PROCEDURE FOR CEMENT PLANTS TO GET APPROVAL FOR CO PROCESSING FROM POLLUTION CONTROL BOARD

Confederation of Indian Industry

SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

Disclaimer

This report is part of Shakti Sustainable Energy Foundation (SSEF) and CII – Godrej GBC's effort to assist the Indian industry to achieve increased usage of AFR.

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The report is only an attempt to detail the CPCB procedures for Co-Processing approvals, which will help cement industries to achieve increased usage of AFR in the manufacturing process.

Introduction

CII- Sohrabji Godrej Green Business Centre is working on an initiative in association with CMA (cement manufacturers association) to increase use of "Alternative Fuels & Raw materials (AFR)" in Indian Cement Industry.

As a part of the initiative CII is working on the project "Facilitate Development of Framework to Promote Alternate Fuel Utilization in India" and is partially supported by Shakti Sustainable Energy Foundation (SSEF), a part of Climate Works Foundation.

The main objective of this project is to accelerate AFR initiatives and increasing usage of AFR in the Indian Cement Industry through capacity building, data availability and facilitating exchange of waste by working closely with Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs), thereby reducing environmental impacts of waste generation and raw material usage.

Co-processing is the use of waste as source of energy or raw material, or both to replace natural resources and fossil fuels. Waste materials used for co-processing are referred as alternate fuels and raw materials (AFR).

As per central pollution control board, there are 36,165 numbers of hazardous waste generating industries in India, generating 6.2 Million Tonnes of hazardous wastes every year.

As an energy intensive industry, especially thermal energy, cement production has an excellent opportunity to consume hazardous waste as AFR. Cement kiln being operated with high temperature of around 1400'C, destroy the hazardous waste and there will be no residue left, still the inorganic content get fixed with the clinker.

The dual factor of resource conservation and reduced carbon emissions make a strong case for considering co-processing hazardous waste in cement kiln as a better alternative for hazardous wastes disposal.

In order to promote AFR utilization in Indian cement industry, Confederation of Indian industry in partnership with Shakti sustainable energy foundation, develop this report, which will act as a catalyst for cement industries to get approval for co- processing from CPCB and SPCB in India. The base document for this write up is CPCB Guidelines on Co-processing in Cement Industry released on Feb 2010.

Central pollution control board has laid down procedures[1] to be followed for obtaining permission to co process waste in cement kiln. This report is a brief of CPCB procedures to be followed while co-processing hazardous waste in cement kiln.

[1] Guidelines on Co-processing in Cement/Power/Steel Industry February 2010
http://www.cpcb.nic.in/divisionsofheadoffice/hwmd/Latest_51_Latest_51_GUIDELINES-ON_CO-ProcessinginCement.pdf

STEP BY STEP PROCESS FOR CEMENT PLANTS TO GET APPROVAL FOR CO- PROCESSING

The procedure to be followed for co-processing hazardous wastes has to conform to the Rules and Regulations as provided for under HW (MHTM) Rules 2008, apart from provisions in various other related Acts and Rules.

As per Rule 11 of HW (MHTM), CPCB has been empowered to grant approval for utilization of hazardous wastes as a supplementary resource or for energy recovery, or after processing. This authorization requirement is also applicable for cement co-processing.

CPCB has laid down guidelines and procedure on co-processing of hazardous combustible waste in cement kilns. Wastes with the potential for co-processing can only be used after conducting trial run study as per the guidelines. Once regular permission for co-processing is granted for any waste, the other cement plants may not be required to conduct the trial run again.

The steps to follow for co processing is as follows and we discuss every topic in details

1. Suitability of substance for co-processing
2. Operating condition
3. Trial run
4. Environmental impacts and rules for emissions
5. Quality assurance of the end product
6. Regular usage

SUITABILITY OF SUBSTANCE FOR CO-PROCESSING

1. The material can be either from waste generators or TSDF.
2. Material depending on the characteristics can be utilized directly from generator or after pre processing.
3. The material should undergo more complete treatment comparing to other possible technologies, without affecting the product, environment and equipment associated with it.
4. Any material which used in the process should give either calorific value from the organic part or material value from the mineral part.
5. The waste material or method should comply with AFR policy of the company.
6. Waste material which satisfies any one of the following can be used in cement plant for co processing

- If GCV of the material should be > 2500 Kcal/kg and raw material = 0%
- If ash content > 50% and raw materials in ash > 80%
- If raw material > 0% and GCV of the balance > 2500 Kcal/kg
- Solve the local waste management problem

7. Material which does not satisfy the four criteria, listed above can be used in cement plant, if the material used does not have adverse effects quality of final product clinker. Example obsolete pesticides, PCB or out-dated pharmaceutical products, which may not have material or energy. For this type of material individual case by case consultation has to be done by cement plant with pollution control board.
8. This is the list of material which has undergone trial run successfully and 22 cement manufacturing units in various states, already started co processing of these few categories of waste with approval of CPCB.

❖ Hazardous waste

- Paint Sludge from automobile sector
- Petroleum refining sludge
- TDI tar waste
- ETP sludge from M/s BASF India Ltd

❖ Other Wastes

- Plastic Wastes
- Tyre chips

9. This is the list of material which cannot be utilized in cement plant for co processing, till otherwise proved/evidenced for, due to environment, health, safety and operation concern.
    - Biomedical waste
    - Asbestos containing waste.
    - Electronic scrap.
    - Entire batteries.
    - Explosives.
    - Corrosives.
    - Mineral acid wastes.
    - Radioactive Wastes.
    - Unsorted municipal garbage
10. For using the waste material in cement kiln, it should posses some characteristics listed in the following table; this is to ensure that the usage of the material will not cause any adverse effects on the product, method or environment, or in large co processing.

If hazardous waste used for material recovery

Parameter	Limit
Volatile organic Hydrocarbon	< 5000 ppm
Total organic Carbon (TOC)	< 1000 ppm
CaO + SiO2 + A1203 + Fe203 + SO3 (In Ash)	> 80 %
Chloride	< 1.5 %
Sulphur	< 1.5 %
PCB/PCT (ppm)	< 5.0
Heavy Metals (ppm) Hg Cd+Tl+Hg As+Co+Ni+Se+Te+Sb+Cr+Sn+Pb+V	 < 10 < 100 < 10,000

If hazardous waste used as energy recovery

Parameter	Limit
Ash -Liquid -Solid	 < 5% < 20%
Chloride	< 1.5 %
Halogens (F+Br+I)	< 1.0 %
Sulphur	< 1.5 %
PCB/PCT (ppm)	< 50
Heavy Metals (ppm) Hg Cd+Tl+Hg As+Co+Ni+Se+Te+Sb+Cr+Sn+Pb+V	 < 10 < 100 < 25,00
pH	4 to 12
Viscosity (cSt) for Liquid	< 100
Flash point (Deg Centigrade) (for Liquid)	> 60

OPERATING CONDITION

Cement plant which utilize the material for co processing should ensure that the gas released from the process should not have adverse effects on the environment. The operator of the co processing unit should be trained and skilled enough to understand and manage hazardous waste in an environmentally sound manner.

Feeding of alternative raw materials containing volatile components to the kiln along with normal raw meal feeding has to be avoided unless it has been demonstrated by trial runs in the kiln that there is no undesired emission from the stack.

The main requirement of the co processing unit is the temperature, which has to be maintained 950'c for 2 sec minimum even in most unfavorable condition and in case of material with more than 1 % halogenated organic substance (expressed as chlorine), the temperature has to be raised to 1100'C.

Waste feeding through automatic system has to be ensured by cement plant and it should stop the feeding when any one of the cases arises

1. At start up (until temperature reaches 950'C or 1100'C)
2. Whenever the temperature (i.e. 950'c or 1100'c) is not maintained
3. Whenever emission values exceeds limit

TRIAL RUN

1. For trial run of hazardous waste in cement plant, a duly filled application form has to be submitted to the state PCB/PCC with necessary details and documents, where the hazardous waste is proposed to be utilized. A copy of the same has to be sent to CPCB.

2. Application for conducting trial run has been attached as annexure 1.

3. If CPCB has any objections the same will be communicated to the applicant along with a copy to SPCB within 30 days of the receipt of application.

4. Approval for co processing trial run will be given by SPCB/PCC after the verification of application details, SPCB will grant permission for trial run within 60 days from the date of application. The approval can be taken as deemed approval of CPCB.

5. The cement plant, which got approval for trial run should inform CPCB, about the date of the trial run 15 days in advance.

6. A detailed protocol to be followed while conducting trial run in cement plant for co processing hazardous waste has been attached as annexure 2.

7. The continuous measurement of particulate matter emission has to be carried out while conducting trial run.

8. The emission data shall be submitted to CPCB and the concerned SPCB/PCC.

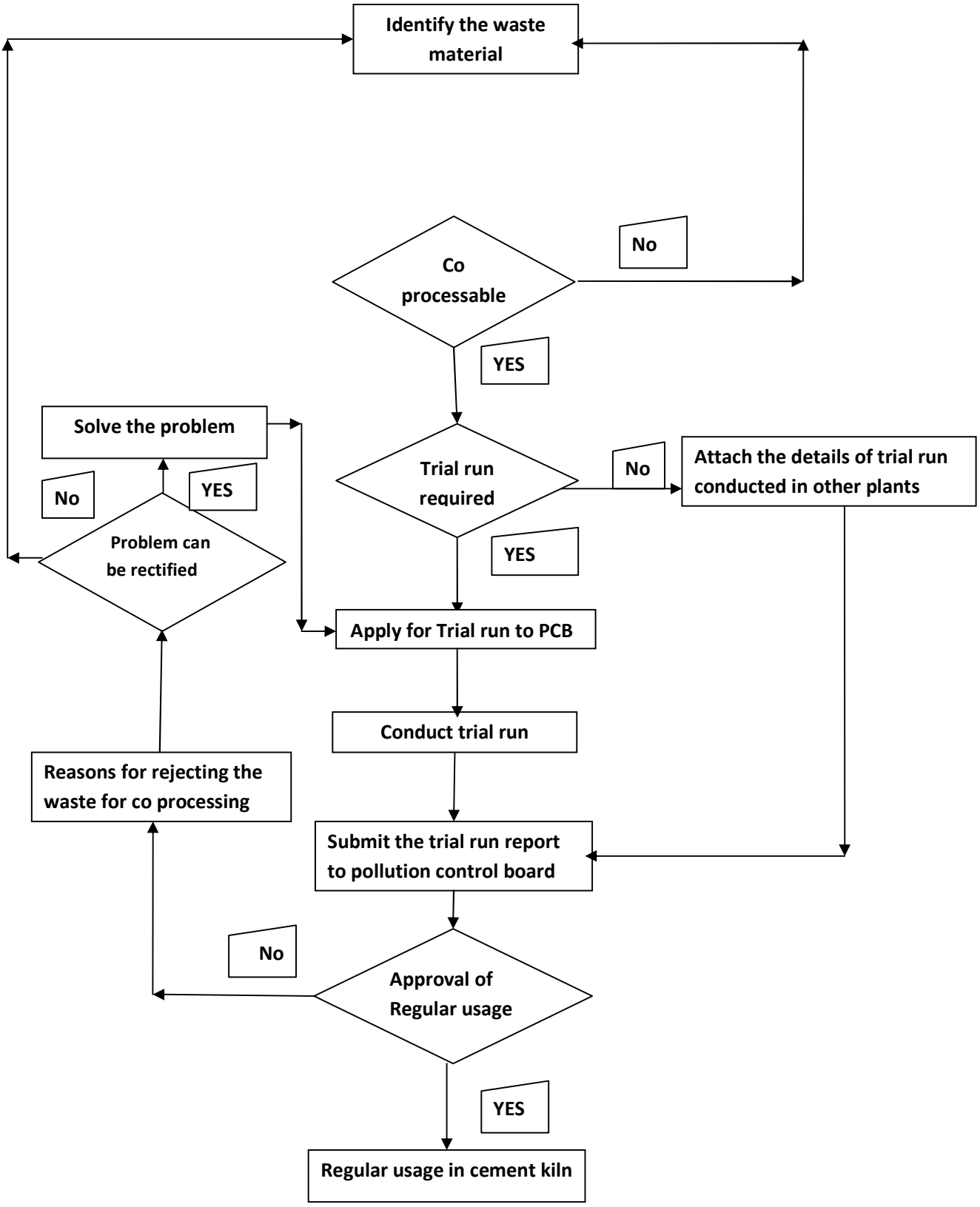
9. Emission during co processing should not exceed the baseline emissions; the emission standards for particulate matter prescribed for cement kiln by the concerned State Pollution Control Board shall be applicable during co-processing.

10. For non-hazardous substances like plastic waste, tyre chips etc. similar procedure may be followed both for trail run and regular permission.

REGULAR USAGE

1. The cement plant which completes the successful trial run on a particular material, can apply regular permission for co processing to CPCB through concerned SPCB/PCC.
2. The application should be on prescribed format along with details of the trail run conducted.
3. CPCB on receipt of the application will put up to a committee for its recommendation.
4. The applicant, cement plant may be called for making presentation before the committee.
5. On recommendations of the committee, CPCB may grant or refuse for regular co processing within 30 days.
6. The permission granted will consists of percentage of hazardous waste to be co processed along with characteristics.
7. For non-hazardous substances like plastic waste, tyre chips etc. similar procedure may be followed both for trail run and regular permission.

FLOWCHART FOR CO PROCESSING APPROVAL FROM POLLUTION CONTROL BOARD



Forms in Hazardous waste management rules

Form No	Details
Form 1	Application for authorization/renewal of authorization for collection/ reception/ treatment/ transport/storage/ disposal of hazardous waste.
Form 2	Authorization for occupiers, re-processors, reusers and operators of a facility for collection, reception, treatment, storage, transport, and disposa1 of hazardous wastes.
Form 3	Format for maintaining records of hazardous wastes by the ccupier/operator of facility.
Form 4	Annual returns pertaining to the generation of Hazardous Wastes.
Form 5	Application for grant/renewal of registration of industrial units processing environmentally sound management facilities for reprocessing /recycling
Form 6	Annual returns & records on recyclable Hazardous Wastes by recyclers.
Form 7	Application for Import or Export of Hazardous Wastes for reprocessing / recycling/reuse.
Form 8	Application for transboundary movement of hazardous wastes.
Form 9	Transboundary Movement – Movement Document.
Form 10	Records of hazardous wastes imported and exported.
Form 11	Transport Emergency (TREM) Card.
Form 12	Marking of Hazardous Waste Containers.
Form 13	Hazardous Waste Manifest.
Form 14	Accident reporting & follow up.
Form 15	Application for Filing Appeal Against the order passed by CPCB/SPCB/PCC.

ANNEXURE-1

FORMAT FOR OBTAINING APPROVAL FROM THE CENTRAL POLLUTION CONTROL BOARD UNDER THE RULE 11 OF THE HAZARDOUS WASTES (MANAGEMENT, HANDLING AND TRANSBOUNDARY MOVEMENT) RULES, 2008

	Name & Address of the Unit:
1.1	Contact Person and phone number:
1.2	Products to be manufactured and quantity (MT/Day):
2	***Details of source of hazardous waste to be utilized***
2.1	Name & address of hazardous waste generating industry:
2.2	Name of the hazardous wastes including category as per the Schedule I:
2.3	Generation (MTA) of hazardous waste proposed for utilization:
2.4	Detailed characteristics of hazardous waste proposed for utilization:
2.5	Process flow diagram of hazardous waste generating unit:
3	***Details of utilization of hazardous wastes***
3.1	Process Flow Diagram:
3.2	Please attach copy of air consent, water consent and authorization:
3.3	Base line data including characteristics pertaining to air emissions, waste water generation and other solid wastes including hazardous waste being generated:
3.4	Material Balance without utilizing hazardous wastes:
3.5	Name and category of hazardous waste including quantity proposed to be to be utilized:
3.6	Quantity of coal to be replaced by co-processing
3.7	Material balance with utilization of hazardous wastes:
3.8	Chemistry involved with and without utilization of hazardous wastes:
3.9	Data including characteristics pertaining to air emissions, waste water generation and other solid wastes including hazardous waste being generated during utilization of hazardous wastes, if available:
3.10	Details of findings of laboratory/ pilot scale study, international practice etc.

ANNEXURE -2

PROTOCOL OF TRIAL RUN FOR CO-PROCESSING OF HAZARDOUS WASTE IN CEMENT KILN

Part – A

Requirement of testing for hazardous waste

At least one representative sample shall be collected (for the whole trial period) and analysed for the following.

- Calorific value of the waste (KCal / Kg) : Gross and net
- Proximate analysis (Moisture content, Ash content, Volatile matter content, Fixed carbon content)
- Ultimate analysis (Carbon content, Hydrogen content, Sulphur content, Nitrogen content, Oxygen content)
- Characteristics of the waste (Chlorine, fluorine and metal content lead, zinc, tin, cadmium, arsenic, mercury, chromium, cobalt, nickel, thallium, copper, vanadium, antimony, manganese, selenium, Iron)
- Total Organic Carbon (TOC)
- TCLP Test
- Total Petroleum Hydrocarbon
- Organo - chlorine compounds
- VOCs and Semi-VOCs
- Poly Chloro Biphenyls (PCBs)
- Poly Chloro Phenols (PCPs)
- Viscosity (for Liquid Hazardous Wastes)
- Water content (for Liquid Hazardous Wastes)
- Solid content (for Liquid Hazardous Wastes)

Requirement of testing for conventional fuel

At least one representative sample shall be collected (for the whole trial period) and analysed for the following.

- Calorific value of sludge (KCal / Kg) : Gross and net
- Proximate analysis (Moisture content, Ash content, Volatile matter content, Fixed carbon content)
- Ultimate analysis (Carbon content, Hydrogen content, Sulphur content, Nitrogen content, Oxygen content)

- Characteristics of the fuel (Chlorine, fluorine and metal content lead, zinc, tin, cadmium, arsenic, mercury, chromium, cobalt, nickel, thallium, Copper, vanadium, antimony, manganese, selenium, Iron)
- Total Organic Carbon (TOC)

Emission monitoring Program at Cement Plant

S. No.	Date and duration	Operation of Cement Kiln
1.	One Day	Emission monitoring during normal operation of cement kiln
2.	Three Days	Emission monitoring during trial run of cement kiln at a fixed percentage of hazardous waste
3.	One Day	Emission monitoring during normal operation of cement kiln

Detailed emission monitoring schedule to be followed before, after and during trial run of co-processing of hazardous waste in cement kiln

S.No	Parameter	Frequency
1.	Particulates	4 samples / day
2.	SO_2	4 samples / day
3.	HCl	4 samples / day
4.	CO	4 samples / day
5.	NOx	4 samples / day
6.	Total Organic Carbon	1 sample / day
7.	HF	4 samples / day
8.	Hydrocarbons	2 samples / day
9.	Opacity (continuous dust emission monitoring)	Continuous
10.	VOC	2 samples / day
11.	PAH	2 samples /day
12.	Metals (both particulate and vapour phase) Cd, Th, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Zn, Sn, Se	1 sample / day

Ambient Air Quality Monitoring

SPM, RSPM, SO_2, NOx Monitoring at three locations (one in upwind and two in down wind direction). The monitoring shall be carried out 24 hourly basis during whole trial period.

Clinker Analysis

Daily one representative sample shall be collected and analyzed for the following.

- Chlorine, Fluorine, Sulphur, Cyanide
- Metals i.e. Cd, Th, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, V, Zn, Sn, Se
- Leachability study of clinker (produced before trial run and during trial run) for fluoride, cyanide etc. including metals i.e. Cd, Th, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, V, Zn, Sn, Se with proper conclusion
- Total Organic Carbon (TOC)

Raw Material Analysis

At least one representative sample shall be collected (for the whole trial period) and analyzed for the following.

- Fluorides as F, Sulphates as SO_4, Aluminium as Al_2O_3, Silica as SiO_2, Iron as Fe_2O_3
- Metals i.e. Cd, Th, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, V, Zn, Sn, Se
- Total Organic Carbon (TOC)

Material Balance

A detailed report with complete interpretation including material balance for heavy metals and other important parameters shall be prepared.

Part – B

Information required to be collected during the trial run by cement industry

1. Coloured computer print of process chart of different sections from Central Control Room
2. Sketch showing stack duct connections and port hole with dimensions
3. Note on hazardous waste handling and feeding mechanism i.e. from arrival of waste from hazardous waste generator to kiln burner / pyro
4. Process flow diagram for co-incineration of hazardous waste in cement kiln
5. Note on difficulties faced in grinding the hazardous waste with suggestions for improvement
6. Distance between hazardous waste generator and cement plant.
7. Copy of Safety manual for transportation of hazardous waste and other related documents, if any
8. Process flow diagram for cement manufacturing (Limestone stacking to packing plant)
9. Layout plan
10. Pyro drawings (with marking of temp.)
11. Copy of consent order (showing prescribed standards)
12. Stack emission and ambient air quality data of previous month
13. Meteorology data (wind speed & direction, temp., rainfall) of trial period
14. Wind rose diagram on daily basis
15. Copy of daily log sheets of Kiln, clinker cooler and Coal mill for the entire period of trial run.
16. Sketch showing locations of ambient air quality stations and soil sampling points w.r.t. cement plant (with marking of North, South direction)
17. Photographs of trial run in CD
18. Hourly data of continuous emission monitoring system for entire period of trial run (along with trend chart) for kiln section
19. Note on manufacturing process of cement
20. Kiln stoppages with date, time, duration and reason
21. Coal mill stoppages with date, time, duration and reason
22. Kiln ESP stoppages with date, time, duration and reason

Design (Optimum) Values

- Design raw mill out put in TPH
- Design kiln feed in TPH
- Design clinker production in TPH
- Design coal consumption in kiln burner in TPH
- Design coal consumption in pyro in TPH
- Design temp. of pyro (max.)
- Design temp. of Kiln (burning zone)
- Average coal mill output in TPH in normal operation
- Average running hours of coal mill in normal operation
- Design coal mill out put in TPH
- Gas residence time in kiln
- Gas residence time in pre-heater

Production data for entire trial period

- Raw mill output in TPH
- Kiln feed in TPH (with trend chart)
- Clinker production in TPH (Hourly average)
- Coal consumption in TPH in kiln (hourly average)
- Coal consumption in TPH in pyro (hourly average)
- hazardous waste consumption in TPH (Hourly average)
- Temperature of pyroclone 6^{th} stage maximum (hourly average)
- Temperature of kiln maximum at burning zone (hourly)
- Coal mill out put in TPH (hourly)

Chemical analysis of clinker (hourly sample homogenized on daily basis) for entire trial period

- Loss on Ignition (LOI) %
- Silica (SiO_2) %
- Iron Oxide (Fe_2O_3) %
- Aluminium Oxide (Al_2O_3) %
- Calcium Oxide (CaO) %
- Magnesium Oxide (MgO) %
- Sulphate (SO_3) %
- Free Lime (CaO) %
- Total Alkalies
- Na_2O%
- K_2O%

Minor Constituents

- P2O5%
- Cl%

Physical tests of cement (hourly sample homogenized on daily basis) for entire trial period

- Blain (m2 / kg)
- Setting Time (minutes)
  - Initial setting time
  - Final setting time
- Soundness
  - Le – Chat (mm)
  - Autoclave (%)
- Compressive Strength (MPa)
  - 3days
  - 7days
  - 28 days

Productivity Parameters during Trial Run

- **Kiln Output Rate**
  - TPD
  - TPH
- **Energy Consumption**
  - Electrical, kWh/t Clinker
  - Thermal, %
  - Kcal/kg Clinker
  - Coal Mill Power, kWh/t Coal
- **Kiln Parameters Observed During the Period of Trial**
  - Kiln Speed, rpm
  - Kiln Torque, Amp.
  - Kiln Feed, tph
  - BE Temperature, ^{o}C
  - BZ Temperature, ^{o}C
- **PH Outlet (P-Line)**
  - Gas Temperature, ^{o}C
  - Draft, mmWG
  - O_2, %
  - CO, %

- **PH Outlet (K-Line)**
  - Gas Temperature, ^{o}C
  - Draft, mmWG
  - O_2, %
  - CO, %

- Secondary Air temperature, ^{o}C
- Tertiary Air temperature, ^{o}C
- Moisture in Coal as fed, %
- Fine Coal residue, % on 90µ
- Litre Weight, g/l

- **Information related to hazardous waste generator**
  - About the company
  - Address of the company
  - Name of the head of the company
  - Year in which plant was commissioned
  - List of the products manufactured with capacity and production data
  - Manufacturing process of each product
  - Process flow chart of each product (including waste generation)
  - Waste water treatment plant details including capacity of tanks, retention time, characteristics of waste water, efficiency of ETP, sludge generation, process description of ETP, flow chart of ETP etc / Details of the process by which hazardous waste is generated.
  - Quantity of hazardous waste generation, physical state of hazardous waste, present method of storage and disposal, cost of disposal.
  - Copy of air, water consent and authorization for hazardous waste disposal

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