

CO-PROCESSING OF WASTE IN CEMENT KILN

Experience of
GRASIM INDUSTRIES LIMITED

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GRASIM INDUSTRIES LIMITED
Green Cementech 2010, Hotel Westin, Hyderabad

OVERVIEW OF THE PRESENTATION

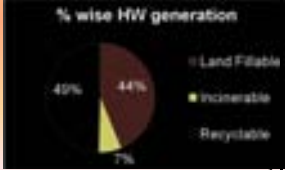
- Ø HW Generation and disposal Status in India
- Ø What is co-processing
- Ø Why co-processing
 - Ø Environmentally sound
 - Ø Technically feasible
 - Ø Economic
- Ø Initiatives taken up by Grasim Industries Limited in the field of co-processing
- Ø Conclusion

PRESENT STATUS OF HAZARDOUS WASTE

Hazardous Waste Generation In India

- ü Hazardous Waste Generating Units: 36,165 nos.
- ü Total Hazardous Waste Generation: 62,32,507 Metric Tonnes.
- ü The category-wise classification of this quantity is as follows:

- Ø Land Fillable – 27,28,326 MTA
- Ø Incinerable - 4,15,794 MTA
- Ø Recyclable - 30,88,387 MTA



3

PRESENT STATUS OF HAZARDOUS WASTE

Hazardous Waste Generation

- Ø Gujarat, Maharashtra and Andhra Pradesh are the top three HW generating States.
- Ø The relative contributions by these States are 28.76 %, 25.16 % and 8.93 % respectively.
- Ø Thereafter, Chhattisgarh (4.74 %), Rajasthan (4.38 %), West Bengal (4.17 %) and Tamil Nadu (4.15 %) are found as major generators of HW.
- Ø These seven States are together generating 80.29 % of country's total HW.
- Ø Maharashtra and Gujarat putting together are generating 62.87 % of country's total incinerable HW. Their individual contributions are 36.75 % and 26.12 % respectively.

4

PRESENT STATUS OF HAZARDOUS WASTE

Highest Hazardous Waste Generating States:



5

PRESENT STATUS OF HAZARDOUS WASTE

Higher HW generating Districts:

In India 369 Districts are generating Hazardous Waste.

HW Generation Range (T/A)	Districts/Regions (Nos.)	Cumulative No. of Districts/ Regions
0-80	119	119
81-2000	111	230
2001-50000	108	338
50001-467100	31	369

6

PRESENT STATUS OF HAZARDOUS WASTE

Higher HW generating Districts:

No. of Districts/Regions	HW generation Range in lakh MTA
3	3.0-4.7
4	2.0-3.0
13	1.0-2.0
11	0.5-1.0

ØBharuch of Gujarat generating 4,67,100 MTA HW

ØAhmedabad of Gujarat generating 3,60,206 MTA HW

Ø Mumbai generating 3,43,129 MTA HW

7

PRESENT STATUS OF HAZARDOUS WASTE

Disposal Status of Hazardous Waste

1. TSDF: 22 No. of TSDF are developed in 10 States with a waste handling capacity of 15,00,568 MTA against the present generation of 27,28,326 MTA.
2. Incinerators: Only 13 No. common incinerators in 6 States apart from 127 individual incinerators in 12 States with a capacity of 3,27,705 MTA against present generation of 4,15,794 MTA.

8

DISADVANTAGES OF PRESENT DISPOSAL METHOD

1. OPEN DUMPING & LAND FILLING:

- Health-Hazard.
- Ground Water and Run-off Pollution
- Nitrous Oxide (N₂O) Is Produced By The Burning Of Garbage In Dumping Yards Under Uncontrolled Conditions.
- It has 179 Times More Global Warming Potential than Co₂

Contd⁹

DISADVANTAGES OF PRESENT DISPOSAL METHOD

- Waste Is Relocated Not Really Destroyed
- Completed Landfill Areas Can Settle And Requires Maintenance Cost
- Requires Proper Planning, Design, And Operation
- Problem Of Space Crunch
- Landfill Gases Generated Could Lead To Various Problems

10

DISADVANTAGES OF PRESENT DISPOSAL METHOD

2. INCINERATION:

- Expensive to Build and Operate
- High Energy Requirement
- Requires Skilled Personnel and Continuous Maintenance
- Generates Gaseous and solid waste

11

The Present Methods Of
Waste Disposal Are
Inadequate And
Environmentally Unsound
While Co-processing Provides
A Safe Alternative

12

CO-PROCESSING

What is Co-Processing?

Co-processing is the use of waste as raw material, as a source of energy, or both to replace natural mineral resources and fossil fuels such as coal, petroleum and gas (energy recovery) in industrial processes, mainly in energy intensive industries (EII) such as cement, lime, steel, glass, and power generation. Waste materials used for Co-processing are referred to as alternative fuels and raw materials (AFR).

13

CO-PROCESSING

Concept of Co-Processing:

Co-processing is a proven sustainable development concept that reduces:

1. Demands on natural resources,
2. Pollution and landfill space,
3. Environmental footprint.

Contd.

CO-PROCESSING

Concept of Co-Processing:

Waste		Substitution	Examples
Energy content (solid, liquid, gas)	Energy recovery	Substitution of fossil energy	Electricity, gas, steam, heat, hydrogen, waste products
Material content (Fe, Pb, Zn, Al, Cu, etc.)	Material recovery	Substitution of raw material	Raw materials, slag, by-products, waste products
Energy content (solid, liquid, gas)	Energy recovery	Substitution of fossil energy	Electricity, gas, steam, heat, hydrogen, waste products
Material content (Fe, Pb, Zn, Al, Cu, etc.)	Material recovery	Substitution of raw material	Raw materials, slag, by-products, waste products

15

CO-PROCESSING

Waste Management Hierarchy

Co-processing is recognized as appropriate option on the Waste Management hierarchy for materials that cannot be recycled.

The diagram shows a pyramid with the following levels from top to bottom: Avoidance, Minimization, Recovery of Materials (Recycle & Reuse), Co-Processing, Incineration, Chem-Physical Pre-Treatment, Landfilling, and Unmanaged Waste. A dashed red line is drawn between Co-Processing and Incineration. Arrows on the left indicate 'Recovery' and 'Recovery' (with a red arrow pointing to Co-Processing). Arrows on the right indicate 'Recovery' and 'Recovery'.

16

WHY CO-PROCESSING

Potential of Co-Processing:

- Ø The global industrial demand for energy is roughly 45% of the total demand.
- Ø Requirements of the energy intensive industries (EII) are 27%.
- Ø Worldwide, wastes suitable for Co-processing have an energy potential of 20% of the fossil fuel energy.
- Ø By 2030, the thermal substitution rate of waste could rise to nearly 30%.
- Ø In the countries of Europe, the available energy potential in waste currently represents nearly 40% of this demand, and this is expected to rise to almost 50% by 2030.
- Ø Roughly 60% of the waste that could be used for Co-processing is biomass and therefore carbon neutral.

17

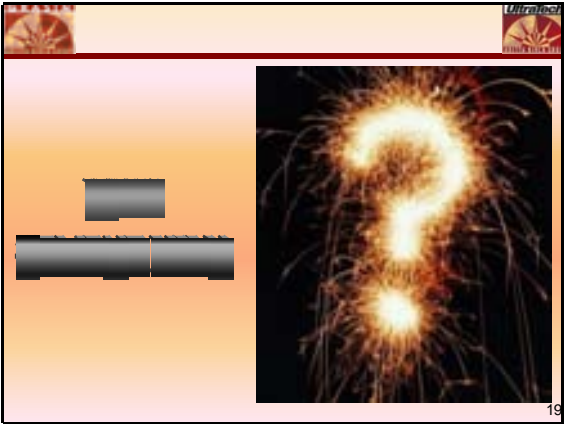
CO-PROCESSING

Emission reduction through Co-Processing:

The diagram shows three scenarios for 'Energy Intensive Industry (EII)'. In the first, 'Waste' is used, resulting in 'Emissions from Waste' (red arrow) and 'Emissions' (blue arrow). In the second, 'Coal' is used, resulting in 'Emissions' (blue arrow). In the third, 'Waste' and 'Coal' are used together, resulting in 'Emissions' (blue arrow). A note states: 'Emissions from waste are significantly lower than from coal'. A red arrow labeled 'Emissions from Waste' points upwards from the first scenario. A blue arrow labeled 'Emissions' points upwards from the second and third scenarios.

Co-processing offers a significant potential for the reduction of greenhouse gas emissions from fossil fuels.

18



TECHNICAL FEASIBILITY

Why cement Kilns are suitable for burning of wastes?

- Ø High flame temperature (2000°C) – ensures complete destruction of harmful pollutants.
- Ø Complete scrubbing of exhaust gas due to countercurrent flow of raw material – resulting in trapping of heavy metals, sulphur and other pollutants within clinker.
- Ø High residence time >5 sec in oxygen rich atmosphere ensures complete destruction of organic compounds found in any waste.
- Ø Complete scrubbing of exhaust gas due to countercurrent flow of raw material- resulting in trapping of heavy metals, sulphur and other pollutants within clinker.

Contd.

TECHNICAL FEASIBILITY

- Ø Inclusion of ashes and residual metals from the wastes within the clinker crystal structure.
- Ø Kiln lines equipped with ESP/Bag filters- ensures negligible particulate emission.
- Ø Intense contact between solid and gas phases- ensures condensation of volatiles, absorbs SO2 and neutralize acid gases.
- Ø Destruction and Removal Efficiency of 99.999%

Wastes - DISPOSALS v/s RECOVERY

Cement Kilns present an opportunity where it is a Recovery Operation. The new terminology is "Valorization"

- Ø The combustible parts of the waste replace fossil fuels.
- Ø The non-combustible parts of the waste replace raw materials – Silica, Iron, etc.
- Ø The energy efficiency in cement kiln is the highest – direct and instant use of energy released; no transmission losses.
- Ø The environmental impact is negligible.

BENEFITS OF CO-PROCESSING

- Ø To conserve natural (non-renewable) resources of energy and materials.
- Ø To reduce emissions of greenhouse gases in order to slow global warming and demonstrate a positive impact on integrated environmental indicators, such as the ecological footprint.
- Ø To reduce the environmental impacts of the extraction (mining or quarrying), transporting, and processing of raw materials.
- Ø To reduce dependence on primary resource markets.
- Ø To save landfill space and reduce the pollution caused by the disposal of waste.
- Ø To destroy waste completely eliminating potential future liabilities.

BENEFITS OF CO-PROCESSING

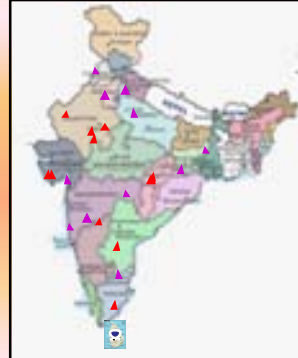
- Ø Cost Saving :
No need for investment in incinerators. Conservation of non renewable fossil .
- Ø Overall lower CO2 and methane emissions by replacement of fossil fuel – Otherwise leading to burning of hazardous wastes in incinerators and fossil fuels in kilns. (A substitution by 50% in EU is equivalent to saving emission from 10 million cars).
- Ø Conservation of raw materials for cement industry as hazardous wastes partially replaces some of the raw materials like silica, iron etc.

INTRODUCTION

GRASIM INDUSTRIES LIMITED (CEMENT DIVISION)

GRASIM & ULTRATECH

- ▲ Integrated Cement Plant
- ▲ Grinding Units
- Bulk Terminals



GRASIM + ULTRATECH

- 11 INTEGRATED CEMENT PLANTS (21 KILNS)
- 11 CEMENT GRINDING UNITS
- TOTAL CAPACITY: 48 MTPA
- 11TH LARGEST CEMENT PRODUCER IN THE WORLD
- 7TH LARGEST CEMENT PRODUCER IN ASIA

Initiatives taken by
GRASIM INDUSTRIES LIMITED
towards
UTILIZATION OF
ALTERNATIVE FUELS .
(a step towards sustainability)

APPROACH

Being a social responsible organization, CSI member and looking in to need of the day, we have following steps towards co-processing

- FOREIGN VISITS BY OUR EXECUTIVES
- SURVEY ON ALTERNATE FUEL AVAILABILITY
- DISCUSSION WITH VENDORS
- DESIGN OF THE SYSTEM
- EXECUTION OF TRIAL RUNS
- FORMATION OF GUIDELINES AND STANDARDS

29

FOREIGN VISITS

More than 40 executives of the company have visited various parts of the world:

- Ø To understand the concept of co-processing.
- Ø To study the system & technology.
- Ø To study the impact on process & final product.
- Ø To analyze the feasibility of Co-processing in Indian scenario.

30

SURVEY ON ALTERNATE FUEL AVAILABILITY

After a detailed survey of the AFR availability, we have following suppliers:

- Ø Paint Industry
- Ø Pharmaceutical Industry
- Ø Automobile Industry
- Ø Textile Industry
- Ø Paper Printing Industry
- Ø Refinery Industry
- Ø Fertilizers Industry
- Ø Farmers
- Ø Municipal Corporation

31

WASTE FEEDING SYSTEMS

- Environment-friendly systems for Handling, pre-processing and conveying of wastes have been installed
- Waste feeding systems are a pre-requisite for use of various waste as fuel in cement Kilns
- Proper feeding systems ensure that feed rate is always kept under control and we can have control on process parameters.

32

DESIGN: ALTERNATIVE FUEL FEEDING SYSTEM

This system has the following advantages:

- Ø Meets a wide variety of waste materials.
- Ø Reduces the need for non-renewable fossil fuels such as coal.
- Ø Simple, compact package.
- Ø Easy integration into existing installations.
- Ø Short pay back period

33

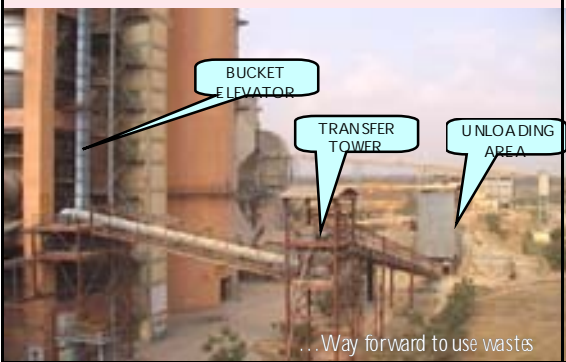
ALTERNATIVE FUEL FEEDING SYSTEM

For the first time in India, we have installed separate alternative fuel feeding system for different type of wastes in Grasim Cement (South Division) in year 2003.



34

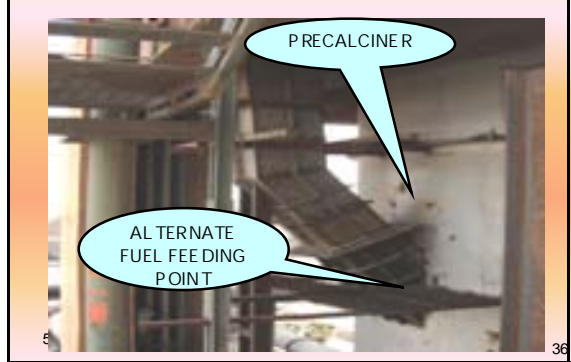
ALTERNATIVE FUEL FEEDING SYSTEM



... Way forward to use wastes

35

ALTERNATIVE FUEL FEEDING SYSTEM



36

ALTERNATIVE FUEL FEEDING SYSTEM

FUEL FEEDING HOPPER

TRANSFER TOWER

Feeding system in Gujarat Plant

ALTERNATIVE FUEL FEEDING SYSTEM

Sicon Conveyor for Solids

Feeding system in Andhra Pradesh Plant

ALTERNATIVE FUEL FEEDING SYSTEM

Solid Waste Storage Shed

ALTERNATIVE FUEL FEEDING SYSTEM

ALTERNATIVE FUEL FEEDING SYSTEM

Solid Waste Storage Shed

Feeding system in Vikram Cement, MP

41

ALTERNATIVE FUEL FEEDING SYSTEM

Feeding system in Vikram Cement, MP

42

ALTERNATIVE FUEL FEEDING SYSTEM




Feeding system in Vikram Cement, MP

43

ALTERNATIVE FUEL FEEDING SYSTEM

Feeding system in Vikram Cement, MP



44

TRIAL RUN

First trial run of co-processing in India at:

- Grasim Rajashree Cements, Malkhed
- During January 2005 (21.01.2005 to 08.02.2005)
- Trials conducted with BASF Sludge
- Successful co-incineration of BASF Sludge in Cement kiln was achieved
- With the sludge up to 1-10% by weight, the pollutant concentration did not exceed the limits of incineration and 3-6% sludge by weight could be hence safely utilized in the cement kiln

45

BASF SLUDGE HANDLING & STORAGE



46

TRIAL RUN FOR CO-INCINERATION OF HAZARDOUS WASTE AT GRASIM SOUTH



TRIAL RUN WITH TUBE CURBS INAUGURATED BY

Shri. J.S. Kamyotra, MS, CPCB &
Dr. V.N. Rayudu, Dy. Director (Labs), TNPCB

47

TRIAL RUN WITH PAINT SLUDGE : INAUGURATION



48

TRIAL RUNS


Trial Run Protocol:

Sr. No.	Period	Operation of Cement Kiln
1	7 Days	Emission monitoring during normal operation of Cement Kiln (Pre-trial run monitoring).
2	7 Days	Emission monitoring of cement kiln during trial run with 5% waste
3	7 Days	Emission monitoring of cement kiln during trial run with 10% waste
4	7 Days	Emission monitoring during normal operation of Cement Kiln (Post-trial run monitoring).


RECOMMENDED PARAMETERS AND FREQUENCY

1	Particulate Matter (PM)	4 samples per day
2	Sulphur dioxide (SO ₂)	4 samples per day
3	Hydrogen chloride (HCl)	4 samples per day
4	Carbon monoxide (CO)	4 samples per day
5	Oxides of Nitrogen (NO _x)	4 samples per day
6	Total Organic Carbon (TOC)	1 sample per day
7	Hydrogen Fluoride (HF)	4 samples per day
8	Hydrocarbons (HC)	4 samples per day
9	Volatile Organic Compounds (VOC)	2 samples per day
10	Poly-aromatic hydrocarbons (PAH)	2 samples per day
11	Metals	1 sample per day
12	Dioxin & Furan	1 sample per day

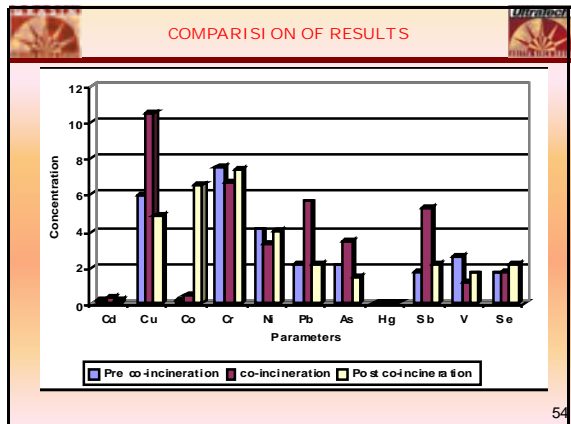
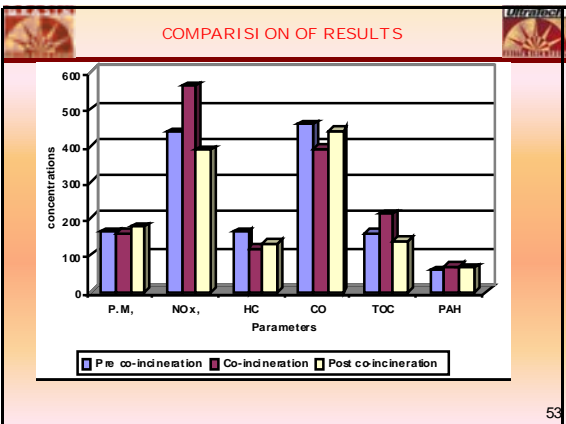
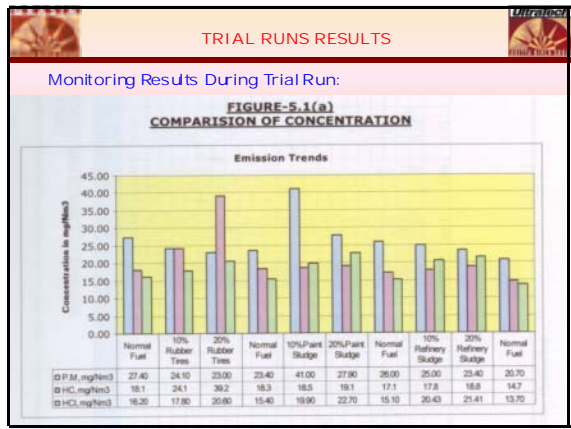
EMISSION MONITORING DURING CO-INCINERATION OF BASF SLUDGE



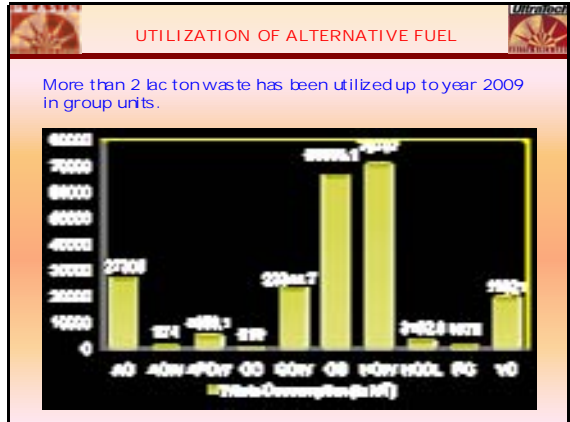
Source Emission Monitoring



AAQ monitoring



STATUS OF TRIAL RUNS				
Sr. No.	Unit Name	Trial Run Details		Waste Approved by CPCB
		Year	Waste	
1	RC	2005	ETP Sludge from BASF	ETP Sludge from BASF
2	GS	2006	Rubber tyres, Paint Sludge & Refinery Sludge	Rubber tyres, Paint Sludge & Refinery Sludge
3	GCW	2009	Organic waste liquid & Organic waste solid	Under Process
4	APQW	2010	Waste mixed liquid & Waste mixed solid	Under Process
5	AC	2010	ETP Sludge & Phosphate Sludge from Automobile Industry	Under Process
6	HOW	2010	SPL	Under Process



ROAD MAP FOR OTHERS

Initiatives taken up by GIL helped to achieve the following:

- Ø Involved in development of protocol for co-processing
- Ø Developing Guidelines for co-processing along with CPCB
- Ø Matching up with international scenario
- Ø Setting an example for others in Cement Companies.
- Ø Being a CSI brand, we maintained our words and works for well being of society and environment

57

PROCEDURE FOR CO-PROCESSING APPROVAL

A. OBTAINING TRIAL RUN PERMISSION:

1. Application duly filled in as per prescribed format (Annexure-7) for trial run to be submitted to concerned State Pollution Control Board (SPCB) with a copy to Central Pollution Control Board (CPCB).
2. In case CPCB has objection, if any, shall communicate the same to the proponent with a copy to SPCB within 30 days.
3. SPCB will accord the approval for trial run within 60 days.
4. Proponent shall communicate the final trial run programme to SPCB & CPCB 15 days in advance.
5. Trial run will be conducted as per CPCB protocol in co-ordination with SPCB and CPCB.

58

PROCEDURE FOR CO-PROCESSING APPROVAL

B. OBTAINING REGULAR PERMISSION:

1. After successful completion of trial run, proponent will submit an application along with trial run details to CPCB through concerned SPCB.
2. CPCB will put up the same to the committee for specific recommendation.
3. The proponent if needed may be called for making a presentation before the committee.
4. On recommendation, CPCB may grant or refuse the permission for regular co-processing within 30 days.

59

PROCEDURE FOR CO-PROCESSING APPROVAL

C. AFTER REGULAR PERMISSION OBTAINED ONCE:

1. Once regular permission for co-processing is granted for any waste, the other cement plants may not require trial run.
2. Proponent will submit the application for regular permission to CPCB through SPCB.
3. CPCB will grant permission within 45 days.

60

WASTES FOR WHICH REGULAR PERMISSION HAS BEEN GRANTED BY CPCB AS ON DATE :

A. HAZARDOUS WASTE:-

1. Paint sludge from automobile sector
2. Petroleum refinery sludge
3. TDI Tar waste
4. ETP Sludge from M/s BASF India Ltd.

B. OTHER WASTES:-

1. Plastic Waste
2. Tyre Chips

61

STEPS FOR UTILIZATION OF ALTERNATIVE FUEL

- Ø Survey of alternative fuel (AF) availability in the area.
- Ø Suitability of AF for co-processing in cement industry.
- Ø Quantity of AF available (for min. 5-10% replacement of coal).
- Ø Obtain trial run permission from concerned SPCB.
- Ø Installation of tentative AF feeding system.
- Ø Conduct trial run with intimation to CPCB.
- Ø Final design of AF feeding system and installation.
- Ø Submit application along with trial run study report to CPCB through SPCB.
- Ø Grant regular permission from CPCB.
- Ø Continuous utilization of AF.

62

STACK EMISSION STANDARDS

Sr. No.	Pollutant	Standard (mg/Nm ³)
1	Particulate Matter	50 / as prescribed by SPCB
2	HCL	Emission during co-processing should not exceed the base line emission i.e during pre-co-processing phase of trial run.
3	SO ₂	
4	CO	
5	Total Organic Carbon	
6	HF	
7	NO _x	
8	Total Dioxin & furans	
9	Cd + Th+ their compounds	
10	Hg & its compounds	
11	Sb+ As+ Pb+ Co+ Cr+ Cu+ Mn + Ni+ V + their compounds	

63

AMBIENT AIR QUALITY STANDARDS

Sr. No.	Pollutant	Time weighted average	Standard
1	SO ₂ (µg/m ³)	Annual 24 Hours	50 80
2	NO _x (µg/m ³)	Annual 24 Hours	40 80
3	PM ₁₀ (µg/m ³)	Annual 24 Hours	60 100
4	PM _{2.5} (µg/m ³)	Annual 24 Hours	40 60
5	Ozone (O ₃) (µg/m ³)	8 Hours 1 Hour	100 180
6	Lead (Pb) (µg/m ³)	Annual 24 Hours	0.5 1.0
7	CO (mg/m ³)	Annual 24 Hours	02 04

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AMBIENT AIR QUALITY STANDARDS

Sr. No.	Pollutant	Time weighted average	Standard
8	Ammonia (NH ₃) (µg/m ³)	Annual 24 Hours	100 400
9	Benzene (C ₆ H ₆) (µg/m ³)	Annual	05
10	Benzo (O) Pyrene (BaP) (ng/m ³)	Annual	01
11	Arsenic (As) (ng/m ³)	Annual	06
12	Nickel (Ni) (ng/m ³)	Annual	20

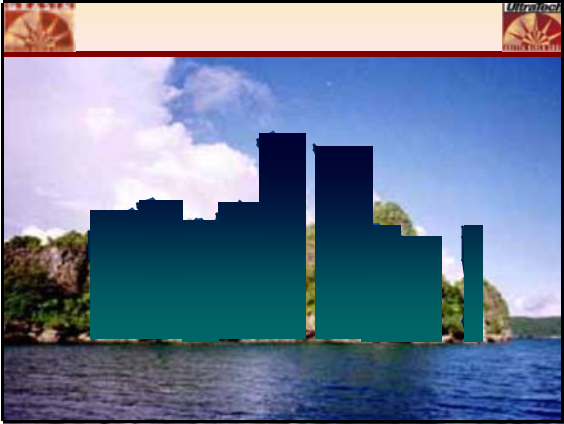
Note: Above Standards are for Industrial, Residential, Rural and other areas except Ecological Sensitive Area

65

MONITORING REQUIREMENTS & RECORDS

- Continuous monitoring of particulate matter.
- Monitoring of Dioxin & furans including other parameters (i.e. CO, TOC, NO_x, HCl, SO₂, HF, Cd, Ti, Hg, As + Pb + Co + Cr + Cu + Mn + Ni + V + their compounds) will be monitored as per CPCB direction.
- Monitoring data shall be submitted to SPCB & CPCB.
- All records will be maintained and submitted to SPCB & CPCB as per Hazardous Waste (M, H & TM) Rules, 2008.

66



Contact details :

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