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INTRODUCTION

India occupies 2.4% of the world's total area and supports 17% of the total world population in that area. There are 25 'Million Cities' (population exceeding 1 million), 6 metros and about 4,000 towns in the country. Urban Solid Waste Management still remains one of the neglected areas of urban management. The magnitude of the problem, the financial and infrastructural constraints including the paucity of land, safe disposal of waste generated, lack of awareness and apathy at all levels have come in the way of safe and efficient management of solid waste

The city of Bangalore is the 6th largest and one among the fast growing cities of India having a population of nearly 6 million. Besides, the city has a floating population of over 5 lakhs. While Bangalore city is being considered as one of the finest and livable cities of India and is considered as a city of choice by the elite as well as industrial entrepreneurs, the city is facing a serious problem of environmental degradation on several counts; one of them is inefficient and outdated system of Solid Waste Management. According to an estimate, 2,200 MT of solid waste is generated in the city everyday.

The Bangalore Mahanagara Palike, the principal agency responsible for solid waste management in the city, until recently did not have any site identified for the disposal of waste. However, Bangalore city is blessed with 3 big composting units that are at present processing nearly 500 MT of city garbage.

Bangalore is no stranger to the subject of garbage composting. About ten years ago, when awareness about the mounting garbage problem became palpable, the resultant public pressure to improve garbage collection services culminated in a number of schemes being started by neighbourhood groups. Assisted by NGOs, these residents organized themselves to collect waste at the doorstep while at the same time providing a livelihood to poor rag pickers who could now earn money from the sale of recyclables in addition to a salary for running and supervising the scheme. About 40 such schemes exist today. Several of these schemes also involve composting at the neighbourhood scale, usually in public parks. The primary focus of these schemes is on changing the attitudes of citizens to achieve the result of environment improvement, resource recovery and participation of stakeholders in rendering an important civic service.

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MINISTRY OF ENVIRONMENT AND FORESTS
NOTIFICATION

New Delhi, the 25th September, 2000

S.O. 908(E).—Whereas the draft of the Municipal Solid Wastes (Management and Handling) Rules, 1999 were published under the notification of the Government of India in the Ministry of Environment and Forests number S.O. 783(E), dated, the 27th September, 1999 in the Gazette of India, Part II, Section 3, Sub-section (ii) of the same date inviting objections and suggestions from the persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which the copies of the Gazette containing the said notification are made available to the public;

And whereas copies of the said Gazette were made available to the public on the 5th October, 1999;

And whereas the objections and suggestions received from the public in respect of the said draft rules have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by section 3, 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules to regulate the management and handling of the municipal solid wastes, namely :-

1. Short title and commencement .—

(1) These rules may be called the Municipal Solid Wastes (Management and Handling) Rules, 2000.

(2) Save as otherwise provided in these rules, they shall come into force on the date of their publication in the Official Gazette.

2. **Application .—** These rules shall apply to every municipal authority responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes .

3. **Definitions.—** In these rules, unless the context otherwise requires ,—

(i) **"anaerobic digestion"** means a controlled process involving microbial decomposition of organic matter in the absence of oxygen;

(ii) **“authorization”** means the consent given by the Board or Committee to the “operator of a facility” ;

(iii) **“biodegradable substance”** means a substance that can be degraded by micro-organisms;

(iv) **“biomethanation”** means a process which entails enzymatic decomposition of the organic matter by microbial action to produce methane rich biogas;

(v) **“collection”** means lifting and removal of solid wastes from collection points or any other location;

(vi) **“composting”** means a controlled process involving microbial decomposition of organic matter;

(vii) **“demolition and construction waste”** means wastes from building materials debris and rubble resulting from construction, re-modelling, repair and demolition operation;

(viii) **“disposal”** means final disposal of municipal solid wastes in terms of the specified measures to prevent contamination of ground-water, surface water and ambient air quality;

(ix) **“Form”** means a Form appended to these rules;

(x) **“generator of wastes”** means persons or establishments generating municipal solid wastes;

(xi) **“landfilling”** means disposal of residual solid wastes on land in a facility designed with protective measures against pollution of ground water, surface water and air fugitive dust, wind-blown litter, bad odour, fire hazard, bird menace, pests or rodents, greenhouse gas emissions, slope instability and erosion;

(xii) **“leachate”** means liquid that seeps through solid wastes or other medium and has extracts of dissolved or suspended material from it;

(xiii) **“lysimeter”** is a device used to measure rate of movement of water through or from a soil layer or is used to collect percolated water for quality analysis;

(xiv) **“municipal authority”** means Municipal Corporation, Municipality, Nagar Palika, Nagar Nigam, Nagar Panchayat, Municipal Council including notified area committee (NAC) or any other local body constituted under the relevant statutes and, where the management and handling of municipal solid waste is entrusted to such agency;

(xv) **“municipal solid waste”** includes commercial and residential wastes generated in a municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes;

(xvi) **"operator of a facility"** means a person who owns or operates a facility for collection, segregation, storage, transportation, processing and disposal of municipal solid wastes and also includes any other agency appointed as such by the municipal authority for the management and handling of municipal solid wastes in the respective areas;

(xvii) **"pelletisation"** means a process whereby pellets are prepared which are small cubes or cylindrical pieces made out of solid wastes and includes fuel pellets which are also referred as refuse derived fuel;

(xviii) **"processing"** means the process by which solid wastes are transformed into new or recycled products;

(xix) **"recycling"** means the process of transforming segregated solid wastes into raw materials for producing new products, which may or may not be similar to the original products;

(xx) **"Schedule"** means a Schedule appended to these rules;

(xxi) **"segregation"** means to separate the municipal solid wastes into the groups of organic, inorganic, recyclables and hazardous wastes;

(xxii) **"State Board or the Committee"** means the State Pollution Control Board of a State, or as the case may be, the Pollution Control Committee of a Union territory;

(xxiii) **"storage"** means the temporary containment of municipal solid wastes in a manner so as to prevent littering, attraction to vectors, stray animals and excessive foul odour;

(xxiv) **"transportation"** means conveyance of municipal solid wastes from place to place hygienically through specially designed transport system so as to prevent foul odour, littering, unsightly conditions and accessibility to vectors;

(xxv) **"vadose water"** water which occurs between the ground, surface and the water table that is the unsaturated zone;

(xxvi) **"vermicomposting"** is a process of using earthworms for conversion of bio-degradable wastes into compost.

4. Responsibility of municipal authority .-

(1) Every municipal authority shall, within the territorial area of the municipality, be responsible for the implementation of the provisions of these rules, and for any

infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

(2) The municipal authority or an operator of a facility shall make an application in **Form-I,** for grant of authorization for setting up waste processing and disposal facility including landfills from the State Board or the Committee in order to comply with the implementation programme laid down in **Schedule I**.

(3) The municipal authority shall comply with these rules as per the implementation schedule laid down in **Schedule I.**

(4) The municipal authority shall furnish its annual report in **Form-II**,-
- (a) to the Secretary-incharge of the Department of Urban Development of the concerned State or as the case may be of the Union territory, in case of a metropolitan city; or
- (b) to the District Magistrate or the Deputy Commissioner concerned in case of all other towns and cities,

with a copy to the State Board or the Committee on or before the 30th day of June every year.

5. Responsibility of the State Government and the Union territory Administrations .--

(1) The Secretary-incharge of the Department of Urban Development of the concerned State or the Union territory, as the case may be, shall have the overall responsibility for the enforcement of the provisions of these rules in the metropolitan cities.

(2) The District Magistrate or the Deputy Commissioner of the concerned district shall have the overall responsibility for the enforcement of the provisions of these rules within the territorial limits of their jurisdiction.

6. Responsibility of the Central Pollution Control Board and the State Board or the Committees .—

(1) The State Board or the Committee shall monitor the compliance of the standards regarding ground water, ambient air, leachate quality and the compost quality including incineration standards as specified under **Schedules II, III** and **IV**.

(2) The State Board or the Committee, after the receipt of application from the municipal authority or the operator of a facility in **Form I,** for grant of authorization for setting up waste processing and disposal facility including landfills, shall examine the proposal taking into consideration the views of other agencies like the State Urban Development Department, the Town and Country Planning Department, Air Port or Air Base Authority, the Ground Water Board or any such other agency prior to issuing the authorization.

(3) The State Board or the Committee shall issue the authorization in **Form-III** to the municipal authority or an operator of a facility within forty-five days stipulating compliance criteria and standards as specified in **Schedules II, III** and **IV** including such other conditions, as may be necessary.

(4) The authorization shall be valid for a given period and after the validity is over, a fresh authorization shall be required.

(5) The Central Pollution Control Board shall co-ordinate with the State Boards and the Committees with particular reference to implementation and review of standards and guidelines and compilation of monitoring data.

7. Management of municipal solid wastes .--

(1) Any municipal solid waste generated in a city or a town, shall be managed and handled in accordance with the compliance criteria and the procedure laid down in **Schedule-II.**

(2) The waste processing and disposal facilities to be set up by the municipal authority on their own or through an operator of a facility shall meet the specifications and standards as specified in **Schedules III** and **IV.**

8. Annual Reports .—

(1) The State Boards and the Committees shall prepare and submit to the Central Pollution Control Board an annual report with regard to the implementation of these rules by the 15th of September every year in **Form-IV**.

(2) The Central Pollution Control Board shall prepare the consolidated annual review report on management of municipal solid wastes and forward it to the Central Government alongwith its recommendations before the 15th of December every year.

9. Accident Reporting .-- When an accident occurs at any municipal solid wastes collection, segregation, storage, processing, treatment and disposal facility or landfill site or during the transportation of such wastes, the municipal authority shall forthwith report the accident in **Form-V** to the Secretary in-charge of the Urban Development Department in metropolitan cities, and to District Collector or Deputy Commissioner in all other cases.

Schedule I

[see rules4(2) and (3)]

Implementation Schedule

Serial No.	Compliance Criteria	Schedule
1.	Setting up of waste processing and disposal facilities	By 31.12.2003 or earlier
2.	Monitoring the performance of waste processing and disposal facilities	Once in six months
3.	Improvement of existing landfill sites as per provisions of these rules	By 31.12.2001 or earlier
4.	Identification of landfill sites for future use and making site (s) ready for operation	By 31.12.2002 or earlier

Schedule -II

[see rules 6(1) and (3), 7(1)]

Management of Municipal Solid Wastes

S. no	Parameters	Compliance criteria
1.	**Collection of municipal solid wastes**	1. Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the State Governments. To prohibit littering and facilitate compliance, the following steps shall be taken by the municipal authority, namely :- (i) Organising house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house-to-house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicle (without exceeding permissible noise levels); (ii) Devising collection of waste from slums and squatter areas or localities including hotels, restaurants, office complexes and commercial areas; (iii) Wastes from slaughter houses, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, shall be managed to make use of such wastes; (iv) Bio-medical wastes and industrial wastes shall not be mixed with municipal solid wastes and such wastes shall follow the rules separately specified for the purpose; (v) Collected waste from residential and other areas shall be

		transferred to community bin by hand-driven containerised carts or other small vehicles; (vi) Horticlutural and construction or demolition wastes or debris shall be separately collected and disposed off following proper norms. Similarly, wastes generated at dairies shall be regulated in accordance with the State laws; (vii) Waste (garbage, dry leaves) shall not be burnt; (viii) Stray animals shall not be allowed to move around waste storage facilities or at any other place in the city or town and shall be managed in accordance with the State laws. 2. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town. 3. It shall be the responsibility of generator of wastes to avoid littering and ensure delivery of wastes in accordance with the collection and segregation system to be notified by the municipal authority as per para 1(2) of this Schedule.
2.	**Segregation of municipal solid wastes**	In order to encourage the citizens, municipal authority shall organise awareness programmes for segregation of wastes and shall promote recycling or reuse of segregated materials. The municipal authority shall undertake phased programme to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare associations and non-governmental organizations.
3.	**Storage of municipal solid wastes**	Municipal authorities shall establish and maintain storage facilities in such a manner as they do not create unhygienic and insanitary conditions around it. Following criteria shall be taken into account while establishing and maintaining storage facilities, namely :- (i) Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities. A storage facility shall be so placed that it is accessible to users; (ii) Storage facilities to be set up by municipal authorities or any other agency shall be so designed that wastes stored are not exposed to open atmosphere and shall be

		aesthetically acceptable and user-friendly; (iii) Storage facilities or 'bins' shall have 'easy to operate' design for handling, transfer and transportation of waste. Bins for storage of bio-degradable wastes shall be painted green, those for storage of recyclable wastes shall be painted white and those for storage of other wastes shall be painted black; (iv) Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.
4.	**Transportation of municipal solid wastes**	Vehicles used for transportation of wastes shall be covered. Waste should not be visible to public, nor exposed to open environment preventing their scattering. The following criteria shall be met, namely:- (i) The storage facilities set up by municipal authorities shall be daily attended for clearing of wastes. The bins or containers wherever placed shall be cleaned before they start overflowing; (ii) Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.
5.	**Processing of municipal solid wastes**	Municipal authorities shall adopt suitable technology or combination of such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:- (i) The biodegradable wastes shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes. It shall be ensured that compost or any other end product shall comply with standards as specified in Schedule-IV; (ii) Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pelletisation can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorisation.
6.	**Disposal of municipal solid wastes**	Land filling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. Land filling shall also

		be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Land filling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land-filling shall be done following proper norms. Landfill sites shall meet the specifications as given in Schedule –III.

Schedule III
[see rules 6(1) and (3), 7(2)]

Specifications for Landfill Sites

Site Selection

1. In areas falling under the jurisdiction of 'Development Authorities' it shall be the responsibility of such Development Authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. Elsewhere, this responsibility shall lie with the concerned municipal authority.

2. Selection of landfill sites shall be based on examination of environmental issues. The Department of Urban Development of the State or the Union territory shall co-ordinate with the concerned organisations for obtaining the necessary approvals and clearances.

3. The landfill site shall be planned and designed with proper documentation of a phased construction plan as well as a closure plan.

4. The landfill sites shall be selected to make use of nearby wastes processing facility. Otherwise, wastes processing facility shall be planned as an integral part of the landfill site.

5. The existing landfill sites which continue to be used for more than five years, shall be improved in accordance of the specifications given in this Schedule.

6. Biomedical wastes shall be disposed off in accordance with the Bio-medical Wastes (Management and Handling) Rules, 1998 and hazardous wastes shall be managed in accordance with the Hazardous Wastes (Management and Handling) Rules, 1989, as amended from time to time.

7. The landfill site shall be large enough to last for 20-25 years.

8. The landfill site shall be away from habitation clusters, forest areas, water bodies, monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.

9. A buffer zone of no-development shall be maintained around landfill site and shall be incorporated in the Town Planning Department's land-use plans.

10. Landfill site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase.

Facilities at the Site

11. Landfill site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.

12. The landfill site shall be well protected to prevent entry of unauthorised persons and stray animals.

13. Approach and other internal roads for free movement of vehicles and other machinery shall exist at the landfill site.

14. The landfill site shall have wastes inspection facility to monitor wastes brought in for landfill, office facility for record keeping and shelter for keeping equipment and machinery including pollution monitoring equipments.

15. Provisions like weigh bridge to measure quantity of waste brought at landfill site, fire protection equipments and other facilities as may be required shall be provided.

16. Utilities such as drinking water (preferably bathing facilities for workers) and lighting arrangements for easy landfill operations when carried out in night hours shall be provided.

17. Safety provisions including health inspections of workers at landfill site shall be periodically made.

Specifications for land filling

18. Wastes subjected to land filling shall be compacted in thin layers using landfill compactors to achieve high density of the wastes. In high rainfall areas where heavy compactors cannot be used,alternative measures shall be adopted.

19. Wastes shall be covered immediately or at the end of each working day with minimum 10 cm of soil, inert debris or construction material till such time waste processing facilities for composting or recycling or energy recovery are set up as per Schedule I.

20. Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil shall be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. Proper drainage berms shall be constructed to divert run-off away from the active cell of the landfill.

21. After completion of landfill, a final cover shall be designed to minimize infiltration and erosion. The final cover shall meet the following specifications, namely :--

(a) The final cover shall have a barrier soil layer comprising of 60 cms of clay or amended soil with permeability coefficient less that 1 x 10^{-7} cm/sec.

(b) On top of the barrier soil layer,there shall be a drainage layer of 15 cm.

(c) On top of the drainage layer, there shall be a vegetative layer of 45 cm to support natural plant growth and to minimize erosion.

Pollution prevention

22. In order to prevent pollution problems from landfill operations, the following provisions shall be made, namely :-

(a) Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water and also for avoiding flooding and creation of marshy conditions;

(b) Construction of a non-permeable lining system at the base and walls of waste disposal area. For landfill receiving residues of waste processing facilities or mixed waste or waste having contamination of hazardous materials (such as aerosols, bleaches, polishes, batteries, waste oils, paint products and pesticides) minimum liner specifications shall be a composite barrier having 1.5 mm high density polyethylene (HDPE) geomembrane, or equivalent, overlying 90 cm of soil (clay or amended soil) having permeability coefficient not greater than 1 x 10^{-7} cm/sec. The highest level of water table shall be at least two meter below the base of clay or amended soil barrier layer;

(c) Provisions for management of leachates collection and treatment shall be made. The treated leachates shall meet the standards specified in Schedule- IV;

(d) Prevention of run-off from landfill area entering any stream, river, lake or pond.

Water Quality Monitoring

23. Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 metres of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit as decided by the Ground Water Board or the State Board or the Committee. Such monitoring shall be carried out to cover different seasons in a year that is, summer, monsoon and post-monsoon period.

24. Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) is to be considered after ensuring its quality. The following specifications for drinking water quality shall apply for monitoring purpose, namely :-

S.No.	**Parameters**	**IS 10500: 1991 Desirable limit (mg/l except for pH)**
1.	Arsenic	0.05
2.	Cadmium	0.01
3	Chromium	0.05
4.	Copper	0.05
5.	Cyanide	0.05
6.	Lead	0.05
7.	Mercury	0.001
8.	Nickel	-
9.	Nitrate as NO_3	45.0
10	PH	6.5-8.5
11.	Iron	0.3
12.	Total hardness (as $CaCO_3$)	300.0
13.	Chlorides	250
14.	Dissolved solids	500
15.	Phenolic compounds (as C_6H_5OH)	0.001
16.	Zinc	5.0
17.	Sulphate (as SO_4)	200

Ambient Air Quality Monitoring

25. Installation of landfill gas control system including gas collection system shall be made at landfill site to minimize odour generation, prevent off-site migration of gases and to protect vegetation planted on the rehabilitated landfill surface.

26. The concentration of methane gas generated at landfill site shall not exceed 25 per cent of the lower explosive limit (LEL).

27. The landfill gas from the collection facility at a landfill site shall be utilized for either direct thermal applications or power generation, as per viability. Otherwise, landfill gas shall be burnt (flared) and shall not be allowed to directly escape to the atmosphere or for illegal tapping. Passive venting shall be allowed if its utilisation or flaring is not possible.

28. Ambient air quality at the landfill site and at the vicinity shall be monitored to meet the following specified standards, namely :-

S.No.	**Parameters**	**Acceptable levels**
(i)	Sulphur dioxide	120 μg/m^3 (24 hours)
(ii)	Suspended Particulate Matter	500 μg/m^3 (24 hours)
(iii)	Methane	Not to exceed 25 per cent of the lower explosive limit (equivalent to 650 mg/m^3)
(iv)	Ammonia daily average (Sample duration 24 hrs)	0.4 mg/m^3 (400 μg/m^3)
(v)	Carbon monoxide	1 hour average : 2 mg/m^3 8 hour average : 1 mg/m^3

29. The ambient air quality monitoring shall be carried out by the concerned authority as per the following schedule, namely:-

(a) Six times in a year for cities having population of more than fifty lakhs;

(b) Four times in a year for cities having population between ten and fifty lakhs;

(c) Two times in a year for town or cities having population between one and ten lakhs.

Plantation at Landfill Site

30. A vegetative cover shall be provided over the completed site in accordance with the following specifications, namely :-

(a) Selection of locally adopted non-edible perennial plants that are resistant to drought and extreme temperatures shall be allowed to grow;

(b) The plants grown be such that their roots do not penetrate more than 30 cms. This condition shall apply till the landfill is stabilised;

(c) Selected plants shall have ability to thrive on low-nutrient soil with minimum nutrient addition;

(d) Plantation to be made in sufficient density to minimize soil erosion.

Closure of Landfill Site and Post-care

31. The post-closure care of landfill site shall be conducted for at least fifteen years and long term monitoring or care plan shall consist of the following, namely :-

(a) Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(b) Monitoring leachate collection system in accordance with the requirement;

(c) Monitoring of ground water in accordance with requirements and maintaining ground water quality;

(d) Maintaining and operating the landfill gas collection system to meet the standards.

32. Use of closed landfill sites after fifteen years of post-closure monitoring can be considered for human settlement or otherwise only after ensuring that gaseous and leachate analysis comply with the specified standards.

Special provisions for hilly areas

33. Cities and towns located on hills shall have location-specific methods evolved for final disposal of solid wastes by the municipal authority with the approval of the concerned State Board or the Committee. The municipal authority shall set up processing facilities for utilization of biodegradable organic wastes. The inert and non-biodegradable waste shall be used for building roads or filling-up of appropriate areas on hills. Because of constraints in finding adequate land in hilly areas, wastes not suitable for road-laying or filling up shall be disposed of in specially designed landfills.

Schedule IV
[see rules 6(1) and (3), 7(2)]

Standards for Composting, Treated Leachates and Incineration

1. The waste processing or disposal facilities shall include composting, incineration, pelletisation, energy recovery or any other facility based on state-of-the-art technology duly approved by the Central Pollution Control Board.

2. In case of engagement of private agency by the municipal authority, a specific agreement between the municipal authority and the private agency shall be made particularly, for supply of solid waste and other relevant terms and conditions.

3. In order to prevent pollution problems from compost plant and other processing facilities, the following shall be complied with, namely :-

   (i) The incoming wastes at site shall be maintained prior to further processing. To the extent possible, the waste storage area should be covered. If, such storage is done in an open area, it shall be provided with impermeable base with facility for collection of leachate and surface water run-off into lined drains leading to a leachate treatment and disposal facility;

   (ii) Necessary precautions shall be taken to minimise nuisance of odour, flies, rodents, bird menace and fire hazard;

   (iii) In case of breakdown or maintenance of plant, waste intake shall be stopped and arrangements be worked out for diversion of wastes to the landfill site;

   (iv) Pre-process and post-process rejects shall be removed from the processing facility on regular basis and shall not be allowed to pile at the site. Recyclables shall be routed through appropriate vendors. The non-recyclables shall be sent for well designed landfill site(s).

   (v) In case of compost plant, the windrow area shall be provided with impermeable base. Such a base shall be made of concrete or compacted clay, 50 cm thick, having permeability coefficient less than 10^{-7} cm/sec. The base shall be provided with 1 to 2 per cent slope and circled by lined drains for collection of leachate or surface run-off;

   (vi) Ambient air quality monitoring shall be regularly carried out particularly for checking odour nuisance at down-wind direction on the boundary of processing plant.

   (vii) In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely:-

Parameters	**Concentration not to exceed * (mg/kg dry basis , except pH value and C/N ratio)**
Arsenic	10.00
Cadmium	5.00
Chromium	50.00
Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
pH	5.5-8.5

* Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

4. The disposal of treated leachates shall follow the following standards, namely:-

S. No	**Parameter**	**Standards (Mode of Disposal)**		
		Inland surface water	**Public sewers**	**Land disposal**
1.	Suspended solids, mg/l, max	100	600	200
2.	Dissolved solids (inorganic) mg/l, max.	2100	2100	2100
3	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4	Ammonical nitrogen (as N), mg/l, max.	50	50	-
5	Total Kjeldahl nitrogen (as N), mg/l, max.	100	-	-
6	Biochemical oxygen demand (3 days at 27^0 C) max.(mg/l)	30	350	100
7	Chemical oxygen demand, mg/l, max.	250	-	-
8	Arsenic (as As), mg/l, max	0.2	0.2	0.2
9	Mercury (as Hg), mg/l, max	0.01	0.01	-
10	Lead (as Pb), mg/l, max	0.1	1.0	-
11	Cadmium (as Cd), mg/l, max	2.0	1.0	-
12	Total Chromium (as Cr), mg/l, max.	2.0	2.0	-

13	Copper (as Cu), mg/l, max.	3.0	3.0	-
14	Zinc (as Zn), mg/l, max.	5.0	15	-
15	Nickel (as Ni), mg/l, max	3.0	3.0	-
16	Cyanide (as CN), mg/l, max.	0.2	2.0	0.2
17	Chloride (as Cl), mg/l, max.	1000	1000	600
18	Fluoride (as F), mg/l, max	2.0	15	-
19	Phenolic compounds (as C_6H_5OH) mg/l, max.	1.0	5.0	-

Note : While discharging treated leachates into inland surface waters, quantity of leachates being discharged and the quantity of dilution water available in the receiving water body shall be given due consideration.

5. The incinerators shall meet the following operating and emission standards, namely:-

A. Operating Standards

(1) The combustion efficiency (CE) shall be at least 99.00%.

(2) The combustion efficiency is computed as follows :

$$C.E. = \frac{\%CO_2}{\%CO_2 + \%CO} \times 100$$

B. Emission Standards

Parameters	Concentration mg/Nm^3 at (12% CO_2 correction)
(1) Particulate matter	150
(2) Nitrogen Oxides	450
(3) HCl	50

(4) Minimum stack height shall be 30 metres above ground.

(5) Volatile organic compounds in ash shall not be more than 0.01%.

Note :

(1) Suitably designed pollution control devices shall be installed or retrofitted with the incinerator to achieve the above emission limits, if necessary.

(2) Wastes to be incinerated shall not be chemically treated with any chlorinated disinfectants

(3) Chlorinated plastics shall not be incinerated.

(4) Toxic metals in incineration ash shall be limited within the regulatory quantities as specified in the Hazardous Wastes (Management and Handling) Rules, 1989 as amended from time to time.

(5) Only low sulphur fuel like LDO, LSHS Diesel shall be used as fuel in the incinerator.

(iii) Total quantity of wastes processed for :

(a) Composting :
....

(b) Vermiculture :
....

(c) Pellets :
....

(d) Others, if any, please specify
....

(iv) Total quantity of waste disposed by landfilling:
....

(a) No. of landfill sites used :
....

(b) Area used : ....

(c) Whether Weigh-bridge facilities available : Yes No

(d) Whether area is fenced : Yes No

(e) Lighting facility on site : Yes No

(f) Whether equipment like Bulldozer, Compacters etc. available. (Please specify) :------------------------------------
----

(g) Total Manpower available on site : --

(h) Whether covering is done on daily basis : Yes No

(i) Whether covering material is used and whether it is adequately available : ----------------------------

(j) Provisions for gas venting provided : Available (Yes/No) Not available

(k) Provision for leachate collection : Provisions made Provisions not made

2671 GI/2000-7

2. Storage facilities

(i) Area covered for collection of wastes : --

(ii) No. of houses covered : -------- ------------------------------------

(iii) Whether house-to-house collection is practised (if yes, whether done by Municipality or through Private Agency or Non-Governmental Organisation) --
-------- ------------------------------------

(iv) Bins :

	Specifications (Shape & Size)	Existing Numbers	Proposed for future
(a) RCC Bins (Capacity) :			
(b) Trolleys (Capacity) :			
(c) Containers (Capacity) :			
(d) Dumper Placers :			
(e) Others, please specify :			

(v) Whether all bins/ collection spots are attended for daily lifting of garbage : Yes No

(vi) Whether lifting of garbage from dustbins is manual or mechanical i.e. for example by using of front-end loaders (Please tick mark) : Manual Loader Others, please specify

3. Transportation

	Existing number	Actually Required/Proposed
(i)Truck :		
(ii)Truck-Tipper :		
(iii)Tractor-Trailer :		
(iv)Refuse-collector :		
(v)Dumper-placers :		
(vi)Animal Cart :		
(vii)Tricycle :		
(viii)Others (please specify) :		

4. **Whether any proposal has been made to improve solid wastes management practices**

5. **Are any efforts made to call for private firms etc. to attempt for processing of waste utilising technologies like :**

Waste Utilisation Technology	Proposals	Steps taken (Quantity to be processed)
(i) Composting :		
(ii) Vermiculture :		
(iii) Pelletisation :		
(iv) Others if any, Please specify :		

6. **What provisions are available and how these are implemented to check unhygienic operations of :**

(i) Dairy related activities :

(ii) Slaughter houses and unauthorised slaughtering :

(iii) Malba(construction

debris) lifting :

(iv) Encroachment in Parks, Footpaths etc. :

7. **How many slums are identified and whether these are provided with sanitation facilities :**

8. **Are municipal magistrates appointed for taking penal action** : Yes No
[If yes, how many cases registered & settled during last three years (give year-wise details)]

9. **Hospital waste management**

(i) How many Hospitals/Clinics under the control of the Corporation :

(ii) What methods are followed for disposal of bio-medical wastes ? :

(iii) Do you have any proposal for setting up of common treatment facility for disposal of bio-medical wastes :

(iv) How many private Nursing Homes, Clinics etc. are operating in the city/town and what steps have been taken to check disposal of their wastes :

Dated : Signature of Municipal Commissioner

Form –III

[See-rule 6(3)]

Format for Issue of Authorisation

File No.: ____________________
Date: ________________________

To,

____
____
____

Ref: Your application number ________________________ dt. ______________

The ________________ State Pollution Control Board/Pollution Control Committee after examining the proposal hereby authorises ________________ having their administrative office at ________________________________ to set up and operate waste processing/waste disposal facility at ________________ on the terms and conditions (including the standards to comply) attached to this authorization letter.

1. The validity of this authorization is till ____________. After the validity, renewal of authorization is to be sought.

2. The ____________________ State Pollution Control Board/Pollution Control Committees may, at any time, revoke any of the conditions applicable under the authorization and shall communicate the same in writing.

3. Any violation of the provision of the Municipal Solid Wastes (Managemeant and Handling) Rules, 2000 will attract the penal provision of the Environment (Protection) Act, 1986 (29 of1986).

Date :
Place :

(Member Secretary)
State Pollution Control Board/
Pollution Control Committee

Form - IV
[see rule 8(1)]

Format of Annual Review Report to be submitted by the State Pollution Control Board/Committees to the Central Pollution Control Board

To,

The Chairman,
Central Pollution Control Board,
(Ministry of Environment and Forests)
Government of India,
'Parivesh Bhawan', East Arjun Nagar,
DELHI- 110 0032.

1. Name of the State/Union territory :
2. Name & address of the State Pollution Control Board/Pollution Control Committee
3. Number of municipal authorities responsible for management of municipal solid wastes in the State/Union territory under these rules :
4. A Summary Statement on progress made by municipal authorities in respect of implementation of Schedule I [rule 4(3)] : Please attach as Annexure-I
5. A Summary Statement on progress made by municipal authorities in respect of implementation of Schedule II [rules 6(1) and (3), 7(1)] : Please attach as Annexure-II
6. A Summary Statement on progress made by municipal authorities in respect of implementation of Schedule III [rules 6(1) and (3), 7(2)] : Please attach as Annexure-III
7. A summary statement on progress made by municipal authorities in respect of implementation of Schedule IV [rules 6(1) and (3), 7(2)] : Please attach as Annexure-IV

Date:
Place :

Chairman or the Member Secretary
State Pollution Control Board/
Pollution Control Committee

Form - V
[see rule 9]
Accident reporting

1. Date and time of accident :

2. Sequence of events leading to accident :

3. The waste involved in accident :

4. Assessment of the effects of the accidents on human health and the environment :

5. Emergency measures taken :

6. Steps taken to alleviate the effects of accidents :

7. Steps taken to prevent the recurrence of such an accident :

Date : .... Signature
....

Place : .... Designation
....

[F. No. 17-2/95-HSMD]
V. RAJAGOPALAN, Jt. Secy.

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Modernization of Solid Waste Management practices in India with NGO, public and private sector participation.

By P. U. ASNANI, Urban Environment Infrastructure Representative, India

US AEP / US AID

Member, Supreme Court Committee on Solid Waste Management in Class-1 Cities in India,

Member, Technology Advisory Group on Solid Waste Management Government of India.

Chairman, Core Group on Appropriate Technologies Research & Development (SWM), Government of India

Solid waste management is an obligatory function of Urban Local Bodies (ULBs) in India. However, this service is poorly performed resulting in problems of health, sanitation and environmental degradation. With over 3.6% annual growth in urban population and the rapid pace of urbanization, the situation is becoming more and more critical with the passage of time. Infrastructure development is not in a position to keep pace with population growth owing to the poor financial health of most of the urban local bodies. Solid waste management is one among the essential services, which suffers the most in such a situation. Lack of financial resources, institutional weakness, improper choice of technology and public apathy towards solid waste management have made this service far from satisfactory.

Present scenario of present solid waste management services.

Waste generation

Waste generation ranges from 200 gms to 500 gms per capita per day in cities ranging from 1 Lac to over 50 Lacs population. The larger the city, the higher is the per-capita waste generation rate. The total waste generation in urban areas in the country is estimated to exceed 39 million tonnes a year by the year 2001.

Composition of Waste

Indian mixed waste has a large proportion of compostable material and inerts. As per NEERI studies compostable matters range from 30% to 57% and inert materials from 40% to 54 %. The component of recyclable material is between 5% to 10%.

Technology adopted for storage, collection, transportation and disposal of waste:

The prevalent SWM practices in the country are highly deficient. Generally no storage of waste is being done at source and instead domestic, trade and institutional wastes including bio-medical and industrial waste, are thrown on the streets, footpaths, drains and water bodies treating them as receptacle of waste. Recyclable waste material is also not segregated at source and is disposed of on the streets, along with domestic, trade and other wastes. Construction and demolition wastes also pose a serious problem as these wastes are also deposited on the roadside or open spaces, obstructing traffic and causing nuisance.

Primary Collection

There is no system of primary collection of waste in most cities in India. The waste thrown on the streets is; therefore, collected from the streets and/or from the street bins, which are inadequate in number and ill designed.

Waste Storage Depots

Open sites or cement concrete bins metal bins, masonry bins and structures are used for temporary bulk storage of wastes. These bins are very unhygienic and necessitate multiple handling of wastes. Waste is more often seen outside the bins than inside them. They are not cleared daily.

Street Sweeping

Street sweeping is not carried out regularly. Several streets are occasionally swept or are not swept at all. No sweeping is done on Sundays and public holidays in many cities. The tools used for street sweeping are also inefficient and out-dated.

Transportation of wastes

Transportation of waste is done through a variety of vehicles such as bullock carts, three-wheelers, tractors and trucks. Some cities use modern hydraulic vehicles. Most transport vehicles are loaded manually and utilized in one shift only, although the number of transport vehicles is inadequate. The fleet of vehicles is thus not optimally utilized. Inefficient workshop facilities deplete the fleet of vehicles. The transportation system also does not synchronize with the system of primary collection and bulk waste storage facilities. Multiple manual handling of waste becomes necessary.

local body must provide and has given technological options in the detailed report which the local bodies may consider while choosing the technology suitable for their cities.

RECOMMENDATIONS FOR MODERNISATION OF SOLID WASTE MANAGEMENT PRACTICES ARE BRIEFLY AS UNDER

Ban on Throwing of Wastes on the Streets

No waste shall be thrown on the streets, footpaths, open spaces, open drains or water bodies.

Storage of waste at source

Waste shall be stored at source of generation in 2 bins/bags, one for food/bio-degradable wastes and another for recyclable waste. Domestic hazardous waste, as and when produced, shall be kept separately from the above two streams.

Multi storeyed buildings, commercial complexes and group housing shall additionally provide community bins for storage of waste generated by their members. Community bins shall also be provided in slums by the local body for the community storage of waste by slum dwellers.

Doorstep Collection of Waste

Both the streams of waste, organic/ biodegradable waste as well as recyclable waste, shall be collected from the doorstep. Containerized handcarts or containerized tricycles or small-motorized vehicles shall be used for daily collection of food/ biodegradable waste from the doorstep through public participation using a bell, whistle or horn as a means of announcing the arrival of the collection staff.

For collection of recyclable waste from the doorstep NGOs may be encouraged to organize the rag pickers. They may allot them the work of collection of recyclable material from the doorsteps instead of picking it up from the streets, bins or dump-yard, thereby upgrading their status. This waste can be collected once or twice a week according to the convenience of the households, shops or establishments.

Hazardous toxic waste material, which is occasionally generated, shall however be disposed of by the citizens in special bins to be provided in the city at suitable locations by the urban local bodies.

Processing and Disposal of Waste

Generally no processing of waste is done in the country except in a few cities where de-centralized or centralized composting is done on a limited scale. Disposal of waste is done in a most unscientific manner. Generally crude open dumping is adopted for disposal of waste in low-lying areas. Most local bodies deposit waste at the dump-yard without ascertaining the suitability of the land for waste disposal and do not bother to cover the waste with inert material. These sites emanate a foul smell, become breeding grounds for flies, rodent and pests, and pose a serious threat to underground water resources. Thus the entire system of waste management in the country is out-dated, unscientific and highly inefficient.

Institutional Arrangements

Institutional arrangements are inefficient. There is lack of professionalism in administration in this service, resulting in poor levels of service. The laws governing the urban local bodies do not have adequate provisions to deal with the situation effectively and local bodies do not have the necessary powers to punish defaulters. Filing cases in the court for sanitation offences have become cumbersome, takes a lot of time and energy does not give the desired results.

Community Involvement

There is total apathy on the part of citizens in the matter of handling their waste and in keeping the city clean. Citizens expect the local body to keep the city clean despite their non-involvement.

NGOs and the informal sector of rag pickers are not optimally utilized in tackling the ever-growing problems of waste management in urban areas.

65% of India's urban population lives in 300 Class I cities having a population above 100,000. These cities have been facing serious problems of solid waste management but no sincere efforts were being made to improve the situation. A public interest litigation was, therefore, filed in the Supreme Court of India and having realized the gravity of the situation, the Hon'ble Supreme Court constituted an expert committee to look into all aspects of solid waste management and make recommendation to improve the situation in class-1 cities (30 cities).

The Committee so formed has carefully considered various options to improve solid waste management practices in these cities and, looking to the present state of SWM practices in urban areas in the country, the institutional capabilities of local bodies, their financial health and other priorities, the Committee has recommended a minimum level of services as under that each

Sweeping of Streets on All Days of the Year

Sweeping of streets and public places having habitation or commercial activities on one or both sides shall be done on all days of the year irrespective of Sundays and public holidays. Arrangements for rotating weekly rest-days are to be made by the local bodies.

Work Norms for Sweeping of Streets

Work norms ranging from 250 to 750 running meters of road length have been recommended, depending on the density of the area and local conditions. Giving a demarcated "pin point" area for street sweeping and waste collection is also recommended for optimum utilization of manpower.

Provision of Litterbins at Public Places

Provision of litterbins at railway stations, bus stations, market places, parks, gardens and important commercial streets may be made, to prevent littering of streets.

Abolition of Open Waste Storage Sites and other Un-hygienic Street Bins

The pathetic condition of street bins must be corrected by the provision of neat mobile closed body containers into which waste can be directly transferred from the containerized hand carts or tricycles and all open waste-storage sites as well as cement concrete or masonry bins must be abolished in a phased manner.

Transportation of Waste to Synchronize with Waste Storage Facility - Dispense with Manual Loading of Waste

For the transportation of waste, a system which synchronizes with both primary collection and bulk waste storage facilities may be introduced. Manual loading and multiple handling of waste may be dispensed with and instead, hydraulic vehicles for lifting the containers may be used in larger cities and tractor trolleys or a tractor container combination may be used in smaller cities.

Transportation of waste shall be done on a regular basis before the temporary waste-storage containers start over-flowing. For economy in expenditure, the vehicle fleet should be used in at least two shifts. Workshop facilities may be optimized to keep at least 80% of the vehicle fleet on road. Transfer stations may be set up in cities where the distance to waste-disposal sites is more than 10 KMs.

PROCESSING AND DISPOSAL OF WASTE:

Conversion of Organic Waste/Bio-degradable Waste into Bio-organic Fertilizer (Compost)

With the availability of land for processing and disposal of waste becoming scarce and the food and bio-degradable component useful to agriculture going waste, measures for conservation of land and organic waste resource shall be taken and Organics shall be returned to the soil. To meet these objectives, all food waste and bio degradable waste shall be composted, recyclable waste shall be passed on to the recycling industry and only rejects shall be landfilled in a scientific manner. Decentralized composting with public and NGOs/CBO participation, may be encouraged wherever possible, and centralized composting of the rest of the waste may be done. Microbial or vermi composting processes may be adopted. A variety of composting options has been given in the report and their processes are explained.

Caution against using unproven technologies

Local bodies are cautioned not to adopt expensive technologies of power generation, fuel pelletisation, incineration etc. until they are proven under Indian conditions and the Government of India or expert agencies nominated by the Government of India advises cities that such technology can be adopted.

Land to be made available on priority for processing and disposal of waste

Availability of land for setting up processing plants and for disposal of waste is a major problem faced by urban local bodies. Government wasteland must therefore be given on top priority for this purpose free or at nominal cost, and if such land is not available or not found suitable, private land should be acquired or purchased through negotiated settlement. A Committee at the district level should identify suitable land and State Governments should form Empowered Committees to give speedy final clearance and prompt possession of suitable land to the ULB.

Criteria for Site Selection, Site Development and Landfill Operations

Criteria for site selection, development of land fill sites and scientific landfill operations may be adopted. Remediation of old abandoned landfill sites should also be done as suggested in the detailed report. Bio-medical waste, industrial waste and slaughterhouse waste may be managed as per the relevant Rules and guidelines of the Government of India and/or Central Pollution Control Board.

Institutional Strengthening and Capacity Building

Institutional strengthening is the key to success of the SWM system. Professionalism in administration, decentralization of administration, delegation of financial and administrative powers, induction of environmental/public health engineers in the solid waste management services and fixation of work norms and proper supervisory levels are recommended. Human resource development through training at various levels needs to be taken up. Municipal Commissioners and Chief Executives should not be transferred frequently and should have a tenure of at least 3 years to perform effectively. Inter-city meets for sharing of experience are recommended.

Adequate safe-guards for the supervisory staff against abuse of the Schedule Caste/Scheduled Tribe (Prevention of Atrocities) Act 1984 may be provided through suitable amendments in the law to enable the Supervisory staff to perform their duties fearlessly.

NGO/Private sector Participation in SWM Services

There is a need to improve accountability and the level of services through NGO/Private sector participation in SWM services to improve overall performance without harming the interests of the existing staff. Suitable amendments in the Contract Labour (Regulation and Abolition) Act 1970 may be done by the Govt. of India to permit private sector participation in this service.

Enforcement

A system of levy of administrative charges or special cleaning charges from those who litter the streets or cause nuisance on the streets may be introduced and powers to punish offenders may be given to the local bodies through suitable additions to the Municipal acts & rules.

Management Information System

MIS is the key to monitoring the performance of manpower and machinery and to help in planning for the future. Detailed management information systems suggested in the report may be introduced.

Financial Aspects

The poor financial health of ULBs is major constraint in improving SWM systems. The financial condition of local bodies may first be improved by setting the house in order and a series of measures towards financial discipline, avoidance of wasteful expenditure, prioritizing the expenditure on essential services, as recommended in the report may be taken. Taxes, user charges and fees should be raised and linked to the cost-of-living index. Area-based property-tax reforms may be taken up to improve the finances of the ULBs.

Health Aspects

Improper SWM practices give rise to problems of health and sanitation. Twenty-two types of diseases are associated with improper SWM practices. Proper management of processing and disposal sites, special attention to cleaning of slums, provision of low cost sanitation facilities to prevent open defecation, prevention of cattle nuisance, proper training to the workforce and use of protective clothing are some of the measures the local body should take immediately to protect the health of the citizens and the work force.

Legal Aspects

Citizens' active participation may be ensured through massive public awareness campaigns. Simultaneously, adequate provisions may be made in local State laws governing the local bodies to ensure public participation and action against defaulters. Legislative provisions to be made by each State have been suggested in the report.

Public Awareness Strategy

Public awareness campaign using information, education and communication (I-E-C) techniques may be used. Waste Reduction, Reuse, Recycling (R-R-R) may be advocated to reduce the burden on the local body and citizens may be motivated to store waste at source in a two-bin system, co-operate with the doorstep primary collection system and keep the city litter-free. Hygienic Solid Waste Management needs to find a place in the National Agenda.

NGO, public and private sector participation.

The entire report of Supreme court committee and the manual for the solid waste management lay emphasize on active involvement of non-governmental organizations (NGOs) in creating awareness among the people, in organizing the rag pickers for collection of recyclable material and in organizing door step collection from households, shops and establishments.

A lot of emphasizes is given on public participation, without which no system would ever succeed. Public participation in the area of storage of waste at source, & at the community level and in the primary collection of waste is highly advocated and insisted upon. Legal provisions are also suggested to take action against the citizens if they fail to comply in spite of repeated instructions through awareness campaign to cooperate in the system.

Private sector participation is the key to success in the areas where higher technologies are involved and where personalized services are proposed to be given. With ever increasing cost of manpower and relatively lower efficiencies of public sector undertakings, it has been strongly recommended that private sector should be involved in the area of door step collection of waste from hospitals, nursing homes, hotels, restaurants, commercial complexes, households, etc. as well as in the area of transportation of waste and setting up solid waste treatment and disposal facilities in the urban areas.

Municipal solid waste (Management & Handling) Rules 2000.

The Government of India, Ministry of Environment have framed rules under the Environment Protection Act for the handling and management of municipal solid waste. These rules are binding to all the urban local bodies in the country. Each city government is, therefore, required to comply with the provision of the rules in the given time frame. However, implementation of laws remains on paper if a proper machinery is not created for the implementation of law and the community as well as community organizations are not actively associated. The Ministry of Urban Development, has for the first time come out with a detailed manual on solid waste management to guide the urban local bodies in improving solid waste management practices and has strongly suggested the involvement of community and the NGOs. All efforts are, therefore, required to be made by the urban local bodies to mobilize the community, motivate them with the help of the NGOs, CBOs and implement the provisions of the aforesaid rules in an environmentally acceptable and Eco-friendly manner to give the desired results of the legislation that has been made to improve the solid waste management practices in the country.

URBAN SOLID WASTE: PROBLEMS AND SOLUTIONS

Almitra H Patel, 50 Kothnur, Bangalore 560077

The Problem:

India uses her streets for dumping waste around the clock and collecting it more or less frequently or not at all.

India uses her low-lying areas, ideal for ground-water recharge, as open dumps for city waste, in rural areas or along highways just outside the city limits.

The Solution:

>> The best way to keep streets clean is to not let them get dirty in the first place.

>> The best way to minimize dumping problems is to treat waste as wealth and recycle as much as possible. This has been done since Vedic times but now forgotten.

These solutions are spelt out in India's latest national policy for handling garbage.

The Ministry of Environment in **September 2000** issued **"Municipal Solid Waste (Management & Handling) Rules 2000"** under our Environment Protection Act. Some highlights:

>> It applies to **all towns and cities over 20,000 population.**
All their local Solid Waste Management (SWM) Plans will now have to be framed in conformity with these Rules.

>> Every **Municipal Authority shall be responsible** for the implementation of these rules and for infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid wastes.

>> The **DM or DC of each district has overall responsibility** for enforcement of rules within the territorial limits of their jurisdiction.

For metropolitan cities (over 10 lakh population), **the Secretary Urban Development** of the State / UT **has overall responsibility.**

>> The **State Pollution Control Board will grant authorization** for setting up waste processing and disposal facility including landfills, **and will monitor air and water quality and compost quality.**

Waste Segregation:

"Municipal authority shall organise awareness programmes for **segregation of wastes** and shall encourage **recycling / reuse of segregated materials.**

The municipal authority shall undertake phased programme to **ensure community participation in waste segregation.**"

Waste Collection:

To **prohibit littering**, municipal authorities should take the following steps:

(i) Organising **house to house collection** of municipal solid wastes through any of the methods... like bell ringing of musical vehicle

(ii) Devising collection of waste from **slums and squatter areas** or localities including hotels, restaurants, office complexes and commercial areas

(iii) **Wastes from slaughter houses**, meat and fish markets, fruits and vegetable markets, which are biodegradable in nature, **shall be managed to make use of such wastes**

(iv) Biomedical wastes and industrial wastes **shall not be mixed with municipal solid wastes...**"

(v) Collected waste from residential areas shall be transferred by hand-driven **containerized carts** or other small vehicles

(vi) Horticultural and construction or demolition wastes or debris shall be **separately collected** ..Wastes generated at **dairies shall be regulated** ..

(vii) **Waste** (garbage, dry leaves **shall not be burnt**

(viii) **Stray animals** shall not be allowed to move around waste ..

Waste Handling:

"**Manual handling of waste shall be prohibited.** If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers."

Waste Transport:

"Vehicles used for transportation of **wastes shall be covered.**

(i) Storage facilities set up by Municipal authorities shall be **daily attended** for clearing of wastes.

(ii) Transportation vehicles shall be so designed that **multiple handling of wastes**, prior to disposal, **is avoided.**"

Waste Processing:

Make use of wastes so as to minimize burden on landfill...

(i) The biodegradable wastes...shall be processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.

(ii) Recoverable resources shall follow the route of **recycling.**

>> Waste processing & disposal facilities must be set up by 2003 or earlier.

Disposal of Compost Rejects and Debris:

Land filling shall be **restricted to non-biodegradable, inert waste** and other waste that are not suitable either for recycling or for biological processing... and residues of waste processing facilities as well as pre-processing rejects...

Land filling of mixed waste shall be avoided.

>> Existing landfill sites must be improved by 31.12.2001 or earlier.

>> New waste processing and disposal sites must be identified and made ready for use by 2002 or earlier.

Landfill Siting:

Development Authorities to identify the landfill sites [large enough to last for 20-25 years] and hand over the sites to the concerned municipal authority [after SPCB clearance]

Selection of landfill sites shall be based on **examination of environmental issues ...** away from habitation clusters, forest areas, water bodies, monuments, National Parks, Wetlands, places of important cultural, historical or religious interest.

Prior approval of airport or airbase authorities is necessary if the site is to be located within 20 km of an airport or airbase.

Dept of Urban Development shall coordinate with concerned organizations for obtaining the necessary approvals and clearances.

A Buffer Zone of No-Development shall be maintained around the landfull site and shall be incorporated in the town Planning Department's land-use plans.

The Rules also describe Facilities required at the site, Specifications for land filling, Pollution prevention, Water quality monitoring, Ambient air quality monitoring, Plantation at landfill site, Closure of landfill site and post-care, and Standards for Compost and for disposal of treated leachates.

KARNATAKA COMPOST DEVELOPMENT CORPORATION LIMITED

A BRIEF NOTE ON THE WORKING OF THE PLANT

Karnataka Compost Development Corporation Limited, a subsidiary of Karnataka Agro Industries Corporation Limited, was, established during 1975 with a subsidy of Rs.29.62 lakhs by Government of India towards capital cost. The Share capital (authorised) is Rs.100 lakhs and the paid up capital is Rs.50.00 lakhs. Karnataka Agro Industries Corporation Limited, contributed Rs.26.00 lakhs and Bangalore Mahanagara Palike and Karnataka State Co-operative Marketing Federation Limited contributed Rs.12.00 lakhs each. The office and plant are situated in its own land of 15 acres and 10 guntas at Haralakunte.

OBJECTIVE: The main object is hygienic disposal of solid wastes of Bangalore City in a semi mechanised compost plant and obtain the compost the end product, for agricultural development and for maintaining soil fertility.

GENESIS: Solid Waste Management and setting up of compost plants in various Cities in India was started on the recommendation of the Committee on Urban Waste Management headed by Sri B. Sivaraman. The Government of India gave capital subsidy to start 24 compost plants in major Cities by the Agro Industries Corporation or Municipal Corporations. Only 10 plants were started in Ahmedabad, Bombay, Bangalore, Baroda, Delhi, Calcutta, Jodhpur, Jaipur, Kanpur and Vijayawada around 1975. Due to technical snags and financial losses, all of them were closed down except the Karnataka Compost Development Corporation Limited, Bangalore.

KCDC was started in 1975 at Bangalore and its main semi mechanised plant was commissioned in 1978. Due to technical snags, it became inoperative and the repair costs were un economical. Since then, composting process is carried out with the help of smaller screening plants whose designs were improved from time to time and now Vibrator Screening Plants are used to obtain fine Organic Manure.

PROCESS: KCDC adopted aerobic decomposition windrow method. When Organic material are decomposed in the presence of oxygen, the process is called aerobic. The garbage received is arranged in windrows after segregation of contararies , on the concrete platform. A nitrogen fixing innoculent is sprayed on the garbage to speed up decomposition and to reduce odours.

The windrows are turned with the help of Auger and Front end loaders for areation once in 5 days so that aerobic process continued un-interupted. Water is sprayed as and when required depending on the moisture content. Composting is completed within 3 to 4 weeks and the degraded Compost is feeded to the Screening Plants to produce different grades of Organic Manure. Organic Manure obtained is in two forms viz. (1) Organic Manure(Pure) (2) Organic Manure(Enriched). The latter has more micro nutrients with enrichment at the stage of decomposition. They are marketed as 'BIOAGRO' and 'BI 'BIOAGRO RICH." The product does not have offencive odour and free from pathogenic organisms and weeds.

PERFORMANCE: The Corporation has turned around in 1994-95. BIOAGRO RICH has established its superiority in quality and price wise it is highly competitive to similar products in the market. Presently, BIOAGRO RICH is sold in the States of Karnataka , Tamil Nadu and Kerala through its dealer network.

CONSULTANCY SERVICES:KCDC with its expertise in simplyfing the process, is offering consultancy services for setting up of compost plants in the States of Orissa, Tamil Nadu, Kerala, Sikkim and Karnataka at a nominal charge.

FUTURE PLANTS: KCDC is proud that it is the only oldest compost plant in Public Sector surviving in India and now we are starting one more compost plants of capacity of 300 M.T per day in Bangalore and there will be increase in the intake of Solid Wastes and production of organic manure.

CONCLUSION: The technical team of the Department of Agriculture, Government of India, in its report of 1993, have rightly observed that organic farming is an alternative to the present system of farming solely dependent on the chemicals. The quality of the compost of KCDC is very good and as per the recent analysis the percentage of NPK ranges from 1 to 2%. BIOAGRO RICH is available in HDPE bags of 25 Kgs and 50 Kgs.

Experiences in collection and composting of urban waste
SHOW, Waste Wise and TIDE

The organic and the inorganic materials produced by the households, commercials, institutions and industrial activities that have lost their values in the eyes of the first owner are termed as solid waste. To find a solution for the urban waste, three groups namely Scientific Handling Of Waste (SHOW), Waste Wise and Technology Informatics Design Endeavour (TIDE) have been working as a team over the last 2 years focusing on the collection, treatment and disposal of the urban wastes at small scales. This presentation provides the learning and experiences from these in the area of waste collection planning and in vessel forced air composting.

The collection system planning is based on having a set of base maps of the area where the collection is to be undertaken. This base maps have been prepared using a combination of existing maps and walk throughs in the area. Based on heuristics of route minimization algorithms we have developed collection routes. Based on this the garbage collection plan has been prepared for a project at Cuttack, Orissa and as part of IUEIP at Bangalore. The procedure used and details of the plan would be discussed in the presentation.

With the effective collection system of the waste, the organic portion was treated to compost. The technology developed for composting was the forced aeration technique. This system involved effective water drainage mechanism for removing the excess water from the urban garbage. Air was forced in to the stacks for the purpose of aeration. This helped in the efficient operation of the system and also no smell composting of the organic waste from the urban garbage. The temperature was allowed to rise to approximately 60 degree C., and kept for a period of two days so that the compost obtained was pathogen free. The important parameters monitored all through the composting process were the Temperature, pH and Moisture content. For 1000Kgs of raw well-segregated urban waste, 300 Kgs of compost was obtained. Our experience with the urban garbage composting with out the use of any microbes has shown a typical composting time of a month. The major accomplishment in this process of technology development and proving has been the standardization of the technology to an extent that it can be easily operated, routinely monitored and for any eventuality a well-defined response mechanism has been established. The concept can now be replicated with minimum technical support and intervention, which is available with the team.

This same technology has been in operation at SHOW since last December 1999, at Cuttack since February 2000, at St. Martha's hospital, Bangalore since March 2000 and recently at the Lingarajpuram, which is an IUEIP project.

DR. UMESH M. SHAGOTI
Kasturi Ecofarm & Vermitech

VERMITECHNOLOGY

(WASTES - WORMS - WEALTH)

(VERMITECHNOLOGICAL BIOPROCESSING OF WEALTHFUL WASTE FOR RESOURCE RECOVERY)

VERMIFARMING :

(LARGE SCALE PRODUCTION OF WORMS FOR) -

- USE AS VERMIPROTEIN FOOD ADDITIVE
- USE AS SEED INOCULUM FOR BIOFARMING.
- USE IN LIESA (ECO-FRIENDLY) FARMING.

VERMICOMPOSTING :

*A VIABLE ALTERNATIVE FOR WASTE MANAGEMENT AND RESOURCE RECOVERY.

II. ARE WASTES REALLY WASTES ? OR MISPLACED RESERVES OF WEALTH.

A. TYPES AND NATURE OF WASTES:

→ NIGHT SOIL.
- LIQUID WASTE : SEWAGE & SULLAGE.
(20% feces + 2.5% urine) (35%)
- SOLID WASTE : (I) GARBAGE
: (II) TRASH/ RUBBISH- COMBUSTIBLE
-NONCOMBUSTIBLE
: (III) MIXED WASTE

B. SOURCE CATEGORIES OF SOLID WASTES :

1. MUNICIPAL : DOMESTIC
:INSTITUTIONAL
:COMMERCIAL
:MUNICIPAL SWEEPINGS

2. INDUSTRIAL COMPOSTIBLE : RICE & POUNDING MILLS
:SAW MILL
:FOOD & FODDER INDUSTRY
:PAPER & PULP INDUSTRY
:DAIRY & BAKERY INDUSTRY

3. AGRICULTURAL :FARM HOUSE WASTES
:FARMING OPERATIONS
:FARM FOOD PROCESSING

C. EFFECTS OF MISMANAGEMENT OF WASTES :

MAY SERVE AS -

*FEEDING & BREEDING GROUND FOR INSECT VECTORS.

*FEEDING & BREEDING GROUNDS FOR RATS.

*FIRE MENACE.

*PERVADING ODOR PRODUCTION SITE.

*AIR & WATER POLLUTION POTENTIAL.

*ENVIRONMENTAL DEGRADATION.

D. AMOUNT OF PLANT NUTRIENTS IN WASTES :

SOURCE	N	P2O5	K2O
CATTLE MANURE	0.3 - 0.4	0.1 - 0.2	0.1 - 0.3
HORSE MANURE	0.4 - 0.5	0.3 - 0.4	0.3 - 0.4
POULTRY MANURE	1.0 - 1.8	1.4 - 1.8	0.8 - 0.9
WOOD ASH (COAL)	0.73	0.45	0.53
ASH HOUSEHOLD	0.5-1.9	1.6 -4.2	2.3 - 12.0
HULL RICE	3.0 -.5.0	0.2 - 0.3	0.3 - 0.5
JOWAR	0.4	0.23	2.17
WHEAT	0.3	0.1	1.0
LEAVES DRY	0.35-1.37	0.12-0.3	0.36-0.58
GREEN MANURE	0.33-0.85	0.15-0.18	0.51-0.58
GROUNDNUT CAKE	3.5	1.9	1.4

FIELD SCALE VERMICOMPOSTING

1. SIZE OF THE PIT : 10.0 M X 1.0 M X 0.3 M.

2. TO PREVENT ENEMIES SPRINKLE 0.2% CHLORPYRIPHOS 20 EC TO THE WALLS OF THE PIT.

3. FILL THE PIT FOR PROVIDING BEDDING MATERIALS IN THE FOLLOWING ORDER :

   I. 5-10 CM THICK COCONUT HUSKS/ GUNNY BAGS / JUTE REFUSES.

   II. 5 - 10 CM THICK MANURE / ANIMAL DUNG.

   III. 15 - 20 CM THICK COMPOSTIBLE AGRICULTURAL SOLID WASTE (COMMUTED).

   IV. 5 - 10 CM THICK MANURE / ANIMAL DUNG.

   V. 15 - 20 CM THICK GREEN LEAVES / WEEDS, OTHER COMPOSTIBLES.

   VI. COVER THE TOP WITH 1- 3 CM THICK BLACK SOIL.

   VII. SPRINKLE WATER SO AS TO SOAK ALL MATERIALS FOR DAYS FOR STIMULATION OF DECOMPOSITION / BREAKDOWN OF ORGANIC COMPOSTIBLES.

   VIII. INTRODUCE ABOUT 1,000 <u>E. EUGENIAE</u> (@ 6 - 7 WORMS / CFT).

   IX. COVER THE PIT WITH 10 - 15 CM THICK RICE STRAW FOR PROVIDING SHADE.

4. SPRINKLE WATER EVERY DAY TO PROVIDE 60 - 70 % MOISTURE (TOP STRAW SHOULD BE ALWAYS WET).

5. AFTER 45 DAYS, VERMICOMPOSTING IN THE FORM OF CASTS START APPEARING ON THE TOP LAYERS.

6. IN ABOUT 90 DAYS, 75 % OF THE COMPOSTIBLES BECOME BLACK MANURE - HUMUS.

7. THREE DAYS BEFORE HARVESTING VERMICOMPOST, STOP WATERING SO AS TO LESSEN THE MOISTURE IN THE TOP LAYERS, AND THEN WORMS MOVE TO THE BOTTOM OF THE PIT.

8. HARVEST THE TOP VERMICOMPOST, DRY IN SHADE AND BAG. THIS CAN BE STORED IN SHADE/ COLD FOR ONE YEAR WITHOUT LOOSING POTENCY.

9. WORM NUMBER DURING 90 DAYS INCREASE BY 40 TIMES THE ORIGINAL.

10. IN ABOUT 1.0 GUNTA LAND, OVER 90 DAYS PERIOD, ONE CAN PRODUCE 2-4 TONES VERMICOMPOST. HENCE PER YEAR 6 - 12 TONES. THE AVERAGE COST OF THIS VERMICOMPOST IS ABOUT 2,000/ TONE. HENCE AVERAGE EARNING WOULD BE RS. 12,000 - 24,000 PER GUNTA TO RS. 4,8,000 - 9,60,000 PER ACRE !

Whither Urban Compost for Crop Production?

Dr. K. Shiva Shankar
Vice-President, Association for Promotion of Organic Farming
Trustee, Environment Education Foundation
Former Professor & HOD, Agronomy/Forestry, UAS, Bangalore
1359, 9th cross, J.P. Nagar, I Phase, Bangalore.

In a bid to clean up our cities and safeguard health and sanitation of our cities, safe disposal of the garbage into dumping sites as land-fills and converting the biodegradable organic waste into "Urban Compost" are being taken up with varying degrees of success. Garbage disposal is a stupendous task for a rapidly expanding city like Bangalore. An Indian, on an average produces 0.5 to 0.6 kilogram of trash everyday compared to three times this quantity by an American of Australian citizen. The minimum quantity of garbage produced in Bangalore City is around 2500 tons per day and it is around 5000 tons in New Delhi. The same is the case with most of the 75 Municipal Corporations in India with garbage production from 1000 tones upwards. Problems encountered are many in quick and complete collection, transport to the outskirts of the city to identified land-fill sites or composting yards, sorting the components, recycling some useful items and composting the organic materials. It appears that everybody has a say as to how the Corporation should tackle these tasks so that they need not keep complaining about the Garbage-Menace in their area! However, no-body seems to get to any concrete action oriented plans on their own volition! Either from an individual's or community's point of view, they can help their city to be kept clean and their environment to be pleasant.

How can an Individual or a Community help upkeep the City clean?

1. At the household level, trash and garbage output can be mimimised. The waste generated in food items could be considerably reduced.

2. Use of "Carry-bags" of plastic origin, must be regarded as a sinning against Nature, innocent living animals like cows, dogs and others as they are generally a recycled item containing lead and dioxins. More than 30 percent of garbage is composed of plastic bags which are not biodegradable and which on burning can release toxic chlorinated compounds. These bags have to be banned by the governments and discarded by all including men, housewives, and housemaids. It is generally the careless house-maid who is creating a demand for these once-used carry-bags so that she can pack all unwanted trash and food items in these and just throw away not necessarily in the dust-bins but anywhere on the road, parks or sometimes in the neighbours front or back-yard where she works, and thus having not to retrace her steps to the household to leave the household basket.

   Unless we learn this lesson of Voluntarily banning the plastic carry bags and adopt alternatives such as bamboo baskets or cloth bags for purchasing vegetables, fruits and groceries, garbage-menace cannot be solved.

3. Besides withdrawal of plastic carrybags, other items like glass, bottles, blades, batteries, broken household items etc. should be withdrawn from the daily throw away list along with kitchen wastes. What is required as a duty is to sort out the household wastes into those which can be "composted" and those which can be "recycled" or "discarded" separately and only the kitchen wastes and garden wastes of leaves, plants etc, (but not chemicals) could be put in the 'dust-bins' of the corporation for taking up 'Composting'. Such a consideration would be humane and would save cuts, injuries and bleeding of workers leading to some severe health problems.

   The recent system of collecting garbage from door to door has been introduced in Bangalore City in many localities. This system is all praise worthy, but there are a few takers for this, as the entire locality is not participating whole-heartedly. The boy who collects the garbage comes at a certain time in the morning when many people are not ready for handing over the garbage. Though there are four separate bins etched on to his trolley, the proportion of the four segregated matter are not equal and many times they are not fully segregated and so the garbage goes only into all the four bins equally. There are instances when these boys empty the whole contents of all the four bins into the nearby big street dust bin. So, the segregation remains an unfulfilled task.

4. Emphasis is also of avoiding 'recycling' of lead and other contaminants in Nature. Deadly chemicals like DDT, Rat-poisons, discarded drugs, paints, hairdyes etc. should not be sent to "Dust-bins" on the grounds that once out of your 'premises', you are safe; they come back to you flying in vegetables, fruits and grains! So, be kind to yourself please. Avoid use of unnecessary chemicals and shun contaminating these in your "Food Chain". A good citizen will do this, at least, out of consideration for his poor ignorant worker in the transport and landfilling system. In the landfills, most of these chemicals would leach down and pollute our ground water! Our "land-fills" are done so unscientifically that there is no awareness of the impending long-range catastrophes of accumulation of poisonous materials, heavy metals and excess of micronutrients, which can lead to destroying of our natural resource of land and water.

Danger Lurking in the Street-bin

Kindly pause for a while and examine a "Street-bin". You consider it an eyesore with overflowing garbage and with foul smell pervading the whole atmosphere. In most instances and cities, only 60 percent of waste are collected. Even the number of dustbins are insufficient. You may also observe the stray-dogs and bandicoots examining, sniffing and pulling out the contents on to the road and the slow intake and mastication of not only the old rotten food but also the plastic carry bags filled with dirt and food by the cows. The plastic bags come in varying sizes and colours and mostly of less than 200-micron thickness. These often get choked in the animal systems leading to death if not operated upon soon to remove the toxic materials loaded with lead, and many arsenals etc.

Recycling of Usable Materials

Metal Scraps and other re-usable poisonous materials like Zinc alloy, electroplated materials etc. also find a way into the dustbin. Torn waste paper mostly printed and hence "lead-laden" also occupies the dustbin. If they are segregated at the home itself, all these items could be collected on a separate day in a week and taken out for recycling the metals/metals etc.

Recycling of Kitchen-Waste for Kitchen Gardening

Every body loves some green plants and beautiful flowers especially those who care for Nature. There is a general complaint of the city dweller that he does not have space to grow a few plants even in the pots. Some would love to grow some plants to offer the flowers to Gods and Goddesses. They are at a loss to see that this is not possible. On a re-examination, most people can attempt a very small scale of roof gardening. Even green lawns can be grown without the fear of pesticides entering your body. The food and nutrition for all this is the kitchen waste. If only we could compost it all, it would become a useful material and would reduce the city's onerous task of disposal and treatment. Vermiculture with suitable earthworms is an enchanting and safe way of converting waste into wealth. School children have been trained to nurture "Vermiculture" and make compost from wastes, green-loppings, grasses, dried leaves and cowdung. Some are even selling such compost enriched with oilcakes but the stocks are limited.

Composting at the back-yard is a feasible approach for those who can ear-mark a space of 3-4'width and 6'-12' length with some protection to the four sides as if walls from slabs of $2^{1/2}$ or 3' or coconut leaf fronds or lantana stems constructed as a vat. The kitchen waste then has to be supplemented with green leaves, loppings of trees, dried leaves, grain-chaff, and any organic matter such as straw used for packaging, mowed grass from the lawns, pruned plants from the garden, etc. It is preferable to buy some cow-dung usually available around the corner with plenty of dairy cows languishing in the city. All these can be put in the vat in layers of 4-5" and repeated till the vat is filled. Moisture can be maintained with watering once in a week and the contents mixed and turned once a month after the initial turning after 8-10 days of filling the vat. Compost would be ready in about 3 to 4 months. A community of neighbors can do this also wherever feasible. A handout on composting by this author is available on sale.

"Urban Composting"

The Urban waste and garbage needs to be studied and tested even after primary sorting at the household level and at the compost-yard. Once found fit for composting, the bulk needs to be homogenized with machineries. Generally, windrows are created after the material has been homogenized and shredded suitably. At KCDC yard, Singasindra, this is being followed but garbage needs to be handled in a large area. The BDA is planning to identify 20-30 acres in different locations on the outskirts to help prepare large-scale compost.

What are the requirements and feasibilities?

Assuming that the garbage fit for compost is only 1000 tons per day, there could be 3.65 lakh tons/year. This is a huge quantity for composting. Large area is required for composting itself. If we turn out three batches of compost a year, it would be around 1.2 lakh tons per batch and it is all a bulky matter occupying space. Why don't we prepare the material fit for composting and sell it as raw material for the farmers to transport it to their farms for eventual composting or even to use it as "mulching material" for the crops? This is worth examining instead of composting without other pre requisites such as green-matter, cow dung and adequate water. Right now for want of landfill sites some trucks are seen to ply some 35km away from the city on the outskirts. The contractors are trying to make quick money by selling the unseggregated garbage in truck-loads to gulliable farmers. Owe unto those tillers, whose lands can be poisoned thus, in no time! Therefore it is better that BDA takes up the challenge of segregation of the garbage, shredding it, homogenizing it and then selling it at suitable rates.

When sufficient space, water and other ingredients are available composting can be undertaken. Green loppings can be planned through a strong tree-foundation in the ring roads and avenues. A kilometer length of road can accommodate 200 trees on each side each of which can produce 0.25 ton of green matter per tree. Caught between Vandalism, so to say, of the KPTC Staff and urban poor salvaging the maimed and hacked for fuel and orderly use of trees is upset. The leaves can be utilized for composting while it is burnt by sweepers. What cannot be composted needs to be examined for retrieving, for using in the inceranators etc.

For an availability of 3.65 lakhs of utilizable city garbage, a 100km ring road and 50km avenues both from North-South and East-West, can yield around 60,000 tons of green matter. Besides, the total livestock, poultry, piggery and other animal wastes have to be tapped to make compost of quality and worthy for use in agricultural fields without any hazardous effects. All this calls for a thorough preparation pragmatically to mutually benefit the city-dwellers of safe disposal of their waste and of rural farmers of securing quality compost. Thus, agricultural production which is being affected for want of organic matter can be given a boost through properly examined and prepared Urban Compost. This has to become a reality early.

REPLICABLE TECHNOLOGIES/MODELS

VERMICOMPOST

Council for Advancement of People's Action and Rural Technology
Zone-V, Core-C, Second Floor, India Habitat Centre, Lodi Road, New Delhi 110 003

Prepared for CAPART by:
Centre for Technology and Development
Society for Economic and Social Studies
B-1, Second Floor, LSC J Block, Saket, New Delhi 110 017

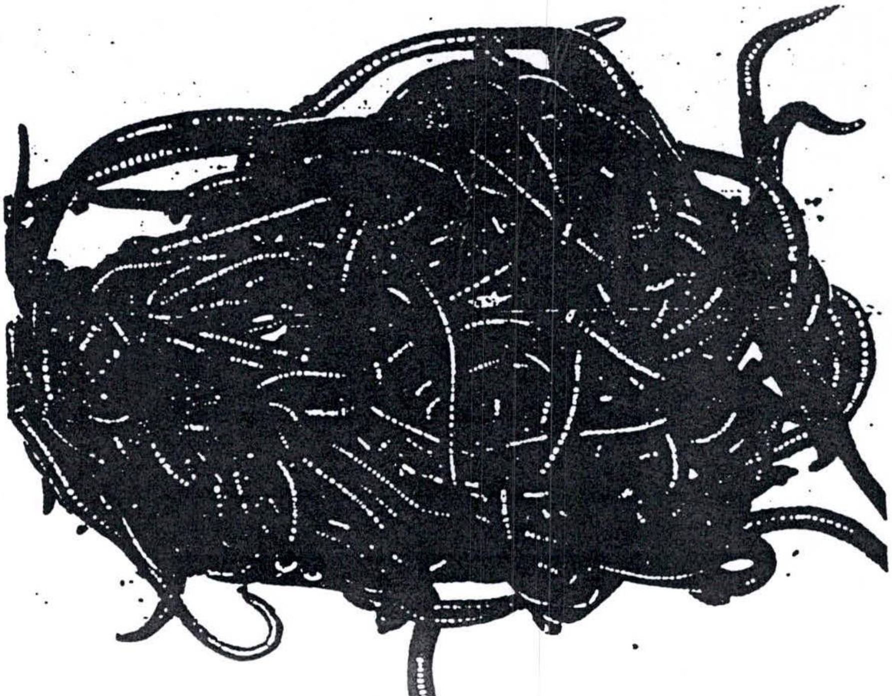
INTRODUCTION

The utility of earthworms in farming has been known for centuries. These 'lowly' creatures are vital for the health of the soil and the plants growing on it.

Scientists have established that this beneficial effect is because earthworms eat up vegetable matter, soil etc. and excrete small pellets of finely ground soil (called casts), very rich in Nitrogen, Phosphorus and Potassium (N, P and K) which are essential nutrients for plants. In this process, they also upturn the soil, thus providing much needed air to micro-organisms and the roots of plants. They thus speed up decomposition of vegetable matter and generate conditions that are conducive for all kinds of small animal and plant life to flourish in the soil. Earthworms are also known to help in maintaining water balance and other chemical levels in the soil.

These 'lowly' creatures are vital for the health of the soil and the plants growing on it.

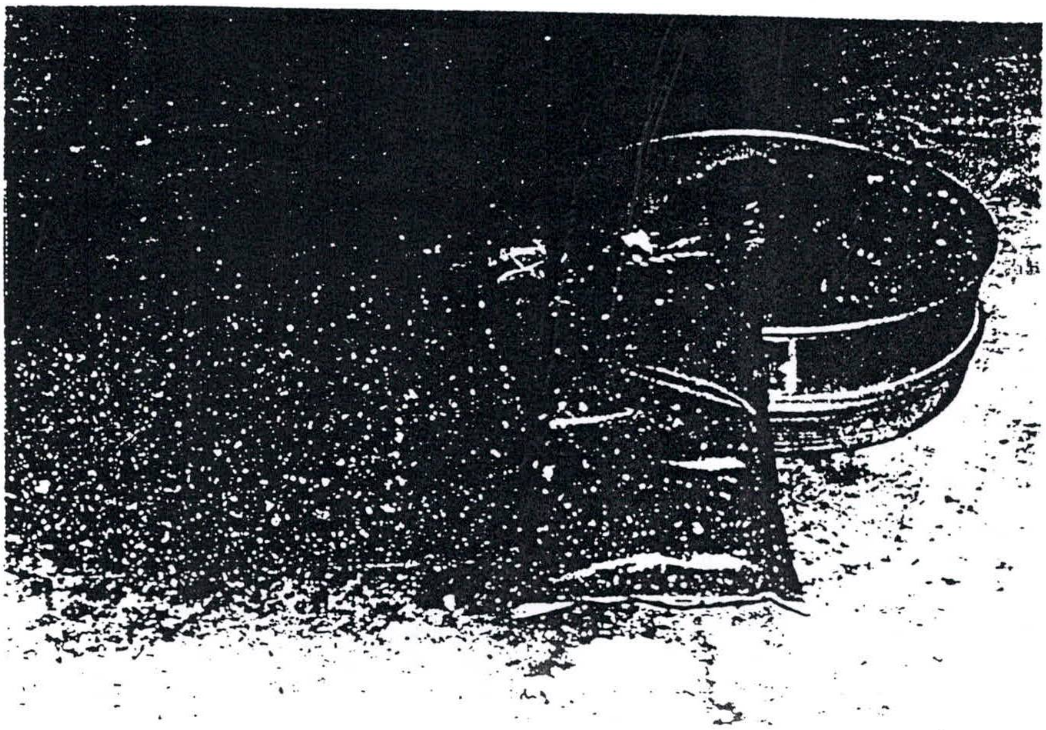
Due to these properties, earthworms can be used to produce rich manure.



What is Vermicompost?

With an eye to all these benefits, increasing attention is being focussed on breeding of earthworms (vermiculture) and their subsequent use for preparation of compost (vermicompost). Organic manures like vermicompost are all the more relevant because of the harmful effects of continued use of chemical fertilisers and pesticides. It is now well known that heavy use of chemicals ruins the soil and its fertility. On the other hand, agricultural residues like cowdung, straw, green leaves, etc are easily available on farms and can be converted into very useful manure. The farmer not only avoids the harmful effects of chemicals but also saves money in the process.

Several methods have been developed by which agricultural residues or waste can be converted into organic manure to replace chemical fertilisers. Of these methods, vermicomposting is most suited in terms of striking a balance between costs and effectivity.

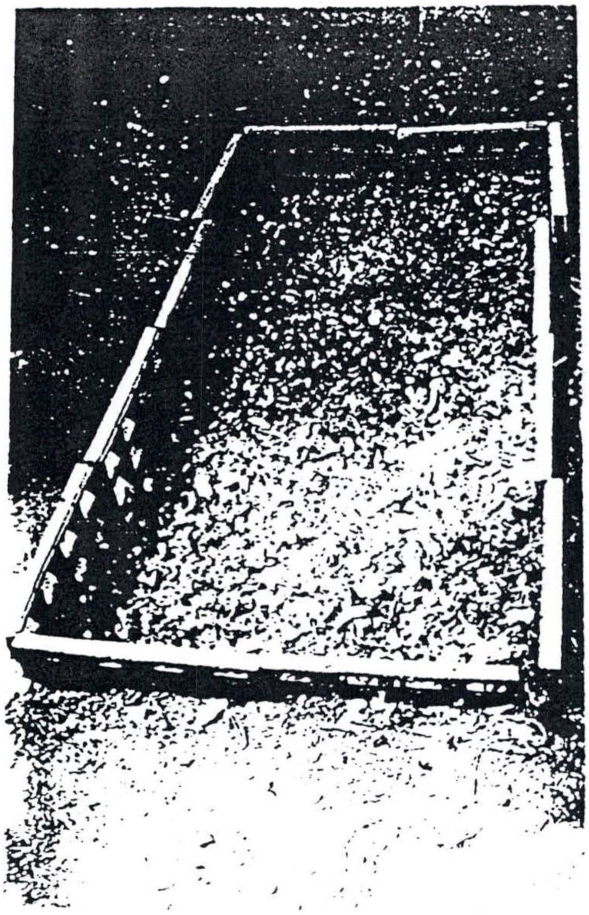


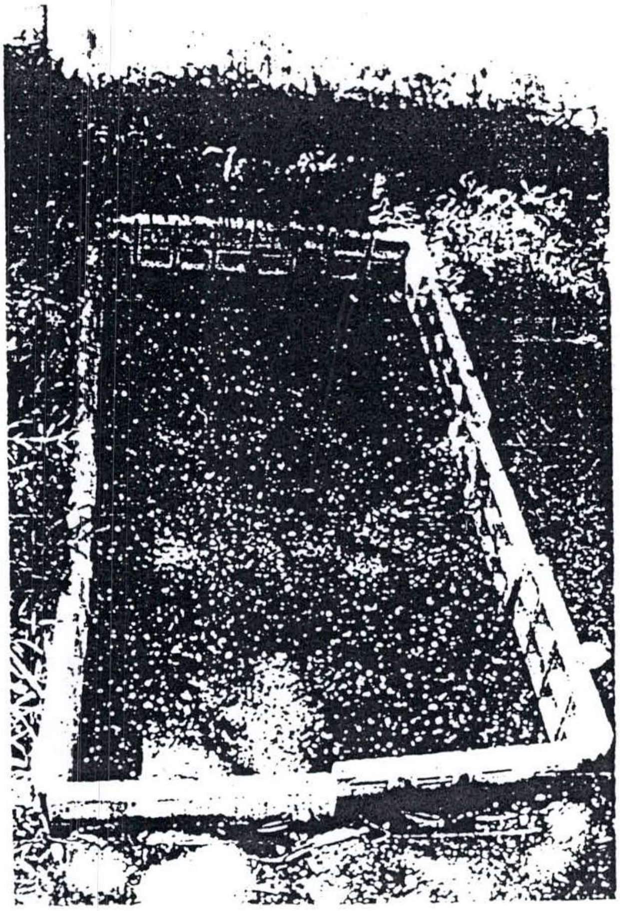
How Is Vermicompost Made?

The production of vermicompost involves the breeding of earthworms in a prepared mixture of cowdung, soil and agricultural residues till the whole mass is converted into casts. These casts are then collected to give vermicompost. Both indigenous and exotic varieties of earthworms can be used.

Benefits of Vermicompost

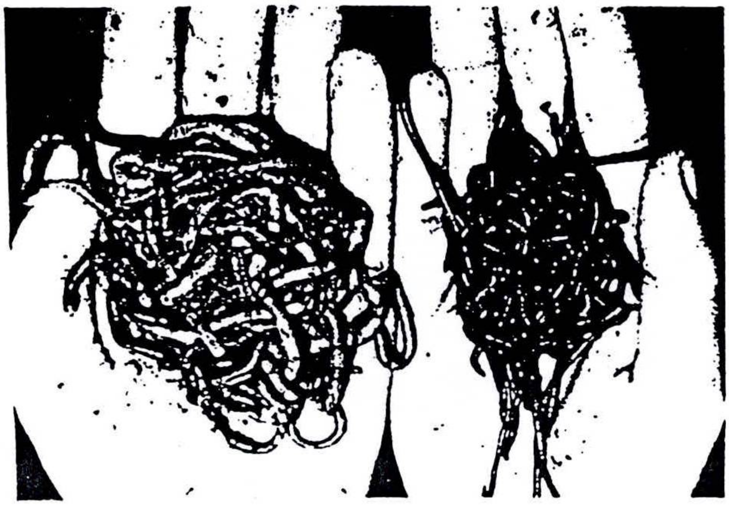
Users of vermicompost affirm that regular and sustained use of vermicompost, as part of an organic farming package, leads to good yields, enhanced soil fertility and regeneration of soil micro-organisms with all its incumbent benefits. Advantages of vermicompost can be summarized as follows:





- eliminates or minimises need for chemical fertilisers, makes the soil healthy with high NPK content and yields crops of better quality
- agricultural and kitchen wastes are put to good use
- can be done at a smaller scale and at a faster rate than other methods of composting
- reduces expenses on external inputs
- can be done for commercial purposes as well as for use on one's own farm
- surplus earthworms can be converted into good livestock feed.

Some details about requirements, conditions and other factors are now given to enable potential users to judge the suitability of this technology for their contexts.



APPLICABILITY AND REQUIREMENTS

Availability of Feed Mixture

Typically, a 1.5 hectare (3-acre) farm will need about 12 tons of biomass which can be converted to about 8 tons of vermicompost which would be sufficient for the given area.

For small and marginal farmers with smaller holdings, availability of sufficient agricultural residue and cowdung from their own farms may be a problem. In such cases some inputs may be procured from nearby, perhaps even at some cost which may be weighed against benefits.

Choice of Earthworms

Best results are obtained with two peregrine (exotic or foreign) species, *Eisenia foetida* and *Eudrilus eugeniae*. These rapidly convert biomass into casts and also breed very fast. These worms have to be bought from specialized vermiculture units.

Endemic species (found naturally in India), like *Perionyx excavatus* and *Perionyx sansibaricus* are also suited to vermicomposting, but they have lower conversion rates and lower breeding rates than the above exotics. Himalayan and Gangetic plains regions have fewer of these endemic species. These two indigenous species and *E. eugeniae* are better suited to southern India where temperatures do not rise very high. *E. foetida* is suitable throughout the country. In case availability of organic waste is low, endogenic (shallow burrowing) species of earthworms like *Lampito mauritii* and *Pontoscolex corethrurus* can be used for south and north India respectively.

Watering

Vermicompost units require maintenance of 40%–50% moisture level and 20–30°C temperature. To achieve this, regular and measured watering of the compost pits as well as wetting of the shelter to lower the temperature is required. Consequently, regular water supply is essential which may be difficult in some parts of the country in summer.

Inputs and Yields

Chemical analysis of a typical sample of vermicompost would show that the NPK content of vermicompost is definitely higher than that of other organic manures. However, compared to chemical fertilisers, larger quantities of vermicompost are needed. For instance, if a crop needs 40kg nitrogen, this could be provided by either 540kg of urea or about four tons of vermicompost. Alternatively, 1 ton of vermicompost should be used along with about 6 tons of mulch biomass to provide the required nitrogen.

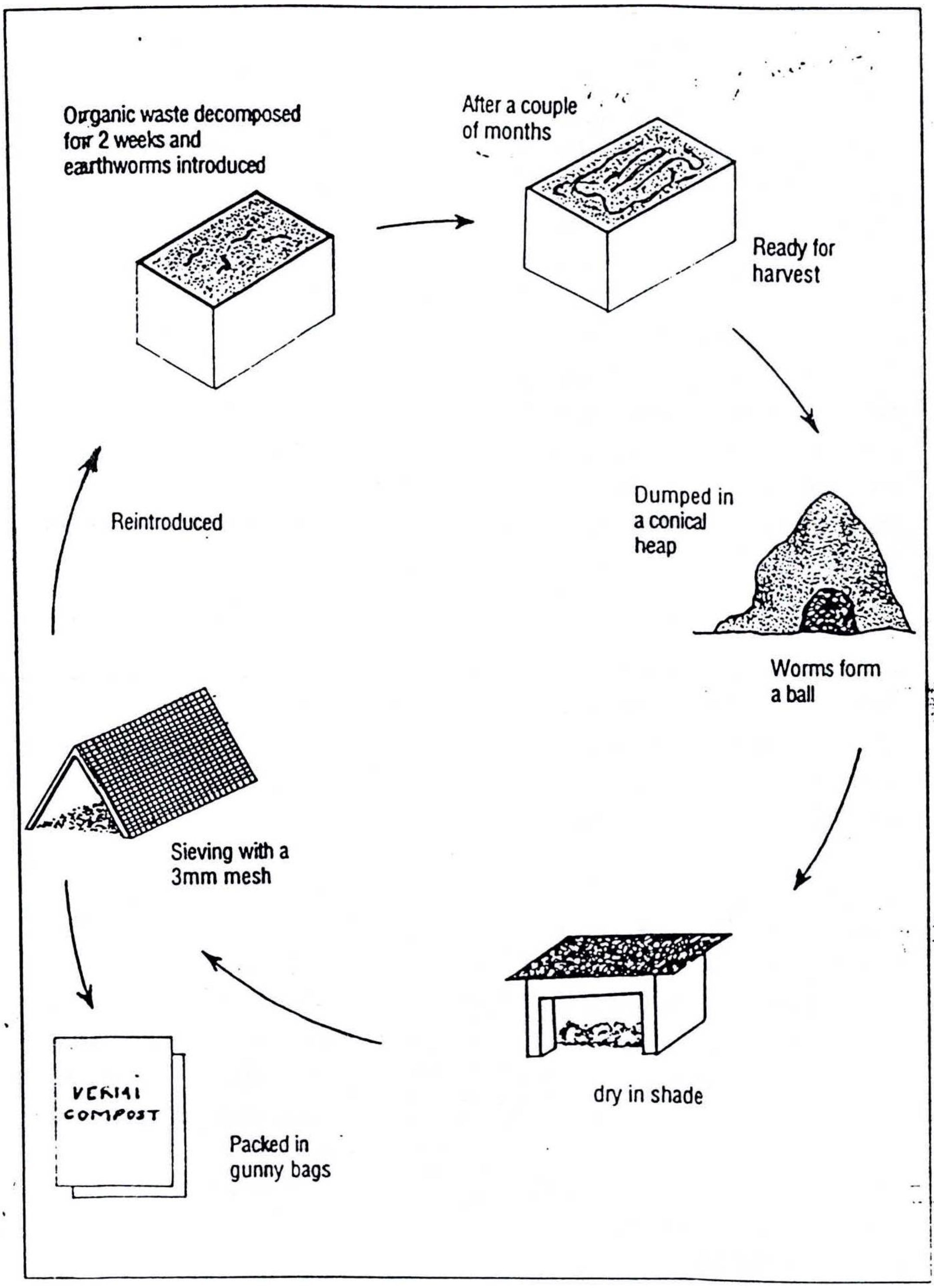
Regular and sustained use of vermicompost, as part of an organic farming package, leads to good yields, enhanced soil fertility and regeneration of soil micro-organisms with all its incumbent benefits.

Crop yields are usually equivalent to those obtained by using chemical fertilisers. Some studies point out that combinations give better results.

Importantly, use of vermicompost leads to regeneration of soil fertility thus promoting long-term sustainability.

Process Cycle Time

Typically, 1.5 tons of feed mixture produces 1 ton of vermicompost in three months. A continuous cycle has to be established and maintained for year-round yield of vermicompost. It should be noted that it takes two to three years of exclusive and regular use of vermicompost for all benefits to become apparent.


Organic waste decomposed for 2 weeks and earthworms introduced
After a couple of months
Ready for harvest
Dumped in a conical heap
Worms form a ball
dry in shade
Sieving with a 3mm mesh
VERMI COMPOST
Packed in gunny bags
Reintroduced

Space Requirement

Vermicompost units need some ground area and a simple roof structure for shade. A unit supplying a 1.5 ha farm would require a 3m x 3m area.

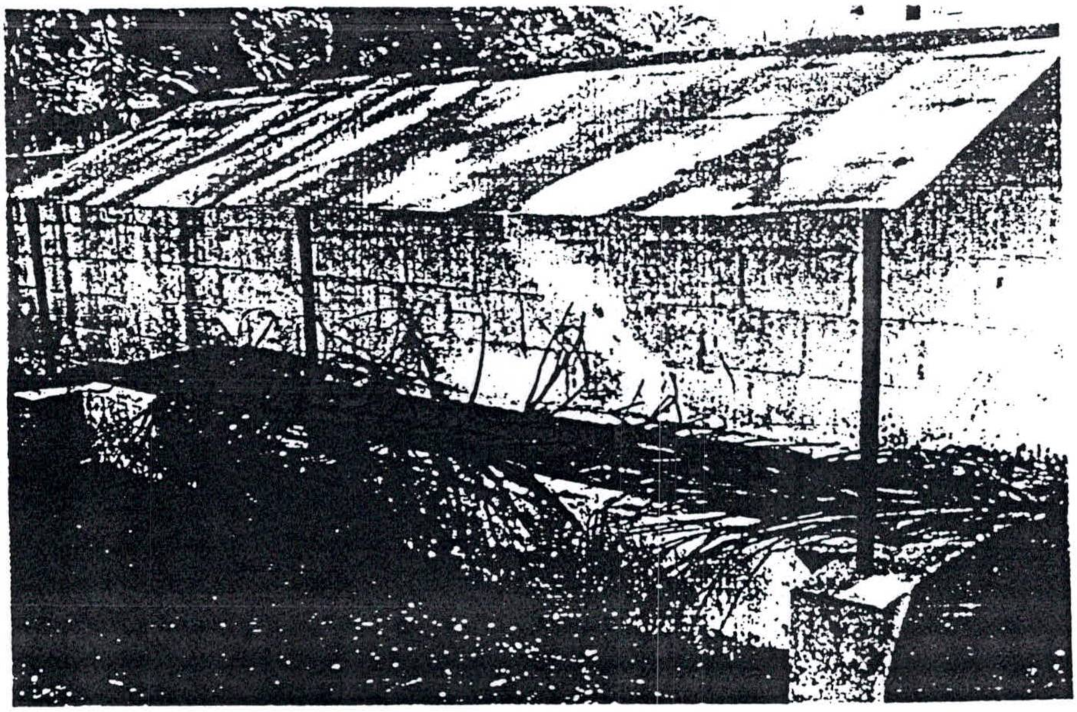
Note:
The various figures given above are only illustrative. Actual correlation between cropping area, availability of agricultural residue, vermicompost yields and crop yields/quality vary with the soil conditions, climate, nature and pattern of cropping, etc.

PRODUCTION PROCESS

Irrespective of scale, the following components and steps are essential for producing vermicompost.

Pits/Troughs

These can be constructed, either above or below the surface, using brick masonry or stone slabs or even plastic. For a volume of $1m^3$, a pit/trough of 1.6m length, 1m width and 0.75m height is suitable. The number of worms is dependent on the volume: in the above case about 6000 to 7000 worms can be used.



Protection

The pit should be constructed indoors; if outdoors, a thatched roof should be built over it. This is because optimum moisture in the 40%–50% range and temperature in the 20–30°C range need to be maintained: higher moisture levels cause acidic conditions which are fatal for earthworms, as are high temperatures.

Protection from predators is essential. A 'moat' or ditch of standing water around the pit will prevent ants from getting to the worms and a wire mesh will keep away cats, dogs or birds.

Feed Mixture

Any organic waste or agricultural residue can be used as feed mixture, e.g. farmyard wastes, green wastes, sugarcane thrash, coir and pith, kitchen wastes. These are mixed with cowdung in the ratio 8:1 and put in the pit. If dung is not available, a little vermicompost and soil may be added. The feed mixture is allowed to decompose for at least 2–3 weeks. During this time, the mass will heat up. If earthworms are introduced in this period, they will die.

Earthworms feed on biomass, assimilating 5%–10% for their growth and excreting the rest in the form of nutrient rich casts.

Inoculation and Breeding

1 kg of earthworms, comprising 600-1000 worms, can convert 45 kg of wet biomass (40% moisture) in a week, yielding about 25 kg of vermicompost. The partially decomposed biomass in the pit is inoculated with earthworms of the chosen species. Regular watering is done daily to maintain optimum moisture levels. 1.5 tons of feed mixture ($^2/_3$ agricultural residue + $^1/_3$ cowdung) produce 1 ton of vermicompost in 3 months.

Collection

The worms feed on the biomass, assimilating 5-10% for their growth and excreting the rest in the form of nutrient-rich casts. Once the feed mixture is seen to largely contain casts, it is dumped in a conical heap and left for a few hours. The worms collect at the base and are easily retrieved for reuse. The remaining dried material is passed through a 3mm sieve to collect the casts as vermicompost. In an innovative, sequential system of vermicomposting, CSV (Wardha) developed various stages in interconnected pits, with the worms migrating from pit to pit. Field studies show encouraging results.

COSTS

A. Vermicomposting unit

Depending on the crop area and manure requirements, two examples of a vermicomposting unit are being given here.

(a) Small unit

A marginal farmer with, say, $^{1}/_{2}$ hectare (1 acre) crop area requiring about three tonnes of vermicompost annually, can set up a unit of 1m^3 capacity from stone slabs. The expenditure incurred would be as follows:

Pit length=1.5m; width=1.0m; height=0.75m

Stone slab area = 5.25 m^2
Stone slabs @ Rs. 86/m^2 = Rs 450
Earth work = Rs 30
Laying and filling of joints with cement = Rs 100

Rs 580

Roof length=3m; width=3m; height=1m

Thatch leaves = Rs 60
Poles = Rs 200
Construction = Rs 40

Rs 300

Protection

Wire-mesh cover = Rs 200

Total cost of unit **Rs 1080**

(b) Medium unit

For producing 15-18 tonnes per year (needed for a 3-4 ha or 6-8 acre farm, or for commercial use), a brick masonry unit can be built.

Pit: length=3m; width=1.2m; height=0.8m; thickness of wall=10 cm (one brick).

(Note: The container is divided into three sections using two dividers made of brick. Stone slabs can be used for the base.)

Total brick area	=	9 m²
Masonry @ Rs.125/m²	=	Rs 1125
Area of base	=	3.6 m²
Stone slabs @ Rs. 86/m²	=	Rs 310
Laying and filling of joints, cement	=	Rs 50
		Rs 1485

Roof length=3m; width=3.5m; height=1m

Thatched leaves	=	Rs 80
Poles	=	Rs 230
Construction	=	Rs 40
		Rs 350

Protection:

Wire mesh	=	Rs 600
Total cost of unit		**Rs 2450**

B. Earthworms

1 kg of earthworms (600 to 1000 no.s) would cost about Rs 200 to Rs 800. These can produce 3000 cocoons per week on an average from which 5000 young worms will emerge. 1000 young worms will multiply to 9000 adult worms in three months. Retrieved worms as well as cocoons can be reused.

C. Feed Mixture

As mentioned above, 1.5 tonnes of feed mixture converts to about 1 tonne of vermicompost in three months. For 1.5 ha of land, 8 tonnes of vermi-compost serves as an excellent manure. The expenditure incurred would be:

2.5 tons cowdung	=	Rs 800
7.5 tons agricultural residue	=	Rs 750
80 kgs of neem cake	=	Rs 800
32 packets decomposing mixture	=	Rs 160
10 days labour	=	Rs 250
Total		**Rs 2760**

Thus, 1 tonne of vermicompost would cost about Rs 345.

Remarks on Costing

1. It may be noted that only external inputs have been used. In most farms, agricultural residue, cow dung etc. are available internally thus substantially reducing costs. Coconut leaves have been taken as an example for roof material.
2. The feed mixture requires regular watering. In summers, in order to maintain optimum temperatures, wetting of roof and even sides of the enclosure would be necessary. Water requirement is thus high and costs for the same have not been included in the above.
3. The operations can be conducted in a tree shade instead of under a roof thereby reducing costs. However, life and effectivity of the earthworms may be somewhat reduced.
4. Neem cake may be added to enhance microbial activity. Karanj cake can also be added to keep ants away. Addition of bonemeal enhances the quality further.
5. Decomposting cultures are added at the beginning to speed up the process. Three types are available consisting of the following bacteria: actinomycetes, acetobacter and phosphate solubilising bacteria.

ACTION PLAN

An outline for an Action Plan on dissemination of vermicompost technology is suggested below. It is only a guideline and the final project proposal should be drafted on the basis of field investigations and as per CAPART guidelines. Locale specific variations in the costing may be made.

Objectives

- To introduce the production and use of vermicompost technology among 20–25 small and marginal farmers (especially those belonging to SC/ST) spread over 8-10 villages.
- To train the beneficiaries in the production process of vermicompost.
- To set up suitably scaled vermicompost units on the land of the beneficiaries and provide hands on training for maintenance and use.
- To provide technical and managerial back-up to the units thus set up, including marketing assistance if required.
- To monitor the use of vermicompost on the crops of the beneficiaries.
- To generally create awareness and propagate the use of environment-friendly composting techniques.

Methodology

A campaign for generating awareness among the people of the field area is carried out. A nodal centre is set up to train the beneficiaries in the various aspects of the technology. Smaller units are set up in the field at the selected beneficiary sites keeping in mind all the applicability conditions. The beneficiaries are provided constant guidance in the maintenance and recovery of vermicompost as well as its application to the crops. If market conditions are suitable then a cooperative system of marketing may also be attempted. Assistance from the resource agency must be taken during the initial stages including training. It would be useful if the VO keeps a record of the unitwise production and application of vermicompost and the subsequent yields. Simultaneous motivation of other people in the field area should continue using the beneficiary plots as demonstration sites. The nodal centre also continues as a production cum demonstration site.

Costs

The budget presented here is for a medium-sized unit which can be viably run on and for a 3-4 ha farm. The feed mixture is costed in the budget. However, if it is generated from the farm itself (whether fully or partially), then saving will be substantial. The pit des-cribed here measures 3m x 1.2m x 0.8m with corresponding roof of 3m x 3.5m x 1m.

While undertaking an Action Plan for Vermicompost, provision should be made for one Project Coordinator and one Supervisor, at appropriate rates, for the twelve month period.

Expenditure provision should be made for awareness generation, travel, training (at the Resource Agency and at Field level, including Institutional Fees for Technical Backup) and overheads.

Besides these provisions, the following costs will be incurred:

Infrastructure (for 21 units)

Pits @ Rs. 1485	=	Rs. 36,000
Roofs @ Rs. 350	=	Rs. 7,500

Supplies and Materials (for 21 units)

Earthworms @ Rs. 500 per kg	=	Rs. 10,500
Feed Mixture @ Rs. 2760 per pit	=	Rs. 58,000

The total cost will thus be in the range of Rs. 2.75 lakhs.

INSTITUTIONS/AGENCIES

Numerous organisations and farms have been utilising vermiculture and vermicomposting successfully. Centres where training can be imparted include:

Institute of Natural Organic Development Trust
100, Kalpana Apartments, Dr. Ketkar Road, Prabhat Road, Erandavana,
Pune 411 004

Natural Resources Development Trust
4/41 Erandavana, Karve Road,
Pune 411 004

Bharatiya Agro-Industries Foundation
Kamdhenu, Senapati Bapat Road,
Pune - 411 016

Centre for Environmental Education
Southern Regional Cell, Kamla Mansion, 143, Infantry Road, Bangalore -
560 001

Mythri Sarva Seva Samiti
94, Farm House, 7th Cross, 3rd Main
Domlur Layout, Bangalore - 560071

Krishna Krishi
Gadag, Dharwad District, Karnataka

M.S. Swaminathan Research Foundation
Tharamani Institutional Area , Madras
600 113

Shri AMM Murugappa Chettiar Research Centre
Tharamani Inst. Area, Madras- 600
113

Agriculture Tools Research Centre
Suruchi Campus, Bardoli - 394 601

Development Alternatives
Gundappa Complex, 29. Jayamahal
Road, Bangalore - 560 046

Dr Hemangi Jambhekar
Institute of Organic Farming and Rural Technologies, B-9 Shivai, Bank of Maharashtra Colony, Sinhagad Road,
Pune 411 030

VANRAI
2064 Vijaynagar, Pune - 411 030.

Dr Sultan Ismail
Institute of Research in Soil Biology and Biotechnology, The New College,
Chennai - 600 014.

Dr Radha Kale
Deptt. of Zoology, University of Agricultural Sciences, Bangalore - 560
065.

Shri U.S.Bhavalkar
Bhavalkar Earthworm Research Institute, Pune - 411 037

HEADQUARTERS

Advisor (RT) or Director General
CAPART
Zone-V Core-C, 2nd Floor, India Habitat Complex,
Lodi Road, NEW DELHI - 110003
Phone: [011]-464 8605, 464 7954 FAX: [011]-464 8607

REGIONAL COMMITTEES

Member Convenors of:

Regional Committee, Jaipur (for Delhi & Rajasthan)
HCM Rajasthan
Institute of Public Administration (SIRD)
Jawaharlal Nehru Marg, JAIPUR - 302017
Phone: [0141]-510556 FAX: [0141]-519883

Regional Committee, Lucknow (for U.P.)
B-3/499 VishalKhand-III, opp. City Montesori School
Gomati Nagar, LUCKNOW (U.P.)
Phone: [0522]-394702 FAX: [0522]-388676

Regional Committee, Ahmedabad (for Maharashtra, Gujarat, Madhya Pradesh, Goa, Daman & Diu, Dadra & Nagar Haveli)
Sardar Patel Institute of Public Administration
opp. ISRO, Satellite Road, AHMEDABAD - 360 015
Phone: [079]-6742775 FAX: [079]-6748722

Regional Committee, Bhubaneswar (for Orissa, West Bengal, Andaman & Nicobar Islands)
State Institute of Rural Development
Unit-8, Gopabandhu Nagar, BHUBANESWAR (Orissa) - 751030
Phone & FAX: [0674]-414924

Regional Committee, Hyderabad (for Kerala, Andhra Pradesh, Karnataka, Tamil Nadu, Pondicherry, Lakshadweep & Minicoy Islands)
A.P. Academy of Rural Development (SIRD)
Rajendra Nagar, HYDERABAD - 500030
Phone & FAX: [030]-257851

Regional Committee, Guwahati (for Sikkim, Arunachal Pradesh, Assam, Manipur, Nagaland, Mizoram, Tripura & Meghalaya)
Ashok Path, Bashistha Road (Survey), GUWAHATI - 781028 (Assam)
Phone & FAX: [0361]-568368

Regional Committee, Chandigarh (for Haryana, Himachal Pradesh, Jammu & Kashmir, Chandigarh, Punjab)
SCO/179-180, 2nd Floor, Sector - 17C, Chandigarh - 160017
Phone: [0172]-700457

Regional Committee, Patna (for Bihar)
Biscomaun Tower, Near Gandhi Maidan,
Patna - 800001

PELLETISATION OF INDIAN MSW : EXPERIENCE OF RDF PLANT, MUMBAI

Dr. Pawan Sikka, Department of Science & Technology,
Govt. of India, New Delhi 110016,
India.

ABSTRACT

Efforts have been made to convert the combustible material in the municipal solid waste into refuse-derived fuel pellets, in an indigenously designed/developed plant, set up in (Mumbai) Bombay, India. The RDF pellets so produced are well accepted and are being used as a coal substitute by the industry. In view of the better plant economics and comparative advantages of RDF pellets over coal, the technology for pelletisation of MSW should be aaapted by other countries.

INTRODUCTION

The effective disposal and utilisation of Municipal Solid Wastes (MSW) has attracted the attention of scientists and technologists, all over the world for evolving a total approach towards reutilisation of the urban waste into some fruitful uses.

The metropolitan cities of India i.e. Bombay (Mumbai), Calcutta, Delhi, Chennai, etc., are generating 4000 to 5000 tonnes of MSW per day - a quantity beyond limit for the existing dumpyards in garbage disposal as landfilling and to create enormous pollution and health hazards. The composition of the MSW, from the household and streets, is heterogeneous in nature (Table 1 and Table 2) varies from city to city, and season to season and contains compositble, combustible, recyclable and other miscellaneous materials. For each of the components, suitable technologies could be considered for the treatment and conversion into materials with economic value, i.e. to provide manure, biofertilizers, energy (methane gas, RDF pellets as coal substitute), and conserve nature.

BOMBAY EXPERIENCE ON RDF PELLETS

With a view to offer a technological solution for the disposal of city garbage and provide options for making metropolitan cities of India cleamer environmentally, a pilot project of

contd.../-

Fuel pellets are economical and have tremendous market potential in non-coal producing zones. The problem of coal in respect of availability, quality, higher prices etc can be overcome by using the fuel pellets. The fuel pellets can be efficiently used in fixed grate, travelling grate, fluidised bed and multi fuel packaged boilers.

Table 4 : RDF Vs Coal

Factors	RDF	Coal
Boiler Efficiency	52.62%	49.30%
Evaporation Ratio (Kg/Kg)	3.68	3.30
Steam Cost (Rs./ton)	326.00	500.00

RDF PLANT ECONOMICS

The RDF Plant set up in Bombay has got the following plant economics:

(i) Raw material input		
- Garbage	160-180 TPD	
- Binder/Additive	2 TPD	(Optional)
(ii) Installed capacity of the plant	2 TPH	
(iii) No. of shifts per day	3	
(iv) Daily production	40 TPD	
(v) Monthly production	1000 TPM	
(vi) Additional Land requirement for solar-drying of MSW.	2 acres	
(vii) Electrical load	375 HP	
(viii) Manpower requirement	60	
(ix) Monthly Sales	Rs. 1.00 million	

(x) Monthly Expenditure	Rs. 0.65 million

- Power
- Manpower
- Consumables/repair/maintenance
- Taxes/water/Insurance
- Office/sales exp.
- Any other

(xi) Monthly Profit	Rs. 0.35 million

ENERGY ECONOMICS

The energy economics of the processing of garbage in the plant is found to have a ratio factor of 10 (energy output/energy input). The computation is indicated in the diagram below:

ELECTRICAL ENERGY INPUT

80 to 100 Kwhr/MT of product

Waste Heat

MSW

Waste Fuel enrich (optional)

FUEL FLUFF/PELLET

3500x103 to 4000x103 Kcal/MT

1000 to 1150 Kwhr/MT

* 1 Kwhr = 860 kcal and considering 25% commission efficiency
from thermal energy to electrical energy.

Energy Output
-------------------- K 10
Energy input

TECHNOLOGY TRANSFER PACKAGE

Based on the experience gained on the pilot project operations, the technology is now commercially offered for producing fuel pellets from municipal garbage. the plant offered here, a total economically viable one, is carefully engineered with equipment sourcing from within the country. The plant design would have to be tailored in accordance with the quality and quantity of garbage from city to city. The technology transfer package would consist of -

- Project feasibility report
- Plant design and project report
- Tendering, Vendor selection, procurement and inspection support
- Plant installation and commissioning
- Training for operation, maintenance and marketing

CONCLUSION

With rapid urbanisation, the generation of municipal solid waste (MSW) is expected to rise manifold in the coming decade. Production of fuel pellets from the combustible portion of the MSW is one of the options for the effective disposal and utilisation of MSW, providing at the same time a clean, energy-efficient, eco-friendly fuel for the coal-based industries.

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VERMICULTURE : CITY LEVEL ENVIRONMENT MANAGEMENT

RADHA D. KALE
Department of Zoology,
University of Agricultural Sciences, GKVK,
Bangalore - 560 065

In India, the quantity of decomposable organic waste generated is astronomical when compared to several other countries. An awareness needs to be created among the urbanites about proper management of waste. Additionally, the significance of waste management in solving environmental related problems and amelioration of productive soil needs to be emphasized. To solve the problems and issues of the people, it is a matter of consideration to use our natural resources. The need lies in developing a comprehensive agenda to arrive at a definite programme.

Management levels for solid waste varies from kitchen, garden and markets to toxic industrial and unhygeinic hospital waste in urban communities. It requires proper scientific understanding and technicalities for handling of decomposable solid organic waste and bio-remedial measures for toxic wastes.

Biowaste recycling has been considered as one of the important strategies in controlling the environmental pollution. Biowastes generated from households is the predominant resource of organic matter (approximately 35-100 kg biowaste per person per year). Most of the communities in cities of Holland collect garbage in 120 litre containers. The composting plants were constructed at different phases to serve the population (Schutle *et al.*, 1991). In Massachusetts, the project was planned in three phases that included development of protocol for handling, collection, transportation and composting procedures. It also included the technicalities and economics involved in operation (Martinson, 1991). Public participation provides impetus for growth of informal programmes. Study indicates that the backyard composting can divert a significant portion of residential waste stream (Taylor, 1991).

Vermiculture :Supportive programme for waste management

Sustainable agriculture and solid waste management are gaining prominence in the present day scenario. One of the major components of sustainable agriculture is the good quality organic amendment to improve the soil productivity. All biodegradable waste when processed properly, can be converted into manure. There are certain measures to be followed such as temperature and moisture regulation and proper aeration in converting the organic waste into manure. Individuals involved in compost production from waste should get the necessary information. When earthworms are used for composting, it is essential to know about the species of earthworms that are suitable for the purpose, their handling including knowledge of protecting them from predators.

The segregated urban decomposable organic waste differs from the rural waste mainly in one character. The waste from households and market yards comes mostly from discarded vegetables and fruits. Thus the moisture level is as high as 80 per cent in such heterogeneous waste in cities. The ideal moisture for proper decomposition is 40 to 60 per cent. There ought to be raise in temperature to destroy any pathogens in the decomposing waste. Finally proper aeration is essential to hasten up the decomposition process and to eliminate the odor. The constructions of structures are important for composting of urban solid waste.

The community activity involves identifying a good leader who can motivate the residents of the locality to take part for a good cause. This also needs to find a suitable place for building the necessary structures. The structures should be such that they look elegant, long lasting, economical and prevent stray animals. As they have to be constructed in residential areas maximum care should be taken to minimise the abnoxious odor from the decomposing material. This is possible only when excess moisture is made to drain out and is absorbed by a natural absorbent like dry leaf matter or waste paper or even brick pieces. After conditioning the waste for 3 to 4 weeks, earthworms can be introduced to feed on the waste and produce compost. Designs have been prepared for use in apartments. Incentive to commercial units by providing land/financial assistance, power and water connection encourages them to establish large scale production units.

The waste source can be from market yards, choultries and hotels and can also be from agro-based industries for these units. The segregated waste from residential areas can also enter these large scale units for vermicompost production. The activity does not require heavy machinery.

Some of the agro-based industries like breweries, sugar factories, seed production, food processing and aromatic oil extraction units have already adopted this simple technology for processing of waste generated in their respective units. This has become an additional income for these units.

Vermiculture in a nut shell

Vermicomposting a simple technology evolved to use earthworms for processing of organic waste results in a) accelerating composting process, b) reduction in phytotoxic chemicals and elimination of pathogens, c) good

Composting process to be aimed at minimising the time of composting, maximum bulk reduction and preventing loss of nutrients. The biological materials like earthworms and consortium of microorganisms contribute to these above features of composting. The epigeic earthworms that feed exclusively on organic waste hasten the process of composting by their voracious feeding and defaecation. The granular mucus coated earthworm castings encourage the microbial activity to enhance further decomposition. The bulk reduction for the urban solid waste by earthworm activity is to a tune of 60 to 70 per cent unlike that of farm waste which is only 50 per cent. About 3 to 4 quintals of compost is recovered from one tonne of urban solid waste. The nutrients get concentrated due to bulk reduction and loss is also minimised due to reduction in time of composting. Thus, the nutrient status of vermicompost is at a higher level than that of the compost derived from other methods. Further enrichment can be made by addition of microbial cultures at the time of application to soil as biofertilizers.

The activity groups can be identified as individuals, localised community groups and large scale commercial units. Vermicomposting has become the backyard hobby of garden lovers with green thumb to produce the vermicompost on their own for their garden. A few individual houses are producing upto 70 to 75 kg vermicompost per annum.

Woven nylon cement/urea bags are used in some homes to collect waste and produce vermicompost. To absorb the excess moisture released from vegetable and fruit peels, waste paper or dry leaf matter is to be used as an additive. Other types of collection containers can be plastic bins or drums or wooden boxes lined with plastic sheet. It is easy to handle and manage small quantities of waste at household level composting.

quality manure to farming community and finally d) solving environmental related problems.

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COMPOSTING OF URBAN SOLID WASTES
A COMPARISION OF DIFFERENT METHODS

Radhakrishna.D and Raghavendra Rao.S
Department of Agricultural Microbiology
University of Agricultural Sciences,
GKVK, Bangalore 560065

A cupful of garbage is just one of the souvenirs one can take home from their experiences at a residential environment education program. Garbage is transformed from food and vegetable wastes into a nutrient rich product in the composting and recycling strategy!

The management of garbage or urban solid wastes has reached a critical stage and emphasis has been on the ultimate deposal of these wastes. The segregation of the biodegradable materials and their amount that contribute to the urban solid wastes vary with place and time. The largest component is paper and card board products (30%) food wastes including kitchen wastes (15%)and yard wastes that includes grass, clippings, leaves, tree and shrub trimmings contribute about 20%. These fractions combined account for nearly two-thirds of the urban solid wastes.

Composting is presently viewed as an alternative means of processing solid wastes into acceptable products that can be used beneficially as bio-fertilizers and soil conditioners and also to dispose as land filling wherein the bulk is reduced by 50%. The general method of composting is a microbial process that depend on the growth and activity of mixed microbial populations that are indigenous to the organic wastes. The composting can be done under aerobic or anaerobic conditions but aerobic-thermophilic method is preferred because it is rapid and also because of higher temperature attained which greatly reduces the pathogens .

METHODS OF COMPOSTING:

Composting of urban solid wastes can be conducted in cement tanks especially for wastes generated from residential area. The main problem of the residential garbage is the foul smell and attraction of files.

Best management practice is required for implementing a low cost technology waste composting . Procedures have to be developed for composting wastes generated by the domestic system. The source segregation of wastes is attractive, cost effective recycling strategy. The first step in developing waste composting program is to determine whether composting is a feasible recycling alternative.

Feasibility of the program is dependent on the following factors:

1.corporate support of the programme.

2.Availability of specialized waste hauling services.

3.Availability of permitted composting facility with expertise in waste composting produce.

4.Economic feasibility of the program.

Composting domestic refuses using low technology approach presents following challenges:

Generation of odors, nuisance animal and flies attraction, high free water content and rate of decomposition. These potential problems can be controlled through a variety of process management techniques, which includes:

1) **Selection of bulking materials and mix ratios.**
2) **Thorough mixing of composting materials**
3) **Incorporation of a process monitoring program**
4) **Maintaining adequate conditions for composting.**

Mixing bulking materials such as yard debris, mixed waste paper, sawdust and dry garden sweeping to absorb water, can readily control drainage of free water from wastes.

Porosity is the single most important component of an initial mix. A mix with insufficient porosity will limit aeration. This is significant when using a low cost technology composting approaches that relies entirely on windrow turning and convection for aeration.

Another alternate method is by providing forced aeration by using mechanical blowers distributes air through the piles of organic wastes dumped in the tanks. The effectiveness of aeration depends on the proper circulation of air through the wastes. This helps in increasing the microbial activity, removes odor and controls flies.

The composting can also be achieved by using mechanical turnings and covering the surface with dry leaves or coir pith to prevent the flies and also to absorb excess water from the wastes.

However, when the quantities of the solid wastes are, formation of windrows is the most convenient method of composting. During this process the optimum conditions necessary for composting are to be provided.

BURNT SOIL – TRADITIONAL METHOD OF WASTE MANAGEMENT

Vasudeva and Venkatesha, M.,
Dept. of Soil Science & Agril. Chem., UAS, GKVK, Bangalore 560 065

Life in costal regions is more close to nature than in other place. Soils here are characterized by acidic reaction, leaching of nutrients due to heavy rainfall and poor in bases. The paddy fields are in undulating topography and surrounded by thick vegetation. The abundant growth of the vegetations cause shade and hence needs to be pruned especially in summer. Thus lot of biomass is obtained. This cannot be decomposed readily as it contains hard to decompose materials such as twigs, small branches, thorns etc. which would rather require more time. Decomposition process would be slow and not practicable during heavy down pore because of large quantities of water every where and in hot summer due to lack of sufficient moisture for decomposition.

In order to find a way to use these it is burnt, but in a special manner. Depending on the amount of material available these are heaped in the open places or in the paddy field itself but after loosening the soil at the base. The material and the soil are heaped in alternate layers up to 1- 1.5m height. This is then burnt. The ratio of soil and plant material is such that the burning process should continue to 4-5 days so that the soil added burns completely with the plant material. The material is allowed to cool and then used as a source of nutrients and also as pest repellent.

The analysis of burnt soil showed that there was 2-3 unit increase in soil pH. The original acidic soil turned alkaline due to addition of mineral or bases from plant material made available during burning (pH 4.9 –5.2 to 7.4 – 7.5). This also led to increase in the electrical conductivity (0.048 – 0.084 d S m-1 to 1.26-2.55). Organic carbon content of fully burnt soil reduced substantially due to oxidation of organic material (2.6-3.1% to 0.88%-Nil). Organic content of half burnt soil is more than unburnt soil. The availability of nitrogen increased to little extent whereas the availability of phosphorus, potassium, calcium and magnesium increased to many folds (8.22 – 20.8 ppm P, 33.22-437 ppm K, 1.9-6.7 meq/100g Ca, 0.72 – 7.1 meq/100g Mg) similarly the available micronutrient content of burnt soil also increased substantially when compared to unburnt soil. The increased nutrient content is attributed to mineral nutrients from organic material made available quickly due to ashing and release of unavailable mineral bound nutrients from the soil particles because of high temperature

The material is first spread in the nursery uniformly before the plughing activity the remaining material is spread in the main field in a similar way. It also finds application as top dressing.

This material also is very important in plantations of areca and coconut. This is applied @ of five kg per palm which is found to enhance the all-round plant development. Other than the use in paddy and plantation it finds a significant place in the cultivation of vegetables especially cucurbits. In vegetable cultivation burnt-soil is used as basal dose along with other organic manure. Also used for top dressing. In addition to its manurial value it finds its place in the management of pests especially termites, other soil borne pests and sucking pests such as aphids.

COMBINED APPLICATION OF URBAN COMPOST AND SEWAGE SLUDGE FOR TOMATO

Dr. V.C. Reddy, ShyamalaKrishna and S.B. Yogananda

ABSTRACT

A field experiment was carried out at Itgalapura, Bangalore north to study the influence of sewage sludge, urban compost and FYM on growth and yield of tomato cv. pusa ruby. Organic sources were applied in combination of different proportions. Fruit yield (t/ha) was significantly higher (15.0 t/ha) with sewage sludge : urban compost (1:1), but was on par with application of sewage sludge:urban compost(1:2) and only sewage sludge application. Plant height (43.3 cm), number of fruits plant^{-1} (72.0) and fruit weight (59.5 g) also followed the same trend. Sewage sludge, urban compost and FYM and soil were analysed before the experiment for pH, EC, OC (%), N, P and K content. Soil physical and chemical properties were improved with the application of sewage sludge, urban compost and FYM. Soil pH, EC, available N, P and K and organic carbon were higher by the combined application of sewage sludge and urban compost in 1:1 proportion.

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ABSTRACT

A field experiment was carried out at Itgalapura, Bangalore north to study the influence of sewage sludge, urban compost and FYM on growth and yield of tomato cv. pusa ruby. Organic sources were applied in combination of different proportions. Fruit yield (t/ha) was significantly higher (15.0 t/ha) with sewage sludge : urban compost (1:1), but was on par with application of sewage sludge:urban compost(1:2) and only sewage sludge application. Plant height (43.3 cm), number of fruits plant^{-1} (72.0) and fruit weight (59.5 g) also followed the same trend. Sewage sludge, urban compost and FYM and soil were analysed before the experiment for pH, EC, OC (%), N, P and K content. Soil physical and chemical properties were improved with the application of sewage sludge, urban compost and FYM. Soil pH, EC, available N, P and K and organic carbon were higher by the combined application of sewage sludge and urban compost in 1:1 proportion.

In recent years, fast urbanization generates large quantities of garbage and sewage. Conversion of garbage into compost and sewage into biogas helps to generate useful manure, which would be a good source of plant nutrients for organic farming. Besides it serves as an effective disposal of wastes and conserves the natural resources such as soil, water and air. Use of compost prepared from urban garbage and sludge from biogas plant as organic supplements improved the crop yields and also soil quality (Reddy *et al.*, 2000). Hence, it is essential to know the effect of combined application of compost and sludge on crop yields.

MATERIALS AND METHODS

A field trial was conduced to test the combined application of urban compost and sewage sludge on tomato cv. pusa ruby during 2000-01 at Itgalpura, Bangalore north. Sewage sludge, urban compost and FYM were applied in combination of different proportions viz 1:1, 1:2 and 1:3 by weight. Treatments were replicated thrice in a randomized block design. The organic manures were applied in furrows opened at 75 cm apart. About thirty days old Pusa raby seedlings of tomato were transplanted at 60cm apart. Irrigation and weeding were given as and when necessary. Staking of plants was done on 30th day and training of plants continued up to 60 days form transplanting. Samples of sewage sludge, urban compost, FYM and soil were analysed for pH, EC, organic carbon and major nutrients before the experiment (Table 1 and 2). Treatments were fixed based on the nutrient content of sewage sludge, urban compost and FYM.

The soil analysis was done after conducting the experiment treatment wise. Observations like plant height, number of fruits per plant, fruit weight and fruit yields per hectare were recorded from each plot and data were analysed statistically. Results were interpreted using Fisher's test of significance at 0.05 probability.

RESULTS AND DISCUSSION

Tomato fruit yield was significantly higher (15.0 t/ha) with 1:1 proportion of sewage sludge and urban compost (Table 2). However, it was on par with the application of 1:2 ratio of sewage sludge: urban compost and sewage sludge alone. Similarly, plant height (43.3 cm), number of fruits per plant (72.0) and fruit weight (59.5 g) followed the same trend. Higher content of nitrogen in sludge and urban compost could be mainly responsible for better growth and yield. Improved plant height, number of fruits per plant and weight of fruits were also responsible for increased tomato yield. These results are in conformity with the reports findings of Reddy (2000) and Kasatikov (1996). Increased yield could also be due to better availability and uptake of nutrients with the application of sewage sludge alone or in combination with urban compost.

Soil properties : The soil chemical properties were analysed before conducting the trial and also after the harvest of crop (Table–3). Soil pH was raised form 6.76 to 7.4 by the application of urban compost and FYM, since they were alkaline in nature (Table-1). Besides, EC was also higher with combined organic supplements. This is in conformity with findings of Epstein (1976). Organic carbon content of the soil is the Key factor to maintain sustainability of crop production. Application of organics to tomato crop raised the residual organic carbon from 0.59 to 1.98 per cent. This was reflected in higher status of available soil nitrogen. Like wise the residual available soil phosphorus was higher with application of sewage sludge only (48.5) compared to status before conducting the trial (13.8). However the available potassium level was lowered with application of sewage sludge in combination with urban compost and FYM (1:1 and 1:2 proportions). Residual soil potassium was improved by the 1:3 proportions. Perhaps, it was due to more K content in compost and FYM than in sewage sludge. Mehta and Daftardar (1984) obtained similar increase in yield with urban garbage compost application.

Combined application of sewage sludge and urban compost in 1:1 and 1:2 proportions helped to realize the high yields of tomato cv. Pusa ruby. Besides, high organic carbon, N and P were maintained in the soil for sustainability in tomato production. However, the potassium level in soil need to be improved in the organic farming through K rich sources.

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Table 1 : Analysis of urban compost, sewage sludge and FYM

	pH	EC (dSm^{-1})	Organic carbon (%)	Total Nitrogen (%)	Total Phosphorus (%)	Total Potassium (%)	C:N Ratio
Sewage sludge	6.69	1.40	12.75	1.72	0.63	0.25	1:8
Urban compost	7.18	0.72	11.80	0.84	0.46	0.59	1:15
FYM	7.28	0.62	10.17	0.74	0.37	0.64	1:14

Table 2 : Growth and yield components of tomato cv. Pusa ruby as influenced by combined application of sewage sludge, urban compost and FYM in different proportions

Treatments	Plant height (cm)	Number of fruits $plant^{-1}$	Fruit weight (g)	Fruit yield ($t\ ha^{-1}$)
1. Sewage sludge : Urban compost (1:1) (12.5 $t\ ha^{-1}$) (12.5 $t\ ha^{-1}$)	43.3	72.3	59.5	15.0
2. Sewage sludge : Urban compost (1:2) (8.33 $t\ ha^{-1}$) (16.66 $t\ ha^{-1}$)	43.1	68.0	58.2	14.0
3. Sewage sludge : Urban compost (1:3) (6.25 $t\ ha^{-1}$) (18.75 $t\ ha^{-1}$)	41.1	64.3	52.8	7.9
4. Sewage sludge : Farm yard manure (1:1) (12.5 $t\ ha^{-1}$) (12.5 $t\ ha^{-1}$)	42.3	59.6	56.3	9.8
5. Sewage sludge : Farm yard manure (1:2) (8.33 $t\ ha^{-1}$) (16.66 $t\ ha^{-1}$)	41.7	58.4	53.2	8.9
6. Sewage sludge : Farm yard manure (1:3) (6.25 $t\ ha^{-1}$) (18.75 $t\ ha^{-1}$)	40.8	58.0	52.4	7.3
7. Only sewage sludge (25 $t\ ha^{-1}$)	43.2	60.9	58.6	14.5
8. Only urban compost (25 $t\ ha^{-1}$)	42.7	59.8	57.2	11.6
9. Only FYM (25 $t\ ha^{-1}$)	40.7	57.3	50.2	6.8
SEm±	1.0084	1.7899	1.4853	0.4867
CD at 5%	3.0232	5.3664	4.4531	1.4592

Table 3 : Chemical analysis of soil from experimental site before and after havest of crop

Treatments	pH	EC (dSm^{-1})	Organic carbon (%)	Available Nitrogen (kg/ha)	Available Phosphorus (kg/ha)	Available Potassium (kg /ha)
Before the experiment	6.76	0.29	0.59	192	13.8	139
After the experiment						
1. Sewage sludge : Urban compost (1:1) ($12.5\ t\ ha^{-1}$) ($12.5\ t\ ha^{-1}$)	7.00	0.20	1.98	250	47.8	72
2. Sewage sludge : Urban compost (1:2) ($8.33\ t\ ha^{-1}$) ($16.66\ t\ ha^{-1}$)	7.30	0.16	1.96	210	29.5	120
3. Sewage sludge : Urban compost (1:3) ($6.25\ t\ ha^{-1}$) ($18.75\ t\ ha^{-1}$)	7.50	0.14	1.38	200	25.5	205
4. Sewage sludge : Farm yard manure (1:1) ($12.5\ t\ ha^{-1}$) ($12.5\ t\ ha^{-1}$)	6.80	0.18	1.63	220	43.2	68
5. Sewage sludge : Farm yard manure (1:2) ($8.33\ t\ ha^{-1}$) ($16.66\ t\ ha^{-1}$)	6.95	0.16	1.18	205	38.0	110
6. Sewage sludge : Farm yard manure (1:3) ($6.25\ t\ ha^{-1}$) ($18.75\ t\ ha^{-1}$)	7.10	0.17	1.15	200	21.2	195
7. Only sewage sludge ($25\ t\ ha^{-1}$)	7.30	0.13	1.93	262	48.5	185
8. Only urban compost ($25\ t\ ha^{-1}$)	7.40	0.15	1.82	220	43.8	195
9. Only FYM ($25\ t\ ha^{-1}$)	7.20	0.22	1.10	205	39.6	190

URBAN SOLID WASTE COMPOST-MATURITY INDICES & QUALITY STANDARDS

Dr.V.R.Ramakrishna Parama,
Associate Professor, Department of Soil Science & Agricultural Chemistry,
University of Agricultural Sciences, GKVK, Bangalore 560065

The need of the hour is to improve soil health by providing the much needed organic matter lest soil becomes impoverished. Towards this end Urban Solid Waste compost could serve as a valuable organic matter source given the shortage of organic nutrient sources.

Organic matter is a component of fundamental importance in the general fertility of soil. It has direct effect on the biological fertility of agricultural substrates and improves physical condition of soil and has a different role to play compared to chemical fertilizers in soil-plant inter relationships. The main effect of organic manures is not so much that of enriching the soil with NP&K but rather its complex role in humus balance and therefore soil structure and related wholesome improvements in soil health, **rightly so Organic Matter** is called **"The Life of Soil".** In the context of organic matter production – promoting the recovery of organic waste through composting requires a standard definition of process and product as a pre requisite for ensuring quality and fostering agricultural use.

Defining quality standards for organic manures is a very difficult task **given the heterogeneity of residues** that occur in city wastes and the processing methods adopted. Further more specifications and definitions for organic soil conditioners in India are hardly standardized. Hence there is an urgent need for guidelines on standard nomenclature and specifications on compost quality.

Compost Maturity Indices & Quality Specifications

The process of composting is entirely mediated by microorganisms. The intermediate products of composting, the time taken for maturity and the quality of final product all depend on types of residues used, conditions prevailing during composting and related parameters.

Therefore it should be realized that the specifications or indicators need to be defined to establish compost maturity on the one hand and on the other to establish nutrient quality and other related quality specifications especially in the Indian context.

The term **composting** refers to the bio oxidative process that involves a heterogeneous organic substrate in the solid state, evolves by passing through a thermophillic phase and leads to production of carbon-di-oxide, water, minerals and **stabilized organic matter (compost).**

Compost is the stabilized and sanitized product of composting which is beneficial to plant growth. It has undergone an initial rapid stage of decomposition and is in the **process of humification.**

Maturity Indices

Maturity of compost is of critical importance as use of immature compost for agricultural purpose would cause undesired effect of nutrient imbalance and biological contamination.

Some of the methods adopted for predicting compost maturity are

1) Physical methods : Temperatures, odour, colour, particle size, water and air content.
2) Chemical methods : pH, C/N ratio, water soluble ions, CEC, crude fiber analysis
3) Plant bio assay : Germination test in water extract, Rye grass growth in compost containing mixtures.
4) Microbiological assays : Indicator organism, respiration rate, microbial activity and biomass suppression and plant pathogens
5) Degree of humification : Content of total humic substances and ratio of humic acids and fulvic acids and non humic fractions and other functional groups.

These methods are complimentary to one another and any one of them will not form a conclusive test as an indicator of maturity.

Any of these methods can be selected for determining compost maturity based on facilities, time and degree of precision required. Invariably one should test compost maturity before packing for sales or applying to field. However the C:N ratio is the most accepted index of maturity.

Compost Quality Specifications

The maturity of compost determines to a great extent the quality of compost to be marketed for agricultural use, compost must be accompanied by specifications relative to its origin, composition and degree of stabilization. The characteristics and composition of compost vary with the type of starter material.

During the process of composting if substrates are added the constituents (in %) must be specified in order of decreasing concentration.

If stabilized organic matter of different origin is mixed with compost for marketing the mixture is not a **compost** but ought to be designated as **organic soil conditioner.**

The content/value of the following parameters are to be indicated in the specifications of final composts.

1.) Organic matter (OC =20-30%)
2.) Moisture content (20-25%)
3.) Inert material (Maximum inerts % dry weight)

Grade	**Sieve size (mm)**	**Glass**	**Plastic**	**Moisture**	**Bio degradable**
Very fine	8	0.1	0.2	30	20
Fine	16	1	0.4	35	25
Medium	24	2	0.8	40	30
Coarse	40	3	1.6	50	35

4.) Nutrient content (minimum)

Nutrient	**Content**
Nitrogen	0.6%
Phosphorus	0.5%
Potassium	0.3%
Calcium oxide	2.0%
Calcium carbonate	3.0%
Magnesium oxide	0.3%

5.) pH 6.5-8.00

6.) Electrical Conductivity < 1 d S m-1

7.) Micronutrients & Heavy Metals (Maximum in compost)

Element	**mg/kg (dry wt of compost)**
Zinc	1000
Lead	750
Copper	300
Nickel	50
Arsenic	-
Mercury	5
Cadmium	5

8.) Stabilization index : Degree of humification

9.) Microbial specification : Content of pathogens *viz., Salmonella, Enterobacter etc.*

These specifications are to be adhered to by the organic manure manufactures and the nutrient contents need to be prominently displayed on the packaging. A strict legislation is very important and of immediate necessity given the increasing number of organic manure producing units. An authorized government agency needs to monitor quality as in case of inorganic fertilizers.

The main requirements for compost is that it should be suitable for agriculture as an organic soil conditioner i.e., should provide for physical, chemical and biological stability, should be non phytotoxic and bring about balance among mineral elements - these are the essential characteristics for **compost** to be useful to the **soil and crops**.

SOLID WASTE MANAGEMENT IN URBAN AREAS AND NEED FOR CLASSIFICATION, EVALUATION AND QUALITY STANDARDISATION OF SOLID URBAN WASTE

Dr. H.R. PRAKASH , ASSISTANT AGRICULTURAL OFFICER ,
DEPARTMENT OF AGRICULTURE, BANGALORE - 560 001.

SUMMERY: The growth of cities compounds the problems whose solution is becoming increasingly costly. The solid waste poses problems such as (a) Extensive land requirements for land fills and for assorting and processing near cities (b) Health risks (c) Marketing difficulties of urban compost and (d) pullution problems.

It is roughly estimated that urban waste collected varies from 0.2 to 0.4 kg per human being per day. The urban solid waste comprises of substances injurious to human beings, animals, birds, crops and soils and non-degradable glass, metal and plastic and degradable organic matter. The urban solid waste comprises of 53 kg partially decomposed compost 30 kg coarse waste, 5 kg fine waste, 1.5 kg metal and 10.5kg glass and plastic. Urban solid waste can be evaluated as plant netrient, soil conditioner and improving biological activity. The quality standardisation calls for analysis of heavy metals which are toxic to human beings , animals and birds. The urban solid waste requires separation, grading composting and use in agriculture.

INTRODUCTION:- The term solid waste means garbage, refuse and other discarded materials including materials resulting from industrial, commercial, agricultural operation and community activity. The criteria for decision in waste management determined by four basic catagories. Costs, Environmental factors, Resource conservation and Institurional factors. The urban solid waste can be used as physical and chemical improvement of soils. The urban solid waste can be calssified based on ingredients present in the waste and evaluation has to be done for heavy metal pollutants. Marketing has to be done based on grading and quality of urban waste.

CLASSIFICATION OF URBAN SOLID WASTE:- The urban solid waste consists of discarded materials mostly from household, commercial organasition and industrial waste. It is very essential that the urban solid waste has to be classified based on the discarded materials present in it. The urban solid waste comprises of broadly the following three types of materials.

01) Sustances which are injurious to human beings, animals, birds, plants and soil.
02) Non-degradable and which can be recycled.
03) Degradable organic matter.

The substances which injurious to animals, plants and soil are heavy metals like lead, cadmium,chromium,nickle,mercury etc., which are in the industrial waste and some poisonous mateirals used for protection from mosquitos and flies and to control insects on plants and discarded materials from hospitals.

The non-degradable recycling waste like metals,alloys, plastic and rubber. The materials can be used economically for reuse.

The degradable organic matter contains rich of nutrients which can be used for nutrition of plants.

A sample analysis of the urban solid waste comprises of following different materials.

01) 50 - 60% partially decomposed organic matter .
02) 20 - 30% un decomposed organic matter
03) 1 - 2 % metals.
04) 10 - 18% glass, plastic and others.

It is very essential that the urban solid waste has to be segrigated at the source (House/Commercial Organisation/Industry) This can be done by following methods.

01) Provision of three bags.
One is red colour for collecting poisonous materials and Second one blue for non-degradable metal, plastic and glass waste, and Third green colour bag for degradable organic matter. This can be done by educating the people through propaganda via mass media like paper, television , radio and use of folders.
02) Conducting training programmeeto educate the urban public. This should be a continuous process.
03) The vehicles which collect solid urban waste shoud have three compartments to collect these three different wastes.
04) Advocate all houses to possess two small compost pits of two feet by four feet in their backyard place whereever possible. This can be used to put all degradable organic matter to produce compost which can be used for kitchen gardening. They can produce their own organically produced vegetables and fruits.

EVALUATION OF URBAN SOLID WASTE:- The degradable organic matter can be evaluated as nutrition to plants and for physical and biological activity of soil.

NUTRITION:- The degradable organic matter are rich in plant nutrients. Following is the nutrient content in urban solid waste.

NUTRIENT	Kg/Tonne Solid Waste
Nitrogen	3 - 5
Phosphorous	1 - 2
Potassium	4 - 6
Calcium	10 - 20
Magnecium	2 - 4
Sulphur	1 - 2
Iron	1 - 2
Copper	0.01-0.02
Zinc	0.[illegible]-0.2
Manganese	0.4 -0.6
Boron	0.1 -0.2
Molybdenum	<0.02

In Karnataka due to intensive agriculture there is wide spread deficency of micronutrients in soils especially zinc iron and boron. This urban solid waste can be used to correct the micronutrient deficencies. Based on the analysis of soil aamples the foloowing picture of micronutrient deficencies are noticed in Karnataka.

MICRONUTRIENT	No. of Samples analysed	No. of Samples deficent	Percentage of Samples deficent
ZINC	86156	61373	71.2
IRON	86078	22687	26.4
BORON	80659	19642	24.4
MANGANESE	86015	4971	5.8
COPPER	85848	1809	2.1

(Karnataka State Department of Agriculture, Bangalore)

SOIL CONDITIONER:- Use of organic matter improves the crop growth and yield indirectly by soil conservation and soil improvement. Organic matter promotes soil aggregation and stabilises soil structure. This improves air -water relationship of soil thus increasing the water retention capacity of soil and encourages more extensive root development of plants. Improved soil structure counter acts soil erosion.

Now ther e is a a great demand for well decomposed compost. The organic matter addition is decreasing day-by-day and hence soils are depleted. The organic matter contents of soil is decreasing. Organic matter addition prevents soil hardening thereby reduces surface runoff and increases infilteration of rain water.

BIOLOGICAL ACTIVITY:- Most of the soil micro organisms are dependent on the supply of decmposable organic material in soil. The soil microbial activity is most improtant for the growth of the plant.

CROP YIELD IMPORVEMENT:- Application of ogranic matter improves the crop yield considerabaly by increasing the fertilizer use efficiency.

QUALITY STANDARDIZATION:- The three most important requirement concerning the quality of urban compost are

01) Absence of substances that are injurious to human beings , animals, birds, crop and soil (lead, arsenic, mercury, pesticides etc.,)
02) Low content of recyclable substances like glass, plastic and metals.
03) High content of organic matter and plant nutrients.

In fertilizer control order 1985 it has been notified the following limits of Arsenic and Lead as impurities in fertilizers.

FERTILIZER	percent impurity mixmum	
Amonium Sulphate	Arsenic	0.01
Zinc Sulphate, Manganese Sulphate, Borax, Copper Sulphate, Ferrous Sulphate, Megnesium Sulphate	Lead	0.03

The rate of application of these fertilizers to raise crops vary from 500 kg per/he in Amonium Sulphate and 5 kg in Copper Sulphate. If there is higher content of these impurities in fertilizer is detected is treated as non-standard and legal action are initiated under essential commodoties act 1955.

The heavy metal contents in urban waste are as follows:-

METAL	RANGE(ppm)	AVERAGE(ppm)
CADMIUM	60-1500	70
COBALT	2- 260	12
CHROMIUM	40 -8800	250
NICKLE	20-5300	80
LEAD	120- 300	126

(Misra and Dinesh Mani 1999)

The urban compost applied to the crop, at the following rates.

CROP	COMPOST RECOMMONDED KG / HA
PADDY	10,000
JOWAR	7,500
H. MAIZE	10,000
RAGI	7,500
BAJRA	6,000
TUR	7,500
SOYBEAN	6,250
GROUNDNUT	10,000
CASTER	5,000
COTTON & TOBACCO	12,500
SUGARCANE	25,000

(Package of Practices for High Yields 1999)

It is very essential that the quality of urban compost has to be standardized so as to prevent the hazards due to heavy metals and poisonous substances. The urban compost has to be brought under quality control by Government to ensure the safety of soil, plants and animals and to reduce pollution problems.

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Capacity Building Approach to a Sustainable Community Level Solid Waste Management Strategy by Empowering Municipal Pourakarmikas to a new role of Local Solid Waste Managers

Leo F. Saldanha, Ranjini Thomas and Shammanna T. J. Benekal
Environment Support Group®

Paper presented at the seminar on '**Eco Friendly Approaches for Solid Waste Management - Sharing Experiences**' organised by Bangalore Development Authority, Integrated Urban Environment Improvement Project, Centre for Environment Education and University of Agricultural Sciences, with sponsorship from the Indo-Norwegian Environment Programme.

Abstract

This paper is an effort to share our experiences in developing a sustainable community level strategy to manage collection of segregated solid waste. The impetus on segregated solid waste collection is to ensure that any environmentally benign solution at city-scale is to a large extent feasible if waste reaching landfills is reduced. Further, that waste reaches in such form that recycling, composting and energy recovery processes are not burdened by the complexity of sorting un-segregated waste, as is presently the case. It also presumes a most satisfying SWM cycle as one where recycling is done at source to the maximum possible extent and composting initiated at the local level to the extent feasible.

The paper narrates and analyses initiatives undertaken by ESG in collaboration with **the Pourakarmikas (Corporation Solid Waste Workers, PKs for short) of 49B Health Ward of the Basavanagudi Health Range, Bangalore Mahanagara Palike** (previously Bangalore City Corporation, BMP for short). This project was initiated during July 1999, supported first by the Human Health and Well Being Programme of the United Nations Environment Programme (UNEP) and presently by the Indo-Norwegian Environment Programme.

Our efforts were focused on training PKs, being the lower most tier of the municipal service administration, to evolve as 'solid waste managers'. We involved the local administrative officers in the training so that they were aware of the methodology used and supportive of the envisaged new role for the workers. The training in the first phase involved an attempt to understand the Pourakarmika (PK), their life situations, their work needs and their perspectives of the solid waste management approaches proposed or underway.

The project involved a preparation phase and a demonstration phase. The preparatory phase largely involved working with PKs in understanding their reality and preparing them to their envisaged roles as "solid waste managers" or even, as defined in emerging policy and legislative efforts. The second phase was a demonstration of their initiative and the practicability of the approach.

The first phase was achieved in reasonable time and with involved participation of the PKs and the local ward officials, thus setting the stage for the implementation of the project on field. However, numerous factors delayed the implementation of the

second phase, not least of all being the absolute preponderance in the BMP of centralising decision levels, and thus delaying, if not denying, the necessary permissions to proceed with the project tasks in reasonable time. With renewed effort, the second phase is now being implemented with support of the Indo-Norwegian Environment Programme.

Introduction:

Solid Waste is a continuing issue of concern, which has plagued the consciousness of both the citizen and the Government over the years. It has been an issue of immediate concern for it is visible, and hits at more than one of our sensory perceptions. The need to find a remedy has been ardent, yet the approaches to the problem have been largely incumbent and sans imagination. Only of late is their active effort to get this critical urban environment management task moving beyond typical constraints.

Whilst over the years certain areas of the waste generating process have received continuous attention, the lower administrative tier of the waste management process has languished silently. Very little attention has been focused on the human resource that has coped with a most challenging and risk-prone task on a day to day basis. Pourakarmikas working in the early hours of the morning is more often than not taken for granted and the contributions of this critical work force is easily escape the recognition of citizens' collective consciousness.

One of the occasional forays of administrative interest into the human resource component of the SWM process has resulted in an active interest to privatise the sector, presently undertaken by BMP Pourakarmikas. The main reason for this has been the pressure to bring down the increasing costs of maintaining a large workforce. Supplementary reasons may well have been various voluntary efforts to improve solid waste collection by engaging 'rehabilitated' street children, area contract supported daily wage workers, community mobilised untenured workers, etc.

Being well aware that PKs were generally perceived to be a burden to carrying forth progressive SWM efforts, we considered it necessary to research if indeed the alternatives, as were being proposed and experimented, would work? And as well find out if ever there had been an effort to train the existing tenured workforce to achieve higher levels of responsibilities and knowledge-based skills so as to facilitate their ability to comprehend more complex and demanding tasks. Proceeding with a belief that a trained and secure workforce is more likely to deliver a critical task of keeping cities clean and healthy, than a mobile and insecure one, we envisioned a proactive role for the Pourakarmika where he/she would be a Community Outreach Agent, imparting awareness regarding waste segregation to the community at large, and as well be a trainer for the other PKs across other Health Wards in Bangalore.

The other factors that contributed to the implementation of the project were two significant developments influencing the, now, constitutionally obligatory role of Solid Waste Management (SWM) for Municipalities in India.

(a) The first being a Report of the Committee Constituted by the Hon. Supreme Court of India on Solid Waste Management in Class I Cities of India, March 1999. This is an exhaustive referral document that lists guidelines for improving the quality of SWM services and proposes various changes in the institutional structure and management approaches for Class I cities with the intention of making this critical service people friendly and reflective of public health concerns. The report is presently under the consideration of the Supreme Court.

(b) Secondly, a Draft Notification of the Ministry of Environment and Forests on Municipal Solid Waste (Management and Handling) Rules, 1999, issued on 5th October 1999. This notification proposes various standards for collection and disposal of solid waste, sets targets for achievement and develops standards for landfill location. Reference should also be made to the Ministry of Environment and Forests Notification on Bio-medical Wastes brought into effect on 20th July 1998 in order to ensure self-compliance by various health facilities across the country.

The essential argument in these policy and legislative initiatives has been that even the most basic steps have not been initiated in terms of evolving a sustainable Solid Waste Management strategy for most cities in India, and Bangalore is no exception. It is largely because of citizen and voluntary action, however, that SWM priorities remain a constant reminder and convenient starting point for the Government to improve the quality of the urban environment.

Our Approach? People, People and People:

Our approach focused on the workforce that made it possible for the community to walk on the streets, the workforce that came in direct contact with solid waste daily - collecting, transporting or just transferring from the community dust bin to the lorry. We considered them to be resources that required a lot of attention and help, a sector that had been denied its basic rights to a humane existence for a very long time.

The thrust of our initiative was to understand them and their needs through interactive sessions, to build their individual capacities through training to evolve as proactive 'Solid Waste Managers', to initiate change in a community's reaction towards waste disposal, and evolve a sustainable and humane waste management practice.

Initiating the Project and Broad Features:

Our first step was to initiate a discussion with the Bangalore Mahanagara Palike explaining what we planned to do and the process of implementation, for we felt that any effort on our part would be less meaningful without the active involvement of the administrative body. We then established contact with the local Health Range office, Basavanagudi. The details of what we planned to do and what we expected from them was discussed with all the Health Inspectors and the Medical Officer of Health and it was agreed that we would start the initiative in 49B Health Ward.

49B Health Ward was ideal for it had markets, commercial establishments, educational institutions, community halls, and residential areas, and the solid waste generated was very varied. The area has a high resident population density because of numerous apartment buildings that have sprung up in an otherwise bungalow type accommodation, and supports a high floating population due to commercial establishments (shopping mainly), educational institutions and markets.

Interactive weekly sessions at the Ward Office and individual house visits helped us establish a relationship with each of the Pourakarmikas of 49 B Health Ward. During the weekly sessions the various topics for discussion were health issues concerning the Pourakarmikas, the various occupational hazards and the possible safeguards for the same, rights and obligations, and even the need for thrift and advise on secure savings.

A Health Camp was also organised, for the basic details regarding their health were not available, and a regular health check up that was mandatory, had not been conducted for years. Based on this, a system of providing Health Cards for every worker was initiated, though the same has not yet been provided to the worker for want of approval from BMP (pending for over a year now).

House visits, which served as an icebreaker in the initiative, helped us to understand the conditions and the constraints within which the Pourakarmikas lived. A social survey enumerated their economic levels, education levels and details regarding their families. As there were no previous studies to compare our findings with, the closest approximation that we could arrive at was that the conditions of the Pourakarmikas were similar to the urban poor who were settled in the slums. This was a shocking realisation as the PKs are tenured workers of the BMP and much of the urban slum dwellers are daily wage earners.

During the interactive sessions, we shared our perspective on the proactive role that we had envisioned for them, wherein they would evolve into Community Outreach agents visiting households and introducing the concept of segregation of waste at source based on a door to door collection model. The enthusiasm and the willingness to try this was heartening indeed.

Unfortunately we were unable to capitalise on this enthusiasm, for the draft of the community educational material is still awaiting endorsement from the BMP. Thus our initiative was temporarily shelved due to the laxity of BMP's administrative clearance process.

Administrative Experiences:

For the success of any initiative persuading the other person to share your point of view is the challenge. Persuading the Pourakarmikas, which we considered a challenge, turned out to be the easy part, but working with higher tiers of administration in the BMP was time consuming and frustrating. Encouragement for the venture was anything but cursory and no interest whatsoever in the progress of the initiative was expressed at higher levels.

The local officers were a lot more enthusiastic, though they operated under numerous constraints. The local office of the Health Range had no authority to look at an initiative and consider its feasibility in the area, or cooperate with a voluntary agency on its own. Decision making was centred completely in the BMP corporate office, robbing the local office of a lot of autonomy.

The time taken for a clearance to be given was anywhere from 2 weeks to 12 months. Whilst we struggled through this process, the Chief Minister introduced with much gusto the Bangalore Agenda Task Force. It was our hope that the clarion call of NGO and community involvement, especially under the *Swaccha Bangalore* programme, would benefit our effort. Our experience did not change much.

Swaccha Bangalore model of training Pourakarmikas and what we propose:

Soon after the introduction of *Swaccha Bangalore* programme, a package of training PKs was introduced. On observation, the approach seemed didactic and the training centralised, with PKs from several wards made to come together. Participation in some of these training programmes revealed that the effort seemed rushed, and reflected little appreciation of PKs needs.

We were informed that whatever initiative we undertook would not have to disturb the processes initiated per this new *Swaccha Bangalore* model. Whilst we agreed completely with every objective of the training, we somehow found it difficult to agree with the approach. On consultation with some PKs who participated in the training process, our apprehensions were confirmed. The PKs realised the need to change their approach, but were unable to comprehend the details and nuances of the changes required. In effect this meant that they were compelled to change, without being able to participate and facilitate this process, and thus make it sustainable.

Further, the BMP supported *Swaccha Bangalore* training programme were conducted mainly as one-way communication interventions. The problems that the workers have with the present system of functioning were not dealt with and passed over with less than an empathetic nod. These training sessions were for a day with 50-60 PKs crammed in a room.

Does this have a lasting impression? Are they able to relate to ground water contamination being caused due to waste being dumped in the landfill, for instance? Do they understand that the solid waste is actually a resource when it is segregated? Do they understand that burning of plastics release toxins and carcinogens in the air and that is the reason why they have been asked not to burn the waste? Would they continue with the concept of segregation? If yes would that be out of understanding or because that is what the management has ordered? Do they understand that the introduction of door to door collection is to reduce their contact with waste to a minimum, ensuring a better working condition for them? Well these are questions well worth addressing at their level, but were not.

When occupational health is not provided importance, then the workers productivity and quality of work would certainly suffer. All the questions raised above are of a fundamental nature and it is not necessary to presume PK's as being past understanding the nature and details of such knowledge.

It seemed to us that a drastic result was being forced out of a system that had, largely because of decades of administrative and political apathy, neglected a critical need of the city. And the PKs or their equivalent workforce under private contract or voluntary initiative, were bearing the brunt of this approach.

What then could be the approach?

In our experience in Ward 49B we have well managed to raise all these issues, with reasonably good response and learning, and as well address issues relating to general human health and wellbeing.

The Pourakarmika who handles the waste on a daily basis is perhaps given least thought when thinking up strategies for community level waste management. The prevalent attitude seems to be: invest in technology to solve the problem. The term 'technology' here is understood as machinery and mechanical gadgets, for which there is no dearth of investment.

That a Pourakarmika could well be a resource person in his/her own right, is an aspect that is completely lost in this approach. Is his/her knowledge utilized? The answer is 'No'. Do their opinions matter? No. Are they consulted in the design of new equipment? No. Do they participate in designing strategies for SWM at the community level? No. Quite simply put, they are reduced to being an extension of the broom they wield on the streets, and more recently the push-carts with containers that have been introduced to facilitate door to door collection. The entire effort wracks of a sense of getting over with an vexatious issue.

Remembering clearly that success or failure at the solid waste collection level could well be definitive of the result at higher levels managing waste at the city-scale levels, be it for energy generation, composting or recycling, the following observations of our initiative are made and alternatives proposed.

Putting People First:

In our approach, the Team took the PKs through a process of self-realisation and self-esteem building exercises. Effectively this involved group discussions on issues of concern, and certain specific interventions at their information assimilative levels on the health risks related to the work and their rights and obligations. This exercise was sustained weekly over two months. By the end of the process, every PK was very much aware of his or her rights, obligations to service and occupational safety measures that should be provided and utilised.

Response of Pourakarmikas to Training Interventions: The training process was a empowering exercise as it helped the PKs share experiences that were otherwise suppressed, develop confidence in articulating concerns with their supervising staff who also sat through the training and come up with a more clearer understanding of the important role they play in society. This helped develop their self-esteem, which was a crucial requirement for the community mobilisation to follow and which they would lead.

Health Camps: Even as this training process was underway, a Health Camp was organised for the PKs. Conducting the Health Camp following the initiation of training benefited the workers more. For with the benefit of health oriented discussions held during the training, they were able to make connections between their health status and harsh work conditions. The Health Check up was conducted early January with the active involvement of Interns and Doctors of the Kempegowda Institute of Medical Sciences and under the supervision of Dr. Shirdi Prasad Tekur. Dr. Saraswathi, Head of the Local Corporation Dispensary, provided the necessary institutional facilities for the Camp.

What we learnt of the Work and Living Conditions of Pourakarmikas

Work ethic of Pourakarmikas: When assessments of complex areas such as SWM are conducted, as in the case of the Supreme Court Report, there is bound to be oversight in the nuances of certain situations. One such area happens to be the comment on the work ethic of the "sweepers", nee "Pourakarmikas" (PKs). The Supreme Court Committee arrives at a conclusion that "productivity of sweepers is generally below 50%", backed by a particular justification. The experience from this project suggests that whilst the assessment of the Committee is most likely a reflection of general inefficiency of the system, a specific estimate of efficiency or the lack of it, especially addressing "sweepers", unnecessarily targets the lowest rung of the SWM institutional infrastructure. This even when qualified by observations such as "lack of supervision" and "motivation".. As a matter of fact, such observations which are based on impressions, rather than analysis, fuel arguments for privatising this sector, and is not a just and rewarding reflection of the very large contribution PKs have made and continue to make to SWM in the cities.

High morale despite harsh work conditions: What has been keenly observed of the work behaviour of PKs in this project presents an altogether different picture to what has been the estimation of the Supreme Court Committee. PKs have a very high degree of work ethic and this despite the most basic occupational and welfare facilities not being made available to them. It would not be an incorrect statement to make, therefore, that it is mainly because of the largely honest effort of the PKs that Bangalore is a relatively clean city. That especially when PKs have no real incentive to perform at higher levels of efficiency. We present such an argument as "large scale absenteeism", for instance, was certainly not evident in the Ward 49B, the Project Area. Nor was there any gross scale of proxy working patterns. Almost all PKs were at work by about 6 a.m. and did so till they finished their day's routine at the turn of noon.

Exploitation of Pourakarmikas: And yet, Rs.50 is collected from each PK by their supervisors in exchange for attendance should they be late. The administrative rule is that should they report to work later than 6.10 a.m., they will be marked absent; and that would mean losing a day's wages. Considering that there is no public transport available at that early hour, and no alternative transport is arranged by BMP for the benefit of this large workforce, as in the case of industrial workers, PKs rely on walking to work or cycling. And this would mean very long walks, or travel over great distances for some.

Skewed Work-Loads: Further, under the prevailing conditions, the workload is rather heavy and unfair to the workers. An instance of such overload is in Ward 49B. According to details supplied by the local Ward office, this area has over 700 households, 10 Apartments, 6 schools, 3 colleges, 13 office blocks, 2 private hospitals, 8 private choultries (marriage halls), 80 shops, 6 refreshments, 6 animal sheds and 4 public toilets arrayed over 25 streets with a total length of 8 kms. The sanctioned work strength for the area is 58 PKs, but only 40 are deployed in effect. The rest have been deputed on tasks unconnected to the area. The existing workforce share amongst them roles of cleaning the drains, sweeping streets, collecting dirt and depositing them in neighbourhood bins on a day-to-day basis.

Work aids ineffective and inappropriate: The facilities provided for PKs are very skimpy - 30 kgs of broomsticks, one cane basket and a metal plate as a scoop, for a six-month duration per worker. In addition, groups are provided with a metal wheelbarrow of very inefficient design. This is all there is as work equipment. Of late new design push carts for house to house waste collection have been introduced under the Swaccha Bangalore programme. The support infrastructure involves trucks for disposal, which collect this waste along with other waste deposited by households and establishments. The removal of waste by trucks is conducted in a most inappropriate manner posing high risk to the workers.

Occupational Health and Protective measures ignored: Despite the shortfall of 18 workers, the existing workforce has to cover the entire 2-sq. kms. (approx.) area of Ward 49 B. And they are not in any way supported to improve their efficiencies. No protective clothing, gloves or shoes are provided whatsoever. A pair of "chappals" provided once a year is the only "protective clothing" that they presently get. In the past PKs were given gloves and shoes, but that practice has been discontinued. Raincoats were last provided in 1985! A pair of uniforms was regularly provided in the past, but that practice has also been discontinued. What is now provided is cloth material for two pairs of uniform, but stitching allowance that covers only one pair. Women workers are particularly affected by this neglect. It is best indicated by the fact that absolutely no washroom facility exists at all, and women have no bathroom facility for use or for changing.

Supreme Court Committee's concerns about worker welfare: The Supreme Court report notes such conditions with concern, as in Section 2.5.2 of the report, that:

"equipment given to sweepers is generally outdated and inefficient. At most places, sweepers are given short handled brooms and old designed inefficient wheelbarrows. Short handle brooms necessitate the sweepers to bend while working. This gives fatigue and does not permit sweepers to work continuously for even 15 minutes. This necessitates intermittent rest and results in waste of time."

In Section 2.3.5, the report acknowledges that:

"The road length to be swept by the sweeper is not standardised nor any scientific planning done to direct which streets should be swept daily, on alternate days, twice a week, etc. depending on the concentration of population/activity on the roads and lanes. Adhocism prevails in this regard. There is no yardstick prescribed. At some places, sweepers are allotted work as per road-length, which varies from 175 metres to 3.7 kms. At other places, it is on the basis of sq. metres, ranging from 3000 sq. metres to 10000 sq. metres or on the basis of Sweeper: Population ratio of one per 250 to 2850 population".

<u>Burden of Solid Waste clearance in Project Area high</u>: Ward 49 B, if the actual work strength is factored on area parameters, each PK contributes to the cleaning of 200 metres of street length and a population of 375. The average for Bangalore is 175 metres and 367 persons. However, the marginally lighter load in terms of lower population than the average is not really reflective of actual ground realities, as the area has a very high mobile population contributing significantly to the solid waste load, and this being in the nature of the students and people shopping. The area has 6 schools and 3 colleges, and every one of them is a major institution with high student strengths. Whilst the resident population may be lower than the city average, the mobile population is significantly higher. In real terms the burden of clearance of solid waste, thus, is significantly higher for the workers of this area.

<u>Inappropriate interventions creating adverse impacts on workers</u>: Such imperatives are never considered in planning local cleaning initiatives, and the result is skewed management impacting adversely the PKs, and not so much any of the higher staff. The appalling nature of the neglect is best exemplified by the fact that even the Supreme Court Committee recommendations, suggest only marginal improvements in terms of developing the infrastructure support for the PKs. Consider for instance the Committee's recommendation Section 2.5.2:

"Long handled brooms are more efficient and enables the sweepers to work with ease for a long duration of time without fatigue. But out of entrenched habit, acceptance of long-handled brooms is very poor."

When PKs are consulted on this aspect, the fact emerges that whilst the long-handled brooms may help the PKs, in effect the design is not effective as it does not clear the waste. The supervisors insist that gravel and dust must be swept the clearance of which the long-handled brooms do not support. Thus, in order to meet cleaning specifications, PKs revert back to the good old short-handled brooms, which do the job much better, but with serious health consequences.

<u>Crying need for worker sensitive SWM interventions</u>: The important aspect to be considered here is that we are even to this day debating on a transition from short-handled brooms to long-handled brooms, and this is reflective of the extent to which the occupational needs of this sector has been neglected. And if the opinion of PKs were to be considered, they would have rejected both brooms and an entirely different implement would have been developed serving both clearance needs and protecting the PK. But there is simply no attention paid to such consultation, or an administrative attitude reflecting such concern. A more recent and troubling instance of the extent to which the worker's concerns have been ignored is evidenced in the protests of BMP workers against the "Swaccha Bangalore" (Clean Bangalore) scheme of the BMP under the initiative of the Bangalore Agenda Task Force. The carts meant for removal of waste in the house-to-house waste collection scheme have been found to be of totally inappropriate design, and burdening the workers.

<u>Weak Institutional support exposing workers to high exposure to toxic and infective waste</u>: When such is the case, quite naturally there is scant attention paid to the fact that these workers are most at risk of contracting deadly diseases or coming in contact with toxic substances. Workers regularly come across vast amounts of bio-medical waste callously

discarded in drains or community bins, and they have to clean it up with their bare hands! One woman worker had the traumatic experience of discovering three dead infants in a dustbin. And others share that such instances are on the increase. One young worker shared the psychological difficulty he had eating with his hands for several months after he joined service, a condition he developed being in constant touch with the repulsive nature of the waste every day. The irony of his experience is such that he had decided never to be occupied in such work having seen the experience of his father who had been a Pourakarmika all his life. But on his father's demise during service, and the need to maintain the family's livelihood support, this young worker was forced to take the very profession that he had hoped all along to avoid.

Workers ineffective due to institutional inefficiency and not inefficient: Such facts are being emphasized here, as it is being widely advocated of late that this sector is inefficient, are an enormous burden to the city's exchequer and consequently pressure is being mounted to "privatise". Privatisation as a panacea for institutional inefficiency is certainly not a burden to be borne by PKs alone, we argue. Particularly given their working and living conditions are what we describe here. We therefore make a case for further positive engagement with PKs and suggest a shift in administrative attitudes towards PKs. Only such efforts would ensure a successful transition from the present state of SWM strategies, to something more benign from the environmental health and human rights point of view.

A Note of Caution on Privatisation:

There is presently a slow phasing out of BMP employed PKs as recruitment has stopped. The current work force will continue till they retire and then private sector will take over with their own hired work force. The contractor thus becomes a key actor in ensuring all goes well. What, though, has been experienced in the phase wise privatisation underway is perhaps telling of the nature of things to come. A good thing, that privatisation is proposed as, is, in effect, exploitation through cheap labour, disregard for human rights, corruption at the cost of the poor, and no regard for workers health and exposure to toxic and infectious conditions.

There was no deployment of SWM workers in Ward 49B under the private sector. However, the neighbouring wards 49 A and C did have a substantial introduction of workers who were deployed on daily-wage basis by private contractors. Preliminary surveys of their work condition revealed that there was hardly any concern demonstrated for their welfare. Considering that absolutely no guarantee of tenured employment was assured for them, these workers saw the job as a last resort in an otherwise difficult situation of securing employment. This desperate situation was thoroughly exploited by the Contractors, who effectively ended up extracting work from these workers, but paid them only half the wages prescribed. Random interviews with various private sector workers confirmed that only about Rs. 800/month was actually being paid, against the BMP prescribed minimum wage of Rs. 1750/-. The exploitation was considerably more severe in the case of women workers. The former BMP Commissioner, Mr. Jairaj, confirmed this fact in a meeting organised by CIVIC Bangalore and the Swabhimana initiative on 17 January 2000.

Despite official recognition of the corruption involved in exploiting daily-wage workers, absolutely no effective administrative measure has been adopted to tackle the problem. The scale at which such exploitation is being engaged in is probably very extensive, considering the fact that about 5,500 workers are engaged by private contractors, almost half the total strength of PKs in the city: 11,000 presently. The Government thinks this to be a saving of public resource, particularly in not taking on the burden of sustaining a large workforce with tenured contract, but this completely obviates the need for just contracts.

Consider this for instance. In Ward 49A of the Basavanagudi Health Range, private contractors were required to employ daily wage workforce to facilitate door to door collection. It was noticed over time that the workers employed would change frequently and the quality of collection, enabled with the newly deployed push-carts with bins, left a lot to be desired. For instance, there was absolutely no segregation, and the workers, often women with children, would bring along other family members, children included, to quickly achieve the task. On enquiry, it was discovered that the worker was paid approximately Rs. 700-800 per month on a daily wage basis, when in fact the allotted amount was about Rs. 1700/- per month. Needless to say, the Contractor was exploiting her ignorance and pocketing the rest of her earnings. Consequently the worker was forced to quickly complete her task in order to work elsewhere and supplement her 'lost' minimum wage.

Another instance. In the College Teachers Layout of Banashankari III Stage for instance, a young man came house to house to collect waste with the push cart and bell. It took about a week for the neighbourhood to realise that he was collecting waste door to door. No segregation was achieved, except if it was voluntary from the household. Soon after. this worker requested Rs. 10-15 per household as his fee. When probed why he had to be paid for BMP should cover his cost, he revealed that the contractor had instructed him to collect his 'salary' from households. Perhaps he did not find the earnings enough, perhaps the neighbourhood did not pay him. This man failed to turn up a week thereafter. And now, the waste gets sort of collected in and around the bin at the ends of streets and the picture in the mornings is the same as before.

Are these stray instances or widely applicable? We don't know. The moot point though is that by undertaking key SWM interventions in such manner, an opportunity of developing a healthy worker-community relationship as beginning of progressive SWM processes is being lost. To regain the community's confidence in reviving this approach, would become all the more difficult later.

What we propose to demonstrate:

Disseminating information, educating communities, developing communication techniques of PKs and ensuring a proactive worker-community relationship is the basic theme of our effort. We believe this can be achieved if the following steps are undertaken systematically.

A. The Pourakarmika is a permanent support person in ensuring the SWM process initiated at the community level succeeds. They need to understand first the implications of this change, and only then will they communicate this to the community and ensure compliance.
B. To address the community, the Pourakarmika should be trained to develop communication skills and necessary aids in communicating the content of the changes required must be provided. Such aids should be easy to use and facilitate communication from even an illiterate Pourakarmika to a literate resident.
C. The community must be facilitated in accepting this new role of the Pourakarmika, especially given their potential daily contact, without prejudice or stigma. The community must also be enlightened on the benefits of this critical intervention, not just locally, but the city at large.
D. The preparation of such engagement would have to be made keeping in mind the possibility of utilising this engagement in many other situations, such as a public health emergency, disaster management, etc.

In our engagement with the Pourakarmikas of Ward 49B, we have developed a set of communication material that has been developed in consultation with them. In other words, what results from this would be material that the Pourakarmika could easily understand and use in communicating the desired changes with the community. The communication material would include

Leaflets in Kannada and English, introducing the initiative to the community. This leaflet would enable the Pourakarmika to prepare the community on the new process of community level waste management system.

Instructional flip charts (largely illustrative) would enable the Pourakarmikas to convey the concept of waste segregation at source to each household/enterprise in a phased manner.

Wall Calendars would be provided in every household/enterprise to remind the key steps in segregating waste, providing them to the collector and the importance of this civic habit to the urban environment at large.

Booklet with detailed information on types of waste, its disposal and effects on the environment and community solutions with useful contacts to be provided to some key leaders and institutions in the community to ensure support for the initiative on a long term basis.

Community Education Video Documentary would be developed as a dramatized version of the various steps of the segregation at source and house to house collection initiative. Efforts will be made to transmit this video through local area cable TV networks and as well in specially organised local community viewing sessions.

Once the Community Education Material is ready, the Pourakarmikas will be motivated to employ them in engaging with the community in changing the pattern of SW management. Resistance from the community to this change in role of the Pourakarmika is expected, due to social stratification. Hence, the workers will be accompanied on the field initially by the ESG Project Team as a confidence building step. All the initiatives in this period will be carefully documented.

Development of Training Module

In order to facilitate the replication of this initiative in other wards, a module providing the various criteria and guidelines to be followed would be developed. This could also be made available to any body/organisation/government agency interested in the application of this initiative. This module will help in training Pourakarmikas in using the educational material generated to interact with the community.

Preparing Select Pourakarmikas as Trainers and Extension to Other Areas

The next significant step would be to enable the formation of a group of trainers from within the Pourakarmikas, who can in turn train Pourakarmikas from other wards. This would ensure the sustainability of the initiative. Similarly, local community leaders and institutions would be invited to share their experience with other neighbourhoods in enabling replication of the initiative.

ESG will provide non-material technical support to the extent possible in strengthening such an initiative on request from communities and agencies.

Note: More documentation on this intervention is available in electronic form (RTF or Word file) on request.

Environment Support Group ®
S-3, Rajashree Apartments, 18/57, 1st Main Road, S. R. K. Gardens, Jayanagar, Bannerghatta Road, Bangalore 560 041.
Telefax: 91-80-6341977 or 6591977 (proposed new no.)
Fax: 91-80-6723926 (PP)
Email: esg@bgl.vsnl.net.in

ಸಮರ್ಪಣಾ ನಂ. 7-ಬಿ, 19ನೇ 'ಡಿ' ಮುಖ್ಯರಸ್ತೆ, ಒಂದನೆ ಬ್ಲಾಕ್, ರಾಜಾಜಿನಗರ. ಬೆಂಗಳೂರು- 10.
—(ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಸಮಾಜ ಸೇವಾ ಸಂಘ) ☎ 3342 6611 ☎ 3322330

ಸಂಚಾರಿ ಕಸದ ಗಾಡಿಯ ಯೋಜನೆ

ಸಂಘದ ಕಿರು ಪರಿಚಯ:-

1982ರಿಂದಲೂ ಒಂದಲ್ಲ ಒಂದು ರೀತಿಯ ಸಮಾಜಸೇವೆ, ಸಾಂಸ್ಕೃತಿಕ ಚಟುವಟಿಕೆಗಳಲ್ಲಿ ತೊಡಗಿರುವ ಸಂಘವು 1993-94ರಲ್ಲಿ ನೋಂದಾಯಿತವಾಯಿತು.

B.M.T.C ಬಸ್ಸುಗಳ ತೊಂದರೆ, ಬೀದಿ ದೀಪಗಳು, ಬೋರ್‌ವೆಲ್ ಸಮಸ್ಯೆ, ರೇಷನ್ ಕಾರ್ಡ್, ಕಸದ ಸಮಸ್ಯೆ ಇವೇ ಮೊದಲಾದ ನಾಗರಿಕ ಸೌಲಭ್ಯಗಳಲ್ಲಿ ಯಾವುದೇ ರೀತಿಯ ತೊಂದರೆಯುಂಟಾದರೆ ಅವುಗಳನ್ನು ಸರಿಪಡಿಸಲು ಸೂಕ್ತ ಹೋರಾಟ, ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳಲಾಗುತ್ತದೆ.

ಸಂಚಾರಿ ಕಸದ ಗಾಡಿಯ ಯೋಜನೆ:-

'ಬಡ ಜನರ ಪುನರುಜ್ಜೀವನದ ಮೂಲಕ ನಗರ ಸ್ವಚ್ಛತಾ ಆಂದೋಲನ'

ಈ ಘೋಷಣೆಯೊಂದಿಗೆ 1989-90ರಲ್ಲಿ ಆರಂಭಿಸಿದ ಗಂಟೆಗಾಡಿಯ ಯೋಜನೆಯನ್ನು ಈ ದಿನದವರೆಗೂ ಸತತವಾಗಿ ನಡೆಸಿಕೊಂಡು ಬಂದಿರುವ ಹೆಮ್ಮೆ ನಮಗಿದೆ.

ಈ ಯೋಜನೆಯಿಂದ ಕೆಳಕಂಡ ಅನುಕೂಲಗಳಿವೆ—

1) ಚಿಂದಿ ಸಂಗ್ರಹಿಸುವ ಬಡಜನರಿಗೆ ಉದ್ಯೋಗ
2) ಮೇಲ್ವಿಚಾರಣೆ ನಡೆಸುವ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸಹಾಯ
3) ರಸ್ತೆ - ಬಡಾವಣೆ ಚೊಕ್ಕಟವಾಗಿರುತ್ತವೆ.
4) ಬಡಾವಣೆಯ ನಾಗರಿಕ ಸಮಸ್ಯೆಗಳ ಪರಿಹಾರಕ್ಕೆ ಪ್ರಯತ್ನಿಸುವ ನಾಗರಿಕ ಸಮಿತಿ ರಚನೆಯಾಗುತ್ತದೆ
5) ಈ ಯೋಜನೆಯ ಸಂಪೂರ್ಣ ಜವಾಬ್ದಾರಿ ಹೊತ್ತಿರುವವರಿಗೆ (ನಿರುದ್ಯೋಗಿ ಯುವಕರು, ಗೃಹಿಣಿಯರಿಗೆ) ಉದ್ಯೋಗ ಸಿಗುತ್ತದೆ.

ಚಿಂದಿ ಸಂಗ್ರಹಿಸುವ ಬಡಜನರಿಗೆ ಉದ್ಯೋಗ:- ಬೆಳಗಿನ 4 ಗಂಟೆಗಳ ಕಾಲ ಅಂದರೆ 6·30 ರಿಂದ 10·30 ರವರೆಗೆ ಕಸ ಸಂಗ್ರಹಿಸಿದರೆ-

ಒಂದು ತಿಂಗಳಿಗೆ	ರೂ. 1000/=
ಒಂದು ದಿನಕ್ಕೆ	ರೂ. 15/= (ಪುನರ್ಬಳಕೆಯ ವಸ್ತುಗಳಿಂದ)

ಇಷ್ಟೇ ಅಲ್ಲದೆ ನಾಗರಿಕರು ನೀಡುವ ತಿಂಡಿ-ಊಟ-ಬಟ್ಟೆ ಸಿಗುತ್ತದೆ

2) **ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಸಹಾಯ:** ತಿಂಗಳ ಒಂದನೇ ತಾರೀಖಿನಿಂದ ಹತ್ತನೆಯ ತಾರೀಖಿನ ಒಳಗಾಗಿ ಯಾವುದಾದರೂ ಒಂದು ದಿನ ಬಂದು..., ಕಸ ಹಾಕುವ ಪ್ರತಿಯೊಂದು ಮನೆಯಿಂದ ರೂ.10/- ಸಂಗ್ರಹಿಸುವುದು ಇವರ ಕೆಲಸ. ಸದಸ್ಯ ನಾಗರಿಕರ ಬಿಲ್ಲಿನ ಪುಸ್ತಕವನ್ನು ತೆಗೆದು ಕೊಂಡು, ಸದಸ್ಯತ್ವದ ಕಾರ್ಡ್ ಹೊಂದಿರುವ ನಾಗರಿಕರಿಂದ ಹಣ ಸಂಗ್ರಹಿಸುತ್ತಾರೆ. ಒಂದು ಕಸದ ಗಾಡಿಯು ಮನೆಗಳಿಂದ (ಸುಮಾರು 250 ಮನೆಗಳು) ವಿದ್ಯಾರ್ಥಿಗೆ ರೂ.250/- ಸಿಗುತ್ತದೆ.

3) ರಸ್ತೆ-ಬಡಾವಣೆಯು ಕಸದ ತೊಟ್ಟಿಗಳಿಲ್ಲದೆ, ತೊಟ್ಟಿಯಿಂದ ಉಂಟಾಗುವ ದುರ್ವಾಸನೆ, ಇಲಿ-ಹೆಗ್ಗಣ, ಸೊಳ್ಳೆಗಳ ಹಾವಳಿಯಿಂದ ಮುಕ್ತವಾಗಿರುತ್ತದೆ.

4) **ನಾಗರಿಕ ಸಮಿತಿ ರಚನೆ:** ಕಸ ಹಾಕುವ 250 ಮನೆಗಳವರು, ಅವರ ನಾಗರಿಕ ಸೌಲಭ್ಯಗಳಾದ ಬೀದಿ ದೀಪ, ಬೋರ್‌ವೆಲ್ ಸಮಸ್ಯೆ ಮೊದಲಾದವುಗಳನ್ನು ಬರೆದು ಕಸ ಸಂಗ್ರಹಿಸುವ ಯುವಕರಿಗೆ ನೀಡುತ್ತಾರೆ. ನಾನು ಆ ದೂರು-ಸಲಹೆಗಳನ್ನು ಸಂಗ್ರಹಿಸಿ ಸಂಬಂಧಪಟ್ಟ ಅಧಿಕಾರಿಗಳಿಗೆ ತಿಳಿಸಿ ಸೂಕ್ತ ಕ್ರಮ ಕೈಗೊಳ್ಳುತ್ತೇನೆ.

5) **ನಿರುದ್ಯೋಗಿ ಯುವಕರಿಗೆ/ ಗೃಹಿಣಿಯರಿಗೆ ಸ್ವಯಂ ಉದ್ಯೋಗ.**

ಈ ಮೇಲೆ ತಿಳಿಸಿದ ಎಲ್ಲಾ ವಿಷಯಗಳನ್ನು ಅರಿತು, ಸುಗಮವಾಗಿ ಯೋಜನೆಯನ್ನು ನಡೆಸುವ ಯುವಕರಿಗೆ ಉದ್ಯೋಗ- ಆರ್ಥಿಕ ಸಹಾಯ ಸಿಕ್ಕಂತಾಗುತ್ತದೆ.

ಕಸದ ಗಾಡಿ ಯೋಜನೆ ನಡೆಸುವಾಗಿನ ಅನುಭವಗಳು:—

ಕಸ ಸಂಗ್ರಹಿಸುವ ಬಡ ಜನರನ್ನು ಗುರುತಿಸಿ ಅವರಿಂದ ಕೆಲಸ ಮಾಡಿಸುವುದೇ ಕಷ್ಟದ ಕೆಲಸ. ಯಾರ ಹಂಗು ಇಲ್ಲದೆ, ಯಾವ ಜವಾಬ್ದಾರಿಯಿಲ್ಲದೆ ಅಲೆದಾಡುವ, ಚಿಂದಿ ಸಂಗ್ರಹಿಸುವ ಯುವಕರು ಕಸದ ಗಾಡಿಯನ್ನು ನಡೆಸಲು ಪ್ರಾರಂಭದಲ್ಲಿ ಇಷ್ಟಪಡುತ್ತಿರಲಿಲ್ಲ. ಅವರಿಗೆ "ಇನ್ನು ಮುಂದೆ ಬೆಂಗಳೂರಿನಲ್ಲಿ ಎಲ್ಲಿಯೂ ಕಸದ ತೊಟ್ಟಿಗಳಿರುವುದಿಲ್ಲ. ನೀವು ಚಿಂದಿ ಆರಿಸಲು ಸಾಧ್ಯವಿಲ್ಲ" ಎಂಬುದನ್ನು ತಿಳಿಸಲು, ಅದನ್ನು ಅರ್ಥ ಮಾಡಿಸಲು ಬಹಳ ಸಮಯ ತೆಗೆದುಕೊಂಡಿತು. ಅದಕ್ಕೆ ತಕ್ಕಂತೆ ನಾವು ಸಹ (ಸಂಘ) ಒಂದೊಂದೇ ಕಡೆ ಕಸದ ತೊಟ್ಟಿಯನ್ನು ತೆಗೆಸಿ ಅವರಲ್ಲಿ ಒಂದು ರೀತಿಯ ಅತಂತ್ರ ಭಾವನೆ ಉಂಟಾಗಲು ಕಾರಣವಾದೆವು. ನಂತರ ಒಂದಿಬ್ಬರು ಕಸ ಸಂಗ್ರಹಿಸಲು ಒಪ್ಪಿ ಬಂದ ನಂತರ, ಒಂದು ವರ್ಷ ಕೆಲಸ ಮಾಡಿ 'ನಮಗೆ ಬೋನಸ್ ನೀಡಿ ಹಾಗೂ ಸಂಬಳ ಹೆಚ್ಚುಮಾಡಿ' ಎಂಬ ಬೇಡಿಕೆ ಹಾಕಿದರು. ಆಗ ಕೂಡಲೇ ಆ ಯುವಕರನ್ನು ಯಾವುದೇ ಕಾರಣ ನೀಡದೆ ಕೆಲಸದಿಂದ ತೆಗೆದು ಹಾಕಲಾಯಿತು.

ಇದಲ್ಲದೆ ಪ್ರತಿ ದಿನ ಹಲವಾರು ಸಮಸ್ಯೆಗಳನ್ನು ಎದುರಿಸುತ್ತೇವೆ. ಪ್ರತಿ ದಿನ ಕಸ ಸಂಗ್ರಹಿಸುವ ಯುವಕ ಒಮ್ಮೊಮ್ಮೆ ಮಹಡಿ ಮನೆಯ ಕಸ, out House ಕಸಗಳನ್ನು ತೆಗೆಯುವುದೇ ಇಲ್ಲ. ಇಲ್ಲವೆ ಗಾಡಿಯು ತುಂಬ ತುಳುಕುತ್ತಿದ್ದರೂ ಸಹ ಇನ್ನೂ ಕಸ ಹೇರಿಕೊಂಡು ರಸ್ತೆಯಲ್ಲೆಲ್ಲಾ ಕಸ ಚೆಲ್ಲುತ್ತಾ ಹೋಗುತ್ತಾನೆ. ಇದರಿಂದ ಗಾಡಿಯ ಬಾಳಿಕೆಯು ಕಡಿಮೆಯಾಗುವುದಲ್ಲದೆ ರಸ್ತೆಯೂ ಗಲೀಜಾಗುತ್ತದೆ. ಇನ್ನು ಕಸ ತುಂಬಿದ ಗಾಡಿಯು ರಸ್ತೆ ನಡುವೆಯೇ ಮುರಿದು ಹೋಗಬಹುದು, ಚಕ್ರ ಬಿಚ್ಚಬಹುದು ..... ಈ ಎಲ್ಲಾ ವಿಷಯಗಳನ್ನು ಗಮನಿಸಿ, ಸೂಕ್ತ ಕ್ರಮ ಕೈಗೊಳ್ಳಲು ನಾನು ಪ್ರತಿದಿನ ಬೆಳಗಿನ 6.30 ರಿಂದ 10.30 ರ ವರೆಗೆ ದ್ವಿಚಕ್ರವಾಹನದ ಮೇಲೆ ಸುತ್ತುತ್ತಲೇ ಇರಬೇಕಾಗುತ್ತದೆ. ಪ್ರತಿದಿನ ಒಂದೇ ಹೊತ್ತಿನ ಸಮಯದಲ್ಲಿ ಭೇಟಿ ನೀಡದೆ ಅನಿರೀಕ್ಷಿತ ಭೇಟಿ (SURPRISE VISIT) ನೀಡಬೇಕು.

ನಾನು ನಡೆಸುವ ಯೋಜನೆಯಲ್ಲಿ ಕೆಲಸ ಮಾಡುವ 14 ಕೆಲಸಗಾರರು (14 ಕಸದ ಗಾಡಿಗಳು) 365 ದಿನಗಳ ಕಾಲ ಕೆಲಸ ಮಾಡುತ್ತಾರೆ. ಯಾವುದಾದರೊಂದು ದಿನ ರಜ ನೀಡಿದರೆ, ಮರುದಿನ ಎರಡುಪಟ್ಟು ಕೆಲಸ ಮಾಡಬೇಕಾಗುತ್ತದೆ. ಯಾವುದೋ ಕಾರಣಕ್ಕೆ ಎರಡನೆಯ ದಿನವೂ ಆತ ಕೆಲಸಕ್ಕೆ ಬರದಿದ್ದರೆ ಬಹಳ ಬಹಳ ತೊಂದರೆಯಾಗುತ್ತದೆ. (ನಮ್ಮ ಅನುಭವದಂತೆ ಯಾವುದೇ ಮನೆಯವರು ಹೆಚ್ಚೆಂದರೆ ಒಂದು ದಿನದ ಕಸವನ್ನು ಮಾತ್ರ ಮನೆಯಲ್ಲಿರಿಸಬಹುದು, ಎರಡನೆಯ ದಿನ ಅದನ್ನು ತೆಗೆಸಲೇಬೇಕು) ಆದುದರಿಂದ ಯಾರಿಗೂ ರಜ ಕೊಡುವುದಿಲ್ಲ. ಆದರೆ ತಿಂಗಳಿಗೆ ಒಂದೆರಡು ದಿನ ರಜ ಹಾಕಿದರೆ ಅದನ್ನು ನಿರ್ಲಕ್ಷಿಸಲಾಗುತ್ತದೆ. 3-4 ದಿನ ರಜ ಹಾಕಿದರೆ ಒಂದು ದಿನಕ್ಕೆ 30/- ರೂಗಳಂತೆ ಅಷ್ಟು ದಿನದ ಹಣವನ್ನು ಕಡಿತಗೊಳಿಸುತ್ತೇನೆ.

ಕಠಿಣ ಕ್ರಮಗಳ ಬಳಕೆ ಕೆಲವೊಮ್ಮೆ ಮಾಡಬೇಕಾಗುತ್ತದೆ. ಮದ್ಯಪಾನ ಮಾಡಿ ಕೆಲಸಕ್ಕೆ ಬಂದಾಗ, ಗಾಡಿ ತಳ್ಳುವಾಗ ಬೀಡಿ, ಸಿಗರೇಟು ಸೇದಿದರೆ, ಅಸಭ್ಯವಾಗಿ ನಾಗರಿಕರೊಂದಿಗೆ ವರ್ತಿಸಿದರೆ, ಹಬ್ಬ ಹರಿದಿನಗಳಂದು ಭಕ್ಷೀಸು ಕೇಳಿದರೆ ...... ಕೂಡಲೇ ಕೆಲಸಕ್ಕೆ ಬರದಿರುವಂತೆ ಆದೇಶ ನೀಡುತ್ತೇವೆ.

ಅದೇ ರೀತಿ ಉತ್ತಮವಾಗಿ ಕೆಲಸ ಮಾಡುವಾಗ, ಆತ್ಮೀಯವಾಗಿ ಮಾತನಾಡಿ, ಆತನ ವೈಯಕ್ತಿಕ ತೊಂದರೆ ನಿವಾರಿಸಲು ಪ್ರಯತ್ನಿಸುವುದು, ಆತ ವಾಸಿಸುವ ಸ್ಥಳಗಳಿಗೆ ಭೇಟಿ ನೀಡುವುದು, ಕೈಗಾಡಿಯು ಮುರಿದರೆ ಕೂಡಲೇ ಸರಿಪಡಿಸುವುದು ... ಈ ರೀತಿಯ ಚಟುವಟಿಕೆಯಿಂದ ಉತ್ತಮ ಕೆಲಸ ಪಡೆಯಬಹುದು.

ಕಸ ಸಂಗ್ರಹಣೆಯ ನಂತರದ ಬೆಳವಣಿಗೆ:-

ಈ ಮೊದಲು ಕಸ ಸಂಗ್ರಹಿಸಿ, ಒಂದು ಗೊತ್ತಾದ ತೊಟ್ಟಿಯಲ್ಲಿ ಕಸ ಸುರಿಯಲಾಗುತ್ತಿತ್ತು. ಆದರೆ ಕಳೆದ ಒಂದೆರಡು ತಿಂಗಳಿಂದ B.m.P.ಯ ಲಾರಿಯು ಬಂದಾಗ ಮಾತ್ರವೇ ನಮ್ಮ ಕಸದ ಗಾಡಿಯಿಂದ ನೇರವಾಗಿ ಲಾರಿಗೆ ನೀಡಲಾಗುತ್ತಿದೆ. B.m.P.ಯ ಕಸ-ಪ್ರಯತ್ನದಿಂದ ಲಾರಿ ಸಾಮಾನ್ಯವಾಗಿ ಸಮಯಕ್ಕೆ ಸರಿಯಾಗಿ ಬರಲು ಯತ್ನಿಸುತ್ತದೆ. ಕೆಲವೊಮ್ಮೆ ನಮ್ಮ ಕಸ ತುಂಬಿದ ಗಾಡಿಯು 1/2 ಗಂಟೆ ಕಾದರೂ ಲಾರಿ ಬರುವುದಿಲ್ಲ. ಇಂತಹ ಸಂದರ್ಭದಲ್ಲಿ ದೊಡ್ಡ ದೊಡ್ಡ ಗೋಣಿ ಚೀಲದಲ್ಲಿ (ಚಿಂದಿ ಸಂಗ್ರಹಿಸುವವರು ಬಳಸುವ ಚೀಲ) ಕಸವನ್ನು ತುಂಬಿ ಗಂಟು ಕಟ್ಟಿಡಲಾಗುತ್ತದೆ; ಲಾರಿ ಒಂದರ್ಧ ಗಂಟೆ ತಡವಾಗಿ ಬಂದರೂ ನಮ್ಮ ಕಸ ಸಂಗ್ರಹಿಸುವ ಕೆಲಸಕ್ಕೆ ತೊಂದರೆಯಾಗುವುದಿಲ್ಲ.

ಕಸ ಸಂಗ್ರಹಿಸುವ ಕೆಲಸ ಮುಗಿದ ನಂತರ ಕಸದ ಗಾಡಿಯನ್ನು ತೊಳೆಯಲೇ ಬೇಕೆಂದು ಕಟ್ಟುನಿಟ್ಟಿನ ಆದೇಶ ನೀಡಿದ್ದೇವೆ. ಸರಿಯಾಗಿ ಗಾಡಿ ತೊಳೆಯದಿದ್ದರೆ ಒಂದು ದಿನಕ್ಕೆ ರೂ.5/- ಕಡಿತಗೊಳಿಸುತ್ತೇವೆ.

ಒಟ್ಟಿನಲ್ಲಿ ಪ್ರತಿ ದಿನ ಬೆಳಗ್ಗೆ 6·30 ರಿಂದ 10·30ರ ವರೆಗೆ ಕಸದ ಗಾಡಿಯ ಮೇಲ್ವಿಚಾರಣೆ ನಡೆಸಿದರೆ ಸುಗಮವಾಗಿ ಕೆಲಸ ನಡೆಯುತ್ತದೆ.

ಸಂಘವು ನಡೆಸುತ್ತಿರುವ ಬಡಾವಣೆಗಳ ವ್ಯಾಪ್ತಿ:-

ರಾಜಾಜಿನಗರ ಒಂದನೆಯ ಬ್ಲಾಕ್, ಸುಬ್ರಮಣ್ಯನಗರ, ಗಾಯತ್ರನಗರ, ಮಿಲ್ಕ್ ಕಾಲೋನಿ (ಇವೆಲ್ಲ ಒಂದರ ಪಕ್ಕ ಒಂದರಂತೆ ಇರುವ ಬಡಾವಣೆಗಳು) ಮಲ್ಲೇಶ್ವರ, ಮಹಾಲಕ್ಷ್ಮಿ ಲೇಔಟ್ ಗಳಲ್ಲಿ ಕಸದ ಗಾಡಿಯ ಕೆಲಸವು ನಡೆಯುತ್ತಿದೆ. ಒಟ್ಟಿನಲ್ಲಿ ಒಂದು ಬಡಾವಣೆಯಿಂದ ಇನ್ನೊಂದಕ್ಕೆ ಹೆಚ್ಚೆಂದರೆ 10 ನಿಮಿಷದ (ದ್ವಿಚಕ್ರದಲ್ಲಿ ಹೋದರೆ) ಅಂತರವಿದೆ.

ಆರ್ಥಿಕ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ:-

ಒಂದು ಕಸದ ಗಾಡಿ ರೂ 5000/- ದಿಂದ 8000/- ವರೆಗೆ ಇದೆ. ನಮ್ಮಲ್ಲಿ 3 ಚಕ್ರದ ಗಾಡಿ, 3 ಚಕ್ರದ ಸೈಕಲ್ ಗಾಡಿ, ಒಂದೇ ಸಲಕ್ಕೆ 100 ಮನೆ ಕಸ ಹಿಡಿಸುವ ದೊಡ್ಡ ಗಾಡಿ... ಗಳಿವೆ.

ಒಂದು ಕಸದ ಗಾಡಿಯಿಂದ 3-4 ಗಂಟೆಗಳಲ್ಲಿ (30 x 40 ಸೈಟಿನ ಮನೆಗಳ ಬಡಾವಣೆಯಲ್ಲಿ) 250 ಮನೆಗಳ ಕಸ ಸಂಗ್ರಹಿಸಬಹುದು. ಒಂದು ತಿಂಗಳಿಗೆ ರೂ.10/- ರಂತೆ 250 ಮನೆಗಳಿಂದ 2500/- ಸಂಗ್ರಹವಾಗುತ್ತದೆ.

ರೂ. 2500/- ಸಂಗ್ರಹಣೆಯಾದಲ್ಲಿ-

	1000/-	ಕಸ ಸಂಗ್ರಹಿಸುವವರಿಗೆ
	250/-	ಹಣ ಸಂಗ್ರಹಿಸುವವನಿಗೆ
ಸರಾಸರಿ ವೆಚ್ಚ ←	200/-	ಕಸದ ಗಾಡಿಯ ದುರಸ್ತಿಗೆ
	450/-	ದ್ವಿಚಕ್ರವಾಹನದ Petrol ಖರ್ಚು (ಮೇಲ್ವಿಚಾರಣೆ ನಡೆಸಲು)
	1900/-	

ಉಳಿದ ರೂ.600/- ಒಂದು ಗಾಡಿಯಿಂದ ಲಾಭ ಬರುತ್ತದೆ.

ಕಸದ ಗಾಡಿ ಯೋಜನೆ ವಿಫಲವಾದ ಬಗ್ಗೆ:-

ಅಪಾರ್ಟ್‌ಮೆಂಟ್‌ಗಳಲ್ಲಿ ಇರುವ ಬಡಾವಣೆಗಳಲ್ಲಿ (ಉದಾ: ನಂದಿನಿ ಲೇಔಟ್) ಕಸದ ಬಗ್ಗೆ ಆಲೋಚನೆಯನ್ನೇ ಮಾಡದ ಬಡಾವಣೆಗಳಲ್ಲಿ (ಉದಾ: Indian Institute of Science) ನಾವು ವಿಫಲರಾದೆವು.

ಅಪಾರ್ಟ್‌ಮೆಂಟ್‌ಗಳ ಜನರಿಗೆ (ಕೆಳಗೆ ವಾಸ ಮಾಡುವ ಜನರನ್ನು ಹೊರತುಪಡಿಸಿ) ತುಂಬಿ-ತುಳುಕುವ ಕಸದಿಂದ ಅಂತಹ ತೊಂದರೆಯಾಗುತ್ತಿಲ್ಲ. ಅದರಂತೆ Indian Institute ನ ನಿವಾಸಿಗಳಲ್ಲಿ ಬಹುಪಾಲು ಜನ ವಿಜ್ಞಾನಿಗಳು... ಇವರು ಕಸದ ಬಗ್ಗೆ ಹೆಚ್ಚು ಯೋಚನೆ ಮಾಡುತ್ತಿಲ್ಲ.

ಈ ಎರಡು ಬಡಾವಣೆಗಳಲ್ಲಿ ಕಸದ ಗಾಡಿಯ ಯೋಜನೆಯನ್ನು ನಾವು ನಡೆಸಲಾಗಲಿಲ್ಲ.

ಈ ಯೋಜನೆಯು ಸುಗಮವಾಗಿ ನಡೆಯಲು -

① ನಾಗರಿಕರ 100% ಸಹಕಾರ
② ನಗರ ಪಾಲಿಕೆಯ ಸಹಯೋಗ
③ ಮೇಲ್ವಿಚಾರಕರ ತತ್‌ಕ್ಷಣದ ಕ್ರಮ, ಆಸಕ್ತಿ ಗಳು ಅವಶ್ಯಕ.

ನಮ್ಮ ಸಂಘವು ಕಸದ ಗಾಡಿಯ ಯೋಜನೆಯಲ್ಲಿ ಯಶಸ್ವಿಯಾಗಲು ಕಾರಣರಾದ ಕೈಗಾಡಿಗಳನ್ನು ಕೊಡುಗೆಯಾಗಿ ನೀಡಿದ S.B.M., ಯೋಜಕ ವ್ಯಕ್ತಿಗಳು, [redacted] ಸೂಕ್ತ ಸಮಯದಲ್ಲಿ ಸಹಕಾರ ನೀಡುತ್ತಿರುವ B mPಯ ಅಧಿಕಾರಿಗಳು, ಸಂಪೂರ್ಣವಾಗಿ ಸಹಕರಿಸುತ್ತಿರುವ ನಾಗರಿಕರೆಲ್ಲರೂ ಕಾರಣ.

ಇವರೆಲ್ಲರನ್ನು ಮನಃಪೂರ್ವಕವಾಗಿ ನೆನೆಯುತ್ತೇವೆ.

(ಶಿವಕುಮಾರ ಹೊರಮಾವಿ)

CEE – UWEP Pilot Project

Integrated Solid Waste Management, a case study of UWEP in Ward 14, Bangalore

The Solid Waste Management Plan for Ward 14, Nagapura seeks to bring together all stakeholders in a project to manage the solid waste generated in the ward in an integrated manner.

The important features of the project are :

- This project envisages coverage of an entire ward of about 6000 households and in addition, commercial establishments and institutions.
- The project is being implemented in close collaboration with the residents and other target groups in the area and an organization called the Sarvajanika Jagriti Vedike headed by the Councillor of ward 14.

Pilot project objectives

The project has the following objectives:

To develop, implement and evaluate a community managed environmentally friendly and viable SWM system covering one ward of the city of Bangalore (Nagapura). The plan includes the various steps from collection through storage and disposal of different types of solid waste.

The project focuses on

- Providing an essential civic service that is not being satisfactorily provided.
- Programs aim at increasing awareness on the different aspects of solid waste management and the role of citizens in this context.
- Improvements in the collection and delivery systems.
- To advocate the need for scientific, environmentally safe disposal systems.
- Involvement in the process and monitoring and evaluation.
- Using the facilities of the local ward office to involve citizens in the process of monitoring and dealing with complaints.

Situation before the start of UWEP in Ward 14 :

Schemes for collecting waste from the doorstep have been on going in the ward for the last few years. One of the projects is run by CEE, where segregated waste from about 400 households is collected and composted in a public park. The CEE had initiated this scheme in 1995. The project provides steady monthly income to six waste retrievers who also earn extra income from the sale of recyclables.

UWEP's involvement

The UWEP project at Nagapura helped to initiate an integrated approach to solid waste management in the ward. Since it's inception, the project has attempted to bring together all the stakeholders around the theme of waste management while achieving two goals - expanding doorstep collection and community mobilization to untouched areas in the ward and consolidating ongoing schemes.

Programmes and workshops have been held (and are ongoing) for different stakeholders in the community – residents, students, teachers, owners of hotels and marriage halls, etc. The project has created a number of opportunities to aim for improvement in the method of waste management and monitoring of the efficiency of the system in partnership with the municipality. The final goal of the project is to achieve replication with modifications as needed, at other wards and/or city level.

The UWEP programme established linkages with other BMP programs initiated at the time, namely one supported by the Asian Development Bank **(ADB)** and the second as part of the Healthy Cities Program of the **WHO**. Both these programs concern the capacity building of municipalities to deliver solid waste management services (among others) by the application of modern management techniques. CEE-UWEP staff has assisted the BMP in both these programmes. After the launch of Bangalore Agenda Task Force **(BATF)** and its SWM programmes with Bangalore Mahanagara Palike in 60 health wards under its first phase of execution, CEE-UWEP staff has trained the paurakarmikas to perform the job of door-to-door collection of waste efficiently in these 60 health wards. In the second phase of execution, which covers 68 health wards, training of the trainers (Medical Officers of Health and Health Inspectors) was conducted.

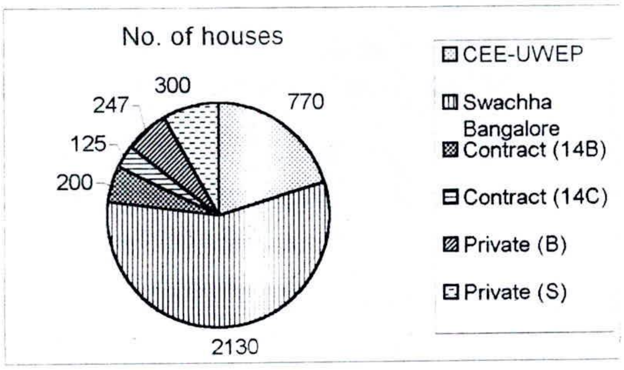
Present status of the project

The ward 14 is divided into three health wards/sub-wards, namely, sub-ward A, sub-ward B, sub-ward C.

Profile of the ward

- Total Population : 62,000
- Total Number of Parcels : 8000
- Total Number of Roads : 98
- Total waste generation(in kg) : 24,000
- Total number of dustbins : 114
- Total number of containers : 2 (in sub-ward A)

Extent of coverage of door to door collection in ward 14 by different initiatives:



The following table shows the details of the sub wards in ward 14:

Ward 14 A		Ward 14 B		Ward 14 C	
Corporation Area		Contract Area		Contract Area	
Waste collecting truck No.	MYW 4798	Waste collecting truck No.	MYA 1065	Waste collecting truck No.	TNK 6786
BMP PKs	52	Contract PKs	55	Contract PKs	45
No. of dust bins	7	No. of dust bins	72	No. of dust bins	35
Population	24,000	Population	22,000	Population	16,000
No. of bell wheels BMP – 20 NGO – 3	23	No. of bell wheels Contract – 1 NGO – 2 Private – 5	6	No. of bell wheels Contract – 2 NGO – 2	4
No. of houses covered	2,530	No. of houses covered	1000	No. of houses covered	420

From a study carried out by CEE-UWEP it has been found that on an average,

- 0.53 kg organic waste per house is generated
- 0.3 kg of recyclables per house is generated
- 0.25 kg of rejects per house is generated

This will sum up to 1.08 kg of total waste generated per house.

A similar kind of study was also conducted for the commercial area, and it was found that on an average,

- 3.7 kg of organic waste per shop is generated
- 0.5 kg of recyclables per shop is generated

Present system of Disposal:

The present system of disposal in the ward varies from composting to dumping.

- ✓ The organic part of the waste collected from around 500 houses in West of Chord Road is being composted in the compost pits built by CEE in one of the public parks.
- ✓ A separate collection system is in place for commercial establishments mainly bulk generators. This greatly reduces the waste coming to the community dustbin. A private contractor has been employed and he is being paid for the service by the participating commercial establishments.
- ✓ The rest of the organic waste in the area is being disposed of in the municipal bins to be cleared by the lorry and taken to the out skirts of the city for dumping.

Wherever the CEE schemes are going on, the dry waste is being taken by the waste retrievers for recycling. The dry waste from the rest of the area is again disposed in the municipal bins.

Indicators to measure impact of the programme:

- Reduction in number of street bins and black spots
- General cleanliness of the neighbourhood
- Regularity of meetings called by the waste management committees
- Fall in complaints received by the BMP office
- Increase in participation in the primary collection system

Learning from the field:

- It is possible to reduce the number of street bins
- You can make a system for commercial establishments work provided the user fee is fixed and based upon the quantum of waste generated
- Citizens participation can and will increase as long as the links in the chain – collection, storage and transportation are efficient and ***citizens can see the difference***
- Simple common sense ideas can plug loopholes (For example, buckets are numbered to prevent frequent losses and to fix responsibility of maintenance on the waste collector)

Integrated Urban Environment Improvement Project
(An Indo Norwegian Environment Programme)

BANGALORE DEVELOPMENT AUTHORITY

IMPLEMENTING AGENCIES

Centre for Environment Education
Tata Energy Research Institute
Technology Informatics Design Endeavour
Waste Wise
&
University of Agricultural Sciences, Bangalore

Integrated Urban Environment Improvement Project (IUEIP)

Project aims and objectives

Quality of life in an urban setting can, only be improved by a sustainable programme for environment management. The Bangalore Development Authority (BDA), is a principal infrastructure planning and development agency of Government of Karnataka for Bangalore. In an attempt to bring about better management of civic amenities in the newly developed areas in Bangalore City, the BDA has launched an innovative scheme involving the residents of four new layouts, NGOs and the concerned Governmental Agencies.

This project, titled 'Integrated Urban Environment Improvement Project', is aimed at developing Environmental Management plans for four BDA layouts of Brindavan Nagar (HBR), Kalyan Nagar (HRBR), Bhuvanagiri (OMBR), Kasturi Nagar (East of NGEF) and some neighbouring areas. This pilot project is being implemented with the assistance of Royal Norwegian Embassy. The project is being implemented by the BDA in coordination with NGOs such as Centre for Environment Education (CEE), Tata Energy Research Institute (TERI), Wastewise (WW), Technology Informatics Design Endeavour (TIDE), Residents Groups/Associations, etc.

Broadly this project aims at

- An Integrated Management plan for waste utilization and disposal
- Preparation of Geographic Information System for the layouts
- Open Spaces and Community Spaces management.

Project Management

The Government of Karnataka has identified the Karnataka State Council for Science and Technology (KSCST) as the agency for overseeing the implementation of this project. An Apex Committee takes all important decisions relating to the project and a Project Implementation Committee will oversee the implementation of the project.

Organisations Involved

Bangalore Development Authority (BDA) is the principal, planning and developing agency of Government of Karnataka for the Bangalore Metropolitan Area.

Centre for Environment Education (CEE) is a national institution set up in 1984 as a Centre of Excellence in the field of Environmental Education by the Ministry of Environment and Forests, Government of India. CEE South, the Southern Regional Cell functions from Bangalore.

Tata Energy Research Institute (TERI) is a registered non-profit research organisation set up in 1974 involved in energy conservation and environment management programmes. It's regional cell functions from Bangalore.

Mythri Sarva Seva Samiti is a non-profit organisation involved in social and economic assistance programmes for waste retrievers and street children. Waste Wise is a Solid Waste Management project promoted by Mythri.

Technology Informatics Design Endeavour (TIDE) is a non-profit society devoted to promoting sustainable development through technological inventions.

Project Activities

Solid Waste Management (SWM)

- Evolving a better system of SWM in the layouts by the residents, NGOs and concerned Government agencies.
- Community based projects like composting of segregated wet waste.
- Educational and training programmes for various target groups.

Geographic Information System (GIS)

- Development of a computer based information system that combines both geographic (map) attributes and data elements, to facilitate spatial analysis.
- Design and development of user friendly software application for maintenance of services, for multiple users such as residents, civic authorities, NGOs, etc.

Open Spaces Management (OSM)

- Development of parks, open spaces in the project area.
- Development of shrub plantations along the medians and lands beneath high tension lines as green gardens.
- Propagation of alternative methodologies for water harvesting and supply systems and other water conservation measures.

In this project CEE South is involved in implementing the Solid Waste Management in two of the layouts namely, HRBR and HBR layouts, based on the models developed out of its previous experiences.

Current Status

- **The project reach is for a total of 3500 households in the four layouts of HBR, HRBR, OMBR and East of NGEF. In addition to these layout, a nearby slum Lingarajapuram is also involved in the SWM programme.** Door-to-Door collection of segregated garbage is going on successfully for the past two and half years in all the four layouts. A total of **1780** houses including **467** non-BDA houses surrounding the project area in HRBR layout and about **815** houses are involved in the SWM programme in HBR layout. In addition to HRBR and HBR layouts various non-BDA houses like Horamavu, Nanjappa Garden, Jayarama Reddy Layout, Ramaiah Layout, Jhanavi Layout etc., are also involved in SWM Programme. About 330 and 120 houses are involved in the SWM proramme in OMBR and East of NGEF layouts. This clearly shows the attitude of the people to have a better garbage management and to have a cleaner area.

- The main emphasis has been on motivation of the project beneficiaries which included imparting training to various target groups like residents, ragpickers, supervisors, eco-club teachers, students, residents' associations, waste management committees and other local bodies. The decentralized solid waste management system involves door-to-door collection of segregated waste, localized composting of the wet waste and selling of the recyclables by the ragpickers.
- The highlight is the formation of Waste Management Committees (WMC's) which comprise of interested residents who will be responsible for the sustainability of the project in the future.
- The solid waste management programme has also been initiated in various schools in the project area to help inculcate values of cleanliness in children at an early age through formation of Eco-clubs, setting up of school composting units etc.
- Various programmes for different stakeholders are being organized to increase Resident's participation in the project activities like formation of an Eco-park in the area, Best Garden Competitions, Street Play, Guest lectures and so on.
- A baseline survey of the existing Health Care Establishments and Industries in the project area has been conducted.
- Educational materials developed under the project includes Project Brochure, Segregation Calendar for the year 1999 and Table Top Calendar on IUEIP project activities for the year 2000, Year Planner for 2001, IUEIP Newsletter, Compost packing cloth bags, visitors brochure. A documentary of the project is being developed.

Methodology adopted

A door to door interaction and campaign with the help of volunteers was found effective during course of the implementation of the project in the residential setup. Motivation is the first step towards creating awareness on a suitable and safe disposal of garbage. The first round of motivation is essentially a door step interaction with the residents, where in the residents are briefed on the aims and objectives of the project. Since segregation is the key to successful SWM, each house was given a basket free of cost in order to collect their dry waste and to initiate and encourage people to segregate waste into dry and wet portions. Hence segregation of waste at source is stressed upon and the residents are required to segregate waste into dry and wet categories. The door step collection of segregated garbage is carried out by two waste collectors in a specific sector with a tricycle designed for waste collection. A service fee of Rs.15 per household for a month is collected which contributes for the Salary of the Waste Collectors and Supervisors and meets other maintenance expenditure of the project. Waste is being collected from selected commercial establishments and non-infectious waste is being collected from two Nursing homes in the project area. Residents of the layout have taken the program very well and today there is 82% participation in HRBR layout where the project was launched for the first time and 80% in HBR layout.

Various training and awareness programmes were conducted for various stakeholders of the project. As for the training of various stakeholders is concerned, Residents mainly retired people, women especially housewives and women clubs, Business community, Healthcare establishments, Schools and Educational Institutions were targeted. Various programmes were organized to impart the interest and commitment towards their own waste management within their layouts.

For Women stakeholders, two annual 'Best Garden Competition' were held to establish a link between kitchen garden, roof terrace garden, lawns and compost generated out of wet garbage. The theme behind this event is popularizing the concept of kitchen gardens at the premises of the households and how best they can utilized their own wet garbage in the form of compost to grow the plants. A good number of housewives participated in the event. Residents were targeted by organizing a 'know your stake in IUEIP' programmes, a field visit to Composting and Research activities in University of Agricultural Sciences (UAS) and Karnataka Compost Development Corporation (KCDC).

Composting Techniques

Composting is the controlled biological decomposition of organic matter achieved under an optimum temperature and moisture. Composting of wet waste is carried out in Composting units situated in 10 different locations in the project area. The method of composting is aerobic carried out in pits with dimension of 9x 4x3 feet. Segregated wet waste from the houses is collected daily by the waste retrievers and put into the pits in their respective sectors or blocks. The wet waste is weighed before it goes into the pit. The wet waste is covered with a thin layer of mud or the coarse compost obtained during previous sieving. The waste is left undisturbed for about 10 days for temperature build up (about 65^0 C-70^0 C) to kill the pathogenic bacteria. Afterwards it is turned manually twice a week till the end of the composting cycle of 60 days. It is then harvested and sieved to obtain fine and coarse compost.

Different Experiments were conducted with the expertise from University of Agricultural Sciences, Bangalore to hasten the composting cycle using electrical blower, mechanical shaft and use of microbes. Experiments were also conducted to enhance the nutrient quality of the compost using rock phosphates and weeds. Coir pith was used to effectively control the problem of smell, leachate and fly menace. Vermicomposting was also tried for coarse materials obtained from the sieving. The harvested fine compost is being sold in unbleached kora bags @ Rs.5/ kg to the residents at IUEIP office. This acts as a good soil nourisher and conditioner.The coarse compost also being sold to Horticulture department and farmers.

School activities

Students and teachers were also involved in many training programmes on Solid Waste programme. Eco-clubs were inaugurated in 6 schools of the project area and in 4 schools 'Model Composting Units' were setup. This will help students to understand the concept of composting out of waste at their early ages itself. Other educational programmes such as guest lectures on sanitation, wildlife, plastics and other issues of Environment were organized. A Nature and Bird watching trail was organized for students near Nagavara tank in the vicinity of the project area. The programme was conducted under the leadership of Mr.Yellappa Reddy, a noted Environmentalist and attended by 250 students from the schools of project area. A teacher training workshop was held to implement the activities mentioned in 'Garbage to Gardens' activity booklet, at various schools in the project area.

Formation of Waste Management Committee (WMC)

The sustainability of all project activities under IUEIP programme lies in the formation and functioning of a body which can maintain, monitor the SWM activities in future after the implementing agencies like CEE South and TERI withdraw from the project area. To achieve the same a Waste Management Committee (WMC) comprising local residents was formed. Residents coming forward to participate and to pay service charges for the door step collection of Garbage shows the concern and commitment they have towards their immediate surrounding. The sensitized residents were made to organize under Waste Management Committee. The role and responsibility of the WMC in local Environmental Management was felt very much necessary. CEE South helped in enhancing and enriching the level of awareness in residents and others through motivation.They were given all help and assistance in setting up these decentralized garbage management system. Hence, today the Waste Management Committees (WMC's) is undergoing various training programmes as to how to handle the SWM system effectively once the implementing agencies withdraw from the project. Here lies the importance of Residents and their association, as the system has to be maintained and monitored keenly after the execution. The Waste Management Committee meets once in a month to discuss various management aspects and improvements in the system.

The Residents Welfare Associations of HRBR & HBR have been instrumental in initiating and motivating the residents towards solid waste management program in their layout. The waste management committee functioning in HRBR is very keenly involved in motivating the non-participating residents. The nutrient rich compost produced out of wet garbage in composting units is sold at the rate of Rs. 5 per kg is a motivating factor for the residents. Besides this, their layout is no more littered with garbage and don't have to see over flowing municipal bins in front of their houses.

Achievements of IUEIP

- Setting up of a decentralized doorstep collection of segregated household garbage.
- Composting of organic wet waste in 10 decentralized composting units set up in various locations of the project area and routing the recycling of recyclables such as plastics, paper, metals, rags and glass.
- Formation of WMC and its effective functioning for monitoring the system of garbage management, from door step collection of garbage, production of compost,

service charge collection, financial transaction, salary distribution and management of Personnel involved in the Project.

- Environment Education and awareness in various stakeholders namely, residents, waste collectors, supervisors, school students and teachers, women, Business Community, Healthcare establishments and so on.
- Waste to wealth is currently being practiced through composting the wet garbage thereby reducing the load of un-segregated garbage for Corporation authorities.
- A Sustainable Solid Waste Management Model for a Urban setting which ensure the cleanliness of the area, awareness and Environment Education to general public.
- Rag pickers have been identified and trained and employed under the project as waste collectors. Awareness on general cleanliness and personal hygiene has been enhanced.
- A very good network between residents with BDA, the government agency has been established, which serves smooth and steady relationship between the public and the government. Residents have organised themselves better through Resident Welfare Associations and Waste Management Committees, and Liaisoning for their rights and responsibilities. This way IUEIP helped for better linkages between various stakeholders.
- Visitors have been continuously flowing to this project area for Information, Study, Evaluation and assessment of the project model. Local visitors being Residents from other parts of the city / Country, Official of state and central government across the country, other organizations representatives, Journalists and so on. Outstation and foreign visitors mainly comprise of students, researchers, consultants and officials of funding agencies. Majority of them appreciated the model, magnitude of community participation and reach of the project.

Geographic Information System (GIS)

To support long-term planning needs, BDA is working with TIDE to install a GIS at the project office to provide digitized maps and support data to other partner agencies like KPTCL,Police,BWSSB,BMRTC and BMP. On successful installation of hardware and software, the GIS will ensure ready availability of data for monitoring and maintenance of project service and amenities

Open Space Management (OSM)

The design for management of Open spaces incorporates various elements such as rain water harvesting, mini forests and landscaping with a combination of shrubbery and ornamental trees. Parks, avenues, community areas and boulevards have been integrated into the planning process. Many civic amenities sites in these layouts have been developed into parks and miniforests. The OSM is implemented through a special horticultural team at the BDA.

On completion of this unique project of BDA, it is hoped that this project will serve as a model for planned and participatory management systems in new urban areas.

ROLE OF UNIVERSITY OF AGRICULTURAL SCINCES, BANGALORE IN INTEGRATED URBAN ENVIRONMENT IMPROVEMENT PROJECT

The University of Agricultural Sciences, Bangalore is a premier Scientific Institution catering to the needs of farming community in particular and the public in general. The three main thrust areas of the University are Teaching, Research & Extension. Keeping in conformity with its goals the UAS (B), offers technical expertise in fields related to nutrient management of which an important component is organic manure preparation and management.

The UAS(B), is one of the key player in the above project under which it has undertaken research programme entitled "Evaluation of Bio and Other Remedial Measures for Urban Waste Management". The main objectives of the project were to

1) Characterize urban waste with regard to their chemical and other properties
2) Evaluate microbial and Vermicultural methods for developing efficient composting of wastes.
3) Analyse nutrient content of composts and to evaluate their performance
4) Design compost stacks for Urban Waste composting.

The following are the contribution of UAS(B) in the IUEIP

1) Developed user friendly protocols for composting Solid Urban Waste
2) Developed protocols for preparation of enriched Solid Urban Waste Compost
3) Developed protocols for Vermicomposting of coarse material.
4) Increased composting efficiency by providing microbial cultures.
5) Standardized procedures for sieving of composts.
6) Offered technical training to rag pickers, members of Solid Waste Management Committees and Residents.
7) Accepted to provide constant technical guidance to the resident associations.

DECCAN HERALD, WEDNESDAY, MAY 3

BDA launches City environment project

DH News Service

BANGALORE, May 2

The Bangalore Development Authority (BDA) has initiated an "Integrated Urban Environment Improvement" project in an attempt to bring about better management of civic amenities schemes involving residents' groups, non-governmental organisations, the city civic bodies.

This Rs 3-crore project, with financial assistance from the Norwegian Agency for Development Cooperation (Norad), will be implemented in the four BDA layouts at Brindavan (HBR layout), Kalyan Nagar (HRBR Layout), Bhuvanagiri (OMBR layout) and Kasturi Nagar (East of NGEF). The BDA will implement this project in co-ordination with the Centre for Environment Education, Tata Energy Research Institute, Waste Wise besides from the residents groups/associations.

Giving these details, BDA Commissioner Laxmi Venkatachalam, at a workshop on the project here today, said the Karnataka State Council for Science and Technology has been identified by the state government as the project implementation overseeing agency.

Ms Venkatachalam said the project will address solid waste management problem, develop a computer-based geographic information system that combines both geographic (map) and attribute data elements for the benefit of the civic agencies as well as the residents groups and also address the management of open spaces within the project areas.

Bangalore Mahanagara Palike Commissioner Dr A Ravindra in his key-note address stressed the need for a systematic approach towards tackling the urban problems like water shortage, pollution and solid waste management.

Though solid waste management is the responsibility of the BMP it is only in the recent years that a scientific approach has been sought to be adopted to address this issue.

On the collection side, the BMP has sought to introduce door-to-door collection of domestic waste but with the waste generated in the city of a diverse nature like toxic industrial waste and hospital waste, it is necessary to study how to collect and dispose these as well. Scientific collection also means doing away with the traditional dust-bins and installing large containers that can hold a lot more garbage and can also be transported with ease.

He pointed out that a couple of private firms in the city which are using garbage to make compost or energy pellets as the case may be. The problem of disposal will come down if the garbage is utilised for generating value in the form of compost and the like.

Urban Development Secretary and BDA Chairman K P Pandey said the traditional dependence of the public on the civic authorities should be done away with in favour of community based organisations and the non-governmental organisations. This because para-statal bodies like the BMP or the BDA as also the State Government are facing a tremendous resource crunch.

Bharatinagar MLA N Rajanna speaking on the occasion called for a collective effort towards tackling the solid waste management problems. Development Commissoner and Commissioner of Agricultural Production Teresa Bhattacharya also spoke on the occasion.

Easy way to dispose of waste

The core strength of the project definitely lies in the community participation, finds out RASHEED KAPPAN.

YOUR NEIGHBOURHOOD needn't be a stinking garbage bin. You don't need to be a victim of mosquitoes, stray dogs and contagious diseases. With a little bit of motivation, a bit of volunteerism and an urge to create a cleaner environment, you could live a better life.

And that is precisely what the Centre for Environment Education (CEE), along with a few other agencies have achieved in four layouts in Bangalore East through their Solid Waste Management Project.

In a few months time, CEE South has succeeded in motivating 85 per cent of the 3,000 households in the targeted layouts of Kalyan Nagar and Brindavan Nagar.

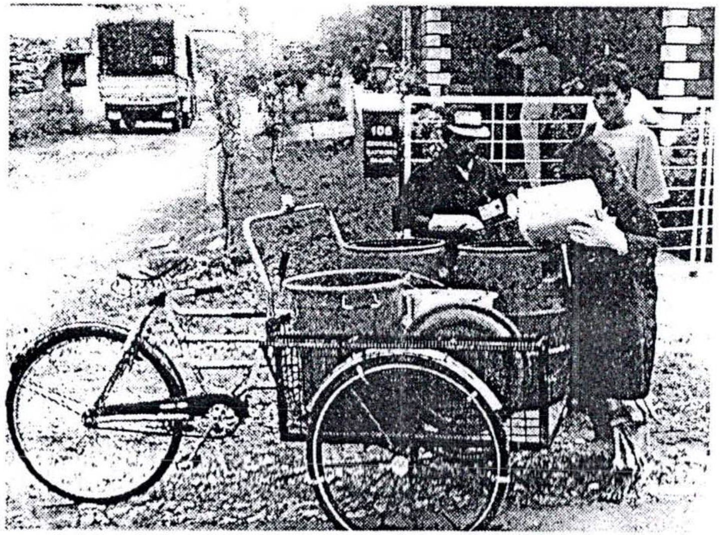
The success story of the project will soon find its echo in other layouts.

The waste disposal is hardly complex. Trained waste collectors pick up the waste from your doorsteps and transport it to the composting units in specially provided tricycles.

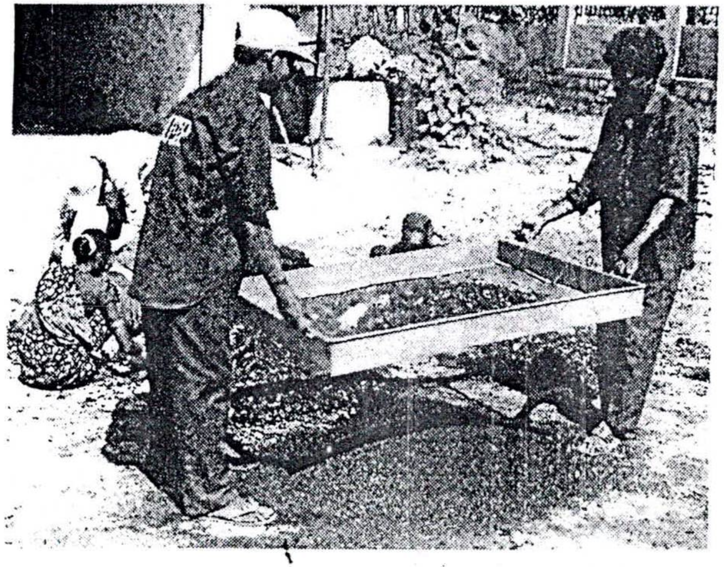
The wet waste is composted while the dry waste is sent for recycling. You just need to separate the waste generated in your house into wet and dry waste; deposit the segregated wet and dry waste in two containers and hand them over to the waste retrievers who will be there at your doorsteps every morning. The entire process will cost you a mere Rs. 5. The benefit: Your residential locality will be clean and green.

The monthly charges collected will provide for the salaries of the waste collectors and in maintenance work.

The local ragpickers are selected as waste-collectors. Since they are being brought from a non-formal to a formal sector, the collectors are trained specifically for the project.



Manure generated from waste (below) being filtered. The door-door collection of garbage (above) of the CEE has proved successful.



They are offered a monthly salary of Rs. 800 for a daily routine which took four hours. And their job: to go house to house and collect the garbage for the day.

But the waste collectors have the option of selling off the recyclable waste to authorised agents and earning those extra incentives. The agents send them for recycling through their own network.

Between 70 and 75 per cent of the waste, which is organic, is composted and sold to the residents by the Waste Management Committees at the rate of Rs. 5 a kg. About 15 per cent of the waste, which account for the unusable rejects, are dumped in the final landfilling sites.

On their part, the Waste Management Committees meet every month on the second Saturday and review the progress of the project.

The committee members are now being trained by CEE and other agencies on the maintenance and monitoring aspects of the project.

The Solid Waste Management (SWM) programme is part of the Integrated Urban Environment Improvement Project aimed at developing environment management plans for the four BDA layouts of Brindavan (HBR), Kalyan Nagar (HRBR), Bhuvanagiri (OMBR), Kasturi Nagar (East of NGEF) and some neighbouring areas.

The project is being implemented by the Bangalore Development Authority (BDA) in coordination with Non-Government Organisations such as the Centre for Environment Education (CEE), Tata Energy Research Institute (TERI), Technology Informatics Design Endeavour (TIDE). Resident groups and associations. The project is funded by the Norwegian Agency for Development Corporation (NORAD).

Evolving a better system of solid waste management in the layouts by involving the residents, NGOs and concerned Government agencies; Community-based projects like composting of segregated wet waste and Educational and training programmes for the various target groups were the main thrust areas of the SWM part of the project.

The core strength of the project definitely lies in the community participation. "Without it, it would not be possible to sustain the benefits beyond the project period.

Community participation is envisaged through resident bodies, clubs, mahila mandalis, etc. Over a period of time, it is hoped that community would become self-sufficient to manage the local environment," says a project coordinator.

The benefit of the door-to-door collection system developed by the project has made its impact as shown by its growing popularity in Bangalore and other parts of Karnataka.

Realising the significance of this practice of segregation of garbage and its suitable disposal, the Central Pollution Control Board has prescribed "Minimal National Requirement for Management of Municipal Solid Waste."

These guidelines are going to be enforced shortly where it becomes necessary.

CEE: For an eco-conscious society

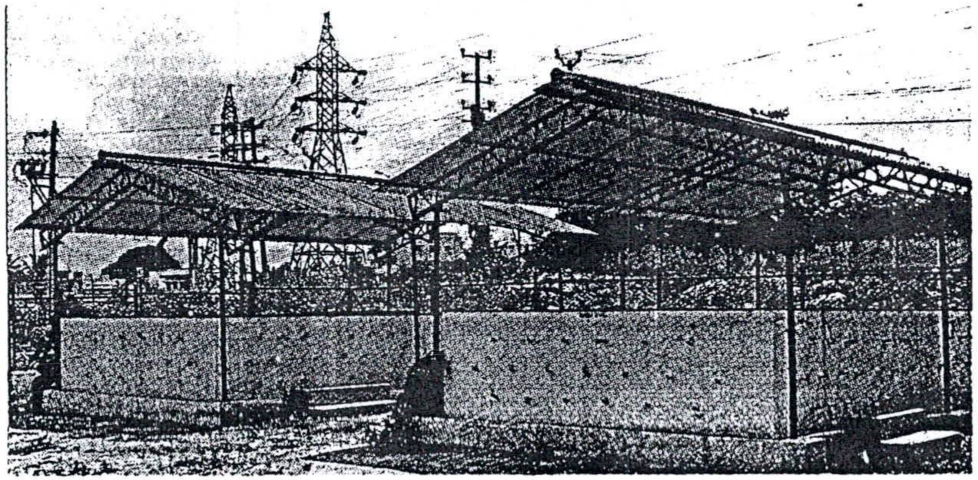
NO ONE escapes environmental problems. It has become a subject of intense discussion. Environmental studies is a specialised subject at various levels. A number of organisations and individuals have taken upon themselves the task of making our habitat better.

The Centre for Environmental Education, started in 1984 and supported by the Ministry of Environment and Forests, is dedicated to creating an awareness among the people about environmental issues.

The CEE has taken the initiative to co-ordinate and conduct a number of educational programmes for schoolchildren. Teachers, who are considered to be the driving force, are trained to impart environment education to children. The CEE has developed educational packages that are based on broad environmental themes. As part of the National Environmental Awareness Campaign, the CEE co-ordinates a network throughout the country to focus on teacher training programmes. Location- specific programmes and materials have been developed to make children appreciate environmental issues better. The Environmental Quality Monitoring is another pilot project where students of high schools, junior colleges and degree courses are involved.

The CEE has developed educational packages that are based on broad environmental themes.

They are required to collect data about natural results which will serve as recorded information about local resources and their status. National Environmental Education Programme in Schools focuses on knitting together the teacher training programmes, the environmental orientation to school education programme and the CEE's Environmental Education Bank to form a comprehensive programme to be implemented in schools throughout India.

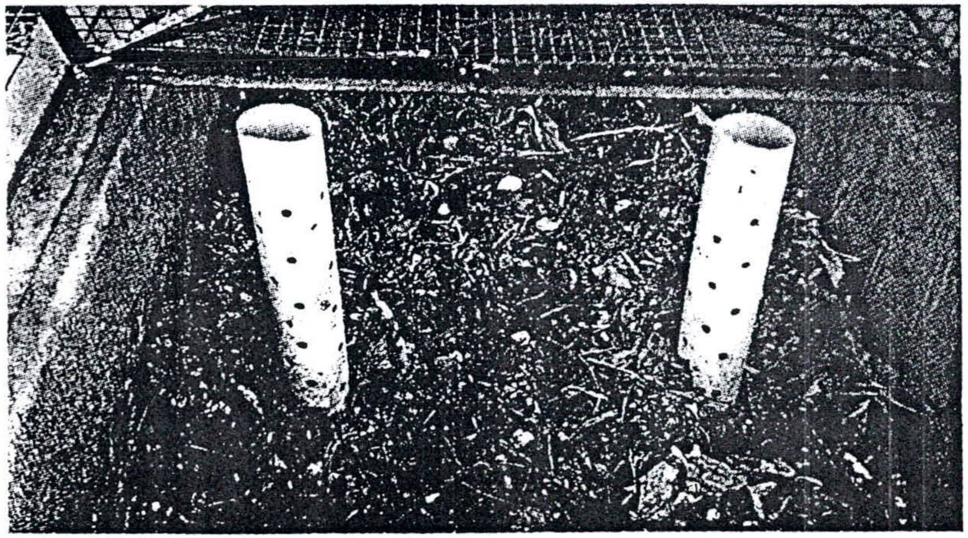

The shed for keeping the segregated waste to become compost at HBR Layout.

Edutech, an educational products division of CEE, provides for good environmental education material through which it reaches out to institutions, organisations and professionals.

In a unique venture, the Bangalore Development Authority and the CEE have come out with a pilot project, "Integrated Urban Environment Improvement Project." In areas such as HBR Layout, the initiative taken by the residents is encouraging. Segregated, systematic door-to-door garbage collection has been going on successfully.

Mr. T.Vijay Kumar, a functionary of the Waste Management Committee of the HBR Layout, feels that individuals and organisations should contribute in some way or the other towards solving these environmental problems.

"There is no use if educated people sit back and criticise organisations about their projects," says Mr. Vijay Kumar. Projects have to be initiated and action taken.


Perforated pipes used to increase aeration in the pits.

The project activities in these areas include evolving a better system of solid waste management, involving the residents. Educational and training programmes for various target groups too are on their agenda. Developing parks, open spaces and green gardens below high tension lines are being worked on. These areas will serve as models to other areas. The effort put in by the organisation and the residents is laudable. They work with the motto, "collective efforts for better environment."

The CEE's community-based programmes endeavour to bring about a realisation among the people in urban and rural areas to take up environmental programmes for improving their quality of life.

It organises workshops and so on, on environmental issues. Its resource centre and library has a good collection of books and journals, and its Environmental Education Bank is a computerised treasurehouse of concepts, activities and case studies. The CEE offers consultancy to the Government, NGOs and private agencies in environmental issues. More details can be had from CEE (ph: 2862167).

SHOBA RAO

THE HINDU Metro Monday, August 3, 1998

Bangalore

Building the foundation for a new Bangalore

The haphazard growth of Bangalore in the recent past has drastically changed the geography of the city. One never dreamt the City would expand almost up to Whitefield or beyond Hebbal Lake. But it has happened.

Unplanned growth brings along its own problems. Civic amenities are either lacking or grossly inadequate. The Bangalore Mahanagara Palike (BMP) has often tried to [illegible] 'betterment charges' to provide amenities [illegible] the new layouts coming under its jurisdiction. But several agencies other than the city corporation are involved in providing [illegible] amenities, such as the Bangalore Water Supply and Sewerage Board and the Karnataka Electricity Board. Lack of coordination among the agencies has often resulted in breakdown of utility services. There are also urban pockets which are yet to be taken over by the BMP.

Environment has suffered the most in this unplanned growth of the City: it can hardly be known as Garden City anymore. This has often been pointed out by concerned citizens and environmental organisations. But they have been unable to do anything about it.

Now comes what is an experiment in facilitating growth of the City along with environmental considerations. To bring about better management of civic amenities in some of the newly developed areas in Bangalore, the Bangalore Development Authority (BDA) has launched an innovative scheme involving local residents.

The two-year project named Integrated Urban Environment Improvement is to develop environment management plans for four BDA layouts on the outskirts of the City. These areas are: Brindavan (on Hennur-Bellary Road), Kalyan Nagar (Hennur Road-Bellary Road), Bhuvanagiri (Old Madras Road-Bellary Road) and Kasturi Nagar (east of NGEF). All are accessible from the new Ring Road.

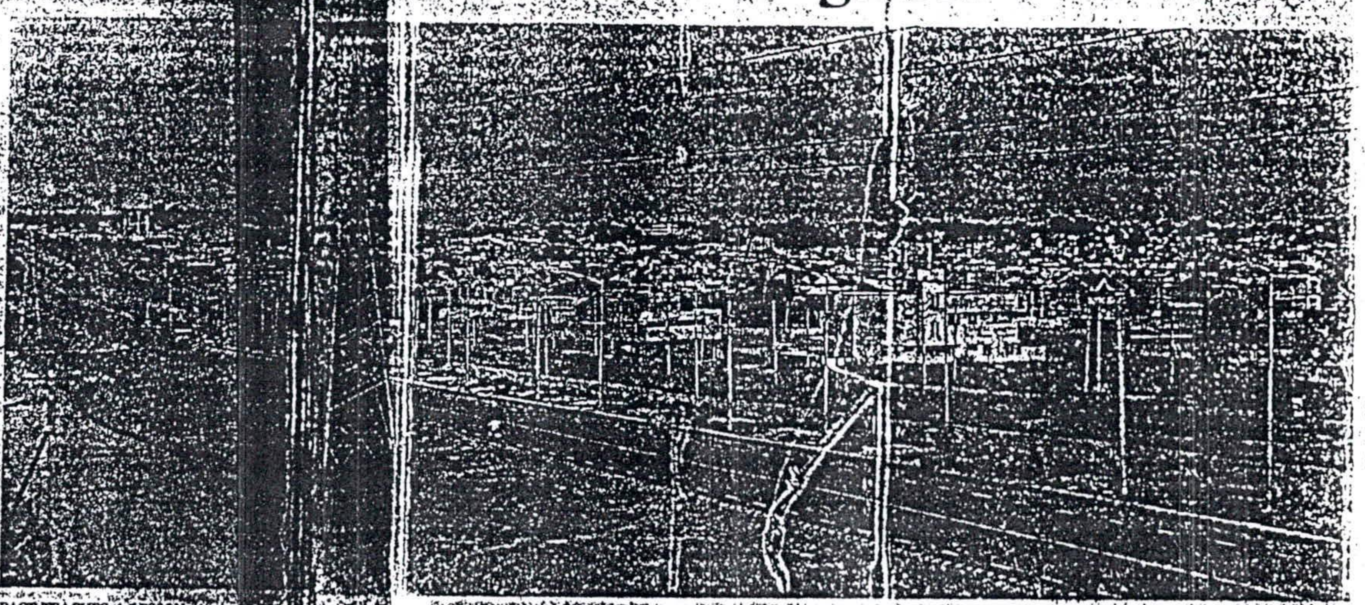
This pilot project is being taken up with assistance from the Norwegian Agency for Development Cooperation (NORAD) and is being implemented by the BDA in coordination with some leading NGOs involved in environmental preservation, energy conservation, waste management and compiling geographic information systems. The Karnataka State Council for Science and Technology has been identified by the State Government as the agency for implementing the project.

All important decisions are to be taken by an Apex Committee headed by the BDA Chairman, with a Project Implementation Committee to oversee the implementation of the project. The implementation committee is headed by the BDA Commissioner and includes NGOs and BDA officials. There is also a State-Level Committee which meets twice a year to monitor the project's progress.

The Norwegian agency was apparently scouting for a suitable project for funding with the stipulation that it should be environment oriented. The idea of providing environment management for newly developing areas appealed to the agency.

The project areas are planned to be models for other new neighbourhoods, according to the BDA Commissioner, Ms. Lakshmi Venkatachalam. The project is based on the principle that 'prevention is better than cure'. If the problems of growth can be dealt with at the formative stage of a layout, there would be better amenities as the area expands and more people start living there.

The project area covers nearly 10,000 house sites spread over 4,600 hectares. There



[illegible] of the four areas in which the Integrated Urban Environment Improvement Project is being implemented. —Picture by K.Gopinathan

[illegible] project that is being implemented in four newly developed areas is based on the principle that problems of growth should be dealt with at the formative stage of a layout, writes K.Satyamurty.

PAST TEACHES A LESSON: A [illegible] are revenue pockets and old villages [illegible] of these areas. The villages, if left [illegible] development now, might grow into [illegible] has happened in older areas of the [illegible]

Solid waste management was identified [illegible] one of the main components of the [illegible] This aspect has been taken up in [illegible] collaboration with NGOs such as [illegible] and the Centre for Environment Education (CEE), a national institution. Waste [illegible] experience in similar situations, is [illegible] spreading the idea of segregating [illegible] and disposing it of in non-polluting [illegible] especially in the lower income groups. In all areas under the project, waste management is to be eventually carried out by associations of local residents. The BDA will provide initial infrastructure such as compost pits.

According to a spokesperson of [illegible] the organisation will help initiate door-to-door collection of segregated waste in [illegible] layouts coming under the project. [illegible] waste is to be collected separately [illegible] incinerators. Some of the waste will [illegible] land fills and the rest will be used [illegible] generation. Where there are industries [illegible] will given assistance to treat the effluents first. Experts from the University of Agricultural Sciences are helping [illegible] composting techniques for the less [illegible] household waste.

Another part of the project is to [illegible] computer based Geographic Information System for the project area. This is being [illegible] by the Technology Informatics Design Endeavour (TIDE) which earlier developed a detailed computerised map for Malleswaram. Dr. S. Rajagopalan, Chairman of TIDE, says a detailed map in the 1:1000 scale will be [illegible] showing houses and other buildings, roads, footpaths, drains, pipelines, powerlines, trees, open spaces, water bodies and slopes and indicating built-up and vacant sites.

The computerised data is to be prepared in a digital format for use by various agencies involved such as the BMP, the BWSSB and Telephones.

An organisation like the CEE for instance will be able to locate where the dustbins are installed in a particular locality. The collected data will be tamper-proof and the information system will be ready by June 1999, says Dr. Rajagopalan. The software for use will be ready by end of this year.

The TIDE is eventually planning a map of the entire City in the scale of 1:2500 or 1:4000 which will be detailed enough to locate a water pipe which has burst.

The BDA itself will be directly involved in the management of all open spaces demarcated in the project area. This means developing parks and playgrounds and planting trees and shrubs along the roads, on road medians and space beneath high-tension power lines. Water harvesting, groundwater regeneration and other conservation measures will be given importance. The BDA Commissioner feels that planting trees and shrubs for beautification alone is not enough and soil and water conservation has to be given importance, keeping in mind the future needs of these areas.

Many of the new layouts in the City have come up without adequate tree cover and green space. This will be avoided in the project area. The Forest Department is also involved in making the areas greener.

The total cost of the project is estimated to be Rs. [illegible] crores with [illegible] funding accounting [illegible] Rs. [illegible] crores. The solid waste management component will require Rs. 1.97 crores, being the core of the [illegible] environmental aspect of the project. Developing the geographical information system will cost Rs. 50 lakhs and Rs. 40 lakhs is to be spent on management of all open spaces. The amount required in excess of that given by the Norwegian agency is to be generated by the BDA.

Ms. Lakshmi Venkatachalam says the cooperation of other NGOs and Government agencies has been sought for implementing the project.

The strength of the project is in community participation at all levels, she adds. Without this it will not be possible to sustain the benefits beyond the two-year period of the project. Community participation is expected through residents' associations, clubs, 'mahila mandalis' and other local organisations.

While something like segregated disposal waste will need initial help from the NGOs and official agencies, it can be sustained in the long run only by the residents themselves. The community has to become self-sufficient enough to manage the local environment.

If this project is successful it could be the forerunner in encouraging community participation in managing the environment in many new layouts which would come up in future.

Map that locates dustbins

The Technology Informatics Design Endeavour (TIDE) is one of the organisations involved in the Norwegian aided Integrated Urban Environment Improvement Project. Preparing computerised geographical information systems (GIS) for the project area will be the TIDE's work.

Earlier, the organisation earlier prepared a GIS of Malleswaram for management of solid waste in the area. This project was carried out in coordination with Mythri Seva Mandali, an NGO and the BMP.

The GIS created for Malleswaram contains both maps and attributable data of all parcels that come under Malleswaram, Ward 7 of Bangalore City. It contains details of roads and important landmarks. This data was computerised using a standard GIS software so that the final product was useful for solid waste management, planning and monitoring.

The process of developing the GIS for Malleswaram was carried out in six stages. These [illegible] collecting and digitalising maps and data, formulating data requirements and database design, integrating data with the digitalised map, demonstrating the use of GIS with sample data and training users on the utilisation of GIS and its updating.

The output from the GIS would include a map of the location of dustbins and open garbage to arrange for collection of the waste. A waste generation map of the area has been prepared by using land use data in combination with estimates of waste generated. This will help in deploying the waste collection personnel. The collection infrastructure would be overlaid on the circles of influence of each waste bin, showing areas not serviced and whether the bins are adequate or not. Transport route planning — for waste collection trucks — is also provided for.

The TIDE is now working on developing a similar detailed GIS for the four areas coming under the Integrated Urban Environment Improvement Project.

The Times of India
7/1/99

Keeping corner garbage bins from flowing over

METRO DIALOGUE

'Teach your children waste disposal'

CITIZEN

I

Make it a point to drop the garbage in the public bin regularly yourself, for those dependent on servants. Educate and insist that the servants should drop the garbage in the bin. Whenever a public bin is full, insist that your servant informs you and does not drop it outside. When the corner bin is full, inform the local municipal office and write to the local papers. Educate children about proper garbage disposal, no matter how old they are. When you notice a neighbour dropping garbage outside the bin, raise the issue at a local area meeting. Ask local schools, colleges and NGOs to educate and create awareness.
— Francis, M.S. Nagar

II

Citizens can keep the BCC informed of the overflowing bins. It is the duty of the citizens to keep the city clean. People should help the BCC by reducing garbage in the first place. Recyclable materials should not be thrown and dead animals can be buried. On its part, the BCC should impose heavy fines and penalty on those found littering.
— T. Shivakumar, Indiranagar.

III

Garbage is a problem to everybody. But the people refuse to have bins near their houses. The problem can be solved if the people living on each road take the complete responsibility for clearance by coordinating with the concerned agency.
— K.K. Dass, Ramamurthy Nagar.

IV

Overflowing bins are a serious problem since they can cause health hazards. The problem can be solved if the citizens develop a little self consciousness and ensure that the garbage was thrown inside the bin and not outside. The BCC should also cooperate with the people, and do its duty sincerely.
— K.N. Kiran, Ashoknagar.

V

Anybody with civic sense can tackle this problem by persuading the people to dump garbage inside the bin. The local corporator should also ensure daily clearance of the garbage. In case the corporator and the BCC fail in their duties, the people will have to take matters in their own hands and stop paying the taxes.
— D. Rajarathinam, Vijanapura.

VI

The citizens should avoid dumping recyclable products and ensure that the garbage is put inside the bin. Do not throw building materials in the bin and try to make a small compost pit in the kitchen garden.
— V. Kannan, Ashoknagar.

'Citizens should alert BCC on time'

AUTHORITY

Dr G. Lokesh, Additional Health Officer, BCC

Like the police department, the BCC has introduced the system of maintaining books for clearing garbage. Citizens can acknowledge the clearance of their corner bins or otherwise in the book and accordingly at the end of month if the contractor has not done the requisite number of trips, his payments will be cut. Citizens can ask for such books from the nearest municipal office and submit complaints about non-clearance.

But the difficulty for the BCC is the fact that the people throw garbage in the bins at all times of the day. If the people put garbage after the lorry has cleared it and continue doing it throughout the day, the bin will certainly overflow. They should inculcate the habit of putting garbage in the bins before the lorry clears the bins.

We are also having a regular dialogue with local officials about listing bins which get filled after the lorry has cleared the bins. In these places the officials will try to create awareness about controlling the timings. If the load is too heavy, then the lorries will have to do another trip. But this will take about two months to put in place.

'It's high time residents took over'

EXPERT

Dr Balasubramanyam, Scientific Handling of Waste

The most important thing for controlling overflowing bins is a proper monitoring system maintained by the citizens or through residents' organisations. This system should ensure that the bins are cleared regularly and the concerned authority is informed if it is not. This will also reduce the load on the authority.

But better still is the system that SHOW has been able to sustain in Dollars Colony and which can be duplicated almost anywhere. We were in a very bad situation four years ago but we managed to control the problem through cooperation and coordination.

A group was set up and we requested the BDA for land. A rag picker couple was employed to collect garbage door-to-door. But the essential basis for this was segregation of garbage at source. Accordingly, it was segregated into organic (kitchen waste), recyclable (paper, plastic) and others (chemicals, refuse). We used the BDA land for composting organic waste, the rag picker couple utilised the recyclable waste for obtaining money and only the third category reached the common bin. Whatever compost is produced is sold back to members for their gardens.

Ours has been a successful operation, and has been implemented in a few other places. Basically this involves cooperation of the community and citizens have to play a big role if they want to keep the city clean. We do this through regular newsletters and other activities. From the situation we were four years ago, we have come a long way. Others can surely follow.

Scientific Handling of Waste (SHOW) is a residents' organisation involved in collecting garbage and composting in Dollars Colony.

— Anita Rao Kashi

WRITE IN

We invite readers to write in on the following topic: *How effective are police helplines?*

Please address your letters marked METRO DIALOGUE, C/o The Editor, The Times of India, 40/1, S&B Towers, M.G. Road, Bangalore-560001.

GARBAGE COUNTDOWN: 5 DAYS TO GO...

Fouzia Hamza

It's a habit that refuses to die. With daily overflow of garbage on Shampur Road in Dr Ambedkar Nagar, residents, like this girl, have resorted to dumping bins right in the middle of the road. Readers are welcome to inform *The Times of India* on uncleaned garbage bins. ☎ 5587287; fax 5586617.

Kalyannagar residents make compost out of garbage — a BDA project.

Residents take to streets with brooms

Civic Correspondent

BANGALORE: As the chief minister's clean-garbage deadline draws near and everyone seems to be screaming hoarse over the matter, some residents have decided not to depend on the BCC, instead clean he neighbourhood themselves.

Residents of Kalyanagar, Kasturinagar, Bhuvanagiri and Brundavanagar off Bellary Road clean the neighbourhood with brooms, garbage carts and mops. Government officials, retired bureaucrats, police officers, software techies, advocates and housewives have pooled together resources for the drive.

Bio-degradable garbage is sifted and collected in pits. Volunteers from the University of Agricultural Sciences help the residents to turn the refuse into fine compost which is then sold.

"Initially, we faced resistance when we fell short of funds to keep the project going. A collective corpus was created and members contributed a monthly sum of Rs 15 each."

Their efforts date back to 1998 when a Norwegian agency, Norad, and the Bangalore Development Authority built a model which can easily be replicated in dirty neighbourhoods across the city.

Such voluntary initiatives will only help in keeping the city clean, residents maintain — chief minister's deadline or not.

Creating environment awareness among students

By Rasheed Kappan

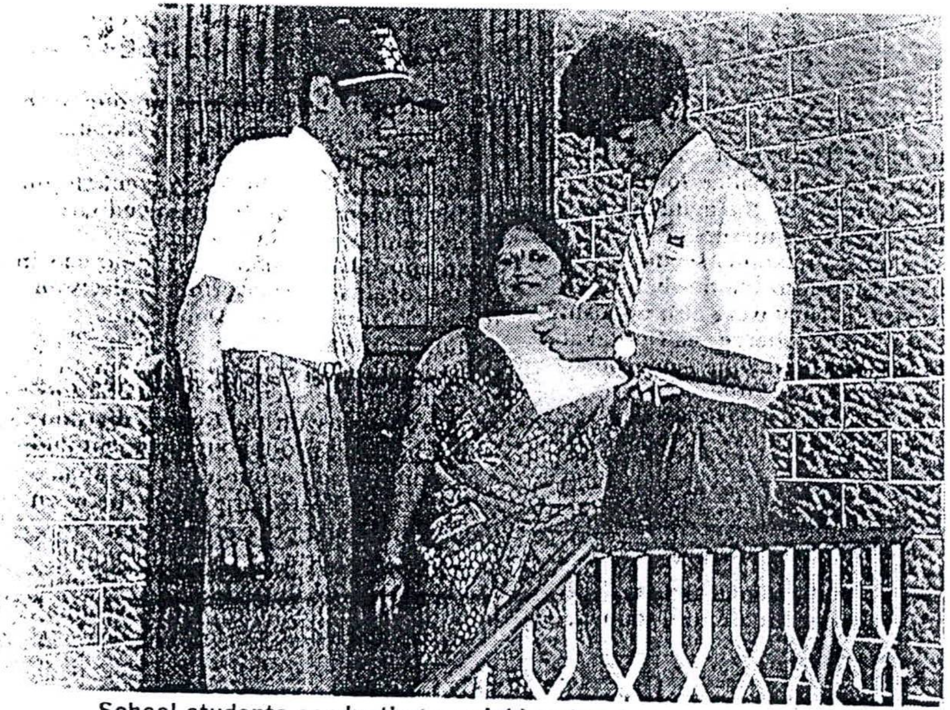
ALORE, JULY 5. A pilot environment edu- programme by the Tata Energy Re- Institute (TERI) and Jyoshika in two ry schools of the City has provided h database for a widespread and cal introduction of environmental in school curriculum. The strategy ed was "Environment awareness for mmunity through children".

nmissioned by the Bangalore Devel- nt Authority (BDA) as part of its In- ed Urban Environment vement Project (IUEIP), the project ed 145 students studying in 4th, 5th th standards at Gem English School ng's Convent in OMBR Layout.

pelled by its success, the project im- nters have recommended that the mme be extended to more schools. tudents sessions, they suggested, be followed up with orientation mmes for teachers, and teaching al developed on a wider variety of nmental topics.

I has already initiated the project's hase, covering six high schools in Layout and East of NGEF, including Government Kannada medium s. The emphasis is on plastics, paper xic household waste.

he first phase, environmental topics on the neighbourhood concept and evance to every day living problems taken up. Themes identified were resources and man's use of these, gradable substances, Water segrega- omposting of wet waste, Conserva- of resources, Urban wildlife, onnections in the food-chain and al hygiene.



School students conducting a neighbourhood survey as part of environment education.

"The idea was to touch upon topics where students could make contributions in real-life situations, rather than talk about distant, unfathomable concepts," explained a TERI official.

Material: The project team prepared charts, posters and collages for classroom activity sessions. The field staff was given the orientation to take classroom sessions. Each session was introduced with either a quiz, or a discussion or a pictorial chart.

"The emphasis was on making the sessions highly participative, thus encouraging students to think on the issues, discuss their responses and initiate some action. Guest speakers were invited for the sessions on Personal Hygiene and Wild Life."

Session: The classroom schedule was such that the themes could be threaded together as parts of a cohesive whole. The first class was planned as an "icebreaker session." The students were asked to name different natural resources and with their help, classified into Renewable and Non-renewable resources.

The next discussion was on the status of a substance that has served its use to mankind. As the official put it, "this involved understanding of the process of natural degradation and identifying items which are non-biodegradable." The students were given an idea of how paper was made and the environmental implications involved in the manufacture of paper.

The sessions also featured a talk on aspects of personal hygiene by Dr. Girish of the M.S.Ramaiah Hospital. A booklet on "We Care" (Children's Awareness in Restoring Environment) supplemented the concepts discussed in the classroom.

Evaluation: The students' evaluation was designed to test their general knowledge levels, their skills in spoken presentation, written presentation, group organisation, role play and pictorial depiction.

To encourage them to spread the environmental awareness to their neighbourhood, the older students were asked to do a survey on "Waste". In all, 40 students interviewed 170 households.

A questionnaire on "Present Practices" administered to the students showed that most households depended on more than one source of water, 95 per cent of them used tap water for drinking. About 62 per cent disposed of kitchen and vegetable waste into garbage bin, while 21 per cent on an empty site.

. "Some of the students," said a project team member, "had started composting the kitchen waste in their homes, after we explained about it in the class and showed them the ready-to- use compost."

The project was developed by Ms. P.Bineesha and Ms. Kanchan Banerjee and coordinated by Mr. H.V.Dayal, Dean and Senior Fellow, TERI.

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ದಿನಾಂಕ: 29-8-2000 ರಂದು ಟೈಮ್ಸ್ ಆಫ್ ಇಂಡಿಯಾ ಪತ್ರಿಕೆಯಲ್ಲಿ:

ಪತ್ರಿಕೆಗಳಲ್ಲಿ ಪ್ರಕಟಗೊಂಡಿರುವ ಪತ್ರಿಕಾ ತುಣುಕುಗಳನ್ನು ಈ ಪತ್ರದೊಂದಿಗೆ ಲಗತ್ತಿಸಿ ತಮ್ಮ ಅವಗಾಹನೆಗೆ ಮತ್ತು ಸೂಕ್ತ ಕ್ರಮಕ್ಕಾಗಿ ಕಳುಹಿಸಿಕೊಡಲಾಗಿದೆ.

29/8

ಸಾರ್ವಜನಿಕ ಸಂಪರ್ಕಾಧಿಕಾರಿ,
ಬೆಂಗಳೂರು ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ,
ಬೆಂಗಳೂರು.

ಪ್ರತಿಯನ್ನು:

1) ✓ಅಧ್ಯಕ್ಷರ ಆಪ್ತ ವಿಭಾಗ, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
2) ✓ಆಯುಕ್ತರ ಆಪ್ತ ವಿಭಾಗ, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
3) ✓ಕಾರ್ಯದರ್ಶಿಯವರು, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
4) ಆರ್ಥಿಕ ಸದಸ್ಯರು, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
5) ಆರ್ಥಿಕ ಸಹಾಯಕರು, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ.
6) ✓ಅಭಿಯಂತರ ಸದಸ್ಯರು, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
7) ನಗರ ಯೋಜನಾಸದಸ್ಯರು, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
8) ಕಾನೂನು ಅಧಿಕಾರಿ, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
9) ಉಪ ಕಾರ್ಯದರ್ಶಿ—1:2:3:4 ಸಹಾಯಕರು ಆಯುಕ್ತರು([illegible])
ಇವರ ಮಾಹಿತಿಗಾಗಿ
10) ಉಪ ಆಯುಕ್ತರು(ಭೂಸ್ವಾಧೀನ)ಬೆಂಅಪ್ರಾ, ಇವರ ಮಾಹಿತಿಗಾಗಿ
11) ಅಪರ ಭೂಸ್ವಾಧೀನ ಅಧಿಕಾರಿ, ಬೆಂಅಪ್ರಾ, ಇವರ ಮಾಹಿತಿಗಾಗಿ
12) ನಗದು ಶಾಖೆ, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ
13) ಸಹಾಯಕ ಆಯುಕ್ತರು, ಜಾರಿದಳ, ಬೆಂಅಪ್ರಾ, ಇವರ ಮಾಹಿತಿಗಾಗಿ
14) ಲೆಕ್ಕಾಧಿಕಾರಿ, ಬೆಂಅಪ್ರಾ, ಬೆಂಗಳೂರು ಇವರ ಮಾಹಿತಿಗಾಗಿ

ಹೊಲಿಗೆ ಜಾಗ

PERSONAL SECTION
OF COMMISSIONER
B D. A.
No. 4186
Date 29/8/2000

It's not rubbish, Bangalore citizens can treat own waste

Sangahamitra Chakraborty

BANGALORE: The University of Agricultural Sciences, partner of the Bangalore Development Authority, and some NGOs managing solid waste in the city, are on the verge of putting finishing touches to three models of composting units that can be used by residents to treat their own waste. These units will be inaugurated next month. The team hopes they would be replicated in every neighbourhood.

Dr Ramakrishna Parama, associate professor in the soil sciences department, at Gandhi Krishi Vigyana Kendra (GKVK) in the UAS, is part of the university team with Dr Radha Kale and Dr Radhakrishna to provide technological support to the programme. "Bangaloreans could treat their own rubbish by using these methods and what's best is that these units could be installed on the roof-tops of apartment blocks."

With most civic activities — waste disposal included — moving towards community-centric solutions, local composting units where domestic waste can be treated efficiently, are being treated as a serious option. There are four neighbourhoods in Bangalore — HBR Layout, HRBR Layout, OMBR Layout and Kasturinagar — where the Indo-Norwegian Environment Programme (INEP) is running projects where residents are already treating their domestic solid waste in composting units. Says Dr Parama: "The community is highly energised and will now take over the running of the units very soon."

The scientific team's objective is to help residents characterise the waste and segregate them, to develop methods of composting that can be used, use vermiculture (the use of earthworms to decompose waste) and the protocol development for residents of BDA layouts to manage solid urban waste.

According to Dr Parama, there are some problems that residents need them to address in treating waste. A very great deterrent is the foul smell; as most organic wastes like vegetables comprise up to 7 per cent of water, the liquid residu called leachate must be dealt wi too. Of course, flies are also a menace. The smell is minimised with th planting of greenery around th composting site which blocks th air which carries it. Coir pilth — dried shells of tender coconuts — which is freely available in th South and can absorb about eigh times its volume of water, can soa the leachate in. The technology als offers options where compostin can happen for an extended duration; the manure recovered at th end of the process is of high volum and good quality.

Says Sushila Sridhar, member of th waste management committee i HRBR Layout: "The waste management in our neighbourhood has bee running efficiently and we hope t take over the entire process soon."

It is now up to the policy makers of course, to decide if they want t vest power with the communities.

TOI 29-8-2000

DECCAN HERALD
9/6/98

Garbage to gold

The cleanliness drive launched by the Tata Energy Research Institute (TERI) and the Bangalore Development Authority (BDA) is a laudable attempt at cleaning up the City's neighbourhoods and in creating among the general public an increased awareness of environment protection. The 'Clean Your Neighbourhood' campaign envisages house-to-house collection of garbage by ragpickers who will be trained to do the task in a scientific way. Initiated in two BDA layouts, the drive, it is hoped, will be extended to other areas as well.

Some features of the campaign merit special attention and could be adopted by other drives that may be launched in future. One is the participation of local residents in the cleaning up of their neighbourhood. As this stimulates a greater sense of responsibility among the community, its impact is substantial. Another plus point is that the campaign is addressing the problem of plastic bags which are not bio-degradable. Awareness will be created to reduce the use of plastic bags. Finally, the campaign is concerned not just with collection of litter but in disposing it in an environment-friendly way. The garbage will be turned into manure in compost units proposed to be set up in each area. There is no dearth of clean-up campaigns being initiated in the City. Few achieve anything. The conceptualisation of the 'Clean Your Neighbourhood' by TERI and BDA is sound. Now the community should help implement it.

DH — 27/01/01

from 7 am in the sereno… phere of Chitrakala Parishat. He was accompanied by Gaurang Kodikal on tabla and Vyasamurthy Katti on harmonium.

Well known Hindustani…

forming in Bangalore on Friday. Pa…
accompanying hi…

Door-to-door garbage collection by BDA evokes good response

DH News Service

BANGALORE, Jan 26

The door-to-door garbage collection system launched by the Bangalore Mahanagara Palike (BMP) in many parts of the City, though has not achieved the expected results, a similar programme launched by the Bangalore Development Authority (BDA) in four of its residential layouts two years ago has drawn better response from the local residents. The management of the entire programme is being handed over to the associations of local residents.

The BDA has launched the door-to-door garbage collection system in Brindavannagar (HBR), Kalyannagar (HRBR), Bhuvanagiri (OMBR) and Kasturi nagar (East of NGEF) under the "Integrated Urban Environment Improvement Project (IUEIP)". The door-to-door garbage collection system covers more than 5,000 households in these layouts apart from two slums. As many as ten compost units have been set up and so far more than 8 tonnes of fine compost has been generated.

Much before any civic agency planned the door-to-door garbage collection system in the City, the BDA conceptualised IUEIP, envisaging solid waste management, development of a computer-based geographic information system and management of open spaces. More than 80 per cent of the households in the area covering 60 sq kms are disposing off waste through the programme, implemented at a cost of Rs 2.9 crore.

An interesting feature is that the local rag-pickers and scavengers are employed for collecting garbage. They have been provided with tricycles. A minimum monthly fee of Rs 15 is collected from every household. After the garbage collection, dry and organic wastes are separated. While dry waste is handed over to the local municipal authorities and BMP for disposal, wet waste (organic) is composted and sold to private parties.

Now, the entire programme will be handed over to the respective area residents' associations in March. "In fact, residents of neighbouring layouts are wanting the programme to be extended into their areas too," Project Co-ordinator V G K Nair said.

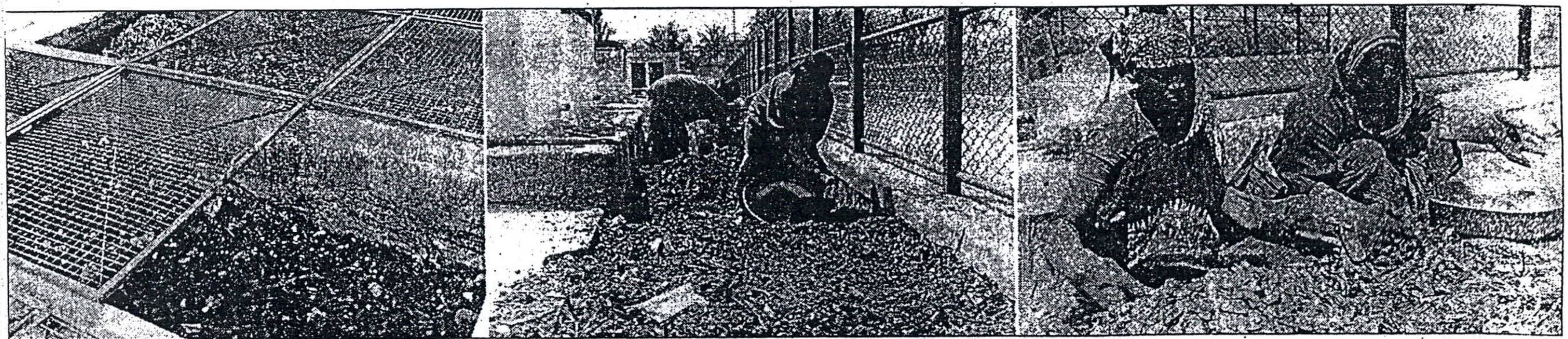
The project was implemented with an assistance from the Norwegian Agency for Development Corporation in association with Centre for Environment Education (CEE), Tata Energy Research Institute (TERI) and two non-governmental organisations - Mythri Sarva Seva Samithi and Technology Informatics Design Endeavour. Scientists from the University of Agricultural Sciences are providing the technical inputs for the programme.

Foreign player loses

recognition techniques on remote sensed data using super computers", Seminar Hall, MVJCE, 10 am.

Monitoring: Free co… hol/ drug addiction

26/01/01



A view of the composting unit at Lingarajpuram slum, which was adopted under IUEIP project. (Right) Workers segregating solid waste at composting unit.

Here, they did not wait for BCC's 'Swachcha Bangalore'

EXPRESS NEWS SERVICE

Bangalore, Jan 25: It was in 1998 that the residents of HBR Layout, HSBR Layout, OMBR Layout and East of NGEF started cleaning their residential areas, keeping it clear of garbage, etc. Thanks to an initiative taken by the Bangalore Development Authority, which along with four NGOs implemented a Norwegian programme 'Integrated Urban Environment Improvement Project' (IUEIP) in these areas.

Three years later, when the implementation of the IUEIP is coming to an end, the respective residential welfare associations are all set to take over the project from the NGOs and continue it as a co-operative cleaning movement.

Now, the four layouts are being re-named as Kalyananagar, Brindavan Nagar, Bhuvanagiri and Kasturinagar. At least 80 per cent of the households in these areas are members of the IUEIP. Besides, the IUEIP has extended its project by adopting Lingarajapuram slum also.

Apart from door-to-door garbage collection, the project had set up composting units. After segregating the garbage, the wet garbage would be put into the composting units for manufacturing fine compost.

The project has also tied up with the University of Agricultural Sciences (UAS) to set up a worm composting unit.

The manufactured compost would be sold at the rate of Rs 5 per kg for the residents and Rs 8 per kg for outsiders. The income would go towards management of the project. Besides, Rs 15 being collected from every member household each month would also be used for the same purpose.

Other than Solid Waste Management, the project also focuses on Geographic Information System (GIS) of the area. A computer-based information system that combines both geographic and attribute data elements to facilitate spatial analysis has been developed. User-friendly software applications has been designed and developed for maintenance of services for multiple users such as residents, civic authorities and NGOs.

Development of parks and open spaces in the area have been taken up as part of the project.

Kalyananagar Residents Welfare Association general secretary G B Karweer said "initially, there was some resistance from the residents to be part of the programme. Now, at least 80 per cent of the households are members".

However, resident associations say they could face problems when they begin managing the cleaning programme by themselves.

"While there will be the problem of coordination between various Government agencies, the present collection of Rs 15 would not be sufficient for managing the project. Either the Government/BCC has to fund us or we may have to collect at least Rs 30 from the members," Karweer said.

Meanwhile, the BDA has adopted Lingarajpuram slum under IUEIP, where door-to-door garbage collection has started. Garbage would be collected from at least 2,556 houses in the slum and a small composting unit has been set up.

Besides, two community toilets were proposed to be built in the area for better sanitation in the slum. While one is being managed by Sulabh International, the other is under construction.

Times of India (Bangalore Times) 17/11

INCINERATORS BURNING UP THE ENVIRONMENT!

Staff Reporter

OVER the past three years, companies peddling incinerators to dispose of medical waste have mushroomed in India. In Bangalore there are more than 12 companies that manufacture and sell incinerators. However, the dangers of incineration and their poor environmental track record in developed countries remain underplayed or unknown.

Civil and environmental activists all over the world are protesting against the use of incinerators. Doctors, scientists and biologists in Bangalore too are concerned about the way in which the environment is being harmed by incinerators.

A limited, informal survey conducted by the Tata Energy Research Institute (TERI) recently found that 23 incinerators installed in various Bangalore hospitals have the combined capacity to burn two tons of waste every hour. Add to this the pathological waste from city hospitals handled by the three municipal crematoria, and already you have far more than the safe limit of pollutants being released into the environment.

"Dioxin and mercury contamination is slowly seeping into our environment. With dioxin, there is no safe limit of exposure because these chemicals have the potential to cause subtle-to-severe health effects that may be irreversible," said Binisha P., research associate at TERI, who is conducting a study on the effects of incineration on the environment. "Autoclaving and microwaving, other methods to do away with hospital waste, are not in use in India. For the time being, we have to use incinerators but we have to take measures to use them in the least harmful way," she says.

St John's Hospital are the only ones who take care to segregate waste and dispose of it accordingly: All pathological waste goes into the incinerator while plastics, used syringes, thermometres and gauze are disposed of in a bio-gas plant that decomposes them into manure.

Despite their relatively small size, medical incinerators rank among the top three sources of the two key environmental toxins — dioxin and mercury — because they burn many plastics and mercury-containing items, such as batteries and thermometers. "On an average, a 100-bed hospital will generate not more than 2 kg of pathological waste. It is, therefore, foolish to spend more than Rs 12 lakh on an incinerator to dispose of 2 kg of waste. It is more viable for hospitals to have common incinerators. This way pathological waste is disposed of but toxic emission is reduced," said Binisha.

Theoretically, the optimum temperature at which pathological waste should be incinerated is 1050 degrees Celsius. "But most hospitals in the city maintain temperatures of only 200 to 400 degrees Celsius," said Binisha. "This becomes just another form of burning and not incineration."

Doctors from Wockhardt, Manipal Hospital, Mallya Hospital and many other hospitals in the city have expressed concern over this misuse of incinerators. "This is more like open burning and much more harmful than incineration," they say.

Infection is a biological problem; the solution is to kill the pathogens without necessarily destroying the plastics, glass and gauze pads on which the pathogens reside, and releasing the toxic chemicals contained within them. TERI has begun a campaign on the implementation of segregation of waste and disinfection in hospitals. "Since there is no other immediate alternative to incineration, we have conducted a study on the amount of medwaste generated in a hospital. We find out how it is handled at each point of generation and tell the hospital staff how to manage it," says Binisha.

"We have found this very helpful and are trying to segregate most of the waste generated in the hospital," said a group of staff members of HOSMAT. "If nothing else, this will be our small contribution towards protecting the environment."

A footnote to hot-footing it abroad

THE HINDU
Metro
Monday, August 3, 1
Bangalore

Building the foundation for a new Bangalore

The haphazard growth of Bangalore in the recent past has drastically changed the geography of the city. One never dreamt the City would expand almost up to Whitefield or beyond Hebbal Lake. But it has happened.

Unplanned growth brings along its own problems. Civic amenities are either lacking or grossly inadequate. The Bangalore Mahanagara Palike (BMP) has often tried to levy 'betterment charges' to provide amenities to the new layouts coming under its jurisdiction. But several agencies other than the city corporation are involved in providing civic amenities, such as the Bangalore Water Supply and Sewerage Board and the Karnataka Electricity Board. Lack of coordination among the agencies has often resulted in breakdown of utility services. There are also urban pockets which are yet to be taken over by the BMP.

Environment has suffered the most in this unplanned growth of the City: it can hardly be known as Garden City anymore. This has often been pointed out by concerned citizens and environmental organisations. But they have been unable to do anything about it.

Now comes what is an experiment in facilitating growth of the City along with environmental considerations. To bring about better management of civic amenities in some of the newly developed areas in Bangalore, the Bangalore Development Authority (BDA) has launched an innovative scheme involving local residents.

The two-year project named Integrated Urban Environment Improvement is to develop environment management plans for four BDA layouts on the outskirts of the City. These areas are: Brindavan (on Hennur-Bellary Road), Kalyan Nagar (Hennur Road-Bellary Road), Bhuvanagiri (Old Madras Road-Bellary Road) and Kasturi Nagar (east of NGEF). All are accessible from the new Ring Road.

This pilot project is being taken up with assistance from the Norwegian Agency for Development Cooperation (NORAD) and is being implemented by the BDA in coordination with some leading NGOs involved in environmental preservation, energy conservation, waste management and compiling geographic information systems. The Karnataka State Council for Science and Technology has been identified by the State Government as the agency for implementing the project.

All important decisions are to be taken by an Apex Committee headed by the BDA Chairman, with a Project Implementation Committee to oversee the implementation of the project. The implementation committee is headed by the BDA Commissioner and includes NGOs and BDA officials. There is also a State-Level Committee which meets twice a year to monitor the project's progress.

The Norwegian agency was apparently scouting for a suitable project for funding with the stipulation that it should be environment oriented. The idea of providing environment management for newly developing areas, appealed to the agency.

The project areas are planned to be models for other new neighbourhoods, according to the BDA Commissioner, Ms. Lakshmi Venkatachalam. The project is based on the principle that 'prevention is better than cure'. If the problems of growth can be dealt with at the formative stage of a layout, there would be better amenities as the area expands and more people start living there.

The project area covers nearly 10,000 house sites spread over 4,600 hectares. There are revenue pockets and old villages in some of these areas. The villages if left out of development now, might grow into slums as has happened in older areas of the City.

Solid waste management was identified as one of the main components of the project. This aspect has been taken up in collaboration with NGOs such as Wastewise and the Centre for Environment Education (CEE), a national institution. Wastewise, with experience in similar situations, is involved in spreading the idea of segregating solid waste and disposing it of in non- polluting ways, especially in the lower income group areas. In all areas under the project, waste management is to be eventually carried out by associations of local residents. The BDA will provide initial infrastructure such as compost pits.

According to a spokesperson of CEE, the organisation will help initiate door-to-door collection of segregated waste in two of the layouts coming under the project. Hospital waste is to be collected separately and fed into incinerators. Some of the waste will go into land fills and the rest will be used for energy generation. Where there are industries, they will given assistance to treat the effluents

PAST TEACHES A LESSON: A view of Kalyan Nagar, one of the four areas in which the Integrated Urban Environment Improvement Project is being implemented. —Picture by K.Gopinathan.

A BDA project that is being implemented in four newly developed areas is based on the principle that problems of growth should be dealt with at the formative stage of a layout, writes K.Satyamurty.

computer based Geographic Information System for the project area. This is being done by the Technology Informatics Design Endeavour (TIDE) which earlier developed a detailed computerised map for Malleswaram. Dr. S.Rajagopalan, Chairman of TIDE, says a detailed map in the 1:1000 scale will be prepared showing houses and other buildings, roads, footpaths, drains, pipelines, powerlines, trees, open spaces, water bodies and slopes and indicating built- up and vacant sites.

The computerised data is to be prepared in a digital format for use by various agencies involved, such as the BMP, the BWSSB and Telephones.

An organisation like the CEE for instance will be able to locate where the dustbins are installed in a particular locality. The collected data will be tamper-proof and the information system will be ready by June 1999, says Dr.

1:4000 which will be detailed enough to locate a water pipe which has burst.

The BDA itself will be directly involved in the management of all open spaces demarcated in the project area. This means developing parks and playgrounds and planting trees and shrubs along the roads, on road medians and space beneath high-tension power lines. Water harvesting, groundwater regeneration and other conservation measures will be given importance. The BDA Commissioner feels that planting trees and shrubs for beautification alone is not enough and soil and water conservation has to be given importance, keeping in mind the future needs of these areas.

Many of the new layouts in the City have come up without adequate tree cover and green space; this will be avoided in the project area. The Forest Department is also involved

waste management component will require Rs. 1.97 crores, being the core of the environmental aspect of the project. Developing the geographical information system will cost Rs. 50 lakhs and Rs. 40 lakhs is to be spent on management of all open spaces. The amount required in excess of that given by the Norwegian agency is to be generated by the BDA.

Ms. Lakshmi Venkatachalam says the cooperation of other NGOs and Government agencies has been sought for implementing the project.

The strength of the project is in community participation at all levels, she adds. Without this it will not be possible to sustain the benefits beyond the two- year period of the project. Community participation is expected through residents' associations, clubs, 'mahila mandalis' and other local organisations.

While something like segregated disposal waste will need initial help from the NGOs and official agencies, it can be sustained in the long run only by the residents themselves. The community has to become self-sufficient enough to manage the local environment.

If this project is successful it could be the

Map that locates dustbins

The Technology Informatics Design Endeavour (TIDE) is one of the organisations involved in the Norwegian aided Integrated Urban Environment Improvement Project. Preparing computerised geographical information systems (GIS) for the project area will be the TIDE's work.

Earlier, the organisation earlier prepared a GIS of Malleswaram for management of solid waste in the area. This project was carried out in coordination with Mythri Seva Mandali, an NGO and the BMP.

The GIS created for Malleswaram contains both maps and attributable data of all parcels that come under Malleswaram, Ward 7 of Bangalore City. It contains details of roads and important landmarks. This data was computerised using a standard GIS software so that the final product was useful for solid waste data, formulating data requirements and database design, integrating data with the digitised map, demonstrating the use of GIS with sample data and training users on the utilisation of GIS and its updating.

The output from the GIS would include a map of the location of dustbins and open garbage to arrange for collection of the waste. A waste generation map of the area has been prepared by using land use data in combination with estimates of waste generated. This will help in deploying the waste collection personnel. The collection infrastructure would be overlaid on the circles of influence of each waste bin, showing areas not serviced and whether the bins are adequate or not. Transport route planning — for waste collection trucks — is also provided for.

CEE South
Centre for Environment Education
Southern Regional Cell
"Kamala Mansion", 143, Infantry Road
Bangalore - 560 001
Phone : 286 9094, 286 2167, 286 9907
Fax : 286 8209
e-mail : ceesouth@vsnl.com