CHAPTER-IV

PERFORMANCE AUDITS (URBAN LOCAL BODIES)

CHAPTER IV

PERFORMANCE AUDITS

URBAN DEVELOPMENT DEPARTMENT

4.1 Management of Municipal Solid Waste by Select Municipal Corporations

Executive Summary

Solid Waste Management is a part of public health and sanitation since it poses a threat to the environment and human life if not handled or disposed of properly.

A Performance Audit conducted on 'Management of Municipal Solid Waste by Select Municipal Corporations' revealed that the selected seven Municipal Corporations (MCs) had neither prepared comprehensive city plan for management of Municipal Solid Waste (MSW) in accordance with the MSW Manual, nor had they met the timelines for improvement of existing landfills and for setting up of new waste processing and disposal facilities in their jurisdiction. Generation of MSW was not assessed properly in all the MCs for want of weigh bridges. Budget provisions were not fully utilized in all the selected MCs, though there were shortages of vehicles for transportation of MSW.

All the MCs, except Amravati and Nagpur MC, had provided separate vehicles for collection of waste generated by hotels. Facility for collection of construction and demolition waste was not available in Amravati and Kalyan-Dombivli MCs. Except Municipal Corporation of Greater Mumbai (MCGM) and Pune MC, where partial segregation was available, segregation of waste at household level was not in place. Different coloured Community bins were not provided by any of the selected MCs for collection of segregated waste. Open body vehicles were used for transportation of MSW in all the MCs except Pune MC.

MSW processing facility was not available in Amravati, Kalyan-Dombivli and Kolhapur MCs. Though MCGM had a plan for installation of three processing plants, only one could be installed till date (January 2017) mainly due to land lease issues. Sanitary Landfills were developed only by Nagpur and Pune MCs. Waste inspection facility to monitor waste brought in for landfill was not in place at the landfill sites except Kanjur in MCGM. No records on the baseline data of ground water quality near landfill site were maintained nor was any test of quality of underground water conducted.

4.1.1 Introduction

In urban areas, the responsibility of management of Municipal Solid Waste (MSW) is vested with Local Self Government Institutions (Section 61 (c) of the Mumbai Municipal Corporation Act, 1888). Municipal Corporations (MCs) in Maharashtra collect waste generated from residential and

commercial establishments and the same is first transported to an intermediate refuse transfer station[1] (RTS) and from there transported to dumping yard/Sanitary Landfill site (SLF) for segregation and processing. Inert[2] segregated at the site is disposed of at the designated site within the dumping yard/SLF. Municipal Solid Wastes (Management and Handling) Rules, 2000 (MSW Rules) provide the legal framework for disposal and management of the solid waste.

The State had 26 MCs that accommodated 32 *per cent* of the total population of the State[3]. During 2015-16, these MCs generated 18,968 Metric Tonnes per Day (MTD) of MSW which constituted 87 *per cent* of the total waste generated in the Urban Local Bodies (ULBs) in the State (21,867 MTD).

The Principal Secretary, Urban Development Department (UDD) is the head of the Administrative department of ULBs. Municipal Commissioner of each Corporation is the administrative head of the body and is assisted by the Deputy Municipal Commissioner and Assistant Commissioners for the management of the MSW. Monitoring of compliance to the MSW Rules by the Corporations/local bodies rests with Maharashtra State Pollution Control Board (MPCB).

4.1.2 Audit Objectives

The audit objectives were to examine whether:

- planning and compliance with the extant rules and provisions for management of MSW were adequate and effective;
- the entire process of collection, segregation, transportation processing and disposal of solid waste was executed effectively, economically and transparently;
- an effective and adequate monitoring and evaluation mechanism existed for compliance with prescribed rules and norms.

4.1.3 Scope and Methodology of Audit

The Performance Audit was conducted during April 2016 to September 2016. An entry conference was held (June 2016) with the Principal Secretary, UDD in which scope and methodology of audit was discussed. The audit covered the period 2011-12 to 2015-16. Test check of records of UDD and seven[4] of 26 MCs was selected using random sampling. Besides, joint physical inspection of MSW management sites (collection, dumping/landfill and processing) in the selected MCs was conducted by audit along with the officials of MCs. The exit conference was held (January 2017) with the Principal Secretary, UDD and representatives of MCs in which audit observations were discussed in detail. The response of the UDD has been incorporated while finalising the Report on Performance Audit.

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1 RTS is an intermediate waste collection point where MSW is brought from all the wards for final transportation to dumping/landfill site

2 Part of MSW that cannot be processed

3 11.24 crore as per 2011 census.

4 Amravati, Kalyan-Dombivli, Kolhapur, MCGM, Nagpur, Pune and Thane

4.1.4 Audit Criteria

The following were the audit criteria:

- The Mumbai Municipal Corporation (MbMC) Act, 1888 and The Maharashtra Municipal Corporation Act, 1949 (Amended 2011);
- Manual of Municipal Solid Waste Management, 2000 issued by Government of India (GoI) and The Municipal Solid Wastes (Management and Handling) Rules, 2000; and
- Instructions, guidelines, policies issued by Central Pollution Control Board (CPCB), Maharashtra Pollution Control Board, GoI/Government of Maharashtra (GoM), on solid waste management from time to time.

Audit Findings

4.1.5 Planning

4.1.5.1 Absence of City Plan for Management of MSW

As per Manual on Municipal Solid Waste Management, 2000, there should be Short-term plan (two to five years), Medium-term plan (five to15 years) and Long-term plan (15 to 25 years) for solid waste management. Paragraph 15 below Schedule III of MSW Rule provided that facility for weighing MSW should be made at dumping/landfill site. Paragraph 19.7 of Manual on MSW of the GoI, envisages the entire administration of MSW management under one umbrella to avoid the problems of lack of coordination and states that it is necessary to have one person exclusively in charge of SWM in the city to have overall control on the management of MSW. We noticed that;

- None of the seven MCs had prepared comprehensive City Plan for management of MSW. The various parameters namely identification of problems, gap analysis of services and involvement of stakeholders in planning process though essential for effective planning were not observed.
- Except MCGM and Nagpur, other MCs did not have facility for weighing of MSW at dumping/landfill sites. The Nagpur MC did not even have the correct data on generation of MSW for the period 2011-16. In Pune and Thane MCs, weighing machines were provided in the RTSs. In Amravati, Kalyan-Dombivli and Kolhapur MCs, generation of MSW was worked out by weighing MSW on random dates, and, the calculation of MSW by these three[5] MCs was on approximation basis only. Thus the assessment of MSW in selected MCs could not be said to be reliable. This affected the planning for transportation and disposal of MSW.
- In three[6] of seven MCs, separate departments for solid waste management did not exist, and, the Solid Waste Management (SWM) wing was functional under the Health Department (headed by the Health

[5] Amravati, Kalyan-Dombivli and Kolhapur
[6] Amravati, Kolhapur and Nagpur

Officer) of the MCs since their establishment. Kolhapur MC had submitted (December 2010) its proposal to UDD for sanction of additional post for separate department. UDD had directed (April 2015) Kolhapur MC to follow the staffing pattern as specified in Government Resolution. No further progress was noticed (January 2017). Amravati and Nagpur MCs did not make any attempt for creation of a separate department for SWM.

- Four[7] MCs had selected technology for processing and disposal of MSW, of which only Municipal Corporation of Greater Mumbai (MCGM) did (2005) a comprehensive study while selecting the waste process technology. The planning for SLF was done only by Nagpur and Pune MCs.

The UDD apprised (January 2017) that comprehensive City Plan would be prepared under Swachh Bharat Mission[8] (SBM) and the aspect of separate department would be addressed.

4.1.5.2 Planning for Execution of Projects under JNNURM

Under 'Jawaharlal Nehru National Urban Renewal Mission' (JNNURM), eight cities[9] in Maharashtra were required to prepare Detailed Project Report (DPR) for improving basic services including management of MSW during the mission period of 2006-13. The DPRs were required to be submitted to GoI through the State Nodal Agency for obtaining funds as per prescribed sharing pattern[10].

We observed that MCGM and Thane prepared DPR between November 2007 and November 2009 for improvement of collection, storage and transport system, closure of old dumping site, infrastructure for processing facility. However, there were deficiencies in DPR which affected setting up of the planned facilities as discussed below:

- In case of MCGM, GoI approved (November 2007) the DPR for partial closure of Deonar and Mulund dumping site, establishing waste management facilities at Deonar and Kanjur and bio-methanation plant at Mulund, for ₹ 178.79 crore out of which ₹ 134.09[11] crore was released to MCGM during May 2008 to March 2012. However, due to improper planning, the processing plants at Mulund and Deonar could not be installed and there was delay of 54 months in installing the processing plant at Kanjur as discussed in **Paragraph 4.1.6.3 (B).**
- For improvement in management of MSW[12], Thane MC had submitted (November 2009) a DPR for ₹ 88.62 crore. But it was not

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7 MCGM, Nagpur, Pune and Thane

8 Swachh Bharat Mission is a national campaign by the GoI to clean the streets, roads and infrastructure of the country

9 MCGM, Kalyan-Dombivli, Mira-Bhayandar, Navi Mumbai, Ulhasnagar, Thane, Pimpri-Chinchwad and Nagpur

10 To be shared among GoI, GoM and MC in the ratio of 35:15:50 in MCGM and in the ratio of 50:20:30 for Kalyan-Dombivli and Thane MC

11 GoI ₹ 46.93 crore + GoM ₹ 20.11 crore + MCGM ₹ 67.05 crore = ₹ 134.09 crore

12 Includes collection, segregation, transportation, processing and disposal of MSW

approved (February 2010) by GoI as the earlier directions (August 2009) for preparation of city specific strategy were not followed by the MC. As a result, the MC lost the opportunity to avail Central and State assistance of ₹ 62.03 crore under JNNURM. Unscientific dumping of MSW was still continuing (January 2017) on unauthorized land and large quantity of leachate is polluting Thane creek as discussed in **Paragraph 4.1.6.4.**

4.1.5.3 Non-adherence to the Timelines by Municipal Corporations

As per Rule 4(2) Schedule I of MSW Rules, a Municipal Authority was required to improve existing landfill sites by 31.12.2001 or earlier and set up waste processing and disposal facilities by 31.12.2003 or earlier. The purpose was to reduce the environmental pollution.

We noticed that none of the test checked MCs met the timeline set for improving existing landfill sites. Though four[13] MCs did set up waste processing facilities, these were not operating at full capacity **(Paragraphs 4.1.6.3 (B), (D), (E) and (F**)). Thane MC had installed processing facility to the extent of three per cent of generation of MSW. Kolhapur MC had set up a compost plant in 2000 but it was non-operational since 2011 whereas Amravati and Kalyan-Dombivli MCs did not set up any such facility so far (January 2017). Partial closure of existing landfill site and development of sanitary landfill was done only by Nagpur (2009) and Pune (2010) MCs.

The MCs had therefore deprived the citizens of the intended benefits of prevention of environmental pollution, reducing burden on landfill site and its use for longer period by not developing processing facilities**.**

The UDD stated (January 2017) that new timeline fixed in the revised MSW Rules, 2016[14] would be adhered to.

The UDD stated (January 2017) that mandates of MSW Rules, 2016 would be implemented in stages under the flagship programme of SBM.

4.1.5.4 Non-utilisation of Budget Provision

MCs mainly used their own budget allocations for meeting the expenses for management of MSW. Besides, funds from other sources such as Maharashtra Suvarna Jayanti Nagarotthan Mahabhiyan (MSJNA)[15], 13th Finance Commission (13th FC) - a 100 *per cent* GoI Scheme and JNNURM were also received by Kalyan-Dombivli MC, Kolhapur MC and MCGM, respectively. The budget provision, expenditure incurred and unutilised fund during 2011-16 in respect of the selected MCs is given in **Appendix 4.1**. An analysis of the budget and expenditure figures indicated the following:

- Seven MCs did not utilize the full budget provision on MSW during the period 2011-16. The extent of utilization of Budget showed fluctuating trend and the unutilized budget ranged from two *per cent*

[13] MCGM, Nagpur, Pune and Thane
[14] Applicable w.e.f. 08 April 2016
[15] Scheme of GoM on the line of JNNURM for implementation of long term plans in ULBs having sharing pattern of 50:50

to 37 *per cent* of budgeted MSW amount of MCs. In Nagpur MC, the amount of expenditure exceeded the budget allocation on MSW during 2011-13 and 2015-16 and the same trend was noticed in Amravati MC during 2013-14. The details of funds received from other sources by three MCs and the utilisation are shown in **Table 4.1.1**.

Table 4.1.1: Funds received under MSJNA, 13th FC and JNNURM

(₹ in crore)

Corporation	Kalyan-Dombivli (2011-16)			Kolhapur (2011-15)	MCGM (2008-12)[16]			
Scheme	MSJNA			13th FC	JNNURM			
Source of Fund	GoM	MC	Total	GoI	GoI	GoM	MC	Total
Sanctioned Fund	43.75	NA	43.75	18.33	62.58	26.82	89.39	178.79
Sharing Pattern	21.875	21.875	43.75	18.33	62.58	26.82	89.39	178.79
Received Fund	10.94	10.94	21.88	18.33	46.93	20.11	67.05	134.09
Utilised fund	10.94	5.91	16.85	17.47	46.93	20.11	67.05	134.09
Unspent Balance	0	5.03	5.03	0.86	0	0	0	0
Source: Information furnished by the MCs								

- Kalyan-Dombivli MC did not utilise the balance amount of ₹ 5.03 crore[17] under MSJNA for purchase of vehicles and bins for improvement in collection and transportation system. The GoM, consequent on non-submission of utilization certificates by the MC, did not release the balance amount of ₹ 10.94 crore till date (January 2017).
- In Kolhapur MC, out of funds received under 13th FC ₹ 0.86 crore remained unspent and kept in Current Account of the MC instead of purchasing required vehicles for improving collection of MSW.
- In MCGM, out of the sanctioned fund of ₹ 178.79 crore under JNNURM, GoI and GoM did not release their share of ₹ 15.65 crore and ₹ 6.71 crore respectively. Consequently, MCGM could not release the matching funds of ₹ 22.34 crore.

In reply, the UDD stated (January 2017) that the budget allocation was huge in MCGM and there were practical problems in implementation of projects. The reply is not tenable as discussed in **Paragraph 4.1.6.3**.

Recommendation 1: MCs may prepare City Plan to recognize the problems in management of MSW and devise mechanism to ensure proper utilisation of budget allocations and funds received from GoI and GoM for strengthening the infrastructure.

4.1.6 Collection, Segregation, Transportation, Processing and Disposal of Solid Waste

The compliance criteria prescribed in MSW Rules for collection, segregation, storage, transportation, processing and disposal and present status of compliance of the parameters in seven selected MCs is shown in **Appendix-4.2**.

[16] Implementation period of JNNURM was from 2006 to 2013 but funds were released to MCGM during 2008-12

[17] ₹ 10.94 crore less actual amount utilised from its own fund ₹ 5.91 crore = ₹ 5.03 crore

4.1.6.1 Collection and Segregation of MSW

As per Schedule II appended to MSW Rules, 2000, the MCs have to organize house-to-house collection of MSW by using community bin/musical vehicle to prevent littering and facilitate compliance. The MCs have to provide differently coloured community bins[18] with lid to ensure collection of segregated waste at household level. The waste collected from residential areas, commercial areas including slums and squatter areas, hotels, restaurants, slaughter houses, flower and vegetable markets were to be recycled to make use of such waste. The manual handling of waste should be carried out only under proper protection with due care for safety of workers. Construction and Demolition (C&D) waste or debris should be collected separately and disposed of adhering to the norms.

The objective of segregation of MSW can be achieved when there are facilities available for treatment/processing of segregated waste. As per Table 3.4 of MSW manual, average compostable matter in MSW generated in Indian cities with population of five lakh and above was 40 *per cent*. In order to encourage the citizens, municipal authority should organize awareness programmes for segregation of wastes. MSW Manual also envisaged ULBs to mobilize voluntary organisations, Non-Governmental Organisations (NGOs) or co-operatives to take up the work of organising street rag-pickers and elevate them to door step waste collectors.

As regards the collection and segregation of MSW, Audit observed that;

- Door to door system of collection of MSW was in place only in respect of independent houses in all the selected MCs. Co-operative housing societies had their own arrangements for door to door collection and this was further collected by all the MCs from the gate of the Co-operative society. In Pune, the MC appointed (September 2008) a co-operative society namely 'Solid Waste Collection and Handling (SWACH)' having 2,300 members for door to door collection and segregation of MSW. Out of the 9,16,886 households in Pune MC, SWACH covers 3,87,666 (42 *per cent*) households. No such arrangement for engagement of organized waste pickers or NGOs for collection and segregation of MSW was in place in other MCs.
- Segregation of waste at household level was not in place in any of the MCs except in MCGM and Pune MC wherein partial segregation existed. MCGM had 31 dry waste collection centres and 46 separate vehicles were engaged for collection of dry waste.
- The selected MCs kept 9,251[19] community bins for collection of MSW from slum and squatter areas and fruit and vegetable markets. However, coloured bins for segregation were not placed in any of the MCs and hence only mixed waste could be collected through these bins.

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[18] Green for biodegradable waste, white for non-biodegradable and black for other waste organic and inorganic waste

[19] Amravati - 332; Kalyan-Dombivli - 549; Kolhapur - 700; MCGM - 6433; Nagpur - 170; Pune - 917; and Thane - 150

- All the MCs had provided separate vehicles for collection of waste generated by hotels, except in Amravati and Nagpur. Further, except for Kalyan-Dombivli, the other MCs did not have separate arrangements for collection of waste from slaughter houses. In absence of processing facility for slaughter house waste in six MCs[20], the possibility of this waste getting mixed with MSW could not be ruled out.
- Though facility for collection of C&D waste was available in five MCs[21], in absence of treatment facility, it was finally dumped with MSW.
- In all the selected MCs, during joint site visit by Audit, it was seen that staff engaged in collection of MSW were not using personal protective equipment such as masks, gumboots and hand gloves in violation of the requirements.

Workers without personal protective equipments

Kolhapur MC

Nagpur MC

- In five MCs[22], rate of segregation ranged from zero to 32 *per cent* for different categories of waste, however, details of efforts made for creating public awareness were not available. In Kolhapur MC and Pune MC, though efforts were made for public awareness the extent of segregation in Kolhapur MC ranged between 18 and 37 *per cent* whereas in Pune MC, it ranged between 13 and 40 *per cent* **(Appendix-4.3)**.
- The objective of segregation of MSW also could not be achieved by all the MCs due to absence of appropriate facilities for treatment/processing of segregated waste. This led to burden on the landfill site to the extent of 7.59 million tonnes[23] on account of biodegradable waste.

[20] Amravati, MCGM, Kolhapur, Nagpur, Pune and Thane

[21] Kolhapur, MCGM, Nagpur, Pune and Thane

[22] Amravati - Nil; Kalyan-Dombivli - 0.91 to 6.26 *per cent*; MCGM - 1.61 to 2.86 *per cent*; Nagpur - 10 *per cent*; and Thane - 15.79 to 31.58 *per cent*

[23] Total MSW generated in the seven MCs during 2011-16 = 2,04,81,533 MT x 40 *per cent* = 96,32,614 MT less processed by five MCs of 20,42,905 MT = 75,89,709 MT

- As of March 2016, the efficiency in collection and extent of segregation of MSW in the selected MCs ranged from 88 to 100 *per cent* and zero to 40 *per cent* of collected waste, respectively **(Appendix-4.3)**. In respect of Nagpur MC, the efficiency of collection was not reliable as the MC did not have the correct data on generation of MSW for the period 2011-16.

In addition to non-compliance with provisions of MSW Rules in collection and segregation of MSW, irregular execution of agreement was noticed in Nagpur MC as discussed below.

A) Irregular Execution of Agreement and Sub-letting of Work

Nagpur MC had a plan for Door to Door collection and transportation of MSW up to dumping site directly and/or through intermediate transfer stations for making Nagpur bin-free city in 10 years period. For this purpose, the MC invited tenders (September 2007) from parties, including consortium, having experience of three years in the management of MSW. The work of collection and transportation of MSW was awarded (January 2008) to a Joint Venture Company[24] on payment of tipping fee of ₹ 449 per MT.

We noticed that Centre for Development & Communication (CDC), a trust, was the successful bidder and the work order was issued (January 2008) to a Joint Venture (JV) of CDC and IL&FS Waste Management and Urban Services Limited. However, the MC executed the agreement with M/s Kanak Resources Management Limited (KRML), a Special Purpose Vehicle (SPV) formed (26 November 2007) out of the JV. MC Nagpur also paid ₹ 174 crore to KRML during 2008-16. According to the scope of work of tender clause, the bidder should not re-assign the work under the contract to any other party without prior written approval of the Nagpur MC. As there was no participation of the JV/SPV in the entire bidding process, execution of Agreement with KRML without approval of MC was irregular and so was the expenditure of ₹ 174 crore.

We further noticed that Health officer of the MC, without approval from MC contrary to the tender terms, permitted KRML (May 2008) to engage a sub-Contractor for execution of the work, which was irregular.

The UDD assured (January 2017) a detailed examination of the issue.

4.1.6.2 Transportation of MSW

As per MSW Rules, 2000, vehicles used for transportation of waste should be covered to prevent the MSW from littering the streets and waste should not be visible to public nor exposed to open environment. MSW collected in primary collection system[25] was brought to the Refuse Transfer Station for disposing in the dumping site/SLF. The vehicle should be designed and

[24] M/s Centre for Development & Communication (CDC) and M/s Infrastructure Leasing & Finance Services (IL&FS) Waste Management and Urban Services Limited for the period 10 years from the date of award of work/agreement subject to renewal

[25] A collection system that includes door to door collection, collection through bins, *etc.* and transfer of the same to the collection points

synchronized[26] with primary collection system to avoid multiple handling of waste prior to final disposal. The bins or containers wherever placed should be emptied before they start overflowing. The details regarding vehicles for collection and transportation of MSW in the seven MCs are shown in **Table 4.1.2**.

Table 4.1.2: Availability of vehicles for collection and transportation of MSW as on December 2016

Name of the MCs	Number of Vehicles required		Number of vehicles available					Shortage of vehicles/*per cent*	
			For collection		For Transport		Total		
	Collection	Transport	Owned by MC	Owned by Contractor	Owned by MC	Owned by Contractor		Collection	Transport
Amravati	542	53	485	Nil	4	34	523	57/ 11	15/ 28
Kalyan-Dombivli	142	110	64	Nil	67	Nil	131	78/ 55	43/ 39
Kolhapur	610	19	310	Nil	15	Nil	325	300/ 49	4/ 21
MCGM	Not available		382	1246	35	307	1970	Not available	
Nagpur	Not available		Nil	743	Nil	32	775	Not available	
Pune	Not available		297	Nil	238	Nil	535	Not available	
Thane	Not available		44	161	29	30	264	Not available	
Source: Information furnished by the MCs									

Our scrutiny revealed:

- Four of seven selected MCs did not assess the requirement of vehicles for collection and transportation of MSW. The remaining three[27] MCs assessed the requirement but there was shortage of vehicles ranging from 11 to 55 *per cent* for collection and 21 to 39 *per cent* for transportation.
- In six[28] MCs, vehicles such as trucks and tippers used in secondary[29] collection were not synchronized with the primary collection system leading to multiple handling of MSW.
- In Kalyan-Dombivli and Kolhapur MCs, there was requirement of 121 and 304 additional vehicles, respectively, for collection and transportation of MSW. Though funds of ₹ 5.03 crore and ₹ 86 lakh, respectively, were available (**Table 4.1.1**) these were not utilized for purchase of required number of vehicles (December 2016). Instances of open transportation, overflowing bins and littering of MSW were noticed during joint visits in four[30] MCs in violation of MSW Rules.

[26] Two vehicles are synchronized if MSW in the smaller one can be transferred to the larger vehicle by mechanical means and no manual handling is required

[27] Amravati - August 2016, Kalyan-Dombivli - February 2016, Kolhapur - 2015-16

[28] Amravati, Kolhapur, Kalyan-Dombivli, Nagpur, Pune and Thane

[29] In Secondary collection system, the MSW is collected from smaller vehicle to a larger vehicle for further transportation to landfill site

[30] Kalyan-Dombivli, Nagpur, Pune and Thane

Open body transport in Kalyan-Dombivli MC

Open Body transport in Thane MC

Recommendation 2: MCs may ensure use of protective equipment by people handling MSW. They may also devise mechanism for maximum segregation. MCs may use synchronized and covered vehicles for collection of MSW to avoid its multiple handling and open littering.

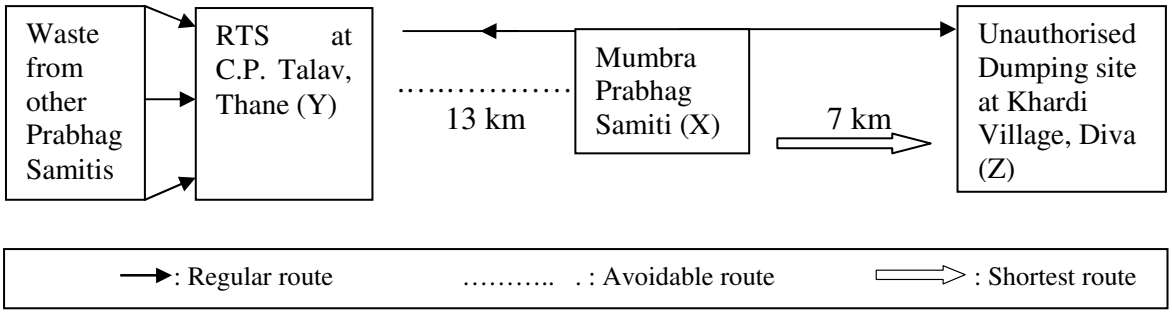
Besides, there were instances of undue favour to contractor and additional expenditure due to injudicious management of transportation in Amravati and Thane MCs.

(A) Injudicious Management of Transport of MSW in Thane MC

Thane MC appointed (March 2012) Contractor "A" for collection of waste from 150 community bins placed at different areas of the 10 Prabhag Samitis[31] of the Corporation. The waste so collected was to be transported to Refuse Transfer Station (RTS) at C.P. Talav, Thane by compactors engaged by the contractor. As per the agreement (March 2012), the contractor was to be paid ₹ 7,100 per trip from the nine Prabhag Samitis to RTS. We noticed that yet another agency, Contractor "B" was appointed (March 2012) for transporting the waste received from all Prabhag Samitis at the RTS to the dumping yard at Khardi village, Diva (an unauthorized site) at the agreed rate ranging from ₹ 226.50 to ₹ 290.85 per MT during the period from October 2012 to March 2016. The RTS is 20 km away from the dumping site. The MSW of Mumbra Prabhag Samiti (Point X) was carried by Contractor "A" to RTS at C.P Talav (Point Y), from where the MSW was further carried by Contractor "B" to the dumping site (Point "Z") as shown in the diagram below. Scrutiny of records and joint inspection (06 February 2016) by Audit along with officials of the MC revealed that Point X falls between Point Y and Point Z.

[31] A Prabhag Samiti is an administrative division of a Corporation comprising some wards

Schematic Diagram of MSW transportation in Thane MC



It would be cost effective to transport MSW directly from point X to point Z, as the distance was only 7 kms, being the shortest route. However, Thane MC's plan to transport MSW from Point X to Point Y, instead of transporting directly to Point Z, resulted in additional expenditure ₹ 1.56 crore[32] during October 2012 to March 2016[33].

Thane MC stated (September 2016) that due to bad condition of road and opposition of local people, MSW was not directly taken to the dumping site. Reply was not tenable as the same road was being used by Contractor "B" for transport of MSW from the RTS to the unauthorized dumping site at Khardi village.

(B) Extending Work without Inviting Tender and Irregular Payment of Price Escalation in Amravati MC

Amravati MC had executed (September 2008) an agreement with a contractor for transportation of MSW from four zones of the MC to the dumping site at Sukali. The agreement was for a period of five years and there was no clause for payment of price escalation. According to clause 17 of the contract, the contractor should carry the MSW at same rates without any change in terms and conditions of contract, after completion of contract period till the MC made any new arrangement for the same. As per the standard practice, tenders for appointment of new contractor should be initiated well before expiry of earlier contract. Further, as per clause 26 of the agreement, if any notifications or directions were issued by the Government, the Commissioner was empowered to include new terms and conditions in the ongoing contract. The agreed rates of transporting MSW in open trucks ranged from ₹ 850 to ₹ 910 per trip and for dumper placer, the same ranged from ₹ 840 to ₹ 900 per trip for the four zones of the Corporation.

We observed that even in absence of direction or notification by GoM on price escalation, in accordance with clause 26 of the agreement, the Standing Committee approved (February 2013) payment of price escalation of ₹ 1.04 crore for the period from April 2011 to October 2013 which was irregular. Further, the contract for transportation of MSW had expired in

[32] ₹ 2.11 crore – ₹ 1.14 crore = ₹ 0.97 crore + ₹ 0.59 crore = ₹ 1.56 crore

[33] The proportionate amount of expenditure for 7 kms from point X to Z works out to ₹ 1.14 crore (Contractor "A" was paid ₹ 2.11 crore for 2,978 trips @ ₹ 7,100 per trips for 13 kms from Point X to Point Y) plus amount paid to Contractor "B" of ₹ 59.02 lakh for transporting waste from Point Y to Z

August 2013 and the MC did not initiate tender procedure well in advance and continued with the same contractor by giving extensions and finally extended the same contract from November 2013 to October 2016, without calling for tenders. The MC also included a new clause for payment of price escalation in the second contract, which was also irregular. The MC paid price escalation of ₹ 3.04 crore in the new agreement, for the period November 2013 to June 2016. Payment of price escalation in absence of any specific clause in the first agreement, irregular continuation of agreement with the same contractor without inviting tender and inclusion of a new clause for payment of price escalation in the second agreement was irregular and an undue favour to the contractor.

The UDD admitted (January 2017) that the extension of contract and payment of escalation was not in public interest and that it should have been sent to GoM for final decision.

4.1.6.3 Absence of facilities for Processing of MSW

The implementation schedule (Schedule IV) of the MSW Rules stipulated that the Municipal authorities should adopt suitable technology for processing of biodegradable MSW such as composting, vermi-composting, aerobic digestion or any other appropriate biological processing so as to minimize the burden on landfill.

- It was noticed that no processing facility existed in Amravati MC, Kalyan-Dombivli MC and Kolhapur MC. Only three *per cent* of MSW generated at Thane MC (691 MTD) was processed, though segregated waste from hotels was available with all the MCs (except Amravati MC) for processing. In Nagpur MC and Pune MC, though the processing facility of the required capacity was available (Nagpur 600 MTD and Pune 1,705 MTD), the desired results as per the plan were never achieved due to non-operation of processing plants in full capacity (Nagpur MC) or due to non-functioning of the plants (Pune MC) as discussed in sub-paragraphs (D), (E) and (F) below.
- In Kalyan-Dombivli MC, we noticed that in an operational plastic recycle plant, erected (2009) at a cost of ₹ 25 lakh under Suvarna Jayanti Urban Employment Scheme (50:50 GoM Scheme and self help group), plastic raw materials used in the machine were not from municipal solid waste but were procured from outside the MC area. Thus, the facility created at a cost of ₹ 25 lakh was not being utilized for the intended purpose.
- For management of MSW in Mumbai, MCGM planned (2005) to close the existing site at Gorai and establish processing facility of approved technology at three sites *viz.,* Mulund, Kanjur and Deonar. For this purpose, MCGM appointed (May 2005) a Consultant, who proposed Biomethanation[34] for Mulund site and Compost[35] processing technology for Kanjur and Deonar.

[34] A type of biological processing technology that decomposes feedstock in absence of oxygen

Prior approval from the GoM under Section 92 DD of the MbMC Act, 1888, was required to lease the land to any private party. We noticed that in anticipation of getting this permission from GoM, MCGM went ahead with the tendering process (June 2006) allowing use of land at annual lease rent. The GoM granted approval belatedly (September 2015) to Kanjur site. It was, however, denied (January 2015) for Mulund and Deonar.

The UDD accepted (January 2017) that in Mulund and Deonar, permission for leasing the land was denied as prior permission was not obtained by MCGM. However, some of the instances indicating the consequential impact of delay/non-permission of lease of land are mentioned below.

(A) Non-installation of Processing Plant at Mulund

The work of relocation of existing dumped MSW to a designated area at the Mulund site, construction of biomethanation plant of 500 MTD on reclaimed area and other site development works[36]was awarded (March 2010) to a JV contractor on DBOOT[37] basis. The contract envisaged payment of tipping fee[38] @ ₹ 525 per MT for the first year with admissible escalation for subsequent period. The entire cost of the project for the concessionaire for 25 years was ₹ 654.84 crore and the installation of biomethanation plant was to be completed by September 2011. The letter of acceptance (LoA) was issued to the concessionaire on 30 March 2010.

Scrutiny revealed that concessionaire had cleared (March 2011) an area of 3.5 ha by relocating the existing waste (2,33,703 MT) for which MCGM paid ₹ 5.75 crore. The processing plant, however, could not be installed since GoM did not approve leasing of land at concessional rates. In absence of processing plant, fresh MSW was again dumped on the reclaimed area, thereby resulting in wasteful expenditure of ₹ 5.75 crore incurred on relocation of MSW. Besides, the purpose of scientific treatment of MSW was not achieved. The contract for installation of biomethanation plant was thereafter terminated (September 2015) without any outcome.

(B) Delay in Installation of Processing facility at Kanjur

MCGM floated tenders for installation of Compost plant of 4,000 MTD[39] for processing of MSW. MCGM awarded the work costing ₹ 4,116.65 crore (September 2009) to a JV for 25 years. As against 4,000 MTD capacity compost plant, the tender offer for setting up Bioreactor landfill plant (3,000 MTD) and Windrow Composting technology (1,000 MTD) was finalised (September 2009) on the grounds of less availability of land. The plants were to be completed by August 2010. While the bioreactor plant was commissioned (March 2015), Windrow composting plant was not installed (January 2017).

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35 A type of biological processing technology that decomposes feedstock in presence of oxygen

36 Construction of peripheral bund with core wall, storm water drainage system, water supply system, construction of road and boundary wall *etc*.

37 Design Build Own Operate and Transfer

38 Tipping fee is payable by MCGM to the concessionaire on a given quantity of MSW received at processing facility or landfill site to offset the cost of operation and maintenance

39 The consultant had recommended 4,500 MTD compost plant

We noticed that MCGM had 65.96 ha at Kanjur that was sufficient for installation of 4,000 MTD capacity plant as against requirement of 52 ha land. Further, National Environmental Engineering Research Institute (NEERI) had suggested (April 2005) composting was the most suitable processing technology for MCGM. Hence, the change in technology from Compost plant to Bioreactor landfill, on the grounds of less availability of land, was perhaps not justifiable. Consequently, the project got delayed as MCGM had to obtain fresh authorization from MPCB and Environmental Clearance from Ministry of Environment and Forest, GoI (December 2014) which led to litigations. Non-obtaining of the permission from GoM to lease the land to the concessionaire before floating the tender further delayed the project, by almost 54[40] months.

As a result, during the period September 2010[41] to February 2015[42], the MC failed to process 6.56[43] million tonnes of waste at Kanjur and the entire quantity of 6.56 million tonnes of waste was dumped at Deonar site, thus overburdening it beyond its capacity[44]. Further, extension was granted for the Compost processing plant of 1,000 MTD up to March 2017, due to delayed approval of GoM for lease land, which led to dumping of this additional 1,000 MTD at Deonar even after March 2015.

In addition to delay in installation of processing plant, MCGM had planned to shift three High Tension towers passing across the landfill site. Before obtaining the No Objection Certificate (NOC) from Forest Department as required under Section 2 of the Forest Conservation Act, 1980, the MCGM remitted ₹ 14.48 crore in advance (March 2012) to Maharashtra State Electricity Transmission Company Limited (MSETCL). As MCGM did not obtain the NOC from the Forest Department till date (January 2017), MSETCL could not shift the HT towers and the fund remitted to MSETCL remained blocked for last four years.

The UDD confirmed (January 2017) that the work was held up due to want of NOC from forest department.

(C) Non-installation of Processing Plant at Deonar

MCGM had planned (2006) partial closure of 65 ha area at Deonar and clearing of 55 ha area by relocating 3.88 million tonnes of existing dumped MSW at Deonar site for installation of 2,000 MTD compost plant. They awarded (October 2009) the contract to a contractor at a cost of ₹ 4,408.96 crore. The scope included partial closure and infrastructure works[45] to be completed by November 2011. The installation of the compost plant was to be completed by November 2012. The tipping fee of ₹ 225 per MT was payable by MCGM for receiving fresh waste at the site.

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[40] Period beyond stipulated completion of August 2010 and actual commencement of plant on 06 March 2015 *i.e.* from September 2010 to February 2015 = 54 months

[41] Month of commencement of plant as per contract

[42] The bioreactor plant was commissioned in March 2015

[43] Period between stipulated commencement of plant as per Agreement (September 2010) and the preceding month of actual commencement of plant (February 2015) = 1,640 days x 4,000 MT per day = 6.56 million tonnes

[44] 4,500 MTD for two years as per Consultants report

[45] Such as fencing, construction of peripheral bund and compound wall, *etc*.

We observed that the dumping of 6.56 million tonnes of waste from Kanjur site, as discussed in the preceding paragraph, coupled with non-approval by GoM for land lease had the following consequences on Deonar site.

a) Contractor had shifted (December 2011) 3.27 million cum (85 *per cent*) of existing waste for which MCGM paid ₹ 50.37 crore. The area so cleared was again filled with dumping of Kanjur MSW, thereby rendering the expenditure of ₹ 50.37 crore wasteful.

b) As the Compost processing plants at Kanjur (1,000 MTD) and Deonar (2,000 MTD) could not be installed, dumping of 3,000 MTD of waste continued at Deonar even after March 2015.

c) Consequent on unscientific dumping of MSW (12.45 million tonnes) at Deonar site, a major fire broke out on 28 January 2016. As per the Fire Investigation Report (February 2016), the Deonar site had neither provided overhead water tanks nor ring hydrant system, for extinguishing and control of fire. The emission of Methane gas increased the intensity of fire and it could be extinguished only on 05 February 2016 after nine days. As per Report of Environmental Information System (ENVIS) (February 2016), Air Quality Index[46] during that period was very poor and reached a hazardous level of 341 which compelled MCGM to shut down 74 schools for two days.

Outbreak of fire at Deonar dumping site, Mumbai

During the joint visit of Deonar (13 August 2016) dumping ground by Audit with officials of MCGM, we noticed that none of the prescribed fire safety measures were installed at the dumping ground.

(D) Wasteful Expenditure on Shifting of MSW and Non-realisation of Revenue in Nagpur MC

Nagpur MC had a plan for processing of MSW, relocation of MSW, partial closure of existing dumping site and development of SLF. A contract for installation of processing plant of 600 MTD capacity and other works was awarded (April 2009) to a Joint Venture Company (JV) on Build Own Operate Transfer (BOOT) basis for 12 years for ₹ 26.78 crore. The scope of work included, establishing a comprehensive mechanism to avail carbon

[46] Air Quality Index is a number used by Government agencies to communicate the pollution level in air

credit derived from Clean Development Mechanism (CDM) by selling the Certified Emissions Reduction (CERs). As per the proposal of the JV, the assured CDM benefit of the project was ₹ 48.64 crore[47] to be shared between concessionaire and Nagpur MC in the ratio of 20:80. As per the agreement, if the concessionaire failed to process the agreed quantity of MSW, the MC was empowered to process MSW through a third party at the risk and cost of the contractor. Repair and maintenance of the plant caused by an emergency, accident or fire was the responsibility of the Concessionaire.

Scrutiny of records of Nagpur MC revealed that the plant was operational from May 2010. Two fire accidents occurred in May 2011 and June 2013. As per report of MPCB (July 2013), a part of segregation unit and plastic recycling unit were destroyed in fire and hence were not in operation since 2012. As a result, the efficiency of the processing plant was reduced and it could process 200 MTD MSW only against the capacity of 600 MTD and approximately 400 MT MSW was dumped per day. The concessionaire also did not take any initiative to increase the capacity of the processing plant. The concessionaire was paid ₹ 6.06 crore for relocation of MSW from the existing dumping site to partial closure site.

However, fresh MSW (3,00,000 MT) was dumped on the reclaimed area up to April 2015, though designated landfill site was available on the premises. Further, during the period 2011-16, the JV could process MSW of 5,07,715 MT only leaving 5,87,285 MT[48] of MSW unprocessed. The MC also did not get the MSW processed by augmenting the efficiency of the existing MSW processing plant at the risk and cost of the contractor.

Thus, failure of the JV to make up for the reduced capacity of the processing plant and improper management not only resulted in wasteful expenditure of ₹ 6.06 crore on shifting of MSW but also non-realisation of potential revenue on carbon credit.

(E) Non-functioning of Compost Plant in Pune MC

The GoI sanctioned (March 2005) construction of two integrated MSW compost plants at Devachi Uruli, Pune, one for 100 MTD[49] (Plant No.1) and another for 500 MTD (Plant No.2) capacity under a Scheme "Solid Waste Management and Drainage in 10 selected Airfield Towns" to be implemented by National Building Construction Corporation Ltd. (NBCC)[50]. The NBCC awarded the work to a contractor at a cost of ₹ 4.02 crore and ₹ 13.88 crore respectively. The scope of work included operation and maintenance of both plants and sanitary landfill for 30 years. Accordingly, on completion of the construction, two separate agreements valuing ₹ 61.69 crore were executed (July 2009 and July 2010) with the

[47] Total CERs estimated to be available from partial closure work (Euro 15,53,057) and MSW processing facility (Euro 60,47,580) = Euro 76,00,637 x 64 (prevailing rate of conversion into Indian rupees) = ₹ 48.64 crore

[48] 5 years x 365 days = 1,825 days x 600 MT = 10,95,000 MT less quantity of waste actually processed by the Concessionaire 5,07,715 MT = 5,87,285 MT

[49] Subsequently the capacity was increased to 500 MTD by the contractor by incurring own expenses on approval (May 2010) from the Standing Committee

[50] A nodal agency appointed by GoI for implementing the Scheme

contractor for operation and maintenance of Plant No. 1 and Plant No. 2 respectively and sanitary landfill for 30 years.

Scrutiny of records of Pune MC revealed that due to frequent breakdown of machinery, both the plants were not working at full efficiency since commissioning. The contractor stopped operation of Plant No.2 in November 2013 and Plant No.1 in February 2014. Although the Pune MC provided assistance of ₹ 20 lakh to the agency to run Plant No.1 and paid ₹ 66.72 lakh towards electricity charges on behalf of the agency, the plant was not made fully operational, whereas Plant No.2 never restarted after November 2013.

As per agreement, the contractor had to take comprehensive insurance policy of ₹ four crore towards the cost of plant and machinery, submit bank Guarantee of ₹ 2.5 crore from a nationalized bank towards performance guarantee valid for the entire period (up to 2040) and the Monitoring Committee (headed by Municipal Commissioner and representative of the MC and the contractor) was to ensure smooth operation of the plant through periodical review. In case the contractor did not perform as per the terms of contract, the municipal authority could get the same completed by a third party, at the risk and cost of the operator.

We observed that the contractor did not insure the plant and machinery, and the Bank guarantee of ₹ 50 lakh submitted initially was also not renewed in Pune MC after July 2014. The Monitoring Committee neither ensured smooth operation of the plant nor proposed to get the job of processing completed by a third party at the risk and cost of the operator.

Poor maintenance of plant and machinery by the agency and inadequate monitoring by the Monitoring Committee resulted in malfunctioning of both the plants erected at a cost of ₹ 17.90 crore reducing them to scrap value of ₹ 3.62 crore (March 2016) in just six years of its construction. As a result, Pune MC could process only 1.46 million tonnes of MSW as against 2.28 million tonnes[51] envisaged, thereby leading to dumping of 0.82 million tonnes of MSW into the landfill site, defeating the very purpose of the project, besides, causing environmental losses which could not be ascertained.

Pune MC accepted (April 2016) that the bank guarantee was not renewed after its expiry and financial assistance was given after approval of the Standing Committee. After evaluation of the performance of the agency, show cause notice (June 2014) followed by termination letter was issued (December 2014) to the contractor.

The UDD stated (January 2017) that due to problems in marketing of compost produced from the plant, the contractor faced financial hardship and could not run the compost plant.

[51] Plant 1: – from 15 July 2009 to 31 March 2016 = 2,466 days
Plant 2: – from 23 July 2010 to 31 March 2016 = 2,101 days
Total 4,567 days x 500 MTD = 22,83,500 MT

Reply of the Department was not tenable as due to non-adherence to the contract conditions and inadequate monitoring by the MC, the plants erected at a cost of ₹ 17.90 crore remained idle.

(F) Loss due to Mechanical Problem in the Waste to Energy Plant in Pune MC

Pune MC had a plan for disposal of MSW by using any processing technology for which expression of interest for erecting a MSW processing plant of 700 MTD on BOOT basis for 30 years was called for (July 2009). The offer of a private Company (concessionaire) for installation of a waste to energy plant on payment of tipping fee of ₹ 300 per MT was accepted as the technology offered 50 *per cent* revenue sharing realised from CERs (estimated at ₹ 1.5 crore per year to Pune MC) and requirement of land was low (2.5 acre). Letter of Intent (LoI) was issued (July 2010), for installation of the plant within 12 months from the date of issue of LoI *i.e.* up to June 2011. Penalty up to 10 *per cent* of the tipping fee on the unprocessed MSW was recoverable from the concessionaire.

We observed that the concessionaire had installed the waste to energy plant of capacity 300 MTD as against the envisaged capacity of 700 MTD. As a result, the concessionaire had processed only 1,95,387 MT of waste as against 9,44,720[52] MT resulting in a shortfall in processing 7,49,333 MT waste during the period 2011-16. Further, there was technical deficiency, particularly mechanical problems in gasification area, due to which the plant could never produce energy from the waste. Since the concessionaire could not generate CER, financial benefit of approximately ₹ 6.75 crore[53] was not passed on to the MC as per contract condition. The MC, however, did not levy penalty of ₹ 2.25 crore[54] on the unprocessed MSW as per the conditions of the Agreement.

Pune MC admitted (April 2016) that the plant was not in operation at full capacity owing to which notices were issued as per the tender conditions and the concessionaire had given assurance to increase the capacity. Out of ₹ 2.25 crore, the MC in the meantime has recovered ₹ 11.67 lakh as penalty from the agency and proposal for imposition of penalty from the date of inception was submitted to the Commissioner (April 2016).

The UDD accepted (January 2017) the facts.

4.1.6.4 Disposal of MSW

As per provisions of the Schedule III of MSW Rules, it should be the responsibility of development authorities to identify the landfill sites and hand over the sites to the concerned municipal authority for development, operation and maintenance. The MCs were also required to obtain authorization from the State Pollution Control Board for a landfill site which should be properly fenced and had facilities like weigh bridge, fire protection and pollution monitoring equipments. We observed that:

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[52] From 11 August 2011 to 31 March 2016 = 1,687 days x 700 MT x 80 *per cent*= 9,44,720 MT

[53] ₹ 1.5 crore per year for four and half years *i.e.* August 2011 to March 2016

[54] Unprocessed waste 7,49,333 MT x tipping fee @ ₹ 300 per MT = ₹ 2,24,79,990 x 10 *per cent* = ₹ 2.25 crore

- MPCB issues authorisation for development of scientific landfills, installation of processing plants and for scientific dumping of MSW. We saw that only Amravati and Nagpur MCs had valid authorization from MPCB for approved landfill sites up to January and April 2017 respectively. In remaining five MCs, the earlier authorisation of MPCB had lapsed during 2014-16 and was not renewed.
- Though MPCB had approved (December 2011 to June 2015) six sites for development of SLF in three MCs[55], they did not develop SLF but were dumping unprocessed waste at unauthorised sites. Similarly, Amravati and MCGM, did not develop SLF and dumped waste at authorised site. In Nagpur MC, though SLF was developed, MSW was being dumped on both authorised as well as an unauthorized site at Bhandewadi.
- Except Pune MC, dumping sites were not properly fenced nor equipped with fire-fighting measures. Further only MCGM and Nagpur MC had provided weigh bridges at the landfill/dumping sites.
- Waste inspection facility to monitor wastes brought in for landfill, office building for record keeping, equipment and machinery such as pesticide spraying machine, masks, gloves and other personal protective equipment were not in place in Kolhapur MC and Thane MC.
- Pollution monitoring equipments were also not installed at the dumping/landfill sites except at Kanjur in MCGM.

Further, during joint visit of the landfill site at Khardi Village, Diva under Thane MC, it was noticed that waste was being dumped on the bank of Mumbra creek violating the norms of Coastal Regulation Zone Rules. No provision for leachate collection and treatment facility was made at the dumping site which could badly affect the environment of the coastal zone.

Unauthorized dumping in private land at Khardi Village, Diva, Thane MC

Untreated leachate flowing in the Mumbra Creek, Thane MC

[55] Kalyan-Dombivli, Kolhapur and Thane

Unauthorized dumping at Kasaba Bawada, Kolhapur MC

Broken compound wall at Adharwadi dumping site, Kalyan-Dombivli MC

The UDD stated (January 2017) that application for renewal of authorisation had already been sent to MPCB. Regarding provision of fire-fighting equipments at Deonar site, it was stated that the regulations in this regard would be examined.

Our scrutiny also revealed that Kalyan-Dombivli MC could not close the unauthorised dumping site and develop SLF which not only led to continuous environmental pollution but also cost escalation and non-realisation of development charges.

(A) Failure of Kalyan-Dombivli MC to control environmental pollution

As per MSW Rules (Schedule III), MC should develop sanitary landfill sites for scientific disposal of MSW. Since its inception (1983), Kalyan-Dombivli MC was dumping MSW at unauthorised site at Adharwadi.

Kalyan-Dombivli MC submitted (March 2010) the DPR for ₹ 43.75 crore sanctioned under JNNURM Scheme to GoM for obtaining funds under MSJNA. The MC did not include the component of closure of the unauthorised dumping ground at Adharwadi in the DPR submitted to GoM. Till date (January 2017) the work of closure of dumping site has not been commenced by the MC and large quantity of leachate generated at the dumping site was causing environmental pollution near Thane creek which was evident during a joint physical verification (01 June 2016).

The cost of the components of closure of dumping site and development of SLF estimated at ₹ 13.83 crore in 2008 under JNNURM has increased to ₹ 61.37 crore as per the latest estimate submitted (February 2016) to GoI under SBM.

The UDD stated (January 2017) that contract for the works of closure of dumping site and development of SLF was being finalised.

Recommendation 3: MCs may initiate timely action to obtain clearances from the concerned authorities before floating tender. Land lease proposals for development of scientific landfill sites need to be actively pursued for clearance. MCs may also devise mechanism for optimum utilisation of installed processing facilities besides developing of SLF for scientific disposal of MSW.

4.1.7 Internal Control Mechanism

4.1.7.1 State Level Control Mechanism

As per Municipal Solid Waste Manual (Paragraph 25.2), the State Government should frame appropriate policies to guide the local bodies and take a lead role in activating the local bodies to perform their obligatory duties effectively.

In Entry Conference (June 2016), the UDD mentioned that MSW Rules, 2000 were being implemented in the State. There was no separate Scheme for management of MSW. During performance audit, it was observed that the UDD had not given any policy; guidelines on management of MSW to the MCs. Guidelines for any contractual arrangements for outsourcing the management of MSW were also not in place. On the contrary when MCGM had sought assistance for starting processing facilities, the application for lease of land for setting up the facilities were either not approved or belatedly approved resulting in piling of MSW at sites.

4.1.7.2 Non-submission of Annual Report of the Municipal Corporation to UDD

As per Rule 4(4) of the MSW Rules, in case of a metropolitan city, every municipal authority should furnish its annual report in Form-II to the Secretary-in-charge of the Department. In case of all other towns and cities, the report in the same format was required to be submitted to the District Magistrate or the Deputy Commissioner concerned with a copy to the MPCB.

We observed that during the period 2011-16, out of the five metropolitan MCs (Kalyan-Dombivli, MCGM, Nagpur, Pune and Thane), only MCGM had submitted the Report in Form II to the Secretary-in-charge of the Department, whereas other MCs namely, Amravati and Kolhapur who were required to submit Report to the Collector or District Magistrate, did not submit the Reports. The concerned authorities also did not ensure the submission of these Reports by the MCs.

4.1.7.3 Absence of Water Quality Monitoring of Landfill Sites

As per the MSW Rule (Paragraph 23 of Schedule III), the MCs should collect baseline data of ground water quality in the area before establishing any landfill site and keep on record for future reference. The MCs should periodically monitor the quality of ground water within 50 metres of the periphery of landfill site to ensure that the ground water was not contaminated beyond acceptable limit.

We observed that MCGM had the baseline data of ground water quality in respect of Kanjur site only. The remaining six selected MCs had not collected the baseline data of ground water quality near dumping/landfill site and maintained the related records.

Except MCGM and Nagpur MC, other five MCs did not conduct any test of underground water as per the norms.

4.1.7.4 Non-existence of Air Quality Monitoring Mechanism

MSW Rules (Paragraph 28 of Schedule III) provide that installation of landfill gas control system including gas collection system should be made at landfill site to minimize odour generation, prevent off-site migration of gases and to protect vegetation planted on the rehabilitated landfill surface. Ambient air quality at the landfill site and at the vicinity should be monitored twice, four times or six times in a year depending on the size of population of the MC.

We observed that except at Kanjur site in MCGM, none of the MCs had installed the gas monitoring system including gas collection system at the dumping/landfill site. Further, as per the Annual reports of MPCB for the year 2015-16, Amravati, Kolhapur, Nagpur and Thane MCs had not conducted ambient air test throughout 2015-16.

The UDD stated (January 2017) that monitoring aspects would be strengthened as per the mandate of MSW Rules, 2016.

Recommendation 4: Government may frame guidelines on contract arrangements/outsourcing for proper management of MSW in MCs. MCs may also ensure regular testing of ground water and ambient air quality so as to adhere to the environmental norms in the management of the MSW.

4.1.8 Conclusion

The selected seven MCs had neither prepared comprehensive city plan for management of MSW in accordance with the MSW Manual, nor had they met the timelines for improvement of existing landfills and for setting up of new waste processing and disposal facilities in their jurisdiction. Generation of MSW was not assessed properly in all the MCs for want of weigh bridges. Budget provisions were not fully utilized in all the selected MCs, though there were shortages of vehicles for transportation of MSW and other measures required for SWM. Door to door collection was in place in respect of all households but requirement of community bins was not assessed by any of the MCs. Staff engaged in handling of MSW were not using personal protective equipment. Segregation at household level was not in place except partially in MCGM and Pune. Primary and secondary collection systems were not synchronized and instances of open transportation of MSW by vehicles were noticed.

Facility for processing of MSW was either non-existent or inadequate. Wherever processing plants were installed, they were either non-functional or the efficiency was not at the desired level. Three MCs did not develop SLFs and were dumping their MSW unscientifically on unauthorised sites. Though Nagpur MC developed SLF, it dumped MSW both on the SLF and unauthorized site. Infrastructure at the landfill/dumping site in terms of fire-fighting equipment, *etc.* was inadequate. GoM did not approve proposal of MCGM for leasing land to concessionaires due to which processing plants could not be installed at two sites and delayed approval for one site led to delay in installation of processing plant by 54 months. Due to mismanagement of MCGM, there was wasteful expenditure of ₹ 56.12 crore as fresh MSW was again dumped on the site meant for

installation of processing plant which was reclaimed by shifting of existing MSW. Consequently, major fire incident occurred at Deonar site in January 2016. Kalyan-Dombivli MC failed to close the unauthorised dumping site resulting in release of large quantity of leachate into Thane creek causing environmental pollution.

There were instances of wasteful/additional expenditure, loss due to non-realisation of CER, poor maintenance of plant and machinery, irregular payment of price escalation during execution of contract in four MCs. Waste inspection facility to monitor wastes brought in for landfill, office building for record keeping, equipment and machinery were not in place at the dumping/landfill sites except at Kanjur in MCGM. No records on the baseline data of ground water quality near landfill site were maintained nor was any test of quality of underground water conducted. Ambient air test was not conducted in four MCs.

The matter was referred (December 2016) to the State Government and they accepted (January 2017) the audit views and recommendations.

ENVIRONMENT DEPARTMENT

4.2 Management of Bio-medical Waste in Municipal Hospitals

Executive Summary

Government of India framed the Bio-medical Waste (Management and Handling) Rules, 1998, under the provisions of the Environment (Protection) Act, 1986 which prescribed the procedures for treatment and disposal of bio-medical waste (BMW) generated by hospitals, nursing homes, blood banks and veterinary institutions. Bio-medical waste is any waste, which is generated during diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological.

The management of bio-medical waste in Municipal Hospitals was audited between February and June 2016 for the years from 2011 to 2016. Audit emphasized on the implementation of BMW Rules with an adequate administrative and regulatory framework. Audit revealed that enforcement of the bio-medical waste (Management and Handling) Rules in the Municipal Hospitals was found to be inadequate. Out of 22 Health Care Establishments (HCEs) inspected, 20 HCEs operated without valid authorisation due to delay in issue of authorisation from Maharashtra Pollution Control Board (MPCB) up to 1,492 days. Only eight HCEs maintained the record of collection of BMW.

Five HCEs at Nashik and Mumbai did not segregate BMW as per BMW Rules. Three HCEs in Nashik did not use blue/white translucent puncture proof containers; instead they used plastic bags. In two HCEs at Mumbai sharp wastes were mixed with incinerable waste. BMW containers/poly bags were not labelled as prescribed in BMW rules, in 16 out of 22 inspected HCEs. Consequently, common facilities disposed un-segregated BMW in an un-scientific manner. In three HCEs, BMW was stored in the vicinity of patient's bed. Only two out of 22 HCEs test checked had carried out chemical analysis of waste effluent, which showed BOD (77 to 227 mg per litre) and COD (280 to 1,044 mg per litre) parameters much beyond the accepted norms. Effluent high in BOD/COD would deplete oxygen in the receiving waters thereby affecting aquatic life and the eco-system.

Inspection of hospitals and common facilities by Maharashtra Pollution Control Board was inadequate. The Advisory Committee for advising the Government and the MPCB on the implementation of the BMW Rules, 1998 did not meet during 2011-16.

The above deficiencies were pointers to the fact that the enforcement needs to be strengthened to ensure effective implementation of BMW Rules.

4.2.1 Introduction

Government of India framed the Bio-medical Waste (Management and Handling) Rules, 1998 (BMW Rules) under the provisions of the

Environment (Protection) Act, 1986 prescribing the procedure for collection, segregation, transportation, treatment and disposal of BMW. The BMW Rules require the BMW generating establishments to comply with the provisions of the Rules.

BMW Rules, 1998 defines bio-medical waste (BMW) as any waste, which is generated during diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biological. Occupiers such as hospitals, nursing homes, clinics, dispensaries, veterinary institutions, animal houses, pathological laboratories and blood banks are BMW generating establishments. During 2010-14, all India average generation of BMW[56] ranged between 194 to 283 grams per bed per day and in Maharashtra it ranged between 188 to 255 grams per bed per day.

There were 140 Municipal Health Care Establishments (HCEs) with in-patient facility in the State under the administrative control of Urban Development Department**.** The Maharashtra State Pollution Control Board (MPCB), under the administrative control of Environment Department of the Government of Maharashtra (GoM) is designated as the prescribed authority for granting authorisation, conducting inspection and enforcing proper implementation of BMW Rules in the State.

4.2.2 Organisational Setup

The Principal Secretary, Environment Department, who also acts as the Chairman, MPCB, is assisted by Principal Scientific Officers, Regional Officers (ROs) and Sub-regional Officers (SROs). MPCB is responsible for implementation of the Rules in the districts.

Municipal hospitals are administratively controlled by Municipal Corporations headed by the Commissioners and assisted by Health Officers in ensuring implementation of the BMW Rules.

4.2.3 Scope and Methodology of Audit

The performance audit was conducted from February 2016 to June 2016 covering the period of five years from 2011-12 to 2015-16. Out of 140 municipal HCEs with in-patient facility in the State, 22[57] were selected employing stratified sampling method. The selected HCEs were located in

[56] As per Central Pollution Control Board data

[57] 1. K.E.M.Hospital & Medical College, Mumbai; 2. Lokmanya Tilak General Hospital & Medical College, Mumbai; 3. G.T. B. Hospital, Mumbai; 4. K. B. Bhaba Rugnalaya, Mumbai; 5. M. T. Agarwal Rugnalaya, Mumbai; 6. M. W. Desai Rugnalaya, Mumbai; 7. Mother and Child Hospital Maternity Home, Mumbai; 8. Smt Kesarbai Chhabildas Lallubhai Bhansali Maternity Home, Mumbai; 9. Matoshri Ramabai Ambedkar Maternity Home, Mumbai; 10. Charkop Maternity Home, Mumbai; 11. Kasturba Cross Road Maternity Home, Mumbai; 12. Bai Rukhminibai Rugnalaya, Kalyan; 13. Bharatratna Pandit Bhimsen Joshi Hospital, Mira-Bhayandar; 14. J.D.C. Bytco Memorial Hospital, Nashik; 15. Upanagar Maternity Home, Nashik; 16. Jijamata Maternity Home, Nashik; 17. General Hospital, Navi Mumbai; 18. YCMH PCMC Hospital, Pimpri-Chinchwad; 19. Bhosari Hospital, Pimpri-Chinchwad; 20. Kamla Nehru Hospital, Pune; 21. Bharatratna Rajiv Gandhi Hospital, Pune; and 22. Chhatrapati Shivaji Maharaj Hospital, Thane

eight[58] Municipal Corporations. Six[59] common bio medical waste treatment and disposal facilities (common facilities) and selected HCEs were jointly inspected with the officials of Municipal Corporations. Eight[60] Sub-Regional Offices of MPCB corresponding to the selected HCEs were also audited. At State level, offices of Principal Secretary, Environment Department and Principal Scientific Officer, MPCB were also visited. Questionnaires and interviews were employed in the field exercise in addition to collection of photographs and documentary evidences. An exit conference was held with Additional Chief Secretary, Environment Department, Government of Maharashtra on 31 January 2017 and Government response was taken into consideration while drafting the report.

4.2.4 Audit Objectives

The objectives of the performance audit were to examine whether:

- Execution of various stages of BMW management *viz.,* handling, segregation, collection, transportation and disposal was effective; and
- Regulatory, Monitoring and Enforcement mechanisms were effective.

4.2.5 Audit Criteria

The main criteria used for the performance audit were derived from the following:

- Bio-Medical Waste (Management and Handling) Rules, 1998;
- Central Pollution Control Board (CPCB) guidelines for Common Bio Medical Waste Treatment and Disposal Facility, 2003;
- Government of India/Government of Maharashtra orders/Government Resolutions issued from time to time; and
- Agreements between Municipal Corporation and Common Bio-Medical Waste Treatment and Disposal Facility (common facility) operators.

Audit Findings

4.2.6 Identification and Authorisation

4.2.6.1 Identification of BMW generating HCEs

As per BMW Rules (Rule 8), every occupier of an institution generating, collecting, receiving, storing, transporting, treating, disposing and/or handling BMW in any manner except such occupier of clinics, dispensaries, pathological laboratories, blood banks providing treatment/service to less

[58] Greater Mumbai, Kalyan-Dombivli, Mira-Bhayandar, Nashik, Navi Mumbai, Pimpri-Chinchwad, Pune and Thane

[59] Mumbai, Navi Mumbai, Thane, Pimpri-Chinchwad, Pune and Nashik

[60] Kalyan, Mira-Bhayandar, Mumbai, Nashik, Navi Mumbai, Pune, Pimpri-Chinchwad and Thane

than 1,000 patients per month shall make an application to the prescribed authority for grant of authorisation.

MPCB carried out a survey in 2009 and 26,525 HCEs were identified in the State. However, no survey was conducted by MPCB for identification of HCEs thereafter.

4.2.6.2 Issue of Authorisation

In accordance with Rule 8 of BMW Rules, 1998, every occupier/operator of BMW facility shall make an application in Form I to the MPCB for grant of authorisation. The authorisation to operate a common facility shall be issued in Form IV for a period of three years.

Every application for authorisation shall be disposed off by the prescribed authority within 90 days from the date of receipt of the application. The prescribed authority may cancel or suspend an authorisation, if for reasons, to be recorded in writing, the occupier/operator failed to comply with any provision of the Act or these rules. Authorisation document mentioned that application for renewal may be made prior to its expiry.

- **Authorisation to Healthcare Establishments**

Out of 22 HCEs inspected, only two[61] in Mumbai had valid authorisation from MPCB up to March 2016. Four[62] HCEs did not apply for authorisation from MPCB and were operating without authorisation. Remaining 16 HCEs though had applied between December 2011 and November 2015 but MPCB did not issue authorisation to them till March 2016, involving a delay of up to 1,492 days.

- **Authorisation to Common Facilities**

A common bio-medical waste treatment facility is a set up where BMW generated from HCEs is imparted necessary treatment to reduce adverse effects that this waste may pose. The treated waste may finally be sent for disposal in a landfill or for recycling purposes.

Out of six common facilities[63] inspected, only three (Mumbai, Nashik and Navi Mumbai) had valid authorisation covering the period 2011-16. Remaining three facilities (Pimpri-Chinchwad, Pune and Thane) had applied during December 2013 to August 2015 for renewal of authorisation. However, this was not granted by MPCB till March 2016, involving delay of up to 749 days. The common facility at Pune was granted authorisation in May 2016.

Government while accepting the fact stated (January 2017) that for granting authorisation it was pre-requisite for MPCB to assess the HCEs record as to

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[61] M. T. Agarwal Rugnalaya and Lokmanya Tilak General Hospital and Medical College, Mumbai

[62] 1. J.D.C. Bytco Memorial Hospital, Nashik; 2. Upanagar Maternity Home, Nashik; 3. Jijamata Maternity Home, Nashik; and 4. Bhosari Hospital Bhosari, Pimpri-Chinchwad

[63] The selected 22 HCEs located in eight Municipal Corporations are disposing their BMW through six common facilities. Each Municipal Corporation has one common facility, however Mira-Bhayandar MC is using facility at Thane and Kalyan-Dombivli MC is using facility at Navi Mumbai

number of beds, quantity of BMW generated and disposed in different categories. Further, it was stated that from the year 2012, a system of combined consent[64] and authorisation was introduced and thus there was delay.

The reply is not tenable as every application for authorisation is to be disposed off by the prescribed authority within 90 days from the date of receipt of the application.

Recommendation 1: The State Government may issue instructions to MPCB to conduct survey at regular intervals to assess the number of HCEs and for timely issue of authorisation.

4.2.6.3 Functioning of Common Facility without Agreement and Authorisation

Kalyan-Dombivli Municipal Corporation (KDMC) in April 2013 selected an agency to operate the common facility. The agency was to upgrade the existing facility and obtain authorisation from MPCB. In May 2013, MPCB granted a temporary authorisation for one month to the agency pending finalisation of the tender by KDMC. However, within the stipulated timeframe, the agency did not sign agreement with KDMC despite notice issued (June 2013) by the latter. Based on the irregularities noticed (June to December 2013) about untimely lifting of BMW, irregular utilisation of common facility and complaints from citizens, Corporators and Indian Medical Association of Kalyan-Dombivli, KDMC cancelled (January 2014) the tender. Eventually, KDMC entered (August 2014) into agreement with another agency, which started services only from March 2015.

Thus, from May 2013 to March 2015, the old agency whose tender was cancelled was handling BMW without executing agreement with KDMC and authorisation from MPCB.

Government while accepting the fact stated (January 2017) that notices were issued to the defaulter but its activity could not be stopped owing to social obligations.

The reply is not acceptable as MPCB failed to enforce the provisions of BMW Rules while KDMC did not act timely despite receipt of complaints from various quarters.

4.2.6.4 Location of Common Facilities

As per CPCB's guidelines of 2003 adopted by MPCB, common facilities were required to be located at places which were reasonably far away from residential and sensitive areas so that they had minimal impact on these areas. However, audit observed that out of six common facilities, two at Pimpri-Chinchwad and Thane were located in hospital premises/residential areas.

Comptroller and Auditor General's Report for the State of Maharashtra for the year ending 31 March 2008 had pointed out presence of common

[64] Consents given to Occupiers under the Water (Prevention And Control of Pollution) Act, 1974 and the Air (Prevention And Control of Pollution) Act, 1981 and Authorisation under BMW Rules, 1998

facility at Pimpri-Chinchwad in residential area. Audit observed (February 2016) that MPCB renewed authorisation to the common facility thrice between February 2010 and October 2014, with the condition to shift the site to land allotted by Pimpri-Chinchwad Municipal Corporation at Moshi and approved by MPCB in January 2012. However, the common facility was still operating in the residential area. In Thane, the common facility was situated in the premises of Chhatrapati Shivaji Maharaj Hospital, which was in a thickly populated residential area.

During exit conference the Government stated (January 2017) that the facility at Pimpri-Chinchwad would be shifted after getting environmental clearance while in respect of Thane, the process of shifting the facility at Diaghar was under process.

The reply is not acceptable as Environment Department itself is the authority for granting environmental clearance and appropriate action should have been taken before renewing the authorisation.

4.2.7 Collection, Segregation, Storage and Labelling of BMW

4.2.7.1 Collection

As per Rule 11 (1) of BMW Rules, every authorised person is to maintain records related to the generation, collection, storage, transportation, treatment, disposal and/or any form of handling of BMW. All records shall be subject to inspection and verification by MPCB at any time.

Out of 22 HCEs, only eight HCEs maintained collection registers showing quantity and category of BMW handed over to common facility operators. Remaining 14[65] HCEs had not maintained any record relating to BMW generated and stated (Feb-May 2016) that henceforth records would be maintained. In absence of record of quantity/category-wise BMW generated by HCEs, the treatment given to different categories of BMW and its quantity disposed off could not be ascertained.

Government while accepting the fact stated (January 2017) that the issue would be addressed in new BMW Rules of 2016. The reply is not acceptable as the BMW Rules, 1998 were explicit about maintenance of BMW records.

4.2.7.2 Segregation

Improper Segregation of Bio-Medical Waste

As per rule 6 (2) of BMW Rules, read with Schedule II, BMW was to be segregated into appropriate colour coded containers/bags at the point of

[65] 1) Bhosari Hospital, Pimpri-Chinchwad; 2) J.D.C. Bytco Memorial Hospital, Nashik; 3) Jijamata Maternity Home, Nashik; 4) Upanagar Maternity Home, Nashik; 5) Kasturba Cross Road Maternity Home, Mumbai; 6) Charkop Maternity Home, Mumbai; 7) Chhatrapati Shivaji Maharaj Hospital, Thane; 8) Smt Kesarbai Chhabildas Lallubhai Bhansali Maternity Home, Mumbai; 9) G.T.B. Hospital, Sewree, Mumbai; 10) Bharatratna Rajiv Gandhi Hospital, Pune; 11) Kamla Nehru Hospital, Pune; 12) Bai Rukhminibai Rugnalaya, Kalyan; 13) Lokmanya Tilak General Hospital & Medical College, Mumbai; and 14) K.E.M. Hospital & Medical College, Mumbai

generation in the HCEs, in accordance with a colour code scheme prior to its transportation, treatment, and disposal as shown in **Table 4.2.1**.

Table 4.2.1: Statement showing colour code for waste category

Colour code	Waste category	Mode of treatment
Yellow	Human anatomical waste, animal waste, micro-biological and bio-technological waste, soiled waste contaminated with blood *etc.*	Incineration/deep burial
Red	Soiled waste such as dressings soiled plaster casts, beddings *etc.*	Autoclaving/Microwaving/ Chemical Treatment
Blue/White translucent	Needles, syringes, scalpels, blades, glass, tubes, catheters *etc.*	Autoclaving/Microwaving/ Chemical Treatment and destruction/shredding
Black	Discarded medicines and cytotoxic drugs, incineration ash and chemical waste	Disposal in secured landfill
Source: BMW Rules, 1998		

It was observed that out of 22 HCEs inspected, five HCEs at Nashik and Mumbai did not segregate BMW as per BMW Rules. As per BMW Rules, 1998 sharp wastes should be collected in blue/white translucent puncture proof containers. Three selected HCEs in Nashik[66] did not use blue/white translucent puncture proof containers; instead they used plastic bags provided by Nashik Municipal Corporation. In two[67] HCEs at Mumbai, sharp wastes were mixed with incinerable waste. HCEs record showed incidences of needle stick injuries to the staff while handling BMW.

Mixing of BMW with Municipal Solid Waste

According to Rule 6 (1) of BMW Rules, BMW was not to be mixed with other wastes. Joint inspection revealed mixing of BMW with municipal solid waste in two out of 22 test checked HCEs (Kamla Nehru Hospital, Pune and J.D.C. Bytco Memorial Hospital, Nashik).

[66] J.D.C. Bytco Memorial Hospital, Upanagar Maternity Home and Jijamata Maternity Home, Nashik

[67] Lokmanya Tilak Municipal General Hospital and K.E.M. Hospital, Mumbai

Picture 1 and 2: BMW mixed with municipal solid waste in J.D.C. Bytco Memorial Hospital, Nashik

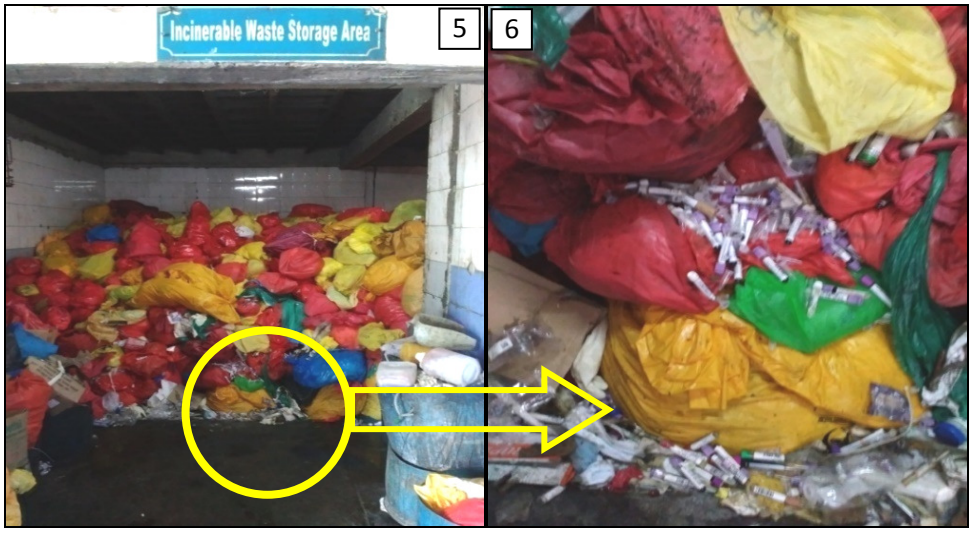
Health Officers at Nashik and Pune Municipal Corporations stated (March 2016) that the hospital staff would be trained in proper handling of BMW.

Receipt of Un-segregated BMW

As per CPCB 2003 guidelines adopted by MPCB, a common facility operator should not accept non-segregated BMW and such incident was to be reported to Maharashtra Pollution Control Board (MPCB).

Audit observed that common facility operators at Mumbai and Nashik had lodged complaints with the Municipal Corporations and MPCB pointing out non-segregation of BMW by the HCEs as per the colour code, mixing of BMW with Municipal Solid Waste, illegal selling of untreated plastic and glass BMW to scrap vendors. During joint inspection of common facilities at Nashik and Mumbai, audit observed that un-segregated BMW was received by the operators which was incinerated as seen from the pictures 3 to 6 below.

Picture 3 and 4: Differently coloured BMW bags lined up for incineration at common facility, Nashik



Picture 5 and 6: Differently coloured BMW bags along with sharps lined up for incineration at common facility, Mumbai

Nashik Municipal Corporation accepted (March 2016) that segregation of BMW was not done by some HCEs to whom notices were issued. Regional Officer, MPCB Mumbai stated (June 2016) that instructions to carefully segregate BMW were issued to the erring HCEs.

Colour Code Protocol not Displayed in HCEs

BMW Rule 6 and Schedule II prescribe colour coding of containers for disposal of BMW. Joint inspection revealed that colour coded segregation protocol was not displayed in seven[68] out of 22 HCEs inspected. Accepting the observation, these HCEs agreed (March to June 2016) to put up the protocol posters at suitable places in their premises.

During exit conference Government stated (January 2017) that as majority of the staff working in Municipal HCEs was on contractual basis, awareness and overall compliance with BMW Rules was low.

Recommendation 2: The Government may ensure proper segregation of BMW at the point of generation by providing training to the staff concerned.

4.2.7.3 Storage

Storage of BMW near Patient Beds

According to Rule 4 of BMW Rules, it is the duty of occupier (HCEs) to take all steps to ensure that BMW is handled without any adverse effect to human health and the environment.

[68] 1) J.D.C. Bytco Memorial Hospital, Nashik; 2) Jijamata Maternity Home, Nashik; 3) Upanagar Maternity Home, Nashik; 4) Kasturba Cross Road Maternity Home, Mumbai; 5) Charkop Maternity Home, Mumbai; 6) Smt Kesarbai Chhabildas Lallubhai Bhansali Maternity Home, Mumbai and 7) G. T. B. Hospital, Mumbai

Joint inspections in three[69] of 22 HCEs revealed that, BMW was being stored in the vicinity of patients' beds as shown in picture 7. This practice of storing BMW could pose a risk to patients.

In Kamla Nehru Hospital, Pune, plaster cast and unwashed linen were kept in store room along with other BMW, and human anatomical waste was put in the open bins as shown in picture 8, increasing the risk of exposure to patients/visiting persons.

The Health Officers, Municipal Corporation Nashik and Pune stated (March 2016) that instructions would be issued to the respective hospitals-in-charge to keep BMW away from the patients. The Medical Superintendent, Smt Kesarbai Chhabildas Lallubhai Bhansali Maternity Home, Mumbai stated (May 2016) that an appropriate place would be identified for storing BMW.

Picture 7: BMW near patient's bed at J.D.C Bytco Memorial Hospital, Nashik
Picture 8: Category 1 BMW in open bin in Kamla Nehru Hospital, Pune kept in corridor

Storage at Common Facilities

As per the CPCB, 2003 guidelines (Clause 4), waste storage area in common facility should be properly ventilated and so designed that BMW may be stored in racks and washing may be done easily. The waste storage room is to be washed and chemically disinfected daily. The floor and inner walls of the incinerator and storage rooms are to have outer covering of impervious and glazed material so as to avoid retention of moisture and for easy cleaning. Separate rooms should be provided for untreated and treated BMW. The treated BMW/incineration ash prior to being disposed in a secured landfill should be stored in a closed sturdy container in a masonry room to avoid any pilferage.

Three[70] out of six common facilities did not store BMW as per the norms laid down by CPCB. In Nashik common facility, the floor and inner walls of incinerator and storage rooms did not have outer covering of impervious

[69] 1) J.D.C. Bytco Memorial Hospital, Nashik; 2) Kamla Nehru Hospital, Pune; and 3) Smt Kesarbai Chhabildas Lallubhai Bhansali Maternity Home, Mumbai

[70] Nashik, Navi Mumbai and Thane

and glazed material. The BMW bags were lying on the floor with oozing BMW fluid and needles and other wastes were scattered on the floor.

The treated ash was put in gunny bags and kept outside the incinerator chamber in the open as shown in pictures 9 and 10 below.

Pictures 9 and 10: Common facility Nashik: Improper storage area for untreated BMW and the floor scattered with BMW

In Navi Mumbai and Thane, the BMW bags were not stored in racks as prescribed. During joint inspection, it was observed that BMW was lying in open on floor, as seen in pictures 11 and 12 below.

Picture 11: Common facility Navi Mumbai Picture 12: Common facility Thane Improper storage of untreated BMW

In common facility, Pimpri-Chinchwad, it was observed that a separate room for treated BMW was not constructed and the same was stored in the entry passage to the facility as seen from picture 13, where untreated BMW was also unloaded.

Picture 13: Common facility Pimpri

During exit conference, the Government assured (January 2017) to conduct training and awareness programme and issue instructions to the common facilities.

The fact remains that HCEs and common facilities did not take necessary steps to ensure proper handling and storage of BMW in accordance with BMW Rules, 1998.

Recommendation 3: The Government may instruct MPCB to organise trainings and awareness programmes to train staff in proper handling and storage of BMW.

4.2.7.4 Labelling

BMW containers/bags are to be labelled at the time of segregation and transportation to waste treatment facility, according to Schedules III and IV appended to BMW Rules[71]. As per CPCB, 2003 guidelines, such labelling is imperative for identifying HCEs that are not segregating BMW as per the rules. The common facility operator should not accept non-segregated BMW and report such incident to MPCB.

Joint inspection revealed that BMW containers/polybags were not labelled as prescribed in BMW rules, in 16[72] of 22 inspected HCEs. In absence of labelling, it was not possible for common facility operators to identify

[71] Schedule III (Label for bio medical waste containers/bags) prescribes such label to have **biohazard cytotoxic** hazard symbols with words '**HANDLE WITH CARE'**. As per Schedule IV (Label for transport of bio medical waste containers/bags), the containers/bags should carry information such as date of generation, waste category number, waste class and its description, sender's name/address with contact person and phone number, receiver's name/address with contact person and phone number, name/address of person to be contacted in emergency, *etc*. Both such labels should be non-washable and prominently visible.

[72] 1. K.E.M. Hospital & Medical College, Mumbai; 2. Lokmanya Tilak General Hospital & Medical College, Mumbai; 3. G.T.B. Hospital, Mumbai; 4. K.B. Bhabha Hospital, Mumbai; 5. M.T. Agarwal Rugnalaya, Mumbai; 6. Mother and Child Hospital Maternity Home, Mumbai; 7. Smt Kesarbai Chhabildas Lallubhai Bhansali Maternity Home, Mumbai; 8. Matoshri Ramabai Ambedkar Maternity Home, Mumbai; 9. Charkop Maternity Home, Mumbai; 10. Kasturba Cross Road Maternity Home, Mumbai; 11. Bai Rukhminibai Rugnalaya, Kalyan; 12. Bharatratna Pandit Bhimsen Joshi Hospital, Mira-Bhayandar; 13. J.D.C. Bytco Memorial Hospital, Nashik; 14. Upanagar Maternity Home, Nashik; 15. Jijamata Maternity Home, Nashik; and 16. General Hospital, Navi Mumbai

HCEs sending improperly segregated BMW and lodge complaint against them with MPCB.

During exit conference the Government stated (January 2017) that as per new BMW Rules 2016, now barcode system would be introduced.

Good Practice

The common facility operator in Pune and Pimpri-Chinchwad, has devised a barcode system of labelling the BMW bags. The barcode is unique for every HCE which indicated registration number, colour, size and serial number of bag. The information is integrated with the weight of the bag and time of collection, as a Data Capture Unit in the collection vehicle picks up these parameters, when a BMW bag with barcode sticker is received. The captured data is downloaded in the main computer at the common facility. Thus a comprehensive database is generated and updated on daily basis with the facility operator, which is time saving and proving useful in instilling confidence in individual HCEs about correctness of weight, time, *etc*.

The operator had also introduced a Global Positioning System (GPS) based vehicle tracking system. All registered HCEs can log in to the operator's website and track the collection vehicles. A live feed of the system is also given to MPCB for monitoring.

4.2.8 Treatment and Disposal of Bio Medical Waste

BMW Rules classify bio-medical waste in ten categories *viz.*, (i) human anatomical waste, (ii) animal waste, (iii) microbiology and biotechnology waste, (iv) waste sharps, (v) discarded medicines and cytotoxic drugs, (vi) soiled waste, (vii) solid waste, (viii) liquid waste, (ix) incineration ash and (x) chemical waste.

4.2.8.1 Treatment of Waste Sharps

As per the Rule 5 of BMW Rules read with Schedule I and II, BMW of category No. 4 *viz.,* needles, syringes, scalpels, blades, glass *etc*. that may cause punctures and cuts should be disinfected in one *per cent* sodium hypochlorite solution or any other chemical reagent. During joint inspection in three HCEs in Nashik, it was noticed that the waste was put into other category bags without treating with hypochlorite solution. At Kamla Nehru Hospital, Pune, it was observed (February 2016) that sharp waste was not disinfected with one *per cent* hypochlorite solution. When pointed out, the hospital staff stated that it did not have hypochlorite solution since last three months. Improper handling and treatment of BMW of category 4 in these HCEs posed threat of infection amongst staff handling BMW.

In reply Municipal Corporation, Nashik stated (March 2016) that instructions would be issued to the concerned staff and Municipal Corporation, Pune stated (March 2016) that buffer stock of hypochlorite solution would be maintained. During exit conference, Government accepted the fact; but did not furnish any reply.

4.2.8.2 Treatment of Liquid Waste

The status of treatment of liquid waste at HCEs and common facilities was as under.

At Healthcare Establishments

According to Schedule V of the BMW Rules, the effluents generated from hospitals should conform to the specified standards of pH, suspended solids, oil and grease, Biochemical Oxygen Demand (BOD) (norm 30 mg per litre), Chemical Oxygen Demand (COD) (norm 250 mg per litre) and Bio-assay test (90 *per cent* survival of fish after 96 hours in 100 *per cent* effluent). These limits are applicable to those hospitals which are either connected with sewers without terminal sewage plant or not connected to public sewers. Advisory Committee had prescribed (March 2011) installation of Effluent Treatment Plants (ETPs) in HCEs having bed capacity of 100 or more and these instructions were passed on by MPCB to its regional offices to ensure compliance.

Audit scrutiny revealed that only two[73]out of 22 HCEs test checked had carried out chemical analysis of waste effluent, which showed BOD (77 to 227 mg per litre) and COD (280 to 1044 mg per litre) parameters much beyond the accepted norms. Effluent high in BOD/COD would deplete oxygen in the receiving waters thereby affecting aquatic life and the eco-system. The effluent was needed to be treated before release in the drain. Scrutiny of records and joint inspection revealed that 13 HCEs[74] out of 22 test-checked HCEs had bed strength of 100 or more and none of them had ETPs for treatment of liquid waste. It was disposed into the municipal drain which released it into creek/rivers routing through terminal sewage treatment plants, without following the prescribed standards. This may adversely impact the environment and lead to water-borne diseases.

Principal Scientific Officer, MPCB stated (August 2016) that Regional Officers of MPCB were instructed to ensure treatment of effluent to prescribed discharge standards. During the exit conference, the Government stated (January 2017) that due to space constraints, ETP could not be installed at Municipal HCEs.

At Common Facilities

As per the CPCB guidelines, 2003 for common facility, every time a vehicle carrying BMW is unloaded, the vehicle and empty waste containers are to be washed and disinfected on an impermeable surface and effluent so generated is to be collected and treated in ETP. ETP was to be installed to

[73] Lokmanya Tilak Municipal General Hospital and K.E.M. Hospital, Mumbai

[74] 1. K.E.M.Hospital & Medical College, Mumbai; 2. Lokmanya Tilak General Hospital & Medical College, Mumbai; 3. G.T.B. Hospital, Mumbai; 4. K.B. Bhabha Rugnalaya, Mumbai; 5. M.T.Agarwal Rugnalaya, Mumbai; 6. M.W.Desai Rugnalaya, Mumbai; 7. Bai Rukhminibai Rugnalaya, Kalyan; 8. Bharatratna Pandit Bhimsen Joshi Hospital, Mira-Bhayandar; 9. J.D.C. Bytco Memorial Hospital, Nashik; 10. General Hospital, Navi Mumbai; 11. YCMH PCMC Hospital, Pimpri-Chinchwad; 12. Kamla Nehru Hospital, Pune; and 13. Chhatrapati Shivaji Maharaj Hospital, Thane

ensure that liquid effluent generated during the process of washing containers, vehicles, floors, *etc.* is disposed after due treatment.

Audit scrutiny revealed that the common facility in Pimpri-Chinchwad, liquid effluent generated after washing of vehicles was directly released into the municipal drain instead of being treated in ETP.

Municipal Corporation, Pimpri-Chinchwad stated (March 2016) that since there was no scope to connect the vehicle discharge to the ETP of common facility, it was being discharged into municipal drains.

During exit conference, it was stated (January 2017) that necessary checks would be carried out by MPCB.

4.2.8.3 Manual Feeding of BMW in Incinerator and Absence of Programmable Logic Control Panel

As per the CPCB guidelines, 2003 adopted by MPCB for 'Design and construction of Bio-medical waste incinerators', BMW is to be charged through automatic feeding device and not by any manual handling during charging of waste into the primary chamber of the incinerator. The automatic device should prevent leakage of hot gas and any backfire.

On inspection of common facility, Thane and Nashik, it was noticed that BMW was being charged manually into primary chamber of incinerator. This resulted in direct exposure of furnace atmosphere to the machine operator and chances of leakages of gas and backfire.

In these two common facilities, Programmable Logic Control (PLC) based control system required for maintaining the requisite temperature and pressure of incinerator and autoclave were not installed. This was in-contravention of CPCB guidelines, 2003 and may result in inadequate treatment of BMW due to inappropriate temperature and pressure of incinerator and autoclave respectively.

During exit conference, the Government stated (January 2017) that Thane facility had now stopped incineration and common facility at Nashik was upgraded with the latest equipments recently.

4.2.9 Inspection, Monitoring and Enforcement

4.2.9.1 Inspection by MPCB

According to Rule 11 of the BMW Rules, all records maintained by the HCEs under the Rules were subject to inspection and verification by MPCB at any time. The State Advisory Committee on BMW suggested (March 2011) monitoring frequency of HCEs and common facility by MPCB as follows:

(i) HCEs above 200 beds - once in three months; (ii) HCEs with bed strength between 50 and 200 - once in six months; and (iii) HCEs with less than 50 beds - once in a year. Common facilities were to be monitored once in a month.

The region-wise position of visits during 2011-16 as stated by the Sub Regional Officers (SROs), MPCB is given in **Appendix-4.4**.

The sub-region wise shortfall in visits of HCEs and common facilities are summarized in **Table 4.2.2**.

Table 4.2.2: Sub-Region wise shortfall in visits during 2011-16

MPCB Sub-Region		Shortfall in percentage	MPCB Sub-Region		Shortfall in percentage
Pune	HCEs	76	Nashik	HCEs	90
	Common facilities	73		Common facilities	18
Mumbai	HCEs	89	Kalyan*	HCEs	0
	Common facilities	0		Common facilities	0
Thane	HCEs	35	Mira-Bhayandar*	HCEs	95
	Common facilities	25		Common facilities	0
Navi Mumbai	HCEs	70	Pimpri-Chinchwad	HCEs	67
	Common facilities	11		Common facilities	62

Source: Information furnished by SROs, MPCB
* Common facility at Navi Mumbai is used by Kalyan HCEs and that at Thane by Mira-Bhayandar HCEs

However, the SROs did not produce any inspection notes in support of the visits made to the HCEs.

The Principal Scientific Officer, MPCB stated (August 2016) that the Board carried out verification/inspection of HCEs mostly on receipt of application for obtaining consent and authorisation from HCEs and upon specific issues/complaints received.

The reply is not tenable as MPCB should have carried out inspections as per norms without waiting for renewal of authorisation. Lack of proper inspections resulted in non-observance of the provisions of the rules by the hospitals and common facilities as brought out in the preceding **Paragraphs from 4.2.6 to 4.2.8.**

During exit conference, the Government stated (January 2017) that due to manpower constraints only large HCEs and common facilities were inspected.

4.2.9.2 Monitoring

Submission of Annual Reports

As per the Rule 10 of BMW Rules, every occupier/operator was required to submit an Annual Report to MPCB by 31 January every year, to include information about the categories and quantities of BMW handled during the preceding calendar year. MPCB should send this information in a compiled form to the CPCB by 31 March every year.

It was observed that out of 22 HCEs test checked, only seven[75] had sent Annual Reports to MPCB during the period covered. Without Annual

[75] 1. K.E.M. Hospital & Medical College, Mumbai; 2. Lokmanya Tilak General Hospital & Medical College, Mumbai; 3. M.T. Agarwal Rugnalaya, Mumbai; 4. Kasturba Cross Road Maternity Home, Mumbai; 5. General Hospital, Vashi, Navi Mumbai; 6. YCMH PCMC Hospital, Pimpri-Chinchwad; and 7. Bhosari Hospital, Pimpri-Chinchwad

Reports, the breakup of BMW generated and disposed in various categories by the remaining 15 HCEs could not be ascertained by MPCB.

During the years 2011-14, there was a delay in submitting of the State Annual Reports to CPCB. MPCB submitted the State Annual Report for the year 2011 with a delay of 87 days, 2012 with a delay of 215 days, 2013 with a delay of 87 days and 2014 with a delay of 349 days. The State Annual Report for the year 2015 was not forwarded to CPCB till date (March 2016).

During exit conference, the Government stated (January 2017) that collection and compilation of annual reports submitted by HCEs was a huge task and hence annual reports were prepared on the basis of annual reports submitted by common facilities. No data from HCEs was taken into consideration in preparation of annual reports.

The reply is not tenable as it is mandatory for every occupier to prepare and submit annual reports to MPCB for compilation and onward submission to CPCB.

Advisory Committee

As per the Rule 9 of BMW Rules, the State Government was to constitute an Advisory Committee comprising experts in the field of medical and health, animal husbandry and veterinary sciences, environmental management, municipal administration, and any other related department or organisation including non-governmental organisations. The Committee was to advise the Government and MPCB about matters related to the implementation of these rules.

Advisory Committee in the State was constituted in January 2003 after four years of the introduction of BMW Rules, 1998. Between 2003 and March 2016, it was re-constituted intermittently. In its meeting of March 2011, the Committee advised GoM and MPCB on issues like collection of BMW within 48 hours from HCEs, technical feasibility of common facility in terms of available BMW, installation of ETP at HCEs with bed capacity 100 and above and monitoring frequency of HCEs (bed capacity wise) by MPCB. During the period 2011-16, the Committee did not meet. Thus, Advisory Committee though constituted in the State, was non-functional, defeating the very purpose of its existence.

During exit conference, it was stated (January 2017) that necessary circular was issued to regional offices of MPCB regarding implementation of recommendations of the Committee. No reply was given on convening of meetings of Advisory Committee.

The reply is not acceptable as the State was deprived of the advantage of expertise on implementation of the Rules.

4.2.9.3 Enforcement Mechanism by MPCB

MPCB while reviewing implementation of BMW Rules found a wide gap between the authorisation conditions and their compliance. Consequently, MPCB issued (April 2013) guidelines linking operation and maintenance, record keeping and performance of BMW generators, transporters and facility operators with bank guarantees (BG). These guidelines became

effective from 01 April 2013.The common facilities and HCEs were to furnish bank guarantees as tabulated in **Table 4.2.3**.

Table 4.2.3: Amount of bank guarantee **(₹ in lakh)**

Common facility	HCEs with 500 and above beds	HCEs with 100 to 500 beds	HCEs with 5 to 99 beds
10.75	5.25	3.00	1.50
Source: MPCB Circular dated 10 April 2013			

Out of the 22 inspected HCEs, MPCB demanded bank guarantees from K.E.M. Hospital and Medical College, Mumbai; Lokmanya Tilak General Hospital and Medical College; and M.T. Agarwal Rugnalaya, Mulund. None of the HCEs furnished bank guarantee. The bank guarantees demanded by MPCB and those furnished by the common facilities is tabulated in **Table 4.2.4**.

Table 4.2.4: Bank guarantees furnished by the common facilities

Sr. No.	Common facility	BG as per Circular (₹ in lakh)	BG demanded (₹ in lakh)	BG furnished (₹ in lakh)
1	Mumbai	10.75	5.25	5.50
2	Navi Mumbai	10.75	No demand	Nil
3	Nashik	10.75	5.50	Nil
4	Thane	10.75	1.50	1.50
5	Pune	10.75	5.50	2.50
6	Pimpri-Chinchwad	10.75	5.50	3.25
Source : Information furnished by facility operators				

Principal Scientific Officer, MPCB stated (August 2016) that in case of old HCEs and common facilities, the bank guarantee would be obtained during renewal of their authorisations.

The reply is not tenable as the guidelines became effective from 1 April 2013; MPCB should have demanded bank guarantee without waiting for renewal of authorisation so as to enforce provisions under BMW Rules.

While accepting the fact in exit conference the Government reasoned (January 2017) that owing to no budgetary provision Municipal HCEs were unable to furnish BG. BMW Rules 1998 did not have any penal clause. The defaulters were prosecuted in the court of law under Section 5 of Air (Prevention and Control of Pollution) Act, 1981. The fact remained that the enforcement mechanism was not very effective.

Recommendation 4: The Government may strengthen the monitoring mechanism with deterrent penalties for effective enforcement and implementation of BMW Rules.

4.2.10 Conclusion

Government of India framed the Bio-Medical Waste (Management and Handling) Rules, 1998 under the provisions of the Environment (Protection) Act, 1986 prescribing the procedure for collection, segregation, transportation, treatment and disposal of BMW. The BMW Rules require the BMW generating establishments to comply with the provisions of the Rules. Performance Audit on Management of Bio-Waste in Municipal Hospitals revealed that MPCB, the enforcement authority for

implementation of BMW Rules in the State, did not conduct survey after 2009 for identification of HCEs. Most of the selected HCEs and common facilities were operating without authorisation from MPCB. They did not maintain record of quantity of BMW generated and disposed. BMW in HCEs was found mixed with solid municipal wastes and in some HCEs, BMW was stored in close proximity to patients' beds. It was not being segregated as per rules in the HCEs leading to unscientific disposal while in common facilities it was improperly stored. Only two out of 22 HCEs test checked had carried out chemical analysis of waste effluent, which showed BOD (77 to 227 mg per litre) and COD (280 to 1,044 mg per litre) parameters much beyond the accepted norms. Effluent high in BOD/COD would deplete oxygen in the receiving waters thereby affecting aquatic life and the eco-system. Inspection and enforcement by MPCB was deficient and it failed to monitor implementation of BMW Rules by the common facilities/HCEs.

The above deficiencies indicate that enforcement needs to be strengthened to ensure effective implementation of BMW Rules.

URBAN DEVELOPMENT DEPARTMENT

4.3 Sewage Management by Municipal Corporation of Greater Mumbai

Executive Summary

A performance audit of Sewage management by Municipal Corporation of Greater Mumbai (MCGM) was conducted to ascertain the status of management of sewage by MCGM. Three Departments *viz*., Sewage Project (SP), Sewage Operation (SO) and Mumbai Sewage Disposal Project (MSDP) under MCGM are responsible for sewage management in Greater Mumbai. MCGM generates 2,146 million litres per day (MLD) sewage of which 1,098 MLD was being treated and 1,048 MLD untreated sewage was directly discharged to sea and creeks as of July 2016.

A master plan was prepared by MCGM (2002) which suggested capital works worth ₹ 5,570.40 crore (2001 price) for all the three departments in five phases up to 2025. The MCGM, however, selected feasible works for execution as suggested by the Ministry of Environment and Forests (MoEF) and Jawaharlal Nehru National Urban Renewal Mission (JNNURM) to provide zone wise point to point solution for collection, conveyance and treatment of generated sewage.

SP identified 105 feasible works (115.67 kms), for laying new sewer lines and upsizing of existing lines. 44 works (49.81 kms) were executed as of July 2016. Besides, out of total 35.52 sq. kms in isolated areas, new sewage network was laid in 7.08 sq. kms areas. However, in respect of 30.3 sq. kms in unsewered slums, SP could not make any comprehensive plan for laying sewer lines.

Rate analysis for the execution of work was prepared in such a manner that excess payments of ₹ 44.36 crore were released to contractors as of July 2016. After spending ₹ 124.03 crore on micro-tunnelling works, these works could not be commissioned by SP.

Out of total 363 kms proposed sewer lines in the Master Plan, SO could rehabilitate only 62.01 kms of old dilapidated sewer lines. Instances of incorrect preparation of estimates of rehabilitation works were also noticed that resulted in excess payment of ₹ 22.05 crore to contractors. As of July 2016, SO also executed condition assessment works of 1,256 kms old dilapidated sewer lines incurring an expenditure of ₹ 89.25 crore, but it did not formulate any time bound programme for rehabilitation of identified dilapidated stretches of sewer lines. Though MSDP was responsible for construction of Waste Water Treatment Facility (WWTF), priority sewers works, improvement in pumping station works, no works were awarded except a pumping station at Shimpoli. However, ₹ 141.78 crore was expended on Project Management Consultancy. There was

almost no change in position of untreated discharge into the sea/creeks.

There was severe contamination of sea water around Mahim creek due to the highly polluted Mithi river. Besides, all the installed aerators at the lagoons of Versova, Bhandup and Ghatkopar WWTFs were not operational which affected the quality of sewage treatment.

Against the assessed shortage of 20,195 toilet seats as of March 2016, MCGM could construct only 5,797 toilet seats. Out of 8,594 available toilet blocks, only 2,476 toilet blocks were connected with sewer lines. The objective of the MSDP for reducing open defecation was not achieved.

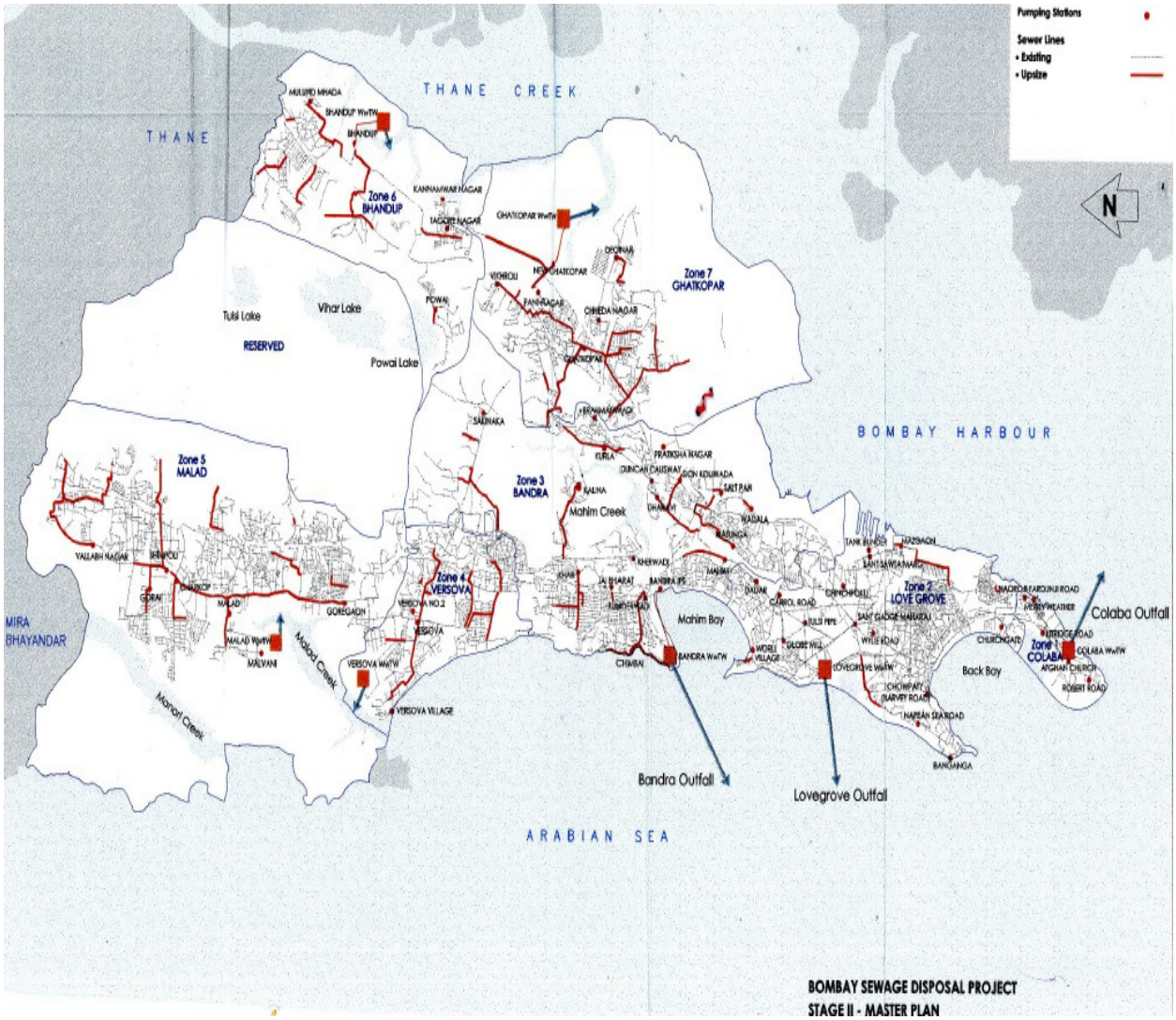
4.3.1 Introduction

The management of sewage comprises collection of sewage through sewer lines at generation points, its conveyance to Waste Water Treatment Facility (WWTF) and treatment of sewage at par with regulatory norms before its disposal into water bodies or other available sites. This also includes monitoring of quality of receiving water at the disposal point in terms of fixed receiving standards. Greater Mumbai has been divided into seven zones[76], for the purpose of collection, transportation, treatment and disposal of sewage. Each zone has one WWTF for treatment of sewage. The treated sewage from Colaba, Worli and Bandra WWTFs is discharged into the Arabian Sea through marine outfalls[77] and from Versova, Malad, Bhandup and Ghatkopar WWTFs into creeks[78] which eventually flow into the sea.

[76] Colaba (Zone-I), Worli (Zone-II), Bandra (Zone-III), Versova (Zone-IV), Malad (Zone-V), Bhandup (Zone-VI) and Ghatkopar (Zone-VII)

[77] Treated Sewage is discharged through tunnels into the deep sea at a distance of 1.2 kms to 3.7 km

[78] A stream or channel in a coastal marshland



Zone wise division of Mumbai city for sewage collection, conveyance and disposal of treated sewage by MCGM

The norms/standards for discharge of treated sewage and water quality standards of receiving water/sea are regulated as per Water (Prevention and Control of Pollution) Act, 1974, the Environment (Protection) Act, 1986 and the Environment (Protection) Rules, 1986. The Maharashtra Pollution Control Board (MPCB) and the Central Pollution Control Board (CPCB) are Regulatory Authorities who fix the treatment standards to be followed by Municipal Corporation of Greater Mumbai. As per MPCB norms, the levels of Biochemical Oxygen Demand (BOD)/Suspended Solids (SS) of treated sewage discharged into creeks should not exceed 100/100 mg/l and level of Dissolved Oxygen (DO) of receiving water at sea should never be less than 3.5 mg/l and BOD level should not exceed 3 mg/l respectively in conformity with Saline Water - II standards as shown in **Appendix-4.5**. The most important parameter of sewage treatment at WWTF *i.e.* level of BOD and SS was revised by MPCB from 100/100 mg/l to 20/30 mg/l in January 2011. These parameters were again made more stringent at 10/20 mg/l in April 2015 and 10/10 mg/l in October 2015 along with some other treatment parameters as detailed in **Appendix-4.6.**

The city had a network of 1,391 kms of sewer lines, 51 sewage pumping stations and seven WWTFs and had generated 1,659 million litres per day (MLD) sewage as of 2001. Only 538 MLD was collected and treated through existing sewage system and 1,121 MLD of untreated sewage was discharged into the sea/creek. Out of 538 MLD treated sewage, 448 MLD sewage was subjected to preliminary treatment[79] and remaining 90 MLD sewage was given secondary treatment[80] meeting the fixed treatment standards.

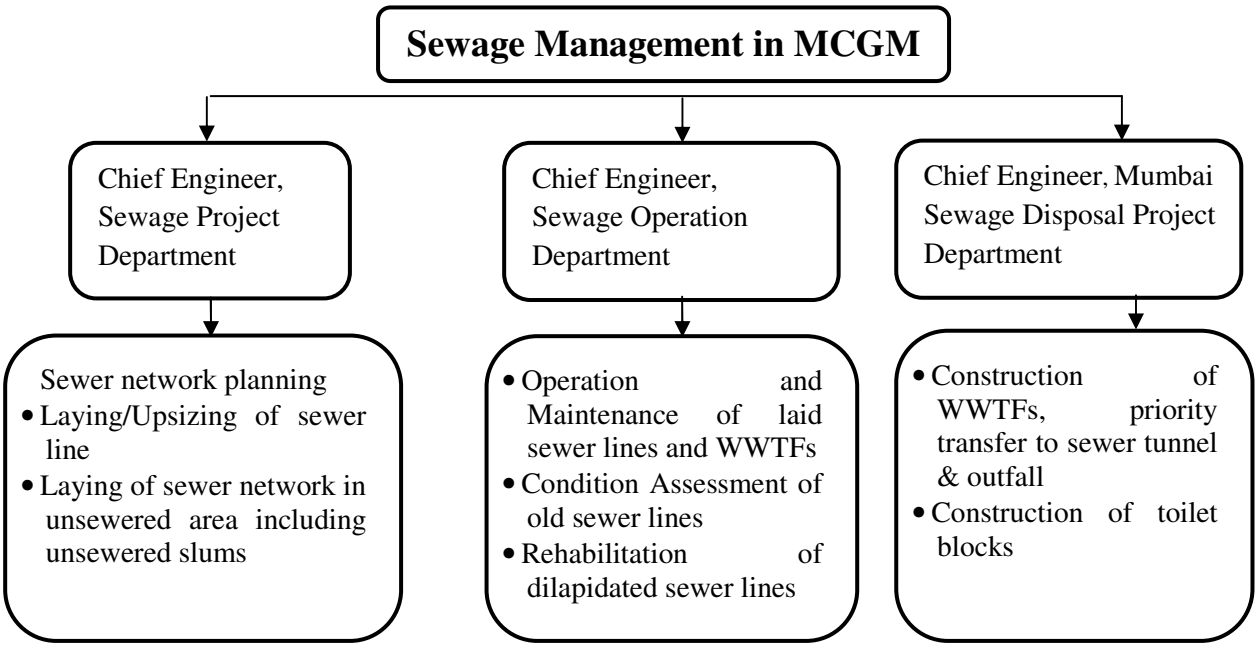
MCGM had prepared (2002) a Master Plan for augmentation of the sewage management system considering the design horizon of 2025, trend of population growth of Mumbai city and water quality of sea around Mumbai so that overall improvement in quality of life could be achieved. The Master Plan Report (2002) proposed execution of capital works worth ₹ 5,570.40 crore (2001 price) to be executed by all the three departments in five phases till 2025 **(Appendix-4.7)** for collection, conveyance and treatment of total sewage. Execution of all proposed works was subject to clearances and approvals from the respective authorities *viz*., MPCB, CPCB and Ministry of Environment and Forest (MoEF), Government of India (GoI) and on availability of land. MCGM however, did not implement the Master Plan for want of funds till advent of Jawaharlal Nehru Urban Renewal Mission (JNNURM) in December 2005. Thereafter, MoEF and JNNURM cell of GoI suggested (2007-08) MCGM to provide point to point collection, conveyance and treatment of sewage. Thus, MCGM selected a number of feasible works from all the five phases for execution and did not follow phase wise implementation of Master Plan.

4.3.2 Organisational Setup

The MCGM, an Urban Local Body, functions under the administrative control of Principal Secretary, Urban Development Department-II, (UDD), Government of Maharashtra (GoM). The Municipal Commissioner is the administrative head of MCGM who is assisted by Additional Municipal Commissioner (Projects). The Management of Sewage is done through three Departments of MCGM *i.e.* Sewage Project (SP), Sewage Operations (SO) and Mumbai Sewage Disposal Project (MSDP) each headed by a Chief Engineer.

[79] Removal of floating materials and grit only by mechanical means
[80] Method of reducing BOD and SS by using lagoons for sewage treatment

The functions of all the three Departments under MCGM are shown in the chart below:



4.3.3 Audit Objectives

The audit objectives were to examine whether;

- any comprehensive plan for Management of Sewage was implemented in an effective, efficient and economical manner;
- the collection and treatment of Sewage was done efficiently and effectively as per norms; and
- an effective internal control and monitoring system exists.

4.3.4 Audit Criteria

The audit criteria for the Performance Audit were derived from the following:

- Mumbai Municipal Corporation Act, 1888;
- Water (Prevention and Control of Pollution) Act, 1974 of Government of India (GoI);
- The Environment (Protection) Act and Rules 1986;
- Circulars and orders issued by the Government of India and GoM;
- Resolutions of MCGM and orders issued by MCGM;
- Relevant reports prepared by MCGM, MPCB, National Institute of Oceanography, National Environmental Engineering Research Institute (NEERI) and Council of Scientific and Industrial Research Institute; and
- Master Plan 2002, Mumbai City.

4.3.5 Audit Scope and Methodology

The Performance Audit conducted (between April 2015 and August 2015) covers the management of sewage by MCGM for the period 2010-15. The facts and figures were subsequently updated till July 2016. The methodology adopted for attaining audit objectives with reference to audit criteria and scope of audit were discussed with the Secretary, Urban Development Department and Commissioner, MCGM in the Entry conference held in April 2015. An Exit conference was held in December 2015 to discuss the audit findings and recommendations wherein the Secretary, Urban Development Department and Commissioner, MCGM were present. The replies of the Government (January 2016) have been considered while finalising the Report.

4.3.6 Financial Position

The works[81] were executed through MCGM's budget and funds received from GoI and GoM under JNNURM. The position of funds allocated and utilised on capital works during 2010 to 2016 were as given in **Table 4.3.1**.

Table 4.3.1: Capital budget and expenditure for Sewage Management in MCGM (2010-16) **(₹ in crore)**

Year	SP		SO		MSDP		Total	
	Budget estimate	Expend-iture	Budget estimate	Expend-iture	Budget estimate	Expend-iture	Budget estimate	Expend-iture
2010-11	140.57	101.61	100.49	73.11	66.00	45.57	307.06	220.29
2011-12	178.07	103.21	77.30	53.82	50.50	41.54	305.87	198.57
2012-13	123.07	76.39	78.98	52.93	77.50	45.75	279.55	175.07
2013-14	98.68	59.72	99.40	84.12	83.91	52.81	281.99	196.65
2014-15	173.18	56.44	101.65	71.55	47.91	10.80	322.74	138.79
2015-16	184.56	137.36	70.11	48.84	137.70	10.70	392.37	196.90
Total	**898.13**	**534.73**	**527.93**	**384.37**	**463.52**	**207.17**	**1889.58**	**1126.27**
Source: Information furnished by the respective departments								

The total fund available for execution of capital works between 2010 and 2016 for the three Departments was ₹ 1,889.58 crore[82] of which ₹ 1,126.27 crore[83] could be utilised. This included grants of ₹ 50.25 crore from GoI and ₹ 35.21 crore from GoM under JNNURM.

The GoI had also sanctioned (2010) a Detailed Project Report (DPR) for ₹ 365.44 crore for construction of Bhandup WWTF. GoI share was to be released after finalisation of tender. As per funding pattern of JNNURM, MCGM had to contribute its share of ₹ 182.72 crore (50 *per cent).* The share of GoI was ₹ 127.90 crore (35 *per cent*) and of GoM ₹ 54.82 crore (15 *per cent*). MCGM, however, could not finalize the tender of Bhandup WWTF, and GoI did not release funds. As a result, MCGM could not avail the funding of ₹ 182.72 crore from GoI and GoM as of March 2016.

[81] The works include capital works for laying of new sewer pipelines, rehabilitation of old sewer lines and consultancy services taken for construction of WWTF

[82] SP ₹ 898.13 crore, SO ₹ 527.93 crore and MSDP ₹ 463.52 crore

[83] SP ₹ 534.73 crore, SO ₹ 384.37 crore and MSDP ₹ 207.17 crore

Audit Findings

4.3.7 Execution of Works by Sewage Project Department

Sewage Project (SP) Department of MCGM is responsible for construction and laying of new sewer lines in existing sewered area; upsizing of existing sewer lines; laying of sewer lines in isolated areas and laying of sewer lines in slums under Slum Sanitation Programme (SSP) for improvement in collection of sewage from generating points.

SP had to construct new sewer lines of 60 kms; upsize 110 kms of existing sewer lines (₹ 442.38 crore); lay new sewer lines in isolated areas (35.52 sq.km) and construct sewer lines (₹ 476.39 crore) in slums covering an area of 30.3 sq. km under SSP for entire collection of sewage across the city as per Master Plan. The SSP had two main objectives *viz.,* connection of toilet blocks with sewer lines in slums to be executed by SP and construction of toilet blocks/seats by MSDP. The details of execution of feasible works out of proposed works is summarised in **Table 4.3.2**.

Table 4.3.2: Works enlisted and executed by SP in Master Plan

(Length in kilometres)

Sl. No.	Description	New sewers		Upsizing works		Total position	
		No.	Length	No.	Length	No.	Length
1.	Total Proposed works	65	59.70	101	113.82	166	173.52
2.	Feasible works	25	25.59	80	90.08	105	115.67
3.	Work completed	12	13.01	32	36.80	44	49.81
4.	Work in progress	7	7.08	15	16.95	22	24.03
5.	Balance works were at planning stage	6	5.50	33	36.33	39	41.83
Source: Information provided by SP							

As of July 2016, SP completed 12 works of new sewer lines (13.01 kms) in existing sewered areas and 32 works of upsizing the existing sewer lines (36.80 kms) after incurring an expenditure of ₹ 20.19 crore and ₹ 245.66 crore respectively. Master Plan had proposed laying of sewer lines in isolated areas admeasuring 35.52 sq. km, of which, SP laid sewer lines of 22.64 kms and covered 8.19 sq. kms by incurring an expenditure of ₹ 83.03 crore on 66 completed works.

Out of above, 71 works[84] were executed (completed/work in progress) by SP during 2010-16. Of which, 34 works were selected for test check audit. The findings are discussed below.

4.3.7.1 Undue Financial Benefit to Contractors

SP prepared estimates for execution of sewer lines through Micro-tunnelling Boring Machine (MTBM) considering various items rates from different schedule of rates prepared by MCGM. One of the main items of work was excavation of tunnel through MTBM and laying of sewer pipes therein. The per running metre rate of laying of pipe lines through MTBM was arrived at by considering per running metre costs of various components such as cost of MTBM machine, auxiliary machines, snappers

[84] Laying of new pipelines and upsizing-44 works and 27 works of laying sewer lines in isolated areas

and cutters, cost of Jacking and Rescue (J/R) pits, cost of labourers, applicable taxes *etc.* Bidders also submitted their bids in the same manner.

Incorrect estimates, payment for work not executed and acceptance of inflated rates resulted in undue benefit of ₹ 44.36 crore to the contractors as of July 2016, as detailed in succeeding paragraphs.

i) Overpayment in Execution of Jacking and Rescue Pits in Micro-tunnelling Works

While preparing the completed item rate for laying of sewer line through MTBM, SP presumed requirement of two J/R pits at an interval of 80 metres along the entire alignment of work. This method of estimation was incorrect and inflated the estimated rate.

Audit noticed that as per approved working plans, J/R pits were actually dug at an average distance of 100 to 225 metres. Thus, the number of J/R pits as per estimates was always higher than the approved working plan. The SP, however, did not verify the actual number of J/R pits excavated.

Incorrect methodology for preparation of estimate and release of payments as per estimate rather than the actual number of J/R pits excavated, resulted in excess payment of ₹ 29.95 crore to contractors in six ongoing works as of July 2016.

The Government stated (January 2016) that payments were released as per conditions of contract; however, the cases would be examined.

ii) Overpayment due to Overstating the Cost of Auxiliary Machines

SP awarded a work (Micro-19) for laying of sewer lines (4,360 metres) using MTBM at ₹ 64.33 crore (at premium of 17.90 *per cent*). Contractor submitted rate analysis of item of work through MTBM which included the cost of auxiliary machines. It was observed that SP did not compare the cost invoices of auxiliary machines submitted along with the tender against its quoted cost. The SP awarded (February 2014) the work to the contractor after negotiated discount of ₹ 3.87 crore without analyzing the quoted rates properly.

Our scrutiny of rates submitted by the contractor revealed that the cost of auxiliary machines was ₹ 54,250 per running metre. However, the rates for auxiliary machines, as per purchase invoices, submitted along with bid documents were ₹ 7,237.53 per running metre. The excess amount involved was ₹ 16.63 crore for entire length of work (4,360 metres) to be executed, considering the discount offered by the contractor. The contractor was already paid an excess amount of ₹ 9.92 crore for execution of 2,109.50 metres of sewer line work through MTBM as of July 2016.

The SP stated (October 2015) that the cost of auxiliary machines of ₹ 7,237.30 per metre considered by audit did not include cost of spares, cutter heads, fuel, cost of man power, operation and maintenance *etc.* The reply of SP was not tenable as cost of above machines and consumables as stated by SP were separate items of works included in the estimate.

The Government stated (January 2016) that payments were made as per contract, however, case would be examined.

iii) Overpayment due to Wrong Application of MTBM Rate for Pit Lengths

Three works[85] for laying of sewer lines for 14,593 running metre for various diameters were awarded (February 2008 and August 2010) to a contractor. As per the working plan, contractor had to excavate 61 jacking and 59 rescue pits by open cut method of length 6.5 metres and five metres respectively. Thus, boring and laying of pipelines of length 691.5 metres by using MTBM was not required in these stretches as J/R pits were already dug by open cut method.

Our scrutiny revealed that contractor was paid at completed item rates of MTBM for entire length of work without reducing the length of said J/R pits (691.5 metres). This resulted in overpayment to the contractors of ₹ 4.49 crore as of July 2016.

The Government stated (January 2016) that the payments were made as per agreement of contract however, cases would be examined.

4.3.7.2 Blocking of Funds of ₹ 124.30 Crore on Un-commissioned Works

SP laid various sewer lines through trenchless technology (micro-tunnelling method) in locations where laying of sewer lines was not possible through open cut method. SP had executed 13 works in intermittent stretches covering 12.68 kms through micro-tunnelling method which was part of new/upsizing sewer line works proposed in the Master Plan. These sewer lines laid at a cost of ₹124.30 crore could not be put to use since 2012. The reasons for non-commissioning of executed works were incomplete down-stream work, non-execution of connecting mains passing through railway lines, want of connectivity with main sewers, non-execution of rest of alignment work due to existence of utility services *etc*. The hindrance arose because the alignment of works was not fixed taking required numbers of trial pits and analysis of geotechnical data before awarding of works. This had resulted in suspension of works leading to blocking of funds amounting to ₹124.30 crore.

The Government stated (January 2016) that the works were stuck due to a pillar of Metro rail that came into the alignment junction at Tembhe bridge. Correspondence with Mumbai Metro was going on and it might take two years to finalise the matter. The reply only confirms that works were awarded without any integrated planning.

4.3.7.3 Failure to coordinate with the MMRDA

The Master Plan proposed upsizing of existing sewer line (from 1,200 to 1,800 mm dia) along Link Road from Vallabh Nagar Pumping Station to Kandarpada junction (1,950 metre), Dahisar (W). Simultaneously, MMRDA had a separate plan to concretize the entire stretch of Link main

[85] Micro 10, 11 and 15

road from Marve Road junction to Dahisar. MMRDA had sought approval (November 2004) from the MCGM for the said work.

It was noticed that MCGM had requested (November 2004 to December 2005) the MMRDA to either lay the sewer line before concretisation of link road or leave a stretch of 5.25 metre width in flexible pavement so that sewer line could be laid by open cut method. However, MCGM failed to pursue the matter with MMRDA and the stretch of Link Road where sewer line was planned to be laid was concretised by MMRDA in October 2005. The SP awarded the work (February 2014) at cost of ₹ 37.80 crore through micro-tunnelling method which was originally planned to be executed through open cut method. The cost of work with open cut method was estimated at ₹ 28.69 crore[86] in 2014. A total of 1,765 metres of sewage pipes had been laid till July 2016 at a cost of ₹ 32.97 crore.

The Government stated (January 2016) that MMRDA without informing MCGM had made concrete road along the entire stretch. The reply was not tenable since MMRDA had agreed to leave adequate space along the road line but MCGM delayed taking up the work in time despite knowing that the entire road was up for 'concretisation' as evident from the correspondence made between them. Thus, there was additional burden due to the lack of coordination between MMRDA and MCGM.

4.3.7.4 Delayed Finalisation of Tender

SP invited tender (July 2012) for providing and laying RC pipe sewer line through MTBM at various locations in the western suburbs at an estimated cost of ₹ 56.93 crore. The Tender Committee recommended (02 November 2012) acceptance of the offer (₹ 49.18 crore) of the lowest bidder. The offer was valid for 150 days *i.e.* up to 22 December 2012. In view of the delay in scrutiny of documents and the recommendation of the Tender Committee, the SP requested the contractor to extend the validity of his offer for 45 days up to 05 February 2013.The contractor accepted the SP Department's request and extended the validity. The SP, however, failed to award the contract to the contractor within the extended time limit.

SP re-invited the tender and awarded (06 February 2014) the work to the lowest bidder[87] at a tendered cost of ₹ 67.17 crore (18 *per cent* premium). Thus, inability of SP in finalising the earlier tender within stipulated period resulted in increase of ₹ 17.99 crore in tender cost.

The Government stated (January 2016) that the contractor was a foreign Company, examining of various submissions took time and when the contractor did not respond for third time extension, the bid process was cancelled and re-tendering was done. The reply is an acceptance of the fact of undue delay in processing the tender.

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[86] Per running metre cost of laying sewer pipes of 1,950 metre in 2009 was ₹ 1,18,419 Rate was increased by 7.5 *per cent* per annum up to 2012-13 *i.e.* ₹ 1,47,111 per metre and total cost worked out ₹ 28.69 crore

[87] M/s Michigan RPS JV

4.3.8 Execution of Works by Sewage Operation Department

Sewage Operation Department (SO) is assigned the work of operation and maintenance of laid sewer lines, intermediary sewage pumping stations, treatment of sewage at WWTFs and disposal of treated sewage into the sea/creek. The work of augmentation of efficiency of pumps and construction of new pumping stations for conveyance of sewage, was assigned to MSDP.

Several stretches of sewage network in Mumbai city were extremely old and were made up of clay brick sewer pipes. SO was required to do condition assessment of these old sewer lines and rehabilitate identified dilapidated stretches of sewer lines.

SO had conducted condition assessment of 150 kms of old sewer lines (1997). Based on this, the Master Plan had estimated 363 kms of old sewer lines needed rehabilitation. The Master Plan had also proposed the condition assessment of sewage network of 1,241 kms[88]. Cost of condition assessment and rehabilitation works was estimated at ₹ 1,174.70 crore (2001 price).

As of July 2016, SO had assessed the condition of 1,256 kms (four works) of old sewer lines during 2010-16 incurring an expenditure of ₹ 89.25 crore. However, out of this condition assessment, stretches of dilapidated sewer lines were not identified for preparation of any time bound rehabilitation plan. As of July 2016, the SO had rehabilitated old sewer lines of 62.01 kms against the total rehabilitation plan of 363 kms. Of the 62.01 kms, SO had taken up five rehabilitation works[89] for execution at a cost of ₹ 210.22 crore (37.31 km) during 2010-16. Two works[90] were completed at a cost of ₹ 22.79 crore; two works[91] were in progress after incurring expenditure of ₹ 42.76 crore and one work[92] awarded at a cost of ₹ 73.63 crore was terminated after incurring an expenditure of ₹ 1.80 crore, as the contractor did not adhere to the safety measures while executing the work.

We selected all the five rehabilitation works and two condition assessment works out of four executed works for test check. The findings noticed in execution of these works are discussed in the paragraphs below.

4.3.8.1 Excess Payments to Contractors

SO invited (2010-15) item rate tenders for execution of rehabilitation works by Pipe Bursting machines, Machine Wound Spiral Lining and Glass Reinforced Pipe lines (GRP liners). Composite rates for execution of works

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88 1,391 kms proposed for condition assessment in Master Plan and assessed 150 kms, thus remaining was 1,241 kms line

89 Executed by M/s MEPL (General Ledger code 505100173 and 358 part), M/s Shriram EPC- Perco JV (General Ledger code -174 part, JNNURM), M/s NPV JV (General Ledger code 174 part, JNNURM), and M/s Shriram EPC Ltd (General Ledger code-358 part)

90 M/s M/s MEPL (General Ledger code 358 part) and M/s Gipsum Structural India Pvt. Ltd (505100174/ JNNURM)

91 M/s Shriram EPC- Perco JV (General Ledger code -174 part, JNNURM) and M/s NPV JV (General Ledger code 174 part, JNNURM)

92 M/s Shriram EPC Ltd (General Ledger code -358 part)

with said machines included cost of machines, snappers and cutters, auxiliary machines, cost of GRP liners, transportation charges, applicable taxes *etc*. As per tender conditions, contractors were to provide details of quoted rates and if required the Department could call for any clarification of rates items. The payments were made to contractors based on item rates finalised and executed length of works.

Our scrutiny revealed various shortcomings in departmental assessment of quoted rates. This resulted in overpayment to contractors of ₹ 22.05 crore as of July 2016 in two cases.

- In works (SO4-09-T-3 & 07-T-1) at 20 locations, GRP liners are used to strengthen dilapidated pipe lines. Payment to the contractors for purchase of GRP per RMT was made at rates ranging between ₹ 21,200 and ₹ 66,920. Based on the Tax Invoice appended to the octroi slips of the material used on the work and other incidental charges, we noticed that the actual per running metre cost of GRP ranged between ₹ 10,345 and ₹ 42,518. Due to inclusion of inflated rates of GRP liners in the contract, the SO made excess payment of ₹ 17.73 crore to the Contractors (between 2012-14 final bill payment). The SO had not taken any action to recover the excess payment made.
- Considering the period of deployment of pipe bursting machines on the work and life time capacity of the machine, proportionate cost of machine was required to be included in the estimate of the works (SO 4-10-T-3 &12-T-3) at 18 locations. Audit analysed that in one case the machine was capable of laying 60,000 metres of pipeline in its entire working life and work order for 8,045 mtrs only was awarded to the contractor. In another case, machine deployed on the work was for 16 months only. However, the contractor included the entire cost of the machines instead of proportionate cost, resulting in excess payment of ₹ 4.32 crore (July 2016).

The Government stated (January 2016) that the cost mentioned in the Excise invoice included only bare fabrication charges and not the other incidental charges. The reply was not acceptable as the amount of overpayments was calculated after allowing all charges for fabrication, transportation and profit elements of contractor. Engineers-in-charge were required to obtain detailed supplementary schedule of rates before award of work and call for supporting documents for the contractor's claims before payment. They were also required to supervise and certify the actual works carried out.

4.3.8.2 Award of Contract at Higher Rates

SO prepared an item rate tender[93] for execution of condition assessment and local repair of man-entry sewers in western suburbs amounting to ₹ 14.45 crore. The tender consisted inter-alia of similar items for execution in Slice-A and Slice-B as a single contract. Work was awarded to two lowest bidders for Slice-A and Slice-B at ₹ 7.62 crore and ₹ 6.29 crore respectively. Work

[93] Contract No. SO4-12-T-2

orders were issued in October 2013 with scheduled completion in December 2015.

Scrutiny of departmental estimates and award of contract for both the slices revealed that the bidder had quoted lower rates for most of the items in Slice-B compared to bidder in Slice-A. SO ignored the difference in rates and awarded the contracts to both the contractors at their quoted rates.

SO did not analyse the rates quoted for Slice-A. The bidder had submitted only block rates of bill of quantities. Considering the awarded rates of individual items of both the contractors, SO had awarded the work for Slice-A at a higher cost of ₹ 1.10 crore.

The Government stated (January 2016) that site conditions for both the works were different. However, the Government, accepted that point was with reference to broader perspective and was well taken. The fact remained that in the absence of proper analysis of rates/break up of rates; the SO awarded the work at higher cost.

4.3.8.3 Execution of Sewage Pumping Station and Priority Tunnels Works

Master Plan identified that the capacity of intermediary sewage pumping stations had reduced up to 48 *per cent* and due to reduction in capacity of pumps and insufficient carrying capacity of sewer lines, 298 MLD sewage generated in Zone-IV[94] and Zone-V was not reaching Malad and Versova WWTFs and the same was discharged untreated in Malad creek.

MSDP engaged (April 2007) a Project Management Consultant (PMC)[95] for preparation of detailed engineering designs and execution works of 15 pumping stations and two priority tunnel works. The Master Plan estimated the cost of pumping works at ₹ 547.58 crore and priority tunnels[96] (Zone-V-Malad) at ₹ 246.52 crore on 2001 price. As of July 2016, the SO, however, could not execute any of the above works except a drop shaft and Shimpoli pumping station at Malad (₹ 29.27 crore) due to unresolved land issues, change in plans, designs and capacity of proposed pumping stations and environmental issues. Thus, there was no improvement in intermediary pumping of sewage and condition of sewage bypass in priority Zone IV and V and this was continuously degrading the water quality of Malad creek.

Recommendation 1: MCGM may ensure analysis of the rates quoted by the contractors with reference to the supporting documents as per tender conditions so as to prevent excess payment.

4.3.9 Failure to Improve Level of Sewage Treatment by MSDP

As per Master Plan, Mumbai Sewage Disposal Project Department (MSDP) was to construct seven WWTFs, two transfer sewers from Malad and Versova WWTFs to Erangal and an outfall from Erangal to the sea at cost

[94] Zone IV Versova and Zone-IV Malad

[95] M/s Mott MacDonald consortium comprising M/s Mott MacDonald Limited, R V Anderson Associates Ltd., Mott MacDonald Pvt. Ltd and PHE Consultants

[96] One tunnel (4.15 km) from Don Bosco School to existing Malad Influent Pumping Station and another from Goregaon Pumping Station to proposed Malad Influent Pumping Station

of ₹ 1,304.10 crore. MCGM appointed (April 2007) PMC for analysis of sewage related data of MCGM, preparation of designs for all the WWTFs as per technology proposed in the Master Plan, preparation of tender documents and procedures related to finalisation of tender. PMC was appointed for a period of five years *i.e.* up to April 2012 at a cost of ₹ 82.36 crore. Based on environment clearance (January 2008) from MoEF and JNNURM cell, MCGM revised (between 2009 and 2012) its plan for construction of all WWTFs simultaneously. The scope of services of PMC was also revised for ₹ 180 crore and the contract was extended up to April 2015.

MCGM could not ensure encumbrance free sites and forest clearances except for Colaba WWTF project. The tendering process for Colaba WWTF started in May 2011 could not be finalised till July 2016 due to deviations in design parameters proposed by the PMC. The PMC was paid ₹ 141.78 crore for designing work done up to April 2013 and the contract terminated in April 2015. As of July 2016, MSDP could not commence any of the proposed WWTF works and 840 MLD sewage was being discharged from Colaba, Worli, Bandra and Malad WWTFs after removal of floating materials and grit causing continued pollution of sea water. The installed infrastructure at Versova, Bhandup and Ghatkopar WWTFs were underutilised. Resultantly 258 MLD sewage could not meet the norms fixed by MPCB/CPCB[97].

4.3.9.1 Huge Un-treated Sewage Discharge into the Sea

The city generated 2,146 MLD Sewage per day[98] during 2015-16. Of this, 1,098 MLD[99] sewage was being collected through 1,860 kms of existing sewer network as stated above. The remaining 1,048 MLD sewage (49 *per cent*) was discharged into the sea without any treatment. The main sources of untreated discharge were sewage received from Mithi river (219.49 MLD), untreated bypass of sewage from Versova and Malad zones (298 MLD), unsewered slum area (178.40 MLD) and 60 open Nallahs (120 MLD). The remaining 233.11 MLD sewage was being discharged from various points not known to MCGM. Thus, approximately 49 *per cent* sewage was discharged into sea and creek without any kind of treatment.

The pollution level of Mithi river, from Powai and Vihar lakes to Mahim creek was alarming and severely polluted the sea around Mahim creek.

MCGM engaged IIT, Mumbai seeking suggestions on the issue. IIT, Mumbai in its report (June 2006) suggested that 37 small Sewage Treatment Plants (STPs) along the Mithi river may be set up. MPCB also accepted (December 2013) the report of IIT, Mumbai. However, MCGM did not act

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97 The norm of sewage treatment was 100/100 mg/l of BOD/SS which was revised by MPCB to 20/30 mg/l in January 2011. The said norm was further revised to 10/20 mg/l in April 2015 and 10/10 mg/l in October 2015 by CPCB

98 Total water supply was 3,748 MLD in 2015-16. After considering industrial consumption and transit losses (27 *per cent)* the net supply worked out to be 2,683 MLD. Sewer generation to be 80 *per cent* of net supply *i.e.* 2,146 MLD

99 80 *per cent* of total sewage collected (1,372.18 MLD) due to reduction in pumping capacity by 20 *per cent*. The WWTF wise breakup of 1,098 MLD collected sewage: Colaba (17.60 MLD), Worli (294.78 MLD), Bandra (355.78 MLD), Malad (171.60 MLD), Versova (67.16 MLD), Bhandup (90.86 MLD) and Ghatkopar (99.95 MLD)

on the report till date (July 2016) citing financial problems, encroachment and its slum programmes. The reasons were not tenable considering the availability of funds with the Corporation and the fact that MCGM was responsible for removing the encroachments. MCGM also did not have any time bound programme for slum development along the entire stretch of Mithi river. Meanwhile, the BOD level of sea water had been increasing with unchecked untreated discharge from Mithi river around Mahim creek. MPCB noticed (2011-13) that the level of BOD of sea water ranged from 33.7 mg/l and 71.7 mg/l against the set norms of 3 mg/l.

4.3.9.2 Under-utilisation of Installed Infrastructure at Bhandup, Ghatkopar and Versova WWTFs

Versova, Bhandup and Ghatkopar WWTFs provided secondary treatment[100] to 258 MLD sewage collected and treated at lagoon system. These WWTFs could meet the discharge standards fixed (100/100 mg/l) by the MPCB during March 2010 to January 2011 by operating[101] four to six aerators. The higher discharge norms could not be met at this level of aerator operations.

The NEERI (October 2008) and Dadar laboratory (in all test reports between 2010 and 2015) suggested MCGM to operate more aerators for better results, however, MCGM failed to do so till date (July 2016).

MCGM initiated tender (November 2015) for replacement of 38 aerators at a cost of ₹ 48.24 crore in lagoon at Versova WWTF in order to achieve the set standards of BOD/SS of 20/30 mg/l treatment by the MPCB. The tendering process was kept pending by MCGM for administrative reasons (January 2017).

The Government stated (January 2016) that due to change in norms, standard set for other parameters of Sewage treatment by the CPCB could not be achieved. Hence they had decided to go ahead with construction plans as proposed in the Master Plan.

The Government's reply did not address the issue of running optimum number of aerators.

Recommendation 2: MCGM may take proper initiative to make all the installed aerators operational at Versova, Bhandup and Ghatkopar WWTFs to safeguard the environmental interest at large and watch the results thereof under expert supervision.

4.3.9.3 Delay in Finalisation of Tender for Colaba WWTF

The Master Plan proposed construction of Colaba WWTF with 85 MLD capacity for treatment of influent Sewage of 31 MLD flow (ADWF[102]) having BOD load of 265 mg/l with Activated Sludge Process (ASP) technology to get desired result of 20/30 mg/l BOD/SS. However, during tendering (May 2011) the values of extant ADWF and BOD load of influent

[100] High rate aerobic or anaerobic system used for reduction in BOD/SS *viz*., Activated Sludge Process, lagoons system *etc*.

[101] Number of aerators installed and operated at a time – Bhandup : 56/4, Ghatkopar : 64/4 and Versova : 57/6

[102] Average dry weather flow (ADWF) is measurement of average sewage generated three days before and after excluding holidays

were changed to 37 MLD and 250 mg/l respectively and cost of construction was estimated at ₹ 75 crore.

The MSDP invited (May 2011) bids on Design Built and Operate basis for ASP and Sequential Batch Reactor (SBR) technologies. The Contractors were required to submit designs for primary and secondary treatment of Sewage, management of sludge, electrical and mechanical design for gas storage and power generation. After technical evaluation of the bids, the Consultant stated that the SBR technology was not capable of treating quantity and BOD load of influent Sewage received at Colaba WWTF. MSDP cancelled the tender process in December 2013. MCGM also sought opinion from a Technical Advisory Committee (TAC)[103] on technology and various vital parameters. The TAC concluded that SBR technology was not suitable for Colaba WWTF and was energy intensive. The MSDP retendered the work in February 2014. Change in design parameters delayed the process of tendering and finally after financial evaluation, the cost of work was found to be on higher side. So this tender process was again cancelled in June 2015.

MCGM again invited tenders in August 2015 wherein option of technology was kept open with criteria of discharge of treated sewage with 10/10 mg/l of BOD/SS. The tendering process was not finalized as of July 2016. Delay in execution of work resulted in continuous discharge of effluent Sewage not complying with MPCB standards.

4.3.9.4 Failure to Recycle and Reuse of Treated Sewage

As suggested by MoEF (January 2008), MCGM conducted a feasibility study (July 2009) to explore recycle and reuse of treated sewage in MCGM. The Consultant after cost benefit analysis/availability of water in the region, extent of safe use of recycled sewage in domestic, agriculture and industrial uses, topography around Mumbai city *etc*. opined (July 2009) that this was not feasible.

Despite this, MCGM constructed (June 2014) a Sewage treatment plant of three MLD at Banganga Pumping station at cost of ₹ 2.59 crore, as a pilot project, for water conservation and to construct STPs in decentralised manner at various Sewage pumping stations. The standard of treatment was fixed at the level of 5 mg/l of BOD/SS along with other parameters. The SO had decided (March 2012) to use the treated waste water for the non-potable uses. Treated Sewage was proposed to be stored at the highest point and the same was to be distributed by separate supply lines. Storage tank and distribution network was to be constructed by Hydraulic Department. The SO prepared a payback calculation after commissioning of the project on assumption basis.

The plant was commissioned in September 2014. However, work of storage tank and distribution network could not be started till date (July 2016) and treated sewage was being discharged into sea despite an expenditure of ₹ 2.59 crore. SO did not intimate any time plan by which treated sewage could be recycled.

[103] TAC- representative from MCGM, NEERI, IIT Mumbai

Recommendation 3: MCGM may ascertain level of implementation of Master Plan works and prepare a road map for completion of balance feasible works besides ensuring elimination of non-point untreated discharge and treatment quality of sewage at par with standards fixed by the Regularity Authorities (MPCB & CPCB).

4.3.10 Poor Implementation of Slum Sanitation Plan

The Master Plan had proposed the construction and rehabilitation of toilet blocks. A comprehensive working plan was to be prepared to provide approach roads, water and electricity connections along with connectivity with main sewer lines to all the toilet blocks. MSDP did not prepare any such comprehensive plan. However, it was mandatory for contractors to bid for toilet block works along with one experienced Non-Governmental Organisation (NGO).

According to census 2011, out of total slum population of 52.07 lakh, 12.20 lakh people had no access to septic toilet. MSDP (Slum Sanitation Programme) had assessed requirement of 25,992[104] toilet seats considering one toilet seat to be used by 50 persons. However, MSDP could construct 5,797 toilet seats leaving deficit of 20,195 toilet seats as of March 2016. It was also observed that out of total available 8,594 toilet blocks only 2,476 toilet blocks were connected with sewer lines and electricity. There was no water connection in 6,464 toilet blocks. As per survey reports[105] user ratio was not maintained as per set norms and it varied from 11 to 417 persons per toilet seat.

It was noticed that out of 477 work orders issued (between 2006 and 2015), 134 work orders were cancelled (28 *per cent*) due to various issues such as, site issues, community disputes, non-formation of Community Based Organisations, objections raised from other departments relating to site of work, refusal of no objection certificate by concerned ward office of Corporation. This adversely affected the objective of the MSDP of reducing open defecation and increased non-point untreated discharges.

Recommendation 4: MCGM may prepare a comprehensive plan for improvement in slum areas thereby providing optimum numbers of toilet blocks along with sewage connection, electricity and water connections.

4.3.11 Internal Control and Monitoring

The internal control and monitoring is one of the important tools to ensure due accountability and transparency in any organization. It was observed that there was no monitoring mechanism in MCGM to ascertain the progress of the implementation of Master Plan. There was failure of MCGM in awarding any single contract after lapse of nine years indicated lack of pursuance of preparatory works such as, resolving land issues, obtaining required statutory clearances from MoEF and finalising

[104] 24,397 toilet seats for slum population of 12,19,850 persons at the rate of one toilet per 50 persons and in lieu of 1,595 defunct toilet seats as of 2011

[105] As per summary Report on Survey conducted by Pratha NGO during September 2013 under Slum Sanitation Programme

technological/capacity issues of WWTFs *etc*. MSDP incurred ₹ 141.78 crore on designing works and no capital work could be commenced for want of preparatory works.

The Department concerned did not verify the rates received from the contractors for execution of capital works. The conditions of the contract were also not applied for verifying the composite rates quoted by bidders during the currency of contract and were not analysed properly along with supporting documents before finalization of the contracts.

There was no system to assess the periodical improvement made in collection of sewage through laying of new sewer lines and upgradation of old ones. Execution of several works was left midway and partly executed length of sewers was lying idle for long periods.

4.3.12 Conclusion

Mumbai city generated 2,146 MLD Sewage per day, of which only 1,098 MLD Sewage was being treated per day and remaining 1,048 MLD (49 *per cent*) Sewage was outside of the Sewage collection system and was discharged into the sea/creeks without any treatment. This combined with poor treatment quality of sewage at four out of seven WWTFs was polluting the sea water. As a result, BOD level of sea water had increased (2011-13). This ranged between 10.9 mg/l and 13 mg/l against the desired level of 3 mg/l as per the Environment Protection Rules, 1986 and consent issued by the MPCB to MCGM.

This was due to inadequate coverage of sewage network and low capacity utilisation of treatment facilities. Sewer line works proposed under Master Plan and feasibility works undertaken by SP were executed to the extent of 43.06 *per cent* (49.81 kms out of 115.67 kms). Similarly, only 17 *per cent* work of rehabilitation of old lines was executed and no improvement took place in WWTFs.

The rate analysis of composite items of works prepared by SP and SO was found faulty in many cases leading to excess/overpayments to contractor. Besides, the composite rates quoted by bidders were not analysed properly along with supporting documents before finalization of the contracts. Instead, Department concerned negotiated with lowest bidders on lumpsum basis resulting in award of contracts at higher rates.

For Slum Sanitation, the MCGM did not prepare comprehensive plans in coordination with the NGOs. The works executed did not meet the norms. Out of the total 477 work orders issued (between 2006 and 2015), 134 work orders were cancelled and 5,797 toilet seats were constructed leaving a deficit of 20,195 toilet seats as on March 2016. This defeated the objective of containing open defecation. The slow progress in construction of toilet blocks and connecting them to existing sewer lines resulted in continued discharge of untreated sewage into open nullahs/creeks/sea.