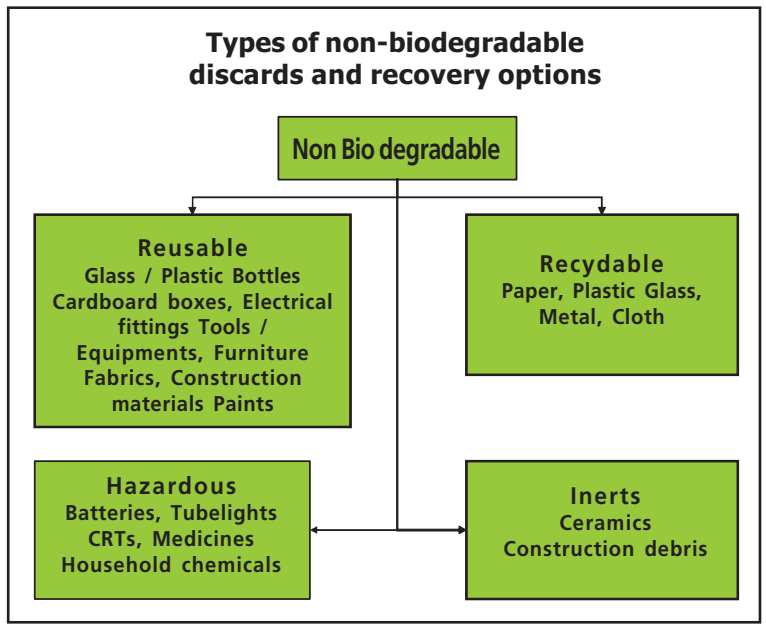
or by drying it up. The liquid separated from slurry should be used as manure in farming or disposed in drains/ soakpits after treating.

Ensure that every biogas plant is complemented with a vermicompost or compost unit to handle those discards which cannot be handled in biogas plant.

## 1.4 Resource Recovery Parks

Generally Resource Recovery Parks are conceived as a place of assembly for enterprising institutions and individuals, both agriculture and non agriculture to recover discards back into production processes. It is a planned and organised system which will provide ease of work and maximum recovery. The elements of RRP is not a new thing to India. The informal sector ranging from rag pickers at the bottom to recycling industries at the top is actually forms a Resource Recovery System. But the major components like collection, cleaning, disassembly, sorting, storing and transportation are done in unorganised and unrecognised sector. This prevents total recovery of discards even though there is a great demand from recycling industries. Moreover, the standard of living and social stature of the people engaged in salvaging the discards are very poor. Bringing in the concept of Resource Recovery in discard handling systems will improve social status of the people engaged in the informal sector and their business and enterprise will get more recognition and acceptance in




the society. Organising the people involved in salvaging and helping them to set up micro-level facilities will create more livelihoods in the locality and will help in discard management through resource recovery.

## 2. Liquid Waste Management

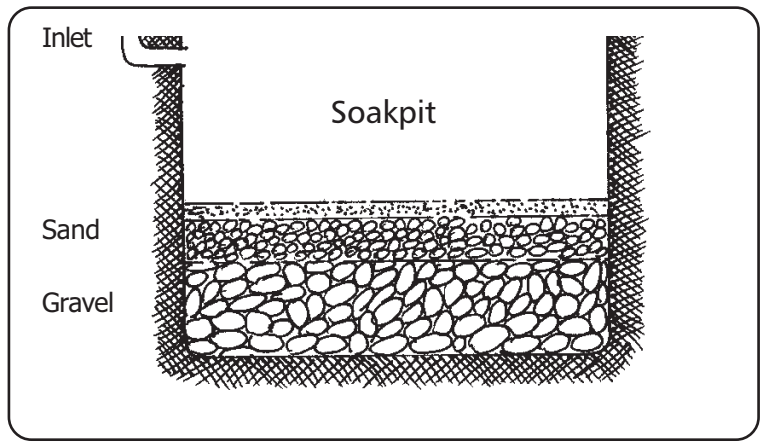
Waste water is any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, industry, and/or agriculture and can encompass a wide range of potential contaminants and concentrations. In the most common usage, it refers to the municipal waste water that contains a broad spectrum of contaminants resulting from the mixing of waste waters from different sources. Waste water can be grey water, (water discharged from washing, bathing and cleaning operations in households and commercial establishments) black water (water contaminated by urine and feces) or chemical effluents (emitted from industrial or chemical processes).

Let us look at the options to handle grey water since it constitutes the majority of waste water produced. Generally the grey water contains suspended solids, microbes, organic matter and inorganic matter. So the cleaning of waste water means removal of these components from water. Suspended solids and inorganic materials can be removed through sedimentation and filtering. Organic matter have to be exposed for decomposition. Microbes will get removed when there is no food left for them in the water. So the process involved is sedimentation, biological decomposition and disinfection. If we provide for this process, we can manage grey water to some extent and can reduce the impact.

### 2.1 Soak Pits

At household level soak pits can ensure recycling of grey water to an extent. Soak pit is a simple structure which provide for filtering and biological decomposition. Soak pit is a simple hole, sometimes lined, where effluent is held and slowly seeps into the ground through perforated sides and bottom. A secondary stage of treatment takes place through biological breakdown in the pit.

The size of the soak pit depends upon the quantity of waste water discharged and its speed. As the speed and quantity increases, the depth and size of soak pit have to be increased. For a household 1m X 1m X 1m meter hole in the ground is enough. Line the sides of the hole with bricks and leave the bottom open. Fill one third of the

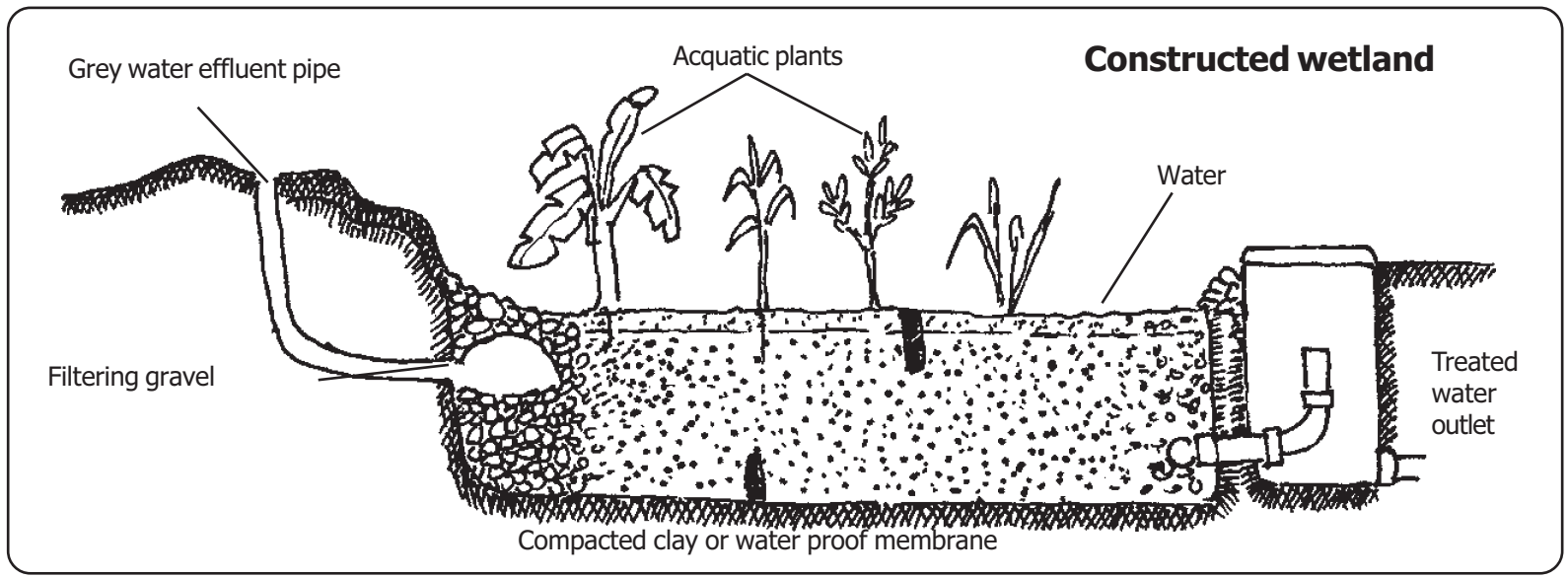


hole with big pieces of rocks above that fill it with small pieces of rocks, earthern tiles etc. to form a layer of 5 inches thickness. Make a layer of sand on the top of it in about 3 inches thickness. Now the soak pit is ready. Place a lid over it if necessary and connect waste water outlet to this soak pit. Growing plants like banana, canna, wild yam and such herbs around the soak pit is good for taking out the nutrients in the waste water.

For commercial establishments like restaurants, hotels etc., this soak pit is not enough. They have to go for bigger soak pit and have to add a sedimentation tank before letting the waste water to the soak pit. This will increase the efficiency of soak pit. Waste water outlet have to be connected to a sedimentation tank where most of the solids in water get sedimented to the bottom in the form of sludge. This sludge has to be removed periodically and can be disposed in a composting/biogas system.

## 2.2 Artificial wetland system/constructed wetland

In some places individual soak pits are not possible due to the lack of space or geographical features. In such cases waste water can be transported through pipes and can dispose in slightly larger waste water treatment system – artificial wetland system. In this system, waste water is first exposed for sedimentation and filtering and then letting it to a pool where lots of water plants are grown to remove all the nutrients in the waste water. Then water may flow out to open drain or into a soak pit.



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5. www.storyofstuff.com
6. Zero Waste Alliance. www.zerowaste.org
7. Health Care Without Harm. www.noharm.org
8. Basel Convention. www.basel.int
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