



## **EXECUTIVE SUMMARY**

### **1.0 Preamble :**

The State of Maharashtra was created on 1<sup>st</sup> May 1960 carved out of the Marathi speaking territory of erstwhile Bombay State. With a land area of 308,000 sq.km., it is the third largest state in India after Rajasthan and Madhya Pradesh. Administratively, Maharashtra is divided in to 34 districts comprising 356 Talukas. As per the 2001 census, Maharashtra has a population of 96,752,247 inhabitants making it the second most populous state in India.

### **2.0 Economy / Industry**

Maharashtra is indisputably the economic powerhouse of India. It accounts for nearly 40% of the revenue collection and ranks first amongst major states in terms of Gross Domestic Product in the country.

Maharashtra is the leader on industrial front in India and occupies leading position in several diverse manufacturing sectors like textiles, metal surface treatment, pesticides, drugs / pharmaceuticals, automobiles and heavy engineering. Other significant industries include chemicals, petrochemicals, organic intermediates, tobacco and tobacco products, paper, paper products, rubber, plastic, petroleum and coal products and electronic hardware. Maharashtra also has a firmly entrenched and vibrant service sector. As a result of the high level of industrialization, Maharashtra accounts for nearly one-fourth of the gross value added by India's industrial sector and a per capita income 60% higher than the national average.

Various policy initiatives aimed at de-licensing of industry and de-reservation of public sector, promoting under developed areas through a slew of economic incentives have resulted in the state being a favoured destination amongst both foreign as well as domestic investors. This has been backed by excellent infrastructure created by Maharashtra Industrial Development Corporation (MIDC), which has developed 225 industrial estates (major and mini) across the state spread over 52,654 hectares of land. During the last three decades, the number of factories registered in Maharashtra increased



from 8,200 to more than 50,000.

### **3.0 HW Inventory –Background:**

The Hazardous Waste Management and Handling Rules were enacted first in the year 1989. In response to a Public Interest Litigation filed by Research Foundation for Science, Technology and Natural Resource Policy (W.P.No. 657 of 1995), MPCB had prepared an inventory of HW generation first through NEERI and later by collecting information from industries. However, the inventory was not found to be adequate as :

- it was prepared hurriedly
- it was based upon personal judgment & sometimes erratic information submitted by industries
- there were ambiguities in 1989 Rules

Considering the dismal state of inventories prepared through out the country & the amendment in HW Rules in the years 2000 & 2003, Honorable Supreme Court passed an Order dated 14.10.2003, directing each State Pollution Control Board to prepare a fresh inventory of HW generation in their state and submit the same to CPCB.

Looking at the diverse nature of industries in Maharashtra with large chemical industry base and the provisions of amended HW Rules, 2000/2003 MPCB realized that the task of preparation of inventory requires good knowledge of process chemistry and industrial unit operations & processes. Hence, it was decided to outsource the work to experts possessing requisite background. The task was assigned to Aditya Environmental Services Pvt. Ltd., a company experienced in carrying out similar assignments.

### **4.0 Methodology/Approach :**

In order to have a comprehensive look at HW generation in the state, it was decided to study generation from both industrial and non-industrial sources. The work commenced in the month of April 2004 and was completed in May 2005. The report was prepared and submitted in June 2005.



**4.1 Industrial Sources :**

It was noted that the industries are covered under the Consent procedure and are already submitting their manufacturing process, utility and environmental control details to the Board. The consultants deputed a team of qualified and experienced scientists and engineers who went through files of industries available with each Regional Office of the Board and identified HW generating units. The HW categories/waste generation quantities were then identified using following procedure :

1. Study of consent / authorisation granted to the unit.
2. Process study for each product manufactured.
3. Study of raw material consumption.
4. Study other aspects of manufacturing viz. utilities, effluent treatment, storages, tankages etc.
5. Study of environment statement / manifest / returns under Form 4 when available.
6. Field visit and discussions with company personnel where required.

**4.2 Non Industrial Sources :**

Number of non-industrial sources of HW generation exist. These include :

Source	Typical Examples	Type of HW
Ports	Mumbai Port Trust, Jawaharlal Nehru Port Trust etc	Waste/Used Oil, Bilge from ships, Waste from Ship breaking, other wastes
Docks	Mazgaon Docks Ltd., Naval Docks etc	Waste/Used oil, waste paint, metal finishing waste etc
Airports	Air India/Indian Airlines, Jet Airways and other Airliners, Airport Authority of India	Waste/Used oil, Storage batteries, other wastes
Power-Transmission & Distribution	Tata Power, Reliance Energy Maharashtra State Electricity Board, etc	Transformer Oil etc
Service Stations, Workshops, Garages	<ul style="list-style-type: none"><li>• Bulk generators involved in Municipal Transport like BEST inter state transport like MSRTC etc.</li><li>• Garages/Workshops on the street side.</li><li>• Company authorized Service stations.</li></ul>	Used/Waste oil, Storage batteries etc
CETPs	<ul style="list-style-type: none"><li>• Waste generated during effluent treatment</li></ul>	Primary sludge.



Since, these are not usually covered under the Consent procedure, the information from these sectors was collected by undertaking a primary survey from typical units and collating this with industry statistics. Questionnaires seeking the desired information were formulated and sent to identified units. Information obtained was collated to give final values.

**5.0 Findings**

**5.1 Industrial Statistics**

Maharashtra Pollution Control Board, has divided the State into 11 Regions, each region being headed by a Regional Officer. The Region wise statistics of consents granted to industrial units classified on the basis of scale of operation and Red/Orange/Green category is as enumerated below :

**Industry Statistics from MPCB Records (Year 2003-2004)**

Sr. No.	Region	Red			Orange			Green			Grand Total
		LSI	MSI	SSI	LSI	MSI	SSI	LSI	MSI	SSI	
1	Mumbai	57	32	634	21	26	351	3	19	3806	<b>4949</b>
2	Navi-Mumbai	106	31	768	8	12	358	2	4	1101	<b>2390</b>
3	Thane	32	82	961	34	9	333	4	6	3686	<b>5147</b>
4	Kalyan	32	38	938	3	5	352	5	7	1043	<b>2423</b>
5	Raigad	75	68	130	11	22	222	1	8	400	<b>937</b>
6	Pune	206	129	1067	32	87	1426	40	82	3436	<b>6505</b>
7	Nashik	146	65	571	12	19	487	13	21	7258	<b>8592</b>
8	Nagpur	108	111	738	8	36	1842	3	5	3104	<b>5955</b>
9	Amravati	41	27	224	3	10	1265	1	-	1955	<b>3526</b>
10	Aurangabad	114	86	291	7	46	843	4	8	3648	<b>5047</b>
11	Kolhapur	62	97	545	18	7	939	1	3	5927	<b>7599</b>
	<b>Total</b>	<b>979</b>	<b>766</b>	<b>6867</b>	<b>157</b>	<b>279</b>	<b>8418</b>	<b>77</b>	<b>163</b>	<b>35364</b>	<b>53070</b>

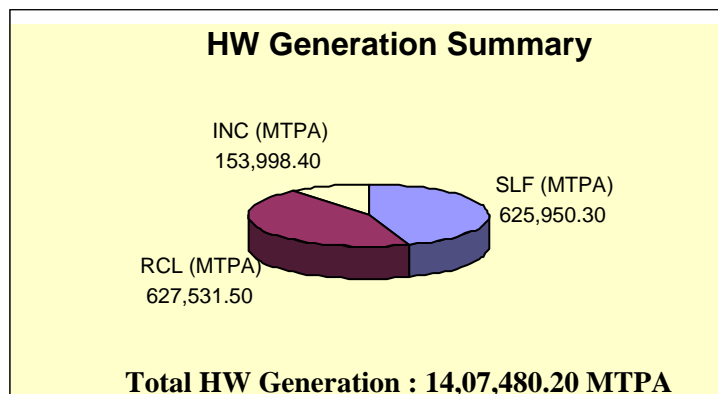


As can be seen :

- Nashik Region has the highest number of industries 8592 (16.2%) followed by Kolhapur -7599 (14.3%).
- The lowest number of industries is in Raigad - 937 (1.7%).
- Pune Region has highest number of Red category industries: 1402 (16.2%) followed by Nagpur - 957 (11.1%) whereas Nashik and Kolhapur Regions have maximum number of Green category industries.

**5.2 Total Waste Generation :**

As per the inventory, total HW generation for Maharashtra State is 14,07,480.20 MT/Annum of which about 44.5% is landfillable, 44.6% is recyclable and balance 10.9% is incinerable.



**5.3 Region Wise Break-up:**

The break-up of Hazardous Waste generation for various Regions of Maharashtra Pollution Control Board indicate that Mumbai Region has the highest generation of waste 2,84,592.6 TPA (20.2%) followed by Kalyan Region with 2,46,474.8 MTPA (17.5%). The lowest generation was observed in Amravati Region 12,920.8 MTPA (0.92%). The generation from other non-industrial sources was observed to be 87,342.9 MTPA (6.2%).

Region wise Break-up of HW					
Sr.No.	Region	Quantity of HW (MT/Annum)			Total
		SLF	RCL	INC	
1	Navi Mumbai	47,047.2	13,958.0	50,991.0	1,11,996.2
2	Pune	43,944.9	19,178.6	14,802.6	77,926.1



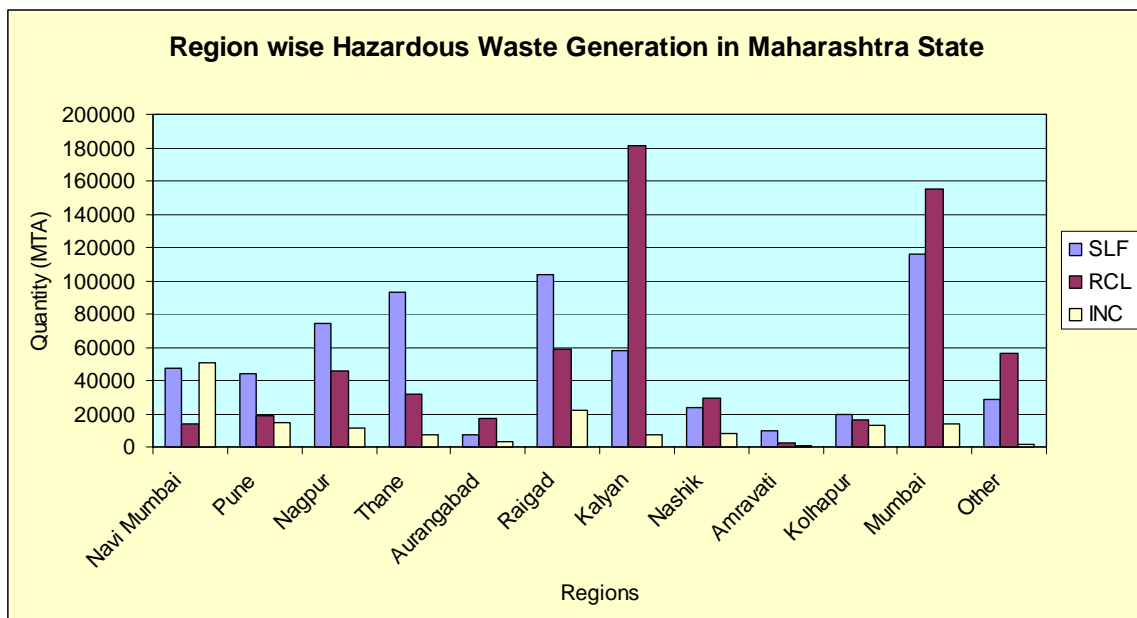
3	Nagpur	74,693.8	45,674.4	11,358.3	1,31,726.5
4	Thane	92,873.3	31,698.5	7,261.5	1,31,833.3
5	Aurangabad	7,753.0	17,513.0	3,370.4	28,636.4
6	Raigad	1,03,450.1	59,027.0	22,078.0	1,84,555.1
7	Kalyan	58,363.0	1,81,092.0	7,019.8	2,46,474.8
8	Nashik	23,899.1	29,179.0	8,107.0	61,185.1
9	Amravati	9,782.8	2,684.0	454.0	12,920.8
10	Kolhapur	19,326.4	16,150.0	12,814.0	48,290.4
11	Mumbai	1,15,857.9	1,54,711.3	14,023.4	2,84,592.6
12	Non-Industrial Sources	28,958.8	56,665.7	1,718.4	87,342.9
	<b>TOTAL</b>	<b>6,25,950.3</b>	<b>6,27,531.5</b>	<b>1,53,998.4</b>	<b>14,07,480.2</b>

SLF : Secured Landfill, RCL : Recyclable, INC : Incinerable

Based on disposal method, salient findings are as below :

**Landfillable Waste :**

Mumbai region is the largest generator with 1,15,857.9 MTPA (18.5%) followed by Raigad region accounting for 16.5% waste that can be disposed in secure landfill. The five Regions closest to Taloja TSDF facility together account for 66.7% of landfillable waste generation.





**Incinerable Waste :**

Navi Mumbai region is observed to be the largest generator accounting for 33.1% of the total incinerable waste followed by Raigad at 14.3%. The five regions closest to CHWTSDF at Taloja generate 65.8% of total incinerable waste.

**Recyclable Waste :**

The largest volume of recyclable waste generation is observed to be in Kalyan Region (28.8%) followed by Mumbai Region (24.6%). Non industrial sources account for 9.1% of total recyclable waste.

**5.4 Statistical Analysis of HW Generation Data:**

Statistical analysis of HW generation has been done based on the type of products manufactured and scale of operation. The findings are presented in **Table 3.7 & Table 3.8** respectively. From the analysis presented it can be seen that the maximum waste generation is from chemical and allied industries.

From **Table 3.8** it is seen that maximum waste generation is done by Large scale “Red” category industries followed by Small Scale “Red” category units.

**5.4 Classification of Industries Generating Hazardous Waste :**

<b>Authorizations – Region wise</b>		
<b>Sr. No.</b>	<b>Region</b>	<b>Total no. of units</b>
1	Navi Mumbai	517
2	Pune	756
3	Nagpur	325
4	Thane	621
5	Aurangabad	238
6	Raigad	341
7	Kalyan	654
8	Nashik	451
9	Amravati	91
10	Kolhapur	294
11	Mumbai	283
	<b>Total</b>	<b>4571</b>

A total of 4,571 authorisations were granted to Hazardous Waste generating units in Maharashtra State.

The largest number of HW generating units are observed to be in Pune Region-756 (16.5%) followed by Kalyan Region (14.3%). Raigad Region has a small number of units (7.5%) but is the largest generator of hazardous waste.



Details and statistics pertaining to authorizations granted according to type of product manufactured and scale of operation are presented in **Tables 3.5 & Table 3.6** respectively. These indicate that maximum number of authorizations are granted to chemical and allied industries and small scale industries in the “Red” category.

#### **5.5 Units engaged in Recycling/Reprocessing Activity :**

The inventory reveals that 178 units are engaged in recycling / reprocessing of Hazardous Waste. Maximum number of such units are seen in Thane (48) followed by Kalyan (26) and Navi Mumbai (23).

The recyclers / re-processors are further classified into Non-ferrous metal re-processors / oil re-processors and other re-processors. The statistics for the same is presented in **Table 3.10**.

Of these, 22 non-ferrous metal re-processors (including 12 lead re-processors) and 9 oil re-processors are approved by MoEF / CPCB as having Environmentally Sound Technology (EST).

Other re-processors include units reprocessing chemicals, polyester / paints / acrylic etc. Solvent distillation to recover / recycle solvents is seen to be a major activity presumably because of the large pharmaceutical industry in the state. Region wise statistics of units involved in recycling hazardous waste presented in **Table 3.10**.

#### **6.0 Comments On HW Rules, 1989 (As Amended 2003)**

The HW Rules were enacted in 1989 and classified the HW into 18 categories based on constituents present in it and quantum of generation.

These Rules were amended in the year 2000 primarily to bring them in line with the Basel convention. The 2000 amendment classified the waste by process of waste generation (Schedule–1) and as per their characteristics (Schedule–2).





The 2003 amendment rationalized the list of processes/ waste streams in Schedule 1 from 44 to 36 and number of waste streams from 148 to 123. The Schedule 2 was essentially left unaltered

During the course of the assignment, the survey team went through hundreds of files and studied processes used, process variants adopted and generation of HW from these. Many difficulties were faced while applying terms used in the HW Rules and its Schedules which led to difficulties in correct classification / categorization of Hazardous Waste. The observations and comments on the HW Rules 2003 are presented in **Chapter 4.0** & major points are given below :

### **6.1 Definition of Hazardous Wastes :**

The HW Rules have defined the term “Hazardous Waste”, but do not define the terms “Hazardous” and “Waste”.

The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 framed under the E.P. Act define “hazardous chemicals” i.t.o. the hazardous properties of the chemicals (in measurable terms such as LC50 / LD 50 / Flash Point etc) These Rules give a “generic” definition so that in case of a chemical not appearing by name in Schedule –I / Part-II, the properties of the chemical can be compared against the hazardous properties given in Schedule-I /Part –I. This greatly helps to identify whether a chemical is hazardous or not.

Whereas, the HW Rules do not define the meaning of the word “Hazardous” in terms of measurable characteristics / basic properties except mentioning that any waste by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment. The list of hazardous characteristics to determine whether a waste is hazardous or not have not been specified in the main Rules but only partly specified in Schedule 3 (part B) in the context of Import / Export of Hazardous Wastes. However, some of the characteristics mentioned therein are in addition to the terms used in the definition of



hazardous waste e.g. Infectious / Ecotoxic which are not seen in the definition given in the text of main Rules.

Thus, it is seen that there is ambiguity in the definition of and basic properties of hazardous waste, which leads to various interpretations.

It is therefore recommended that :

1. The term “hazardous” and “waste” should be properly defined
2. The ambiguities for example such as whether an infectious waste is hazardous or not ? should be removed from the Rules.
3. The Rules should identify the hazardous characteristics / basic properties of wastes in order for it to be classified as “hazardous”.

## **6.2 Processes / Activities not covered under Schedule-1 :**

It is observed that many processes/activities are not covered under Schedule-1 of the HW Rules, 2003. The nature of wastes from such activities / processes is such that they cannot be covered under Schedule-2. It is also felt that the Schedule-1 is easier to understand as waste streams / unit processes generating them are identified, whereas, Schedule-2 identifies wastes based on class of compounds which requires good knowledge of chemistry. Hence, it is felt that Schedule-1 list should be as explicit as possible. **Table 4.1** lists our observations regarding processes/activities not covered under Schedule-1.

## **6.3 Discrepancies in Terms used in Schedule-1 :**

While preparing the Inventory some discrepancies were observed in the terms used as also certain waste streams were not seen to be properly identified in Schedule-1. Our observations regarding this are presented in **Table 4.2**.

## **6.4 Discrepancies observed in Schedule-2 :**

Our observations regarding discrepancies in terms used in Schedule 2 are presented in **Table 4.3**.



## **7.0 Action Plan :**

As logical outcome of the inventorisation effort, an action plan has been developed for more effective implementation of HW Rules.

### **Documentation / Inventory upgradation :**

- An inventory is in a dynamic state and needs to be updated continuously as various factors viz change in technology, expansion / modernization of existing units, creation of new sources will govern the hazardous waste generation. It is proposed to take-up upgradation of inventory on a quarterly basis.
- As a strengthening measure for this inventory, in-plant audit shall be carried out to verify the authenticity of submitted data by industrial units as well as to achieve correct quantification of waste generation due to manufacturing process and or technology. Candidate manufacturing units shall be selected to represent category as well as technologies employed by various sectors of industry.
- Training shall be given to officers involved in consent management to impart requisite knowledge of various provisions of the HW Rules as well as to attain desired understanding of processes and activities leading to generation of Hazardous Wastes.
- A special cell has been created for supervising hazardous waste management. Necessary training shall be given to the officers in this cell for proper understanding of the legal aspects of Hazardous Waste Rules as well as advanced training in waste audits.
- As a capacity building measure, uniform documentation and record maintenance procedure shall be adopted in all Regional Offices to enable easy access to desired data. This will enable officers to function more effectively irrespective of postings as also facilitate creation of central database.
- Industries submitting consent applications shall be asked to submit complete information in respect of raw materials, catalyst, intermediates



and finished products in the consent application. Material balance in respect of all products will also have to be furnished to enable Board officers to assess correctness of information submitted particularly in terms of waste generation.

- Submission of concerned documentation, particularly copies of manifest and returns in Form 4 to respective Regional Offices shall be made obligatory. This will enable the concerned local offices to track movement of hazardous waste in their jurisdiction as well as to keep tabs on the actual quantity of hazardous waste disposal vis a vis quantity declared in the application for grant of consent / authorization.
- A computerized / on-line tracking system for manifest shall be put in place, so as to make proper tracking of hazardous wastes possible.
- All movement of hazardous waste including to recyclers / reprocessors shall be strictly through the manifest route.
- An effort shall be made to create a web-based on-line hazardous waste data base as envisaged under National Hazardous Waste Information System (NHWIS). The manifest system should be linked to this data base so that status of compliance will be known immediately.

#### **Non-Industrial Sources :**

As seen in the inventory a substantial quantity of hazardous waste is generated by non industrial sources. MPCB has already initiated several measures for bringing the wastes from ports / air ports in the form of sending un-cleared hazardous chemicals cargo for proper disposal. However, the ports / airports also have other hazardous waste generation as seen in the inventory report, which need additional actions. Following actions are being considered :

- Require all such generators to obtain authorisation from the Board to bring them under the regulatory mechanism.
- In addition to un-cleared hazardous cargo, ports / airports have own generation of used oil and non ferrous metal scrap which will thus be properly regulated / disposed off.
- Power transmission and distribution activity results in generation of



spent transformer oil. The quantity of such oil is substantial and management of this waste needs to be regulated. All agencies in Maharashtra engaged in power transmission / distribution shall be asked to follow procedure as laid down under The Hazardous Waste Rules for management of this waste.

- A targeted program shall be taken up for environmental improvement of automotive service stations which are presently only covered partially under consent / authorization mechanism. As first step, all service stations attached to automotive manufacturers, large fleet owners and oil companies shall be asked to follow procedure as laid down under The Hazardous Waste Rules for management of wastes generated in their establishments. Subsequently they will also be brought under consent mechanism to ensure that steps for Water Pollution Control / Hazardous Waste Management / Air Pollution Control and disposal of waste batteries are taken as per the relevant Rules.
- The disposal of used batteries to automotive electrical repair shop is already being closely regulated through a combination of measures targeted at battery suppliers / importers and bulk consumers. These measures shall be continued to regulate the battery sector on the basis of Environmentally Sound Technologies.