CHAPTER – IV

COMMENTS ON HAZARDOUS WASTE MANAGEMENT & HANDLING RULES, 1989 (as amended 2003)

4.1 Introduction :

The Hazardous Waste Management & Handling Rules were enacted in 1989 & classified the Hazardous Waste 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). Thus, in all 44 categories were identified comprising of 148 waste streams in Schedule 1 and 79 types of wastes in Schedule 2. The 2003 amendment rationalized the list of processes/ waste streams in Schedule 1 thus number of industrial processes generating Hazardous Waste was reduced from 44 to 36 and number of waste streams from 148 to 123. The Schedule 2 was essentially left unaltered. In the effort to prepare an inventory of the waste generation in Maharashtra State, the study Team has gone through hundreds of files of industries and studied the processes used, process variants and generation of hazardous wastes from each of these. The waste streams identified from industrial processes were then matched with waste streams identified in Schedule 1 and the categories designated. If the waste streams were not seen to be identified in Schedule 1, the likely constituents were examined (based on raw materials used, chemical reaction likely in the process etc) and the waste category as per Schedule 2 was identified.

While doing such a monumental task, many difficulties were faced while applying terms used in the Hazardous Waste Management Rules and its Schedules which led to difficulties in correct classification / categorization of Hazardous Waste.

The comments regarding the Hazardous Waste Management and Handling Rules are given below :

4.2 Definition of Hazardous Wastes :

The Hazardous Waste Management & Handling Rules do not define the terms "Hazardous" & "Waste". The term "Hazardous Waste" has been defined in the Rules as given below :

Definition of Hazardous Waste as given in the HW Rules, 2003.

"Hazardous Waste" means any waste which 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, whether alone or when in contact with other wastes or substances and shall include :

a) Waste listed in column (3) of Schedule – 1

b) Waste having constituents listed in Schedule – 2 if their concentration is equal to or more than the limit indicated in the said Schedule and

c) Wastes listed in lists "A" and "B" of Schedule- 3 (Part-A) applicable only in case(s) of import or export of hazardous wastes in accordance with rules 12, 13 and 14 if they possess any of the hazardous characteristics listed in Part-B of Schedule -3.

Explanation : For the purposes of this clause :

i. All wastes mentioned in column (3) of Schedule - 1 are hazardous wastes irrespective of concentration limits given in Schedule - 2, except as otherwise indicated and Schedule - 2 shall be applicable only for wastes or waste constituents not covered under column (3) of Schedule -1.

Schedule - 3 shall be applicable only in case (s) of import or export.

4.2.1 Defining the term " Waste" :

While applying / enforcing the Rules, in many instances, one wonders whether to cover a particular stream from an industrial process as a waste or not? In many such cases, industry claims that such stream is a by-product and not a

waste. It is felt that it is essential to have a dividing line between waste and by-product streams. Thus, it is felt that the Rules must have a definition of the word "waste" or detailed enumeration to assist classification.

4.2.2 Defining the term "hazardous" :

The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 framed under the E.P. Act defines "hazardous chemicals" i.t.o. the hazardous properties of the chemicals (in measurable terms such as LC50 / LD 50 / Flash Point etc in Schedule-I / Part-I and also lists about 684 chemicals in Schedule-I / Part-II. The point to be noted is that the Rule 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 Hazardous Waste Management & Handling Rules donot 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 in the context of Import / Export of Hazardous Wastes. The Schedule 3 (part B) lists fourteen hazardous characteristics of waste, which includes some characteristics in addition to the characteristics mentioned in the definition of hazardous waste e.g. Infectious / Ecotoxic which are not seen in the definition given in the text of main Rules. The CPCB in its document on "Hazardous Waste Identification in Petrochemical sectors" has described four basic properties for categorizing a waste as hazardous or non-hazardous. The characteristics of hazardous wastes as considered in this CPCB Document and that in the Schedule 3 / Part B Rules also varies as given below :

Characteristics of Hazardous Waste as per CPCB	Characteristics of Hazardous Waste as per Schedule 3, Part B
I. Ignitability An ignitable waste can cause fire hazard during routine management. If the flash Point is less than 60°C by Pensky-Martens closed cup tester, the waste is considered to be ignitable.	**Term Used : Flammability** Flammable liquids are liquids, a mixtures of liquids, or liquids containing solids in solution or suspension which give off a flammable vapour at a temperature of not more than 60.5°C, closed cup test or not more than 65.5°C, open cup test
II. Corrosivity The corrosive waste is able to deteriorate standard containers, damage human tissue and /or dissolved toxic components of other wastes. A waste is considered corrosive, if it has a pH less than 2 or greater than 12.5.	Substances or wastes which by chemical action will cause severe damage when in contact with living tissue, or in the case of leakage, will materially damage, or even destroy, other goods or the means of transport, they may also cause other hazardous
III. Reactivity A reactive waste has a tendency to become chemically unstable under normal condition or react violently when exposed to air or mixed with water or can generate toxic gases .The reactivity characteristic is a narrative definition without a mandatory testing protocol or specified decision level. A waste can be reactive if:	Do not define the term reactivity but define Oxidizing / Peroxides/ Substances or wastes liable to spontaneous combustion and substances or wastes which in contact with water emit flammable gases.

• It is normally unstable and undergoes violent change • It forms potentially explosive mixtures with water • When mixed with water it generates toxic gases and vapours • It is a cyanide and sulphide-bearing waste, when exposed to pH between 2 and 12.5 generate toxic gases and vapours , etc.	
IV. Toxicity • EPA introduced leaching procedure for toxicity which is known as Toxicity characteristics Leaching Procedure (TCLP). EPA has also specified toxicity characteristics constituents and their regular threshold.	Substances or Wastes which, if they are inhaled or ingested or if they penetrate the skin, may involve delayed or chronic effects including carcinogenicity.
Source: Identification of Hazardous Waste stream their characterization and waste Minimisation Options in Petrochemical sector CPCB, July 2003.	**Source**: Hazardous Waste Management & Handling Rules 1989 (as modified 2003). Schedule 3, Part B.

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" & "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".

4.3 Processes / Activities not covered under Schedule - 1 :

It is observed that many processes / activities are not covered under Schedule - 1 of the Hazardous Waste Management & Handling 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** below lists our observations regarding type of industry, nature of manufacturing process and wastes which may be generated and also whether it can be covered under Schedule – 1.

Table 4.1
Process / Activities not covered under Schedule - 1

Sr. No.	Type of Industry	Brief manufacturing process/ Waste stream generated	Comments regarding coverage under HW Rules
1.	Metal Salt Industry	▪ Manufacture of salts of ferrous / non-ferrous metals eg. ZnSO4 / CuSO4 / MnSO4 /Chromium Sulfate etc mostly from ferrous / non-ferrous metal scrap or waste non-ferrous metal eg. Spent catalyst or from ore. ▪ Process involves acidification with H2SO4 & subsequent clarification of the mass in centrifuge / filters to remove the product ▪ Waste sludge formed is highly acidic. Also contaminated filter/centrifuge bags are generated	▪ Not covered under Schedule - 1 (except $ZnSO_4$ covered under 6.1) ▪ Ferrous metal sludge & sludge from salts of Manganese etc cannot be covered under Schedule - 2 although they are highly acidic in nature. ▪ Contaminated filter cloth / centrifuge cloth cannot be included in category 35.1 as contaminants are inorganic in nature.
2.	Synthetic Rubber / Latex Industry	▪ Manufacture of latex products like gloves / condoms etc. Number of wastes generated in the process such as coagulated latex from drains / spills / aging tanks etc. ▪ Waste may also contain some silicon oil.	▪ Was covered under HW Rules 2000 as category 23, but excluded from HW Rules 2003.
3.	Storage of Organic Chemicals	▪ Tank bottom sludge is generated in storage tanks	▪ Cannot be included in category 3.0 due to use of word “Petroleum” with respect to oil storage tanks.
4.	Automobile Servicing Repairs etc	▪ Generates used oil, filters contaminated with oil, waste greases, and oily sludge	▪ Difficult to classify in existing Rules. ▪ Was previously covered under 2000 Rules, as category 43, but excluded from HW

			Rules 2003
5.	Edible Oil Refining	▪ The oil is extracted from the seeds using suitable solvents (usually hexane). The solvent is then distilled off, recycled into the process. The oil produced then undergoes degumming (using strong phosphoric / sulfuric acid) followed by steam refining to remove fatty acids. This oil is then clarified using 0.5-2.5% Bleaching Earth to remove colour, hydrogenated over Nickel catalyst to saturate the unsaturated radicals and deodorized. ▪ Waste stream from manufacturing process include - Bleaching Earth - Centrifuge cloth - Spent Nickel Catalyst - Spent Solvent	▪ Difficult to classify under category 4 as it deals with Petroleum Refining.
6.	Manufacture of Glycerin / Distillation of fatty Acids	▪ Involves splitting of fats to produce fatty acids and glycerin which is removed with water (Sweet Water). Sweet water is heated to skim off fatty acids ▪ NaOH/lime added to it to remove fatty acids. Lime sludge needs disposal ▪ Sweet water distilled to separate water + glycerin ▪ Distillation of fatty acids and α-olefins results in formation of pitch which needs to be disposed off.	
7.	Non-ferrous Metal Reprocessing / Alloy manufacture	Eg. Units manufacturing alloys of Pb / Sb / As and Ingots of Pb/Sb/As etc. Units engaged in recovery of metals. Waste generated include :	▪ Waste generated cannot be classified under Schedule – 1.

		▪ Heavy metal containing ash/slag/residue ▪ Emission control dust ▪ Salt bath waste	
8.	Manufacture of Organic intermediates	Eg. Manufacture of intermediates for drugs (p-Nitrophenol / m-PDA etc) pesticides (chlorotoluene / chlorobenzene etc), synthetic tanning Agents, leather chemicals etc	Rules only cover Dye intermediates under category 26. Donot cover other intermediates such as Drug / Pesticide intermediates and other organic intermediates
9.	Manufacture of Organic chemicals	Eg. Aromatic Amines, Formaldehyde, Acetone , Aniline, Nitrobenzene, Phenol etc	No category is included for manufacture of general purpose organic chemicals.
10.	Manufacture of Inorganic Chemicals	Eg. Ferric Alum / Phosphorous based chemicals. Ferric Alum is made by reaction of Bauxite ore with sulfuric acid. ▪ Balance sludge left over is highly acidic.	No category covers this class of chemicals
11.	Manufacture of Agro-based Products	▪ Extraction of Turmeric Powder using EDC, further solvent is distilled off. ▪ Manufacture of Pectin from papaya by extraction with solvent ▪ Left over sludge maybe hazardous	No category covers these processes
12.	Production of Bio-pharmaceuticals	▪ A unit in Navi Mumbai manufactures antigens / antibodies for HIV/AIDS infected patients. Done by extraction of diseased / infected organs using solvents and then isolating the strains. ▪ Manufacture of Insulin is done by extraction from Pancreas of Cattle using Isopropanol. ▪ In both cases, the balance material, which is highly infectious is to be disposed	▪ Not covered under BMW Rules also. ▪ Since the term infectious is not covered under definition given for “hazardous wastes” this does not get covered under HW Rules either.

		off.	
13.	Photographic Chemicals	▪ The roll to be developed is passed through three baths comprising Developer – Bleacher and Fixer / Stabilizer. ▪ Waste generated include – sludge / spent chemicals	Previously included under HW Rules 2000 a Category 26 but excluded from 2003 amendment.
14.	Purification Processes for Inorganic Chemicals	Unit operations used include filtration / activated carbon treatment etc	Category 35 deals with Purification of organic compounds / solvents only
15.	Manufacture of Acids	Sludge generated during manufacturing of HF / H_3PO_4 etc	Category 17.1 should be modified to include process residue
16.	Housekeeping operations	▪ Saw dust /cotton waste is used for equipment / floor cleaning in pesticide/paint/printing ink industry. ▪ Similarly cotton waste used in Automobile Servicing.	Cannot be categorised under Schedule - 1

4.4 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. These have been given below in **Table 4.2**.

Table 4.2

Discrepancies in Terms Used in Schedule – 1

Category No.	Process	Anamolies Seen / Reasons	Suggestions for Rectification
1.0	Petrochemical Processes and Pyrolytic operations	▪ Difficulty to cover Polymer Industry (ex. HDPE/PVC Mfr.) - Category 1.0 is for Petrochemical Process and Pyrolytic operations - Category 22 is for Production of Plastic raw materials but covers Vinyl chloride and Acrylonite mfg., which are	▪ Classify where polymer industry is to be covered - Include Coke as a Waste Category - Change category 1.5 "Residues

		basically petrochemicals. - Other waste streams covered under Category 22 are those from manufacture of additives/plasticizers etc.	from alkali wash of fuels" to "Residues from alkali treatment/ alkali wash"
		▪ Coke Generation Not Included - In some processes eg. / Ethylene / Ethylene dichloride manufacture, coke is formed during thermal cracking. Coke formed during EDC cracking contains residual chlorinated hydrocarbons and is removed from VCM by filtration.	- Include Coke as a Waste Category
		▪ Category 1.5 is restricted by the use of term "of fuels" - Final purification of VCM involves lime neutralization to reduce acidity. This generates a spent lime waste. - Pour point depressants are Polymers formed by esterification of fatty alcohol and acrylic acid. The ester is distilled and water washed. The washed water is treated with lime, treated followed by acidification using H_2SO_4. The acrylic acid is then recovered. The $CaSO_4$ sludge formed is a hazardous solid waste.	- Change category 1.5 "Residues from alkali wash of fuels" to "Residues from alkali treatment/ alkali wash"
		▪ Category 1.9 is ambiguous due to use of the term "containing hazardous constituents" - In case of all other categories, the Rules specify chemical sludge from Waste water Treatment Plant as Hazardous Waste. Thus, any primary sludge from ETP is taken as hazardous waste. - The term "containing hazardous constituents" is ambiguous and not in line with other industry categories	- Rephrase the category 1.9 as "chemical sludge from waste water treatment"

		▪ Categories 1.2 and 1.6 as also Category 1.3 and 1.8 appears repetitive	- Remove repetition
4.0	Petroleum Refining / Re-refining of used oil / recycling of waste oil	▪ Molecular sieve/carbon not included - Petroleum refining processes use Molecular sieves / carbon which is not included in the waste stream identified	- Include Molecular sieve/carbon under category 4.2
		▪ Distillation Residues not included - During re-refining of used oil some distillation residues are formed which are not indicated in the waste streams identified	- Remove the word "Organic" from Category 4.4
13.0	Production of Iron and Steel including other ferrous alloys	▪ Non-ferrous alloy, not included - Non-ferrous metals / alloy production not included eg. Pb Ingots / Pb alloys / ingots (Pb / Se/ Pb /Sb) etc from Pb / antimony / Se waste scrap etc	- Include non-ferrous alloy manufacturing
18.0	Production of Nitrogenous and Complex fertilizers	▪ Scope of 18.3 category is restricted by the use of words "containing arsenic". - Thus other sludges generated from fertilizer manufacturing cannot be included in Category 18.3. Eg. Sludge produced from Iron powder /soda ash is used to remove Vanadium / Chromium / Silica /Fluoride in H_3PO_4 in manufacture of sodium tri poly phosphate	- Remove the word "containing Arsenic" from category 18.3

22.0	Production of Plastic Raw Materials	▪ Clashing with category 1.0 - Acrylonitrile is a Petrochemical and therefore covered under category 1.0 and has again been included in 22.4	- Remove ambiguity in classification
		▪ The term "Plastic Raw Materials" is not clear - Does this mean Polymer industry or Additives (like Plasticizer/Flame/Retardants etc) used in Plastic manufacture	- Define the industry segment properly and identify waste stream accordingly
34.0	Purification Processes for Air and Water	▪ Scope of the Category 34.2 restricted by the words "in Water Purification" - Ion Exchange materials are used for removing metals in number of other applications such as effluent treatment in Electroplating Industries.	- Remove the words "in Water Purification"

4.5 Discrepancies in Schedule – 2 :

Discrepancies observed in terms used in Schedule 2 are highlighted below :

Table 4.3

Discrepancies in Schedule - 2

Class No.	Description	Discrepancies/Suggestions
- (General Observations)	- Since the rules mention concentration of chemicals the issue should be qualified by stating "expressed as _____" eg. Antimony and Antimony Compounds expressed as Antimony	- Mention the concentrations "expressed as _____"

-	- Some metals have been written as Arsenic and Arsenic Compounds while some have been generally written as Nickel compounds	- Rectify this anomaly for B1/B2/B3/B5/B5/B7/B8/B9/B10 Metals
	▪ Some compounds are repeated in different classes Examples : 1. Organic Nitrogen Compounds appear as D7 category but also appear in B14/B15/B16/B17/B18 2. Category B22 is Halogen Silanes (which includes chemicals like Silicon Tetra chloride) but this appears again in B30 3. Category B24 Fluorine which appears again in C4	- Remove repetition of compounds such as those cited
	▪ Rules do not specify if the Concentration limit is for leachate generated or for the constituent itself	- The CPCB Manual on Hazardous Waste Analysis give methods for analysis of leachates.
B24 - B26	Fluorine / Chlorine / Bromine	- Should this be fluorides / chlorides / Bromides? - How can these be present in elemental form?
B28 - B29	Ferro Silicate and alloys, Manganese Silicate	- The terms Ferro silicate / Manganese silicates have no meaning. These are not listed in Condensed Chemical Dictionary - The terms “and alloys” is not clear - The terms used in 2000 amendment Rules was Ferro Silicon and Manganese silicon. These additives are used in Iron and Steel Industry during production of Pig Iron. - In applying these clause one fails to understand – whether slag generated in iron and steel manufacture is hazardous waste ?