

# Guidelines for the Disposal of Non-recyclable Fraction (Multi-layered) Plastic Waste

(As per Rule '6(2)(d) & 9(2)' of Plastic Waste Management Rules, 2016, as amended 2018)



## **CENTRAL POLLUTION CONTROL BOARD**

(Ministry of Environment, Forest and Climate Change, Government of India)

'Parivesh Bhawan' C. B. D. Cum-Office Complex,

East Arjun Nagar, Shahdara, Delhi-110032

**(April, 2018)**

## **CONTENTS: -**

1	Background:	2
2	Definitions:	2
3	Sources of non-recyclable plastic waste:	3
4	Quantification of non-recyclable plastic waste generated in India:	3
5	Management of Non-recyclable plastic waste:	4
5.1	Collection, Segregation & Transportation:	4
5.2	Extended Producers Responsibility (EPR):	5
5.3	Management /Disposal Options:	5
5.3.1	Minimizing the waste generation:	6
5.3.2	Co-processing of non-recyclable plastic waste in cement plants:	6
5.3.3	Disposal of non-recyclable plastic waste by Plasma Pyrolysis Technology (PPT):	7
5.3.3.1	Major Components of PPT System	7
	Annexure-1	9

## 1. Background:

Plastic products have become an integral part in our daily life as a basic need. Its broad range of application is in packaging films, wrapping materials, shopping and garbage bags, fluid containers, clothing, toys, household & industrial products and building materials. It is a fact that plastics will never degrade and remain on landscape for several years. The recycled plastics are more harmful to the environment than the virgin products due to mixing of colour, additives, stabilizers, flame retardants etc. Further, the recycling of a virgin plastic material can be done 2-3 times only, because, after every recycling, the strength of plastic material is reduced due to thermal degradation.

The Government of India notified Plastic Waste Management (PWM) Rules, 2016, as amended 2018 as amended 2018 by superseeding Plastic Waste (Management & Handling) Rules, 2011. As per the Rule '6(2d)' of PWM Rules, 2016, as amended 2018, processing and disposal of non-recyclable fraction of plastic waste shall be in accordance with the Guidelines issued by the Central Pollution Control Board. In compliance of the direction, the Central Pollution Control Board has prepared the "**Guidelines for the Disposal of Non-recyclable Plastic Waste**". Thereafter, processing and disposal of non-recyclable fraction of plastic waste (mainly comprises of thermoset plastic waste) shall be in the accordance with the said Guidelines, as amended from time to time. However, disposal of thermoset plastic waste shall be in the accordance with Guidelines issued by CPCB, titled as "**Guidelines for disposal of Thermoset Plastic Waste including Sheet Moulding Compounds (SMC)/Fibre Reinforced Plastics (FRP)**", as amended time to time.

## 2. Definitions:

Some of the important terminologies, as defined in the Plastic Waste Management (PWM) Rules, 2016, as amended 2018, are given below:

### a. Plastic:

As per Rule '3(o)' of PWM Rules, 2016, as amended 2018, plastic means material which contains as an essential ingredient a high polymer such as polyethylene terephthalate, high density polyethylene, vinyl, low density polyethylene, polypropylene, polystyrene resins, multi-materials like acrylonitrile butadiene styrene, polyphenylene oxide, polycarbonate, polybutylene terephthalate.

### b. Multilayer Packaging:

As per Rule '3(n)' of PWM Rules, 2016, as amended 2018, Multilayer Packaging means any material used or to be used for packaging and having at least one layer of plastic as the main ingredients in combination with one or more layers of materials such as paper, paper board, polymeric materials, metalised layers or aluminium foil, either in the form of a laminate or co-extruded structure.

As per Rule 9(2)-Primary responsibility for collection of used multi-layered plastic sachet or pouches or packaging is of Producers, Importers and Brand Owners who introduce the products in the market. They need to establish a system for collecting back the plastic waste generated due to their products. This plan of collection to be submitted to the State Pollution

Control Boards while applying for Consent to Establish or Operate or Renewal. The Brand Owners whose consent has been renewed before the notification of these rules shall submit such plan within one year from the date of notification of these rules and implement with two years thereafter.

As per Rule '9(5)' of PWM Rules, 2016, as amended 2018, no producer shall on and after the expiry of a period of **Six Months** i.e. after 30<sup>th</sup> September, 2016 from the date of final publication of these rules in the Official Gazette manufacture or use any plastic or multilayered packaging for packaging of commodities without registration from the concerned State Pollution Control Board or the Pollution Control Committees, following shall be complied:- As per Rule 13(2)- Every producer or brand-owner shall, for the purpose of registration or for renewal of registration, make an application in **Form-I** to

- i. "The concerned State Pollution Control Board or Pollution Control Committee of the Union territory, if operating in one or two States or Union Territories"; or
- ii. The Central Pollution Control Board, if operating in more than two States or Union Territories".

**c. Recycling:**

As per Rule '3(t)' of PWM Rules, 2016, as amended 2018, recycling is the process of transforming segregated plastic waste into a new product or raw material for producing new products.

**d. Non-recyclable fraction of Plastic Waste:**

Non-recyclable fraction of plastic (here onwards referred as non-recyclable plastic) is the plastic which can not be recycled by conventional recycling methods i. e., plastic waste which can not be remoulded on heating. Such material mainly comprises of multilayered structure, which may be made from thermoset or thermoplastic material, but due to complex structure, it can not be separated, hence called as non-recyclable. Multilayer plastic is generally used in the packaging industry where better barrier properties are required for food, pharmaceuticals, electronic goods etc. Multilayer laminates are produced by joining various input materials such as aluminium foil, polyethylenetherephtalate (PET), polypropylene (BOPP), polyethylene (PE) & paper etc.

**3. Sources of non-recyclable plastic waste:**

S. No.	Sources	Uses
1	Food packaging	Multilayered films are used for packing of biscuits, namkeen, chips, edible oil, juices etc.
2	Pharmaceutical & cosmetics products	Multilayered packing for packing of medicines, tablets and cosmetics etc.
3	Electrical and electronic goods	Multilayered films such as bubble raps, laminates are used for packing of electrical and electronic items etc.
4	Item used for food storage & serving	Thermocol products such as plates, cups etc. are used for serving food, tea, coffee etc. Also used as fillers in packing of goods/items etc.

**4. Quantification of non-recyclable plastic waste generated in India:**

As per the study conducted by Central Pollution Control Board (CPCB) in 60 major cities of India (2012), it has been observed that around 4059 T/day of plastic waste is generated from these cities. The fraction of plastic waste in total Municipal Solid Waste (MSW) varies from

3.10% (Chandigarh) to 12.47% (Surat). Average plastic waste generation is around 6.92% of MSW. With extrapolation of per capita plastic waste generation data from 60 major cities, it is estimated that approximately 9.46 million tons per annum of plastic waste is generated in India, which is around 25,940 T/day. As per the results of the study, out of total plastic waste, around 94% waste comprises of thermoplastic content, which is recyclable such as PET, LDPE, HDPE, PVC etc. and remaining 6% belongs to the family of thermoset and other categories of plastics such as SMC, FRP, multi-layered, thermocol etc. , which is non-recyclable. As per an estimation, every year approximately **0.56 million tons of non-recyclable plastic waste** is dumped in India.

## **5. Management of Non-recyclable plastic waste:**

The use of plastic products/item specially for packaging & food servings have simplified the modern life. At the same time, the extensive use of plastic products/items in every walk of life have caused serious plastic waste management problems. The handling of increased amount of plastic waste has become a serious issue globally specially in India and is also a cause of depletion of petroleum resources, which are an essential requirement of the mankind.

### **5.1 Collection, Segregation & Transportation:**

5.1.1. At present, no system exists with Urban & Rural Municipal Bodies for collection, segregation & transportation of all kind of plastic waste including multilayer plastic waste. However, as per Rule "6" of the Plastic Waste Management Rules, 2016, as amended 2018: -

1. Every Urban Local Body and Gram Panchayat shall be responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste either on its own or by engaging agencies or producers.
2. The Urban Local Body and Gram Panchayat shall be responsible for setting up, operationalisation and co-ordination of the waste management system and for performing the associated functions, namely:-
  - a. Ensuring segregation, collection, storage, transportation, processing and disposal of plastic waste;
  - b. ensuring that no damage is caused to the environment during this process;
  - c. ensuring channelization of recyclable plastic waste fraction to recyclers;
  - d. ensuring processing and disposal on non-recyclable fraction of plastic waste in accordance with the guidelines issued by the Central Pollution Control Board;
  - e. creating awareness among all stakeholders about their responsibilities;
  - f. engaging civil societies or groups working with waste pickers; and
  - g. ensuring that open burning of plastic waste does not take place.
3. The Urban Local Body and Gram Panchayat for setting up of system for plastic waste management shall seek assistance of producers and such system shall be set up within **one year** from the date of final publication of these rules in the Official Gazette of India.
4. The Urban Local Body and Gram Panchayat to frame bye-laws incorporating the provisions of these rules. "

## 5. 2 Extended Producers Responsibility (EPR):

As per the Rule “9(1)” of the Plastic Waste Management Rules, 2016, as amended 2018 “The producers, within a period of six months from the date of publication of PWM Rules, 2018, (i. e. after 27<sup>th</sup> March, 2018), shall work out modalities for waste collection system based on Extended Producers Responsibility and involving State Urban Development Departments, either individually or collectively, through their own distribution channel or through the local body concerned.

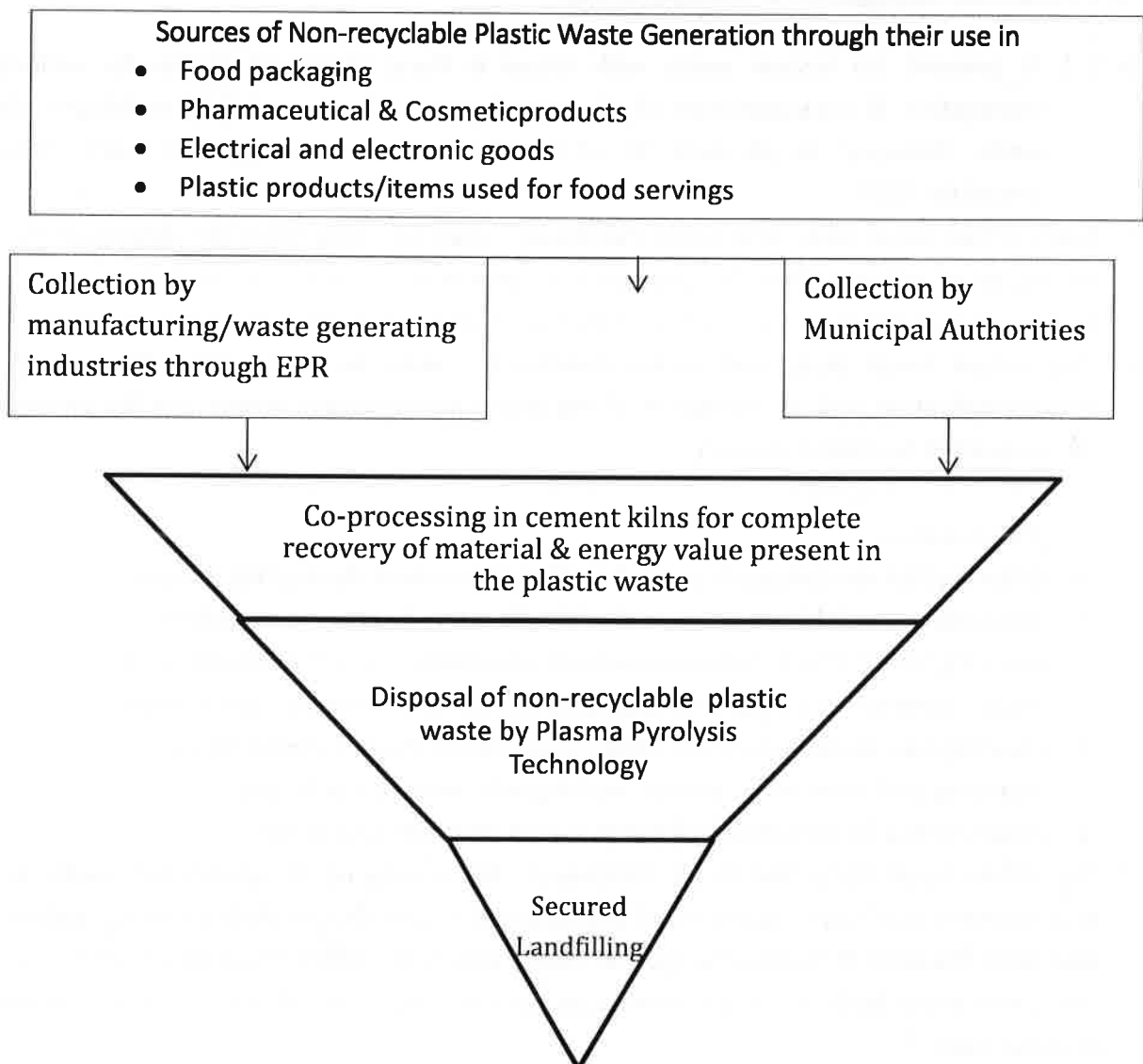
## 5. 3 Management /Disposal Options:

The most preferred options are:

- (i) Minimizing the waste generation
- (ii) Co-processing in cement kilns
- (ii) Disposal of non-recyclable plastic waste by plasma pyrolysis technology
- (iii) Disposal in secured landfills

Based on the various options practiced globally for disposal of non-recyclable plastic waste, the waste management hierarchy, recommendations. on collection & disposal are illustrated in Fig - 1:

Figure – 1: Collection and Disposal of Non-recyclable Plastic Waste



### 5. 3. 1 Minimizing the waste generation:

The most preferred option is minimization of use of non-recyclable plastic products & promoting use of alternate material, which could be easily recyclable/reusable/degradable and compostable.

### 5. 3. 2 Co-processing of non-recyclable plastic waste in cement plants:

Co-processing is a more environmentally friendly and sustainable method of waste disposal as compared to land filling and incineration because of reduced emissions and no residue after the treatment. Co-processing refers to the use of waste materials in industrial processes as alternative fuels or raw material (AFR) to recover energy and material from them. Due to the high temperature in cement kiln, all types of wastes can be effectively disposed without any harmful emissions. As per the Basel Convention, variety of wastes including hazardous wastes, get disposed in an environmentally safe and sound manner through the technology of co-processing in cement kiln. Disposal of non-recyclable plastic wastes through co-processing is practiced in many countries as a regular method for their environmentally sound disposal. Figure 2. shows the flow diagram of the cement kiln with the facility for co-processing of plastic waste.

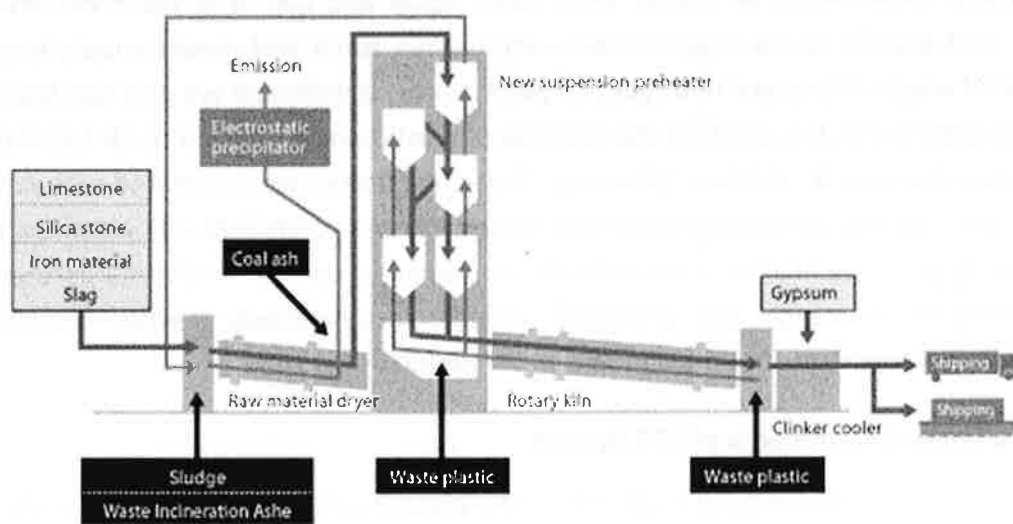


Figure – 2: Flow Diagram for Co-processing of Plastic Waste in Cement Kilns

#### 5. 3. 2. 1 Pre-requisites for Co-processing of non-recyclable plastic waste in cement plants:

Following should be considered as a prerequisite for permitting Co-processing of non-recyclable plastic wastes in cement plants.

- a) The producers of non-recyclable plastic, major users like food packaging, pharmaceuticals, multilayer film manufacturing industries etc. in consultation with local body can arrange to collect the non-recyclable plastic waste in packed form and transport to cement plants for proper mangemnet. The record of quantity generated and handed over to cement plants shall be maintained by the producers.

- b) The cement plants shall maintain a record of quantity received and utilised by them.
- c) The producers of non-recyclable plastic, major user like food packaging, pharmaceuticals, multilayer film manufacturing industries etc. shall assist the cement plants for establishment of required facilities for utilization of non-recyclable plastic like shredding, feeding system, safety measures as applicable for co-incineration. The cement industries should set-up online emission monitoring for PM, SO<sub>2</sub> and NO<sub>x</sub>, and stack monitoring of heavy metals, dioxin and furans based on Extended Producers Responsibility.
- d) The co-processing of the non-recyclable plastic waste in cement kilns shall follow the emission standards as notified by Ministry of Environment, Forest and Climate Change, in notification titled as "Environment (Protection) Third Amendment Rules, 2016", dated 10.05.2016 (Annexure-I).

### **5.3.3 Disposal of non-recyclable plastic waste by Plasma Pyrolysis Technology (PPT):**

Plasma pyrolysis is one of the technologies which can be opted for disposal of non-recyclable plastic waste such as thin carry bags, metalized and multi layer pouches etc. In Plasma Pyrolysis, high temperature (around 2000°C) is produced using plasma torch in oxygen starved environment to destroy plastic waste efficiently and in an ecofriendly manner. Plasma is a fourth state of matter after solid, liquid and gas. It is the most active state of matter. Hot plasma which is generated using plasma torch and power supply is used for the disposal of waste. There are two types of plasma arcs: transferred arc and non-transferred arc. Graphite plasma torch is used for the disposal of plastic waste. Plasma torch has three graphite electrodes (one anode and two cathodes). These electrodes are connected with power supply. Plasma arc is produced among these electrodes. Plasma torch converts electrical energy into heat energy and this heat is used to heat the primary chamber. In plasma pyrolysis the most likely compounds which are produced include carbonaceous matter, methane, carbon monoxide, hydrogen, carbon dioxide and water molecules.

#### **5.3.3.1 Major Components of PPT System**

Figure 3 shows the flow diagrams for the plasma pyrolysis technology for the disposal of plastic waste. Following are the major components of any Plasma Pyrolysis System for disposal of Plastic Waste:

##### **a. Plasma Torch & Power Supply:**

Plasma torch comprises of three graphite electrodes (one anode and two cathodes). The graphite plasma torch produces non-transfer arc. DC power supply is used to produce plasma arc. Plasma torch converts electrical energy into heat energy, which is used to heat the primary chamber where pyrolysis takes place.

##### **b. Feeder:**

Arrangement for feeding waste to primary chamber.



**c. Primary Chamber:**

Primary chamber is the rectangular steel chamber with refractory lining. Temperature in this chamber is generally more than 1000°C near pyrolysis zone and more than 650°C, close to chamber wall.

**d. Secondary Chamber:**

Secondary chambers are cylindrical in shape, having refractory lining to reduce heat loss. Electrically operated igniter are used to ignite combustible gases coming from primary chamber. Temperature in this chamber varies between 800°C to 1000°C.

**e. Scrubbers:**

Venturi and secondary scrubbers are used for quenching as well as for scrubbing the gases.

**f. Induced Draft Fan and Chimney:**

The gases such as CO<sub>2</sub>, H<sub>2</sub>O are released in the environment using induced draft fan.

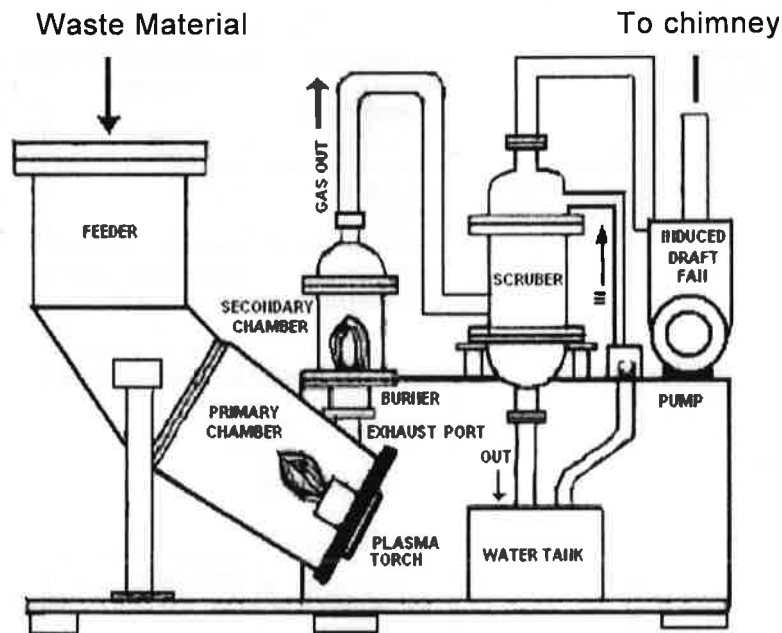


Figure – 3: Flow diagram for Plasma Pyrolysis System for Disposal of Plastic Waste

**g. Cost Aspects:**

Approximately cost of equipments machineries for 0.3 T/day capacity is around ₹50.0 lacs and for 1 Ton/day capacity is approximately ₹1.0 Crore, excluding operational and maintenance cost. It has been estimated, if heat energy recovery system start with this type of system, the payback period of plasma pyrolysis plant of 1 Ton/day, capacity is around 5 years, thenafter this system can be profitable.

## MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

## NOTIFICATION

New Delhi, the 10th May, 2016

G.S.R. 497 (E). – In exercise of powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely :-

1. Short title and commencement - (1) These rules may be called the Environment (Protection) Third Amendment Rules, 2016.  
(2) They shall come into force on the date of their publication in the Official Gazette.
2. In the Environment (Protection) Rules, 1986.-  
(a) in schedule 1, after serial number 10 and the entries relating thereto, the following serial number and entries shall be inserted, namely:-

"S. No. (1)	Industry (2)	Parameter (3)	Standards (4)			
"10A.	Cement Plant with co-processing of wastes	<b>A- Emission Standards</b>				
		Rotary Kiln – with co-processing of Wastes				
			<b>Date of Commissioning</b>	<b>Location</b>	<b>Concentration not to exceed, in mg/Nm<sup>3</sup></b>	
			<b>(a)</b>	<b>(b)</b>	<b>(c)</b>	
		Particulate Matter (PM)*	on or after the date of notification (25.8.2014)	anywhere in the country	30	
			before the date of notification (25.8.2014)	critically polluted area or urban centres with population above 1.0 lakh or within its periphery of 5.0 kilometer radius	30	
				other than critically polluted area or urban centres	30	
		SO <sub>2</sub> *	irrespective of date of commissioning	anywhere in the country	100, 700 and 1000 when pyritic sulphur in the limestone is less than 0.25%, 0.25 to 0.5% and more than 0.5% respectively.	
NO <sub>x</sub> *	After the date of notification (25.8.2014)	anywhere in the country	(1) 600			
	Before the date of notification	anywhere in the country	(2) 800 for rotary kiln with In Line Calciner			

R

		(25.8.2014)	(ILC) technology.  (3) 1000 for rotary kiln using mixed stream of ILC, Separate Line Calciner (SLC) and suspension pre-heater technology or SLC technology alone or without calciner.
		HCl	10 mg/Nm <sup>3</sup>
		HF	1 mg/Nm <sup>3</sup>
		TOC	10 mg/Nm <sup>3</sup> **
		Hg and its compounds	0.05 mg/Nm <sup>3</sup>
		Cd +Tl and their compounds	0.05 mg/Nm <sup>3</sup>
		Sb+As+Pb+Co+Cr+Cu+Mn+Ni+V and their compounds	0.5 mg/Nm <sup>3</sup>
		Dioxins and Furans	0.1 ngTEQ/ Nm <sup>3</sup>
		<p><b>Note:</b> The abbreviations used in the Table shall mean as under: SO<sub>2</sub>- Sulphur dioxide; NO<sub>x</sub> - Oxides of Nitrogen; HCl – Hydrogen Chloride; HF – Hydrogen Flouride; TOC - Total Organic Carbon; Hg – Mercury; Cd – Cadmium; Tl – Thallium; Sb – Antimony; As – Arsenic; Pb – Lead; Co – Cobalt; Cr – Chromium; Cu – Copper; Mn – Manganese; Ni – Nickel; and V - Vanadium.”;</p> <p>* The concentration values and timeline for implementation in respect of PM, SO<sub>2</sub> and NO<sub>x</sub> shall be governed in accordance with the provisions under notification published vide GSR No. 612 (E), dated the 25<sup>th</sup> August, 2014 and amended from time to time.</p> <p>**Permitting authority may prescribe separate standards on case to case basis, if Total Organic Carbon (TOC) does not result from the co-processing of waste.</p> <p>(a) The height of each individual stack connected to Kiln, Clinker Cooler, Cement Mill, Coal Mill, Raw Mill, Packaging section, etc. shall be of a minimum of 30 metres or, as per the formula <math>H = 14 (Q1)^{0.3}</math> and <math>H = 74 (Q2)^{0.27}</math> whichever is more, where “H” is the height of stack in metres and “Q1” is the maximum quantity of SO<sub>2</sub> expected to be emitted in kg/hr and “Q2” is the maximum quantity of PM expected to be emitted in tonnes/hr through the stack at 100 percent rated capacity of the plant;</p> <p>(b) The monitored values of SO<sub>2</sub>, NO<sub>x</sub>, HCl, HF, TOC, Metals and Dioxins and Furans at main kiln stack shall be corrected to 10% Oxygen, on dry basis and the norms for SO<sub>2</sub>, NO<sub>x</sub>, HCl, HF, TOC, Metals and Dioxins and Furans shall be applicable to main kiln stack and the norms for Particulate Matter (PM) shall be applicable to all the stacks in the plant. PM, SO<sub>2</sub>, NO<sub>x</sub> shall be monitored continuously. HCl, HF, TOC, Metals and Dioxins and Furans shall be monitored once in a year;</p> <p>(c) Scrubber meant for scrubbing emissions shall not be used as quencher and plants having separate stack for gaseous emission for the scrubbing unit, the height of this stack shall be at least equal to the main stack.</p>	
		<p><b>B- Service waste water (with co-processing of wastes)</b> All efforts shall be made by the industry for 'zero discharge' of service wastewater and in case, the industry prefers to discharge service wastewater, the following norms shall be complied with:</p>	
			<b>Concentration not to exceed, milligram per litre (except pH and temperature)</b>
		pH	5.5 to 9.0
		Suspended Solids	100

		Oil and Grease	10
		Temperature	not more than 5°C higher than the intake water temperature
		<b>C- Storm water</b>	
		(I) Storm-water shall not be allowed to mix with effluent, treated sewage, scrubber water and or floor washings.	
		(II) Storm-water within battery limits of industry shall be channelised through separate drain(s).”.	

- (b) in Schedule VI, under 'Part-D' relating to General Emission Standards, in item III relating to Load or Mass based standards, after serial number 10 and the entries relating thereto, the following serial number and entries shall be inserted, namely:-

(1)	(2)	(3)	(4)
"10A	Cement Plants (with co-processing)	Rotary kiln based plants (Particulate Matter from raw mill, kiln and pre-calciner system put together)	0.125 kg/ tonne of clinker.”.

[F. No.- Q-15017/30/2007-CPW]

Dr. RASHID HASAN, Advisor

**Note .-** The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i), vide number S.O. 844 (E), dated the 19<sup>th</sup> November, 1986 and subsequently amended vide the following notifications, namely:-

S.O. 433 (E), dated the 18<sup>th</sup> April 1987; G.S.R. 176(E), dated the 2<sup>nd</sup> April, 1996; G.S.R. 97 (E), dated the 18<sup>th</sup> February, 2009; G.S.R. 149 (E), dated the 4<sup>th</sup> March, 2009; G.S.R. 543(E), dated the 22<sup>nd</sup> July, 2009; G.S.R. 739 (E), dated the 9<sup>th</sup> September, 2010; G.S.R. 809(E), dated, the 4<sup>th</sup> October, 2010, G.S.R. 215 (E), dated the 15<sup>th</sup> March, 2011; G.S.R. 221(E), dated the 18<sup>th</sup> March, 2011; G.S.R. 354 (E), dated the 2<sup>nd</sup> May, 2011; G.S.R. 424 (E), dated the 1<sup>st</sup> June, 2011; G.S.R. 446 (E), dated the 13<sup>th</sup> June, 2011; G.S.R. 152 (E), dated the 16<sup>th</sup> March, 2012; G.S.R. 266(E), dated the 30<sup>th</sup> March, 2012; and G.S.R. 277 (E), dated the 31<sup>st</sup> March, 2012; and G.S.R. 820(E), dated the 9<sup>th</sup> November, 2012; G.S.R. 176 (E), dated the 18<sup>th</sup> March, 2013; G.S.R. 535(E), dated the 7<sup>th</sup> August, 2013; G.S.R. 771(E), dated the 11<sup>th</sup> December, 2013; G.S.R. 2(E), dated the 2<sup>nd</sup> January, 2014; G.S.R. 229 (E), dated the 28<sup>th</sup> March, 2014; G.S.R. 232(E), dated the 31<sup>st</sup> March, 2014; G.S.R. 325(E), dated the 07<sup>th</sup> May, 2014, G.S.R. 612, (E), dated the 25<sup>th</sup> August 2014; G.S.R. 789(E), dated the 11<sup>th</sup> November 2014; S.O. 3305(E), dated the 7<sup>th</sup> December, 2015; S.O.4(E), dated the 1<sup>st</sup> January 2016; G.S.R. 35(E), dated the 14<sup>th</sup> January 2016 and lastly amended vide notification G.S.R. 281 (E), dated the 7<sup>th</sup> March, 2016.