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From the Director's Desk...

Dissemination of information on various issues related to environment of the State is the main objective of establishment of our ENVIS Centre. We have discussed on various issues in our earlier publications. In this issue we have focused on one of the important topic "Waste: Its treatment and management". I hope the information will be useful.



I appreciate the efforts of our ENVIS team for collecting information and publication of this issue.

Shri Bhagirathi Behera, IFS
Director, Centre for Environmental Studies

Waste : Its treatment and management

"Even a whole society, a nation, or even all simultaneously existing societies taken together, are not the owners of the globe. They are only its possessors, its usufructuaries, and, like boni patres familias, they must hand it down to succeeding generations in an improved condition."

Karl Marx

INTRODUCTION:

Urbanisation is now becoming a global phenomenon, but its ramifications are more pronounced in developing countries. Natural growth of population, reclassifications of habitation and migration trends are important in urban population in India. The population of urban India was 285 million as per 2001 census, which accounts for 27 percent of the total population. Global experience shows that when a country's urban population reaches almost 25 percent of the overall population as in the case of India, the pace of urbanization accelerates.

Due to rapid urbanization and uncontrolled growth rate of population, solid waste management has become acute in India. According to the 2001 census the total population of the State Orissa is 36,804,660. The State holds eleventh rank among states and union territories in population size. 85 percent population is residing in the rural areas of the state. The growth rate of total population in Orissa does not display a systematic pattern. It has been fluctuating from decade to decade. Looking at the gradual increase of population particularly in urban areas there is need of systematic management of solid waste. The present issue aims to outline the existing status of solid waste generation and its management especially municipal solid waste management.

Environmental Pollution may be defined as the release of substances and energy (in excess of permissible limit) as waste products of human activities which result in changes, naturally harmful, within the natural environment. It means the lowering of environmental quality at local, regional and global levels, by both natural and man-made processes. The word 'pollution' has been derived from the Latin word 'pollure' which means to soil or defile. Pollution is an undesirable change in the physical, chemical and biological characteristics of air, water and land that may, can and will adversely affect human life, or that of other living species, our developmental activities and socio-cultural activities.

Rapid advancement in science and technology in the last part of the 20th century have changed our life-style providing the basic needs and comfort through extensive industrialization and intensive agriculture. Unfortunately these activities have taken place at the cost of large-scale deforestation and have generated a tremendous amount of waste material and reactive chemical substances, which are being discharged into our environment. This has resulted in undesirable changes in our surroundings, has made the air unsuitable for breathing, water unsafe for domestic and other uses, has changed the climatic pattern. The process is known as pollution and the waste materials and chemical substances are known as pollutants.

Scope of Environmental Management:

Environmental Management is in very wide in its scope. It includes all the technical, economic and other aspect of environment. Environmental Management begins with the identification of the problem to finding its solution. Thus it encompasses:

- ↪ Prevention and control measures
- ↪ Policy framing and modeling
- ↪ Environmental monitoring

A proper environmental management strategy aims at creating minimum pollution, minimizing usage of resources leading to sustainable development.

For this to be successful, environmental management must include:

- ↪ Environmental science and engineering
- ↪ Economics and policy

Environmental science and engineering use different theoretical concepts and practical tools for prevention and control of pollution.

Environmental economics deals with the cost and benefits analysis of environmental and natural resources. Environmental policy includes set of rules and regulations framed by concerned and qualified authorities for safeguarding the welfare and security of the environment.

Waste Management :

Waste is not a uniform material in term of its constituents. However, the main distinguishing feature related to the products from which it is derived is perceived as useless and unwanted. This view influenced Society's approach towards waste management. The past two decades have witnessed a change in attitude towards waste as serious concerns towards health, environment and sanitation. The problems continued to bugle the minds of both waste generators and policy makers, particularly in terms of means and efforts to prevent or to minimize waste production And the characteristics/nature of wastes. The composition of waste varies from biodegradable to non-biodegradable materials or substances. This increases further, the existing problems of waste handling as well as disposal.

Disposal of Wastes:

Every home produces wide array and variable quantities of tin cans, packages, waste papers, glass and other rubbish materials. Homes and factories also produce sewage. If this waste is not disposed of with care, it can become hazardous causing disease and pollution.

The activities involved with management of solid wastes, from the point generation to final disposal, have been grouped into six functional elements, such as:

- ↪ Waste generation
- ↪ On-site handling
- ↪ Storage and processing
- ↪ Collection
- ↪ Transfer and transport
- ↪ Processing, recovery and disposal

Waste management also includes waste water treatment. The practice of cleaning and filtering water is as old as civilization. People have been using traditional practices of cleaning waste water through boiling, lime and alcem treatment etc. since very long. The waste water treatment should incorporate the following steps:

- ↪ preliminary process of storing dirty water and making sludge through sedimentations for several hours
- ↪ adopting primary treatment with micro-organisms for the removal of the organic matters
- ↪ filtration of dirty water
- ↪ removal of toxic chemicals and microorganisms through chemical oxidation, chlorination, ozonization and solarization
- ↪ removal of undesirable quantities of nutrients from water
- ↪ supply of clean and safe-water for community use

Methods of Waste Disposal:

There are different methods of disposing waste. Landfill is the most common and cost-effective method of disposal. Collection and transportation of waste accounts 75 percent of the total budget of waste

management. Generally in a modern landfill; refuse are spread in thin compact layers and covered by a layer of clean earth. Pollution of surface water and ground water is minimized by lining and contouring the fill, compacting and planting the upper most cover layer, diverting drainage and selecting proper soil in sites not subject to flooding or high ground water levels.

The main methods of safe disposal of waste include segregation, dumping, composting, incineration and drainage.

Segregation:

In Waste management, wastes should be categorized and segregated according to their category. This is because the method of disposal would be different for different wastes. For examples - hospital wastes can be categorized and segregated on the basis of their weight, density and constituents. These are :

Infectious: Materials containing dangerous concentrations or quantities of waste, if exposed, can cause diseases are included in this category. It includes waste from surgery and autopsies on patients with infectious diseases.

Sharp disposable needles, syringes, saws, blades, broken glasses, nails or any other items that can inflict injury.

Pathological: Tissues, organs, body parts, human flesh, foetus, blood and body fluids.

Pharmaceuticals: Drugs and chemicals that are returned from wards, spilled, expired, contaminated or exposed for longer period are included in this category.

Radio-active: Solids, liquids and gaseous waste contaminated with radioactive substances used in diagnosis and treatment of diseases.

Others: Include waste from the offices, kitchens including utensils, papers, etc. These wastes can be further disposed of differently, according to their category.

Dumping :

Waste dumping is a method of controlled final disposal at landfill sites which must be done using state-of-the-art methods (base sealing, treatment of percolation water, landfill gas disposal, utilisation, etc.). Waste dumping, to some extent, represents the final stage

of any disposal sequence, the only exception is where waste substances or residues are fully recycled (e.g. agricultural use of sewage, sludge, etc.). The improved form of open dumping is termed as land-filling:

Composting :

Composting is a multi-step natural degradation process in which biodegradable materials are broken down by anaerobic micro-organisms. Microbial activities release heat, carbon dioxide, ammonium and methane. The ammonium is further converted into nitrites and nitrates. The final material resulting from the process is rich in nutrients and can be applied to land to enhance soil quality. Assuming a typical application rate of two inches per year, a land area of one square mile (640 acres) would be required for sustaining composting of 500 tonnes per day of municipal wastes. The major advantages of using this as soil conditioner are :

Improved retention of water, improved crop yield, reduced irrigation requirements, and reduces dependence on fertilisers and pesticides.

Vermi-composting :

The degradation of organic waste by earthworms is known as vermin-composting. The earthworms physically aerate, crush, mix, chemically degrade complex molecules to simple molecules and biologically help in stimulating nutrients in this system.



Solid Waste Scenario

Solid waste management is an integral part of the Environmental Management of each city. Due to rapid growth of urban population, as well as constraint in resources, the management of municipal solid waste poses a difficult and complex problem for the society and its proper management gravely affects the public health and degrades environment. Analysis across countries reveals that generation of municipal solid waste is positively related to variation in per capita income and with population size.

In India Municipal Solid Waste or city garbage is a heterogeneous mixture of paper, plastic, cloth, metal, glass, demolition matter, organic matter, bio-medical waste etc. generated from household, industries, hospitals and commercial institutions. Size varies from 0.1 to 0.5 Kg/capita/day. It generally contains recyclable material varying from 13 to 20%.

The growth rate of population, solid waste generation, required land fill area in Indian scenario is as given below :

	1947	2001	Growth %
Urban Population (in million)	56.9	285	500
Waste generated (kg/capita/day)	0.295	0.56	190
Total waste generated (million ton/year)	6.0	55.3	920
Land fill area (in ha.)	0.12	23.3	19415

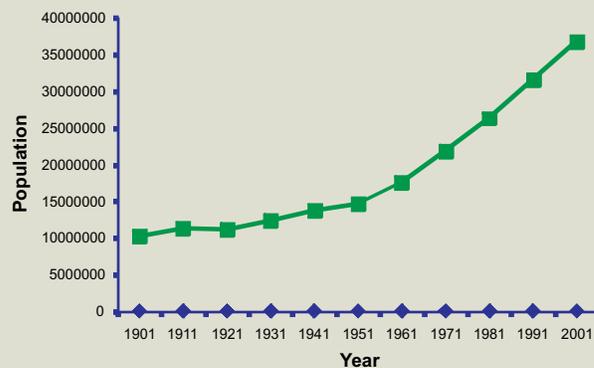
Source - Orissa Review (April 2005)

Demography of Orissa

According to the 2001 Census the total population of Orissa is 36,804,660. The state holds eleventh rank among states and union territories in popu-

lation size. Orissa has registered a net accretion of 5,144,924 persons to the 1991 Census population figure of 31,659,736. About 85 per cent population is residing in rural areas of the state. There are 138 towns and 51,349 villages.

The Growth of Population of Orissa



Among the districts, Ganjam is most populated district with 3,160,635 population and constitute 8.6 per cent of the state's population. Debagarh, on the other hand, with 274,108 population is the laest populated district and accounts for 0.7% of the state's population. Census has shown increase of household population.

The present decade of 1991-2001, has recorded the population growth rate 16.3 per cent as against the all India growth.

As per the report of Central Pollution Control Board on Municipal Waste Generation in some important cities of the country, it is found that the maximum daily waste generation is in Delhi. In case of Bhubaneswar city the daily average waste generation is 234 tone per day (TPD). The general composition of waste is compostable items (49.81%) and recyclable items (12.69%).

Average Waste Generation in some important cities :

Sl. No.	Name of City	Population (As per 2001 census)	Waste Quantity (TPD)	Compostables (%)	Recyclables (%)
1.	Gangtok	29354	13	46.52	16.48
2.	Itanagar	35.022	12	52.02	20.57
3.	Simla	142555	39	43.02	36.64
4.	Raipur	605747	184	51.40	16.31
5.	Bhubaneswar	648032	234	49.81	12.69
6.	Chandigarh	808515	326	57.18	10.91
7.	Ranchi	847093	208	51.49	9.86
8.	Coimbatore	930882	530	50.06	15.52
9.	Allahabad	975393	509	35.49	19.22
10.	Patna	1366444	511	51.96	12.57
11.	Bhopal	1437354	574	52.44	22.33
12.	Nagpur	2052066	504	47.41	15.53
13.	Jaipur	2322575	904	45.50	12.10
14.	Pune	2538473	1175	62.44	16.66
15.	Ahmedabad	3520085	1302	40.81	11.65
16.	Hyderabad	3843585	2187	54.20	21.60
17.	Bangalore	4301326	1669	51.84	22.43
18.	Chennai	4343645	3036	41.34	16.34
19.	Kolkata	4572876	2653	50.56	11.48
20.	Delhi	10306452	5922	54.42	15.52

Source - CPCB Report

A report on MSW generation & collection was also published by CPCB. As per this report the percentage of waste collection efficiency in the state Orissa is 55%. The total average generation of waste in the state is 6178866 TPD. This report also indicates that the waste generation is maximum in Maharashtra state.

State-wise MSW Generation & Collection

Sl. No.	State / UTs	Total Towns	% Waste Collection Efficiency	MSW Generation (TPD)
1.	Chandigarh	1	75	1389159
2.	Gujarat	242	75	24588124
3.	Maharashtra	378	70	55052207
4.	West Bengal	375	70	27445574
5.	Meghalaya	16	68	525243
6.	Andhra Pradesh	210	65	25353613
7.	Delhi	62	65	22526265
8.	Punjab	157	65	10504627
9.	Haryana	106	62	7530141
10.	Madhya Pradesh	394	62	19347071
11.	Uttar Pradesh	704	62	40281443
12.	Himanchal Pradesh	57	60	642275
13.	Karnataka	270	60	22845629
14.	Kerala	159	60	9983801
15.	Rajasthan	222	60	15687050
16.	Tamil Nadu	832	60	37167161
17.	Pudducherry	6	56	994048
18.	Assam	125	55	3794170
19.	Orissa	138	55	6178866
20.	Bihar	130	50	9408294

Source - CPCB Report

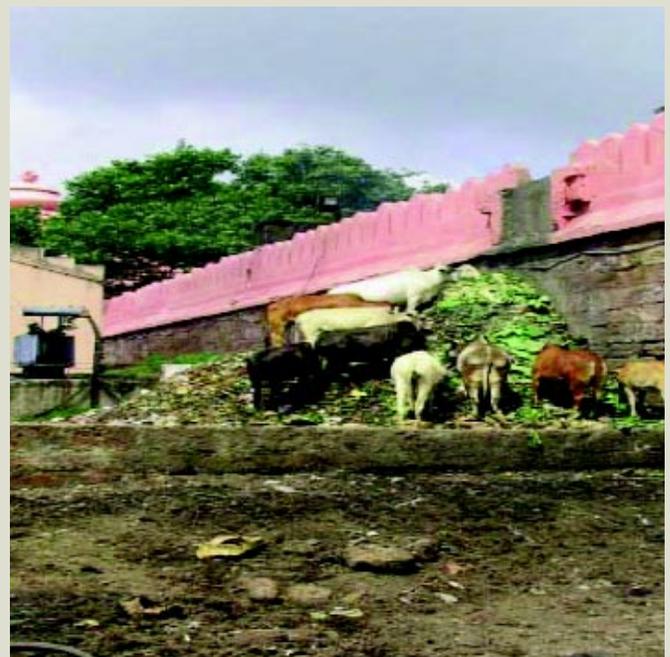
Status of Solid Waste Management in Puri Municipality

In Puri Municipality there exists a mechanised Bio-compost plant for treatment of garbage generated of capacity 100 TPD installed by M/s Excel Industries Ltd., Bombay and other details related to MSW is given in the following table.

Population (2001)	157776
Floating Population Daily Average	30000 to 40000
During Car Festival	7 to 8 lakh
Slum pockets	32
No. of wards	30
No. of employees	890
Waste generation kg/capita/day	0.3 to 0.5
Garbage generated/day	79 MT
Garbage collected/day	50 MT
Public Toilets	13 nos.
Sweepers	484
Janadars	24
Sanitary Inspectors	6
Health Officer	1
Road Paved	150 km
Kutchha	185 km
Length of drain	118 km
Equipment	Short & long, handle broom, wheel barrow, auto trolley, tractor, mini truck

Source - Orissa Review (April 2005)

The waste collected by the sweepers during sweeping is brought by them to dustbin sites by wheel barrows and ultimately to solid waste management plant at Baliapanda.



Status of Solid Waste Management in Rourkela Municipality

The Municipality is divided into 32 No. of Wards. As per present practice collection, carriage and disposal of Solid Waste is done by engaging 429 nos. of sweepers under supervision of 1 Health Officer, 8 Nos. of Sanitary Inspectors and 10 nos. of Sanitary Supervisors for collection and disposal of garbages. Around 200 nos. of wheel barrows, 2 nos. of tractors and 5 nos. of trucks are engaged daily for carriage of solid waste from transit /community bins to disposal sites. The dumped garbages are allowed to decompose and shrink at the spot, spreading and leveling are often done by dozor / excavators as and when required.

	1991	2001	2011
Population in lakhs	1.77	2.30	3.00
Total Solid Waste/day (leaving for recycling)	89 MT	115 MT	150 MT
Approx. Volume (@ 450 kg/m ³)	197cum	256 cum	333 cum
Total organic content (@ 20% of volume)	39 cum	51 cum	67 cum
Compostable materials /day (@35% volume)	69 cum	90cum	117 cum
Approximate community bins/required (1 bin/100)	1740 nos	2300 nos	3000 nos
Solid waste generated/ 100 population with alternate day cleaning	100 kg= 0.2 cum	100 kg= 0.2 cum	100 kg= 0.2 cum
Capacity of each community bin considering 50% extra volume	0.3 cum =300 liter	0.3 cum =300 liter	0.3 cum =300 liter
Growth in solid waste generated with respect to usage & demand for packed products	0.3 cum =300 liter	0.5 cum =500 liter	0.75 cum =750 liter

Source - Orissa Review (January-2006)



NEED FOR 3Rs

(Reducing, Reusing and Recycling) :

Practising the '3Rs' everyday is not only important for a healthy environment but also a good method of waste management.

Reduce / Reduction :

A key part of waste reduction is 'Conservation' - Using natural resources wisely, and using less than usual in order to avoid waste. Many stores allow shoppers to scoop out the amount they need of buck goods like nuts or coffee. This considerably reduces waste and packaging materials. Buy in buck by selecting bigger quantities, in a single box package for example, buy the largest box of toothpaste or concentrated detergent. This not only reduces the waste but also save money.

Reuse :

Reuse of materials in their original form is practised instead of throwing them away, or passing those materials on to others who could use them too! Remember, one man's trash is another man's treasure! Here are some examples of reuse :

Take along washable cups or travel mugs instead of disposables, a lot of restaurants and convenient stores will be glad to fill or refill your own mug.

At the time of wing disposables like plastic cups, plates, utensils, and plastic food storage bags, don't throw them away! Wash and reuse them - most of them will last for a long time with many uses. They may not cost much to replace, but it doesn't make any more sense to throw away those things than it does to throw away your bicycle after one use.

Use cloth gift bags and stop ripping the paper off gifts! If you remove the wrapping paper carefully, you can use it again, and there's nothing wrong with doing just that! And don't forget to use canvas or cloth bags when shopping, so that you don't need to make the choice between "Paper or Plastics".

Use washable table napkins instead of paper napkins - cloth napkins are usually much larger and more absorbent than paper products, and they can dress up your dinner table too!

Recycling :

It has been estimated that 60% of the materials that we throw away could be sorted and recycled (used again). Rubbish from homes and factories, contains useful materials that can be recycled. More than half of contents of the average family dustbin could be sorted from the rubbish and used again.

Glass is unique in that it can be used over and over again without any loss of quality. Broken or waste glass is mixed with sand, limestone and soda ash, and used to make new glass.

More than half of household waste is paper, and although recycled paper is not as good as the original, it still has many uses. Recycled paper and cardboard are used in the building industry.

Even before recycling became economically important, there was a scrap-metal industry. People collected waste metal products, particularly iron, for sale to metal - producing firms. Some metals are easily separated from rubbish, and then melted down and reused. They include the tin coating on most steel food cans, as well as the valuable aluminium used to make soft-drink cans, metal foil and milk bottle tops.

Plastic bottles, bags and containers can be recycled. It is important to recycle plastic because it does not rot and can give off harmful gases when burned. Even the rubbish dumped in land fill sites can be recycled to provide an energy source. When the rubbish is compressed, it produced a gas called methane. This can be used as a fuel. If we recycled 75% of the world's paper, over 35 million trees would be saved each year.

Enforcement of Environment Laws to Minimize Waste :

The constitution of India imposes a duty on every citizen to protect and improve the natural environment as directive principles of the fundamental rights. Following environment - related laws have been enforced to manage the environment.

Environment (Protection) Act, 1986

The Act defines terms such as environment, environmental pollutant, hazardous substances. According to the Act the government is empowered to take major steps to protect and improve the environment, give direction and make rules to regulate environmental pollution (air and water quality standard, prohibiting or restricting the handling of hazardous materials etc.)

Conclusion :

Preservation of the environment for the future generation needs knowledge of the natural processes and those imposed by human activities that are going on within the atmosphere, the geosphere and the hydrosphere all taken together, some of the environmental issues are acute and require immediate attention.

Population is gradually increasing. Accordingly waste will be generated. There is a need of proper management. This is being practiced in some areas. However much efforts are needed to cover the state. In this regard, public awareness will play an important role in addressing the issue at local level. Various types of awareness programmes are being organized to spread the awareness for management of this problem. More impact will be noticed if this will be continued and cover all corners of the state.

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