
Energy
Industry
Resources
Society
Economy
Environment
Health & Safety
Risk
Compliance
Sustainability
ERM

Quality Assurance - AFR - Monitoring & Measurement

The business of sustainability

ERM

About ERM

About ERM(global)

The world's leading provider of environmental, health, safety, risk, social consulting and sustainability related services

5,000+
people
and offices in
countries and
territories
40

We work for

60% of

the **global Fortune 500 companies** in the past 3 years

We have worked in over

160

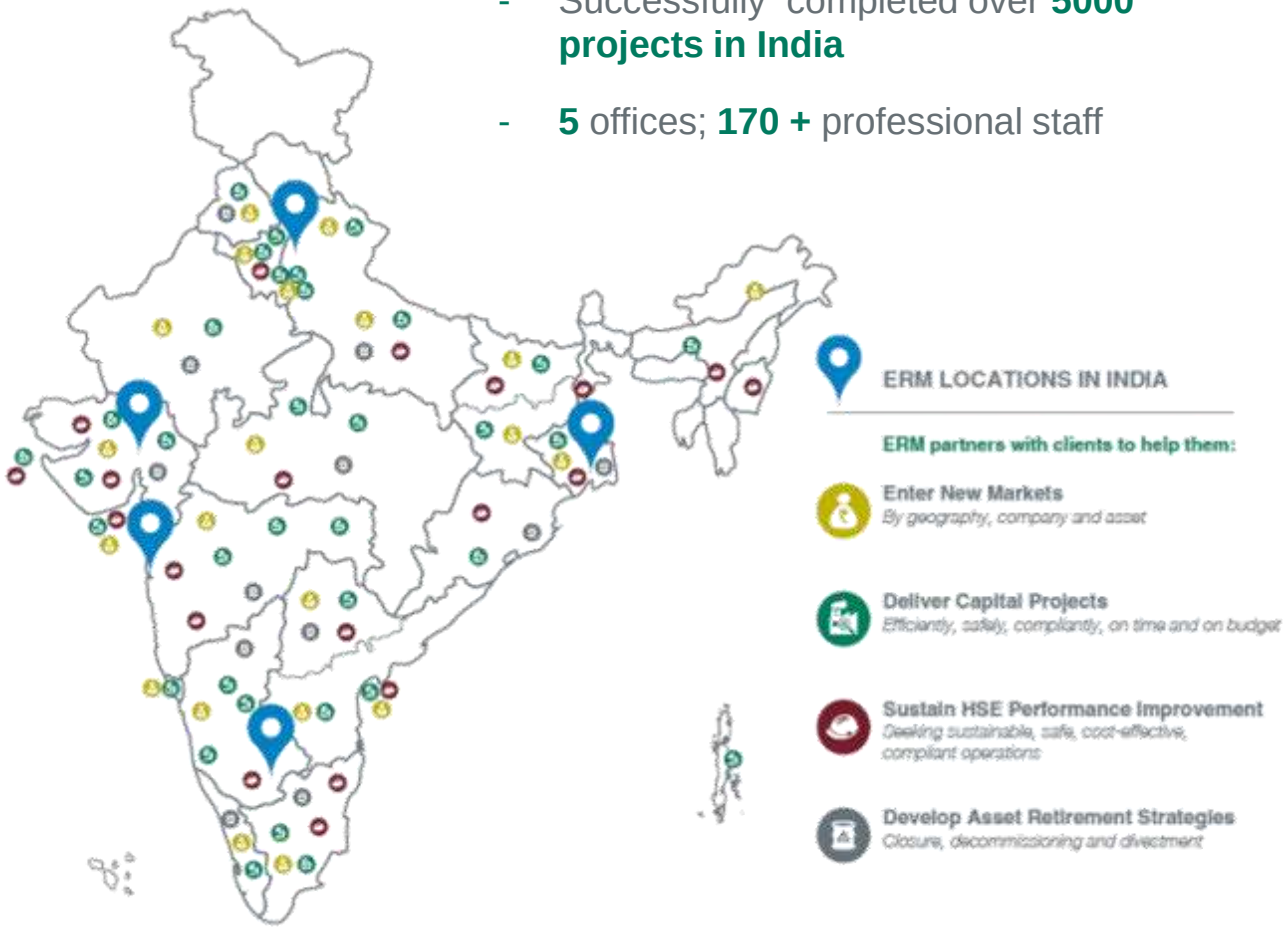
countries in the past 3 years

The business of sustainability

ERM

ERM in India

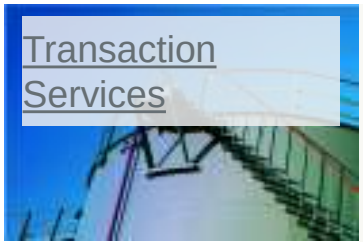
- Leading Provider of Environmental, Social, Safety, Risk and Sustainability Solutions
- Successfully completed over **5000 projects in India**
- **5** offices; **170 +** professional staff



ERM

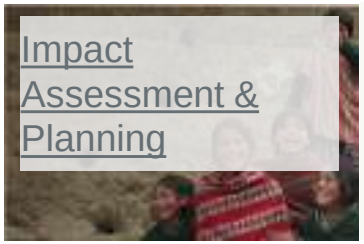
ERM Services : *Creating Value. Managing Risk. Building Reputation*

Working together to meet your environmental, health and safety, risk and social needs



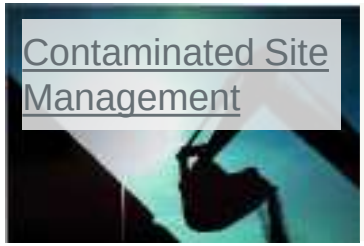
Transaction Services

Providing critical, time-sensitive advice on the sustainability risks, liabilities and opportunities associated with investment decisions



Impact Assessment & Planning

Helping to deliver sustainable projects by managing environmental, social and health impacts



Contaminated Site Management

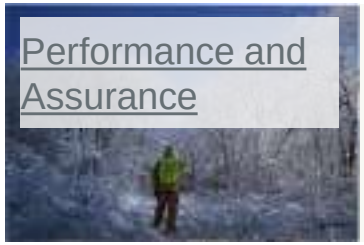
Creating strategies and implementing projects to support clients through the life cycle of contaminated site mitigation from initial investigations and risk assessments to remediation

Air Quality & Climate Change

Helping clients to understand and manage the full cycle of effects their operations can have on the atmospheric environment including regulatory support to ensure long term, successful compliance

Risk

Quantifying and managing the safety risks associated with hazardous installations and processes in oil and gas



Performance and Assurance

Helping corporations reach their environmental, health and safety performance potential

Information Solutions

Helping clients meet the information needs of diverse audiences – internally and outside the company

Corporate Sustainability Strategy

Helping address the overarching strategy and tactics for corporate development and operational excellence within an organisation


At ERM, we are shaping a sustainable future
with the world’s leading organizations.

Quality Assurance & Control

Quality Assurance & Control

The product meets the specification.

Compliance to Environmental regulation.

No adverse impact on the plant. (Equipment and Productivity)

Identify and Mitigate Health and Safety risk.

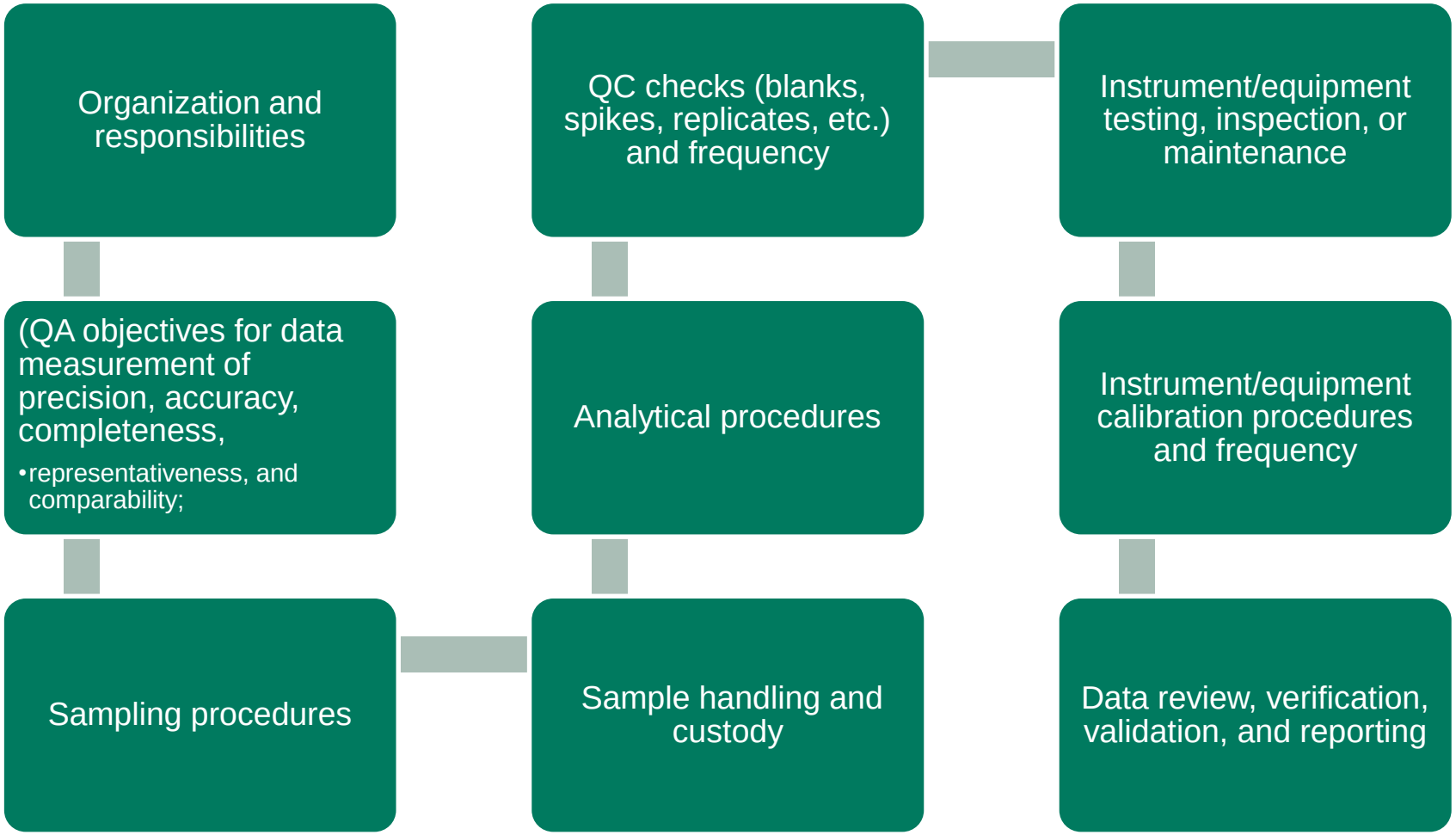
Ensure all the data and decisions from the data are

- Technically sound.
- Statistically valid.
- Properly documented.

QA Plan- Monitoring & Testing

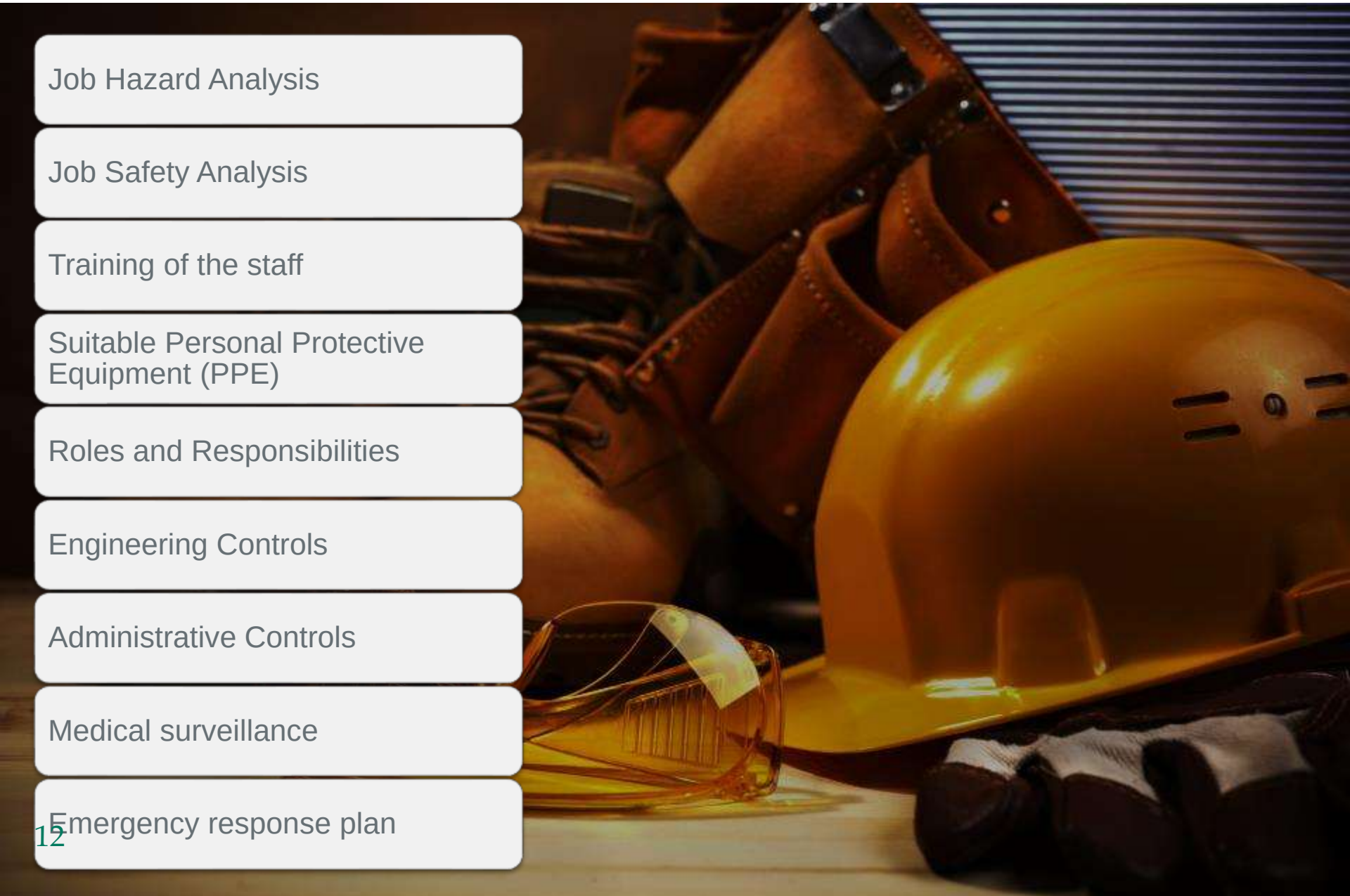
- ✓ QA plan should be prepared to help ensure that the **monitoring, sampling**, and **analytical data** meet specific objectives for ***precision, accuracy***, and ***completeness*** and to ***provide the framework*** for evaluating data quality.
- ✓ The plan should cover **waste streams** ,**product** materials handled at the facility and should also include the HSE plan with detailed instructions covering the What, Who, How and When.

QA plan- Content



Health, Risk and Safety Plan, ISO 17025

Health and Safety



- Job Hazard Analysis
- Job Safety Analysis
- Training of the staff
- Suitable Personal Protective Equipment (PPE)
- Roles and Responsibilities
- Engineering Controls
- Administrative Controls
- Medical surveillance
- Emergency response plan

Trial Burn- Introduction

Trial burn is the process of validating the use of waste as a alternative fuel such that it doesn't have adverse impact on the environment, product and the production process.

- CPCB have a set a clear guidelines for emission during the trial burn.
- Based on the outcome of the trial burn the approval is sanctioned to the industry for use of a specific type of waste.
- It is important to ensure a accurate data is obtained during the trial burn to ensure environmental compliance and the impact of the product.

Trial Burn- Objective

- To validate the destruction removal efficiency (DRE) of the waste in the cement kiln is over 99.9%.
- The impact of the co processing on the environmental emission.
- The impact on the product quality.
- The impact on the process stability.
- To develop a operating protocol for various types of waste to ensure safety, legal compliance and minimization of the preparation and handling cost.

Applicable laws

- Hazardous Waste (Management; Handling and Transboundary Movement) 2016.
- Public Liability Insurance Act, 1991
- Water Act 1974
- Air Act 1981

Preparation Before Trial Run

Study of Base Line Emission Report if available

Technical Assessment: AFR Potential of Plant

Risk Assessment Plan for each AFR Stream on the basis of MSDS.

Team formation for various activities during Trial Run which include following personnel:

- AFR Department (Plant & H.O.)
- Safety Department (Plant)
- Security Department (Plant)
- Environment Department (Plant)
- Process Department (Plant)
- Laboratory (Plant)
- HR (Plant)
- E&I (Plant)

Preparation Before & During Trial Run

Analyzing the Capacity of the feeding system

- Calculate weight of Material can be transported to AFR Feeding Platform
- Cycle time for each trip
- Weight of Material can be fed in connecting chute based on drive speed.

Important activities entire Period of Trial Burn

- Regular Sampling
- Hourly process data
- Constant feed rate of AFR
- Photographs
- Documentation

Parameters to be tested in the waste

- 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)*
- Characteristic of waste *(Chlorine, Fluorine and metal content lead, zinc, tin, cadmium, arsenic, mercury, cobalt, nickel, thallium, copper, vanadium, antimony, chromium, manganese, selenium, iron)*
- Total Organic Carbon
- Total Petroleum Hydrocarbon
- Organo - chloride compounds
- VOC's and Semi VOCs
- TCLP Test
- Poly Chloro Biphenyl (PCBs)
- Poly Chloro Phenols (PCPs)
- Viscosity (for hazardous waste)
- Water content (for Liquid Hazardous Waste)
- Solid Content (for Liquid Hazardous waste)

Parameters to be tested in conventional fuel

- Calorific Value: Gross & 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)
- Characteristic of fuel (Chlorine, Fluorine and metal content lead, zinc, tin, cadmium, arsenic, mercury, cobalt, nickel, thallium, copper, vanadium, antimony, chromium, manganese, selenium, iron)
- Total Organic Carbon

Methodology - Emission

Sr. No.	Parameter	Method	Instrumentation
1	PM	USEPA 17	By using iso-kinetic thimble sampling train
2	Velocity	USEPA 2	By S type pitot tube
3	Carbon Dioxide, Oxygen, Molecular Weight	USEPA 3B	By Orset apparatus/ online gas analyser
4	Moisture	USEPA 4	Flue gas sampling kit
5	Heavy Metals	USEPA 29	By using isokinetic thimble sampling train /ICPMS/AAS
6	Mercury	USEPA 29/101 A	By using isokinetic thimble sampling train /Mercury analyzer
7	Sulfur Dioxide (SO_2)	USEPA 6B	Flue gas sampling kit/ NDIR based online analyser.
8	Nitrogen Oxides (CO & NO_X)	USEPA 7E	By Horiba PG 250 online analyzer
9	HCl, HF, HBr	USEPA 26	Flue gas sampling kit
10	Volatile Organic Compounds (VOC)	USEPA 25A	PCF Electronica HOT FID model 2001 – TOC Analyser, Italy
11	Dioxins and Furans	USEPA 23A / 8290A	Multicomponent Dioxin sampling kit
12	Benzene	N1501	Flue gas sampling kit
13	Ammonia	Indophenol Method	Flue gas sampling kit
14	PAH	CEPA Method 429	PAH Sampling kit/GCMS

Methodology- Raw material, Waste, Product

Sr. No.	Parameter	Method	Instrumentation
1	Heavy Metals	USEPA 3051A/3052	Microwave digestion & AAS/ICP MS
2	Mercury	USEPA 3051A/3052	Microwave digestion & Mercury analyzer/ICP MS
3	Ultimate Analysis (Carbon, Hydrogen, Sulfur, Nitrogen, Oxygen)	By CHNSO Analyzer	CHNSO Analyzer
4	Proximate Analysis (Moisture, Ash, VM, Fixed carbon)	By Thermo gravimetric analyzer	Thermo gravimetric analyzer
5	Total Organic Carbon	TOC Analyzer/ Walkley-Black Method	Instrumentation/ Titrimetric Analysis
6	Calorific Value (Gross)	By Bomb Calorimeter	Bomb Calorimeter
7	TCLP (For Heavy Metal)	As per EPA 1311	AAS/ICP-OES
8	Total Petroleum Hydrocarbon	USEPA 8015B	GC FID
9	Organ chlorine/Phosphorous pesticides	USEPA 8270 C	GCMS/GCECD
10	VOC & SVOCs	USEPA 8260B, USEPA 8270C & 8270D	GCMS/GCFID
11	PCBs	USEPA 8082A	GCMS/GCECD
12	PCPs	USEPA 8270C	GCMS/GCECD

Sampling Equipment

- Stack Monitoring Kit
- Flue gas analyzer
- Online TOC Analyzer (Hot FID)
- Dioxin/Furan sampling kit
- High Volume Sampler
- Respirable Dust Sampler (PM 10)
- VOC sampling Kit
- Portable Weather Monitoring Station
- Portable Wind Anemometer
- Indoor Air Quality monitor
- Low volume & Personal Air sampler
- Noise Level Meter
- Carbon Monoxide Monitor

Laboratory Equipment

- ICP – MS
- ICP- OES
- TCLP apparatus – USEPA approved
- LCMS-MS
- Atomic Absorption Spectrometer
- Mercury Analyzer
- Microwave Digester
- GC – MS / MS
- GCMS with Purge & Trap and Head Space attachment
- HRGC MS
- GCMS with Thermal Desorption System
- Gas Chromatography with Methanizer
- Gas Chromatography with FID/ECD
- HPLC
- UV- Visible Spectrophotometer
- BOD Incubator
- COD Digester
- All Glass Double Distillation Plan

Monitoring requirement- New Waste

S.No	Duration	Operation of Cement Kiln
1.	1 day	Emission monitoring during normal operation of cement kilns
2.	3 day	Emission monitoring during trial run of cement kiln at a fixed percentage of hazardous waste (less than 10%)
3.		Emission monitoring during trial run of cement kiln at another fixed percentage of solid waste (more than 10%)
4.	1 day	Emission monitoring during normal operation of cement plant

Monitoring Schedule- Before, During & After

S.No	Parameter	Frequency
1.	Particulates	4 Samples/ day
2.	SO2	4 Samples/ day
3.	HCL	4 Samples/ day
4.	CO	4 Samples/ day
5.	NOx	4 Samples/ day
6.	Total Organic Carbon	1 Samples/ day
7.	HF	4 Samples/ day
8.	Hydrocarbon	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 vapor phase) Cd, Th, Hg,Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Zn, Sn, Se	1 Samples/ day
13.	Dioxin and Furan	1 Samples/ day
14.	Cyanide	1 Samples/ day

Ambient Air Quality Measurement

1. SPM
2. RSPM
3. SO2
4. NOX

Monitoring at three locations (one in upward & 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 and Sulphur
- Metal i.e. Cd, Th, Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V, Zn, Sn, Se
- Leachability study for 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, Ni, V, Zn, Sn, Se with proper conclusion
- Total Organic Carbon (TOC)

Data to be collected

- Colored print out of process chart of different sections from central Control Room
- Sketch showing stack duct connection and port hole dimensions
- Note on hazardous waste handling and feeding mechanism i.e. from arrival of waste from hazardous waste generator to kiln burner / pyro.
- Process flow diagram for co - incineration of hazardous waste in cement kiln
- Note on difficulties faced in grinding the hazardous waste with suggestions for improvement
- Distance between hazardous waste generator & cement plant
- Copy of safety manual for transportation of hazardous waste and other related document, if any
- Process flow diagram for cement manufacturing (lime stone stacking to packing plant)
- Layout plan
- Pryor drawing (with marking temp.)
- Copy of consent order (showing prescribed standards)
- Stack emission and ambient air quality data of previous month
- Metrological data (wind speed & direction, temp., rainfall) of trial period

Data to be collected

Wind rose diagram on daily basis	Copy of daily log sheet of Kiln, clinker cooler and coal mill for the entire period of trial run.	Sketch showing location of ambient air quality stations and soil sampling point w.r.t cement plant (with marking of North South direction)
Photographs of trial run in CD	Hourly data of continuous emission monitoring system for entire period of trial run (along with trend chart) for kiln Section	Note on manufacturing process of cement
Kiln stoppage with date, time, duration and reason	Coal mill stoppage with date, time, duration and reason	Kiln ESP stoppage with date, time, duration and reason

Design (Optimum Value)

- Design raw mill output in TPH
- Design feed rate in TPH
- Design clinker production in TPH
- Design coal consumption in kiln main 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 output in TPH
- Gas residence time in the kiln
- Gas residence time in the pre - heater

Production data for the trial period

- Raw mill output in TPH
- Kiln feed rate 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)
- Temp. of pyro-cyclone 6th stage maximum (Hourly average)
- Temp of Kiln maximum at burning zone (hourly)
- Coal mill output in TPH (hourly)

Chemical Analysis of Clinker

- Loss on Ignition (LOI) %
- Silica (SiO2)%
- Iron Oxide (Fe2O3)%
- Aluminum Oxide (Al2O3)%
- Calcium Oxide (CaO)%
- Magnesium Sulphate (MgO)%
- Sulphate (S03) %
- Free Lime (CaO)%
- Total Alkali
  - Na2O %
  - K2O %
- Minor Constituent
  - P2O5 %
  - Cl %

Physical tests of Cement for Entire Trial Period

(Hourly Sample Homogenized on daily basis)

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

Productivity Parameters during Trial Runs

- Kiln Output Rate
  - TPD
  - TPH
- Energy Consumption
  - Electrical, kWh/t clinker
  - Thermal, Kcal / kg Clinker
  - Coal Mill Power, kWh/t Coal

Kiln Parameters during the Period of Trial

- Kiln Speed, RPM
- Kiln Torque, Amp.
- Kiln Feed, TPH
- BE Temperature, C
- BZ Temperature, C
- PH outlet (P - Line)
  - Gas Temperature, C
  - Draft, mm WG
  - O2, %
  - CO2, %
- PH Outlet (K-Line)
  - Gas Temperature, C
  - Draft, mm WG
  - O2, %
  - CO2, %
- Secondary Air Temperature ^{O}C
- Tertiary Air Temperature, ^{O}C
- Moisture in Coal as Fed, %
- Fine Coal Residue, % on 90 u
- Litre Weight, g/l

Information- Hazardous waste generator

About Company

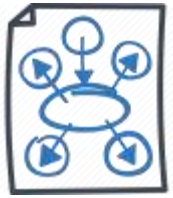
Address of the Company

Name of the head of the Company

Year in which the plant was commissioned

List of the products manufactured with capacity and production data

Manufacturing process of each producer



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 process by which 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.

Reporting

1. Introduction of the organization, plant details, layout and its capacity and current status (consent to operate).

2. Introduction of the waste generator and the quality of waste.

3. QA/QC plan (incl the H&S) of the study covering the Monitoring schedule, parameter, detailed methodology of monitoring and Testing, Photographs during the trial burn.

4. Plant operating conditions including the productivity parameters.

5. Results of the emission before, during and after co-processing including the graphical representation showing the trend along with the mass balance of the various emission parameters .

6. Final comments comparing the emission with the CPCB regulations.

SUSTAINABILITY LEADERS AWARDS 2014 WINNER

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Sustainability at ERM is a commitment to supporting socioeconomic development that meets the needs of the present, without compromising the ability of future generations to meet.

Read our latest sustainability report:
ERM Sustainability Report 2016

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