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सत्यमेव जयते

नीति आयोग

National Institution for Transforming India

Report of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan

स्वच्छ भारत

एक कदम स्वच्छता की ओर

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List of Abbreviations

ASP	Activated Sludge Process
ASSOCHAM	Associated Chamber of Commerce and Industry of India
BCC	Behaviour Change Communication
BIS	Bureau of Indian Standards
BM	Biomethanation
BOD	Biochemical Oxygen Demand
C&D	Construction and Demolition
CC	Conventional Composting
CIPET	Central Institute of Plastics Engineering and Technology
CLTS	Community Led Total Sanitation
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CRSP	Central Rural Sanitation Programme
CSE	Centre for Science and Environment
CSR	Corporate Social Responsibility
DBFOT	Design, Build, Finance, Operate, Transfer
EA	Extended Aeration
EGSB	Expanded Granular Sludge Bed
EPA	Environment Protection Act
EPC	Engineering, Procurement and Construction
GP	Gram Panchayat
HPEC	High Powered Expert Committee
IEC	Information, Education and Communication
IHHL	Individual Household Latrine
IIP	Indian Institute of Petroleum
IRC	Indian Roads Congress
ITI	Industrial Training Institute
IWP	Integrated Waste Processing
JnNURM	Jawaharlal Nehru National Urban Renewal Mission
KRC	Knowledge Resource Centre
LPG	Liquefied Petroleum Gas
MBBR	Moving Bed Biofilm Reactor
MBR	Membrane Bioreactor
MDWS	Ministry of Drinking Water and Sanitation
MFIs	Micro Finance Institutions

MLD	Million Litres Per Day
MoUD	Ministry of Urban Development
MSWM	Municipal Solid Waste Management
NGO	Non-Governmental Organization
NGP	Nirmal Gram Puraskar
NLCP	National Lake Conservation Plan
NPCA	National Plan for Conservation of Aquatic Ecosystems
NRCP	National River Conservation Plan
NSSO	National Sample Survey Office
NUSP	National Urban Sanitation Policy
O&M	Operation and Maintenance
OD	Open Defecation
ODF	Open Defecation Free
PIL	Public Interest Litigation
PPP	Public Private Partnership
PRI	Panchayati Raj Institution
RCC	Reinforced Cement Concrete
RDF	Refuse Derived Fuel
RWA	Resident Welfare Association
SBA	Swachh Bharat Abhiyaan
SBM	Swachh Bharat Mission
SBR	Sequencing Batch Reactor
SHG	Self-Help Group
SLWM	Solid Liquid Waste Management
SMS	Short Messaging Service
SQUAT	Sanitation Quality, Use, Access ad Trends
SWM	Solid Waste Management
TERI	The Energy and Resources Institute
TPD	Tonnes per day
TSC	Total Sanitation Campaign
UASB	Upflow Anaerobic Sludge Blanket
ULBs	Urban Local Bodies
UNICEF	United Nations Children's Fund
UT	Union Territory
VC	Vermi Composting
WHO	World Health Organization

Executive Summary

Background

The Swachh Bharat Mission (SBM) was launched on 2nd October, 2014 to fulfil the vision of a cleaner India by October 2, 2019 as a tribute to Mahatma Gandhi on his 150th birth anniversary. The SBM is a concerted approach and one of the biggest ever drives to accelerate efforts towards achieving universal sanitation coverage, improving cleanliness and eliminating open defecation in the country. The Swachh Bharat Mission has both rural and urban components – Swachh Bharat Mission (Urban) and Swachh Bharat Mission (Gramin). Ministry of Urban Development (MoUD) is in charge of the Swachh Bharat Mission (Urban) and Ministry of Drinking Water and Sanitation (MDWS) is in charge of Swachh Bharat Mission (Gramin) and the overall mission is coordinated by MDWS.

In order to realize the aim of Swachh Bharat by 2nd October 2019, a Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan was constituted by NITI Aayog as per decision taken at the first meeting of the Governing Council of the NITI Aayog chaired by the Prime Minister on 8th February, 2015. The Sub-Group consists of Chief Ministers of Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Maharashtra, Mizoram, Sikkim, Uttarakhand and West Bengal as Members with Chief Minister of Andhra Pradesh as the Convener of the Sub-Group and CEO, NITI Aayog as the coordinator of the Sub-Group. The Terms of Reference of the Sub-Group included the following:

i. To examine financial requirements for comprehensive implementation of the Swachh Bharat Mission and suggest measures for meeting budgetary needs;
ii. To recommend robust institutional mechanisms for effective implementation;
iii. To recommend measures for technological support for different components of SBM, including solid and liquid waste management in rural and urban areas;
iv. To examine models for private sector participation in the Swachh Bharat Mission and to suggest ways for substantial improvement in participation of private sector and civil society organizations for effective implementation;
v. To recommend ways to make the SBM sustainable; and
vi. Any other measures.

The Sub-Group met four times in New Delhi, Chandigarh and Bengaluru. In pursuance of the decision taken in the first meeting of the Sub-Group, a Working Group was

constituted to prepare a draft report and compile the best practices and technologies in the field of sanitation and solid & liquid waste management. Further, three Sub-Groups on Technology, Behaviour Change and Revenue models for Operation & Maintenance of Public and Community toilets were constituted to deal with the specific aspects. This report is the outcome of several consultations with the Chief Ministers, Working Groups, Nodal and other Ministries, NGOs and stakeholders. Teams comprising officials from NITI Aayog and member States visited various States to study the best practices and technologies which have been listed in the annexure of the report. The field visits were conducted in Mizoram (Aizawl and three adjoining villages), West Bengal (Nadia), Maharashtra (Pune), Karnataka (Bengaluru), Andhra Pradesh (Visakhapatnam) and Haryana (Karnal). Some of the commendable success stories have special mention in the report as box items.

The Swachh Bharat Mission consists of components like construction of individual household toilets, community and public toilets and waste management. The sources of funds for the Mission include budgetary allocations to Swachh Bharat Mission (Centre and State); Commitments under Corporate Social Responsibility (CSR); Contributions to Swachh Bharat Kosh; Enabling provision to empower central government to impose Swachh Bharat cess on all or certain taxable services at the rate of 2% on the value of such taxable services, as announced in the Union Budget 2015-16; Assistance (both technical and financial) from multilateral and external sources and; Grants devolved to Local Bodies by the Fourteenth Finance Commission.

Present Status: Sanitation and Waste Management

As per Census 2011, the rural household toilet coverage stands at 32.7% and urban household toilet coverage stands at 87.4%. The aim of this Mission is to achieve open defecation free status by 2nd October, 2019. However, there is a major challenge in achieving this goal as tremendous effort is required to bring about a transformation in the behavior of the people to bring them out of their deep rooted practice of defecating in the open. Further, challenges related to sanitation include operation and maintenance of community and public toilets; revival of dysfunctional toilets constructed under the Total Sanitation Campaign; and elimination of manual scavenging.

In case of waste management, sub-optimal techniques of waste management and lack of scientific treatment and disposal of waste are major concerns. Appropriate measures are required to deal with different types of waste like municipal solid waste, construction and

demolition waste, e-waste, bio-medical waste etc. To achieve litter free and clean environment, there is a need to develop an integrated solid waste management system. Mainstreaming of rag pickers in the waste management process, selection and procurement of appropriate technology and enforcement of rules and regulations are some other major issues which need to be addressed.

Recommendations of the Sub-Group

I. Behaviour Change Communication (BCC) Strategy

- The proportion of funds for BCC may be increased uniformly, in both urban and rural areas, to about 25% of the total funds for the programme.
- Involve political and social/thought leaders, celebrities and media houses to spread the message of importance of cleanliness and sanitation.
- A database needs to be created which captures toilet usage by all households which will help in framing the strategy for the behaviour change campaign and also enable to undertake mid-course corrections.
- A professional agency needs to be involved both at the Central and State level to design the strategy, mode of implementation and to monitor and evaluate the progress of the campaign as partnerships with UNICEF and WHO were crucial in the success of campaign like the Pulse Polio campaign.
- Extensive media campaign in the form of electronic, web and print to be used for conveying messages and encouraging the people to pay for usage of public toilets for their sustainability.
- Concept of three R's –Reduce, Reuse and Recycle needs to be strongly advocated.
- Cleaning occupations must be seen as a dignified work and widely respected.

II. Education Strategy for Sustainable Swachh Bharat Mission

- Inculcating sanitation practices in children by including a chapter in school curriculum from the first standard itself.
- In each school and college, a team of students may be formed which will be called the '*Swachhata Senani*', to spread awareness about sanitation and cleanliness.

- Skill Development courses/ Diploma courses may be introduced in State ITIs and polytechnics/ colleges to train personnel in the field of solid and liquid waste management.
- Centres of Excellence may be set up in the institutes of higher learning to promote research in the specialized fields of sanitation & waste management.
- Specialized courses on Environmental Sciences, Public Health Engineering and Municipal Engineering with focus on sanitation and waste management may be introduced at under graduate and post graduate level.
- Joint Research Programmes with foreign universities/higher educational institutions would enhance knowledge and capacities to work on waste management technologies.

III. Financial Requirements for the Swachh Bharat Mission

- The funding pattern for this programme between the Centre and States may be in the ratio of 75:25, while for hilly States it may be kept at 90:10.
- The State Governments may consider setting up a Swachh Bharat Kosh on the lines of the Swachh Bharat Kosh constituted at the Central level. Donations to the Kosh should be eligible for 100% deduction under section 80G of the Income Tax Act.
- To generate additional resources for the programme, the Central Governments may levy a Swachh Bharat cess on petrol, diesel and telecom services. Swachh Bharat cess on accumulated waste produced by mineral waste generation plants like coal, aluminium, and iron ore may be levied by the Central Government.
- Each waste generator should pay for the waste generated based on polluter- pay principle. The charges for waste management may be collected along with property tax, water supply bills or electricity bills, as felt appropriate by the State Govts. / ULBs.
- A certain part of the CSR contributions by PSUs/Companies may be spent in the states where they are located.
- It is proposed that the first charge on the expenditure on 14th Finance Commission grants to Local Bodies shall be on the activities to be undertaken under Swachh Bharat Mission. The Government of India may advise the States accordingly.
- The Fourteenth Finance Commission (FFC) recommendations have not covered the local bodies in rural areas in some of the North Eastern States. These local bodies have not received the grants under FFC as received by local bodies in other States of the country. Hence, it is recommended that Government of India may consider releasing grants to such States at the same level as provided to the local bodies in other States.

IV. Robust Institutional Mechanisms

- There should be a Mission at National and State level headed by the Prime Minister and Chief Minister respectively to coordinate the activities across all concerned Departments.
- The Mission may be in the form of a Society, an SPV or an autonomous agency. The body will have the implementing cells dealing with the areas of toilet construction, solid waste management, liquid waste management and Construction and Demolition waste management. Further, there will be wings related to IEC, Knowledge Resource Centre, Swachh Bharat Kosh, National Technical Board and Monitoring.
- There is a need to review all laws and rules on waste management for strict enforcement.

V. Measures for Technological Support

- It is recommended that a National Technical Board may be set up to provide the knowledge and handholding of Local Bodies in the entire process from identification to final procurement of technology. The National Technical Board shall comprise practitioners in the field, O&M experts, reputed subject matter experts, technology providers and financial analysts.
- Treatment of liquid waste is not covered under the Swachh Bharat Mission (Urban). Hence, it is suggested that sewage management may also be included in the urban component of the Mission.
- MoUD and MDWS may work out the indicative cost for procuring equipment for solid and liquid waste management projects. A model procurement policy may be devised.
- Decentralized wastewater treatment processes and reuse of treated water should be promoted in housing colonies, hotels, schools, high-rise buildings, hospitals and public toilets.
- Management of existing dumpsites can be tried with the recent technology called "Bio-Mining" for processing of waste in existing dump sites. This process refers to onsite above ground treatment of waste (stabilization) and extracting organic matter and other recoverable.

I. Measures to Encourage Private Sector Participation

- It is recommended that tariff policy for power generated from waste to energy may be formulated by Ministry of Power and tariff for power from these plants may be fixed by the Electricity Regulatory Commission.

- In order to improve the viability of solid waste management projects, tax exemptions may be provided. For bigger municipalities and cluster of municipalities, waste to energy plant is suggested and for smaller towns and rural areas, composting methods may be adopted.
- Output based subsidy may be provided to the private sector for sale of by-products like compost. The subsidy on chemical fertilizers may be reduced and correspondingly subsidy on compost may be increased to promote the use of compost.
- A sound framework of PPP needs to be outlined for a fair and transparent procurement mechanism. The responsibility of the municipal authority and PPP partner needs to be clearly identified.

VII. Sustainability of the Mission

- Separate measures for operation and maintenance of community and public toilets in both urban and rural areas have been suggested.
- NITI Aayog may provide a common platform for resolution of inter-sectoral and inter-departmental issues.
- NITI Aayog may develop, in consultation with Ministries and State Governments, an objective assessment framework for (i) assessing ODF and (ii) assessing ODF plus, that is, cleanliness.
- NITI Aayog may document the best practices related to Sanitation and Waste Management.

The detailed recommendations of the Sub-Group have been listed in Chapter 4 of the report.

Chapter 1

Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan

Everyone must be his own scavenger.

Mahatma Gandhi

The Swachh Bharat Mission (SBM) was launched on October 2, 2014 to fulfil the vision of a cleaner India by October 2, 2019 as a tribute to Mahatma Gandhi on his 150th birth anniversary. The SBM is one of the biggest ever drives to accelerate efforts towards eliminating open defecation, achieving universal sanitation coverage and improving cleanliness by October 2, 2019. Apart from making the country open defecation free, the other objectives of the Mission include eliminating manual scavenging, ensuring proper management of solid and liquid waste, and facilitating participation of private sector towards provision of cleanliness facilities. The Mission *inter alia* aims to achieve these objectives by behaviour change and enhancing awareness about the positive effects of sanitation on health outcomes. This is a massive campaign to initiate the theme of sanitation and cleanliness all through the country.

Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan

The first meeting of the Governing Council of the NITI Aayog chaired by the Prime Minister was held on 8th February, 2015 and it was decided to set up a Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan. The Sub-Group comprises Chief Ministers of Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Maharashtra, Mizoram, Sikkim, Uttarakhand and West Bengal as Members. The Convener of the Sub-Group is the Chief Minister of Andhra Pradesh. CEO, NITI Aayog is the Coordinator of Sub-Group.

The copy of the order constituting the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan is at Annexure I.

The Terms of Reference of the Sub-Group are as follows:

(i) To examine financial requirements for comprehensive implementation of the Swachh Bharat Mission and suggest measures for meeting budgetary needs;

(ii) To recommend robust institutional mechanisms for effective implementation;

(iii) To recommend measures for technological support for different components of SBM, including solid and liquid waste management in rural and urban areas;

(iv) To examine models for private sector participation in the Swachh Bharat Mission and to suggest ways for substantial improvement in participation of private sector and civil society organisations for effective implementation;

(v) To recommend ways to make the SBM sustainable; and

(vi) Any other measures.

Meetings and Deliberations of the Sub-Group

The first meeting of the Sub-Group of Chief Ministers was held on 30th April, 2015 in NITI Aayog, New Delhi. Some of the major points that were discussed included sharing of best practices and technologies; political leadership to spearhead the Mission; involvement of social leaders etc. In pursuance of the decision taken in the first meeting of the Sub-Group, a Working Group was constituted to prepare a draft report and compile the best practices in the field of sanitation including solid and liquid waste management. Further, three Sub-Groups out of the members of the Working Group at the official level were constituted to deal with Technology, Behaviour Change, and Revenue models for Operation & Maintenance of Public and Community toilets.

The second meeting of the Sub-Group of Chief Ministers was held on 19th May, 2015 at Chandigarh. In this meeting, the issues that were discussed included capacity building of ULBs for assessment of technologies; including a curriculum on sanitation in schools; providing bathing spaces and other additional facilities in community toilets; and technologies on solid and liquid waste management. During the discussion, it was emphasised that cleanliness has to be seen as a dignified work and as conferring dignity and self-respect. The third meeting of the Sub-Group of Chief Ministers was held on 24th June 2015 at Bengaluru. The main points discussed during the meeting were sharing financing of the programme between the Centre and States; technology support for scientific waste management; sanitation coverage; and encouraging Public Private Partnerships (PPP) as well as inviting private sector participation. The fourth and final meeting of the Sub-Group of Chief Ministers of Swachh Bharat Abhiyaan was held on 23rd September, 2015 at New Delhi. The major points discussed were the sharing pattern of funds for the programme, raising financial resources for the programme, enhancing incentive for construction of household

toilets in both urban and rural areas, PPP framework for waste to energy plants, and Swachh Bharat Grading/Rating for all Gram Panchayats, Municipalities, Blocks, Districts and States. After due deliberations, the recommendations of the Sub-Group were finalised which are listed in Chapter 4 of this report. The record of discussions of the meetings of the Sub-Group of Chief Minister is at Annexure II. The Sub-Group sought suggestions of all the States/UTs regarding the Swachh Bharat Abhiyaan. Some of the State Governments have provided their inputs and suggestions on various aspects of Swachh Bharat Abhiyaan which include issues related to financial support, technology support, behaviour change, institutional mechanism and best practices followed in the States. The details of the inputs are at Annexure III.

Examples of Best Practices in some States

Teams comprising officials from NITI Aayog and member States visited various States to study the best practices and technologies. The field visits were conducted to Mizoram (Aizawl and three adjoining villages), West Bengal (Nadia), Maharashtra (Pune), Karnataka (Bengaluru), Andhra Pradesh (Visakhapatnam) and Haryana (Karnal). Mizoram is an example of a clean city which has been maintained by the combined efforts of Government, Non-Governmental Organisations (NGOs) and general public. Community mobilisation has been the key element in keeping the city clean. The role played by the civil society organisations, especially Young Mizo Association has been noteworthy in bringing about desired changes in behaviour towards cleanliness as a social norm. Nadia in West Bengal has become the first open defecation free district of India after the launch of the Swachh Bharat Mission. The Sabar Shouchagar movement in Nadia has been successful in creating the demand for sanitation facility among people. The administrative machinery was very actively involved in the campaign and used various strategies like creating awareness among students, involving religious leaders, involving women Self-Help Groups (SHGs) and monitoring through Nazardari committees.

In Bengaluru, the model of e-toilets was noted to have been working successfully and which could be promoted across the country. This model is easy to install and requires less area, consumes less water but ensures enhanced cleanliness through auto flushes and floor washing, is power efficient, operations are unmanned and waste is treated using anaerobic bio-degradation where it is not connected to sewer lines. The common effluent treatment plant in Visakhapatnam, Andhra Pradesh has been working successfully in treatment of the effluents of the industries located in the Jawaharlal Nehru Pharma City (JNPC) and the Hazardous Waste & Waste Water Management Facility at Brandix India Apparel City. The

Exnora (an NGO) model, where Resident Welfare Associations (RWA) are involved and collection of a monthly charge of Rs.20/- per household for garbage collection is done through RWA, should be expanded to other wards of the city. The waste management projects in Haryana were successful where the Gram Panchayats were actively involved. Pune is a good example of cooperative framework in Municipal Solid Waste Management (MSWM) between State Government, Municipal Corporation and Civil Society. Segregation of household waste has been successfully undertaken in Pune and can be rolled out across cities. In Pune, it was observed that Non-Governmental Organisations (NGOs) were efficient in handling municipal solid waste. The report of the team visits are provided in Annexure IV.

Chapter 2

Swachh Bharat Mission (2014-2019)

The Swachh Bharat Mission, launched on October 2, 2014, has both rural and urban components – Swachh Bharat Mission (Gramin) and Swachh Bharat Mission (Urban). Ministry of Drinking Water and Sanitation (MDWS) is in charge of Swachh Bharat (Gramin) and Ministry of Urban Development (MoUD) is in charge of the Swachh Bharat (Urban) and the overall mission is coordinated by MDWS.

The Swachh Bharat Mission (Gramin) aims to (i) promote cleanliness, hygiene and eliminate open defecation (ii) accelerate sanitation coverage in rural areas (iii) motivate communities and Panchayati Raj Institutions to adopt sustainable sanitation practices and facilities through awareness creation and health education (iv) encourage cost effective and appropriate technologies for ecologically safe and sustainable sanitation and (v) develop wherever required, community managed sanitation systems focusing on scientific solid & liquid waste management systems for overall cleanliness in the rural areas. The components of the mission are construction of individual household latrines and community sanitary complexes; Information, Education and Communication (IEC); start-up activity and capacity building; and solid and liquid waste management activities in Gram Panchayats.

The Swachh Bharat Mission (Urban) aims at (i) elimination of open defecation (ii) eradication of manual scavenging (iii) modern and scientific municipal solid waste management (iv) to effect behavioural change regarding healthy sanitation practices (v) generate awareness about sanitation and its linkage with public health (vi) capacity augmentation of Urban Local Bodies and (vii) to create an enabling environment for private sector participation in capital and operation and maintenance expenditure. The components of the mission include construction of household toilets, community and public toilets; solid waste management; IEC & public awareness and capacity building.

Project Costs and Funding

The Swachh Bharat Mission (SBM) consists of components for providing individual household toilets, community and public toilets and scientific waste management. The estimated cost of the programme is approximately Rs.2,23,692 crore.

The details of estimated cost of programme components are provided in Table 1 below.

Table 1: Estimated cost of components of the Swachh Bharat Mission

Component	Physical target to be achieved (In Numbers) for Swachh Bharat Mission		Estimated Cost (in Rs crore)
SBM (Gramin)	IHHL (Individual toilets)	684 Lakh	1,34,386
	Community Sanitary Complexes	1,14,313	
	SLWM Projects	2,50,000	
SBM (Urban)	Household toilets	104.12 Lakh	62,010
	Community Toilet	2,51,830	
	Public toilet blocks	2,55,757	
	End-to-end SWM Operational (in no. of towns)	4041	
School Toilets	New Toilets	1,45,815	2,528
	Non-functional to functional toilets	1,67,054	
Anganwadi Toilets	Number of toilets	7,12,744	768
IHHL under MGNREGA	IHHL (Individual toilets)	200 lakh	24,000
Grand Total			**2,23,692**

Source: Compiled from data received from Ministry of Drinking Water & Sanitation, Ministry of Urban Development, Ministry of Human Resource Development, Ministry of Women & Child Development and Ministry of Rural Development.

Presently, the sources of funds made available for the Mission include the following:

- Budgetary allocations to Swachh Bharat Mission (Centre and State)
- Commitments under Corporate Social Responsibility (CSR)
- Contributions to Swachh Bharat Kosh which has been set up by Government of India to attract funds from various sources
- Enabling provision to empower the Central Government to impose Swachh Bharat Cess on all or certain taxable services at the rate of 2% on the value of such taxable services , as announced in the Union budget 2015-16
- Assistance (both technical and financial) from multilateral and external sources
- Grants devolved to Local Bodies following the recommendations of the Fourteenth Finance Commission

The key difference between SBM and previous programmes can be found in the efforts to attract partners to supplement public sector investment with a multi-stakeholder approach.

Chapter 3

Sanitation and Waste Management: Present Status, Issues and Challenges

I. Sanitation

There is a direct relationship between sanitation, health, and human wellbeing. Improper disposal of human excreta, lack of personal and food hygiene and lack of scientific solid and liquid waste management have been some of the major causes of many diseases which have a significant direct and indirect cost to the society and nations. More than half of India's 250-million odd households do not have access to toilets close to places where they live. To add to this, community toilets at railway stations, in markets, parks, schools and so on are also woefully inadequate and, moreover, very poorly maintained. Lack of sanitation causes a tremendous disease burden for the poor, especially poor infants and young children.

Globally, due to inadequate and unsafe drinking water, poor sanitation and unhygienic practices, diarrhoea has emerged as one of the leading causes of child deaths under age of five, claiming nearly 11 percent of total deaths in the age group[1]. Further it has been reported that a 10% increase in open defecation is associated with 0.7% increase in both stunting and severe stunting in children[2]. However, studies indicate that sanitation behaviour is not motivated by health concerns because open defection is generally not recognised in rural India as a threat to health.

Sanitation: Rural

Rural sanitation was the focus of the Government in the first U.N. World Water Decade of 1980s. The Central Rural Sanitation Programme (CRSP) was started in 1986 to provide sanitation facilities in rural areas. It was a supply driven infrastructure oriented programme based on subsidy. CRSP was restructured and launched as Total Sanitation Campaign (TSC) in 1999. TSC was a demand driven, community led, project based programme organized around the district as the unit. Gram Panchayats had the pivotal role, at times with the assistance of Voluntary Organizations/ Non-Governmental Organizations, in

[1] Pneumonia and Diarrhoea: Tackling the deadliest diseases for the world's poorest children, UNICEF, June 2012

[2] Spears D, Ghosh A, Cumming O (2013) Open Defecation and Childhood Stunting in India: An Ecological Analysis of New Data from 112 Districts. PLoS ONE 8(9): e73784.doi:10.1371/ journal. pone.0073784

the implementation of the TSC in terms of construction of toilets and maintenance of clean environment through safe disposal of waste.

The TSC was given a further boost with the introduction of the Nirmal Gram Puraskar (NGP) in 2003, an innovative incentive scheme for Gram Panchayats, Blocks and Districts, that have attained cent per cent sanitation coverage. The incentive pattern is based on population criteria and varies from Rs.50,000 to Rs.50 lakh. Gram Panchayats, Blocks and Districts, which achieve 100% sanitation coverage in terms of (a) 100% sanitation coverage of individual households, (b) 100% school sanitation coverage (c) free from open defecation and (d) maintenance of clean environment are eligible for Nirmal Gram Puraskar (NGP). Organizations, that have been the driving force for effecting full sanitation coverage in the respective geographical areas, are also eligible for NGP. Incentive amount is offered only to Panchayati Raj Institutions (PRIs). Organisations are given citations and trophies in recognition of their efforts[3].

In addition to Nirmal Gram Puraskar, many States have introduced their own clean village schemes to encourage sanitation and best hygiene practices. The States who have taken such initiative are Maharashtra, Andhra Pradesh, Haryana, Himachal Pradesh, Bihar and Karnataka. An Assessment Study of impact and sustainability of Nirmal Gram Puraskar was carried out by Ministry of Rural Development in 2011. The main purpose of the study was to assess the impact of NGP on the pace of progress of sanitation availability and usage in the country under TSC and its related impacts on health, education, gender empowerment, social inclusion in rural areas on different user groups particularly the rural poor. This study also focused on the durability and sustainability of the provision and usage of sanitary facilities over time. 66% of the eligible households reported that the household pattern of usage had improved after NGP year of their Panchayat implying the impact of preparation/ IEC activities of NGP. As far as coverage of 100% households and institutions under sanitation facilities is concerned, NGP status was not found to have sustained in most States.

[3] http://nirmalgrampuraskar.nic.in

Box 1: Evaluation Study on Total Sanitation Campaign, Planning Commission (2013)

The Programme Evaluation Organisation (PEO) of Planning Commission conducted an independent evaluation of the TSC programme to assess the socio economic impact of the programme. The study covered 122 districts, 206 blocks, 1207 GPs, 127 Rural Sanitary Marts spread over 27 States of the country.

In terms of impact, the study revealed that the implementation of TSC programme did have a favourable impact on the level of income of the rural households. The Nirmal Gram Panchayats reported fewer incidences of diseases due to hygienic and safe water supply which resulted in lower medical expenses and increased time for earning. Apart from improving general wellbeing among the rural poor, access to toilets at home have also made women feel more secure. It was reported that the practice of open defecation continue to linger in some households in villages where GPs had acquired ODF status. In rural areas, the estimated percentage of households, where at least one member of the family practices open defecation, was around 72.63% of total respondent households. Unavailability of toilets was singled out as the prime reason of such high prevalence of open defecation, with 66% of respondent households resorted to open defecation due to this reason. Non availability of adequate water for flushing was another major challenge observed among rural households.

Interpersonal communication was an important demand generation instrument under the IEC framework of the TSC programme. However, there was a feeble attempt on behalf of the Gram Panchayats in appointing motivators to create awareness and persuade people to construct latrines. In the case of households with existing toilet facilities, lack of awareness and established age old practices were singled out as the prime reason of why people continue to resort to open defecation, despite availability of household toilet facilities.

Similarly, much was left to be achieved with regard to hygiene behaviour, as more than half of the rural poor did not use soap before and after the meals. Construction of Community Sanitary Complexes was below target and the idea of using these as an effective alternative for the poor has not really caught up in most of the States. The initial six years of the programme did not cover solid and liquid waste management. Collective institutional effort for adopting scientific approach to solid and liquid waste management were absent in the TSC programme.

In 2012, the TSC was revamped as Nirmal Bharat Abhiyan (NBA) to accelerate the sanitation coverage in rural areas through saturation approach and by enhancing incentives for IHHLs. Further additional support was also obtained from Mahatma Gandhi National

Rural Employment Guarantee Act (MGNREGA). However, there were implementation difficulties in convergence of NBA with MGNREGA as funding from different sources created delays.

On October 2, 2014 Swachh Bharat Mission was launched to conclude on October 2, 2019-the 150th anniversary of Mahatma Gandhi's birth.

Sanitation: Urban

In comparison to rural sanitation, fewer programmes have been enacted to tackle deficiencies in urban sanitation. In the 1980s, the Integrated Low-Cost Sanitation Scheme provided subsidies for households to purchase low-cost toilets. Additionally, the National Slum Development Project and its replacement programme, the Valmiki Ambedkar Awas Yojana (VAMBAY) launched in 2001, were programmes that aimed to construct community toilets for slum populations.

In 2005, an Inter-Ministerial Task Force on universal sanitation in urban areas was constituted to frame the national policy to mobilize governments and civil society to create community-driven Nirmal Shahars, or totally sanitized cities and towns. Sewerage and sanitation was also covered under Jawaharlal Nehru National Urban Renewal Mission (JnNURM). The sectors and projects eligible for JnNURM assistance included water supply (including desalination plants) and sanitation, and sewerage and solid waste management and covered 63 identified cities.

In 2008, the National Urban Sanitation Policy (NUSP) was brought out during the United Nations International Year of Sanitation. The policy pertains to management of human excreta and associated public health and environmental impacts. It recognized that integral solutions need to take into account other elements of environmental sanitation, i.e. solid waste management; generation of industrial and other specialized / hazardous wastes; drainage; and also the management of drinking water supply. The NUSP envisaged creation of fully sanitized cities through awareness generation, State sanitation strategies and integrated city sanitation. State sanitation strategies and City Sanitation Plan (CSP) were developed in 2009.

In 2010, the *Nirmal Shahar Puraskar* (Clean Cities Award), designed along the lines of the Nirmal Gram Puraskar, was launched to honour cities that achieve total sanitation, including Open Defecation-Free (ODF) status and 100 percent safe waste disposal. 436 cities

rated themselves in terms of their achievements and processes concerning sanitation in an effort supported by the Ministry of Urban Development with the assistance of several multilateral and bilateral donors. About 40% of the cities were in the "red category" (in need of immediate remedial action), more than 50% were in the "black category" (needing considerable improvement) and only a handful of cities were in the "blue category" (recovering). The rating served as a baseline to measure improvements in the future and to prioritize actions.

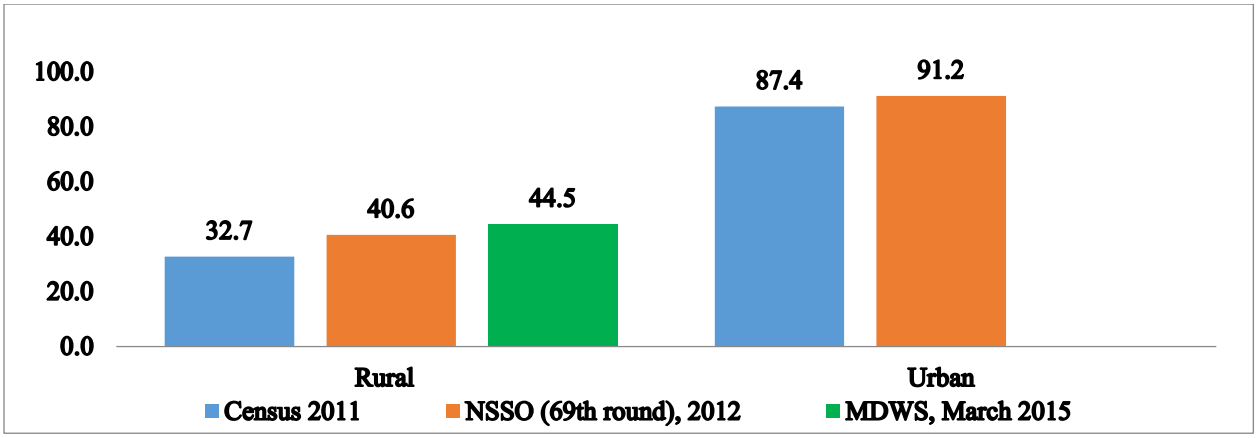
The Ministry of Urban Development has recently published the Swachh Bharat rankings of 476 Class I cities on the basis of the survey conducted during 2014-15. The cities with a population of above one lakh were surveyed for assessing total sanitation practices covering a set of parameters including the extent of open defecation, solid waste management, septage management, waste water treatment, drinking water quality, surface water quality of water bodies and mortality due to water borne diseases etc. and they have been given the ranking accordingly.

Status of Sanitation Coverage

Though sanitation was historically and culturally rooted in India, even today 48% of country's population defecates in the open. Out of the total of one billion people defecating in the open across the world, 59.7% (597 million) reside in India.[4] There is a wide disparity in rural and urban sanitation coverage in the country as depicted in the figure below. As per Census 2011, the rural household toilet coverage stands at 32.7% and urban household toilet coverage stands at 87.4%. Open defecation is linked to the presence or absence of household-level sanitation infrastructure. The Census and sample surveys at the national level do not explicitly ask whether individuals or families defecate in the open. Open Defecation is presumed after all other forms of access to sanitation infrastructure (household toilets, community toilets, public toilets) have been negated. Since a measurement of Open Defecation is not available, except visual verification, the absence of household toilet coverage is presumed to be the percentage of Open Defecation.

[4] Progress on Drinking Water and Sanitation, 2014 Update: UNICEF

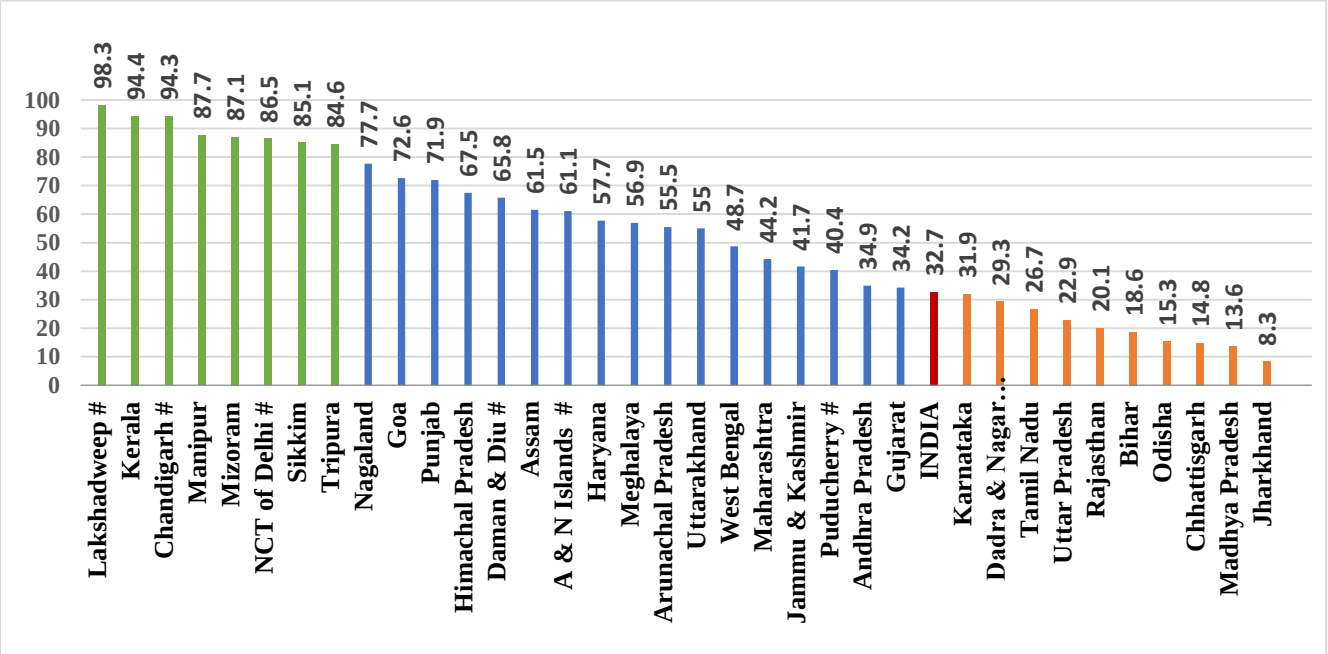
Figure 1: Overall Household Toilets Coverage (In Percentage)



NSSO- National Sample Survey Office;
**MDWS- Ministry of Drinking Water and Sanitation (Baseline survey)*

As per the 1981 Census, rural sanitation coverage was only 1%. Toilet coverage increased from 10% to 20% during 1986-1999. By 2001, only 22% of the rural families had access to toilets. It increased further to 32.7 % by 2011. As per NSSO 2012, toilet coverage in rural areas was estimated at around 40.6%. The State wise rural household toilets coverage is indicated in Figure 2.

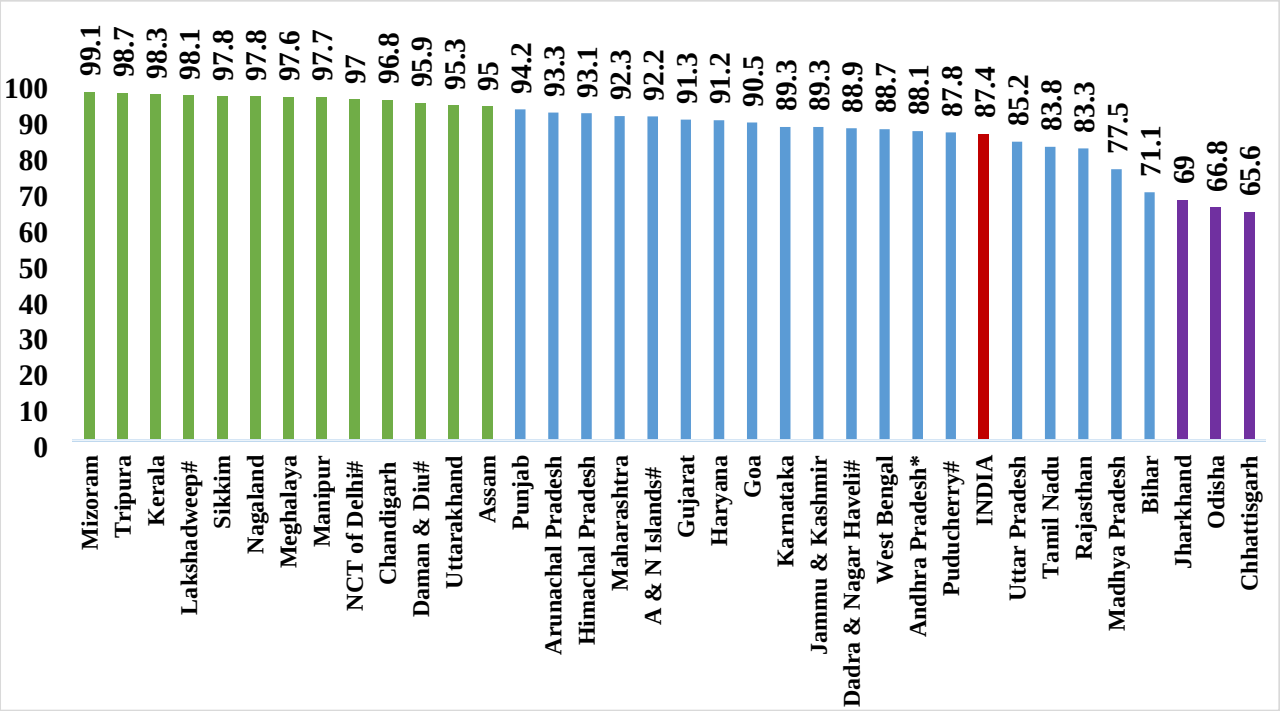
Figure 2: Rural Household Toilets Coverage (In Percentage)



** Andhra Pradesh includes Telangana*
 # Union Territories
Source: Census of India, 2011

The urban sanitation, coverage in 1991 was around 60%. In 2001 Census, sanitation coverage increased to 74%. The overall household coverage increased to 87.4 % in 2011. Open defecation is not only a rural phenomenon but is also prevalent in urban areas. As per Census 2011, nearly 12% of urban households resorted to open defecation and another 8% used public or shared toilet facilities. The problem seems to be even bigger in smaller cities (population below 100,000), with open defecation rate around 22%. The State wise urban household toilets coverage is shown in the figure below:

Figure 3: Urban Household Toilets Coverage (In percentage)



** Andhra Pradesh includes Telangana*
 # Union Territories
Source: Census of India, 2011

Goal of Swachh Bharat Mission: Sanitation

The Swachh Bharat Mission (SBM) aims at elimination of Open Defecation and transition from the current status of 48% open defecation to Open Defecation Free Status.

Issues

The issues and challenges in effecting this transition within the next few years are inducing a behavioural change among people, developing sustainable revenue models for maintenance of community and public toilets, revival of dysfunctional toilets and elimination of manual scavengers.

Behaviour Change

The Sub-Group felt that Behaviour Change is the core of Swachh Bharat Mission since access alone does not translate into usage. Provision of sanitation facility alone may not lead to complete elimination of Open Defecation. There is a need for a strong behavioural change among people which will induce them to use toilets as a habit and resist open defecation. Providing access to toilets and changing the habits are therefore equally important. As seen in the previous section, earlier programmes of the Central Government for increasing sanitation coverage focussed on construction of toilets. Though IEC component was part of the programmes, the thrust has not been that strong enough.

The SBM realises that sanitation coverage can be improved by generating the demand for it and hence behaviour change is the heart and soul of this programme. Bringing about a transformation in habits requires formulation of policies which recognises the essence of behavioural approach. It is seen that the design and implementation of development policies and interventions that target human choice and action (behaviour) can be improved by paying attention to how humans think (the processes of mind) and how history and context shape thinking (the influence of society).[5]

The Swachh Bharat Mission includes construction of individual household latrines, school sanitation, sanitation facilities at the Anganwadi Centres and community sanitary complexes. The success of an ODF programme will be measured by increased toilet usage and not toilet construction alone. The patterns of toilet usage and sanitation behaviour indicate that social, cultural and allied factors connected to the sanitation chain have a greater impact on the sanitation behaviour rather than the presence or absence of a toilet. Various references have been found to substantiate this behaviour.

The J-PAL Evaluation of Total Sanitation Campaign in Madhya Pradesh indicates:
Open defecation is practiced in spite of having IHHL because of "culture, habit, or preference for defecating in open."

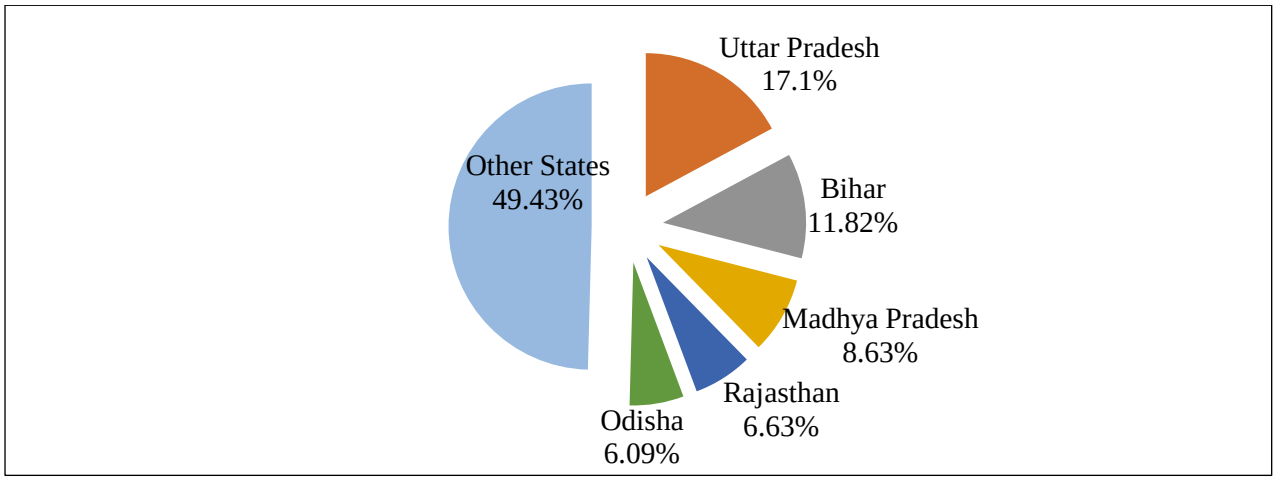
[5] World Development Report, 2015: Mind, Society and Behaviour, World Bank, 2015

UNICEF's website for Eliminating OD in India claims:

"Society does not view the lack of a toilet as unacceptable. Building and owning a toilet is not perceived as aspirational. Construction of toilets is still seen as the government's responsibility, rather than a priority that individual households should take responsibility for. The challenge is to motivate people to see a toilet as fundamental to their social standing, status and well-being."

The Sanitation Quality, Use, Access and Trends (SQUAT) survey conducted in five States of North India (Bihar, Haryana, Uttar Pradesh, Madhya Pradesh and Rajasthan) show that there is a 'revealed preference' for open defecation. The report indicates that *"Of people who defecate in the open, 47% explain that they do so because it is pleasurable, comfortable, or convenient... Many respondents told us that defecating in the open provides them an opportunity to take a morning walk, see their fields, and take in the fresh air."*

Figure 4: Major States contributing to Open Defecation
(as a percentage of total open defecation in the country)



Source: Census of India, 2011

It was found that people who had toilets built with government support are more than twice likely to defecate in the open as compared to the people whose toilets were privately constructed. A modelling done to assess the efficacy of providing 100% government constructed latrine to all households not having toilets predicts that in the four focus States of the SQUAT survey, person level open defecation would only fall from the observed 70% to a predicted 51%.

The focus on behaviour change is therefore as crucial as the construction of toilets for achievement of open defecation free status. Further, it is essential to instil in people the importance of general cleanliness so that littering of waste is reduced. Understanding the importance of segregation of waste is also essential for the effective processing of waste.

Box 2: ODF Success Story: A Case of Nadia District, West Bengal

The district administration of Nadia district in West Bengal launched the "Sabar Shouchagar" Movement to make the district open defecation free in 2013. At the start of the Movement, there were about 10.40 lakh households in the district, of which nearly 33% (3,39,881) did not have toilets. The campaign was evolved with a dual focus of ensuring universal access to latrines and ensuring behaviour change away from open defecation. The programme was launched in July 2013 with "Nadia Sanitation Day", and initially piloted in 17 Gram Panchayats of 17 rural blocks. In October, 2013, the model was rolled out to all 187 Gram Panchayats in the district. The final achievement was construction of 3,55,609 household toilets, 175 community toilets, 516 toilets in brick fields , 116 toilets for dhabas, and 73 cluster toilets. In April, 2015 Nadia district was declared, the first Open Defecation Free (ODF) district in the after launching of the Swachh Bharat Mission in October 2014.

Under the movement, elected representatives in the Panchayats across the district were mobilised and oriented to the key elements of the movement in extensive three-tier training programmes. By-laws for each Gram Panchayat were devised wherein defecating in the open was punishable. Every Monday, pledges were taken in all schools against defecating in the open. Awareness and training programmes were held for the faith leaders, who were also roped in as change agents for the movement. Anganwadi Workers were roped in for a 'catchment area approach', promoting the health and hygiene benefits to the people. There are 48 women's groups functioning as sanitary marts with the help of SHGs and their clusters for service delivery, thereby generating livelihood opportunities for them. The district undertook a number of IEC and community-based activities to bolster the visibility of the movement in the district. Overall, the movement has reported improved health indices, reduction in water borne diseases, empowerment of women through greater participation and increased livelihood opportunities, collective behaviour change among communities towards toilet use, and decentralised institutional capacity for sanitation programme service delivery.

It has been found that a focussed and intense behaviour change communication (BCC) is necessary for the SBM. Examples of successful examples of South East Asian nations, like Bangladesh, Sri Lanka and Vietnam were observed. The open defecation in these countries are 3%, 0% and 2% respectively (UNICEF Data, May 2014).

Experiences in these countries show that toilet construction was not entirely supported by Government funds. There was involvement of community and local people and toilet construction resulted more through demand generation than subsidy linked support. Community mobilisation, involving self-help groups and local government leadership were instrumental in spreading sanitation coverage. The mode of funding, allocation pattern and innovative funding models were also found to be instrumental in the success of the sanitation campaign. In Bangladesh, almost 25% of the total funds for sanitation programme were earmarked for promotional activities. There was also flexibility in fund allocation as per the need of the community.

The case of innovative funding model worked in case of Sri Lanka. The funding model was a revolving loan fund where financial support was provided through a credit facility. Seed money was provided to the community based organizations from which they provided loans to prospective beneficiaries. Involvement of professional agency like World Bank and well-designed strategy has been an important factor in the successful behaviour change campaigns. Participation of local people in building the toilets and procuring locally available raw materials also inculcated a sense of participation among the communities.

The World Development Report, 2015 cites that the Community Led Total Sanitation (CLTS) Programmes were found to decrease open defecation by 7 percent and 11 percent from very high levels in Indonesia and India respectively. Additional findings suggest that CLTS can complement, but perhaps not substitute for, resources for building toilets.

Box 3: Swachh Bharat-Lessons from Mizoram

Mizoram has over 80% coverage in individual household toilets. The State is largely free from the problem of open defecation. The reason for a rather high standard of cleanliness in Mizoram is embedded in its tradition. The Mizo society has been practicing *Tlawmngaihna* – a shared value which places the well-being of community ahead of one's own needs. The Chief would, as and when required, call for '*Hnatlang*' or community service in which all the able bodied people would participate as an obligation towards the society. The '*Hnatlang*' could be for cleaning the village streets or constructing houses for the destitute or helping families hit by fire, landslide etc. If due to some reason a household could not take part in the '*Hnatlang*', it would be obliged to pay '*Phatna*', or 'exemption fee' in kind or in cash, which would go into a community fund. Mizoram state has 8 districts and 3 Autonomous District Councils (ADC). The only urban local body of the State i.e. Aizawl Municipal Council looks after the sanitation of Aizawl city with the help of various Local Councils. Sanitation in the 5 district headquarters townships of Champhai, Kolasib, Serchhip, Lunglei and Mamit is looked after by the Department of Urban Development & Poverty Alleviation. In the rural areas the sanitation is the responsibility of duly elected Village Councils with the help of sanitation committees under the umbrella of Public Health Engineering Department. The headquarters townships of the 3 ADC areas are looked after by the respective ADCs – Mara ADC in Saiha, Lai ADC in Lawngtlai and Chakma ADC in Chawngte. The '*Clean Zarkawt Committee'* looks after sanitation work for Zarkawt market in the heart of Aizawl City to keep the market area clean. The role played by the Mizo Youth Association (MYA) was crucial in maintaining cleanliness in the State.

Telling people that there is a way to improve their health is barely sufficient to change behaviour. In general, successful health promotion campaigns engage people emotionally and activate or change social norms as much as they provide information. Successful campaigns address many or most of the following: information, performance, problem solving, social support, materials, and media. A campaign should tell people that a behaviour will improve their health (information), demonstrate and model the behaviour (performance), reduce barriers to its adoption (problem solving), create a system for supporting people who choose to adopt it (social support), provide the materials necessary to begin adoption (materials), and provide a background of support through in-person, print, radio, television, and other approaches (media).[6]

[6]World Development Report, 2015: Mind, Society and Behaviour, World Bank 2015

Challenge: The SBM recognises that to achieve Open Defecation Free status, a rigorous approach towards spearheading behavioural change is required within the span of the programme period. The challenge is to design an effective strategy which will change the age old habits and practices which stand in the way. The message has to reach nook and corner of the country and be strong enough to effect the change which the earlier programmes could not successfully achieve.

Operation and Maintenance

The success of the Swachh Bharat Mission depends upon the sustainability of the mission which rests heavily on the operation and maintenance (O&M) of facilities constructed or developed under this mission. Sustainability requires that O&M of the facilities are carried out till the facility is in use. Sustainable O&M requires planning and budgeting to carry out the necessary tasks.

The Sub-Group deliberated this issue and felt that the challenge in O&M of community and public toilets is the revenue generation for the O&M activities and entrusting of responsibility to the Government, Private sector, PPP arrangement or the Community. The O&M costs of community/public toilets should be fully covered by revenues. Major O&M costs include desludging, facility maintenance (plumbing repairs, painting, consumables, water and electricity etc.) and the wage of the attendant.

The issue of community and public toilets would have to be handled in a different manner. O&M activities, which encompass not only technical issues, but also managerial, social, financial and institutional issues, must be directed towards the elimination or reduction of the major constraints which prevent the achievement of sustainability. Many failures are not technical ones. They may result from poor planning, inadequate cost recovery, or the outreach inadequacies of agencies.

The Sub-Group felt that for O&M of community and public toilets in rural and urban areas, separate revenue models are required. O&M of Community toilets, which are provided to meet the basic needs of poor residential areas, in rural areas was a matter of concern due to limited recourse for revenue generation.

Challenge: The challenge is to develop sustainable revenue models for the operation and maintenance of Public and Community toilets with proper planning for rural, urban and slum areas due to different socio-economic conditions and limited space. The huge task is to inculcate a sense of responsibility and ownership in case of community toilets. For public toilets, the challenge is to find the entity which will take up this responsibility and find adequate sources of revenue generation for keeping it clean and usable. Implementing the pay and use model is a big challenge.

Revival of dysfunctional toilets

The visible improvement in toilet coverage across Indian states is deeply undermined by the poor quality of operation and maintenance of these facilities. Besides this, weak management and poor water availability inside toilets also led to their dysfunctional status. The number of rural households with defunct or dysfunctional toilets are 1.39 crore out of total 7.41 crore household toilets as per the All India Baseline survey conducted by Ministry of Drinking Water and Sanitation in 2012-13. It is seen that the financial assistance provided under the previous Government programmes was inadequate and led to improper construction of toilets which slowly became dysfunctional. The incentive provided ranged from Rs.500/- in 2004 to around 3,200/- in 2011. In 2012, the assistance was enhanced to Rs.4,600/- and also an additional assistance from the MGNREGA programme amounting to Rs.5,400/- was provided. The financial assistance being provided under SBM for construction of toilets for rural and urban areas is Rs.12,000/- and Rs.4,000/- respectively.

Challenge: The main challenge in achieving ODF status by October 2, 2019 is reviving the dysfunctional toilets by providing adequate funds. The current focus of the SBM is towards construction of new toilets. However, there are a large number of dysfunctional toilets which also need to be made functional. The challenge is to find the sources of funding and amount of support to be extended.

Manual Scavenging

The widespread presence of insanitary toilets and single pit toilets is singled out as the primary reason for prevalence of the practice of manual scavenging, despite it being prohibited under law. Manual scavenger means a person engaged or employed by an individual or a local authority or an agency or a contractor for manually cleaning, carrying, disposing of, or otherwise handling in any manner, human excreta in an insanitary latrine or in an open drain or pit into which the human excreta from the insanitary latrines is disposed of, or on a railway track.

The practice of manual scavenging was outlawed under the Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993. Later, the Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act, 2013, strengthened the cause against this dehumanising practice with added provision for higher penalties, rehabilitation of manual scavengers and their family members, prohibiting construction of insanitary latrines and proscribing employment, either directly or indirectly, of manual scavengers and hazardous cleaning of sewer and septic tanks. In the case of existing insanitary latrines, the Act directs either demolition of such structures or converting them into sanitary latrines. Under the new law, responsibilities were set for each local authority, cantonment board and railway authority for conducting survey of manual scavengers and insanitary latrines falling under their jurisdiction.

However, despite the Act, insanitary latrines are still in existence. As per the House Listing and Housing Census Data, 2011, the prevalence of insanitary latrines is widespread in rural areas with 5,86,067 households still using such latrines where night soil is removed by manual scavengers, compared to 2,08,323 households using these in urban areas. State such as Uttar Pradesh, Jammu and Kashmir, West Bengal, Tamil Nadu, Andhra Pradesh (including Telangana) Maharashtra and Assam together contributed to nearly 72 percent of insanitary latrines in the country. The recent data released under Socio Economic and Caste Census, 2011, shows that 1,80,657 people in rural areas are still employed as manual scavengers. States with highest number of manual scavengers include Maharashtra (63,713), Madhya Pradesh (23,093), Uttar Pradesh (17,619), Tripura (17,332), Karnataka (15,375) and Punjab (11,949).

The Swachh Bharat Mission does recognise that this dehumanising practice needs to be eliminated and both the urban and rural components provide for measures to achieve this objective. The Swachh Bharat Mission (Urban) includes conversion of insanitary latrines into

pour-flush toilets by making all households with single pit and insanitary toilets as the target group of the Mission, while ensuring that no new insanitary toilets are constructed in future. Under the Mission strategy, the State Governments shall identify all manual scavengers in urban areas, upgrade insanitary toilets linked to their employment to sanitary toilets and provide adequate rehabilitation. Similarly, the Swachh Bharat Mission (Rural) prohibits construction of 'insanitary latrines' while suggesting conversion of existing 'insanitary latrines' if any, to sanitary latrines and the sharing pattern for incentive for the targeted beneficiaries to be made identical to that of construction of individual household latrines.

Challenge: The challenge in this regard is strict enforcement of the Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act, 2013. It is also important to convert all insanitary latrines to sanitary latrines so that the requirement for manual scavengers does not arise.

II. Waste Management

Waste solid or liquid is a severe threat to the public health concern and cleanliness. Improper disposal of solid and liquid waste are leading to vector borne diseases such as diarrhoea, Malaria, Polio, Dengue, Cholera, Typhoid, and other water borne infections such as schistosomiasis. The time has now come to move onward to a "Sanitation Plus" drive to holistic waste management.

Solid waste can be defined as the organic and inorganic waste materials produced by households, commercial & industrial establishments that have no economic value to the owner. Solid waste can be classified as biodegradable (e.g. Kitchen waste, animal dung, agricultural waste etc. and non-biodegradable (e.g. plastic, paper, old cloth tetra packs, carbon paper, thermo coal)

Municipal Solid Waste:

Municipal Solid Waste Management (MSWM) is an essential and obligatory function of the Urban Local Bodies. The policy interventions by Government of India in this sector can be traced to as early as 1960s when the Ministry of Food and Agriculture provided loans

for composting of solid waste. However, focused policy action in the sector gained momentum since mid-1990s in the aftermath of the plague outbreak in Surat. In 1995, the J. L. Bajaj Committee set up by the Planning Commission made wide ranging recommendations including waste segregation at source, primary collection, levy of user charges, use of appropriate equipment and vehicles, focus on landfills and composting, encouraging Private Sector Participation on a pilot basis. Around the same time, the Ministry of Health and Family Welfare initiated a National Mission on Environmental Health and Sanitation. The Central Public Health and Environmental Engineering Organisation (CPHEEO) under the Ministry of Urban Development also prepared a draft policy which dealt with funding issues and requirements for MSWM. The late 1990s also saw an increase in the role of private sector in composting and waste treatment plants and a significant public interest in the sector as noticed by the large number of Public Interest Litigations (PILs) relating to MSWM. In the context of the growing PILs, the Supreme Court set up the Asim Burman Committee with members drawn from Municipal Corporations and Ministries of the Government of India. This Committee submitted its report in March, 1999 and made wide-ranging recommendations on institutional, financial, health and legal aspects of MSWM.

In 2000, the Municipal Solid Waste (Management and Handling) Rules, 2000 (MSW Rules) were notified by the Ministry of Environment & Forests (MoEF) making it mandatory for ULBs to improve their waste management systems in a timeframe ending 31st December, 2003. The MSW Rules have assigned responsibilities for ULBs, State Governments and Central & State Pollution Control Boards for different aspects of MSW management. While the rules make ULBs responsible for their implementation and for any infrastructure development relating to collection, storage, segregation, transportation, processing and disposal of municipal solid wastes, they entrust waste generators with the responsibility to avoid littering. For managing other types of waste like e-waste, plastic waste and bio-medical waste, rules have been notified by the Government of India to manage and handle such wastes. Construction & Demolition (C&D) waste finds a brief mention in Schedule III of the Municipal Solid Waste (Management and Handling) Rules, 2000 for separate collection. The Manual on Municipal Solid Waste Management (2000) of Ministry of Urban Development includes a chapter on C&D waste which provides some basic guidelines on handling of C&D waste.

The High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, 2011 noted that although the generation of

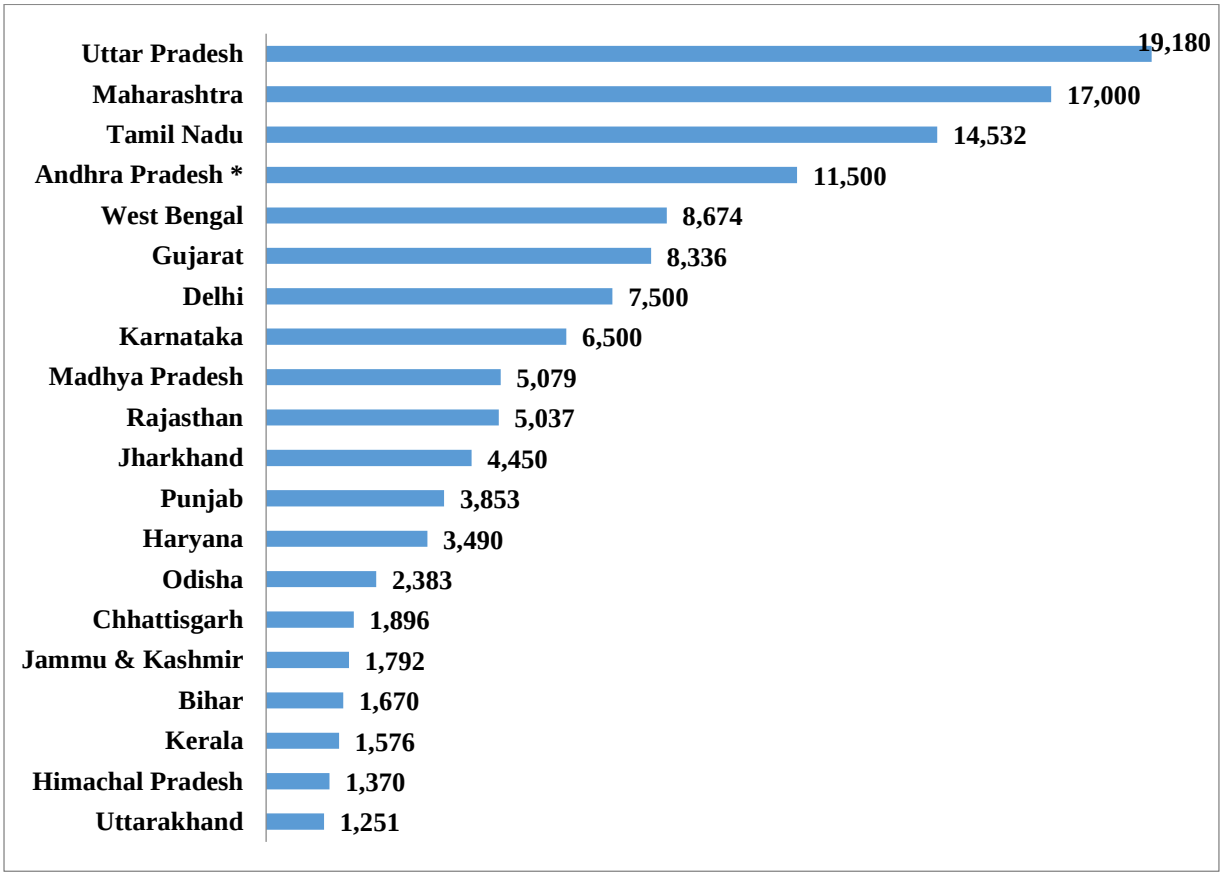
solid waste is at much lower rates than in most countries, the management and disposal of solid waste generated in Indian cities leaves a great deal to be desired. The distribution of the expenditure is heavily loaded in favour of collection and transportation, and little attention is paid to processing and scientific disposal of the waste. The committee estimated Rs. 48,000 crore of investment for solid waste management over a period of twenty years (2012-2031).

The Task Force on Waste to Energy, constituted by the Planning Commission, in its report submitted in 2014 also analysed the issue of waste management in detail and recommended an integrated waste management system. The Report suggested technological options for processing of waste on the basis of the quality of waste and quantum of population. It estimated that untapped waste has a potential of generating 439 MW of power from 32,890 TPD of combustible wastes including Refused Derived Fuel (RDF), 1.3 million cubic metre of biogas per day or 72 MW of electricity from biogas and 5.4 million metric tonnes of compost annually to support agriculture.

Quantum of Municipal Solid Waste

According to MSW Rules 2000, MSW includes commercial and residential wastes generated in a municipal or notified area in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes. There have been varying estimates regarding the quantum of waste generation in the country. As per 2011 census, the 377 million people living in 7,935 urban centres generate 1,70,000 tonnes per day (TPD) and 62 million tonnes of MSW per year, based on an average per capita generation of 450 gm. per person per day. The Central Pollution Control Board (CPCB) Annual Report, 2013 has reported that 1,33,760 metric tonnes of waste is generated daily in urban areas in the country. The Energy and Resources Institute (TERI) has estimated that by 2047, waste generation in Indian cities will increase five-fold to touch 260 million tonne per year, implying that the current solid waste generation is over 50 million tonne per year. A study by the World Bank (2006) puts India's annual generation of municipal solid waste to be somewhat lower, i.e.in the range of 35 to 45 million tonne, amounting to about 1,00,000 to 1,20,000 metric tonne every day. It has been estimated that the annual increase in overall quantity of solid waste in India's cities will be at a rate of 5 percent per annum. The estimated waste generation in Indian cities is as follows:

Figure 5: Estimated Municipal Solid Waste Generation in India, 2012
(in metric tonnes/day)



Source: Report of Task Force on Waste to Energy, 2014
** Andhra Pradesh includes Telangana*
Note: Municipal Solid Waste in Metric Tonnes/day for top 20 States/UTs which together constituted nearly 97% of total MSW generated in 2012.

As per CPCB report of 2012-13, out of the 1,33,760 metric tonnes per day of MSW generated daily, only 91,152 TPD waste is collected and 25,884 TPD treated. The MSW, therefore, dumped in low lying urban areas is a whopping 1,07,876 TPD, which needs 2,12,752 cubic meter space every day and 776 hectare of precious land per year.

The CPCB Annual Report 2013 reveals that only 68% of the MSW generated in the country is collected of which, 28% is treated by the municipal authorities. Thus, merely 19% of the total waste generated is currently treated. The remaining waste is disposed of at dump sites / landfill sites untreated.

The collection efficiency ranges between 70 to 90% in major metro cities, whereas in several smaller cities it is below 50%. It has been estimated that the ULBs spend about Rs. 500 to Rs.1500 per tonne on solid waste collection, transportation, treatment and disposal. About 60-70% of this amount is spent on collection, 20-30% on transportation, and hardly any fund is spent on treatment and disposal of waste.

Waste composition

Studies conducted by National Environmental Engineering Research Institute (NEERI) show that waste composition has changed rapidly during 1996-2011 and the proportion of high calorific value waste is increasing. The change in composition of waste is illustrated below:

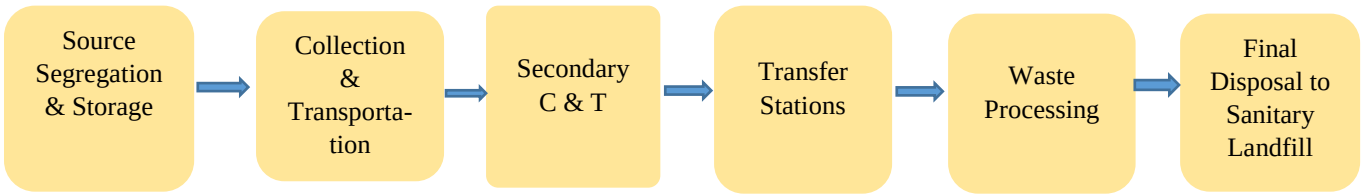
Table 2: Composition of Solid Waste in India

Year	Composition (In Percentage)							
	Biodegradable	**Paper**	**Plastics**	**Metal**	**Glass**	**Rags**	**Others**	**Inerts**
1996	42.21	3.63	0.60	0.49	0.60	Nil	Nil	45.13
2005	47.43	8.13	9.22	0.50	1.01	4.49	4.016	25.16
2011	42.51	9.63	10.11	0.63	0.96	-	-	17.00

Source: Report of Task Force on Waste to Energy, 2014

Municipal Solid Waste Management Chain

Municipal Solid Waste Management (MSWM) refers to a systematic process that comprises of waste segregation and storage at source, primary collection, secondary storage, transportation, resource recovery, processing, and final disposal of solid waste.



The processing of waste results in following by-products: (i) Compost is derived from processing of the organic component of waste and is used as manure (ii) Refuse Derived Fuel or RDF is prepared from the combustible portion of MSW and can be used in cement industry and waste to energy plants (iii) Waste processing yields an important source of fuel for power generation through biogas and also directly by setting up waste to energy plants (iv) Bricks, tiles and other construction aggregates can be made from the Construction and Demolition waste and (v) Methane recovered through landfill is also a source of energy. Landfill gas extraction systems add to climate change initiatives as it helps in reducing greenhouse gas emissions through avoidance of landfill gas (mainly comprising of methane) into the atmosphere.

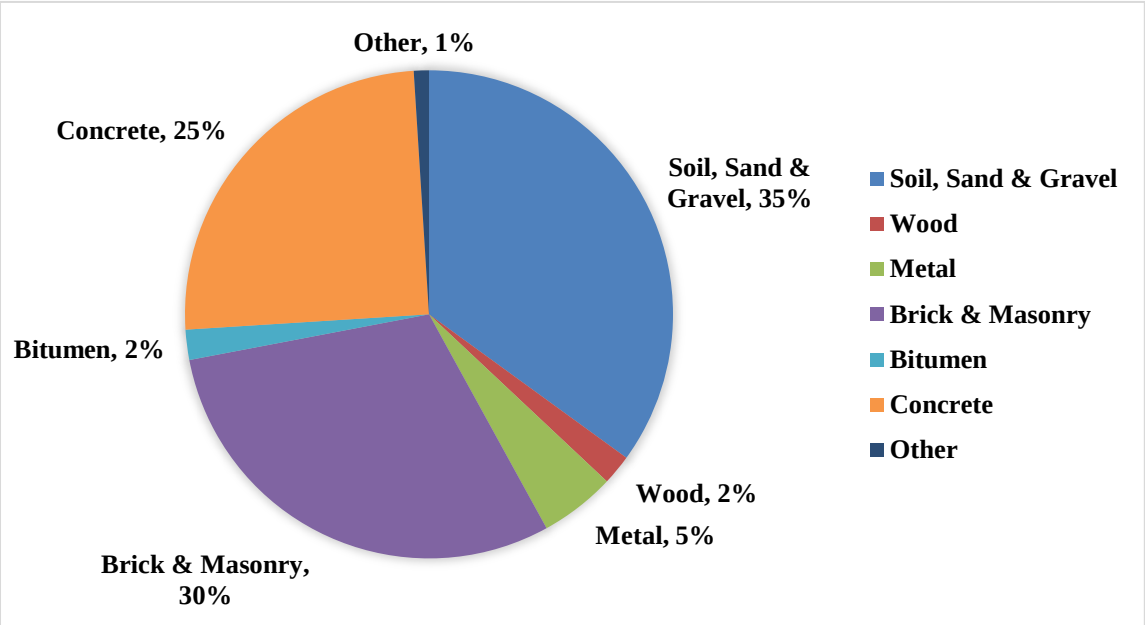
Construction & Demolition Waste

Construction and Demolition (C&D) debris is defined as the waste material produced in the process of construction, renovation or demolition of structures (both buildings and roads). In addition, it includes the materials generated as a result of natural disasters.

Components of C&D debris include materials such as concrete, asphalt, wood, brick, metals, wallboard, and roofing shingles. Demolition wastes are much larger in volume than the construction wastes. Construction and demolition waste can be classified into two components; major components include cement concrete, bricks, cement plaster, steel from RCC, doors & windows, roofing support systems, rubble, stones, timber etc. and minor components include conduits, GI pipes/Iron pipes/Plastic pipes, electrical fixtures, panels, glass etc.

Construction and Demolition Wastes generally constitute upto 10-20 per cent of all solid waste. However, latest estimates regarding the quantum of C&D waste generated in India is not available. Even the Performance Audit of "Management of Waste in India" by Comptroller and Auditor General (CAG) in 2008 noted that "No estimates or even guesstimates exist for construction and demolition waste" in the country. As per estimates of the Technology Information, Forecasting and Assessment Council (TIFAC) 2000, the total quantum of C&D waste generated in India is estimated to 11.4 to 14.69 million tonnes per annum. The Ministry of Urban Development in 2000 estimated that 10-12 million tonnes of C&D waste is generated annually. The Ministry of Environment and Forests report of 2010 also states the same quantum. However, as per some recent estimates around 25 to 30 million tonnes of C&D waste is generated annually and only less than 5% of the waste is processed.

Figure 6: Various Constituents of Construction Waste



Source: Utilization of Waste from Construction Industry, Technology Information, Forecasting and Assessment Council, Department of Science and Technology, Government of India (2000)

e-waste

As per the preliminary estimates of Central Pollution Control Board (CPCB), annual e-waste generation in India was estimated to be 0.8 million tonnes (2012). According to a recent study on "Electronic Waste Management in India" conducted by ASSOCHAM (The Associated Chamber of Commerce & Industry of India), eight largest States generating e-waste in India are Maharashtra, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, Delhi, Gujarat, Karnataka and West Bengal. Of the total e-waste generated in India, approximately 1.5% is recycled by formal recyclers and institutional processing and recycling. 90.5% is handled by the informal sector and rest 8% goes to landfills. e-waste accounts for approximately 40% of lead and 70% of heavy metals found in landfills. This leads to ground water contamination, air pollution and soil acidification. High and prolonged exposure to chemicals/pollutants emitted during unsafe e-waste recycling is hazardous to health. The study states that 76% of e-waste workers are suffering from respiratory ailments due to improper safeguards.

Bio-Medical Waste

Bio-Medical waste is defined as waste generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals. The expansion of health care and medical facilities in India has led to a rise in bio-medical waste generation, which has emerged as a threat to human health and safety. As of 2013, the amount of bio-medical waste generated per day in India was 4.84 lakh kg and the major States contributing to bio-medical waste generation in the country are Karnataka, Maharashtra, Kerala, West Bengal and Tamil Nadu.

Plastic waste

Though, there is no authentic estimation of annual plastic waste generation in India, assuming 70 percent of total plastic consumed ends up as waste, approximately 5.6 million tonnes of waste plastic are generated annually. With 15,342.46 tonnes of plastic waste being generated daily, only 9,205 tonnes /day (60 percent by weight) is collected, while the remaining 6,137 tonnes/day remains uncollected and littered. A study conducted by Central Pollution Control Board (CPCB) and Central Institute of Plastics Engineering and Technology (CIPET), Allahabad, on assessment and quantification of plastic waste generation in major 60 cities in India, found that 3501 tonnes of plastic waste is generated every day, with four big metros being the major contributors. Delhi was the highest producer

with 689.5 tonnes/day, followed by Chennai (429.4 tonnes/day), Kolkata (425.7 tonnes/day) and (Mumbai 408.3 tonnes/day).

Sanitation: Liquid Waste

Used and unwanted water is called waste water. Untreated urban sewage is considered by far the largest source of surface water pollution in India. Liquid waste generated in toilets containing faeces, urine and flush water is termed as 'Blackwater' waste or 'sewage' waste having harmful pathogens. Waste generated in kitchen, bathroom and during laundry is called 'Greywater' waste or 'sullage'. It may also contain pathogens. Creation of sewerage infrastructure for sewage disposal is the responsibility of the State Governments/Urban Local Bodies.

Effective liquid waste management is an essential element of a complete sanitation solution for a city or town. Liquid waste management can be defined as a systematic administration of activities that provide for the proper handling, treatment and disposal of waste water or sewage. Improper disposal of sewage can lead to contamination of surface water, ground water and soil and can have serious health implications.

The Water (Prevention and Control of Pollution) Act, 1974 was enacted with the primary objective of prevention and control of water pollution and restoration of water quality. The legal and institutional provisions have been made in Water (Prevention and Control of Pollution) Act, 1974 wherein standards are developed and enforced for treatment of municipal wastewater by Pollution Control Boards/Pollution Control Committees.

To tackle the problem of sewage treatment, the Central Government launched the Ganga Action Plan in 1985, releasing central funds to cities along the river Ganga for construction of Sewage Treatment Plants (STPs). Subsequently, Action Plans for other rivers were also taken up and in 1995, these separate programmes were merged under the National River Conservation Plan (NRCP). A National River Conservation Directorate was set up under the Ministry of Environment and Forests (MoEF) to manage the programme. Similar to the NRCP, the MoEF also administered the National Lake Conservation Plan (NLCP) and the National Wetland Conservation Programme (NWCP), which included sewage treatment infrastructure to protect important lakes and wetlands. In 2013, the two schemes were merged into an integrated scheme, the National Plan for Conservation of Aquatic Ecosystems (NPCA). Sewage treatment was also addressed under JnNURM.

The National Urban Sanitation Policy (NUSP) of 2008 addresses reuse of wastewater as an important factor in helping to meet the environmental targets of the city. The NUSP recommends the Service Level Benchmarks defined by the Ministry of Urban Development (MoUD) which is a minimum of 20% reuse of wastewater in every city. The National Water Policy of 2012 encourages recycling and reuse of water after treatment to specified standards as well as preferential tariffs that incentivize treated wastewater over freshwater.

Quantum of Liquid waste: Sewage

Currently, there is no official account of sewage waste generated or treated in our cities, as there are different ways in which people source and dispose water. However, there are rudimentary ways to estimate sewage.[7] Centre for Public Health and Environmental Engineering Organisation has estimated that about 70-80% of total water supplied for domestic use gets generated as wastewater. As per CPCB (2009) estimates, major cities in India generate an estimated 38,354 million litres per day (MLD) sewage, however the sewage treatment capacity is only of 11,786 MLD. The major States contributing to sewage generation are Maharashtra, Uttar Pradesh, Delhi, West Bengal and Andhra Pradesh (including Telangana).

The 498 Class I cities (with population over 1,00,000), which account for 93% of the urban sewage generated in the country, have a combined treatment capacity of about 32% of generation, while the 410 Class II towns (population between 50,000 and 1,00,000) have a combined treatment capacity of only 8% of their generation. However, as per 2010 report of Centre for Science and Environment (CSE), the effective treatment capacity is only 19% of total sewage generation compared to an installed capacity of 30%.

Legal and Regulatory Framework for Waste Management

Article 243 W of the Constitution of India specifies the powers, authority and responsibility of the municipalities to carry out functions listed in the 12th Schedule which inter alia includes solid waste management, public health, sanitation conservancy and protection of environment, safeguarding interests of weaker sections and urban poverty alleviation. The Environment (Protection) Act (EPA), 1986 is the umbrella Act that pertains to management of wastes in the country. Ministry of Environment and Forests (MoEF) has enacted rules under EPA that govern the management of all kinds of waste in India like the

[7] Twelfth Five Year Plan (2012–2017) Faster, More Inclusive and Sustainable Growth, pp-163, Planning Commission

Municipal Solid Waste (Management and Handling) Rules, 2000; Plastic Waste Management Rules, 2011; Biomedical Waste (Management and Handling) Rules, 1998 amended in 2011; e-Waste (Management and Handling) Rules, 2010 amended in 2011; The Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules, 2008 etc.

Municipal Solid Waste (Management and Handling) Rules, 2000

The Municipal Solid Waste (Management and Handling) Rules, 2000 notified by the Ministry of Environment & Forests (MoEF) made it mandatory for ULBs to improve their waste management systems in a timeframe ending 31st December, 2003. The MSW Rules have set responsibilities for ULBs, State governments and Central & State pollution control boards for different aspects of MSW management. The rules make ULBs responsible for the implementation and for any infrastructure development relating to collection, storage, segregation, transportation, processing and disposal of municipal solid wastes. The rules also entrust waste generators with the responsibility to avoid littering. To improve the system, the following seven directions were given:

(i) Prohibit littering on the streets by ensuring storage of waste at source in two bins: one for biodegradable waste and another for non-biodegradable waste.
(ii) Primary collection of biodegradable and non-biodegradable waste from the doorsteps at pre-informed time on a day-to day basis using containerized tricycles/handcarts/pick-up vans.
(iii) Street sweeping covering all the residential and commercial areas on all the days of the week irrespective of Sundays and holidays.
(iv) Abolition of open waste storage depots.
(v) Transportation of waste in covered vehicles on a day-to-day basis.
(vi) Treatment of biodegradable waste using composting or waste to energy technologies meeting the standards laid down.
(vii) Minimize the waste going to the landfill and dispose of only rejects from the treatment plants and inert material at the landfills as per the standards laid down in the rules.

Plastic Waste (Management and Handling) Rules, 2011

The Ministry of Environment and Forests, has notified the rules regarding management and handling of plastic waste in the country. The State Pollution Control Board and Pollution Control Committee in respect of Union Territories will enforce the provisions of the rules related to authorization, manufacture, recycling and disposal.

The function of enforcement of the provision of the rules relating to the use, collection, segregation, transportation and disposal of post-consumer plastic waste has been assigned to the municipal authority. The municipal authority shall also be responsible for setting up, operationalising and coordination of waste management system and performing associated functions related to safe collection, storage, segregation, transportation, processing and disposal of plastic waste, ensuring that such activities are performed in an environmentally sound manner. The authority will also set up plastic waste collection centres involving manufacturers and ensure waste is channelized to recyclers and also engage with agencies or groups working in waste management including waste pickers, thus ensuring that the residues generated from recycling processes are disposed of in compliance with Rules under the Environment (Protection) Act, 1986.

The municipal authority shall encourage use of plastic waste by adopting suitable technology such as in road construction, co-incineration etc. The rules also state the conditions to be fulfilled during the course of manufacturing, stocking, distribution, sale, and using of carry bags and sachets. Guidelines with regard to registration of producers, manufactures and recyclers, and marking and labelling of plastic bags and multi-layered packaging have also been specified.

In order to encourage users to reuse plastic bags and minimise waste generation, the rules require concerned municipal authority to determine the minimum price for carry bags. A State Level Advisory Body shall be constituted to monitor the implementation of these rules. Each State Pollution Control Board or Pollution Control Committee shall prepare and submit the annual report to the Central Pollution Control Board (CPCB), while a consolidated report will be prepared by the CPCB on use and management of plastic waste and forwarded to the central government.

e-waste (Management and Handling) Rules, 2011

The Ministry of Environment and Forests notified the e-waste (Management and Handling) Rules, 2011, which fixes the responsibility for producers of electrical and electronic equipment to collect e-waste generated during manufacturing process and channelize it for recycling and disposal.

The rules define e-waste as waste generated from electrical and electronic equipment, whole or in part or rejects from their manufacturing and repair process, which are intended to be discarded. Recognising that there are various stakeholders in the process of e-waste

management, the rules have set specific responsibilities for producer, consumer or bulk consumer, collection centre, dismantler and recycler of e-waste, which are involved in the manufacture, sale, purchase, and processing of electrical and electronic equipment or components. Based on the principle of 'Extended Producer Responsibility', the main responsibility of e-waste management has been placed on the producers of the electrical and electronic equipment, whereby the producer of electrical and electronic equipment shall be responsible to collect e-waste generated from the end of life of their products and ensure that such e-wastes are channelized to registered dismantler or recycler.

In order to reduce the use of hazardous substances in electrical and electronic equipment, the rules provide specific thresholds for use of hazardous material such as lead, mercury, cadmium, chromium etc. in the production of electrical and electronic equipment. Every producer of electrical and electronic equipment, collection centre, dismantler and recycler of e-waste shall obtain an authorization from the State Pollution Control Board or Pollution Control Committee of Union Territories concerned.

The rules have also assigned duties to Central Pollution Control Board, State Pollution Control Boards and Urban Local Bodies with regard to e-waste management. Guidelines regarding collection, storage, transportation, segregation, refurbishment, dismantling, recycling and disposal of e-waste have been kept in accordance with the procedures laid down by the Central Pollution Control Board. Furthermore, rules mention the guidelines related to transportation of e-waste and reporting in case of an accident and follow-up.

Bio-Medical Waste (Management & Handling) Rules, 1998

The rules for management and handling of bio-medical waste in the country were notified by the Ministry of Environment and Forests, which applies to all persons who generate, collect, receive, store, transport, treat, dispose, or handle bio-medical waste in any form.

The notification defines bio-medical waste as any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals. Any institution generating bio-medical waste, which includes a hospital, nursing home, clinic dispensary, veterinary institution, animal house, pathological laboratory, blood bank etc., shall take all steps to

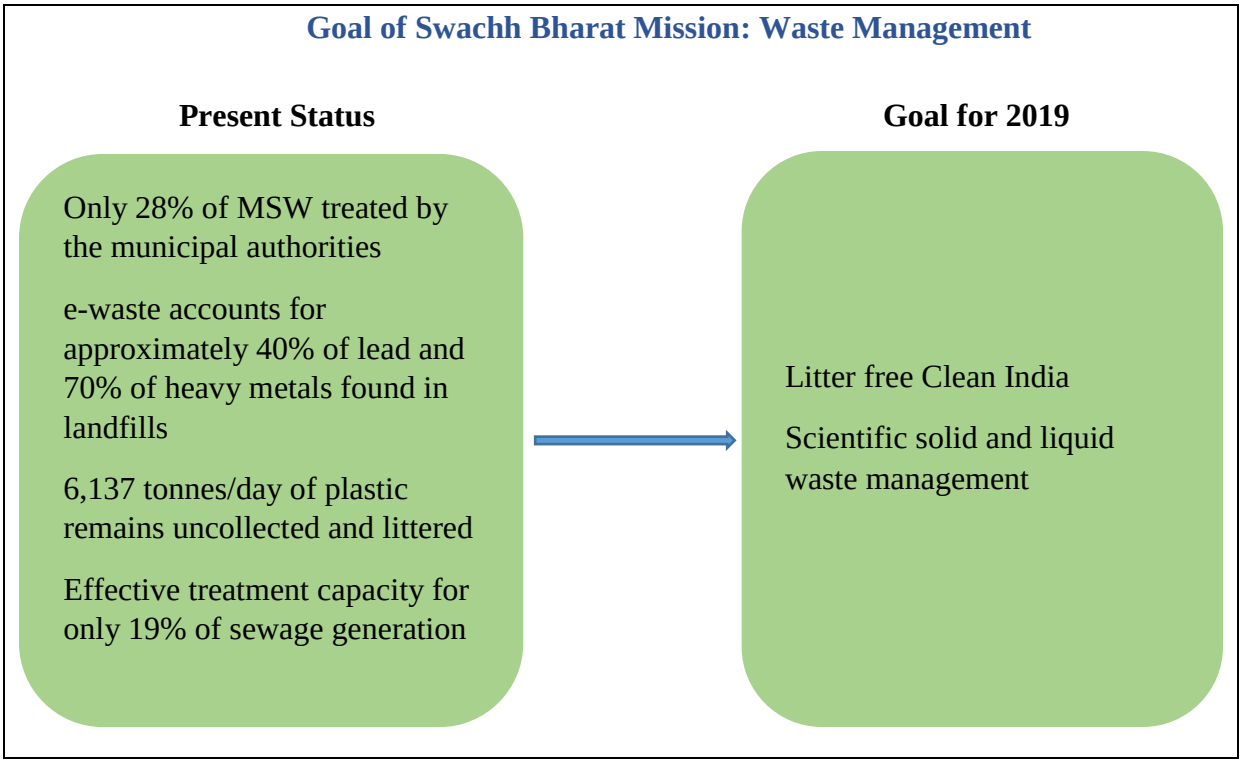
ensure that such waste is handled without any adverse effect to human health and environment.

The rules specify the guidelines with regard to segregation, packaging, transportation, storage treatment and disposal of bio-medical waste. The prescribed authority for implementation of the rules and enforcement of the provisions in all health care establishments is the State Pollution Control Boards in respect of States and the Pollution Control Committees in respect of the Union Territories. The Central Pollution Control Board is assigned the responsibility to monitor the implementation of these rules in respect of all the Armed Forces health care establishments under the Ministry of Defence.

Every occupier of an institution generating, collecting, receiving, storing, transporting, treating, disposing and/or handling bio-medical waste in any other manner, except such occupier of clinics, dispensaries, pathological laboratories, blood banks providing treatment/service to less than 1000 (one thousand) patients per month, will have to apply for grant of authorization to the prescribed authority.

According to rules, the Government of every State/Union Territory shall constitute an advisory committee, which as and when required, shall advise the Government of the State/Union Territory and the prescribed authority on matters related to the implementation of these rules. Every occupier/operator is required to submit an annual report to the prescribed authority which shall include information about the categories and quantities of bio-medical wastes handled during the preceding year. The prescribed authority shall send this information in a compiled form to the Central Pollution Control Board, each year. Further, every authorized person shall maintain records related to the generation, collection, receipt, storage, transportation, treatment, disposal and/or any form of handling of bio-medical waste in accordance with the rules and any guidelines issued. In case an accident occurs at any institution or facility or any other site where bio-medical waste is handled or during transportation of such waste, the authorised person needs to report the accident to the prescribed authority.

The Ministry of Environment, Forest and Climate change has recently published the draft rules in 2015 for management and handling of solid waste, plastic waste, bio-medical waste and e-waste in the country, seeking comments from public, experts and stakeholders



Issues

The concerns facing the current sub-optimal waste management practices and ensuring scientific management of solid and liquid waste are bringing about a transformation in the people to avoid littering, setting up an integrated waste management system where the informal sector like ragpickers and kabadiwalas are integrated into the system; technology support to ULBs; sustainable waste management practices and enforcement of rules.

Avoidance of Littering

Littering in public places is a lingering problem in Indian cities, thus becoming the leading cause of several environmental and human health related issues, besides damaging the aesthetic appeal of public spaces. It is seen that both contextual and individual related behavioural factors lead to littering. The presence of litter conveys a sense that littering is acceptable. Littering is related to lack of awareness about its ill effects and absence of personal responsibility towards keeping the surroundings clean.

Promoting cleanliness and hygiene in public places and bringing about an improvement in quality of life has been the overarching principle guiding the Swachh Bharat Mission. The Mission envisages individual participation in ensuring cleanliness of public spaces. The Draft Solid Waste Management Rules, 2015 entrusts Urban Local Bodies to

direct waste generators not to litter; frame by-laws and prescribe criteria for levy of spot fines to person who litters and also create awareness among people through IEC campaign not to litter.

To create a litter free environment, adequate provision of dustbins- separate for biodegradable and non-biodegradable waste, are required at appropriate places. Access and availability of adequate infrastructure needs to be ensured. To promote the citizens to keep their surroundings clean, both awareness and provision of waste disposal avenues are essential. It is also essential to strictly enforce rules which deal with this menace.

Challenge: The challenge is to inculcate a sense of cleanliness among the people to avoid littering of waste. This requires not only provision of access to infrastructure but also developing a sense of responsibility to keep the surroundings clean. The main daunting task is to bring about this behavioural change through awareness, incentives or penalties.

Integrated Solid Waste Management

A fragmented approach to management of waste is not sufficient. Rather an integrated waste management requires that all stages of waste management starting from source segregation, collection and transportation to waste processing centres and final disposal to landfills be undertaken in a coordinated manner. Source segregation into dry and wet waste is important for further processing of waste. Door to door collection of waste from households and from other centres like commercial establishments, shops etc. need to be ensured. The transportation of waste to the respective waste processing centres needs to be streamlined. After the processing of waste which will result in by products like compost, RDF, bio-gas, power etc., the final inert matter has to be scientifically disposed of in landfills.

It has been estimated by CPCB in 2008 that the inert wastes for landfilling occupies 40-55% of the total wastes depending upon the type of city. The Task Force on Waste to Energy has estimated that considering the projected waste generation of 165 million tonnes by 2031, the requirement of land for setting up landfill for 20 years could be as high as 66 thousand hectares of land. It is, therefore, imperative to minimize the waste going to landfills.

This reinforces the importance of adoption of the 3R approach (Reduce, Reuse, and Recycle) to waste management which is aimed at optimizing the management of municipal solid waste from all the waste-generators and involving all the stakeholders (waste

generators, service providers, informal sector, regulators, government, and community/neighbourhoods). The adoption of the 3R concept helps to minimize the amount of waste to be handled by the municipal authority, minimizing the public health and environmental risks associated with it. This approach has a significant impact on the waste composition and quantities of waste to be handled and disposed.

Challenge: The challenge is to frame an integrated waste management framework which includes all the aspects of waste management chain. The challenge has many elements where source segregation needs to be encouraged, efficient collection of waste, scientific processing of waste and final disposal of waste. The main challenge is to minimise inerts to landfills in view of scarcity of land. This reinforces the importance of minimisation of waste generation and 3R strategy of waste management-Reduce, Reuse and Recycle.

Rag pickers

In urban areas, rag pickers form the backbone of the informal waste recycling set-up, where they collect, segregate, and sell waste to earn livelihood. Emerging approaches of waste management lay emphasis on modernisation, privatisation and mechanisation of waste management which can result in loss of livelihood for rag pickers as the formal ownership of waste may change from being openly accessible resource to a private good. In the new arrangement, only formal participants of the waste management process may have access and ownership to waste, denying the informal sector access to waste, which use it as a resource. In addition, lack of formal recognition, absence of social security, working without safety equipment and contemptuous treatment by the society, are some important issues which impinge the status of rag pickers.

For efficient utilization of untapped resources and source segregation of MSW, the informal institution of *kabadiwalas* and rag pickers may be appropriately integrated into the system through recognition and strengthening of this sector. They are working in unhygienic condition. By integrating them into the system, they will get accessories so that their health conditions may not get adversely affected. At the same time dignity will be accorded to their work. The municipal authorities may support association of rag pickers or NGOs in setting up Recyclable Waste Collection Centres (RWC) on municipal land where the rag pickers can sell for a price the recyclable materials collected by them. The municipal authority may also

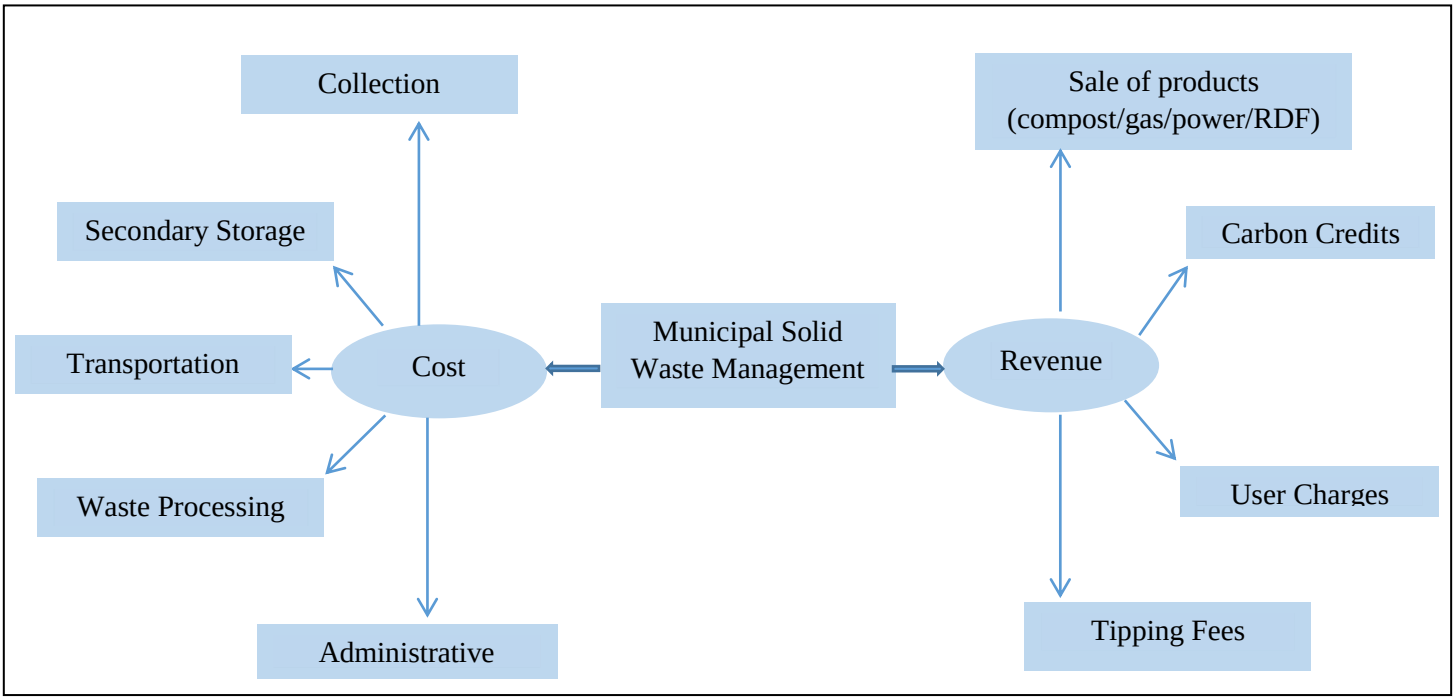
involve the rag pickers through NGOs or private sector for picking plastic and other recyclable materials from the streets in a designated area for making the cities "litter free" and preventing the useful material going to landfills. Such rag pickers could be paid incentive money for carrying out the task satisfactorily. To facilitate sorting of recyclable materials collected by informal sector and supporting recycling industry, the municipal authorities should set up waste sorting facilities at suitable locations and permit the informal sector to use the facility for segregation of recyclables.

Challenge: The challenge is to integrate rag pickers into the waste management system so that their livelihood is not affected.

Technology Support for solid and liquid waste management

The Sub-Group had a detailed discussion on the issue of technology support for scientific waste management. It was felt that appropriate selection of technology is very critical for the success of the project. As multiple technologies for solid and liquid waste management are available, appropriate selection of the required one is a major challenge. There is a lack of information among GPs/ULBs of the financial viability, sustainability and scalability of the technologies. Moreover, the capacities required for sustainable operation and maintenance of facilities are, as yet, not available at all levels. The management of MSW is an organisational, technological and economic challenge. One of the reasons for the present dismal situation of waste management is the lack of financial viability. This would be better understood by analysing the cost and revenue streams of waste management which has an influence on the choice of technology

Cost and Revenue Streams of Municipal Solid Waste Management



Note: Tipping Fees is a financial incentive for the private sector which undertakes waste management whereas it is a cost for the ULB.

The issues which need to be addressed are:

a. Segregation of waste at source and responsibility for ensuring the same;
b. User charges to be levied for collection of waste and if so the rate, collection agency (whether ULB or private partner) and frequency of collection;
c. Tipping fees to a private operator and if so, determine the viable range of Tipping fees;
d. Alternatives to Tipping Fee and incentivising reduced transportation costs;
e. Pricing of the by-products like Compost/ RDF and Power;
f. Creating Market for the products from waste management;
g. Financial viability of ULBs

(a) Solid Waste Management Technologies

1. Identification

The technologies for processing solid waste may be classified into biological and thermal. Biological technologies include conventional composting, vermicomposting and biomethanation. Thermal processes include incineration, gasification and pyrolysis (Table 3). The suitability of a particular technology depends on several factors like quality of waste, techno-economic viability, environmental safeguards, sustainability, and location.

Table 3: Technologies for Solid Waste Management

Sl. No	Category	Technology	Remarks
1	Biological Treatment Technologies	Composting	Suitable for organic waste and produces compost.
		Biomethanation	Suitable for kitchen waste and other putrescible wastes. Generates gas as well as manure.
		Bioreactor landfill	Suitable for closure of existing dumpsite as it accelerates the process of decomposition.
2.	Thermal Treatment Technologies	Incineration	Suited for waste with high calorific value and pathological wastes. Reduces waste volume by 90% and generates energy. This technology however leads to emission of particulates like SOx, NOx etc.
		Gasification	Suitable for waste with high calorific value. Produces syngas which can be used as fuel. Does not lead to emission of harmful pollutants.
		Pyrolysis	Suitable for high calorific value of waste and produces a mixture of combustible gas.
		Plasma arc	This technology is suitable for smaller quantity of waste preferably for hazardous waste.
3	Physical Treatment Technology	Refuse Derived Fuel (RDF)	This technology is suitable when assured buyer is available in the radius of 50- 80km. The RDF can be used in cement plants.
4	Catalytic Conversion	Conversion of waste plastic to liquid fuel	Catalytic conversions are used in small batch/ cyclic operation - Soiled plastic waste is being used for strengthening roads by blending chopped polymeric waste with molten bitumen which reported enhancing the life of the road by 30%.

The details of the Technologies are given in Annexure V.

Centralized and Decentralized Technology: Options

The selection of a centralized or decentralized model of solid waste management is principally dependent on quality and quantity of waste, scarcity value of land, health risk, and cost.

Table 4: Selection Criteria for Centralized and Decentralized Technologies for SWM[8]

Type	Selection Criteria
Decentralized	• Land for composting/biogas are available in local area • Availability of informal workers for processing of waste • High degree of organic content in waste • Markets for compost/biogas is available • Possible to manage health risks adequately • Operational expenditure is generally low
Centralized	• Land is not available close to the community for decentralized model • Local level resistance • Economies of scale makes the project viable • In large cities, high proportion of combustibles like paper, plastics etc. in waste, warrants setting up of large / centralized facilities.

In cases where a number of by-products like Compost/ RDF and Energy are to be generated in integrated plants, a centralized facility is preferable. Certain processes are more amenable to be taken on centralized basis like incineration, pyrolysis, gasification, RDF production and managing sanitary landfills. Segregation at source, transportation, bio-methanation, conventional composting are more suited for decentralized mode. Decentralized processing is preferred in case of bio-degradable waste. Utilization of biodegradable components of waste at a decentralized level will help in minimizing the cost of collection and transportation to centralized processing facilities.

[8] Report of the Task Force on Waste to Energy, 2014

Options based on Population size to manage MSW in towns and cities are given below:

Table 5: Technological options based on population

Population Range	**Waste Generated TPD**	**Technological Options**	**Minimum requirements**	**Value added products**	**Approximate cost (excluding land cost)**
Above 2 Million	>1100	IWP comprising - BM +CC+ RDF RDF to cement industry W to E plant for power Plastic to fuel oil	Segregate wet wastes at source for BM and / or CC, dry wastes to be recycled or converted into RDF as feed stock for its own power plant / cement industry or any other power plant. Inerts to be land filled	Biogas/ Electricity/ Manure/ RDF	Rs. 5-7 cr. per 100 TPD of MSW composting + RDF Rs. 15/20 lakh capital cost per 1 TPD for gas / electricity through Bio-methanation Rs. 10 cr. per MW power plant. Rs. 20 lakh per 50 kg capacity / shift catalytic conversion technology plastic waste to liquid fuel. Rs. 16 crore per 10 tonnes of plastic (pyrolysis technology)
1-2 Million	550 to 1100	IWP comprising - BM +CC+ RDF RDF to cement industry W to E plant for power, where wastes exceeds 500 TPD Plastic to fuel oil	Segregate wet wastes at source for BM and / or cc, dry wastes to be recycled or converted into RDF as a feed stock for large power plant and landfill the inerts	Biogas/ Electricity/ Manure/ RDF	As above
1 lakh to 10 lakh	30 to 550	IWP-BM, CC + RDF as feed stock to power plant / cement industry. Plastic to fuel oil	Segregate wet wastes at source for BM and / or CC, dry wastes to be recycled or converted into RDF as a feed stock for large power plant / cement industry and inerts to be landfilled	Biogas/ /Manure/ RDF	Cost for BM, CC and RDF as above Rs. 20 lakh per 50 kg capacity / shift catalytic conversion technology for plastic waste to liquid fuel. Rs. 16 crore per 10 tonnes of plastic (pyrolysis technology)

50,000 to 1 Lakh	10 to 30	BM, VC or CC RDF	Segregate wet wastes at source for BM and / or VC / CC, dry wastes to be recycled or converted in to RDF as feedstock for power plants and landfill the inerts.	Biogas/ Electricity/ Manure/ RDF/Liquid Fuel	Rs. 15/20 lakh capital cost per 1 TPD for gas / electricity through Bio-methenation Rs. 7- 10lakh per TPD for VC/CC
Less than 50,000	Less than 10	BM VC / CC and RDF	Segregate wet wastes at source for BM, /CC, dry wastes to be recycled or converted into RDF as a feed stock and inerts to be landfilled	Biogas/ Manure/ RDF	As above
Hill towns (State Capitals)	-	BM, CC / RDF as feed stock. Plastic to fuel oil	Segregate wet wastes at source for BM / CC, dry wastes to be recycled and landfill the inerts. Dry wastes to be recycled or converted into RDF as a feeder stock. Plastic waste can be converted to liquid fuel and inerts to be landfilled	Biogas/ Manure/ RDF	As above Rs. 20 lakh per 50 kg capacity / shift catalytic conversion technology for plastic waste to liquid fuel Rs 16 crore per 10 tonne of plastic (pyrolysis technology)

Source: Report of Task Force on Waste to Energy 2014, Planning Commission
IWP: Integrated Waste Processing, CC: Conventional Composting, VC: Vermi Composting, BM: Biomethantion, RDF: Refuse Derived Fuel

C&D waste

The challenge for the recycled products from C&D waste is the absence of provision under the Bureau of Indian Standards (BIS) for quality standards for the recycled product from C&D waste. Codes of practices for construction prescribed by the Bureau of Indian Standards (BIS), Indian Roads Congress (IRC) and others neither envisage use of building materials recycled from C&D wastes, nor have any specifications for such materials so far. In addition, the specifications for use of by products are not included in the relevant building code(s) to incentivize construction agencies and promote their use.

Plastic Waste

Indiscriminate and rampant littering, unskilled recycling/reprocessing and non-biodegradability of plastic waste raise several environmental issues like toxic emissions generated by burning plastics; garbage mixed with plastics interferes in waste processing facilities and also cause problems in landfill operations as non-recyclable plastic wastes poses disposal problems.

In the Indian context, so far, following instances of reuse of plastic as an input for other economic activities have emerged viz., for road construction, and conversion into petroleum products.

The Indian Institute of Petroleum (IIP), Dehradun, an institute under CSIR, has developed a technology whereby plastics like polythene and polypropylene can be converted into either gasoline or diesel or aromatics along with simultaneous production of Liquefied Petroleum Gas (LPG) in each case. The process of converting plastic to fuel and aromatics is environment friendly as no toxic substances are evolved or left over. Another unique feature of this technology is that liquid fuel, gasoline and diesel generated through this process are compliant with Euro-III fuel specifications. Furthermore, different products can be obtained from the same raw material by simply changing the catalyst and operating parameters.

A method has been developed at Thiagarajar College of Engineering, Madurai which consumes waste plastic as an input to lay bitumen roads. While each kilometre of road laid using the traditional method requires 10 tonnes of bitumen, plastic roads save one tonne of bitumen for every kilometre road. Different types of waste plastic can simply be shredded and used as an input to the process eliminating the need for plastic to be segregated. Furthermore, the method does not require acquisition of any new machinery or operating any parallel industrial process. No toxic gases like dioxin are produced during the process. Roads laid using this process are found to have better resistance to water and addresses the problem of water stagnation, occurring due to stripping and potholes, thus increasing the road life. It has emerged from the performance studies that these roads have higher skid resistance and are endowed with good texture value, with lesser of progressive unevenness over a period of time.

e-waste

The major impediment in management of e-waste is about collection of such waste and un-authorized recyclers in informal sector. Current e-waste management practices in India are beset with numerous weaknesses, such as the difficulty in inventorisation of generated e-waste, unhealthy conditions of informal recycling, inadequate capacities, lack of information among generators of e-waste as well as ULBs.

Bio medical waste

Under the Biomedical Waste (Management & Handling) Rules, 1998, the biomedical waste generated from hospitals and nursing homes needs to be managed separately from municipal waste. The physical, chemical and biological nature of these components, their toxicity and potential hazard are different, necessitating different methods /options for their treatment / disposal.

(b) Liquid Waste Management Technologies

The liquid waste technologies can be classified into:

(i) Conventional sewage treatment technologies:

- Activated Sludge Process (ASP) - Conventional activated sludge systems commonly include an aeration tank and secondary clarifier. Aerobic biomass reduces the biochemical oxygen demand (BOD) and ammonia concentrations in the aeration tank. Biomass then flows to the secondary clarifier, where it is separated into clarified water and thickened biomass by gravity sedimentation. The clarified treated water overflows at the top of the secondary clarifier, and the thickened biomass is recycled to the aeration tank or managed at sludge dewatering facilities.
- Upflow Anaerobic Sludge Blanket (UASB) Reactor-The UASB reactor is a methane-producing digester that evolved from the anaerobic clarigester. A similar but variant technology to UASB is the expanded granular sludge bed (EGSB) digester.
- Extended Aeration (EA) - Extended aeration is a method of sewage treatment using modified activated sludge procedures. It is preferred for relatively small waste loads, where lower operating efficiency is offset by mechanical simplicity.

(ii) Reactors: The following are the modern technologies for management of liquid waste:

- Sequencing Batch Reactor (SBR) - SBR reactors treat wastewater such as sewage or output from anaerobic digesters or mechanical biological treatment facilities in batches. The treated effluent may be suitable for discharge to surface waters or possibly for use on land.
- Moving Bed Biofilm Reactor (MBBR) - MBBR processes improve reliability, simplify operation, and require less space than traditional wastewater treatment systems.

(iii) Others: The following is the relatively latest technology for liquid waste management:

- Membrane Bioreactor (MBR) - MBR systems offer several operational and economic advantages compared to conventional wastewater treatment plants. By incorporating GE's membrane technology, MBR systems eliminate the need for secondary clarifiers and tertiary treatment. These are relatively new technologies that have become available.

Conventionally, sewage is collected through a vast network of sewerage system and transported to a centralized treatment plant which is resource intensive. On the other hand, a decentralized Sewage Treatment Plant (STP) system is used to collect, treat & discharge or reclaim/reuse the sewage water from an individual commodity/dwelling or a cluster without the use of the entire centralized sewer system. The decentralized system can result in the reduction or even elimination of underground sewerage systems, are scalable and have low operating and maintenance costs.

Hence for each component of waste, several technologies are in existence and the appropriate technology which suits the needs of the locality needs to be identified.

2. Assessment and Evaluation

Evaluation of technology is the next important step as the appropriate technology has to be selected after evaluation of the available options. This is dependent on the choice of parameters for assessment of technologies. Some of the parameters for assessment of technologies required for solid and liquid waste management are as follows.

Solid Waste

- Waste characteristics
- Quantity of waste
- Calorific value of the waste
- Organic fraction
- Moisture content

Liquid Waste

- Waste water generation
- Influent and effluent characteristics
- Nearest water body to discharge treated water in cases where recycling and reuse is not feasible
- Capability of the plant to give the desired performance to meet effluent discharge standards
- Health and safety aspects;
- Ease of operation;
- Manpower requirement, skilled and unskilled
- Local conditions such as climate, final mode of disposal, etc.
- Appropriateness to local context.

3. Selection of technology

The evaluation of technologies will help in understanding the range of options available for waste processing. The final selection needs to be done on the basis of available finance and other resources with the local bodies. The preparation of a sound Detailed Project Report (DPR) is also highly essential for the appropriate selection of technology and final success of the project. The selection of technology should be such that it minimizes the use of land, water and energy; is tried & tested and integrates the informal sector.

4. Procurement of technology

Procurement of technology is one of the biggest challenges as a fair, transparent and sound procurement system needs to be set up. It requires simplified and transparent contract documents. The project structuring needs to be rigorous, clarifying the incentives and concessions, standardising the competitive bidding procedures, maintaining transparency at all stages of project cycle, and safeguarding the interests of consumers, private sector, and public sector are paramount to the success of PPPs in India.

Challenge: The challenge lies is identification, evaluation, selection and procurement of appropriate technology from the various choices available.

Encouraging Private Sector Participation and Public Private Partnership

Given the budgetary, technical and operational constraints, it is very essential that Private sector participation and Public Private Partnership (PPP) is encouraged. However, the experience of PPPs has been mixed and not that forthcoming in this sector.

The urban infrastructure sector is seen as a very high-risk sector, leading to low inflows of private capital. Most of the urban sector investments involve third tier of governments, which increase the perceived political risks for private sector investments. The experience for Public Private Partnership in urban infrastructure service delivery has been varied because of poor capacity to structure projects and execute contracts; preparing bankable and financially sustainable projects considering the opportunity and risk involved; absence of rationalisation of tariff and user charges; complexity in unbundling urban service delivery; lack of availability of long term funds and lack of appropriate standards for products.

Large-scale PPP intervention in MSWM sector was initiated in the mid-1990s. Private sector participation has been involved in solid waste management in different ways like door-

to door collection of solid waste, secondary storage and transportation, treatment and disposal of waste and integrated MSWM. The prevalent formats of PPP in this sector are shown below.

The challenge in encouraging PPP in waste management is to make the waste processing activity viable which includes appropriate pricing of the product, finding market for the product and standardization and certification for the product.

Table 6: Prevalent PPP formats in SWM

Sl. No.	Scope of Services	PPP format
1	Door-to-Door Collection	Service/Management contracts
2	Street Sweeping	Service contracts
3	Construction & Maintenance of Community Bins	BOT and its variance and/or Separate EPC and O&M Contract
4	Transportation of Waste to Integrated processing & disposal facility	Concession and/or O&M Contract
5	Design, development, operations & maintenance of processing and treatment facility for MSW including special waste like vegetable market and/or abattoir waste	BOT and its variance and/or Separate EPC and O&M Contract
6	Design, development, operations & maintenance of sanitary landfill site	BOT and its variance and/or DFBOT and/or Separate EPC and O&M Contract

BOT: Build Operate Transfer; EPC: Engineering, Procurement and Construction; DFBOT: Design, Finance, Build, Operate, Transfer

The Task Force on Waste to Energy critically looked at failure/under performance of the waste processing facilities (waste to energy) set up and observed that the major reasons for failure of plants were (i) lack of due diligence on the part of investors as well as public sector (ii) non supply of committed quantity / quality of waste to the plant by the municipal authority (iii) presence of inerts - dust and C&D waste in MSW delivered for processing, making the operations difficult and very expensive (iv) Inadequate market for sale of compost/RDF (v) public outcry against the location of a plant and (vi) lack of financial viability of projects.

A sound framework of PPP needs to be outlined for a fair and transparent procurement mechanism. The responsibility of the municipal authority and PPP partner needs to be clearly identified. It is very essential that municipal authority identifies suitable land for setting up processing/ disposal facilities and obtain all necessary clearances; supply the

collected waste at the processing plant free of cost or appropriately compensate the private operator wherever collection is undertaken by him and also ensure that the quantity and quality of waste is supplied to the concessionaire as agreed in the concession agreement and should further ensure that Construction and Demolition (C&D) waste as well as street sweeping and silt removed from the surface drains is not delivered at the processing facility. Municipal authority should broadly assess the requirement of funds and modalities of financing for ensuring construction, operation and maintenance of the facility/ services.

Operation and Maintenance of waste management facilities is highly essential for sustainability of the plants and the entire waste management chain. Any failure in O&M will have repercussions on the different levels of waste processing and finally lead to accumulation of waste. On the other hand, appropriate O&M of waste management facilities can yield expected level of environmental and human health benefits and ensure long term financial viability of the investment. The factors affecting O&M are capacity and capability related issues of waste management which include lack of trained manpower with required technical capabilities to operate the facilities, lack of sufficient funds with the ULBs to provide necessary infrastructure and support waste management activities including transportation, secondary storage, processing and disposal of waste generated.

The private partner (concessionaire) should develop the project as per the timelines and adhere to the key performance standards prescribed in the concession agreement. The concessionaire should meet the environmental standards prescribed for the waste processing plant. The processing of waste should be undertaken in such a manner that inerts sent to landfills are as minimum as possible.

Challenge: The challenge is to create an enabling environment for attracting private sector participation and encouraging Public Private Partnerships by providing business opportunities to them.

Chapter 4

Recommendations of the Sub-Group

The recommendations of the Sub-Group of Chief Ministers to achieve the objectives of the Swachh Bharat Mission are as follows:

I. Behaviour Change Communication (BCC) Strategy

Behaviour Change Communication needs to be undertaken in campaign mode. The communication has to be internalised by the people. Behaviour change is not limited to toilet usage but also refers to habit of avoiding littering, paying for use of public toilets and keeping the streets or places clean. All waste generators, either individual or companies, should ensure that the generated waste is processed with minimal effect on the environment. This can be achieved only through collective effort and accountability towards the system. At the same time, dignity of labour and according respect to cleaning as occupation must also be recognised. Efforts for toilet construction and solid waste management can then only bring real outcomes i.e. toilet usage and over all cleanliness).

The Sub-group recommends the following:

Toilet Construction and Promoting use

(i) Toilet construction and Behaviour Change campaign have to be given equal priority as the success of an ODF programme will ideally be measured against the increase in toilet usage.

(ii) Effective investment in Information, Education and Communication (IEC) for BCC is necessary to improve understanding and awareness around sanitation. Studies indicate that world-wide almost 25 to 30% of funds have been used for BCC. There is a need to ensure effective funding and resource allocation to track efficacy of spending vis-à-vis successful targeting, since data shows that States with lower rates of OD spend more money on BCC. The proportion of funds for BCC may be increased uniformly, in both urban and rural areas, to about 25% of the total funds and Central Government may fund the BCC for the programme.

(iii) Involve political and social/thought leaders in conveying the message of sanitation as they have a wide reach and influence. Social leaders and celebrities may be involved in campaign on pro bono basis leading to cost saving in the IEC Campaign.

(iv) Involve electronic and print media to spread the message of cleanliness and sanitation on voluntary basis.

(v) A database needs to be created which captures toilet usage by all households. Periodic and systematic collection of data will help in framing the strategy for the behaviour change campaign and also enable to undertake mid-course corrections.

(vi) A professional agency needs to be involved both at the central and State level to design the strategy, mode of implementation and to monitor and evaluate the progress of the campaign as partnerships with UNICEF and WHO were crucial in the success of campaign like the Pulse Polio campaign

(vii) It is imperative that specific, contextualised and target-based behaviour change communication strategies are evolved. To lead to effective behaviour change, communication should focus on the following points which address social and cultural concerns: (i) social norms around open defecation (ii) lack of aspiration in owning a toilet (iii) misinformation surrounding use and cleaning of latrine pits and (iv) lack of targeting of male-users.

(viii) Anybody contesting an election for local bodies must have an individual household toilet.

(ix) It has been observed that effective communication design, gain-framed and loss-framed messages have different success rates depending on a number of factors, including the health outcomes. In making decisions regarding messaging contents, it may be useful to conduct trials to see if people who show a preference for open-defecation are influenced by gain or loss framed messages in the context of their health, or their families' health. For example,

"Shauchalay jao, sehat bachao" vs. "Shauchalay na jaoge, sehat na bacha paoge"

(x) Personalised messaging could be used as a powerful tool to promote behaviour change. In this context, personalised text messages like SMS could be explored to communicate the benefits of good sanitation behaviour.

(xi) Extensive media campaign in the form of electronic, web and print to be used for conveying messages related to sanitation, importance of segregation of waste and general cleanliness.

(xii) Campaign should also focus on encouraging the people to pay for usage of public toilets for their sustainability.

(xiii) Cleaning occupations must be seen as dignified work and widely respected.

Waste Management:

(xiv) Importance of segregation of waste into biodegradable and non-biodegradable components, including plastics at the household level, may be spread through NGOs, community leaders and resident welfare associations. Segregation at source shall be encouraged by amending building rules to install separate chutes in all high-rise buildings, restaurants, hotels and commercial establishments.

(xv) The concept of three R's –Reduce, Reuse and Recycle needs to be strongly advocated in all campaigns.

(xvi) The ill effects of unhygienic surroundings may also be vigorously conveyed to people to sensitize them to the magnitude of the problem of improper waste management

(xvii) There is a need to inculcate higher degree of professionalism in waste management which takes care of all aspects including provision of latest equipment, evolving standardised procedures and handling the entire process in an organised and structured manner. To make the system more efficient, certain activities may be outsourced and even SHGs and Women Groups may also be involved.

II. Education Strategy for Sustainable Swachh Bharat Mission

Education plays an important role in changing behaviour and sustaining Swachh Bharat Mission among people. The effectiveness of sanitation and waste management programmes can be substantially improved through a well-designed educational curriculum which exhibits linkages between sanitation, cleanliness and health. Through school curriculum, message of hygiene and cleanliness can be effectively disseminated among millions of school going children, which will eventually produce long term health and economic benefits.

Children of today will become parents in future. School students will not only become beneficiaries but also emerge as agents of behaviour change, promoting good hygiene, sanitation and cleanliness practices. Further, the students can function as awareness raisers, and trigger adoption of good habits both at the households and community level, as they take home learnings on sanitation, hygiene and cleanliness. Imparting correct behavioural practices such as washing hand before and after using toilet and having meals, keeping surroundings clean etc. and health related education from primary school onwards can create a positive impact on the health and hygiene conditions of the community as a whole.

Regular courses, vocational education and other training programmes are needed to prepare a set of skilled and trained manpower to undertake diverse functions involved in the waste management process. The process of scientific waste management requires skilled and trained manpower to handle various sub-activities such as waste collection and transportation, recycling, treatment, and disposal. There are different types of waste generated such as municipal solid waste, e-waste, biomedical waste, plastic waste, C&D waste, and liquid waste, that need various approaches and technologies for their management. The courses can be effective in imparting pre-employment skills for preparing individuals for the potential employment opportunities. This can also help in upgrading the skills of those already performing these functions. Similarly, diploma, ITI and engineering courses should be designed to impart technical knowledge related to waste management process. At higher-level, separate research grants may be provided to the technical institutions for continuous update of designs for people friendly sanitation facilities and for innovative methodologies to bring behavioural changes in the communities. Further, it will ensure that the all activities are performed using scientific techniques and approaches. This will instil professionalism in the entire process of waste management and improve the status of sanitation work in the country.

The Sub-Group, therefore, recommends the following:

(xviii) Inculcating sanitation practices in children by including a chapter in school curriculum from the first standard itself. This will not only help the children but also the entire family in understanding good sanitation practices.

(xix) In each school and college, a team of students may be formed which will be called the '*Swachhata Senani*', with a specific uniform, similar to the National Green Corps, to spread awareness about sanitation and cleanliness. The team may organise events which promote the importance of sanitation and cleanliness.

(xx) Skill Development courses/ Diploma courses may be introduced in State ITIs and polytechnics/ colleges to train personnel in the field of solid and liquid waste management. This may also be integrated with the on-going programmes for Skill Development.

(xxi) Centres of Excellence may be set up in the Institutes of higher learning to promote research in the specialized fields of sanitation & waste management for producing quality doctoral and post-doctoral level researchers.

(xxii) Capacity building of local bodies and Government officials at all levels is required by regular training and updation of skills. The training module developed by Ministry of

Drinking Water and Sanitation may be shared among all training institutions, both public and private.

(xxiii) Specialized courses on Environmental Sciences, Public Health Engineering and Municipal Engineering with focus on sanitation and waste management may be introduced at under graduate & post graduate level in the higher educational institutions including technical training institutions. In addition, a special semester course may be introduced in every engineering college curriculum relating to sanitation sewerage and liquid waste management.

(xxiv) Joint Research Programmes with foreign universities/higher educational institutions would enhance knowledge and capacities to work on waste management technologies.

III. Financial Requirements for the Swachh Bharat Mission

The Swachh Bharat Mission is very comprehensive in its coverage and requires huge amount of funds to cover all aspect of the mission. Though certain measures have been already taken, it is essential to augment the financial resources and find additional sources of funds for this programme. A financial projection for Swachh Bharat Mission needs both additional funds as well as convergence with the ongoing programmes. The Mission is being undertaken on a Mission Mode and adequate availability of funds is required for its smooth progress and realisation of targets by October 2, 2019. The Sub-Group, therefore, makes the following recommendations in this regard:

1. Budgetary Support

(i) This is a national programme of paramount importance and to take it forward adequate availability of funds is required. Therefore, it is a joint responsibility of both Central and State Governments to carry forward this programme. In this scenario, it is recommended that the State Governments may share the financing provided by the Central Government for this programme. The sharing pattern of funds for this programme between the Centre and States may be in the ratio of 75:25, while for hilly States it may be kept at 90:10. States may also provide additional funds for the programme.

(ii) Since the construction of toilets has to be done in Mission Mode, higher budgetary support may be provided by the Centre and States for the construction of toilets in the next three years to ensure that construction targets are achieved in a time bound manner.

(iii) Additional resource mobilisation may be done by the State Governments to raise funds for the programme. Wherever feasible, funds from other Government programmes may be tied up for SBM.

(iv) Certain States have already made a substantial progress in the construction of toilets. For such States, the budgetary allocation of funds for the programme will be low. Hence, additional allocation of funds should be made for the IEC component of the programme to enable them to sustain the mission.

(v) The financial support extended by the Ministry of Finance through the Viability Gap Funding Scheme for infrastructure projects through Public Private Partnerships may be availed. The solid waste management sector is included in this scheme. Apart from the financial support made available under this scheme (upto a maximum of 20%), an additional grant of up to 20% can be provided by the sponsoring Ministry or State Government.

2. Corporate Social Responsibility, External Sources and other contributions

(vi) Funds from the following sources may also be channelized for Swachh Bharat Mission

a) Funds from Corporate Social Responsibility for SBM. A certain part of the CSR contributions by PSUs/Companies may be spent in the States where they are located.

b) Contributions to the Swachh Bharat Kosh set up by the Government of India from various sources. Donations to the Kosh shall be eligible for 100 per cent deduction under section 80G of the Income Tax Act, as announced in the Union Budget 2015-16.

c) The State Governments may consider setting up a Swachh Bharat Kosh at the State Level on the lines of the Swachh Bharat Kosh constituted at the central level. Donations to this Kosh should also be eligible for all tax incentives as applicable to the Swachh Bharat Kosh set up by Government of India.

d) Assistance (both technical and financial) obtained from multilateral and externally-aided sources.

3. Fourteenth Finance Commission

(vii) The grants provided to the Local Bodies under the 14th Finance Commission are to be utilised over a range of services being provided by the GPs/ULBs to improve the status of basic civic services including water supply, sanitation including septage management, sewerage and solid waste management, storm water drainage, maintenance of community assets, maintenance of roads, footpaths and street-lighting, and burial and cremation grounds. As Swachh Bharat Mission is the most important programme for the next four years, it is proposed that the first charge on the expenditure on 14th Finance

Commission grants to Local Bodies shall be on the activities to be undertaken under Swachh Bharat Mission. The Government of India may advise the States accordingly.

(viii) The Fourteenth Finance Commission (FFC) recommendations have not covered the local bodies in rural areas in some of the North Eastern States. These local bodies have not received the grants under FFC as received by local bodies in other States of the country. Hence, it is recommended that Government of India may consider releasing grants to such States at the same level as provided to the local bodies in other States

4. Tax provisions

(ix) Enabling provision to empower Central Government to impose Swachh Bharat Cess on all or certain taxable services at the rate of 2% on the value of such taxable services, as announced in the Union budget 2015-16 to generate additional resources for SBM.

(x) Long term tax-free Swachh Bharat Bonds may be issued by the Central Government to generate additional resources. The State Governments may also issue Swachh Bharat bonds. The Central Government may provide tax exemption on these bonds issued by the States.

(xi) To generate additional resources for the programme the following cess may be levied:

a) Swachh Bharat Cess on petrol, diesel and telecom services may be levied by the Central Government.

b) Swachh Bharat cess on accumulated waste produced by mineral waste generation plants like coal, aluminium, and iron ore may be levied by the Central Government.

The amount generated through cess will enable the Central Government to meet its share of 75% in all States, other than hilly States where it may be 90%.

5. Financial Institutions

(xii) Sanitation facility is now a part of priority sector lending. Hence, funds from financial institutions may be availed for this programme. It is recommended that the Swachh Bharat infrastructure may be included as a part of priority sector lending.

6. Innovative Financing

(xiii) Innovative financing models may be availed to generate additional resources for the programme. An example of innovative financing being adopted by an NGO, WATSAN:

Box 4: WATSAN Financing – an innovative mechanism to improve SBM

Water.org is a non-governmental organisation which works with local partners across the world to enable millions of people obtain access to safe water and sanitation improvements through an innovative financing mechanism called Water Credit. Water.org has invested USD 8.15 million worth philanthropic capital in India through more than 20 handpicked credible Micro Finance Institutions (MFIs). This has stimulated more than 550,000 loans worth USD 102 million with 96% of the borrowers being women at a repayment rate of 99%. While the majority of the work has been focused in the two States of Tamil Nadu and Karnataka, Water.org's partners are now present in around 12 States. Philanthropic contribution directed towards WaterCredit enables Water.org to provide grants (smart subsidies) to incentivise its partner financial institutions to cover start-up costs associated with launching a WaterCredit loan portfolio.

Water.org does not provide funding for the loan portfolio itself or make microloans directly. Grants are provided to the parent NGOs of MFIs or WASH NGOs in the area who spread awareness, create demand on the need for toilets and for community mobilisation. Water.org also provides assistance to the financial partners to build institutional capacity to give water and sanitation loans. Water Credit loans are given for various infrastructure requirements such as individual water connections, shallow wells/hand pumps, bore holes / bore wells, rainwater harvesting structures, leachpit latrines, and toilets with septic tank and bathing facilities, biogas digesters and sanitation improvements.

As the loans are repaid, the loan capital is redeployed to additional people in need of safe water and sanitation services. Through Water Credit, Water.org "stretches the impact of each rupee" (12.50 times the philanthropic capital in India) by channelling and redeploying philanthropic capital more efficiently to impact increased numbers of people through demand-driven, sustainable services.

7. Other measures: Polluter Pays Principle

(xiv) Each waste generator should pay for the waste generated. The charges for waste management may be collected along with property tax, water supply bills or electricity bills, as felt appropriate by the State Govt. / ULBs.

8. Financial Assistance under SBM

(xv) Dysfunctional toilets constructed under Total Sanitation Campaign to be treated as no toilets and therefore should be made eligible for fresh financial assistance. Hence one time assistance for re-construction of dysfunctional toilets constructed under the Total Sanitation Campaign may be provided from budgetary source to achieve ODF.

(xvi) Incentive amount for construction of one unit of IHHL in urban and rural areas should be equal and enhanced to Rs.15,000/- for both urban and rural areas

(xvii) Additional incentive grant may be given to best performing States to encourage their activities in the field of sanitation and waste management.

(xviii) State Specific cost norms may be devised by the State Government for construction of toilets and sanitation facilities in certain difficult areas like hilly regions, flood prone areas and riverine islands etc.

IV. Robust Institutional Mechanism

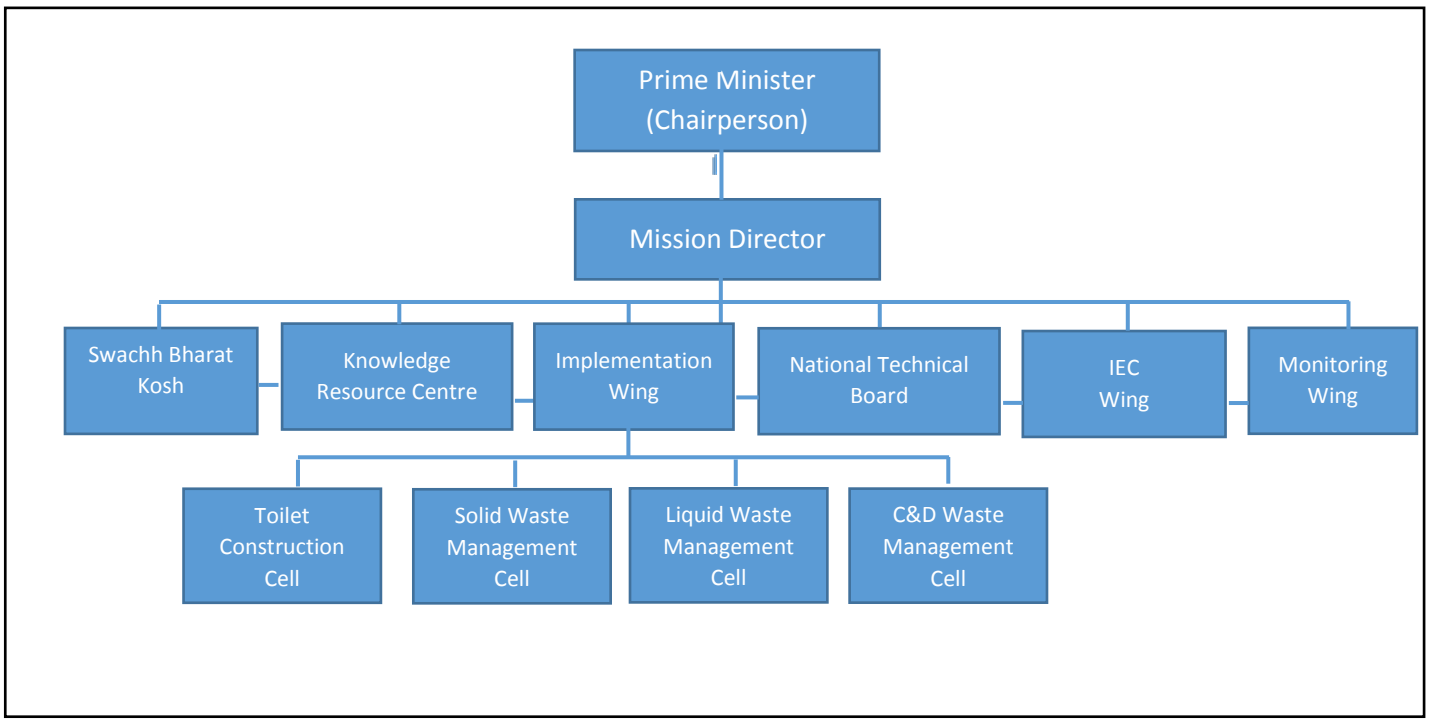
The success of Swachh Bharat Mission rests on a strong institutional framework which will help in efficient implementation of the program. Links between components of institutional framework can enhance and thereby bring the robustness of the system. Coupling between resource users and public infrastructure providers is a key variable that impacts the robustness of the system. There is always wider and effective impact of national leaders' involvement in any project on the people. A call from the Prime Minister on August 15, 2014 for constructions of toilets in schools within a year has motivated the implementing agencies in nearly achieving the target in a mission mode. Hence, there is a need to put a thrust both at National and State level by the highest political leadership to make the Swachh Bharat Mission a success within the prescribed time frame.

The Sub-Group is of the view that the Mission should be led from the highest level and therefore recommends the following framework:

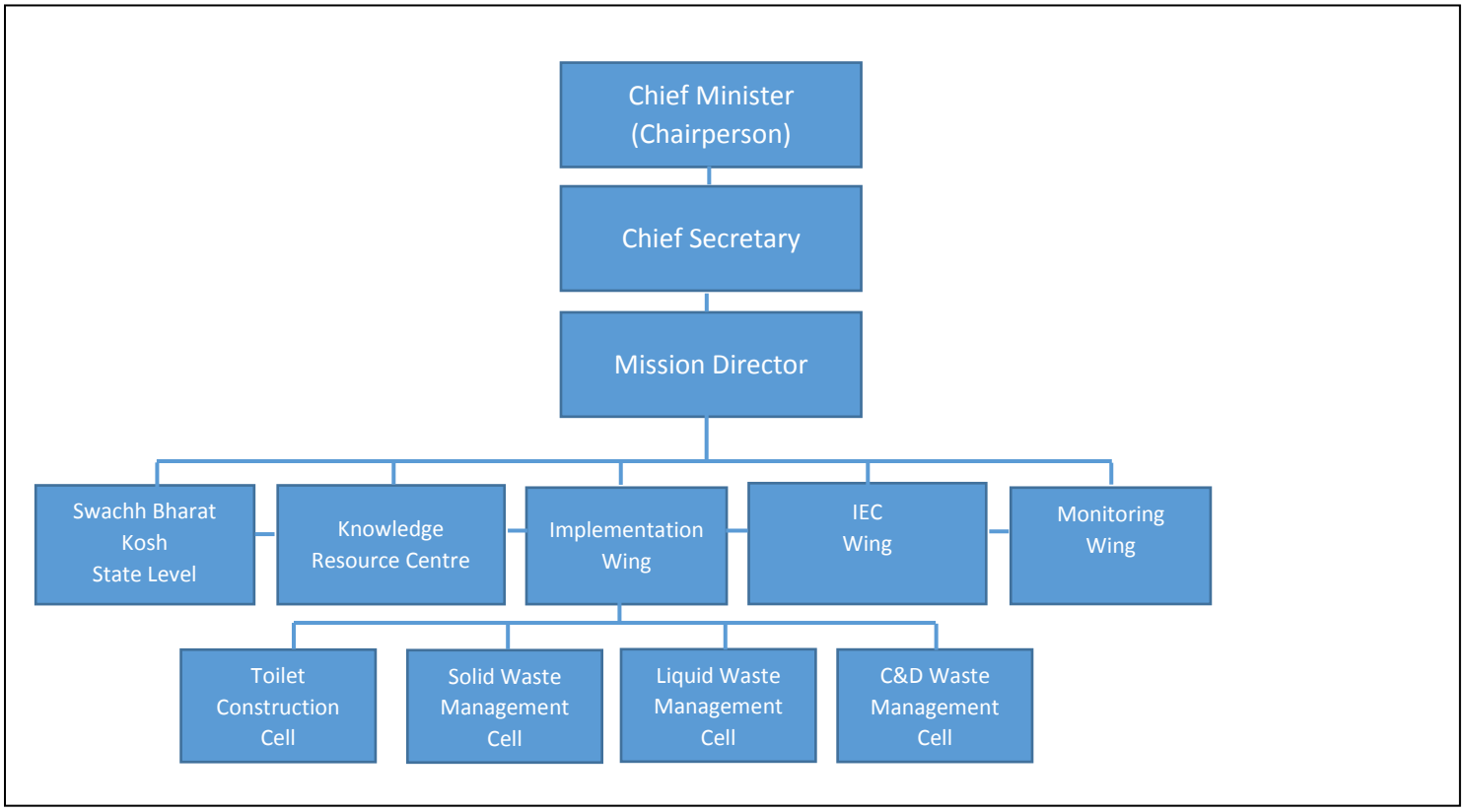
(i) There should be a Mission at national level headed by the Prime Minister, who will be the chairperson and coordinated by the Mission Director who would coordinate across all concerned Departments at the Govt. of India level. At the State Level, the Mission may be headed by the Chief Minister as the Chairperson and coordinated by the Chief Secretary. A Mission Director would be the nodal authority. This Mission Structure is being recommended so as to involve the leadership at the highest level to achieve the objectives of the Swachh Bharat Mission within the time frame.

(ii) The Mission may be in form of a Society, an SPV, an autonomous agency or even a strong department of the government. The body will have the implementing cells dealing with the areas of toilet construction, solid waste management, liquid waste management and C&D waste. Further, there will be wings related to IEC, Knowledge Resource Centre, Swachh Bharat Kosh, National Technical Board and Monitoring.

Structure of National Level Mission



Structure of State Level Mission



(iii) Apex Committee may be set up under the chairpersonship of Chief Minister of the State with all the ministers of the concerned departments as members for quarterly monitoring of the progress of the programme.

(iv) The institutional mechanism provided for the Swachh Bharat Mission, for both urban and rural, under the chairpersonship of Chief Secretary may continue to provide feedback and support to the 'Apex Committee'.

(v) A dedicated team of officers at the district level may be deputed for Swachh Bharat Mission, who shall report to the District Collector/Deputy Commissioner. A District Swachhata Committee under the chairpersonship of the District Collector may be formed to coordinate the activities of the departments related to sanitation and waste management and ULBs at district level, and resolve the issues if any.

(vi) Review all laws and rules on waste management like bio-medical waste and e-waste including municipal laws etc. for strict enforcement and penal provisions.

(vii) All municipal corporations should have a Sanitation Management Cell comprising technical and supervisory staff for Solid and Liquid Waste Management. The cell should ensure efficient SLWM.

V. Measures for Technological Support

Processing and treatment of waste in a scientific manner is the need of the hour. For scientific treatment of waste, various technologies are available. The choice of appropriate technology, its evaluation and procurement has been found to be very difficult process and there is a vacuum relating to technological assistance to States and ULBs in this regard. Further, in the long run, innovative technologies also need to be identified which use less of resources and are cost effective. Providing technological support to States and ULBs is therefore very crucial for the success of this mission. The Sub-Group recommends the following measures for providing technological support to States and ULBs.

(i) Waste Management technologies may vary as per the area (rural and urban), population, nature and quantum of waste. So the technology appropriate to the requirements of the locality must be chosen.

(ii) There is absolute necessity to guide ULBs in identification, evaluation, costing, selection and procurement of technology for solid and liquid waste management, especially for generation of waste to energy because technologies are mostly not indigenous, yet to be established and accepted in India. There is a lack of understanding and confidence in the ULBs to deal with the vendors and procure the technology

required. The Sub-Group, therefore, recommends that a National Technical Board may be set up, preferably by the Ministry of Urban Development, to provide the knowledge and handholding of Local Bodies in the entire process from identification to final procurement of technology. The National Technical Board shall comprise practitioners in the field, O&M experts, reputed subject matter experts, technology providers and financial analysts. The board shall facilitate State Government/ ULBs in adoption of appropriate systems and technologies for an efficient delivery

(iii) There is a need for developing the standards and certification for products derived from Construction & Demolition waste as lack of appropriate standards is affecting its marketing and use. The Bureau of Indian Standards and Indian Roads Congress may bring out the relevant standards. The building codes may be modified so that all the government buildings use a certain percentage of recycled materials from construction and demolition waste.

(iv) The facility for treatment and disposal of Biomedical Waste should be provided on cluster basis considering the high level of technologies and expertise requirement. The cost of disposal should be borne by the producer of the waste.

(v) A centralized facility in each State in line with Centralized Hazardous Waste Management Facility should be provided for proper treatment and material recovery fore-waste. The informal sector like *Kabadiwalas* can be brought in formal sector for collection of e-waste.

(vi) It is important that all components of sanitation planning are incorporated in SBM. The Swachh Bharat Mission (Urban) has major components relating to the construction of toilets and municipal solid waste management. Treatment of liquid waste is not covered under the Swachh Bharat Mission (Urban). Hence, it is suggested that sewage management may also be included in the urban component of the Mission.

(vii) Use of recycled or treated water to be encouraged.

(viii) Reputed Research institutions, both at Central and State level, may be made a technical partner for evolving cost effective technologies for solid and liquid waste management. Further, the research institutions may also work towards developing technologies which use less land and water.

(ix) The Ministry of Drinking Water & Sanitation and Ministry of Urban Development have published compendium and handbook of technologies. It is recommended that the same may be referred for guidance.

(x) Ministry of Urban Development and Ministry of Drinking Water and Sanitation may work out the indicative cost of procurement of equipment for Solid and Liquid Waste Management projects. A model procurement policy may be devised.

(xi) Management of existing dumpsites can be tried with the recent technology called "Bio-Mining" for processing of waste in existing dump site. This process refers to onsite above ground treatment of waste (stabilization) and extracting organic matter and other recoverable.

(xii) Decentralized wastewater treatment processes should be promoted in housing colonies, hotels, schools, high-rise buildings, hospitals and public toilets.

(xiii) Slaughter houses may be modernized for creating hygienic conditions.

(xiv) Initiative similar to Clean Ganga Model may be used to clean other rivers as well.

VI. Measures to encourage private sector participation

The Swachh Bharat Mission is a programme which is being undertaken in a Mission mode with wide scale objectives to be achieved in a short duration of time. This needs a fast track and efficient system to be put in place. The efforts of the government, therefore, need to be supplemented by the Private Sector. Private sector participation and PPPs are required to mobilise funds, provide innovative technologies, efficient and fast delivery of outcomes. However, this is not an area which is financially attractive and viable and lacks standardised procedures. An enabling policy framework is needed to encourage private sector participation.

In this regard the Sub-Group makes the following recommendations:

(i) Tariff policy for power generated from waste to energy may be formulated by Ministry of Power and tariff for power from these plants may be fixed by the Electricity Regulatory Commission in a manner that such projects are viable. Also, the State Electricity Boards or Distribution companies may be mandated to compulsorily buy the power generated from the waste to energy plants.

(ii) In order to improve the viability of Solid Waste Management projects tax exemptions may be provided. For bigger municipalities and cluster of municipalities, Waste to Energy plants are suggested and for smaller towns and rural areas, composting is suggested.

(iii) Output based subsidy may be provided to the private sector for sale of by-products like compost. Provision of subsidy of Rs.1500/- for compost is under consideration by the Government of India. It is recommended to reduce the subsidy on chemical fertilizers

and correspondingly increase subsidy on compost to promote the use of compost. The Central Government may prescribe the standards for composting. Labelling, branding and certification of the compost may be done by the State Governments based on nationally determined standards. Liquid Waste Management projects may be undertaken through PPP mode. There is a need to locate bulk users of treated water like industries. The treated water may also be used for gardening, parks as well as flushing of toilets.

(iv) The Ministry of Urban Development should also encourage marketing of RDF and biogas etc.

(v) The recommended National Technology Board may also evolve simplified and transparent procurement mechanism to encourage private sector participation.

(vi) The Civil Society Organisations may be encouraged to play an active role in this Mission by recognising their work in this area.

(vii) Waste to Energy plants may be set up on PPP mode. A sound framework of PPP needs to be outlined for a fair and transparent procurement mechanism. The responsibility of the municipal authority and PPP partner needs to be clearly identified. It is very essential that municipal authority identifies suitable land for setting up processing/ disposal facilities and obtain all necessary clearances; supply the collected waste at the processing plant free of cost or appropriately compensate the private operator wherever collection is undertaken by him and also ensure that the quantity and quality of waste supplied to the concessionaire is as agreed in the concession agreement and should further ensure that Construction and Demolition (C&D) waste as well as street sweeping and silt removed from the surface drains is not delivered at the processing facility. Further, it may be ensured that contracts for transportation of waste are not biased in favour of tipping fee based on weights. Municipal authority should broadly assess the requirement of funds and modalities of financing for ensuring construction, operation and maintenance of the facility/ services. The private partner (concessionaire) should develop the project as per the timelines and adhere to the key performance standards prescribed in the concession agreement. The concessionaire should meet the environmental standards prescribed for the waste processing plant. The processing of waste should be undertaken in such a manner that non-recyclable or residue articles sent to landfills is minimal

(viii) For international and national level events like melas, sporting events etc. where temporary congregation occurs, provision of sanitation facilities by services providers may be encouraged and appropriate incentives may be provided to them.

VII. Sustainability of the Mission

Dealing with the rapidly increasing amount of waste, construction of toilets, behaviour change, be it toilet usage or say no to littering, are complex challenges in itself. The focus must turn to sustainable solutions to develop appropriate measures to make India clean. The Swachh Bharat Mission endeavours to create infrastructure and motivate people in using sanitation facilities and maintaining cleanliness. The mission has a time frame of 4 years remaining to achieve the objectives. The initial years will put the infrastructure in place. However to keep the momentum going on and to sustain the mission in long run, adequate measures are required.

Incentives and Rewards:

(i) Swachh Bharat Grading/Rating may be done for all Gram Panchayats, Municipalities, Blocks, Districts and States every year to promote competition among them

(ii) One day in each month and one week each year (culminating with 2nd October) may be assigned for the activities of the SBA and to reward best performing Gram Panchayat, Block, ULB, District and State as per the Swachh Bharat rating. To boost up the programme, motivate institutions and individuals and generate competition among them, the award may be given by Prime Minister and Chief Ministers.

Operation and Maintenance of community and public toilets may differ in rural and urban areas.

Rural:

(iii) The issue of community and public toilets would have to be looked differently. In rural areas, individual household toilet is preferable. However, where availability of space in households is limited, cluster toilets may be constructed and each household may be provided a dedicated toilet. The maintenance of the toilets will then be done by the household itself.

(iv) In rural areas, public toilets could be constructed in places where congregation takes place like bus stops, parks, haat bazar, religious institutions, Panchayat office, Govt. / semi-Govt. / private owned office, banks, commercial places, cinema halls or any other community based organisations. O&M of toilets in premises, buildings etc. may be done by the owners of the building. The responsibility for O&M of toilets in parks, bus stands, haat bazars etc. may be done by Gram Panchayats and part of the resources for the O&M may be provided by the State Government.

Urban:

(v) In urban areas, pay and use system could be more feasible. The toilets could be constructed in places where parking facility is available. The private partner to whom the parking is leased out may also be entrusted with the O&M of toilets.

(vi) Toilets in slum areas may be constructed in the available space and directly connected to sewer lines, to address public health concerns, assuming that basic services should be provided to all, irrespective of ownership of the land. However, provision of such services shall not confer any land rights to the occupants. Bio-Toilets may be provided where toilets constructed in slum areas cannot be connected to sewer lines. The usage of toilets may be made free for the first two years and charges may be levied after the people get used to it. This is to inculcate the habit of toilet usage in the community.

(vii) Religious institutions and other community based organisations may be motivated to take the responsibility of O&M of toilets in their areas.

(viii) Advertisements on walls of public toilets may also be a source of revenue generation for operation and maintenance.

(ix) In urban areas also, O&M of toilets in premises, buildings etc. may be done by the owners of the building. However, for usage of public toilets in parks, bus stands etc., user charges may be levied.

Others:

(x) In the user charge model for community toilets, provision of monthly payments in the form of tokens or smart cards may also be introduced as an easy and convenient mode of payment.

(xi) Every public building or privately owned commercial building may have toilet facilities as per the footfall in the building. The building by-laws/rules may include norms for construction of toilets if there is congregation of more than a certain number of people.

Role of NITI Aayog

(i) NITI Aayog may provide a common platform for resolution of inter-sectoral and inter-departmental issues.

(ii) NITI Aayog should develop, in consultation with Ministries and State Governments, an objective assessment framework for (i) assessing ODF and (ii) assessing ODF plus, that is, cleanliness.

(iii) NITI Aayog will evolve verification protocol and National Level Guidelines to ensure that uniform procedure is followed in acknowledging the ODF status by States.

(iv) NITI Aayog may document the best practices related to Sanitation and Waste Management.

Chapter 5

Action Plan

Sanitation

(i) Need assessment of the number of toilets- individual household, community and public toilets; location; design etc. may be done by December, 2015.

(ii) Each State must phase the construction of toilets- individual household, community and public toilets in such a manner that the construction of the toilets is completed by March, 2019. An assessment may be done in April, 2019 about the status and any shortfalls or gaps may be completed by September, 2019.

(iii) The phasing of construction of toilets may be done in such a manner that in each financial year, at least 25 percent of the required construction is completed. Any shortfall in construction may be carried forward to next financial year but no later than March, 2019.

(iv) The Operation and Maintenance strategy for maintenance of community and public toilets may be prepared by December, 2015.

(v) The professional agency for designing the behaviour change communication strategy may be put in place by the State Governments and Central Government by March, 2016.

(vi) The State may select the social/thought, political and celebrity leaders to spread the message of sanitation and chalk out the strategy by March, 2016.

(vii) Ministry of Human Resource Development along with the State Government may make efforts to add sanitation in school curriculum, preferably from Class I onwards, from the next academic year in 2016. The curriculum may be decided by December, 2015.

(viii) The State Government may amend the building by-laws/rules mandating construction of toilets as per the footfall in the building, either public or privately owned commercial building by March, 2016.

(ix) Ministry of Drinking Water & Sanitation in consultation with MoUD and other related Ministries may devise a methodology to capture toilet usage by December, 2015.

(x) NITI Aayog may, in consultation with Ministries and State Governments, develop an objective assessment framework for assessing ODF and ODF plus, that is, cleanliness by December, 2015.

Waste Management

(i) Each State must do an assessment of the quantum of waste generation, (including municipal solid waste, C&D waste, bio-medical waste, e-waste, plastic waste, liquid waste etc.) in the State; status of existing waste processing plants and the processing facilities required to be set up further. This assessment may be completed by March, 2016.

(ii) The National Technical Board may be set up in Ministry of Urban Development by March 2016. This organisation may guide the States/Union Territories in identification, selection and procurement of technologies for waste management.

(iii) The Ministry of Urban Development may bring out simplified contract documents by December, 2015.

(iv) The Ministry of Power may finalise the tariff policy for energy generation from waste by December, 2015.

(v) The States may phase the setting up of waste processing plants in such a manner that the facilities are set up by March, 2019. An assessment may be done in April, 2019 about the status and any shortfalls or gaps may be completed by September, 2019.

(vi) The phasing of setting up of waste processing facilities may be done in such a manner that composting facilities are set up in the first 2 years and waste to energy plants are set up in 3-4 years.

(vii) The States may regularly update their status of waste management every six months and provide the information to the Ministry of Urban Development (MoUD) by October, 2015 and April, 2015 of next year. The format for the information to be furnished by the States may be provided by the MoUD by December 2015.

(viii) Ministry of Skill Development may design a course, including diploma course, to train personnel in the field of solid and liquid waste management in consultation with the related ministries by March 2016.

General

(i) Ministry of Urban Development may work out the tax exemptions required for making the waste processing activities viable and put forth the proposal for consideration of Ministry of Finance by March, 2016. The States/Union Territories may also work out the tax exemptions levied by them.

(ii) Ministry of Drinking Water and Sanitation may monitor the progress of the Swachh Bharat Mission and compile the information from various Ministries like Ministry of

Human Resource Development, Ministry of Women and Child Development, Ministry of Rural Development and Ministry of Urban Development etc. The format for the same may be designed by the Ministry of Drinking Water & Sanitation by December, 2015 and uploaded on the website.

(iii) The 'Apex Committee' under the Chairpersonship of Chief Minister of the State may be constituted by December, 2015.

(iv) Setting up of Swachh Bharat Kosh in States by March, 2016.

(v) Setting up of a National and State level mission by March, 2016.

Table 7: Action Plan for Swachh Bharat Mission 2015-19

Sl. No	Activities	2015-16	2016-17	2017-18	2018-19	2019-20 (Upto Oct. 2, 2019)
1	**Sanitation**					
1.1	Need assessment of the number of toilets, individual household, community and public toilets; location; design etc. to be done **by MDWS, MoUD, States /UTs** by December, 2015.	**31st Dec.**				
1.2.1	Each **State/UT** must phase out the construction of toilets, individual household, community and public toilets in such a manner that the construction of the toilets is completed by March, 2019. An assessment may be done in April, 2019 about the status.				**31st Mar.**	**30th April**
1.2.2	Any shortfalls or gaps found in the assessment by the **MDWS, MoUD, States /UTs** may be completed by September, 2019.					**30th Sept.**
1.3	The phasing of construction of toilets by **MDWS, MoUD, States /UTs** may be done in such a manner that in each financial year, at least 25 per cent of the required construction is completed. Any shortfall in construction may be carried forward to next financial year but no later than March, 2019.	**25% of required toilets to be constructed**	**25% of required toilets to be constructed**	**25% of required toilets to be constructed**	**25% of required toilets to be constructed**	**31st Mar.**
1.4	The Operation and Maintenance strategy for maintenance of community and public toilets may be prepared **MDWS, MoUD, States /UTs** by December, 2015.	**31st Dec.**				
1.5	The professional agency for designing the behaviour change communication strategy may be put in place by the **MDWS, MoUD, States /UTs** by March, 2016.	**31st Mar.**				
1.6	The **MDWS, MoUD, States/UT** may select the social/thought, political and celebrity leaders to spread the message of sanitation and chalk out the strategy by March, 2016.	**31st Mar.**				
1.7	**Ministry of Human Resource Development along with the State Governments/UTs** may make efforts to add sanitation in school curriculum, preferably from Class I onwards, from the next academic year in 2016. The curriculum may be decided by December, 2015.	**31st Dec**				
1.8	The **State Governments/UTs** may amend the building by-laws/rules mandating construction of toilets as	**31st Mar**				

	per the footfall in the building, either public or privately owned commercial building.					
1.9	**Ministry of Drinking Water & Sanitation in consultation with MoUD and other related ministries** may devise a methodology by December, 2015 to capture toilet usage.	**31st Dec.**				
1.10	NITI Aayog may in consultation with Ministries and State Governments develop an objective assessment framework for assessing ODF and ODF plus, that is, cleanliness by December, 2015	**31st Dec**				
2	**Waste Management**					
2.1	Each **State/UT** must do an assessment of the quantum of waste generation, (including municipal solid waste, C&D waste, bio-medical waste, e-waste, plastic waste, liquid waste etc.) in the State; status of existing waste processing plants and the processing facilities required to be set up further. This assessment may be completed by March, 2016.	**31st Mar.**				
2.2	The National Technical Board may be set up in **Ministry of Urban Development** by March, 2016. This organisation may guide the State in identification, selection and procurement of technology as per the assessment done by the States.	**31st Mar.**				
2.3	The **Ministry of Urban Development** may bring out the simplified contract documents by December 2015.	**31st Dec**				
2.4	The **Ministry of Power** may finalise the tariff policy for energy generation from waste by December, 2015.	**31st Dec**				
2.5.1	The **MoUD**, **States/UTs** may phase the setting up of waste processing plants in such a manner that the facilities are set up by March, 2019. An assessment by **MoUD, State/UT** may be done in April, 2019 about the status of waste management.				**31st Mar.**	**30th Apr.**
2.5.2	Any shortfalls or gaps in implementation of waste management may be completed by **MoUD, State/UT** September, 2019.					**30th Sept.**
2.6	The phasing of setting up of waste processing facilities may be done by **MoUD, State/UT** in such a manner that composting facilities are set up in the first 2 years and waste to energy plants are set in 3-4 years.					**30st Sept.**
2.7	The **States/UTs** may regularly update their status of waste management every six months and	**31st Dec**				

	provide the information to the Ministry of Urban Development by the 15th of October and 15th of April next year. The **format for the information to be furnished by the States may be provided by the MoUD by December 31, 2015.**					
2.8	**Ministry of Skill Development** may design a course, including diploma course, to train personnel in the field of solid and liquid waste management in consultation with the related ministries, by March 31, 2016.	**31st Mar**				
3	**General**					
3.1	**Ministry of Urban Development** may work out the tax exemptions required for making the waste processing activity viable and put forth the **proposal for consideration of Ministry of Finance** by March, 2016. The States/UTs may accordingly work out the tax exemptions.	**31st Mar**				
3.2	**Ministry of Drinking Water and Sanitation** may monitor the progress of the Swachh Bharat Mission and compile the information from various ministries like Ministry of Human Resource Development, Ministry of Women and Child Development, Ministry of Rural Development, Ministry of Urban Development etc. **The format for the same may be designed by the Ministry of Drinking Water & Sanitation** in consultation with other related ministries by December, 2015 and uploaded on the website.	**31st Dec.**				
3.3	The 'Apex Committee' under the Chairmanship of Chief Minister of the **State/UT** may be constituted by December, 2015.	**31st Dec.**				
3.4	Setting up of Swachh Bharat Kosh in States by 31st March, 2016.	**31st Mar**				
3.5	Setting up of a National and State level mission by March, 2016.	**31st Mar**				

Note: Year denotes financial year.

Annexure I

Order of the constitution of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan

M-12043/04/2015-NI
National Institution for Transforming India
(Plan Coordination and Management Division)

NITI Aayog, New Delhi
24th March 2015

ORDER

Sub: Modification in constitution of a Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan

*****

In partial modification of the order of even number dated March 9, 2015, the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan is hereby re- constituted as follows.

Composition

a) Chief Minister , Andhra Pradesh	: Convener
b) Chief Minister, Bihar	: Member
c) Chief Minister, Delhi	: Member
d) Chief Minister, Haryana	: Member
e) Chief Minister, Karnataka	: Member
f) Chief Minister, Maharashtra	: Member
g) Chief Minister, Mizoram	: Member
h) Chief Minister, Sikkim	: Member
i) Chief Minister, West Bengal	: Member
j) Chief Minister, Uttarakhand	: Member
k) CEO, NITI Aayog	Coordinator

The Sub-Group would be serviced by NITI Aayog.

2. **Terms of Reference of the Sub-Group will be as follows:**

(i) To examine financial requirements for comprehensive implementation of the Swachh Bharat Mission and suggest measures for meeting budgetary needs;

(ii) To recommend robust institutional mechanisms for effective implementation;

(iii) To recommend measures for technological support for different components of SBM, including solid and liquid waste management in rural and urban areas;

(iv) To examine models for private sector participation in the Swachh Bharat Mission and to suggest ways for substantial improvement in participation of private sector and civil society organisations for effective implementation,

(v) To recommend ways to make the SBM sustainable;

(vi) Any other measures.

3. General

a) Since the Governing Council had decided this to be a Sub-Group of Chief Ministers, it is clarified that no other person may represent the Members in case the concerned CM is unable to attend the deliberations. However, the Convener may co-opt any other official/non-official expert/representative of any organisation to assist the Sub-Group.

b) The expenditure on TA/DA in connection with the meeting of the sub-group in respect of a Member or any co-opted official will be borne by the respective States/ Department. However, in case of co-opted non-official persons, they will be entitled for TA/DA as admissible to Grade-I Officials of the Government of India limited to economy class in case of air journey where applicable and the expenditure in this regard would be met by the NITI Aayog.

c) The Sub-Group will submit its report within three months of its notification.

This issues with the approval of the Prime Minister and Chairman, NITI.

(Sindhushree Khullar)
CEO (NITI)

To,

Convenor and all Members of the Sub-Group

Copy also for information to:

1. All Members of the Governing Council of NITI Aayog
2. Principal Secretary to the Prime Minister
3. PS to the Prime Minister
4. Vice Chairman and Full Time Members of NITI Aayog

(Sindhushree Khullar)
CEO (NITI)

Annexure II

Record of Discussions of the meetings of the Sub-Group of Chief Ministers

Record of discussions of the first meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan held on 30-04-2015 at 10 AM at NITI Aayog, New Delhi.

The Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan was constituted as per the decision taken in the first meeting of the Governing Council of NITI Aayog chaired by the Prime Minister on 8th February, 2015. The Sub-Group consists of Chief Ministers of Andhra Pradesh, Bihar, Delhi, Haryana, Karnataka, Maharashtra, Mizoram, Sikkim, Uttarakhand and West Bengal as Members. Convenor of the Sub-Group is the Chief Minister of Andhra Pradesh.

2. The First meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan convened by Sri N. Chandrababu Naidu, Chief Minister of Andhra Pradesh was held on 30.04.2015 at NITI Aayog, New Delhi from 10 AM onwards. The list of participants is enclosed at Annexure.

3. CEO NITI Aayog, welcomed all the dignitaries and participants.

4. Meeting started with a brief presentation by Dr. Ashok Kumar Jain, Adviser, NITI Aayog about the Terms of Reference of the Sub-Group on Swachh Bharat Abhiyaan. He explained the overall sanitation coverage in the country including the programme's focus and target, issues for discussion and way forward to make India Open Defecation Free by the 2nd October, 2019, which is the 150th Birth anniversary of Mahatma Gandhi.

5. Thereafter Chief Ministers and representatives from member States stated about some of the achievements of their States. Chief Minister, Karnataka told about Constitution of a High- Powered Committee (HPC), Constitution of a State Mission Directorate, Creation of a Project Management Unit (PMU) and Constitution of a District Level Monitoring Committee in order to implement Swachh Bharat Mission in Urban areas effectively. To guarantee sanitation facilities in rural areas, Karnataka Rural Sanitation Facility Guarantee Bill is being introduced in the current year. The programme of constructing community sanitation complexes (CSCs) has been initiated last year and action is being taken to construct 2000

CSCs, each at a cost of Rs.20.00 lakhs. Each CSC consists of 7 toilets, 4 bathrooms, one attendant room, one washing platform and a washing machine with independent water and power supply. The provision for toilet-cum-bathroom would cost Rs.14000. He also mentioned about the software 'Panchtantra' developed by the State for uploading the information of families who possesses the Individual household toilets and who do not possess these.

6. Chief Minister, Haryana stated about the achievement of 86% coverage of Individual Household Latrines in rural areas of Haryana State and development of the three ponds system for Liquid Waste Management in 50 villages. The State is now developing a five pond system. Pilot projects are under way to test the new paradigm and technology. In urban areas, 6 Solid Waste Management projects have been setup and one more is being established.

7. Chief Minister, Haryana emphasised the need for attention by Municipal Corporation for unauthorised colonies. The fund should be raised for the new cities and their cleaning should be done at wee hours. Bio and Non-Bio waste could be separated at home, as a matter of habit that would make easier for recycling of waste material. The central assistance for individual latrines is Rs. 12000 under SBM (Gramin); whereas it is only Rs. 4000 under SBM (Urban). The two should be at par at least for slums, peri-urban areas and those where sewerage system is not available. There is no plan for peri-urban areas and what are called "Census Towns". These are the areas where urbanization happens at a fast pace but usually there is neither a Panchayat nor a municipal body to look after their sanitation needs. Hence, he laid emphasis to take care of sanitation needs in peri-urban areas also and proposed setting up of two sub-missions for peri-urban and urban areas.

8. Always there is great impact of religious gurus over masses. If the need for cleanliness could be propagated through them linking it with religion, then certainly, it would motivate the people. At the end, he emphasised the need for development of comprehensive solutions and the life cycle costs of these solutions discarding a piecemeal approach.

9. The Chief Minister, Andhra Pradesh, deliberated upon the importance of the Sub-Group and concerns of the Prime Minister for achieving Swachh Bharat by 2nd October, 2019. He mentioned to finalise a Comprehensive Report by the end of June, 2015. He also informed that in India about 80% of the waste is dumped as land-fills without segregating it into hazardous and non-hazardous ones, whereas this is only about 1% to 2% in some of the

countries. Also power generation from waste to energy is quite low in the country (about 20-30 MW) as compared to its potential. He told about the need for studying the best practices/ technologies for sanitation including solid and liquid waste management in India and abroad. He also emphasised to collect the best practices/ technologies from various parts of India as well as other countries. He further mentioned that a team of officers may visit few places in India and abroad to study the best practices/ technologies to learn the lessons from them to appropriately implement in the country. He also laid the emphasis on the lead to be taken by Chief Ministers for bringing the change in the mind set of people to make the programme successful. The convener also mentioned about the need to control the pollution of water bodies, rivers and sea beaches by taking up solid and liquid waste management activities. He also emphasised the need of segregating the garbage, recycling of garbage, waste to fertilizers, waste to energy as being done in many countries like USA, Germany, China etc. In India, it is at very low key. He also shared some thoughts on how to generate the funds for this programme besides other sources, which are as follows:

(i) Giving the Income Tax exemptions on the contributions made by any individual, industry or institution etc.
(ii) Levying the Swachh Bharat Cess on petrol and diesel etc.

10. The Ministers and officials from the member-States also put forward the achievements of their State and mechanism to fill the gap. Sikkim has got the Nirmal Rajya Puruskar in 2008 but aftermath of earthquake in 2011 has put a challenge in handling solid waste management in the State. The representative from West Bengal told that there should be a separate fund for revival of defunct/dis-functional toilets.

11. Dr V. K. Saraswat, Member, NITI Aayog told that there could be innovative technology that might be suitable for one State but may not suit other States due to different climatic, geographical and social conditions. Hence viability of each technology may or may not be universal.

12. The CEO NITI Aayog told that visit across the States in India is feasible to know the best practices/ technologies. She further told that villages adopted through Saansad Adarsh Gram Yojana could be developed as model villages for sanitation. She also mentioned that partly the requirement of funds can be met from funds under MPLADS and MLALADS funds.

13. At the end, it was decided to hold the next meeting of the Sub-Group of Chief Ministers around mid-May, 2015 at Chandigarh where the Secretaries of the concerned Central Ministries dealing the programme may be invited. The Sub-Group decided to constitute a working group to prepare a draft report and to compile the best practices and technologies in the field of sanitation including solid and liquid waste management after seeking inputs from States and various experts. It will also suggest ways in which the private sector could be roped in and a permanent institutional mechanism to be put in place.

14. Finally, CEO, NITI Aayog thanked all the participants.

Annexure

List of Participants

1. Sri N. Chandrababu Naidu, Chief Minister of Andhra Pradesh and Convener of the Sub-Group
2. Shri Siddaramaiah, Chief Minister of Karnataka and Member of the Sub-Group
3. Shri Manohar Lal, Chief Minister of Haryana and Member of the Sub-Group
4. Shri P. Narayana, Minister of Municipal Administration and Urban Development, Andhra Pradesh
5. Shri Dinesh Agarwal, Minister of Forest & Wildlife, Justice & Law and Sports, Uttarakhand
6. Shri Asim Ahmad Khan, Minister of Environment and Forest, Delhi
7. Shri Ranjeet Patil, State Minister of Urban Development, Maharashtra
8. Dr. V. K. Saraswat, Member, NITI Aayog
9. Dr. Bibek Debroy, Member, NITI Aayog
10. Smt. Sindhushree Khullar, CEO, NITI Aayog
11. Senior officials/ Nodal Officers of member-States
12. Senior officials of NITI Aayog

Record of discussions of the second meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan held on 19-05-2015 at Haryana Niwas, Chandigarh

The second meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan, convened by Sri N. Chandrababu Naidu, Chief Minister of Andhra Pradesh, was held on May 19, 2015 at Chandigarh. The list of participants is enclosed at Annexure.

2. Chief Minister, Haryana welcomed all the participants to the meeting and expressed that all issues, formal and informal needs to be discussed in this meeting.

3. Chief Minister, Andhra Pradesh while initiating the formal proceedings for meeting, outlined that the context of this meeting was about the Swachh Bharat Mission (SBM) with new thrust and achievement of sanitation in rural and urban areas. He emphasised the following points for the successful achievement of goal viz., involvement of public under political leaders and government functionaries; waste segregation as social responsibility; developing a framework of tax exemption for waste management particularly for Waste to Energy plants by both Central and State Governments, adequate budgetary provision for non-viable components; intense awareness campaign; staffing and training of Urban Local Bodies (ULBs); research grants to academic institutions for innovation in waste management process and technologies, corporatisation of the mission at National, State and District levels and enabling framework for different components of Swachh Bharat. He advocated the need for output based incentives and marketing support to the stakeholders involved in waste management practices and it was cited that tax exemption by Central and State Governments to reduce the cost of electricity production and also fixation of appropriate rates of electricity by Regulatory Commissions will make this activity viable. The examples of China, Japan and Singapore were cited and it was reiterated that best practices across the world and cities need to be adopted in India.

4. Chief Executive Officer (CEO), NITI Aayog explained the three focus areas which had evolved during the last meeting of the sub-group, namely, Behaviour Change, Technologies and Operation & Maintenance issues for Community and Public toilets in rural and urban areas. The emphasis was also given on the aspects of technology to minimise solid waste in order to achieve zero waste and promote ‘reduce, reuse and recycle’. CEO informed that three sub-groups within the main working group of officials have been formed to look

into these areas. It was suggested that the nodal officers of each State should visit the best practices in other States.

5. The Chief Minister, Haryana felt need of involving the public as well as social and religious institutions for behaviour change and promotion of sanitation practices. He emphasised on: putting the cleanliness and sanitation practices in school curriculum right from the 1st Class in order to develop the right habits in children. He also emphasised on the ways to deal with toxic waste, economic support to municipalities and other bodies to lead this Abhiyaan and ways to promote recycling, providing support to rag pickers and helping them to be organized, skill development for promoting waste to wealth, involving local communities and Mohalla committees in management and implementation of the programme. He also mentioned that Pollution Control Board should formulate the necessary rules and regulations for Solid Waste as well. He further said that Rs. 5 lakhs incentive will be given by Govt. of Haryana to those villages which will achieve the goal of Swachh Bharat, i.e. Open Defecation Free village and for practising Solid and Liquid waste Management.

6. CEO, NITI Aayog, thereafter, requested the representatives of Ministry of Drinking Water and Sanitation, Ministry of Urban Development and Ministry of Housing and Poverty Alleviation, Govt. of India to make their presentations. This would help in clarifying the perspective of Government of India on the Swachh Bharat Mission.

7. Joint Secretary, Ministry of Drinking Water & Sanitation gave a presentation on SBM (Gramin) focusing on the goal, initiatives taken, issues and challenges in the implementation of SBM. He emphasized that States must lead in implementation of the programme. The recent initiatives undertaken by the Ministry were explained such as the massive media campaigning for behavioural change, orientation programmes for District Collectors and IAS probationers and Mashelkar Committee to accredit innovative technologies that are affordable, appropriate, acceptable and scalable. It was stated that around 11.11 crore households required sanitation facility. The target of Ministry of Drinking Water & Sanitation is to construct 6.84 crore toilets between 2014-15 to 2018-19 and 2 crore toilets are to be constructed under MGNREGA. The concerns and challenges in this regard were highlighted which included the funding pattern, behavioural issue, collective attitudinal change, dearth of agencies for capacity building and need for facilitating action at State and District level.

8. Joint Secretary, Ministry of Urban Development gave a presentation on SBM (urban) outlining the targets under the urban component of the mission. The various sanitation technologies available for construction of toilets like twin pit system, DRDO bio-digesters were explained. Examples of Chhattisgarh, Pune, Bhopal, Gurgaon and Delhi were cited where different construction models have been envisaged. He described the model of Tiruchirappalli where construction of community toilets was undertaken by NGO with the help of Women SHGs. The maintenance of toilets was also done by the SHGs. For solid waste management, the technologies in practice like incineration and gasification and the plants running or being constructed under this technology were explained. One incineration plant is operational in Okhla, New Delhi and another plant is about to be commissioned at Ghazipur, New Delhi. Gasification plants are under construction at Chennai, Pune and Kolhapur. The current interventions of the Ministry were highlighted. The Ministry is working with M/o Chemicals & Fertilizers on Compost Marketing Obligation to extend subsidy on sale of compost along with chemical fertilizers (Rs. 1500/- per MT). Ministry of Power is amending the Electricity Act, 2003, wherein a provision is being included to mandatorily purchase power generated from municipal waste by State Distribution Companies (DISCOMS). Ministry is pursuing with Central Electricity Regulatory Commission (CERC) to determine the rate for Waste-to-Energy. Bureau of Indian Standards (BIS) is developing standards for use of processed C&D waste as aggregate in construction.

9. Joint Secretary, Ministry of Housing and Urban Poverty Alleviation described the initiatives of the Ministry in the field of sanitation. The mandate of National Housing and Habitat Policy, 2007 was highlighted. He explained the draft Affordable Housing Policy which envisages creating infrastructure facilities such as water supply, sanitation and solid waste management in all affordable housing projects and slum rehabilitation projects. The proposed scheme of 'Housing for All' also envisages the slum redevelopment and construction of 2 crore houses including household toilets. Hindustan Prefab Limited, a PSU under the Ministry is constructing nearly 14,621 toilets in schools across the country under CSR. He suggested that the way forward for mainstreaming sanitation included measures like behavioural change; all housing projects with a minimum threshold of population to move towards zero waste; promoting by-laws on reuse of recycled water in commercial complexes and all housing projects etc.

10. The representatives of Government of Andhra Pradesh made a presentation on the technologies for management of solid and liquid waste. It was stated that technological

choices in rural and urban areas may vary significantly. Creating sophisticated treatment systems that rely on chemicals or sophisticated equipment may not be the appropriate solution for the village and may be financially difficult for village to maintain. The examples of operational and upcoming projects in Delhi for treatment of waste including C&D waste were cited. The waste to compost project in collaboration with Mother dairy was explained. Enabling framework for compost, C&D waste, RDF and Waste to Energy were suggested. The needs for output based support in the forms of tariff, marketing support and tax exemptions were emphasised. With regard to liquid waste management in urban areas, the details of existing waste water plants, assessment of various treatment options and costs involved in the process was explained. Some of the measures suggested included decentralized treatment at local level using technology based on natural process; waste stabilization ponds for small towns and wherever feasible waste water treatment plants to include power generation. For liquid waste management in rural areas, it was suggested that grey water generated at household level should be managed upto zero level discharge or minimum waste generated which will be tackled at community level; depending on the population density, the proper sewer collection system with Anaerobic, Facultative and Maturation treatment system can be adopted for Black and Grey water management and the Water should be reused for irrigation and fish farming.

11. Chief Minister, Maharashtra stated that the ULBs lack actual capacity in implementing technologies. Hence it is important that capacity building of ULBs be done for accepting new technologies and a roadmap be devised for adoption of technologies. He further said that there was also a need to adopt technologies which can be taken to scale. It was also emphasised that technologies should not only take into account the composition of waste in the country but also our habits. Behavioural change is a process which will set in slowly and therefore there is a need to align the technologies to the present circumstances. The importance of operation expenditure (Opex) was also emphasised. It was suggested that all the best practices may be collected and a basket of technologies along with a road map may be brought out in the form of a handbook. The importance of training to officers especially Mayors and Presidents of councils was stressed upon. Further, the incentives should be provided for the end product and not for the process. Also a need was there to look into the issues and solution for plastic waste. The Chief Minister also pointed out that under Swachh Bharat Mission (Urban), the central assistance for building the individual toilets is less especially when the central government is contributing more under Swachh Bharat Mission (Gramin).

12. Chief Minister, Mizoram explained that Mizoram is a relatively cleaner State and there is no incidence of open defecation except in remotest villages at the borders of Myanmar and Bangladesh. Young Mizo Association, a Civil Society Organisation has played a vital role in inculcating the value of sanitation among Mizo people. The State government has also been observing cleanliness week since 1977 to create mass awareness and therefore, 80% of the households already have individual toilets. Chief Minister, Mizoram informed that the institutional arrangements for implementing the Swachh Bharat Mission have already been put in place and for the year 2015-16, the State would require a sum of Rs. 35 to 40 crore. He made the following key suggestions for the realisation of the objectives of the mission. The Sub- Group should study, analyse and address the reasons for the state of sanitation in the country as many other countries are maintaining a high degree of cleanliness. The underlying reasons for uncleanliness in the country need to be addressed to make the mission sustainable. There should be dignity in cleaning work and the cleanliness must become everybody's work, if the mission has to succeed. The sub-group may address this issue in the report. Sanitation is a multi- stakeholder, multi-agency and multi-stage activity. So, the institutional capacity of various stakeholders needs to be strengthened. There is a need for an array of technologies and management models so that adequate flexibility is there to adopt what is appropriate. He also mentioned that the State should provide the access to toilets to those who do not have it.

13. Minister of Rural Development & Panchayat Raj, Karnataka said that construction of toilets alone cannot make the rural areas clean. The issue of cow dung also needs to be addressed. This can be converted into useful products. He suggested that toilet cum bathroom should be constructed and cited the example of public toilets constructed in the State which also provide a washing machine and washing space. The importance of underground drainage system in towns of more than one lakh population was emphasised. He did not support the construction of 2 crore toilets under MGNREGA, since it will create a confusion at the field level to maintain 60:40 ratio of wage and material. Rather, he stressed the need for a single window system to sanction the toilets so that the toilets are constructed duly following the same guidelines. Policy level changes were also required and it was suggested that in the National Water Policy, water requirement for sanitation must be accorded priority just after drinking water.

14. Minister of Medical & Health, Uttarakhand suggested that a fund on the lines of Prime Minister Relief Fund may be created to raise the finances required for the mission.

Other measures like cess, corporate social responsibility initiatives and funding from international institutions like ADB may be explored. The entire funding support from the Central Government was suggested. He emphasised the importance of timely allocation of finances and also monitoring of the activities. The example of Sulabh in the field of sanitation needs to be looked. He stressed the importance of awareness campaign and including sanitation in school curriculum. The need to assess the achievements and failures of earlier programmes like Total Sanitation Campaign and Nirmal Bharat Abhiyaan was essential for realisation of objectives of this mission. He also mentioned that the villages which were shown as fully covered in the past but do not have sufficient toilets should also be considered under the programme.

15. Minister of Environment & Forest, Govt. of Delhi shared the initiatives taken by the Government of Delhi in this regard. Construction and maintenance of two lakh toilets was envisaged to be taken up. It was suggested that waste to compost units may be set up in localities so that the waste in the area is treated there itself. It was also suggested that green cover may be increased.

16. The convener of the Sub-Group and the Chief Minister, Andhra Pradesh summed up the discussions and laid down the following action points. NITI Aayog should conduct two workshops- one with technology providers in the field of waste to energy, compost and C&D waste and second on best practices adopted locally and globally. It was suggested that the best practices from the States should be integrated in the report. The representatives of West Bengal and Bihar were requested to send the comments in writing. The venue of the next meeting was decided as Bengaluru and which will tentatively be around June 15, 2015. The issues for discussion would include achievement of ODF status by October 2, 2019; zero waste; reduce, reuse and recycle; institutional mechanisms needed for effective implementation and monitoring at National, State and District levels; behaviour change communication; technologies for conversion of waste to wealth; models for public-private participation; revenue models for operation and maintenance of community and public toilets; how to give tax exemptions and how to increase more number of NGOs. He concluded by stating that sanitation was a universal problem and the mission approach would help in achieving the objectives of a clean India.

Annexure

List of Participants

1. Sri N. Chandrababu Naidu, Chief Minister of Andhra Pradesh and Convener of the Sub-Group
2. Shri Manohar Lal, Chief Minister, Haryana
3. Shri Lal Thanhawla, Chief Minister, Mizoram
4. Shri Devendra Fadnavis, Chief Minister, Maharashtra
5. Shri H.K.Patil, Minister, Rural Development & Panchayat Raj, Govt. of Karnataka
6. Shri Surinder Singh Negi, Minister, Medical & Health, Govt. of Uttarakhand
7. Shri Asim Ahmed Khan, Minister, Environment & Forest, Govt. of Delhi
8. Shri Rao Narbir Singh, Minister, Public Works Department, Govt. of Haryana
9. Shri O.P. Dhankar, Minister, Development and Panchayat, Govt. of Haryana
10. Smt. Sindhushree Khullar, Chief Executive Officer, NITI Aayog
11. Shri D. S. Dhesi, Chief Secretary, Govt. of Haryana
12. Shri Alok Kumar, Additional Secretary, NITI Aayog
13. Shri Ashok Kumar Jain, Adviser (RD), NITI Aayog
14. State Plans Advisers of Member-States and other Senior officials from NITI Aayog
15. Shri Saraswati Prasad, Joint Secretary, Ministry of Drinking Water & Sanitation, Govt. of India
16. Shri Praveen Prakash, Joint Secretary, Ministry of Urban Development, Govt. of India
17. Shri Rajiv Ranjan Mishra, Joint Secretary, Ministry of Housing and Urban poverty Alleviation, Govt. of India
18. Senior officials/ Nodal Officers of Member-States

Record of discussions of the third meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan held on June 24, 2015 at Bengaluru

The third meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan was held on June 24, 2015 at Bengaluru. The list of participants is placed at Annexure.

2. Chief Minister, Karnataka welcomed the Chief Ministers of Andhra Pradesh, Mizoram, Uttarakhand, Ministers from Haryana, Maharashtra and all the participants to the meeting. The initiatives taken by the State Government with regard to sanitation and solid waste management were explained. The State had already launched the "Shouchalayakkagi Samara" (Crusade for Toilet) in 2013-14 to make Karnataka Open Defecation free by October 2, 2018, a year ahead of Government of India's deadline of October 2, 2019.

3. Chief Minister, Andhra Pradesh stated that Swachh Bharat Abhiyaan was the responsibility of every citizen of the country and the Government at all levels- Centre, State, and Local bodies. The Sub-Group has to now come up with a clear set of recommendations on various aspects including solid waste management especially waste to energy, tax exemptions, tariff fixation for power generation by Electricity Regulatory Commissions, segregation of waste, sewerage treatment and sanitation and initiate an action plan. The Report of the Sub-Group must be an implementable one.

4. A short video clip was shown demonstrating the initiatives of the Government of Karnataka in the field of sanitation and solid waste management. Thereafter, Adviser (Energy), NITI Aayog shared the observations made and the lessons learnt from the team visits undertaken by officers of NITI Aayog and Working Group officers to Nadia, Pune, Mizoram, Bengaluru, Visakhapatnam and Haryana.

5. CEO, NITI Aayog and Adviser (RD), NITI Aayog made a presentation on the action taken by the Sub-Group so far and the draft recommendations of the Sub-Group. The main issues highlighted were the technology support, Public Private Partnership (PPP) and sustainability of the mission. It was essential that new technologies rationalise the use of land and water. In case of public toilets, it was suggested that the building codes must include a mandatory provision for toilets. With regard to PPP, simple and understandable concession agreements and O & M agreements were required. In India, we need to develop waste management as business opportunities as in the case of South East Asian nations. The

challenge with regard to waste management lies in reduction of waste and marketing of the products generated from processing of waste. There was a need for low cost decentralised technologies.

6. Chief Minister, Andhra Pradesh felt that there was immense potential for energy generation from waste given that 1,33,760 tonnes per day of waste was being generated in the country. He suggested that NITI Aayog could visit and study more waste to energy plants. Provision of tax exemptions will make the plants more viable. Chief Minister Uttarakhand, however, opined that one model would not be applicable for all places. There is a need for separate models for urban areas, smaller towns and rural areas which include composting, biomethanation and energy generation. Cluster approach should be explored and subsidy should be provided to compost. He suggested that smaller waste to energy plants may be set up by the Central Government as an example. Chief Minister, Andhra Pradesh suggested that setting up decentralized waste processing plants as in Japan may also be explored.

7. Chief Secretary, Karnataka suggested that Viability Gap Funding support may be provided for waste processing. He cited the example of pyrolysis technology which completely burns out the waste. The issue of plastic waste was also raised and it was suggested that they can be used for construction of roads.

8. Minister for Agriculture, Irrigation and Development & Panchayats, Haryana suggested that a subject on waste management can be introduced in the higher education curriculum as there is a lack of experts in the field. Further waste management plants may be mandated in residential areas, hospitals and markets while approving the building plans. The organisations or institutions which maintain a high degree of cleanliness may be showcased like the Delhi Metro. To realise the objectives of the Abhiyaan, it was essential to increase manpower and post special duty officers at all levels for five years duration of the mission. Regarding financial resources, an increase in financial support was required or the ratio of 75:25 is to be maintained.

9. Chief Minister, Mizoram suggested that the financial resources saved from the falling crude oil prices could be directed to Swachh Bharat Abhiyaan. PSUs may be involved in the implementation of the programme. Some districts of Mizoram do not get financial resources devolved under the fourteenth finance commission as they are outside the purview of the 73rd and 74th constitutional amendment Act. The funding support for this programme was

therefore suggested to be kept at 90: 10. Further, enhanced awareness and behaviour change needs to be promoted.

10. Chief Minister, Uttarakhand put forth the following points;

(i) Construction of individual toilets without providing adequate water supply is not workable.

(ii) Community toilets should be on payment basis.

(iii) Sewerage facility needs to be looked into

(iv) Separate models of waste management required for each State

(v) For all this activity, funding from centre government is crucial. So it should be either a 100% centrally sponsored scheme or shared in the ratio 90:10. This programme will be non-starter if it is left to the State governments

(vi) States can take care of the Behaviour Change Campaign and provide necessary training to its staff. The State can also bear the administrative expenses. A cess on petrol may be levied to raise financial resources

(vii) Centre should take the lead in the matter of technology support.

11. Minister for Urban Development & Home, Government of Maharashtra suggested that subsidy component in toilets in urban areas needs to be increased. The viability gap funding may be raised from 20 to 40% for solid waste management. The technologies for management of waste will differ from area to area. The Central Government should guide the State Governments for selection of best technology and take into account global best practices as well. He suggested that a technology cell may be created at the central level.

12. Minister for Rural Development & Panchayat Raj, Karnataka said that there is a potential for generation of around 1500 MW of energy from waste. The possibility of carbon credits should be explored. He cited the example of the successful conversion of cow dung into manure in the State. There was a need to look into the aspect of calorific value addition for energy generation and sand making from Construction and Demolition (C&D) debris. The use of plastics in construction of roads was also mentioned. He stated that construction of bathrooms along with toilets would be a pragmatic approach.

13. Chief Minister, Andhra Pradesh summed up the meeting with the following observations:

(i) Building the toilets is not enough. The construction needs to be supplemented by promoting usage of toilets.

(ii) Financing aspect of the Swachh Bharat Abhiyaan is important.

(iii) Segregation of waste is required

(iv) There is a need to translate the strategy into action and prepare an implementable report.

(v) Role of Centre/State and local bodies needs to be brought out.

14. Chief Minister, Andhra Pradesh stated that for solid waste management, various technologies are available. The Sub-Group report needs to come out with workable solutions. Toilets using less water need to be constructed. PPP models needs to be explored. The use of sewage water for industrial purposes may also be seen. The issue of C&D waste was also mentioned. He suggested that convergence of various programmes into sanitation is required. The Sub-Group may also if need be have a meeting with the concerned Ministers like Minister of Finance, Minister of Power, Minister of Urban Development etc. for sorting out the various issues and come up with an implementable solution. He suggested that a cell in NITI Aayog may be created for Swachh Bharat Abhiyaan. Intense persuasion is required as it will take time in the country to reach at a higher level of sanitation. He cited the example of Japan where it was a part of culture and Singapore where it was a part of discipline. Chief Minister of Andhra Pradesh also suggested that the additional funds devolved to local bodies may be utilised for Swachh Bharat Abhiyaan also as in comparison to the Thirteenth Finance Commission, devolution of funds to local bodies has gone up by almost Rs. 2 lakh crore.

15. Joint Adviser, Ministry of Urban Development, Government of India indicated that some of the issues discussed in the meeting like subsidy for compost, tariff policy and tender documents are already under process of finalisation in the Ministry. He was requested to circulate the model tender documents to the Members of the Sub-Group for their perusal. CEO, NITI pointed out that year wise action plan and mechanism to implement the plan may be charted out by the States.

16. The next meeting was proposed to be held in Delhi in July, 2015 and it was decided that the report would be submitted to Prime Minister before August 15, 2015.

Annexure

List of participants

1. Shri N. Chandrababu Naidu, Chief Minister of Andhra Pradesh and Convener of the Sub-Group
2. Shri Siddaramaiah, Chief Minister, Karnataka
3. Shri Harish Rawat, Chief Minister, Uttarakhand
4. Shri Lal Thanhawla, Chief Minister, Mizoram
5. Shri H.K. Patil, Minister of Rural Development & Panchayati Raj, Govt. of Karnataka
6. Shri O.P. Dhankar, Minister for Agriculture, Irrigation and Development & Panchayats, Govt. of Haryana
7. Shri Ranjith Patil, Minister for Urban Development & Home, Govt. of Maharashtra
8. Smt. Sindhushree Khullar, CEO, NITI Aayog
9. Shri Kaushik Mukherjee, Chief Secretary, Govt. of Karnataka
10. Shri Alok Kumar, Additional Secretary, NITI Aayog
11. Shri Ashok Kumar Jain, Adviser (RD), NITI Aayog
12. State Plans Advisers of Member-States and other senior officials from NITI Aayog
13. Shri Saraswati Prasad, Joint Secretary, Ministry of Drinking Water & Sanitation, Govt. of India
14. Shri Rajesh Goel, CMD, Hindustan Prefab Limited representing Ministry of Housing and Urban poverty Alleviation, Govt. of India
15. Shri V.K. Chaurasia, Joint Adviser, Ministry of Urban Development, Govt. of India
16. Senior officials/ Nodal Officers of Member-States

Record of discussions of the fourth meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan held on September 23, 2015 at NITI Aayog, New Delhi

The fourth meeting of the Sub Group of Chief Ministers on Swachh Bharat Abhiyaan was held on September 23, 2015 at NITI Aayog, New Delhi. The list of participants is placed at Annexure.

2. CEO, NITI Aayog welcomed the Chief Ministers of Andhra Pradesh, Haryana, Karnataka, Maharashtra, Mizoram and Uttarakhand; Ministers of Sikkim and Delhi; officials of member States, and all other participants in the meeting. Chief Minister, Andhra Pradesh and convener of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan after a brief introduction of issues requested CEO, NITI Aayog to present the report. At the outset, CEO thanked all the officers for their contribution in drafting the report and member as well as non- member states for their feedback.

3. CEO, NITI Aayog made a brief introduction about the report of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan. She recapped the terms of reference, issues and challenges and summarised the actions taken so far as per the discussions in the meetings of the Sub-Group since its constitution.

4. CEO, NITI Aayog explained that the major recommendations emphasise on the behaviour change, financing, regulatory framework, and technological Support. It was felt that technological support was one area where strong hand-holding from the Central Government was required and proper framework documents and processes were needed to be put in place. Manual scavenging has to be done away with strong enforcement of law. The persons from the informal sectors like rag pickers and kabadiwalas should be integrated into the system with professional training. She further added that courses like municipal engineering or sanitation engineering should be restarted as earlier or a semester could be introduced in these areas in engineering courses.

5. Chief Minister, Andhra Pradesh suggested that tax exemptions by both Central and State Governments are required to make solid waste management projects viable. Presently, the tariff set for power generated from waste is about Rs. 6.80. per unit. Tax exemptions will attract private participation in Solid Waste Management projects.

6. Chief Minister, Maharashtra expressed his concern regarding the tipping fees where the quantity of waste was enhanced by adding water, silt and other construction waste etc. which adversely impact the viability of waste to energy plants. Contracts for transportation of waste should not be based on weight. He suggested that tipping fee may be provided on the output generated from the waste.

7. Member (VKS), NITI Aayog was also of the similar view that demarcation of functions to create a mechanism for feeding the right quality and quantity of material into the plant with regard to waste management is very essential. Most of the ULBs have no resources of their own and the collection and transportation of waste is outsourced. A list of technologies should also be readily available to the users.

8. It was agreed that a framework for waste to energy plants may be developed duly specifying the responsibilities of both ULBs and private entities. Collection and transportation of waste may be undertaken by local bodies and processing of waste may be done by the PPP partner. The responsibility of supplying the appropriate quality of waste should be with the local bodies. A penalty clause may be built in the contract to take care of the issues arising in this regard. It was proposed that for bigger municipalities and cluster of municipalities, waste to energy plants may be set up while for smaller towns and rural areas, composting may be adopted.

9. The recommendations pertaining to financial requirements of the mission were discussed in detail. It was proposed that the sharing pattern of funds for this programme between the Centre and States may be kept at 75: 25, while for hilly States it may be kept at 90:10. Incentive amount for construction of one unit of IHHL in both urban and rural areas should be equal and was proposed to be enhanced to Rs.15,000/-. Dysfunctional toilets constructed under Total Sanitation Campaign to be treated as no toilets and therefore should be made eligible for fresh financial assistance under the programme. Chief Minister, Uttarakhand suggested the enhancement of the viability gap support to 50% (25% by Central Government and 25% by State Government). However, after detailed discussion, consensus was arrived at keeping the existing viability gap funding support. He also mentioned that a certain part of the CSR contributions by PSUs/Companies may be spent in the States where they are located. The CEO, NITI Aayog explained the mode of operation of the Swachh Bharat Kosh.

10. Chief Minister, Maharashtra suggested that the State Governments may also be allowed to raise Swachh Bharat Bonds and Central Government may provide the tax exemption in this regard. Principal Secretary, Bihar suggested that special assistance is required to the States having larger areas to be covered under this mission to achieve the targets in time. The Chief Minister, Andhra Pradesh suggested to levy the Swachh Bharat cess on telecom services as well as on diesel and petrol to raise the funds for this programme. Chief Minister, Uttarakhand was of the opinion that chemical industries should also be included under similar cess. However, Sub-Group felt that it may not be practically possible to levy the cess on chemical industries at this stage. It was suggested that the Swachh Bharat cess should be raised by the central government and the amount so collected would help the Central Government to meet its 75% share (90% share in hilly States) of the funding pattern.

11. Chief Minister, Andhra Pradesh proposed the capacity building of local bodies as well as Government officials at all levels by regular training and upgradation of skills. The issue pertaining to the fixation of rates for procurement of equipment for solid and liquid waste management by Directorate General of Supplies and Disposals (DGS&D) was discussed in detail. It was suggested that only indicative costs should be suggested and a model procurement policy may be devised. Chief Minister, Maharashtra was also of similar opinion. The Sub-Group finally agreed that only indicative cost of equipment for solid and liquid waste management may be suggested by MoUD and MDWS and they should also devise the model procurement policy. However the rates prescribed should not be binding on the State Governments.

12. The issue of construction of toilets in slum and difficult areas was also discussed. Chief Minister, Uttarakhand raised the concern that there are no sewer lines in most of the areas. Chief Minister, Maharashtra discussed the problems in the States where slums are located on Central Government's land. Installation of bio-toilets was considered as an option where toilets constructed in slum areas cannot be connected to sewer lines. Other innovative options may also be tried out. The Central Government may relax laws and norms for construction of toilets in these areas because the basic facility cannot be denied to the people. However, it will not confer any right to them on such lands. The issue about providing the toilet facilities in those areas where the congregation of people (floating population); international, national or other events like melas, and sporting events etc. take place, was also discussed. Such congregation occur at regular intervals and include people from various States. It was suggested that the incentives may be provided to service providers to create

sanitation facilities in such places of congregation. Chief Minister, Uttarakhand suggested that mandatorily sanitation facilities may be set up in new areas which are being developed.

13. Chief Minister, Haryana suggested involving electronic and print media to spread the message of cleanliness and sanitation on voluntary basis. Representative of Government of Sikkim suggested that anybody contesting an election for local bodies must have an individual household toilet. This was agreed by the Sub-Group. He further suggested that anybody not having toilet will not be eligible for any Government benefits. However Sub-Group did not agree this suggestion from Sikkim as it would be too harsh.

14. Chief Minister, Mizoram told that the Fourteenth Finance Commission (FFC) recommendations have not covered the local bodies in rural areas in some of the North Eastern States like Mizoram. These states have not received the grants under FFC as received by the local bodies in other states of the country. He suggested that such local bodies should also be given the grant by Central Government so that they can also take up the activities of Swachh Bharat Abhiyaan.

15. The Sub-Group discussed about the issue of subsidy to compost. The provision of subsidy of Rs.1500/- was under consideration by Central Government. It was proposed that subsidy on chemical fertilisers may be reduced and correspondingly subsidy on compost may be increased so as to promote the use of compost by farmers. Further, all laws and rules related to waste management need to be reviewed.

16. Chief Minister, Andhra Pradesh proposed that the performance of all Panchayats, Municipalities, Blocks, Districts and States regarding the sanitation and overall cleanliness may be rated every year and awards may be given to them. This will instil a sense of competition among them. One day in every month and one week every year (culminating with October 2nd) may be devoted for Swachh Bharat celebrations. This will be a constant reminder to all people to continue the activities of the mission. Chief Minister, Uttarakhand suggested that the States which are better performing may be given incentives in form of grants by Central Government. Chief Minister, Andhra Pradesh agreed and suggested that such states may be incentivised out of the money received from Swachh Bharat cess to enhance the competition among them.

17. It was also suggested that NITI Aayog may develop the verification protocol and National Level Guidelines to ensure that uniform procedure is followed in evaluating the ODF and ODF plus status by States. NITI Aayog may document the best practices related to Sanitation and Waste Management. The representative from West Bengal explained the practice followed in West Bengal and stated that if a uniform assessment is there, then regional discrepancies in assessment will not arise. Joint Secretary, Ministry of Drinking Water and Sanitation explained that the Ministry of Drinking Water & Sanitation has already developed a methodology for assessment and verification.

18. At the end, Chief Minister, Andhra Pradesh and convenor of the Sub-Group concluded that all the issues where there is a consensus would be incorporated in the report. He told that now it is responsibility of all the States to implement the recommendation to achieve the goals of Swachh Bharat Abhiyaan. All the Chief Ministers thanked the convenor for steering the Sub Group and bringing the broad issues at one platform and consensus among all.

Annexure

List of participants

1. Shri N. Chandrababu Naidu, Chief Minister, Andhra Pradesh
2. Shri Manohar Lal, Chief Minister, Haryana
3. Shri Siddaramaiah, Chief Minister, Karnataka
4. Shri Devendra Fadnavis, Chief Minister, Maharashtra
5. Shri Lal Thanhawla, Chief Minister, Mizoram
6. Shri Harish Rawat, Chief Minister, Uttarakhand
7. Shri N.K. Subba, Minister of Urban Development and Housing, Sikkim
8. Shri Asim Ahmed Khan, Minister, Environment & Forests, Delhi
9. Dr. V.K. Saraswat, Member, NITI Aayog
10. Smt. Sindhushree Khullar, CEO, NITI Aayog
11. Shri Alok Kumar, Additional Secretary, NITI Aayog
12. Shri Ashok Kumar Jain, Adviser (RD), NITI Aayog
13. Senior Officers from Government of India and State Governments

Annexure III

Inputs from State Governments/Union Territories

STATE	INPUTS
Andhra Pradesh	**Financial** • Appropriate budget for non-viable activities of waste management. • Research grant to IITs. • Corporatisation of the Mission. • Income tax exemptions on the contributions made by any individual, industry or institution etc. for Swachh Bharat Abhiyaan. • Levying the Swachh Bharat Cess on petrol and diesel etc.
	Technology • Study the best practices/technologies from various parts of India as well as other countries. • Control the pollution of water bodies, rivers and sea beaches by tying up solid and liquid waste management activities • Setting up waste to energy plants. • Provision of tax exemptions to make waste to energy viable. • Setting up of tariff by Regulatory Commissions for energy generated from waste.
	Other Measures • The involvement of political and government leaders. • Staffing and training of Urban Local Bodies (ULBs).
Haryana	**Financial** • The central assistance for individual latrines for Gramin (Rs. 12,000) and Urban (Rs. 4,000) component needs to be looked into. • Proposed setting up of two sub-missions for peri-urban and urban areas. • Financial incentives to Gram Panchayats. • Provide tax exemptions and institute awards to villages which successfully undertake sanitation measures. • Fund should be raised for the new cities and their cleaning should be done at wee hours.

STATE	INPUTS
	Technology • Address the problem of toxic waste. • Marketing support for compost. • Emphasis on organised recycling. • Need for development of comprehensive solution and assessment of the life cycle costs of technologies.
	Behavioural • Bio-degradable and Non-biodegradable waste could be separated at home, as a matter of habit. • Include sanitation issues in school curriculum. • Subject on waste management to be introduced in higher education curriculum to develop experts in this field.
	Other Measures • The need to include social and religious institutions in the mission. • Need for attention by Municipal Corporation for unauthorized colonies. • Developing the skill of the youth in this area. • Institutionalization of rag pickers. • Waste management system may be mandated in residential areas, hospitals and markets.
Maharashtra	**Financial** • Central assistance to urban sanitation projects to be at par with assistance provided to rural sanitation. • Financial commission grant to be used productively especially for treatment of waste water and solid waste.
	Technology • A roadmap be devised for adoption of technologies. • Need to look into solution for plastic waste. • Low maintenance cost technology should be on the approved panel list**.**

STATE	INPUTS
	Others • Capacity building of ULBs to be done for accepting new technologies. • School children should be given bonus for having IHHL and its usage • Excellence award given to individuals (IAS and State Cadre officials/Institutions/States/Districts) • Mandatory to have IHHL for contesting elections to Gram Panchayats for any citizen. • Any certificate issued by GP/Govt. should be given on the condition of having IHHL • All Government offices should have separate clean toilets for men and women • District Guardian Minister should be appointed being responsible for a district to become ODF.
Gujarat	**Technological** • State has sent their best practices on sanitation and waste management.
Mizoram	**Financial** • To use financial resources saved from falling crude oil prices. • Incentive amount for IHHL in cities be increased to Rs.12,000/- to bring it at par with Swachh Bharat Gramin. • Special dispensation should be made for providing additional funds and flexibility to North Eastern States as leveraging of funds from corporate and private entities is difficult in these States.
	Technology • Need for an array of technologies and management models so that adequate flexibility is there to adopt what is appropriate.
Sikkim	**Financial** • Need special allocation from the Swachh Bharat Kosh or from budgetary sources for the IEC component for sustainability of the mission. • One time assistance for construction of dysfunctional toilets constructed under the Total Sanitation Campaign may be provided from budgetary source or Swachh Bharat Kosh.

STATE	INPUTS
Karnataka	**Policy** • Single window system for the programme. • Water requirement for sanitation may be accorded priority just after drinking water in the National Water Policy. • To empower the States to bring about amendments in rules which enables them to levy fines or impose punishments for littering.
Uttarakhand	**Technology** • Separate models of waste management for cities, towns and rural areas.
	Financial • A fund on lines of Prime Minister's Relief Fund may be created to raise the finances required for the mission. • Other measures like cess, corporate social responsibility initiatives, funding from international institutions like ADB may be explored. • Cess on petrol may be levied.
	Behaviour • Awareness campaign • Include sanitation in school curriculum
	Others • The need to assess the achievements and failures of earlier programmes like Total Sanitation Campaign and Nirmal Bharat Abhiyaan was essential for realization of objectives of this mission.
Delhi	**Technology** • Decentralised waste to energy and waste to compost plants may be set up so that the waste in the area is treated there itself.
Himachal Pradesh	**Technology** • State has sent their best practices on sanitation and waste management.
West Bengal	**Financial** • Separate fund for revival of defunct/dis-functional toilet.

STATE	INPUTS
	Behaviour • Sustained IEC/ BCC is a must to ensure that the social norms are attuned to cleaner environment through sustained ODF status.
Rajasthan	**Financial** • SBM(G) allocations may not be curtailed.
	Others • Require regular monitoring of habitations and GPs becoming ODF. ODF verification needs to be regular process.
Punjab	**Technology** • R&D groups should be established in every State to carry out applied research and suggest viable technological options. • Skill Development courses may be introduced in State it is and polytechnics to train professionals in solid and liquid waste management.
	Financial • Central share should not be reduced. If construction of toilets has to be reduced as per the availability of funds, the SBM may be extended from five to seven years. • Incentive amount for Individual Household latrines in water logged areas may be increased. • Solid and Liquid waste management may be bifurcated into two separate components and allocations may be made separately. • Micro financing through financial institutions can be explored. • Each State may establish a Swachh Bharat fund and contributions thereto may be exempted from payment of income tax. • Investment in solid and liquid waste management infrastructure should attract low interest.
	Others • Gram Panchayat Water and Sanitation Committees may be set up in all villages. • Third party audit of construction and usage of IHHLs should be done • Water Pollution Act may be amended and should be made compulsory for water polluting industries to use treated domestic effluent water.

STATE	INPUTS
Telangana	**Technology** • State has sent their best practices on sanitation and waste management
Chhattisgarh	**Financial** • Financial requirement will be for IEC part of campaign and MSWM and total Sanitation • SWM fee may be collected along with electricity bill
	Technology • An IIT can be made a technical partner in evolving appropriate cost effective technologies
	Others • Strong enforcement against those who litter and penalty against defaulters • SBM volunteers can be raised as a supporting force
Bihar	**Financial** • SBM funding for poorer States like Bihar has to be revised from the current 75:25 pattern to 90:10 pattern • The beneficiary eligibility condition needs to be revised under Swachh Bharat Mission (Gramin) by making coverage universal instead of selective. • For the flood prone areas, the cost of toilets should be increased to Rs. 20,000 from the existing Rs.12,000. • The incentive amount under Swachh Bharat Mission (Urban), may be increased to Rs.12,000 from the present Rs.4,000.
	Others • Toilets should be made compulsory in all the urban housing schemes. • Knowledge Resource Centre needs to be established in every State to provide technical support in the implementation of the SBM • Need to develop a directory of sanitation and solid liquid waste management technology providers. • Toilet construction and sanitation should be included in the course design of National Skill Mission.

Annexure IV

Report of Team Visits

Report of Team Visits undertaken by officers of the Working Group of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan.

Pursuant to the first meeting of the Sub-Group of Chief Ministers on Swachh Bharat Abhiyaan on April 30, 2015, team of officers from the Working Group were constituted to study best practices and technologies for sanitation including solid and liquid waste management in various States which had furnished the best practices and technologies in their States. The following team on Swachh Bharat Abhiyaan were constituted;

(i) Nadia, West Bengal (Recently declared as Open Defecation Free District)
(ii) Mizoram (State having the highest sanitation coverage in the country)
(iii) Haryana (Solid and Liquid waste management in villages)
(iv) Karnataka (Public/Community Toilets in Bengaluru)
(v) Pune, Maharashtra (Best practices on Solid Waste Management adopted by Pune Municipal Corporation)
(vi) Visakhapatnam, Andhra Pradesh (Common Effluent Treatment Plant)

The main observations of the above team visits are detailed below;

I. Nadia, West Bengal

The Sabar Shouchagar movement in Nadia, which started on a pilot basis in July 2013, resolved to make Nadia Open Defecation Free by March 31, 2015. It was started on a pilot basis in 17 Gram Panchayats in 17 blocks and later introduced in all 187 blocks by October 2, 2013. The inspiration to make Nadia an ODF district came from Bangladesh where only 4 % of population practices open defecation.

Nadia is a traditional backward district in West Bengal covering an area of about Rs.3,900 sq.km with a population density of about 1,300 persons per sq.km. According to Census 2011, more than 72% of the population is located in the rural areas. The total population of Nadia (2011-12) was about 5.2 million where about 30% of the households do not have access to toilets. In March 2013, a re-verification of the base line survey data was

conducted by the district administration to assess the actual requirement of toilets. The strategies adopted by the district administration to make Nadia ODF were the following:

(i) Enhancing awareness towards adopting improved sanitation and hygiene practices. The efforts of the district administration included involving teachers and school children in the programme; meticulous micro level planning; prescription by doctors to use toilets as the first remedy where children suffered from diarrhoea; undertaking by public distribution system beneficiaries that they have access to toilets; extensive use of print and folk media; involving religious leaders; holding special programmes and involvement of grass root functionaries.

(ii) Increased efficiency of service delivery by setting up rural sanitary marts which provided material to beneficiaries and also constructed toilets on their behalf. The Rural Sanitary Marts are either NGOs and Women SHGs and setting up toilets through these marts also generated revenue for the NGOs and women SHGs. The district administration has tried to promote capacity building of these marts by setting up two permanent training facilities.

(iii) Convergence of the government programme like MGNREGA and Swachh Bharat Abhiyaan.

(iv) Monitoring and vigilance for sustainability by setting up Nazardari Committees. The committee consisted of people from villages itself who took regular rounds early morning to catch offenders defecating in the open. Pressure was also kept through the village doctors and PDS shops so as to maintain the habit of using toilets.

Key learnings:

(i) A very detailed and intensive awareness campaign was launched where pressure was kept on the society to construct toilets at their residence. Carrot and stick policy of district administration paid off.

(ii) Operation of rural sanitary marts has been exceptional since they have been able to provide, under one roof all that is required for construction of toilets. The marts also generated income for various stakeholders which has ensured that the activity gets sufficient impetus.

(iii) Leadership showed by District Administration was exemplary.

(iv) All party political consensus on the issue was prevalent.

II. Bengaluru, Karnataka

The team visited the following community/public toilets:

(i) Public Toilet model of Bengaluru Metro Rail Corporation Ltd. (BMRCL)

(ii) Public e-Toilet model of Bruhath Bengaluru Mahanagar Palike (BBMP)

(iii) Community Toilet model of Karnataka Slum Clearance Board

(iv) Community Sanitary Complex Model of Rural Water Supply and Sanitation Department at Gadag.

The BMRCL has two high-end-pay and use toilets constructed on PPP mode. The land has been provided by the BMRCL and construction and maintenance has been done by the private partner. Besides the construction cost and one time concession fee, the private partner has to pay rent for the toilet for a period of eight months and bear the entire maintenance cost during the period of concession. In lieu of the above, the private partner has the advertisement rights on toilet area and collects user fee for toilet usage.

The e-toilet is a modular, pre-fabricated toilet made of steel and is integrated with user friendly electronic interfaces to ensure cleanliness and hygiene to every user. It is easy to install and requires less area, consumes less water but ensures enhanced cleanliness through auto flushes and floor washing, is power efficient, operations are unmanned and waste is treated using anaerobic bio-degradation where it is not connected to sewer lines. The e-toilets are currently being manufactured by M/s Eram Scientific Solutions Pvt. Ltd., a Kerala based company. A cost effective pre-fabricated e-toilets of durable material specifically for schools was being developed by the company.

The community toilet in slum area has been constructed jointly by Slum Clearance Board and Sulabh International and is being maintained by Sulabh international through user charges. Each toilet consists of 5 water closets and 1 bathroom for gents and 4 water closets for ladies.

The community sanitary complex at Gadag is an attempt by the Government of Karnataka to provide comprehensive facilities under one roof by providing toilets, bathrooms, washing platform, washing machine, dressing room, hair drier and attender room. It has been proposed to provide independent water and power supply, lawn to add aesthetic value and clean and green environment around such complexes. The modalities of funding and user charges are yet to be finalized.

Key Suggestions:

(i) The first priority should be to construct Individual Household Latrine (IHHL). Community toilets should be made only where there is no space available in the individual households.

(ii) It is believed that potential for revenue generation from advertisements is quite high. But it was seen that there was general reluctance on part of companies to use advertisement space on toilets. This is hampering partnering of the private sector with the Government in building/maintenance of public/community toilets. Therefore, advertisements released by the Government organisations should be given first preference to public/community toilets.

(iii) E-toilet has a distinct advantage as it does not require manpower for maintenance and is easy to install. It may be promoted across the country.

(iv) In urban areas, multi-level community and public toilets may be considered.

(v) Community toilets should be designed such as to have adequate number of bathrooms and latrines; must be operated 24 x 7; charges can be collected on lump sum on weekly/monthly basis; viability gap funding may be provided.

(vi) Public toilets should be constructed by municipal bodies, panchayats etc. on PPP basis on pay and use model.

(vii) All community and public toilets should be connected by the sewer line or should have local DEWAT (Decentralised Waste Water System) technology or bio-digester technology.

III. Mizoram

Mizoram is relatively a cleaner State, compared to many other parts of the country due to combined efforts of the Government, NGOs and general public. The Government has initiated various measures for cleanliness and improving sanitation in the State. The following were the points observed during the visit:

(i) Community mobilization is exemplary. Mizoram's tradition of working with the Mizo Youth Association (MYA) has been suggested to be followed throughout the country. The concept of 'support organisation' as provided for in the national guidelines to SBM (G) can best be utilized if such a voluntary association is demonstrated.

(ii) Presence of large and credible NGOs who are involved in various social activities have been helpful.

(iii) Citizen's initiative in undertaking sanitation and cleanness in cities/villages especially in Baktawng village was prominent.

(iv) Role played by the civil society organisations, especially Young Mizo Association in the Mizo dominated areas is catalytic in bringing desired changes in behaviour towards cleanliness as a social norm.

(v) Moreover, since the Government takes up cleaning of streets only in the city and towns, NGO's particularly Young Mizo Association and Village Councils took up cleanliness drives at the village level voluntarily.

(vi) Presences of Sanitation Committees and Clean Committees have been very significant. The sanitation committees have taken up various sanitation activities/including collection of fees, organising social/voluntary works for cleaning of streets. The 'Çlean Zarkawt Committee' is very active in Zarkawt locality in Aizwal city.

(vii) It is noticed that the habit of using toilets is ingrained in the psyche of the people and every member of the family is actively involved in keeping the households clean.

However, regarding solid waste management, the team noticed that there was no segregation of solid waste, either at the household level or at the landfill site.

IV. Visakhapatnam, Andhra Pradesh

The team visited the Common Effluent Treatment Plant located at Jawaharlal Nehru Pharma City (JNPC) and the Hazardous Waste & Waste Water Management Facility at Brandix India Apparel City and also some other locations in Vishakhapatnam.

Each industry located at 971 hectare in JNPC industrial park is connected with two separate network of underground HDPE pipe line for High Total Dissolved Solids (HTDS) and Low Total Dissolved Solids (LTDS) effluents. Magnetic Flow Meters provided to each industry monitors the quantities of effluent discharged by each industry to conveyance system. Each industry has been asked to provide 2 tanks of HTDS and LTDS; one is used during filling stage and another one in the process of testing and discharge. The treatment facilities are taken based on the characteristics of HTDS and LTDS i.e., 13 steps process. After treating the effluent, the liquid waste is stored in to the guard ponds which are controlled by APPCB with lock and key system and finally the treated water is released to the sea.

In Brandix India Apparel city, the following is the system of Waste Water Management

- BIAC will provide 56 MLD effluent treatment plant (CETP).
- Marine outfall facilities to dispose of treated water
- Two 125 MLD (total of 250 MLD) effluent water guard ponds to ensure that the treated water meets strict environmental safety standards prior to discharge
- The individual units do not have to pre-treat water resulting in a huge reduction in investment and operating costs to the partners

The team had also visited certain colonies where waste was collected, other waste collection centres and dump yards. The main observations made by the team regarding waste management are as under:

(i) Segregation at the point of collection should be promoted to reduce the volume of garbage flow to the dump yard.

(ii) The Exnora model in which involvement of Resident Welfare Associations (RWA) and collection of a monthly charge of Rs.20/- per household is done by the agency through RWA for collection of garbage should be expanded to other wards of the city.

(iii) Marketing of Windrow composting is not being done. The farmers/users have to come to the dumping yard to collect the compost free of cost. It is suggested that the trucks/dumpers carrying garbage to the dump yard should take back the compost prepared at dump yard to the areas designated for marketing of the compost where farmers/users can purchase the compost to make it a revenue generating activity.

(iv) So far as treatment of industrial effluents is concerned, the process has to be industry specific and the discharge of treated effluents and water etc. has to be taken undertaken with the concurrence of Pollution Control Board and related organisations.

V. Waste Management Projects in Haryana (Kurukshetra and Karnal)

The solid and liquid waste management projects in Haryana were visited by the team. The Government of Haryana has initiated a solid waste management project known as 'Kachre Se Kamai'. The project was initially launched in one Gram Panchayat (GP), Sanwla, on a pilot basis in November 2010. Since then it has been started in 42 Gram Panchayats and is functional in 25 GP in districts. There is strong community participation. Ward wise community meetings are held. For creating awareness door to door campaign are held and households are motivated to maintain two different dustbins for biodegradable and non-

biodegradable waste. In addition, Panchayat engages workers for door to door collection, segregation and processing. The GP gets a monthly income of about Rs.800 to Rs.4,000 from the sale of non-biodegradable waste and Rs.400 to Rs.500 from sale of compost, depending upon the size of Gram Panchayat. The following observations were made after examining the working of waste management in three villages; Leadership at Gram Panchayat level is very important for the success of the project; There is a need for generating community awareness among the residents about the benefits of cleanliness and economic benefits of reusing waste; Monitoring at State level is very important; There is a need to maintain database and finally the model needs to be self-sustainable.

The liquid waste management in three villages of Shahpur, Dabri and Jadoli in Karnal district was also observed. The State has developed three pond system (Anaerobic pond, facultative pond and maturation pond) for treatment and re-use of grey water. These have been successful in reducing the BOD/COD (Bio chemical oxygen demand/ Chemical oxygen demand) to a large extent in 15 villages. The project depends on availability of land and resources as for ponds huge land mass is required. Single pond for residential area was found to be good but the cost is very high.

VI. Pune, Maharashtra

Pune is a good example of cooperative framework in Municipal Solid Waste (MSW) between State Government, Municipal Corporation and Civil Society. The city has seen multiple experiments in the area of public participation in handling household waste, segregation of waste and setting up of Waste to Energy (WTE) plant**.** The team saw the following activities:

(i) Conversion of garden waste to fuel briquettes.
(ii) Vermi composting through heat process in oven.
(iii) WTE plant.
(iv) Hotel food waste based biomethanation.
(v) Waste aggregation and trans-shipment facility

The city is experimenting with multiple technology solutions – three forms of composting, bio-gasification (hotel waste), integrated WTE plant (under commissioning) and landfills. Active involvement of NGO is seen in waste segregation.

While most of the above technologies are common and in vogue in most of the local bodies, it was the WTE plant which was a learning experience. The plant is capable of handling nearly 700 MT of MSW per day. While the plant presently segregates waste up to the stage of RDF, the conversion of the same into electricity is still not happening and is likely to be commissioned in the near future. During discussions with the local management and Pune Municipal Corporation (PMC) officials, it came to light that there is still ambiguity in the minds of all whether the present technology adopted in PMC of Pyrolysis is the preferred route over the alternative route of incineration. Then the challenges of getting adequately separated waste at the WTE plant and its economics continues to bother municipal authorities. The team felt that it would be prudent to collect expert advice on the above issues for guidance of local bodies.

The biomethanation process is quite successful with a number of such facilities at different locations in Pune city. The facility converts the methane through a generator into electricity which is utilized in street lighting. However, the PMC officials plan to supply the gas into local city gas distribution grid for better utilization.

On the basis of the above visit, a number of issues emerged:

(i) Even large cities of India with strong finances still do not have technically sound personnel or a vision to handle MSW efficiently.

(ii) Segregation of household waste has been successfully undertaken in Pune and can be rolled out across cities.

(iii) MSW handling can be better done through NGOs as has been the experience in Pune. However, there needs to be acknowledgement about the role of NGOs by State Governments so as to encourage this system.

(iv) Handling of municipal waste is a losing proposition for the finances on local bodies. Business models on taxation, etc., should be considered also through site value for advertisements for public facilities, etc. to bring commerciality for investment in this activity.

(v) There needs to be a State level body (including one at the national level) which may identify relevant technologies for handling different kind of MSW, contracting methodologies and raising the technical skill of global bodies for induction of latest technologies in treatment of MSW.

Annexure V

Technologies for Sanitation and Solid and Liquid Waste Management

Technological Alternatives for Municipal Solid Waste Management in Urban Areas

The relevant technologies for Municipal Solid Waste Management in Urban Areas include the following:

1. **Waste to Energy**
   - (i) Refuse Derived Fuel (RDF)/Pelletisation
   - (ii) Incineration
   - (iii) Gasification
   - (iv) Pyrolysis
2. **Bio-methanation**
3. **Waste to Compost**
   - (i) Aerobic Composting
   - (ii) Vermi-Composting
4. **Construction & Demolition Waste**
5. **Recycling of Waste (Plastics, paper, glass, metal etc.)**
6. **Sanitary Land filling**

A brief description of above technologies is given below:

1. Waste to Energy

Refuse Derived Fuel (RDF) / Pelletisation:

Refuse Derived Fuel (RDF) or Solid Recovered Fuel (SRF) is a type of fuel, which is produced by shredding and dehydrating solid waste with waste converter technology. RDF primarily consists of combustible components of municipal solid waste (MSW) such as plastics .This processing method can be very effective in preparing an enriched fuel feed for thermal processes like incineration, or for use in industrial furnaces. RDF/pellets can be conveniently stored, transported, and effectively take care of imbalances in input waste feed to the power plant. As it involves significant MSW sorting operations, it provides a greater opportunity to remove environmentally harmful materials from the incoming waste prior to combustion. This process may not be suitable for excessively wet municipal solid waste, especially during the monsoon season.

(i) Incineration:

Incineration is used in mostly developed countries where there is a shortage of land

for waste treatment and disposal, and/or the waste has high calorific value on account of large component of paper, plastic, packaging material, etc. This is an important method of waste disposal/volume reduction (can reduce waste volumes by over 90%) and conversion to innocuous material, with energy recovery. When the waste is dry, it may not need any auxiliary fuel except for start-up, but when the waste is wet and this input waste is mixed municipal solid waste rich in inert materials/elements and moisture content, supplementary fuel may be needed to sustain combustion, adversely affecting net energy recovery and adding to capital and O&M costs. This process is relatively noiseless and odourless and requires very little area for setting up the plant. Excessive moisture and inert content affects net energy recovery, and requires high capital and O&M costs. This process is associated with emission of particulates, SOx, NOx, chlorinated compounds, ranging from HCI to Dioxins.

(ii) Gasification:

Gasification is the main technology for biomass conversion to energy and an attractive alternative for the thermal treatment of solid waste. Gasification produces combustible gasses such as hydrogen, synthetic fuels, and is a process that converts dry organic or fossil based carbonaceous materials into carbon monoxide, hydrogen, and carbon dioxide at elevated temperature (500-1800^{o}C). The syngas can be used as a feedstock for the chemical industry (through some reforming processes, or as a fuel for efficient production of electricity and/or heat). This method is recognized as an attractive option for disposal of MSW as besides net energy recovery, proper destruction of waste is also ensured. This method therefore, has an advantage over incineration and is considered more efficient. As compared to incineration, control of atmospheric pollution can be dealt with in a superior way because NOx and SOx gases emissions do not occur in normal operation due to the lack of oxygen in the system. Net energy recovery may suffer in case of waste with excessive moisture and inert content.

(iii) Pyrolysis

Pyrolysis uses heat to break down combustible polymeric materials in the absence of oxygen, producing a mixture of combustible gases (methane, complex hydrocarbons, hydrogen, and carbon monoxide), liquids and solid residues. The end products of the pyrolysis process are gas mixture, liquid (bio-oil/tar) and solid residue (carbon black). This method functions at relatively low temperatures (400-900°C), but usually about 650°C is employed compared to gasification. The purpose of pyrolysis of waste is to minimize

emissions, to maximize the gain and quality of recyclable products, as well as to minimize the amount of organic waste, and sterilize the hazardous components.

2. Bio-methanation

Bio-methanation is the anaerobic digestion of organic materials which gets converted into biogas, a gaseous combustible mixture of methane (CH_4). Bio-methanation is a biological treatment method that can be used to recover both nutrients and energy contained in biodegradable municipal waste. This technology has dual benefits as it gives both bio-gas as well as manure as end products. Fibre fraction of waste can also be recovered for use as a soil conditioner after bio-methanation.

Bio-methanation is an established technology for farmyard manures/animal slurries and stabilization of sewage sludge, and also helps in disinfections, deodorization of waste. As it leads to bio-gas/power generation in addition to production of compost (residual sludge), it provides a value addition to the Aerobic (Composting) process and also offers certain other clear advantages over composting in term of energy production/consumption, compost quality and net environmental gains.

This technology is suitable for kitchen waste and other putrescible waste, which may be too wet and lacking in structure for aerobic composting and energy-producing process (100-150 Kwh per tonne of waste input). The process is free from bad odour, rodent and fly menace, visible pollution, and social resistance.

3. Waste to compost

(i) Aerobic Composting

Composting is the natural process of 'rotting' or decomposition of organic matter by microorganisms under controlled conditions. Raw organic materials such as crop residue, animal waste, organic waste, some municipal waste, and suitable industrial waste, enhance their suitability for application to the soil as a fertilizing resource, after having undergone composting. Aerobic composting takes place in the presence of oxygen. In this process, aerobic microorganisms break down organic matter and produce carbon dioxide (CO_2), Ammonia, water, heat, and humus - the relatively stable organic end product. The heat generated accelerates the breakdown of proteins, fats, and complex carbohydrates, and hence, the processing time is shorter. The product can be used as manure, soil conditioner for parks, gardens, agricultural lands, landfill cover, etc., depending upon its composition/quality.

(ii) Vermi-Composting

Vermi-compost is the process of composting using various worms, usually red wigglers, white worms, and other earthworms to create a heterogeneous mixture of decomposing vegetable or food waste, bedding materials, and Vermi-cast. Vermi-cast, also called worm castings, worm humus or worm manure, is the end-product of the breakdown of organic matter by an earthworm. These castings have been shown to contain reduced levels of contaminants and a higher saturation of nutrients than organic materials before vermin-composting.

Containing water-soluble nutrients, vermin-compost is an excellent, nutrient-rich organic fertilizer and soil conditioner. There are two main methods of large-scale vermin-culture. Some systems use a windrow, which consists of bedding materials for the earthworms to live in, acts as a large bin, and organic material is added to it. The second type of large-scale vermin-composting system is the raised bed or flow-through system. Vermi-composting systems usually use kitchen and garden waste, using earthworms and other microorganisms to digest organic waste, such as kitchen scraps.

4. Construction and Demolition Waste

Construction & Demolition (C&D) waste consists of unwanted material produced directly or incidentally by the construction or other similarly related industries. This waste type includes building materials such as insulation, nails, electrical wiring, and rebar, as well as waste originating from site preparation such as dredging materials, tree stumps, and rubble. C&D waste may contain lead, asbestos, or other hazardous substances. Much of the waste originating from building construction and demolition is made up of materials such as bricks, concrete, and wood (damaged or unused for various reasons during construction).

In 2009, the erstwhile Municipal Corporation of Delhi (MCD), and IL&FS Environmental Infrastructure and Services Ltd (IEISL) took up the pioneering initiative of setting up a pilot project to process 500 tons per day (TPD) of C&D Waste in Burari, Jahangirpuri, Delhi, which was a first of its kind plant in the country, based on the Public Private Partnership model. The plant capacity is now enhanced to 1500 TPD. A Concession Agreement for a period of 10 years had been signed and 7 acres of land provided by MCD for setting up the processing unit. The IL&FS facility gets mixed C&D waste from 28 designated points in three zones of the North Corporation, which pays for transportation. The civic body collects and transports the waste to the plant from the remaining areas. The C&D waste is recycled in this process into aggregates, which is in turn converted to Ready Mix Concrete

(RMC), cement bricks, hollow bricks, pavement blocks, kerb stones, concrete bricks and manufactured sand.

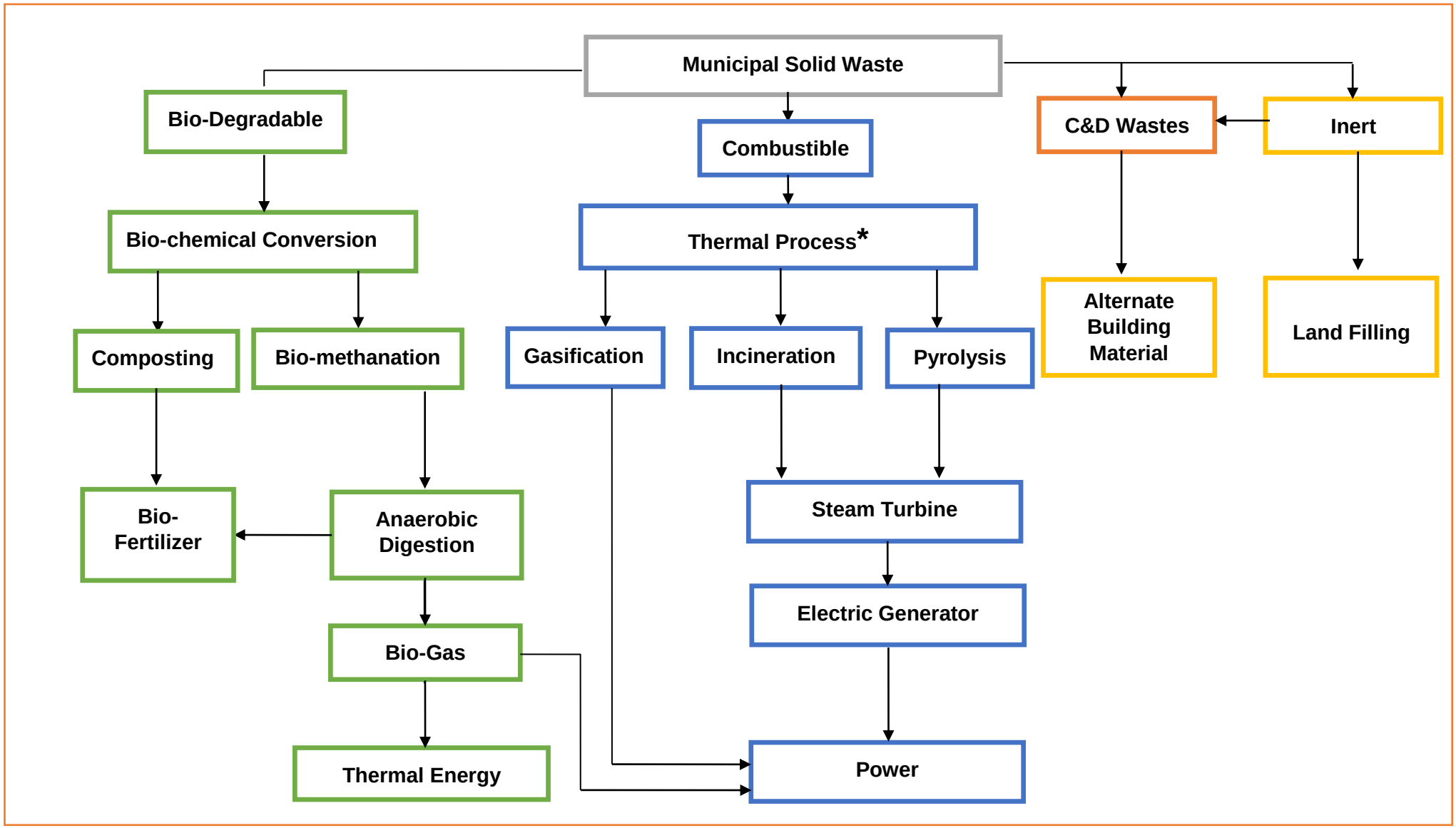
5. Recycling Waste

Recycling is a process to change waste materials into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution (from incineration) and water pollution (from landfilling) by reducing the need for "conventional" waste disposal, and lower greenhouse gas emissions as compared to plastic production. Recycling is a key component of modern waste reduction. Recyclable materials include many kinds of glass, paper, metal, plastic, textiles, and electronics. Composting or other reuse of biodegradable waste such as organic waste or garden waste is also considered recycling. Materials to be recycled are either brought to a collection centre or picked up from the kerbside, then sorted, cleaned, and reprocessed into new materials bound for manufacturing.

6. Sanitary Land-filling

Sanitary landfill is a site for the disposal of waste materials by burial and is the oldest form and most common method of organized waste disposal and remains so in many parts of the world, for waste treatment. Some landfills are also used for waste management purposes, such as the temporary storage, consolidation and transfer, or processing of waste material (sorting, treatment, or recycling).

Methane is naturally generated by decaying organic wastes in a landfill. It is a potent greenhouse gas, and can itself be a danger because it is flammable and potentially explosive. In properly managed landfills, the gas is collected and utilized. This could range from simple flaring to landfill gas utilization. Poorly run landfills may become nuisances because of factors such as rats and flies which can cause infectious diseases. The occurrence of such nuisance causing factors can be mitigated through the use of daily cover.



As per MSW Rules, 2000, biodegradables cannot be land filled, hence no combustible gas collection is considered.
*RDF enhances the efficiency of thermal processes.

Technological Options for onsite Sanitation and Solid and Liquid Waste Management in Rural Areas

I. Technological Options for Onsite Sanitation in Rural Areas:

There are several technology options for human waste disposal. Most of the technologies are a refinement of already known and practiced methods, based on experience by different communities. Based on the hydro-geological conditions of the areas and socio-cultural behaviour of people, the technology options can be broadly grouped for (i) normal soil with low water table and (ii) high water table area and rocky area.

Every toilet has two major parts (a) Substructure and (b) Super structure. Substructure is technically important as it provides safe disposal or reuse of human wastes. All the technical options are meant for substructures only. Superstructure is basically meant to provide privacy of the toilet and major technical inputs are not required for this component. There may be a wide range of superstructures for the same type of sub structure, depending on the affordability of the beneficiaries. The technological options are as detailed below:

1. Twin pit Pour Flush Water Seal Toilet

The twin pit pour flush water seal toilet is a complete on-site sanitation measure at household level which, on one hand fulfils all the sanitary requirements of a toilet and on the other hand, provides continuous use with minimal maintenance. The main components of such a toilet are the two pits used alternately, a pan, water seal / trap, squatting platform, junction chamber and a superstructure.

There are two pits which are used alternately. Both the pits are connected with a junction chamber at one end. Pit walls have honeycombed structure. Bottom of the pit is not plastered and is earthen. Depending on the number of users of toilet, size of the pit varies. Capacity of each pit is normally kept for 3 years. First pit, after it gets filled up in about 3 years is blocked at the junction chamber and second pit is put in operation. Water part of excreta percolates in soil through honey combs. After 2 years of blocking of the first pit, its contents degrade completely and turn to solid, odourless, pathogen free manure. It is dug out by beneficiaries and used for agriculture and horticulture purposes.

After the second pit is filled, it is similarly blocked and the first pit is put in use again. Thus, alternate use of both the pits continues.

Pit toilet is not suitable for high water table and rocky areas. In high water table areas, there is chance of ground water contamination. In coastal areas also these toilets are not suitable at all. Further, due to high water table, adjoining soil of the pit becomes saturated and further percolation from pit reduces significantly causing frequent filling of the pits.

In case of rocky areas, there is no chance of percolation of water from pits. Consequently, pit gets filled in frequently. For coastal and other areas having high water table and also for rocky areas the technologies like Ecosan Toilet, Bio toilet and Septic tank toilet are more suitable.

2. Ecosan Toilet

Ecological Sanitation or Ecosan toilet is based on the principle of minimizing the loss of nutrients inhuman wastes and using such wastes, including urine for agriculture purposes. It is a closed-loop system, which treats human excreta as a resource. In this system, excreta are processed on site until it is free of pathogenic organisms. In the system, faeces and urine are collected separately in containers. Urine is used in agriculture land directly, whereas faeces are stored for 6 months or so, to degrade it and its use in agriculture. In this system, water is not used for cleaning purpose. To prevent foul smell, dry ash is put after each use of toilet, in the container. Degraded human waste is directly used for agriculture purposes.

3. Bio digester Toilet

Bio digester toilet is a toilet having different chambers where anaerobic or aerobic condition for degradation of human excreta is provided. Such chambers are lined with any rough surface plastic materials that help grow bacteria on the sheet and degrade human wastes. Degraded human excreta are left to pass through outlet chamber either into a soak pit or drain depending on the site condition. The chambers can be prefabricated making it easy to install at the site.

In case of anaerobic bio digester toilet methane gas with carbon dioxide is evolved. Since produced methane gas is very low, it has no practical use for cooking and any other purpose. The gas is left to escape through a vent pipe in atmosphere.

In case of aerobic bio digester toilet, aerobic condition is maintained in the tank. In this case rate of degradation of human excreta is comparatively faster and produced gas is mainly carbon dioxide that is allowed to escape through vent pipe in atmosphere. Due to high rate degradation of waste in the tank, life of the tank increases. It requires longer time interval to empty the tank. Such anaerobic and aerobic bio digester toilets have been installed in some States in India by different entrepreneurs.

4. Septic Tanks

A septic tank is a combined sedimentation and digestion tank where the retention time of sewage is one to two days. During this period, solids settle down to the bottom. This is accompanied by anaerobic digestion of settled solids (sludge) and liquid, resulting in reasonable reduction in the volume of sludge, reduction in biodegradable organic matter and release of gases like carbon dioxide, methane and hydrogen sulphide. The effluent although clarified to a large extent, will still contain appreciable amount of dissolved and suspended putrescible organic solids and pathogens. Hence, the effluent of septic tank should be discharged into the small bore sewer or covered surface drains. The outfall from such drains should be connected to a small sewage treatment plant. The second option of septic tank effluent discharge could be a soak pit. It should be noted that the option using a soak pit may not be environmentally friendly depending on the soil type, groundwater table, population density and should generally be avoided if financial resources allow.

In order to control the effluent quality and prevent the clogging of soakage pits, septic tank requires desludging. Though desludging frequencies vary, it is generally recommended to desludge tanks every two to three years, or when the tank become one-third full. The most satisfactory method of sludge removal is by vacuum tankers. Regular desludging activities require well-organized community and public/private service providers.

II. Technological Options For Solid and Liquid Waste Management in Rural Areas:

The technologies for solid and liquid waste management in rural areas are as follows:

II-A. Solid Waste Management

Technological options for composting of organic wastes

1. NADEP Method

The NADEP method of organic composting was developed by a Gandhian follower, Narayan Deorao Pandhari Pandey of Maharashtra (Pusad). Under this method, compost can be prepared from a wide range of organic materials including dead plant material such as crop residues, weeds, forest litter, cattle dung and kitchen wastes. In this method, composting materials are put in layers. This method of making compost involves the construction of a simple, rectangular brick tank with enough space maintained between the bricks for necessary aeration. The above ground-perforated structure facilitates passage of air for aerobic decomposition. The floor of the tank is laid with bricks. The tank is covered on top with a thatched roof. The ingredients for making compost are agro-wastes, animal dung and soil in the ratio of 45:5:50 by weight. The ingredients are added in layers starting with vegetable matter, followed by dung and soil in that order. After 15-30 days of filling, the organic biomass in the tank gets automatically pressed down to 2 ft. The tank is refilled by giving 2-3 layers over it and is resealed. After this filling, the tank is not disturbed for about 3 months, when organic matters are almost completely degraded by the help of different groups of microorganisms. About 22-50 litres of water is to be sprinkled twice a week after the tank is fully loaded. After degradation, nutrients produced in the compost tank are absorbed by the soil layers thus preventing their loss. One tank can be used three times in a year. With production of 3 tons to 3.5 tons of compost produced per cycle, about 9 to 10 tons of compost can be made annually from one tank. The compost can be stored for future use.

2. Bangalore Method

Acharya (1939) had initiated the work of composting the town refuse and night soil. This process is also called *Hot Fermentation Mechanism* of composting or the Bangalore method**.** The raw materials used are mixed plant residues, animal dung and urine, earth, wood ash and water. All organic material wastes available on a farm such as weeds, stalks, stems, fallen leaves, pruning, chaff, fodder leftovers and so on, are

collected and stacked in a pile. Green materials, which are soft and succulent, are allowed to wilt for two to three days to remove excess moisture before stacking; they tend to pack closely if they are stacked in the fresh state. The mixture of different kinds of organic material residues ensures a more efficient decomposition. While stacking, each type of material is spread in layers about 15 centimetres thick until the heap is about one and a half meters high. This is a pit method of composting which conserves moisture and so it is useful in areas with low rainfall and a long dry season. It should not be used in wet areas, as the compost may become waterlogged.

3. Indore Method

This process was developed by Howard and Wad in 1931 at Indore, Madhya Pradesh. In this method, waste materials such as plant residues, animal wastes, weeds, street refuse and other organic wastes can be composted. The waste materials are cut into small pieces and spread in layers of 10-15 cm thickness either in pits or in heaps of 1 m wide, 1 m deep and of convenient length. It is properly moistened with cow dung using earth. To ensure 50% moisture sufficient water should be sprinkled for making the composting materials moist. Periodically, three to four turnings are given. This method of composting in pits involves filling of alternate layers of similar thickness as in Bangalore method. For starting the turning operation, the first turn is manually given using long handled rakes, 4 to 7 days after filling. The second turn is given after 5 to 10 more days. Third turn is also given after 5-10 days. Further turning is normally not required and the compost is ready in 4-5 weeks. The Indore method stabilizes the material in shorter time, needs lesser land space and is environment friendly. The composted material obtained by this method will contain 1.5% nitrogen, 1.0% phosphorus and 1.5% potassium.

4. Vermi composting

Vermi compost is a natural compost of organic wastes through earthworms, who take up organic wastes and after degradation and digestion, convert such wastes in the form of granules, rich in nitrogen content. Such vermin cast or vermicompost has good plant nutrients and therefore compost produced is of high quality. This is a natural composting method being used in India and other countries for centuries. However, in recent years there has been systematic methods developed to enhance such composting by using improved methods and strains of earthworms in rural as well as urban areas in India also.

Any type of biodegradable waste like kitchen wastes, animal/ cow dung and leafy biomass are more suitable for vermicompost and the following species of earth worm commonly found in India are used for vermicomposting: *Eiseniafoetida, Amyanthesdiffrigens, Eudrilluseuginea.*

5. Rotary drum composting

5.1 For single household

A batch Rotary drum of 250 litres capacity is used for batch composting of household organic waste. The inner side of the drum is covered with anti-corrosive coating. The drum is mounted on four rubber rollers, attached to metal stand and the drum is rotated manually. In order to provide the appropriate mixing of wastes, 40 mm long angles are welded longitudinally inside the drum. In addition, two adjacent holes are made on top of the drum to drain excess water. Once a day clockwise turning is carried out manually by handle, which ensures proper mixing and aeration. Two to three rotations at a time are made to ensure that the material on the top portion moved to the central portion, where it was subjected to higher temperature. The drum is operated for the waste combination containing uncooked vegetables waste, cow dung, tree leaves and sawdust were collected from various places and the mixture is shredded to 1 cm in order to provide better aeration and moisture control. The drum is applicable for rapid composting of kitchen and other organic waste generating from a single household in all seasons without causing any odour, vector, leachate in all seasons. Primary stabilized compost is achieved within 15-20 days.

5.2 For Community purpose

Community scale continuous rotary drum composter of 3.5 m^3 capacity is used for high rate composting of 150-200 kg organic waste per day. In order to provide the appropriate mixing and agitation, 400 mm long angles with 4 mm width and 150 mm height are welded longitudinally. A 2.5 kW air blower fixed at the inlet end is used to suck the air from outlet end for aeration. It also promoted the escape of water vapours and foul gases generated during composting. Two ports are provided at the middle and outlet zone of drum to drain possible excess water and to collect compost samples.

6. Biogas Technology

Biogas plant is important in providing sustainable energy sources in rural communities. Generation and utilization of bio-energy has multiple advantages. It helps improve sanitation, provide bio-energy at almost nil recurring expenditure and finally slurry / effluent of biogas plant has plant nutrient value to be used for agriculture purposes. Thus toilet linked biogas plant has additional benefits in terms of improving sanitation. In villages where household wastes contain mainly organics, they are also suitable for biogas generation. Such wastes can also be mixed in the same biogas plant to generate biogas production. In case of community toilets, biogas generation from human waste is sustainable option.

Biogas is a mixture of gas produced by methanogenic bacteria while acting upon biodegradable materials in an anaerobic condition. Biogas is mainly composed of 50 to 70 percent methane, 30 to 40 percent carbon dioxide (CO_2) and low amount of other gases. Biogas is an odourless and colourless gas that burns with clear blue flame similar to that of LPG gas. For family size biogas plant there are basically two designs (i) Floating drum type popularly known as Khadi and Village Industries Commission (KVIC) model and (ii) Fixed dome type, popularly known as Deenbandhu Model.

6.1 KVIC Model: In the KVIC model gas holder is made up of iron sheet (mild steel). During winter season when temperature falls down to 10 degree celsius or so, this model ceases to function as the iron sheet gas holder acts as good conductor of heat and inner temperature of the digester also attains the same temperature. Secondly, this gas holder requires regular care and maintenance to prevent from getting worn out because of corrosion. It has short working life. Manufacturing of gas holder requires sophisticated workshop facility that is rarely found in rural areas. Therefore, in rural or in urban areas the success rate of this model of biogas plant is far below the level of satisfaction.

6.2 Deenbandhu model - This model is predominately found in India. It is an underground fixed dome digester made up of complete brick or RCC structure. It is a permanent structure having almost nil operation and maintenance costs. There is no separate gas holder; biogas is stored inside plant through liquid displacement chamber. This design is suitable also for generation of biogas from human wastes along with cow dung and kitchen wastes. There is almost no effect of atmospheric variation of temperature on biogas generation during winter season. It has several advantages over the

KVIC design. Cow dung biogas plant linked with toilet has additional advantages. There is additive effect on biogas production rate when cow dung based biogas plant is linked with toilet. Further, percentage of methane in toilet linked biogas plant is higher (63.8%) over without toilet linked (60.4%).

II-B. Liquid Waste Management

There is a range of technological options for waste water management in India. The wastewater from various household activities can be classified into;

(i) Grey water: Wastewater generated from bathing, kitchen and other household activities except toilet.
(ii) Blackwater: Wastewater generated from toilets.
(iii) Combined wastewater: It can be either mix of grey water and effluent of septic tank treating black water or effluent of septic tank treating black and grey water.
(iv) Sewage: Combined grey and black water generated from household in the absence or presence of septic tank.

1. Covered Surface drains

One of the cheapest and interim options for disposal of grey water, grey water plus septic tank effluent is the covered surface drains. Further, open channels often exist in rural areas and hence can be upgraded to covered drains with little efforts. The objective of covered surface / storm water drain is to remove waste water/ rain water from the households/ premises in a controlled and hygienic manner in order to minimize public health and environmental risks, inconvenience to residents and the deterioration of other infrastructure.

It is an interim and fast solution of wastewater collection and can be applied in any village at reasonable cost. However, to prevent clogging, regular cleaning service for the removal of sludge is necessary. Further, if existing open channels (Nallas) are upgraded it has to be taken care of providing sufficient slope of the drains for dry weather flow as existing drains often lead to stagnant dry weather flow which causes unhygienic conditions and may infiltrate in the ground.

To enhance the efficiency of septic tank system, one of the recommended solutions is the provision of anaerobic filter type and contact aeration system for the treatment of septic tank effluent. Such system can be used with system made of brick, cement or package type. The package type is based on well-established Japanese

technology Jouksou. The later type advanced on-site systems were developed with light-weight materials such as plastics and fibreglass and used in many countries.

Three types of advanced on-site systems for waste water treatment are discussed in the following sections:

2. Package type Anaerobic Filter System

This type of package of on-site treatment system can be prefabricated of LLDPE (Low Linear Density Polyethylene) or FRP (Fibre Reinforced Plastic) and can be installed easily in a very short time. It consists of two chambers, i.e., settling and anaerobic filter. The first chamber works as a septic tank, where solids are settled down and further degraded anaerobically at the bottom zone. The second chamber consists of up flow anaerobic filter where further removal of organic matter takes place. Anaerobic filters are made up of synthetic plastic media with high specific surface area, which not only prevents clogging but also provides intensive contact between the wastewater and the fixed film anaerobic bacteria for the fast degradation of organic matter. The treatment performance ranges 50-70 % for BOD and SS removal. The package type anaerobic filter system is particularly applicable for (i) as an alternative to conventional septic tank from individual houses where higher effluent quality is desired. (ii) Septage/Sludge collection and treatment facility is available nearby.

3. Package Contact Aeration System

It consists of two chambers, i.e., settling and contact aeration with synthetic plastic media. The first chamber works as a septic tank, where solids are settled down and further degraded anaerobically at the bottom zone. Second stage is high specific surface area fixed film plastic media to retain high mass of aerobic micro-organism to degrade the organic matter in the wastewater. The high specific surface area not only prevents clogging but also provides intensive contact between the wastewater and the fixed film aerobic bacteria for the fast degradation of organic matter. The treatment performance ranges 80-95 % for BOD and Suspended Solid (SS) removal. The package type contact aeration system is particularly applicable for (i) wastewater treatment from individual houses where high effluent quality is desired for reuse or to discharge to sensitive water bodies. (ii) Rural areas having continuous power supply. (iii) Sensitive, tourist and un-approachable locations and (iv) sludge collection and treatment facility is available nearby.

4. Package Anaerobic Filter – Contact Aeration System.

It consists of anaerobic filter chamber, contact aeration chamber, sedimentation chamber and disinfection chamber in series. The anaerobic filter chamber separates, anaerobically decomposes and stores solid matter in the influent. The contact aeration tank is used for the aerobic treatment of effluent from the anaerobic filter chamber by the action of bio film grown on the surface of contact media. Tablets of chlorine disinfectant are stored in a cylinder and gradually dissolve to disinfect effluent. There is no sludge treatment in the system, and the sludge that produced in the treatment process is collected by a vacuum truck for further treatment and disposal. The system is particularly applicable for (i) wastewater treatment from individual houses where high effluent quality is desired for reuse or to discharge to sensitive water bodies. (ii) Rural areas having continuous power supply with availability of skilled manpower. (iii) Sensitive and unapproachable locations (iv) climatic variation is high from season to season.

Collection system of waste water in rural areas

In rural areas, per capita water supply ranges from 40 lpcd to 70 lpcd only. Consequently, generation of waste water is too low to make conventional trunk sewer system effective. Further, the system requires a lot of mechanical and electrical devices to pump. Further, the system requires a lot of mechanical and electrical devices to pump waste water that is not sustainable in rural areas.

5. Small bore sewer systems

For grey water, surface drain is the cheapest option for collecting such waste water. For black water, mixed with grey water, small bore / swallow sewer is the appropriate and sustainable options for collecting waste water in rural areas. Small bore sewer systems are designed to receive only the liquid portion of household wastewater for off-site treatment and disposal. Grit, grease and floating materials are separated from waste flow in interceptor tanks. Such interceptor tanks are installed after each household or group of households as per the site conditions. Depending upon the size of interceptor tanks and inflow of waste water, settled solids are removed periodically from the interceptor tanks.

Small bore sewer systems provide an economical way to upgrade existing sanitation facilities to a level of service comparable to conventional sewers. Because of

the lower costs of construction and maintenance and the ability to function with little water, small bore sewers can be used where supply of water is low and consequently low volume of waste water is generated per household.

Decentralised Treatment of Waste Water:

Decentralised treatment of waste water in rural areas is more suitable. In such areas waste water contains only organic wastes that can be treated easily by the help of natural microbes present in waste water. Due to absence of toxic and heavy metals in such waste water, treated waste water as well as sludge can be effectively used for agricultural purposes. Following options are available for decentralised treatment of waste water.

1. Waste Stabilisation Ponds

Waste stabilization ponds (WSP) are shallow man-made basin into which wastewater flows and from which, after a retention time of few days a well-treated effluent is discharged. WSP systems comprise of a series of ponds- anaerobic, facultative and maturation ponds in series. If properly maintained and by desludging anaerobic ponds regularly, the Waste stabilization ponds (WSPs) are a low-cost, low-energy, low-maintenance and, above all, the most sustainable method of wastewater treatment. It is the most appropriate method of wastewater treatment in India particularly in rural areas as the climate in India is very favourable for the efficient operation of WSP. The high temperatures that occur throughout the year in most of the country are especially favourable for anaerobic ponds.

2. Duck Weed Pond System

Duckweed based wastewater treatment is potentially suitable for small scale application at rural level and for medium-sized facilities at community, (peri-) urban level. Duckweed is a group name belonging to botanical family Lamnaceae that consists of four genera namely- Spirodela, Lemna, Wolffia and Wolfiella; first 3 genera are commonly found in India. It is cosmopolitan and found everywhere in organic nutrients rich stagnant water. It has very high growth rate; at optimum nutrient environment it doubles within 2-3 days. It tolerates wide range of temperature- between 10^0-46^0C, depending upon the genera. Size of the plant is very small. Wolffiella is the smallest plant having pin head size, while Spirodella is the largest one, having its size of 2-3 cm only. The most important feature with this plant is that it contains up to 30 % edible

protein, vitamins A and C. It is a complete feed for certain species of fish like Grass carp, Silver carp, Common carp, Rehu and Mrigal. High yield of fish has a direct linkage with economic return and thus, employment avenue with the system.

3. Constructed wetlands

A horizontal flow constructed wetland (horizontal flow CW) is a planted filter bed for secondary or tertiary treatment of wastewater (e.g. grey water or black water). After primary treatment for solids removal in a UASB or Anaerobic baffled reactor, the wastewater is fed at the inlet zone and flows horizontally through the porous filter medium (sand or gravel) until it reaches the outlet zone. The water is treated by a combination of biological and physical processes. The effluent of a well-functioning constructed wetland can be used for irrigation and aquaculture or safely been discharged to receiving water bodies. Horizontal flow CW are relatively inexpensive to build where land is affordable and can be maintained by the local community as no high-tech spare parts, electrical energy or chemicals are required.

4. Soil Bio-Technology (SBT) for Sewage treatment / effluent treatment

This technology has been developed by IIT, Mumbai. SBT engages three fundamental process of nature – photosynthesis, respiration and mineral weathering and is achieved by soil micro-organisms which are regulated by soil micro-organisms (geophagus earthworms). The organic and inorganic in waste water is consumed and converted into useful by-products and simultaneously water of desirable quality is produced. The SBT is ideal for treating waste water less than 5 MLD.

SBT is an efficient process of synthesis to completely utilize solids and liquids, with economical capital and recurring costs. It efficiently integrates the physical, chemical and biological processes into a single aerobic system based on natural biophysical and biochemical principles. A specified addictive is added in a predefined proportion. The SBT plant requires mineral O&M periodically that includes cleaning of pipes, scraping of the top surface to remove the settled suspended particles. The microbial culture is tested and recommended to be changed every 8 – 10 years. The system does not require highly skilled labour.

5. Phytorid Technology for Wastewater Treatment

Phytorid technology is developed by NEERI for sewage treatment and this technology has world patent to its credit. The main objective of this technology is to provide a simple, feasible, practically sound, eco-friendly, maintenance free and cost-effective technology, which can handle the sewage waste water treatment leading to reuse of treated water for purposes like gardening. Phytorid is a scientifically developed systematic treatment methodology for waste water. It combines Physical, Biological and Chemical processes which work on gravity; no electric power requirement and is scalable technology.

This is used for the treatment of sewage or domestic wastewater which will consists of a basin or a channel with a barrier to prevent seepage, but the systems / cells / beds contain a suitable depth of porous media. A primary treatment facility would also be constructed along with basic for effective removal of solids and thus reduces the marginal BOD. The porous media also supports the root structure of emergent vegetation. The design of the Phytorid system assumes that the water level in the cells will remain below the top of the filter media.

The vegetation to be utilized for the said Phytorid system is very important. The salient features are that the treatment efficiencies of the removal of fecal coli forms, BOD, COD, nutrients are up to 80%, which is greater than the traditional chemical methods and the quality of treated water is comparable to irrigation standards.

6. Biogas Technology (Toilet linked Biogas)

Animal dung along with human wastes can be effectively used for biogas generation through on-site biogas plant linked with toilet. Biogas plant is important in providing sustainable energy sources in rural communities. Generation and utilization of bioenergy has multiple advantages. It helps improve sanitation, provide bioenergy at almost nil recurring expenditure and finally slurry / effluent of biogas plant has plant nutrient value to be used for agricultural purposes. Thus toilet linked biogas plant has additional benefits in terms of improving sanitation. In villages where household wastes contain mainly organics, they are also suitable for biogas generation. Such wastes can also be mixed in the same biogas plant to generate biogas production. In case of

community toilets, biogas generation from human waste is sustainable option. Biogas is an odourless and colourless gas that burns with clear blue flame similar to that of LPG gas.

Site of biogas should be selected properly avoiding water logged area and shady places. Biogas plant should be near to its use points as longer distance will reduce the gas pressure in gas pipe. The size of the plant depends upon the daily availability of cattle dung, users of toilet (toilet-linked) and water requirements.

7. Sequential Batch Reactor (SBR) Technology for Sewage treatment

This technology helps in treating the pre-treated sewage. The SBR system is operated in a Batch Reactor mode which eliminates all the inefficiencies of the continuous process. Two modules are provided to ensure continuous treatment. No additional settling unit/ secondary clarifiers are required. The complete biological treatments are divided into cycles. Each cycle of operation comprises of three phases- aeration, settlement and decanting. Liquid is filled in the SBR basin up to a set of operating liquid level. After aeration the biomass settles and once settled, the supernatant is removed from the top using a decanter. Solids are then removed from the tanks. The above phases constitute one cycle, which is then repeated. Suitable for areas, where land availability is limited.

8. Membrane Bio reactor (MBR) for waste water

Sewage treatment plant with MBR technology called as SSEC membrane bioreactor (MBR) can treat waste without adding any chemicals. The advantages include high quality treated water, small space for installation and easier operation compared to conventional activated sludge process. MBR process use revolutionary submerged polymeric hollow fibre membranes in the biological process water tank, so as to produce high quality permeate from domestic sewage, primary and secondary waste water, cooling tower blow down etc. SSEC MBR is also ideal for retrofitting, augmenting capacity, quality of existing waste water plants.

9. Moving Bed Bio-film Reactor (MBBR) Technology

This technology employs thousands of polyethylene biofilm carriers operating in mixed motion within an aerated waste water treatment basin. Each individual bio-carrier

increases productivity through providing protected surface area to support the growth of heterotrophic and autotrophic bacteria within its cells. It is this high density population of bacteria that achieves high rate biodegradation within the system. This technology provides cost-effective treatment with minimal maintenance and since MBBR processes self-maintain an optimum level of productive biofilm. The biofilm attached to the mobile carriers within the system automatically responds to the load fluctuations.

10. Anaerobic Baffled Reactor (ABR)

An anaerobic baffled reactor (ABR) is an improved septic tank, which, after a primary settling chamber, uses a series of baffles to force all kind of wastewater to flow under and over the baffles as it passes from the inlet to the outlet. The wastewater is introduced into the chamber at the bottom, leading to an enhanced contact with the active biomass which results in an increased retention and anaerobic degradation of suspended and dissolved organic pollutants. ABRs are robust and can treat a wide range of wastewater, but both remaining sludge and effluents still need further treatment in order to be reused or discharged properly.

ABRs are suitable for a wide range of *wastewater*, but its efficiency increases with higher *organic* load. The system must be followed by polishing aerobic treatment such as facultative pond, constructed wetland etc., ABRs take advantage of the easy construction, low cost and strong resistance of septic tanks but allow for much higher treatment efficiency. The BOD removal efficiency is reported between 60-80 %, much higher than conventional septic tank. It is applicable in waste water treatment in rural areas where land is limited and Septage/Sludge collection and treatment facility is available nearby.

11. Upflow Anaerobic Sludge Blanket (UASB) Reactor

The UASB is a high rate suspended growth type of reactor in which a pre-treated raw influent is introduced into the reactor from the bottom and distributed evenly. The influent passes upward through, and helps to suspend, a blanket of anaerobic sludge. Particulate matter is trapped as it passes upward through the sludge blanket, where it is retained and digested. Digestion of the particulate matter retained in the sludge blanket and breakdown of soluble organic material generates gas and relatively small amounts of new sludge. The rising gas bubbles help to mix the substrate with the anaerobic biomass.

The biogas, the liquid fraction and the sludge are separated in the gas/liquid/solids (GLS) phase separator, consisting of the gas collector dome and a separate settler. The settling zone is relatively free of the mixing effect of the gas, allowing the solid particles to fall back into the reactor. The clarified effluent is collected in gutters at the top of the reactor and removed. The biogas has methane content typically around 75 percent and may be collected and used as a fuel or flared.

In rural areas, the treated wastewater is generally used for irrigation, if medium to low quality effluent is needed, then the system is very promising. Very limited experience is available on the application of UASB in rural areas.

12. Settling -Contact Aeration System

It can be a concrete, steel, LLDPE or FRP tank which can be used anywhere for aerobic treatment of sewage. It is ideal for schools, hospitals and other complexes in rural areas. The system consists of three zones, solid separation zone, aeration zone and final sedimentation zone respectively.

(i) Settling –contact aeration system – steel tank

Solid Separation Zone transforms the influent solids to settled solids while allowing scum to float on the surface. It is a primary sedimentation zone in which settled sludge is stabilized by anaerobic digestion. The treatment efficiency of the chamber is in the range of 30% BOD removal. Second stage is the aerobic zone along with plastic media installed inside the tank which in turn increases the surface area and retain micro-organism long enough to digest the organic substance remained. Final stage involves the sedimentation where organic wastes are settled in the sedimentation zone. The settled waste in the bottom of the tank is pumped back to the primary sedimentation zone as a return sludge having active biomass (MLSS) to increase the efficiency of the system and ensure the effluent quality meets the stipulated standards. The system is compact tubular tank easy to transport. Sludge removal is once in 3 years. It works from no load to peak load. Can take weight up to 30 tones, hence may be installed underground and may be relocated or upgraded easily. Many Package Contact Aeration systems were installed for various residential housing colonies, institutions, offices and hotels all over India.

(ii) Settling –contact aeration system – LLDPE type

A simplified method for settling - contact aeration system has been developed and tested. The system is connected with a toilet block having 3 nos. of Water Closets (WCs) and one bath used by over 20 persons per day. The system has two Linear Low Density Polyethylene (LLDPE) tanks of different sizes. They are connected in series with inlet chamber of waste water. Smaller tank (1^{st} tank) has retention time of 12 hrs. whereas larger (2^{nd} tank) has of two days. 1^{st} tank works as anaerobic settling chamber and 2^{nd} as aerobic & treatment chamber. In the 2^{nd} chamber, air is provided through air pump having flow of 60-80 lpm. It is desirable to provide air for 24 hrs. However, due to limited elecric supply it is not feasible always. At reduced air supply level of BOD and other parameters of waste water will increase.

For the bacteria growth media, coir rope which is having huge rough surface area can be used. Such growth medium is easily available in most of rural areas and much cheaper than other plastic media. Treated waste water is stored in a storage tank from where it is reused for agriculture purposes. Effluent is chlorinated to make bacteria free, whenever required. Such effluent, under aerobic condition, is free from any odour and colour making suitable for use in agriculture and other non- potable purposes. Effluent from anaerobic condition can be used for agriculture purpose.

13. Extended Aeration

The extended aeration process is a modified activated sludge process which provides biological treatment for the removal of BOD and Total Suspended Solid (TSS) under aerobic conditions. Air may be supplied by surface or diffused aeration to provide the oxygen required to sustain the aerobic biological process

The wastewater enters the treatment system and is typically screened and degritted immediately to remove large suspended, settleable, or floating solids that could interfere with or damage equipment downstream in the process. If the plant requires the flow to be regulated, the effluent will then flow into equalization basins which regulate peak wastewater flow rates. Wastewater then enters the aeration tank, where it is mixed and oxygen is provided to the microorganisms. The mixed liquor then flows to a sedimentation tank where most microorganisms settle to the bottom of the sedimentation tank and a portion is pumped back to the incoming wastewater at the beginning of the plant. This returned material is the return activated sludge (RAS) (US EPA, 2000). The material that is not returned, the waste activated sludge (WAS), is removed for treatment

and disposal. The clarified wastewater then flows over a weir and into a collection channel before being diverted to the disinfection system.

14. Karnal Technology

The Karnal Technology involves growing trees on ridges 1m wide and 50cm high and disposing of the untreated sewage in furrows. The amount of the sewage/ effluents to be disposed of depends upon the age, type of plants, climatic conditions, soil texture and quality of effluents. The total discharge of effluent is regulated in such a way that it is consumed within 12-18 hours and there is no standing water left in the trenches. Through this technique, it is possible to dispose of 0.3 to 1.0 ML of effluent per day per hectare. This technique utilizes the entire biomass as living filter for supplying nutrients to soil and plant; irrigation renovates the effluent for atmospheric re-charge and ground storage. Further, as forest plants are to be used for fuel wood, timber or pulp, there is no chance of pathogens, heavy metals and organic compounds to enter into the human food chain system, a point that is a limiting factor when vegetables or other crops are grown with sewage.

Though most of the plants are suitable for utilizing the effluents, yet, those tree species which are fast growing can transpire high amounts of water and are able to withstand high moisture content in the root environment, are most suitable for such purposes. Eucalyptus is one such species, which has the capacity to transpire large amounts of water, and remains active throughout the year. This technology for sewage water use is relatively cheap and no major capital is involved. The expenditure of adopting this technology involves cost of making ridges, cost of plantation and their care. This system generates gross returns from the sale of fuel wood. The sludge accumulating in the furrows along with the decaying forest litter can be exploited as an additional source of revenue.