

**DRAFT ENVIRONMENTAL IMPACT
ASSESSMENT REPORT**

&

ENVIRONMENTAL MANAGEMENT PLAN

FOR

**PROPOSED BROWN FIELD
INTEGRATED CEMENT PROJECT:
CEMENT PLANT, CAPTIVE POWER PLANT & D. G. SET**

AT

**VILLAGE - RAWAN,
TEHSIL - SIMGA, DISTRICT - RAIPUR
(CHHATTISGARH)**

APPLICANT

M/s. GRASIM CEMENT
(A Unit of Grasim Industries Ltd.)
P.O. Grasim Vihar, Village - Rawan, Distt. Raipur
(Chhattisgarh)

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B. EIA REPORT

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F. No. J-11011/262/2009- IA II (I)
Government of India
Ministry of Environment and Forests
(I.A. Division)

Paryavaran Bhawan
CGO Complex, Lodhi Road
New Delhi – 110 003

E-mail : pb.rastogi@nic.in
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Dated 9th October, 2009

To,

✓ The Executive President
M/s Grasim Industries Ltd.
B-23, Ravi Nagar, Pandri, Jeevan Bima Marg
Raipur, Chhattisgarh

E-mail : grasimcement@adityabirla.com / jmenviron@hotmail.com ;
Fax No. : 07726 – 288215 ;

Subject: Expansion of Integrated Cement Project (Cement Plant, 3.3 to 6.5 MTPA; Clinker 2.1 to 5.0 MTPA; Captive Power Plant, 30 to 80 MW) at Village Rawan, Tehsil, Simga, District Raipur, Chhattisgarh by M/s Grasim Industries Ltd. - TORs reg.
Ref. : Your letter no. nil dated 16th April, 2009.

Sir,

Kindly refer your letter no. nil dated 16th April, 2009 alongwith project documents including Form-I, Pre-feasibility Report and draft 'Terms of Reference' as per the EIA Notification, 2006. It is noted that proposal is for the expansion of Integrated Cement Project (Cement Plant, 3.3 to 6.5 MTPA; Clinker 2.1 to 5.0 MTPA; Captive Power Plant, 30 to 80 MW) at Village Rawan, Tehsil, Simga, District Raipur, Chhattisgarh by M/s Grasim Industries Ltd.

Draft Terms of Reference (TOR) have been discussed and finalized during the 3rd Expert Appraisal Committee (Industry) meeting scheduled for 23rd-24th September, 2009 for preparation of EIA/EMP. Following are the 'TORs':

1. A site location map on Indian map of 1:10,00,000 scale followed by 1:50,000/1:25,000 scale on an A3/A2 sheet with at least next 10 kms of terrains i.e. circle of 10 kms and further 10 kms on A3/A2 sheets with proper longitude/latitude/heights with min. 100/200 m. contours should be included. 3-D view i.e. DEM (Digital Elevation Model) for the area in 10 km radius from the proposal site.
2. Present land use should be prepared based on satellite imagery. High-resolution satellite image data having 1m-5m spatial resolution like quickbird, Ikonos, IRS P-6 pan sharpened etc. for the 10Km radius area from proposed site. The same should be used for land used/land-cover mapping of the area.
3. Location of national parks / wildlife sanctuary / reserve forests within 10 km. radius should specifically be mentioned. A map showing landuse / landcover, reserved forests, wildlife sanctuaries, national parks, tiger reserve etc in 10 km of the project site.

4. Project site layout plan showing raw materials, fly ash and other storage plans, bore well or water storage, aquifers (within 1 km.) dumping, waste disposal, green areas, water bodies, rivers/drainage passing through the project site should be included.
5. Details and classification of total land (identified and acquired) should be included.
6. Proposal should be submitted to the Ministry for environment clearance only after acquiring total land. Necessary documents indicating acquisition of land should be included.
7. Rehabilitation & Resettlement (R & R) should be as per policy of the State Govt. and a detailed action plan should be included.
8. Permission and approval for the use of forest land and recommendations of the State Forest Department regarding impact of proposed expansion on the surrounding reserve forests, if applicable, should be included.
9. A list of industries containing name and type in 25 km radius should be incorporated.
10. Residential colony should be located in upwind direction.
11. List of raw material required and source alongwith mode of transportation should be included. All the trucks for raw material and finished product transportation must be "Environmentally Compliant".
12. Petrological and Chemical analysis and other chemical properties of raw materials used (with GPS location of source of raw material) i.e. ores, minerals, rock, soil, coal, iron, dolomite quartz etc. using high definition and precision instruments mentioning their detection range and methodology such Digital Analyzers, AAS with Graphite furnace, ICPMS, MICRO-WDXRF, EPMA, XRD, Nano studies or at least as per ISO-10500 and WHO norms. These analysis should include trace element and metal studies like Cr (vi), Ni, Fe, As, Pb, Zn, Hg, Se, S etc. Presence of radioactive elements (U, Th etc.).
13. Petrography, grain size analysis and Major element analysis of raw material and soil from project site and raw material should be done on the same parameters along with analysis for SiO_2 , Al_2O_3 , MgO , MnO , K_2O , CaO , FeO , Fe_2O_3 , P_2O_5 , H_2O , CO_2 .
14. If the rocks, ores, raw material has trace elements their petrography, ore microscopy, XRD, elemental mapping EPMA, XRF is required to quantify the amount present in it and hence future risk involved while using it and management plan.
15. Studies for fly ash, muck disposal, slurry, sludge material and solid waste generated should also be included, if the raw materials used has trace elements and a management plan.
16. Manufacturing process details for all the cement plant and captive power plant should be included.
17. Mass balance for the raw material and products should be included.
18. Energy balance data for all the components including proposed power plant should be incorporated.
19. Site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall should be collected.
20. Data on existing ambient air, stack emission, fugitive emissions data; water requirement and water balance cycle; generation, re-utilization and disposal of solid/ hazardous waste for the existing plant and predicted increase in pollution load (GLCs) due to proposed expansion should be incorporated.
21. Point-wise compliance to the specific and general conditions stipulated in the environmental clearance for the existing plant should be included.
22. Sources of secondary emissions, its control and monitoring as per the CPCB guidelines should be included.
23. A full chapter on fugitive emissions and control technologies should be provided.
24. A write up on use of high calorific hazardous wastes from all the sources in kiln and commitment regarding use of hazardous waste should be included. ✓

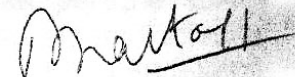
25. Ambient air quality at 8 locations within the study area of 10 km., aerial coverage from project site with one AAQMS in downwind direction should be carried out.
26. The suspended particulate matter present in the ambient air must be analyzed for the presence of poly-aromatic hydrocarbons (PAH), i.e. Benzene soluble fraction. Chemical characterization of RSPM and incorporating of RSPM data.
27. Determination of atmospheric inversion level at the project site and assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features.
28. Air quality modeling for all the plants proposed including mine for specific pollutants needs to be done. APCS for the control of emissions within 50 mg/Nm³ [or at the most 75 mg/Nm³ due to expansion of the existing plant] should be included.
29. Ambient air quality monitoring modeling alongwith cumulative impact should be included for the day (24 hrs) for maximum GLC alongwith following :
 - i) Emissions (g/second) with and without the air pollution control measures
 - ii) Meteorological inputs (wind speed, m/s), wind direction, ambient air temperature, cloud cover, relative humidity & mixing height) on hourly basis
 - iii) Model input options for terrain, plume rise, deposition etc.
 - iv) Print-out of model input and output on hourly and daily average basis
 - v) A graph of daily averaged concentration (MGLC scenario) with downwind distance at every 500 m interval covering the exact location of GLC.
 - vi) Details of air pollution control methods used with percentage efficiency that are used for emission rate estimation with respect to each pollutant
 - vii) Applicable air quality standards as per LULC covered in the study area and % contribution of the proposed plant to the applicable Air quality standard. In case of expansion project, the contribution should be inclusive of both existing and expanded capacity.
 - viii) No. I-VII are to be repeated for fugitive emissions and any other source type relevant and used for industry
 - ix) Graphs of monthly average daily concentration with down-wind distance
 - x) Specify when and where the ambient air quality standards are exceeded either due to the proposed plant alone or when the plant contribution is added to the background air quality.
 - xi) Fugitive dust protection or dust reduction technology for workers within 30 m of the plant active areas.
30. Impact of the transport of the raw materials and end products on the surrounding environment should be assessed and provided.
31. One season data for gaseous emissions other than monsoon season is necessary.
32. An action plan to control and monitor secondary fugitive emissions from all the sources as per the latest permissible limits issued by the Ministry vide G.S.R. 414(E) dated 30th May, 2008.
33. Presence of aquifer(s) within 1 km of the project boundaries and management plan for recharging the aquifer should be included.
34. Source of surface/ground water level, site (GPS), cation, anion (Ion Chromatograph), metal trace element (as above) chemical analysis for water to be used. If surface water is used from river, rainfall, discharge rate, quantity, drainage and distance from project site should also be included.
35. Ground water analysis with bore well data, litho-logs, drawdown and recovery tests to quantify the area and volume of aquifer and its management.
36. Ground water modeling showing the pathways of the pollutants should be included
37. Column leachate study for all types of stockpiles or waste disposal sites, at 20°C-50°C should be conducted and included. ✓

38. Permission for the drawl of water from the concerned authority and water balance data including quantity of effluent generated, recycled and reused and discharged is to be provided. Methods adopted/to be adopted for the water conservation should be included.
39. A note on the impact of drawl of water on the nearby River during lean season.
40. Surface water quality of nearby River (60 m upstream and downstream) and other surface drains at eight locations must be ascertained.
41. If the site is within 10 km radius of any major river, Flood Hazard Zonation Mapping is required at 1:5000 to 1:10,000 scale indicating the peak and lean river discharge as well as flood occurrence frequency.
42. A note on treatment of wastewater from different plants, recycle and reuse for different purposes should be included.
43. Provision of traps and treatment plants are to be made, if water is getting mixed with oil, grease and cleaning agents.
44. If the water is mixed with solid particulates, proposal for sediment pond before further transport should be included. The sediment pond capacity should be 100 times the transport capacity.
45. Wastewater characteristics (heavy metals, anions and cations, trace metals, PAH) from washed / beneficiated plants / washery.
46. The pathways for pollution via seepages, evaporation, residual remains are to be studied for surface water (drainage, rivers, ponds, lakes), sub-surface and ground water with a monitoring and management plans.
47. Ground water monitoring minimum at 8 locations and near solid waste dump zone, Geological features and Geo-hydrological status of the study area are essential as also Ecological status (Terrestrial and Aquatic) is vital.
48. Geo-technical data by a bore hole of upto 40 mts. in every One sq. km area such as ground water level, SPTN values, soil fineness, geology, shear wave velocity etc. for liquefaction studies and to assess future Seismic Hazard and Earthquake Risk Management in the area.
49. Action plan for solid/hazardous waste generation, storage, utilization and disposal.
50. A note on the treatment, storage and disposal of all type of solid waste should be included.
51. End use of solid waste and its composition should be covered.
52. All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water.
53. Action plan for the green belt development plan in 33 % area should be included. The green belt should be around the project boundary and a scheme for greening of the traveling roads should also be incorporated. All rooftops/terraces should have some green cover.
54. A scheme for rainwater harvesting have to be put in place. Incorporation of water harvesting plan for the project is necessary, if source of water is bore well.
55. Detailed description of the flora and fauna (terrestrial and aquatic) should be given with special reference to rare, endemic and endangered species.
56. Socio-economic development activities need to be elaborated upon.
57. Disaster Management Plan including risk assessment and damage control needs to be addressed and included.
58. Occupational health of the workers needs elaboration. Health effects of other metals used and health hazard plans based on monthly correlation of these metal related diseases and people affected and mitigation plans. Arsenicosis Management Plan if Arsenic is present in ore, rock, coal, fly ash, water. Action Plan for protecting the workers against hazardous chemicals such as Sulphuric acid, pesticides, solvents etc./

59. Occupational health of the workers needs elaboration including evaluation of noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and steps taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc. Occupational hazards specific pre-placement and periodical monitoring and periodical monitoring should be carried out. The detailed plan to carry out above mentioned activity should be mentioned.
60. Plan for the implementation of the recommendations made for the steel plants in the CREP guidelines must be prepared.
61. A note on identification and implementation of Carbon Credit project should be included.
62. Total capital cost and recurring cost/annum for environmental pollution control measures.
63. Public hearing issues raised and commitments made by the project proponent on the same should be included separately in EIA/EMP Report in the form of tabular chart.
64. Any litigation pending against the project and / or any direction / order passed by any Court of Law against the project, if so, details thereof.

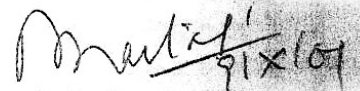
These 'TORs' should be considered for the preparation of EIA / EMP report for the expansion of Integrated Cement Project (Cement Plant, 3.3 to 6.5 MTPA; Clinker 2.1 to 5.0 MTPA; Captive Power Plant, 30 to 80 MW) at Village Rawan, Tehsil, Simga, District Raipur, Chhattisgarh in addition to all the relevant information as per the 'General Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. The EIA/EMP as per TORs should be submitted to the Chairman, Chhattisgarh Environment Conservation Board (CECB), Chhattisgarh for public consultation. The CECB shall conduct the public hearing/public consultation as per the provisions of EIA notification, 2006.

You are requested to kindly submit the final EIA/EMP prepared as per TORs and incorporating all the issues raised during Public Hearing / Public Consultation to the Ministry for considering the proposal for environmental clearance.



(Dr. P.B. Rastogi)
Director

Copy to : The Chairman, Chhattisgarh Environment Conservation Board, 1-Tilak Nagar, Shiv Mandir Chowk, Main Road, Avanti Vihar, Raipur – 492001, Chhattisgarh.



(Dr. P.B. Rastogi)
Director

F. No. J-11011/262/2009- IA II (I)
Government of India
Ministry of Environment and Forests
(I.A. Division)

Paryavaran Bhawan
CGO Complex, Lodhi Road
New Delhi – 110 003
E-mail: plahujarai@yahoo.com
Tele/fax: 011 – 2436 3973
Dated: May 31, 2010

To,
The Executive President
M/s Grasim Industries Limited
B-23, Ravi Nagar, Pandri, Jeevan Bima Marg
Raipur, Chhattisgarh

Sub: proposed expansion of integrated cement project (cement plant 3.3 MTPA to 6.5 MTPA), clinker 2.1 MTPA to 6.5 MTPA, CPP 30MW to 80MW at village Rawan, tehsil Simga in District Raipur (Chhattisgarh by M/s Grasim Industries Limited-reg.

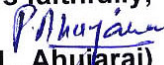
Sir,

This in continuation of this Ministry's earlier letter of even no. dated 9th October, 2009 and your letter no dated GCR/BFE/2000/5 dated 5th January, 2010 and subsequent communication dated 23rd April, 2010 requesting the Ministry for amendment of TORs prescribed vide Ministry's letter of even no dated 9th October, 2010 due to enhancement of clinker capacity from 2.1 MTPA to 6.5 MTPA instead of from 2.1 MTPA to 5.5 MTPA.

2. The Ministry has the examined the proposal. The TORs prescribed vide this Ministry's letter of even no. dated on 9th October, 2009 for integrated cement project (cement plant 3.3 MTPA to 6.5 MTPA), clinker 2.1 MTPA to 5.5 MTPA, CPP 30MW to 80MW shall remain same as prescribed for integrated cement project (cement plant 3.3 MTPA to 6.5 MTPA), clinker 2.1 MTPA to 6.5 MTPA, CPP 30MW to 80MW due to enhancement of clinker capacity.

3. With the above amendment for Terms of Reference, the draft EIA report prepared shall be submitted to the State Pollution Control Board for conducting public hearing . The final EIA report along with the issues raised during the public hearing shall be submitted to the Ministry for obtaining environmental clearance. While submitting the final EIA report along with public hearing you may also obtain comments of Chhattisgarh Environment Protection conservation Board w.r.t pollution load as the unit is located in District Raigarh, Chhattisgarh.

3. This issues with the approval of competent authority.

Yours faithfully,

(Dr. P. L. Ahujarai)
Scientist 'F'

Copy to: The Chairman, Chhattisgarh Environment conservation Board , 1-Tilak Nagar, Shiv Mandir Chowk, Main Road, Avanti Vihar, Raipur- 392001, Chhattisgarh.


Dr. P. L. Ahujarai
Scientist 'F'

ToR Reply

Subject: Expansion of Integrated Cement Project (Cement Plant, 3.3 to 6.5 MTPA; Clinker 2.1 to 5.0 MTPA; Captive Power Plant, 30 to 80 MW) at Village Rawan, Tehsil Simga, District Raipur, Chhattisgarh by M/s Grasim Industries Ltd.

Ref.: MoEF F. No. J-11011/262/2009- IA II (I) & MoEF ToR Letter Dated 9th October, 2009

Point No.1: A site location map on Indian map of 1:10, 00,000 scale followed by 1:50,000/1:25,000 scale on an A3/A2 sheet with at least next 10 Kms of terrains i.e. circle of 10 kms and further 10 kms on A3/A2 sheets with proper longitude/latitude/heights with min. 100/200 m. contours should be included. 3-D view i.e. DEM (Digital Elevation Model) for the area in 10 km radius from the proposal site.

Reply : A site location map on Indian map of 1:10, 00,000 scale followed by 1:50,000 scale on an A3 sheet with 10 Kms radius study area, with proper longitude/latitude/heights with 100 m contours has been prepared alongwith the 3-D view i.e. DEM (Digital Elevation Model) for the area in 10 km radius from the proposal site & incorporated in the Draft EIA/EMP Report; Chapter 3 section no. 3.2.2; page no. 42 to 45.

Point No. 2: Present land use should be prepared based on satellite imagery. High-resolution satellite image data having 1m-5m spatial resolution like quickbird, Ikonos, IRS P-6 pan sharpened etc. for the 10Km radius area from proposed site. The same should be used for land used/land-cover mapping of the area.

Reply : Present land use based on satellite imagery has been prepared using High-resolution satellite image data of IRS P-6 pan sharpened having 5m spatial resolution. Result shows that the study area is dominated by Crop land with 46.93% of the total area in the 10 km radius. Fallow land & open waste land are also found in significant amount with 28.25% & 12.75% of the total study area respectively. Details have been incorporated in the Draft EIA/EMP Report; Chapter 3 section no. 3.2.1; page no. 35 to 41.

Point No. 3: Location of national parks / wildlife sanctuary / reserve forests within 10 km. radius should specifically be mentioned. A map showing landuse / landcover, reserved forests, wildlife sanctuaries, national parks, tiger reserve etc in 10 km of the project site.

Reply: There are no National Park/ Wildlife Sanctuary/ Tiger Reserve within the 10 km radius of the study area. The landuse /landcover map of the study area has been prepared showing the Reserved Forest in the in the study area. Details have been incorporated in the Draft EIA/EMP Report; Chapter 3 section no. 3.2.1; page no. 35 to 41.

Point No. 4: Project site layout plan showing raw materials, fly ash and other storage plans, bore well or water storage, aquifers (within 1 km.) dumping, waste disposal, green areas, water bodies, rivers/drainage passing through the project site should be included.

Reply : Project site layout plan showing raw materials, fly ash and other storage plans, water storage tank, pond & the green areas has been incorporated in the Draft EIA/EMP Report; Chapter 2; section no. 2.3.1; page no. 17 to 20.

There is no waste generation from the plant process & hence no dumping & waste disposal sites within the plant layout are present. There is no river / drainage passing through the project site hence the same are not shown in the plant layout.

Point No. 5: Details and classification of total land (identified and acquired) should be included.

Reply: This is a brown field project & expansion is proposed within the existing plant premises. No additional land is required for the proposed project activity. The details of the classification is given below, all of which has been acquired.

S. No.	Particular	Area (ha)
1.	Government Land	43.091
2.	Private Land	345.279
	Total Plant Area	388.37

Details have also been incorporated in the Draft EIA/EMP Report; Chapter 2; section no. 2.4.2; page no. 21.

Point No. 6: Proposal should be submitted to the Ministry for environment clearance only after acquiring total land. Necessary documents indicating acquisition of land should be included.

Reply : This is a brown field project & expansion is proposed within the existing plant premises. No additional land is required for the proposed project activity. Necessary documents indicating acquisition of land are enclosed as **Annexure 3**.

Point No. 7: Rehabilitation & Resettlement (R & R) should be as per policy of the State Govt. and a detailed action plan should be included.

Reply : This is a brown field project & expansion is proposed within the existing plant premises. No additional land is required for the proposed project activity. Hence, no Rehabilitation & Resettlement is applicable.

Point No. 8: Permission and approval for the use of forest land and recommendations of the State Forest Department regarding impact of proposed expansion on the surrounding reserve forests, if applicable, should be included.

Reply: There is no Forest land involved in the project activity. The No Objection Certificate from the Forest Divisional Officer Raipur, Chhattisgarh has been obtained & is attached as **Annexure 4**.

Point No. 9: A list of industries containing name and type in 25 km radius should be incorporated.

Reply: A list of industries containing name and type in 25 km radius has been incorporated in the draft EIA/EMP Report; Chapter 3; section no 3.12.3; page no. 96.

Point No. 10: Residential colony should be located in upwind direction.

Reply : This is an existing plant & the colony already exists. The same colony will be used after the proposed project activity also. The Pre-dominant Direction for the project site is South-East & the colony is also located in the same direction. Details also mentioned in the draft EIA/EMP Report; Chapter 2, item 2.3.1, page no. 17 to 20.

Point No. 11: List of raw material required and source along with mode of transportation should be included. All the trucks for raw material and finished product transportation must be Environmentally Compliant.

Reply: The main raw material for the Cement Plant is limestone, which will be transported from the captive limestone mine through covered conveyor belt. Other material transportation will be taking place by road or rail depending on the distance & available facilities. Railway siding & road facilities for the transportation of materials are already present in the plant premises which shall be used for the project activity also. All the vehicles used for the transportation of raw material and finished product including trucks, tippers, and dumpers are maintained regularly & checked for Pollution Under Control.

Raw Material Requirement & Source Details

S. No.	Minerals	Quantity in MTPA			Source	Mode of Transportation
		Existing	Additional	Total		
1.	Limestone	2.8	6.95	9.75	Captive Mine	Covered Conveyor Belt
2.	Iron Ore	Nil	0.05	0.05	Nearby Area	Road
3.	Coal (Cement Plant)	0.3	0.6	0.9	Captive Coal Washery & Nearby Market	Road
4.	Coal (CPP)	0.2	0.4	0.6		
5.	Clinker	2.1	4.4	6.5	Captive Plant	-
6.	Gypsum	0.1	0.15	0.25	Nearby Area	Road / Rail
7.	Fly Ash	0.5	0.5	1.0	CPP , Balco, NTPC Korba	Rail (250 km)
8.	Slag	0.5	0.5	1.0	Bhilai steel plant/ NICCO	Road / Rail (~100km)

Details also mentioned in the draft EIA/EMP Report; Chapter 2, item 2.5.2, page no. 24 to 25.

Point No. 12: Petrological and Chemical analysis and other chemical properties of raw materials used (with GPS location of source of raw material) i.e. ores, minerals, rock, soil, coal, iron, dolomite quartz etc. using high definition and precision instruments mentioning their detection range and methodology such Digital Analyzers, AAS with Graphite furnace, ICPMS, MICRO-WDXRF, EPMA, XRD, Nano studies or at least as per I30-10500 and WHO norms. These analysis should include trace element and metal studies like Cr (vi) Ni, Fe, As, Pb, Zn, Hg, Se, S etc. Presence of radioactive elements (U, Th etc.).

Reply: Petrological & Chemical analysis of the raw materials (limestone, coal, Iron Ore) used, soil from project site has been done using the AAS with Graphite furnace. The analysis was also done for trace element and metal studies, but no trace elements were found in the material. Details are mentioned in the draft EIA/EMP Report; Chapter 3, item 3.9, page no.80 to 90.

Point No. 13: Petrography, grain size analysis and Major element analysis of raw material and soil from project site and raw material should be done on the same parameters along with analysis for SiO_2 , Al_2O_3 , MgO , MnO , K_2O , CaO , FeO , Fe_2O_3 , P_2O_5 , H_2O , CO_2 .

Reply: Petrography, grain size analysis and Major element analysis of raw material and soil from project site and raw material was also done on the same parameters & details are mentioned in the draft EIA/EMP Report; Chapter 3, item 3.9, page no. 80 to 90.

Point No. 14: If the rocks, ores, raw material has trace elements their petrography, ore microscopy, XRD, elemental mapping EPMA, XRF is required to quantify the amount present in it and hence future risk involved while using it and management plan.

Reply: The rocks, ores & raw material does not contain trace elements hence the further studies were not conducted to calculate their amount. Simultaneously, there is no risk involved during their use.

Point No. 15: Studies for fly ash, muck disposal, slurry, sludge material and solid waste generated should also be included, if the raw materials used has trace elements and a management plan.

Reply : Trace elements are absent in the raw materials; hence studies & management plan for fly ash, muck disposal, slurry, sludge material and solid waste generated are not applicable.

Point No. 16: Manufacturing process details for all the cement plant and captive power plant should be included.

Reply : Manufacturing process details have been incorporated in the Draft EIA/EMP Report, Chapter 2, item 2.5 for Cement Plant (page no 24 to 27) & 2.6 for Captive Power Plant (page no 27 to 30).

Point No. 17: Mass balance for the raw material and products should be included.

Reply: The details are incorporated in draft EIA/EMP Report Chapter 2, item 2.4.7. page no 23.

Point No. 18: Energy balance data for all the components including proposed power plant should be incorporated.

Reply: Details of the energy components of the plant have been incorporated in draft EIA/EMP report, Chapter 8, item 8.1.5, page no 184 to 186.

Point No. 19: Site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall should be collected.

Reply: Site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall have been incorporated in Draft EIA/EMP Report, Chapter 3, item 3.5, page no. 59 to 63.

Point No. 20: Data on existing ambient air, stack emission, fugitive emissions data; water requirement and water balance cycle; generation, re-utilization and disposal of solid/ hazardous waste for the existing plant and predicted increase in pollution load (GLCs) due to proposed expansion should be incorporated.

Reply: Data on existing ambient air, stack emission, fugitive emissions data are incorporated in Draft EIA/EMP Report, Chapter 3, item 3.6 page no. 64 to 72.

Point No.21: Point-wise compliance to the specific and general conditions stipulated in the environmental clearance for the existing plant should be included.

Reply: Point-wise compliance to the specific and general conditions stipulated in the environmental clearance for the existing plant have been enclosed in Draft EIA/EMP Report as **Annexure 1** (for Cement Plant) & **Annexure 2** (for Captive Power Plant).

Point No.22: Sources of secondary emissions, its control and monitoring as per the CPCB guidelines should be included.

Reply: Sources of secondary emissions, its control and monitoring as per the CPCB guidelines are included in draft EIA/EMP Report, Chapter 6, item 6.2, page no 135 to 144.

Point No. 23: A full chapter on fugitive emissions and control technologies should be provided.

Reply: Details of fugitive emissions and control technologies have been provided in draft EIA/EMP Report, Chapter 6, item 6.2, page no 135 to 144.

Point No.24: A write up on use of high calorific hazardous wastes from all the sources in kiln and commitment regarding use of hazardous waste should be included.

Reply: Grasim Cement is committed for sustainable development and conservation of natural resources through utilization of various types of industrial wastes and raw materials in cement manufacturing process. Fly ash generated from Captive Power plant is entirely used (upto 30% of Cement) for Cement production.

Feasibility study has been carried out for the availability of the high calorific hazardous waste in the nearby areas. The results show that the high calorific hazardous waste is not available in the sufficient quantity in the nearby areas.

Point No.25: Ambient air quality at 10 locations within the study area of 10 km., aerial coverage from project site with one AAQMS in downwind direction should be carried out.

Reply: Ambient air monitoring was carried out at 10 locations for the Study Period within the study area of 10 km to assess the ambient air quality at the source, AAQMS in downwind direction & upwind directions were taken. Details have been provided in draft EIA/EMP Report, Chapter 3, item 3.6, page no 65 to 73.

Point No. 26: The suspended particulate matter present in the ambient air must be analyzed for the presence of poly-aromatic hydrocarbons (PAH), i.e. Benzene soluble fraction. Chemical characterization of RSPM and incorporating of RSPM data.

Reply: The Ambient air was analysed for the presence of poly-aromatic hydrocarbons. Chemical characterization of RSPM has also been reported in the draft EIA/EMP report. Details have been provided in draft EIA/EMP Report, Chapter 3, item 3.6, page no 64 to 72.

Point No. 27: Determination of atmospheric inversion level at the project site and assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features.

Reply: The details of the inversion level & assessment of ground level concentration of pollutants from the stack emission have been incorporated in draft EIA/EMP Report Chapter 4, item 4.4.4. The mixing height and inversion data used in predictions has been given below.

Mixing Height Used for the Air Pollution Mathematical Modelling

Time (Hours)	Mixing Height (m)
0500	100
0600	100
0700	150
0800	200

0900	400
1000	850
1100	1000
1200	1500
1400	1500
1500	1500
1600	2000
1700	2000
1800	1500
1900	400

Source: CPCB publication, "Spatial Distribution Of Hourly Mixing Depth Over Indian Region", PROBES/88/2002-03

Inversion heights have been assumed to be 450 m in the night.

Point No. 28: Air quality modelling for all the plants proposed including mine for specific pollutants needs to be done. APCS for the control of emissions within 50 mg/Nm³ [or at the most 75 mg/Nm³ due to expansion of the existing plant] should be included.

Reply: Air quality modelling for all the plants proposed including mine have been incorporated in draft EIA/EMP Report Chapter 4, item 4.4.4. APCS for the control of emissions within 50 mg/Nm³ have been incorporated in draft EIA/EMP Report Chapter 8, item 8.1.1 page no 170 to 177.

Point No. 29: Ambient air quality monitoring modeling alongwith cumulative impact should be included for the day (24 hrs) for maximum GLC alongwith following :

- i) Emissions (g/second) with and without the air pollution control measures.
- ii) Meteorological inputs (wind speed, m/s), wind direction, ambient air temperature, cloud cover, relative humidity & mixing height) on hourly basis.
- iii) Model input options for terrain, plume rise, deposition etc.

- iv) Print-out of model input and output on hourly and daily average basis
- v) A graph of daily averaged concentration (MGLC scenario) with downwind distance at every 500 m interval covering the exact location of GLC.
- vi) Details of air pollution control methods used with percentage efficiency that are used for emission rate estimation with respect to each pollutant.
- vii) Applicable air quality standards as per LULC covered in the study area and % contribution of the proposed plant to the applicable Air quality standard. In case of expansion project, the contribution should be inclusive of both existing and expanded capacity.
- viii) No. I-VII are to be repeated for fugitive emissions and any other source type relevant and used for industry.
- ix) Graphs of monthly average daily concentration with down-wind distance.
- x) Specify when and where the ambient air quality standards are exceeded either due to the proposed plant alone or when the plant contribution is added to the background air quality.
- xi) Fugitive dust protection or dust reduction technology for workers within 30 m of the plant active areas.

Reply: Air quality modelling for all the plants proposed including mine have been incorporated in draft EIA/EMP Report Chapter 4, item 4.4.4 (page no 104 to 109). Fugitive dust protection or dust reduction technology for workers have been detailed in draft EIA/EMP Report, Chapter 4, item 4.9.1 (page no 114).

Point No. 30: Impact of the transport of the raw materials and end products on the surrounding environment should be assessed and provided.

Reply: Impact of the transport of the raw materials and end products on the surrounding environment has been assessed and it was concluded that surrounding environment will not be effected due to this project activity. Impact of the transport of the raw materials and end products on the surrounding environment is provided in draft EIA/EMP Report, Chapter 4, item 4.4.3. page no 102 to 104. **ToR Point No.31:** One season data for gaseous emissions other than monsoon season is necessary.

Reply: One season data for gaseous emissions for winter season have been given in Chapter 3, item 3.6.6, page no. 72.

Point No. 32: An action plan to control and monitor secondary fugitive emissions from all the sources as per the latest permissible limits issued by the Ministry vide G.S.R. 414(E) dated 30th May, 2008.

Reply: An action plan to control and monitor secondary fugitive emissions from all the sources have been detailed in draft EIA/EMP Report, Chapter 6, item 6.2 page no 135 to 144.

Point No. 33: Presence of aquifer(s) within 1 km of the project boundaries and management plan for recharging the aquifer should be included.

Reply: Presence of aquifer(s) within 1 km of the project boundaries and management plan for recharging have been provided in the Hydro-geological Study Report incorporated in draft EIA/EMP Report, Chapter 6, item 6.3 page no 144 to 164.

Point No. 34: Source of surface/ground water level, site (GPS), cation, anion (Ion Chromatograph), metal trace element (as above) chemical analysis for water to be used. If surface water is used from river, rainfall, discharge rate, quantity, drainage and distance from project site should also be included.

Reply: Water will be sourced from the existing bore wells & from the mines sump water. The mine sump water will be used for industrial purpose; whereas bore wells water will be used to fulfill the domestic requirement only. There is no surface water body in the study area & no surface

water will be used. Chemical analysis of the water to be used for the project activity have been incorporated in draft EIA/EMP Report, Chapter 3, item 3.4.3, page no 56 to 58 .

Point No. 35: Ground water analysis with bore well data, litho-logs, drawdown and recovery tests to quantify the area and volume of aquifer and its management.

Reply: Ground water analysis with bore well data, litho-logs, drawdown and recovery tests to quantify the area and volume of aquifer and its management have been done. Details have been provided in the Hydro-geological Study Report incorporated in draft EIA/EMP Report, Chapter 6, item 6.3 page no 144 to 164.

Point No. 36: Ground water modeling showing the pathways of the pollutants should be included.

Reply: The analysis of the quality of the ground water was done & it was found that there are no pollutants in the ground water. Simultaneously there is zero effluent discharge from the existing project activity & which will also be same for the proposed project activity. Rain water harvesting is already being practised in the existing plant & colony premises, & hence the storm water is not mixed with the plant operation. All these activities will be maintained in future also & leads to no pathway of the pollutants due to the project activity.

Point No. 37: Column leachate study for all types of stockpiles or waste disposal sites, at 20°C-50°C should be conducted and included.

Reply: No solid waste is generated in cement manufacturing process. Fly ash generated from Captive Power Plant (Existing + Proposed) is utilized in the manufacturing of Cement. Dust collected from air pollution control equipment is 100% recycled in process. Sludge from Sewage Treatment Plant (STP) is used as manure for green belt development. The hazardous waste generated from the use of oil etc is being sold to authorized vendors. There is no leachate generated from the plant

activity. All the raw material & products are stored in proper storage facilities as per the CPCB guidelines. Hence there column leachate study is not required for the project activity.

Point No. 38: Permission for the drawl of water from the concerned authority and water balance data including quantity of effluent generated, recycled and reused and discharged is to be provided. Methods adopted/to be adopted for the water conservation should be included.

Reply: The total ground water requirement is 1,500 KLD (Existing+ Proposed) for which CGWA approval is already obtained enclosed as **Annexure 8** in Draft EIA/EMP Report. Water will be sourced from the captive mine sump for industrial purpose. For drinking purposes it will be procured from the existing bore wells, Water will not be discharged outside the plant as water is absorbed in the process or is subjected to evaporation. Other details related to recycled and reused, water conservation measures has been incorporated in draft EIA/EMP Report, chapter 8, sect 8.1.3 page no 178 to 182.

Point No. 39: A note on the impact of drawl of water on the nearby River during lean season.

Reply: Water will not be sourced from the river so there will be no impact.

Point No. 40: Surface water quality of nearby River (60 m upstream and downstream) and other surface drains at eight locations must be ascertained.

Reply: There is no river within the 10 km radius study area.

Point No. 41: If the site is within 10 km radius of any major river, Flood Hazard Zonation Mapping is required at 1:5000 to 1:10,000 scale indicating the peak and lean river discharge as well as flood occurrence frequency.

Reply: There is no river within the 10 km radius study area, hence Flood Hazard Zonation Mapping has not been prepared.

Point No. 42: A note on treatment of wastewater from different plants, recycle and reuse for different purposes should be included.

Reply: Details related to recycled and reused, water conservation measures has been incorporated in draft EIA/EMP Report, chapter 8, item 8.1.3 page no 178 to 182.

Point No. 43: Provision of traps and treatment plants are to be made, if water is getting mixed with oil, grease and cleaning agents.

Reply: The proposed project activity will be of zero effluent discharge system. No waste water will be mixed with oil, grease & cleaning agents. Storm water is harvested for the ground water recharge.

Point No. 44: If the water is mixed with solid particulates, proposal for sediment pond before further transport should be included. The sediment pond capacity should be 100 times the transport capacity.

Reply: Water is not mixed solid particulates, hence no sediment pond for further transport is included.

Point No. 45: Wastewater characteristics (heavy metals, anions and cations, trace metals, PAH) from washed / beneficiated plants / washery.

Reply: The proposed project activity will be of zero effluent discharge system. There is no proposed beneficiation plant/ washery, in the project activity.

Point No. 46: The pathways for pollution via seepages, evaporation, residual remains are to be studied for surface water (drainage, rivers, ponds, lakes), sub-surface and ground water with a monitoring and management plans.

Reply: No industrial waste water is generated during plant operation. In Cement Plant process, water is absorbed in the process or it is subjected to evaporation, hence no wastewater generation. The wastewater generated from the CPP is recycled back to the process and used for cooling and dust suppression. Domestic waste water generated from the colony will be treated in STP and used for green belt development / Horticulture purpose. The proposed project activity will be of zero effluent discharge system. There is no source of seepage of effluent in the ground water. No surface water body is present in the study area& no chances of any impact on the same are there. The ground water

monitoring will be done as per the post project monitoring plan incorporated in Chapter 5 & management measures will be undertaken as per the details incorporated in Chapter 8, item 8.1.3.

Point No. 47: Ground water monitoring minimum at 8 locations and near solid waste dump zone, Geological features and Geo-hydrological status of the study area are essential as also. Ecological status (Terrestrial and Aquatic) is vital.

Reply: Ground water monitoring has been done for the study area, details have been incorporated in draft EIA/EMP Report, Chapter 3, item 3.4 (page no 51 to 58). Geological features and Geo-hydrological status of the study area have been also studied & incorporated in the

Point No. 48: Geo-technical data by a bore hole of upto 40 mts. in every One sq. km area such as ground water level, SPTN values, soil fineness, geology, shear wave velocity etc. for liquefaction studies and to assess future Seismic Hazard and Earthquake Risk Management in the area.

Reply: The project site is far from any active faults or thrusts and hence makes the site to fall in seismic safe zone. Hence the risk of earthquake at the site is minimal and so the site is safe. Further details have been incorporated in draft EIA/EMP Report, Chapter 3, item 3.2.1. page no 46 to 49.

Point No. 49: Action plan for solid/hazardous waste generation, storage, utilization and disposal.

Reply: No solid waste will be generated from the plant, details related to the same has been incorporated in chapter 8, section 8.1.4 page no 183 to 184.

Point No. 50: A note on the treatment, storage and disposal of all type of solid waste should be included.

Reply: Note on the treatment, storage and disposal of all type of solid waste have been incorporated in chapter 8, sec 8.1.4 page no 183 to 184.

Point No. 51: End use of solid waste and its composition should be covered.

Reply: End use of solid waste have been incorporated in chapter 8, sec 8.1.4, page no 183 to 184.

Point No. 52: All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water.

Reply: No such stock piles will be developed which will cause leaching of materials to ground water.

Point No. 53: Action plan for the green belt development plan in 33 % area should be included. The green belt should be around the project boundary and a scheme for greening of the travelling roads should also be incorporated. All rooftops/terraces should have some green cover.

Reply: Out of the 388.37 ha (plant + colony area), 212.54 ha is already covered under plantation i.e. 55% of the total plant & colony area. The green belt has been done around the project boundary, roads. Rooftops/terraces have also been covered under green cover. Action Plan for green belt development with other details have been incorporated in draft EIA/EMP Report, Chapter 8, item 8.2.

Point No. 54: A scheme for rainwater harvesting have to be put in place. Incorporation of water harvesting plan for the project is necessary, if source of water is bore well.

Reply: Details related to rainwater harvesting has been incorporated in draft EIA/EMP Report, chapter 8, item 8.1.2 page no 177 to 178.

Point No. 55: Detailed description of the flora and fauna (terrestrial and aquatic) should be given with special reference to rare, endemic and endangered species.

Reply : As per the field study and secondary data it was observed that no rare, endemic and endangered species found within 10 km radius of the project site, list of flora and fauna as per the study conducted has been

mentioned in draft EIA/EMP Report, Chapter 3, item 3.10 page no 90 to 93..

Point No. 56: Socio-economic development activities need to be elaborated upon.

Reply: Socio-economic development activities has been elaborated in chapter 7 page no 165 to 168.

Point No. 57: Disaster Management Plant including risk assessment and damage control needs to be addressed and included.

Reply: Disaster Management Plant including risk assessment and damage control has been prepared, the same has been incorporated in chapter 6, sect 6.1 page no 127 to 134.

Point No. 58: Occupational health of the workers needs elaboration. Health effects of other metals used and health hazard plans based on monthly correlation of these metal related diseases and people affected and mitigation plans. Arsenicosis Management Plan if Arsenic is present in ore, rock, coal, fly ash, water. Action Plan for protecting the workers against hazardous chemicals such as Sulphuric acid, pesticides, solvents etc.

Reply: Details of the Occupational health of the workers has been elaborated in chapter 8, sect 8.3.7 page no 195 to 196.. Arsenic has not been found in the raw material, hence Arsenicosis Management Plan is not required.

Point No. 59: Occupational health of the workers needs elaboration including evaluation of noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and steps taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc. Occupational hazards specific pre-placement and periodical monitoring and periodical monitoring should be carried out. The detailed plan to carry out above mentioned activity should be mentioned.

Reply: Impact on occupational health & mitigation measures have been incorporated in draft EIA/EMP Report, Chapter 4, item 4.9 page no 113

to 116.. Periodical medical check up of the workers is being done. Management Plan has been incorporated in chapter 8, sect 8.3. page no 192 to 196.

Point No. 60: Plan for the implementation of the recommendations made for the cement plants in the CREP guidelines must be prepared.

Reply: Plan for the implementation of the recommendations made for the cement plants in the CREP guidelines has been complied with, details have been mentioned in chapter 8, sect 8.5 page no 197 to 199.

Point No. 61: A note on identification and implementation of Carbon Credit project should be included.

Reply: Note on identification and implementation of Carbon Credit project has been included in draft EIA/EMP Report, Chapter 8, item 8.1.6 page no 186 to 187.

Point No. 62: Total capital cost and recurring cost/annum for environmental pollution control measures.

Reply: Total capital cost and recurring cost/annum for environmental pollution control measures are as follows :

- Capital Cost for project: Rs 950 Crores
- Capital cost for EMP: Rs 100 Crores
- Recurring cost for EMP: Rs 05 Crores

Point No. 63: Public hearing issues raised and commitments made by the project proponent on the same should be included separately in EIA/EMP Report in the form of tabular chart.

Reply: Public hearing for the project has to be conducted. Public hearing issues raised and commitments made by the project proponent on the same would be included separately in EIA/EMP Report in the form of tabular chart.

Point No. 64: Any litigation pending against the project and / or any direction / order passed by any Court of Law against the project, if so, details thereof.

Reply: There is no litigation pending against the project and / or any direction / order passed by any Court of Law against the project.

CHAPTER-I

INTRODUCTION

1.1 PURPOSE OF THE PROJECT

Every anthropogenic activity has some impact on the environment. More often it is harmful to the environment than benign. However, mankind as it is developed today cannot live without taking up these activities for his food, security and other needs. Consequently, there is a need to harmonize developmental activities with the environmental concerns. Environmental Impact Assessment (EIA) is one of the tools available with the planners to achieve the above mentioned goals.

It is desirable to ensure that the development options under consideration are sustainable. In doing so, environmental consequences must be characterized early in the project cycle and accounted for in the project design.

Law requires that every project proponent must take Environmental Clearance from Ministry of Environment and Forests, New Delhi, before starting up any project. The environmental clearance is also mandatory for the expansion, modernization or renewal projects. The conditions are applicable as per the MoEF guidelines and EIA notifications issued and amended time to time.

To keep the Environment congenial for better standard of living, the provisions have been made in the constitution of India and many Enactments have taken place, so that, industrialization may not have adverse impact on the environment.

There are many Acts / Rules / Notifications issued by MoEF, New Delhi few of them are mentioned below:

1. Environment (Protection) Act 1986
2. Environment (Protection) Rules, 1986
3. Water (Prevention & Control of Pollution) Act, 1974

4. Air (Prevention & Control of Pollution) Act, 1981
5. New Environmental Impact Assessment (EIA) Notification, dated 14th September 2006

Environmental Impact Assessment (EIA) is defined as a systematic identification & evaluation of the potential impacts of the proposed projects, plans, programmes, or legislative actions related to the Physical, Chemical, Biological and Socio-economic components of the total environment. It is the evaluation of various impacts and the resultant natural and induced changes, as simply and precisely as possible, for optimizing the development to the environment. By virtue of EIA, the patterns, directions, strengths, and the causal relationships existing among all the relevant variables are studied.

It also helps in the determination of additional project components that may be required to restore, maintain or extend the resources. EIA is useful for decision making, as it is based on understanding the environmental implications including social, cultural and aesthetic concerns, which could be integrated with the analysis of the project costs and benefits.

The main purpose of Environmental Impact Assessment is to assess the beneficial and adverse impacts of the proposed project on the existing environmental systems. Thus the report is a summarized presentation of environmental consequences of the project activity so that all the factors are considered tactfully in eventually arriving at a decision.

1.2 IDENTIFICATION OF PROJECT PROPONENT

Aditya Birla Group is India's second largest business house, with turnover of over Rs. 141 billion, is in the league of Fortune 500. It is anchored by an extraordinary force of 1,30,000 employees, belonging to 30 different nationalities. In India, the Group has been adjudged "The Best Employer in India and among the top 20 in Asia" by the Hewitt-Economic Times and Wall Street Journal Study 2007. Over 50 per cent of its revenues flow from its overseas operations.

The Group operates in 25 countries in Cement, Aluminum, Fertilizers, Viscose Staple Fiber, Textiles, Petroleum Refining, Power, Telecommunications, Industrial, Chemicals and Financial Services.

Grasim Cement, an ISO 9002 & 14001 certified company is a unit of Grasim Industries Ltd. with cement manufacturing unit at Rawan, Simga Tehsil, Raipur district in Chhattisgarh with gross cement production capacity of 3.3 MTPA.

1.2.1 STATUS OF THE PROJECT

Grasim Cement Plant has an existing Cement Plant (3.3 MTPA) Captive Power Plant (30 MW) along with Captive Rawan Jhipan Limestone Mine (ML Area – 722.834ha; Limestone production capacity - 2.8 MTPA) at Village Rawan, Tehsil Simga, District Raipur, Chhattisgarh. The Cement plant was commissioned in 1995.

The Environmental Clearance for the existing Cement Plant, Captive Power Plant & Rawan Jhipan Limestone Mine has been accorded by MoEF, New Delhi. All the existing units are working with the required clearances/consents from MoEF & SPCB for their present capacity.

The Environmental Clearances for the existing Cement Plant had been obtained from MoEF, New Delhi through letter no J-11011/628/2008.IA II (I) dated 22.09.08, copy of the same along with point wise compliance to the specific & general conditions stipulated in the Environmental Clearance are enclosed as **Annexure 1**.

Environmental Clearance for the existing Captive Power Plant have been obtained from MoEF, New Delhi vide letter no J-13011/57/2006.IA-II(T) dated 20.06.07, copy of the same along with point wise compliance to the specific & general conditions stipulated in the Environmental Clearance are annexed as **Annexure 2**.

M/s Grasim Industries Limited (GIL) is now proposing for Brown Field Integrated Cement Project in the existing Cement Plant premises by expansion in Cement production capacity from 3.3 MTPA to 6.5 MTPA, Clinker from 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30 MW to 80 MW & D.G. Set 12 MW (2x6 MW) near village Rawan, Tehsil Simga, District Raipur.

Proposed Brown Field Integrated Cement Project: Cement Plant, Captive Power Plant & D.G. Set At Village Rawan, Tehsil Simga, District Raipur (Chhattisgarh)	Draft EIA/EMP Report
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TABLE -1.1
PROPOSED PROJECT ACTIVITY

S. No.	Category	Existing capacity	Additional Capacity	Capacity after Expansion
1.	Clinker Production	2.1 MTPA	4.4 MTPA	6.5 MTPA
2.	Cement Production	3.3 MTPA	3.2 MTPA	6.5 MTPA
3.	Captive Thermal Power Plant	30 MW	50 MW	80 MW
4.	D. G. Set	12 MW (2X6 MW)	-	12 MW

Source: Prefeasibility Report

1.3 BRIEF DESCRIPTION ABOUT THE NATURE SIZE, LOCATION OF THE PROJECT

GRASIM CEMENT (A Unit of Grasim Industries Limited) unit is located at village Rawan, Tehsil Simga, District, Raipur of Chhattisgarh, which is 25 km away from nearest Railway station Bhatapara and 70 km from Raipur in SE Railway. The place is well connected to other parts of the country by road, rail and air. The salient features of the project are as follows:

TABLE NO: 1.2
SALIENT FEATURES OF THE PROJECT

S. No.	PARTICULARS	DETAILS
1.	Nature & Size of the Project	Brownfield Integrated Cement Project : Cement Plant from 3.3 MTPA to 6.5 MTPA, Clinker production - 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30MW to 80 MW, D.G. Set 12 MW (2x6 MW).
2.	Location	
	Village	Rawan
	Tehsil	Simga
	District	Raipur
	State	Chhattisgarh
	Latitude	21° 33' – 21° 35' N
	Longitude	81° 58' – 82° E

Proposed Brown Field Integrated Cement Project: Cement Plant, Captive Power Plant & D.G. Set At Village Rawan, Tehsil Simga, District Raipur (Chhattisgarh)	Draft EIA/EMP Report
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S. No.	PARTICULARS	DETAILS
1.	Nature & Size of the Project	Brownfield Integrated Cement Project : Cement Plant from 3.3 MTPA to 6.5 MTPA, Clinker production - 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30MW to 80 MW, D.G. Set 12 MW (2x6 MW).
	Toposheet No.	64 G/14 & 64 K/2
3.	Total Plant Area	388.37 ha
4.	Green Belt Development	~212.54 ha (~55 % of the total area, thus the same will be maintained in future as well)
5.	Cost of the project	Rs 950 Crores
6.	Cost for Environmental Protection	Rs 100 Crores
7.	Recurring cost per annum for environmental pollution control measures	Rs 05 Crores
8.	Water Requirement (KLPD)	➤ Existing :1,962 KLPD ➤ Proposed : 2,000 KLPD ➤ Total : 3,962 KLPD Source : Mine Sump Water & existing Bore Well
9.	Power Requirement	➤ Existing :30 MW ➤ Proposed : 50 MW ➤ Total : 80 MW Source : Captive Power Plant
10.	Manpower Requirement	➤ Existing :480 ➤ Proposed : 85 ➤ Total : 565
11.	Elevation Range	265 m to 284 m with respect to mean sea level
12.	General Ground Level	276 mRL
13.	Nearest Village	Rawan Village
14.	Nearest Railway Station	Bhatapara – 17 km (South-East)
15.	National Highway	NH-6 at 70 km connecting Sambalpur and Nagpur
17.	Nearest Airport	Raipur – 85 km
18.	Nearest Town / City	Raipur
19.	Archaeological Important Place	None

Proposed Brown Field Integrated Cement Project: Cement Plant, Captive Power Plant & D.G. Set At Village Rawan, Tehsil Simga, District Raipur (Chhattisgarh)	Draft EIA/EMP Report
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S. No.	PARTICULARS	DETAILS
1.	Nature & Size of the Project	Brownfield Integrated Cement Project : Cement Plant from 3.3 MTPA to 6.5 MTPA, Clinker production - 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30MW to 80 MW, D.G. Set 12 MW (2x6 MW).
20.	Ecological Sensitive Areas	No Wildlife Sanctuaries, National Park, Biosphere Reserve, Reserve Forest, Protected Forest exists within 10 km radius of the project site.

Source: Pre-feasibility Report

1.4 IMPORTANCE TO THE COUNTRY, REGION

India is the world's second largest producer of cement after China, with cement companies adding nearly 11 million tonnes (MT) capacity during April-September 2009, taking the total installed capacity to around 231 MT by September 2009. Cement demand in the country grows at roughly 1.5 times the GDP growth rate. With the boost given by the government to various infrastructure projects, road networks and housing facilities, growth in the cement consumption is anticipated in the coming years. According to the Cement Manufacturer's Association, cement despatches were 14.13 MT in December 2009, showing a growth of 13 per cent as compared to 12.48 MT in December 2008. During December 2009, cement production was 13.91 MT, registering a growth of 13 per cent as compared to 12.31 MT in December 2008. Between April to December 2009, cement production totaled 116.01 MT while cement despatches amounts to 115.31 MT.

The demand of cement in year 2009-2010 is expected to increase by 50 million tons despite of the recession and decline in demand of housing sector. Against India's GDP growth of 7%, the experts have estimated the cement sector to grow by 9 to 10 % in the current financial year. Major Indian cement manufacturers and exporters have all made huge investments in the last few months to increase their production capability. This heralds an optimistic outlook for cement industry.

The increase of production within the existing plant premises is based on the following considerations.

- ❖ Proximity of the site to limestone mines (captive) and abundant availability of reserves.
- ❖ Market demand in the eastern region.
- ❖ Availability of the land – no additional land is proposed to be acquired.
- ❖ Availability of existing infrastructure.

1.5 SCOPE OF STUDY

The disciplines covered under the work programme are prerequisite information of the site, manufacturing process, effluent generation and its proper disposal, impacts and management plans. This report contains environment baseline data of ambient air, noise monitoring, Water & Soil quality of the study area as well as the ecological studies, biological environment study & socio-economic study carried out during the winter season i.e. December 2009 to February 2010.

The project was considered in front of Expert Appraisal Committee (EAC) (Industry-1) for its First technical presentation on 24th September, 2009. The EAC committee has suggested Terms of References (ToR) for preparation of the Environmental Impact Assessment (EIA) Report and Environmental Management Plan (EMP) Vide its File No. J-11011/262/2009-IA.II (I) & Letter dated 9th October, 2009. As per the ToR's issued we have collected all the data/ information and incorporated in this Draft EIA/EMP Report. The ToR points as prescribed by the EAC for the EIA preparation are as follows :

1. A site location map on Indian map of 1:10, 00,000 scale followed by 1:50,000/1:25,000 scale on an A3/A2 sheet with at least next 10 Kms of terrains i.e. circle of 10 kms and further 10 kms on A3/A2 sheets with proper longitude/latitude/heights with min. 100/200 m. contours should be included. 3-D view i.e. DEM (Digital Elevation Model) for the area in 10 km radius from the proposal site.

Proposed Brown Field Integrated Cement Project: Cement Plant, Captive Power Plant & D.G. Set At Village Rawan, Tehsil Simga, District Raipur (Chhattisgarh)	Draft EIA/EMP Report
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2. Present land use should be prepared based on satellite imagery. High-resolution satellite image data having 1m-5m spatial resolution like quickbird, Ikonos, IRS P-6 pan sharpened etc. for the 10Km radius area from proposed site. The same should be used for land used/land-cover mapping of the area.
3. Location of national parks / wildlife sanctuary / reserve forests within 10 km. radius should specifically be mentioned. A map showing landuse / landcover, reserved forests, wildlife sanctuaries, national parks, tiger reserve etc in 10 km of the project site.
4. Project site layout plan showing raw materials, fly ash and other storage plans, bore well or water storage, aquifers (within 1 km.) dumping, waste disposal, green areas, water bodies, rivers/drainage passing through the project site should be included.
5. Details and classification of total land (identified and acquired) should be included.
6. Proposal should be submitted to the Ministry for environment clearance only after acquiring total land. Necessary documents indicating acquisition of land should be included.
7. Rehabilitation & Resettlement (R & R) should be as per policy of the State Govt. and a detailed action plan should be included.
8. Permission and approval for the use of forest land and recommendations of the State Forest Department regarding impact of proposed expansion on the surrounding reserve forests, if applicable, should be included.
9. A list of industries containing name and type in 25 km radius should be incorporated.
10. Residential colony should be located in upwind direction.
11. List of raw material required and source alongwith mode of transportation should be included. All the trucks for raw material and finished product transportation must be Environmentally Compliant.
12. Petrological and Chemical analysis and other chemical properties of raw materials used (with GPS location of source of raw material) i.e. ores, minerals, rock, soil, coal, iron, dolomite quartz etc. using high

definition and precision instruments mentioning their detection range and methodology such Digital Analyzers, AAS with Graphite furnace, ICPMS, MICRO-WDXRF, EPMA, XRD, Nano studies or at least as per I30-10500 and WHO norms. These analysis should include trace element and metal studies like Cr (vi) Ni, Fe, As, Pb, Zn, Hg, Se, S etc. Presence of radioactive elements (U, Th etc.).

13. Petrography, grain size analysis and Major element analysis of raw material and soil from project site and raw material should be done on the same parameters along with analysis for SiO₂, Al₂O₃, MgO, MnO, K₂O, CaO, FeO, Fe₂O₃, P₂O₅, H₂O, CO₂.
14. If the rocks, ores, raw material has trace elements their petrography, ore microscopy, XRD, elemental mapping EPMA, XRF is required to quantify the amount present in it and hence future risk involved while using it and management plan.
15. Studies for fly ash, muck disposal, slurry, sludge material and solid waste generated should also be included, if the raw materials used has trace elements and a management plan.
16. Manufacturing process details for all the cement plant and captive power plant should be included.
17. Mass balance for the raw material and products should be included.
18. Energy balance data for all the components including proposed power plant should be incorporated.
19. Site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall should be collected.
20. Data on existing ambient air, stack emission, fugitive emissions data; water requirement and water balance cycle; generation, re-utilization and disposal of solid/ hazardous waste for the existing plant and predicted increase in pollution load (GLCs) due to proposed expansion should be incorporated.
21. Point-wise compliance to the specific and general conditions stipulated in the environmental clearance for the existing plant should be included.

22. Sources of secondary emissions, its control and monitoring as per the CPCB guidelines should be included.
23. A full chapter on fugitive emissions and control technologies should be provided.
24. A write up on use of high calorific hazardous wastes from all the sources in kiln and commitment regarding use of hazardous waste should be included.
25. Ambient air quality at 8 locations within the study area of 10 km., aerial coverage from project site with one AAQMS in downwind direction should be carried out.
26. The suspended particulate matter present in the ambient air must be analyzed for the presence of poly-aromatic hydrocarbons (PAH), i.e. Benzene soluble fraction. Chemical characterization of RSPM and incorporating of RSPM data.
27. Determination of atmospheric inversion level at the project site and assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features.
28. Air quality modeling for all the plants proposed including mine for specific pollutants needs to be done. APCS for the control of emissions within 50 mg/Nm³ [or at the most 75 mg/Nm³ due to expansion of the existing plant] should be included.
29. Ambient air quality monitoring modeling alongwith cumulative impact should be included for the day (24 hrs) for maximum GLC alongwith following :
 - i) Emissions (g/second) with and without the air pollution control measures.
 - ii) Meteorological inputs (wind speed, m/s), wind direction, ambient air temperature, cloud cover, relative humidity & mixing height) on hourly basis.
 - iii) Model input options for terrain, plume rise, deposition etc.
 - iv) Print-out of model input and output on hourly and daily average basis

- v) A graph of daily averaged concentration (MGLC scenario) with downwind distance at every 500 m interval covering the exact location of GLC.
 - vi) Details of air pollution control methods used with percentage efficiency that are used for emission rate estimation with respect to each pollutant.
 - vii) Applicable air quality standards as per LULC covered in the study area and % contribution of the proposed plant to the applicable Air quality standard. In case of expansion project, the contribution should be inclusive of both existing and expanded capacity.
 - viii) No. I-VII are to be repeated for fugitive emissions and any other source type relevant and used for industry.
 - ix) Graphs of monthly average daily concentration with down-wind distance.
 - x) Specify when and where the ambient air quality standards are exceeded either due to the proposed plant alone or when the plant contribution is added to the background air quality.
 - xi) Fugitive dust protection or dust reduction technology for workers within 30 m of the plant active areas.
30. Impact of the transport of the raw materials and end products on the surrounding environment should be assessed and provided.
 31. One season data for gaseous emissions other than monsoon season is necessary.
 32. An action plan to control and monitor secondary fugitive emissions from all the sources as per the latest permissible limits issued by the Ministry vide G.S.R. 414(E) dated 30th May, 2008.
 33. Presence of aquifer(s) within 1 km of the project boundaries and management plan for recharging the aquifer should be included.
 34. Source of surface/ground water level, site (GPS), cation, anion (Ion Chromatograph), metal trace element (as above) chemical analysis for water to be used. If surface water is used from river, rainfall,

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discharge rate, quantity, drainage and distance from project site should also be included.

35. Ground water analysis with bore well data, litho-logs, drawdown and recovery tests to quantify the area and volume of aquifer and its management.
36. Ground water modeling showing the pathways of the pollutants should be included
37. Column leachate study for all types of stockpiles or waste disposal sites, at 20oC-50oC should be conducted and included.
38. Permission for the drawl of water from the concerned authority and water balance data including quantity of effluent generated, recycled and reused and discharged is to be provided. Methods adopted/to be adopted for the water conservation should be included.
39. A note on the impact of drawl of water on the nearby River during lean season.
40. Surface water quality of nearby River (60 m upstream and downstream) and other surface drains at eight locations must be ascertained.
41. If the site is within 10 km radius of any major river, Flood Hazard Zonation Mapping is required at 1:5000 to 1:10,000 scale indicating the peak and lean river discharge as well as flood occurrence frequency.
42. A note on treatment of wastewater from different plants, recycle and reuse for different purposes should be included.
43. Provision of traps and treatment plants are to be made, if water is getting mixed with oil, grease and cleaning agents.
44. If the water is mixed with solid particulates, proposal for sediment pond before further transport should be included. The sediment pond capacity should be 100 times the transport capacity.
45. Wastewater characteristics (heavy metals, anions and cations, trace metals, PAH) from washed / beneficiated plants / washery.
46. The pathways for pollution via seepages, evaporation, residual remains are to be studied for surface water (drainage, rivers, ponds,

lakes), sub-surface and ground water with a monitoring and management plans.

47. Ground water monitoring minimum at 8 locations and near solid waste dump zone, Geological features and Geo-hydrological status of the study area are essential as also. Ecological status (Terrestrial and Aquatic) is vital.
48. Geo-technical data by a bore hole of upto 40 mts. in every One sq. km area such as ground water level, SPTN values, soil fineness, geology, shear wave velocity etc. for liquefaction studies and to assess future Seismic Hazard and Earthquake Risk Management in the area.
49. Action plan for solid/hazardous waste generation, storage, utilization and disposal.
50. A note on the treatment, storage and disposal of all type of solid waste should be included.
51. End use of solid waste and its composition should be covered.
52. All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water
53. Action plan for the green belt development plan in 33 % area should be included. The green belt should be around the project boundary and a scheme for greening of the traveling roads should also be incorporated. All rooftops/terraces should have some green cover.
54. A scheme for rainwater harvesting have to be put in place. Incorporation of water harvesting plan for the project is necessary, if source of water is bore well.
55. Detailed description of the flora and fauna (terrestrial and aquatic) should be given with special reference to rare, endemic and endangered species.
56. Socio-economic development activities need to be elaborated upon.
57. Disaster Management Plan including risk assessment and damage control needs to be addressed and included.
58. Occupational health of the workers needs elaboration. Health effects of other metals used and health hazard plans based on monthly

correlation of these metal related diseases and people affected and mitigation plans. Arsenicosis Management Plan if Arsenic is present in ore, rock, coal, fly ash, water. Action Plan for protecting the workers against hazardous chemicals such as Sulphuric acid, pesticides, solvents etc.

59. Occupational health of the workers needs elaboration including evaluation of noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and steps taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc. Occupational hazards specific pre-placement and periodical monitoring and periodical monitoring should be carried out. The detailed plan to carry out above mentioned activity should be mentioned.
60. Plan for the implementation of the recommendations made for the cement plants in the CREP guidelines must be prepared.
61. A note on identification and implementation of Carbon Credit project should be included.
62. Total capital cost and recurring cost/annum for environmental pollution control measures.
63. Public hearing issues raised and commitments made by the project proponent on the same should be included separately in EIA/EMP Report in the form of tabular chart.
64. Any litigation pending against the project and / or any direction / order passed by any Court of Law against the project, if so, details thereof.

Efforts have been laid down to address each & every aspect of Impact of Project activity on the environment. With proper management efforts & systems for all the biotic & abiotic factors of environment the project activity will lead to development of the area.



CHAPTER-II

PROJECT DESCRIPTION

2.1 TYPE OF THE PROJECT

Grasim Cement Plant has an existing Cement Plant (3.3 MTPA) Captive Power Plant (30 MW) along with Captive Rawan Jhipan Limestone Mine (ML Area – 722.834ha; Limestone production capacity - 2.8 MTPA) at Village Rawan, Tehsil Simga, District Raipur, Chhattisgarh. The Cement plant was commissioned in 1995.

M/s Grasim Industries Ltd (GIL) is now proposing for Brown Field Integrated Cement Project in the existing Cement Plant premises by expansion in Cement production capacity from 3.3 MTPA to 6.5 MTPA, Clinker from 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30 MW to 80 MW & D.G. Set 12 MW (2x6 MW) near village Rawan, Tehsil Simga, District Raipur.

As per the New Notification 14th September 2006, this Brown Field Integrated Cement Project falls in Category 'A' and therefore this project requires Environmental Clearance from MoEF, New Delhi.

2.2 NEED FOR THE PROJECT

Cement is an essential ingredient for the modern building construction. The new generation cement plants in India now employs the latest technology for better efficiency, energy conservation and economics of large capacity production. The improved market conditions witnessed recently, after a gap of recession over a long period, are expected to continue due to high priority being given by the Government to housing construction and also in view of the massive investment proposed in industry and rural sectors. Therefore, there is an urgent need to increase the cement production capacity in the country inspite of severe resource constraints. Hence this project will help in decreasing demand of cement countrywide.

Under the discussion of project's importance to the country & region in Chapter -1; it was discussed that the Cement demand in the country grows at roughly 1.5 times the GDP growth rate. With the boost given by the government to various infrastructure projects, road networks and housing facilities, growth in the cement consumption is anticipated in the coming years. According to the Cement Manufacturer's Association, cement despatches were 14.13 MT in December 2009, showing a growth of 13 per cent as compared to 12.48 MT in December 2008. During December 2009, cement production was 13.91 MT, registering a growth of 13 per cent as compared to 12.31 MT in December 2008.

The demand of cement in year 2009-2010 is expected to increase by 50 million tons despite of the recession and decline in demand of housing sector. Against India's GDP growth of 7%, the experts have estimated the cement sector to grow by 9 to 10 % in the current financial year. This heralds an optimistic outlook for cement industry.

2.3 LOCATION

Grasim Cement Complex is located near Rawan village, Tehsil Simga, Raipur District of Chhattisgarh State. The project area falls under SOI Topo sheet No. 64 G/14 & 64 K/2. The topography of the area is almost flat with average ground level around 276 m above msl.

The project area is accessed by road in all seasons and is located at about 75 km from Raipur in East direction, and about 17 km South East from Bhatapara railway station on East – central main line. The tehsil headquarter Simga is located at 40 km from the project site. The nearest airport is Raipur located at a distance of 85 km away from the plant. The highlights of the project site are as follows :

- Most of the villages have electric supply from State Electricity Board for domestic and agriculture purposes.
- The source of water supply of drinking water is ground water through well, tube-wells and handpumps. The tap water supply is also available in the villages.

- Post office and telegraph facilities are also available.
- The main mode of transportation is by road. Regular bus service is available in the nearby villages.
- Thus the area has good infrastructure facilities. These facilities have been increased after commissioning of the Cement Plant.

2.3.1 Project Layout

Being a Brownfield project, the project will be beneficated by the available existing facilities of storage of material, transportation facilities etc. Moreover, enough space is available in the existing plant premises for the proposed project activity.

This is an existing plant & the colony already exists. The same colony will be used after the proposed project activity also. The Pre-dominant Direction for the project site is South-East & the colony is also located in the same direction.

The features of the plant layout are as follows:

- The major utilities and service facilities are centrally located;
- Sufficient space has been provided for ease of operation and maintenance;
- Outward movements of materials from customers/suppliers has been segregated from internal plant traffic; and
- Safety requirements have been kept in mind while locating the workshops and vehicular movement inside the plant.

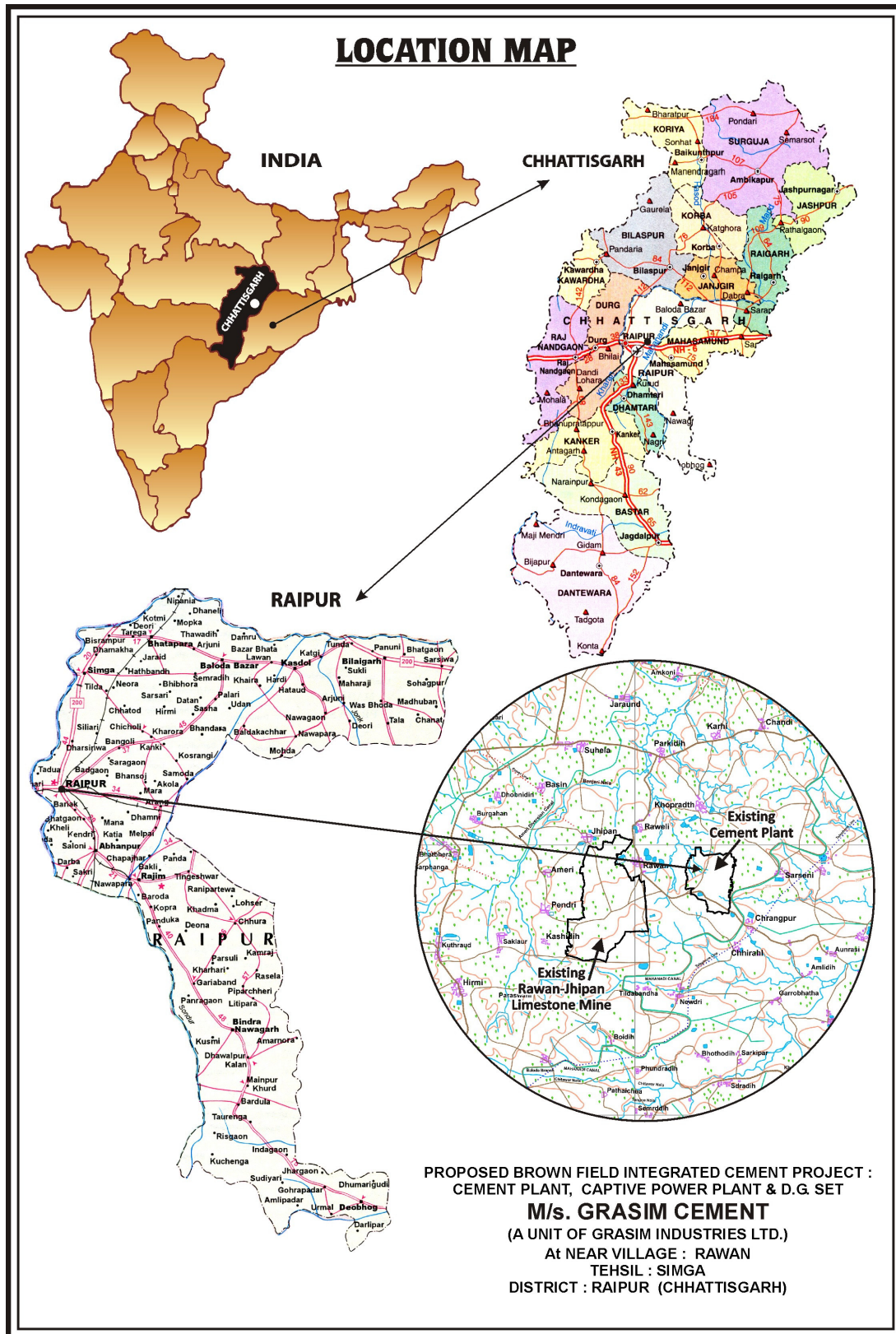


FIGURE 1: LOCATION MAP OF THE PROJECT SITE

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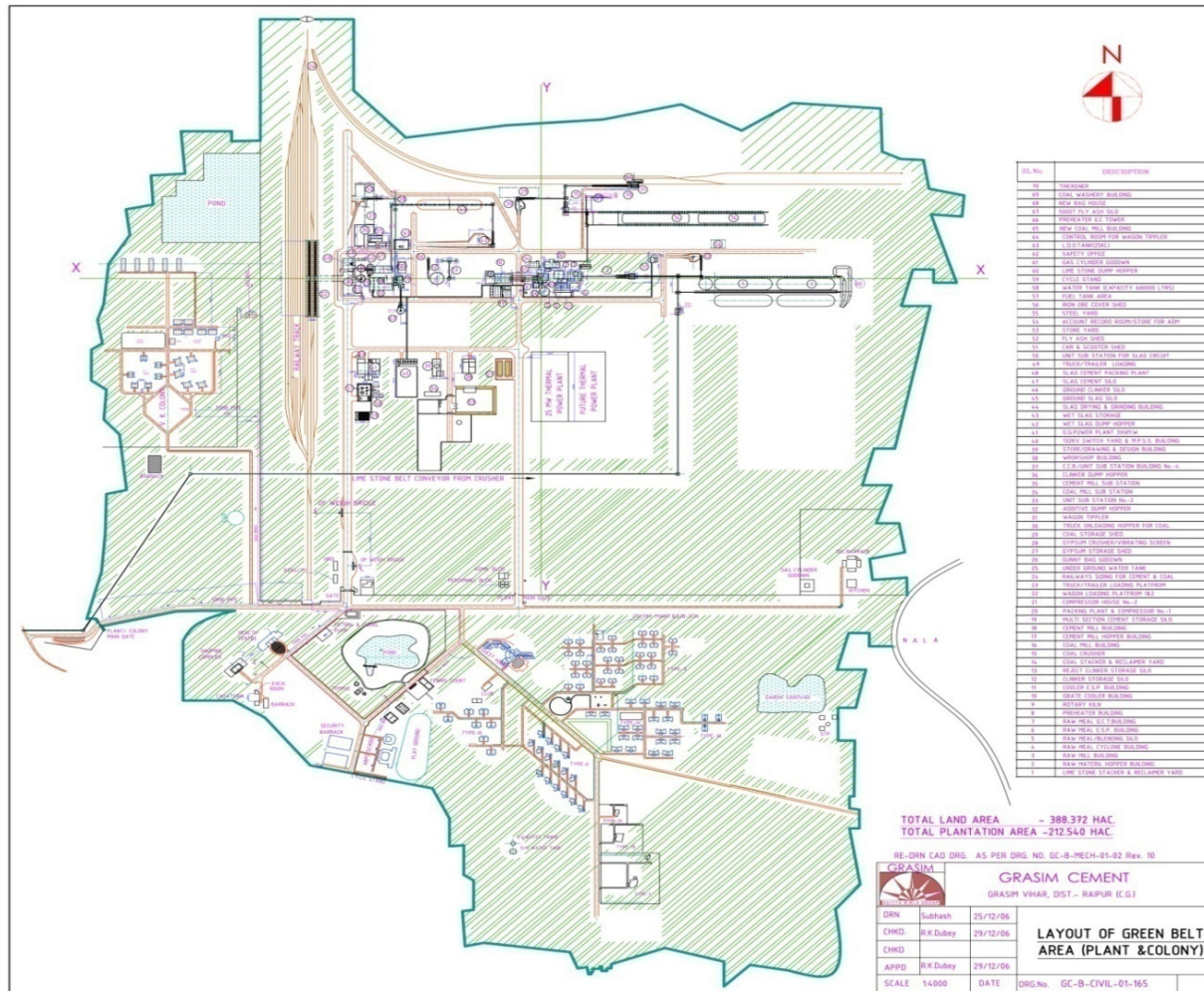


FIGURE 2: PLANT LAYOUT (EXISTING & PROPOSED)



FIGURE 3: VIEW OF PROPOSED PROJECT SITE

2.4 HIGHLIGHTS OF THE PROJECT

2.4.1 LAND AREA DETAILS

Proposed expansion will be done within the existing cement plant premises, no additional land will be required. Details related to the existing and proposed land requirement is as mentioned in table no 2.1,

TABLE – 2.1
PLANT AREA DETAILS

S. No.	Land Use	Area in Hectares
1.	Existing Plant Area	28 ha
2.	Proposed Plant Area	36 ha
3.	Colony(build -up)	50 ha
4.	Green Belt/Plantation	212.54 ha (Plant+ Colony)
5.	Un used area	61.83 ha
Total land available		388.37 ha

Source: Pre-feasibility Report

2.4.2 CLASSIFICATION OF LAND

Total available plant area is 388.37 ha & documents of land acquisition are enclosed as **Annexure 3**. Classification of total land acquired are as mentioned in the table below:

TABLE – 2. 2
CLASSIFICATION OF LAND

S. No.	Particular	Area (ha)
1.	Government Land	43.091
2.	Private Land	345.279
	Total Plant Area	388.37

Source: Project Report

2.4.3 Water Requirement

The total water requirement after proposed project shall be 3962 KLPD (Existing 1962 KLPD & Additional 2000 KLPD). Presently, the water requirement is met from the accumulated rain water of the captive limestone mine sump and existing bore wells. Additional water requirement will also be met from the captive mines sump and existing bore well (for drinking purpose only). This will be made possible by enhancing the mine sump capacity for catering the present and future requirement.

The mine sump water will be used for industrial purpose; whereas bore wells water will be used to fulfill the domestic requirement only. The water details are as given in the below table.

TABLE – 2.3

Total Water Requirement

Utility	Present Requirement (in KLD)	Additional Requirement (in KLD)	Total Requirement (in KLD)
Cement Plant	1212	1200	2412
Power Plant	300	600	900
Domestic	450	200	650
Total	1962	2000	3962

Source: Pre-feasibility Report

2.4.5 Power Requirement

Power requirement for the project activity after proposed project activity will be 80 MW, which will be made available through captive power plant.

TABLE – 2.4

POWER REQUIREMENT

Utility	Present Requirement	Additional Requirement for the Proposed Project	Total Requirement
Cement Plant	30 MW	50 MW i.e. (2X25 MW)	80 MW
Power Plant	Included in Cement Plant		

Source: Pre-feasibility Report

2.4.6 Man Power Requirement

GIL has provided employment to the people living in nearby villages. The unskilled and semi-skilled categories of labour are available from the nearby villages and towns. GIL has provided direct employment to about 480 persons and after the expansion about 85 persons will be employed.

TABLE – 2.5
MANPOWER REQUIREMENT

Utility	Present Requirement	Additional Requirement for the Proposed Project	Total Requirement
Cement Plant	450	75	525
Power Plant	30	10	40

Source: Pre-feasibility Report

2.4.7 PRODUCTION CAPACITY DETAILS

Details related to the Cement Production capacity has been summarized in the table shown below :

TABLE – 2.6
PRODUCTION CAPACITY DETAILS

Category	Present Capacity (MTPA)	Additional Capacity (MTPA)	Total Capacity (MTPA)
Clinker Plant	2.1	4.4	6.5
Cement Plant	3.3	3.2	6.5
Cement Production Details			
PPC	1.8	1.5	3.3
PSC	1.2	1.3	2.5
OPC	0.3	0.4	0.7

The total Clinker production capacity will be 6.5 MTPA; Out of the additional clinker quantity 5.0 MTPA will be used for Cement Production in the Grasim Cement Plant, & the remaining quantity of the clinker viz. 1.5 MTPA will be sent to Dhutra (Jharsugda) & Durgapur Grinding Unit 298 Km & 731 Km respectively away from the Grasim Cement Plant, for Cement Production. The existing Cement Production Capacity of Dhutra (Jharsugda) & Durgapur Grinding Unit is 1.0 MTPA & 1.2 MTPA respectively for which 0.7 MTPA & 0.9 MTPA of Clinker respectively is required. The new grinding unit at Cuttack (Orissa) – 1.5 MTPA and at Ranchi (Jharkhand) is proposed.

2.5 PROCESS DESCRIPTION

2.5.1 Cement Plant

The cement plant will adopt Dry Process Technology for Cement manufacturing with Pre Heating and Pre Calcliner Technology. The type of cement will be manufactured are Ordinary Portland Cement (OPC), Pozzolona Portland Cement (PPC), Portland Slag Cement (PSC).

The process largely comprises of the following steps:

- Crushing the Limestone
- Raw Mix preparation
- Raw mix homogenization
- Coal preparation
- Calcination & Clinkerisation
- Cement Grinding
- Packing & Dispatch

2.5.2 Raw Material

The main raw material for the Cement Plant is limestone, which will be transported from the captive limestone mine through covered conveyor belt. Other material transportation will be taking place by road or rail depending on the distance & available facilities. Railway siding & road facilities for the transportation of materials are already present in the plant premises which shall be used for the project activity also. All the vehicles used for the transportation of raw material and finished product including trucks, tippers, and dumpers are maintained regularly & checked for Pollution Under Control. The details of the quantity required and their source are shown in table below.

TABLE - 2.7
RAW MATERIAL REQUIREMENT & SOURCE

S. No.	Minerals	Quantity in MTPA			Source	Mode of Transportation
		Existing	Additional	Total		
1.	Limestone	2.8	6.95	9.75	Captive Mine	Covered Conveyor Belt
2.	Iron Ore	Nil	0.05	0.05	Nearby Area	Road
3.	Coal (Cement Plant)	0.3	0.6	0.9	Captive Coal Washery & Nearby Market	Road
4.	Coal (CPP)	0.2	0.4	0.6		
5.	Clinker	2.1	4.4	6.5	Captive Cement Plant	-
6.	Gypsum	0.1	0.15	0.25	Nearby Area	Road / Rail
7.	Fly Ash	0.5	0.5	1.0	CPP , Balco, NTPC Korba	Rail (250 km)
8.	Slag	0.5	0.5	1.0	Bhilai steel plant/ NICCO	Road / Rail (~100km)

Source: Pre-feasibility Report

2.5.3 Cement Manufacturing Process

Grasim Cement has adapted most advanced state of art technology available in the world and is therefore able to keep high quality standards with consistency. The plant is one of the most modern dry process cement plant using a short kiln and preheater with SLC pre-calcinator.

The limestone and Iron ore (as an additive) is taken into separate hopper and are fed to Vertical Roller Mill (VRM) through weigh feeder and ground to produce a Raw Mix suitable for producing clinker of exceptionally good quality. The raw mix so produced is taken into a blending-cum-storage silo having multiflow with 6 inlets & 12 outlets. The homogenized Raw Mix is fed into preheater (FLS & L&T make) from the top where about 90% of the material is calcined with a current of hot gases drawn from kiln. The calcined material is pyroprocessed at 1400 °C temperatures in the rotary kiln of above specifications to produce clinker. The clinker so produced is

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cooled by passing through Air Quenching Grate Cooler and is stored in clinker silo and another silo.

The clinker so produced is ground with Gypsum (acts as setting time retarder) and fly ash (to produce PPC Cement) in a close circuit Ball Mill in conjunction with Roller Press (make - KHD/CIMMCO) to produce cement of required fineness and uniform quality. The cement thus produced is taken into cement silo.

For making Portland Slag Cement, there is a separate Slag Grinding System, a latest technology from Krupp Polysius, in which slag is ground in roller Press – Polycom after drying in dryer and is stored separately in to ground slag silos. The clinker and gypsum is ground in the Cement mill Section i.e., through KHD, Humboldt Roller Press & Cement Mill and stored in separate silo.

The ground slag and ground clinker is extracted separately from the respective silos and is uniformly mixed in a paddle mixer in desired and predetermined proportion so as to get PSC with excellent particle size distribution. Thus the PSC produced is stored in a silo. The entire process from the stage of raw material grinding to the point of filling the cement silos is controlled from a “Central Control Room”. The quality of cement produced is assured (to comply with the relevant ISI standards specification) by carrying out physical and chemical tests at different stages of manufacture in the quality control laboratory (QC).

To minimize dust emission to bare minimum level in and around the factory, high efficiency Bag filters & ESP will be installed. high efficiency process at Raw Mill/Kiln, Coal Mill, Cooler & Cement Mill respectively. The installation of these air pollution control equipments helps in achieving emission standards as per Air Pollution Control Act.

The Cement is extracted from silo and packed in bags with the help of electronic packing machines. The packed cement bags are loaded into trucks/wagons with the help of insertable loaders for onward despatch to their destination. Specifically this type of packaging unit is very effective to arrest dust emission right at source.

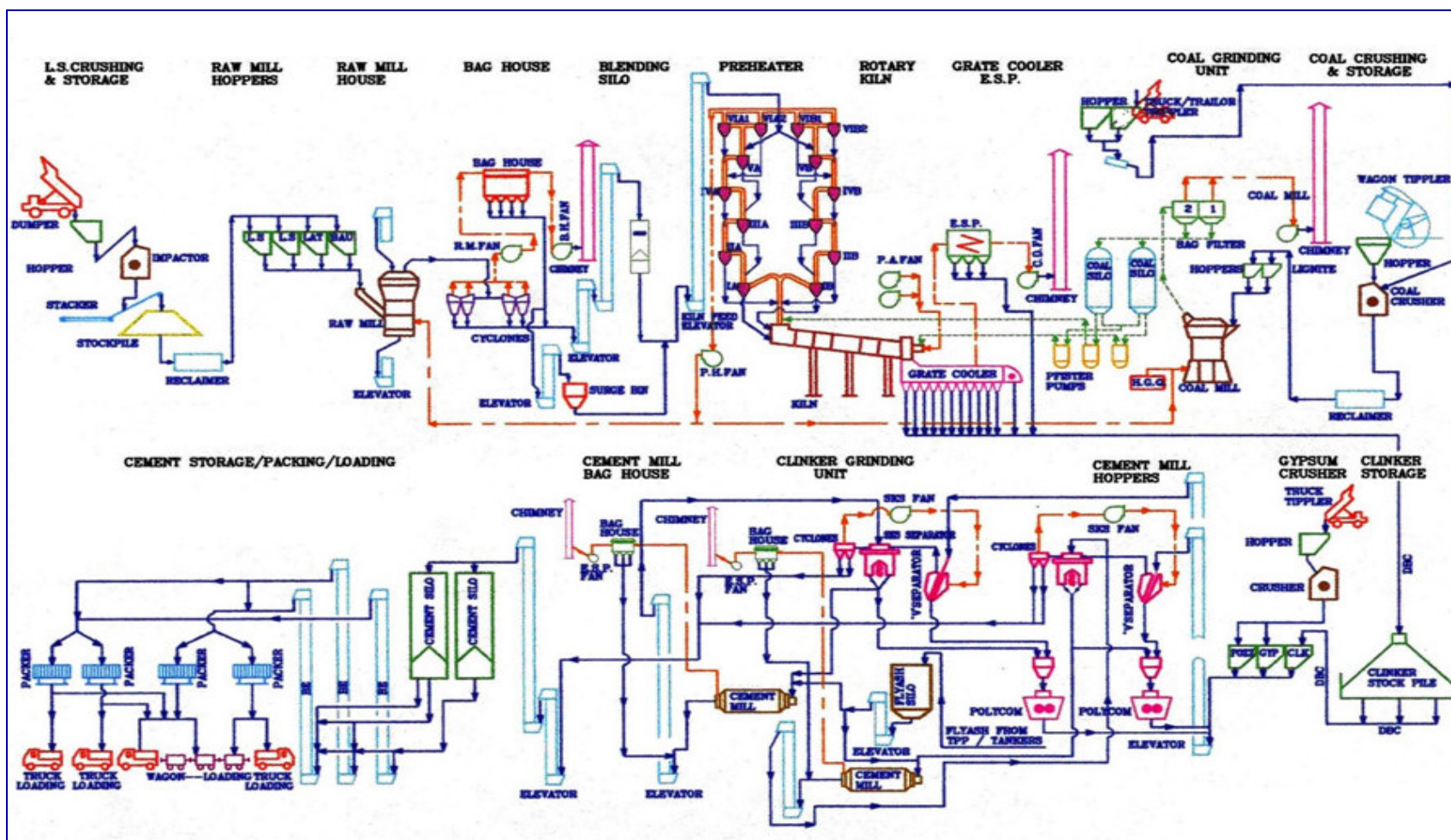


FIGURE 4 : CEMENT PLANT - PROCESS FLOW CHART

2.6 THERMAL POWER PLANT PROJECT INFORMATION

There is a proposal to expand capacity of thermal plant from 30 MW to 80 MW. Hence, power generation capacity of 50 MW (2x50 MW) will be added in the existing capacity.

The raw coal is passed through the coal crusher to crush it to a size below 6 mm and the same is transported to Coal bunker of the power plant from where it is extracted and fed to the Boiler for generating sufficient heat to produce steam required for the turbine.

In the boiler plant the coal is burnt and the water is converted into high-pressure steam, which is further heated in a super heater. The super heated steam is passed in the turbine to rotate the turbine blades, thus it converts the heat energy into mechanical energy. After imparting energy to the turbine rotor it passes out and the pressure of the steam decreases and volume increase. This low-pressure steam passes through the condenser. In the condenser the steam is condensed either by circulation of cold water or with the help of air-cooled condensers. The condensed water is further supplied to low-pressure water heater where the low-pressure steam increases the temperature of feed water; it is then again heated in a high-pressure heater where the high-pressure steam is used for heating.

The rotor of the turbine is connected to a Gearbox, which further increases output rpm. The other end of the gearbox (output shaft) is connected to the Alternator. Thus the turbine supplies input mechanical power required to the AC generator. Due to rotation of the Alternator the AC generator generates field electricity. In our case the electricity will be generated at 11 kV, 50 Hz, 3 phase and it will be stepped-up to 132 KV, 50 Hz and transmitted through adequate rating of HT XLPE cables to the main distribution board through Circuit breaker for catering the required power to the various section / equipment of the Cement plant.

Proposed Heat Cycle Equipment

The deaerator has been considered at 2 ata pressure, having a temperature of 120°C. This ensures adequate feed water heating in the

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H.P. heater (i.e. 120°C to 190°C) to achieve improved thermal efficiency. The STG will have one extraction for HP heater at about 17 ata and an extraction at 3.5 ata for the deaerator. The air ejector steam will be available from the HP heater extraction.

The turbine would be standard 3000 rpm multi-stage single cylinder unit, exhausting against a condenser pressure of 0.10 ata. The condenser will be double-pass surface type with divided water-box.

In case of conventional water-cooled condenser, using a cooling tower for heat dissipation, condenser vacuum of about 0.1 kg/cm²a is achievable. However, in this case there is a considerable amount of heat dissipation in evaporative cooling tower, which involves make-up water requirement for evaporation and blow down from the cooling tower. Therefore, the alternative arrangement has been proposed to go for a dry cooling arrangement for condenser cooling. This will involve air-cooled condenser instead of conventional water-cooled condenser. The dry cooling condenser will be an outdoor structure with induced draft fans at top and finned cooling pipes through which steam/condensate flow takes place. The basic heat cycle configuration remains the same except that the condenser exhaust pressure goes up, since the cooling is only by sensible heat transfer without any evaporative cooling.

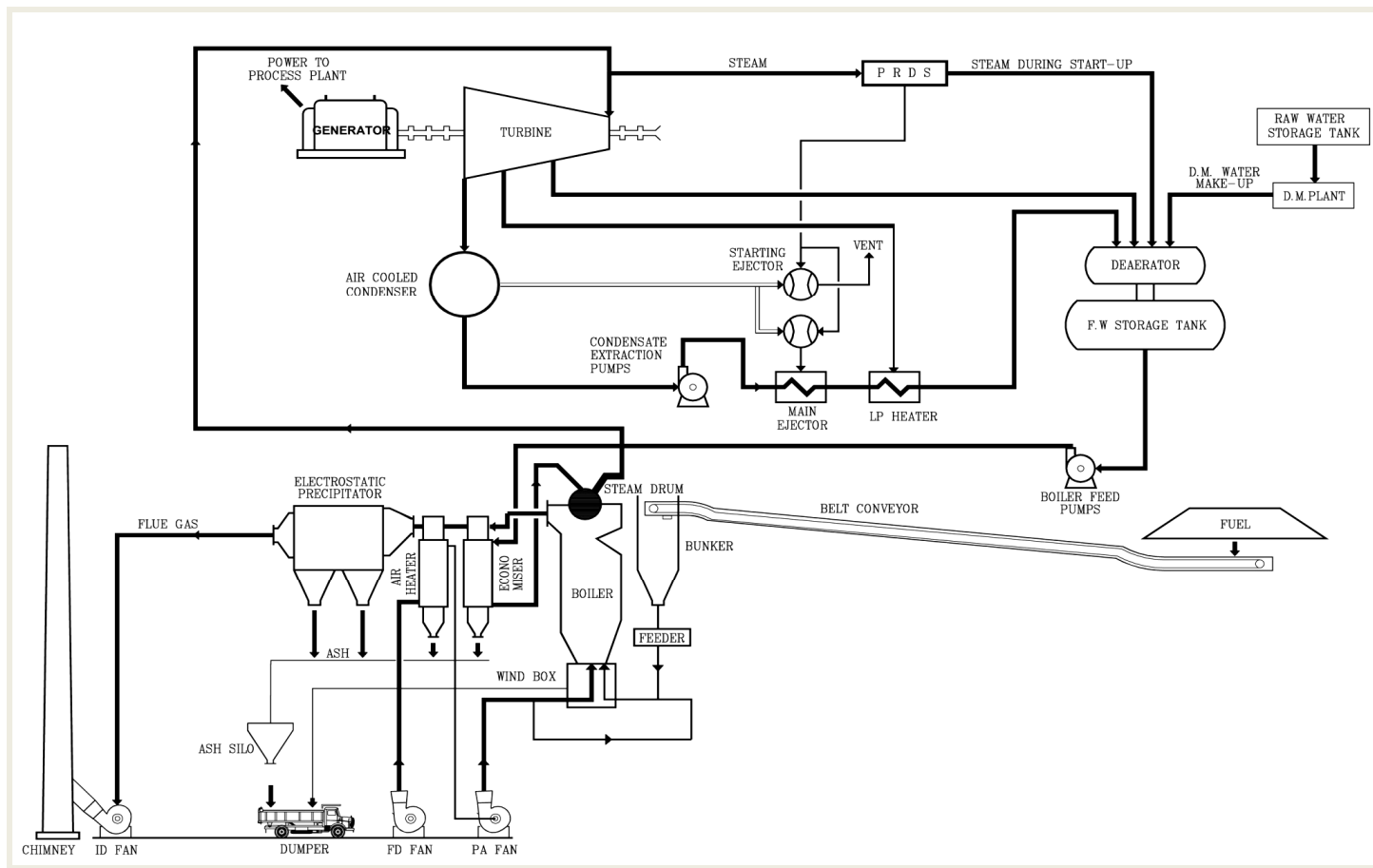


FIGURE 5: CAPTIVE POWER PLANT - PROCESS FLOW CHART

2.7 MITIGATION MEASURES

The major sources of pollution in a cement plant are stack attached to the process units. Air pollution will be the major concern to be looked upon for the project activity. No major water, noise & soil pollution is envisaged from the project activity. Various mitigation measures proposed to take care of the environment in respect of air, water, noise, soil & the green cover of the project site & nearby villages.

2.7.1 Air Environment

- To control air emission in Cement Plant & CPP highly efficient ESPs / bag filters will be installed at various stages of the process.
- To control the dust emission from transfer points of the belt and bucket conveyors, bag filters will be provided at various locations of the transfer points.
- Greenbelt development will be further enhanced around the plant premises.
- CPCB guidelines will be followed to control fugitive emissions.
- Limestone will be transported via covered conveyor belts to the plant site.
- Dust suppression/ dust extraction systems with bag filters along with water sprinklers will be provided to prevent the fugitive dust emissions.
- All the above measures are being followed in the existing plant process also.

2.7.2 Water Environment

- No industrial waste water is generated during plant operation.
- In Cement Plant process, water is absorbed in the process or it is subjected to evaporation, hence no wastewater generation.
- The wastewater generated from the CPP is recycled back to the process and used for cooling and dust suppression.
- Domestic waste water generated from the colony will be treated in STP and used for green belt development / Horticulture purpose.

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- Air cooled condenser is used in Thermal Power Plant to reduce water requirement.
- During monsoon, rain water harvesting is being practiced at plant and colony area.

2.7.3 Noise Environment

- Walls and ceilings of the concerned buildings are lined with sound absorbing materials.
- Properly insulated enclosures are provided to staff working close to the high noise sources.
- Personal Protective Equipments like earplugs and earmuffs are provided to the workers exposed to high noise level.
- Sufficient green belt within the plant and colony area has already been developed and maintained.
- Regular monitoring of noise level has been carried out and corrective measures in concerned machinery will be adopted accordingly to the possible extent, as also done in the existing plant operation.
- Silencers have also been provided in the D.G. Sets.
- Well developed greenbelt has already been developed which attenuates the noise produced from the plant operation.

2.7.4 Solid Waste Management

- No solid waste is generated in cement manufacturing process.
- Fly ash generated from Captive Power Plant (Existing + Proposed) is utilized in the manufacturing of Cement.
- Dust collected from air pollution control equipment is 100% recycled in process.
- Sludge from Sewage Treatment Plant (STP) is used as manure for green belt development.
- The rejects of Coal Washery is utilized in the CPP. The additional rejects coal/F grade coal will be brought from the nearby market.

2.7.5 Greenbelt Development

- Since the inception of the plant Grasim Cement has taken up massive green belt development plan. Saplings have been planted in the plant, colony and mining area.
- Out of the 388.37 ha (plant + colony area), 212.54 ha is already covered under plantation.
- Avenue plantation along the roads, and green belt development in the colony, mines and plant has been developed under afforestation program.
- In order to develop the green belt and afforestation in scientific way, Grasim Cement has setup a horticulture department, which is headed by an experienced horticulturist.
- Local species has been planted as per guidelines.



CHAPTER-III

DESCRIPTION OF THE ENVIRONMENT

3.0 INTRODUCTION

The main objectives of describing the environment, which may be potentially affected, are (i) to assess present environmental quality and the environmental impacts and (ii) to identify environmentally significant factors that could preclude project development. The chapter contains information on existing environmental scenario for the following parameters.

1. Water Environment
2. Micro – Meteorology
3. Air Environment
4. Noise Environment
5. Soil Environment
6. Land Environment
7. Biological Environment
8. Socio-economic Environment

To achieve these objectives, our team monitored the environmental parameters within the core zone and buffer zone (10 km. radial distance) from the project site in accordance with the Guidelines for EIA issued by the Ministry of Environment & Forests, Govt. of India.

This chapter and the related discussions contain the results of field studies carried out during the Winter Season- Decemeber, 2009 to February, 2010.

3.1 STUDY AREA AT A GLANCE

The study area is 10 km radius known as buffer zone has been measured from the boundary of the project site in every direction which includes Cement plant and CPP. The buffer zone area falls in Tehsil Simga of Raipur district.

1. General Particulars:

- ♦ Village : Rawan
- ♦ Tehsil : Simga
- ♦ District H.Q. : Raipur
- ♦ State : Chattisgarh
- ♦ Latitude : 21° 33'39.89" – 21° 34'56.55" N
- ♦ Longitude : 82° 00'42.89" – 82° 01'56.62"E

2. Demography (10 km radius of the project site)

- ♦ Total Population : 36565
- ♦ Number of Households : 10068
- ♦ Scheduled Castes : 15.80%
- ♦ Scheduled Tribes : 6.98%
- ♦ Literates : 57.23%
- ♦ Workers : 40.78%

3. Climatology

During study period (Winter Season – Decemeber, 2009 to February, 2010)

- i) Minimum Temperature : 11.2 °C
- ii) Maximum Temperature. : 30.1 °C
- iii) Relative Humidity (%)
 - At 08:30 hrs : 36% to 97%
 - At 17:30 hrs : 23% to 80%
- iv) Dominant Wind Direction : Form NE

3.2.1 Landuse/Land Cover Study

The present Land use / Land cover map for the proposed project activity of Grasim Cement is prepared by current vintage of satellite image, which has helped in the study of present land use pattern of the study area. This report will also help in assessing the impact on land use pattern in the study area due to the proposed project activity.

(A) DATA USED

Indian Remote Sensing satellite IRS P6 LISS IV MX digital FCC (False Color Composite) of current vintage data has been used for preparation of Land use/ Land cover thematic map of present study area. Satellite image has been procured from **National Remote Sensing Centre, Hyderabad**. Survey of India toposheet as a reference map on 1:50,000 scale has been used for preparation of base layer data like road, rail network, village and plant site and for georeferencing of satellite image.

Technical Details

- Satellite Image - IRS P6 LISS IV MX
- Satellite Data Source - NRSA Hyderabad
- Software Used - Earth Resources Data Analysis System (ERDAS) Imagine 9.2

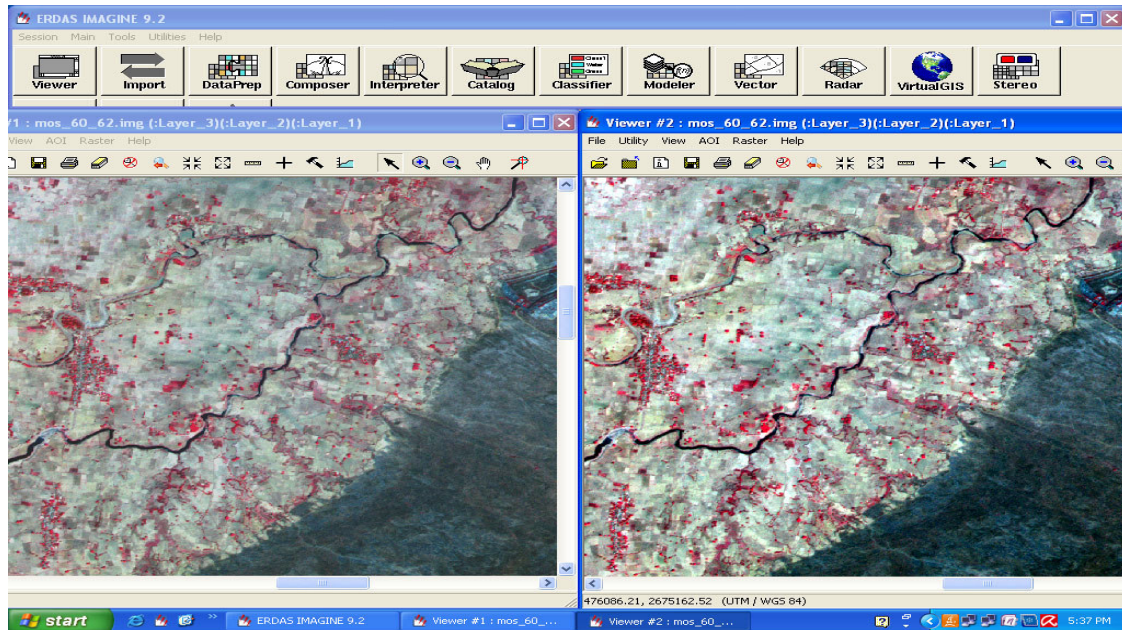
(B) METHODOLOGY

Land use / Land cover map preparation, Base map creation; Geometric and Radiometric correction of satellite image has been processed using ERDAS Imagine 9.2 Software.

The methodology used for present LU/LC study area is explained in following headings.

(i) ENHANCEMENT OF SATELLITE IMAGE

Satellite data is composed of substantial noise and haze errors due to various environmental factors, which affect the amount of reflectance (information) that can be deciphered. Since mapping of satellite images is based on spectral signatures, it is necessary to normalize the redundant values into near true values. This process of deriving true reflectance values is known as normalization. This will enhance the interpretability of the satellite image thereby facilitating better identification of land features viewed on satellite imagery. Histogram equalization and radiometric correction has been used for satellite image enhancement.



Original Image

Radiometrically Enhanced Image

Fig.- 6 Difference between Original image and Radiometrically enhanced images

(ii) GEOREFERENCING OF SATELLITE IMAGE

Survey of India Toposheet has registered in Geographic lat/long. Satellite image has been georeferenced by using registered SOI toposheet as a reference map taking suitable Ground Control Points (GCP) points like intersection point of railway, Road network, landmarks and permanent feature.

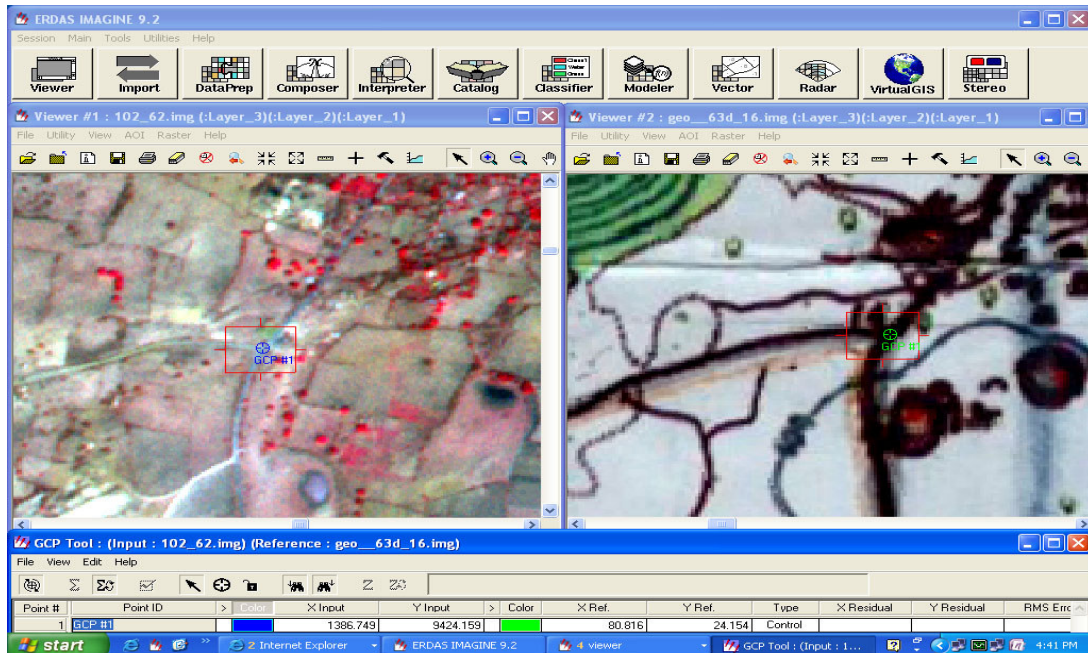


Fig. - 7 Georeferencing of satellite image using SOI toposheet

(iii) BASE MAP LAYER CREATION

Base map has been prepared using Survey of India Toposheet as a reference map on 1:50000 scale. In base layer linear and point feature like road, rail, canal, village location and plant site have been created in vector data format. Base map layer information has been used for analysis of surrounding feature like road, rail, village location near Plant site activity through superimposed on thematic map for data integration.

(iv) INTERPRETATION OF REMOTE SENSING DATA

Satellite images are composed of array of grid, each grid have a numeric value that is known as digital number. Smallest unit of this grid is known as a pixel that capture reflectance of ground features represent in terms of Digital number, which represent a specific land features. Using image classification technique, the satellite data is converted into thematic information map based on the user's knowledge about the ground area. Hybrid technique has been used i.e. visual interpretation and digital image processing for identification

of different land use and vegetation cover classes based on spectral signature of geographic feature. Spectral signature represents various land use class. Image interpretation keys are developed based on image characteristics like color, tone, size, shape, texture, pattern, shadow, association etc, which enables interpretation of satellite images for ground feature. Training sites are then assigned based on their spectral signature and interpretation elements. Using image classification algorithm land use map is then generated.

(C) RESULTS

A hybrid technique has been used i.e. visual interpretation and digital image processing to generate output Land use / Land cover map of 10 km study area on 1:50000 scale. Statistical data observations and results obtained from satellite image are given below:-

Table No. : 3.1
Breakup of the Land Use Pattern of the Study Area

S. No.	Legend	% Area
1.	Water Bodies	2.14
2.	Plantation	1.15
3.	Crop Land	46.93
4.	Fallow Land	28.25
5.	Industry	0.13
6.	Human Settlement	1.16
7.	Open Scrub	5.73
8.	Vegetation	0.24
9.	Open Waste Land	12.75
10.	Dense Scrub	0.60
11.	Mine Quarry	0.65
12.	Stony Waste	0.27
	Total	100

Result shows that the study area is dominated by Crop land with 46.93% of the total area in the 10 km radius. Fallow land & open waste land are also found in significant amount with 28.25% & 12.75% of the total study area respectively.

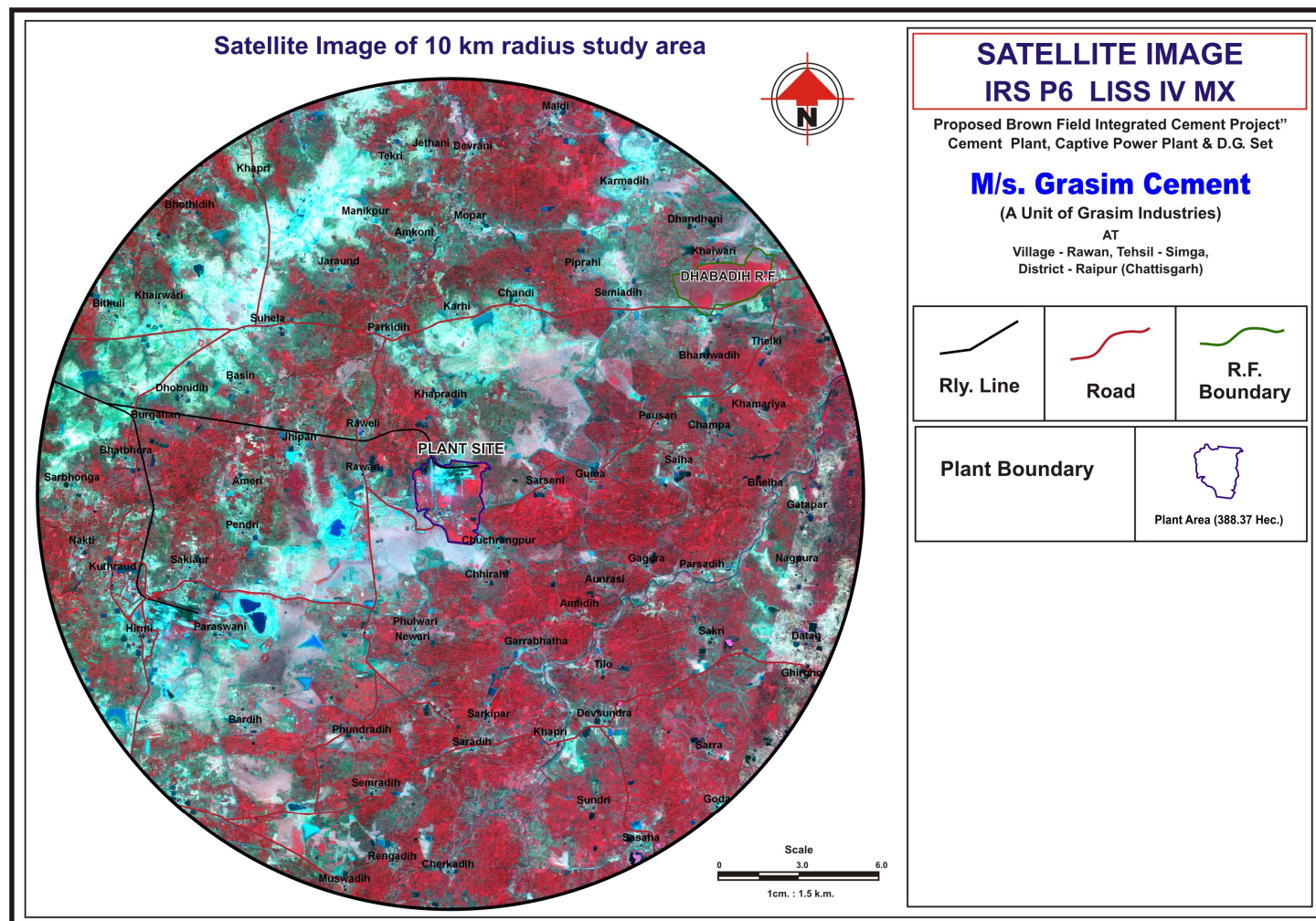


Figure 8: Satellite Imagery of the Study Area



Figure 9 : Land Use/ Land Cover Map of the Study Area

3.2.2 Digital Elevation Model

Digital Elevation Models are data files that contain the elevation of the terrain over a specified area, usually at a fixed grid interval over the "Bare Earth". The intervals between each of the grid points will always be referenced to some geographical coordinate system. This is usually either latitude-longitude or UTM (Universal Transverse Mercator) coordinate systems. The closer together the grid points are located, the more detailed the information will be in the file. The details of the peaks and valleys in the terrain will be better modeled with small grid spacing than when the grid intervals are very large. Elevations other than at the specific grid point locations are not contained in the file. As a result peak points and valley points not coincident with the grid will not be recorded in the file. For practical purpose this "Bare Earth" DEM is generally synonymous with a Digital Terrain Model (DTM). DEM has been prepared for the proposed project activity of Grasim Cement for 10 km radius study area.

(A) DATA USED

DEM Data : Shuttle Radar Topographic Mission (SRTM) data
Data Source : <ftp://e0srp01u.ecs.nasa.gov/srtm/version2/SRTM3/>
Software Used : ERDAS Imagine 9.2 & Arc GIS 9.2

(B) METHODOLOGY

Shuttle Radar Topographic Mission (SRTM) data has been used for creation of Digital Elevation Model of the study area. The SRTM data has vertical accuracy of 16m and the spatial resolution is of 90m.

1st Stage :

The first processing stage involves importing and merging the 1-degree tiles into continuous elevational surfaces in ArcGRID format.

2nd Stage :

Resampling the data at 23m is done and a contour interval of 10m through the usual process of interpolation is created.

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3rd Stage :

SRTM data is converted in grid format through ArcGIS 9.2 to obtain elevation information of study area. Contours are then generated at 10 m interval through 3D analyst of ArcGIS and then are interpolating with raster data.

4th Stage :

Integration of DEM with contour map showing 3D view for analysis of surface is done.

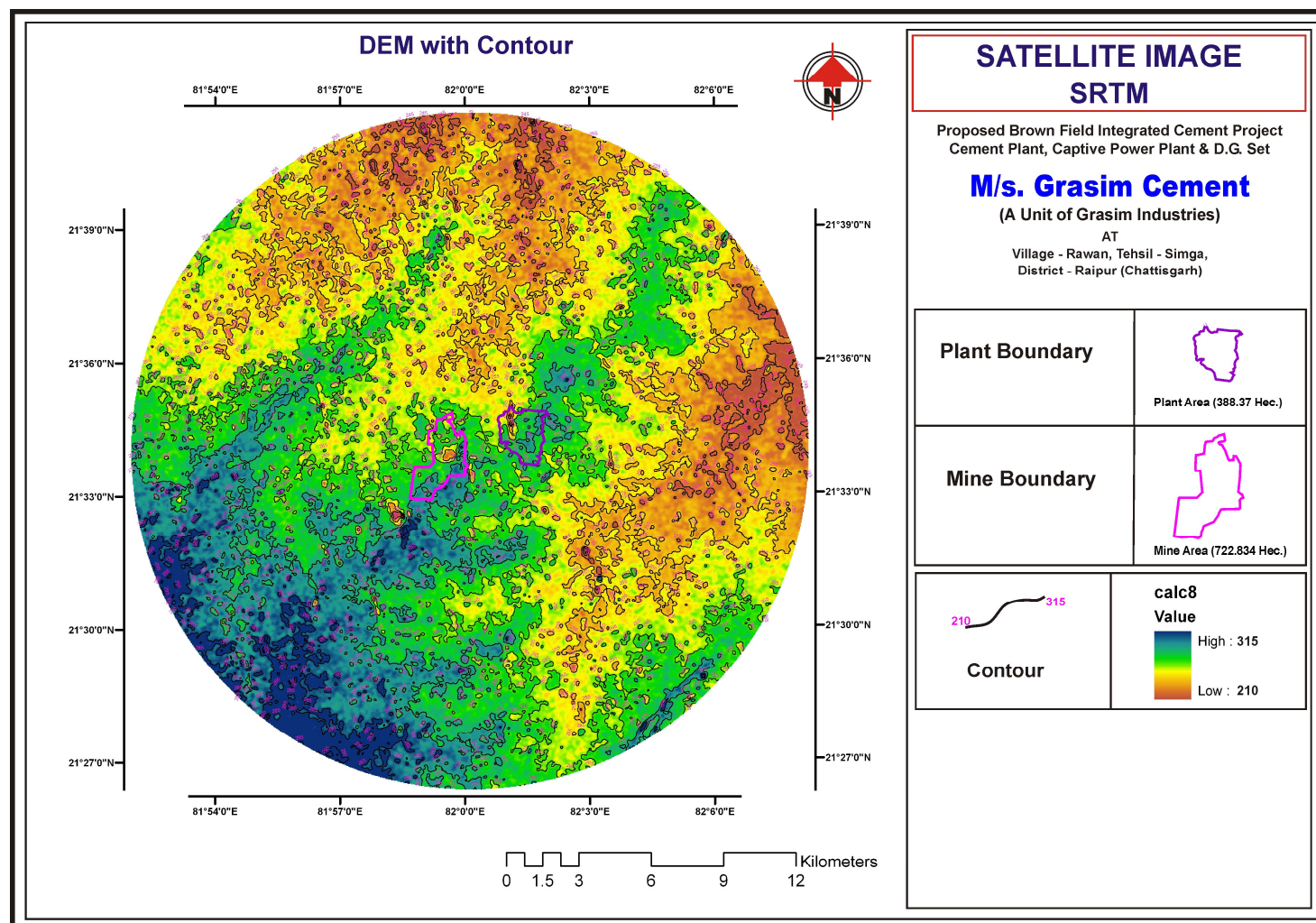


Figure 10: Digital Elevation Model of the Study Area

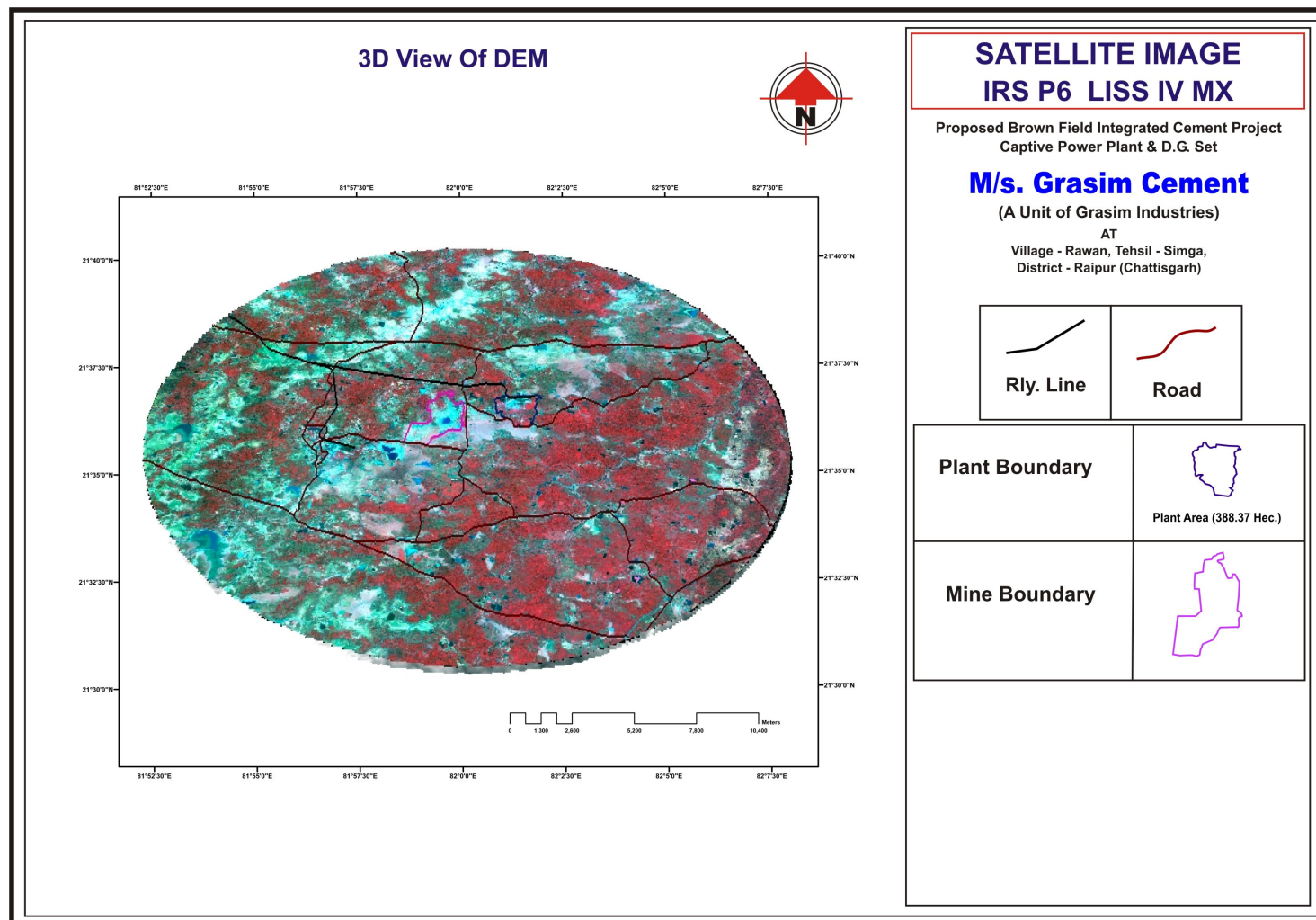


Figure 11 : 3-D view of the Digital Elevation Model

3.2.3 PHYSIOGRAPHY AND DRAINAGE

The terrain of the study area is gently to moderately sloping and having gentle slope. Overall drainage of the area is moderate and of dendritic type. There is no major water body in the subject area.

Geologically, the study area is a gently undulating to almost a plain area with general elevation ranging from 268 – 280 meters above mean sea level. Gently dipping limestone out crops was observed at some area while there is thin alluvial soil cover comprising mostly silty clays. The drainage is mostly dendritic in nature and takes north - western course in the north and south – easterly course in the south. The drainage is controlled mainly due to two raised outcrops. One in the north – eastern corner while another in the western limestone area. The drainage is well developed due to high rainfall.

3.2.1 Seismicity of Area

Chhattisgarh has very low rates of seismic activity. In recent years, tremors from earthquakes in neighbouring states have been felt, most notably in 1954. Minor seismic activity has been recorded in the vicinity of Chiraikund and Muirpur along the border with Madhya Pradesh. A few faults which form the eastern section of the Narmada-Son Fault Zone have shown movement during the Holocene epoch. Another active fault is the Tatapani Fault which trends in an east-west direction in the vicinity of Manpura in Sarguja district. In the south, the Godavari fault, which forms the northern flank of the Godavari Graben run through the southern part of the state and is also active.

The seismic hazard map of India was updated in 2000, by the Bureau of Indian Standards (BIS). The main change in the map for the state of Chhattisgarh was the merging of Zones I and II under which much of the state falls. Parts of the northern districts of Bilaspur, Janjgir, Jashpur, Korba, Korla and Sarguja lie in Zone III. Since the earthquake database in India is still incomplete,

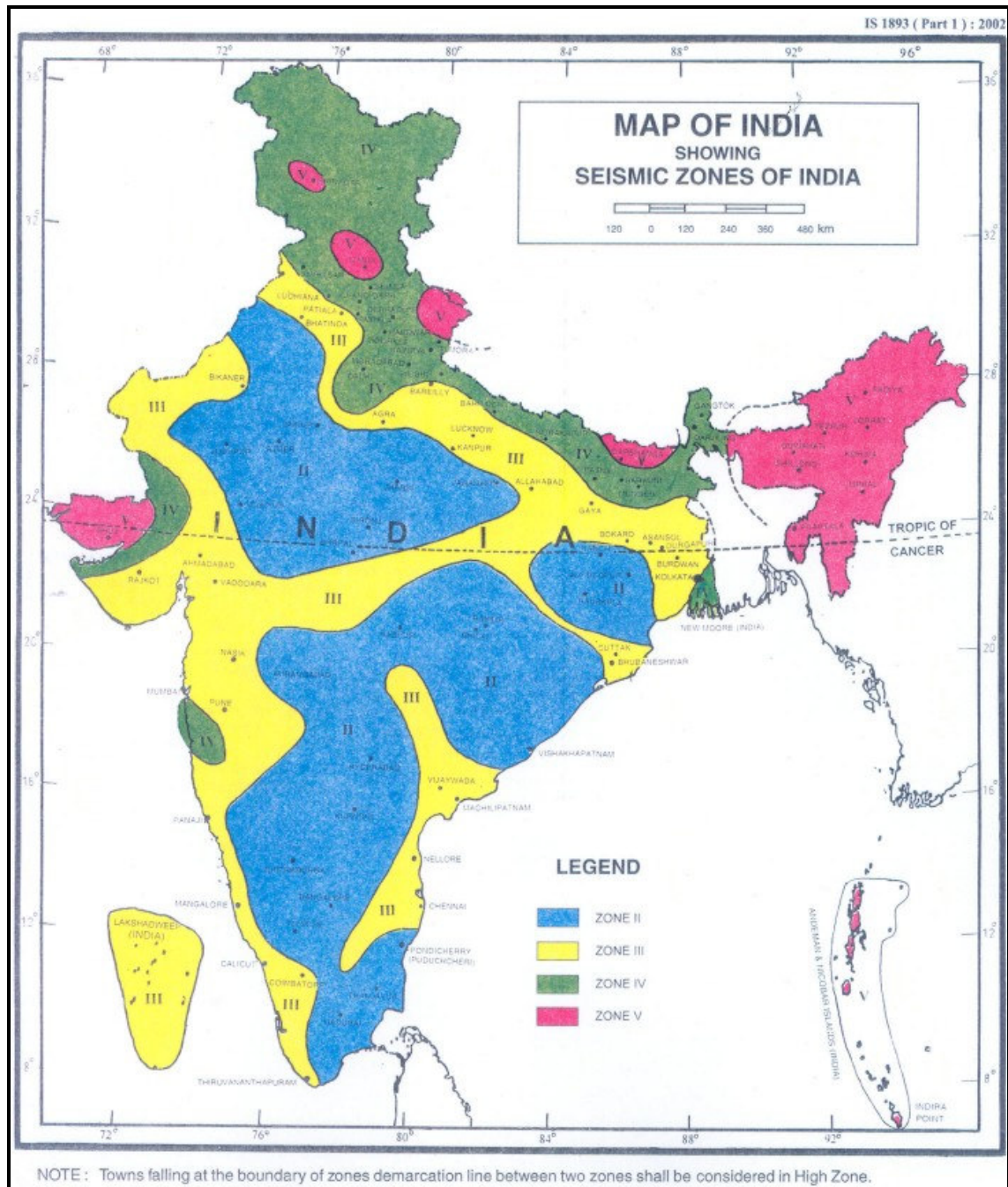


FIGURE 12 : SEISMIC ZONE MAP

especially with regards to earthquakes prior to the historical period (before 1800 A.D.), these zones offer a rough guide of the earthquake hazard in any particular region and need to be regularly updated.

The following list briefly outlines known earthquakes in this region which either had observed intensities of V or higher (historical events) or had known magnitudes of M 4.5 or more (instrumented events). General locations are provided for historical events for which "generalized" epicentral co-ordinates are available. Some events which were significant for other reasons are also included. Please note that Magnitude and Intensity are NOT THE SAME. All events are within the state or union territory covered on this page unless stated otherwise.

Table No. 3.2
History of Earthquakes in Chhattisgarh

S. No.	DATE	Area and District	Latitude & Longitude	Time (OT)	Magnitude	Depth (kms)
1.	05 January, 1954	Gorka-Konta area, Dantewara, Chattisgarh	18.000 N, 18.000 N		M _? 4.0 (5).	
2.	12 February, 1996	Lemru area, Korba, Chhatisgarh	22.616 N, 82.893 E	20:39:54	M _L 4.3 (7)	33.0
3.	22 May, 1997	Jabalpur-Kosamghat area, Madhya Pradesh	23.083 N, 80.041 E	22:51:28.7	M _W 5.8 (7)	36.0
4.	10 October, 2000	Surta-Ambikapur area, Chhatisgarh	23.060 N, 82.917 E	06:11:32	M _B 4.5 (7).	5.4
5.	10 June, 2001	Ambikapur area, Chhatisgarh	23.030 N, 83.154 E	01:12:18	M _L 3.6 (3)	16.5
6.	12 June, 2001	Konokjora-Sundargarh area, Orissa,	22.240 N, 83.918 E	12:41:00	M _W 4.7	025.5
7.	13 April, 2007	Jaldega-Dharamjaygarh area, Chhattisgarh	22.700 N, 83.200 E	11:49:42	M _? 3.1	10.0
Acronyms Used: OT=Origin Time, MW=Moment Magnitude, MB=Body Wave Magnitude, ML=Local Magnitude, M?=Magnitude Type unknown						

According to GSHAP data, the state of Chhattisgarh falls in a region of low seismic hazard with the exception being moderate hazard in areas along the Maharashtra and Andhra Pradesh state borders. Historically, parts of this state have experienced seismic activity in the M4.0 range. The largest instrumented Earthquake in last 10 years in Chhattisgarh was of 10 October 2000 at Surta-Ambikapur area, Chhattisgarh, located to the north-east of Korba. This event had a magnitude of 4.5 (7). Apart from this no other major event is recorded in this area. Thus there is no prominent activity in this area. The project site is far from any active faults or thrusts and hence makes the site to fall in seismic safe zone. Hence the risk of earthquake at the site is minimal and so the site is safe.

3.3 INSTRUMENT USED FOR ENVIRONMENTAL BASELINE DATA COLLECTION

The following instruments were used at the site for environmental baseline data collection work.

1. Respirable Dust Collector with attachment for gaseous Pollutants, Envirotech APM 460.
2. Fine Particulate Matter (FPM) Sampler
3. Digital D.O. Meter Model – 831 E.
4. Dry and Wet Bulb Thermometer.
5. Sound Level Meter Model SL – 4010
6. Micro Meteorological Station Model Enviro Wm 251
7. Water Level Indicator
8. GPS

In addition to the above samples collected, the data on land use, vegetation and agricultural crops were also collected by the field team by meeting with a large number of local inhabitants in the study area and different Government departments / agencies. This provided an excellent opportunity to the members of the field team for obtaining an intimate feel of the environment of the study area.

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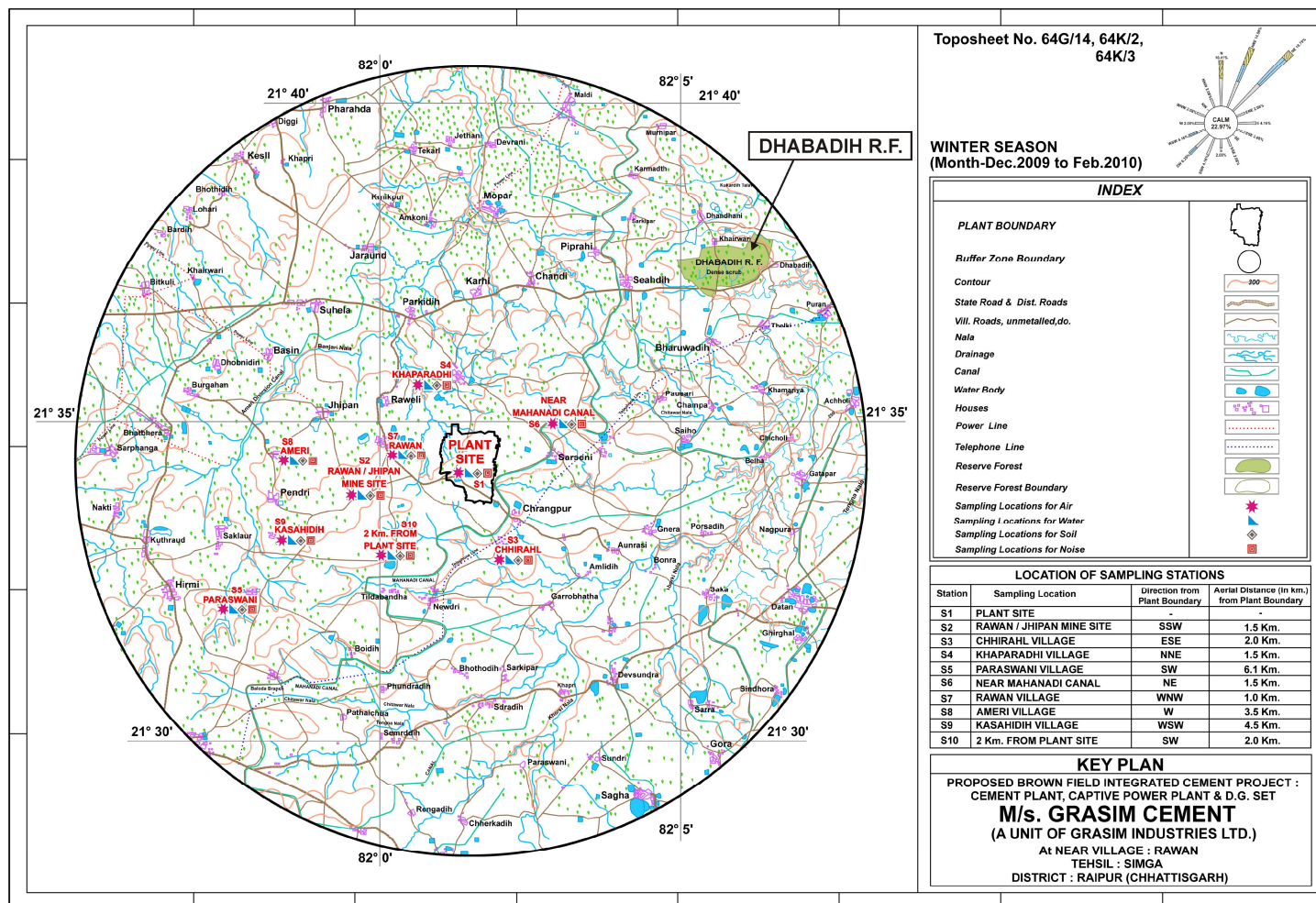


FIG 13: KEY PLAN

3.4 WATER ENVIRONMENT

3.4.1 Hydrology

The occurrence of ground water is different in different formation and rock types. The weathered and fractured zone provides scope of ground water storage and movement. In the area, ground water occurs under phreatic condition in weathered portion and semi-confined to confined conditions in fractures/cavernous part of rocks i.e. limestone and shale at depths.

3.4.1 Surface Water

The Mahanadi Canal is about 0.5 km from the project area, in which water is available in rainy season only. There is no major river in the 10 km radius study area & hence surface water sampling was not carried out for the project activity.

Rainfall is the only direct source of ground water recharge for the study area. While, two major rivers i.e. Mahanadi (40 km, E) & Godavari (30 km, W) recharge the ground water of the Raipur district.

3.4.2 Ground Water Quality

The sources of potable water are the tube-wells & dug-wells in the area. Samples were collected from the available water resources around the project area. The samples were collected & tested from different sites.

The quality of ground water was studied by collecting ten water samples from representative open dug wells and tube wells. The water sampling stations are shown below:

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TABLE -3.3

GROUND WATER SAMPLING STATIONS

STUDY PERIOD – WINTER SEASON (DECEMBER, 2009 TO FEBRUARY, 2010)

Station	Sampling Location	Direction from Plant Site	Aerial distance in km. From Boundary of Project Site
GW1	Plant Site	-	-
GW2	Rawan Jhipan Mine Site	SSW	2.0
GW 3	Chhirahl Village	ESE	2.0
GW 4	Khaparadhi Village	NNE	3.0
GW 5	Paraswani Village	SW	6.1
GW6	Near Mahanadi Canal	NE	1.5
GW7	Rawan Village	WNW	1.0
GW 8	Ameri Village	W	3.5
GW 9	Kasahidih Village	WSW	4.0
GW10	2 Km from Plant Site	SW	2.0

TABLE No.: 3.4
GROUND WATER QUALITY
STUDY PERIOD – WINTER SEASON (DECEMBER, 2009 TO FEBRUARY, 2010)

S. No.	PARAMETERS	Water Sampling Locations										Specification as per IS:10500	Detection Limit
		GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8	GW9	GW10		
1.	pH	7.66	7.70	7.68	7.72	7.69	7.52	7.78	7.81	7.75	7.79	6.5-8.5	0.1-13.9
2.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	
3.	Colour (Hazen Unit)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5 (Max,25)	5.0 – 100 Hazen Units
4.	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
5.	NTU	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	5 (Max. 10)	1-100 NTU
6.	TDS (mg/l)	498	468	472	488	446	468	469	485	480	469	500 Max. (2000)	1.0 – 1000 mg/l
7.	Conductance (µSiemens/cm)	905	850	858	887	810	851	852	881	875	870	-	-
8.	Total Hardness as CaCO ₃ (mg/l)	298.5	255.10	266.8	310.7	222.6	255.7	244.3	299.7	287.98	295.7	300 Max. (600)	1 – 1000 mg/l
9.	Calcium as Ca ⁺² (mg/l)	62.4	48.10	79.33	77.8	66.1	65.2	55.3	50.2	54.24	55.12	75, Max. (200)	1 – 200 mg/l

10.	Magnesium as Mg ⁺² (mg/l)	42.79	32.42	33.97	27.98	13.84	22.16	25.51	41.87	32.25	33.75	30, Max. (100)	1 – 100 mg/l
11.	Fluoride as F ⁻ (mg/l)	0.64	0.46	0.55	0.56	0.51	0.53	0.48	0.52	0.50	0.58	1.0, Max (1.5)	0.02 – 10 mg/l
12.	Chlorides (as Cl), mg/l	75.10	37.30	42.91	56.00	38.16	51.00	32.26	36.21	35.64	38.45	250 max. (1000)	0.5 – 100 mg/l
13.	Nitrates (as NO ₃) mg/l	8.56	9.86	10.00	11.56	10.6	10.46	10.6	11.52	10.57	11.12	45, max. (100)	0.1 – 5.0 mg/l
14.	Sulphate as SO ₄ ²⁻ (mg/l)	29.92	23.80	17.12	19.94	15.23	19.34	20.12	18.66	19.32	20.56	200, Max (400)	1 – 50 mg/l
15.	Iron as Fe (mg/l)	0.08	0.10	0.10	0.09	0.07	0.08	0.07	0.09	0.06	0.09	0.3, Max (1.0)	0.02 – 10 mg/l
16.	Alkalinity as CaCO ₃ mg/l	255.5	140.22	160.74	172.50	152.23	168.50	133.22	141.23	1138.54	143.62	250 (600)	0.5 – 1000 mg/l
17.	Phosphate	<0.02	<0.02	<0.02	0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	-	-
18.	Sodium as Na (mg/l)	93.10	88.2	89	112	115	98	98.1	102.5	99.5	101.52	-	-
19.	Potassium as K (mg/l)	29	23	31	25	30	24	25	26	24	28	-	-
20.	Copper as Cu (mg/l)	0.03	0.02	0.03	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.05 (max. 1.5)	0.02 – 15 mg/l
21.	Manganese as Mn (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1 (max. 0.3)	0.10 – 5.0 mg/l
22.	Lead as Pb (mg/l)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05 (No relaxation)	0.05 – 10mg/l
23.	Zinc as Zn (mg/l)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	5 (Max. 15)	0.1 – 10.0 mg/l

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24.	Chromium as Cr (mg/l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05 (No relaxation)	0.01 – 20 mg/l
25.	Aluminum as Al (mg/l)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03 (max. 0.2)	0.03 – 5.0 mg/l
26.	Boron (mg/l)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	1 (max. 5)	0.5-10mg/l
27.	Phenolic compounds (as C ₆ H ₅ OH) (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001 (max. 0.002)	0.01 – 0.50 mg/l
28.	Anionic Surfactants (mg/lit)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.02(max.1.0)	0.02-10.00 ppm
29.	Hexa Chromium (mg/lit)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05(No relaxation)	0.01-20.0 ppm
30.	Nickel (mg/lit)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	0.2-10.0 ppm

Source: Field sampling & analysis report

A review of the above chemical analysis reveals that there is not much variation in chemical composition of water tapped from shallow open wells and from tube wells. The ground water from all sources remains suitable for drinking purposes as all the constituents are within the limits prescribed by drinking water standards promulgated by Indian Standards IS: 10500. Analysis results of ground water reveal the following: -

- pH varies from 7.66 to 7.81
- Total hardness varies from 222.6 mg/l to 310.7 mg/l
- Total Dissolved Solids varies from 446 mg/l to 498 mg/l

All parameter values in ground water sources are well and within the permissible limits laid by Ministry of Health, Govt. of India, for potable water.

3.4.3 CHEMICAL ANALYSIS OF WATER TO BE USED IN THE PLANT

Water requirement will also be met from the captive mines sump and existing bore well (for drinking purpose).

Sample water from both of the sources was taken and it was analysed, the results are as under:

TABLE : 3.5
CHEMICAL ANALYSIS OF SOURCE WATER

S. No.	PARAMETERS	Mine Sump Water	Bore Well Water	Specification as per IS:10500
1.	pH	7.61	7.66	6.5-8.5
2.	Odour	Unobject ionable	Unobject ionable	Unobjectionable
3.	Colour (Hazen Unit)	<5	<5	5 (Max,25)
4.	Taste	Agreeable	Agreeable	Agreeable
5.	NTU	<1	<1	5 (Max. 10)
6.	TDS (mg/l)	283	498	500 Max. (2000)
7.	Conductance (µSiemens/cm)	--	905	-
8.	Total Hardness as CaCO ₃ (mg/l)	272.48	298.5	300, Max. (600)
9.	Calcium as Ca ⁺² (mg/l)	95.87	62.44	75, Max. (200)
10.	Magnesium as Mg ⁺² (mg/l)	7.99	42.79	30, Max. (100)
11.	Fluoride as F ⁻ (mg/l)	<0.02	0.64	1.0, Max (1.5)
12.	Chlorides (as Cl), mg/l	8.69	75.10	250 max. (1000)
13.	Nitrates (as NO ₃) mg/l	0.09	8.56	45, max. (100)
14.	Sulphate as SO ₄ ²⁻ (mg/l)	12.24	29.92	200, Max (400)
15.	Iron as Fe (mg/l)	0.16	0.08	0.3, Max (1.0)

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16.	Alkalinity as CaCO ₃ (mg/l)	148.35	255.5	250 (600)
17.	Phosphate	-	<0.02	-
18.	Sodium as Na (mg/l)	-	93.10	-
19.	Potassium as K (mg/l)	-	3.58	-
20.	Copper as Cu (mg/l)	<0.02	0.03	0.05 (max. 1.5)
21.	Manganese as Mn (mg/l)	<0.10	<0.10	0.1 (max. 0.3)
22.	Lead as Pb (mg/l)	-	<0.05	0.05 (No relaxation)
23.	Zinc as Zn (mg/l)	<0.10	<0.10	5 (Max. 15)
24.	Chromium as Cr (mg/l)	0.010	BDL	0.05 (No relaxation)
25.	Aluminum as Al (mg/l)	BDL	<0.03	0.03 (max. 0.2)
26.	Boron (mg/l)	BDL	BDL	1 (max. 5)
27.	Phenolic compounds (as C ₆ H ₅ OH) (mg/l)	BDL	BDL	0.001 (max. 0.002)
28.	Anionic Surfactants (mg/lit)	<0.02	<0.02	0.02-10.00 ppm
29.	Hexa Chromium (mg/lit)	<0.01	<0.01	0.01-20.0 ppm
30.	Nickel (mg/lit)	<0.2	<0.2	0.2-10.0 ppm

3.5 METEOROLOGY

Meteorology plays a vital role in affecting the dispersion of pollutants, once discharged into the atmosphere. Since meteorological factors show wide fluctuations with time, meaningful interpretation can be drawn only from long-term reliable data. Such source of data is the Indian Meteorological Department (IMD), which maintains a network of meteorological stations at several important locations. The nearest IMD station to the study area is located at Raipur. The Meteorological parameters were obtained for **Winter Season (Dec, 09 to Feb, 10)** from this station is temperature, humidity, rainfall, wind speed, and wind direction, recorded at two synoptic hours i.e. 8:30 and 17:30 hours.

3.5.1 Climate

Raipur has a tropical wet and dry climate, temperatures remain moderate for most of the year, apart from the summer from March to June, which can be extremely hot. The city receives about 1400 mm of rain, mostly in the monsoon season from late June to early October. Winters last from November to January and are mild, although lows can fall to 5 °C (42 °F). There is only one observatory located in Raipur which is about 90 km away from the cement plant maintained by Indian Meteorology Department.

3.5.2 Rainfall

The area enjoys tropical climate with hot summer followed by well-distributed rainfall through South-West monsoon season. The winter commences from December and last till the end of February. The period from March to the end of May is hot season. The monsoon season starts from the middle of June and last till the end of September. The annual rainfall of the area is around 730 mm. The rainfall generally increases from the north-west to the south-east. About 94 percent of the annual rainfall is received during the period June to October, July and August being the rainiest months. The variation in annual rainfall from year to year is very large. On an average there are 60 - 80 rainy days in a year. During the south-west monsoon season, the relative humidity is generally (08:30 am) 72% and (17:30 pm) 45% and during the rest of the year, the air is dry. The rainfall data is been given in Table-below.

TABLE: 3.6
ANNUAL RAIN FALL

YEAR	RAINFALL (mm)
1999	655.8
2000	422.2
2001	971.0
2002	591.6
2003	1475.6
2004	837.6
2005	1182.0
2006	1140.2
2007	1351.0
2008	717.0
2009	1153.6

Source: Grasim Cement Plant Observatory

3.5.3 Wind Speed / Wind Rose Diagram

Wind speed and wind direction data recorded during the study period is useful in identifying the influence of meteorology on the air quality of the area. Based on the collected meteorological data, relative percentage frequencies of different wind directions are calculated and plotted as wind roses for eight hourly and twenty four hour duration respectively. Maximum and minimum temperatures including percentage relative humidity were recorded simultaneously.

The observed wind pattern during the study period is described below and is plotted for the study period. The predominant over all wind patterns for the study period is from **North East direction**. Wind speed during this period varies from 3 km/hr to 12 km/hr.

3.5.4 Micro-Meteorology at Site

Meteorological station was set-up at site to record surface meteorological parameter during study period (Dec, 09 to Feb, 10).

The wind recorded during the survey period at the site is more or less according to the trend indicated in wind rose diagram according to the trend indicated in wind rose diagram. The details of the hourly wind speed & wind direction as enclosed as **Annexure 5**.

TABLE No.: 3.7
MICRO-METEOROLOGY AT SITE
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

DATE	DETAILS				WIND SPEED & DIRECTION			
	TEMPERATURE °C		RELATIVE HUMIDITY %		8:30 Hrs.		17:30 Hrs.	
	Max.	Min.	8:30 Hrs.	17:30 Hrs.	Direction	Speed km/hr.	Direction	Speed km./hr.
03.12.2009	27.2	11.2	94	48	N	03	NE	09
04.12.2009	26.6	13.5	65	52	CALM	00	CALM	00
11.12.2009	24.4	13.4	71	50	NNE	12	NE	09
12.12.2009	25.3	12.7	55	45	CALM	00	CALM	00
20.12.2009	25.7	13.6	49	38	CALM	00	N	04
21.12.2009	23.8	13.9	52	31	SW	04	SW	08
28.12.2009	24.6	14.2	60	42	N	12	CALM	00
29.12.2009	25.1	14.0	51	47	NNE	07	NE	08
03.01.2010	25.8	13.6	63	75	CALM	00	SSW	04
04.01.2010	26.7	13.9	58	80	NE	07	NNE	04
11.01.2010	26.2	14.1	66	66	SSW	03	E	03
12.01.2010	26.7	13.6	70	43	SW	03	N	03
20.01.2010	27.3	13.7	97	38	N	11	CALM	00
21.01.2010	27.5	14.0	85	23	NNW	06	NNE	04
26.01.2010	26.8	13.9	56	34	NNE	03	SSE	03
27.01.2010	27.8	14.8	45	30	E	04	CALM	00
04.02.2010	28.1	15.5	48	41	WSW	03	NE	04
05.02.2010	28.0	15.8	36	65	NE	03	ENE	04
13.02.2010	28.9	16.1	68	58	WNW	04	CALM	00
14.02.2010	29.0	16.5	53	61	S	03	NE	03
22.02.2010	28.8	16.9	55	63	W	04	NNE	08
23.02.2010	29.6	17.1	62	42	NNE	11	WSW	07
27.02.2010	29.7	17.5	60	53	ESE	04	CALM	00
28.02.2010	30.1	18.0	76	49	NE	04	NE	12

Source: Micrometeorology Station at Project Site

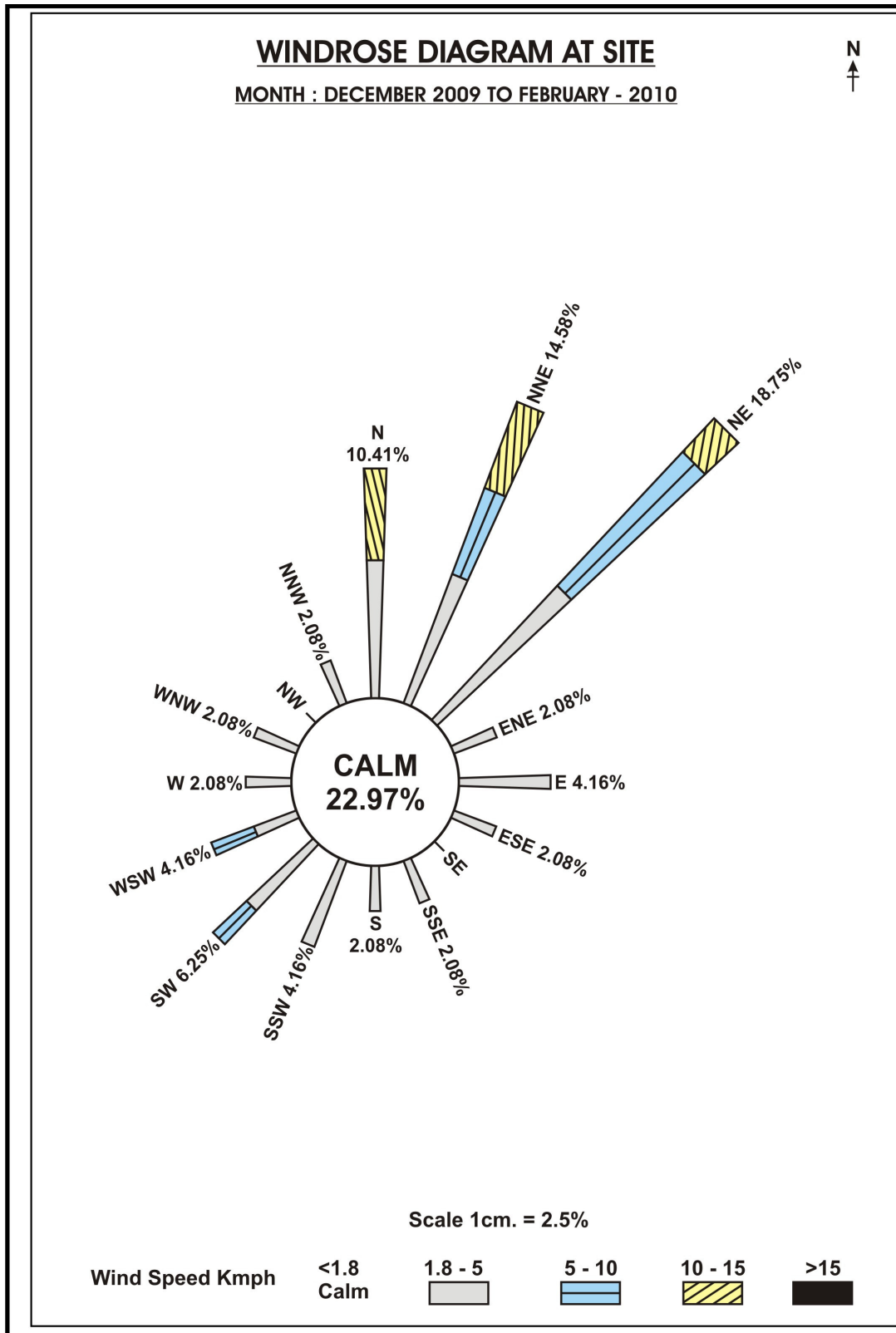


Figure 14: Windrose Diagram at Project Site

3.5.5 Mixing Height & Inversion Height

Mixing height is the height to which significant mixing of added pollutants occurs within the atmosphere. Mixing height depends on basic meteorological parameters, surface turbulent fluxes and physical parameters, and follows a diurnal cycle.

Inversion may be defined as the “departure from the usual increase or decrease of an atmospheric property with altitude.” It usually refers to an increase in temperature with increasing altitude, which is a departure from the usual decrease of temperature with height.

In the absence of onsite data, details have been used from the CPCB publication, “Spatial Distribution Of Hourly Mixing Depth Over Indian Region” for the study area. Mixing height is as given in below & Inversion height has been taken as 450 m in the night.

TABLE: 3.8
MIXING HEIGHT FOR THE PROJECT SITE
STUDY PERIOD (DEC, 09 TO FEB, 10)

Time (Hours)	Mixing Height (m)
0500	100
0600	100
0700	150
0800	200
0900	400
1000	850
1100	1000
1200	1500
1400	1500
1500	1500
1600	2000
1700	2000
1800	1500
1900	400

Source: CPCB publication, “Spatial Distribution Of Hourly Mixing Depth Over Indian Region”, PROBES/88/2002-03

3.6 AMBIENT AIR ENVIRONMENT

3.6.1 Air Quality

The ambient air quality with respect to the study zone of 10 km radius around the project site forms the baseline information. The various sources of air pollution in the region are dust rising from unpaved roads, domestic fuel burning, vehicular traffic, agricultural activities, other industries, etc.

The prime objective of baseline air quality monitoring is to assess existing air quality of the area. This will also be useful in assessing the conformity to standards of the ambient air quality during the plant operations.

The baseline status of the ambient air quality has been assessed through scientifically designed ambient air quality network. The design of monitoring network in the air quality surveillance program has been based on the following considerations:

- *Meteorological conditions.*
- *Topography of the study area.*
- *Likely impact area.*

3.6.2 Ambient Air Monitoring

Ambient air monitoring was carried out on monthly basis in the surrounding areas of project site to assess the ambient air quality at the source. To know the ambient air quality at a larger distance i.e. in the study area of 10 km. radius, air quality survey has been conducted at 10 locations over a period of Winter season (Dec, 09 to Feb, 10). Detail of Ambient Air Quality are enclosed as **Annexure -7**. The ambient air quality monitoring stations were set up at the following locations which are shown in key plan & their direction & distance are shown in below.

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TABLE NO.: 3.9
LOCATIONS OF AAQ MONITORING STATIONS NEAR PROJECT SITE
STUDY PERIOD – WINTER SEASON (DEC,09 TO FEB, 10)

Station	Sampling Location	Direction from Plant Site	Aerial distance in km. From Boundary of Project Site
SA1	Plant Site	-	-
SA2	Rawan Jhipan Mine Site	SSW	2.0
SA3	Chhirahl Village	ESE	2.0
SA4	Khaparadhi Village	NNE	3.0
SA5	Paraswani Village	SW	6.1
SA6	Near Mahanadi Canal	NE	1.5
SA7	Rawan Village	WNW	1.0
SA8	Ameri Village	W	3.5
SA9	Kasahidih Village	WSW	4.0
SA10	2 Km from Plant Site	SW	2.0

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TABLE NO.: 3.10
AMBIENT AIR QUALITY MONITORING
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

(Unit in $\mu\text{g}/\text{m}^3$)

Station	Sampling Location	PM10		PM2.5		SO ₂		NO _x		PAH (Benzene Soluble Fraction)
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	
SA1	Plant Site	70.86	52.86	33.50	21.10	16.30	11.20	21.00	14.30	BDL
SA2	Rawan Jhipan Mine Site	82.76	61.72	38.10	21.30	13.4	9.3	18.3	11.3	BDL
SA3	Chhirahl Village	64.80	45.12	30.50	20.50	11.5	6.7	14.5	8.4	BDL
SA4	Khaparadhi Village	51.23	33.12	25.0	18.50	12.7	6.8	13.6	10.4	BDL
SA5	Paraswani Village	50.13	31.87	24.28	18.49	11.8	6.6	13.3	10.2	BDL
SA6	Near Mahanadi Canal	56.86	33.12	28.60	19.10	10.7	6.8	13.4	8.5	BDL
SA7	Rawan Village	61.32	40.36	30.00	20.00	12.9	8.00	14.8	10.3	BDL
SA8	Ameri Village	48.32	32.09	25.00	18.81	10.3	5.50	12.6	8.5	BDL
SA9	Kasahidih Village	52.87	33.12	26.40	18.50	12.2	7.2	12.7	8.7	BDL
SA10	2 Km from Plant Site	57.32	34.12	27.15	18.46	12.5	7.1	12.6	8.2	BDL

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TABLE NO.: 3.11

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		Method of Measurement
			Industrial Area, Residential Rural & Other Areas	Ecologically Sensitive Area (Notified by Central Govt.)	
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual Average * 24 hours **	50 80	20 80	1. Improved West and Gacke Method. 2. Ultraviolet fluorescence
2	Oxides of Nitrogen as NO ₂ , µg/m ³	Annual Average * 24 hours **	40 80	30 80	1. Modified Jacob & Hochheiser (Na-Arsenite) Method 2. Chemiluminescence (Gas phase)
3	Particulate Matter (size less than 10µm) or PM ₁₀ , µg/m ³	Annual Average * 24 Hours **	60 100	60 100	1. Gravimetric, 2. TOEM, 3. Beta attenuation.
4	Particulate Matter (size less than 2.5µm) or PM _{2.5} , µg/m ³	Annual Average* 24 Hours **	40 60	40 60	1. Gravimetric, 2. TOEM, 3. Beta attenuation.
5	Ozone (O ₃), µg/m ³	8 Hours ** 1 Hours *	100 180	100 180	1. UV Photometric, 2. Chemiluminescence, 3. Chemical Method.

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6	Lead (Pb), $\mu\text{g}/\text{m}^3$	Annual Average * 24 Hours **	0.50 1.0	0.50 1.0	1. AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper. 2. ED-XRF using Teflon filter
7	Carbon Monoxide (CO), mg/m^3	8 Hours** 1 Hours	02 04	02 04	Non Depressive Infrared (NDIR) Spectroscopy
8	Ammonia (NH_3), $\mu\text{g}/\text{m}^3$	Annual Average* 24 hours **	100 400	100 400	1. Chemiluminescence (Gas phase) 2. Indophenol blue method
9	Benzene (C_6H_6), $\mu\text{g}/\text{m}^3$	Annual Average*	05	05	1. Gas Chromatography based continuous analyzer, 2. Adsorption and Desorption followed by GC analysis.
10	Benzo(α) Pyrene (BaP) – Particulate Phase only, ng/m^3	Annual Average*	01	01	Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m^3	Annual Average*	05	06	AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper.
12	Nickel (Ni), ng/m^3	Annual Average*	20	20	AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper.

* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24 hourly / 8 hourly values should be not 98% of the time in a year. However 2% of the time, it may exceed but not on two consecutive days.

3.6.3 Result

The concentration of PM_{2.5} for all the 10 AAQM stations ranges between 18.40 to 38.10 µg/m³. The concentration of PM₁₀ for all the 10 AAQM stations ranges between 31.87 µg/m³ to 82.76 µg/m³.

As far as the gaseous pollutants SO₂ and NO_x are concerned, the promulgated CPCB limit of 80 µg/m³ for residential and rural areas has never surpassed at any station. The SO₂ concentrations are in the range of 5.50 µg/m³ to 16.30 µg/m³ and the NO_x concentration in the range of 8.2 µg/m³ to 21.00 µg/m³ for all the 10 AAQM stations.

3.6.3.1 Respirable Suspended Particulate Matter

RSPM is “defined as the component of inhaled respirable dust small enough to reach the pulmonary or alveolar region of the lung”

TABLE-3.14

CLASSIFICATION OF RSPM

Classification	Type of particles	Size of the particles
PM ₁₀	Inhalable particles	≤ 10µm
PM _{2.5}	Fine particles	≤ 2.5µm

TABLE -3.15
SIZES OF RSPM

Description	Examples
Very Small (0.01 to 5 µm)	Paint pigments, tobacco, smoke, sea salts particles
Larger 5 to 100 µm	Cement dust, soil dust, pulverized coal

3.6.3.2 Chemical characterization of RSPM in the environment

Main Constituents of RSPM are the inorganic ions, organic compounds, carbonaceous species, elemental carbon and organic carbon. The chemical characterization of the RSPM was also done according to the specified standards. The free Silica found was about 1.98 %, which is well below its specified limit i.e. 5%.

3.6.4 ANALYSIS OF POLY-AROMATIC HYDROCARBONS (PAH) IN SPM

Over the past years PAHs have been found to be ubiquitous constituents of urban airborne particles and have become a major health concern mainly due to their well-known carcinogenic and mutagenic properties. PAHs are formed during incomplete combustion of organic materials such as fossil fuels, coke and woods. Residence time and removal mechanisms of PAHs in the atmosphere depend on their distribution among the particle size fractions.

PAHs emitted from combustion sources and thus emitted to atmosphere in gas phase or in fine particles. After the entrance to atmosphere they are cold and they unite or adsorbed into small particles. Those processes lead PAHs in higher concentrations to fine particles.

PAHs analysis was also done during the study period for all the air sampling stations but has been found Below Detection Limit.

3.6.5 STACK & FUGITIVE EMISSION DATA

Stack Emission (Dust) details from the stacks attached to different units in the cement plant are as follows:

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TABLE – 3.12 (A)
STACK EMISSION DETAILS

Month	Raw mill/Kiln ESP	Cooler ESP	Coal mill ESP	Cement mill ESP	Sepol stack	Limestone crusher stack	DG-1	DG-2	TPP
	in mg/Nm ³	in mg/Nm ³	in mg/Nm ³	in mg/Nm ³	in mg/Nm ³	in mg/Nm ³		in mg/Nm ³	in mg/Nm ³
APR'09	60	49	64	55	65	44	36	41	26
MAY'09	55	47	59	54	64	41	39	43	27
JUNE'09	50	47	52	43	45	41	35	39	21
JULY'09	42	34	39	39	46	42	38	34	22
AUG'09	37	40	41	37	54	39	36	42	36
SEP'09	38	40	42	37	45	40	38	36	25
OCT'09	35	44	35	35	43	40			28
NOV'09	41	44	35	44	48	43	39	35	23
DEC'09	39	35	31	38	43	39	44	37	30
JAN'10	36	40	32	37	45	42			21
FEB'10	35	39	30	35	41	39	34	38	21
MAR'10	34	31	29	35	40	37			19
AVERAGE	41.8	40.8	40.8	40.8	48.3	40.6	37.7	38.3	24.9

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TABLE – 3.12 (B)
FUGITIVE EMISSION DETAILS - SPM (in microgram/m³)
[CEMENT PLANT AND TPP FROM SEP'08-MAR'09]

Month	Packing Plant	Cement mill	Clinker cooler	Gypsum/F/ash shed	Coal crusher	Limestone stacker	Clinker stockpile
SEP'08	3352	2865	1255	964	824	1675	2456
DEC'08	3351	3764	924	734	682	1284	1556
MAR'09	2959	3940	1415	1757	1191	1164	2161
Average	3221	3523	1198	1152	899	1374	2058

3.6.6 GASEOUS EMISSIONS DETAILS

One-month data for gaseous emissions data for Winter Season within the plant & nearby area is as follows:

TABLE -3.13
GASEOUS EMISSIONS FOR WINTER SEASON
in microgram/m³

Month	WAGON TIPPLER			LOCO-SHED			GAMMA METRICS			WORKER COLONY			CHUCHURUNG PUR VILLAGE		
	SO ₂	NO _x	CO	SO ₂	NO _x	CO	SO ₂	NO _x	CO	SO ₂	NO _x	CO	SO ₂	NO _x	CO
DEC'09	11.6	16.1	BDL	12.6	17.4	BDL	12.2	16.7	BDL	11.3	15.4	BDL	9.2	13.6	BDL
JAN'10	11.5	15.4	BDL	12.5	16.5	BDL	11.9	16.7	BDL	11.1	15.4	BDL	9.4	13.7	BDL
FEB'10	11.4	15.5	BDL	11.95	16.2	BDL	11.4	15.8	BDL	10.9	14.6	BDL	9.3	13.9	BDL

3.7 NOISE ENVIRONMENT

Noise often defined as unwanted sound, interferes with speech communication, causes annoyance, distracts from work, disturb sleep, thus deteriorating quality of human environment. Noise Pollution survey has therefore been carried out.

Noise levels were measured near highways, residential areas and other settlements located within 10 km radius around the plant site

In order to know the baseline noise levels, in and around the project site, noise levels were measured at the plant site and also at villages in the study area. Table-below shows the locations of the noise monitoring stations of the study area.

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TABLE No.: 3.15
NOISE MONITORING STATIONS
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

Station	Sampling Location	Direction from Plant Site	Aerial distance in km. From Boundary of Project Site
SN1	Plant Site	-	-
SN2	Rawan Jhipan Mine Site	SSW	2.0
SN3	Chhirahl Village	ESE	2.0
SN4	Khaparadhi Village	NNE	3.0
SN5	Paraswani Village	SW	6.1
SN6	Near Mahanadi Canal	NE	1.5
SN7	Rawan Village	WNW	1.0
SN8	Ameri Village	W	3.5
SN9	Kasahidih Village	WSW	4.0
SN10	2 Km from Plant Site	SW	2.0

There are several sources in the 10 km radius of study area, which contributes to the local noise level of the area. Traffic, cement plant, activities at limestone mines as well as activities in near by villages and agricultural fields add to the ambient noise level of the area.

Noise monitoring data along with relevant standards are given in following table-below.

TABLE No.: 3.16
AVERAGE NOISE LEVEL
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

S. No.	LOCATIONS	NOISE LEVEL Leq. dB (A)	
		Day Time (6:00 a.m. to 10:00 p.m.)	Night Time (10:00 p.m. to 6:00 a.m.)
SN1	Plant Site	71	53
SN2	Rawan Jhipan Mine Site	55	43
SN3	Chhirahl Village	47	36
SN4	Khaparadhi Village	49	37
SN5	Paraswani Village	48	39
SN6	Near Mahanadi Canal	50	40
SN7	Rawan Village	49	40
SN8	Ameri Village	46	41
SN9	Kasahidih Village	48	38
SN10	2 Km from Plant Site	52	41

TABLE No.: 3.17
CPCB NOISE STANDARDS

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40
1. Day Time is from 6:00 AM to 10:00 PM 2. Night Time is reckoned between 10:00 PM to 6:00 AM 3. Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones. Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply		

3.7.1 Result

Ambient noise levels were measured at 10 locations around the proposed project site. Noise levels varies from 46 to 71 Leq dB(A) during day time and during night time noise levels ranges from 36 to 53 Leq dB(A). Thus noise levels at all locations were observed to be within the prescribed limits.

From the above study and discussions it can be concluded that noise levels in the study area are well within the prescribed limits as prescribed by the CPCB and State Pollution Control Board.

3.8 SOIL ENVIRONMENT

3.8.1 Soil Quality and Characteristics

The information on soils has been collected from various secondary sources and also through primary soil sampling analysis of which is described in this section.

For studying the soil profile of the region, 10 locations were selected to assess the existing soil conditions in and around the project area

representing various land use conditions. The concentrations of physical and chemical parameters were determined. In addition to the above, information on the availability of water sources at sampling locations were also collected.

The sampling locations have been finalized with the following objectives:

- To determine the baseline soil characteristics of the study area; and
- To determine the impact of industrialization on soil characteristics.

Quality of the soil in the area is showing a marked diversity in nature depending upon the parent rock and climatic conditions prevailing in different parts of the district. The analysis results of the soil samples collected are given in table below.

TABLE No.: 3.18
SOIL MONITORING STATIONS
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

Station	Sampling Location	Direction from Plant Site	Aerial distance in km. From Boundary of Project Site
SS1	Plant Site	-	-
SS2	Rawan Jhipan Mine Site	SSW	2.0
SS3	Chhirahl Village	ESE	2.0
SS4	Khaparadhi Village	NNE	3.0
SS5	Paraswani Village	SW	6.1
SS6	Near Mahanadi Canal	NE	1.5
SS7	Rawan Village	WNW	1.0
SS8	Ameri Village	W	3.5
SS9	Kasahidih Village	WSW	4.0
SS10	2 Km from Plant Site	SW	2.0

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TABLE NO.: 3.19
SOIL ANALYSIS REPORT
STUDY PERIOD – WINTER SEASON (DEC, 09 TO FEB, 10)

S. No.	Parameters	Sampling Locations									
		PLANT SITE	RAWAN JHIPAN MINE SITE	CHHIRAHL VILLAGE	KHAPARADHI VILLAGE	PARASWANI VILLAGE	1.5 KM FORM PLANT SITE, NEAR MAHANADI CANAL	RAWAN VILLAGE	AMERI VILLAGE	KASAHIDIH VILLAGE	2 KM FROM PLANT SITE
01.	pH (1:2 Soil Water Suspension)	7.82	7.78	7.59	7.71	7.70	7.67	7.65	7.72	7.63	7.50
02.	Colour	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown	Yellowish Brown
03.	Electrical Conductivity, milli siemens	0.36	0.33	0.34	0.37	0.36	0.39	0.38	0.42	0.39	0.37
04.	Organic Carbon, %	0.92	0.88	0.83	0.86	0.84	0.77	0.80	0.79	0.76	0.82
05.	Nitrogen as N ₂ , kg/Ha	348	310	298	302.5	300.1	244	298.5	288.5	276.1	310.5
06.	Soil Texture	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay	Loam Clay
07.	Phosphorus as P ₂ O ₅ , kg/Ha	33	30.2	28.3	30.0	29.0	25	26.3	25.5	23.60	27.5
08.	Potassium as K ₂ O,	148.2	128.1	115.2	121.5	120.6	108.5	109.2	116.5	105.6	118.6

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	kg/Ha										
09.	Calcium as Ca, mg/100gm	8.87	7.55	6.21	6.78	6.76	5.26	5.56	5.20	4.58	6.10
10.	Magnesium as Mg, mg/100gm	3.58	3.12	2.58	3.10	2.99	2.16	2.26	2.18	2.30	3.60
11.	Chloride as Cl, mg/100gm	15.23	13.20	12.50	15.56	15.54	11.5	12.10	11.60	11.25	12.11
12.	Sodium mg/100gm	3.25	4.10	3.58	4.15	3.99	3.18	3.50	2.58	2.38	2.40
13.	Bulk Density, gm/cc	1.26	1.29	1.30	1.29	1.27	1.39	1.29	1.28	1.30	1.29
14.	WHC(%)	46.12	42.16	40.5	43.16	42.23	40.10	42.5	41.6	38.10	40.2
15.	Manganese as Mn, mg/100gm	8.28	7.15	6.58	7.08	7.05	6.20	7.36	7.38	5.20	6.48
16.	Copper as Cu, mg/100gm	3.21	2.68	3.10	2.52	2.41	2.58	3.60	2.82	3.48	2.69
17.	Lead as Pb, mg/100gm	0.56	0.68	0.38	0.46	0.43	0.50	0.48	0.42	0.40	0.38
18.	Chromium as Cr, mg/100gm	0.28	0.30	0.32	0.31	0.30	0.27	0.31	0.33	0.34	0.37
19.	Cadmium as Cd, mg/100gm	0.10	0.12	0.14	0.15	0.11	0.12	0.15	0.12	0.11	0.13
20.	Zinc as Zn, mg/100gm	4	5	4	6	6	4	6	4	4	4

TABLE NO.: 3.20
STANDARD SOIL CLASSIFICATION

S.No.	Parameters	Classification
1.	pH	<4.5 extremely acidic 4.51 – 5.0 very strong acidic 5.01 – 5.5 strongly acidic 5.51-6.0 moderately acidic 6.1 – 6.5 slightly acidic 6.51-7.3 Neutral 7.31-7.8 slightly alkaline 7.81-8.5 moderately alkaline 8.51 – 9.0 strongly alkaline >9.0 Very strongly alkaline
2.	Salinity Electrical Conductivity (mho/cm) 1 mho/cm = 640 ppm	Up to 1.0 average 1-2 harmful to germination 2-3 harmful to crops
3.	Nitrogen (kg/ha)	Up to 50 very less 51-100 less 110-150 good 151-300 better >300 sufficient
4.	Phosphorus (kg/ha)	Up to 15 very less 15 – 30 less 31-50 medium 51-65 on average sufficient 66-80 sufficient >80 more than sufficient
5.	Potassium (kg/ha)	0-120 very less 120-180 less 180-240 medium 241-300 average 301-360 better >360 more than sufficient

Soil is the media for supplying the nutrients for plant growth. Nutrients are available to plants at certain pH and pH of soils can reflect by addition of pollutants in it either by air, or by water or by solid waste or by all of these. In order to establish the baseline status of soil characteristics, soil samples were collected at 6 sampling locations. The analysis results show that soil is neutral in nature as pH value ranges from 7.50 to 7.82, with organic carbon 0.76% to 0.92%. The concentration of Nitrogen, Phosphorus & Potassium has been found to be in good amount in the soil samples. Soil texture is sandy loam.

3.9 PETROLOGICAL ANALYSIS

The raw materials used in the plant are Limestone, Iron Ore, Coal. The samples were collected for petrographical and chemical analysis.

Table No. 3.21
Samples Location Details

S.No.	Material	Geographical Coordinates	Source
1.	Limestone	Latitude : 21°33'45" N Longitude : 82°52'12" E	Captive Limestone Mine of Grasim Cement, Raipur District, Chhattisgarh
2.	Soil	Latitude : 21° 33'50" N Longitude: 82° 01'10" E	Grasim Cement Plant premises, Raipur District, Chhattisgarh
3.	Iron ore	Latitude : 18°41'38.21' N Longitude : 81°13' 20.07 E	Iron Ore Mines, Dantewara District, Chhattisgarh
4.	Coal	Latitude : 22° 19'59.74' N Longitude : 82°40' 12.56 E	Coal Mines, District Raigarh, Chhattisgarh

The Petrographical, XRD and Geochemical studies were carried out for coal, limestone, iron ore and soil samples.

3.9.1 Petrographical Studies

3.9.1.1 Sample Preparation

The samples collected from the field were analyzed for petrographical composition for which thin section slides were prepared. The first step for specimen preparation is sectioning which is performed for the following reasons:

- Obtain a manageable size specimen from the parent material
- Reduce thickness of the specimen so that grinding time is decreased (as in the case of preparing thin sections)
- Expose the surface of interest

These very thin samples were cut and mounted on glass slides using clear epoxy solution. After this the grinding was performed to remove deformation induced in sectioning and to planar grind; and removes excess material. Thus the samples were further grinded to reduce the thickness to 0.01 mm. The samples were ground on laps and then on silicon carbide or carborundum abrasives, progressively from 120 to 1200 grit. Once a section is ground to the desired thickness, the specimen can be examined using transmitted light or it can be further polished. The purpose of polishing a specimen is to remove any final deformation induced by the grinding process and yield a surface that is essentially damage-free. Polishing is accomplished by abrading the surface with fine abrasives, progressively decreasing to sub-micrometer size. The samples were polished with chromium sesquioxide (about 5- μ m grain size) and finally with magnesium oxide (about 0.5- μ m grain size). A polished thin section can be examined with either a transmitted or reflected light microscope. Advantages for polishing during the thin section preparation process include the following:

- Mineral hardness may be determined
- Chemical tests can be performed on the polished surface
- The time consuming procedure used for applying the cover glass is eliminated
- Cellular **detail is revealed**

Samples were examined in white light and also in a reflected mode for ore microscopy. A Nikon Eclipse E-600 POL microscope was used for examinations of thin section samples having 100 x zoom Photographs were taken using a Nikon-Orthomat automatic camera system fitted to the microscope.

3.9.1.2 Limestone Sample

A) DESCRIPTION

The rock is soft and massive calcareous sedimentary rock and mainly composed of calcite (CaCO_3). It is composed mainly of calcium carbonate minerals like calcite, aragonite, dolomite and minor amount of chert and calcite with siderite.

The results shows the Calcite, Dolomite & Quartz is 60-77%, 10-15% & 2-3% respectively.

Calcites are fine to medium grained, anhedral to subhedral. At places, medium grained calcite grains show typical calcite cleavage. They show very good twinning. Some grains of calcite are replaced by fine quartz grains. Dolomites are also fine to medium grained, anhedral, granular and massive. They have perfect cleavage. Aragonites are fine grained and anhedral. Some of grains show polysynthetic twinning. Chert occurs as very fine to fine grained anhedral crystals. Minor amount of siderite (Iron carbonate) are present arbitrary as inclusion in calcite. Very fine to fine grains of quartz are present as an altered product of calcite.

B) COMMENTS

The rock is soft and massive calcareous sedimentary rock and mainly composed of calcite (CaCO_3). It is composed mainly of calcium carbonate minerals like calcite, aragonite, dolomite and minor amount of chert and calcite with siderite. No trace elements are observed in ore microscopy also.

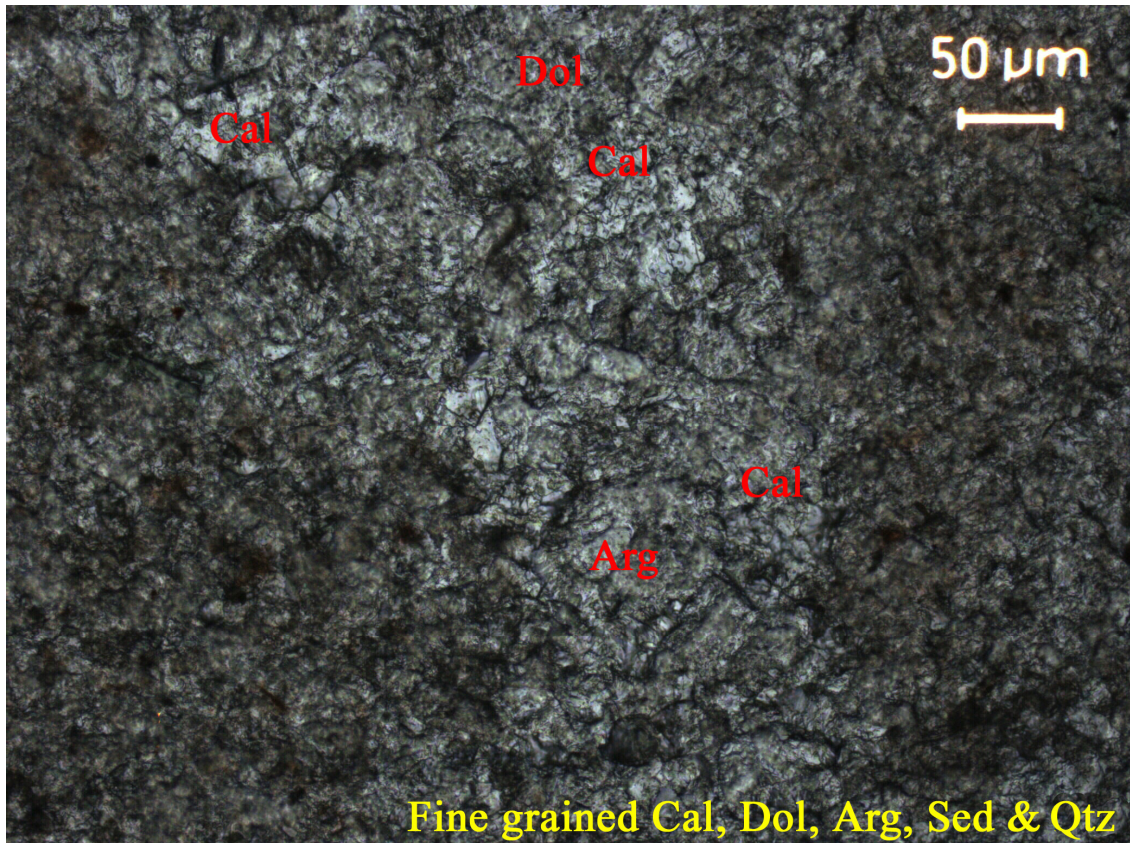


Fig. 15: Photomicrograph showing calcite (Cal), dolomite (Dol), aragonite (Arg), sedirite (Sed) and quartz (Qtz) in plane polarized light.

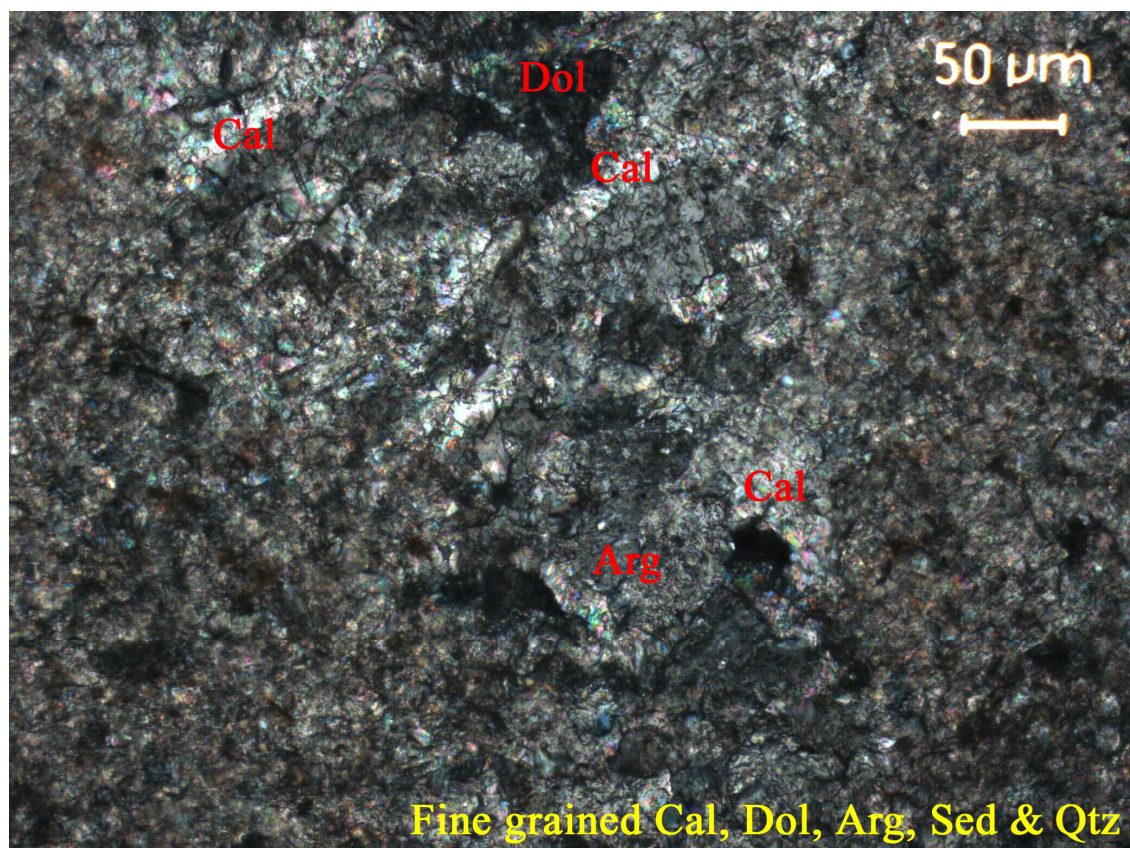


Fig. 16: Photomicrograph showing calcite (Cal), dolomite (Dol), aragonite (Arg), sedirite (Sed) and quartz (Qtz) in crossed nicols.

3.9.1.3 Coal Sample

A) DESCRIPTION

The rock is non clastic carbonaceous sedimentary rock, mainly composed of organic materials. The rock is black to dark grey in colour, have glossy luster and splintery fracture. It composed of vitran, fusian, clarian, durian and organic matrix.

Vitrans (42-47%) occur as fine to medium sized, brilliant black band of organic material. They are aligning along the main foliation of the rock. They form the most of the percent of the rock. Fusians (22-27%) also occur as very fine to fine, soft and powdery bands. They occur alternately and in association with vitrans. Clarians (10-15%) occur as fine, laminated bright grains. They are distributed randomly throughout the rock. Durians (6-9%) occur as very fine to fine dull bands, in association with other bands of vitran and fusian. They rock is cemented together by very fine organic materials (2-4%).

B) COMMENTS

The rock is non clastic carbonaceous sedimentary rock, mainly composed of organic materials. It composed of vitran, fusian, clarian, durian and organic matrix. No trace elements (eg. Arsenopyrite) are observed in ore microscopy also. Hence the coal is free from arsenic bearing mineral and so its residual fly ash will also be free from arsenic concentration.

Thus there is no need to carry out XRF, EPMA or ICPMS analysis for trace elements and hence the management plan for Arsenicosis is not required.

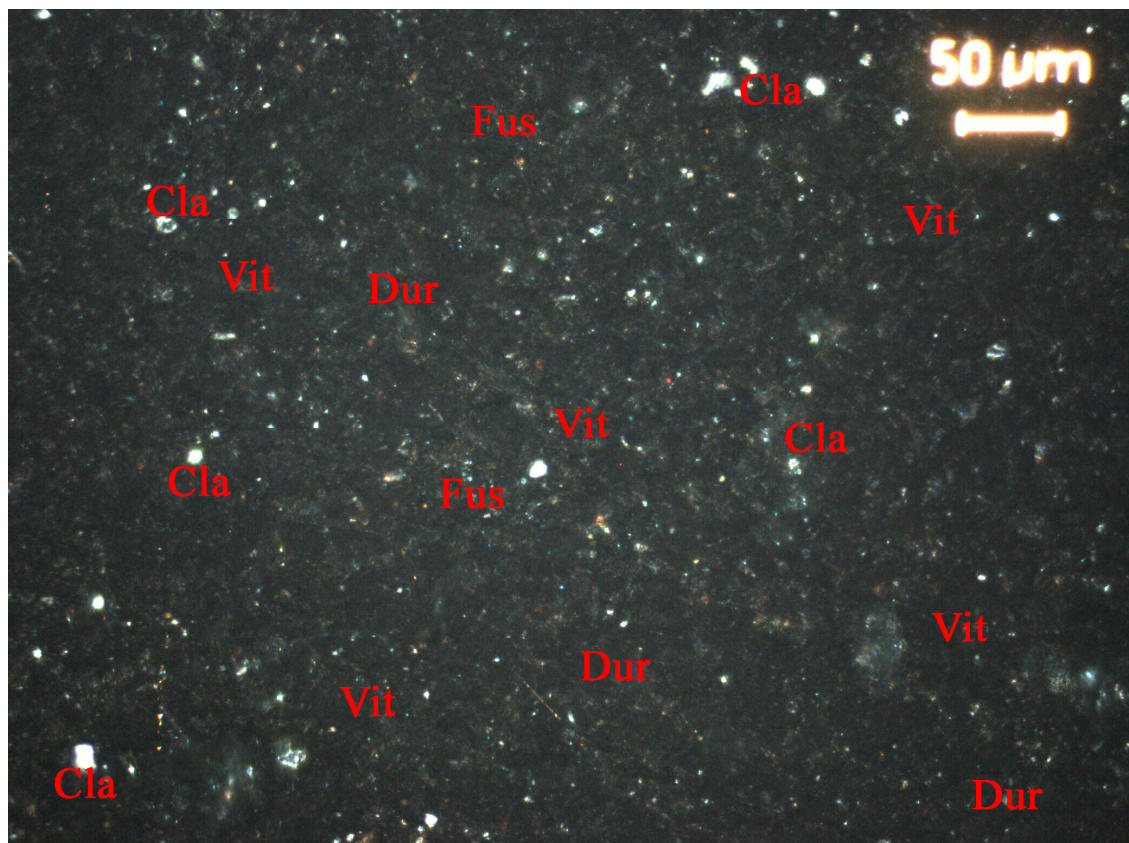


Fig. 17: Photomicrograph showing vitran (Vit), fusian (Fus), clarian (Cla) and durian (Dur) in plane polarized light.

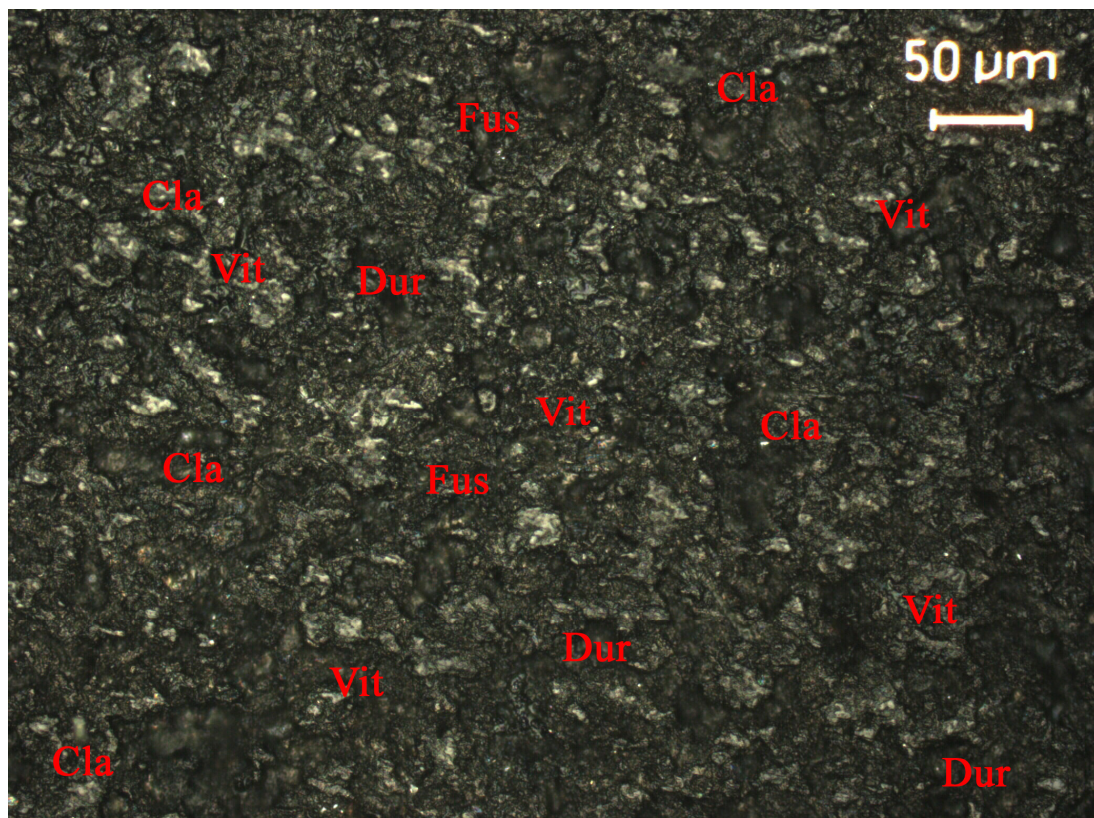


Fig. 18: Photomicrograph showing vitran (Vit), fusian (Fus), clarian (Cla) and durian (Dur) in crossed nicols.

3.9.2 XRD ANALYSIS OF THE RAW MATERIALS

Coal is a readily combustible black or brownish-black sedimentary rock normally occurring in rock strata in *layers or veins* called coal beds. The classification of coal is generally based on the content of volatiles. However, the exact classification varies between countries.

The quality of Indian coals, in general, is rather poor, being of low, non-coking grade, high mineral matter content, for which reason such coals need to be necessarily beneficiated to improve their quality to make them suitable not only for use in thermal power plants for power generation and steel industry but also for other non-fuel uses. Most of the coals resources in India are of Permian age constitute approximately 99% of the total coal reserves of the country. These resources were formed when the subcontinent was lying between 70° and 40 °S latitude. The climate was cold to temperate with high precipitation, conditions of considerable importance in the origin and evolution of Indian coals. The chief coal resources of Permian age of India are mostly found in the peninsular part of the Indian subcontinent and are aligned along the Damodar, Son, Mahanadi, Satpura, Wardha and Godavari River Valleys. These valleys have been preserved within tectonic lineaments, the oldest rocks of which form the Archean basement complex.

XRD is an important tool for identification of crystalline phases and it is also used for determination of minerals in coal. The coal sample was ground to 15 mm size in an agate mortar in alcohol for half an hour and It was further washed with distilled water and air-dried to get rid of any moisture and alcohol. The material obtained was used to prepare smear slides. The smear slides were then run on potassium KA₂ stripping, Phillips X-Ray Diffractometer with nickel filter Cu-K radiation. For each sample a diffractogram was recorded for 2° ranging from 2° to 60°, scanning speed 1°/min., chart speed at 10mm per minute and C.P.S. 4 X 10². The X-rays diffractogram so obtained and the d-spacing d₁, d₂,, d_n Å° were noted where d₁ is the largest spacing and others are successive smaller spacings. These spacings were computed by the formulae $d^2/d_1^2/d_1^2/d_n^2 \dots \dots \dots d_1^2/d_n^2$. This set of squared quotients was used to determine the different minerals.

The coal sample show dominance of vitrinite content in petrographic analysis which is similar to other coals from Gondwana basin in India. The vitrinite content ranges upto 50% as shown in petrographic analysis. The vitrinite macerals were derived from the fragments of wood and bark, generally in a fine-grained state; they form one of the important constituents of these Indian coals. The vitrinite macerals are very closely associated with siderite, sulphide (e.g., pyrite), clay minerals, and with silica minerals. Thus the mineral matter in the coal sample consists of clay minerals, quartz, siderite and pyrite. Clay minerals are the most prominent in the Indian Permian coals. Minor amount of quartz is also present. Clay minerals are present as fine disseminations within vitrinite, as well as in filling of fusinite and also in cracks of vitrinite. Siderite is more abundant in the coals of the Son-Mahanadi Valley than in other coal basins studied. X-ray diffraction studies on coal samples show that the coals contain Kaolinite, Quartz, Pyrite, and Calcite as indicated in the following figure.

Table No. 3.22
Comparison of maceral-group and mineral-matter contents of coals from various Gondwana basins of India

Maceral group/ Mineral-Matter content	Damodar Valley basins		Son-Mahanadi Valley Basin	Pench-Kanhan Valley basin
	Raniganj	Jharia		
Vitrinite	L-H	L-M	L-M	L-H
Mean %	60	50	42	42
Range %	43-79	13-70	25-58	28-68
Exinite (Liptinite) Mean %	M-H	L-H	L-H	L-H
	9	5	14	11
Range %	6-19	2-20	4-23	2-20
Inertinite	L-M	L-M	L-M	L-H
Mean %	22	35	32	29
Range %	17-33	33-59	17-56	20-67
Mineral matter	M-H	M-H	L-H	L-H
Mean %	9	10	12	18
Range %	6-19	5-18	8-20	2-28

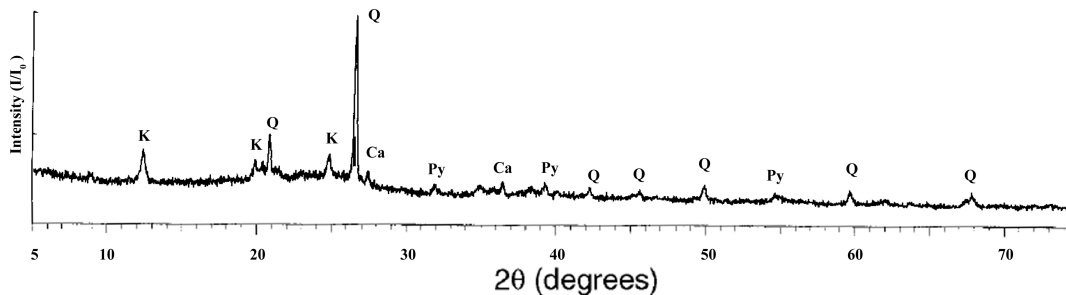


Fig 19 : X-Ray Diffraction graph of coal sample showing mineral composition of Quartz (Q), kaolinite (K), Pyrite (Py) and Calcite (Ca).

The X-Ray Diffraction analysis on the basis of the peak intensity counts and intensity percentages of the distinctive peaks suggest that the material is dominantly composed of Vitrinite and Silica. The sulphides are present in the form of pyrite but in trace amount as shown by XRD graph. There is no presence of arsenopyrite shown in the coal sample and hence chances of arsenic pollution will be nil from coal combustion.

3.9.3 Geochemical Analysis Of Rocks And Soils

3.9.3.1 Iron Ore - Analysis

Iron used in cement plant was procured in the form of rock for ICPMS. The area lies in Bastar craton where mafic dykes trending NW-SE direction intersect the granitic craton. Mafic rocks of varying petrological and geochemical characteristics are exposed in the Bastar craton in the form of dykes as well as volcanics. There are two distinct mafic dyke of sub-alkaline nature in the southern part of the Bastar craton. Samples were selected for the whole rock major and trace-element analyses by fusion inductively coupled plasma mass spectrometry having a precision of approximately 5 and 5–10% for major oxides and trace/ rare-earth elements, respectively. Geochemical data show that these mafic dykes have high-silica (53.34–53.92 wt%), high-magnesium (10.91–15.36 wt%), high-iron (10.62–11.08 wt%). These samples do not contain any toxic elements and hence can be used for the cement industry. The ICPMS results clearly indicate that the Iron used from these areas do not have high amount of heavy metals in them and so will not pollute the environment.

3.9.3.2 Soil Analysis

The soil from the project site near village Ravan, Raipur district were collected. The samples were air dried and passed through a 0.2-mm sieve prior to analysis for total Pb, Ni, and Cu. The procedure mentioned in methods of Soil Analysis, Part – 1, 2nd edition, 1986 (American Society of Agronomy and Soil Science Society of America) was followed for homogenization of the soil samples so that they come in line with IS: 2720. Their chemical analysis was carried out using a flame atomic absorption spectrophotometer for Pb, Ni, and Cu using an air–acetylene flame and the table given below indicates its results. The detection limit for the instrument is 10 ppb. The concentration of Pb, Ni and Cu are 115 mg kg⁻¹, 42 mg kg⁻¹ and 119 mg kg⁻¹ respectively.

3.10 BIOLOGICAL ENVIRONMENT

3.10.1 Introduction

Anthropogenic activities tend to bring instability in the species composition and functioning of ecosystem. The first component to be affected directly as well as indirectly and in a short, medium and long time span would be the biotic component of the area. This sets a cyclic process, which may aggravate the situation unless corrective measures are adopted.

Generation of base-line data and knowing the type and extent of pollutants would be the first step of the environmental study report. The biological assessment is trustworthy and acceptable method to understand the impact of surroundings. This leads to suggesting remedial measures for minimizing impact.

3.10.2 Flora

The area is generally devoid of large trees. At places a few trees, bushes, etc. of local nature have been observed.

Besides the trees, natural vegetation grows mostly during monsoon and fades away with the onset of summer. These include grasses and shrubs, which are wild and grazed by animals. The study area has no rare, endangered species of flora. Name of some of the plant species & fauna species are mentioned below.

TABLE – 3.23
PLANT SPECIES FOUND IN STUDY AREA

S.No.	Name of Plant Species	Local Name
TREES		
1.	<i>Acacia nilotica</i>	Babul
2.	<i>Tectona grandis</i>	Sagwan
3.	<i>Terminalia tomentosa</i>	Saja
4.	<i>Madhuca indica</i>	Mahua
5.	<i>Spondias pinnate</i>	Amera
6.	<i>Emblica officialis</i>	Amla
7.	<i>Acacia catechu</i>	Kher
8.	<i>Terminalia arjuna</i>	Arjun
9.	<i>Terminalia belerica</i>	Bahera
10.	<i>Aegle marmelos</i>	Bel
11.	<i>Acacia arabica</i>	Babul
12.	<i>Ficus religiosa</i>	Pipal
13.	<i>Albizzia odoratissima</i>	Chichwa, kela siris
14.	<i>Anogeissus latifolia</i>	Dhaora
15.	<i>Tamarindus indica</i>	Imli
16.	<i>Ficus glomerata</i>	Gular
17.	<i>Capparis sepiaria</i>	Kanker
18.	<i>Gmelina sepiaria</i>	Gamari (khamar)
19.	<i>Dalbergia sisso</i>	Sisam
20.	<i>Ficus bengalensis</i>	Bargad
21.	<i>Syzygium cumini</i>	Jamun
22.	<i>Lynnea coromandelica</i>	Moyen (Gunja)
23.	<i>Azadirachta indica</i>	Neem
24.	<i>Butea monosperma</i>	Palas
25.	<i>Shorea robusta</i>	Sal (Sarai)
26.	<i>Boswellia sp.</i>	Salai
27.	<i>Salmaia malabarica</i>	Semal
28.	<i>Diospyros melanoxylon</i>	Tendu
29.	<i>Eucalyptus sp.</i>	Safeda
30.	<i>Mangifera indica</i>	Mango
31.	<i>Anthocephalus cadamba</i>	Kadam
SHURBS		
32.	<i>Abrus precatorius</i>	Ghumchi

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33.	<i>Achyranthes aspera</i>	Chirchitta
34.	<i>Calotropis procera</i>	Akund/Mada
35.	<i>Ipomoea purpurea</i>	Tall morning glory
36.	<i>Lantana camara</i>	Besharm
37.	<i>Mimosa pudica</i>	Mimosa
38.	<i>Ocimum basilicum</i>	Ban Tulsa
39.	<i>Peganum harmata</i>	Harman
40.	<i>Ziziphus mauritiana</i>	Bar

The red data book of species does not include any of these species. However, biotic inference in this area will pose a problem of migration of these animal species. As the above given species are not endemic, rare or endangered, an inevitable developmental activity may be undertaken with all the precautionary measures of ecological sustainability e.g. controlled noise level, controlled air pollution and green belt development.

3.10.3 Fauna

The area hosts various types of animals. The species of fauna generally found in the area are given in table:

TABLE No.: 3.24
FAUNA OF STUDY AREA

S. No.	Common Name	Zoological Name	Schedule as per Wild life Act 1972
Core zone			
1.	Brahminy myna	<i>Sturnus pagodarum</i>	Schedule IV
2.	Hare	<i>Lepus nigricolis F</i>	Schedule IV
3.	Wall Lizard	<i>Hemidactylus brookii</i>	-
4.	Rat	<i>R. rattus</i>	Schedule V
Buffer Zone			
1.	Brahminy myna	<i>Sturnus pagodarum</i>	Schedule IV
2.	Common Babblers	<i>Turdoides caudatus</i>	Schedule IV
3.	Black drongo	<i>Dicrurus adsimilis</i>	Schedule IV
4.	White bellied drongo	<i>Dicrurus caerulescens</i>	Schedule IV
5.	Red vented bulbul	<i>Pycnonotus cafer</i>	Schedule IV
6.	Wall Lizard	<i>Hemidactylus brookii</i>	--

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7.	Spotted dove	<i>Streptopelia chinensis</i>	Schedule IV
8.	Brown wood dove	<i>Streptopelia senegalensis</i>	Schedule IV
9.	House crow	<i>Corvus splendens</i>	Schedule V
10.	Little egret	<i>Egretta garzetta</i>	Schedule IV
11.	Cotton teal	<i>Nettapus coromandelianus</i>	Schedule IV
12.	Hare	<i>Lepus nigricolis F</i>	Schedule IV
13.	Rat	<i>R. rattus</i>	Schedule V

3.11 ECOLOGICAL SENSITIVE AREAS

No National Parks / Wildlife Sanctuary / Protected Forests fall within 10 km. radius of the project site. Dhabhadih Reserve forest falls at a distance of 7 Km from the project site. There is no Forest land involved in the project activity. The No Objection Certificate from the Forest Divisional Officer Raipur, Chhattisgarh has been obtained & is attached as **Annexure 4.**

3.12 SOCIO-ECONOMIC ENVIRONMENT

Socio-economic environment includes description of demography, available basic amenities like housing, health care services, transportation, education and cultural activities. Information on the above said factor has been collected to define the socio-economic profile of the study area (10 km radius).

3.12.1 Demography

The population as per 2001 Census records is 36565 (for 10 km radius buffer zone). Scheduled Caste fraction of the population of the study area (10 km) is 15.80% and Scheduled Tribe 6.98%. Percentage of literacy is 57.23% and that of workers those actually engaged in occupation is 40.78% including, 30.43% of Main workers & 10.35% of marginal workers. Rest 59.22% of the total population, are considered as non-workers.

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TABLE NO: 3.25
DEMOGRAPHY DETAILS OF STUDY AREA

Name	'Total Population'	'Total SC Population'	'Total ST Population'	'Total Literates'	'Total Illiterates'	'Total Working Population'	'Total Main Worker'	'Total Marginal Worker'	'Total Non Worker'	'Number of Household'	Sex ratio	'Literacy Rate'	'Male Population'	'Female Population'
Tulsi	1630	78	9	858	772	736	716	20	894	316	1038	64.2	800	830
Bhothdih (Chaurenga)	354	0	93	156	198	135	95	40	219	77	934	51.8	183	171
Aurethi	1560	315	21	804	756	723	621	102	837	279	1000	63.6	780	780
Pousari(Bhainsa)	501	27	97	224	277	245	221	24	256	94	1159	55.3	232	269
Bhanwargarh (Bhawargarh)	352	38	50	180	172	178	178	0	174	71	1058	64.7	171	181
Tekari	636	2	124	368	268	283	264	19	353	125	1032	68.9	313	323
Amakoni	698	91	94	327	371	268	262	6	430	154	1102	58.8	332	366
Diggi	517	507	1	244	273	258	201	57	259	106	936	63	267	250
Khapri	168	161	0	95	73	75	72	3	93	29	888	73.6	89	79
Bhothidih Alias Titahid	282	14	27	150	132	119	112	7	163	51	1169	67	130	152
Kesli(Shikari)	1028	123	198	615	413	450	366	84	578	208	1056	71.3	500	528
Lohari	655	95	4	345	310	275	83	192	380	134	1282	64	287	368
Nawapara	2087	247	170	1172	915	852	781	71	1235	366	1011	69.3	1038	1049
Bardih(Bitkuli)	309	35	215	163	146	121	75	46	188	73	943	62.5	159	150
Suhela	1867	235	76	1169	698	717	419	298	1150	372	1058	76.7	907	960
Basin	664	206	29	361	303	278	133	145	386	160	1075	63.9	320	344
Chandi	700	17	180	351	349	313	270	43	387	163	1201	65.1	318	382

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Khapradih	1171	81	0	726	445	512	257	255	659	215	978	75.1	592	579
Jhipan	1441	211	84	838	603	662	404	258	779	266	942	71.8	742	699
Raweli	862	249	37	494	368	402	373	29	460	148	928	72.1	447	415
Rawan	4712	282	93	3002	1710	1755	1509	246	2957	1108	889	80.7	2495	2217
Khairwani	186	1	127	138	48	90	79	11	96	36	1214	86.8	84	102
Dhobnidih	411	172	0	261	150	178	148	30	233	70	860	75.7	221	190
Budgahan	814	148	46	503	311	283	124	159	531	194	943	71.2	419	395
Bhat Bhera	1214	127	188	714	500	537	341	196	677	268	1010	68.9	604	610
Ameri	578	148	9	298	280	306	239	67	272	118	993	62	290	288
Kuthraud	2615	499	171	1719	896	893	590	303	1722	577	969	82.4	1328	1287
Saklor	1765	253	28	966	799	755	608	147	1010	323	937	70.5	911	854
Pendri	600	184	16	242	358	276	96	180	324	132	1182	51.4	275	325
Kasahidih	144	138	0	59	85	65	28	37	79	37	1000	52.2	72	72
Hirmi	4318	489	291	2374	1944	1529	1091	438	2789	864	906	71	2266	2052
Bardih(Hirami)	772	241	42	484	288	359	160	199	413	157	1032	75.2	380	392
Paraswani	954	364	31	526	428	285	211	74	669	167	1013	72.1	474	480
Total	36565	5778	2551	20926	15639	14913	11127	3786	21652	7458	1022	-	18426	18139
%	-	15.80%	6.98%	-	-	40.78%	30.43%	10.35%	59.22%	-	-	57.23%		

Source: Census 2001

3.12.2 Health & Diseases

Details were collected regarding health status of the study area & it was found that though common diseases like Malaria, Viral Fever, Typhoid, Pneumonia, fungal infections, cholera are found to occur but no major disease / endemic diseases were noticed with the study area.

3.12.3 Industries Falling with 25 Km Radius of the Area

Few industries are located near 25 km radius of the project site, these are listed as shown in the table below:

- Ultratech Cement Ltd., Cement Plant, Hirmi (10km)
- Ultratech Cement Ltd, Captive Limestone Mine (10km)
- Ambuja Cement Ltd., Cement Plant, Ravaana (22 km)
- Ambuja Cement Ltd., Captive Limestone Mine, Ravaana (22 km)
- Lafarge India Pvt.Ltd., Sonadih Cement works, Sonadih, (25 km)
- Stone Crushers within 25 km radius – approximate 35 in number
- Rice Processing Plants

Proposed Industries within 25 km radius are as follows:

- Grasim Cement, Rawan, Guma Limestone mine (5 km)
- Grasim Cement, Rawan, Kukurdih Limestone mine
- Shree Cement Ltd., Integrated Cement Project
- JayPee Cement Ltd., Integrated Cement Project, Devsundra
- Emami Cement Ltd. Integrated Cement Project, Risda

3.13.4 Basic Amenities

1. Most of the villages are electrified.
2. The social activities such as literacy camps, family planning and eye camps have been organized both by the local government bodies and industries in association with voluntary agencies.
3. Telephone and Telegraph facilities are available.
4. Medical facilities are available in the nearby towns

5. Almost all the villages in the buffer zone are electrified. L.T. power is being supplied for drawing water from a large number of tube wells sunk around the important village of the buffer zone, for irrigation purpose. Most of the tanks and ponds as well as the river water are being utilized for irrigation.
6. **Development programmes:** Housing schemes for weaker section, plantation under Social Forestry Scheme, establishment of primary health centers under Rural Welfare scheme development of roads, supply of drinking water, sinking tube wells/etc., are some of the important programmes of the government.



CHAPTER-IV

ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION MEASURES

4.0 ENVIRONMENTAL IMPACT ASSESSMENT

The likely impacts of the proposed Integrated Cement Project of Cement Plant and Captive Power Plant would be:

- Due to construction phase of the proposed Cement Plant and Captive Power Plant,
- Due to operation of proposed Cement Plant and Captive Power Plant.

These operations can disturb environment of the area in various ways, such as removal of mass, change of landscape, displacement of human settlement, flora and fauna of the area, surface drainage, and change in air, water and soil quality. While for purpose of development and economic upliftment of people, there is need for establishment of industries, but these have to be environmental friendly. Therefore, it is essential to assess the impacts of this brown field integrated cement project on different environmental parameters, so that abatement measures could be planned in advance for eco-friendly Cement Plant & CPP operation in the area.

The increasing awareness among the people about ecological imbalance and environmental degradation has raised many apprehensions. The impacts on different environmental parameters due to this integrated project are discussed below:

4.2 IMPACT DUE TO PROJECT ACTIVITY

Impacts due to project activity have been divided according to the temporal scale into impacts during Construction phase & impacts during operation phase. Construction activity spreads over pre-construction, machinery installation and commissioning stages and ends with the

induction of manpower and start-up. During operation phase of the proposed project, the impacts will be mostly permanent and irreversible in nature. Impacts on various environmental parameters during construction activities & operation activities for different parameters are described in the following paragraphs.

4.3 IMPACT ON SOIL & LAND USE PATTERN

4.3.1 Construction Phase

(A) Impact on Soil

The proposed project activity will be within the existing plant premises, where enough land is available for the activity. Existing paved area & storage facilities will be used during the construction activity.

During construction activity the impact on soil will be limited to the construction site only. Impact on soil during construction would be mainly due to the left out of construction material used. Hence proper care would be taken so that minimum amount of waste is produced and most of it gets recycled.

(B) Impact on Land Use & Cropping pattern

The direct impact of project activity on land use pattern will only be in core zone & that is within the existing plant premises. Hence no major impact due to the project activity will be there.

4.3.2 Operation Phase

(A) Impact on Soil

There may be some pollution affecting the soils adjacent to plant area if proper care is not taken. The anticipated pollution to soil environment due to plant activities is as follows.

- i) Changes in soil texture due to settling of air borne dust or due to wash off of solid particulates by surface or ground water. This will lead to change in porosity, permeability & other such physical characteristics of soil of the area.

- ii) Changes in soil chemistry due to addition of foreign material from polluted air and water due to plant activities in the area.

But proper mitigative measures like use of efficient pollution control systems, proper stack height, use of top soil in plantation will results in no significant impact on soil of the core zone. There will be no impact on soil of the study area located beyond the working area of the proposed integrated project. Soil samples will be collected and tested at regular intervals for the near by areas. This will help in mitigation of any harmful impact on soil due to the project activity, if any.

4.3.3 Land Use Pattern & Cropping Pattern

The overall indirect impact on the land use is considered as positive due to adoption of latest methods of sowing and irrigation as there is likelihood of increase in purchasing power of local habitats, which could be attributed to the improvement in income. There is likely to be no change in the cropping pattern in the close vicinity of the plant, from the prevalent cropping pattern in the surrounding areas. There will be no major impact on the cropping pattern of the area as:

- Plant will work on the principle of “**Zero Effluent Discharge Unit**” as no industrial waste water will be generated during plant operation.
- In Cement Plant process, water is absorbed in the process or subjected to evaporation, hence no wastewater generation will take place from the plant.
- The wastewater generated from the CPP will be recycled back to the process and will be used for cooling and dust suppression.
- No solid waste will be generated from cement manufacturing process as Entire fly ash generated in the CPP will be utilized in cement manufacturing process and Cement Dust collected from air pollution control equipment will be 100% recycled in process.

- Periphery of plant and surrounding areas of office building is covered by thick green belt to attenuate the pollutants emitted by the Plant.
- Proper maintenance of vehicles will be done to reduce gaseous emissions.
- Ambient air quality and stack emissions will be regularly monitored to ensure that ambient air quality standards and suggested limits on stack emission loads will be met honestly all the time.
- Water sprinkler will be provided on the haul roads for dust suppression.
- Electrostatic Precipitator and bag filters/bag house will be installed in order to maintain the stack emission within prescribed limits by CPCB.
- Bag filters will be provided at all loading /unloading points.

All the above practises are already being adopted in the Cement Plant & Captive Power Plant. Therefore, the impacts of proposed Cement Plant and CPP on the land use pattern shall be insignificant.

4.4 IMPACT ON AIR QUALITY AND MITIGATION MEASURES

4.4.1 Impact during construction phase

Air pollution due to the proposed plant will mainly include gaseous pollution (SO₂, NO_x and CO) and Particulate Matter. The sources of air emissions during construction phase will include site clearing, emission from vehicles used for transportation of man and material to the site and from construction equipment. These emissions are expected to have temporary adverse impact on ambient air quality of surroundings of the construction site.

Traffic at the site during construction will be more intensive and much heavier than at present and in normal operating conditions. In turn, it will subject roads to more stress. The prevailing soil surface particles within

the proposed plant area shall have a tendency to become airborne by vehicular tyres once the area is disturbed by construction activities. This dust will lead to an increase in the background PM concentration of the area if proper control measures are not adopted.

Hence, the impacts on the ambient air quality during construction phase will be temporary and reversible in nature for short duration and restricted to small area. Proper upkeep and maintenance of vehicles, sprinkling of water on roads and construction site, providing sufficient vegetation etc. are some of the measures that would greatly reduce the impacts during the construction phase.

4.4.2 Impact during operation phase

The key emissions from the cement manufacturing process are emissions due to Particulate Matter, oxides of Nitrogen (NO₂) and Sulphur dioxide (SO₂). In the cement industry, NO₂ are produced as a direct result of the high temperature flame in the cement kiln. Better maintenance and installation of proper pollution control equipment like Bag Houses, Bag filters and ESPs help in reducing such emissions.

Hence, the overall quality of the ambient air shall be within the limit prescribed by CPCB/SPCB after the commencement of the operation of proposed Cement plant.

4.4.3 Impact Due to Transportation of Raw Material

The major raw materials used in the manufacture of cement will be limestone, fly ash, coal and gypsum. Following raw materials will be required for the integrated cement project:

TABLE – 4.1
TRANSPORT OF RAW MATERIALS

S. No.	Minerals	Source	Mode of Transportation
1.	Limestone	Captive Mine	Covered Conveyor Belt
2.	Iron Ore	Nearby Area	Road
3.	Coal	Captive Coal Washery & Nearby Market	Road
4.	Clinker	Captive Cement Plant	-
5.	Gypsum	Nearby Area	Road / Rail
6.	Fly Ash	CPP , Balco, NTPC Korba	Rail (250 km)
7.	Slag	Bhilai steel plant/ NICCO	Road / Rail (~100km)

The transportation of raw material like coal, fly ash will be done by conveyor belts or trucks. Mode of transportation for gypsum, slag and iron ore will be the trucks/dumpers. The cement will be transported to market according to the feasibility and the distance through rail.

4.4.3.1 Mitigation measures

There will not be any adverse impact on the environment due to transportation of raw materials as following mitigation measures are being adopted by the GIL management during the transportation of raw materials, which will be further extended to the proposed expansion activity:

- To control the dust emission from transfer points of the belt and bucket conveyors, bag filters are provided at various locations of the transfer points.
- Moreover there is an adequate arrangement of atomized dust suppression arrangement at conveyor belts. Operators and attendants are provided with dust mask.
- The roads in the cement plant are paved to prevent dust emissions.

- Proper mitigation measures are taken to control fugitive dust emission and noise from transport (like water sprinkling during transport activities) along with green belt development along the road sides to control pollution.
- At present there are about 150 per day vehicles such as trucks, dumpers, jeep, tractor etc in the buffer area, after the proposed activity number of vehicles will get increased. The existing network of road is adequate to handle the increased load.
- Proper maintenance of vehicles is being done regularly.
- Periodic air quality survey will be carried out to monitor the changes as per the norms of State Pollution Control Board.

Hence there will not be any major impact on the on the environment due to the transportation of raw materials.

4.4.4 Cumulative Impact through Mathematical Modelling for Integrated Project

4.4.4.1 Air Pollution Modelling

Prediction of impacts on air environment has been carried out employing mathematical model based on a steady state Gaussian plume dispersion model designed for multiple point sources for short term. In the present case, AERMOD version 6.4 dispersion model based on steady state gaussian plume dispersion, designed for multiple point sources and developed by United States Environmental Protection Agency [USEPA] has been used for simulations from Industrial sources.

4.4.4.2 Pollutants/Model Options Considered For Computations

The model simulations deal with major pollutant Particulate Matter (PM₁₀), SO₂ & NO₂ emitted from the proposed projects all together i.e, Cement plant, and Lime stone Mining together.

4.4.4.3 Model Options Used For Computations

The options used for short-term computations are:

- The plume rise is estimated by Briggs formulae, but the final rise is always limited to that of the mixing layer;

- Stack tip down-wash is not considered;
- Buoyancy Induced Dispersion is used to describe the increase in plume dispersion during the ascension phase;
- Calms processing routine is used by default;
- Wind profile exponents is used by default, 'Irwin';
- Flat terrain is used for computations;
- It is assumed that the pollutants do not undergo any physico-chemical transformation and that there is no pollutant removal by dry deposition;
- Washout by rain is not considered;
- Cartesian co-ordinate system has been used for computations; and
- The model computations have been done for 20 km with 500-m interval.

4.4.4.4 Model Input Data

The emission details are given in Table-4.2 and 4.3.

TABLE-4.2 : Cement Project Emissions

S. NO	STACK ATTACHED	A.P.C. EQUIPMENT INSTALLED	PM EMISSION CONCENTRATION mg/Nm ³	EFFICIENCY OF THE EQUIPMENT (%)
EXISTING CEMENT PLANT & CPP			(Existing Details)	
1.	Kiln/Raw Mill	ESP	70	99.89
2.	Coal Mill	ESP	72	99.79
3.	Clinker Cooler	ESP	56	99.76
4.	Cement Mill	ESP	64	99.98
5.	CPP boiler	ESP	27	99.90
PROPOSED CEMENT PLANT & CPP			(Design Details)	

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1.	Kiln/Raw Mill	Bag Filter / ESP	50	99.99
2.	Coal Mill	ESP	50	99.99
3.	Clinker Cooler	ESP	50	99.99
4.	Cement Mill	ESP	50	99.99
5.	CPP BOILER	ESP	100	99.99

TABLE 4.3 : Lime Stone Mining Emissions

Ore	MTPA	7.5
Total Working Days	number	300
Activity rate	t/hr	1562.5
Uncontrolled emission		
Emission factor	gm/t	23.6
Emission Rate	g/sec	10.24
Area of influence	Sq.m	3079740
Area Source Emission rate	gm/sec/Sq.m	0.000003324
Controlled Emissions	gm/sec/Sq.m	0.000001108

4.4.4.5 Modelling Procedure

Prediction of ground level concentrations (glc's) due to proposed Cement plant and Mining has been made by AERMOD version 6.4 as per CPCB guidelines. It is US-EPA approved model to predict the air quality. The model uses rural dispersion and regulatory defaults options as per guidelines on air quality models (PROBES/70/1997-1998). For this study uniform polar receptors on flat terrain have been assumed.

Meteorological inputs required are hourly wind speed and direction, ambient temperature, stability class, and mixing height. The model details are as follows.

4.4.4.6 Gaussian Plume Model

The AERMOD version 6.4 model is based on a numerical integration over the area in the upwind and cross wind directions of Gaussian plume formula. This can be applied to the Point, Area, Line, Volume sources (& other forms of area sources) simultaneously and their resultant incremental concentration of the pollutant can be predicted.

4.4.4.7 Extrapolation of Wind Speed

Wind speed at stack level is calculated by power law as given below.

$$U_{\text{stack}} = U_{10}(\text{Stack height}/10)^p$$

Where U_{10} is the wind speed at 10 meter level and p is the power law coefficient (0.07, 0.07, 0.10, 0.15, 0.35 and 0.55 for stability classes A,B,C,D,E and F respectively) as per Irwin for rural areas (USEPA, 1987).

4.4.4.8 Stability Classification

Hourly stability is determined by wind direction fluctuation method as suggested by Slade(1965)and recommended by CPCB (PROBES/70/1997-1998).

$$\sigma_a = W_{dr}/6$$

σ_a , is standard deviation of wind direction fluctuation, W_{dr} is the overall wind direction fluctuation or width of the wind direction in degrees. The table for stability classes is given as under.

Stability Class	σ_a (degree)
A	> 22.5
B	22.4 – 17.5
C	17.4 – 12.5
D	12.4 – 7.5
E	7.4 – 3.5
F	< 3.5

4.4.4.9 Dispersion Parameters

Dispersion parameters σ_y and σ_z for open country conditions (Briggs, 1974) are used as the project is located on a flat terrain in a rural area. Atmospheric dispersion coefficients vary with downwind distance (x) from emission sources for different atmospheric stability conditions. (CPCB – PROBES/70/1997-98).

Rural Conditions

Stability Class	σ_y	σ_{az}
A	$0.22x(1+0.0001x)^{-5}$	$0.20x$
B	$0.16x(1+0.0001x)^{-5}$	$0.12x$
C	$0.11x(1+0.0001x)^{-5}$	$0.08x(1+0.0002x)^{-5}$
D	$0.08x(1+0.0001x)^{-5}$	$0.06(1+0.0015x)^{-5}$
E	$0.06x(1+0.0001x)^{-5}$	$0.03x(1+0.0003x)^{-1}$
F	$0.04x(1+0.0001x)^{-5}$	$0.16x(1+0.0003x)^{-1}$

4.4.4.10 Mixing Height

As site specific mixing heights were not available, mixing heights based on CPCB publication, "SPATIAL DISTRIBUTION OF HOURLY MIXING DEPTH OVER INDIAN REGION", PROBES/88/2002-03 has been considered for Industrial Source Complex model to establish the worst case scenario.

MIXING HEIGHT FOR THE PROJECT SITE STUDY PERIOD (DEC, 09 TO FEB, 10)

Time (Hours)	Mixing Height (m)
0500	100
0600	100
0700	150
0800	200
0900	400
1000	850
1100	1000

1200	1500
1400	1500
1500	1500
1600	2000
1700	2000
1800	1500
1900	400

Source: CPCB publication, "Spatial Distribution Of Hourly Mixing Depth Over Indian Region", PROBES/88/2002-03

4.4.4.11 Meteorological Data

Data recorded at the continuous weather monitoring station on wind speed, direction, and temperature at one hour interval for the monitoring period was used as meteorological input.

4.4.4.12 Presentation of Results

In the present case model simulations have been carried using the hourly Triple Joint Frequency data. Short-term simulations were carried to estimate concentrations at the receptors to obtain an optimum description of variations in concentrations over the site in 10-km radius covering 16 directions.

The incremental concentrations are estimated for the monitoring period. For each time scale, i.e. for 24 hr the model computes the highest concentrations observed during the period over all the measurement points

The maximum incremental GLCs due to the proposed Cement Plant Captive Power Plant and Lime stone mining together for PM₁₀, SO₂ and NO_x are superimposed on the maximum baseline PM₁₀, SO₂ and NO_x concentrations recorded at the monitoring locations during the field monitoring period. The cumulative concentrations (baseline + incremental) after implementation of the project are tabulated below in Table- 4.4. The maximum GLCs after implementation of the proposed project are likely to be within the prescribed NAAQ standards.

TABLE 4.5: Cumulative Concentrations (Baseline + Incremental)

Sampling Locations	Monitored Maximum concentrations in ug/m3			Predicted incremental Maximum concentrations in ug/m3			Resultant Maximum concentrations in ug/m3		
	PM ₁₀	NO ₂	SO ₂	PM ₁₀	NO ₂	SO ₂	PM ₁₀	NO ₂	SO ₂
Plant Site	70.86	21.00	16.30	14.48	4.1	5.30	85.34	25.1	21.6
Mine Site	82.76	18.3	13.4	7.38	1.1	1.10	90.14	19.4	14.5

4.5 IMPACT ON WATER QUALITY AND MITIGATION MEASURES

4.5.1 Impact due to construction phase

During construction stage initially water will be drawn from tube-wells till the permanent water system is laid. The extraction of water from the ground water reserves of the area may not lead to any major adverse impact on ground water table, as there is sufficient ground water availability in the vicinity of the plant. Hydrological investigations have ascertained the ground water potential.

The construction workers colony will be provided with drinking water taps and sanitation discharge into septic tanks and soak pits. The exploitation of ground water resources during the construction phase will not have a significant impact on the ground water availability in the area. Also there will not be any discharge from the site which can have any impact on the water quality.

4.5.2 Impact due to Operation phase

4.5.2.1 Waste Water

The wastewater generated during construction phase is mainly from domestic activities. Since most of the workers are from local area, wastewater generated is minimal. Domestic waste generated is treated in existing STP & treated water will be used for horticultural activities.

4.5.2.2 Industrial Effluent

No industrial waste water will be generated as the proposed plant is a dry process cement plant.

4.5.2.3 Domestic Effluent

Domestic effluent generated mainly from the colony is treated in sewage treatment plant. Treated effluent is utilized for green belt development.

4.5.2.4 Water Resources

The total water requirement for the Integrated Cement Project will be around 3962 m³/day which will be met from mine sump water & existing borewell.

The plant will be zero effluent discharge unit. Therefore, for the operation of proposed Cement Plant shall not pose any adverse impact on the ground water resources of the area.

4.6 IMPACT ON NOISE LEVEL AND MITIGATION MEASURES

4.6.1 Impact due to construction phase

The general noise levels due to construction activities such as working of heavy earth moving equipment and machinery installation may go sometime up to 80 dB (A) at the work sites in daytime during construction phase. The workers in general are likely to be exposed to an equivalent noise level of 75-80 dB (A) in 6-hour shift for which all statutory precautions as per the law will be implemented. Use of proper personal protective equipment shall further mitigate any adverse impact of noise to the workers.

Present noise levels at Proposed Project site during day time and night time are 71 Leq dB (A) and 53Leq dB (A), respectively.

Impacts on the noise levels of the area will be temporary in nature.

4.6.2 Impact due to operation phase

Due to operation of machinery, there is likely hood of some increase in noise. The Noise Level near the machinery is/will be below 75 dB (A) and the expected noise levels at the project boundary is/will be below 70 dB (A).

Proper noise abatement measures are beeing taken and persons working just close to machine and machine operators has been provided with personal protective equipment viz. Ear plugs / Ear muffs etc for further protection. Vibrations due to any other operation are ruled out.

4.7 IMPACT DUE TO SOLID WASTE GENERATION AND ITS PROPER MANAGEMENT

During construction phase, solid waste such as excavated soil, debris, some metal waste and very small amount of oil & grease from construction machines will be generated. This waste may contaminate soil at plant site temporarily and would be restricted to a small area. Excavated topsoil will be used for plantation.

The solid waste generated by labour as municipal waste is collected and segregated and disposed at appropriate site.

4.7.1 Industrial Waste

No solid waste is/will be generated in cement manufacturing process. Dust collected from air pollution control equipment is/will be 100% recycled in process. Solid waste in the form of sludge is/will be generated from sewage treatment plant & it is/will be used as manure for green belt development.

4.7.2 Domestic Waste

Solid waste generated from STP is/will be used as manure for green belt development. Therefore, impact of solid/liquid waste generation will be insignificant.

4.8 SOCIO-ECONOMIC CONDITIONS

The unskilled and semi-skilled categories of labour will by and large be available from the nearby villages and towns. Thus, accommodation for not more than 20% of the labour strength will have to be provided at site. This labour force along with their families will put marginal pressure on the resources of the area both physical and aesthetic.

Further, many of the agricultural labourers will be attracted to take up the steady, round the year employment at construction site. This might result, especially on occasions of harvesting, in a steep rise in agricultural wages in the surrounding villages.

Suitable cash compensation shall be made for land acquisition along with priority of employment for the families whose lands are acquired for the project. Hence, the short-term positive impacts on socio-economic conditions of the area are anticipated during the construction phase.

4.9 IMPACT ON OCCUPATIONAL HEALTH & MITIGATION MEASURES

The cement manufacturing industry is labor intensive and uses large scale and potentially hazardous manufacturing processes. The industry experiences accident rates that are high compared with some other manufacturing industries. Cement industries experiences risk of a number of hazards inherent to the cement production process. Some examples of such hazards are:

- Exposure to dust and
- Exposure to High temperatures;
- Noise exposure.
- Physical Hazards
- Chemical hazards and other industrial hygiene issues
- others

These mainly impact on those working within the industry, although health hazards can also impact on local communities.

4.9.1 Exposure to Dust

Exposure to fine particulates is associated with work in most of the dust-generating stages of Integrated Cement Plant, but most notably from, raw material handling, and clinker / cement grinding. Workers with long term exposure to fine particulate dust are at risk of pneumoconiosis, emphysema, bronchitis, and fibrosis.

Methods to prevent and control exposure to dust include the following:

- Control of dust through implementation of good housekeeping and maintenance;
- Use of air-conditioned, closed cabins;
- Use of dust extraction and recycling systems to remove dust from work areas, especially in grinding mills;
- Use of PPE, as appropriate (e.g. masks and respirators) to address residual exposures following adoption of the above-referenced process and engineering controls;

4.9.2 Exposure to High temperatures

The principal exposures to heat in this sector occur during Handling of hot raw meal (Powdered limestone, laterite additives etc will be heated in a pre heater cyclone), hot clinker and operation & maintenance of kilns or other hot equipment. Recommended prevention and control techniques include the following:

- Shielding surfaces where workers proximity and close contact with hot equipment is expected, using Personal Protective Equipment (PPE), as needed (e.g. insulated gloves and shoes);
- Minimizing the work time required in high temperature environments by implementing shorter shifts at these locations;

4.9.3 Noise and Vibration Exposure

Exhaust fans and grinding mills, turbine, compressors, motors will be the main sources of noise and vibrations in the Integrated Cement Plant. Control of noise emissions will include the use of silencers for ID fans, room enclosures for mill operators, noise barriers, and, if noise cannot be reduced to acceptable levels, personal hearing protection (ear plugs/muffs).

4.9.4 Physical hazards

Injuries during Project operation are typically related to slips, trips, and falls; contact with falling / moving objects; and lifting / over-exertion. Other injuries may occur due to contact with, or capture in, moving machinery (e.g. dump trucks, front loaders, forklifts). Activities related to maintenance of equipment, including crushers, mills, mill separators, fans, coolers, and belt conveyors, represent a significant source of exposure to physical hazards. Such hazards may include the following:

- Falling / impact with objects;
- Hot surface burns; and
- Transportation.
- Contact with allergic substances; and

Following management measures are being implemented to prevent the physical hazards in the plant:

- Any person working on equipment with moving parts personally ensures the equipment is de-energized, isolated and locked/tagged out.
- Any person working from a position with the potential risk for a fall from height uses fall protection.
- Prescribed PPE has been provided to all workers exposed to open processes or systems.

- In case of any accident immediate & proper medical care is being provided at the plant site.

High Risk Categories:	Prevention:
Contractors	Contractor Safety Management
Young/Temporary Employees	Special Safety Induction
Direct Causes	
Traffic & Mobile Plant	Driver Training
Falls from Heights, Objects falling from Heights	Safety Procedures for Work at Heights, Overhead Protection
Caught in Starting/Moving Equipment	Plant Isolation Procedures

4.10 TERRESTRIAL ECOLOGY

4.10.1 Impact during construction phase

Available land to be utilized for proposed Cement Plant and CPP within the same premises is free from trees, shrubs and herbs and no vegetation will need to be cleared for the construction of the proposed Cement Plant. Therefore, impact of the proposed setting up of the Cement Plant and CPP is anticipated to be insignificant on terrestrial ecology of the area.

4.10.2 Impact during operation phase

During the operation phase terrestrial ecology of the area is not affected in any way. However, the overall impact on the terrestrial ecology is considered positive as green belt of appropriate width has been developed and maintained by GIL in the area, which further improves the flora at site.

4.11 IMPACT DUE TO HAZARDOUS WASTE AND ITS MANAGEMENT

No hazardous waste will be generated due the project activities, only waste oil will be generated as and when lubricating oil is changed from the various gearboxes. It is mainly disposed off as per the following:

- Burning waste oil in cement Kiln under controlled condition.

- Reuse in lubrication of other equipment exposed to dust/raw material where the waste oil gets consumed.
- Transaction with those waste oil reprocessing units which are registered with the Ministry of Environment & Forests and have further authorization from the State Pollution Control Board under Hazardous Waste (Management & Handling) Rules for using waste oil as raw meal for manufacturing lubrication oil.

4.12 IMPACT ON SOCIO-ECONOMIC CONDITIONS

Grasim Industries Limited will be actively contributing to improve the socio-economic conditions of the area and also actively participating in implementing Government schemes for the welfare of the society of the area.

The overall impact of the proposed integrated project, Cement Plant and CPP will be positive and beneficial as Grasim Industries Limited is committed to continue its efforts for improving the socio-economic conditions of the area.

4.13 IMPACT ON SENSITIVE TERRESTRIAL TARGETS

A study of surrounding area of the proposed Cement Plant site brought out that there are no sensitive targets such as habitat of endangered species of wildlife or plants, sites/monuments of historical and cultural importance within a radius of 10 km.

A comparison of the plant diversity analysed during pre commissioning of plant and currently in the core and buffer zones around the project site reveals that the project has no adverse impact on the plant diversity. All the representative plant species of the region were found to grow in and around the study site. No endangered plant species were encountered in the area.

4.13.1 Impact Evaluation

The environmental impact evaluation of possible effects as a result of project site activities and operation on various environmental parameters is primarily based on careful study of plant, plant operations, surrounding environment etc. The aspects, such as water, land and related issues and air components of environment have been assessed on the basis of plant operations for similar plants.



CHAPTER-V

ENVIRONMENTAL MONITORING PROGRAMME

5.0 INTRODUCTION

Post Project Monitoring is an essential part to check the negative impact of any project activity. Hence monitoring of various environmental parameters will be carried out on a regular basis to ascertain the following:

- ❖ State of Pollution within the project site and in its vicinity.
- ❖ Generate data for predictive or corrective purpose in respect of pollution.
- ❖ Examine the efficiency of pollution control system installed in the plant.
- ❖ To assess environmental impacts.

Grasim Industries Ltd has been undertaking Environment monitoring in its existing plant premises & nearby villages as per the norms of Chhattisgarh Environment Conservation Board (CECB) and CPCB. The environment monitoring programme will be further extended for this project activity also.

The various environmental components and pollution sources, which would be monitored under Environmental monitoring programme, would be stack emission, ambient air quality, liquid effluent and noise levels. Details of the Environmental Monitoring programme, which would be undertaken for various environmental components, are detailed below:

TABLE No.: 5.1
POST PROJECT MONITORING

S. No.	DESCRIPTION	FREQUENCY OF MONITORING
1.	Meteorological Data	Daily
2.	Ambient Air Quality at project site	Quarterly
3.	Stack Emissions	Weekly
4.	Water Quality	Quarterly
5.	Noise Level Monitoring	Quarterly
6.	Soil Quality	Quarterly

5.1 METHODOLOGY ADOPTED

On the basis of the environmental conditions at the proposed site and the nature of adjoining area, the project site is considered as core zone and the area lying within 10 km radius from the proposed site is considered to be the buffer zone where some impacts may be observed on physical and biological environment. In the Buffer zone slight impact may be observed and that too is occasional.

5.2 DATA COLLECTION

As given in chapter III, the baseline data for the project site and 10 km radius area were collected in accordance with the requirement of guidelines of Ministry of Environment & Forests, New Delhi. Monitoring was done during study period (Dec, 2009 – Feb, 2010). Similarly the post project monitoring once project operation phase begins will be done to study the impact of project activity on the surrounding environment and concerned people. The data will be collected on following parameters:

TABLE NO.: 5.2
DATA TO BE COLLECTED

S. No.	Description	Location
1.	Ambient Air Quality	Project site, Villages in Buffer Zone
2.	Stack Emissions	Stack
3.	Meteorological data	Project site
4.	Noise Level Monitoring	Project Boundary, Villages in Buffer Zone
5.	Health Check-up	Workers

5.3 DATA COLLECTION

The Post Project Monitoring would include details of any major/ minor impact in the core zone and area within buffer zone for the following parameters: -

- Fauna & flora in this region.
- Sensitive places/ historical monuments and sanctuaries.

- Land use pattern within core zone and buffer zone including the cropping pattern.
- Demography and socio-economic analysis based on last available census data for entire study area.
- Water bodies, hills, roads etc.

5.4 INSTRUMENT TO BE USED

The following instruments will be used for data collection work in the monitoring schedule:

1. Respirable dust collector with attachment for gaseous pollutants, Envirotech APM 460.
2. Digital D.O. Meter model – 831 E.
3. Wind Direction Van – one
4. Dry and Wet Bulb Thermometer.
5. Sound Level Meter Model SI – 4010
6. Anemometer Model AM – 4201
7. High Volume Sampler
8. GPS

In addition to the above instruments, the data on land use, vegetation and agricultural crops will be collected by the field team by meeting with a large number of local inhabitants in the study area and different government departments / agencies.

5.5 LOCATIONS OF MONITORING STATIONS

Monitoring will be done in the core and buffer zone of the project site. Changes in the sampling sites might be done if required by MoEF, and their number might get reduced and according to the preferences and convenience of the project proponent.

5.6 PROCEDURE FOR DETERMINING VARIOUS AIR QUALITY PARAMETERS

The procedure for determining various air quality parameters has been given by MoEF and the same will be used for the post project monitoring of the project.

**TABLE NO.: 5.3
TESTING PROCEDURE**

Parameters	Testing Procedure
PM₁₀ & PM_{2.5}	Gravimetric Method using Respirable Dust Sampler Envirotech RDS - APM 460 IS: 5182 (Part-IV) & Fine Particulate Matter (FPM) Sampler
NO_x	Absorption in dil NaOH and then estimated colorimetrically with sulphanilamide and N (I-Nephthyl) Ethylene diamine Dihydrochloride and Hydrogen Peroxide (CPCB Method).
SO₂	Absorption in Potassium Tetra Chloromercurate followed by Colorimetric estimation using P-Rosaniline hydrochloride and Formaldehyde (IS: 5182 Part - II).

TABLE No.: 5.4

GUIDANCE FOR ASSESSMENT OF REPRESENTATIVENESS AND RELIABILITY OF BASELINE ENVIRONMENTAL ATTRIBUTES

Attributes	Sampling		Measurement Method	Remarks
A. Air Environment	Network	Frequency		
Meteorological <ul style="list-style-type: none"> Wind speed Wind direction Dry bulb temperature Wet bulb temperature Relative humidity Rainfall 	Minimum 1 site in the project impact area	Regularly in one season by Weather Monitoring Station	Mechanical/automatic weather station Rain gauge As per IMD specifications As per IMD specifications	IS 5182 Part 1-20 Site specific primary data is essential
Pollutants <ul style="list-style-type: none"> PM₁₀ 	4 to 6 locations in the project impact area (at least one	24 hourly twice a week Revised National Ambient Air	Gravimetric (High-Volume)	Monitoring Network <ul style="list-style-type: none"> Minimum 2 locations in upwind side,

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	station at max. GLC point, one in upwind & one in Downwind direction)	Quality Standards (NAAQS) vide MoEF, Circular, dated 16.11.2009		more sites in downwind side / impact zone
<ul style="list-style-type: none"> PM_{2.5} 			Gravimetric [Fine Particulate Matter (FPM) Sampler]	<ul style="list-style-type: none"> All the sensitive receptors need to be covered
<ul style="list-style-type: none"> SO₂ 			EPA Modified West & Geake method	
<ul style="list-style-type: none"> NO_x 			Arsenite modified Jacob & Hochheiser	

Note: For Rapid Environmental Impact Assessment one complete season data except monsoon is adequate while the comprehensive Environmental Impact Assessment Resources coverage of three seasons.

5.6.1 Water Regime

The quality of ground water will be studied by collecting water samples from representative hand pumps and tube wells.

5.6.2 Locations of Water Monitoring Stations & Parameters that will be analyzed

Monitoring will be done in the core and buffer zone of the project site. The parameters that will be analyzed are mentioned in the table given below:

TABLE NO.: 5. 5
PARAMETERS TO BE ANALYSED

S. No	Parameters	Permissible limits as per IS: 10500
1.	pH	6.5 – 8.5
2.	Odour	Unobjectionable
3.	Turbidity (NTU)	5 (max 10)
4.	Total hardness as CaCO ₃ (mg/l)	300(max 600)
5.	Calcium as Ca (mg/l)	75(max 200)
6.	Sulphate as SO ₄ (mg/l)	200(max400)
7.	Total dissolved solid (mg/l)	500(max 2000)
8.	Alkalinity as CaCO ₃ (mg/l)	200(max 600)
9.	Iron as Fe (mg/l)	0.3(max 1.0)
10.	Fluoride as F (mg/l)	1.0(max 1.5)
11.	Magnesium as Mg ⁺² (mg/l)	30 (max.100)

TABLE NO.: 5.6

GUIDANCE FOR ASSESSMENT OF REPRESENTATIVENESS AND RELIABILITY OF BASELINE ENVIRONMENTAL ATTRIBUTES

ATTRIBUTES	SAMPLING	MEASUREMENT METHOD	REMARKS
Water			
Parameters for water quality <ul style="list-style-type: none"> pH, turbidity, magnesium hardness, total alkalinity, chloride, sulphate, nitrate, fluoride, sodium, potassium, salinity Total nitrogen, total phosphorus, DO, BOD, COD, Phenol Heavy metals Total coliforms, faecal coliforms Phyto plankton Zoo plankton 	<ul style="list-style-type: none"> Set of grab samples during pre and post-monsoon for ground and surface water for 10 km distance 	Diurnal and Season wise	Samples for water quality should be collected and analyzed as per : <ul style="list-style-type: none"> IS : 2488 (Part 1-5) methods for sampling and testing of Industrial effluents Standard methods for examination of water and wastewater analysis published by American Public Health Association.

5.7 NOISE ENVIRONMENT

5.7.1 Base Line Data

Noise levels will be measured at in the study area to establish present scenario. Noise monitoring will be done in the core and buffer zone of the project site. Noise levels standards are presented in table below.

**TABLE NO.: 5.7
CPCB NOISE STANDARDS**

Category of Zones	Leq in dB(A)	
	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence Zone	50	40
1. Day Time is from 6.00 AM to 10.00 PM. 2: Night Time is reckoned between 10.00 PM to 6.00 AM 3.Silence Zone is defined as an area up to 100m around premises of Hospitals, Educational Institutions and Courts. Use of vehicle horn, loudspeaker and bursting of crackers is banned in these zones. Note: Mixed categories of areas be declared as one of the four above mentioned categories by the competent Authority and the corresponding standards shall apply		

5.8 SOIL ENVIRONMENT

Soil is the media for supplying the nutrients for plant growth. Nutrients are available to plants at certain pH and pH of soils can reflect by addition of pollutants in it either by air, or by water or by solid waste or by all of these. In order to study the any impact of project activity on soil, samples will be collected from the core and buffer zone of the project site.

5.9 BIOLOGICAL ENVIRONMENT

There are no National Parks, Wild Life Sanctuaries / Biosphere Reserves within 10 km radius of the study area. The soil in the area is low to medium fertile with reference to its agriculture potential. No rare, endangered and critically endangered species have been found during the baseline study for the project, which shows there will not be any significant impact on the biological environment of the area.

The following mitigation measures will be taken up for protection of fauna in the study area:

- Improvement of habitat that includes augmenting water sources, water regime development, eradication of weeds, and development and restoration of grasslands.
- Educate the local people to develop awareness to protect the animals;
- Formulate wild life protection committees in near by villages to control the poaching and hunting;
- Protect and regulate the herbivorous animals in the forest area as well as the project near to plant area; and
- Formulate a wild life patrolling committee to monitor the wild animals' movement.
- Mitigation of man-animal conflicts,
- Inoculation of domestic cattle against contagious diseases.

5.10 SOCIO-ECONOMIC ENVIRONMENT

There will be only positive impacts on the socio- economic environment of the project area, with the employment opportunities and other activities as Corporate Social Responsibility of the Grasim Industries Ltd. However guidelines given by the MoEF for socio- economic analysis will be followed as a part of Post Project Monitoring.

5.11 DETAILED BUDGET

The budget for the proposed Brown Field Integrated Cement Project have drafted as follows:

TABLE – 5.5
DETAILS FOR THE COST

S.No.	Details	Details for the Cost
1.	Total Cost for the project	Rs 950 Crores
2.	Cost for EMP measures	Rs 100 Crores
3.	Recurring cost / annum for environmental pollution control measures.	Rs 05 Crores



CHAPTER-VI

ADDITIONAL STUDIES

6.0 PUBLIC CONSULTATION

As per the New EIA Notification dated 14th September 2006, Public hearing for this project has to be conducted in accordance with the procedure to obtain the Environmental Clearance.

The project was considered in front of Expert Appraisal Committee (EAC) (Industry-1) for its First technical presentation on 24th September, 2009. The EAC committee has suggested Terms of References (ToR) for preparation of the Environmental Impact Assessment (EIA) Report and Environmental Management Plan (EMP) Vide its File No. J-11011/262/2009-IA.II (I) & Letter dated 9th October, 2009. This Draft EIA/EMP Report has been prepared for the conduction of Public Hearing for the Brown Field Integrated Cement Project - Cement Plant from 3.3 MTPA to 6.5 MTPA, Clinker from 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30 MW to 80 MW & D.G.Set (2x6=12 MW) near village Rawan by M/s Grasim Cement.

6.1 RISK ASSESSMENT

Activities requiring assessment of risk due to occurrence of most probable instances of hazard and accident are both on site and off site.

6.1.1 Risk Analysis Methodologies

Risk assessment often requires the synthesis of risk profiles, which represent the probability distribution of total annual loss due to a certain set of events or activities. These assessments usually involve estimation of losses for several sub-classifications of the overall process and synthesis of the results into an aggregate risk profile.

Main risk assessment technologies are:

- Hazard and operability study (Hazop), and
- Fault Tree Analysis (FTA)

6.1.2 Hazop Study

The hazop study is a systematic technique of identifying hazards of operability problems of a process and lists all possible deviations from normal operating condition and how they might occur. The consequences of the process are assessed and the means available to detect and correct the deviations are examined. Thus, within the entire process all “credible” deviations that could lead to hazardous events or operability problems are identified.

6.1.3 Fault Tree Analysis (FTA)

FTA is primarily a means of analyzing non-identifiable hazards. Hazards of top events (the ultimate happening that is to be avoided) are first identified by other techniques such as HAZOP. Then all combinations of individual failures that can lead to that hazardous event show the logical format of the fault tree. Estimating the individual probabilities and then using the appropriate arithmetical expressions can calculate the top event frequency.

6.1.4 Disaster Management Plan

6.1.4.1 Definition

A major emergency in a work is one, which has the potential to cause serious injury or loss of life. It may cause extensive damage to property and serious disruption both inside and outside the work. It would normally require the assistance of emergency services to handle it effectively.

Emergency may be caused by a number of different factors, e.g. plant failure; it will normally manifest itself in three basic forms, viz fire, explosion or toxic release.

6.1.4.2 Scope

The aim of hazard control and disaster management is concerned with preventing accidents through good design, operation, maintenance and

inspection, by which it is possible to reduce the risk of an accident, but it is not possible to eliminate it. Since, absolute safety is not achievable; an essential part of major hazard control must also include mitigating the effects of a major accident.

An important element of mitigation is emergency planning, i.e. recognizing accidents as soon as possible, assessing the consequences of such accidents and deciding on the emergency procedures, both on-site and off-site, that would need to be implemented in the event of an emergency.

6.1.4.3 Objective

The overall objectives of the emergency plan will be:

- a) To localize the emergency and, if possible eliminate it; and
- b) To minimize the effects of the accident on people and property.

Elimination will require prompt action by operations and works emergency staff using, for example, fire-fighting equipment, water sprays etc.

Minimizing the effects may include rescue, first aid, evacuation, rehabilitation and giving information promptly to people living nearby.

To deal with the above emergencies, the Emergency Plan is prepared.

6.1.5 Identification and Assessment of Hazards- Cement Plant & CPP

This stage is crucial to both on-site and off-site emergency planning and requires to systematically identify what emergencies could arise in the plant. These should range from small events which can be dealt with by plant personnel without outside help to the largest event for which it is practical to have a plan. Experience has shown that for every occasion that the full potential of an accident is realized, there are many occasions when some freak event occurs or when a developing incident is made safe before reaching full potential. Most major hazard accidents come within the following categories:

(A) Events pertaining to the manufacturing process of cement

The following areas are identified as hazard prone incase of cement plant where Disaster management plan is required.

(i) Handling of Coal

1. The coal will be received in the wagon tipplers and stored in stock yard. The possible hazards are envisaged due to failure of wagon tipplers and slipping of wagon during unloading.
2. During summer season, there is chance of coal catching fire due to hot temperatures.
3. Effective sprinkling systems has been provided all round the coal stock yards.

(ii) Handling of Fine Dust

The hot raw meal (Powdered limestone, laterite additives etc is heated in a pre heater cyclone) is stored in the raw mill silos. It is very common that the hot raw meal gets jammed in the chute and screw conveyers. During the maintenance process, the operator generally works in the pre-heater cyclone and other areas. Always there is a possibility of hazard that the jammed material falls on the workers and due to hot temperature of the material, possibility of injury may occur to the worker, sufficient care has been taken in the maintenance operations.

(iii) Handling of Hot Clinker

The hot clinker is transported by chain conveyors to the top of the silo where it is subjected to screening. During this operation, there is a possibility of spill out of hot clinker. Proper care for the conveyor system and the bund wall for the clinker stock pile has been provided.

(iv) Handling of Cement

Cement is the fine dust which requires proper care in handling, storage and packing to avoid any health hazards.

(B) The management system to be provided in cement plant and power plant to avoid / minimize the disasters are detailed below:

(i) Alarm and Communication Systems

Communication is crucial factor in handling an emergency. It is the practice at many plants that any employee can raise an emergency alarm, so allowing the earliest possible action to be taken to control the situation.

Alarm systems vary and depends on the size of the plant. There should be an adequate number of points from an audible warning, or indirectly, viz. a signal or message to a permanently manned location. The alarm should alert the people to implement appropriate emergency procedures. In areas where a high level of noise; it may be necessary to install more than one audible alarm transmitter or flashing lights. Automatic alarms may be appropriate on some sites.

There should be a reliable system for informing the emergency services as soon as the alarm is raised on site. The details of the communication arrangements should be agreed locally; in some cases it may be advisable to have a direct line to the fire bridge. Predetermined code works to indicate the scale and type of the emergency may be valuable.

6.1.7 Social Impact Assessment Report

As practiced at other cement plant of GIL, social welfare activities has been taken up on a large scale at the this project.

GIL act as a catalyst for accelerating the all-round development process in

these villages. It has provided services to ensure that the full-benefits of development schemes of Government and other agencies reach the villagers.

The socio welfare activities are handled by a full time mixed husband-wife team of village development officials who monitor the programme and gives necessary back-up support. The programmes has made broad based by involvement of local groups and government agencies to the maximum extent possible.

GIL had contributed lot in the development of the area, table mentioned below shows the condition of the villages before the intervention of the plant and present condition after the community initiatives and rural development activities undertaken by the management of GIL :

TABLE- 6.1.7
SOCIAL IMPACT ASSESSMENT

S. No.	Condition of the villages before intervention	Present Condition of the Villages
Education		
	<ul style="list-style-type: none"> • Low literacy level (48 to 50 %) • High drop out level • Lack of school buildings • Lack of teaching staff • Lack of motivational system for talented students 	<ul style="list-style-type: none"> • Adequate Number of Schools buildings • Competition among students • Balanced Teachers – Students ratio • Selection of village students in Navodaya School, Mana • Distribution of Mid-day meals in systematic way • Increased literacy level and reduced drop out level
Health & Family welfare		

	<ul style="list-style-type: none"> • No medical services for the local people • Lack of health centres • Low interest of health workers and maintenance towards medical services 	<ul style="list-style-type: none"> • Treated all the TB patients and eliminated the chances • Ensured Pulse-polio vaccination to all the eligible kids • Minimized the cataract patients in the area • Increased awareness of people on Family Planning drive • Hepatitis-B vaccination to all the eligible kids of near by villages • Increased awareness level of the people on HIV/AIDS
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Sustainable livelihood & Agriculture

	<ul style="list-style-type: none"> • Low income level of the local people • Lack of motivation for self employment • Traditional agriculture system • Dependency on single crop • Drinking water problem • Low depth of ponds • Unemployment 	<ul style="list-style-type: none"> • Increased awareness level & standard of living of people • Adequate employment opportunities • Increased capacity of the water bodies • Adequate drinking water, No. of Bores & hand-pumps • Created self-employment opportunities for youths • Increased awareness on multi-cropping
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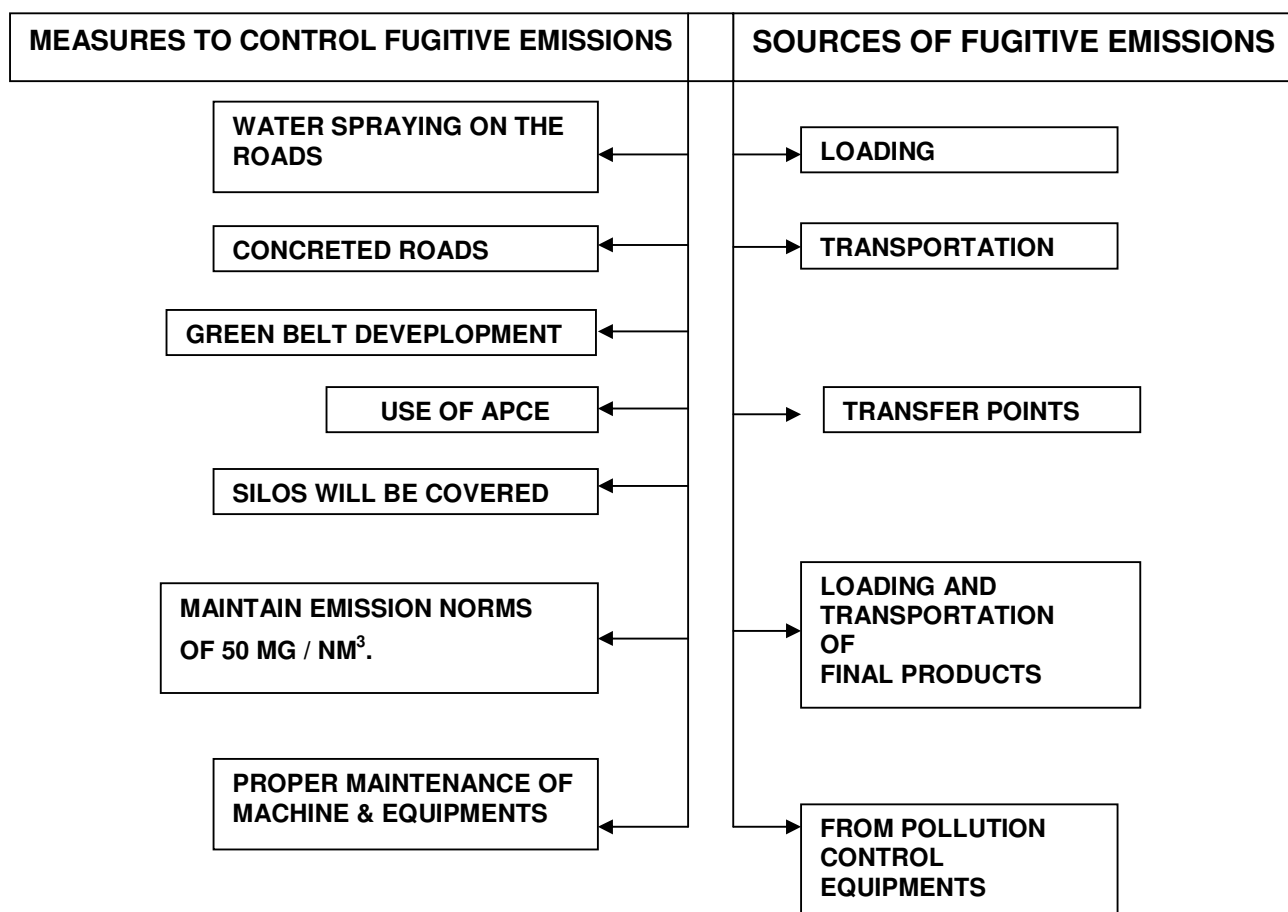
Infrastructure

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	<ul style="list-style-type: none"> • No pacca houses • Lack of roads • Lack of community buildings • Lack of stairs near ponds • Poor condition of village tracks 	<ul style="list-style-type: none"> • All villages are well connected with Pacca roads • All village ponds have stairs • All the villages are having community buildings • Most of the villages have concrete street lanes • Increased No. of Pacca houses in villages
Social Issues		
	<ul style="list-style-type: none"> • Low awareness level of the people • Lack of motivation to local artists • No care for handicapped people 	<ul style="list-style-type: none"> • Distributed tricycles to all the handicapped persons • Increased No. of cultural & Social activities • Awareness level of the women and adolescent girls increased

Source: Prefeasibility Report

6.2 SOURCES OF FUGITIVE EMISSIONS AND MEASURES IMPLEMENTED IN THE PLANT TO CONTROL FUGITIVE EMISSIONS



1) Loading:

Proper maintenance of haul roads and regular water sprinkling on them leads to minimization of dust generation during haulage activity.

2) Transportation:

- ❖ The roads in the cement plant have been paved to prevent dust emissions.
- ❖ There may be some fugitive dust emissions and noise from transport but proper mitigation measures has been taken (like water sprinkling during transport activities) along with green belt development along the road sides to control pollution.

4) Transfer Points (Conveyor belt to Stockpiles):

At the discharge point, dust is emitted due to free fall of product and wind carry over. To control the dust emission from dropping/transfer points of the belt and bucket conveyors, bag filters/bag houses has been provided at various locations of the transfer points. Water spraying has been done on belt conveyors from crusher to stacker.

5) Storage of raw materials

Dust may be generated here due to carryover by wind. However to avoid this clinker has been stored in closed clinker silo, gypsum has been stored in covered shed and pulverized coal in bins.

6) Transportation:

Movement of heavy trucks/vehicles on the unmetalled road generates substantial quantity of dust emission.

This is due to the presence of dust over the road, which is carried away by wind. To control the generation of dust all the roads inside the plant premises has been concreted. Regular sweeping of all the roads & floors is being done. Water spray through tankers is being done on bare lands & roads. The main haulage roads are being constantly kept watered by means of spraying water with the help of mobile water tankers.

7) Other Factors:

Dust that is generated from air pollution control system i.e. ESP or any other air pollution control system installed with kiln. Secondary flue dust may also be generate from Bag Filters or any other air pollution control equipment installed with Raw Material Handling, Coal Crusher, Cooler Discharge and product house unit. The selection of Air Pollution Control Equipment has been done on the basis of the following factors:

- a) Size of dust particles
- b) Flue gas characteristics

- c) Collection efficiency
- d) Emission standard
 - ✓ The selection and specification of pollution control equipment at GIL has been given extreme importance due to which it is possible to maintain emission norms of 50 mg / Nm³.
- e) Techno-economic Feasibility of APCE

On the basis of the above criteria GIL has selected the following pollution control equipments for their proposed project:

TABLE -
POLLUTION CONTROL EQUIPMENT THE PROPOSED PLANT

S. NO.	STACK ATTACHED	A.P.C. EQUIPMENT INSTALLED	PM EMISSION CONCENTRATION (mg/Nm ³)	Efficiency of the Equipment (%)
1.	Kiln/Raw mill	Bag Filter / ESP	50	99.99
2.	Coal Mill	ESP	50	99.99
3.	Clinker Cooler	ESP	50	99.99
4.	Cement Mill	ESP	50	99.99
5.	CPP Boiler	ESP	100	99.99

Source: Pre-feasibility Report

As per CPCB Guidelines following measures are being implemented in the cement plant & CPP to control the generation of fugitive emissions:

- a) Enclosure has been provided for all unloading operations, except wet materials like gypsum.
- b) Water is sprayed on the material prior and during unloading.
- c) All transfer point locations are kept fully enclosed.
- d) Bag filters has been provided at all the transfer points.
- e) Water is periodically sprayed on the stockpiles so as to retain some moisture in the top layer & to avoid wind blowing of fines.
- f) All the Roads inside the plant premises have been concreted.
- g) Regular sweeping of all the roads & floors is being done.

- h) The coal stock pile is being done under covered shed.
- i) Dust collected from air pollution control equipment is 100% recycled in process.
- j) Clinker is stored in closed clinker silo.
- k) Gypsum is stored in covered shed.
- l) Pulverized coal will be stored in bins.
- m) Flyash is pumped directly from the tankers to silos pneumatically in closed loop or mechanically such that fugitive emissions do not occur.
- n) Dry fly ash is transported into closed bulkers.
- o) Wet fly ash is covered by tarpaulin.
- p) The packing machines is equipped with dust extraction arrangement such that the packing operation is performed under negative pressure. The dust may be captured in bag filters.
- q) Adequate ventilation for the packing hall has been provided for venting out suspended particulate thereby ensuring dust free work environment.

6.2.1 CPCB Guidelines for the Fugitive Emissions

For achieving effective prevention and control of potential fugitive emission sources in cement manufacturing plants, specific requirements along with guidelines have been given by CPCB, which are being followed specifically in the project operation. Regular inspection is being carried out of all fugitive control system and records are being maintained as per CPCB guidelines. For the purpose of effective prevention and control of fugitive emissions, following measures are being taken as per the guidelines:

1. UNLOADING SECTION (LIMESTONE, COAL & OTHER RELEVANT MATERIAL)

Sr. No.	Control Measures to be Provided	Guidelines
1.	Enclosure will be provided for all unloading operations, except wet materials like gypsum	The enclosures for the unloading sides could be flexible curtain type material covering up to height of dumpers discharge from the roof.
2.	Water will be sprayed on the material prior and during unloading	A dust suppression system should be provided to spray water. The amount of water sprayed should preferably be optimized by employing proper design of spray system. Suitable systems may be adopted to reduce the problems like choking, jamming of the moving parts.

2. MATERIAL HANDLING SECTION (INCLUDING TRANSFER POINTS)

S. No.	Control Measures to be Provided	Guidelines
1.	All transfer point locations would be fully enclosed.	The enclosures from all sides with the provision for access doors, which shall be kept, closed during operation. Spillages should be periodically removed.
2.	Airborne dust at all transfer operations / points would be controlled either by spraying water or by extracting to bag filter.	Either water spray system should be provided for suppressing the air borne dust or dry extraction cum bag filter with adequate extraction volume.
3.	Water would be periodically sprayed on the stockpiles so as to retain some moisture in the top layer.	Spray sufficient quantity of water to moist the top layer to avoid wind blowing of fines.

3. COAL STORAGE SECTION

Sr. No.	Control Measures to be Provided	Guidelines
1.	Coal yard / storage area would be clearly earmarked.	A board should be erected to display the area earmarked.
2.	The pathways in coal yard for vehicle movement would be paved.	Proper pathways with entry and exit point should be provided.
3.	Accumulated dust shall be removed / swept regularly and water the area after sweeping.	Any deposits of dust on the concrete roads should be cleaned regularly by sweeping machines.
4.	Coal other than coal stock pile would preferably be stored under covered shed.	Where ever blending activity is carried out by chaining in open ground, covered shed should be provided to reduce the fine coal dust getting airborne. The enclosure walls shall cover minimum three sides up to roof level.
5.	The coal stock pile would preferably be under covered shed for new plants.	The enclosure should be from three sides and roof so as to contain the airborne emissions.
6.	Instead of dust extraction cum bag filter system, If dust suppression measure is used, following additional control measures should be provided.	
A	Wetting before unloading.	Coal should be sufficiently moistened to suppress fines by spraying minimum quantity of water, if possible.
B	Spray water at crusher discharge and transfer points.	Water spray should also be applied at crusher discharge and transfer points.

4. CLINKER COOLER SECTION

Sr. No.	Control Measures to be Provided	Guidelines
1.	Air borne fines extracted from clinker cooler will be separated and sent to last possible destination directly, if possible.	<p>The possibilities especially in new cement plant may be explored for the following:</p> <p>The unit may need to add on / install necessary provisions for separating fine particulates from the clinker cooler ESP collection. Fines separation may be achieved by passing collected dust through cyclone, the fines</p>

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	escaping cyclone to be separated, cyclone collection (coarse particles) could be recycled. The fines shall be recycled to the last possible destination (like clinker day silo) suitable or safely disposed.
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5. CLINKER STOCK PILES SECTION

Sr. No.	Control Measures to be Provided	Guidelines
1.	In new cement plant, clinker would be stored preferably in silo.	Bag filter may be provided before venting out the gases.
2.	Clinker would be stored in closed enclosure covered from all sides and would have a venting arrangement along with a bag filter.	The enclosures should have a venting arrangement located at transfer point where clinker is dropped to the stockpile. The extraction / venting should be sufficient enough. Clinker stockpile access door should be covered by mechanical gate or by flexible rubber curtain. The access doors shall be kept closed at all possible times.
3.	The dust extracted and captured in bag filter would be avoided to feed back / recycled to the clinker stockpile, if possible.	Extracted dust should be captured in bag filter and the collected dust should be avoided to feed back to the clinker stockpile, if layout permits. It may be recycled at last possible destination i.e., cement mill section through suitable arrangement, if possible.
4.	Generally open storage of clinker should be avoided. Only in case of emergency clinker would be stored in open with following control measures.	
5.	Area for open storage of clinker should be clearly earmarked.	After earmarking the open storage area of clinker, a board should be erected to display the area earmarked.
6.	Provide cover on openly stored clinker.	During the period when the openly stored clinker is inactive, it should be covered fully by HDPE or tarpaulin type sheets to prevent wind blowing of fugitive dust.
7.	Provide windbreak walls or greenbelt on three sides of open	Install three sided enclosures, which extend to average height of the

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	stock piles	stockpile, where ever feasible.
8.	Provide partial enclosure for retrieving area.	Flexible type wind breaking enclosure should be provided covering the clinker retrieval area as wind barrier to prevent dust carry over by wind. The enclosure could be of lightweight material like moulded plastic material or similar, which could be dismantled/assembled and shifted from one place to other.
9.	The travel path of pay loaders would be paved and frequently swept.	Travel areas path used by the front – end pay loader shall be paved with concrete. It should be regularly swept by high efficiency vacuum sweeper to minimize the material build – up.
10.	Provide loading of clinker by pay loaders into trucks / trailers be carried out in an enclosure vented to a bag filter.	The possibilities especially in new cement plant may be explored for the following: An enclosure fitted with bag filter could be located at the most central place adjacent to the clinker storage area. The pay loader moves to the fixed loading area from one end of the enclosure and the truck/trailer enters the enclosure from other end.

6. STORAGE OF LIMESTONE, GYPSUM, FLYASH AND OTHER ADDITIVES:

Sr. No.	Control Measures to be Provided	Guidelines
1.	The storage would be done under covered shed.	The enclosure walls shall cover minimum two sides up to roof level.
2.	Dry fly ash shall be transported by closed tankers. In case of wet fly ash trucks may be used for transportation.	Flyash shall be pumped directly from the tankers to silos pneumatically in closed loop or mechanically such that fugitive emissions do not occur.
3.	Dry Fly ash shall be stored in silos only.	The silo vent be provided with a bag filter type system to vent out the air borne fines.

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4.	<p>Flyash in the dry form would be encouraged and in wet form would be discouraged. In case wet flyash is to be used, it may be stored in open temporarily for the purpose of drying with necessary wind break arrangement to avoid wind carryover of fly ash. The fly ash should be removed immediately after drying.</p>	<p>If possible, the dry flyash should be sent to closed silos. Otherwise, flyash should be transported through closed belt conveyors to avoid wind carryover of flyash.</p>
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7. CEMENT PACKING SECTION:

Sr. No.	Control Measures to be Provided	Guidelines
1.	Provide dust extraction arrangement for packing machines.	The packing machines should be equipped with dust extraction arrangement such that the packing operation is performed under negative pressure. The dust may be captured in bag filters.
2.	Provide adequate ventilation for the packing hall.	Adequate ventilation for the packing hall should be provided for venting out suspended particulate thereby ensuring dust free work environment.
3.	Spillage of cement on floor shall be minimized and cleared daily to prevent fugitive emissions.	<p>The spilled cement from the packing machine should be collected properly and sent for recycling.</p> <p>The spilled cement on the shop floor should be swept by vacuum sweeping machines periodically.</p> <p>Proper engineering controls to prevent the fugitive emissions may include arrangements like providing guiding plate, scrapper brush for removing adhered dust on cement bag etc.</p>
4.	Prevent emissions from the recycling screen by installing appropriate dust extraction system.	The vibratory screen provided for screening/ recycling spilled cement should be provided with a dust extraction arrangement to prevent fugitive emission from that section.

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8. SILO SECTION:

Sr. No.	Control Measures to be Provided	Guidelines
1.	The silo vent will be provided with a bag filter type system to vent out the air borne fines.	The bag filter should be operated and maintained properly, especially the cleaning of bags to avoid pressurization of silos thereby causing fugitive emissions from leakages etc.

9. ROADS:

Sr. No.	Control Measures to be Provided	Guidelines
1.	All roads on which vehicle movement of raw materials or products take place would be paved.	The paved roads should be maintained as paved at all times and necessary repairs to be done immediately after damages to the road if any.
2.	Speed of vehicles will be limited.	Limit the speed of vehicle to 10 Km/h for heavy vehicles with in the plant premises to prevent the road dust emissions.
3.	Preventive measures to be employed to minimize dust build up on roads.	Preventive measures include covering of trucks and paving of access areas to unpaved areas.
4.	To carry out regular sweeping of roads to minimize emissions.	Mitigative controls include vacuum sweeping, water flushing.

6.3 Hydrogeological Study Report

Project : Groundwater Resources Evaluation & Rainwater Harvesting

Promoters : M/S GRASIM INDUSTRIES LTD.,
VILLAGE RAVAN, TEHSIL SIMGA,
DISTRICT RAIPUR, CHATTISGARH

Possible sources: Groundwater & Rainwater water in the plant.

Investigation Methodology:

- Surface Hydro geological studies for Plant & Colony area (Core Zone)
- Surface Hydro geological studies for Buffer zone (10 Km radius).
- Estimation of ground water Recharge & Discharge factors for both core and Buffer zone.
- Recognition of nature of problem for rainwater harvesting.
- Selection & Design of rainwater harvesting methods.

Coverage: (a) 3.8837 Sq.Km. of plant area (Core Zone)

Approx. 10 Km radius

Findings:

- The regional water level ranges between 32m. to 35m. below ground level during the pre monsoon period. Post monsoon water levels are 26m to 28m below ground level.
- Based on results of hydrogeological survey conducted in the area, it appears that ground water occurs in water table condition in weak zones of medium hard & hard rock. In the investigated area, thickness of top soil is very less generally not more than 3m in plant area.
- For buffer zone (10 km radius) total recharge due to rainfall & irrigation return flow at normal rainfall works out to be 80.65 mcm/annum. Total discharge works out to be 31.68 mcm/annum & stage of development is 39%.
- Gross dynamic reserves in the core zone, which includes both plant and Colony area, have been estimated of the order of 0.466 mcm/annum.
- Recharge from open land of plant & colony area works out to be 1697637Cum.
- Recharge from rooftop, roads, cemented plant area will be 145752cum.

- Total rainwater available for groundwater recharge works out to be about 1843389Cum. Eight new Injection wells each of 40m depth with desilting and filter pit will be used for recharging available runoff.

6.3.1 Surface Hydrogeological & Hydrological Investigation

INTRODUCTION

M/S GRASIM INDUSTRIES LTD., has proposed an expansion of integrated cement project (cement plant 3.3 to 6.5 MTPA: Clinker 2.1 to 6.5 MTPA), captive power plant (30 to 80 MW)at village Ravan in tehsil Simga Raipur, Chhattisgarh.

For meeting the water demands, it was decided to carry out detailed investigation for indicating feasible subsurface, which may meet water requirement on sustainable basis.

This chapter comprises of the main objectives & the investigation methodology.

OBJECTIVES

- Hydrological & Hydrogeological studies of the core & buffer zone for plant area..
- To assess groundwater resources of plant & Colony area.
- To assess groundwater resources of buffer zone of plant area.
- Water conservation measures to augment ground water storage.

GEOLOGY OF THE AREA

The area under discussion has been mapped by GSI as well as DGM. The regional geological set up of **Chhattisgarh super group** is as under:

	<i>Recent to sub recent</i>	-	Alluvium, laterite
	<i>Maniari Formation</i>	-	Purple shale with dolomite

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	Hirmi Formation	-	Dolomitic limestone, & gypsum, gray dolomite
	Tarenga Formation	Bilha member	Purple dolomite, argillite green clay
		Daguari member	Chert and shale intercalations
		Kusmi member	Pink to purple calc. shale
Raipur Group	Chandi Formation	Nipania member	Purple green bedded limestone, purple arg. Stromatolitic dolomite
		Pendri/ Deodongar member	Purple and grey stromatolitic limestone & dolomite with flaggy limestone/shale intercalations, ferrug. glauconitic arenite & shale
		Newari member	Pink and buff stromatolitic limestone & dolomite
	Gunderdehi Formation	Anda/ Dotopar member	Predominantly pink, purple and gray shale with limestone intercalations/ arenite buff to green shale member in the middle.
	Charmuria Formation	Bagbura member	Purple limestone (phosphetic)
		Kasdol member	Dark gray bedded limestone/ arg. Limestone with minor shale intercalations
		Ranidhar member	Cherty limestone & dolomite
		Sirpur member	Chert & clay intercalations,
Chandrapur Group	Kansapathar Formation		Glauconitic white to pinkish quartz arenite
	Chaporadih Formation		Purple green, gray and black shale with silt stone/ quartz arenite with shale intercalations
	Lohardih Formation		Ferruginous purple arkose & greywacke arenite with shale partings and conglomerate at the base

The limestone of chandi formation is underlain in the east, along Khorsi nala by shale of Dotopar member of Gunderdehi formation.

PHYSIOGRAPHY, DRAINAGE PATTERN & RAINFALL DATA

Topographically the area of interest forms flat landscape of Chhattisgarh. State wherein number of undulations and protuberances of different gradient are formed. The elevation of the area varies from 253m to 274m above mSL. The slope of the area is towards the southeast. Karst topography is observed in the area occupied by the sporadic outcrops of limestone.

The Mahanadi the major river system of the area of 10km radius falling within Toposheet No.64K/2. The Mahanadi traverses the area from southwestern quadrant, flows towards the northeast and crosses the area towards east of Datrengi village. The main tributaries which traverse the area of Chhattisgarh are Chitawar and Khorsi Nalas. The drainage of the area is open dendritic which is typical characteristics of flat terrain.

The area is tropical monsoon climate. Rainy season extends from June to September, the maximum rains in August; winter showers are confined to January. May is hottest part of the year when the temperature rises to 46⁰ c (approx.) and usual range is 27⁰ c to 48⁰ c. January is the peak winter when the max. and min. are around 25⁰ c and 10⁰ c respectively. Hot dusty winds blow from mid April. Average rainfall of the area is 1200 to 1300 mm/annum.

AQUIFER TYPES

Investigated area has hard rock aquifer. Hard rock aquifers have either limestone or Shale as main aquifer. Ground water generally occurs in unconfining to semi confining conditions in both type of aquifers.

In general, in the investigated area limestone have moderate hydraulic conductivity It is because of the fact that these rocks are impervious in nature and do not have primary porosity. These rocks have the secondary porosity due to presence of fracture zone and weathering. The secondary porosity decreases with depth due to overlying weight of the rocks. Shales are prone to weathering, get weathered to adequate depths and develop primary porosity. Hence maximum hydraulic conductivity is observed at shallow depth generally less than 50m.

WATER LEVEL AND SEASONAL FLUCTUATION

Water level in the area ranges from 32 mts. To 35mts. below ground level in pre monsoon period and 26-28 m in post monsoon period. Seasonal fluctuation is about 2 to 6 m. Fluctuation in water levels is mostly due to recharge of ground water through rainfall and ground water discharge from wells used for irrigation. This high range of water level fluctuation is only due to moderate hydraulic conductivity of limestone aquifer.

YIELD POTENTIAL

There are few operating tube wells in the Plant, Colony & near by areas. Tube wells in the area have discharge between 100to 200 KL/day.

In the near by areas hand pumps have been constructed by the govt. to an average depth of 40 to 50m. The yield of such hand pumps is not much and is just sufficient to meet the drinking water requirement.

GROUND WATER MOVEMENT

In the investigated area the movement of ground water is governed mainly by secondary fractures as metamorphics are impervious in nature and do not possess primary porosity. The ground water also follows the topography and surface water moves in South- Southwestern to northern or North-eastern direction. The hydraulic gradient is not so high and has been observed as a meter per kilometre.

GROUND WATER QUALITY

Quality of ground water is generally potable and electrical conductivity is less than 2000 michromhos per cm. And total dissolved salts do not exceed 1000 mg/lit. All the constituents remain within allowable limits of drinking water standards with fluorides remaining less than 1.5 mg/lit and nitrates less than 45 mg/l. water is therefore suitable for drinking and irrigation purposes.

6.3.2 GROUND WATER RESOURCES EVALUATION

Ground water resources of an area can be distinguished under two categories:-

1. Dynamic ground water resources
2. Static ground water resources

DYNAMIC GROUND WATER RESOURCES

Dynamic ground water is that amount of water, which is found in the natural zone of fluctuation in an aquifer due to ground water recharge. Total ground water recharge (R_T) of the area can be estimated by assessing the various components of the following equation: -

$$R_T = R_r + R_s + R_i + S_r + R_c \text{ ----- (I)3}$$

Where,

R_r = Recharge from Rainfall.

R_s = Recharge from Irrigation due to surface water.

R_i = Recharge from Irrigation due to ground water.

S_r = Recharge through surface water bodies.

R_c = Recharge to confined aquifers.

GROUND WATER RESOURCES IN THE CORE ZONE

The investigated area covers 3.8837 Sq.km. this land had been acquire from the state govt. and from private cultivators. The main source of ground water recharge is recharge due to rainfall by direct percolation.

RECHARGE DUE TO RAINFALL (R_{rm})

(A) BY GROUNDWATER TABLE FLUCTUATION METHOD:

Recharge due to rainfall is computed by specific yield water table fluctuation method as below: -

$$R_r = A \times S.F \times S_y \text{ ----- (III)}$$

Where,3

R_r = Recharge due to rainfall in the investigated area.

A = Rechargeable area = 3.8837 Km^2

S.F. = Seasonal fluctuation in water level = 3m.

S_y = Specific yield = 4% for Limestone aquifer

For Limestone

$$= 3.8837 \times 0.04 \times 3$$

$$= 0.466 \text{ mcm/annum}$$

$$R_{rm} \approx 0.466 \text{ mcm/annum}$$

(B) BY RAINFALL INFILTRATION FACTOR METHOD:

In areas where groundwater level monitoring is not adequate in space & time, rainfall infiltration may be adopted. The ground water estimation committee, Govt. of India (1997) has suggested norms of recharge from rainfall under various hydro geological conditions. The committee has suggested 8% for limestone aquifer has been adopted which appears to be reasonable while looking to the hydro geological and geomorphological settings. An attempt can be made to find out if it matches with the ground water recharge calculated by seasonal fluctuation method.+

$$R_{r2m} = \text{area} \times \text{normal rainfall} \times \text{R.I. factor}$$

$$= 3.8837 \times 10^6 \times 1.3 \times 0.08$$

$$= 0.403 \text{ mcm/annum}$$

TOTAL DYNAMIC RESERVES

Considering all above recharge components, total dynamic reserves in the investigated area will be:

$$R_{TS} = R_{rm}$$

$$R_{Tm} = 0.466 \text{ mcm/annum}$$

$$R_{Tm} = 0.466 \text{ mcm/annum}$$

GROUND WATER DRAFT

Ground water draft in the area can be estimated by assessing the various components of the following equation:

$$D_T = D_i + D_d + D_{in} + D_w + D_{et} + D_o \text{-----} (B)$$

D_T = Total ground water draft

D_i = Ground water draft for irrigation in the area

D_d = Ground water draft for domestic use in the area

D_{in} = Ground water draft for industrial use in the area

D_w = Ground water draft for irrigation & domestic use around the area in the radius of influence.

D_{et} = Ground water draft by way of evapotranspiration.

D_o = Ground water draft as out flow from unconfined aquifer.

PLANT AREA

From equation no. (B)

$$D_T = D_i + D_d + D_{in} + D_o + D_{et}$$

In the investigated area, ground water draft will occur only through existing ground water structure, which are constructed in the mining lease area and being used for the industrial purpose. Eva transpiration losses are negligible as water table is deep. So at present there is no other ground water draft in the investigated area.

Hence ground water draft can be computed by reducing the equation (B) to:

$$D_{Tm} = D_{in}$$

Present water requirement of industry is 1962Cum/day. After expansion total water requirement will become 3962 cum/day. This amount of water will be used for plant purpose and domestic use . Hence total ground water withdrawal will be as under

$$\begin{aligned} D_{in} &= \text{water requirement} \times \text{total working days} \\ &= 3962 \times 330 \\ &= 1.307 \text{ mcm/annum} \end{aligned}$$

TOTAL GROUND WATER DRAFT OF AREA (D_T)

$$D_T = 1.307 \text{ mcm/annum}$$

GROUND WATER RESOURCES (BUFFER ZONE)

The area of Buffer zone (314 Sq.km. – 3.8837 sq.km = 310.116 sq.km.) lies in SIMGA block of Raipur district. This buffer zone has limestone and shale as main aquifer. Main recharging factors in this area is recharge due to rainfall, due to return flow from the applied irrigation from surface and ground water and recharge form the surface water bodies.

RECHARGE DUE TO RAINFALL (R_{RB})

(A) BY GROUNDWATER TABLE FLUCTUATION METHOD:

The groundwater recharge for the buffer zone has limestone and shale as main aquifer. There is hardly any canal irrigation and entire area of buffer zone has been irrigated by open wells / tubewells, ponds.

It has been observed in the key wells penetrating both limestone and shale aquifer that average rise in water table is 2 to 6m. at an average level it can be taken as 4m for both the aquifers.

Recharge due to rainfall in the buffer zone is computed by specific yield water table fluctuation method as below: -

$$\begin{aligned} R_{r1} &= A \times S.F \times S_y \\ &= 310.116 \times 4 \times 0.03 \\ &= \mathbf{37.21 \text{ mcm/annum}} \end{aligned}$$

$$R_r \approx 37.21 \text{ mcm/annum}$$

(B) BY RAINFALL INFILTRATION FACTOR METHOD:

The ground water recharge can also roughly estimated by rainfall infiltration method. The ground water estimation committee, Govt. of India (1997) has suggested norms of recharge from rainfall under various hydro geological conditions. For areas as that of Raipur having consolidated sedimentaries and favourable hydro geological conditions of shallow water level and well-developed drainage, rainfall infiltration factor has been

suggested as 6% to 10% of the normal rainfall. At an average level infiltration factor for the area can be taken as 8%.

$$\begin{aligned} R_{r2} &= \text{area} \times \text{mean annual rainfall} \times \text{R.I. factor} \\ &= 310.116 \times 1.3 \times 0.08 \\ &= 32.25 \text{ mcm/annum} \end{aligned}$$

RECHARGE DUE TO GROUND WATER APPLIED FOR IRRIGATION (R_{IB})

Ground water recharge from the return flow of irrigation water is normally taken as 30% of the total water applied for irrigation as suggested by the committee. Total groundwater applied for irrigation is 8.64 mcm/annum. Ground water recharge from the above factors is as under

$$\begin{aligned} 20.88 \times 0.3 &= 6.26 \text{ mcm/annum} \\ R_{IB} &= 6.26 \text{ mcm/annum} \end{aligned}$$

RECHARGE DUE TO SURFACE WATER APPLIED FOR IRRIGATION (R_{SB})

Ground water recharge from the return flow of surface water irrigation water normally taken as 40% (For paddy irrigation) of the total water applied for irrigation as suggested by the GWREC(1997). Total irrigated area is 185.36 Sq.km, taking 0.4m as depth of water applied for the irrigation, total groundwater applied for irrigation at 80% efficiency works out to be 9.268 mcm/annum. Ground water recharge from the above factors is as under Surface water applied for irrigation

$$(185.36 \times 0.4) / 0.8 = 92.68 \text{ mcm/annum}$$

Recharge to ground water

$$\begin{aligned} 92.68 \times 0.4 &= 37.07 \text{ mcm/annum} \\ R_{SB} &= 37.07 \text{ mcm/annum} \end{aligned}$$

RECHARGE DUE TO SURFACE WATER BODIES (S_{IB})

As per the land use pattern of the buffer zone total area under surface water bodies work out to be 8.46 Sq.km. As per the GWEC ground water recharge through surface water bodies can be taken as 60% of the total spread area. hence Ground water recharge from the above factors is as under

$$8.46 \times 0.6 = 5.07 \text{ mcm/annum}$$

$$S_{IB} = 5.07 \text{ mcm/annum}$$

TOTAL RECHARGE OF BUFFER ZONE (R_B)

$$\begin{aligned} R_B &= R_{rB} + R_{IB} + R_{SB} + S_{IB} \\ &= 32.25 + 6.26 + 37.07 + 5.07 \\ R_B &= 80.65 \text{ mcm/annum} \end{aligned}$$

GROUND WATER DRAFT OF BUFFER ZONE

From equation no. (B)

$$D_{TB} = D_{iB} + D_{dB} + D_{inB} + D_{oB} + D_{etB}$$

In the investigated area, ground water draft will occur due to applied irrigation, due to domestic use, due to industrial use and outflow from the unconfined aquifer. Evatranspiration losses are negligible as water table is deep. Hence ground water draft can be computed by reducing the equation (B) to:

$$D_{TB} = D_{iB} + D_{dB} + D_o$$

DRAFT DUE TO APPLIED IRRIGATION (D_{iB})

The ground water draft in the buffer zone takes place mainly by dug well and tube wells used for irrigation. There are about 1450 dug wells/tube wells tapping limestone & shale aquifer. It has been stated earlier that in the limestone area ground water structures usually have a discharge of 150 cum/day, while in shale area it is 100 cum/day. Hence at an average level 120 Cum/day of discharge can be taken for both limestone and shale aquifer. The annual draft has been calculated after considering that these structures will operate only for four months a year. The annual ground water withdrawal from these wells is as under:

$$1450 \times 120 \times 4 = 20.88 \text{ mcm/annum}$$

DRAFT DUE TO DOMESTIC USE (D_{dB})

In the buffer area, the population is about 50019 according to Census figures for 2001. As population growth percentage has been @ 5.6 % per annum since 2001, the present population is estimated at 75,228 persons

Considering 100 liters (0.1 m³) as domestic consumption in rural and semi urban area (as per GERC Report 1997), the total water withdrawal for domestic use will be:

$$\begin{aligned} D_{dB} &= 75228 \times 0.1 \times 365 \\ &= 2.74 \text{ mcm/annum} \end{aligned}$$

DRAFT DUE TO OUTFLOW FROM UNCONFINED AQUIFER

As per the GWEC, 10% of the total ground water recharge can be taken as the unaccounted outflow from the unconfined aquifer. Hence

$$\begin{aligned} D_o &= 80.65 \times 0.1 \\ &= 8.06 \text{ mcm/annum} \end{aligned}$$

TOTAL DRAFT IN THE BUFFER ZONE

$$\begin{aligned} D_{TB} &= D_{iB} + D_{dB} \\ &= 20.88 + 2.74 + 8.06 \\ D_{TB} &= 31.68 \text{ mcm/annum} \end{aligned}$$

SURPLUS DYNAMIC RESERVES OF BUFFER ZONE

Surplus ground water reserves are those reserves, which are available for utilization and are expected to recharge every year. These reserves calculations are based on the rainfall of 2010. Therefore, surplus reserves (R_w) are computed as follows: -

$$R_{WB} = \text{Total Dynamic Reserves} - \text{Total ground water draft}$$

$$R_{WB} = R_{TB} - D_{TB}$$

$$R_{WB} = 80.65 - 31.68$$

$$R_{WB} = 48.97 \text{ mcm/annum}$$

Total recharge to the buffer zone is 80.65 mcm/annum. Total ground water pumpage is 31.68 mcm, indicating that the area is under safe zone and present stage of ground water development is 39% of the long term ground water recharge.

6.3.3 Artificial Ground Water Recharge

NEED FOR ARTIFICIAL GROUND RECHARGE

Based on the assessment of long term ground water recharge and total requirement & proposal of meeting this requirement from ground water but by doing this status of ground water become critically exploited. To minimize the effect on ground water status, it is necessary that ground water storage of the area must be augmented by rainwater harvesting so that the existence of industry does not adversely effects the ultimate ground water status.

NATURE OF PROBLEM

Rainfall is only source of water in the area; rainfall & evapotranspiration are two major factors controlling the quantum of rainwater available for recharge. The investigated area receives rainfall for just 26 to 30 days a year. Thus not only the total rainfall but also its availability is confined to few days during which entire water resources planning has to be done.

The other important factors controlling the natural recharge to ground water are rainfall intensity, hydrogeology & depth of water level. It is observed that majority of rainfall occurs in 3-5 major storms lasting only a few hours. Natural recharge to ground water is further restricted due to impervious hard strata. Some of water, which infiltrates during rainy period, is entrapped in the soil and it never reaches the water level. This water is ultimately lost due to potential evapo- transpiration. The rates of potential evapo - tranpiration (PET) is very high in the area. On an average, annual PET is higher than the rainfall in the area. Thus any artificial recharge by indirect techniques should be such that most of the water stored on surface is put to ground water within the shortest possible time to avoid losses.

As indicated earlier, hydro geologically the area is composed of hard rock and for artificial ground water recharge Injection wells & open wells will be most feasible recharge techniques. This will help in augmenting the groundwater storage around the tube wells and open wells so that they can sustain in long term.

METHODS OF RAINWATER HARVESTING SYSTEM

Following methods shall carry out the rainwater harvesting

1. Roof top rainwater harvesting through proposed injection wells.
2. Surface rainwater runoff available from paved area, green area and open land shall be used for recharging through injection wells.

DESIGN OF ROOF TOP RAINWATER AND SURFACE RUNOFF HARVESTING SYSTEM

Rooftop rainwater runoff: -

The industrial roofs are of RCC finished with cement sand mortar. Most of the water can be collected with roof drains hence 85% rainwater can be available. About 15% of water is lost in evaporation etc. The water is collected through rainwater drains from rooftop. The roof should be finished to avoid percolation and should be cleaned every year before rains. The roof top rainwater & surface runoff rainwater shall be collected through existing rainwater drains

Surface Runoff of Rainwater

The subsurface reservoirs are technically feasible alternative for storing surplus monsoon runoff. Wide spectrums of techniques are in vogue to recharge ground water reservoir. The artificial recharge techniques vary widely depending upon hydro geological studies of the area. The detailed hydro geological studies were carried out and it was found that water table of area is 18 to 35m in post monsoon period.

The maximum rate at which water can enter the soil at particular point depends upon infiltration capacity. The infiltration capacity depends upon soil type, moisture content, organic matter, vegetative cover, season, air entrapment, etc. The infiltration and percolation capacity are closely related. The infiltration takes place due to gravity but capillary force divert gravity water.

The infiltration capacity of land formation is not suitable for surface percolation system hence for recharge of ground water reservoir through injection well system is proposed. This system will improve both quality & quantity of water.

Runoff coefficient for gently sloping barren hard rock area of Raipur area can be taken as 35%. Similarly for cemented area it has been taken as 70% and for Rooftop area it can be taken as 85%.

Average runoff coefficient taken for the area is as under:

1. Average runoff coefficient for rooftop = 85%
2. Average runoff coefficient for Paved area = 70%
3. Average runoff coefficient for open land = 35%

(Gently sloping Barren hard rock area)

RAINFALL INTENSITY = 120 MM/HR.

Design of Silting Pit

After getting the total amount of rainwater available for recharge with peak rate of runoff, it is necessary to design the required silting & filter pits of appropriate dimensions so that they can accommodate total runoff water. Design of silting pit in black cotton soil become very necessary because of the fact that clay has very fine particles usually remain suspended in the rainwater runoff and required time for the settlement. If rainwater is injected in the subsurface without passing it through the settling pit, it will retard the intake capacity of the inverted wells. This may result in clogging and short life of recharging structures. Settling pit design has one most important factor settling velocity, which can be calculated as under:

Settling Velocity

$$V_s = 418 (S_s - S) d^2 \{(3t+70)/100\}$$

Where,

S_s = Specific gravity of particles = 2.65

S = Specific gravity of fluid = 1

d = Dia of particle = 0.02 cm

t = temperature = 40° C

$$= 418 (2.65-1)(0.02)^2 \{(3 \times 40+70)/100\}$$

$$= 0.524 \text{ mm/sec}$$

$$V_s = 0.0524 \text{ cm/sec}$$

1. RAINFALL RECHARGE INSIDE THE INDUSTRIAL UNIT

A. Roof Top Rainwater Runoff

The Industry has proposed to setup a cement plant and residential area for the staff. These area has different buildings with RCC and V shaped roof. To collect water from flat RCC roof drainpipes has been proposed. These drain pipes are proposed to connect to main rainwater collection pipes, provided with collection chambers. In case of V shaped roof rainwater is collected through gutters attached at the end of the roof and these gutters are connected to rainwater pipes.

Average Rooftop Rainwater Runoff Available:

$$= A \times R_f \times A_v R_c$$

Where,

$$A = \text{Roof top area} = 35176 \text{ Sq.m}$$

$$R_f = \text{Rainfall} = 1300 \text{ m.m. (Average)}$$

Average rainwater runoff available

$$= 35176 \times 1.30 \times 0.85$$

$$= \mathbf{38870 \text{ Cum. ----- (A)}}$$

B. Black Topped Roads and Cemented Area

The project area has approach roads from entry gate to different buildings. These roads will be 6m wide. The project area also has parking and other cemented portion. Slop of these cemented area and roads are maintained in such a way that the available runoff should move towards the proposed open drains and this water shall be taken to the recharge tube wells/ open wells. Total road and cemented area is about 117453 sq.m. Taking 70% as runoff coefficient for paved area, the availability of water has been worked out as under

Average Rainwater Runoff Available From Paved Area:

$$= A \times R_f \times A_v R_c$$

Where,

$$A = \text{Total Paved area} = 117453 \text{ Sq.m.}$$

$$R_f = \text{Rainfall} = 1300 \text{ m.m. (Average)}$$

Average rainwater runoff available

$$= 117453 \times 1.30 \times 0.7$$

$$= 106882 \text{ Cum. ----- (B)}$$

C. Green Area and Open land

The total area of industry is 3883700 Sq.m. the rooftop area is 35176Sq.m, road and cemented area is 117453Sq.m. and rest of the area will be developed as green belt area or left as open land. The balance land area is 3731071 Sqm. Taking 35% as runoff coefficient; the runoff available has been worked out as under.

Average open land Rainwater Runoff Available:

$$= A \times R_f \times A_v R_c$$

Where,

$$A = \text{Total open area} = 3731071 \text{ Sq.m.}$$

$$R_f = \text{Rainfall} = 1300 \text{ m.m. (Average)}$$

Average natural recharge

$$= 3731071 \times 1.30 \times 0.35$$

$$= 1697637 \text{ Cum. ----- (C)}$$

Expected Rainwater Recharge from all the above structures

$$= (A) + (B) + (C)$$

$$= 38870 + 106882 + 1697637$$

$$= 1843389 \text{ Cum}$$

DESIGN OF DESILTING & FILTER PIT WITH INJECTION WELL

$$\text{Peak rate of runoff} = 0.85 \times 0.04 \times 35176 + 0.7 \times 0.04 \times 117453$$

$$= 1196 + 3289 \text{ Cum/hr.}$$

$$= 4485 \text{ Cum/hr.}$$

Design of Silting Pit

Surface Loading

$$= 4485000 \times 0.0524$$

$$\begin{aligned}
 &= 235014 \text{ Lit/hr/m}^2 \\
 \text{Assumed depth of Tank} &= 1.5 \text{ m.} \\
 \text{Design detention period} &= 1.5 / \{0.05241 \times 36\} \\
 &= 0.795 \text{ hours} \\
 \text{Volume of water in 1 hr} &= (4485000/1000) \times (0.795/24) \\
 &= 148.56 \text{ Cum} \\
 \text{Area} &= 148.56/1.5 = 99.04 \text{ m}^2
 \end{aligned}$$

$$\text{Area of one pit} = 99.04/8 = 12.38$$

$$\text{Hence Width} = 2 \text{ m Length} = 6 \text{ m.}$$

The rainwater of roof top and surface runoff shall be used for artificial recharge through 8 injection wells of 40m depth through silting pit (2 x 6x1.5m) & filter pit (3x 3 x 2.7m).(Fig.2).

Total rainwater thus available from rooftop area and paved area will be diverted to eight proposed recharge tube wells or existing openwells through rainwater drains and injected into the aquifer after passing through the filter pit. Location of injection wells will be decided on the basis of **Geophysical investigation**. Their number can be increased and decreased depending upon the actual filed condition, which is to be evaluated during monsoon and post monsoon period.

The industry proposes to withdraw 3962Cum/day. The total withdrawal of groundwater per annum will amount to 1307460 cum considering 330 working days.

However, there is no deficient in ground water recharge and to facilitate additional recharge the industry proposes to construct artificial rainwater harvesting structures in some of the nearby villages, depending upon the feasibility. Industry also proposes to recharge ground water by constructing rooftop rainwater recharge structures, renewal/ construction of ponds, cleaning and deepening of existing wells and construction of recharge tubewells depending upon the local hydrogeological conditions. The complaisance of the above proposal and periodic reports of progress

made in constructing the structures shall be communicated to CGWB. Necessary technical guidance shall also be sought from CGWA whenever it is required.

6.3.4 CONCLUSIONS

- The regional water level ranges between 32m. to 35m. below ground level during the pre monsoon period. Post monsoon water levels are 22m to 25m below ground level.
- Based on results of hydrogeological survey conducted in the area, it appears that ground water occurs in water table condition in weak zones of medium hard & hard rock. In the investigated area, thickness of top soil is very less generally not more than 3m.
- Total recharge to ground water through Rooftop & surface runoff of industrial and nearby area has been to the tune of 1843389Cum. Details are as under:

Water requirement = 3962 Cum/day = 1307460 Cum/annum			
Total working days = 330 days			
Plant & Residential area = 3883700Sqm			
DETAIL	AREA (Sq.m.)	R.C.	E.R. (Cum/annum)
Rooftop	35176	85%	38870
Paved	117453	70%	106882
OPEN LAND	3731071	35%	1697637
		Total	1843389

Proposed Rainwater harvesting structures
Eight new injection wells (40m depth) with desalting and filter pit for rooftop and paved area.

PRECAUTIONS

While carrying out roof top rainwater harvesting & surface runoff utilization works following precautions must be taken so that maximum benefits are derived.

- The roof tops of the buildings to be used for collecting rainwater must be cleaned before the onset of first rainfall so that any dust, leaves, pollutants do not enter the filtration tank. Grating must be used to trap debris or tree leaves before rainwater enters the drainpipes.
- A steel wire mesh maybe enveloped around the slotted pipe of injection well to minimize the clogging of slots.
- The filter material must be washed with water before putting in the filtration tank as these may be covered with silt or clay. Every year, before the onset of first monsoon, the filter material must be taken out and washed and then put back in the filtration tank & other recharge structures so that silt/clay deposited during the filtration process of preceding year is removed and original filtration rate is achieved.



CHAPTER-VII

PROJECT BENEFITS

7.0 INTRODUCTION

Grasim Industries Limited is very much conscious of its obligations to society at large. The company has contributed substantially to the exchequer. In addition, the company has provided opportunities for all around socio-economic development.

7.1 PROMOTION OF SOCIAL & ECONOMIC STATUS

Grasim Industries Limited has promoted rural development programme in the various fields like education, health & family welfare, agriculture etc, like;

- Health awareness programmes and surgical camps (eye camps, cleft lips correction camps, dental camps, pulse polio camps, etc.)
- It is running 18 hospitals.
- Increasing awareness for protection and conservation of environment.
- Promotion of Educational Programmes
- Promoted Community Programmes
- Grasim Cement has laid black top roads on the following stretches as part of community and infrastructure development, regular maintenance of these roads are being undertaken by Grasim Cement.
 - Rawan to Hathbandh - 27 km.
 - Rawan to Hirmi - 11.5 km.
 - Rawan to Chuchurungpur - 2.9 km.
 - Pakidi to Balodabazar - 20 km.
 - Rawan by pass road is under construction

- Grasim Cement has extended help to the farmers under the project Swarojgar, and Griha Udyog. Grasim Cement has rendered its support to the farmers in providing the training on agriculture, depending of ponds, servicing of hand pumps & bore wells, veterinary training and cattle health camps.
- Under the health and family welfare programme, Grasim Cement has conducted, medical health, family planning and aids awareness camps apart from training on first aid, health and hygiene and camp for eradication of leprosy.
- Following social welfare activities were undertaken by GIL management from 01.04.07 to 31.03.08;

TABLE – 7.1
SOCIO ECONOMIC ACTIVITIES

S. No.	Activities	Beneficiary
1.	Coaching for admission in Navodaya School-NTMM	150
2.	Distribution of Scholarship to students	133
3.	Block Level Sports Tournaments	643
4.	Computers to 4 High schools	1900
5.	Balbhoj to primary school students	250
6.	Distribution of utensils to primary school students	1030
	Total	4160

Source: Project Report

7.2 PROPOSED SOCIO ECONOMIC DEVELOPMENTAL ACTIVITIES

Rural developmental activities done from the year 2008 – 2009 and proposal for the year 2010

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TABLE – 7.2

S. No.	Parameters	Parameters of work done	Expenditure 2008-09 (Rs.)	Till Date 01.04.09 (Rs.)	Expenditure Proposed-2009-10 (Rs.)
1	Housing	<ul style="list-style-type: none"> ➤ Repairing of and community buildings ➤ Repairing of Roads ➤ Indira Awas/ Gobar Gas Plant 	72000	1264250	800000
2	Water Supply	<ul style="list-style-type: none"> ➤ Mines water in villages ➤ Repairing of Borewells and pumps/ water supply ➤ Water Harvesting (Deepening of pond and construction of stairs near pond) 	84000	1139000	300000 430000
3	Health, Safety & Medical Facilities	<ul style="list-style-type: none"> ➤ Family Planning Camps ➤ Medical facilities to villagers ➤ Cataract Operations, 	169000	1650222	675000
4	Education & Training	<ul style="list-style-type: none"> ➤ Distribution of Tatpattis to local schools, Scholarship to village students, Asist. In construction of school buildings/ boundry/ shed, Coaching for Navodaya school, Silai & Tailoring Training, Agriculture training to farmers & Distribution of uniform to student. 	237000	2975950	750000

Source: Pre-feasibility Report

7.3 CONCLUSION

Expansion of cement plant thereby increase of cement production will result in increase of revenue for Grasim Cement to promote more rural development programme in the expansion phase of the cement plant.

Project activity and the management has supported the local administration and provided other form of assistance for the development of public amenities in this region.

Grasim Industries Limited has generated fair amount of direct and indirect employment in the study area. The local economy has received boost due to employee spending and services generated. The overall effect has improved buying power of employees and thus a higher standard of living viz. better education, improved health and sanitation facilities housing and acquisition of consumer durable. This is envisaged as a major positive benefit.



CHAPTER-VIII

ENVIRONMENTAL MANAGEMENT PLAN

8.0 INTRODUCTION

Based on the evaluation of impacts and baseline conditions, an Environmental Management Plan (EMP) has been delineated to mitigate the adverse impacts. The EMP includes formulation, implementation and monitoring of environmental protection measures. The EMP features guidelines and methodologies to be adopted at different stages of cement plant for mitigating the impacts of various activities. The EMP is herein outlined after taking into account the various Acts, Rules and Regulations/Standards concerned with the environmental management.

- All the pollutant-releasing units has been provided with dust collecting devices like bag filters and Electro Static Precipitators (ESPs). These dust abatement measures has been installed at all the dust prone points and will work efficiently by proper maintenance and upkeep.
- The industry achieves water saving by recycling of cooling water and leakage prevention by proper maintenance of the water supply system.
- It has undertaken plantation of saplings in and around the manufacturing facility and colony.
- The unit has supplied Occupational Health Safety (OHS) gears like crash helmets, safety shoes and dust masks etc., to their workers. Use of these OHS gears are strictly followed. GIL has implemented the housekeeping and the Occupational Heath and Safety (OHS) measures in the plant.

8.1 ENVIRONMENTAL MANAGEMENT PLAN – OPERATIONAL PHASE

Environmental Management Plan of the cement plant during operation phase details the environmental quality control measures which will be taken up and which are proposed in the Cement plant to achieve clinker production of 6.5 MTPA and cement production of 6.5 MTPA by complying with the stipulated standard limits specified by CPCB and State Pollution Control Board. Environmental Management Plan which is being implemented is detailed under the following heads.

- Air Pollution Control
- Noise Mitigation
- Wastewater Management
- Solid Waste Management
- Energy Conservation
- Greenbelt Development
- Implementation of EMP and Monitoring Programme

8.1.1 Air Pollution Control

8.1.1.1 Air Pollution Control in Cement Plant & CPP

Environmental Management is an approach to resource conservation and minimization of impact by human activities on the physical and ecological environment.

Grasim Industries Limited has competent technical team taking care of the operation and maintenance of equipment efficiently. Importance has been given to preventive maintenance of equipment so as to minimize breakdowns and avoid conditions leading to pollution.

Following Pollution Control Equipments have been installed in the plant, details related to the existing pollution control equipments and proposed one as mentioned in the table 8.1.1.1(A), detailed information regarding the same is given in table 8.1.1.1(B)

TABLE – 8.1.1.1 (A)
EXISTING AND PROPOSED POLLUTION CONTROL EQUIPMENTS

S. No	Stack Attached	A.P.C. Equipment Installed	PM Emission Concentration (mg/Nm ³)	Efficiency of the Equipment (%)
Existing cement plant & CPP			(Existing Details)	
1.	Kiln/Raw mill	ESP	70	99.89
2.	Coal Mill	ESP	72	99.79
3.	Clinker cooler	ESP	56	99.76
4.	Cement Mill	ESP	64	99.98
5.	CPP Boiler	ESP	27	99.90
Proposed cement plant & CPP			(Design Details)	
1.	Kiln/Raw mill	Bag Filter / ESP	50	99.99
2.	Coal Mill	ESP	50	99.99
3.	Clinker Cooler	ESP	50	99.99
4.	Cement Mill	ESP	50	99.99
5.	CPP Boiler	ESP	100	99.99

Source: Project Report

Pollution control equipment at Grasim Industries Limited will be designed for an emission standard below 50 mg / Nm³.

The selection and specification of pollution control equipment at Grasim Industries Limited has been given extreme importance due to which it is possible to maintain emission norms less than 50 mg / Nm³.

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TABLE 8.1.1.1(B)
DESCRIPTION ABOUT THE EXISTING POLLUTION CONTROL EQUIPMENTS

S. No.	Stack attached	Height of stack from ground in meters	Diameter/dimension of ventilator in mm	A.P.C. Equipment installed	Year of installation	Max. Emission concentration mg/nm ³	Efficiency of the equipment
	MAIN ESP STACKS						
1.	KILN/RAW MILL	135.00	3800	ESP	1995	100	99.89
2.	COAL MILL	77.00	1750	ESP	1995	100	99.79
3.	CLINKER COOLER	30.00	3500	ESP	1995	100	99.76
4.	CEMENT MILL	64.00	1500	ESP	1995	100	99.98
5.	TPP BOILER	110.00	3000	ESP	2008	50	99.90
	BAG FILTER VENTING STACKS						
1.	LS HOPPER BOTTOM	13.20	725X600	BF	1995	100	99.83
2.	DUST HANDLING	22.40	550X354	BF	1995	100	99.83
3.	DUST HANDLING(Air Slide)	22.40	550X354	BF		100	99.83
4.	BLENDING SILO TOP	75.00	900X600	BF	1995	100	99.83
5.	BLENDING SILO BOTTOM	23.00	450	BF	1995	100	99.89
6.	BLENDING SILO BOTTOM	23.00	450	BF	1995	100	99.89
7.	PREHEATER TOP	88.00	600X500	BF	1995	100	99.89
8.	CLINKER SILO TOP	49.50	900X600	BF	1995	100	99.90
9.	DBC FEED	3.03	528X328	BF	1995	100	99.90
10.	CLINKER SILO BOTTOM	10.02	1072X604	BF	1995	100	99.90
11.	CEMENT MILL HOPP.TOP	31.80	785X650	BF	1995	100	99.90

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12.	CEMENT MILL HOPP.EXT.	15.26	600X312	BF	1995	100	99.90
13.	ROLLER PRESS FEED	14.70	750X650	BF	1995	100	99.90
14.	DAG & SEPARATOR	46.50	700X500	BF	1995	100	99.90
15.	CEMENT MILL BIN FEED	14.70	500X400	BF	1995	100	99.90
16.	CEMENT MILL CONV.SYSTEM	22.00	500X400	BF	1995	100	99.90
17.	CEMENT MILL CONV.SYSTEM	11.50	377X300	BF	1995	100	99.90
18.	CEMENT SILO TOP	63.00	559X960	BF	1995	100	99.90
19.	CEMENT SILO BOTTOM	9.04	418X338	BF	1995	100	99.90
20.	PACKER	42.60	936X650	BF	1995	100	99.90
21.	PACKER	42.60	936X650	BF	1995	100	99.90
22.	FINE COAL BIN TOP	40.31	435X296	BF	1995	100	99.90
23.	FINE COAL BIN TOP	40.31	435X296	BF	1995	100	99.90
24.	FK PUMP HEAD HOPPER	18.00	342X377	BF	1995	100	99.90
25.	FK PUMP HEAD HOPPER	18.00	342X377	BF	1995	100	99.90
26.	FK PUMP HEAD HOPPER	18.00	342X377	BF	1995	100	99.90
27.	LS CRUSHER	39.50	1500	BF	1995	100	99.90
28.	SURGE HOPPER TOP	40.00	735X520	BF	1995	100	99.90
29.	SEPOL (SLAG)	50.00	2100	BF	1997	50	99.90
30.	SLAG GROUND VENTING	48.45	1800	BF	1997	50	99.90
31.	GROUND SLAG SILO TOP	39.84	735X520	BF	1997	50	99.90
32.	GROUND CLINKER SILO TOP	39.84	735X520	BF	1997	50	99.90
33.	FINE COAL BIN TOP	16.00	248X198	BF	1997	50	99.90

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34.	GR.SLAG CONV.SYSTEM	13.99	485X343	BF	1997	50	99.90
35.	GR CLINKER CON.SYSTEM	13.99	485X343	BF	1997	50	99.90
36.	SLAG CEMENT SILO TOP	62.35	905X640	BF	1997	50	99.90
37.	SLAG CEMENT SILO BIN	18.00	100X125	BF	1997	50	99.90
38.	SLAG CEMENT TRANSPORT	13.95	536X518	BF	1997	50	99.90
39.	PACKER	43.60	1250	BF	1997	50	99.90
40.	CLINKER DUMP HOPPER	3.25	816X498	BF	1995	100	99.90
41.	CLINKER TRANFER AT DBC	8.95	550X354	BF	1995	100	99.90
42.	750 MT FLY ASH SILO	48.90	300X400	BF	2006	50	99.90
43.	CLINKER TANKER EXTRACTION	1.50	300X400	BF	2006	50	99.90

Source: Project Report

The major pollutants of air in the cement plant are the suspended particulate matters from the various stacks and fugitive emissions due to material handling.

The main pollutant emitted from the cement plant is particulate matter. In order to regulate the particulate matter emission in the exhaust, Grasim Cement has provided the pollution control devices and interlocking systems in all the critical areas are shown below.

All the existing emissions sources are provided with pollution control devices to comply with the norms of State Pollution Control Board. The cement dust collected in the pollution control devices is recycled back to the cement manufacturing process. Grasim Cement has incorporated interlocking mechanism for all the pollution control equipment and process units. The details of interlocking system are given below:

TABLE-8.1.1.1(C)
INTERLOCKING SYSTEM

S. No.	LOCATION	POLLUTION CONTROL EQUIPMENT	INTERLOCKING SYSTEM
1.	Raw Mill / Kiln	ESP for raw mill and kiln exhaust gases	All devices and fan interlocked with raw mill and kiln
2.	Kiln Feeding System	Bag filter / ESP	Bag filter fan and purging air system are interlocked with kiln
3.	Clinker Cooler	ESP	Cooler exhaust fan interlocked with cement mill
4.	Coal Mill	ESP	ESP fan interlocked with coal mill
5.	Cement Mill	ESP	ESP all devices and ESP fan interlocked with cement mill

Source: Project Report

Other measures implemented in the cement plant to reduce the dust emission are as follows:

- a) Maintenance of Bag Filters
- b) Upgradation of ESPs
- c) Reduction in fugitive Emissions

8.1.1.2 Reduction in Fugitive Emission

- Plantation will be done along the roadsides wherever needed, to mitigate the vehicular fugitive emissions.
- The roads in the cement plant are paved to prevent dust emissions.
- Limestone will be transported via covered conveyor belts to the plant site.
- To control the dust emission from dropping/transfer points of the belt and bucket conveyors, bag filters will be provided at various locations of the transfer points.
- To control air emission in Cement Plant & CPP highly efficient ESPs / bag filters will be installed at various stages of the process.
- Dust suppression/ dust extraction systems with bag filters along with water sprinklers will be provided to prevent the fugitive dust emissions.
- To prevent fugitive dust, from clinker transport, water sprinkling is being practiced during transport activities.
- Conveyor systems in cement mills are covered.
- Clinker is stored in closed clinker silo.
- Gypsum is stored in covered shed.
- Pulverized coal is stored in bins.
- Regular sweeping of all the roads & floors is being done.
- Water spraying is done regularly on belt conveyors.
- Dry fly ash is pneumatically loaded into fly ash silo from closed bulkers containing fly ash.

- Dry fly ash is transported into closed bulkers.
- Wet fly ash is covered by tarpaulin.
- Water spray through tankers is done on bare lands & WBM roads.
- Green belts around the periphery of plant as well as intermittent green belts is developed to curtail/contain the fugitive dust emission, if any.
- At the storage area of the raw material, falling of the material from the pile generates dust. All the raw material stockpiles are covered with aprons to absorb fugitive emissions.

8.1.2 Noise Pollution Mitigation in Cement Plant & CPP

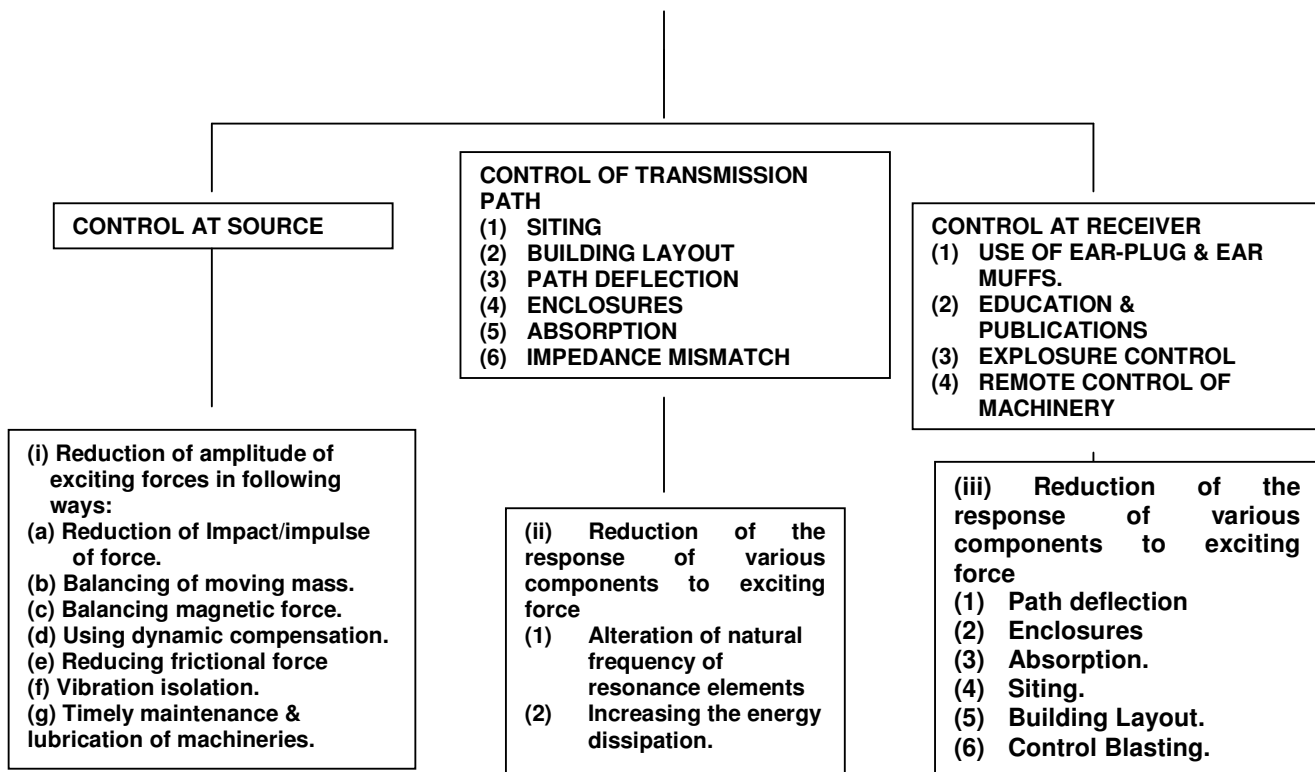
Exposure of high noise level to workers for long duration may lead to certain occupational diseases. To mitigate the high noise level, following measures are being adopted:

- Walls and ceilings of the concerned buildings have been lined with sound absorbing materials.
- Properly insulated enclosures have been provided to operators working close to the high noise sources.
- Noise attenuating devices like earplugs and earmuffs has been provided to the workers exposed to high noise level.
- Sufficient green belt is being maintained around the cement plant.
- Regular monitoring of noise level is being carried out and corrective measures in concerned machinery are being adopted accordingly.
- Green belt has been developed in an area, which greatly helps in reducing noise levels in GIL plant area.
- Improved silencers are being provided in the machineries generating **high noise.**

8.1.2.1 Noise Abatement and Control

- All the latest machines has been purchased and due care is given to generation of noise by the equipment.
- Plantation of dense belt of trees has been planned under green belt development programme, which will act as an acoustic barrier, so that public at large is not affected.
- Dense plantation has been carried on the sides of approach roads, on both sides of belt conveyor system, around office complex and plant area.
- In order to reduce the effect of noise pollution, earmuffs has been provided to all operators and employees as a safety measure.

NOISE ABATEMENT STRATEGIES



8.1.3 Wastewater Management

- No industrial wastewater is generated from the existing plant and after the proposed expansion also there will be no generation of

waste water outside the plant premise as the proposed cement plant is/will be operated on the dry process.

- In Cement Plant process, water is/will be absorbed in the process or is/will be subjected to evaporation, hence no wastewater generation.
- The wastewater generated from the CPP is/will be recycled back to the process and used for cooling and dust suppression.
- Air cooled condenser is/will be used in Thermal Power Plant to reduce water requirement.
- Waste water generated from Township is treated in STP and treated water is used for greenbelt development and dust suppression.

RECYCLE AND REUSE: GIL has adopted recycle and reuse technology. Process water / treated domestic sewage water is used for dust suppression and green belt development. Details of recycle and reuse are mentioned below:

TABLE – 8.1.3

DETAILS FOR REUSE AND RECYCLE TECHNOLOGY

S. No.	Details	m ³ /day	m ³ /year
a.	Quantity of treated water available	585	213525
Reuse			
b.	Reuse in industrial activity	485	177025
c.	Reuse for green belt development	100	36500
d.	Other Use	-	-
	Total	585	213525

Source: Project Report

Therefore, from the plant process there is negligible effluent generated which doesnot cause pollution to the environment.

8.1.3.1 Water Conservation measures

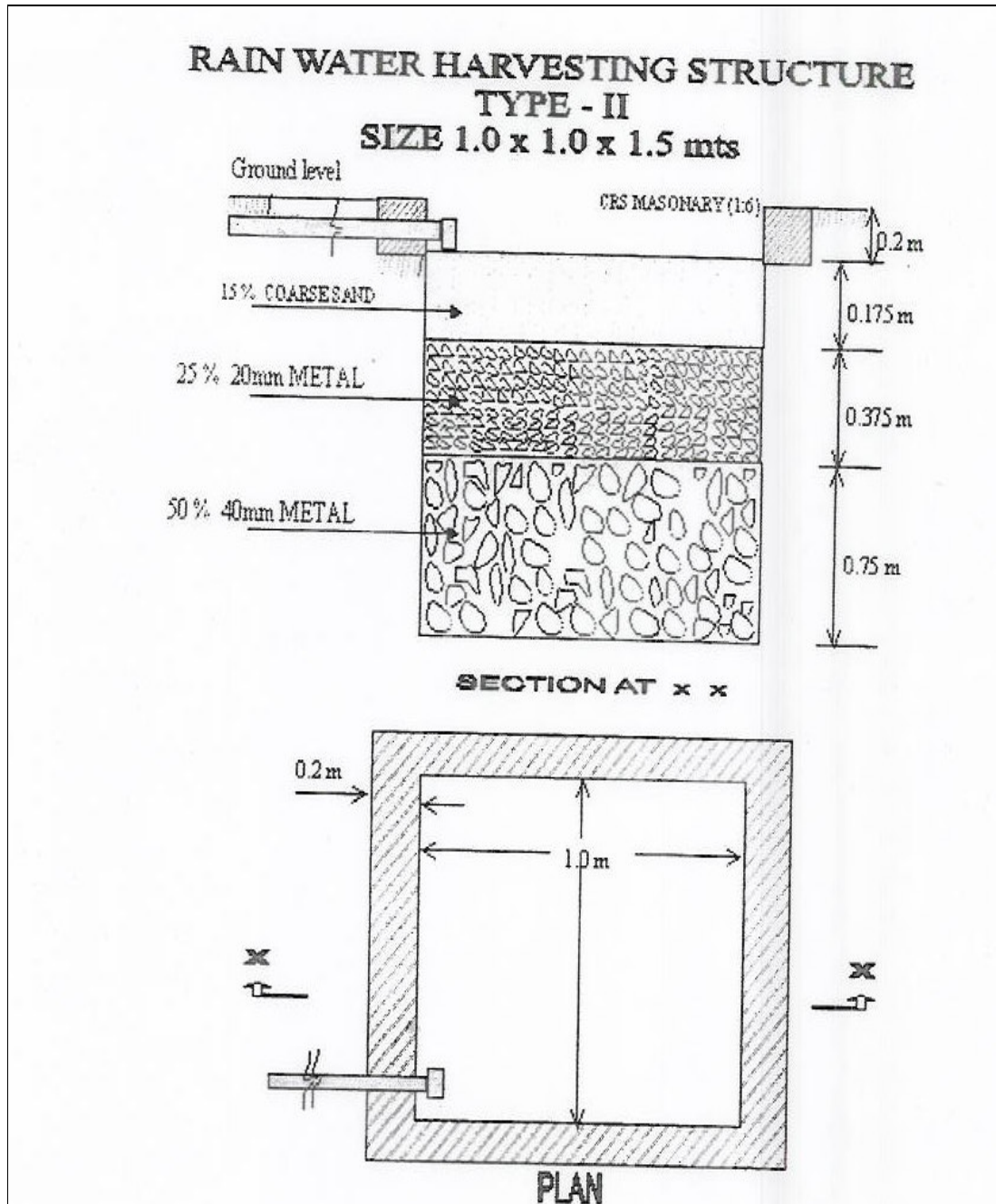
- Rain Water Harvesting is being done in the cement plant, & colony.

- Open drains are made to collect storm water from first order seasonal stream. Rain water harvesting system designs and construction details are given below;

TABLE –8.1.3.1
RAIN WATER HARVESTING SYSTEM DESIGN

S. No.	Volume (m ³)	Description
1.	4.5	Excavation in hard gravelly and all available soil
2.	2.25	65 mm metal
3.	1.25	20 mm metal
4.	0.625	Coarse sand
5.	0.24	CRS masonry in 1:6 prop
6.	4.5	Carting of excavated earth for a lead of 8 km

Source: Project Report



RAIN WATER HARVESTING STRUCTURE

ROOF WATER HARVESTING SCHEME

Sr.no.	Locations	Area of the roof / Ponds (in m2)	Average rainfall per year in mm	Average rainfall per year in meter	Max.Quantity of rain water collected (in m3)	Considering 80% ground water recharge in m3
1	CCR building	3346	927	0.927	3102	2481
2	GCJST Hospital	1032	927	0.927	957	765
3	Shopping complex	669	927	0.927	620	496
4	ABP School	1394	927	0.927	1292	1034
5	Mine office	177	927	0.927	164	131
6	TPP DM plant building	259	927	0.927	240	192
7	TPP raw water pumphouse building	216	927	0.927	200	160
8	TPP STG building	1300	927	0.927	1205	964
9	TPP ESP compressor building	287	927	0.927	266	213
10	Narayan sarover (at Temple)	12500	927	0.927	11588	9270
11	Gandhi sarover (near STP)	15000	927	0.927	13905	11124
12	Hans sarover (near VK colony)	60750	927	0.927	56315	45052
		20000	927	0.927	18540	14832
Total Ground water Recharge per year in m ³						86716

8.1.4 Solid Waste Management

No solid waste is generated in cement manufacturing process.

1. Dust collected from air pollution control equipment is 100% recycled in process.
2. Solid waste in the form of sludge is generated from sewage treatment plant & it is used as manure for green belt development.
3. In the CPP, entire fly ash generated is utilized in cement manufacturing process (PPC). The effluent water generated is recycled back in the process after due treatment.
4. Grasim Industries Limited implements the following measures for solid waste management in cement plant:
 - Maintenance to prevent spillage and leakage.
 - Recycling of the collected spillage.
 - Selling of refractory bricks replaced in kiln.
 - Disposal of solid waste generated from colony and sewage treatment plant.
5. GIL to prevent spillage and leakage implements the following maintenance. The maintenance include inventory for the leakage/spillage, and to investigate and prevent.
 - Holes in bends etc. caused by the abrasive character of the materials.
 - Wear out of bearing houses (in screw conveyors or rotary valve) and leakages from cover joints of screw conveyor.
 - Deterioration of flexible joints flaps and seals.
 - Corrosion etc.
6. Cleaning team of GIL collects spillage to prevent fugitive emissions caused by wind. The collected spillage is recycled back to the process.
7. Dry fly ash is pneumatically loaded into fly ash silo from closed bulkers containing fly ash and wet fly ash is covered by tarpaulin.

8. Solid waste generated from colony is disposed after segregating the waste into biodegradable and non-biodegradable. The sludge generated from STP is utilized as manure for horticulture purpose.

*Same practices will be adopted after the expansion.

The table given below gives the information regarding the composition, storage and end use of solid waste :

TABLE – 8.1.4
SOLID WASTE GENERATED & ITS END USE

S. No.	Type of Waste	End Use / Disposal
1.	Dust collected from air pollution control equipment	100% recycled in process
2.	Sludge is generated from sewage treatment plant	Manure for green belt development
3.	Fly ash from CPP	Utilised in cement manufacturing process for PPC
4.	Solid waste generated from colony	Disposed after segregating the waste into biodegradable and non-biodegradable

Source: Project Report

8.1.5 Energy Conservation Measures

The use of energy for the production of clinker is first of all a design parameter, which means that only with minor changes in the equipment, Grasim Cement has achieved significant energy savings during the past year.

In order to conserve energy, Grasim Cement has installed high efficient Pre-calciner, insulation of kiln and Pre-heater, high efficiency air-separators etc.

Apart from the above Grasim Cement has implemented the following measures.

- Control of fans with frequency converters instead of dampers.
- Minimize sir inlet by leakage control (e.g. kiln seals).
- Minimize the use of compressed air.

The frequent start and stop of the plant results in higher fuel consumption per ton of Clinker. In order to save fuel consumption to heat the Kiln, Pre-calciner and Pre-heater, Grasim Cement is trying to increase the production period as long as possible at higher capacity of the kiln.

Grasim Cement is regularly checking the leakage in the kiln system to reduce higher flue gas flow and also lower energy efficiency of the pre-heater and possibly the grate cooler. Regular checking and adjustment.

Energy saving activities adopted by Grasim Industries Ltd in the last 3 years is as mentioned in the table below:

TABLE – 8.1.6
ENERGY CONSERVATION ACTIVITIES IN LAST 3 YEARS

S. No.	Project description	Achievement of energy savings per year basis			
		Electricity	Fuels*		
		(Lakhs (kWh))	Coal (tonnes)	F.Oil / Diesel (KL)	Total (fuel) in MkCal)
a.	Use of cooler exhaust gas for slag drying.			324.00	
b.	Modification of Cement mill feed circuit to eliminate 2 no. belt conveyor and 1 no. bucket elevator.	4.20			
c.	Installation of variable speed drive for classifier, belt conveyor and reclaimers travel drive.	2.40			
d.	Widening of PC fan inlet duct.		4.00		
e.	False Air Reduction in Coal Mill	1.97			
	Sub total	8.57	4.00	324.00	0.00
f.	Installation of clog bricks from 21 to 40 meter in kiln to reduce thermal energy escape from kiln shell.		345.00		1587
g.	Installation of VFD in	4.11			

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	cooler fan and coal mill booster fan				
h.	Instillation of energy efficient motor with VFD	3.52			
i.	Installation of compressed air optimiser	2.82			
j.	Installation of energy efficient street light	0.76			
k.	Replacement of air cooled condensor with water cooled condensor in AC plant	1.15			
l.	Installation of lub oil recovery system	0.98			
	Sub total	13.34	345.00	0.00	1587.39
m.	VFD in Packer - 1 Bag Filter	2.05			
n.	VFD in Mines dewatering pump	0.82			
	VFD in Kiln feed circuit bag filter, 2 Nos	0.49			
	VFD in Bag filter Clinker feeding Circuit	1.09			
q.	VFD in New cooler fans 4 numbers	10.26			
	Cooler hot air used directly in separator		2925.00		13458
	Sub total	14.72	2925.00	0.00	13458.31
	Grand Total for 3 Yrs	36.63	3274.00	324.00	15045.70

Source: Project Report

8.1.6 Initiatives taken for the abatement of Green House Gases through CDM & CCX Project

Grasim Cement (GC) is the progressive Cement Manufacturing Company of India, operating since 1995. The cost of energy plays a lead role in cement manufacturing to decide the bottom line of business. One the other hand, GC, being ISO-9001, ISO-14001, ISO18001 and SA-8000 certified unit in India is

aware of its environmental responsibilities and therefore is prepared to go out of the way to preserve the environment by reduction in GHG emission. While Electrical and Thermal Energy Conservation is one of the business objectives of GC, it has taken up many measures of energy efficiency for the cause of environmental preservation to reduce the GHG emission. Most of the energy efficiency measures taken by GC are innovative and emerged out of their own in house process study & development. Therefore Grasim Cement has relevant experience of implementation and operation of energy efficiency project and continual upgradation of their plant and technology to reduce GHG emission associated with its activities.

Grasim cement has under taken a CDM Project “Energy efficiency by up-gradation of clinker cooler in cement manufacturing” which is registered in UNFCCC vide registration number 0858 dated 3rd March 2007. The crediting period of 10 years i.e. from 1st Oct 2004 – 30th Sep 2014 with reduction of 15,157 metric tonnes CO₂ equivalent per annum.

8.2 GREENBELT DEVELOPMENT & PLANTATION PROGRAMME

Out of the 388.37 ha (plant + colony area), 212.54 ha is already covered under plantation i. Thus the land has been turned from barren land into green area.

A thick green belt all along the roads, colony and plant has been developed under afforestation program. In order to develop the green belt and afforestation in scientific way, M/s. GIL has setup a horticulture department, which is being headed by an experienced horticulturist.

GIL has social obligation to recreate the environmental status by providing thick canopy cover to suppress fugitive emission and provide aesthetic beauty. Trees form the important part of the biosphere in the Eco-system. The ecological belt maintains the natural balance of the area.

A green belt of tree plantation around the project site of GIL has helped to arrest the particulate matter in the area and hence attenuate the pollution to a great extent.

Details of the plantation done by GIL during the last few years is as mentioned in the table below:

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TABLE-8.2
ACTION PLAN FOR PLANTATION

Location	Details	Plantation Details									Total
		Upto 2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	
Plant Area	No of Plants	81898	5600	24329	8172	4850	21281	0	1600	1926	149656
	Area in hect	71.68	2.24	11.06	3.71	1.94	7.60	0.00	0.50	0.5	99.24
Colony Area	No of Plants	60449	12400	56977	23307	15150	37658	0	1357	1074	208372
	Area in hect	5.00	5.00	25.90	10.59	6.06	12.80	0.00	0.00	0	113.3

Source : Project Report

The following characteristics have been taken into consideration while selecting plant species for green belt development and tree plantation.

- I. They should be fast growing and tall trees.
- II. They should be perennial and evergreen.
- III. They should have thick canopy cover.
- IV. The planting should be in appropriate alternate rows around the site to prevent lateral pollution dispersion.
- V. The trees should maintain regional ecological balance and conform to soil and hydrological conditions. Indigenous species should be preferred.
- VI. Species had been planted as per CPCB guidelines and native species

8.2.1 Guidelines for Green Belt Development

Following guidelines are being followed for the Green Belt Development Plan in the plant and colony area.

- 1) All the barren areas should be vegetated. Areas other than this are having good natural vegetation. Soil and other environment are very encouraging and the expected growth rate should be more than 90%. Saplings are purchased from the local Forest Department and plantation preparation are taken up out before every monsoon. Suitable people having track record in such a field are entrusted with the nursery job and plantation and after care as well.
- 2) Trees growing to a height of 5m or more should be planted.
- 3) Plantation of trees should be undertaken in around the area in alternating rows to prevent horizontal pollution dispersion.
- 4) Trees should be planted along roadsides, to arrest auto-exhaust and noise pollution, and in such a way that there is no direct line of sight to the installation when viewed from a point outside the foliage perimeter.

- 5) Since tree trunks are normally devoid of foliage (upto 3 m), it should be appropriate to have shrubbery in form of such trees to give coverage to this portion.
- 6) Fast growing trees with thick perennial foliage should be grown, as it will take many years for trees to grow to their full height.

In order to facilitate the proper growth of vegetation, limited measures involving preparation of seedbed with suitable amount of fertilizers and treatment with mulches are taken. The topsoil should be used for green belt development.

Vegetation covers in and around the plant workings generally helps in:

- ✚ Stabilizing erodible slopes to minimize pollution.
- ✚ Control of dust.
- ✚ Enhancement of aesthetic value.
- ✚ Maximizing evapo -transpiration, which helps minimizing run off.
- ✚ Reducing noise.

8.2.2 Baseline Data & Potential Impacts of the Study Area

The flora and fauna of an area shows a certain affinity to the existing environmental setting. Due to the proposed facility, there could probably be a change in the environmental surroundings for a short duration due to the construction phase and for a long term due to the operation of the project activities. Thus, in order to predict the ecological impacts from the project site, it is necessary to detail the baseline data.

As the project site lies in tehsil Simga, the flora and fauna of region has been used as the baseline data.

The potential impacts on the ecology of the study area are discussed below:

1. As no wastewater from the plant site is discharged outside the GIL premises, there is no impact as the ecology of the study area due to wastewater, which is generated.

2. The flora and fauna of the area could be disturbed if the various air pollutants discharged from the facility would not be maintained within specified permissible limits. However, various air pollution control equipment such as the Bag filters / Bag houses, ESP etc. has been provided. Other emissions such as Suspended Particulate Matter, Sulphur Dioxide and Nitrogen Oxides are kept below the prescribed permissible limits. Thus, the potential impact of air emission can be rated as marginal impact.

GIL has adopted adequate pollution reduction measures for water, air and solid waste for effective protection of the environment. Thus, it could be said that the potential impact of solid wastes is insignificant.

Moreover, the proposed green belt helps in reducing the adverse impacts further if any.

8.2.3 Management & Organization

The natural vegetation of the area is represented by plant species, which are able to subsist and regenerate under poor moisture and soil conditions.

The authorities of GIL show concern greatly for the green belt formation. A wide belt of green trees has been planted which has helped in preventing the fugitive emissions.

In order to facilitate the greenbelt activities, a nursery has been developed in the area;

The following plant species has been planted according to CPCB guidelines:

TABLE – 8.2.3
PLANTS SPECIES PLANTED IN THE PLANT AS WELL AS COLONY AREA

S. No.	NAME OF THE PLANTS
Forestry Plant	
1.	Teak
2.	Sisoo
3.	Karanga
4.	Peltaform

5.	Casia siamia
6.	Kadamba
7.	Nilgiri
8.	Gliricidia
9.	Bahunia
10.	<i>Accasia auriculiformis</i>
11.	Kaner
12.	Subabool
13.	Amaltas
14.	Ashok
15.	Bamboo
16.	Casurina
17.	Champa
18.	Gulmohar
19.	Neem
20.	Rain tree
21.	Alasthomia
22.	Sirasa
Fruits	
23.	Mango
24.	Guava
25.	Lemon
26.	Musambi
27.	Awala
28.	Bel
29.	Anar
30.	Ber
C-bio diesel plants	
31.	<i>Jetropa curcus</i>

8.3 OCCUPATIONAL HEALTH AND SAFETY MEASURES

To control and minimize the risks at workplace, GIL has implemented Health, Safety and Environment Policy with the following objectives:

- To prevent hazards
- To provide safe and healthy environment to all the employees.

The company, therefore, has adopted the policy set below for the purpose of creating and maintaining safe and healthy environment.

8.3.1 Health and Safety Policy

- Health, Safety and Environmental Protection (HSE) has been the part of GIL's commitment to conduct the activities in harmony with society and nature and without compromising on the health and safety.
- GIL has integrated Health, Safety and Environment Protection into the business strategies to add value to the enterprise, to manage risk and to enhance the reputation.
- The health and safety of the employees, neighbors, customers and consumers, and the protection of the environment has been the company's' priorities consistently pursued throughout.
- GIL has taken HSE into account in all business decisions and activities. GIL has complied with all relevant statutory requirements in the area of Health, Safety and Environment.
- Each employee is made to comply with the HSE guidelines and the laws applicable to her or his area of operational responsibility.

8.3.2 Rules and Procedures

The Rules and procedures for effective implementation of safety and health policy of the company has been drawn out and also made known to all employees.

8.3.3 Safety Committee

A safety committee has been formed and manned by equal participation from management and workers with the following functions:

- a) Accident prevention and control including ensuring the use of safety appliances.
- b) Publicity, propaganda, education and training.
- c) Assisting and cooperating with the management in achieving the aims and objectives outlined in the "Health and Safety Policy" of the occupier.

- d) Carrying out health and safety surveys for identifying unsafe working conditions/practices, which causes accident.

8.3.4 Medical Facilities

Necessary care will be taken to provide health and safety aids to the villagers around the project area, Mobile clinical van has also been provided to render the necessary clinical facilities at villages. A fully fledged dispensary is available in the plant premises, which extends all sort of medical services and free of cost medicines to employee as well as to all the villagers. This dispensary is well equipped. The company had employed full time doctors and adequate number of paramedical staff.

The medical facility is adequately manned by doctors and paramedical staff to provide round the clock services in case of any emergency.

- The hospital is having all infrastructure facilities to perform minor surgical procedures like fracture, stitches and foreign body removal from eye, nose, ear, burns and electrical injury.
- GIL hospital has been provided with an ambulance to bring the patients to hospital in emergency.

8.3.5 Medicines and Equipments at the Medical Centre

Injection – Morphine, Pathidine, Fortwin, Betnesol, Coramine, Atropine, Tetanus Toxoid mixtures for treatment of common ailments. Sterilized dressing materials, general surgical instruments, blood pressure measuring instrument and oxygen cylinders etc

8.3.6 First Aid Boxes

First aid boxes has been provided at prominent places with following items:

- a) Small size sterilized dressing.
- b) Medium size sterilized dressing.
- c) Large size sterilized dressing.
- d) Burnol Ointment.
- e) Sterilized cotton wool.

- f) Bottle (120 ml) of cetramide solution (1%) of suitable antiseptic solution.
- g) Bottle (120 ml) of Mercurochrome solution (in 2% water).
- h) Pair of scissors.
- i) Rolls of adhesive plaster (2cm x 1 m).
- j) Sterilized eye pads in separate sealed packets.
- k) Aspirin tablets.
- l) Potassium Permanganate crystals.

Locations where First Aid Boxes will be kept are given below:

TABLE-8.3.6
LOCATION OF FIRST AID BOXES

S.No.	LOCATION	S.No.	LOCATION
1.	Raw Mill	2.	Instrumentation Office
3.	Coal Mill	4.	Stores
5.	Kiln & Cooler	6.	Canteen
7.	Cement Mill	8.	Safety Office
9.	Packing Plant	10.	Emergency Control Room
11.	DG Plant	12.	Fire Brigade
13.	Electrical Office	14.	Personnel/Time Office

8.3.7 Major Health and Safety Measures / Activities Taken By Gil Management

- Treated all the TB patients and eliminated the chances
- Ensured Pulse-polio vaccination to all the eligible kids
- Minimized the cataract patients in the area
- Increased awareness of people on Family Planning drive
- Hepatitis-B vaccination to all the eligible kids of near by villages
- Increased awareness level of the people on HIV/AIDS
- Family Planning Camps
- Medical facilities to villagers

- Cataract Operations,
- Health Awareness Programmes and Surgical Camps (Eye Camps, Cleft Lips Correction Camps, Dental Camps, Pulse Polio Camps, Etc.)
- Regular medical check up of all the workers is being done and the patients are given the treatment. Medical check up reports of the workers for last years has been attached as **Annexure-6** in this reference.

GIL management has decided to invest **Rs 6,75,000** during the year 2009-10 towards health and safety measures.

8.4 COMPLIANCE OF CREP CHARTER BY M/s GRASIM INDUSTRIES LIMITED

GIL has implemented the following measures as per CREP Guidelines:

- 1) To comply with notified standards.
 - a. Augmentation of existing Air Pollution Control Devices.
 - b. Replacement of existing Air Pollution Control Devices.
- 2) To maintain stack emission norms 50 mg/Nm^3 for all the stacks.
- 3) Cement Plant meets the limit of 50 mg/Nm^3 for particulate matter emissions for all the stacks.
- 4) The cement plant have emission monitoring arrangement of SO_2 and NO_x . GIL will complies with emission norms of SO_2 and NO_x decided by CPCB.
- 5) The cement have fugitive control arrangement from all the sections such as unloading, material handling, transfer points, coal yard section, clinker storage section, storage of limestone, gypsum, fly ash, additives, cement packing section and silo section by putting these facilities in closed conduit and installation of bag filters.
- 6) All the guidelines of CPCB are being followed for fugitive emission management.

- 7) There are arrangement for use of petroleum coke in kiln of cement plant.
- 8) In the cement plant there is on line continuous monitoring system in major stacks.
- 9) In the cement plant state of art technology bag house has been installed in the kiln circuit, therefore there is no tripping.
- 10) Cement Plant have arrangement for maximum fly ash utilization and all the dust collected from pollution control equipment is 100% recycled back in the process.
- 11) The Grasim Industries Ltd has implemented the utilization of hazardous waste, which has high calorific value as fuel, in kiln.
- 12) Feasibility study has been carried out after commissioning and studying the flue gas characteristics.

8.5 IMPLEMENTATION OF EMP AND MONITORING PROGRAMME

8.5.1 Environmental Management Cell

In order to maintain the environmental quality within the standards, regular monitoring of various environmental components is necessary. GIL has a full-fledged Environmental Management Cell (EMC) for environmental monitoring and control. The EMC team takes care of pollution monitoring aspects and implementation of control measures.

A group of qualified and efficient engineers with technicians are deputed for maintenance, up keeping and monitoring the pollution control equipment, to keep them in working at the best of their efficiencies.

8.5.2 Environmental Monitoring

Monitoring of various environmental parameters has been carried out on a regular basis to ascertain the following:

- State of Pollution within the project site and in its vicinity.
- Generate data for predictive or corrective purpose in respect of pollution.

- Examine the efficiency of pollution control system installed in the cement plant.
- To assess environmental impacts.

GIL undertakes monitoring in the cement plant as per the norms of SPCB and CPCB. The various environmental components and pollution sources, which are monitored under Environmental monitoring programme, stack emission, ambient air quality, and liquid effluent and noise levels. Details of the Environmental Monitoring programme, which had been undertaken by GIL for various environmental components is detailed below:

8.5.2.1 Meteorology

A meteorological station had been installed on the proposed site for recording of meteorological parameters. In addition, minimum and maximum temperatures, atmospheric pressure, rainfall and humidity are also being measured daily as per the guidelines of Central Pollution Control Board (CPCB).

8.5.2.2 Ambient Air Quality

To determine the extent to which the cement plant contributes to pollution in the area, a network of ground level monitoring stations for monitoring of various parameters along with the stack monitoring will be carried out.

Pollution control equipment like Bag filters; Bag Houses, ESP's etc. had been installed.

Ambient air quality is monitored twice a week for Suspended Particulate Matter, RSPM, SO₂, and NO_x.

The pollution control equipment had been designed to maintain the emission levels of dust particles within the permissible level.

8.5.2.3 Water Quality

Treated wastewater quality at the outlet of Sewage treatment plant is analyzed for parameters, such as pH, Total Dissolved Solids, Suspended Solids, Dissolved Oxygen, Bio-Chemical Oxygen Demand, Chemical oxygen demand, Oil and Greases, to assess the quality of water for use in plantation / gardening.

8.5.2.4 Noise Environment

Noise levels are being monitored for day and nighttime at plant area and nearby villages on regular basis.

8.6 CONCLUSION

As discussed, it is safe to say that the project will not likely to cause any significant impact on the ecology of the area, as adequate preventive measures will be adopted to contain the various pollutants within permissible limits. Green belt development around the area would also be taken up as an effective pollution mitigative technique, as well as to control the pollutants released from the premises of GIL.



CHAPTER-IX

SUMMARY & CONCLUSION

9.1 INTRODUCTION

The applicant M/s Grasim Industries Limited is a flagship company of Aditya Birla Group having business interest in Cement manufacturing, Viscose Staple Fibre, Sponge Iron, Textiles, Software Services etc. Cement manufacturing is core business of the Group and contributes to about 50% of the Groups turnover and is well experienced in cement manufacture with large capacity cement plants already running successfully in various parts of the country.

M/s Grasim Cement has an existing Cement Plant Complex comprising of Cement Plant, Captive Thermal Power Plant & Limestone Mine (ML area: 722.834ha) at village Rawan, Tehsil Simga, District Raipur (C.G.)

Grasim management is proposing for a Brown Field Integrated Cement Project in the existing Cement Plant premises by expansion in Cement production capacity from 3.3 MTPA to 6.5 MTPA, Clinker from 2.1 MTPA to 6.5 MTPA, Captive Power Plant from 30 MW to 80 MW & D.G. Set 12 MW (2x6 MW) at village Rawan, Tehsil Simga, District Raipur (C.G.).

The project was considered in front of Expert Appraisal Committee (EAC) (Industry-1) for its First technical presentation on 24th September, 2009. The Terms of References (ToR) letter has been issued by MoEF, New Delhi for preparation of the EIA/ EMP Report vide File No. J-11011/262/2009-IA.II (I) & Letter dated 9th October, 2009.

As per the New EIA Notification dated 14.09.2006, this project falls in category 'A'.

9.2 JUSTIFICATION FOR THE PROJECT

The following points show the justification for the implementation of the project:

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- Proposed Brown Field Integrated Project activity shall be within the existing cement plant premises.
- No additional land is required for the proposed project.
- Emissions for existing Cement Plant & CPP are maintained <100 mg/Nm³ as per Environmental Clearance conditions.
- Emissions for proposed Cement Plant (<50 mg/Nm³) and CPP (<100 mg/Nm³) will be maintained, as per guidelines.
- CREP guidelines for Cement production are being followed.
- CPCB guidelines for fugitive emissions are being followed.
- 55 % of the total Plant & Colony area has been covered under plantation.
- No forest land is involved.
- No R & R plan is involved.
- No court case/ litigation is pending against this project.
- No National Park, Biosphere Reserve, Wild Life Sanctuary, Reserve Forest, Protected Forest within the study area.
- There is not any kind of major pollution due to the project activity, as the project is being implemented with environment friendly technology
- For the manufacturing of cement dry process technology is being adopted, therefore wastewater generation is negligible from the process
- No solid waste is generated from the cement manufacturing process
- Better maintenance and installation of proper pollution control equipment like Bag Houses, Bag filters and ESP has helped in reducing such emissions
- Proper care has been taken by incorporating sound-proof enclosures for equipments and providing earmuffs and earplugs for operators.

9.3 DETAILS ABOUT THE PROJECT

TABLE – 9.3
PROJECT DETAILS

S.No.	Particulars	Details
1.	Location	
	A. Village	Rawan
	B. Tehsil	Simga
	C. District	Raipur
	D. State	Chhattigarh
2.	Latitude	21° 33'39.89" – 21° 34'56.55" N
3.	Longitude	82° 00'42.89" – 82° 01'56.62"E
4.	Toposheet No.	64 G/14 & 64 K/2
5.	General ground level	276 mRL
Project Detail		
6.	Project Cost	Rs. 950 Crores
7.	Cost of Environmental Protection measures	Rs. 100 Crores
8.	Recurring cost of Environmental Protection measures	Rs. 05 Crores
9.	Area Details (Plant & Colony)	388.37 ha
10.	Green belt Area	~212.54 ha
11.	Total Power Requirement	80 MW [Source: Captive Power Plant (Existing & Proposed)]
12.	Total Water Requirement	3962 KLD [Source: Mine Sump Water & existing Bore Well]
13.	Total Man Power Requirement	565
Climatology (Winter Season: December 2009 to February 2010)		
14.	A. Temperature	23.6 ° C – 42.1° C
	B. Relative Humidity	36% to 97%
	At 8:30 hrs. At 17:30 hrs.	23% to 80%
15.	Dominant Wind Direction	From NE
Project Site Vicinity Details		
16.	Nearest National Highway	NH-6 (70 km)
17.	Nearest Railway Station	Bhatapara (17 km)
18.	Nearest Town	Raipur (85 km)
19.	Nearest Airport	Raipur (85 km)

Proposed Brown Field Integrated Cement Project: Cement Plant, Captive Power Plant & D.G. Set At Village Rawan, Tehsil Simga, District Raipur (Chattisgarh)	Draft EIA/EMP Report
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20.	Ecological Sensitive Areas (National Park, Wild Life Sanctuaries, Biosphere Reserves, Reserved / Protected Forest etc.)	No National Park, Wild Life Sanctuaries, Biosphere Reserves, Protected Forests falls in the 10 km radius study area. Dhabhadih Reserve Forest exists at a distance of ~ 7 km from the plant boundary.
21.	Nearest Water Body	Mahanadi Canal (500 m)
22.	Seismic Zone	Zone – II

9.4 MANUFACTURING PROCESS

- The cement plant will adopt Dry Process Technology for Cement manufacturing with Pre Heating and Pre Calcliner Technology.
- The type of cement will be manufactured are Ordinary Portland Cement (OPC), Pozzolona Portland Cement (PPC), Portland Slag Cement (PSC).
- The process largely comprises of :
 - Crushing the Limestone
 - Raw Mix preparation
 - Raw mix homogenization
 - Coal preparation
 - Calcination & Clinkerisation
 - Cement Grinding
 - Packing & Dispatch

9.5 MITIGATION MEASURES

9.5.1 Air Environment

- To control air emission in Cement Plant & CPP highly efficient ESPs / bag filters will be installed at various stages of the process.
- To control the dust emission from transfer points of the belt and bucket conveyors, bag filters will be provided at various locations of the transfer points.
- Greenbelt development will be further enhanced around the plant premises.

- CPCB guidelines will be followed to control fugitive emissions.
- Limestone will be transported via covered conveyor belts to the plant site.
- Dust suppression/ dust extraction systems with bag filters along with water sprinklers will be provided to prevent the fugitive dust emissions.
- All the above measures are being followed in the existing plant process also.

9.5.2 Water Environment

- No industrial waste water is generated during plant operation.
- In Cement Plant process, water is absorbed in the process or it is subjected to evaporation, hence no wastewater generation.
- The wastewater generated from the CPP is recycled back to the process and used for cooling and dust suppression.
- Domestic waste water generated from the colony will be treated in STP and used for green belt development / Horticulture purpose.
- Air cooled condenser is used in Thermal Power Plant to reduce water requirement.
- During monsoon, rain water harvesting is being practiced at plant and colony area.

9.5.3 Noise Environment

- Walls and ceilings of the concerned buildings are lined with sound absorbing materials.
- Properly insulated enclosures are provided to staff working close to the high noise sources.
- Personal Protective Equipments like earplugs and earmuffs are provided to the workers exposed to high noise level.
- Sufficient green belt within the plant and colony area has already been developed and maintained.

- Regular monitoring of noise level has been carried out and corrective measures in concerned machinery will be adopted accordingly to the possible extent, as also done in the existing plant operation.
- Silencers have also been provided in the D.G. Sets.
- Well developed greenbelt has already been developed which attenuates the noise produced from the plant operation.

9.5.4 Solid Waste Management

- No solid waste is generated in cement manufacturing process.
- Fly ash generated from Captive Power Plant (Existing + Proposed) is utilized in the manufacturing of Cement.
- Dust collected from air pollution control equipment is 100% recycled in process.
- Sludge from Sewage Treatment Plant (STP) is used as manure for green belt development.

9.5.5 Greenbelt Development

- Since the inception of the plant Grasim Cement has taken up massive green belt development plan. Saplings have been planted in the plant, colony and mining area.
- Out of the 388.37 ha (plant + colony area), 212.54 ha is already covered under plantation.
- Avenue plantation along the roads, and green belt development in the colony, mines and plant has been developed under afforestation program.
- In order to develop the green belt and afforestation in scientific way, Grasim Cement has setup a horticulture department, which is headed by an experienced horticulturist.
- Local species has been planted as per guidelines.

9.6 CONCLUSION

As discussed, it is safe to say that the project is not likely to cause any significant impact on the ecology of the area, as adequate preventive measures will be adopted to contain the various pollutants within permissible limits. Green belt development around the area would also be taken up as an effective pollution mitigative technique, as well as to control the pollutants released from the premises of GIL.



CHAPTER-X

DISCLOSURE OF CONSULTANTS ENGAGED

10.1 DISCLOSURE OF CONSULTANTS ENGAGED

J.M. EnviroNet Pvt. Ltd. (JMEPL) was established in the year 1993. 'JM' in the name of the Company is derived from the name of 'Lord Shiva' - the Temple of 'Jharkhand Mahadev' (JM). The Temple is located at Queens Road, Vaishali Nagar, Jaipur.

The Registered office of JMEPL is at 7-CH-10, Jawahar Nagar, Jaipur. Its Delhi-NCR Corporate office is at SCO-16, Sector 10A, Gurgaon (Haryana). JMEPL has a Branch office at Goa also.

J.M. EnviroNet Pvt. Ltd. is accredited with ISO-9001: 2000 for EIA Division. The Company has its own Environmental Laboratory at Gurgaon (Haryana) approved under EPA (Environment Protection Act) From the Ministry of Environment & Forests, Govt. of India, New Delhi vide notification No.865E dated 11.04.2008 published in the Gazette of India dated 11.04.2008. The EIA Division is also approved by National Registration Board for Personnel & Training (NRBPT) (Quality Council of India) with Registration No. EIA 81 004. The Environmental Laboratory is also approved by the National Accreditation Board for Testing and Calibration Laboratories, Govt. of India (NABL) (Registration No.NABL-T-1327), as also ISO-17025: 2005.

The Company's work has spread over in 20 States viz.:- Andhra Pradesh, Kerala, Gujarat, Maharashtra, Orissa, Tamil Nadu, Goa, Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Assam, West Bengal. Karnataka & Uttarakhand.

JMEPL is offering Environmental Consultancy Services in various sectors viz Industrial Projects / Chemical Industries / Cement Plants / Thermal Power Plants / Mining Projects / Real Estate Projects / Distilleries / Steel Plants etc.

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In the Mining sector, JMEPL is covering mines of minerals viz. Limestone, Bauxite, Chromite, Coal, Zinc, Copper, Gypsum, Soapstone, Iron & Manganese ore, Clay, Silica Sand, Feldspar, Quartz etc.

Besides this, its MoEF and NABL approved Environmental Laboratory at Gurgaon is also providing Analytical Laboratory Services of various elements and environmental parameters.

Annual monitoring as per MoEF / CPCB / SPCB guidelines, Risk Assessment and Disaster Management Plan, consultancy for Rain Water Harvesting Plan, detailed Hydro-geological Study for major mining projects, preparation of Environmental Statement Reports (Environmental Clearance Compliance Conditions), etc. are amongst the various other consultancy services offered by the Company.

JMEPL has a highly qualified team of Subject Experts. As Faculty Heads of the EIA Division we have Retd. General Managers of the Reputed Cement Companies, Ex-Head EIA Division of big Business Group, STP & ETP designing experts, Retd. Mining and Geology Experts with vast experience in their respective fields.



LIST OF ANNEXURES

Annexure 1	Point wise compliance to the specific & general conditions stipulated in the Environmental Clearance for the existing Cement Plant
Annexure 2	Point wise compliance to the specific & general conditions stipulated in the Environmental Clearance for the existing Captive Power Plant
Annexure 3	Documents of land Purchase
Annexure 4	No Objection Certificate from the Forest Divisional Officer Raipur, Chhattisgarh
Annexure 5	Hourly wind speed & wind direction
Annexure 6	Occupational Health Reports
Annexure 7	Detail Ambient Air Quality Monitoring Tables
Annexure 8	CGWA Permission for Ground Water withdrawal 3

Grasim Cement: Rawan Apr'09 to Sep'09

Compliance status of the specific conditions imposed in the Environmental Clearance for Expansion of cement plant (3.0 MTPA to 3.3 MTPA) and clinker production (1.725 MTPA to 2.10 MTPA) at village Rawan, Tehsil Simga, District Raipur, Chhattisgarh by M/s Grasim Cement Ltd. as per the F.No.J-11011/628/2008-IA II (I) dated 22.09.2008 by Government of India, MoEF, (I.A.Division)

Sr.	Specific Conditions	Compliance status
i	Electrostatic precipitators (ESPs) installed at raw mill / kiln, coal mill, clinker cooler and cement mill and bag filters provided at appropriate places in the cement grinding mill shall be properly maintained and operated to control gaseous emissions within 100 mg/Nm ³ . All the devices in raw mill/kiln, kiln feeding system, clinker cooler, coal mill, cement mill and cement silo shall be interlocked. Continuous stack monitoring facilities for all the stacks and adequate air pollution control systems shall be provided and data submitted to the Ministry's Regional office at Bhopal half yearly, CPCB and CECB quarterly.	ESP & Bag Filters provided in the plant are of the high efficiency & higher capacities for controlling the emission and competent maintenance team do the regular maintenance of all the pollution control equipments and particulate matter emission is well within 100 mg/Nm ³ . Opacity meter for online stack monitoring is installed at Kiln/raw mill, coal mill and cement mill ESP stacks. Stack monitoring data for Apr'09 to Sep'09 is enclosed as per Annexure-1 The stack monitoring data is sent to CPCB quarterly and CECB monthly.
ii	The gaseous emissions (SPM, SO ₂ , Nox, CO) and particulate matter from various units shall conform to the standards prescribed by the Chhattisgarh	We are regularly monitoring the particulate matter emission from various units which is well

Sr.	Specific Conditions	Compliance status
	Environment Conservation Board (C.E.C.B.). At no time, particulate emissions from the cement plant shall exceed 100 mg/Nm ³ . Interlocking facility shall be provided in the pollution control equipment so that in the event of the pollution control equipment not working, the respective unit (s) is shut down automatically.	below 100 mg/Nm ³ . The interlocking arrangement have been provided in such manner that in case of power failure of control equipment, the power supply for production unit get automatically shutt-off.
iii	Ambient air quality monitoring stations shall be set up as per statutory requirement in consultation with the Chhattisgarh Environment Conservation Board (CECB). Ambient air quality monitoring stations (AAQMS) shall be set up in the downwind direction as well as where maximum ground level concentration of SPM, SO ₂ , and NO _x are anticipated as per statutory requirement in consultation with the Chhattisgarh Environment Conservation Board (CECB). Ambient air emissions shall not exceed the standards stipulated under EPA or by the State authorities. Monitoring of ambient air quality shall be carried out regularly in consultation with CECB and data submitted to the Ministry's Regional office at Bhopal half-yearly, CPCB and CECB quarterly.	We are regularly monitoring the ambient air quality within the factory premises which is well below the norms. The ambient air monitoring data for Apr'09 to Sep'09 is enclosed as per Annexure-2. The ambient air monitoring data is sent to CPCB quarterly and CECB monthly.
iv	Secondary fugitive emissions shall be controlled and shall be within the prescribed limits and regularly monitored. Guidelines / code of practice issued by the CPCB in this regard shall be followed. The fugitive emissions during loading and unloading should be suitably controlled by installing adequate dust collection and extraction system and at all the transfer points. Fugitive emission shall also be controlled by proving silos and closed roof	Fugitive emission is controlled and monitored as per the CPCB guidelines. Water sprinkling arrangement is provided on the belt conveyors. We are storing most of the raw materials / products in silos / covered roof shed. Water sprinkler is provided around the

Sr.	Specific Conditions	Compliance status
	sheds for raw materials and product. Water sprinkling arrangement shall be made in the raw material stock yard and cement bag loading areas to prevent fugitive emissions.	coal stock yard to suppress dust emission during loading / unloading. Bag filters are provided at suitable locations to control the fugitive emission.
v	Total water requirement from mine pit and bore wells shall not exceed 242 m ³ /day. All the effluent shall be treated and used for ash handling, dust suppression and green belt development. No effluent shall be discharged outside the factory premises and 'zero' discharge shall be strictly followed. Domestic waste water shall be treated in sewage treatment plant (STP) and used for green belt development.	It is ensured. The domestic waste water is treated in the STP and treated water is used for horticulture.
vi	Total surface/ground/mine pit water requirement for the expansion shall not exceed 242 m ³ /day and prior permission shall be obtained from the concerned department and the copy of permission shall be submitted to the Ministry's Regional office at Bhopal.	The total water consumption required for expansion is well below the 242m ³ /day. We have obtained permission to withdraw 1500KL/day ground water from CGWA. A copy of the permission letter is enclosed.
vii	All the cement dust collected from pollution control devices like bag house, bag filters etc. shall be recycled and reused in the process and used for cement manufacturing. STP sludge shall be used as manure. Waste oil shall be sold to authorized recyclers / re-processors only.	All the materials collected through the pollution control equipments like bag filters, bag house, ESP are recycled back to the respective storage silos. STP sludge is used as manure. Used oil/Waste oil is sold to MoEF/CPCB approved vendors.

Sr.	Specific Conditions	Compliance status
viii	Fly ash and slag shall be used maximum in the production of Pozzolana Portland Cement (PPC) and Portland Slag Cement.	We are using maximum fly ash and slag in the production of Portland Pozzolana Cement (PPC) and Portland Slag Cement.
ix	Green belt already developed in 54.6% area in and around the project site shall be properly maintained and further efforts shall be made to enhance green cover to reduce impact of fugitive emissions as per Central Pollution Control Board (CPCB) guidelines in consultation with DFO.	The plantation work for developing green belt around the factory has been taken up as a continuous process. Further greenbelt of broad leaf local species approved by DFO will be developed all along the periphery of the plant premises and open space.
Sr.	Specific Conditions	Compliance status
x	Other necessary statutory clearances from the concerned Departments including 'No Objection Certificate' from the Chhattisgarh Environment Conservation Board (CECB) shall be obtained prior to commencement of construction and / or Operation.	The Air and water Consent to Operate obtained from CECB.
xi	All the recommendations mentioned in the Corporate Responsibility for Environment Protection (CREP) guidelines shall be followed and implemented.	It is ensured.

B) General Conditions:

Sr. no.	General Conditions	Compliance status
i	The project authorities must strictly adhere to the stipulations made by the Chhattisgarh Environment Conservation Board (CECB) and the State Government.	It is ensured.
ii	No further expansion or modifications in the plant should be carried out without prior approval of the Ministry of Environment and Forests.	Agreed
iii	The gaseous and particulate matter emissions from various units shall conform to the standards prescribed by the Chhattisgarh Environment Conservation Board (CECB). At no time, the particulate emissions from the cement plant shall exceed 100 mg/Nm ³ . Continuous on-line stack monitoring facilities for all the stacks and adequate air pollution control systems shall be provided and data shall be submitted to the CECB and CPCB regularly. Interlocking facility shall be provided in the pollution control equipments so that in the event of the pollution control equipments not working, the respective unit(s) is shut down automatically.	The particulate matter emission from various units is maintained as per the CECB stipulated standards. Opacity meter is installed at Kiln/RM, Coal mill and cement mill ESP stacks. The interlocking arrangement have been provided in such manner that in case of power failure of control equipment, the power supply for production unit get automatically shutt-off.
iv	Ambient air quality including ambient noise levels shall not exceed the standards stipulated under EPA or by the State authorities. At least four ambient air quality monitoring stations should be established in the downward direction as well as where maximum ground level concentration of SPM, SO ₂ and NO _x are anticipated in consultation with the CECB. One ambient air quality monitoring station shall be installed in downwind direction. Monitoring of ambient air	Ambient air quality and ambient noise level is regularly monitored and data is regularly sent to CECB/ Ministry Regional Office at Bhopal/CPCB

Sr. no.	General Conditions	Compliance status
	quality and stack emissions shall be carried out regularly in consultation with CECB and report shall be regularly submitted to this Ministry including its Regional Office at Bhopal and the CECB / CPCB once in six months.	
v	The company shall provide adequate dust collection and extraction system to control fugitive dust emissions at various transfer points, raw mill handling (unloading, conveying, transporting, stacking), vehicular movement, bagging and packing areas etc. Asphalting / concreting of roads and water spray all around the coal stockpiles shall be carried out to control fugitive emissions.	Fugitive emission is controlled and monitored as per the CPCB guidelines. Water sprinkling arrangement is provided on the belt conveyors. We are storing most of the raw materials / products in silos / covered roof shed. Water sprinkler is provided around the coal stock yard to suppress dust emission during loading / unloading. Bag filters are provided at suitable locations to control the fugitive emission.
vi	Secondary fugitive emissions shall be controlled and shall be maintained within the prescribed limits and regularly monitored. Guidelines / Code of Practice issued by the CPCB in this regard shall be followed.	Secondary fugitive emission is regularly monitored and is maintained below prescribed limit.
vii	Industrial waste water shall be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19 th May, 1993 and 31 st December, 1993 or as amended from time to time. The treated waste water shall be utilized for plantation	There is no generation of industrial waste water as the cement plant is dry process, and the water is used for only cooling purpose.

Sr. no.	General Conditions	Compliance status
	purpose.	
viii	The overall noise levels in and around the plant area shall be kept well within the standards (85dBA) by providing noise generation. The ambient noise levels should conform to the standards prescribed under EPA Rules, 1989 vis. 75 dBA (day time) and 70 dBA (night time).	The noise level in and around plant area shall be maintained below 85 dB(A). The ambient noise is maintained below prescribed norms.
Ix	The company shall harvest the rainwater from the roof tops and storm water drains to recharge the ground water. The company must also collect rain water in the mined out pits and use the same water for the various activities of of the project to conserve fresh water.	The rain water harvesting system is installed and the rain water is stored in the captive mine sump, which is utilized for industrial cooling purpose.
x	All the recommendations of the CREP guidelines shall be strictly followed	It is followed.
xi	The project proponent shall also comply with all the environmental protection measures and safeguards recommended in the EIA / EMP report.	It is ensured.
xii	The company must undertake socio-economic development activities in the surrounding villages like community development programmes, educational programmes, drinking water supply and health care etc.	The socio-economic development activities in the surrounding villages are regularly taken up like community development program, educational programs etc.
xiii	As proposed, Rs.60.50 crores and Rs.2.00 crores shall be allocated towards capital and recurring cost / annum for environmental protection measures to implement the conditions stipulated by the Ministry of Environment and Forests as well as the State	The fund allotted for the environment protection measures is not diverted for any other purposes.

Sr. no.	General Conditions	Compliance status
	Government and an implementation schedule for implementing all the conditions stipulated herein shall be submitted to the Regional Office of this Ministry at Bhopal. The funds so provided shall not be diverted for any other purpose.	
xiv	The Regional Office of this Ministry at Bhopal / CPCB / CECB will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation shall be submitted to them regularly.	Half yearly compliance report and monitoring data is being sent to MoEF regional office/CPCB/CECB.
xv	The project proponent shall inform the public that the project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with the CECB / Committee and may also be seen at Website of the Ministry of Environment and Forests at http://envfor.nic.in . This shall be advertised within seven days from the date of issue of the clearance letter, at least in two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned and a copy of the same should be forwarded to the Regional Office at Bhopal.	Advertisement of Environment Clearance had been done in two local newspapers.
xvi	Project authorities shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the date of commencing the land development work.	It is complied.

Grasim Cement: Rawan

Compliance of Terms and conditions laid down by CECB vide letter no. 3789/TS/CECB/2006 Raipur dated: 28.07.2006 in NOC of Thermal Power Plant.

Sr.	Terms and Conditions	Status / Responsibility															
1	<p>Adequate facility for proper treatment of industrial and domestic effluent shall be provided before commissioning of the plant. In case of any failure of effluent treatment plant, it shall be immediately rectified or some alternate arrangement shall be provided by the industry. Industry shall ensure the treated effluent quality within standard prescribed by Chhattisgarh Environment Conservation Board published in Gazette notification dated: 25.03.1988. The major parameters of treated effluent shall be ensured within the limit as follow:-</p> <table> <tr> <td>A</td><td>pH</td><td>5.5 – 9.0</td></tr> <tr> <td>B</td><td>BOD</td><td>30 mg/lit</td></tr> <tr> <td>C</td><td>COD</td><td>250 mg/lit</td></tr> <tr> <td>D</td><td>Oil and Grease</td><td>10 mg/lit</td></tr> <tr> <td>E</td><td>Suspended Solids</td><td>100 mg/lit</td></tr> </table> <p>Chhattisgarh Environment Conservation Board may further stipulate stringent limit depending upon environmental conditions. Industry shall also ensure the treated effluent quality within standards prescribed by Ministry of Environment and Forests, Government of India / Central pollution control board</p>	A	pH	5.5 – 9.0	B	BOD	30 mg/lit	C	COD	250 mg/lit	D	Oil and Grease	10 mg/lit	E	Suspended Solids	100 mg/lit	<p>Arrangement of Effluent disposal system is provided and the treated water quality is within the stipulated limit. The monitoring data is enclosed. Also sewage treatment plant for the treatment of domestic sewage is already provided and the outlet water quality is well within the norms.</p>
A	pH	5.5 – 9.0															
B	BOD	30 mg/lit															
C	COD	250 mg/lit															
D	Oil and Grease	10 mg/lit															
E	Suspended Solids	100 mg/lit															
2	<p>Any liquid effluent whatsoever generated from industrial activities shall not be discharge into any river or surface water bodies under any</p>	<p>STP is being provided and the treated water is used for the development of greenbelt through</p>															

Sr.	Terms and Conditions	Status / Responsibility
	<p>circumstances and it shall be used wholly in the process / plantation within premises. All the industrial effluent generated shall be recirculated/ reused after proper treatment. Industry shall provide sewage treatment plant of adequate capacity for treatment of domestic effluent generated from township. The untreated / treated domestic effluent shall not be discharge into the any river or surface water bodies. The treated domestic effluent shall be used for plantation purpose. Industry shall make proper arrangements of suitable drains /pipe networks to ensure adequate flow for utilization of treated effluent inside the premises. The concept of zero discharge shall be maintained all the time.</p>	<p>the network of pipelines and zero discharge condition is maintained.</p>
3	<p>Adequate measuring arrangement shall be provided for the measurement of water utilized in different categories and effluent generated before commissioning of the plant.</p>	<p>Water meter for raw water consumption and effluent generated is provided.</p>
4	<p>Industry shall provide adequate pollution control arrangements at all points and non point sources of emission before commissioning of the plant. Electro Static Precipitator having efficiency of not less than 99.8%(with designed emission of not more than 50 mg/Nm³ of particulate matter) with all the boilers, suitable & effective air pollution control equipments for the control of fugitive emissions and for the control of pollution during the handling & transportation of raw materials / fuel and fly ash/ bottom ash etc.shall be installed before commissioning of</p>	<p>High efficient ESP is provided and emission of particulate matter is within 50 mg/Nm³.</p>

Sr.	Terms and Conditions	Status / Responsibility												
	<p>the plant. The emission of particulate matter from the point sources shall be maintained less than 50 mg/Nm³ all the time. Chhattisgarh Environment Conservation Board may further stipulate stringent particulate matter emission limit depending upon environment conditions.</p>													
5	<p>Ambient air quality within the factory premises shall not exceed the standards prescribed by Chhattisgarh Environment Conservation Board in Gazette Notification dated 25.03.1988. The ambient air quality within the premises shall not exceed the following limits:-</p> <table border="1"> <tr> <td>a</td><td>Suspended particulate matter</td><td>500 micrograms / m³</td></tr> <tr> <td>b</td><td>Sulphur dioxide</td><td>120 micrograms / m³</td></tr> <tr> <td>c</td><td>Oxides of Nitrogen</td><td>120 micrograms / m³</td></tr> <tr> <td>d</td><td>CO</td><td>5000 micrograms / m³</td></tr> </table> <p>Industry shall ensure the ground level concentration of pollutants within the standard prescribed for residential, rural areas in the nearby residential / rural areas due to establishment / commissioning of the power plant.</p>	a	Suspended particulate matter	500 micrograms / m ³	b	Sulphur dioxide	120 micrograms / m ³	c	Oxides of Nitrogen	120 micrograms / m ³	d	CO	5000 micrograms / m ³	<p>We are regularly monitoring the ambient air quality which is well within the norms.</p>
a	Suspended particulate matter	500 micrograms / m ³												
b	Sulphur dioxide	120 micrograms / m ³												
c	Oxides of Nitrogen	120 micrograms / m ³												
d	CO	5000 micrograms / m ³												
6	<p>Ambient air quality monitoring stations shall be established in the core zone as well as buffer zone for SPM, RPM, NO_x and SO₂. Adequate number of permanent ambient air quality monitoring station (not less than four) should be set-up in the down wind direction as well as where maximum ground level concentrations are anticipated in consultation with the Board. Location and number of the ambient air quality</p>	<p>A detail scheme for setting up of Ambient air quality station based on meteorological data, topographical features and environmentally and ecologically sensitive targets is submitted after consultation with the R.O. CECB, Raipur.</p>												

Sr.	Terms and Conditions	Status / Responsibility
	stations shall be decided based on meteorological data, topographical features and environmentally and ecologically sensitive targets and the frequency of monitoring shall be undertaken in consultation with the Chhattisgarh Environment Conservation Board.	
7	Industry shall install separate electric metering arrangements for the running of the pollution control devices. These arrangements shall be made in such a fashion that any non-functioning of pollution control devices shall immediately stop the electric supply to the production / fuel supply unit and shall remain tripped till such time the pollution control device / devices are made functional again.	We have installed separate energy meters for all the pollution control equipments. The interlocking arrangement has been provided in such a manner that in case of power failure of control equipment, the power supply for production unit get automatically shutt-off.
8	Appropriate arrangement shall be provided to meet the emission standards of SO ₂ , NO _x , mercury and other toxic heavy metals to be developed by Ministry of Environment and Forest / Central Pollution Control Board.	CFBC technology is adopted which itself ensures complete combustion of fuel and reduces the formation of SO ₂ , NO _x , mercury and other toxic heavy metals.
9	The coal dust extraction and suppression systems shall be provided that for control of fugitive dust emissions within and around the coal handling plant. Dust suppression systems shall be installed at all requisite points of dust emission in coal handling plant and coal stockyard etc. All junction points, transfer points and conveyor belt shall be covered to avoid fugitive emission.	We have provided water sprinkling system around coal handling location and at transfer points and all the belt conveyors are covered to avoid fugitive dust emission.
10	Stack of height as per formulae $H = 14(Q)^{0.3}$ (where Q is emission rate of SO ₂ in kg/hr and H is stack height in meters) or as per the	Stack height is 110 meters, which is well above the statutory requirements.

Sr.	Terms and Conditions	Status / Responsibility
	<p>guidelines of Ministry of Environment and Forests, Government of India / Central pollution control board based on micro meteorological data or 98 meters (whichever will be more) with arrangement of stack monitoring shall be provided for power plant boilers. The height of other stacks (if any) shall not be less than 30 meters.</p>	
11	<p>Continuous monitoring system and opacity meter shall be installed for monitoring of emissions level both in the ambient and the stack before commissioning of the plant.</p>	<p>Opacity meter for the online monitoring of stack emission is installed.</p>
12	<p>Adequate arrangement shall be provided for proper storage, handling etc. of all solid wastes generated to avoid any fugitive emission. All internal roads should be made pucca before commissioning of the plant. Good house keeping practices shall be adopted by the industry.</p>	<p>The only solid waste generated from TPP shall be fly ash and it is transported to 5000MT- silo through pneumatic system. Most of the internal roads had been made pucca. We have adopted 5S practices under World Class Manufacturing to maintain & improve housekeeping.</p>
13	<p>Effective step shall be taken for the safe disposal of solid wastes and sludge. Industry shall obtain from Board for Management and Handling of Hazardous Wastes as per Hazardous Waste (Management and Handling) Rules, 1989 (as amended).</p>	<p>We have obtained permission under Hazardous waste (M&H) rules, 2000 & as per amended rules, 2003.</p>
14	<p>Industry shall adopt dry fly ash extraction system and adopt dry fly ash disposal system. Industry shall incorporate total fly ash utilization as integral part of the project. Fly ash and bottom ash generated shall be collected in dry</p>	<p>The 100% dry fly ash generated from the power plant is used in the manufacturing of cement and the bottom ash is backfilled in the low lying area and also utilized in</p>

Sr.	Terms and Conditions	Status / Responsibility
	<p>form and it shall be utilized 100% for other beneficial uses such as cement manufacturing in the existing cement plant belonging to M/s Grasim Cement. Industry shall provide ash storage silos of sufficient capacity with pneumatic collection system in silo and dust suppression system. If at any point of time all the storage silos completely filled with ash, then in that case industry shall shut down the power plant till such time the ash disposed for utilization in existing cement plant belonging to M/s Grasim cement for cement manufacturing. All the fuel (coal) shall be stored in closed shed.</p>	<p>manufacturing of Portland Pozzolana Cement. The dry fly ash is pneumatically handled and stored in 5000 MT silo.</p>
15	<p>Industry shall follow the guidelines, notification etc. for utilization of fly ash / bottom ash issued by Ministry of Environment and Forests, Government of India / Central pollution control board/ Government of Chhattisgarh / Chattisgarh Environment Conservation Board from time to time. Industry shall abide by the decisions taken by Ministry of Environment and Forest, Government of India / Chhattisgarh Environment Conservation Board from time to time regarding use of fly ash / bottom ash.</p>	<p>It is ensured.</p>
16	<p>Extensive free plantation shall be carried out in and around project area. At least 15-20 meters wide green belt of broad leaf local species shall be developed all along the plant premises. Industry shall procure additional land for this purpose (if required). Industry shall abide by the decisions taken by Ministry of Environment Conservation Board from time to time in this</p>	<p>The plantation around the project area already exists and arrangement for further plantation will be done in the open area.</p>

Sr.	Terms and Conditions	Status / Responsibility
	regard. Industry shall plant 1500 – 2000 saplings per hectare with broad leaf local species in consultation with local forest department.	
17	The construction of effluent treatment plant and installation of air pollution control equipments shall be taken up simultaneously with other civil / mechanical works. Industry shall submit technical details (Drawing, Design Criteria, Design Treatment Capacity and efficiency etc.) and copy of work orders of effluent treatment plant and air pollution control equipment to be installed within 3 months or before commissioning of the plant (whichever will be earlier).	The technical details and a copy of work orders of effluent treatment plant / Electrostatic precipitator is submitted to CECB on 26.02.08.
18	Comprehensive Environmental Impact Assessment (EIA) report covering one-year data (4 seasons) shall be submitted to the Board with 15 months from commissioning of the plant.	CEIA report covering one-year data (4 seasons) shall be submitted to the Board with 15 months from commissioning of the plant.
19	Industry shall adopt rainwater-harvesting technique in the project area and residential area (if any) for recharge of ground water. The rain harvesting technique shall be incorporated right from the design stage of all structures. Industry shall develop rainwater-harvesting structures to harvest the rainwater for utilization in the lean season as well as to recharge the ground water table.	Rainwater harvesting system is provided at ABPS school, GCJST hospital, Shopping complex, and Mine office. The rain harvesting system is installed in the TPP buildings
20	Industry shall provide proper arrangement to control the noise pollution. Industry shall install appropriate noise barriers / control measures including acoustic hoods, silencers, enclosures	We have taken effective steps for controlling the noise pollution by dynamic balancing of equipments. Noise level shall be maintained

Sr.	Terms and Conditions	Status / Responsibility
	etc. on all sources of noise generation to control the noise. The noise level shall not exceed the limit 75 dB(A) during the day time and 70 dB(A) during the night time within the plant premises. Adequate measures shall be taken for control of noise levels below 85 dB(A) in the work environment.	within the prescribed limit in factory premises.
21	Industry shall establish an environmental management cell to carryout function relating to environmental management under the supervision of senior executive who will directly report to the head of organization.	We have already setup Environment Management Cell headed by Functional Head (TPP).
22	Industry shall use fly ash bricks, fly ash blocks or fly ash based products for their construction / repairing activities. Industry shall also utilize fly ash / bottom ash for filling low lying within premises.	We have used fly ash bricks for the construction of all the buildings of Thermal Power Plant and also used in repairing/other construction activities.
23	Garland drains with appropriate check dams shall be provided all along the fuel / solid wastes storage areas to avoid any possibility of erosion during rain. Garland drain (size, gradient and length) and sump capacity shall be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the project site. Sump capacity shall also provide adequate retention period to allow proper setting of silt material. Sedimentation pits shall be constructed at the corners of the garland drains. The surface runoff shall be de-silted through a series of check dams and drains before re-use / disposal.	The garland drain around the coal storage area is constructed and the sedimentation pit construction is under progress.
24	Industry shall adopt clean coal and clean power	CFBC technology is adopted which

Sr.	Terms and Conditions	Status / Responsibility
	<p>generation technology to the extent feasible. The quality of coal used shall confirm to the standards prescribed by Ministry of Environment and Forests, Government of India / Central Pollution Control Board / Government of Chhattisgarh / Chhattisgarh Environment Conservation Board. Industry shall follow provisions of notification issued by Ministry of Environment & Forest, Government of India regarding use of beneficiated coal. Industry shall also follow the provision of charter on Corporate Responsibility for Environmental Protection issued by Government of India in this regard.</p>	<p>itself ensures complete combustion of fuel and reduces the formation of SO₂ & NO_x. The compliance status of the provisions of CREP for TPP is enclosed.</p>
25	<p>Space provision shall be provided in the layout and retrofitting of the FGD shall be carried out without delay, if 98th percentile values for SO₂ exceeds the prescribed limit for sensitive areas, rural, residential and other areas, based on actual monitored field data, after commissioning of the plant.</p>	<p>Space provision is provided for FGD unit.</p>
26	<p>Necessary fund shall be provided for implementation of the condition issued by the Board and for environment up-gradation / protection. The funds earmarked for environment protection measures shall be kept in separate account and not diverted for any other purpose.</p>	<p>Separate fund for the environment protection / up-gradation is allocated.</p>
27	<p>Industry shall obtain statutory clearances / licenses from concerned Central Government / State Government Departments, Boards, Bodies and Corporations etc. before establishment of the plant. Industry shall follow direction issued</p>	<p>It is ensured.</p>

Sr.	Terms and Conditions	Status / Responsibility
	by Central Government / State Government / Central pollution control board / Chhattisgarh Environment Conservation Board from time to time regarding control of water and air pollution and for environmental conservation.	
28	The total gross capital investment on all capital works including land, building, plant / machinery and equipments etc. for proposed 30 MW Thermal Power Plant shall not exceed Rs. 132 crores under any circumstances.	It will be ensured
29	Industry shall monitor ground water quality, surface water quality around the project area regularly and report shall be submitted to the Board quarterly.	The ground water quality, surface water quality around the project area is monitored regularly and the report submitted to the Board quarterly.
30	Industry shall obtain permission from competent authority to cut down trees prior to any construction (if any).	Not applicable
31	Industry shall follow the action point mentioned in 'Charter on Corporate Responsibility for Environmental protection' of Thermal power Plant issued by Ministry of Environment & Forests, Government of India.	It will be followed
32	Industry shall follow any other conditions given at the time of grant of consent under the Water (Prevention & control of pollution) Act, 1974 and the Air (Prevention & control of pollution) Act, 1981.	It will be followed
33	The issuance of "No Objection Certificate" does not convey any property right in either real or personal property, or any exclusive privileges nor does it authorize any injury to private property or any invasion of personal right, nor	Agreed

Sr.	Terms and Conditions	Status / Responsibility
	any infringement of Central, State or local laws or regulations.	
34	Any change in production capacity, process, project profile etc. shall be intimated to the Board and prior permission of the Board shall be obtained for the same.	It will be ensured.
35	Board may amend / cancel any of the conditions and add new conditions to be incorporated in the permission to establish and consent to operate and further stringent the emission / effluent limit as and when deemed necessary in the interest of environmental protection, change in the project profile or non-satisfactory implementation of the stipulated conditions etc.	Agreed

Compliance status of CREP (Corporate Responsibility for Environment Protection) for Thermal Power Plants

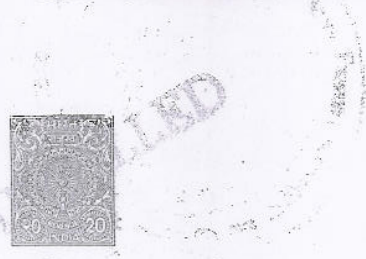
Sr. No.	CREP action points of TPP	Status
1	Implementation of Environmental Standards (emission & effluent) in non-compliant* Power plants (31 & 27) – Submission of action plan: June 30, 2003 - Placement of order for pollution control equipment: September, 2003 - Installation & commission: December 31, 2005	A high efficient ESP is already installed after Boiler.
2	For existing thermal power plants, a feasibility study shall be carried out by Central Electricity Authority (CEA) to examine possibility to reduce the particulate matter emissions to 100 mg/Nm ³ . The study should also suggest the road map to meet 100 mg/Nm ³ wherever	Not applicable

	found feasible. CEA shall submit the report by March 2004.	
3	New / Expansion power projects to be accorded environmental clearance on or before 01.04.2003 shall meet the limit of 100 mg/Nm ³ for particulate matter.	Not applicable
4	Development of SO ₂ & NO _x emission standards for coal based plants by Dec. 2003. – New / expansion power projects shall meet the limit of SO ₂ & NO _x w.e.f 1.1.2005 – Existing power plants shall meet the limit of SO ₂ & NO _x w.e.f. 1.1.2006	SO ₂ & NO _x emission standards are not notified till date. As per design SO _x <_ 525 PPM @7% O ₂ dry volume NO _x <_ 200 PPM @ 7% O ₂ dry volume
5	Install / activate opacity meters/continuous monitoring systems in all the units by December 31, 2004 with proper calibration system.	Opacity meter is installed
6	Development of guidelines / standards for mercury and other toxic heavy metals emissions by December 2003.	Not applicable
7	Review of stack height requirement and guidelines for power plants based on micro meteorological data by June 2003.	ESP outlet stack height is 110 meter as per design and norms.
8	Implementation of use of beneficiated coal as per GOI Notification: Power plants will sign fuel supply agreement (FSA) to meet the requirement as per the matrix prepared by CEA for compliance of the notification as short term measure. Options/mechanism for setting up of coal	Washery plant is already set up inside the premises

	<p>washeries as a long term measure</p> <ul style="list-style-type: none"> ○ Coal India will set up its own washery ○ State Electricity Board to set up its own washery ○ Coal India to ask private entrepreneurs to set up washeries for CIL and taking washing charges ○ SEBs to select a private entrepreneur to set up a washery near pit- head installation of coal beneficiation plant 	
9	Power plants will indicate their requirement of abandoned coal mines for ash disposal & Coal India / MOC shall provide the list of abandoned mines by June 2003 to CEA .	100% dry fly ash will be used for manufacturing cement
10	Power plants will provide dry ash to the users outside the premises or uninterrupted access to the users within six months.	Not applicable as 100% dry fly ash will be used for manufacturing cement
11	Power Plants should provide dry fly ash free of cost to the users.	Not applicable as 100% dry fly ash will be used for manufacturing cement
12	State P.W.Ds / construction & development agencies shall also adhere to the specifications / Schedules of CPWD for ash / ash based products utilization. MoEF will take up the matter with State Governments.	Not applicable
13	(i) New plants to be accorded environmental clearance on or after 1.04.2003 shall adopt dry flyash extraction or dry disposal system or Medium (35-40%) ash concentration slurry disposal system or Lean phase with hundred	100% dry fly ash is pneumatically conveyed to 5000 MT dry fly ash silo.

	<p>percent ash water re-circulation system depending upon site specific environmental situation.</p> <p>(ii) Existing plants shall adopt any of the systems mentioned in 13 (i) by December 2004.</p>	
14	Fly ash Mission shall prepare guidelines/manuals for flyash utilization by March 2004.	Not applicable
15	New plants shall promote adoption of clean coal and clean power generation technologies	We have our own washery plant for clean coal and we are using CFBC boiler for TPP.

* Units will submit bank guarantee to respective SPCB.



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क्रमांक १४६६ ७३/१२६३

नाम वि. उद्योगिक औद्योगिक लिमिटेड रायपुर

तह. रायपुर, रायपुर (म.प्र.)

नाम रायपुर

संस्थापक रायपुर

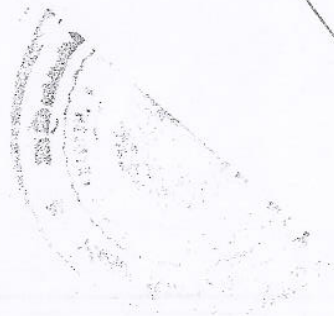
रायपुर रायपुर



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श्री १०८४४

संख्या	१०८४४	दिनांक	०८/१२/९३
प्राप्त	१०८४४	प्रति	१०८४४

(Revised form of the lease deed common for both land in Industrial area/estate and shed in Industrial Estate).

(Common for land/building)

This deed is made 08.12.1993 this day... December...
..... of 1993.. between the Governor of Madhya Pradesh,
acting through... S.M.D.C., Raipur... (hereinafter called the
'lessor' which expression shall where the context so admits include
his successor in Office) of the one part and M/s Grasim Cement (A Unit
of Grasim Industries Limited) in Tehsil Baloda Bazar and Simga of
District-Raipur, acting through Shri S.S.Chhaparia, S/o Sri R.K.
Chhaparia, registered Office at Birlagram, Nagda (MP) (hereinafter
called the 'Lessee') which expression shall, where the context so
admits, include its successors and permitted assigns of the other
part.

(For land)

Where as upon the request of the lessee, the lessor has agreed
to grant to the lessee, subject to the terms and conditions
hereinafter specified, a lease of the piece of a land in the
Industrial area/estate at Villages - Chuchrungpur, Sarseni and Rawan
comprising of an area measuring approximately 43.091 hectares or
there about, situated in the villages - Chuchrungpur, Sarseni and
Rawan of Tehsil Baloda Bazar & Simga of the Raipur District. More
particularly described in schedule..... hereto
annexed and thereon coloured red (hereinafter referred to 'the said
land') for a term of THIRTY years commencing from... 08.12.1993
and ending on... 07.12.2023... for the purpose of construction and
establishing thereon a factory for the manufacture of Cement and
purpose ancillary thereto (hereinafter referred to as the said
business).

(For Building)

Whereas upon the request of the lessee the lessor has agreed to
grant to the lessee subject to the terms and conditions herein
contained, a lease of the plot of land situated at.....
..... in the Industrial Estate/Area..... measuring
about .. sq. meter together with building erected thereon being
building No..... more particularly described in the
Schedule hereunder and for greater clearness delineated on the plan
hereto annexed and thereon shown with boundaries coloured red (herein-
after called as the said premises) for a term of TEN years from the
date of handing over its possession to the lessee for the purpose of
.....

General Manager.

For, Grasim Industries Ltd.
Unit-Grasim Cement contd... p-2

S. S. Chhaparia

- 2 -
(Common for land/building)

And whereas the lessee has agreed to take the lease on the said terms and conditions.

Now therefore this deed witnesseth and it is hereby agreed and declared as follows:-

(Common for land/building)

1. In consideration of the premium and rent (for land) or rent (for premises) herein reserved and the covenants on the part of the lessee herein contained, the lessor shall demise to the lessee and the lessee shall accept a lease of the said land/building to hold the same for the purpose of Plant and Colony for a period of 30 years commencing on the date on which the possession of said land/premises is handed over to the lessee.

(For land)

2. The lessee having paid to the lessor for the said land the advance rent and premium of Rs.22896/- (Rupees twenty two thousand eight hundred ninety six only) advance rent for one year and premium of Rs.22,89,642/- (Twenty two Lakhs eighty nine thousand six hundred forty two only) as prescribed under Rule 10 of the Madhya Pradesh Industries (Allotment of sheds, plots and land) Rules, 1974 (hereinafter referred to as the said rules) for the said land three years rent Rs.68688/- (Rupees sixty eight thousand six hundred eighty eight only) as security deposit within thirty days before of the execution of this deed.

Thereafter, during the terms of the lease the lessee shall pay to the lessor the annual ground rent of Rs.22896/- (Rupees twenty two thousand eight hundred ninety six only) and such other sums as may be determined in accordance with clause 3 hereunder on or before 10th day of January of each year in the Office of the General Manager or such place or places as the General Manager from time to time may direct.

(For building)

The lessee having paid to the lessor for the said premises the advance rent as prescribed under rule 10 of the said rules he shall pay to the lessor for the said premises one year's rent as security deposit within thirty days of the execution of this deed. Thereafter, during the terms of the lease, the lessee shall pay the lessor a monthly rent of Rs..... (Rupees.....) only on or before the 10th day of

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General Manager,
District Industries Centre,
RAIPUR (M.P.)

For, Grasim Industries Ltd. contd..p-3

Unit- Grasim Cement

S. S. Chhaparia
S. S. Chhaparia,
Executive President

each calendar month at the Office of the General Manager, or at such place or places as the General Manager from time to time may direct.

m (Common for Land/Shed)

m 3. If the yearly/monthly rent of the land/premises or any part thereof is not paid within one month after the date prescribed by Industries Commissioner the same will have to be deposited with interest @18% per annum for the first one year/12 months of such default and @24% per annum for the remaining period thereafter.

(For land)

4. The ground rent of Rs.22896/- (Rupees twenty two thousand eight hundred ninety six only) per annum shall be liable to be increased on the expiry of 10 years from the date of execution of this deed and also at subsequent intervals of 10 years, provided that the increase on each occasion may not exceed one quarter of the rent fixed for the proceeding 10 years.

(For building)

NA
m The monthly rent as mentioned in clause 2 above shall be reviewable from time to time subject to the conditions that the enhancement of rent at any one time may not exceed 30% of rent payable at the time of review.

in (Common for land/building)

5. The lessee shall from time to time and at all times during the term of the lease pay and discharge except as aforesaid, all taxes, rates assessments and other charges and outgoing which are or may at any time hereafter during the said terms be assessed, charged or imposed upon the said land/premises whether on the land-lord or on the tenant.

(For land)

6. The lessee hereby agree that he shall within a period of one year, in the case of small scale industry and within a period of three years, in the case of large and medium scale industry, from the date of his takingover possession of the land implement the project and go into production.

(For land)

7. The lessee hereby agrees that he shall utilize the complete land leased out to him hereunder for implementation of the project or for its expansion within a period of three years in case of SSI

General Manager,
District Industries Centre,
RAIPUR, JHARKHAND.

- 4 -

and five years in case of Medium & Large Scale Industries for the abovesaid purposes.

(For land)

8. The lessee further agrees that if he is unable to utilize the complete land lease out to him within the period prescribed in clause 6 or 7 the lessors shall have the right of re-entry in the surplus unutilised land without payment of any sort or compensation after giving due opportunity for representing his case.

(For land)

9. The lessee shall submit to the lessor or any Officer authorised by him in writing from time to time, the plans and specifications for the said construction which shall be in accordance with the plans and specifications as may be approved by the lessor.

m (Common for land/building)

m 10. The lessee shall use said premises, land and building structures and works, erected or constructed thereon only for the purpose of the said business of manufacturing cement and other allied products as mentioned in project report/provisional registration for construction of Offices, administrative building, godowns and shall not use the same or any other part thereof or permit it or any other part thereof to be used for any other purpose without the previous permission in writing of the lessor.

(For land)

11. The lessee shall, at his own expenses forthwith erect and at all times maintain, repair and keep in good condition all boundary marks and pillars alongwith the boundaries of the said land according to the demarcation shown in the plan hereto annexed.

m (Common for land building)

m 12. The lessee shall keep the said premises, land and building erected thereon in a condition fit for habitation and at his own expenses the effluent treatment systems as prescribed by the MP Pollution Control Board or the local authority concerned.

(For building)

13. The lessee shall not make any permanent and temporary additions or alternations whatsoever in the said premises without obtaining the prior consent in writing of the Industries Commissioner. The decision of the Industries Commissioner with regard to what constitutes additions or alternations, shall be final and binding on the lessee.

contd..p-5

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General Manager,
District Industries Centre,
RAIPUR (M.P.)

For, Grasim Industries Ltd.
Unit- Grasim Cement

S. S. Chhaparia
S. S. Chhaparia,
Executive President

(For building)

14. If there is any necessity of any additions or alterations to the said premises to suit any particular requirement of the lessee the same may be made by the lessee at his own cost with the previous permission in writing of the Industries Commissioner. This permission may be refused if the same is considered undesirable or unsafe for the premises. Any addition and alterations carried out by the lessee shall be subject to removal on the expiry of the said term at the lessee's cost, if so required by the Industries Commissioner. If the Industries Commissioner does not insist on such removal, no compensation or expenses incurred in making the additions and alterations shall be payable by the lesser to the lessee.

(Common for land/building)

15. The lessee shall not subject, assign or otherwise transfer the said premises/land or any part thereof or any building constructed thereon for any purpose, whatsoever, except as provided in rule 19 of the said rule.

(Common for land/building)

16. The lessee shall not change the constitution of ownership of the unit without the prior permission of the Allotting Authority in writing. If due to the change in the constitution the share of the original allottee has reduced to less than 50% share than it will be deemed to be taken that unit has been transferred to some other hand and accordingly the case of transfer shall be dealt with by the lessor..

(For land)

17. The lessee shall plant at least fifty trees per hectare of land allotted to him at his own cost and shall be liable to maintain them. The lessee shall not be entitled to recover any expenses on this account. Failure to comply with this condition shall be deemed as a breach of the condition of allotment of the said premises.

(Common for land/building)

18. The lessee shall not carry on any offensive trade or business on the said land/premises. The decision of the Allotting Authority with regard to what is offernsive trade or business shall be final and binding on lessee.

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General Manager.
District Industries Centre.
RAIPUR (M.P.)

contd..p-6

For, Grasim Industries Ltd.
Unit- Grasim Cement

S. S. Chhaparia
S. S. Chhaparia,
Executive President

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(Common for land/building)

19. While using the said land/premises if the lessee cause any harm or injury to any person, he shall be liable to pay compensation or damages in the same manner as a tenant of land/building is general liable to pay.

(For building)

20. The lessee shall insure and keep insured the.....
.....in the name of the Industries Commissioner and shall at all times during the said term keep the same insured independently and separately against any loss or damage caused by fire and against all other risks, as the Industries Commissioner may require, in the sum of Rs.....(Rupees.....
.....only) with an Insurance Company approved by the Industries Commissioner and shall deposit with the General Manager, District Industries Centre all such insurance policies and payment of the premiums in respect of the same. The lessee shall insure the said premises independently of and not alongwith any of the property of the lessee.

(For building)

21. The lessee shall complete all formalities required under clause 20 above and deposit the insurance policy and receipt of payments towards the same with the General Manager, District Industries Centre within the period of one month from the date of taking over possession of the said premises by the lessee.

(Common for land/building)

22. The lessee shall comply with all acts, rules and regulations in force from time to time in respect of the working of Cement production.

(Common for land/building)

23. The lessee shall continuously run, during the period of lease the factory for which the land/premises is allotted. Closure of the factory for a continuous period exceeding six months without proper reasons to the satisfaction of the Allotting Authority be considered as a breach of this condition.

(Common for land/building)

24. The lessee shall during the said term keep the said land/premises in a reasonably good condition.

(For building)

25. The lessor shall carry out all such normal repairs to the said premises as he may deem necessary. If any repair are occasioned by any negligence for default on the part of the lessee, the same shall be carried out by the lessee at his own cost of by the

General M. J. S.
District Industries Centre.

For, Grasim Industries Ltd.
Unit-Grasim Cement

Industries Commissioner as to what shall constitute normal repairs and whether any repairs are occasioned by any negligence or default on the part of the lessee shall be final and binding on the lessee.

(For building)

26. If the rent hereby reserved or any part thereof shall at any time be in arrears and unpaid for six calendar months in the case of land and two months in the case of premises next after the date whereon the same shall have become due, whether the same shall have been lawfully demanded or not or if the lessee becomes insolvent and/or goes into liquidation voluntarily or otherwise or if there be any attachment on the said premises or there is a breach or non-observance by the lessee of any of the conditions and covenants therein contained and the lessee fails to remedy the breach within sixty days of the notice in writing given by the lessor or becomes insolvent or enters into an agreement with his creditors for composition of the Industry, this lease will be deemed to have been terminated and the lessor may notwithstanding the waiver of any previous cause right of re-entry and without prejudice to any right or remedy of the lessor for recovery of rent remaining due under the lease upon the said land/premises and repossess the same as if this demise had not been made.

(For land)

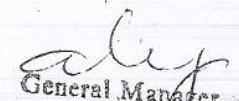
27. On the expiry of the lease period or termination of the lease due to breach of the conditions of the lease deed or surrender of land after the execution of lease deed, the lessor, shall have the right of re-entry over the land/premises. On such re-entry, the lessor may refund to the lease the premium/cost of acquisition paid by the lessee at the time the land was allotted/leased out to the lessee in the following manner:-

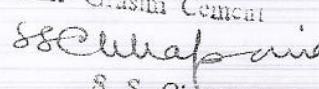
(i) Full premium if surrender of allotted/leased land occurs within one year and three years, in respect of small scale industry and large and medium industry, respectively.

(ii) 10% less, if surrender of allotted/leased out land occurs after one year but within two years and after three years, but within four years in respect of small scale industry and large and medium industry respectively.

(iii) 20% less if surrender of allotted/leased out land occurs after two years but within three years, and after four years but within five years in respect of small scale industry and large/medium industry respectively.

contd...p-8


General Manager,
District Industries Centre,
RAIPUR (M.P.)

For, Grasim Industries Ltd.
Unit- Grasim Cement

S. S. Chhaparia,
Executive President

iv) No refund of premium shall be permissible to unit not falling under category (i) (ii) and (iii) above.

(For land)

28. On termination/surrender of lease, the lessee shall be given an opportunity to transfer or otherwise dispose off the building, plant and machinery and any other construction on the said premises within the period of 3 months in a manner acceptable to the lessor. After the said 3 months period the lessor shall have the full right on all the property left over in the said premises without payment of any compensation and will be free to dispose it off accordingly.

(For building)

29. The lessee shall handover the said building to the lessor at the expiry of the said term or on the earlier determination of the lease in the same condition as was handedover when occupied or received by the lessee after reasonable wear and tear expected.

(For land)

30. The lessor may at his discretion, if the lessee shall have duly paid the rent hereby reserved and observed and performed the conditions herein contained at the request and cost of lessee, renew the lease for a further period of FIVE years.

Provided that the rent may be enhanced for the grant of every renewed lease and that every renewed lease shall contain such of the conditions herein contained as shall be applicable and such other conditions as may be thought necessary by the lessor.

(For land)

31. Lessee may surrender the leased area in part or whole by giving to the lessor, THREE calendar months notice in writing of his intention to do so.

(Common for land/building)

32. All costs and expenses incurred or which may be incurred for preparation, execution and registration of this lease shall be borne and paid by the lessee, subject to such relaxations as may be approved by the lessor in this behalf.

(Common for land/building)

33. It is FURTHER DECLARED that the lessee shall deposit a sum of Rs.22,89,642/- (Rupees Twenty two lakhs eighty nine thousand six hundred forty two only) as security in pursuance of clause 2 of

contd...p-9

For, Grasim Industries Ltd.
Unit- Grasim Cement

S. S. Chhabaria,
Executive President

General Manager,
District Industries Centre,
RAIPUR (M.P.)

- 9 -
this lease deed for the due payment of the rent and observances and performance by him of the several conditions herein contained.

h (Common for land/building)

34. Upon breach or non-observance by lessee of any of the terms and conditions herein contained it shall be lawful for the lessor to forfeit the security deposit referred to in clause 33 above, without prejudice to any other right or remedy of the lessor in that behalf/and to resume the possession of the said land/premises.

h (Common for land/shed)

35. The security deposit unless forfeited as aforesaid and after deducting all such sums as may be due to and recoverable by the lesser under these presents, shall be returned to the lessee after determination of the lease by afflux of time or otherwise.

h (Common for land/building)

36. The lessee may file a representation if he is aggrieved by an order of the Allotting Authority as under:-

A representation may be filed before:-

- (i) The Additional/Joint Director of Industries, Zonal Industries Office against an original order of the General Manager.
- (ii) The Industries Commissioner against an original order of the Additional/Joint Director of Industries, Zonal Industries Office.
- (iii) The State Govt. in Commerce & Industry Department, against an original order of the Industries Commissioner. The decision given on such representation shall be final & no further representation will be entertained.

However such a representation shall be made within Thirty (30) days of the receipt of an original order.

(For land)

37. The lessee shall provide regular employment to..... (No.) persons belonging to those families who have been dispossessed from their land due to its acquisition for the Industrial Area/ Estate/Growth Centre within one year of its going into production. The list of persons entitled for consideration under this clause will be as provided by the District Collector,

O R

(Where the major portion of acquired land is to be used for a particular Industry).

General Manager
District Industries Centre.
RAIPUR (M.P.)

contd..p-10
For, Cassia Industries Ltd.
Bhilai Cassia Cement
S. S. Chhaparia
S. S. Chhaparia
Executive Presid.

The lessee shall rehabilitate one person belonging to each of those families which have been disposed due to acquisition of their land for Industrial purpose according to the rehabilitation programme as approved by the Industries Commissioner. This rehabilitation programme will have to be implemented fully within one year of its going into production. (Strike out whichever is not applicable)

n (Common for land/building)

38. The Industries Commissioner or any other Officer to whom the powers of allotment have been delegated will also be competent to terminate the lease deed on behalf of the lesser.

n (Common for land/building)

39. All sums recoverable under this deed may be recovered as arrears of land revenue.

ali
General Manager,
District Industries Centre
RAIPUR (M.P.)

For, Grasim Industries Ltd.
Unit- Grasim Cement

S. S. Chhaparia
S. S. Chhaparia,
Executive President,



POWER OF ATTORNEY

TO ALL WHOM THESE PRESENTS shall come, we Grasim Industries Limited being a Company Limited by Shares Incorporated under the Companies Act, 1956, having its Registered Office at P.O. Birlagram, Nagda, SEND GREETINGS: NOW KNOWN YE AND THESE PRESENTS WITNESSETH that we, do hereby nominate, constitute and appoint severally Shri M.C. Bagrodia, Sr. Executive President and Shri S.S. Chhaparia, Executive President to do or cause to be done all or any of the following acts and things in relation to the GRASIM CEMENT DIVISION of the Company at Raipur district (Madhya Pradesh).

1. To sign Bills of Lading, Forwarding notes, railway receipts, bills, custom house warrants, official receipts, letters and correspondence in the ordinary course of business.
2. To enter into contracts for the sale and purchase of goods, merchandise machinery, plant & spare parts, General Stores, etc. and to sign vouchers for payment and receipts in the ordinary course of business.
3. To make applications to the Chief Inspector of Boilers, the Inspector of Factories, the Commissioner of Workmen's

Cond..2/-

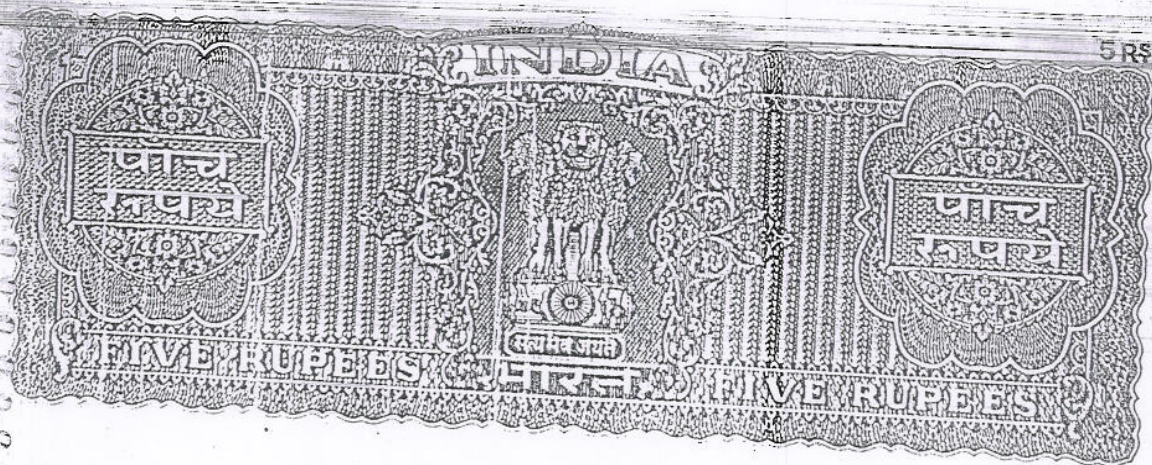


- 2 -

Compensation, Excise Authorities, District Boards, Railway Authorities and any other officer, commission or committees of Labour or other Tribunal appointed by any State Governments or the Central Government of India and to appear before them and sign any agreements, documents, bonds, admitting execution thereof and getting them duly registered before any of the above officials or committees etc.

4. To negotiate, carry on correspondence with any Association, Company, Firm, Corporation, Municipality, any department of the Government or any other person or public body (and particularly all Mining, Excise, Electricity Board and Hydro Electric departments of the Government, Civil Mining Authority) and execute and file all applications, agreements, deeds, documents including guarantee, security etc. that they may be required or deemed proper for or in relation to the business of the Company, and to observe and comply with all relevant Acts, rules and Regulations.
5. To apply to appropriate Government authorities for land required for factory, Staff and Worker's Colony, Railway Siding and for other purposes, to appear before such authorities to negotiate terms.

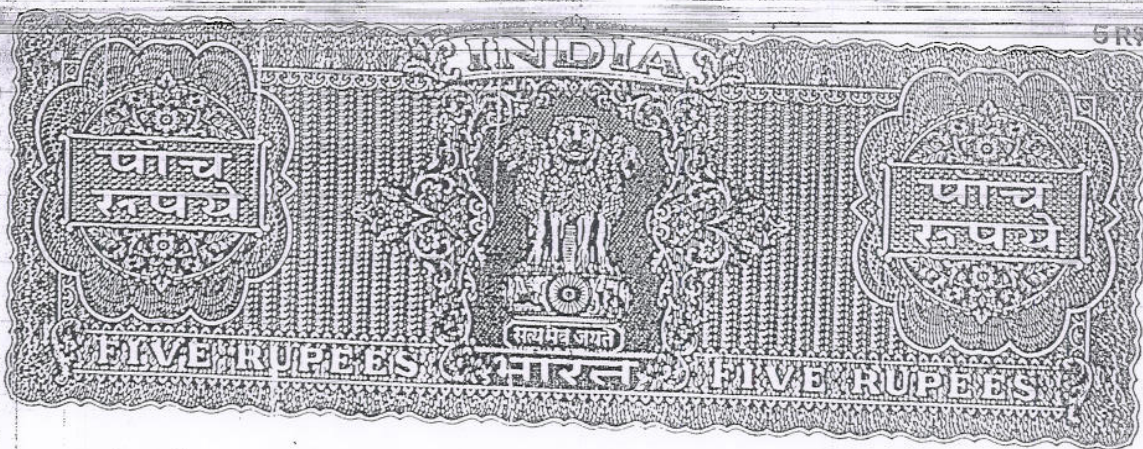
Cond., 3/-



- 3 -

- 5.A. To apply for, obtain, execute and renew all leases including mining lease, all licences, permits, agreements, etc. that may be necessary for carrying on the work of the Company.
6. To commence any action, file suit or other legal proceedings in any Court of Justice for the recovery of any debt or sum of money, right, title, interest, property, matter or thing whatsoever now due, or payable or to become due or payable or anywise belonging to us and such action suit or proceedings or all other actions suits or proceedings to prosecute or discontinue or adjust or compromise as our said attorney shall see cause or be advised.
7. To defend all actions, suits, proceedings, applications or appeals that are now pending or may hereafter be brought, instituted or made in our name, in such a manner as our said attorney shall think fit.
8. To prefer any appeal to any proper court against any judgement in any decree or order made in any suit or suits, actions, proceedings or applications and to prosecute or discontinue, adjust or settle the same as to our said

Contd...4/-



- 4 -

attorney shall appear proper.

9. To sign and verify the plaints and written statements, appeals and applications, pleadings, affidavits etc. and to institute suits, actions (criminal, civil or revenue) appeals and other proceedings of any kind.
10. To accept arbitration and to appoint one or more arbitrators in any of the said suit or suits, actions or proceedings as our said attorney shall think fit.
11. To retain, pleaders, vakils, attorneys, counsels and other legal practitioners as our said attorney shall think fit and shall sign or execute all retainers, vakalatnamas, papers and documents as may be necessary to be signed and also verify the same when occasion shall arise.
12. To appear before any registrar or sub-registrar or any other registering officer and to present for registration any deed or documents already executed or that may hereafter be executed by us or that may be executed or signed on our behalf and to admit the execution of such document or

Contd...5/-

documents and otherwise to do all acts, deeds, matters and things and to get the said deed or document registered in the form of law.

13. To delegate all or any of the Power conferred with this Power of Attorney to the Officers of the Grasim Cement Division as and when necessary in the ordinary course of business.
14. To do all or any other act incidental to but not specified in which we are or may be interested.

AND we do hereby ratify and confirm and agree at all times during the continuance of these presents to ratify and confirm whatsoever our said attorney shall lawfully do or cause to be done in respect of matters aforesaid by virtue hereof.

IN WITNESS WHEREOF the Common Seal of Grasim Industries Limited, has been hereunto affixed this 1st day of July One Thousand Ninehundred Ninetyone.

The Common Seal of Grasim Industries Limited was hereunto affixed pursuant to Resolution of the Board of Directors passed on 14th May, 1991 in the presence of:-

1. *[Signature]*

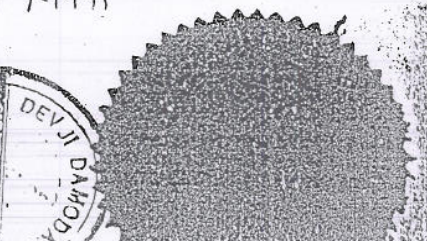
2. *[Signature]*

Signed before me

[Signature]
NOTARY,
UNION OF INDIA
(7-1991)

The Directors of the Company

THE DIRECTORS OF THE COMPANY



SCHEDULE

Name of villages : Chuchrungpur, Sarseni and Rawan.
 Name of Tehsil : Balodabazar and Simga.
 Name of District : Raipur
 Name of Industrial Area/Estate.
 Plot No. : Nil
 Size : Nil
 Block No. : Nil
 Shed No. : Nil
 Covered area : Nil
 Open space : Nil

Surrounded by

-KH No.20,21&29 of village Sarseni
 Private land of Grasim Industries Ltd., On the east
 -Kh.No.82, Govt.tank of village
 Chuchrungpur

-Kh.No.15/1 to 15/4 of village Sarseni
 Private land of Thanwar, Mahesh&others
 -Kh.No.663&664 of village Rawan On the north
 Private land of Dayaram Ramchand and
 Kh.No.116/3,116/4, private land of
 Grasim Industries Ltd.

-Kh.No. 721/21, 779/1&779/2
 Private land of Grasim Industries Ltd. On the west

-Kh.No.79/1 grass land of village
 Chuchrungpur
 Kh.No.104&106 private land of Grasim
 Industries Ltd. On the south
 Kh.No.781/22 & 920/2 of village Rawan
 Pvt.land Tirath Ram Kejwat and
 Kh.No. 718/5 private land of Grasim
 Industries Ltd.

Above details shown in the annexed plan.

In witness whereof the parties herebo have signed this deed on
 the date and year respectively mentioned against their signatures.

Witness:

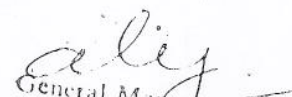
1..... Signature of General Manager/
 General Industries Commissioner/
 Centre on behalf of the Governor of M.P.
 Date 8/12/93

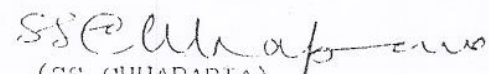
1..... Signature of behalf of
 For, Grasim Industries Ltd.
 2..... Unit- Grasim Cement
 (C. S. VERMA)
 (C. S. VERMA)
 (C. S. VERMA)

Signature of T. S. Verma
 8/12/93
 886/11/1

ANNEXURE - 1

Village	P.C. No.	Khasra No.	Area (In Hecta.)
Rayan	30	418/1	1.900
		418/12	0.356
		715/4	2.800
		719/1	7.436
		419	0.890
		704/1	1.500
		719/2	1.416
		1249	0.100
		1254	0.040
		1218	0.530
		1125	0.910
		918	1.546
		1107	1.234
		1083	0.417
		1208	0.615
		1241	0.607
		1006	0.182
		1224	1.813
	Total	18	25.132
Chuchrungpur	17	79/16	4.047
		79/17	1.213
		79/1	1.500
		85	0.640
	Total	4	7.400
Gorseni	17	38	2.750
		72/1	0.809
	Total	2	10.559
Grand Total		24	43.021


 General Manager,
 Distt. Industries Centre,
 RAIPUR (M.P.)


 (33 CHHAPARIA)
 EXECUTIVE PRESIDENT

कार्यालय वनमण्डलाधिकारी रायपुर वनमण्डल, रायपुर (छत्तीसगढ़)

☎ : (0771) 2427640, Fax :- 2427640 - E-mail- dfo_raipur@rediffmail.com

क्रमांक/माचि/रा/...1854

रायपुर दिनांक 21/05/2009

प्रति,

ग्रासीम सीमेंट

ग्रासीम विहार

ग्राम:- रावन जिला:-रायपुर

रायपुर(छ.ग.)

विषय :- अनापत्ति प्रमाण पत्र बाबत ।

संदर्भ :- आपका कार्यालयीन पत्र क्रमांक/cg/forest 2009/01 दिनांक 15.05.09


0000

विषयांकित के संबंध में लेख है कि ग्रासीम सीमेंट रावन रायपुर तह.- सिमगा के द्वारा ग्राम - रावन झीपन, कसीडीह, फुंडरडीह, पेंडरी, चुचुरंगपुर, सरसेनी एवं छिराही के विभिन्न खसरों की भूमि वन भूमि न होने संबंधी प्रमाण पत्र चाही गई है । आवेदक द्वारा उपलब्ध कराये गये राजस्व अभिलेख एवं वन विभाग के अभिलेखों के साथ स्थल का निरीक्षण उप वनमंडलाधिकारी रायपुर द्वारा संयुक्त निरीक्षण उपरांत यह पाया गया कि आवेदित भूमि निजी स्वामित्व की भूमि है । उक्त भूमि आरक्षित वन / संरक्षित वन अथवा आरेंज एरिया के अंतर्गत नहीं आता है । आवेदित भूमि वन सीमा से लगभग 15 किलोमीटर की दूरी पर स्थित है ।

अतः ग्रासीम सीमेंट ग्राम रावन जिला:- रायपुर को सीमेंट प्लांट माइन्स , कालोनी एवं पावर प्लांट के लिए उपयोग किए जाने हेतु इस कार्यालय को कोई आपत्ति नहीं है ।



D:\NOC\NOC


वनमण्डलाधिकारी
रायपुर वनमण्डल, रायपुर

ANNEXURE - 5

HOURLY WIND SPEED DATA
STUDY PERIOD – Dec 2009 TO Feb 2010

For the Month of Dec, 2009**Date: 03.12.2009**

Hours	Wind	
	Speed (kmph)	Direction
01:00	03	NNE
02:00	00	CALM
03:00	03	N
04:00	00	CALM
05:00	00	CALM
06:00	04	N
07:00	03	NNE
08:00	03	N
09:00	04	N
10:00	04	NNE
11:00	06	NNE
12:00	04	NE
13:00	06	WNN
14:00	08	N
15:00	07	NNE
16:00	09	NNE
17:00	09	NE
18:00	08	NE
19:00	06	NE
20:00	06	NNE
21:00	05	NE
22:00	04	NE
23:00	04	ENE
00:00	04	ENE

Date: 04.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	NE
02:00	05	ENE
03:00	04	ENE
04:00	03	NE
05:00	03	NE
06:00	00	CALM
07:00	00	CALM
08:00	00	CALM
09:00	03	NE
10:00	03	ENE
11:00	04	N
12:00	06	N
13:00	05	N
14:00	04	WNN
15:00	03	WNN
16:00	03	WNN
17:00	00	CALM
18:00	00	CALM
19:00	03	WN
20:00	03	WN
21:00	05	WNN
22:00	06	N
23:00	06	N
00:00	06	N

Date: 11.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	07	NNE
02:00	08	N
03:00	11	WNN
04:00	11	N
05:00	09	NNE
06:00	09	NE
07:00	11	NNE
08:00	12	NNE
09:00	12	NE
10:00	10	ENE
11:00	08	E
12:00	08	ESE
13:00	07	ESE
14:00	07	E
15:00	07	ENE
16:00	06	ENE
17:00	08	ENE
18:00	09	NE
19:00	09	ENE
20:00	07	ENE
21:00	08	N
22:00	08	N
23:00	06	N
00:00	06	WNN

Date: 12.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	04	N
02:00	05	N
03:00	05	NNE
04:00	04	NNE
05:00	03	NNE
06:00	00	CALM
07:00	00	CALM
08:00	00	CALM
09:00	03	NNE
10:00	03	NNE
11:00	03	N
12:00	03	NNE
13:00	04	NNE
14:00	05	NNE
15:00	04	N
16:00	03	N
17:00	03	N
18:00	00	CALM
19:00	00	CALM
20:00	00	CALM
21:00	00	CALM
22:00	00	CALM
23:00	00	CALM
00:00	03	NE

Date: 20.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	03	ENE
02:00	03	ENE
03:00	04	E
04:00	04	ESE
05:00	04	ESE
06:00	03	ESE
07:00	03	E
08:00	00	CALM
09:00	03	E
10:00	00	CALM
11:00	00	CALM
12:00	03	E
13:00	03	E
14:00	03	E
15:00	05	ESE
16:00	05	SE
17:00	04	SE
18:00	04	ESE
19:00	05	SSE
20:00	06	SE
21:00	07	SE
22:00	06	SE
23:00	05	S
00:00	06	S

Date: 21.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	06	S
02:00	06	SSW
03:00	06	S
04:00	05	S
05:00	04	S
06:00	06	SW
07:00	05	SW
08:00	04	SW
09:00	04	WSW
10:00	04	SW
11:00	04	SW
12:00	05	SW
13:00	05	WSW
14:00	06	W
15:00	06	S
16:00	05	SW
17:00	05	SW
18:00	04	SW
19:00	05	W
20:00	05	WNW
21:00	06	NW
22:00	06	NW
23:00	08	WNW
00:00	07	NW

Date: 28.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	07	NW
02:00	07	NNW
03:00	08	NW
04:00	08	NW
05:00	09	NNW
06:00	11	N
07:00	11	N
08:00	12	N
09:00	08	N
10:00	07	NNW
11:00	07	NNW
12:00	05	N
13:00	04	N
14:00	04	N
15:00	03	N
16:00	00	CALM
17:00	03	N
18:00	00	CALM
19:00	00	CALM
20:00	03	NNE
21:00	04	NNE
22:00	05	NNE
23:00	05	NE
00:00	06	NE

Date: 29.12.2009

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	NE
02:00	04	ENE
03:00	05	ENE
04:00	06	NE
05:00	07	NNE
06:00	06	NE
07:00	07	NNE
08:00	07	NNE
09:00	06	N
10:00	06	N
11:00	07	WNW
12:00	06	N
13:00	05	N
14:00	06	NNE
15:00	06	NNE
16:00	06	NE
17:00	07	NE
18:00	08	NE
19:00	06	NE
20:00	06	NNE
21:00	05	NNE
22:00	06	NNE
23:00	05	NE
00:00	05	NE

Date: 03.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	ENE
02:00	04	ENE
03:00	04	ENE
04:00	04	NE
05:00	04	NE
06:00	03	ENE
07:00	03	ENE
08:00	00	CALM
09:00	03	E
10:00	03	E
11:00	04	SE
12:00	04	SE
13:00	05	SSE
14:00	04	S
15:00	05	S
16:00	05	SSW
17:00	04	S
18:00	04	SSW
19:00	05	SSW
20:00	06	SSE
21:00	05	SE
22:00	06	SE
23:00	06	ESE
00:00	07	E

Date: 04.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	06	ESE
02:00	05	E
03:00	05	ENE
04:00	06	E
05:00	05	ENE
06:00	06	NE
07:00	06	NE
08:00	07	NE
09:00	07	NE
10:00	07	NNE
11:00	07	NE
12:00	06	NNE
13:00	06	N
14:00	05	N
15:00	05	NNE
16:00	05	NE
17:00	05	NNE
18:00	04	NNE
19:00	04	NE
20:00	04	ENE
21:00	04	E
22:00	04	E
23:00	05	ESE
00:00	05	SSE

Date: 11.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	04	SSE
02:00	03	S
03:00	03	S
04:00	03	S
05:00	00	CALM
06:00	03	S
07:00	03	SSW
08:00	03	SSW
09:00	03	SSW
10:00	00	CALM
11:00	00	CALM
12:00	03	S
13:00	03	S
14:00	03	SSE
15:00	04	ESE
16:00	04	ESE
17:00	03	E
18:00	03	E
19:00	03	E
20:00	00	CALM
21:00	03	E
22:00	04	ESE
23:00	04	ESE
00:00	04	SSE

Date: 12.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	04	S
02:00	03	S
03:00	03	SSW
04:00	00	CALM
05:00	00	CALM
06:00	00	CALM
07:00	03	SW
08:00	03	SW
09:00	03	W
10:00	03	WNW
11:00	03	NW
12:00	03	NW
13:00	03	NNW
14:00	04	NW
15:00	04	NW
16:00	04	N
17:00	03	N
18:00	03	N
19:00	03	N
20:00	03	NNW
21:00	00	CALM
22:00	04	NNW
23:00	04	NW
00:00	06	NW

Date: 20.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	06	WNW
02:00	07	WNW
03:00	07	NW
04:00	07	NW
05:00	09	NNW
06:00	09	NNW
07:00	09	NNW
08:00	11	N
09:00	08	N
10:00	06	N
11:00	06	N
12:00	04	NNE
13:00	04	NNE
14:00	04	NNE
15:00	03	NE
16:00	00	CALM
17:00	00	CALM
18:00	00	CALM
19:00	03	NE
20:00	03	ENE
21:00	03	ENE
22:00	04	NE
23:00	04	NE
00:00	04	NNE

Date: 21.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	03	NNE
02:00	03	N
03:00	04	NNE
04:00	05	NE
05:00	05	NE
06:00	06	NE
07:00	06	NNE
08:00	06	NNE
09:00	05	NE
10:00	05	ENE
11:00	04	ENE
12:00	04	E
13:00	03	NNE
14:00	00	CALM
15:00	03	E
16:00	03	ENE
17:00	03	ENE
18:00	04	NNE
19:00	05	NE
20:00	06	NE
21:00	06	NE
22:00	05	ENE
23:00	05	ENE
00:00	06	NE

Date: 26.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	06	NE
02:00	07	ENE
03:00	05	NE
04:00	06	NE
05:00	04	NNE
06:00	04	N
07:00	04	N
08:00	03	NNE
09:00	04	NE
10:00	04	ENE
11:00	04	E
12:00	05	E
13:00	05	ESE
14:00	04	SE
15:00	04	SE
16:00	03	SE
17:00	03	SSE
18:00	03	SSE
19:00	03	SSE
20:00	03	SE
21:00	03	SE
22:00	03	ESE
23:00	04	E
00:00	04	E

Date: 27.01.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	03	E
02:00	03	ENE
03:00	03	ENE
04:00	00	CALM
05:00	00	CALM
06:00	03	ENE
07:00	04	E
08:00	04	E
09:00	04	ENE
10:00	03	ENE
11:00	04	E
12:00	04	E
13:00	04	E
14:00	03	ESE
15:00	03	SE
16:00	03	SE
17:00	03	SE
18:00	00	CALM
19:00	00	CALM
20:00	00	CALM
21:00	03	SSE
22:00	03	SSE
23:00	04	S
00:00	04	S

Date: 04.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	03	S
02:00	04	SSW
03:00	03	S
04:00	04	SSW
05:00	03	SW
06:00	03	SW
07:00	03	WSW
08:00	03	WSW
09:00	03	SW
10:00	04	S
11:00	03	S
12:00	00	CALM
13:00	03	SSE
14:00	03	SE
15:00	03	SE
16:00	04	E
17:00	04	ENE
18:00	04	NE
19:00	04	ENE
20:00	04	ENE
21:00	05	ENE
22:00	06	NE
23:00	06	NE
00:00	05	NE

Date: 05.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	NNE
02:00	04	NNE
03:00	04	NE
04:00	03	NNE
05:00	04	NE
06:00	04	ENE
07:00	03	ENE
08:00	03	NE
09:00	03	NE
10:00	03	ENE
11:00	03	NE
12:00	00	CALM
13:00	03	NE
14:00	03	NE
15:00	04	ENE
16:00	04	ENE
17:00	04	NE
18:00	04	ENE
19:00	05	NE
20:00	06	NNE
21:00	06	NNE
22:00	06	N
23:00	07	N
00:00	06	NNW

Date: 13.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	NNW
02:00	05	NW
03:00	04	NW
04:00	05	NW
05:00	05	WNW
06:00	04	WNW
07:00	04	W
08:00	04	WNW
09:00	04	W
10:00	03	W
11:00	03	WSW
12:00	04	WSW
13:00	03	W
14:00	03	W
15:00	00	CALM
16:00	03	WSW
17:00	03	WSW
18:00	00	CALM
19:00	00	CALM
20:00	03	WSW
21:00	03	SW
22:00	03	SW
23:00	03	SSW
00:00	04	SW

Date: 14.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	04	SW
02:00	04	SSW
03:00	03	SSW
04:00	03	S
05:00	03	S
06:00	04	SSW
07:00	03	S
08:00	03	S
09:00	03	SSE
10:00	03	SE
11:00	03	SE
12:00	03	SE
13:00	00	CALM
14:00	00	CALM
15:00	03	E
16:00	03	ENE
17:00	04	NE
18:00	03	NE
19:00	04	NNE
20:00	05	NNE
21:00	05	N
22:00	05	NNW
23:00	06	NNW
00:00	06	NW

Date: 22.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	NW
02:00	04	WNW
03:00	03	WNW
04:00	00	CALM
05:00	00	CALM
06:00	03	WNW
07:00	03	W
08:00	04	W
09:00	05	NNW
10:00	05	N
11:00	06	NNE
12:00	06	NE
13:00	07	NNE
14:00	07	NE
15:00	06	ENE
16:00	07	E
17:00	07	NE
18:00	08	NNE
19:00	08	NNE
20:00	08	NE
21:00	08	NNE
22:00	09	NE
23:00	10	NE
00:00	10	E

Date: 23.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	09	E
02:00	08	NE
03:00	09	NNE
04:00	10	NE
05:00	10	N
06:00	10	N
07:00	11	NNE
08:00	11	NNE
09:00	11	NW
10:00	12	WNW
11:00	10	WNW
12:00	10	W
13:00	09	WSW
14:00	08	WSW
15:00	09	SW
16:00	08	SW
17:00	08	WSW
18:00	07	WSW
19:00	07	SW
20:00	07	SW
21:00	06	SSW
22:00	06	S
23:00	06	SSE
00:00	05	SSE

Date: 27.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	05	SE
02:00	04	ESE
03:00	05	SE
04:00	05	SSE
05:00	04	SE
06:00	04	SE
07:00	04	SSE
08:00	04	SEE
09:00	04	SE
10:00	04	SE
11:00	03	SSE
12:00	03	SSE
13:00	03	SE
14:00	03	SE
15:00	03	SE
16:00	00	CALM
17:00	00	CALM
18:00	00	CALM
19:00	03	ESE
20:00	03	ESE
21:00	03	SE
22:00	03	SE
23:00	04	E
00:00	04	E

Date: 28.02.2010

Hours	Wind	
	Speed (kmph)	Direction
01:00	04	ENE
02:00	03	NE
03:00	03	NE
04:00	03	NNE
05:00	04	NE
06:00	04	NE
07:00	04	NE
08:00	04	NE
09:00	05	NNE
10:00	06	N
11:00	06	N
12:00	08	NNW
13:00	09	NNW
14:00	09	N
15:00	10	N
16:00	11	NNE
17:00	11	NE
18:00	12	NE
19:00	12	ENE
20:00	11	ENE
21:00	12	E
22:00	11	ESE
23:00	11	ESE
00:00	10	SE

STAFF ANNUAL MEDICAL EXAMINATION- 2007-2008

S.NO	E.CODE	NAME [MR]	DEPARTMENT	CBC	URINE	B/GROUP	B/SUGAR	ECG	X-RAY	SPIRO.	AUDIO.	OTHER	T.NO	H.RISK CASES	HIT./WEIGT	CH.EXAP.	NS.-NON SMOKER	EYE R/L	COL.BIL.
1	1004	FATEH SINGH SHEKHAWAT	SECURITY	DONE	DONE	"O"+VE	104MG%	N.DONE	L/YEAR	NA	NA	NA	207		175/75	101/108	6/6		NIL
2	1011	TATA VENKAT SAMBA S.RAO	ACCOUNT	DONE	DONE	A-VE	112/102	WNL	NA	NA	NA	NA	226	NORMAL	166/68	102/109	6/12,6/12		NIL
3	1030	MM.JOHN	PERSONNEL	DONE	DONE	B -VE	169MG%	LVH	2007-08	NA	NA	NA	229	DIABETES	179/66	90/98	6/6		NIL
4	1032	SANJAY SHARMA	INSTRUMENTATION	DONE	DONE	O+VE	80	WNL	L/YEAR	DONE	DONE		263	NORMAL ECG	167/73	91/97	6/6		NIL
5	1067	TEK RAM NAYAK	MINES	DONE	DONE	"O"+VE	109.0 MG%	WNL	L/YEAR	DONE	DONE	NA	89	NORMAL	168/62	86/98	6/6		NIL
6	1113	SANJAY MAHESHWARI	PURCHASE (RAIPUR)	DONE	DONE	AB+VE	100	DONE	12.4.08	NA	NA	NA	289	NORMAL	171/72	93/102	6/6,6/36		NIL
7	1140	SATYAJEET SONI	PRODUCTION	DONE	DONE	B+VE	85	WNL	L/YEAR	NA	NA	NA	296	NORMAL	172/89	99/108	6/6		NIL
8	1146	YOGENDRA KUMAR	ELECTRICAL	DONE	DONE	B+VE	100	WNL	L/YEAR	DONE	DONE	NA	252	NORMAL	175/65	88/94	6/6		NIL
9	1163	BARUN KUMAR NATH	RMH.	DONE	DONE	"B"+VE	116MG%*	WNL	L/YEAR	NA	NA	NA	167	NORMAL ECG	165/55	85/90	6/6		NIL
10	1164	GHANSHYAM PD.DEWANGAN	ADMINISTRATION	DONE	DONE	"O"+VE	100MG%	LVH	L/YEAR	NA	NA	NA	220	NORMAL	159/52	84/92	6/6,6/9		NIL
11	1170	TAKESHWAR PD.VERMA	Q&EC	DONE	DONE	"A"+VE	98mg%	DONE	L/YEAR	NA	NA	NA	16	NORMAL	175/72	94/100	6/6		NIL
12	1176	MURARI LAL DEWANGAN	MINES	DONE	DONE	"B"+VE	96 MG%	DONE	L/YEAR	DONE	DONE	NA	56	RODERLINE ECG	172/70	98/104	6/6/		NIL
13	1178	VINOD KUMAR MANGLA	PERSONNEL	DONE	DONE	"O"+-VE	142MG%	ABNO.	L/YEAR	NA	NA	NA	45	ABNORMAL	177/73	95/101	6/6		NIL
14	1191	Lt.Col.AMITAVA SENGUPTA	ADMINISTRATION	DONE	DONE	B-VE	143	WNL	L/YEAR	NA	NA	NA	274	NORMAL	174/67	85/95			NIL
15	1194	ANIL KUAMR SHRIASTAVA	PACKING PLANT	DONE	DONE	A+VE	134	WNL	L/YEAR	NA	NA	NA	282	NORMAL	172/70	98/105	6/6,6/6G		NIL
16	1199	OM PRAKASH AGRAWAL	TPP AND PROJECT	DONE	DONE	"A"+VE	112 MG%	WNL	DONE	NA	NA	NA	84	Diabetes normal ECG	163/66	96/102	6/6		G-NIL
17	1219	JORAWAR SINGH CHOUHAN	ELECTRICAL	DONE	DONE	B+VE	100	WNL	L/YEAR	DONE	DONE	NA	255	NORMAL	165/66	85/93	6/6		NIL
18	1220	PRASHAM JAIN	ACCOUNT	DONE	DONE	B-VE	81	WNL	NA	NA	NA	NA	235	NORMAL	161/66	93/11			NIL
19	1222	NAVEEN M DAVE	DGPP	DONE	DONE	B+VE	93	WNL	L/YEAR	NA	DONE	NA	290	NORMAL	180/74	90/98	6/6		NIL
20	1232	MANORANJAN JAIN	PRODUCTION	DONE	DONE	"B"+VE	100MG%	WNL	L/YEAR	NA	NA	NA	152	ABNORMAL	174/65	92/96	6/6		NIL
21	1233	P.C.HARDENIYA	ELECTRICAL	DONE	DONE	B+VE	93	WNL	L/YEAR	DONE	DONE	NA	259	NORMAL	167/56	84/91	6/6		NIL
22	1237	O P VIJAY	CIVIL	DONE	DONE	"B"+VE	123MG%	WNL	L/YEAR	NA	NA	NA	32	NORMAL	180/79	103/109	6/6,6/9G		NIL
23	1241	SANJAY SHARMA	CIVIL	DONE	DONE	A+VE	158	WNL	L/YEAR	NA	NA	F.PP,LIPID	287	DIABETES	177/75	93/102	6/6G		NIL
24	1242	AVINASH KUMAR SHARMA	INSTRUMENTATION	DONE	DONE	"O"+VE	101MG%		L/YEAR		NA	NA	37	NO DOCTOR CONSULT	176/64	88/93	6/6		NIL
25	1244	NIRMALYA BHATTACHARJEE	PROJECT	DONE	DONE	"B"+VE	217 mg%	DONE	L/YEAR	NA	NA	NA	85	Diabetes	164/75	96/100	6/6		NIL
26	1247	RAVINDRA KUMAR SADHYA	ELECTRICAL	DONE	DONE	O+VE	104	WNL	L/YEAR	DONE	DONE	NA	256	NORMAL	166/64	86/91	6/6G		NIL
27	1248	VIPIN KUMAR PANWAR	MECHANICAL	DONE	DONE	"O"+-VE	93MG%	WNL	L/YEAR	NA	NA	NA	148	ABNORMAL ECG	174/61	82/89	6/9,6/9G		NIL
28	1249	SACHIN BANGUR (PAGE NO 7)	FINANCES&COMMERCE	DONE	DONE	A+VE	81	WNL	L/YEAR	NA	NA	DLC	227	NORMAL	185/75	94/99	6/6		NIL
29	1253	PRAMOD KUMAR GUPTA	INSTRUMENTATION	DONE	DONE	"O"+VE	80mg%	DONE	L/YEAR	NA	NA	NA	38	AUDIO LEFT EAR MILD	178/55	83/89	6/6		NIL
30	1254	BHUPENDRA SINGH	HR	DONE	DONE	O-VE	129	DONE	2007-08	NA	NA	NA	238	NORMAL	169/59	86/92	6/6		NIL
31	1255	VIKASH TIWARI	Q&EC	DONE	DONE	AB+VE	100MG%*	WNL	L/YEAR	NA	NA	NA	180	NORMAL ECG	169/70	96/100	6/6		NIL
32	1256	RAJESH KUMAR SINGH	Q&EC	DONE	DONE	"A"+VE	84MG%*	DONE	L/YEAR	NA	NA	NA	165	ABNORMAL	176/72	89/95	6/6		NIL
33	1257	GOPAL KUMAR SEN	Q&EC	DONE	DONE	"B"+VE	94mg%	wnl	L/YEAR	NA	NA	NA	133	NORMAL	170/67	84/87	6/6		NIL
34	1258	NIRMALA KUMAR PRADHAN	ELECTRICAL	DONE	DONE	"B"+VE	127MG%	DONE	L/YEAR	NA	NA	NA	26	NORMAL	177/69	91/95	6/6		NIL
35	1261	GRISH KUMAR KASHYAP	MECHANICAL	DONE	DONE		100mg%	DONE	L/YEAR	NA	NA	NA	12	NORMAL	188/87	106/112	6/6		NIL
36	1264	K.V.S.PARTHA SARTHI	MECHANICAL	DONE	DONE	B+VE	110	WNL	L/YEAR	DONE	DONE	NA	254	NORMAL	177/66	89/96	6/6		NIL
37	1266	AMIT JAIN	ACCOUNT	DONE	DONE	A+VE	77	DONE	L/YEAR	NA	NA	NA	224	NORMAL	174/65	82/93	6/6		NIL
38	1268	JAN NISAR AKHTAR FAROOQUEE	INSTRUMENTATION	DONE	DONE	"B"+VE	87MG%	DONE	L/YEAR	NA	NA	NA	110	ABNORMAL ECG	178/69	89/95	6/6		NIL
39	1269	PARTH BASU	MINES	DONE	DONE	O+VE	112	WNL	L/YEAR	DONE	DONE	NA	269	NORMAL	160/58	81/89	6/6		NIL
40	1270	GOVIND NARAYAN JAIN	PRODUCTION	DONE	DONE	O NEG.	119	WNL	L/YEAR	NA	NA	NA	285	NORMAL	163/59	90/98	6/6		NIL
41	1271	K.RAJESWAR KUMAR DUTT	INSTRUMENTATION	DONE	DONE		DONE	DONE	L/YEAR	NA	NA	NA	11	NORMAL	177/62	85/88	6/6		NIL
42	1273	OM PRAKASH KHELKAR	MINES	DONE	DONE	AB+VE	100	WNL	L/YEAR	DONE	DONE	NA	264	NORMAL	180/84	96/104	6/6		NIL
43	1274	SUBHASH CHANDRA SONBOIR	DRAWING&DESIGN	DONE	DONE	O+VE	105	WNL	21.5.08	NA	NA	NA	294	NORMAL	167/52	83/89	6/12,6/12		NIL
44	1276	PRADEEP KUMAR UPADHYAY	PRODUCTION	DONE	DONE	O+VE	98	DONE	L/YEAR	NA	NA	NA	295	NORMAL	163/50	81/89	6/6		NIL
45	1277	SANDEEP KUMAR	MECHANICAL	DONE	DONE	"O"+-VE	100MG%*	WNL	L/YEAR	NA	NA	NA	164	NORMAL ECG	179/65	86/98	6/6		NIL
46	1280	SANJAY KUMAR GUPTA	HR	DONE	DONE	B+VE	87	WNL	L/YEAR	NA	NA	NA	240	NORMAL	164/64	91/95	6/6		NIL
47	1284	ALOK PATHAK	SAFETY	DONE	DONE	"B"+VE	102 MG%	DONE	L/YEAR	NA	NA	NA	96	NORMAL ECG	170/78	96/101	6/6		NIL
48	1286	BINAY KUMAR AWASTHI	Q&EC	DONE	DONE	"O"+VE	11mg%*	WNL	L/YEAR	NA	NA	NA	209	NORMAL	171/68	93/99	6/6		NIL
49	1287	AJIT KUMAR	PURCHASE	DONE	DONE	"O"+VE	176MG%	DONE	2007-08	NA	NA	F.PP,R.	241	DIBETICS	165/69	94/100	6/6		NIL
50	1288	SUNIL KUMAR VERMA	MATERIALS	DONE	DONE	"B"+VE	88	DONE	L/YEAR	NA	NA	NA	243	NORMAL	170/75	92/100	6/6		NIL
51	1289	DEO PRAKASH AGRAWAL	Q&EC	DONE	DONE	"B"+VE	120MG%	DONE	L/YEAR	NA	NA	NA	17	NORMAL	169/65	90/95	6/6		NIL
52	1292	TULSI RAM YADAV	ELECTRICAL	DONE	DONE	A+VE	89	WNL	L/YEAR	DONE	DONE	NA	257	NORMAL	167/64	88/96	6/6		NIL
53	1295	RAJESH KUMAR JAISWAL	INSTRUMENTATION	DONE	DONE	"B"+VE	101MG%	WNL	L/YEAR	NA	NA	NA	146	ABNORMAL ECG	175/66	85/90	6/6		NIL
54	1296	MAYANK PIYUSH	MECHANICAL	DONE	DONE	O+VE	100mg%	WNL	L/YEAR	DONE	DONE	NA	253	normal	170/83	104/111	6/6		NIL
55	1297	HITENDRA JHA	HRD	DONE	DONE	B+VE	95.0	WNL	L/YEAR	NA	NA	NA	276	NORMAL	167/58	81/89	6/6,6/36		NIL
56	1298	ANANT KUMAR SHRAMA (PAGE 6)	HRD	DONE	DONE	O+VE	99	DONE	L/YEAR	NA	NA	NA	237	NORMAL	170/77	98/108	6/6		NIL

57	1299	AMAR KUMAR	ACCOUNT	DONE	DONE	B+VE	93	DONE	L/YEAR	NA	NA	NA	225	NORMAL	164/64	91/97	6/6	NIL
58	1301	SANJEEV KUMAR JAIN	MATERIALS	DONE	DONE	AB+VE	100	WNL	L/YEAR	NA	NA	NA	275	NORMAL	173/75	75/93	6/6	NIL
59	1303	PRAFUL TANBA SORTE	MINES MAINTENANCE	DONE	DONE	B+VE	80mg%	DONE	L/YEAR	DONE	DONE	NA	281		165/63	93/104	6/6	NIL
60	1306	K.V.RAMANA MURTY	MECHANICAL	DONE	DONE	"B"+VE	100MG%	WNL	L/YEAR	DONE	NA	NA	117	ABNORMAL ECG	168/65	92/97	6/6	NIL
61	1308	RAKESH KUMAR CHATURVEDI	PROCESS	DONE	DONE	"A"+VE	103MG%	WNL	L/YEAR	NA	NA	NA	119	ABNORMAL ECG	173/65	95/98	6/6	NIL
62	1312	MOHD.KHADER KHAN	MINES	DONE	DONE	O+VE	100	WNL	L/YEAR	NA	NA	NA	280	NORMAL	176/77	99/113	6/6	NIL
63	[0051	K.N.TIWARI	PROJECT	DONE	DONE		207MG%	DONE	2007-08	NA	NA	F,PP	242	DIABETES	178/75	96/102		NIL
64	[0056	INDRESH KUMAR NAYAK	ELECTRICAL	DONE	DONE	"B"+VE	129MG%*	WNL	L/YEAR				208	NORMAL	168/55	81/87	6/6	NIL
65	[0057	DAYANATH DEO	ELECTRICAL	DONE	DONE	O+VE	385MG%	WNL	L/YEAR	DONE	DONE	NA	250	DIBETICS	165/60	95/101	6/6	NIL
66	[0060	J.PRAKASH SINGH	INSTRUMENTATION	DONE	DONE	O+VE	80.0MG%	WNL	L/YEAR	NA	NA	NA	292	NORMAL	175/56	81/88	6/6	NIL
67	[0063	DEVI DIN CHATURVEDI	MINES OPERATION	DONE	DONE		110MG%*		L/YEAR	DONE	DONE	NA						
68	[0121	A.I.MADHAVAN UNNI	PERSONNEL	DONE	DONE	"A"+VE	233MG%	DONE	L/YEAR	NA	NA	NA	13	DIABETES	170/65	94/98	6/9G	NIL
69	[0123	K.HEMCHANDRA RAO	MINES	DONE	DONE	O+VE	79	DONE	L/YEAR	NA	NA	NA	231	NORMAL	161/63	95/100	6/6	NIL
70	[0124	K.MURALIDHARAN	OMF&O(SECRETARIAT	DONE	DONE	"B"+VE	118 MG%	DONE	L/YEAR	NA	NA	NA	70	NORMAL	173/65	93/98	6/9,6/12	NIL
71	[0134	MURARI LAL KESHARWANI	ACCOUNT	DONE	DONE		90mg%	DONE	L/YEAR	NA	NA	NA	30	NORMAL	170/81	101/105	6/6.	NIL
72	[0148	S.K.PANIGRAHI	ACCOUNT	DONE	DONE	B+VE	126	WNL	L/YEAR				228	NORMAL	176/78	99/105	6/6	NIL
73	[0149	RAMESHKUMAR AGRAWAL	RAW MATERIAL	DONE	DONE	B+VE	110	DONE	L/YEAR	DONE	NA	NA	283	NORMAL	176/72	96/106	6/6	NIL
74	[0151	RAJESH MANTRI	ACCOUNT	DONE	DONE	AB+VE	72	WNL	L/YEAR	NA	NA	NA	234	NORMAL	174/77	98/104	6/6	NIL
75	[0163	K.P.SREEKUMAR	SI-VP(PROJECT&SECRETARIAT	DONE	DONE	"B"+VE	105 MG%	LVH	L/YEAR	NA	NA	NA	50	ABNORMAL	147/47	81/85	6/9,6/9G	G -NIL
76	[0171	MRITYUNJAY DASH	INSTRUMENTATION	DONE	DONE	"O"+VE	97MG%	DONE	L/YEAR	NA	NA	NA	27	NORMAL	165/72	96/100	6/6.	NIL
77	[0194	CHUDAMANI GIRDHARI JAISHI	SECURITY	DONE	DONE	"O"+VE	120MG%	DONE	L/YEAR	NA	NA	NA	15	NORMAL	167/70	98/104	6/6.	NIL
78	[0221	UDAY NARAYAN MISHRA	Q&EC	DONE	DONE	"A"+VE	98MG%	DONE	L/YEAR	NA	NA	NA	128	ABNORMAL	173/72	100/104	6/9,6/9	NIL
79	[0223	MAHENDRA KUMAR SHARMA	RAW MATERIAL HANDLING	DONE	DONE	"AB"+VE	139mg%	WNL	L/YEAR	NA	NA	NA	93	Otherwise normal ECG,HT	170/54	77/82	6/6	NIL
80	[0226	N.V.SUBBA RAO	MINES MAINTENANCE	DONE	DONE	A+VE	100	WNL	L/YEAR	NA	NA	NA	244	NORMAL				
81	[0230	VINOD KUMAR BANCHHORE	MINES OPERATION	DONE	DONE	O+VE	95	WNL	L/YEAR	DONE	DONE	NA	271	NORMAL	170/66	88/95	6/6	NIL
82	[0237	ARUN KUMAR SARDAR	MINES OPERATION	DONE	DONE	"O"+VE	118 mg%	WNL	L/YEAR	DONE	DONE	NA	81	NORMAL	174/95	106/111	6/6	NIL
83	[0247	JAI PRAKASH SARASWAT	Q&EC	DONE	DONE	"B"+VE	110MG%*	wnl	L/YEAR	NA	NA	NA	201	NORMAL	171/75	98/105	6/6	NIL
84	[0248	SHAISHAV AGRAWAL	STORES	DONE	DONE	"O"+VE	78 MG%	WNL	L/YEAR	NA	NA	NA	60	NORMAL	168/70	93/98	6/6,6/9	NIL
85	[0254	RAMENDRA KUMAR SHRIVASTAVA	PRODUCTION	DONE	DONE	"O"+VE	113MG%*	WNL	L/YEAR	NA	NA	NA	159	BORDARLINE ECG	162/62	89/94	6/6	NIL
86	[0280	SAJAL KUMAR GHOSH	MINES OPERATION	DONE	DONE	AB+VE	110	DONE	L/YEAR	DONE	DONE		267	borderline normal ECG	173/83	102/106	6/6	NIL
87	[0288	DILIP KUMAR AAGRAWAL	PRODUCTION	DONE	DONE	"O"+VE	121 MG%	WNL	L/YEAR	NA	NA	NA	90	ABNORMAL ECG	163/75	98/102	6/6	NIL
88	[0289	KORATA VENUGOPALA RAO	PRODUCTION	DONE	DONE	"B"+VE	297 MG%	WNL	L/YEAR	NA	NA	NA	68	Otherwise normal ECG	176/77	94/99	6/9,6/9	NIL
89	[0291	SHIVANAND TIWARI	ACCOUNT	DONE	DONE	A+VE	89mg%	WNL	NA	NA	NA	NA	245	NO PATHOLOGY	182/80	96/104	6/6	NIL
90	[0299	SUNIL VASU	RAW MATERIAL	DONE	DONE	"A"+VE	104MG%	WNL	L/YEAR	NA	NA	NA	140	NORMAL ECG	160/62	90/94	6/6	NIL
91	[0303	OM PRAKASH VERMA	PACKING PLANT	DONE	DONE	O+VE	96	WNL	L/YEAR	DONE	DONE	NA	270	NORMAL	154/65	92/102	6/6	NIL
92	[0304	D.SUNDAR RAO	RURAL DEVELOPMENT	DONE	DONE	O+VE	114	WNL	L/YEAR	NA	NA	NA	293	NORMAL	175/72	95/102	6/6	NIL
93	[0324	BYOMOJIT DIXIT	ELECTRICAL	DONE	DONE	"B"+VE	105	WNL	L/YEAR	DONE	NA	NA	258	NORMAL	175/75	95/103	6/6	NIL
94	[0440	LALIT KUMAR NAYAK	ELECTRICAL	DONE	DONE	"B"+VE	97	WNL	L/YEAR	NA	NA	NA	239	NORMAL	170/71	93/98		NIL
95	[0455	ANIL KUMAR VERMA	RAW MATERIAL	DONE	DONE	O+VE	93.0MG%*	WNL	2007-08	DONE	DONE	NA	218	NORMAL	164/54	83/99	6/6	NIL
96	[0504	NARENDRA MOHAN AGRAWAL	Q&EC	DONE	DONE	"B"+VE	84MG%	DONE	L/YEAR	NA	NA	NA	168	ABNORMAL ECG	180/92	99/104	6/6	NIL
97	[0536	GRIJA SHANKAR TIWARI	PACKING PLANT	DONE	DONE	"B"+VE	128 MG%	WNL	L/YEAR	NA	DONE	NA	80	Otherwise normal ECG	175/77	99/103	6/9,6/9	NIL
98	[0536	GRIJA SHANKAR TIWARI	PACKING PLANT	DONE	DONE	"B"+VE	128 MG%	WNL	L/YEAR	DONE	DONE	NA	80	Otherwise normal ECG	180/90	95/104	6/6	NIL
99	[0548	NAVIN SHARMA	PACKING PLANT	DONE	DONE	"B"+VE	118MG%*	WNL	L/YEAR	NA	NA	NA	162	Otherwise normal ECG	175/60	88/94	6/6	NIL
100	[0558	GEORGE KUTTY P.P.	RAW MATERIAL	DONE	DONE	"O" -VE	103MG%	DONE	L/YEAR	DONE	DONE	NA	221		170/70	95/102	6/6	NIL
101	[0569	C.GRISH NAIDU	Q&EC	DONE	DONE	"B"+VE	99mg%	WNL	L/YEAR	NA	NA	NA	39	NORMAL	179/80	103/99	6/6	NIL
102	[0577	SUDHIR KUMAR SAHAY	STORES	DONE	DONE	O+VE	173MG%	WNL	L/YEAR	NA	NA	NA	230	DIABETES	181/80	96/102	6/6	NIL
103	[0613	RAJNEESH SHARMA	PURCHASE	DONE	DONE	AB+VE	291	WNL	L/YEAR	NA	NA	NA	268	NORMAL	171/75	100/107	6/9,6/9G	NIL
104	[0643	SANJAY KUMAR TAHKUR	PACKING PLANT	DONE	DONE	"B"+VE	100*	WNL	L/YEAR	DONE	NA	NA	158	Otherwise normal ECG	179/60	83/88	6/6	NIL
105	[0851	ANGAD KUMAR DWIVEDI	SECURITY	DONE	DONE	"O"+VE	115 MG%	WNL	L/YEAR	NA	NA	NA	94	Otherwise normal ECG	181/84	97/103	6/9,6/9G	NIL
106	[0855	RATAN LAL GUPTA	PACKING PLANT	DONE	DONE	O+VE	125%*	N.DONE	L/YEAR	DONE	DONE	NA	186	Otherwise normal ECG	161/78	89/95	6/6	NIL
107	[0874	DINESH KUMAR VERMA	RMH.	DONE	DONE	"O"+VE	110mg%*	N.DONE	L/YEAR	NA	NA	NA	195	NORMAL	172/94	104/111	6/6	NIL
108	[0881	RAMESH PAL	RMH.	DONE	DONE	"A"+VE	120MG%	OTH.	L/YEAR	NA	NA	NA	49	Otherwise normal ECG	165/75	94/98	6/6	NIL
109	[0890	AMAR PREM (PAGE NO 3)	MECHANICAL	DONE	DONE	"B"+VE	87 MG%	WNL	L/YEAR	NA	NA	NA	71	NORMAL	166/69	90/94	6/6	NIL
110	[0892	SANJEEV MISHRA	RMH.	DONE	DONE	"B"+VE	83MG%	WNL	L/YEAR	NA	NA	NA	125	ABNORMAL ECG	168/70	95/99	6/6	NIL
111	[0893	SHASHI KANT SHARMA	ELECTRICAL	DONE	DONE	O+VE	118MG%*	DONE	L/YEAR	NA	DONE	NA	211	NORMAL	178/70	89/97	6/6	NIL
112	[0907	SUBIR KUMAR SENGUPTA	Q&EC	DONE	DONE	"B"+VE	88 MG%	WNL	L/YEAR	NA	NA	NA	97	BORDARLINE	162/72	96/99	6/6	NIL
113	[0911	SATYA PRAKASH YADAV	MECHANICAL	DONE	DONE	"B"+VE	90 MG%	WNL	L/YEAR	NA	NA	NA	46	NORMAL	168/65	95/100	6/9,6/6	NIL
114	[0944	RAJ KUMAR MAURYA	MINES	DONE	DONE	O+VE	113	WNL	L/YEAR	N	NA	NA	279	NORMAL	169/95	109/116	6/6	NIL
115	[0967	N.RAMA RAO	VP(P&A AND HR)	DONE	DONE	"O"+VE	113 mg%	WNL	L/YEAR	NA	NA	NA	98	Otherwise normal ECG	160/55	89/94	6/6	NIL
116	[0979	SANTOSH KUMAR	RAW MATERIAL HANDLING	DONE	DONE	O+VE	100MG%*	N.DONE	L/YEAR	NA	NA	NA	170	UNCOPLEET	169/50	83/88	N.DONE	NIL

117	[0980]	DAULAT RAM BAGHEL	PRODUCTION	DONE	DONE	"B"+VE		WNL	L/YEAR	NA	NA	NA	57	NORMAL	179/84	100/104	6/6	NIL
118	[0991]	BALDAU RAM SAHU	RAW MATERIAL	DONE	DONE	"O"+VE	112MG%*	WNL		NA	NA	NA	171	ABNORMAL	167/65	90/94	6/6	NIL
119	1281	VIKASH TIWARI	PRODUCTION	DONE	DONE	B+VE	109	WNL	L/YEAR	NA	NA	NA	297	NORMAL	171/66	87/94	6/6	NIL
120	1239	H.MALIK (PAGE NO 4)	P&A AND HR	Medical		Examination done by out of Hospital & record not avelabal												
121	1293	VIJAY KUMAR DWIVEDI	PROCESS	DONE	DONE	O+VE	93	WNL	L/YEAR	NA	NA	NA	298	NORMAL	168/72	92/103	6/6	NIL
122	1272	RAKESH PATNAYIK	TECHNICAL	DONE	DONE	O+VE	86	WNL	L/YEAR	NA	NA	NA	299	NORMAL	166/70	92/100	6/6	NIL
123	[0848]	G.SRINIVAS RAO	TECHNICAL SERVICES	DONE	DONE	A+VE	89	WNL	L/YEAR	NA	NA	NA	300		166/73	95/103	6/6 G	RED
124	1252	VIJAY KUMAR DATTATRAYA MALI	MINES			Examination done by out of Hospital & record not avelabal							301					
125	[0028]	SHEO PRAKASH SHRIVASTAVA	ADMINISTRATION	DONE	DONE	B+VE	85	WNL	NA	NA	NA	NA	302	NORMAL	162/74	98/107	6/6,6/9	NIL
126	1062	SANJAY GOVIND NAYAK	DGPP	DONE	DONE	B+VE	76	WNL	L/YEAR	NA	NA	NA	21.6.2008	NORMAL	177/107	116/123	6/6	NIL
127	1205	VIKASH KUMAR SARASWATULLA	MECHANICAL	DONE	DONE	O NEG.	100	DONE	L/YEAR	NA	NA	NA	23.6.08	NORMAL	169/49	77/84	6/6	NIL
128	1217	KAUTUK SHRIVASTAVA	MECHANICAL	DONE	DONE	AB+VE	81	WNL	L/YEAR	NA	NA	NA	25.6.08	NORMAL	167/75	93/99	6/6	NIL
129	1218	MITHILESH DABRAL	INSTRUMENTATION	DONE	DONE	AB+VE	95	DONE	L/YEAR	NA	NA	NA	23.6.08	NORMAL	177/62	88/98	6/6	NIL
130	1221	P.K. VISHWAKARMA	MECHANICAL	DONE	DONE	O+VE	108	DONE	L/YEAR	NA	NA	NA	30.6.08	NORMAL	168/64	85/94	6/6	NIL
131	1260	BHARAT BHUSHAN VERMA	MECHANICAL	DONE	DONE	O+VE	93	WNL	L/YEAR	NA	NA	NA	25.6.08	NORMAL	168/77	94/102	6/6	NIL
132	1265	SANDEEP VERMA	PROJECT	DONE	DONE	B+VE	92	WNL	L/YEAR	NA	NA	NA	23.6.08	NORMAL	169/65	89/100	6/6	NIL
133	5048	JALESHWAR SINGH	MECHANICAL	DONE	DONE	A+VE	98	WNL	L/YEAR	NA	NA	NA	23.6.08	NORMAL	171/62	87/94	6/6	NIL
134	[0025]	ATUL MUKUND POPHLI	I.T	DONE	DONE	ONEG.	105	WNL	L/YEAR	NA	NA	NA	27.6.08	NORMAL	165/72	93/100	6/6	NIL
135	[0266]	TARUN DEWAN	PRODUCTION	DONE	DONE	B -VE	174	WNL	L/YEAR	NA	NA	NA		NORMAL	167/67	88/97	6/6	NIL
136	[0457]	RAVI SHANKAR SHARMA	ELECTRICAL	DONE	DONE	"O"+VE	116	WNL	23.6.08	NA	NA	NA	23.6.08	NORMAL	163/60	92/98	6/6	NIL

AMBIENT AIR QUALITY

LOCATION: SA1 Plant Site

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
05.03.2009	11.20	14.30	14.65	19.01	12.99	17.52	52.86	21.10
06.03.2009	11.12	14.36	14.99	19.25	13.20	17.23	53.85	21.25
11.03.2009	11.52	14.56	15.23	19.12	13.56	17.02	54.56	21.95
12.03.2009	11.45	14.65	15.64	19.54	13.45	17.41	55.96	22.20
19.03.2009	11.65	14.87	15.25	19.44	13.65	17.45	57.24	22.95
20.03.2009	11.78	14.65	15.45	19.65	13.54	17.61	57.96	23.20
26.03.2009	11.58	14.52	15.47	19.74	13.99	17.65	58.52	23.45
27.03.2009	11.65	14.66	15.97	19.54	13.87	17.92	58.53	24.12
02.04.2009	11.84	14.98	16.00	19.23	13.78	17.85	60.23	24.92
03.04.2009	11.87	14.85	16.12	19.66	13.98	17.54	61.25	25.10
09.04.2009	11.98	14.58	16.02	19.85	13.85	18.02	62.58	25.54
10.04.2009	12.02	15.00	16.24	19.74	13.87	18.05	63.25	25.95
16.04.2009	12.45	15.21	16.03	19.54	13.54	18.54	64.45	26.15
17.04.2009	12.33	15.32	16.12	19.24	13.77	18.22	65.25	26.65
24.04.2009	12.56	15.24	16.22	19.85	13.64	18.65	65.55	27.23
25.04.2009	12.64	15.64	16.07	19.99	13.54	18.45	64.96	28.65
03.05.2009	12.74	15.44	16.21	20.01	13.25	18.65	66.21	29.12
04.05.2009	12.98	15.21	16.13	20.13	13.45	18.77	68.12	29.95
10.05.2009	12.85	15.99	16.17	20.15	13.88	18.74	67.99	30.12
11.05.2009	12.45	16.25	16.01	20.32	13.74	18.25	68.99	31.45
16.05.2009	12.94	16.29	16.11	20.54	13.99	18.78	69.26	31.96
17.05.2009	12.78	16.66	16.12	20.98	13.47	18.04	69.99	32.77
25.05.2009	12.69	16.52	16.19	20.54	13.97	18.47	70.86	33.10
26.05.2009	12.54	16.99	16.22	21.00	13.32	18.12	70.45	33.50

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	16.30	21.00	70.86	33.50
Min.	11.20	14.30	52.86	21.10
98%tile	27.42	20.7952	70.6714	55.516

AMBIENT AIR QUALITY

LOCATION: SA2 MINE SITE

(Unit $\mu\text{g}/\text{m}^3$)

DATE								
	00 - 08		08 – 16		CLOCK HOURS		24 HOURS	24 HOURS
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x	PM ₁₀	PM _{2.5}
01.03.2009	9.30	11.30	12.37	15.23	11.02	14.32	61.96	21.30
02.03.2009	9.52	11.45	12.40	15.15	11.12	14.22	61.77	22.64
09.03.2009	9.87	11.65	12.42	15.20	11.05	14.25	61.72	23.21
10.03.2009	9.65	11.32	12.46	15.25	11.13	14.44	62.21	23.99
15.03.2009	9.74	11.77	12.49	15.30	11.15	14.46	62.45	24.98
16.03.2009	9.66	11.79	12.52	15.32	11.32	14.56	62.65	25.24
22.03.2009	9.57	11.80	12.65	15.45	11.29	14.52	62.35	26.63
23.03.2009	10.02	12.02	12.59	15.55	11.44	14.78	62.77	27.98
04.04.2009	10.16	12.32	12.53	15.78	11.65	14.87	63.12	28.12
05.04.2009	10.12	12.45	12.61	15.99	11.56	14.82	64.12	28.54
11.04.2009	10.22	12.54	12.62	16.25	11.62	14.80	65.64	29.65
12.04.2009	10.31	12.52	12.77	16.45	11.78	14.82	66.46	30.23
18.04.2009	10.34	12.58	12.74	16.65	11.82	14.88	67.62	31.12
19.04.2009	10.42	12.60	12.88	16.78	11.98	14.85	68.23	31.95
26.04.2009	10.65	12.64	12.84	16.82	12.02	14.90	69.54	32.56
27.04.2009	10.55	12.66	12.66	16.98	12.11	14.92	72.26	33.10
01.05.2009	10.78	12.70	12.54	170.5	12.09	14.95	73.45	34.52
02.05.2009	10.92	12.82	12.95	17.23	12.05	14.99	76.87	35.20
14.05.2009	11.02	13.56	13.01	17.45	12.03	14.96	75.89	35.98
15.05.2009	11.15	13.66	13.16	17.65	12.22	14.87	77.26	36.12
20.05.2009	11.23	13.85	13.25	17.85	12.25	14.98	80.12	36.65
21.05.2009	11.16	13.94	13.30	18.03	12.24	15.02	81.69	37.47
26.05.2009	11.27	13.87	13.20	18.23	12.34	15.05	81.54	37.99
27.05.2009	11.62	14.02	13.24	18.30	12.35	15.12	82.76	38.10

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	13.4	18.3	82.76	38.10
Min.	9.3	11.3	61.72	21.30
98%tile	13.246	18.2706	82.2678	38.0494

AMBIENT AIR QUALITY

LOCATION: SA3 Guest House

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 - 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
03.03.2009	6.7	8.40	10.14	12.01	8.05	10.65	45.23	20.50
04.03.2009	6.85	8.52	10.65	12.14	7.99	10.71	45.12	20.66
13.03.2009	6.74	8.65	10.54	12.24	8.03	10.77	45.32	21.03
14.03.2009	6.77	8.71	10.32	12.34	8.13	10.89	45.44	21.23
20.03.2009	6.82	8.77	10.65	12.36	8.25	10.82	45.65	21.45
21.03.2009	6.87	8.82	10.74	12.41	8.32	10.87	45.54	21.56
28.03.2009	6.98	8.91	10.81	12.44	8.36	10.89	45.59	21.99
29.03.2009	6.92	8.93	10.85	12.46	8.46	10.94	46.99	22.35
06.04.2009	6.91	8.99	10.89	12.56	8.49	10.95	47.25	22.91
07.04.2009	6.95	9.02	10.87	12.62	8.54	11.02	47.85	23.12
13.04.2009	6.93	9.12	10.95	12.72	8.56	11.05	47.99	23.54
14.04.2009	7.01	9.15	10.97	12.79	8.65	11.15	48.65	23.95
20.04.2009	7.04	9.25	10.91	12.85	8.66	11.22	49.12	24.78
21.04.2009	7.12	9.32	11.02	12.86	8.67	11.35	51.02	24.98
28.04.2009	7.23	9.45	11.12	12.84	8.72	11.65	52.24	25.23
29.04.2009	7.45	9.46	11.23	12.95	8.77	11.72	53.25	25.65
06.05.2009	7.33	9.52	11.30	12.99	8.76	11.85	54.99	26.42
07.05.2009	7.46	9.55	11.32	13.25	8.89	11.76	56.42	26.75
12.05.2009	7.54	9.65	11.25	13.65	8.94	11.89	57.48	27.13
13.05.2009	7.62	9.71	11.34	13.75	9.12	11.90	58.12	28.78
22.05.2009	7.60	9.82	11.40	13.85	9.55	11.91	59.46	28.99
23.05.2009	7.78	9.89	11.42	13.95	9.42	11.93	61.58	29.14
28.05.2009	7.89	10.25	11.50	14.25	9.46	11.96	62.24	30.20
29.05.2009	7.91	10.35	11.46	14.50	9.81	11.99	64.80	30.50

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	11.5	14.5	64.80	30.50
Min.	6.7	8.4	45.12	20.50
98%tile	11.4432	14.124	63.6224	30.362

AMBIENT AIR QUALITY

LOCATION: SA4 Khaparadhi Village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 - 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
05.03.2009	6.8	10.4	11.45	12.01	9.23	11.15	33.23	18.50
06.03.2009	6.82	10.45	11.56	12.10	9.35	11.20	33.12	18.77
11.03.2009	6.87	10.56	11.58	12.12	9.45	11.22	33.95	18.90
12.03.2009	6.89	10.52	11.59	12.25	9.56	11.32	35.25	19.25
19.03.2009	6.98	10.62	11.65	12.29	9.87	11.34	35.98	19.45
20.03.2009	7.01	10.64	11.64	12.32	9.75	11.35	36.21	19.75
26.03.2009	7.12	10.71	11.72	12.35	9.78	11.40	37.85	19.99
27.03.2009	7.15	10.77	11.78	12.45	9.94	11.42	38.25	20.12
02.04.2009	7.32	10.75	11.75	12.49	10.21	11.46	39.45	20.23
03.04.2009	7.42	10.79	11.85	12.52	10.34	11.47	41.52	21.35
09.04.2009	7.56	10.77	11.82	12.56	10.45	11.49	43.56	21.65
10.04.2009	7.85	10.78	11.86	12.58	10.56	11.52	44.65	21.85
16.04.2009	7.95	10.81	11.89	12.62	10.64	11.65	45.21	22.16
17.04.2009	8.012	10.82	11.90	12.65	10.67	11.72	45.65	22.36
24.04.2009	8.25	10.83	11.98	12.68	10.87	11.69	45.98	22.77
25.04.2009	8.32	10.85	11.99	12.71	10.79	11.68	46.25	22.99
03.05.2009	8.45	10.86	12.00	12.75	10.98	11.75	46.99	23.12
04.05.2009	8.52	10.91	12.04	12.74	11.02	11.78	47.25	23.56
10.05.2009	8.77	10.92	12.11	12.78	11.15	11.76	47.65	23.64
11.05.2009	8.82	10.95	12.23	12.80	11.16	11.85	48.12	23.71
16.05.2009	8.95	10.93	12.34	13.00	11.19	11.80	49.57	24.12
17.05.2009	8.98	10.94	12.45	13.20	11.23	11.82	50.94	24.45
225.05.2009	8.99	10.99	12.65	13.45	11.34	11.99	51.23	24.65
26.05.2009	8.97	11.02	12.70	13.60	11.42	11.98	51.11	25.00

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	12.7	13.6	51.23	25.00
Min.	6.8	10.4	33.12	18.50
98%tile	12.566	13.345	51.1748	24.839

AMBIENT AIR QUALITY

LOCATION: SA5 Raweli village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
01.03.2009	5.9	8.90	10.14	12.01	8.05	10.65	31.87	18.40
02.03.2009	6.12	8.91	10.65	12.14	7.99	10.71	32.85	18.77
09.03.2009	6.35	8.92	10.54	12.24	8.03	10.77	33.45	18.90
10.03.2009	6.45	8.93	10.32	12.34	8.13	10.89	34.56	19.25
15.03.2009	6.55	8.94	10.65	12.36	8.25	10.82	35.98	19.45
16.03.2009	6.64	8.95	10.74	12.41	8.32	10.87	36.21	19.75
22.03.2009	6.78	8.96	10.81	12.44	8.36	10.89	37.85	19.99
23.03.2009	6.92	8.97	10.85	12.46	8.46	10.94	38.25	20.12
04.04.2009	6.91	8.99	10.89	12.56	8.49	10.95	39.45	20.23
05.04.2009	6.95	9.02	10.87	12.62	8.54	11.02	41.52	21.35
11.04.2009	6.93	9.12	10.95	12.72	8.56	11.05	43.56	21.65
12.04.2009	7.01	9.15	10.97	12.79	8.65	11.15	44.65	21.85
18.04.2009	7.04	9.25	10.91	12.85	8.66	11.22	45.21	22.16
19.04.2009	7.12	9.32	11.02	12.86	8.67	11.35	45.65	22.36
26.04.2009	7.23	9.45	11.12	12.84	8.72	11.65	45.98	22.77
27.04.2009	7.45	9.46	11.23	12.95	8.77	11.72	46.25	22.99
01.05.2009	7.33	9.52	11.30	12.99	8.76	11.85	46.99	23.12
02.05.2009	7.46	9.55	11.32	13.25	8.89	11.76	47.25	23.56
14.05.2009	7.54	9.65	11.25	13.65	8.94	11.89	48.95	23.64
15.05.2009	7.62	9.71	11.34	13.75	9.12	11.90	50.12	23.71
20.05.2009	7.60	9.82	11.40	13.85	9.55	11.91	51.23	24.12
21.05.2009	7.78	9.89	11.42	13.95	9.42	11.93	51.98	24.45
26.05.2009	7.89	10.25	11.50	14.25	9.46	11.96	52.52	24.65
27.05.2009	7.91	10.35	11.60	14.30	9.81	11.99	52.67	25.10

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	11.6	14.3	52.67	25.10
Min.	5.9	8.9	31.87	18.40
98%tile	11.4664	14.124	52.601	24.893

AMBIENT AIR QUALITY

LOCATION: SA6 Chuchurungpur Village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 - 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
03.03.2009	6.8	8.50	9.35	12.01	8.05	10.65	33.23	19.10
04.03.2009	6.82	8.55	9.37	12.14	7.99	10.71	33.12	19.25
13.03.2009	6.85	8.65	9.38	12.24	8.03	10.77	33.95	19.85
14.03.2009	6.88	8.71	9.42	12.34	8.13	10.89	35.25	20.12
20.03.2009	6.90	8.77	9.51	12.36	8.25	10.82	37.28	20.25
21.03.2009	6.92	8.82	9.55	12.41	8.32	10.87	38.65	20.65
28.03.2009	6.98	8.91	9.58	12.44	8.36	10.89	39.54	20.84
29.03.2009	6.92	8.93	9.62	12.46	8.46	10.94	40.25	21.63
06.04.2009	6.91	8.99	9.65	12.56	8.49	10.95	41.54	21.99
07.04.2009	6.95	9.02	9.68	12.62	8.54	11.02	43.56	22.12
13.04.2009	6.93	9.12	9.69	12.65	8.56	11.05	45.26	22.78
14.04.2009	7.01	9.15	9.70	12.72	8.65	11.15	46.58	23.15
20.04.2009	7.04	9.25	9.72	12.75	8.66	11.22	47.85	23.54
21.04.2009	7.12	9.32	9.82	12.81	8.67	11.35	48.25	23.90
28.04.2009	7.23	9.45	9.95	12.84	8.72	11.65	50.23	24.78
29.04.2009	7.45	9.46	10.02	12.89	8.77	11.72	51.23	24.92
06.05.2009	7.33	9.52	10.25	12.90	8.76	11.85	52.26	25.15
07.05.2009	7.46	9.55	10.32	12.99	8.89	11.76	52.89	25.64
12.05.2009	7.54	9.65	10.45	13.02	8.94	11.89	53.12	26.78
13.05.2009	7.62	9.71	10.56	13.11	9.12	11.90	54.12	26.98
22.05.2009	7.60	9.82	10.60	13.15	9.20	11.91	54.65	27.20
23.05.2009	7.78	9.89	10.65	13.19	9.22	11.93	55.15	27.45
28.05.2009	7.89	10.25	10.64	13.35	9.25	11.96	56.23	28.12
29.05.2009	7.91	10.35	10.70	13.40	9.32	11.99	56.86	28.60

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	10.7	13.4	56.86	28.60
Min.	6.8	8.5	33.12	19.10
98%tile	10.6458	13.2858	56.5702	28.3792

AMBIENT AIR QUALITY

LOCATION: SA7 Rawan village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
05.03.2009	8.01	10.30	10.14	12.01	8.46	11.42	40.36	20.00
06.03.2009	8.00	10.35	10.65	12.14	8.48	11.52	41.23	20.66
11.03.2009	8.12	10.42	10.54	12.24	8.50	11.55	42.56	21.03
12.03.2009	8.14	10.45	10.32	12.34	8.66	11.59	43.96	21.23
19.03.2009	8.16	10.52	10.65	12.46	8.70	11.60	44.25	21.45
20.03.2009	8.17	10.56	10.74	12.56	8.73	11.62	45.65	21.56
26.03.2009	8.20	10.58	10.81	12.62	8.75	11.68	46.54	21.99
27.03.2009	8.22	10.62	10.85	12.72	8.80	11.70	48.77	22.35
02.04.2009	8.25	10.65	10.89	12.79	8.82	11.72	50.23	22.91
03.04.2009	8.27	10.71	10.87	12.85	8.91	11.75	51.65	23.12
09.04.2009	8.30	10.77	10.95	12.86	8.95	11.78	52.56	23.54
10.04.2009	8.31	10.79	10.97	12.95	8.98	11.80	52.95	23.95
16.04.2009	8.33	10.82	11.23	12.99	9.01	11.82	53.45	24.78
17.04.2009	8.34	10.87	11.45	13.20	9.12	11.85	53.95	24.98
24.04.2009	8.32	10.89	11.65	13.34	9.23	11.83	54.54	25.23
25.04.2009	8.34	10.94	11.72	13.56	9.54	11.89	54.95	25.65
03.05.2009	8.36	10.95	11.75	13.62	9.64	11.90	55.12	26.42
04.05.2009	8.38	11.02	11.92	13.99	9.87	11.92	56.45	26.75
10.05.2009	8.40	11.05	12.12	14.23	9.92	11.93	57.85	27.13
11.05.200	8.41	11.15	12.23	14.34	9.95	11.94	58.24	28.78
16.05.2009	8.42	11.16	12.32	14.57	9.99	11.96	59.24	28.99
17.05.2009	8.44	11.20	12.46	14.62	10.12	11.97	60.23	29.14
25.05.2009	8.45	11.23	12.78	14.78	10.23	11.98	61.12	29.58
26.05.2009	8.46	11.32	12.90	14.80	10.31	11.99	31.32	30.00

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	12.9	14.8	61.32	30.00
Min.	8.00	10.3	40.36	20.00
98%tile	12.6456	14.7128	60.7106	29.8068

AMBIENT AIR QUALITY

LOCATION: SA8 Ameri Village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
01.03.2009	5.50	8.50	9.71	12.01	7.04	10.65	32.09	18.81
02.03.2009	5.52	8.55	9.73	12.05	7.12	10.71	32.23	18.98
09.03.2009	5.55	8.65	9.75	12.12	7.23	10.77	32.54	19.21
10.03.2009	5.58	8.71	9.78	12.15	7.45	10.89	33.25	19.25
15.03.2009	5.62	8.77	9.82	12.18	7.33	10.82	33.66	19.45
16.03.2009	5.63	8.82	9.84	12.20	7.46	10.87	34.56	19.75
22.03.2009	5.64	8.91	9.86	12.21	7.54	10.89	35.25	19.99
23.03.2009	5.66	8.93	9.88	12.23	7.62	10.94	36.65	20.12
04.04.2009	5.68	8.99	9.90	12.25	7.60	10.95	36.92	20.23
05.04.2009	5.70	9.02	9.92	12.27	7.78	11.02	36.99	21.35
11.04.2009	5.75	9.12	9.95	12.29	7.89	11.05	37.35	21.65
12.04.2009	5.60	9.15	9.96	12.31	7.91	11.15	37.85	21.85
18.04.2009	5.62	9.25	9.99	12.33	8.23	11.22	38.54	22.16
19.04.2009	5.71	9.32	10.02	12.34	8.34	11.35	39.54	22.36
26.04.2009	5.79	9.45	10.05	12.37	8.45	11.65	40.23	22.77
27.04.2009	5.82	9.46	10.09	12.40	8.56	11.72	41.25	22.99
01.05.2009	5.89	9.52	10.12	12.42	8.62	11.85	42.34	23.12
02.05.2009	6.12	9.55	10.15	12.45	8.72	11.76	43.56	23.56
14.05.2009	6.23	9.65	10.17	12.48	8.84	11.89	44.65	23.64
15.05.2009	6.34	9.71	10.19	12.50	9.12	11.90	45.85	23.71
20.05.2009	6.54	9.82	10.21	12.51	9.34	11.91	45.98	24.12
21.05.2009	6.65	9.89	10.23	12.53	9.45	11.93	46.35	24.45
26.05.2009	6.72	10.25	10.27	12.55	9.56	11.96	47.85	24.65
27.05.2009	6.77	10.35	10.30	12.60	9.66	11.99	48.32	25.00

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	10.3	12.6	48.32	25.00
Min.	5.50	8.5	32.09	18.81
98%tile	10.2532	12.5416	48.1038	24.839

AMBIENT AIR QUALITY

LOCATION: SA9 Kasahidih Village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
03.03.2009	7.2	8.7	11.45	11.03	9.23	10.4	33.12	18.50
04.03.2009	7.5	8.72	11.56	11.12	9.35	10.45	33.23	18.77
13.03.2009	7.6	8.75	11.58	11.45	9.45	10.56	33.45	18.90
14.03.2009	7.7	8.77	11.59	11.56	9.56	10.52	34.56	19.25
20.03.2009	7.10	8.79	11.65	11.65	9.87	10.62	35.98	19.45
21.03.2009	7.11	8.82	11.64	11.78	9.75	10.64	36.21	19.75
28.03.2009	7.12	8.85	11.72	11.89	9.78	10.71	37.85	19.99
29.03.2009	7.15	8.86	11.78	11.98	9.94	10.77	38.25	20.12
06.04.2009	7.32	8.89	11.75	12.02	10.21	10.75	39.45	20.23
07.04.2009	7.42	8.91	11.85	12.12	10.34	10.79	41.52	21.35
13.04.2009	7.56	8.94	11.82	12.15	10.45	10.77	43.56	21.65
14.04.2009	7.85	8.95	11.86	12.19	10.56	10.78	44.65	21.85
20.04.2009	7.95	8.99	11.89	12.20	10.64	10.81	45.21	22.16
21.04.2009	8.012	9.05	11.90	12.23	10.67	10.82	45.65	22.36
28.04.2009	8.25	9.07	11.98	12.30	10.87	10.83	45.98	22.77
29.04.2009	8.32	9.12	11.99	12.32	10.79	10.85	46.25	22.99
06.05.2009	8.45	9.23	12.00	12.35	10.98	10.86	46.99	23.12
07.05.2009	8.52	9.44	12.02	12.38	11.02	10.91	47.25	23.56
12.05.2009	8.77	9.54	12.05	12.42	11.15	10.92	48.95	23.64
13.05.2009	8.82	9.59	12.08	12.45	11.16	10.95	50.12	24.58
22.05.2009	8.95	9.86	12.09	12.52	11.19	10.93	51.23	25.62
23.05.2009	8.98	9.94	12.10	12.56	11.23	10.94	51.98	25.75
28.05.2009	8.99	10.02	12.12	12.62	11.34	10.99	52.52	26.22
29.05.2009	8.97	10.23	12.20	12.70	11.42	11.02	52.87	26.40

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	12.2	12.7	52.87	26.40
Min.	7.2	8.7	33.12	18.50
98%tile	12.116	12.5948	52.709	26.3172

AMBIENT AIR QUALITY

LOCATION: SA10 Kasahidih Village

(Unit $\mu\text{g}/\text{m}^3$)

DATE	CLOCK HOURS							
	00 – 08		08 – 16		16 – 24		24 HOURS PM ₁₀	24 HOURS PM _{2.5}
	SO ₂	NO _x	SO ₂	NO _x	SO ₂	NO _x		
03.03.2009	7.10	8.2	11.45	11.03	9.23	10.4	34.12	18.46
04.03.2009	7.12	8.25	11.56	11.12	9.35	10.45	34.56	18.77
13.03.2009	7.15	8.35	11.58	11.45	9.45	10.56	35.98	18.90
14.03.2009	7.22	8.55	11.59	11.56	9.56	10.52	36.21	19.25
20.03.2009	7.25	8.64	11.65	11.65	9.87	10.62	37.85	19.45
21.03.2009	7.28	8.77	11.64	11.78	9.75	10.64	38.25	19.75
28.03.2009	7.30	8.85	11.72	11.89	9.78	10.71	39.45	19.99
29.03.2009	7.31	8.86	11.78	11.98	9.94	10.77	41.52	20.12
06.04.2009	7.32	8.89	11.75	12.02	10.21	10.75	43.56	20.23
07.04.2009	7.42	8.91	11.85	12.12	10.34	10.79	44.65	21.35
13.04.2009	7.56	8.94	11.82	12.15	10.45	10.77	45.21	21.65
14.04.2009	7.85	8.95	11.86	12.19	10.56	10.78	45.98	21.85
20.04.2009	7.95	8.99	11.89	12.20	10.64	10.81	46.99	22.16
21.04.2009	8.012	9.05	11.90	12.23	10.67	10.82	47.25	22.36
28.04.2009	8.25	9.07	11.98	12.30	10.87	10.83	48.95	22.77
29.04.2009	8.32	9.12	11.99	12.32	10.79	10.85	50.12	22.99
06.05.2009	8.45	9.23	12.00	12.35	10.98	10.86	51.23	23.12
07.05.2009	8.52	9.44	12.02	12.38	11.02	10.91	51.98	23.56
12.05.2009	8.77	9.54	12.05	12.42	11.15	10.92	52.52	23.64
13.05.2009	8.82	9.59	12.08	12.45	11.16	10.95	53.24	24.58
22.05.2009	8.95	9.86	12.20	12.52	11.19	10.93	54.55	25.62
23.05.2009	8.98	9.94	12.35	12.56	11.23	10.94	55.64	25.75
28.05.2009	8.99	10.02	12.42	12.59	11.34	10.99	56.72	26.22
29.05.2009	8.97	10.23	12.50	12.60	11.42	11.02	57.32	27.15

	SO ₂	NO _x	PM ₁₀	PM _{2.5}
Max.	12.5	12.6	57.32	27.15
Min.	7.1	8.2	34.12	18.46
98%tile	12.3906	12.5774	57.044	26.7222

Central Ground Water Authority

Ministry of Water Resources

Government of India

No. 21-4(55)/NCCR/CGWA/2009-

158

Dated: 08-7-2009

To,

M/s Grasim Cement Ltd.,
P.O. Grasim Vihar,
Village Rawan, District Raipur-493196
Chhattisgarh

Sub: No Objection for withdrawal of ground water in respect of M/s Grasim Cement Ltd., for their limestone mine & cement manufacturing unit at village Rawan, Block Simga, Taluka Baloda Bazar, District Raipur, Chattisgarh -reg.


Sir,

Kindly refer to your letter-dated 09.06.2009 on the above-cited subject. As the above mentioned site falls in 'Safe Category' area on ground water resource considerations, Central Ground Water Authority has no objection for the proposed withdrawal of **1500 m³/day** of ground water in respect of **M/s Grasim Cement Ltd., for their limestone mine & cement manufacturing unit at village Rawan, Block Simga, Taluka Baloda Bazar, District Raipur, Chattisgarh.**

However, taking into consideration the adverse effect of the ground water withdrawal that may arise on long term basis, the firm/industry is advised to implement Rain Water Harvesting and Conservation measures, Recycling and Re-use of water and Monitoring of the ground water levels in and around the area as per the hydrogeological investigation report. The data may be submitted to this office for perusal.

The NOC is valid till the area remains under 'Safe Category' on ground water resource consideration, or, for a period of five years from the date of issue of this letter, whichever is earlier.

Yours faithfully,


(S Bhattacharya)
Scientist 'D'

for Member Secretary

Copy for information to:

- 1) The Regional Director, CGWB, NCCR, Raipur.
- 2) The TS to Chairman, CGWB, NH -IV, Faridabad.

1
(S Bhattacharya)
Scientist 'D'
for Member Secretary