

Environment Protection Act, 1986 ("EPA")

- Enacted pursuant to the UN Conference on the Human Environment held in 1972.
- An umbrella legislation for environment protection and improvement through regulation of developmental activities.
- Empowers Ministry of Environment, Forest and Climate Change ("MoEFCC") with powers relating to formulation of nation-wide planning, policymaking and co-ordination of actions taken by State Governments

Source: Environmental Law Institute

MoEFCC Powers under EPA

EPA enables MoEFCC to:

- Lay down standards for environmental quality; emissions or discharge of environmental pollutants from various sources.
- Devise procedures for handling hazardous substances.
- Formulate rules for locating industry.
- Mandates compulsory reporting of environment pollution by industry.
- Provide for recovery of costs of cleanup from the polluter.

Bhopal disaster, 1984

- Deaths: At least 3,787; over 16,000 claimed
- Injuries: At least 558,125
- Union carbide compensation: US \$470 million

Deepwater Horizon oil spill

or **BP oil spill**, or the **BP oil disaster** or the **Gulf of Mexico oil spill**

Location: Gulf of Mexico near Mississippi River Delta, United States

Casualties: 11 dead

Spill date: 20 April – 15 July 2010

Well officially sealed: 19 September 2010

Operator: Transocean under contract for BP

Spill characteristics

Volume: 4.9 million barrels (780,000 cubic meters)±10%

Area: 6,500 to 180,000 km²

In November 2012, BP and the United States Department of Justice settled federal criminal charges with BP pleading guilty to 11 counts of manslaughter, two misdemeanors, and a felony count of lying to Congress.

BP also agreed to four years of government monitoring of its safety practices and ethics, and the Environmental Protection Agency announced that BP would be temporarily banned from new contracts with the US government.

BP and the Department of Justice agreed to a record-setting \$4.525 billion in fines and other but further legal proceedings not expected to conclude until 2014 are ongoing to determine payouts and fines under the Clean Water Act and the Natural Resources Damage Assessment.

As of February 2013, criminal and civil settlements and payments to a trust fund had cost the company \$42.2 billion.

In July 2015, BP agreed to pay \$18.7 billion dollars in fines, the largest corporate settlement in U.S. history.

Umbrella framework under Environment Protection Rules, 1986

Land use regulation

- Declaration of ecologically fragile and historically significant areas as 'No-development zones', such as, Taj Trepezium near Taj Mahal, etc.

Waste management

- Hazardous and Other Wastes (Management & Transboundary Movement) Rules, 2016
- Bio-Medical Waste Management Rules, 2016
- Solid Waste Management Rules, 2016
- Construction and Demolition Waste Management Rules, 2016
- Plastic Waste Management Rules 2016

Environment impact assessment ("EIA")

- Environment Impact Assessment Notification, 2006

Regulation of developmental activities in coastal stretches

- Coastal Regulation Zone Notification, 1991 ("CRZ Notification")

Umbrella framework under Environment Protection Rules, 1986

Management of Chemicals

- Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989
- Ozone Depleting Substances (Regulation and Control) Rules, 2000
- The Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
- Rules for the Manufacture, Use, Import, Export and Storage of Hazardous micro-organisms Genetically engineered organisms or cells, 1989

Noise Pollution

- Noise Pollution (Regulation & Control) Rules, 2000

Eco-marks Scheme

- Scheme on Labeling of Environment Friendly Products (ECOMARK), 1991
- The criteria for labeling Cosmetics as Environment Friendly Products, 1992

Electronic Waste

- E-waste (Management) Rules, 2016

Others

- Batteries (Management and Handling) Rules, 2001
- The Recycled Plastics Manufacture and Usage Rules, 1999

Source: Environmental Law Institute

Solid Waste Management Rules, 2016

- The objective was to make every municipal authority responsible for the implementation of the various provisions of the Rules within its territorial area and also to develop an effective infrastructure for collection, storage, segregation, transportation, processing and disposal of Municipal Solid Wastes.

Legal Framework-MSW

As per the Rules, the citizens are responsible for

- (1) Every waste generator shall,-
 - (a) segregate and store the waste generated by them in three separate streams namely bio-degradable, non biodegradable and domestic hazardous wastes in suitable bins and handover segregated wastes to authorised waste pickers or waste collectors as per the direction or notification by the local authorities from time to time;
 - (b) wrap securely the used sanitary waste like diapers, sanitary pads etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as instructed by the local authorities and shall place the same in the bin meant for dry waste or non- bio-degradable waste;
 - (c) store separately construction and demolition waste, as and when generated, in his own premises and shall dispose off as per the Construction and Demolition Waste Management Rules, 2016; and
 - (d) store horticulture waste and garden waste generated from his premises separately in his own premises and dispose of as per the directions of the local body from time to time

Legal Framework-MSW

- (2) No waste generator shall throw, burn or burry the solid waste generated by him, on streets, open public spaces outside his premises or in the drain or water bodies.
- (3) All waste generators shall pay such user fee for solid waste management, as specified in the bye-laws of the local bodies
- (4) No person shall organise an event or gathering of more than one hundred persons at any unlicensed place without intimating the local body, at least three working days in advance and such person or the organiser of such event shall ensure segregation of waste at source and handing over of segregated waste to waste collector or agency as specified by the local body.
- (5) Every street vendor shall keep suitable containers for storage of waste generated during the course of his activity such as food waste, disposable plates etc.
- (6) All resident welfare and market associations shall, within one year from the date of notification of these rules and in partnership with the local body ensure segregation of waste at source by the generators as prescribed in these rules, facilitate collection of segregated waste in separate streams, handover recyclable material to either the authorised waste pickers or the authorised recyclers. The bio-degradable waste shall be processed, treated and disposed off through composting or bio-methanation within the premises as far as possible. The residual waste shall be given to the waste collectors or agency as directed by the local body.
- (7) All gated communities and institutions with more than 5,000 sqm area shall, same as above
- (8) Same for hotels and restaurants as above

Standards for disposal of treated leachate

S.No	Parameter	Standards (Mode of Disposal)		
		Inland surface water	Public sewers	Land disposal
1.	Suspended solid, mg/1, max	100	600	200
2.	Dissolved solids (inorganic) mg/1, max	2100	2100	2100
3.	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
4.	Ammonical nitrogen (as N), mg/1, max	50	50	-
5.	Total Kjeldahl nitrogen (as N), mg/1, max.	100	-	-
6.	Biochemical oxygen demand (3 days at 27° C_ max. (mg/1)	30	350	100
7.	Chemical oxygen demand, mg/1, max.	250	-	-
8.	Arsenic (as As), mg/1, max	0.2	0.2	0.2
9.	Mercury (as Hg), mg/1, max	0.01	0.01	-
10.	Lead (as Pb), mg/1, max	0.1	1.0	-
11.	Cadmium (as Cd), mg/1, max	2.0	1.0	-
12.	Total Chromium (as Cr), mg/1, max.	2.0	2.0	-
13.	Copper (as Cu), mg/1, max	3.0	3.0	-
14.	Zinc (as Zn), mg/1, max	5.0	15	-
15.	Nickel (as Ni), mg/1, max	3.0	3.0	-
16.	Cyanide (as CN), mg/1, max	0.2	2.0	0.2
17.	Chloride (as Cl), mg/1, max	1000	1000	600
18.	Fluoride (as F), mg/1, max	2.0	1.5	-
19.	Phenolic compounds (as C ₆ H ₅ OH) mg/1, max.	1.0	5.0	-

Compost Standards

Parameters	Organic Compost (FCO 2009)	Phosphate Rich Organic Manure (FCO 2013)
(1)	(2)	(3)
Arsenic (mg/Kg)	10.00	10.00
Cadmium (mg/Kg)	5.00	5.00
Chromium (mg/Kg)	50.00	50.00
Copper (mg/Kg)	300.00	300.00
Lead (mg/Kg)	100.00	100.00
Mercury (mg/Kg)	0.15	0.15
Nickel (mg/Kg)	50.00	50.00
Zinc (mg/Kg)	1000.00	1000.00
C/N ratio	<20	Less than 20:1
pH	6.5-7.5	(1:5 solution) maximum 6.7
Moisture, percent by weight, maximum	15.0-25.0	25.0
Bulk density (g/cm ³)	<1.0	Less than 1.6
Total Organic Carbon, per cent by weight, minimum	12.0	7.9

Compost Standards

Total Nitrogen (as N), per cent by weight, minimum	0.8	0.4
Total Phosphate (as P ₂ O ₅) percent by weight, minimum	0.4	10.4
Total Potassium (as K ₂ O), percent by weight, minimum	0.4	-
Colour	Dark brown to black	-
Odour	Absence of foul Odor	-
Particle size	Minimum 90% material should pass through 4.0 mm IS sieve	Minimum 90% material should pass through 4.0 mm IS sieve
Conductivity (as dsm-1), not more than	4.0	8.2

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

Implementation Schedule

Municipal Solid Waste (Management & Handling) Rule, 2000

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

Time frame for implementation

Identification of suitable sites for setting up solid waste processing facilities	1 year
Identification of suitable sites for setting up common regional sanitary landfill facilities for suitable clusters of local authorities under 0.5 million population and for setting up common regional sanitary landfill facilities or stand alone sanitary landfill facilities by all local authorities having a population of 0.5 million or more	1 year
procurement of suitable sites for setting up solid waste processing facility and sanitary landfill facilities	2 year
enforcing waste generators to practice segregation of bio degradable, recyclable, combustible, sanitary waste domestic hazardous and inert solid wastes at source ,	2 years
Ensure door to door collection of segregated waste and its transportation in covered vehicles to processing or disposal facilities. Ensure separate storage, collection and transportation of construction and demolition wastes	2 years

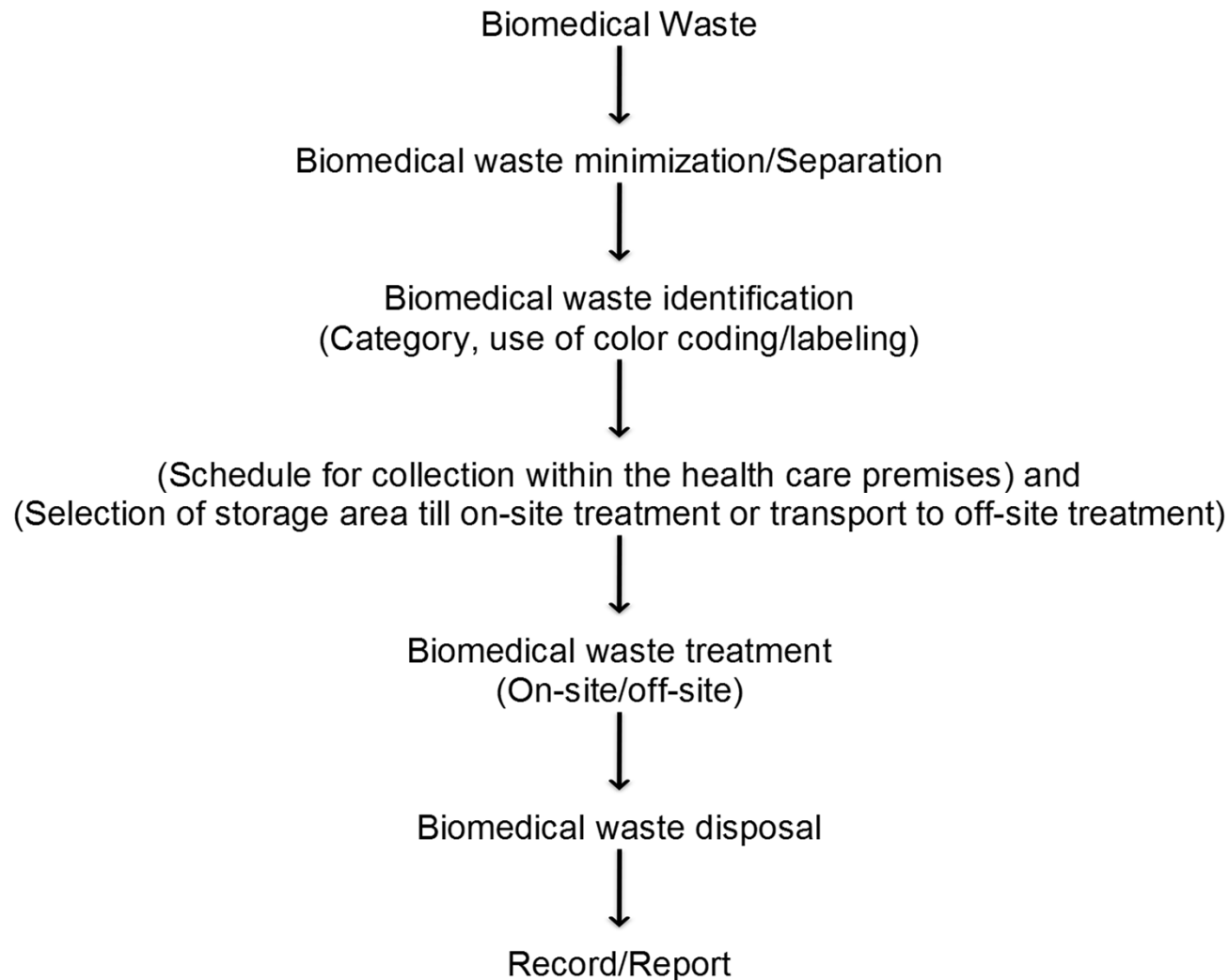
Time frame for implementation

Setting up solid waste processing facilities by all local bodies having 100,000 or more population	2 years
Setting up solid waste processing facilities by local bodies and census towns below 100000 population	3 years
setting up common or stand alone sanitary landfills by or for all local bodies having 0.5 million or more population for the disposal of only such residual wastes from the processing facilities as well as untreatable inert wastes as permitted under the Rules	3 years
setting up common or regional sanitary landfills by all local bodies and census towns under 0.5 million population for the disposal of permitted waste under the rules	3 years
bio-remediation or capping of old and abandoned dump sites	5 years

Bio Medical Waste : (Management and Handling) Rules 2016

- Every occupier generating BMW, irrespective of the quantum of wastes comes under the BMW Rules and requires to obtain authorisation
- Every hospital generating Biomedical waste **need to set up requisite Biomedical Waste Treatment** facilities to ensure requisite treatment of waste.
- **No untreated Biomedical waste shall be kept stored beyond a period of 48 hours.**

Elements of the Biomedical Waste Management (As per rules)



Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Yellow	(a) Human Anatomical Waste: Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of Pregnancy Act 1971, amended from time to time).	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*
	(b) Animal Anatomical Waste : Experimental animal carcasses, body parts, organs, tissues, including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*
	(c) Soiled Waste: Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial* In absence of above facilities, autoclaving or microwaving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery.

Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Yellow	(d) Expired or Discarded Medicines: Pharmaceutical waste like antibiotics, cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.	Yellow coloured non-chlorinated plastic bags or containers	Expired cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200 C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >1200C Or Encapsulation or Plasma Pyrolysis at >1200C. All other discarded medicines shall be either sent back to manufacturer or disposed by incineration.
	(e) Chemical Waste: Chemicals used in production of biological and used or discarded disinfectants.	Yellow coloured containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.
	(f) Chemical Liquid Waste : Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activities etc.	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given in Schedule III.

Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Yellow	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated yellow plastic bags or suitable packing material	Non- chlorinated chemical disinfection followed by incineration or Plazma Pyrolysis or for energy recovery In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plazma Pyrolysis.
	(h) Microbiology, Biotechnology and other clinical laboratory waste: Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines, human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures	Autoclave safe plastic bags or containers	Pre-treat to sterilize with nonchlorinated chemicals on-site as per National AIDS Control Organisation or World Health Organisation guidelines thereafter for Incineration.

Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Red	Contaminated Waste (Recyclable) (a) Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and vacutainers with their needles cut) and gloves.	Red coloured non-chlorinated plastic bags or containers	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible. Plastic waste should not be sent to landfill sites.
White (Translucent)	Waste sharps including Metals: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, or any other contaminated sharp object that may cause puncture and cuts. This includes both used, discarded and contaminated metal sharps	Puncture proof, Leak proof, tamper proof containers	Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit

Biomedical wastes categories and their segregation, collection, treatment, processing and disposal options

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Blue	(a) Glassware: Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.	Cardboard boxes with blue colored marking	Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling.
	(b) Metallic Body Implants		

NOTE:

- 1) CHEMICAL TREATMENT SHOULD BE DONE BY USING AT LEAST 1% HYPOCHLORITE OR EQUIVALENT AGENT**
- 2) MUTILLATION /SHREDDING SHOULD BE DONE TO PREVENT REUSE.**
- 3) THERE WILL BE NO CHEMICAL PRETREATMENT BEFORE INCINERATION.**
- 4) CHLORINATED PLASTIC BAGS SHOULD NOT BE INCINERATED**
- 5) DISPOSAL BY DEEP BURIAL IS PERMITTED ONLY IN RURAL AREA WHERE COMMON FACILITIES OF BIOMEDICAL WASTE MANAGEMENT IS NOT AVAILABLE.**

DEEP BURIAL

1. A pit or trench should be dug about 2 meters deep. It should be half filled with waste, then covered with lime within 50 cm of the surface, before filling the rest of the pit with soil.
2. Must be ensured that animals do not have any access to burial sites. Covers of galvanised iron/wire meshes may be used.
3. On each occasion, when wastes are added to the pit, a layer of 10 cm of soil shall be added to cover the wastes.
4. Burial must be performed under dedicated supervision.
5. The deep burial site should be relatively impermeable and no shallow well should be close to the site.
6. The pits should be distant from habitation, and sited so as to ensure that no contamination occurs of any surface water or ground water. The area should not be prone to flooding or erosion.
7. The location of the deep burial site will be authorised by the prescribed authority.
8. The institution shall maintain a record of all pits for deep burial.

Incinerators

It is a controlled combustion process where waste is completely oxidized and harmful microorganisms present in it are destroyed/denatured under high temperature.

A. Operating Standards

1. Combustion efficiency (CE) shall be at least 99.00%.
2. The Combustion efficiency is computed as follows:

$$\text{C.E.} = \frac{\% \text{CO}_2}{\% \text{CO}_2 + \% \text{CO}} \times 100$$

3. The temperature of the primary chamber shall be 800 ± 50 °C.
4. The secondary chamber gas residence time shall be at least 1 (one) second at 1050 ± 50 °C, with minimum 3% Oxygen in the stack gas.

B. Emission Standards

Sl. No.	Parameter	Standards	
(1)	(2)	(3)	(4)
		Limiting concentration in mg Nm³ unless stated	Sampling Duration in minutes, unless stated
1.	Particulate matter	50	30 or 1NM ³ of sample volume, whichever is more
2.	Nitrogen Oxides NO and NO ₂ expressed asNO ₂	400	30 for online sampling or grab sample
3.	HCl	50	30 or 1NM ³ of sample volume, whichever is more
4.	Total Dioxins and Furans	0.1ngTEQ/Nm ³ (at 11% O ₂)	8 hours or 5NM ³ of sample volume, whichever is more
5.	Hg and its compounds	0.05	2 hours or 1NM ³ of sample volume, whichever is more

C. Stack Height: Minimum stack height shall be 30 meters above the ground and shall be attached with the necessary monitoring facilities as per requirement of monitoring of 'general parameters' as notified under the Environment (Protection) Act, 1986 and in accordance with the Central Pollution Control Board Guidelines of Emission Regulation Part-III.

Hazardous Waste Management

- Ministry of Environment & Forests, Government of India, notified the **Hazardous Waste (Management & Handling) Rules**: July 28, 1989 under the provisions of the Environment (Protection) Act, 1986
- Amended in the year **2000** and **2003**
- Further amended recently **“Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008**
- **Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.**
- Enforcement agency of the Rules : **State Pollution Control Boards**

Hazardous Waste Management

- The primary objective of these Rules is to evolve a regulatory mechanism and specify the procedures to be adopted for safe and proper handling and management of hazardous wastes.
- The primary aim is to ensure appropriate collection, reception, treatment, storage and disposal of hazardous wastes listed in schedule I, II & III of the H.W. Rules.

Hazardous Waste Definition

- By “**Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016:**
- any waste which by reason of characteristics such as physical, chemical, biological, reactive, toxic, flammable, explosive or corrosive, causes danger or is likely to cause danger to health or environment, whether alone or in contact with other wastes or substances, and shall include :

Hazardous Waste Definition

- **(i) waste specified under column (3) of Schedule I;**
- **(ii) waste having equal to or more than the concentration limits specified for the constituents in class A and class B of Schedule II or any of the characteristics as specified in class C of Schedule II;**
- **and (iii) wastes specified in Part A of Schedule III in respect of import or export of such wastes or the wastes not specified in Part A but exhibit hazardous characteristics specified in Part C of Schedule III;**

Schedule- I (rules 3 (1))

List of processes generating hazardous wastes

S.No.	Processes	Hazardous waste
1.	Petrochemical processes and pyrolytic operations	1.1 Furnace or reactor residue and debris 1.2 Tarry residues and still bottoms from distillation 1.3 Oily sludge emulsion 1.4 Organic residues 1.5 Residues from alkali wash of fuels 1.6 Spent catalyst and molecular sieves 1.7 Oil from wastewater treatment
2.	Crude oil and natural gas production	2.1 Drill cuttings excluding those from water based mud 2.2 Sludge containing oil 2.3 Drilling mud containing oil
3.	Cleaning, emptying and maintenance of petroleum oil storage tanks including ships	3.1 cargo residue, washing water and sludge containing oil 3.2 cargo residue and sludge containing chemicals 3.3 Sludge and filters contaminated with oil 3.4 Ballast water containing oil from ships

4.	Petroleum refining or reprocessing of used oil or recycling of waste oil	4.1 Oil sludge or emulsion 4.2 Spent catalyst 4.3 Slop oil 4.4 Organic residue from processes 4.5 Spent clay containing oil
5.	Industrial operations using mineral or synthetic oil as lubricant in hydraulic systems or other applications	5.1 Used or spent oil 5.2 Wastes or residues containing oil 5.3 Waste cutting oils
6.	Secondary production and / or industrial use of zinc	6.1 Sludge and filter press cake arising out of production of Zinc Sulphate and other Zinc Compounds. 6.2 Zinc fines or dust or ash or skimmings in dispersible form 6.3 Other residues from processing of zinc ash or skimmings 6.4 Flue gas dust and other particulates
7.	Primary production of zinc or lead or copper and other non-ferrous metals except aluminium	7.1 Flue gas dust from roasting 7.2 Process residues 7.3 Arsenic-bearing sludge 7.4 Non-ferrous metal bearing sludge and residue.

8.	Secondary production of copper	8.1 Spent electrolytic solutions 8.2 Sludge and filter cakes 8.3 Flue gas dust and other particulates
9.	Secondary production of lead	9.1 Lead bearing residues 9.2 Lead ash or particulate from flue gas 9.3 Acid from used batteries
10.	Production and/or industrial use of cadmium and arsenic and their compounds	10.1 Residues containing cadmium and arsenic
11.	Production of primary and secondary aluminum	11.1 Sludges from off-gas treatment 11.2 Cathode residues including pot lining wastes 11.3 Tar containing wastes 11.4 Flue gas dust and other particulates 11.5 Drosses and waste from treatment of salt sludge 11.6 Used anode butts 11.7 Vanadium sludge from alumina refineries
12.	Metal surface treatment, such as etching, staining, polishing, galvanizing, cleaning, degreasing, plating, etc.	12.1 Acidic and alkaline residues 12.2 Spent acid and alkali 12.3 Spent bath and sludge containing sulphide, cyanide and toxic metals 12.4 Sludge from bath containing organic solvents 12.5 Phosphate sludge 12.6 Sludge from staining bath 12.7 Copper etching residues 12.8 Plating metal sludge

13	Production of iron and steel including other ferrous alloys.	13.1 Sludge from acid recovery unit 13.2 Benzol acid sludge 13.3 Decanter tank tar sludge 13.4 Tar storage tank residue
14	Hardening of steel	14.1 Cyanide,nitrate,nitrite containing sludge 14.2 Spent hardening salt
15	Production of asbestos or asbestos-containing materials	15.1 Asbestos containing residues 15.2 Discarded asbestos 15.3 Dust/particulates from exhaust gas treatment
16	Production of caustic soda and chlorine	16.1 Mercury bearing sludge 16.2 Residue/sludge and filter cakes 16.3 Brine sludge containing mercury
17	Production of mineral acid	17.1 Residues, sludge or filter cakes 17.2 Spent catalyst

18	Production of nitrogenous and complex fertilizers	18.1 Spent catalyst 18.2 Spent carbon 18.3 Sludge/residue containing arsenic 18.4 Chromium sludge from water cooling tower
19	Production of phenol	19.1 Residue/sludge containing phenol
20	Production and/or industrial use of solvents	20.1 Contaminated aromatic, aliphatic or naphthenic solvents may or may not be fit for reuse 20.2 Spent solvents 20.3 Distillation residues
21	Production and/or industrial use of paints,pigments,lacquers,varnishes and inks	21.1 Process wastes, residues & sludges 21.2 Fillers residues
22	Production of plastic raw materials	22.1 Residues of additives used in plastic manufacture 22.2 Residues and waste of plasticisers 22.3 Non-polymerized residues 22.4 Residues from acrylonitrile production 22.5 residues from vinyl chloride monomer production

23	Production and/or industrial use of glues,cements,adhesives and resins	23.1 Wastes/ residues (not made with vegetable or animal materials)
24	Production of canvas and textiles	24.1 Chemical residues
25	Industrial production and formulation of wood preservatives	25.1 Chemical residues 25.2 Residues from wood alkali bath
26	Production or industrial use of synthetic dyes, dye-intermediates and pigments	26.1 Process waste sludge/residues containing acid or other toxic metals or organic complexes 26.2 Dust from air filtration system
27	Production of organo-silicone compounds	27.1 Process residue

28	Production/ formulation of drugs/pharmaceuticals & health care product	28.1 Process residues and wastes 28.2 Spent catalyst/spent carbon 28.3 Off specification products 28.4 Date-expired, Discarded and off-specification drugs/medicines 28.5 Spent organic solvents
29.	Production and formulation of pesticides including stock-piles	29.1 Process residues and wastes 29.2 Chemical sludge containing residue pesticides 29.3 Date-expired and off-specification pesticides
30	Leather tanneries	30.1 Chromium bearing residues and sludge
31	Electronic Industry	31.1 Process residues and wastes 31.2 Spent etching chemicals and solvents
32	Pulp & paper industry	32.1 Spent chemicals 32.2 Corrosive waste arising from use of strong acid and bases 33.3 Process sludge containing absorbable organic halides (AOx)

33	Handling of hazardous chemicals and wastes	<p>3.1 Empty barrels/containers/liners contaminated with hazardous chemicals /wastes</p> <p>33.2 Contaminated cotton rags or other cleaning materials</p>
34	De-contamination of barrels / containers used for handling of hazardous wastes/chemicals	<p>34.1 Chemical-containing residue arising from decontamination.</p> <p>34.2 Sludge from treatment of waste water arising out of cleaning / disposal of barrels /containers</p>
35	Purification and treatment of exhaust air, water and wastewater from the processes in this schedule and common effluent treatment plants	<p>34.1 Flue gas cleaning residue</p> <p>34.2 Spent ion exchange resin containing toxic metal's</p> <p>34.3 Oil and grease skimming residues</p>

36	Purification process for organic compounds or solvents	36.1 Any process or distillation residue 36.2 Spent carbon or filter medium
37	Hazardous waste treatment processes, e.g. pre-processing, incineration and concentration	37.1 Sludge from wet scrubbers 37.2 Ash from incinerator and flue gas cleaning residue 37.3 Concentration or evaporation residues
38.	Chemical processing of Ores containing heavy metals such as Chromium, Manganese, Nickel, Cadmium etc.	38.1 Process residues 38.2 Spent acid

Toxicity

A waste exhibits the characteristics of toxicity if the leachate from the representative sample by Toxicity Characteristics Leaching Procedure (TCLP) test method (as followed by USEPA, vide No: S.W 46, till Indian standards are notified by MoEF / CPCB) contains any of the contaminants listed in Table below in excess of the concentration limits mentioned there upon.

PROCEDURE FOR HANDLING HAZARDOUS WASTES

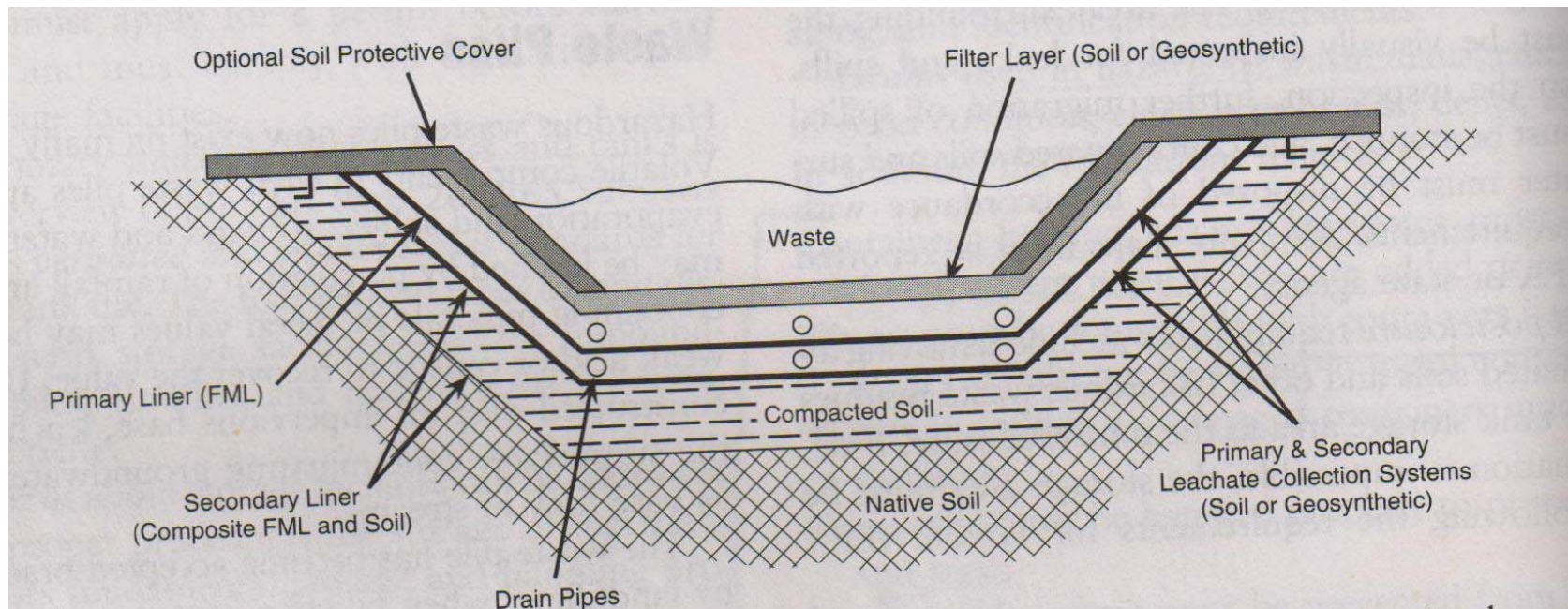
- **Responsibilities of the occupier for handling of hazardous wastes**
 - The occupier shall be responsible for safe and environmentally sound handling of hazardous wastes generated in his establishment.
- **Grant of authorization for handling hazardous wastes**
 - Every person who is engaged in generation, processing, treatment, package, storage, transportation, use, collection, destruction, conversion, offering for sale, transfer or the like of the hazardous waste shall require to obtain an authorization from the State Pollution Control Board.
- **Power to suspend or cancel an authorization**
- **Storage of Hazardous Waste**

PROCEDURE FOR RECYCLING, REPROCESSING OR REUSE OF HAZARDOUS WASTES

- **Procedure for grant of registration**
- **Conditions for sale or transfer of Hazardous Wastes for recycling**
- **Standards for recycling**
- **Utilization of hazardous wastes**
- **Import and export (transboundary movement) of hazardous wastes**
- **Import or export of Hazardous Waste for recycling, recovery and reuses**

- **TREATMENT, STORAGE AND DISPOSAL FACILITY FOR HAZARDOUS WASTES**
- **PACKAGING, LABELLING, AND TRANSPORT OF HAZARDOUS WASTE**

Cross-section of a secure landfill double liner system



GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART-A : EFFLUENTS

The Environment (Protection) Rules, 1986

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¹[SCHEDULE – VI]

(See rule 3A)

GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART-A : EFFLUENTS

S. No.	Parameter	Standards			
		Inland surface water	Public Sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
1.	Colour and odour	See 6 of Annexure-I	--	See 6 of Annexure-I	See 6 of Annexure-I
2.	Suspended solids mg/l, Max.	100	600	200	(a) For process waste water- 100 (b) For cooling water effluent 10 percent above total suspended matter of influent.
3.	Particulate size of suspended solids	Shall pass 850 micron IS Sieve	--	--	(a) Floatable solids, max. 3 mm. (b) Settleable solids, max. 850 microns.
² 4.	***	*	--	***	--
5.	pH Value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6.	Temperature	shall not exceed 5°C above the receiving water temperature	--	--	shall not exceed 5°C above the receiving water temperature

¹ Schedule VI inserted by Rule 2(d) of the Environment (Protection) Second Amendment Rules, 1993 notified vide G.S.R. 422(E) dated 19.05.1993, published in the Gazette No. 174 dated 19.05.1993.

² Omitted by Rule 2(d)(i) of the Environment (Protection) Third Amendment Rules, 1993 vide Notification No.G.S.R.801(E), dated 31.12.1993.

S. No.	Parameter	Standards			
		Inland surface water	Public Sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
7.	Oil and grease mg/l Max.	10	20	10	20
8.	Total residual chlorin mg/l Max.	1.0	--	--	1.0
9.	Ammonical nitrogen (as N), mg/l Max.	50	50	--	50
10.	Total Kjeldahl Nitrogen (as NH ₃) mg/l, Max.	100	--	--	100
11.	Free ammonia (as NH ₃) mg/l, Max.	5.0	--	--	5.0
12.	Biochemical Oxygen demand ¹ [3 days at 27°C] mg/l max.	30	350	100	100
13.	Chemical Oxygen Demand, mg/l, max.	250	--	--	250
14.	Arsenic (as As), mg/l, max.	0.2	0.2	0.2	0.2
15.	Mercury (as Hg), mg/l, Max.	0.01	0.01	--	0.01
16.	Lead (as Pb) mg/l, Max.	0.1	1.0	--	2.0
17.	Cadmium (as Cd) mg/l, Max.	2.0	1.0	--	2.0
18.	Hexavalent Chromium (as Cr+6), mg/l max.	0.1	2.0	--	1.0

¹ Substituted by Rule 2 of the Environment (Protection) Amendment Rules, 1996 notified by G.S.R.176, dated 2.4.1996 may be read as BOD (3 days at 27°C) wherever BOD 5 days 20°C occurred.

S. No.	Parameter	Standards			
		Inland surface water	Public Sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
19.	Total chromium (as Cr.) mg/l, Max.	2.0	2.0	--	2.0
20.	Copper (as Cu) mg/l, Max.	3.0	3.0	--	3.0
21.	Zinc (As Zn.) mg/l, Max.	5.0	15	--	15
22.	Selenium (as Se.) mg/l, Max.	0.05	0.05	--	0.05
23.	Nickel (as Ni) mg/l, Max.	3.0	3.0	--	5.0
¹ 24.	***	*	*	*	*
¹ 25.	***	*	*	*	*
¹ 26.	***	*	*	*	*
27.	Cyanide (as CN) mg/l Max.	0.2	2.0	0.2	0.2
¹ 28.	***	*	*	*	*
29.	Fluoride (as F) mg/l Max.	2.0	15	--	15
30.	Dissolved Phosphates (as P), mg/l Max.	5.0	--	--	--
² 31.	***	*	*	*	*
32.	Sulphide (as S) mg/l Max.	2.0	--	--	5.0
33.	Phenoile compounds (as C ₆ H ₅ OH) mg/l, Max.	1.0	5.0	--	5.0

¹ Omitted by Rule 2(d)(i) of the Environment (Protection) Third Amendment Rules, 1993 vide Notification No.G.S.R.801(E), dated 31.12.1993.

S. No.	Parameter	Standards			
		Inland surface water	Public Sewers	Land for irrigation	Marine coastal areas
1	2	3			
		(a)	(b)	(c)	(d)
34.	Radioactive materials :				
	(a) Alpha emitter micro curie/ml.	10^{-7}	10^{-7}	10^{-8}	10^{-7}
	(b) Beta emitter micro curie/ml.	10^{-6}	10^{-6}	10^{-7}	10^{-6}
35.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
36.	Manganese (as Mn)	2 mg/l	2 mg/l	--	2 mg/l
37.	Iron (as Fe)	3 mg/l	3 mg/l	--	3 mg/l
38.	Vanadium (as V)	0.2 mg/l	0.2 mg/l	--	0.2 mg/l
39.	Nitrate Nitrogen	10 mg/l	--	--	20 mg/l
¹ 40.	***	*	*	*	*

WASTE WATER GENERATION STANDARDS - PART-B

S.No.	Industry	Quantum
1.	Integrated Iron & Steel	16 m ³ /tonne of finished steel
2.	Sugar	0.4 m ³ /tonne of cane crushed
3.	Pulp & Paper Industries	
	(a) Larger pulp & paper	
	(i) Pulp & Paper	175 m ³ /tonne of paper produced
	(ii)Viscose Staple Fibre	150 m ³ /tonne of product
	(iii)Viscose Filament Yarn	500 m ³ /tonne of product
	(b) Small Pulp & Paper :	
	(i) Agro residue based	150 m ³ /tonne of paper produced
	(ii) Waste paper based	50 m ³ /tonne of paper produced
4.	Fermentation Industries :	
	(a) Maltry	3.5 m ³ /tonne of grain produced
	(b) Brewery	0.25 m ³ /KL of beer produced
	(c) Distillery	12 m ³ /KL of alcohol produced
5.	Caustic Soda	
	(a) Membrane cell process	1 m ³ /tonne of caustic soda produced excluding cooling tower blowdown
	(b) Mercury cell process	4 m ³ /tonne of caustic soda produced (mercury bearing) 10% blowdown permitted for cooling tower
6.	Textile Industries : Man-made Fibre	
	(i) Nylon & Polyester	120 m ³ /tonne of fibre produced
	(ii) Viscose rayon	150 m ³ /tonne of product
7.	Tanneries	28 m ³ /tonne of raw hide
8.	Starch, Glucose and related products	8 m ³ /tonne of maize crushed
9.	Dairy	3 m ³ /KL of Milk

10.	Natural rubber processing industry	4 m ³ /tonne of rubber
11.	Fertilizer	
	(a) Straight nitrogenous fertilizer	5 m ³ /tonne of urea or equivalent produced
	(b) Straight phosphatic fertilizer (SSP & TSP) excluding manufacture of any acid	0.5 m ³ /tonne of SSP/TSP
	(c) Complex fertilizer	Standards of nitrogenous and phosphatic fertilizers are applicable depending on the primary product

LOAD BASED STANDARDS - PART-C

¹[1. Petroleum Oil Refinery:

Parameter 1	Standard 2
	Quantum limit in Kg/l 1,000 tonne of crude processed
1. Oil & Grease	2.0
2. BOD _{3 days, 27° C}	6.0
3. COD	50
4. Suspended Solids	8.0
5. Phenols	0.14
6. Sulphides	0.2
7. CN	0.08
8. Ammonia as N	6.0
9. TKN	16
10. P	1.2
11. Cr (Hexavalent)	0.04
12. Cr(Total)	0.8
13. Pb	0.04
14. Hg	0.004
15. Zn	2.0
16. Ni	0.4
17. Cu	0.4
18. V	0.8
19. Benzene	0.04
20. Benzo (a) – Pyrene	0.08

¹ Substituted by Rule 2(ii)(a) of the Environment (Protection) Amendment Rules, 2008 notified by G.S.R.186(E), dated 18.3.2008

GENERAL EMISSION STANDARDS - PART-D

I. Concentration Based Standards		
Sl. No.	Parameter	Standard Concentration not to exceed (in mg/Nm ³)
1.	Particulate Matter (PM)	150
2.	Total Fluoride	25
3.	Asbestos	4 Fibres/cc and dust should not be more than 2 mg/Nm ³
4.	Mercury	0.2
5.	Chlrine	15
6.	Hydrochloric acid vapour and mist	35
¹ 7.	***	*
8.	Sulphuric acid mist	50
9.	Carbon monoxide	1% max. (v/v)
¹ 10.	***	*
11.	Lead	10 mg/Nm ³
¹ 12.	***	*

GENERAL EMISSION STANDARDS - PART-D

II. Equipment based Standards

²[For dispersal of sulphur dioxide, in minimum stack height limit is accordingly prescribed as below]

Sl. No.	Parameter	Standard
1.	Sulphur dioxide	Stack-height limit in metre
	(i) Power generation capacity :	
	- 500 MW and more	275
	- 200/210 MW and above to less than 500 MW	220
	- less than 200/210 MW	$H=14(Q)^{0.3}$
	(ii) Steam generation capacity	
	- Less than 2 tonne/h	Less than 8.5 MT 9
	- 2 to 5 tonne/h	8.5 to 21 MT 12
	- 5 to 10 tonne/h	21 to 42 MT 15
	- 10 to 15 tonne/h	42 to 64 MT 18
	- 15 to 20 tonne/h	64 to 104 MT 21
	- 20 to 25 tonne/h	104 to 105 MT 24
	- 25 to 30 tonne/h	105 to 126 MT 27
	- More than 30 tonne/h	More than 126 MT 30
		or using the formula $H=14(Q)^{0.3}$

¹ Omitted by Rule 2 (g) (iv) of the Environment (Protection) Third Amendment Rules, 1993 vide G.S.R. 801(E) dated 31.12.1993.

² Substituted by Rule 2(h)(i), *ibid.*

Note : H – Physical height of the stack in metre

Q – Emission rate of SO₂ in kg/hr.

III. Load/Mass based Standards

Sl. No.	Industry	Parameter	Standard	
1.	Fertiliser (Urea)			
	Commissioned Prior to 1.1.82	Particulate Matter (PM)	2 kg/tonne of product	
	Commissioned after 1.1.82	Particulate Matter (PM)	0.5 kg/tonne of product	
2.	Copper, Lead and Zinc Smelter/converter	Sulphur dioxide	4 kg/tonne of concentrated (100% acid produced	
3.	Nitric Acid	Oxides of Nitrogen	3 kg/tonne of weak acid (before concentration) produced	
¹ [4.	Sulphuric Acid Plant		Quantum Limit in kg/tonne Plant capacity for 100% Existing Unit New Unit concentration of	
		Sulphuric Acid (tonne/day)		
		Sulphur dioxide (SO ₂)	Upto 300	2.5 2.0
			Above 100	2.0 1.5]
5.	Coke Oven	Carbon Monoxide	3 kg/tonne of coke produced.	
² [6.	Petroleum Oil Refinery (Sulphur Recovery)	Installed Capacity of SRU* (tonne/day)	Kg/tonne of sulphur in the feed to SRU Existing New SRU	
		Sulphur Dioxide	Above 20	26 10
			5 to 20	80 40
			Upto 5	120 80

* SRU – Sulphur Recovery Unit]

¹ Substituted by Rule 2(ii) of the Environment (Protection) Third Amendment Rules, 2008 notified by G.S.R.344(E), dated 7.5.2008.

² Substituted by Rule 2 of the Environment (Protection) Fifth Amendment Rules, 2009 notified by G.S.R.595(E), dated 21.8.2009.

7. Aluminium Plants :

(i)	Anode Bake Oven Total Fluoride		0.3 Kg/MT of Aluminium
(ii)	Pot room		
(a)	VSS	-do-	4.7 Kg/MT of Aluminium
(b)	HSS	-do-	6 Kg/MT of Aluminium
(c)	PBSW	-do-	2.5 Kg/MT of Aluminium
(d)	PBCW	-do-	1.0 Kg/MT of Aluminium

Note : VSS = Vertical Stud Soderberg
 HSS = Horizontal Stud Soderberg
 PBSW = Pre Backed Side Work
 PBCW = Pre Backed Centre Work

8. Glass Industry :

(a)	Furnace Capacity		
(i)	Up in the product draw	Particulate matter	2 Kg/hr ca
	capacity of 60 MTD/Day		
(ii)	Product draw capacity	-do-	0.8 Kg/MT of Product drawn
	more than 60 MT/Day		

Thermal Power Plants

S.NO.	Industry	Parameter	Standards
1	2	3	4
5(a)	Thermal Power Plant	Water consumption	<ol style="list-style-type: none"> 1. All plants with once through cooling (OTC) shall install cooling tower(CT) and achieve specific water consumption max. 4 m³/ MWh within 2 years period from the date of notification. 2. All existing CT- based plants shall reduce specific water consumption upto maximum of 3.5 m³/ MWh within 2 years period from the date of notification. 3. New plants to be installed after January 01, 2017 shall meet specific water consumption maximum of 2.5 m³/ MWh and achieve zero liquid discharge

Thermal Power Plants

Parameter	Standards
TPPs (units) installed before 31 st December, 2003*	
Particulate Matter	100 mg/Nm ³
Sulphur Dioxide (SO ₂)	600 mg/Nm ³ (Units Smaller than 500MW capacity units)
	200 mg/Nm ³ (for units having capacity of 500MW and above)
Oxides of Nitrogen (NO _x)	600 mg/Nm ³
Mercury (Hg)	0.03 mg/Nm ³ (for units having capacity of 500MW and above)

Thermal Power Plants

TPPs (units) installed after 1 st January,2003, up to 31 st December, 2016*	
Particulate Matter	50 mg/Nm ³
Sulphur Dioxide (SO ₂)	600 mg/Nm ³ (Units Smaller than 500MW capacity units)
	200 mg/Nm ³ (for units having capacity of 500MW and above)
Oxides of Nitrogen (NO _x)	300 mg/Nm ³
Mercury (Hg)	0.03 mg/Nm ³
TPPs (units) to be installed from 1 st January, 2017**	
Particulate Matter	30 mg/Nm ³
Sulphur Dioxide (SO ₂)	100 mg/Nm ³
Oxides of Nitrogen (NO _x)	100 mg/Nm ³
Mercury (Hg)	0.03 mg/Nm ³

*TPPs (units) shall meet the limits within two years from date of publication of this notification.

** Includes all the TPPs (units) which have been accorded environmental clearance and are under construction".

Plastic Waste (Management and Handling) Rules, 2016

Salient Features:

- Plastic waste, which can be recycled, shall be channelized to registered plastic waste recycler and recycling of plastic shall conform to the Indian Standard: IS 14534:1998 titled as Guidelines for Recycling of Plastics, as amended from time to time.
- Local bodies shall encourage the use of plastic waste (preferably the plastic waste which cannot be further recycled) for **road construction** as per Indian Road Congress guidelines or **energy recovery** or **waste to oil** etc. The standards and pollution control norms specified by the prescribed authority for these technologies shall be complied with
- **Carry bags** shall **either** be in natural shade which is without any added pigments or made using only those pigments and colorants which are in conformity with Indian standards.
- **No** person shall use carry bags made of **recycled plastics** or compostable plastics for storing, carrying, dispensing or packaging **food stuffs**.

Plastic Waste (Management and Handling) Rules, 2016

Salient Features:

- Carry bag made of virgin or recycled plastic, shall not be less than **fifty microns** in thickness.
- The provision of thickness shall not be applicable to carry bags made up of compostable plastic. Carry bags made from compostable plastics shall conform to the Indian Standard: IS 17088:2008 titled as Specifications for Compostable Plastics, as amended from time to time. The manufacturers or seller of compostable plastic carry bags shall obtain a certificate from the Central Pollution Control Board before marketing or selling;
- Sachets using plastic material shall not be used for storing, packing or selling gutkha, tobacco and pan masala.
- No carry bags will be made available free of cost to the consumers by the retailers. The concerned municipal authority may determine the minimum price of the carry bags
- The local body shall utilize the amount paid by the customers for the carry bags exclusively for the sustainability of the waste management system within their jurisdictions

Prescribed authority for enforcement of the provisions related to **manufacture and recycling** is SPCB.

For enforcement of the provisions related to **use, collection, segregation, transportation and disposal** shall be the **District Collector** of the concerned District

- Blockage in the drainage system by plastic was the primary cause for the 2005 floods in Mumbai which killed thousands.
- Severe floods have also affected countries like Bangladesh and Manila due to the clogging of plastic bags in the drainage system.
- Plastic bags are banned in many cities/states

Source: <http://www.cseindia.org/node/3705>

- A plastic bag takes an average of one thousand years to decompose completely

AUTOMOBILES POLLUTION STANDARDS



Source: www.indiandrives.com

Indian Emission Standards (4-Wheel Vehicles)

Standard	Reference	Date	Region
India 2000	Euro 1	2000	Nationwide
Bharat Stage II	Euro 2	2001	NCR*, Mumbai, Kolkata, Chennai
		2003.04	NCR*, 11 cities†
		2005.04	Nationwide
Bharat Stage III	Euro 3	2005.04	NCR*, 11 cities†
		2010.04	Nationwide
Bharat Stage IV	Euro 4	2010.04	NCR*, 13 cities‡
		2015.07	Above plus 29 cities mainly in the states of Haryana, Uttar Pradesh, Rajasthan and Maharashtra
		2015.10	North India plus bordering districts of Rajasthan (9 States)
		2016.04	Western India plus parts of South and East India (10 States and Territories)
		2017.04	Nationwide
Bharat Stage V	Euro 5	n/a ^a	
Bharat Stage VI	Euro 6	2020.04	Nationwide

* National Capital Region (Delhi)

† Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Secunderabad, Ahmedabad, Pune, Surat, Kanpur and Agra

‡ Above cities plus Solapur and Lucknow. The program was later expanded with the aim of including 50 additional cities by March 2015

^a Initially proposed in 2015.11 but removed from a 2016.02 proposal

Source: www.dieselnet.com/standards/in

Emission Standards for Light-Duty Vehicles, g/km

Year	Reference	CO	HC	HC+NO _x	NO _x	PM
Diesel						
1992	-	17.3-32.6	2.7-3.7	-	-	-
1996	-	5.0-9.0	-	2.0-4.0	-	-
2000	Euro 1	2.72-6.90	-	0.97-1.70	-	0.14-0.25
2005†	Euro 2	1.0-1.5	-	0.7-1.2	-	0.08-0.17
2010†	Euro 3	0.64	-	0.56	0.50	0.05
		0.80		0.72	0.65	0.07
		0.95		0.86	0.78	0.10
2010‡	Euro 4	0.50	-	0.30	0.25	0.025
		0.63		0.39	0.33	0.04
		0.74		0.46	0.39	0.06
Gasoline						
1991	-	14.3-27.1	2.0-2.9	-	-	-
1996	-	8.68-12.4	-	3.00-4.36	-	-
1998*	-	4.34-6.20	-	1.50-2.18	-	-
2000	Euro 1	2.72-6.90	-	0.97-1.70	-	-
2005†	Euro 2	2.2-5.0	-	0.5-0.7	-	-
2010†	Euro 3	2.3	0.20	-	0.15	-
		4.17	0.25	-	0.18	-
		5.22	0.29	-	0.21	-
2010‡	Euro 4	1.0	0.1	-	0.08	-
		1.81	0.13	-	0.10	-
		2.27	0.16	-	0.11	-
*for catalytic converter fitted vehicles † earlier introduction in selected regions ‡ only in selected regions						

Light-Duty Vehicles (GVW ≤ 3,500 kg)

The lowest limit in each range applies to passenger cars (GVW ≤ 2,500 kg; up to 6 seats)

Source: www.dieselnet.com/standards/in/

Emission standards for passenger cars

Stage	Year	CO	HC	HC+NOx	NOx	PM	PN
		g/km					#/km
Gasoline Vehicles							
	1991	14.3	2.0	-	-	-	
	1996	8.68	-	3.00	-	-	
	1998*	4.34	-	1.50	-	-	
India 2000	2000	2.72	-	0.97	-	-	
BS II	2005†	2.2	-	0.5	-	-	
BS III	2010†	2.3	0.20	-	0.15	-	
BS IV	2010‡	1.0	0.10	-	0.08	-	
BS V	n/a ^b	1.0	0.10 ^d	-	0.06	0.0045 ^e	
BS VI	2020 ^a	1.0	0.10 ^d	-	0.06	0.0045 ^e	6.0x10 ^{11e}

Emission standards for passenger cars (Diesel Engines)

Stage	Year	CO	HC	HC+NO _x	NO _x	PM	PN
		g/km					#/km
	1992	17.3	2.7	-	-	-	
	1996	5.0	-	2.0	-	-	
India 2000	2000	2.72	-	0.97	-	0.14	
BS II	2005 [†]	1.0	-	0.7	-	0.08	
BS III	2010 [†]	0.64	-	0.56	0.50	0.05	
BS IV	2010 [‡]	0.50	-	0.30	0.25	0.025	
BS V	n/a ^b	0.50	-	0.23	0.180	0.0045	6.0x10 ¹¹
BS VI	2020 ^a	0.50	-	0.17	0.080	0.0045	6.0x10 ¹¹

Emission Standards for Diesel Truck and Bus Engines, g/kWh

vehicles of GVW > 3,500 kg

Stage	Year	Test	CO	HC	CH ₄	NOx	PM	PN	NH ₃
			g/kWh					kWh ⁻¹	ppm
	1992	ECE R49	17.3	2.7		-	-		
	1996	ECE R49	11.2	2.4		14.4	-		
India 2000	2000	ECE R49	4.5	1.1		8.0	0.36 ^a		
BS II	2005†	ECE R49	4.0	1.1		7.0	0.15		
BS III	2010†	ESC	2.1	0.66		5.0	0.10		
		ETC	5.45	0.78		5.0	0.16		
BS IV	2010‡	ESC	1.5	0.46		3.5	0.02		
		ETC	4.0	0.55		3.5	0.03		
BS V	n/a ^b	ESC	1.5	0.46		2.0	0.02		
		ETC	4.0	0.55	1.1 ^d	2.0	0.03		
BS VI	2020 ^c	WHSC (CI)	1.5	0.13		0.40	0.01	8.0×10 ¹¹	10
		WHTC (CI)	4.0	0.16		0.46	0.01	6.0×10 ^{11e}	10
		WHTC (PI)	4.0	0.16 ^f	0.50	0.46	0.01	6.0×10 ^{11e}	10

† earlier introduction in selected regions, see [India: Table 1](#)

‡ only in selected regions, see [India: Table 1](#)

^a 0.612 for engines below 85 kW

^b Initially proposed in 2015.11 [3297][3298] but removed from a 2016.02 proposal [3349]

^c Proposed schedule and limits

^d For CNG engines only

^e Applicable from April 1, 2025 for new models and April 1, 2026 for existing models

^f NMHC

World Harmonized Stationary Cycle (WHSC)

World Harmonized transient test cycle (WHTC)

Source: www.dieselnet.com/standards/in/

Emission Standards for 2- And 3-Wheel Vehicles, g/km

For 2-and 3-wheelers, Bharat Stage II is applicable from April 1, 2005 and Stage III standards come in force from April 1, 2010.

Bharat Stage IV standards for 2-wheeled gasoline vehicles (motorcycles) were adopted in July 2014

[Source: www.dieselnets.com/standards/in/](http://www.dieselnets.com/standards/in/)

Emission Standards for 2- And 3-Wheel Vehicles, g/km

Year	Standard	CO	HC	HC+NOx	PM
2-Wheel Gasoline Vehicles					
1991		12-30	8-12	-	-
1996		4.50	-	3.60	-
2000		2.00	-	2.00	-
2005.04	BS II	1.5	-	1.5	-
2010.04	BS III	1.0	-	1.0	-
3-Wheel Gasoline Vehicles					
1991		12-30	8-12	-	-
1996		6.75	-	5.40	-
2000		4.00	-	2.00	-
2005.04	BS II	2.25	-	2.00	-
2010.04	BS III	1.25	-	1.25	-
2- And 3-Wheel Diesel Vehicles					
2005.04	BS II	1.00	-	0.85	0.10
2010.04	BS III	0.50	-	0.50	0.05

Source: www.dieselnet.com/standards/in/

BS IV 2-wheel vehicle classification and testing requirements

Class	Definition*	Test Cycle†
Class 1	$50 < D < 150 \text{ cc and}$ $V_{\max} \leq 50 \text{ km/h}$ or $D < 150 \text{ cc and}$ $50 < V_{\max} < 100 \text{ km/h}$	Part 1 reduced speed cold [0.5] + Part 1 reduced speed hot [0.5]
Class 2-1	$D < 150 \text{ cc and}$ $100 \leq V_{\max} < 115 \text{ km/h}$ or $D \geq 150 \text{ cc and}$ $V_{\max} < 115 \text{ km/h}$	Part 1 reduced speed cold [0.5] + Part 1 reduced speed hot [0.5]
Class 2-2	$115 \leq V_{\max} < 130 \text{ km/h}$	Part 1 cold [0.3] + Part 2 hot [0.7]
Class 3-1	$130 < V_{\max} < 140 \text{ km/h}$	Part 1 cold [0.25] + Part 2 hot [0.5] + Part 3 reduced speed [0.25]
Class 3-2	$V_{\max} \geq 140 \text{ km/h}$	Part 1 cold [0.25] + Part 2 hot [0.5] + Part 3 [0.25]

* Abbreviations: D - engine displacement; V_{\max} - maximum design speed.
† WMTC phase sequence. Values in square brackets are weighting factors.

Table 3
BS IV emission standards for 2-wheel gasoline vehicles, g/km

Date*	Stage	Class	CO	NOx	HC+NOx†	
					SHED ≤ 2 g	SHED ≤ 6 g
2016.04	BS IV	Class 1 & 2-1	1.403	0.39	0.79	0.59
		Class 2-2	1.970	0.34	0.67	0.47
		Class 3-1 & 3-2	1.970	0.20	0.40	0.20
* New type approvals—all models one year later. † The limit depends on the result of the evaporative emission test (SHED).						

Table 4
Proposed BS VI emission standards for 2- and 3-wheel vehicles, g/km

Date	Stage	Type	CO	HC	NMHC	NOx	PM
2-Wheel Vehicles (new models only)							
2020.04	BS VI	SI	1.0	0.10	0.068	0.06	0.0045*
		CI	0.50	0.10	0.068	0.09	0.0045
3-Wheel Vehicles (all models)							
2020.04	BS VI	SI	0.44	0.35	-	0.085	-
		CI	0.22	0.10	-	0.10	0.025
* Gasoline direct injection only							

Spark Ignition (SI) Engine

Compression Ignition (CI) Engine

Bharat (CEV) Emission Standards for Diesel Construction Machinery

Engine Power	Date	CO	HC	HC+NO _x	NO _x	PM
<i>kW</i>		<i>g/kWh</i>				
Bharat (CEV) Stage II						
P < 8	2008.10	8.0	1.3	-	9.2	1.00
8 ≤ P < 19	2008.10	6.6	1.3	-	9.2	0.85
19 ≤ P < 37	2007.10	6.5	1.3	-	9.2	0.85
37 ≤ P < 75	2007.10	6.5	1.3	-	9.2	0.85
75 ≤ P < 130	2007.10	5.0	1.3	-	9.2	0.70
130 ≤ P < 560	2007.10	5.0	1.3	-	9.2	0.54
Bharat (CEV) Stage III						
P < 8	2011.04	8.0	-	7.5	-	0.80
8 ≤ P < 19	2011.04	6.6	-	7.5	-	0.80
19 ≤ P < 37	2011.04	5.5	-	7.5	-	0.60
37 ≤ P < 75	2011.04	5.0	-	4.7	-	0.40
75 ≤ P < 130	2011.04	5.0	-	4.0	-	0.30
130 ≤ P < 560	2011.04	3.5	-	4.0	-	0.20

Bharat Emission Standards for Diesel Agricultural Tractors

Engine Power	Date	CO	HC	HC+NO _x	NO _x	PM
<i>kW</i>		<i>g/kWh</i>				
Bharat (Trem) Stage I						
All	1999.10	14.0	3.5	-	18.0	-
Bharat (Trem) Stage II						
All	2003.06	9.0	-	15.0	-	1.00
Bharat (Trem) Stage III						
All	2005.10	5.5	-	9.5	-	0.80
Bharat (Trem) Stage III A						
P < 8	2010.04	5.5	-	8.5	-	0.80
8 ≤ P < 19	2010.04	5.5	-	8.5	-	0.80
19 ≤ P < 37	2010.04	5.5	-	7.5	-	0.60
37 ≤ P < 75	2011.04	5.0	-	4.7	-	0.40
75 ≤ P < 130	2011.04	5.0	-	4.0	-	0.30
130 ≤ P < 560	2011.04	3.5	-	4.0	-	0.20

Emission Standards for Diesel Engine Generator Sets

Table 1

Emission Standards for Diesel Engines ≤ 800 kW for Generator Sets (2004/2005)

Engine Power (P)	Date	CO	HC	NOx	PM	Smoke
		g/kWh				1/m
$P \leq 19$ kW	2004.01	5.0	1.3	9.2	0.6	0.7
	2005.07	3.5	1.3	9.2	0.3	0.7
$19 \text{ kW} < P \leq 50$ kW	2004.01	5.0	1.3	9.2	0.5	0.7
	2004.07	3.5	1.3	9.2	0.3	0.7
$50 \text{ kW} < P \leq 176$ kW	2004.01	3.5	1.3	9.2	0.3	0.7
$176 \text{ kW} < P \leq 800$ kW	2004.11	3.5	1.3	9.2	0.3	0.7

Table 2

Emission Standards for Diesel Engines ≤ 800 kW for Generator Sets (2014)

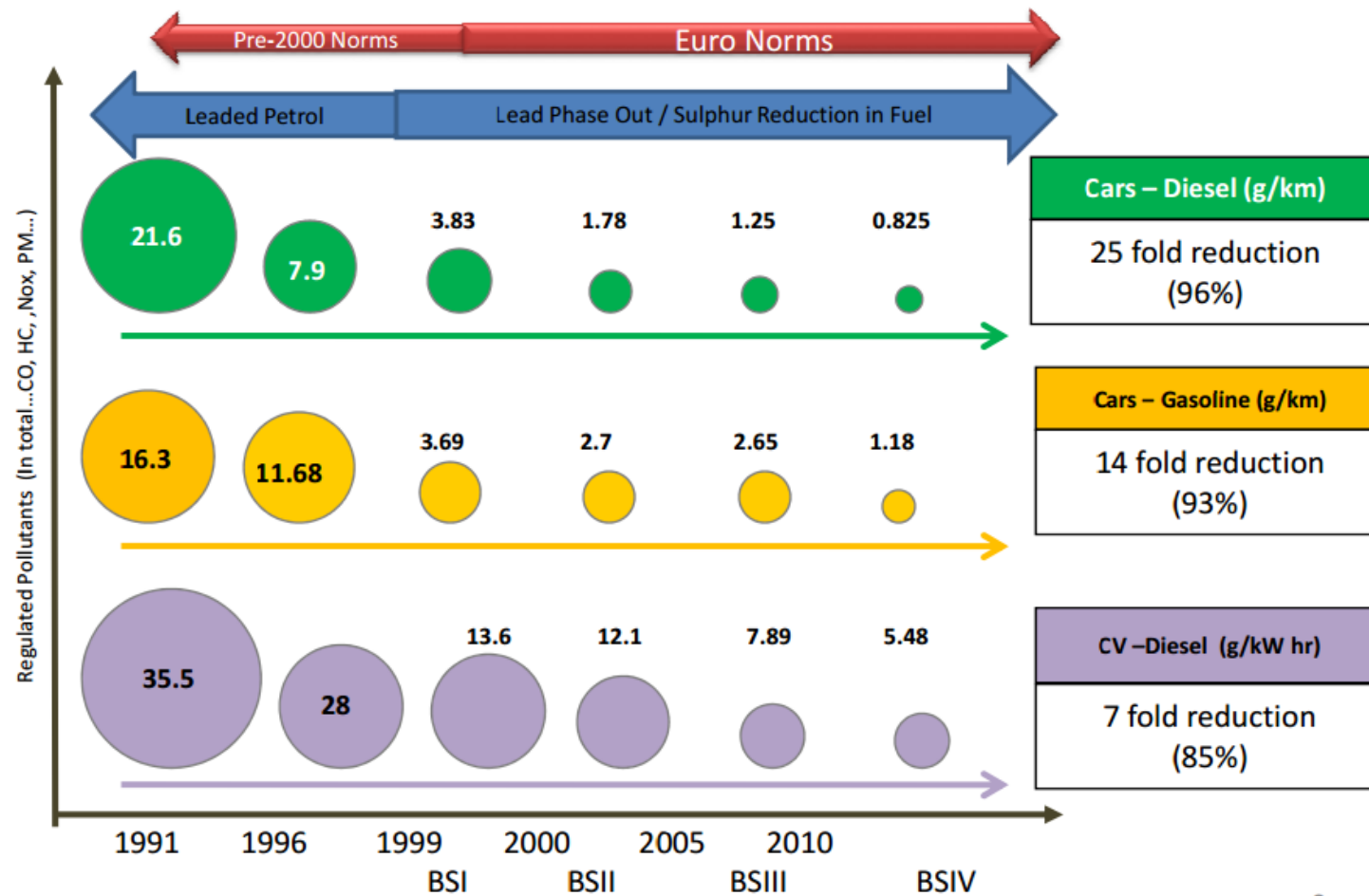
Engine Power (P)	Date	CO	NOx+HC	PM	Smoke
		g/kWh			1/m
$P \leq 19$ kW	2014.04	3.5	7.5	0.3	0.7
$19 \text{ kW} < P \leq 75$ kW	2014.04	3.5	4.7	0.3	0.7
$75 \text{ kW} < P \leq 800$ kW	2014.04	3.5	4.0	0.2	0.7

Emission Standards for Diesel Engine Generator Sets

Emission Limits for Diesel Engines > 800 kW for Generator Sets

Date	CO	NMHC	NOx	PM
	<i>mg/Nm³</i>	<i>mg C/Nm³</i>	<i>ppm(v)</i>	<i>mg/Nm³</i>
Until 2003.06	150	150	1100	75 ^b
2003.07 - 2005.06	150	100	970 (710 ^a)	75 ^c
2005.07	150	100	710 (360 ^a)	75 ^c
^a For engines in plants of total power rating above 75/150 MW located in urban/rural areas, respectively. ^b 150 mg/Nm ³ for engines fueled with furnace oil. ^c 100 mg/Nm ³ for engines fueled with furnace oil.				

Concentrations are corrected to dry exhaust conditions at 15% residual O₂.



Emission standards for CNG and LPG vehicles

- I) Mass emission standards for vehicles when operating on CNG shall be same as are applicable for gasoline vehicles with the exception that HC shall be replaced by NMHC, where $NMHC = 0.3 \times HC$
- II) Mass emission standards for vehicles when operating on LPG shall be same as are applicable for gasoline vehicles with the exception that HC shall be replaced by RHC, where $RHC = 0.5 \times HC$
- III) Crank case emission and SHED test are not applicable in CNG/LPG mode.
- IV) Applicable emission norms for CNG & LPG driven vehicle

Category	Applicable Emission Norms
OE CNG/ LPG Category M and Category N Vehicles with GVW=3500kg, 3 wheelers and 2 wheelers	Prevailing gasoline norms *
CNG/LPG Category M and Category N Vehicles with GVW= 3500kg, 3 wheelers and 2 wheelers retro fitment from Gasoline	Prevailing gasoline norms
CNG/LPG Category M and Category N Vehicles with GVW= 3500kg, 3 wheelers and 2 wheelers retro fitment from Diesel	Prevailing diesel norms**
CNG/LPG Category M and Category N Vehicles with GVW > 3500kg, manufactured upto 1 st April 2010	Prevailing diesel engine norms based on 13-mode steady-state engine dynamometer test or 13 -mode Engine steady state cycle as applicable **
CNG/LPG Category M and Category N Vehicles with GVW > 3500kg, manufactured on and from 1 st April 2010	Prevailing diesel engine norms **

NMHC: Non methane hydrocarbon

RHC: Relative hydrocarbon

Source: https://www.araiindia.com/pdf/Indian_Emission_Regulation_Booklet.pdf

CO₂ emission from vehicles

- India's auto sector accounts for about 18% of the total CO₂ emissions in the country.
- Like the EU, currently no standards for CO₂ emission limits for pollution from vehicles.
- A system exists in the EU to ensure that information relating to the fuel economy and CO₂ emissions of new passenger cars offered for sale or lease in the Community is made available to consumers in order to enable consumers to make an informed choice.

Fuel efficiency regulation: cars

	Equivalent CO ₂ in g/km					
	2015	2016	2017	2018	2019	2020
USA	181	157				
Korea	150					
Japan	138					116*
EU	130					95*
Canada		153				
Mexico	142+*	135.7+*				
China	167					117*
India (Earlier Proposal of BEE - 2011 agreed by industry)	138*				123* / 128* High Octane / Low Octane	
India (New BEE Proposal - 2012)	129*					108*

*Proposed

India's proposed regulations are very stringent and impractical

Indian diesel specifications

S. No	Characteristic	BSII	BSIII	BSIV	BSV	BSVI
1	Density kg/m ³ 15 °C	820-800	820-845	820-845		
2	Sulphur Content mg/kg max	500	350	50	10	10
3(a) 3(b)	Cetane Number minimum and / or Cetane Index	48 or 46	51 and 46	51 and 46		
4	Polycyclic Aromatic Hydrocarbon	-	11	11		
5	Distillation					
(a)	Reco Min At 350 °C	85	-	-		
(b)	Reco Min At 370 °C	95	-	-		
(c)	95% Vol Reco at 0 °C	-	360	360		

Diesel Fuel Quality in India

Date	Particulars
1995	Cetane number: 45; Sulfur: 1%
1996	Sulfur: 0.5% (Delhi + selected cities)
1998	Sulfur: 0.25% (Delhi)
1999	Sulfur: 0.05% (Delhi, limited supply)
2000	Cetane number: 48; Sulfur: 0.25% (Nationwide)
2001	Sulfur: 0.05% (Delhi + selected cities)
2005	Sulfur: 350 ppm (Euro 3; selected areas)
2010	Sulfur: 350 ppm (Euro 3; nationwide)
2016 (proposed)	Sulfur: 50 ppm (Euro 4; major cities)
2017 (proposed)	Sulfur: 50 ppm (Euro 4; nationwide)
2020 (proposed)	Sulfur: 10ppm (Euro 6; entire country)

Overview of the emission norms in India

- **1991** Mass Emission Norms for Gasoline Vehicles.
- **1992** - Mass Emission Norms for Diesel Vehicles.
- **1996** - Revision of Mass Emission Norms for Gasoline and Diesel Vehicles, **mandatory fitment of Catalytic Converter for Cars in Metros on Unleaded Gasoline.**
- **1998** - Cold Start Norms Introduced.
- **2000** - India 2000 (Equivalent to Euro I) Norms, Bharat Stage II Norms for Delhi.
- **2001** - Bharat Stage II (Equivalent to Euro II) Norms for All Metros, Emission Norms for CNG & LPG Vehicles.
- **2003** - Bharat Stage II (Equivalent to Euro II) Norms for 13 major cities.
- **2005** - From 1 April Bharat Stage III (Equivalent to Euro III) Norms for 13 major cities.
- **2010** - Bharat Stage III Emission Norms for 4-wheelers for entire country whereas Bharat Stage - IV (Equivalent to Euro IV) for 13 major cities.
- **2020** – Proposed date for country to adopt Bharat Stage VI norms for cars, skipping Bharat Stage V

Electronic Waste– How much??

- National (Waste Electrical and Electronic Equipment (WEEE) task force in 2005 suggest that total WEEE generation in India is **~146,000 tonnes per year**
- A Study in 2007 put the estimate to **330,000 tonnes per year**
- In 2009 various sources estimates **~ 420,000 tonnes per year**
- E-waste generation equipment wise (UNEP report 2010)
 - 100,000 tonnes from refrigerators,
 - 275,000 tonnes from TVs,
 - 56,300 tonnes from personal computers,
 - 4700 tonnes from printers
 - 1700 tonnes from mobile phones.
 - **The data only includes equipment generated nationally but does not include waste imports (both legal and illegal)**

E-waste Management and Handling Rules, 2011

E-waste Management and Handling Rules, 2011
came into effect from May 1, 2012.

E-waste Management and Handling Rules, 2011

Categories of electrical and electronic equipment covered under the rules

Sr. No.	Categories of electrical and electronic equipment
i.	Information technology and telecommunication equipment : Centralised data processing: Mainframes, Minicomputers Personal computing: Personal Computers (Central Processing Unit with input and output devices) Laptop Computers(Central Processing Unit with input and output devices) Notebook Computers Notepad Computers Printers including cartridges Copying equipment Electrical and electronic typewriters User terminals and systems Facsimile Telex Telephones Pay telephones Cordless telephones Cellular telephones Answering systems
ii.	Consumer electrical and electronics: Television sets (including sets based on (Liquid Crystal Display and Light Emitting Diode technology), Refrigerator, Washing Machine, Air-conditioners excluding centralised air conditioning plants

E-waste Management and Handling Rules, 2011

Responsibilities of the Producer

- Collection of e-waste during manufacture of electrical and electronic equipment and channeling it for recycling or disposal
- To ensure that e-waste is collected, transported to specific collection, dismantling and processing units, and safely disposed under the principle of Extended Producer Responsibility (EPR).
- Financing and organizing a system to meet the costs involved in the environmentally sound management of e-waste generated
- Setting up collection centers or take back systems either individually or collectively

E-waste Management and Handling Rules, 2011

Responsibilities of Consumer or Bulk Consumer

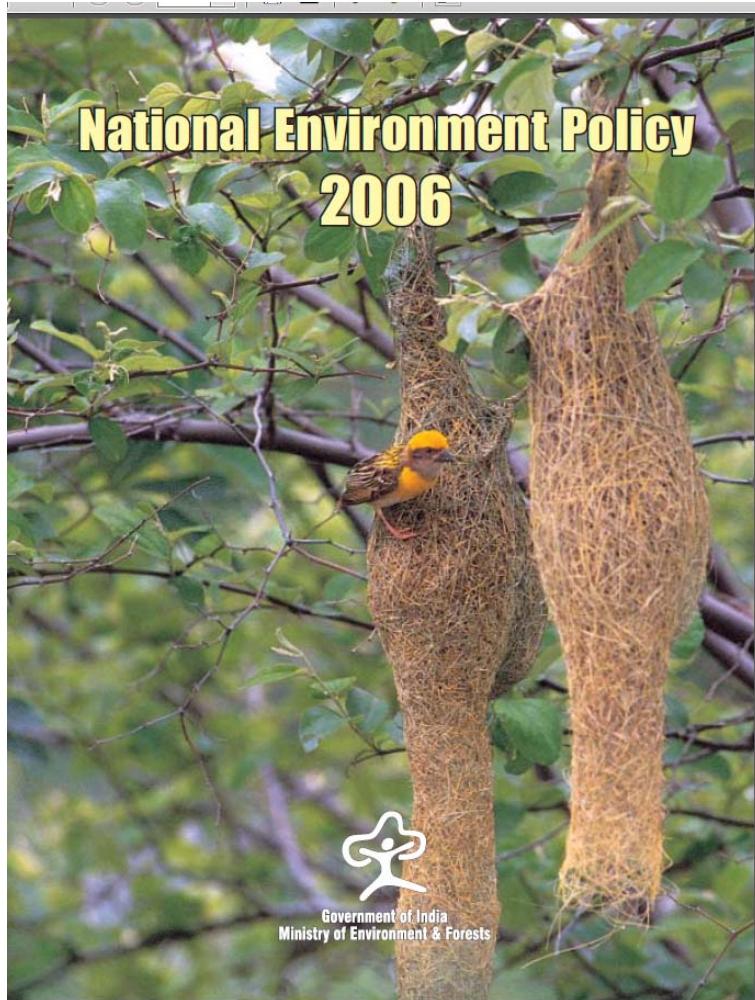
- Ensure that the waste is channelized to authorized collection centers—dismantlers--recyclers
- Bulk consumer shall maintain records of e-waste generated in form 2

E-waste Management and Handling Rules, 2011

Non-Compliance and Penalties

1. Imprisonment for a term which may extend to five years with fine which may extend to one Lakh rupees.
2. In case the failure or contravention continues, with additional fine which may extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first such failure or contravention
3. If the failure or contravention referred to in sub-section (1) continues beyond a period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term which may extend to seven years.

National Environmental Policy



Intended to mainstream environmental concerns in all development activities.

The **dominant theme** of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.

Objectives of the National Environment Policy

- **Conservation of Critical Environmental Resources**
- **Intra-generational Equity: Livelihood Security for the Poor:** To ensure equitable access to environmental resources and quality for all sections of society, and in particular, to ensure that poor communities, which are most dependent on environmental resources for their livelihoods, are assured secure access to these resources.
- **Inter-generational Equity:**

Objectives of the National Environment Policy

- **Integration of Environmental Concerns in Economic and Social Development**
- **Efficiency in Environmental Resource Use**
- **Environmental Governance:** Apply the principles of good governance to the management and regulation of use of environmental resources
- **Enhancement of Resources for Environmental Conservation:** To ensure higher resource flows, comprising finance, technology, management skills, traditional knowledge, and social capital, for environmental conservation through mutually beneficial multi-stakeholder partnerships between local communities, public agencies, the academic and research community, investors, and multilateral and bilateral development partners.

Principles

- **Human Beings are at the Centre of Sustainable Development Concerns:**
 - Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.
- **The Right to Development:**
 - The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.
- **Environmental Protection is an Integral part of the Development Process:**
 - Environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it
- **The Precautionary Approach:** Where there are credible threats of serious or irreversible damage to key environmental resources, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
- **Economic Efficiency:** The services of environmental resources be given economic value, and such value to count equally with the economic values of other goods and services, in analysis of alternative courses of action.
 - **Polluter Pays**

Principles

- **Legal Liability:**
 - Fault Based Liability
 - Strict Liability
- **Public Trust Doctrine:**
- **Decentralization:**
- **Integration:** Integration refers to the inclusion of environmental considerations in sectoral policymaking, the integration of the social and natural sciences in environment related policy research, and the strengthening of relevant linkages among various agencies at the Central, State, and Local Self- Government levels, charged with the implementation of environmental policies.
- **Environmental Standard Setting:** Environmental standards must reflect the economic and social development situation in which they apply.
- **Preventive Action:**
- **Environmental Offsetting:** General obligation to protect threatened or endangered species and natural systems that are of special importance to sustaining life, providing livelihoods, or general well-being

Strategies and Actions

- **Regulatory Reforms:**
 - **Revisiting the Policy and Legislative Framework:**
 - **Process Related Reforms**
 - **Substantive Reforms:**
- **Enhancing and Conserving Environmental Resources:**
- **Environmental Standards, Management Systems, Certification, and Indicators:**
 - **Environmental Standards: New standards on the basis of scientific knowledge; Strengthening monitoring mechanism**
 - **Environmental Management Systems, Ecolabeling and Certification**
- **Clean Technologies and Innovation**
- **Environmental Awareness, Education, and Information**
- **Partnerships and Stakeholder Involvement**
- **Capacity Building**
- **Research and Development**
- **International Cooperation**
- **Review of the Policy**
- **Review of Implementation**

