NIRMA LTD.

RAPID ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN

FOR

THE PROPOSED CEMENT PLANT (CEMENT 1.91 MTPA, CLINKER 1.5 MTPA), CAPTIVE POWER PLANT (50 MW) AND COKE OVEN PLANT (1.5 LAKH TPA)

AT

VILLAGE PADHIARKA, TALUKA MAHUVA, DISTRICT BHAVNAGAR, GUJARAT

JULY, 2008

Prepared by:

MIN MEC CONSULTANCY PVT. LTD.

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Estb. 1983

An ISO 9001:2000 approved company

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CHAPTER 0

COMPLIANCE TO TERMS OF REFERENCE (TOR)

CHAPTER 0

COMPLIANCE TO TERMS OF REFERENCE (TOR)

0.1 COMPLIANCE TO TERMS OF REFERENCE

The compliance of terms of reference (TOR) for proposed cement plant (cement plant 1.91 MTPA, 1.5 MTPA clinker), Coke oven plant (1.5 Lac TPA) and Captive plant (50 MW) capacity at village Padhiarka, as given by MoEF vide letter no. J-11011/992/2007–IAII(I) dated 27th February,2008 (**Annexure I**) is given in Table 0.1.

TABLE 0.1
COMPLIANCE TO TOR

Sl. No.	Description as per MoEF	Covered in EIA/EMP as per details
1.	Present land use based on satellite imagery should be included.	Present land use based on satellite imagery has been included in Chapter 3, Fig 3.14, page no.3-22. The area under various land uses has been tabulated in Table 3.13, page no. 3-21.
2.	Information on National Park/Sanctuary/Reserve Forests within 10 KM radius of the project site, if any, should be included.	There is no National Park/ Sanctuary/ Reserve Forests within 10 km radius as recorded in para 3.16, page no.3-34 in Chapter 3.
3.	Site-specific micro- meteorological data including inversion height and mixing height should be incorporated.	Please refer para no. 3.3.3, Table 3.4, page no. 3-7 and Annexure XVII.
4.	Existing ambient air, stack emission monitoring of HC, CO alongwith SPM, RSPM, SO_2, NO_X and VOCs should be included.	The existing ambient air quality data is given in para no. 3.4, page no. 3-11 and Annexure IV. The parameters monitored for three months are SPM, RSPM, SO_2 and NOx at a frequency of twice a week. The VOC's have been monitored for one month at the monitoring stations. Since this is a proposed plant, the industry has not been constructed. Hence, stack emission monitoring has not been done. However, the manufacturers estimates of stack emissions are given in para no. 4.4

Sl. No.	Description as per MoEF	Covered in EIA/EMP as per details
		page no. 4-2. Since the temperature in the Coke oven is around 1250°C, the Volatile Matter in the coal will be oxidized and there will be no VOC in the coke oven stack exit.
5.	Details of coke oven plant along with the reasons for the use of non-recovery type of coke oven.	Please refer para no 2.4 page no. 2-10 for details of the coke oven plant and para no. 2.4.11, page no.2-16 and para no. 2.4.16, page no. 2-18, gives the reasons for use of non-recovery type of coke oven.
6.	Proper and full utilization of coke oven gases in power plant and no discharge of gases into the air should be included.	Please refer para no. 2.4.17, page no. 2-18 for details of coke oven gases.
7.	Mass balance of coke oven gases should be incorporated.	Please refer para no. 2.4.17, page no. 2-18, Fig 2.6, page no. 2-19 for mass balance of coke oven gases.
8.	Air quality modelling for the cement and coke oven plant and Air Pollution Control System proposed for the cement, coke oven plant and WHRB.	Please refer para no. 4.4 page no.4-2 for air quality modeling summary and Annexure XVII & XIX for the complete details.
9.	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.	Please refer para no. 4.4 page no.4-2 for air quality modeling summary and Annexure XVII for the complete details based on anticipated stack emissions and site-specific meteorological features.
10.	Sources of secondary fugitive emissions, its control and monitoring as per the CPCB guidelines should be included.	Please refer para no.4.4 page no. 4-2. (fugitive emission) for sources of secondary fugitive emissions and its control.
11.	Impact of the transport of raw material and finished product on the transport system should be assessed and provided.	Please refer para no.4.7 page no. 4-14 for the impact of the transport of raw material and finished product on the transport system.
12.	Chemical characterization of RSPM and incorporation of RSPM data. Location of one AAQMS in downwind direction should be included.	One ambient air quality monitoring station is in the downwind direction as seen in Fig 3.11, page no.3-13 The chemical characterization of RSPM is given in Table 3.9, page no. 3-16.
13.	One-month data for gaseous emissions other than monsoon season should be included.	Please refer chapter 3 para no. 3.4 page no.3-11 Table 3.8 page no. 3-16 for three months data on SPM, RPM,

Sl. No.	Description as per MoEF	Covered in EIA/EMP as per details
		NOx and SO_2. The VOC data has been provided for one month.
14.	'Permission' for the drawl of sea water and water from River Narmada should be incorporated. Water balance cycle data including quantity of effluent generated, recycled and reused and discharged should be included.	Water balance cycle data including quantity of effluent generated, recycled and reused and discharged have been included in para no. 2.10, page no.2-23 & Fig 2.8 & 2.9, page no. 2-25 & 2-26. The permission for withdrawal of water from sea will be taken after submission of NIO report to the concerned authorities and allocation from Narmada water (1.0 MLD) has been done. Refer Annexure XXII for copy of the allocation letter.
15.	A chapter on hydrology study by the State Govt. should be included. Ground water monitoring minimum at 8 locations should be included and assurance that no ground water will be used as proposed.	Please refer para no. 3.5, page no.3-17 for ground water monitoring results. It is assured that no ground water will be used for the proposed plant. The hydrology study by the State Govt. is underway and the summary of the same shall be included as soon as it is available.
16.	Surface as well as roof top rainwater harvesting and ground water recharge should be included.	For rainwater harvesting details, please refer para no. 4.5.3, page no.4-10, Fig 4.1 & 4.2, page no.4-11 & 4-12.
17.	Status of CRZ clearance and impact assessment study for the disposal of treated effluent into the seawater.	The National Institute of Oceanography (NIO) is conducting the marine EIA studies for the seawater intake and wastewater disposal point. The first phase was completed in the year of 2004 and the second phase of studies was completed in 2005. The CRZ clearance shall be obtained based on the NIO reports concurrent to the environmental clearance for the proposed cement plant, coke oven plant and captive power plant.
18.	A write up on use of high calorific hazardous wastes in kiln and commitment regarding use of hazardous waste should be included.	The kiln will be designed to function as an incinerator so that high calorific hazardous waste can be utilised in the kiln as fuel. The detailed write up on use of the high calorific hazardous wastes in kiln is given in para no. 4.9.3 page no. 4-19 of chapter 4 along with the commitment in Annexure XXIII.

Sl. No.	Description as per MoEF	Covered in EIA/EMP as per details
19.	Scheme of proper storage of fly ash, gypsum, clinker should be included.	Storage facilities have been provided for various raw materials. Please refer para no. 2.6, page no. 2-22 & Table 2.7 and 2.8, page no. 2-22.
20.	Risk assessment and damage control should be incorporated.	Please refer chapter 7 for risk assessment and disaster management plan.
21.	Occupational health of the workers should be incorporated.	Occupational health concerns and the measures taken to counter adverse impacts are given in para no.4.14, page no. 4-21.
22.	Green belt development plan for 33% as per CPCB guidelines should be incorporated.	33% of the plant area shall be in green belt/Canal development which can be seen in Table 2.1 page no. 2-1 (Break up of land use) and layout plan in Fig 2.1 page no. 2-2. For further details on greenbelt please refer para no. 4.8.2 page no. 4-15 and Fig 4.3, page no. 4-16.
23.	Socio-economic development activities should be included.	Please refer para no. 4.12 page no. 4-20 and chapter 8,page no. 8-1.
24.	Compliance to the recommendations mentioned in the CREP guidelines should be included.	The CREP guidelines will be followed as discussed in para no.4.15, page no.4-22 of chapter 4.

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THE REPORT

Cement plants appears at Sl. No. 3 (b) of the Schedule of the Environmental Impact Assessment Notification no. S.O. 1533 dated 14th September 2006, and requires environmental clearance from the Central Government since it is Category. A project i.e. more than 1 million tones per annum production capacity. Coke oven plants (Sl. No. 4(b)) of more than 25000 upto 2,50,000 tonnes per annum capacity require environmental clareance from the State level (Category B) while those more than 2,50,000 tonnes per annum capacity require environmental clearance from the Centre (Category A). Furthermore, thermal power plants at Sl. No. 1(d) of more than 5 MW require environmental clearance from Centre or State as per capacity defined for Category A or Category B, respectively. As a result, obtaining environmental clearance before the establishment of the cement plant, coke oven plant and the power plant is a statutory requirement for which the draft environmental impact assessment (EIA) and environmental management plan (EMP) has to be prepared after obtaining the terms of reference (TOR) from the Ministry of Environment and Forests, New Delhi. The public Consultation/hearing is held on the basis of the draft EIA/EMP incorporating the terms of reference and finalized after incorporating the comments and suggestions by the public. The final EIA/EMP is submitted to the MoEF for environmental clearance.

1.2 PROJECT PROPONENT

Nirma Ltd. is a part of the Nirma Group engaged in the business of consumer products like Soap, Detergent and Industrial products like Sulphuric acid, Oleum, Distilled Fatty acids, Linear Alkyl Benzene, Soda ash (Light & Dense), Salt etc. This Group came in existence in the year 1980 and since then continuously expanding its wings for increase in production capacities and diversification. It has overall about 14,000 employee-base and annual turnover of around Rs. 3500 crores.

Production facilities of the Nirma group at its various units are given in Table 1.1.

TABLE 1.1
PRODUCTION FACILITIES OF NIRMA GROUP IN GUJARAT

Sl. No.	Location	District	State	Products Manufactured
1.	Kalatalav	Bhavnagar	Gujarat	Soda Ash, Detergent Powder & Cake, Toilet Soap, Salt etc.
2.	Alindra	Baroda	Gujarat	Linear Alkyl Benzene, Detergent Powder & Cake etc.

Sl. No.	Location	District	State	Products Manufactured
3.	Mandali	Mehsana	Gujarat	Oleum, Sulphuric Acid, Fatty Acids, Alpha Olefin Sulphonate, Glycerin, Toilet Soap, Detergent Powder & Cake etc.
4.	Moraiya	Ahmedabad	Gujarat	Detergent Powder & Cake, Single Super Phosphate, Packaging Plant etc.
5	M/s. Saurashtra Chemicals Limited, Porbandar	Porbandar	Gujarat	Soda Ash
6.	Sachana	Ahmedabad	Gujarat	Intravenous Fluids, Large Volume Parenterals (LVP), Small Volume Parenterals (SVP), Medical Devices etc.

1.3 BRIEF INTRODUCTION TO THE PROJECT

Nirma Limited (NL) proposes to set up a cement plant (cement plant 1.91 million tonnes per annum (MTPA), 1.5 MTPA clinker), coke oven (capacity 1.5 Lakh TPA) and a captive power plant (capacity 50 MW) at village Padhiarka, 15 km from Taluka headquarters Mahuva in district Bhavnagar of Gujarat. Nirma Limited has a good market share in soaps and detergents. This is their first venture into the cement market. Nirma Limited has appointed M/s Min Mec Consultancy Pvt. Limited as its consultant for the preparation of Environmental Impact Assessment and Environmental Management Plan (EIA/EMP). The Techno-Economic Feasibility Report (TEFR) for the project has been prepared by Holtec Consulting Private Limited (HOLTEC).

For the Cement project, major raw material is Limestone which will be mined out from the captive mines located at Padhiarka, Doliya, Madhiya, Vangar, Gujarda, Dudheri, and Dudhala villages. Lignite will be procured locally from Kutch/Bhavnagar. Good quality coal will be imported from Indonesia. The project will be set up over 280 hectares of land, out of which 170 hectares will be utilized for the cement plant, Captive power plant and provision for future expansion. The balance land will be utilized for upcoming Coke Oven Plant. However 33% of the total project area (i.e.92.6 ha.) will be used for Green belt/Canal development. Salient features of the project are shown in Table 1.2.

TABLE 1.2
SALIENT FEATURES OF THE PROJECT AT A GLANCE

Company Name	Nirma Ltd.
Location	Village Padhiarka, Taluka Mahuva, District Bhavnagar, State of Gujarat
Project	Cement plant (1.91 MTPA, 1.5 MTPA clinker) coke oven (1.5 Lakh TPA) and a captive power plant (50 MW)

Product	Cement & clinker, coke
Total land requirement	280 hectares
Raw materials	Limestone (high grade, cement grade, marly), sand, clay, fly ash, lithomargic clay, gypsum, coal.
Estimated project cost	Rs. 893.52 Crores

1.4 LOCATION AND COMMUNICATION

Location

The location map of the area is shown in Fig 1.1. The study area of the proposed project falls in Survey of India Toposheet No. 41 and lies at

Latitude : 21° 01' N

Longitude : 71° 40' E

Communication

Road Link: Proposed site is located near the national highway NH-8E (coastal highway), which is at a distance of 1.0 km from the site.

Rail Link: The nearest railway station is Mahuva which is at a distance of 15 km in north east from the site. Rajula is at a distance of 20 km while Bhavnagar is at a distance of 100 km.

Sea transport: The proposed site is about 25 km north east of the port of Pipavav.

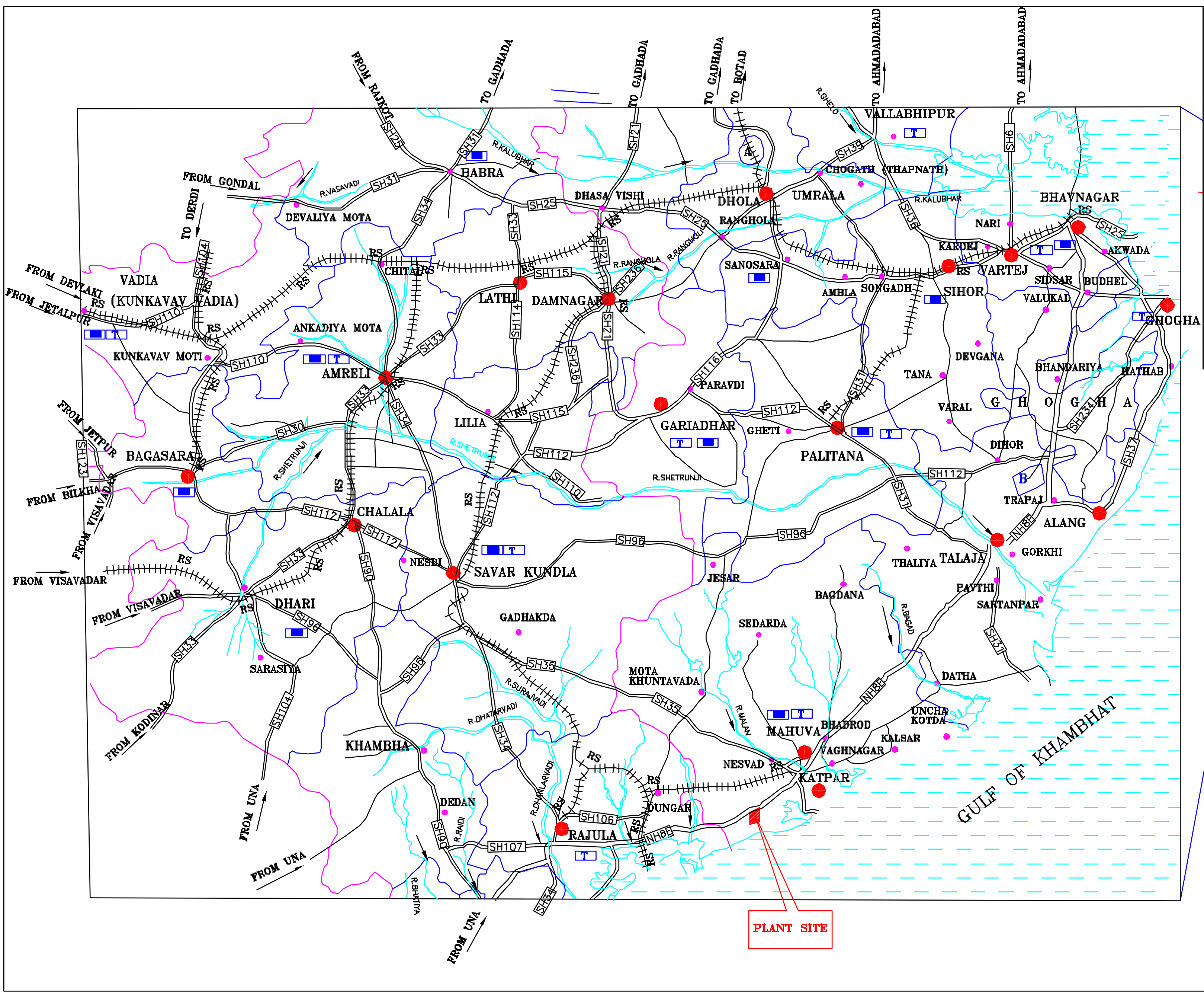
Air Link: The nearest airport is at Bhavnagar about 100 km from the site in north east direction.

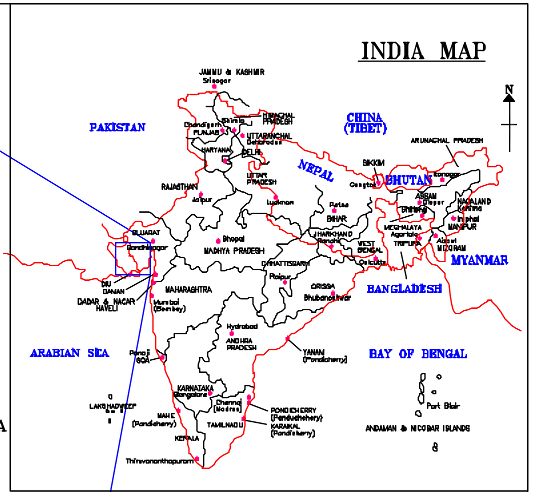
1.5 IMPORTANCE IN THE REGION AND COUNTRY

On assessing the demand-supply gap in the domestic market, it is found that considering the cement plants of the entire country, an overall surplus of 33 MTPA exists in India. The Southern regions has a maximum surplus of 15.1 MTPA followed by North with 12.2 MTPA. In the western sector it is only 1.9 MTPA.

India exported 5.9 MT of cement and 3.1 MT of clinker in FY 07.This amounts to a total of around 9.1 MT in equivalent cement demand. Presently, exports are being predominantly made by port based plants in the Gujarat cluster.

The exports from Gujarat are approximately 7.9 MT. This includes 5.1 MT of cement export and 2.7 MT of clinker export. The total exports from Gujarat thus constitute 87% of the total exports from India.





LEGEND

- PLANT SITE
- RIVER/DRAINAGE
- ROAD
- DISTRICT BOUN.
- RAILWAY
- RAILWAY STATION (RS)
- LOCATION TOWN & VILL.
- TALUKA BOUN.
- DEGREE COLLEGE AND TECHNICAL INSTITUTIONS

MIN MEC CONSULTANCY PVT. LTD.
NEW DELHI, PH. 29534777,29532236,29535891
An ISO 9001 : 2000 Approved Company

PROJECT: NIRMA CEMENT PLANT, CAPTIVE POWER AND COKE OVEN PLANT		
TITLE: EIA/EMP LOCATION MAP		CLIENT: NIRMA LTD.
DRAWN BY: B.R.MATLOTIA	APPROVED BY: B.D.SHARMA	FIG.NO. 1.1
SCALE : AS SHOWN	DATE : 13-09-2007	

Imports are not expected to impose a significant threat to domestic players in future, even in a WTO regime. The primary reason for this is the fact that apart from sea freight, the delay due to congestion at Indian ports and the high cost of loading/unloading adds considerably to the cost for non-competitiveness of imported cement.

Hence, in terms of availability of raw material in near vicinity of the proposed plant and the port of Pipavav being located within 25 km, the production costs and export shall be extremely advantageous for this project. A CAMA (Competitive advantage and market attractiveness) analysis has been done by Holtec Consultants and concluded that approximately 6% of the market share in Gujarat can be captured by the company amounting to 1.38 MTPA, therefore, Nirma will be able to sell its entire volume in the domestic market. Export of cement is not foreseen at present by the technical consultants.

Thus, the project will be contributing to the state exchequer, strengthening the self-sufficiency in cement in the country and if and when required, will earn foreign exchange in the future.

1.6 LEGAL ASPECTS

The relevant NOC's (No Objection Certificates) and licenses will be obtained from the statutory agencies under the following Acts, Rules and their amendments and project proponent will adhere to the guidelines specified in:

1. The Factories Act, 1948
2. The Explosive Act, 1884 and the Explosive Rules 1983
3. Manufacture, Storage and Import of Hazardous Chemical Rules 1989 amended in 2000.
4. The Hazardous Waste (Management and Handling) Rules 1989 under the Environment (Protection) Act – 1986 and its amendments to date
5. The Boiler Act

The project proponent will comply with the prescribed limits laid down for air, effluent and noise emissions for protection of the environment under the following Acts, Rules and amendments:

1. The Water (Prevention and Control of Pollution) Act, 1974
2. The Water (Prevention and Control of Pollution) Cess Act, 1977
3. The Air (Prevention and Control of Pollution) Act, 1981
4. The Environment (Protection) Act, 1986 which is also called umbrella act or legislation
5. The Environment Impact Assessment Notification, 2006

Compliance to State Rules and Notifications will also be ensured.

1.7 SCOPE OF ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PLAN

Nirma Ltd. wish to get the Rapid Environmental Impact Assessment studies prepared for its proposed integrated cement plant, coke oven plant and captive power plant at village Padhiarka, Taluka Mahuva, Bhavnagar district of Gujarat for getting the environmental clearance from the Ministry of Environment and Forests (MoEF), New Delhi.

1.7.1 Objective of EIA/ EMP

The major objectives of the EIA/ EMP are listed below: -

- To establish the present environmental scenario.
- To anticipate the impacts of proposed cement project, during construction and operation phases, on the environment.
- To suggest preventive and mitigative measures to minimise adverse impacts and to maximise beneficial impacts.
- To prepare a detailed action plan for the implementation of mitigation measures.

1.7.2 Methodology for EIA/ EMP

The project area is termed as "core zone". The area within 10 km radius from the periphery of the plant boundary has been considered for identifying and assessing impact in respect of air, water, noise, land use, land based biota and socio-economic environment. This area has been referred as "buffer zone". The core zone and buffer zone together comprise the "study area".

The baseline data on parameters of the above-mentioned aspects over a season provides means for identifying possible impact- positive and adverse. An Environmental Impact Assessment and Environmental Management Plan comprising an overall assessment of the impact due to project activity over base line condition of the existing environment and a mitigating action plan to counter the adverse impact is defined. An environmental monitoring programme is also chalked out to provide scientific support to future actions of environmental protection.

1.7.3 Scope of EIA

The EIA study envisages characterization of the existing status of air, soil, water, noise, ecology, sociology, land use pattern, socio-economic and heritage of the study area of 10 km radius and quantifying impacts on the environmental parameters. Based on the study, the EIA evaluates the proposed control measures by the project and prepares an Environmental Management Plan (EMP), outlining additional proposed activities and delineates the requirements of Environmental Monitoring Programme.

1.7.4 Terms of Reference

The terms of reference on the basis of which the EIA has been prepared are given below:

1.7.4.1 Data generation

The data has been generated by Min Mec R&D Laboratory and Min Mec Consultancy Pvt. Ltd., New Delhi in accordance with the requirement of statutory agencies during 1st March 2007 to 30th May 2007, and is summarised in Table 1.3. The monitoring and testing has been done as per the guidelines of MoEF and the IS standards. Monitoring has been conducted for the following parameters:

TABLE 1.3
DATA GENERATED

Sl. No.	Description	No. of locations	Total no. of samples
1.0	**AIR** Ambient air monitoring (24 hourly samples), twice a week for 3 months for one season **Parameters :** SPM, SO_2, NOx, RPM, CO	5 (one in core zone and 4 in buffer zone)	120
1.1	Meteorological parameters will be measured at hourly duration simultaneously at one air monitoring station for 3 months. **Parameters :** a. Wind speed, direction b. Relative humidity c. Temperature d. Cloudiness e. Rainfall	1	90 days
2.0	**WATER** Water /effluents sample to be collected from each of the various locations (surface and ground water) in core and buffer zone (10 km radius) **Parameters :** Water/effluents : tested for physical and chemical and biological parameters as well as according to applicable standards	10	10
3.0	**SOIL**	3	3
4.0	**NOISE** Hourly readings taken for 24 hours (Leq)	10	10 sets
5.0	**TRAFFIC DENSITY**	1	1 set

1.7.4.2 Data collected

The REIA study has been done for the plant site (core zone) and area within 10 km radius (buffer zone), both of which comprise the 'study area'. The following data, through field survey and other sources, have been collected

by Min Mec for preparing the EIA/EMP for the proposed cement plant with related facilities.

i Relevant meteorological data, for previous decades from India Meteorological Department (IMD)
ii Sensitive places / historical monuments/ biosphere reserves/ wildlife sanctuaries within 10 km radius.
iii Major industries within 10 km radius.
iv Identification of water bodies, hills, roads etc within 10 km radius
v Land use pattern within core zone and buffer zone (10 km radius around the core zone)
vi Demography and Socio-economic based on last available Census data for entire study area
vii Details of fauna and flora within a distance of 10 km from the plant boundary including forest details
viii Study of present environmental protection and mitigation measures in nearby operating similar projects, if any.
ix Geo-hydrological aspects based on available data from various sources.

1.7.4.3 Preparation of EMP

The EMP includes the following details

(a) Study of the Techno-Economic Feasibility Report of the proposed plant
(b) Present Environmental Scenario
The base line data generated and collected are used to establish the present environmental scenario.
(c) Identification, prediction and evaluation of anticipated environmental impacts due to the proposed cement plant and related facilities

The environmental impacts are anticipated in core and buffer zone on:

- Topography and drainage
- Climate
- Water Quality (Surface/Ground)
- Hydro-geological Regime
- Air quality
- Noise Levels
- Flora and Fauna
- Traffic density
- Land-Use
- Socio-Economic Conditions
- Occupational health and safety
- Sensitive Places/Historical Monuments
- Aesthetics and Visual intrusion

The impacts are anticipated based on experience of similar projects.

(d) Proposed Environmental Safeguards and Monitoring Mechanism

Relevant guidelines as per Environmental Impact Assessment (EIA) Notification issued in January 1994 and subsequently in September 2006 under the Environment (Protection) Act, 1986 has been kept in mind while spelling out mitigation measures.

The following aspects have been covered

i Reclamation of areas disturbed during construction but not required for any activity during operation.

ii Measures to control the surface and ground water pollution due to various effluents to be discharged

iii Measures to control air pollution due to proposed activities/ operation.

iv Green belt development plan and plantation in the plant. Identification of flora species, which can be planted in and around the project

v Measures to contain noise pollution and mitigate adverse impact on workers and habitat in core and buffer zone

vi Solid waste management

vii Occupational health and safety measures

viii Pronounce the improvement in socio-economic conditions and benefits, the people will get on implementation of the project

ix Environmental monitoring, implementation organization and feedback mechanism to effect mid course corrections.

x Total and specific cost of implementation of control measures

The experience of similar project(s) has been made use of for envisaging the pollution control measures.

1.7.5 Activities falling in CRZ

The laying of Pipeline for proposed Seawater Intake and Outfall of disposal of effluent will fall in CRZ area. For this, Nirma has engaged M/s. National Institute of Oceanography, Mumbai for EIA study and suggesting Seawater Intake and Outfall location in Gulf of Khambhat. After receipt of NIO report, Nirma will approach competent authority for necessary CRZ clearance.

CHAPTER 2

PROJECT DETAILS

CHAPTER 2

PROJECT DETAILS

2.1 PRODUCTS AND CAPACITY

M/s Nirma Ltd. has proposed to set up a cement plant (1.91 MTPA), coke oven (1.5 LTPA) and a captive power plant (50 MW) with associated infrastructure facilities. The total investment in the project is estimated as Rs. 893.52 crores. The capital investment and recurring annual cost for environmental protection is given in chapter 6.

2.2 PLANT LAYOUT

280 hectare of barren land is available for the cement plant. The area is sufficient to accommodate the proposed facilities and any future expansion also. The captive power plant and the coke oven plant is also proposed within the same premises.

The plant layout is shown in Fig 2.1 and the areas proposed under different uses are given in Table 2.1.

TABLE 2.1
PROPOSED LAND USE OF PLANT AREA

Sl. No	Building Name	Cement Plant	Coke Oven Plant	Total Area, ha.	Percentage
1	Approach Road	24.00	10.00	34.00	12.14
2	Adm. Building	0.56	1.00	1.56	0.56
3	Engg. Building	0.56	0.40	0.96	0.34
4	Laboratory	0.28	0.50	0.78	0.28
5	Workshop	0.28	0.40	0.68	0.24
6	Store Building	0.28	0.50	0.78	0.28
7	Raw Material Handling	15.00	16.00	31.00	11.07
8	Coke Oven Plant	-	10.00	10.00	3.57
9	Cement Plant	65.00	-	65.00	23.21
10	Power Plant & Waste Heat Recovery based Power Plant	2.00	2.00	4.00	1.43
11	Sub Station I &II	1.14	-	1.14	0.41
12	RO & DM Plant	0.86	0.20	1.06	0.38
13	Seawater/ Sweet water Storage	3.00	3.00	6.00	2.14
14	Waste treatment/settling pond	0.86	2.50	3.36	1.2
15	Green Belt & Canal Area	56.18	36.50	92.68	33.1
16	Open Space area for Railway track & future expansion	-	27.00	27.00	9.65
	Total	**170.00**	**110.00**	**280.00**	**100.00**

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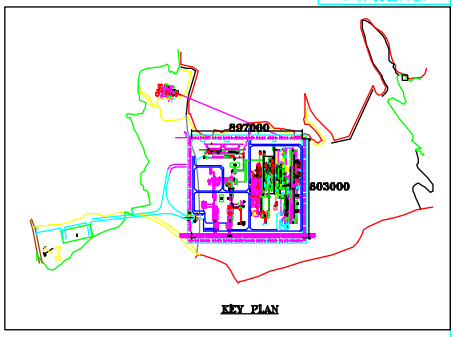
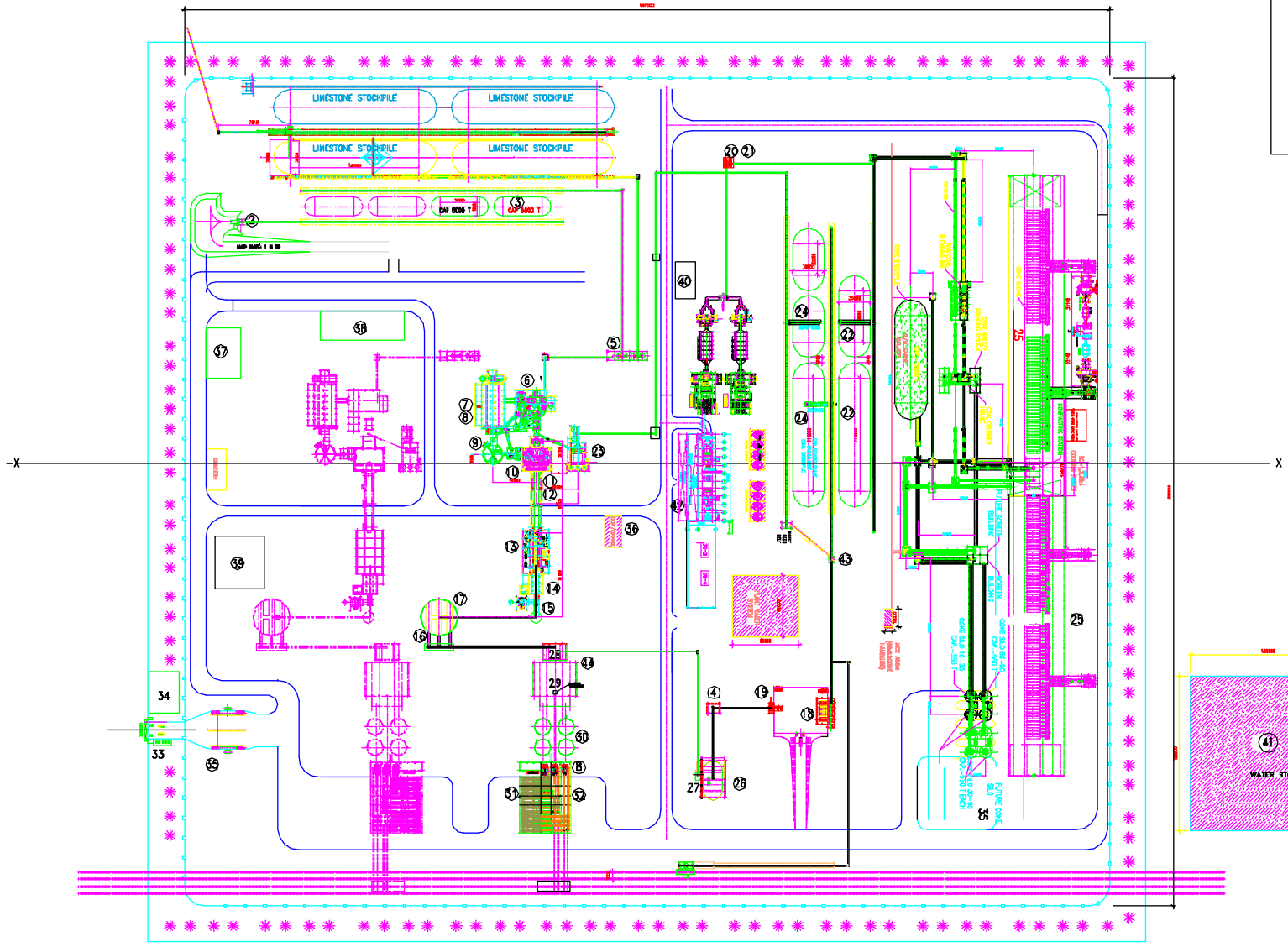
IF IN DOUBT ASK



KEY PLAN



LEGEND	
S NO.	DESCRIPTION
1.	LIMESTONE PREBLENDING STOCKPILE
2.	CORRECTIVE DUMP HOPPER
3.	CORRECTIVE STOCKPILE
4.	GYPSUM CRUSHER
5.	RAW MAT'L HOPPERS
6.	RAW MILL HOUSE
7.	BAG HOUSE/MCC & I/O ROOM (UNDER BAG HOUSE)
8.	COMPRESSOR HOUSE
9.	CF SILO
10.	PREHEATER TOWER
11.	KILN
12.	TA DUCT
13.	COOLER HOUSE
14.	COOLER ESP
15.	CLINKER TRANSFER TOWER & UNBURNT CLINKER HOPPER
16.	CLINKER LOADING
17.	CLINKER SILO
18.	DUMP HOPPER WITH TIPPLER FOR COAL/LIGNITE
19.	DUMP HOPPER FOR GYPSUM
20.	COAL CRUSHER & SCREEN FOR POWER PLANT
21.	INTERMEDIATE BUNKER STATION
22.	COAL/LIGNITE/PETCOKE STOCKPILE
23.	COAL MILL HOUSE
24.	COAL STOCKPILE (FOR POWER PLANT)
25.	COKE OVEN PLANT
26.	GYPSUM STOCKPILE
27.	GYPSUM DUMP HOPPER / CRUSHER
28.	CEMENT MILL HOPPERS
29.	CEMENT GRINDING
30.	CEMENT SILOS
31.	PACKING PLANT
32.	TRUCK LOADING PLATFORM
33.	SECURITY
34.	CEMENT DESPATCH OFFICE
35.	WEIGH BRIDGE
36.	CCR/ LAB./ TECH. OFFICE
37.	ELECT./MECH. WORKSHOP
38.	GENERAL STORE
39.	ADMINISTRATIVE BUILDING
40.	SWITCH YARD & SUB STATION
41.	WATER STORAGE
42.	UTILITY BUILDING
43.	COAL CRUSHER
44.	FLY ASH SILO

LEGEND

NEW

FUTURE

FIG. NO. 2.1

REV	DATE	ISSUED FOR	BY
4	14.05.05	BHMA	SDH
3	29.11.04	BHMA	RAK
2	25.11.04	BHMA	RAK
1	19.10.04	BHMA	RAK
0	30.09.04	BHMA	RAK

Q	NR		NR
REV	01	DATE	04
CONFORMANCE			

REFERENCES

REFERENCE NO.	DETAILS

NOTES

1. DO NOT SCALE, WORK TO DIMENSIONS ONLY.
2. FOR TOLERANCES REF. HOLTEC STD. DRG. NO. A1-HOL-STD-1-128

THIS DRG. IS TO BE READ IN CONJUNCTION WITH OUR FOLLOWING STD. DRG's.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

REV No	DATE	BY	CHKD	APPD	DETAILS
4A	14.05.05	KSI	AA	SDH	PYRO PROCESSING LOCATION FROZEN
4	15.03.05	BK	AA	SDH	LOCATION OF POWER PLANT FROZEN
3	22.12.04	SKR	IB	RAK	DRAWING REVISED ACCORDING TO FFE COKEOVEN PLANT LAYOUT.
2	25.11.04	SKR	IB	RAK	DRAWING GENERALLY REVISED
1	19.10.04	SKR	IB	RAK	DRAWING GENERALLY REVISED

REVISIONS

HOLTEC CONSULTING PRIVATE LIMITED

CUSTOMER : M/s NIRMA LIMITED

DES.	SPS	13.09.04	PROJECT : 04153, NIRMA
DRN.	SPS	18.09.04	
CHKD.	KS MAU	18.09.04	PLANT LAYOUT
APPD.	RAK	18.09.04	4500 TPD. AT PADHARKA

SCALE : 1:2000

DRG.NO. 04153-02-01

REV. 4A

2.3 CEMENT PLANT

The sizing of main machinery for the cement plant is based on the Indian cement industry experience and kiln capacity. The process norms been followed for deciding the equipment size are given in Table 2.2 and the basis of plant design are given in Table 2.3.

TABLE 2.2
BASIS FOR PLANT DESIGN

Clinkerisation factor	Raw meal: Clinker: 1.58:1
Raw mix	Limestone: 97.5% (Moisture: 8-10%)
	Fire Clay: 1.5%
	Sand: 1.0% (Moisture: 8-10%)
Cement mix (OPC & PPC)	Clinker: Gypsum : 95:5 Clinker: Fly Ash: Gypsum: 65:30:5
Fuel consumption	The specific heat consumption is 725 Kcal/kg clinker. The average specific heat consumption has been considered as 750 Kcal/kg clinker.
Net calorific value (NCV) of fuels	Imported coal=6200 kcal/kg
	Lignite=4200 Kcal/kg
	Fuel with 50% imported coal and 50% Lignite is envisaged for production. This implies an average NCV of 5200 kcal/kg. For machinery sizing an NCV of 4,200 Kcal/kg has been considered.

TABLE 2.3
CAPACITY OF MAIN MACHINERY

Items	Capacity (TPH)
Limestone crushing	850
Raw material grinding (VRM)	400
Clinkerisation line	4500
Coal grinding (VRM)	45
Cement grinding VRM	330
Packing machine	3X150 tph

VRM: Vertical Roller Mill

2.3.1 Process technology

The following manufacturing processes are in use for the manufacture of cement.

1. Wet process
2. Semi dry process
3. Dry process

The selection of kiln process is mainly governed by thermal and electrical energy economy. To avail the overall energy efficiency, dry process of manufacture with pre-heater and pre-calcinator has been adopted for the plant. Coal and Lignite are used as fuel for kiln and pre-calcinator.

For the drying and grinding of raw material vertical roller mill has been provided to avail the best advantage on account of energy and drying efficiency. For cement grinding also energy efficient VRM's have been considered.

Process flow sheet of the manufacturing process adopted (dry process) is shown in Fig 2.2.

2.3.2 Process description

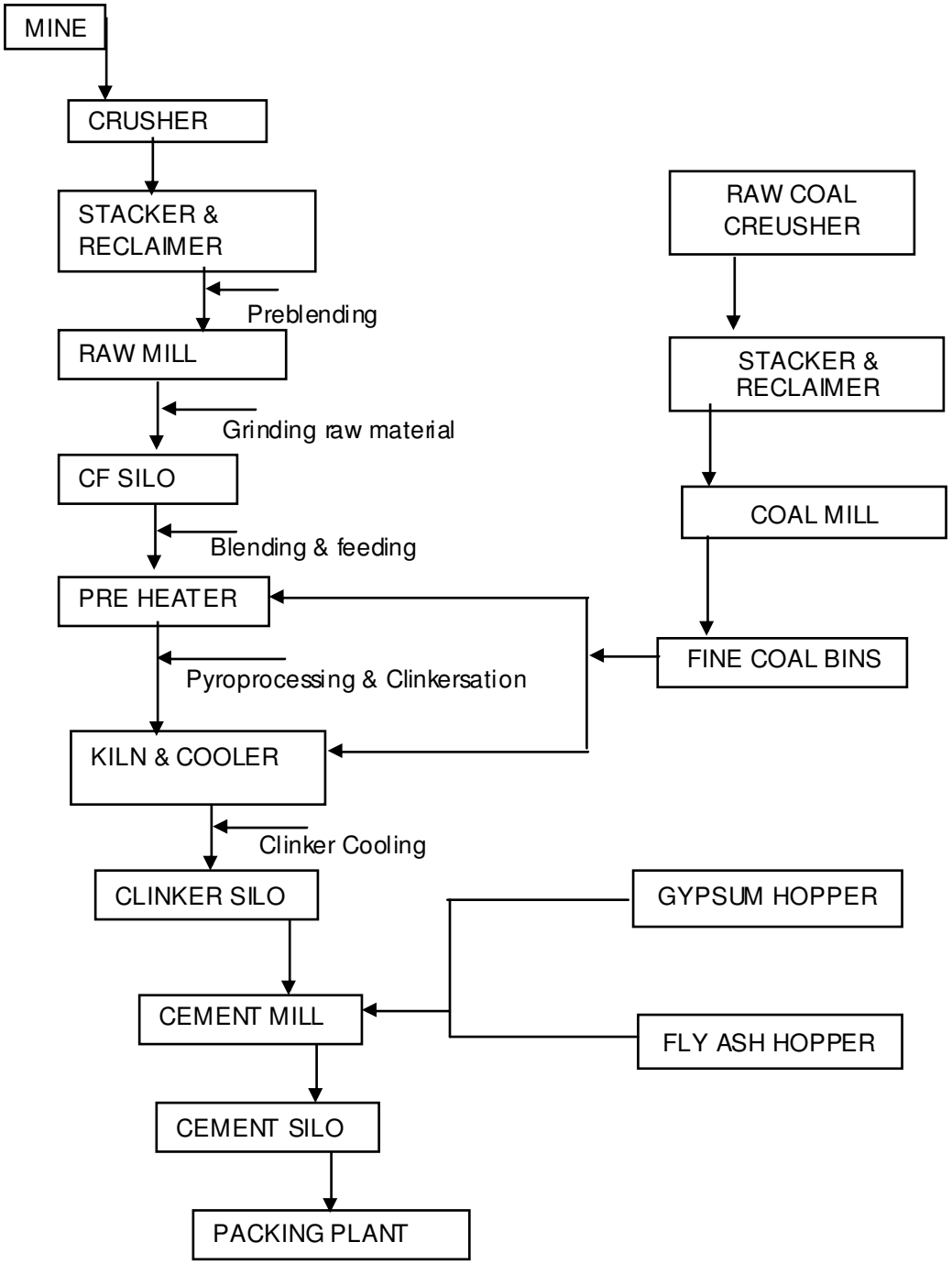
(i) Cement Manufacturing Process

The different steps involved in manufacture of cement from limestone, clay, laterite, gypsum and coal/lignite are as follows:

a) Limestone crushing
b) Raw material grinding
c) Kiln feed and pre-heaters
d) Pre-heating system
e) Clinker storage and transport
f) Cement grinding
g) Cement Transport, Storage and packing
h) Coal mill & fuel unloading, storage and crushing

The main raw material, limestone, is obtained from the captive mines located nearby the plant. In these captive mines, cement grade limestone is available and a very little quantity of additive is to be obtained from outside. The manufacturing process of cement is diagrammatically depicted in Fig 2.2 and Fig 2.3.

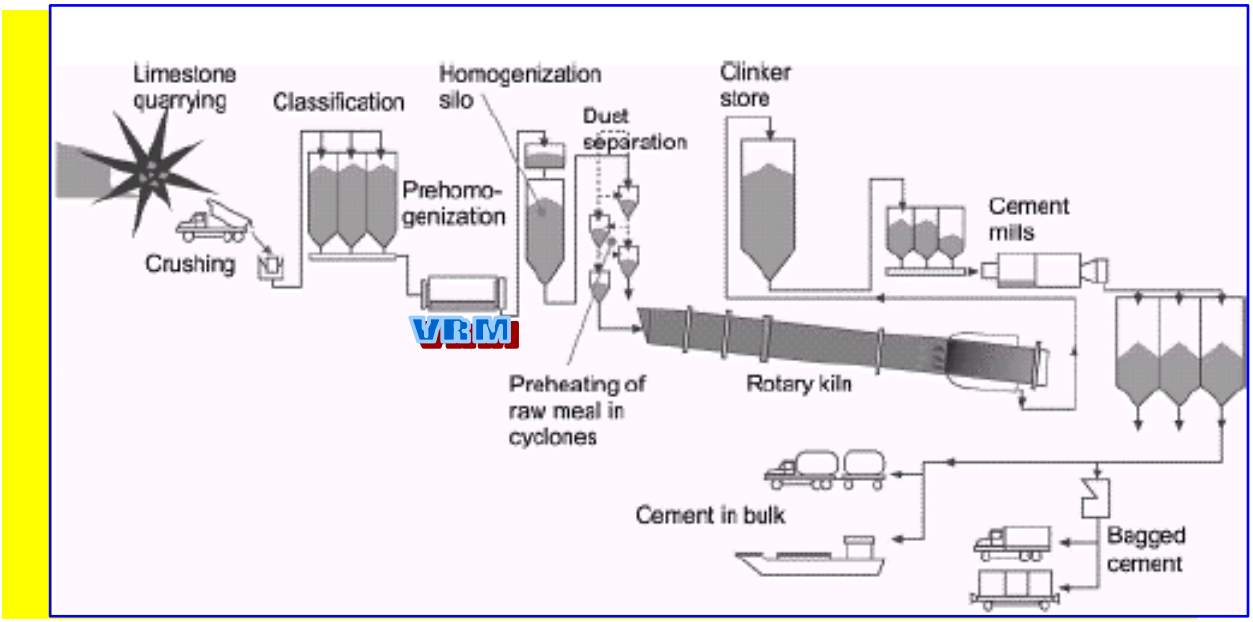
FIG 2.2 : PROCESS FLOW SHEET FOR CEMENT PRODUCTION



The proposed manufacturing process, based on dry process technology consists of essentially two steps:

a. A finely ground mixture (raw mix) of limestone, laterite and clay materials with a small amount of fluxing material is heated to a high temperature to form clinker.
b. The clinker is finely ground along with gypsum, with or without pozzolonic materials to produce cement of different grades.

FIG 2.3 : CEMENT MANUFACTURING PROCESS



Crushing, stacking & reclaiming

The mined limestone is hauled from quarry to stock pile through a belt conveyor. A limestone pre-blending stacker is provided with a reclaimer. Additive material is added to the crushed limestone through an additive hopper, which bypasses the crusher. The material is passed on to the stacker via belt conveyors, which stocks the material in longitudinal layers. The stacked material is lifted by the reclaimer, which reclaims it by cutting transversely the longitudinal stacked layers ensuring perfect blending and homogenizing.

Raw meal grinding

The buffer stock of reclaimed material is stored in the Raw Mill hoppers along with the additive material in different hoppers. The desired material is drawn through the weighing feeders and is fed to the vertical roller mill through air locking feeder. The vertical mill consists of a rotating table upon which rotating rollers are hydraulically pressed. The material is dried, ground and transported by the hot kiln exit gases. The size of the pulverised material is controlled by a dynamic separator which separates the oversized grits and sends it back on the table for further grinding. The pulverised material is transported to the C.F. Silo via energy efficient bucket elevators.

Storage & blending

The pulverized material is stored and blended in the controlled flow silo. The blending action is achieved by extracting the material from the outlets at a different rate. The extracted material is conveyed to a weighing bin where it is further blended. The operation of extraction is controlled by a PLC. The blended material is fed to the preheater for preheating via bucket elevator.

Preheating, clinkerisation and cooling

The kiln feed from the silo; is fed into the both strings of preheaters. Approximately 50% of the feed is given to each preheater string where it gets preheated by the hot kiln exit gases and gets calcined upto 30% approximately. This 30% calcined feed from the preheater string is fed to the calciner. Here, about 90% calcination is achieved. This 90% calcined feed is transferred to the kiln for the remaining 10% calcination and sintering where the flux materials and silica melt and react with lime to form four major clinker constituents. This is achieved by firing pulverized coal in the rotary kiln.

The clinker coming out of the rotary kiln is at a temperature of 1300 -1450°C and hence cooling of the same is required. This is achieved by pumping atmospheric air in the reciprocating grate cooler by centrifugal fans. The clinker gets cooled and the air gets heated up which is used as Secondary and Tertiary air in Kiln and Pre-Calciner respectively, and the excess air if any is vented out at a lower temperature. The recuperation of the heat in the cooler is in the vicinity of 65-70%.

Clinker storage & transport

The clinker which is cooled to about 100°C is stored in a silo which has a capacity of 45,000 T. The clinker is transported to the silo by deep bucket conveyors. The silo for clinker is a salient feature of the plant as the clinker does not get weathered. Another silo of 1000 T capacity is provided to store specified products/non confirming products. The clinker from the clinker silo is transported to the clinker silos of the cement mills for grinding.

Cement mills

For OPC and PPC a common 330 TPH Vertical Roller Mill is considered. Based on the production planning it can at a time produce anyone of the grade. The mill is swept with air, which transports the material through the mill. The cement is pumped to the cement silos with the help of air slides and bucket elevators. There are four different silos for cements of different grades.

Packing plant

The packing is done by automatic rotary packers which have a capacity of 150 TPH each. There are total 3 No. of rotary packers. The packed bags are directly loaded into the trucks by belt conveyors and auto loaders.

Raw coal & fine coal plant

Raw coal is also stacked and reclaimed by a stacker and reclaimer hence ensuring a perfectly blended raw coal. The raw coal is pulverised in a vertical roller mill which is similar to that for the limestone and clinker.

(ii) Coke Oven process

For the production of the Coke, process adopted will be Energy recovery / Non recovery type coke making. In this process volatiles evolved during coal carbonization are not recovered as by-products but are combusted completely in presence of controlled quantity of air and the heat of the volatiles of evolving gases is utilized for coking the coal mass into coke and thus no external heating is required. The balance heat in waste flue gas gainfully utilized for energy generation. Process produces high quality low ash metallurgical coke for a given coal blend.

2.3.3 Unit operations

A summary of the various unit operations involved in cement manufacturing are given in Table 2.4.

TABLE 2.4
UNIT OPERATIONS IN CEMENT PRODUCTION

Unit Operation	Description	Chemical Reaction	Time Required
1) Crushing	Crushing of the limestone from a bigger to a smaller size & adding additive material.	No chemical reaction	---
2) Stacking	Stacking of the crushed limestone in longitudinal layers to form a stockpile.	No chemical reaction	---
3) Reclaiming	Reclaiming of the longitudinally stacked material by cutting it transversely to ensure blending.	No chemical reaction	---
4) Raw Grinding	The material from the pile is pulverised to a very fine powder & is stored in a Controlled Flow Silo.	No chemical reaction	---
5) Pyro Processing	The Raw Meal is extracted from the silo & it is Preheated in the Preheater where it gets calcined upto approx. 90% and enters the Kiln for further calcination & sintering. Sintering is the process wherein the clay components melt & form a liquid which reacts with lime to form the potential clinker components.	Chemical reaction takes place	Retention Time In Kiln is approx. 20-25 Minutes.
6) Cooling	The clinker thus formed is very hot and hence it is cooled by pumping cold air in the cooler through fans which cools the clinker & heats up the combustion air. The extra cooling air is vented out through an ESP.	No chemical reaction	Retention Time approx. 20 Minutes.

Unit Operation	Description	Chemical Reaction	Time Required
7) Finished Grinding	The cooled clinker is drawn from the silo & is pulverised to a very fine powder. Also, Gypsum is mixed at the inlet of the mill.	No chemical reaction	Retention Time approx. 30 Minutes
8) Packing	Finished Cement is extracted from Cement Silo and packed in bags through Rotary packer.	No chemical reaction	Retention Time approx. 30 Minutes.
9) Coal Handling	The coal received is stacked in piles with the help of a Stacker & is again reclaimed with Reclaimer and fed to the Coal Mill Storage Hopper.	No chemical reaction	---
10) Coal Grinding	Raw coal is pulverised to a fine powder in order to facilitate fast ignition of coal in a vertical mill.	No chemical reaction	---

2.3.4 Chemical reactions

The clinker is made up of the following four constituent.

1) Tri-calcium silicate (C_3S) $3CaOSiO_2$
2) Bi-calcium silicate (C_2S) $2CaOSiO_2$
3) Tri-calcium aluminate (C_3A) $3CaOAl_20_3$
4) Tetra calcium alumino ferrate (C_4AF) $4CaOAl_2O_3Fe_2O_3$
5) Minor constituents SO_3; Alkalies; Magnesium- oxide and free lime

The sequence of the chemical reactions involved in the formation of Clinker can be summarised in Table 2.5.

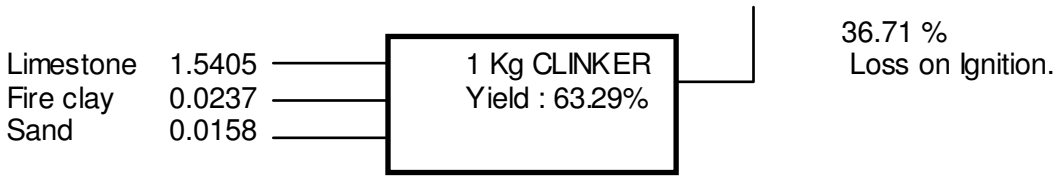
TABLE 2.5
SEQUENCE OF CHEMICAL REACTIONS

Sl. No.	Temperature	Chemical Reaction
I	Below 800°C	Decomposition of limestone & formation of $CaO.Al_2O_3$ begins
II	900 - 1100°C	1) Decomposition of Calcium Carbonate is complete. 2) Formation & Decomposition of Gehlenite ($2\ CaO+Al_2O_3+SiO_2$) 3) Formation of C_3A, C_4AF starts.
III	1000 - 1200°C	Formation of C_2S, C_3A & C_4AF is nearly complete.
IV	1200 - 1300°C	Liquid formation starts.
V	1200 - 1450°C	Assimilation of CaO through solid-liquid reactions & formation of C_3S

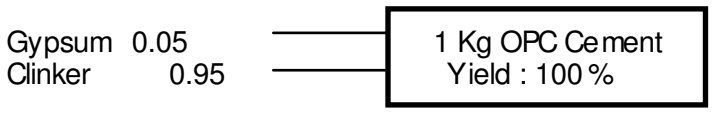
2.3.5 Material balance

The material balance for clinker and cement production are as follows.

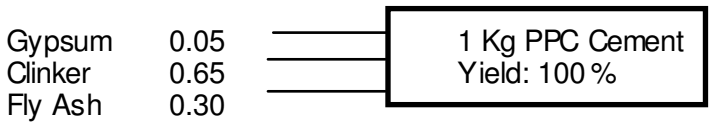
CLINKER



OPC CEMENT



PPC CEMENT



2.4 COKE MANUFACTURING PROCESS

2.4.1 Principle of coal carbonisation

Coking coals are the coals which when heated in the absence of air, first melt, go in the plastic state, swell and re-solidify to produce a solid coherent mass called coke. When coking coal is heated in absence of air, a series of physical and chemical changes take place with the evolution of gases and vapours, and the solid residue left behind is called coke.

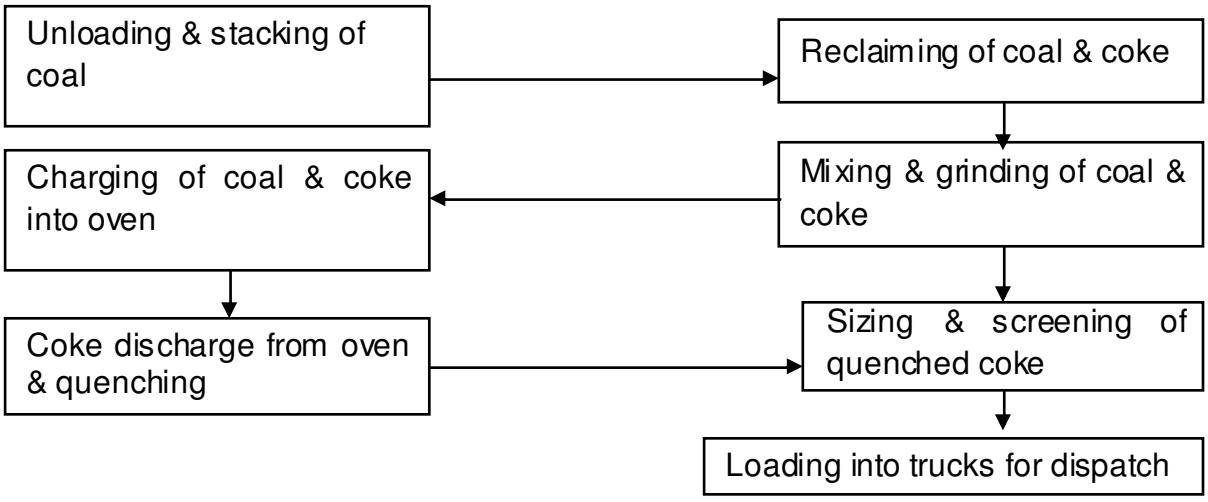
Conventional coke making is done in a coke oven battery of ovens sandwiched between heating walls. They are carbonized at a temperature around 1000^{o}-1100^{o} C upto a certain degree of devolatization to produce metallurgical coke of desired mechanical and thermo-chemical properties.

The coke oven by-product plant is an integral part of the by-product coke making process. In a by-product coke oven the evolved coke oven gas leaves the coke oven chambers at high temperatures approaching 2000^{o}F. This hot gas is immediately quenched by direct contact with a spray of aqueous liquor (flushing liquor). The resulting cooled gas is water saturated and has a temperature of 176^{o}F. This gas is collected in the coke oven battery gas collecting main. From the gas collecting main the raw coke oven gas flows into the suction main.

The amount of flushing liquor sprayed into the hot gas leaving the oven chambers is far more than is required for cooling, and the remaining unevaporated flushing liquor provides a liquid stream in the gas collecting main that serves to flush away condensed tar and other compounds. This stream of flushing liquor flows under gravity into the suction main, along with the raw coke oven gas.

The raw coke oven gas and the flushing liquor are separated using a drain pot (the down comer) in the suction main. The flushing liquor and the raw coke oven gas then flow separately to the by-product plant for treatment. The manufacturing process with schematic diagram is shown as Fig 2.4.

FIG 2.4
PROCESS FLOW DIAGRAM FOR COKE MANUFACTURING



2.4.2 Basic design data

Plant Capacity	:	1, 50,000 tonnes per annum
Requirement of Coal	:	2, 22,000 tonnes per annum
Coal Stock at plant	:	40,000 MT
Coal Size	:	0-50 mm
Total Moisture	:	8% (max.) on as received basis
Water Requirement	:	0.7 m^3/tonne of coke
Requirement of Power	:	7 unit/tonne of coke + material handling

2.4.3 System description

The capacity of Coke Oven plant will be 1.5 lacs tons/year. There will be 64 ovens in two batteries of 32 ovens each. These are laid in a straight length of about 220 m and width about 50m. The end car maintenance sheds total length will be app. 300 m. There are around 4 transfer towers of steel framed construction. The cross section of the Coke Oven plant is given in Fig 2.5. The sections details of coke oven plant are as follows: -

No. of Ovens	:	64
Size of Oven	:	2.7 m X10.7 m
No. of Battery	:	2

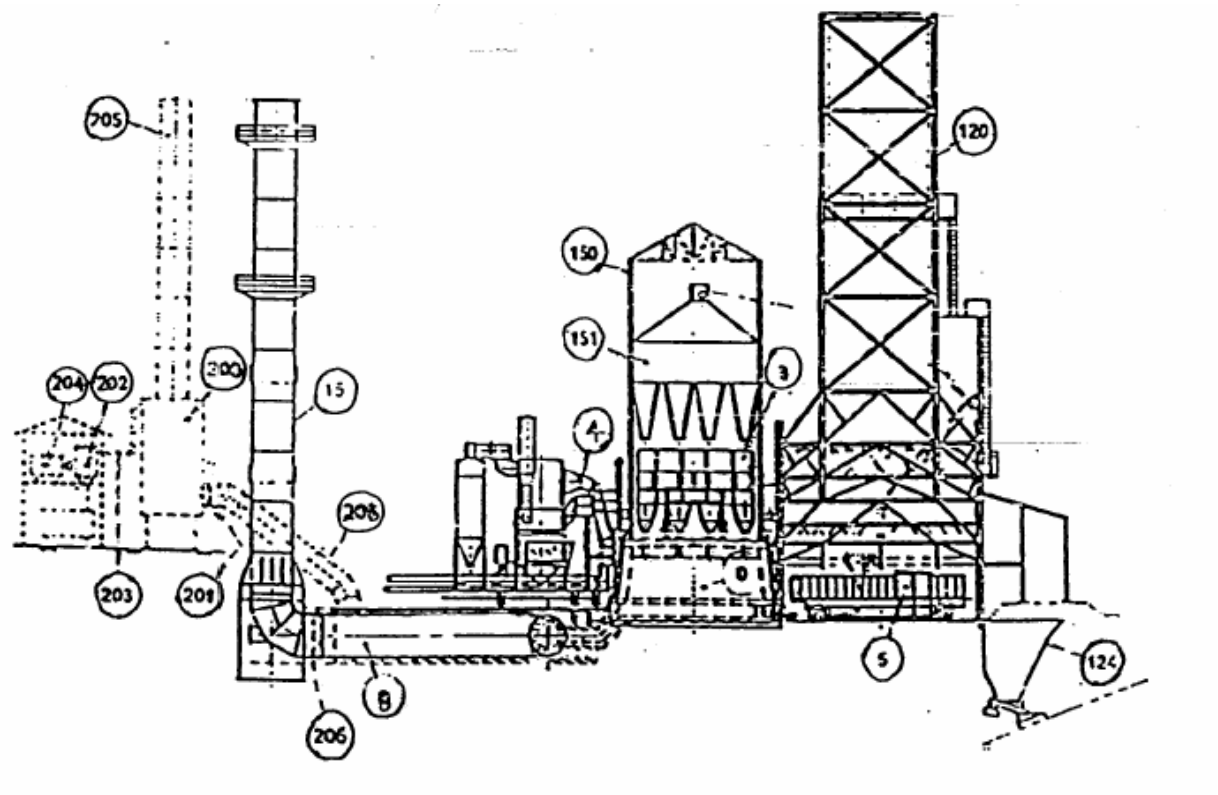


FIG 2.5 : CROSS-SECTION OF THE COKE OVEN PLANT

Legend:

0	Oven	151	Coal Bin
3	Charge car	200	Boiler
4	Ram car	201	Valve
5	Hot Coke car	202	Turbine
8	Common Flue	203	Steam Pipe
15	Stack	204	Generator
120	Quench Tower	205	Power Plant Stack
124	Hopper	206	Damper
150	Coal Bin Tower	208	Duct

2.4.4 Coal receipt & handling system

The purchase coal will be brought to plant by trucks & dumped in hopper which shall be conveyed by belt conveyor & discharges into the coal stacking conveyor, which in turn stacks the material through stacker conveyor and tripper. The material is then loaded to the fixed hopper by front-end loader or through reclaimer and then conveyed to the blending bins by belt conveyors.

The material is extracted at a required rate from each bin to achieve blending through weigh feeders. Extraction is designed for 24 hour

operation per day and conveyed through belt conveyor to crush the coal from 50mm to - 3mm. Magnetic separator and metal detectors are provided on the belt conveyor for the safety of cage mill operation. From the crusher, the material is conveyed to the hopper located above the charging car and coke oven battery.

2.4.5 Charging car

The charging car is located above the oven battery and moves on the rails. The charging car has hoppers with load cell. From the coal hopper charging car shall receive the coal at desired quantity measured by load cell. The charging car shall remove the manhole on the top of the oven through magnet. This coal is charged by charging car and transferred to particular oven.

2.4.6 Coke oven batteries

There are 32 Oven with coking cycle of 48 Hours. These set of 32 Ovens are connected to single stack.

The ovens are constructed of alumina bricks of different sizes and specification. The numbers of shapes of bricks is limited to approximately 100, reducing the brick layers efforts & enabling the achievement of high productivity level during construction.

The above logic is also followed for design of doors, coal charge car, the pusher car with leveling mechanism and hot cake car. The carbonizing time for the charged coal cake is approximately 48 Hours.

The well coked charged is pushed out of the oven in 48 Hours with minimal burning loss of the order of below 2%. The coking cycle time & high temperature used in the process produce fine quality of coke. The process control in the oven is achieved by controlling the ingress of primary air into oven chamber and secondary air into under flues. While these operation are largely time dependent, there is certain element of control consequent to visual input and more importantly a feedback of the temperature achieved in the oven crown and various portion of the sole flues.

The cooling of the oven foundation is through a network of passages in the refractory of the foundation. This enables to maintain the temperature of the foundation and ground below at a maximum of 600°C.

The cooling air moves without external motive power through the foundation by induction, exiting at approximately 500°C. It is subsequently introduced into the oven as a primary air for combustion and into the under flues as secondary air to further aid combustion. It is also introduced into the common flue as a tertiary air, helping to ignite any remaining combustible particulates and to raise the oxygen level of the exhaust flue gas before admission to the boiler.

The Coke Oven consists of

- Oven consists of High & Low Alumina bricks.
- Insulation bricks
- Castable bricks
- Refractory insulated side doors
- Under flue dusts with refractory lining.
- Dampers for ducts
- Steel Stack with refractory lining.
- Top lids for stacks.
- Winch System for oven door opening & pulling charging plates.

2.4.7 Heat recovery through primary and secondary air

The air from the oven foundations, available each end of the oven in a header, is tapped and reintroduced into the ovens as primary air, replacing partly the atmospheric air admitted for combustion.

The introduction of the foundation cooling air into the oven under flues as air for secondary combustion is controlled through butterfly valves.

2.4.8 Tertiary air injection

The air existing from the ovens into the common flue has a high percentage of carbon monoxide and total absence of oxygen. The admission of the hot air from the oven foundation cooling network into the common flue converts all remaining carbon monoxide to dioxide, and it is also helps in igniting any combustible particulate matter that may have escaped into the common flues.

The inlet damper of the air is automatically controlled with help of oxygen meter; the ingress of this air into the common flue does not cause any significant decrease in the temperature of the flue gases.

2.4.9 Pusher car

Coke pushing operation after 48 hours cycles from oven will be done with help of separate coke push car, which pushes the hot coke cake into a hot coke car.

The pushing car will be positioned in pusher side of the oven and hot coke car will be positioned on the coking side. Coke oven door of both sides will be opened, pusher beam will slowly push the hot coke cake from oven to hot coke car.

Hot coke cake from oven pushed from pusher has to slide into hot coke car at same horizontal level to avoid a potential emission source arising out of coal falling and disintegrating during pushing.

The Pusher Car consists

- Fabricated pusher beam and blade with rack and pinion drive arrangement.
- Guide Rollers for guiding pusher beam lateral movement inside the oven.
- Support roller for guiding and to take pusher beam load.
- Carriage assemblies with drive arrangement for rack and pinion.
- Wheel with drive assemblies including motors, gearbox, couplings, brakes etc.
- Hydraulic system with cylinder.
- Electric
- Bag Filter with Fan
- Water tank
- PLC, Master switch, position transducer
- Operation cabin

2.4.10 Hot car

Hot coke car will have a long travel car, which travels lengthwise along with coke ovens at coking side. On this trolley a hot coke tray is fixed to receive hot coke cake from ovens & brings the same to quenching tower for quenching operation.

Hot coke tray is hydraulically operated with guide wheels & rested on support beams for long travel car.

When hot coke cake will be ready a particular oven to push the same to hot coke car the long travel will be taken to that particular oven and hot coke tray will be fixed near the oven floor. The hydraulic cylinder will operate and fix the hot coke tray near the oven keeping the trolley level and oven floor level on same line. When hot coke cake slide to hot coke tray the long travel car will travel & bring the cake to quenching tower for quenching operation.

The Hot Car consists of

- Long travel car with liners
- Wheels and their drives
- Hot Coke tray with special liner
- Hydraulic system including cylinder for cross movement
- Current collector arrangement
- Guide wheel for hot coke tray
- Protection system for hydraulic system
- Special skirt plate arrangement for hot
- MCC and Operation cabin

2.4.11 Quenching tower

When hot coke car comes to quenching tower, the car will be positioned and dousing large quantity of water will quench hot coke cake. The quantity of water required for this operation will be of the order of about 70 M^3 for each quenching operation. But the loss of water through evaporation shall be in the range of 0.7 M^3 /Tonne of Coke.

After quenching the hot coke a pusher will push the coke from hot coke tray to coke hoppers for process of screening and coke crushing to desired size.

Quenching tower will have a chain conveyor with drive for pusher to and fro movement inside hot coke tray for cleaning the tray.

The tower is fitted with a system of grit arresters, which trap particulates and make to fall back to bottom of the tower.

A water tank and necessary pipes & spray nozzles becomes part of quenching tower.

The Quenching Tower consists of

- Tower structure, grits, tie beams, ladders, staircase etc.
- Pusher blade frame arrangement.
- Pusher blade drive arrangement with chain conveyor
- Crane beam and rail beams
- Shed assembly
- Set of pipes & nozzles
- Coke Hoppers
- Louvre box assembly
- Water tank

The screening system consists of primary double deck & secondary single deck screen with as Sizer. Dedusting System is installed in all transfer points & ventilation / water spray system in coke dump hopper tunnel to maintain clean environment.

As per the regulation vide the Gazette of India, MoEF`s notification dated 31-10-1997 adoption of non recovery coke ovens for coke making is in itself a low-emission procedure ensuring control of emissions and maintain environmental quality in work zone area.

2.4.12 Configuration and capacity

Simplicity and robustness are the hallmarks of the design of plant. Ease of construction, operation and maintenance follow from this. Most importantly the capital cost is quite low. For the installation of the 1,50,000 tonnes per annum coke oven plant at Padhiarka with coal unloading, storage and blending facilities as well as coke cutting and screening facilities, capital cost of approx. Rs. 65 Crores is envisaged.

2.4.13 Process operation and coke quality

Coal is charged by gravity as is done in the conventional by-product ovens into the hot coke oven from the top of the oven with the help of a coal charge car that discharges predetermined quantities of coal from its 4 canisters in a sequence so as to minimize emissions and achieve a uniform and optimum bulk density.

The process control is achieved by controlling the ingress of primary air into the oven chamber and secondary air into the under flues. While these operations are largely time dependant there is a certain element of control consequent to visual input and more importantly a feed back of the temperatures achieved in the oven crown and in various portions of the sole flues.

2.4.14 Coal blend used

Admittedly, the coke quality is primarily dependent on the coal blend used. A typical blend would be as under:

Moisture	:	6%
Volatile Matter	:	22%
Ash	:	8.6 %
Fixed Carbon	:	69.2 %
Phosphorous	:	0.026
Sulphur	:	0.5
CSN	:	6.5
Bulk Density	:	0.78
Size (below 3 mm)	:	83%

2.4.15 Coke quality

The coking cycle times and the high temperatures used in this process contribute to the achievement of good coke quality. The coke CRI and CSR are 2 to 3 % better than those achieved in a corresponding by product oven using the same coal blend. The typical specifications of BF grade coke are as under:

Moisture	:	3-4 %
Volatile matter	:	1.0-1.25%
Ash	:	11.5 % max.
Fixed Carbon	:	87.3-87.9 %
Phosphorous	:	0.03 %
Sulphur	:	0.5 %
M20	:	90%
M10	:	10%
CRI	:	16%
CSR	:	74.5
Bulk Density	:	0.78

2.4.16 Use of energy recovery/ non recovery coke oven plant

- Non recovery coke ovens have staged a come back with the intrinsic capacity to meet emission control norms and recover waste heat energy to generate power.
- Successful energy recovery provides valuable gains where power cost is relatively high.
- Non recovery oven cost is low compared to recovery oven plant.
- For the Coke Oven plant by adopting non-recovery type technology, no liquid effluents will be generated.
- In this process volatiles evolved during coal carbonization are not recovered as by-products but are combusted completely in presence of controlled quantity of air and the heat of the volatiles of evolving gases is utilized for coking the coal mass into coke and thus no external heating is required. The balance heat in waste flue gas gainfully utilized for energy generation. Process produces high quality low ash metallurgical coke for a given coal blend.

As per the Gazette of Indian (MoEF)'s notification dated 31.10.1997 adoption of Non Recovery Coke Ovens for making Coke is in itself a LOW-EMMISION PROCEDURE ensuring control of emissions and maintain environmental quality in work zone area.

Based on the Notification, M/s Nirma Limited proposes to adopt the Non recovery type Coke manufacturing process.

2.4.17 Mass balance of coke oven gases and coke oven gas utilization

The flow diagram of coke oven plant showing the mass balance table for flow of air is given in Fig 2.6.

Fig 2.7 shows the schematic diagram of coke manufacturing to be adopted by M/s Nirma Limited. The coke oven batteries will be operated at a temperature of @ 1200-1300°C for conversion of coal into the desired quality of coke. Because of high temperature as well as controlled quantity of air in coke oven batteries, VOCs will convert into CO_2, H_2O etc., so there may not be any generation of VOCs in the exhaust waste gases (flue gases).

After carbonization, the exhausted waste gases (flue gases) from the coke oven batteries, having temperature of @ 950-1250 °C will be transferred to the Waste Heat Recovery Boiler (WHRB). The WHRB utilizes the sensible heat energy of the waste gas to generate steam at a rate of approx. 50- 65 TPH having temperature @ 490°C. The WHRB (Vertical Single drum boiler) along with Steam Turbine & Generator (STG) set will be operated to generate power.

SOLID/LIQUID/GAS	UNITS	AVERAGE OPERATING CONDITIONS OF ONE OVEN					AVERAGE OPERATING CONDITIONS OF 16 OVENS	
		OVEN FEED S1	OVEN OUTPUT AS PUSHED S2	PRIMARY AIR S3	SECONDARY AIR S4	FEEDER FLUE S5	TERTIARY AIR S6	COMMON FLUE S7
MASS FLOW – SOLID	KG/BATCH	32531	24398.25	–	–	–	–	–
MASS FLOW –LIQUID	KG/BATCH	2449	–	–	–	–	–	–
MASS FLOW – GAS	KG/HR	–	–	1196	920	2490	23150	62970
MASS FLOW – TOTAL	KG/HR	–	–	1196	920	2490	23150	62970
MASS FLOW – TOTAL	KG/BATCH	34980	24398.25	–	–	–	–	–
VOLUME	AM^3/HR	–	–	–	–	–	–	–
VOLUME	NM^3/HR	–	–	925	712	2027	17904	49700
VOLUME	LT/MIN	–	–	–	–	–	–	–
TEMPERATURE	°C	35	1200	35	35	1300	35	1010
STATIC PRESSURE	MMWG	–	–	–	–	12	–	25
DENSITY	KG/NM^3	–	–	1.293	1.293	1.228	1.293	1.267
DENSITY	KG/AM^3	–	–	–	–	–	–	–
DUST LOAD	GM/AM^3							
H_2O DEW POINT	°C							
COMPOSITION H_2O	VOL % H_2O							
COMPOSITION O_2	VOL % O_2							

SOLID/LIQUID/GAS	UNITS	AVERAGE OPERATING CONDITIONS OF ONE BATTERY (32 OVENS)			
		COAL FEED S8	GROSS COKE OUTPUT AS PUSHED S9	GROSS COKE OUTPUT WITH 5% MOISTURE S9	STACK INLET S10
MASS FLOW – SOLID	KG/DAY	520496	390372	390372	–
MASS FLOW –LIQUID	KG/DAY	39184	–	20546	–
MASS FLOW – GAS	KG/HR	–	–	–	125940
MASS FLOW – TOTAL	KG/HR	–	–	–	125940
MASS FLOW – TOTAL	KG/DAY	559680	390372	410918	–
VOLUME	AM^3/HR	–	–	–	–
VOLUME	NM^3/HR	–	–	–	99400
VOLUME	LT/MIN	–	–	–	–
TEMPERATURE	°C	35	1200	140	1010
STATIC PRESSURE	MMWG	–	–	–	35
DENSITY	KG/NM^3	–	–	–	1.267
DENSITY	KG/AM^3				
DUST LOAD	GM/AM^3				
H_2O DEW POINT	°C				
COMPOSITION H_2O	VOL % H_2O				
COMPOSITION O_2	VOL % O_2				

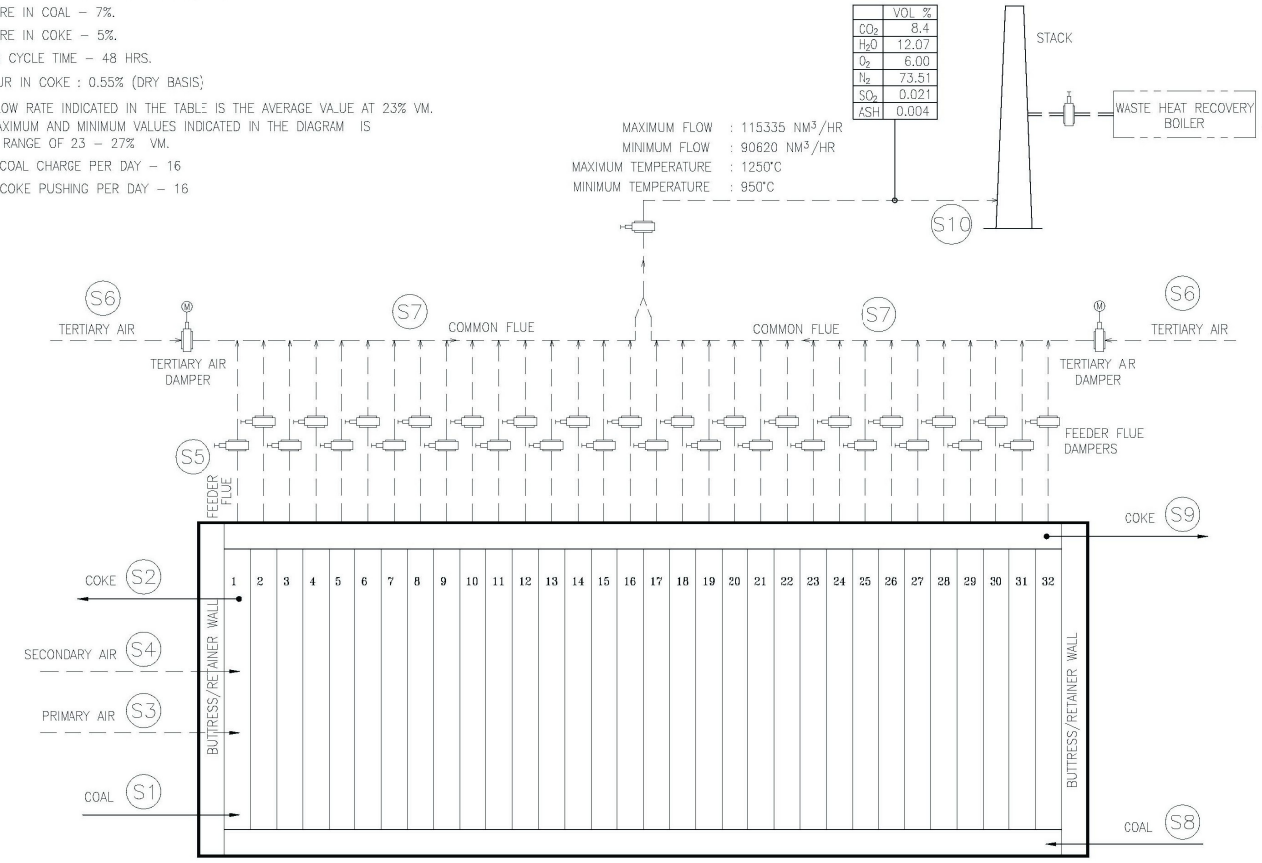
NOTES:

1. AMBIENT TEMPERATURE IS 45.0 DEG C(MAX.).
2. MOISTURE IN COAL – 7%.
3. MOISTURE IN COKE – 5%.
4. COKING CYCLE TIME – 48 HRS.
5. SULPHUR IN COKE : 0.55% (DRY BASIS)
6. GAS FLOW RATE INDICATED IN THE TABLE IS THE AVERAGE VALUE AT 23% VM. THE MAXIMUM AND MINIMUM VALUES INDICATED IN THE DIAGRAM IS FOR A RANGE OF 23 – 27% VM.
7. No.OF COAL CHARGE PER DAY – 16
8. No.OF COKE PUSHING PER DAY – 16

	VOL %
CO_2	8.4
H_2O	12.07
O_2	6.00
N_2	73.51
SO_2	0.021
ASH	0.004

MAXIMUM FLOW : 115335 NM^3/HR
MINIMUM FLOW : 90620 NM^3/HR
MAXIMUM TEMPERATURE : 1250°C
MINIMUM TEMPERATURE : 950°C

GAS FLOW
MATERIAL FLOW
ALTERNATE GAS FLOW
ALTERNATE MATERIAL FLOW
EXAMPLE:
S1 THEORETICAL FLOW RATES
S80 EQUIPMENT RATINGS



COKE OVEN BATTERY

QUENCH WATER SCHEME

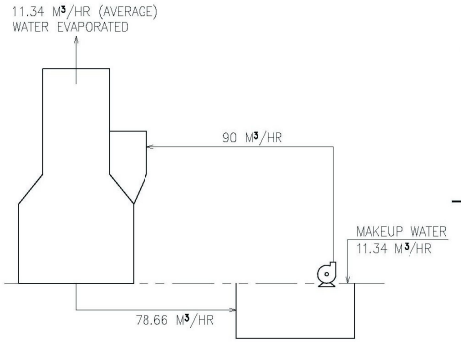


FIG. NO. 2.6

Rev 1	TSM	RSEN	CVI	19FEB2008	QUENCH WATER SCHEME ADDED
Rev 0	TSR	RM	CV	05OCT2004	Revision in zone / Description
Scale	Drawn	Chkd	Appr	Appr Date	Reference No with ◯, see legend
N.T.S	DO NOT SCALE DRAWING		PC 136		Plan No

NIRMA LIMITED

1,50,000 TPA COKE OVEN PLANT

PROCESS FLOW DIAGRAM OF COKE OVEN PLANT

FFE MINERALS INDIA PRIVATE LTD.

Drawing Number 1.568845

Rev 1

After maximum heat recovery, the waste gas exiting the WHRB passes through a ESP to remove SPM in the exhaust gases. The SPM collected in the hoppers of the ESP will be used in the Cement plant.

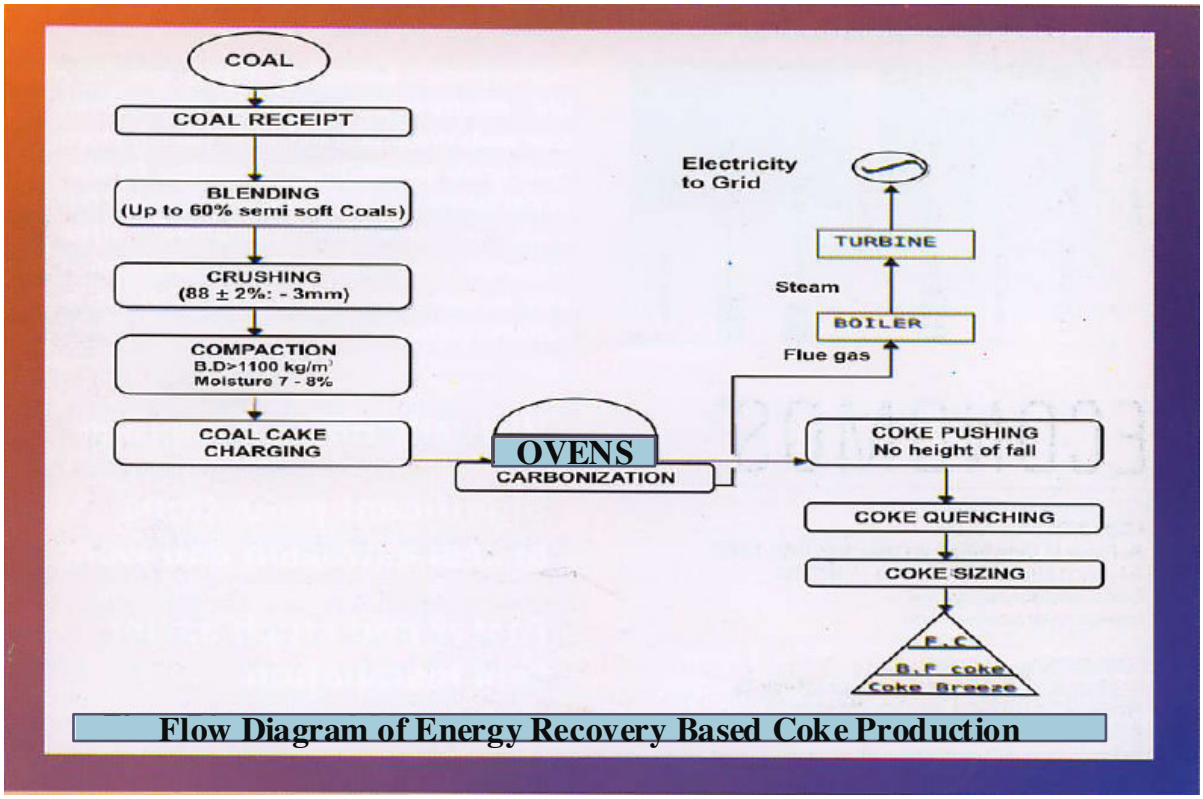


Fig 2.7 : Schematic diagram of Energy recovery based Coke Production

By adopting the Waste Heat Recovery Boiler concept in combination with the Coke Oven plant, M/s Nirma will gain advantage of good environmental conditions within plant premises as well as in ambient air and also the facility will qualify under KYOTO PROTOCOL.

2.5 CAPTIVE POWER PLANT

- The proposed Captive Cogeneration Plant (CCP) is configured with 2 Nos CFBC Boilers (each 110 TPH capacity) and 2 Nos Steam Turbine generating 25 MW each.
- The boiler shall be of circulating fluidised bed type, natural circulation, balanced draft, and membrane wall radiant furnace design with two stage super-heaters and inter-stage de-superheater.
- The steam generator shall be provided with a steam drum and the drum shall be of fusion welded type. The steam drum shall be with necessary nozzle connections for the steam outlets, safety valves, feed water inlets, down-comers, continuous blow down, level indicators, chemical dosing, sampling connection, drains and vents to assure the required steam purity.
- The proposed plant shall be configured with two Coal/Lignite fired **CFBC Boilers** each capable to generate **2X110TPH** capacity.

- The proposed **2x25 MW Steam Turbine** shall have three extractions for regenerative heaters (High Pressure Heaters, Low Pressure Heaters and Deaerator).
- One **Water-cooled Condenser** suitable for cooling.
- One **Fuel cum Limestone Handling System** meeting the requirement of the proposed power plant in 12 hours operation is envisaged.
- Dense Phase pneumatic **Ash Handling System** shall be used for conveying the Fly Ash and Bed Ash generated in the boilers to respective Ash silos.
- The proposed **Water System** includes Auxiliary Cooling water System & Firewater system. Seawater cooling for condenser is considered.
- The **Electrical System** includes CPP HT & LT auxiliaries, evacuation transformer and feeders for power evacuation.
- **Distributed Control System (DCS)** is envisaged for the operation and monitoring of main power plant equipment.
- **Civil work** for the proposed power plant including one no. RCC Chimney, one STG Building for STG, Switchgear and Control room and foundations for STG, Boiler and other equipment.

The detailed specifications for the proposed power plant are as given in Table 2.6.

TABLE 2.6
CONFIGURATION ADOPTED FOR THE CPP

Steam Generator (CFBC)	A	No. and ratings	2X110 TPH steam maximum continuous rating & 540^{0}C
	B	Type of boiler	CFBC
	C	No. of boiler fans	100% duty for ID and FD and 2 X 100% for PA operations
	D	Type of atmospheric pollution control system	Electrostatic precipitators with outlet dust concentration less than 50 mg/Nm^3
Steam Turbine Generator	A	No. and rating of turbine	1 no. of inlet parameters, 107 ata & 540°C
	B	Capacity	2 X 25 MW Maximum continuous rating
	C	No. of controlled extractions	3 nos. 1 HP, 1 MP and 1 LP
	D	Type of exhaust steam cooling	Through soft water circulation with water cooled condenser

2.6 RAW MATERIAL AND UTILITIES

2.6.1 Raw material and fuel

The raw material required for the cement plant includes limestone, clay, gypsum, coal, lignite and fly ash which shall be obtained from different sources as given in Table 2.7. Lignite and imported coal is proposed to be used as fuel. The required quantity of Lignite is proposed to be obtained from Kutch/Bhavnagar and imported coal is to be imported from Indonesia.

TABLE 2.7
RAW MATERIAL CONSUMPTION FOR CEMENT PLANT AND CPP

Raw Material	Quantity (TPD)	Source
Limestone	6935	Padhiarka (captive mines)
Clay	110	Ghoghna, Gujarat
Sand	71	Bhavnagar, Gujarat
Gypsum	390	Barmer, Rajasthan or Marine gypsum from Saurashtra area
Coal	300	Imported
Lignite	500	Kutch/Bhavnagar
Fly ash	1370	CPP & Gandhi Nagar, Gujarat
Lignite (CPP)	1560	Kutch/Bhavnagar

The raw material consumption for coke oven plant is given in Table 2.8.

TABLE 2.8
REQUIREMENT OF RAW MATERIALS FOR PROPOSED COKE OVEN PLANT

Sl. No.	Raw material	Source of Raw material	Requirement	
			Kg/T	Tonnes/year
1	Coking coal	Imported	1400	2,10,000

2.7 FACILITIES FOR STORAGE OF GOODS OR MATERIALS

Storage capacity in the Cement plant, CPP plant and Coke oven plant are summarized in Table 2.9.

TABLE 2.9
STORAGE CAPACITY IN THE CEMENT PLANT

Department	Storage quantity in T	Mode of Storage
Limestone Pre-blending Stockpile	2 x 50,000	
Corrective (Clay & sand)	1 X 3,500 (clay) & 1X2,000(sand)	
Raw Meal Storage (Active)	15,000	
Clinker Storage	45,000	Different Silos with filter at Silo Top
Coal/ Lignite Storage	2x15,000 (coal) & 7,500 (lignite)	
Cement Storage	4x 10,000	

Department	Storage quantity in T	Mode of Storage
Fly Ash Storage	5,000	Different Silos with filter at Silo Top
Gypsum Storage	4,500	Stored in hopper and pile
Coal	40,000	
Coke	1,000	

2.8 POWER

The power to the cement plant /coke oven plant is proposed to be fed from a captive thermal power plant. The capacity of the power plant is proposed as 2x25 MW.

The total power demand for the proposed cement plant is estimated as 25.7 MW. Seawater pump house will consume 2 MW. Assuming, 20% extra margin, the maximum power requirement is expected to be 33.24 MW. Coke Oven plant power requirement is approx.1.5 MW. Power plant auxiliaries requirement is 6 MW. RO/DM plant will consume approx.2.5 MW.

2.9 STACK DETAILS

There are 7 number of stacks envisaged in the plant. The details of the proposed stacks are given in the Table 2.10.

TABLE 2.10
DETAILS OF PROPOSED STACKS

Sl. No.	Stack name	Height (m)	Dia (m)	Temp (°C)	Exit gas Vol. (m^3/s)	Pres-Sure (Kpa)	Emission rate (µg/s)		
							SPM	SO_2	Nox
1	CPP Boiler – ESP	121	2.91	150	53.180	101.325	1870000	29600000	11520000
2	Roller Mill/ Raw Mill	90	4.48	110	188.894	101.325	7360000	58100000	45190000
3	Cooler	45	3.65	250	125.448	101.325	2780000	-	-
4	Cement mill	45	3.99	90	124.973	101.325	5130000	-	-
5	Packing plant	35	0.79	60	5.879	101.325	260000	-	-
6	Coal mill	40	1.62	90	24.722	101.325	1010000	-	-
7	WHRB of Coke Oven Plant	35	1.45	160	35.608	101.325	-	4490561	2245000

2.10 WATER

The total water requirement has been estimated as 8500 m^3/day (process water) for the cement plant, captive power plant and coke oven plant. The water requirement shall be met from the seawater which will require a suitable treatment facility (RO+ DM) as required for different applications. The integrated water balance diagram is shown in Fig 2.8 for cement plant, power plant, coke oven plant, jetty, mine and domestic usage and for the once-through system for power plant in Fig 2.9. The total seawater requirement is 20,000 m^3/hr as given in Fig 2.9. Alternatively till seawater facilities are created, sweet water can be sourced from Narmada Pipeline.

2.10.1 Desalination process

The plant based on Reverse Osmosis process, which utilizes the membranes for removing dissolved impurities. The total process involves processes as below:

1. Antiscalant dosing
2. Dechlorination
3. Cartrige filteration
4. Reverse Osmosis
5. RO cleanup

Raw sea water is fed to Pretreatment tanks where silt and other no - soluble impurities are removed by addition of anti scalants and then water is mixed with sodium bisulphite to remove residual chlorine. This water is passed through cartridge filters fitted with micron rating filters before feeding to main RO membrane filters with the help of high pressure pumps.

The product water is stored in desalinated water tanks from where it is pumped to consumption sites. In this process 30 – 35% permeate water is produced and balance 65 – 70% is rejected as brine.

The membranes are cleaned regularly with the help of citric acid & NaOH.

2.11 MAN POWER

During implementation phase 133 Persons will be required. Out of this 49 persons may be taken on contract. During operation phase the total no. of persons will be 418. Most of the employees will be from neighbouring villages.

The total number of working days envisaged are 330 days with three shift operation.

FIG 2.8 : WATER FLOW DIAGRAM FOR PROPOSED PROJECT OF NIRMA LTD.

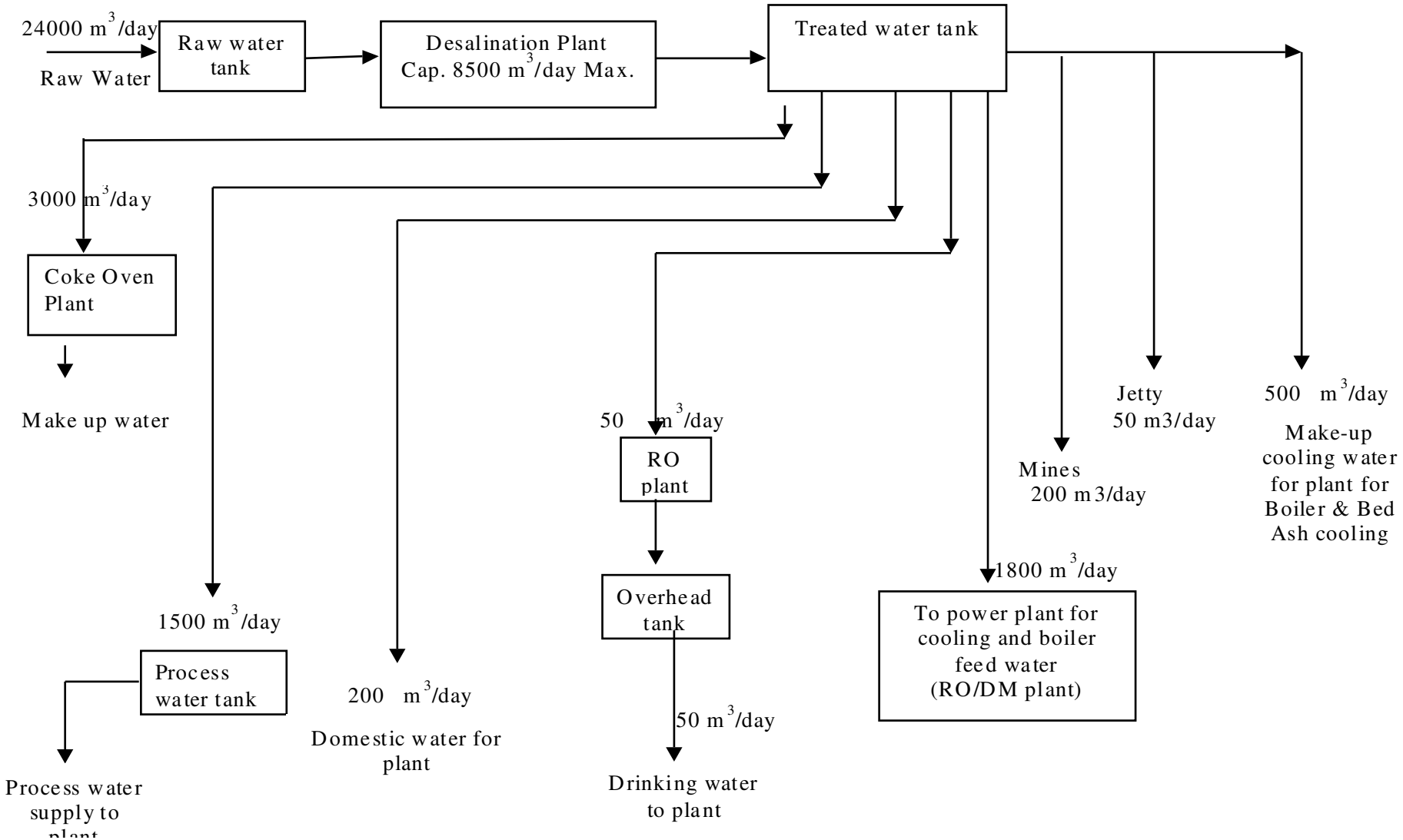
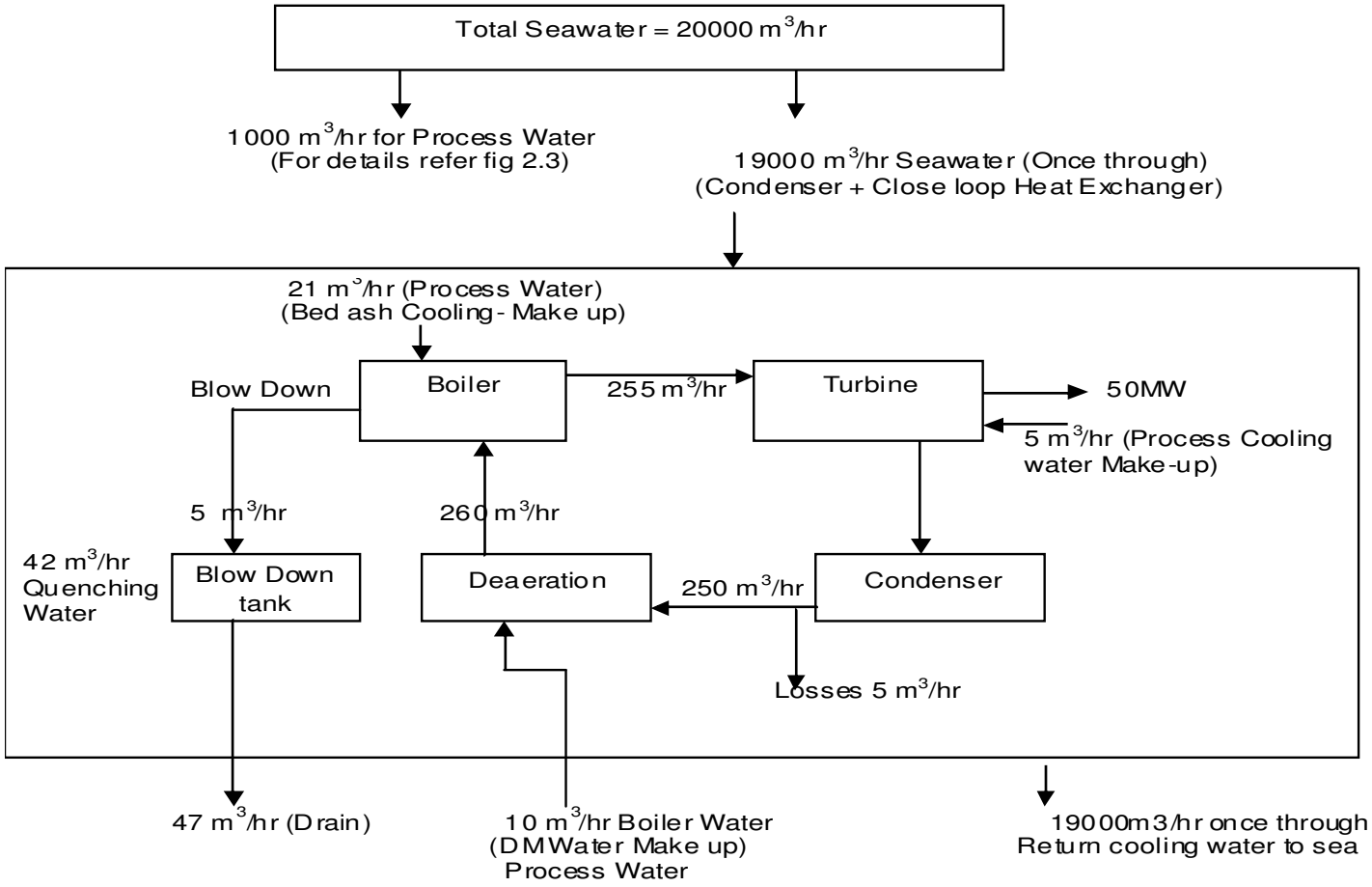


FIG 2.9 : SEA WATER BALANCE FOR PROPOSED PROJECT



CHAPTER 3

PRESENT ENVIRONMENTAL SCENARIO

CHAPTER 3

PRESENT ENVIRONMENTAL SCENARIO

3.1 GENERAL

3.1.1 Sources of environmental data

The information on micro-meteorological data, ambient air quality, water quality, noise levels, soil quality and floristic descriptions are largely drawn from the data generated by M/s Min Mec R&D Laboratory and Min Mec Consultancy Pvt. Limited, New Delhi. Meteorological data recorded at the nearest location and data generated has been used. Apart from these, secondary data have been collected from Census Handbook, Revenue Records, Statistical Department, Soil Survey and Land use Organisation, District Industries Centre, Forest Dept. etc. The generation of primary data as well as collection of secondary data and information from the site and surroundings was carried out during the summer season, i.e., March 2007 to May 2007.

3.1.2 Study area

To facilitate uninterrupted availability of the main raw material, the project proponent also propose to operate a captive limestone mine, located at Padhiarka at a distance of 1 km, from the cement plant. For the description of baseline environmental scenario, the cement project area has been considered as the core zone. The area falling within a distance of 10 km from the boundary of the core zone has been considered as the buffer zone. The core zone and the buffer zone, combined together, for the study area for determination of baseline status and for assessment of impacts.

3.2 TOPOGRAPHY AND DRAINAGE

3.2.1 Topography

The topography of the study area is generally plain with minor undulations. The land acquired for the project is barren and low lying land, which will be changed to industrial area.The core zone elevation is ranging between 8-10m above MSL and in Buffer zone elevation is ranging 0-55m MSL.

3.2.2 Drainage

Malan River is present at North east part of the study area at a distance of 9.5 km (aerially). Narmada water pipeline is present approximately 10 km from the proposed plant. The distance of Arabian Sea is 3.5 km in the south of the study area. Since the project area is a low-lying area, a suitable drainage system will need to be constructed to avoid flooding. The rainfall is very scanty with the average annual rainfall being 618.2 mm. The nalas and river hold some water only during monsoon season and remain dry during

the remaining months of the year. The topography and drainage map is given in Fig 3.1.

3.3 CLIMATE AND METEOROLOGY

3.3.1 Climate

The climate of the district is arid with large annual variations in rainfall and moderate humidity. The area experiences extreme climate conditions. January is the coldest month, with the temperature falling below 4°C. May is the hottest month of the year, when the maximum ambient temperature exceeds 40°C. As per the Climatological table for Bhavnagar Meteorological station, the average annual rainfall (1993 to 2004) in the area is 618.2 mm. The period from June to September accounts for more than 95% of total annual rainfall.

3.3.2 Long-term meteorology

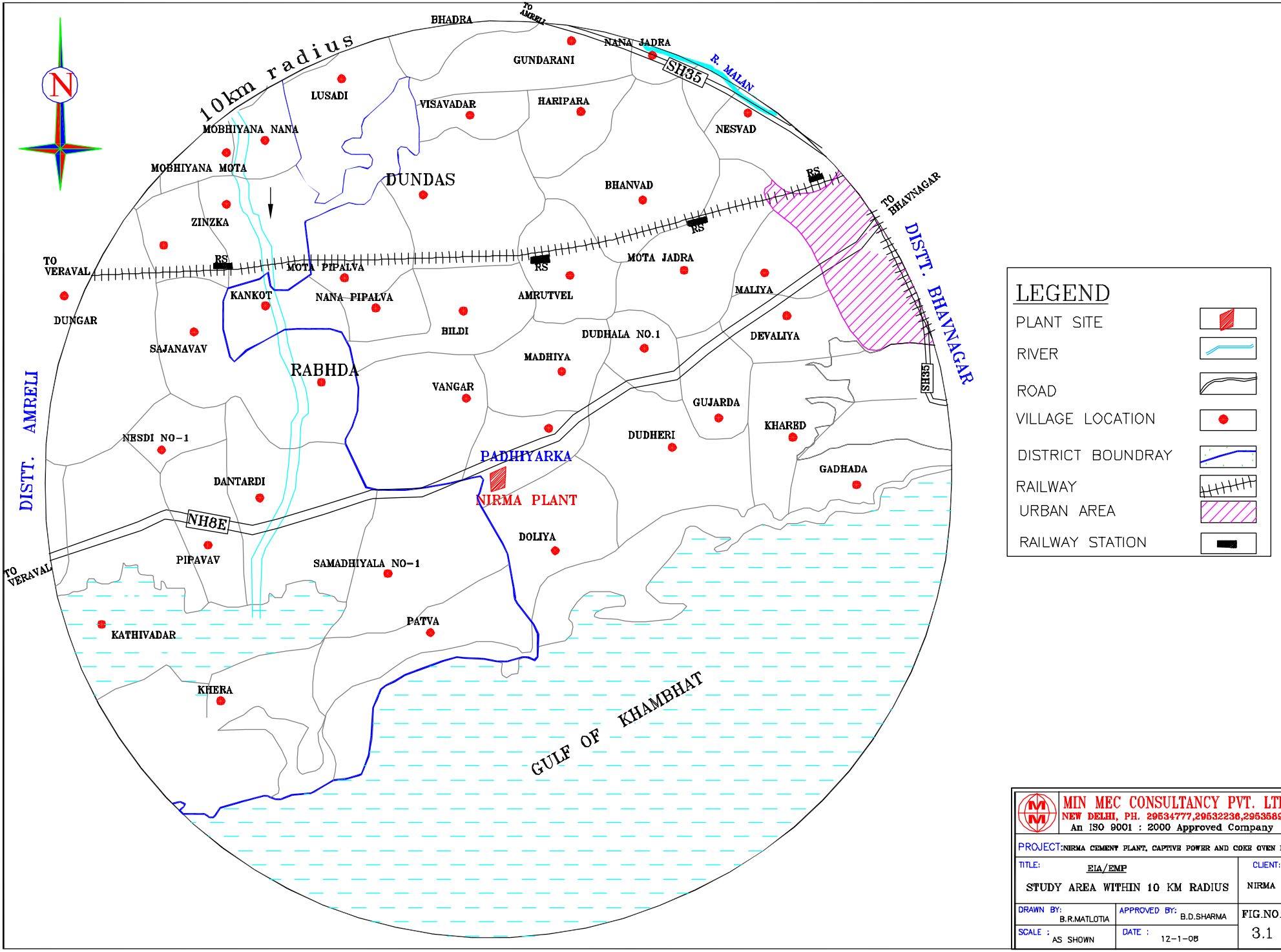
The nearest meteorological station of IMD is at Bhavnagar which is approximately 100 km to the North east of the project area. The following meteorological parameters for the period 1993 -2004 for Bhavnagar station have been collected from India Meteorological Department for study of long-term meteorology of the study area, and are appended as **Annexure II.** The data in respect of various parameters are briefly discussed in the following paragraphs.

Temperature

Monthwise average maximum and minimum temperatures for the ten year period from 1993 to 2004 as recorded at IMD station Bhavnagar, have been furnished in Table 3.1 and visualised in Fig 3.2 & 3.3 and given in **Annexure II.**

TABLE 3.1
MONTHLY AVERAGE MAX. & MIN. TEMPERATURE (1993-2004)

Months	Temperature (°C)	
	Maximum	Minimum
January	28.24	14.3
February	30.89	15.84
March	35.51	20.53
April	38.17	23.90
May	39.70	26.35
June	36.66	26.88
July	33.20	25.92
August	32.29	25.04
September	33.56	24.52
October	34.98	23.11
November	32.75	18.71
December	29.63	14.80
Mean	**33.80**	**21.69**



LEGEND

- PLANT SITE
- RIVER
- ROAD
- VILLAGE LOCATION
- DISTRICT BOUNDRAY
- RAILWAY
- URBAN AREA
- RAILWAY STATION

MIN MEC CONSULTANCY PVT. LTD. NEW DELHI, PH. 29534777,29532236,29535891 An ISO 9001 : 2000 Approved Company	
PROJECT: NIRMA CEMENT PLANT, CAPTIVE POWER AND COKE OVEN PLANT	
TITLE: EIA/EMP STUDY AREA WITHIN 10 KM RADIUS	CLIENT: NIRMA LTD.
DRAWN BY: B.R.MATLOTIA / APPROVED BY: B.D.SHARMA	FIG.NO. 3.1
SCALE : AS SHOWN / DATE : 12-1-06	

The mean of monthly minimum temperatures recorded at IMD station Bhavnagar ranges from 14.26 °C in January to 26.35°C in May. The mean of monthly maximum temperatures ranges from 28.24°C in January to 39.70°C in May.

FIG 3.2 : MONTHLY AVG. MAX. & MIN. TEMPERATURE (°C)
IMD STATION, BHAVNAGAR (1993-2004)

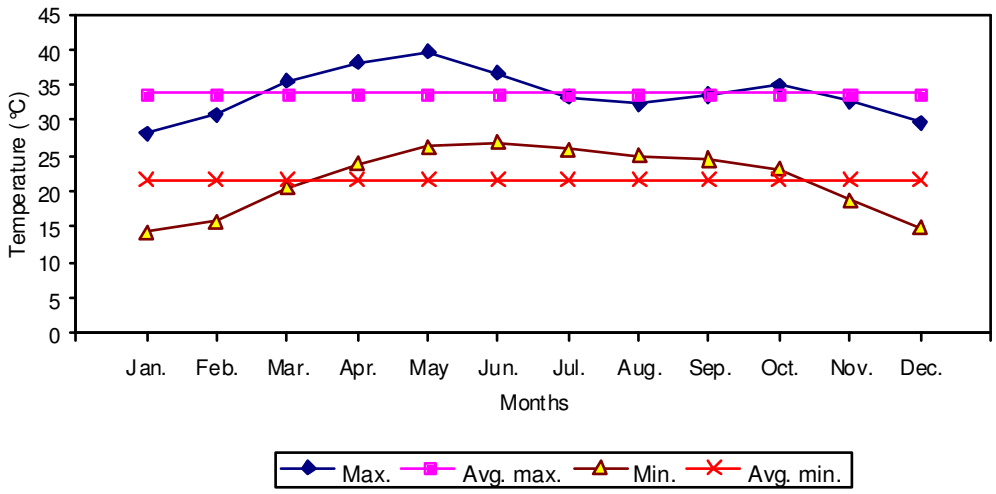
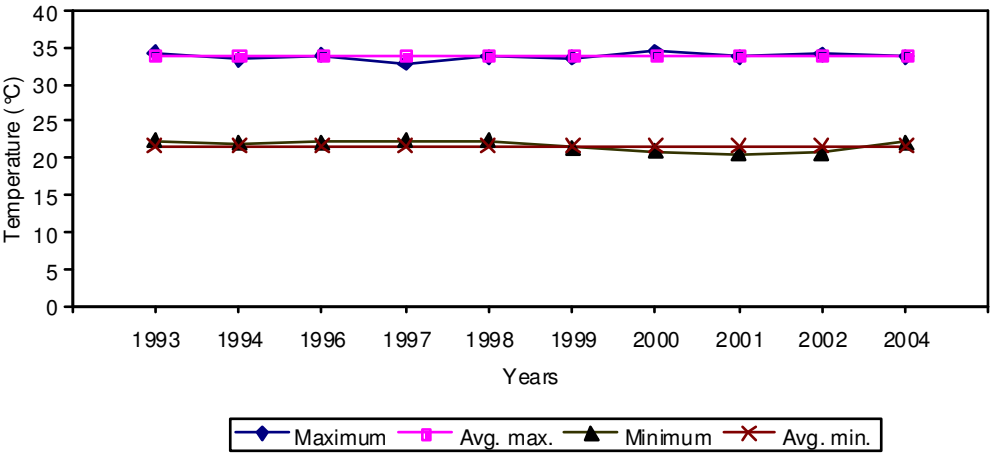


FIG 3.3 : ANNUAL AVG. MAX. & MIN. TEMPERATURE (°C)
IMD STATION, BHAVNAGAR(1993-2004)



Rainfall

It may be observed from **Annexure II** that the rainfall does not show any cyclic occurrence and shows wide and erratic variations. The average annual rainfall for the period 1993 to 2004. The annual rainfall was 618.2 mm recorded at IMD station Bhavnagar for the period of 1993-2004 is given in Table 3.2 and the monthly average values of rainfall are shown in Fig 3.4 & 3.5 and given in **Annexure II.**

TABLE 3.2
ANNUAL RAINFALL OBSERVED AT BHAVNAGAR

YEAR	RAINFALL, mm
1993	434.2
1994	751.5
1995	675.0
1996	613.8
1997	801.1
1998	444.5
2000	230.0
2001	680.4
2002	933.6
2004	617.4
Average	**618.2**

FIG 3.4 : MONTHLY AVERAGE RAINFALL (mm)
IMD STATION, BHAVNAGAR (1993-2004)

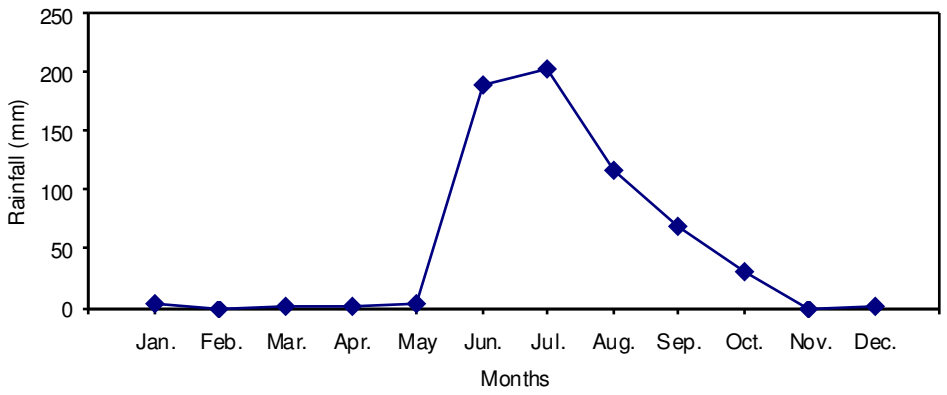
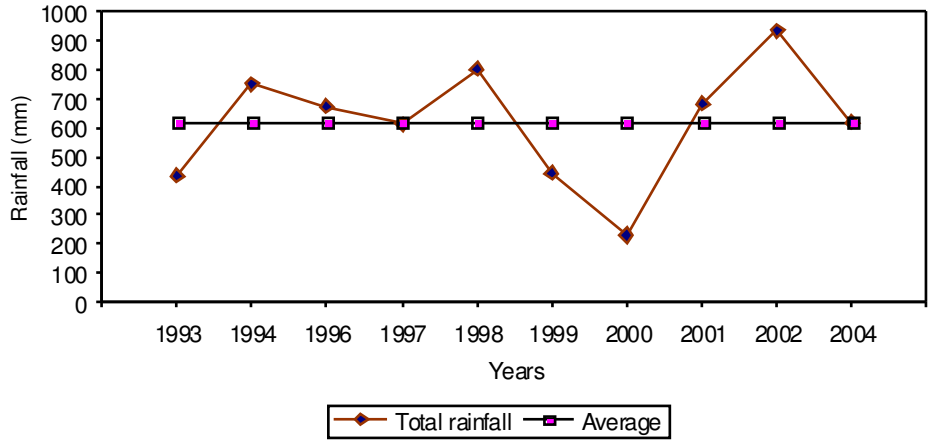


FIG 3.5 : ANNUAL TOTAL RAINFALL (mm)
IMD STATION, BHAVNAGAR (1993-2004)



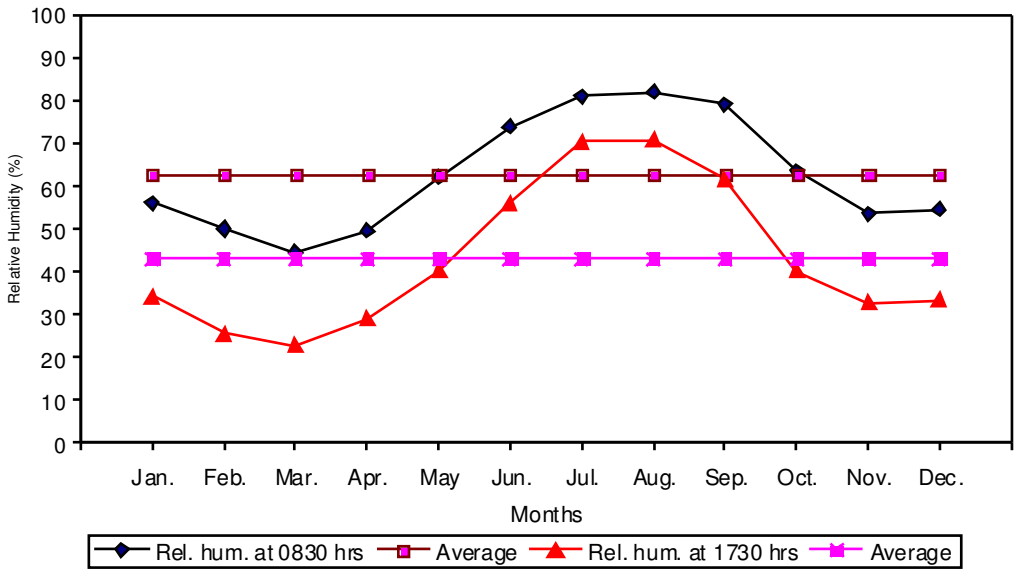
Relative Humidity

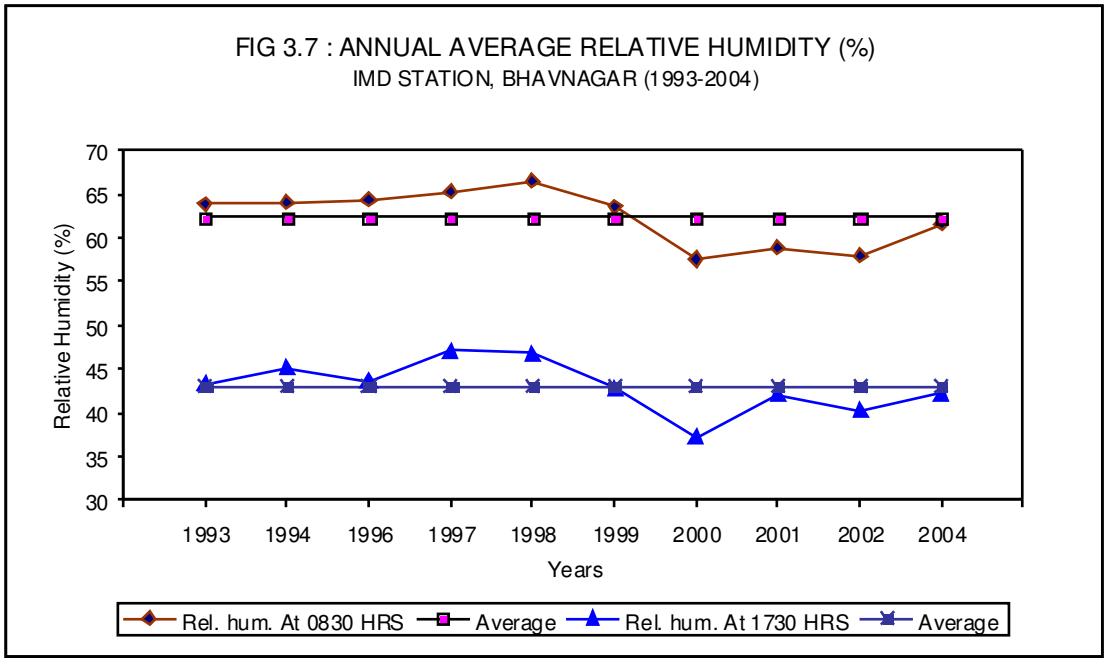
The average daily relative humidity data has been studied at IMD station, Bhavnagar for the period 1993 - 2004 and is given in Table 3.3 and shown in Fig 3.6 & 3.7 and given in **Annexure II.**

TABLE 3.3
AVERAGE MONTHLY RELATIVE HUMIDITY
FROM 1993-2004 (IMD STATION, BHAVNAGAR)

Month	Relative Humidity, %	
	08:30 Hrs	17:30 Hrs
January	56	34
February	50	26
March	45	23
April	49	29
May	62	40
June	74	56
July	81	70
August	82	71
September	79	62
October	64	40
November	54	33
December	54	33
Average	**62**	**43**

FIG 3.6 : MONTHLY RELATIVE HUMIDITY (%)
IMD STATION, BHAVNAGAR (1993-2004)





It is seen from the above that relative humidity is higher during the period of summer season and lower during other winter seasons.

Wind Speed and Wind rose

The nearest station in similar climatologically conditions is Bhavnagar where wind speed and direction data is recorded. The windrose diagram for the period from 1988 to 2002, supplied by IMD Pune, are presented in Fig 3.8 and Fig 3.9 for 8.30 hrs and 17.30 hrs respectively.

3.3.3 Micro-meteorology

The micro-meteorological data of the study area have been recorded by Min Mec. R&D Laboratory, New Delhi with an automatic weather station for the summer season from March 1st, 2007 to May 31st, 2007. The daily average of the monitored micro-meteorological data is given in **Annexure III** and summarized in Table 3.4. The various parameters are discussed in subsequent paragraphs.

TABLE 3.4
SUMMARY OF MONITORED MICRO-METEOROLOGICAL DATA, MARCH-MAY, 2007

Parameter	Maximum	Minimum	Mean
Temperature (°C)	40.90	23.70	33.25
Relative Humidity (%)	94.00	24.60	55.78
Wind speed (kmph)	29.40	0.00	3.48
Wind direction	Predominant wind direction is from SW (78.99%)		

FIG 3.8 : WINDROSE DIAGRAM OF IMD STATION BHAVNAGAR (AT 8:30 HRS)

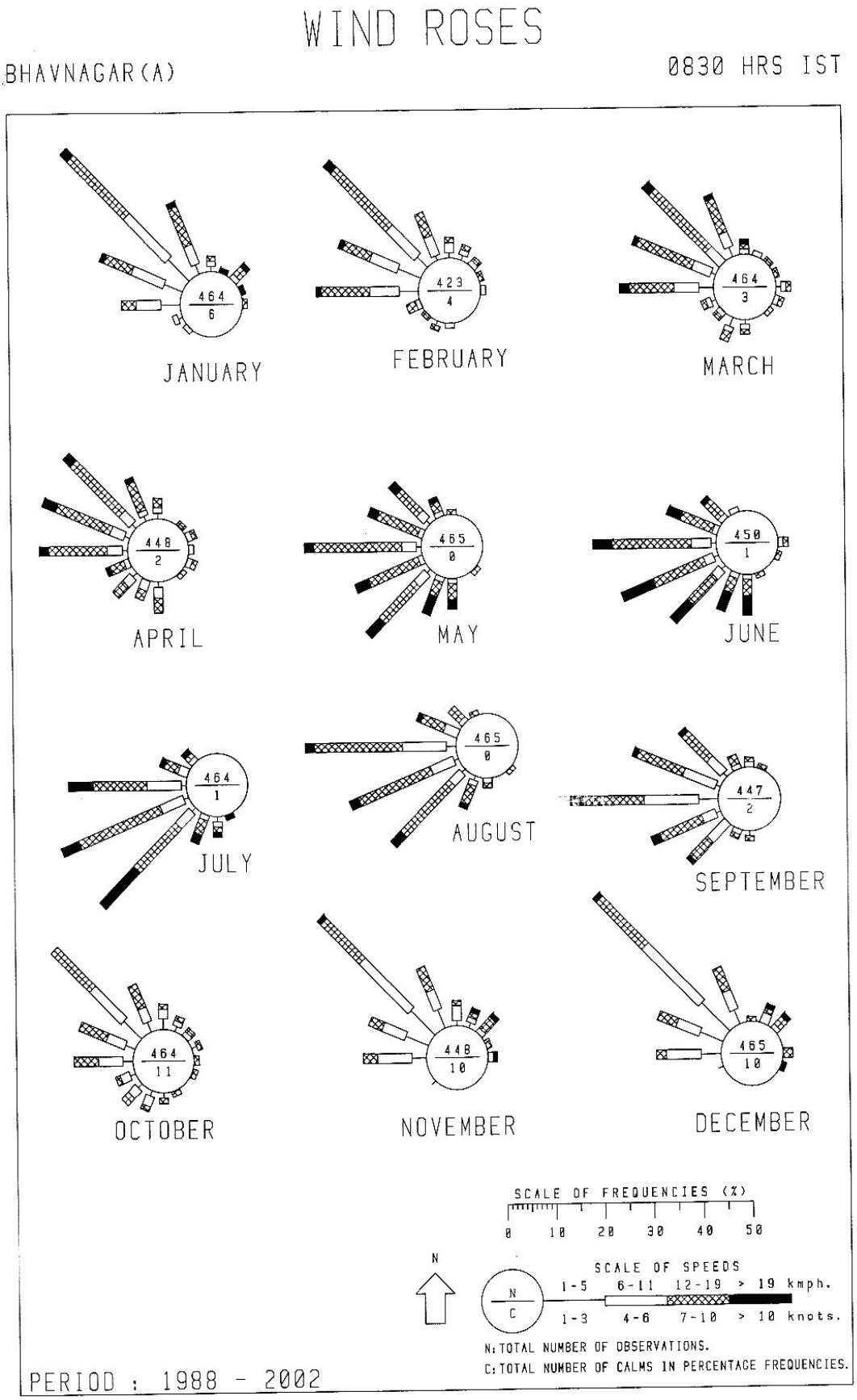
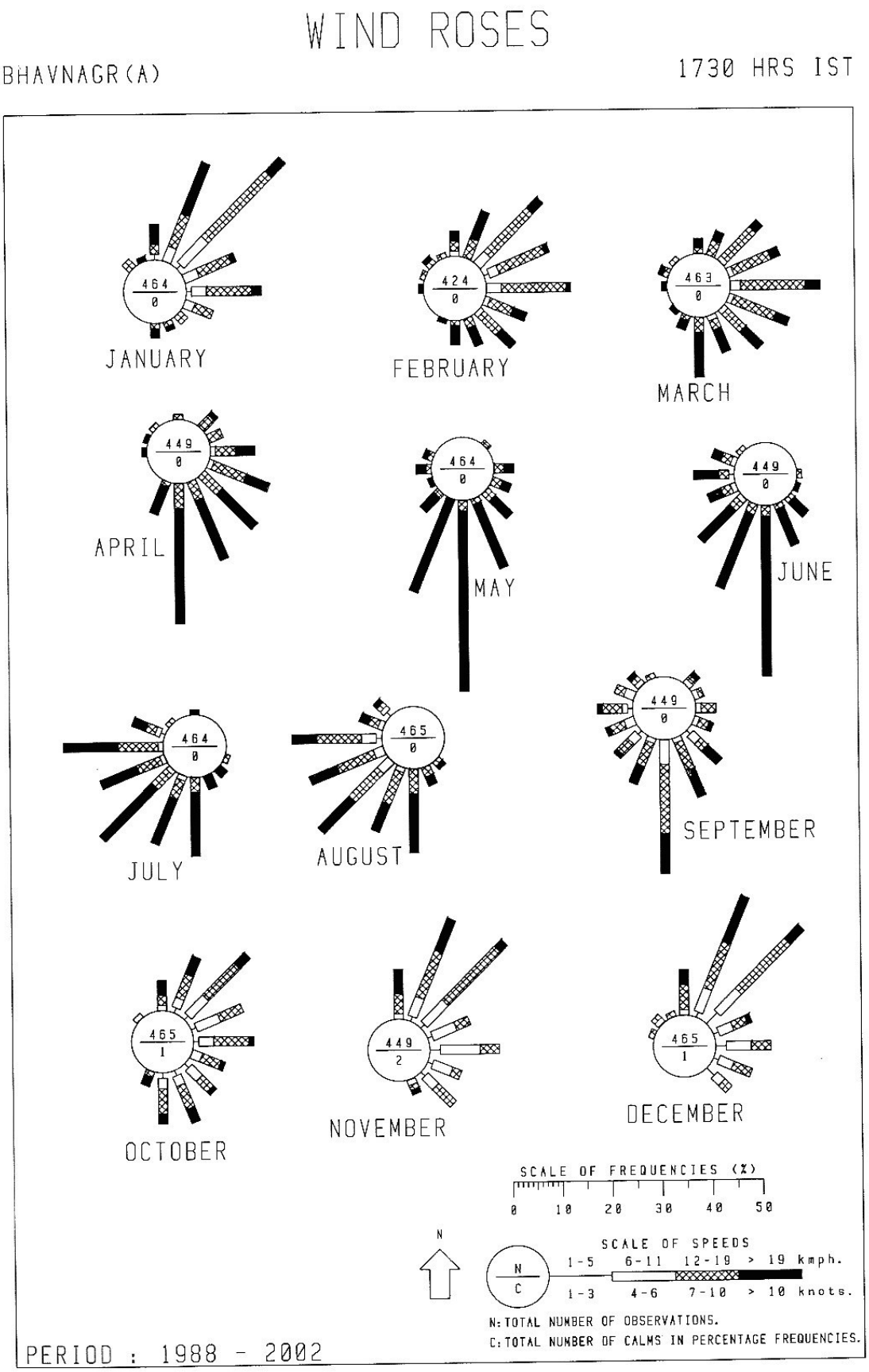


FIG 3.9 : WINDROSE DIAGRAM OF IMD STATION BHAVNAGAR (AT 17:30 HRS)



The above table shows that temperature was recorded as a minimum of 23.7°C and maximum of 40.90°C, relative humidity as a minimum of 24.60% and maximum of 94% during the monitoring period. The wind speed varies between calm to 29.40 km/hr and the predominant wind direction was observed from SW with 78.99% of occurrences. The wind frequency table is given in Table 3.5 and the corresponding windrose diagram is shown in Fig 3.10.

TABLE 3.5
WIND FREQUENCY OF MONITORED AT SITE DATA (01/03/2007-31/05/2007)

Wind direction from	% of readings in different ranges of wind speed (km/hr)							
	Calm	1.8-5	5-10	10-15	15-20	>20	Total	Ex-calm
	DAY (6 hrs to 17 hrs)							
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.54	0.00	0.00	0.00	0.00	0.00	0.54	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	4.35	1.09	0.00	0.00	0.00	0.00	5.44	1.09
WNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	36.59	7.34	19.66	5.62	1.09	0.54	70.84	34.25
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.36	0.00	1.90	0.82	0.00	0.00	3.08	2.72
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	8.33	2.63	4.98	3.08	1.09	0.00	20.11	11.78
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**50.17**	**11.06**	**26.54**	**9.52**	**2.18**	**0.54**	**100.01**	**49.84**
from	**NIGHT (18 hrs to 5 hrs)**							
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	0.00	0.54	0.00	0.00	0.00	0.00	0.54	0.54
WNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	52.54	13.41	19.47	1.18	0.54	0.00	87.14	34.60
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Wind direction	% of readings in different ranges of wind speed (km/hr)							
	Calm	1.8-5	5-10	10-15	15-20	>20	Total	Ex-calm
S	1.27	0.00	0.72	0.18	0.00	0.00	2.17	0.90
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	6.70	1.18	1.90	0.36	0.00	0.00	10.14	3.44
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**60.51**	**15.13**	**22.09**	**1.72**	**0.54**	**0.00**	**99.99**	**39.48**
COMPOSITE								
E	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NE	0.27	0.00	0.00	0.00	0.00	0.00	0.27	0.00
NNE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NW	2.17	0.82	0.00	0.00	0.00	0.00	2.99	0.82
WNW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW	44.57	10.37	19.57	3.40	0.82	0.27	79.00	34.43
SSW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S	0.82	0.00	1.31	0.50	0.00	0.00	2.63	1.81
SSE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SE	7.52	1.90	3.44	1.72	0.54	0.00	15.12	7.60
ESE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**55.35**	**13.09**	**24.32**	**5.62**	**1.36**	**0.27**	**100.01**	**44.66**

Note : Calm is cut off at wind speed <1.8 km/hr as per CPCB

3.4 AMBIENT AIR QUALITY

3.4.1 Ambient air sampling

To establish the ambient air quality, ambient air quality study has been carried out carried out to cover one full season (summer) from 01.03.2007 to 31.05.2007.

3.4.2 Location of ambient air sampling stations

The air sampling stations were established in and around the core and buffer zone to study the present ambient air quality, one station in proposed cement plant of Nirma Ltd. and 4 stations in study area. The ambient air quality survey was conducted during summer season from 1st March 2007 to 31st May 2007. A map of the study area showing the locations of these sampling station locations, as mentioned in Table 3.6, is presented in Fig 3.11.

WINDROSE DIAGRAM OF MONITORED DATA,
PADHIYARKA PLANT OF NIRMA LTD. (01/03/2007 TO 31/05/2007)

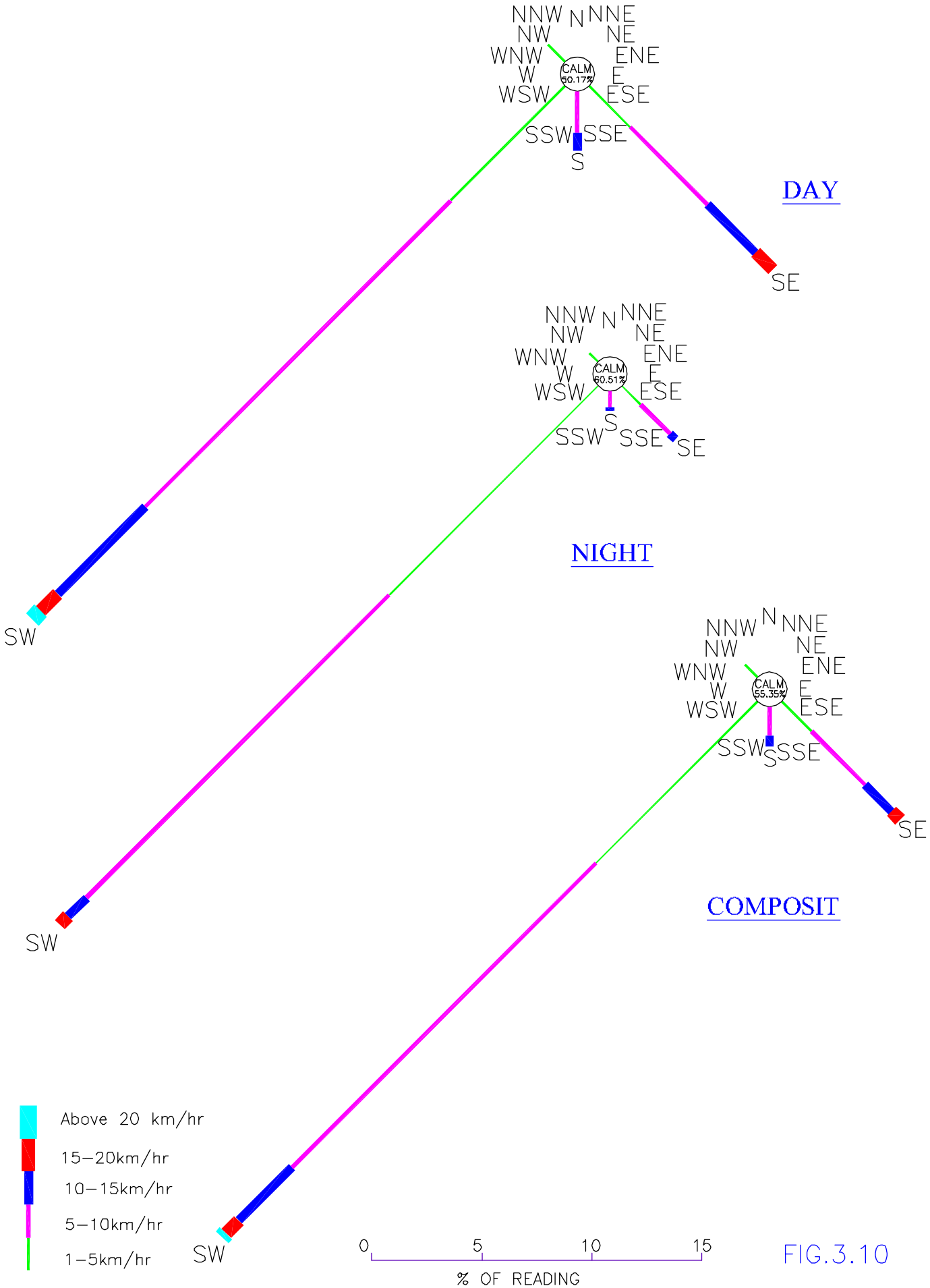
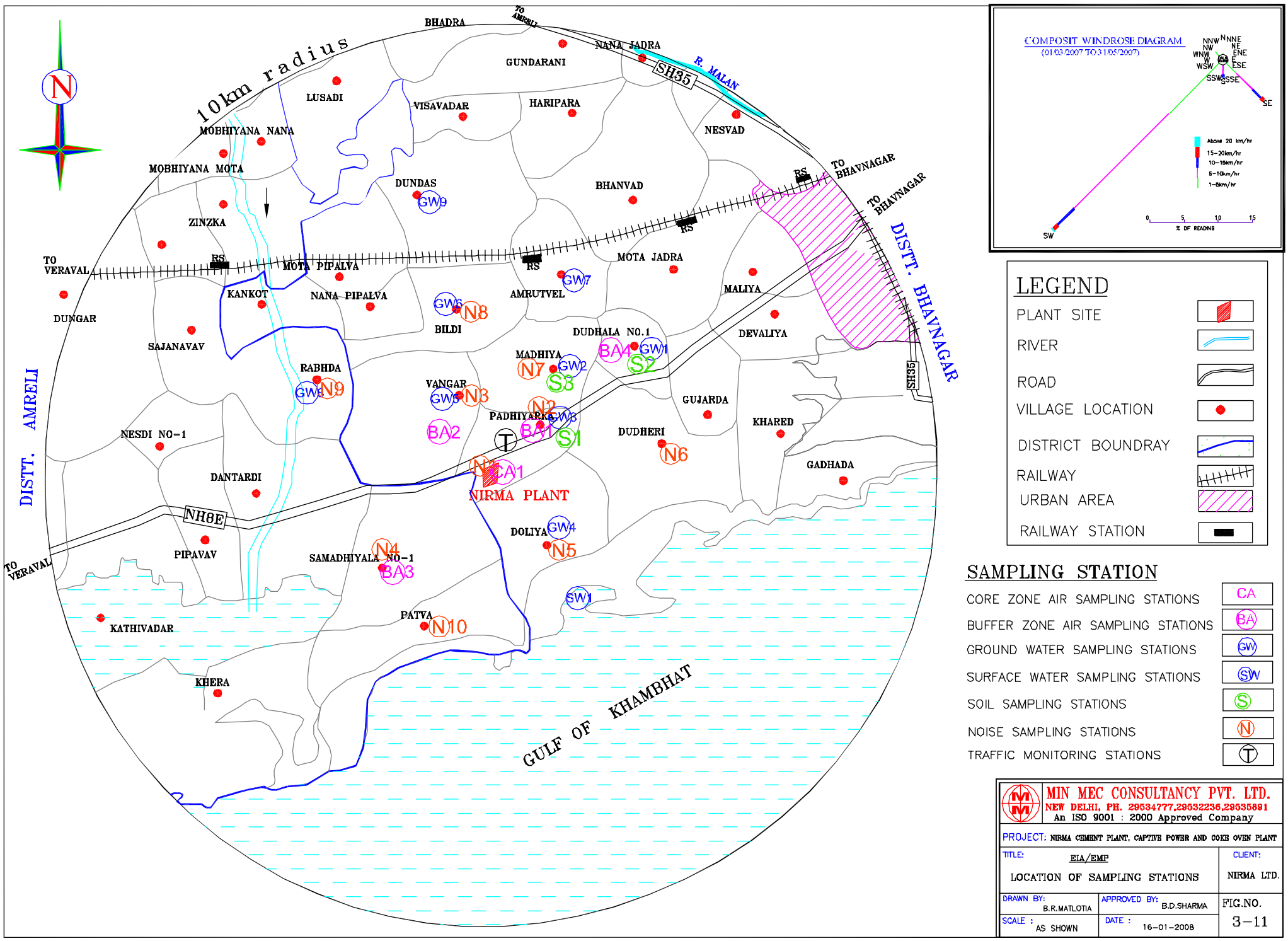


FIG.3.10



LEGEND

- PLANT SITE
- RIVER
- ROAD
- VILLAGE LOCATION
- DISTRICT BOUNDRAY
- RAILWAY
- URBAN AREA
- RAILWAY STATION

SAMPLING STATION

CORE ZONE AIR SAMPLING STATIONS	CA
BUFFER ZONE AIR SAMPLING STATIONS	BA
GROUND WATER SAMPLING STATIONS	GW
SURFACE WATER SAMPLING STATIONS	SW
SOIL SAMPLING STATIONS	S
NOISE SAMPLING STATIONS	N
TRAFFIC MONITORING STATIONS	T

MIN MEC CONSULTANCY PVT. LTD.
NEW DELHI, PH. 29534777,29532236,29535891
An ISO 9001 : 2000 Approved Company

PROJECT: NIRMA CEMENT PLANT, CAPTIVE POWER AND COKE OVEN PLANT

TITLE: EIA/EMP
LOCATION OF SAMPLING STATIONS

CLIENT: NIRMA LTD.

DRAWN BY: B.R.MATLOTIA
APPROVED BY: B.D.SHARMA
FIG.NO. 3-11
SCALE : AS SHOWN
DATE : 16-01-2008

TABLE 3.6
LOCATION OF AIR SAMPLING STATIONS

Station code	Location of ambient air monitoring stations	Distance from project site (km)	Direction from project site
CA1	Core Zone	-	-
BA1	Padhiarka	1.0	NE
BA2	Vangar	1.3	NW
BA3	Samadiyala	2.9	SW
BA4	Dudhala	3.6	NE

3.4.3 Sampling schedule and air quality parameters

The study was conducted by Min Mec R&D Laboratory, New Delhi. The survey was performed during the 3 month period of March – May 2007, with frequency of twice a week at each site. 24-hour average samples were collected from each station. These samples were analysed in laboratory by adopting the methods specified in National Ambient Air Quality Standards, The following air pollution parameters were monitored during the sampling periods.

The following parameters were determined for each sample :

- Suspended Particulate Matter (SPM)
- Respirable Particulate Matter (RPM)
- Sulphur dioxide (SO_2)
- Oxides of nitrogen (NOx)
- Carbon Monoxide (CO)

3.4.4 Methodology

Respirable Particulate Matter

The sampling of ambient air was performed with Respirable Dust Sampler (Make: Envirotech Instruments, New Delhi), which is primarily a High Volume Sampler fitted with a cyclone separator for pre-separation of particles larger than 10 microns diameter. Air exiting from the separator is drawn at a measured rate through the separator followed by a pre-weighed glass fibre sheet of 20 cm x 25 cm sizes (Whatman, EPM-2000). The RPM concentrations are determined gravimetrically from the average airflow rate, sampling period and the mass of particulate matter collected over the GF filter surface.

Suspended Particulate Matter

Sampling for SPM was also performed with the sampler used for RPM sampling. The coarser particles (NRPM) collected in the cyclone separator are transferred quantitatively on a petri dish and evaluated gravimetrically. The sum of masses of coarser (NRPM) and respirable particles (RPM)

gives the mass of SPM collected during sampling. The SPM concentrations are computed from the total mass of SPM and total volume of air sampled.

Sulphur dioxide

The sampling of ambient air for evaluating SO_2 concentrations was performed with a Multigas Sampler, using the vacuum created by the Respirable Dust Sampler for drawing the air samples through the impingers. Air is drawn at a measured and controlled rate of 400 to 500 ml/min through a solution of sodium tetrachloromercurate.

After completion of the sampling, the used absorbing reagent is treated with dilute solutions of sulfamic acid, formaldehyde and para rosaniline hydrochloride. The absorbance of the intensely coloured para rosaniline methyl sulphonic acid is measured and the amount of SO_2 in the sample is computed from graphs prepared with standard solutions. The ambient SO_2 concentrations were computed from the amount of SO_2 collected and the volume of air sampled.

Oxides of Nitrogen

The sampling of ambient air for evaluating NOx concentrations was performed with a Multigas Sampler, using the vacuum created by the Respirable Dust Sampler for drawing the air samples through the impingers. Air is drawn at a measured and controlled rate of about 200 ml/minute through an orifice-tipped impinger containing solutions of sodium hydroxide and sodium arsenite. After completion of the sampling, an aliquot of the used absorbing solution was treated with solutions of H_2O_2, sulphanilamide and NEDA. The nitrite ion present in the impinger was calculated from the absorbance of the resulting solution and from the graphs prepared with standard solutions. The ambient NOx concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the impinger and the procedure, and the volume of air sampled. A summary of the methodology is given in Table 3.7.

Carbon Monoxide

The continuous method of determining carbon monoxide is reaction with iodine pentoxide and titration of liberated iodine with thiosulphide (IS : 5182, part X, 1976 or GLC method). However, instantaneous CO was determined using MSA detection tubes with hand held aspirator.

TABLE 3.7
PROCEDURE FOR DETERMINING VARIOUS AIR QUALITY PARAMETERS

Parameters	Testing Procedure
SPM	Gravimetric method using high volume air samplers IS : 5182 (Part IV)1973
RPM	Respirable Dust Sampler (RDS)

Parameters	Testing Procedure
SO_2	Absorption in Sodium Tetra Chloro-mercurate followed by Colorimetric estimation using P-Rosaniline hydrochloride and Formaldehyde (IS : 5182 Part. II. 1969)
NOx	Absorption in dil. NaOH and then estimated calorimetrically with sulphanilamide and N(I-Nepthyle) Ethylene diamine Dihydrochloride and Hydrogen Peroxide (IS:5182 1975, Part VI)
CO	MSA detection tubes with hand held aspirator

The summarised results of the air quality studies are given in Table 3.8 and the details are given in the form of **Annexure IV** and National Ambient Air Quality Standard (NAAQS) is given in **Annexure V.**

TABLE 3.8
SUMMARY OF AMBIENT AIR QUALITY MONITORING RESULTS
(MARCH - MAY 2007)

Pollutants	24 hours average concentrations (µg/m^3)											
	SPM			RPM			SO_2			NO_X		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Core zone	84	151	124	34	61	50	5.1	7.1	6.2	7.1	9.9	8.5
Padiarka	98	166	134	40	67	54	7.5	10.4	8.8	10.3	13.8	12.0
Vangar	93	156	123	38	63	50	6.1	8.4	7.3	8.4	10.9	9.6
Samadhiyala	76	146	114	31	59	46	5.0	6.6	5.7	6.5	8.4	7.5
Dudhala	96	154	121	39	62	49	6.2	8.1	7.1	8.6	10.7	9.7

24 hourly average SPM levels were always found to be below 200 µg/m^3 in all the locations. SO_2 and NOx values are much on the lower side. The concentrations of respirable particulate matter (RPM) are within limits and the hydrocarbon content is almost absent. CO value was found to be less then 1000 µg/m^3 at all locations on all sampling days.

The chemical composition was tested for one respirable dust sample at each location. The results are tabulated in Table 3.9.

TABLE 3.9
CHEMICAL COMPOSITION OF PARTICULATE MATTER (PM_{10})
CONCENTRATION IN µg/m^3

	Core zone	Padiarka	Vangar	Samadhiyala	Dudhala
Carbon (Organic+Elemental)	3.5	3.3	4.4	4.0	3.3
Sulphate	2.1	1.9	2.6	2.4	1.9
Nitrate	1.6	1.5	1.9	1.8	1.5
NH4	0.7	0.7	0.9	0.8	0.7
Alumina	0.9	0.9	1.2	1.1	0.9
Silica	1.9	1.8	2.4	2.2	1.8
Carbonate	0.4	0.4	0.5	0.4	0.4

	Core zone	Padiarka	Vangar	Samadhiyala	Dudhala
Calcium	0.3	0.3	0.4	0.3	0.3
Lead	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01

3.5 WATER RESOURCES

3.5.1 Surface water and hydrology

The study area is devoid of any drainage. Malan River is present at North east part of the study area at a distance of 9.5 km (aerially). Narmada water pipeline is present approximately 10 km from the proposed plant. The nalas and river hold some water only during monsoon season and remain dry during the remaining months of the year.

3.5.2 Ground water and hydrogeology

The area is underlain by the aeolian deposit of recent age milolitic limestone. The thickness of windblown sand varies between 2-10m. The sand dunes are present in isolated patches. The soil cover having thickness of 0.5 to 5m constituting black cotton soil, is invariably present overlying the limestone. The limestone are hard & compact, occasionally marly in nature these limestone are devoid of any primary porosity. The ground water is found with in the secondary porosity of limestone in the form of joints & fracture. Occasional cavities are present in these limestone. The ground water in these formations occur in unconfined state. The geomorphology is the main controlling factor for occurrence and movement of ground water. The water table lies between 10-15 m below the ground. The annual rainfall of the area is 618.2mm, larger portion (507.6 mm) of which falls during monsoon period between July to October every year. The ground water storage in the area gets charged through rainfall alone. The non-monsoon rainfall is much lower than potential evapotranspiration rate. Therefore it may not contribute any recharge to ground water storage. Probable recharge to groundwater storage would be around 15.4MCM. The ground water flows towards the sea in the south. The entire recharge to ground water is ultimately lost to sea.

3.5.3 Water quality

To assess the water quality of the area 10 water sample were collected and analysed in the laboratory of Consulting Group. The sample analyses results indicate that the ground water over the area is invariably brakish to saline except for Dudhala & Doliya villages. These two villages may be representing highly localised condition, perhaps perched water status due to accumulation of rainwater for a short period over the year.

The six grab samples including one sea sample, were collected during the study period from various locations within the study area and were analyzed for physico-chemical quality. The details of water monitoring stations are shown in Fig 3.11 and given in Table 3.10.

TABLE 3.10
LOCATION OF WATER SAMPLING STATIONS

Station code	Location of sampling stations	Distance from project site (km)	Direction from project site
SW1	Doliya Sea Water	3.30	SE
GW1	Dudhala (bore well)	3.6	NE
GW2	Mandhiya(bore well)	2.8	NE
GW3	Padhiyarka (hand pump)	1.0	NE
GW4	Doliya (hand pump)	1.75	SE
GW5	Vanger(hand pump)	1.3	NWN
GW6	Bildi(bore well)	4.0	NWN
GW7	Amrut vel (hand pump)	4.50	NEN
GW8	Rabhda (bore well)	4.3	WNW
GW9	Dundas (bore well)	6.15	NWN

The physico-chemical characteristics of ground and surface water samples have been presented in **Annexure VI**. To facilitate comparison with drinking water standards, Characteristics for Drinking Water as per IS 10500: 1991, has been included in the **Annexure VII**.

The analysis of the water samples shows:

- Colour, odour, taste and turbidity are within desirable limits and unobjectionable.
- pH value varies between 6.41 to 6.76 for the collected samples.
- Chloride exceeds the desirable limit in 1 surface water sample.
- Total hardness exceeds prescribed limits in 4 samples of ground water.
- Dissolved solids exceed the desirable limit in 1 surface water sample and 5 ground water samples.
- Calcium in all samples is within the desirable limits.
- copper, manganese, sulphate, nitrate, fluoride and zinc are within desirable limit.
- Cadmium, selenium, arsenic, mercury, lead, hexavalent chromium, aluminum, boron and nickel are below the detectable limits.
- Alkalinity exceeds prescribed limits in 3 sample of ground water.

3.6 LAND ENVIRONMENT

3.6.1 Land use in core zone

Total 280 ha. land is required for the cement plant. Of this 170 ha. is proposed to be used for the cement plant, captive plant and remaining 110 Ha shall be used for coke oven plant. However, 33% of the total project area (i.e.92.6 ha.) will be used for Green belt/Canal development.

Present land use is barren. The Revenue patta plan of the proposed site of cement plant is given in Fig 3.12

3.6.2 Land use in buffer zone

District /Taluk wise land use pattern in study area has been studied on the basis of 2001 Census data. The number of villages falling in different taluks and the corresponding areas are given in Table 3.11.

TABLE 3.11
DISTRICTS/TALUK WISE VILLAGES IN BUFFER ZONE

District	Taluk	No. of villages	Area (ha.)
Amreli	Rajula	12	8007.44
Bhavnagar	Mahuva	26	15140.05
Mud flats		-	2698.85
Gulf of Kutch			7478.94
Total		**38**	**33325.28**

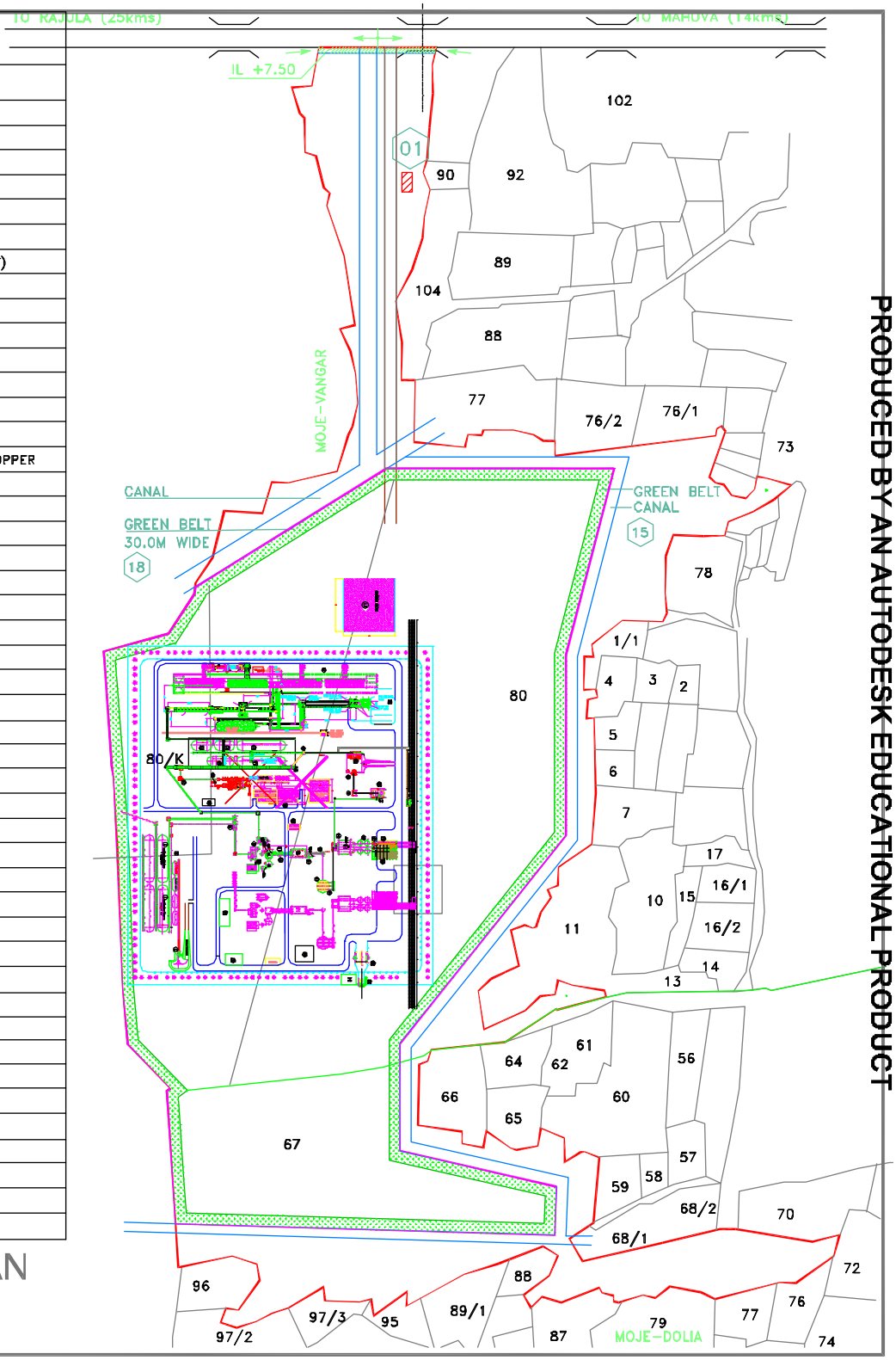
Detailed break up of land use pattern in study area is given in **Annexure VIII** and summarised in Table 3.12 and given in Fig 3.13.

TABLE 3.12
LAND USE DETAILS OF STUDY AREA (10 KM RADIUS)

Land use	Area (ha.)	% of total land area
Forest	339.54	1.02
Irrigated agricultural land	2757.94	8.28
Unirrigated agricultural land	13939.31	41.83
Culturable waste	2063.14	6.19
Area not available for cultivation	14225.35	42.69
Total	**33325.28**	**100**

LEGEND

S NO.	DESCRIPTION
1.	LIMESTONE PREBLENDING STOCKPILE
2.	CORRECTIVE DUMP HOPPER
3.	CORRECTIVE STOCKPILE
4.	CORRECTIVE STOCKPILE
5.	RAW MAT'L HOPPERS
6.	RAW MILL HOUSE
7.	BAG HOUSE/MCC & I/O ROOM (UNDER BAG HOUSE)
8.	COMPRESSOR HOUSE
9.	CF SILO
10.	PREHEATER TOWER
11.	KILN
12.	TA DUCT
13.	COOLER HOUSE
14.	COOLER ESP
15.	CLINKER TRANSFER TOWER & UNBURNT CLINKER HOPPER
16.	CLINKER LOADING
17.	CLINKER SILO
18.	DUMP HOPPER WITH TIPPLER FOR COAL/LIGNITE
19.	COAL CRUSHER PRIMARY
20.	COAL CRUSHER & SCREEN
21.	INTERMEDIATE BUNKER STATION
22.	COAL/LIGNITE/PETCOKE STOCKPILE
23.	COAL MILL HOUSE
24.	COAL STOCKPILE (FOR COKE OVEN)
25.	GYPSUM STOCKPILE (UNCRUSHED)
26.	GYPSUM DUMP HOPPER / CRUSHER
27.	CEMENT MILL HOPPERS
28.	CEMENT GRINDING
29.	CEMENT SILOS
30.	PACKING PLANT
31.	TRUCK LOADING PLATFORM
32.	SECURITY
33.	CEMENT DESPATCH OFFICE
34.	WEIGH BRIDGE
35.	CCR/ LAB./ TECH. OFFICE
36.	ELECT./MECH. WORKSHOP
37.	GENERAL STORE
38.	ADMINISTRATIVE BUILDING
39.	SWITCH YARD & SUB STATION
40.	WATER STORAGE
41.	UTILITY BUILDING
42.	COAL CRUSHER SECONDARY
43.	WATER TREATMENT PLANT
44.	GREEN BELT & CANAL AREA
45	APPROACH & GATE
42.	COAL CRUSHER SECONDARY



REVENUE PATTA PLAN

FIG. NO. 3.12

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

FIG 3.13 : LAND USE PATTERN IN THE STUDY AREA
(CENSUS 2001)

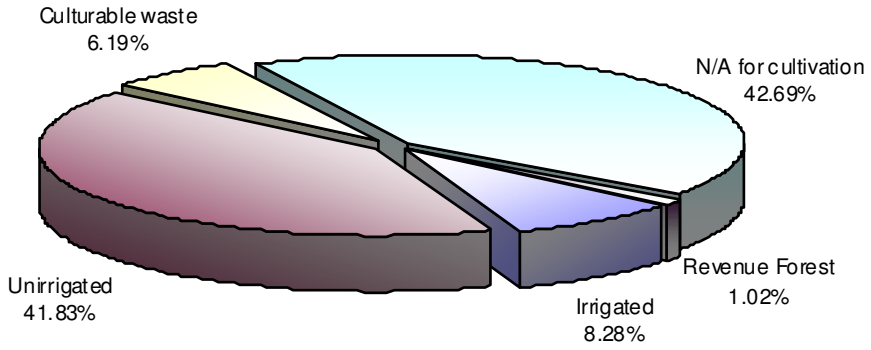
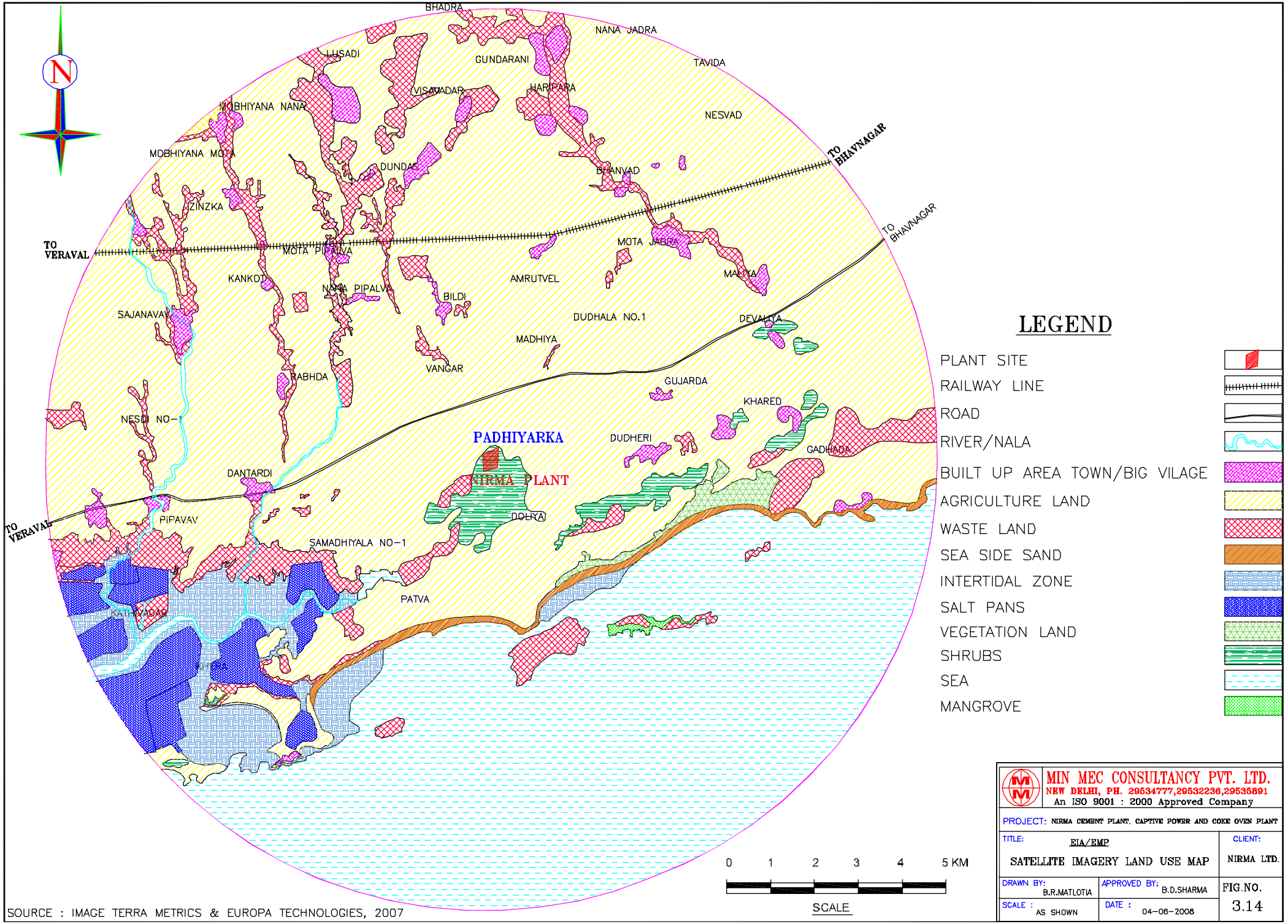


Table 3.13 shows the details of land use of the study area using satellite imagery. The Satellite imagery showing various land use is given in Fig 3.14.

TABLE 3.13
LAND USE PATTERN OF STUDY AREA BASED ON SATELLITE IMAGERY INTERPRETATION

Sl. No.	Land Use categories	Area in Hectare	%
1	Built up area	5.716	1.73
2	Waste lands	25.5184	7.74
3	Sea Side sand	2.4051	0.73
4	Intertidal zone	11.39743	3.45
5	Salt pan	9.2434	2.80
6	Vegetation land	1.7357	0.53
7	Shrubs	5.1919	1.57
8	Water body	88.1331	26.73
9	Mangroves	0.2838	0.09
10	Agricultural land	180.1205	54.63
Total		**329.7222**	**100.00**



SOURCE : IMAGE TERRA METRICS & EUROPA TECHNOLOGIES, 2007

MIN MEC CONSULTANCY PVT. LTD.
NEW DELHI, PH. 29534777,29532236,29535891
An ISO 9001 : 2000 Approved Company

PROJECT: NIRMA CEMENT PLANT, CAPTIVE POWER AND COKE OVEN PLANT

TITLE: EIA/EMP
SATELLITE IMAGERY LAND USE MAP

CLIENT: NIRMA LTD.

DRAWN BY: B.R.MATLOTIA
APPROVED BY: B.D.SHARMA
SCALE : AS SHOWN
DATE : 04-06-2008
FIG.NO. 3.14

3.7 SOIL QUALITY

Top soil samples were collected from three villages in the study area. Two sets of samples were collected from each location. The location of soil sampling stations and the results of the analysis is given in Table 3.14 and shown in Fig 3.11.

TABLE 3.14
SOIL SAMPLING STATIONS

Parameters	Units	Padhiarka	Dudhala	Madhiya
pH	-	7.96	8.02	8.24
E.C.	µmho/cm	114	102	118
$CaCO_3$	% by mass	14.5	11.7	11.2
Bulk Density	g/cm^3	1.02	1.13	1.07
Moisture	% by mass	5.25	3.25	4.31
Organic Matter	% by mass	1.49	1.49	1.74
Chloride	% by mass	0.28	0.14	0.13
Sulphate	% by mass	0.05	0.10	0.35
Phosphorous	ppm (mg/kg)	1.36	0.72	0.50
Nitrate	ppm (mg/kg)	2.78	5.32	3.19
Iron	ppm (mg/kg)	36.80	30.00	43.80
Sodium	% by mass	2.28	0.11	2.33
Potassium	% by mass	0.24	0.34	0.23
Soil texture/ Type of soil	-	Clay	Silt loam	Clay loam
Permeability	Cm/hour	0.06	1.2	0.52
Infiltration rate	mm/hour	3.9	15	7.8
Water holding capacity	% by mass	59	36	42

The pH of soils is normal to saline while the electrical conductivity varies from 114 to 118 µmhos /cm. the soils have a bulk density of 1.02 to 1.13 g/cm^3 indicating soft soils and the organic matter content varies from 1.49 to 1.74.

3.8 CROPPING PATTERN

Total agricultural land of the area is not sown since it is dependent on the rainwater. The tube well is the major source for agriculture and seasonal river also use in agriculture. Tube well feed only about 8.28% of the area under irrigation. The main crops of the area are wheat, Bajra, Groundnut, Til and Cotton. Bajra, Til and Groundnut is grown in Kharif season. There are three seasonal crop seasons in area viz. Kharif, Rabi and summer.

3.9 NOISE ENVIRONMENT

Noise level

Ambient noise levels were measured at ten locations in and around the site using a sound level meter along with filter. During studies it was found that the noise level was well within the limits. The observations made during the

study have been presented in **Annexure IX.** The noise levels around the site are given in Table 3.15.

TABLE 3.15
AMBIENT NOISE LEVELS

Station code	Location of noise monitoring Station	Distance from project site, km	Direction from site	Noise levels (Leq)	
				Day	Night
N1	Core Zone	-	-	47.10	38.60
N2	Padhiyarka	1.0	NE	47.90	40.80
N3	Vangar	1.30	NWN	47.90	38.30
N4	Samadhiyal	2.9	SW	51.70	42.20
N5	Doliya	1.75	SE	49.40	39.80
N6	Dudheri	4.0	E	48.00	39.20
N7	Madhiya	2.8	NE	49.60	38.60
N8	Bildi	4.0	NWN	48.20	37.80
N9	Rabhda	4.3	NW	53.10	41.30
N10	Patva	3.3	SWS	45.10	37.70

Ambient air quality standards for noise are given in **Annexure X**. Based on the observations made during the studies, it is concluded that the noise levels observed at all the locations are within the limits specified for residential and rural area category. The noise location sampling station shown in given in Fig 3.11.

3.10 TRAFFIC DENSITY

The traffic density survey was conducted on NH-8E Mahuva to Una Road. The location of station is shown in Fig 3.11. The monitoring was performed on 18/04/2007 (from 14.00hrs) to 19/04/2007 (till 14.00 hrs) by visual observation and counting of vehicles under different categories viz. cycles, 2/3 wheelers, light motor vehicle (L.M.V.) and heavy motor vehicles (H.M.V.). The details are given in **Annexure XI** and summarised in Table 3.16.

TABLE 3.16
TRAFFIC DENSITY DURING 24 HOURS

Traffic Vehicle	Total No. of traffic
Cycles	89
Two/Three wheelers	430
L.M.V	723
H.M.V	815
Total	**2057**

The traffic density with respect to two/three wheelers is generally higher during day time. The movement of heavy motor vehicles are almost uniform

through out the 24 hour period. The movement of light motor vehicles is low during the night hours.

3.11 ECOLOGY

3.11.1 Flora

Flora in core zone

The floral species found in the whole of core zone. Trees are like Harmo, Desi-babool, Gorad, Limdo, Pipli, Shrubs are Akdo, Awal Dhaturo, Kantaro thor, Arand, Herbs are Chirchitta, Dudhi bel, Piludi. Grasses and Bamboo are Rosha ghans, Gandharu, Dhro, Babsaliu, Nakkatoka-gaddi *etc*. the detailed is given in **Annexure XII**

Flora in study area

The floral species found in the whole of study area. Trees species like Harmo, Desi-baval, Limdo, Pipli, Shrubs are Akdo, Awal Dhaturo, Jakhmi, Kaner etc. Shrubs are Ratanjot, Mehndi, Harsingar, Peela kaner, Mehndi, Kharsani thor. Herbs are Chirchitta, chaulii, Dudhi bel, Tulsi, Piludi. Grasses and Bamboo are Bhamgoru, Lapduu, Kanti vans, Rosha ghas, Gandharu, Dhro, Motha, Manvel, Babsaliu and Nakkatoka-gaddi. The detailed list of flora found in the study area is given in **Annexure XII.**

Phyto-sociological study

To understand the attribute of communities, a phyto-sociological study of vegetation was conducted all through, wherever small patches of *Acacia senegal* growth were present. The sites were selected on the basis of vegetation component and their importance for project view point. An attempt has been made to study only for tree flora because herbaceous flora was not identifiable. A list of flora for trees, shrubs and herbaceous plant species is listed separately in **Annexure XII.**

At each selected site random vegetation sampling was done with the help of 10 m X 10 m quadrate size. Presence and absence of species, number of individual species and basal area of each plant species in each quadrate was recorded. Frequencies and densities were calculated following Curtis and Mc. Intosh (1951) method. Species diversity index was estimated using Shannon-Weiner index (1963).

Shanon Weiner diversity Index was calculated by following formula :

$$\overline{H} = \Sigma \text{ Pi Log Pi}$$

Where : $\overline{H}$ = Shanon Weiner diversity index

Pi = ni/N where ni is number or biomass or IVI of individual species and N is the total number or biomass or IVI of all individuals.

In the present study IVI (Importance Value Index) has been taken into consideration for evaluation of diversity index. IVI gives total performance of individual species at a particular site. IVI is the total of relative frequency (RF), relative density (RD) and relative dominance (RDO). Since IVI includes many of the attributes at a time, therefore consideration of IVI was preferred on number for evaluation of Shannon-Weiner diversity index. This diversity index includes both richness of species and apportionment of species at any particular site. Higher the value of index, more is the stability of that community. Thus Shannon-Weiner diversity index is an indication of goodness of community.

Phytosociological study of tree layer vegetation was conducted at various sites, however more emphasis was given on study around the proposed project site. The parameters such as frequency, density, abundance, relative frequency, relative density, relative dominance and IVI were evaluated at each forest stand. Shanon-Weiner diversity index was also calculated for each studied stand. A general description of forest stands, where classified forest are not present, has also been covered in following paragraphs:

The existing *Acacia senegal* forest of the study area is degraded one. A very small portion of study area is occupied by forest area. Canopy density (Canopy area of trees/Total ground cover area) of the forested area is very low. The value is never exceeding 0.2. General canopy density is below 0.1. Tree heights vary from 1.5 to 4.5m. Canopy diameter of tree species varies from 1.0 to 3.6m. The forest stands are dominated mostly by a leguminous tree species of *Acacia senegal*. Very few stands are dominated by *Acacia leucophloea* tree species. Overall forest areas are characterised by low species diversity.

Number of total plant species is limited to seven only. All the stands are dominated by either *Acacia senegal* or *Acacia leucophloea*. A detailed vegetation study was done for the following sites.

There are four analytical sites i.e. Doliya, Padiarka, Dundas and Dudheri. Tree flora vegetation analysis results are shown in Table 3.17 to 3.20.

TABLE 3.17
TREE FLORA AT DOLIYA

Name of species	F	D	AB	RF	RD	RDO	IVI
Acacia senegal	60.00	1.30	2.17	18.75	21.31	4.19	44.25
Ailanthus excelsa	60.00	0.60	1.00	18.75	9.84	20.43	49.02
Acacia nilotica	60.00	1.20	2.00	18.75	19.67	24.18	62.60
Acaica leucophloea	50.00	1.40	2.80	15.63	22.95	3.13	41.71
Cocos nucifera	20.00	0.80	4.00	6.25	13.11	28.66	48.02
Dalbergia sissoo	20.00	0.30	1.50	6.25	4.92	9.70	20.87
Ficus religiosa	20.00	0.20	1.00	6.25	3.28	7.53	17.06
Zizyphus mauritiana	30.00	0.30	1.00	9.38	4.92	2.18	16.47

Diversity Index = 0.86

TABLE 3.18
TREE FLORA AT PADHIARKA

Name of species	F	D	AB	RF	RD	RDO	IVI
Acacia leucophloea	50.00	1.90	3.80	16.13	26.76	9.12	52.01
Acacia nilotica	70.00	1.30	1.86	22.58	18.31	33.00	73.89
Acacia senegal	70.00	2.50	3.57	22.58	35.21	17.28	75.07
Azadirachata indica	50.00	0.50	1.00	16.13	7.04	21.60	44.77
Ficus infectoria	20.00	0.20	1.00	6.45	2.82	11.10	20.36
Zizyphus mauritiana	30.00	0.40	1.33	9.68	5.63	3.25	18.56
Prosopis juliflora	20.00	0.30	1.50	6.45	4.23	4.66	15.34

Diversity Index = 0.77

TABLE 3.19
TREE FLORA AT DUNDAS

Name of species	F	D	AB	RF	RD	RDO	IVI
Acacia nilotica	90.00	1.30	1.44	28.13	20.31	39.25	87.68
Acacia senegal	80.00	3.30	4.13	25.00	51.56	12.41	88.97
Azadirachta indica	40.00	0.40	1.00	12.50	6.25	12.80	31.55
Eucalyptus hybrid	30.00	0.60	2.00	9.38	9.38	13.18	31.93
Ficus benghalensis	20.00	0.20	1.00	6.25	3.13	11.05	20.43
Mangifera indica	20.00	0.20	1.00	6.25	3.13	7.54	16.92
Zizyphus mauritiana	40.00	0.40	1.00	12.50	6.25	3.77	22.52
Acacia nilotica	90.00	1.30	1.44	28.13	20.31	39.25	87.68

Diversity index = 0.75

TABLE 3.20
TREE FLORA AT DUDHERI

Name of species	F	D	AB	RF	RD	RDO	IVI
Acacia leucophloea	40.00	1.20	3.00	13.79	17.39	4.02	35.20
Acacia nilotica	50.00	0.90	1.80	17.24	13.04	22.80	53.08
Zizyphus mauritiana	40.00	0.60	1.50	13.79	8.70	7.38	29.87
Acacia senegal	40.00	2.20	5.50	13.79	31.88	5.12	50.79
Albizzia lebbeck	20.00	0.30	1.50	6.90	4.35	5.47	16.71
Cassia fistula	20.00	0.40	2.00	6.90	5.80	9.53	22.22
Eucalyptus hybrid	20.00	0.50	2.50	6.90	7.25	15.07	29.22
Ficus recemosa	20.00	0.20	1.00	6.90	2.90	7.44	17.24
Mangifera indica	20.00	0.30	1.50	6.90	4.35	14.13	25.37
Syzygium cumini	20.00	0.30	1.50	6.90	4.35	9.04	20.29

Diversity index = 0.96

Note : F - Frequency, D - Density, AB - Abundance, RF - Relative Frequency, RD - Relative Density, RDO - Relative Dominance, IVI - Importance Value Index

3.11.2 Fauna

Fauna in core zone

Aves: Barred jungle owlet, Indian Myna, Koel, Blue rock pigeon, Common quail and Red vented bulbul.

Mammals: Jackal, Five striped palm squirrel, Indian hare, and Nilgae.

Reptiles: Common Garden Lizard, common Indian krait and Dhaman. The details of core zone fauna are given in **Annexure XIII.**

Fauna in buffer zone

Aves: Barred jungle owlet, Indian Myna, Koel, Blue rock pigeon, Common quail, House sparrow, Peacock, Rose ringed parakeet, Common crane and Red vented bulbul.

Mammals: Jackal, Five striped palm squirrel, Indian hare, Nilgae, Chital and Mangoose.

Reptiles: Common Garden Lizard, common Indian krait and Dhaman. All details of fauna give in **Annexure XIII.**

3.12 SOCIO-ECONOMIC CONDITIONS

3.12.1 Demographic details

There are 38 inhabited villages in the buffer zone of the study area. Human settlement having total 21888 households with a total 134069 population within the study area. The district and taluk wise population as per Census 2001 records are given in Table 3.21.

TABLE 3.21
DISTRICT & TALUKWISE POPULATION (CENSUS 2001)

District	Taluk	No. of villages	Total population	Males	Females
Bhavnagar	Mahuva	26	117930	60399	57531
Amreli	Rajula	12	16139	7959	8180
Total		**38**	**134069**	**68358**	**65711**

A summary of the same is presented in Table 3.22. Distribution of population and percentage of literates, and the percentage of SC and ST population are presented through pie graphs in Fig 3.15 and 3.16 respectively. Demographic profile of individual villages, as per 2001 Census records, are presented in **Annexure XIV.**

TABLE 3.22
DEMOGRAPHIC DETAILS OF THE STUDY AREA (As per Census 2001)

Description	Total
Total Population	134069
Male Population	68358
Female Population	65711
Females/1000 males	961
No. of households	21888
Average Family size, persons/family	6
Schedule caste	6178
SC as % of total population	4.61
Schedule Tribe	325
ST as % of total population	0.24
Total literates	71217
Male literates	43292
Female literates	27925
Literates as % of total population	53.12
Male literates as % of male population	63.33
Female literates as % of female population	42.50

FIG 3.15 : LITERACY LEVEL IN THE STUDY AREA
(CENSUS 2001)

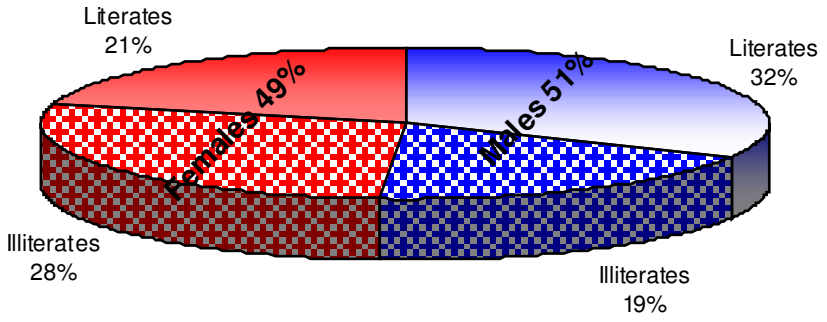
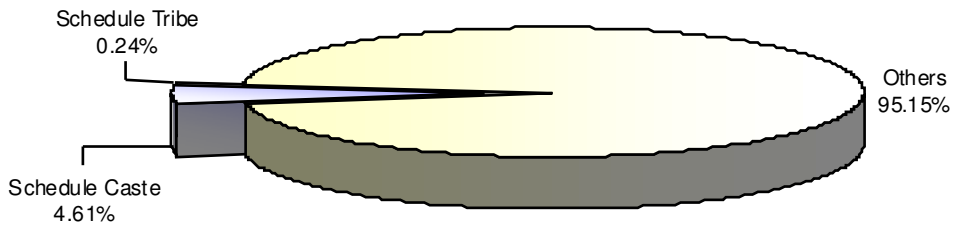


FIG 3.16 : BREAK UP OF SC & ST IN THE STUDY AREA
(CENSUS 2001)



Salient features of the demographic profile are as follows:

a) There are about 961 females per 1000 male population.

b) The average family size is more than to 6 persons/family.

c) Schedule castes and Schedule tribes form a small part of the population (4.61% and 0.24 % respectively).

d) Literacy rate is 53.12%. Female literacy is much lower than the male literacy rate.

3.12.2 Employment pattern

The village wise employment pattern within the study area including their break-up is given in **Annexure XV** and summarised in Table 3.23.

The employment pattern, break-up of main workers and break-up of marginal workers are graphically depicted in Fig 3.17, 3.18 and 3.19 respectively.

TABLE 3.23
SUMMARY OF EMPLOYMENT & OCCUPATION IN THE STUDY AREA

Description	Total
Main workers	38152
Main workers as % of total population	28.46
Marginal workers	10256
Marginal workers as % of total population	7.65
Non workers	85661
Non workers as % of total population	63.89

Description	Total
Break-up of main workers	
Cultivators (%)	15.60
Agricultural labours (%)	23.50
Household industries (%)	2.77
Other workers (%)	58.13
Total	**100**
Break-up of marginal workers	
Cultivators (%)	11.59
Agricultural labours (%)	63.31
Household industries (%)	3.67
Other workers (%)	21.43
Total	**100**

FIG 3.17 : EMPLOYMENT PATTERN IN THE STUDY AREA
(CENSUS 2001)

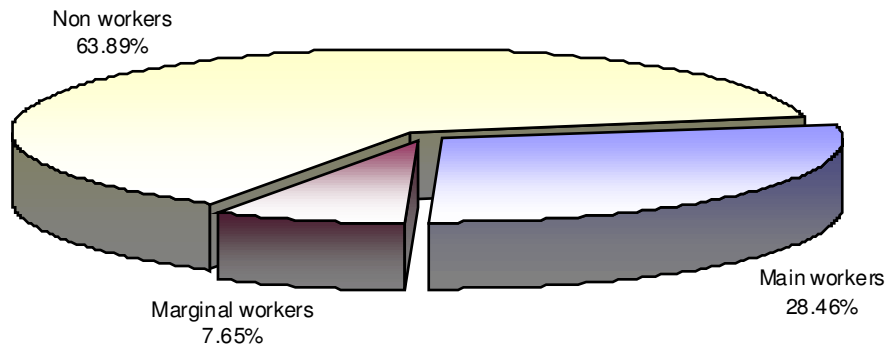


FIG 3.18 : BREAK UP OF MAIN WORKERS IN THE STUDY AREA
(CENSUS 2001)

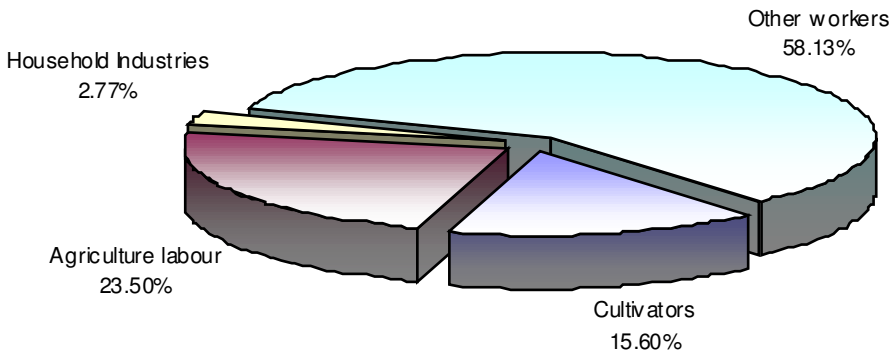
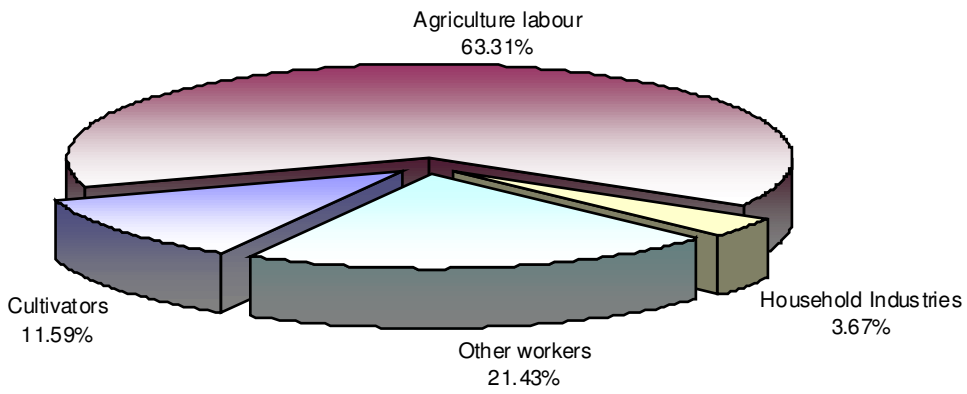


FIG 3.19 : BREAK UP OF MARGINAL WORKERS IN THE STUDY AREA
(CENSUS 2001)



Salient features of employment pattern and occupation in the study area are as follows:

a) Cultivators and agricultural labourers account for 39.1 % of total main workers and 74.9 % of total marginal workers. These figures indicate that agriculture is the main occupation.

b) The average family size in the study area is above 6 persons/household. Main workers constitute 28.46% of the total workers. More than half of the population is unemployed.

3.13 AMENITIES

The village wise details of amenities available in the study area are given in **Annexure XVI.** A summary of the amenities available in the villages is as follows:

- Education facilities in the study area consist of 39 primary schools and 1 secondary school.
- Medical facilities in the study area consist of 1 ayurvedic dispensary, 8 primary health centre, 3 family welfare centre, 2 child welfare centre, 17 registered private medical practitioners, 12 community health workers.
- Tube well, hand pumps & dug wells are the main source of drinking water. 32 have hand pumps, 8 have tap water connections, 1 tank water, well water is used in 35 villages, tube wells 6, 1 river water and 4 other water sources.
- In the study area, 20 villages have power supply for all purposes, 17 for domestic power and 13 for agriculture.

- There are 21 post offices and 204 telephones in the study area.
- Communication within the study area comparatively good. There are 34 bus stops in these villages, 7 railway stations. Only 30 villages are connected with pucca roads, 22 villages with mud roads, 16 with footpath and 1 navigable water ways.
- 1 village having 1 commercial bank in the study area.

3.14 SEISMICITY

The proposed plant site of Padhiarka falls in Zone III of the seismic zoning map of India prepared under the auspices of Bureau of Indian Standards (BIS Code : IS 1893 : Part-I : 2002). Thus, the seismic zone factor is 0.24 as per the BIS. The ground acceleration and hence the intensity of an earthquake at a place depends on magnitude of earthquake, distance from the epicenter, duration of earth quake, type of underlying soil and its damping characteristics and depth of water table. The damage to the buildings founded on sandy soil is higher than the similar type of buildings having their foundation on hard bedrock.

The area of Bhuj-Kachchh in Gujarat and its neighbourhood has been affected by earthquake of moderate to great intensity in the past. Notable amongst them are as follows:

1. The great Rann of Kachchh eartquake of 16th June 1819 (Magnitude=8.0)
2. The eartquake of 19.04.1845 (Magnitude=6.0)
3. The earthquake of 29.04.1864 (Magnitude=6.0)
4. The earthquake of 19.04.1919 (Magnitude=6.0)

The severest earthquake experienced in the region was the Rann of Kachchh earthquake of 16th June 1819. It took a toll of about 1543 human lives and destruction to the property in the epicentral area, which extended from Ahmedabad in the east to Porbander in the west, Jaiselmer in the north and included the important town of Bhuj and Anjar. In Bhuj alone, more than 7000 houses were overthrown.

A remarkable observation of the damage to the houses in Anjar showed that half of the town built on rocky ridges suffered little damage while the other half founded on a slope leading to plain of springs and swamps was completely ruined. This earthquake was followed by a large number of aftershocks. During the first three months following the main shock, not a single day passed without one or two shocks, thereafter the frequency decreased gradually.

A list of important earthquakes occurred in the region bounded by Lat. 23.00 to 24.00° N and Long. 68.00 to 70.00° E for the period 1505 to 2000 is given

in Table 3.24. Some of these earthquakes could have been experienced in the region.

TABLE 3.24
LIST OF EARTHQUAKES FROM IMD CATALOGUE OCCURRING BETWEEN LAT 21.00 TO 25.00 DEG. N AND LONG 68.00 TO 72.00 DEG. E FOR THE PERIOD 1505 TO 2000

Date	O-Time	Latitude.	Longitude.	DPTH	Magnitude
16.06.1819	00-00-00	24.00	70.00	0	8.0
13.08.1821	00-00-00	23.00	70.00	0	5.0
19.04.1845	00-00-00	24.00	69.00	0	6.0
25.04.1845	00-00-00	24.00	69.00	0	5.5
29.04.1864	00-00-00	24.00	70.00	0	6.0
14.01.1903	00-00-00	24.00	70.00	0	6.0
31.10.1940	10-43-50	23.70	69.90	0	5.8
20.01.1991	19-44-56	23.08	69.50	35	0.0
17.02.1996	02-43-39	23.20	69.40	33	4.5
08.10.1998	15-01-13	23.68	68.80	33	0.0

In the recent past, on 26th January 2001 a devastating earthquake having the following hypo-central parameters occurred near Bhuj (Gujarat).

Date : 26.01.2001
Origin Time : 08 hrs 46 min 42.9 sec (IST)
Epicenter : Lat. 23.40°N, Long. 70.28°E
Focal Depth : 25 km.
Magnitude : M_L = 6.9 (Richter Scale), M_b = 7.0, M_s = 7.6, M_w =7.7

Bhuj town and the village Bhachau 60 km. East of Bhuj were the worst affected and many other area of Gujarat including its capital, Ahmedabad were badly affected. It took a toll of 13,805 human lives and 12,05,198 houses have been damaged. Under the influence of strong ground motion lasting for a long duration. The damages were large in the districts of Kachchh, Ahmedabad, Rajkot, Jamnagar, Surendranagar, Patan Surat and Banaskantha. This earthquake was followed by a large number of aftershocks, eleven of them having magnitude > 5. The Bhuj earthquake of 26th January 2001 has been the largest seismic event in India in the last five decades and the most destructive of recorded events so far in India, in terms of socio-economic losses.

3.15 INDUSTRIES AROUND THE PROJECT AREA

There exist no major industries, except some salt pans i.e. salt manufacturing industries, in the study area.

3.16 PLACES OF TOURIST/RELIGIOUS/HISTORICAL INTEREST/NATIONAL PARK/SANCTUARY

There is no such place within core zone or in the study area of tourist, or historical importance or National Park/Sanctuary.

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 GENERAL ASPECTS

Keeping in mind the environmental baseline as detailed in Chapter 3 and the proposed mining activity described in Chapter 2, it is attempted to assess the likely impact and its extent on various environmental parameters in this chapter. The parameters, which are relevent within the context, are as detailed below.

The likely effects are disscussed in this chapter on various environmental descriptions, namely:

- Topography
- Climate conditions
- Air quality
- Water resources
- Water quality
- Noise levels and ground vibration
- Land use
- Ecological factors
- Socio economic conditions

The environment management plan has been developed with a view to bring down the levels of impacts within limits. In each of the area of impact, measures have to be taken to mitigate adverse impacts and where these are benificial in nature such impacts are to be enhanced /augmented so that the overall adverse inpacts are reduced to as low level as possible.

4.2 TOPOGRAPHY & DRAINAGE

4.2.1 Impact and management on topography and drainage

Construction phase

The topography will change only due to construction of buildings which will be constructed for the purpose of cement plant, captive power plant and coke oven plant and related facilities. It is a low lying area with an average fill of 1.5 m. Any change in topography due to digging and earth work will be of temporary nature and the drainage will be managed by storm water drainage.

Operational phase

There will be no change in topography or drainage during the operation phase. Green belt development and landscaping will contribute to the aesthetics of the topography.

4.3 CLIMATE AND METEOROLOGY

4.3.1 Impact on climate and meteorology

The climatic conditions including temperature variations, wind direction and speed, rainfall and humidity are governed by regional factors and the monsoons. As such the mining and other allied activities will not tend to influence the climate. Further, carbon dioxide (green house gas) contributing fossil fuel in the form of diesel will be used to operate the trucks and earth moving machinery, which will be a necessity.

During the construction phase, the activities will be restricted to construction of roads, warehouse buildings, erection of structures, water reservoir, plants and machinery, construction of oil/fuel storage areas etc. Thus, no effect on climate and meteorology of area is expected due to the construction activities.

There are no activities in the proposed cement plant, captive power plant and coke oven plant that may cause impact on the climate and meteorology of the area.

4.3.2 Mitigation measures

The operations are to be carried out in a limited area, as a result no large scale climatological impacts are anticipated. Development of greenbelt in the plant premises will contribute in a positive manner towards mitigation fo greenhouse gases. Global warming is a global concern and hence, the company will be undertaking all possible measures to minimise the CO_2 emissions. Furthermore, it will be ensured that the vehicles are having their “pollution under Control” (PUC) certificates.

4.4 AIR ENVIRONMENT

4.4.1 Impact on air quality during construction

Sources of air pollution, during the construction phase will be:

- Vehicle exhausts for transport of materials
- Dust generation due to excavation work, shifting of construction materials (cement, sand and gravel), vehicle movement on unpaved roads and concrete preparation plant.
- Exhaust from construction equipment like compressors, DG sets, heavy earth moving machinery etc.

Primary impact from these sources on air quality will be suspended particulate matter generation resulting into increased SPM levels in the surrounding areas. Further movement of construction equipment for these operations as well as for transport of material will lead to increased level of SPM, SO_2, NOx and CO in the surrounding areas. Thus, adverse impacts on air quality are envisaged. These, however, in the construction shall be low in magnitude, temporary in nature and reversible.

During operation phase emissions from various types of industries vary from one another in terms of quality and quantity of emissions, production capacity of the plant, type of fuel used, type and complexity of the process employed, use of air pollution control measures and degree of maintenance enforced. The factoral emissions from different activities will enable the total load to be known and linked to the receptor point by use of dispersion models.

The production capacity of the plant will be 4500 TPD clinker along with a captive power plant of 50 MW. There will be a coke oven of 1.5 LTPA. Impacts on air environment due to the proposed cement plant, captive power plant and coke oven plant are predicted on the basis of anticipated emission superimposed upon the micro-meteorological data collected at site.

i. Air Emissions from combustion sources

In cement plant there is no requirement of a boiler or any other independent combustion equipment.Kiln & Pre-Calciner, part of cement manufacturing, use powdered lignite combustion, release process emissions. Also because of combustion gases having to pass through alkaline solid materials, active gases such as SO_2 and NOx are emitted in insignificant quantities. Hence impact of such gases on the environment are negligible.

Lignite/imported coal based captive power plant of 50 MW capacity is envisaged at the site for power supply to the cement plant. This will consist of two boilers and the air emissions from the power plant are also considered in the model since the power plant is for captive use, no back up generators are envisaged.

Coke oven plant involves the conversion of coal to coke. Due to higher coking temeperatures i.e. 1200-1250°C, the hydrocarbons in the coke oven gas are broken into combustible compounds and burnt. This process emits suspended particulate matter within 50 mg/Nm^3, CO 25 ppm, SO_2 75 ppm and NOx 50 ppm. With the high exhaust gas temperatures and the inert composition mentioned above it is very convenient to utilize the high sensible heat content in unfired heat exchangers (waste heat recovery boilers) to produce high-pressure steam that can operate a turbine. The Sesa design circulates air in the foundation below the battery to keep it cool and this cooling air which absorbs certain amount of heat is reintroduced in the oven as primary and secondary air with a view to enhance the heat recovery. this puts a significant amount of energy back into the ovens and

makes it possible to use lower Volatile Matter in the coal blend resulting in a higher coal to coke yield. Alternatively with the same Volatile Matter, more power could be generated from the flue gases.

The transportation of majority of limestone from mine to plant shall be through conveyors, thereby removing potential pollution threat due to transportation of limestone. Some limestone from mines which are across the highway (NH 8-E) has to move with the help of vehicles. However, because of coal and lignite transportion to site, automobile emissions can be a source of air pollution. In the present case, raw materials and finished products will be mainly transported through truck transport on metal road or rail Linkage or the port at Pipavav. The port is 25 km in the west, hence, the impact due to transportation shall be limited.

ii Process emission

Process emission in a cement industry can be considered to be mainly suspended particulate matter (SPM) with a considerable proportion being respirable particulate matter. In the proposed plant best control measures will be adopted. Typical anticipated emission levels of the seven major stacks are given in Table 2.10 in Chapter 2.

iii Air pollution dispersion modelling

Different types of mathematical models are available for short term prediction of Ground Level Concentrations (GLC's) of air pollutants. These models deal with different types of atmospheric dispersion computations, air pollution sources, topographic features and comprehend to different types of atmospheric conditions. The available mathematical models require the input of stack characteristics such as diameter, height, source strength, meteorological data and computer resources to handle the available inputs. Keeping the mentioned facts in view, one has to identify a proper and suitable model applicable to the characteristics of source and prevailing topographic conditions to enable GLC to be known at any location under a variety of factoral changes.

The area around the cement plant is generally flat. The site is in the coastal area of district Bhavnagar and the Gulf of Khambat is 3.5 km on the south eastern side. The stacks are identified as elevated continuous point sources. To determine the impact of proposed plant on the ambient air quality, dispersion modelling has been done. The incremental GLC's for the proposed plant have been determined.

The modelling is based on hourly meteorological data collected at the plant site during the summer season of 2007. 24 hour average incremental GLC's have been predicted for the proposed plant for multi stack dispersion modeling using double Gaussian diffusion equation : IS 8829-1978 as per 'Assessment of Impact to Air Environment : Guidelines for Conducting Air Quality Modelling' by CPCB, Delhi, (PROBES/70/1997-98). Various parameters like directional wind speeds and corresponding stability classes

have been given in **Annexure XVII**. Major pollutant of the source would be SPM, SO_2, and NOx. The sulphur content (max 2%) in lignite will be almost totally absorbed by kiln feed during clinkerization. In case lignite is sourced from Bhavnagar, then the sulphuir content will be higher, around 6% for which lime dosing will be require as given in Table 4.1.

TABLE 4.1
LIMESTONE REQUIREMENT IN CASE OF 6% SULPHUR LIGNITE USAGE

System Load	220 TPH
Lignite feed/ hr	55 TPH
Ash generation (@ 15%)	8.25 TPH
Bed Ash (@20% of Total Ash)	1.65 TPH
For 90 % Sulphur capture with 6 % sulphur in lignite Limestone feed required	9.30 TPH
Approx. limestone stay in bed @ 90 %	8.4 TPH
Total Ash Generated (Bed Ash)	10.05 TPH
Total Fly Ash generation (80%)	6.6 TPH

The sulphur capture will occur as discussed subsequently. Any NOx. emission will be checked by specially designed precalciners. The dispersion modelling has been carried out considering contribution of SO_2 and NOx in the exhaust gases from the CPP boiler and roller mill.

The method of calculation and assumptions made in the model for GLC calculation are given in detail in **Annexure XVII**. The results are also presented in the same Annexure. 24 hours average incremental GLCs are summarised in Table 4.2.

iv. Ground level concentration

The method of calculation and assumptions made in the model for GLC calculation are given in detail in **Annexure XVII** and the results are also depicted in Fig 1, 2 & 3. 24 hours average incremental GLCs are summarised in Table 4.2.

TABLE 4.2
CALCULATED MAX INCR. GLC ($\mu g/m^3$)
(TOWARDS THREE MOST PREDOMINANT WIND DIRECTIONS)

Direction	Maximum Ground Level Concentrations (µg/m3)		
	SPM	SO_2	NO_x
NE	3.55 (5.0 km)	9.05 (2.0 km)	5.85 (2.0 km)
NW	1.08 (1.0 km)	3.64 (2.0 km)	2.17 (2.0 km)
N	0.70 (1.0 km)	1.24 (4.0 km)	0.69 (4.0 km)

The three most predominant wind directions observed during the monitoring period are towards NE, NW and N directions for 38.9%, 11.0% and 5.2% of time respectively during monitoring period (March to May 2007). The GLCs observed are lesser in the second and third predominant downwind directions than the first predominant downwind direction.

The results of dispersion modeling show that the incremental ground level concentrations are negligible. The maximum incremental GLCs for SPM, SO_2 and NOx are 3.55, 9.05, and 5.85 µg/m^3, respectively. These concentrations, when superimposed over the existing maximum concentrations show that the air quality will remain practically unaffected. It is, therefore, concluded that the ambient air quality will undergo minor change and will remain within the ambient air quality standards.

4.4.2 Air pollution control

Stack emissions from process

The main sources of process emissions are the kiln, clinker cooler, lignite mill, cement mills and the packing house. The emissions from captive power plant also add to these sources. Flue gases from the kiln, which are the product of coal/ lignite combustion as well as the clinkerization process, are passed through the raw mill for recovery of heat. Due to combustion of coal/ lignite, the flue gas contains particulates, SO_2 and NOx. Major portion of SO_2 and part of NOx react with the limestone and are retained in the clinker. During clinkerization and heat recovery in raw mill, the gas is further enriched with particulates. To control particulates, the gas is passed through high efficiency bag filters before discharge through stack of appropriate height. Emissions from cooler, coal/lignite mill, cement mills and packing house comprise of air containing particulate matter (clinker, coal fines and cement fines) picked up during handling of lignite, clinker and cement. For control of particulate matter, these air streams are passed through bag filters, and discharged through stacks. Electrostatic precipitators will be used for cleaning the vent gases from the captive power plant, and the clinker cooler. All the air pollution control devices are designed keeping in view the emission standards of 50 mg/Nm^3.

The main stacks emitting major part of total SPM emission are given in Table 4.3 along with the proposed air pollution control equipment.

TABLE 4.3
MAIN STACKS AND SPM CONTROL EQUIPMENT

Sl. No.	Stack	SPM control equipment
1	Raw mill & kiln	Bag house with multicyclone
2	Clinker cooler	ESP
3	Coal/ Lignite mill	Bag house with multicyclone
4	Cement mill	Bag house
5	CPP boiler	ESP
6	Cement mill	Bag house
7	Cement Packing Plant	Bag filter

Pollution control equipment for outlet of raw mill & kiln has got two options, namely : ESP and bag filter, both are extensively used by large cement plants. ESP has got the advantage of low pressure loss, high temperature

adaptability and low recurring cost. However, tripping due to system failure is rather common & frequent, requiring very high degree of maintenance.

Bag filters are also available for high temperature (upto 260°C. on continuous basis and 280°C for a shorter period). Pressure loss is high and maintenance cost is very high as it requires regular replacement of bags which have to be imported. If the system fails due to process disturbance and temperature increases, fresh air is automatically drawn in, to maintain the temperature of gases within permissible temperature range. Bag filters are being successfully & satisfactorily used by many cement plants having excellent environmental cleanliness. For the main stack, bag filter offers to be a better choice from environmental point of view. Emission levels are generally low in case of bag filter compared to that of ESP.

For clinker cooler, ESP will be the only choice. Multicyclone will not be able to maintain emission level below 50 mg/Nm^3. Provision has been made for installing bag filters before all dust emitting stacks. Use of efficient multi-channel burners is envisaged to keep NO_2 emission low. This plant has planned to adopt latest technology for low NOx generation in its precalcinator.

In case of the coke oven plant, the norms of the GPCB/ CPCB will be maintained because there will be minimal pushing emission, minimum charging emissions due to sequence charging and quench plume will have grit arrestors for minimal SPM.

Fugitive emissions

The cement plant handles large quantities of solids viz., limestone, coal/Lignite, clinker and cement, which are subjected to various dust generating operations like crushing, grinding, transfer, packing, etc. These operations generate large quantities of fugitive dust, which would otherwise disperse into the work zone atmosphere and plant surroundings. To control the dispersion of fugitive dust, all crushers and transfer points will be provided with dust extraction system. Most of the dust extraction systems consist of hoods, ducting, bag house ID fans and exhaust ducts. The dust extraction system brings down the particulate matter concentration in the exhaust air to approximately 50 mg/Nm^3.

Tentative list of Pollution Control equipments to be installed is as follows:

Sl. No.	Section	Description	Type of Pollution Control Equipment	Capacity (m^3/hr)	Dust load at inlet (gm/m^3)	Dust emission to atmosphere (mg/Nm^3)
1	Limestone Reclaimer	Belt conveyor	Bag filter	7740	30	50
2	Raw mill	Air slide & bucket elevator	Bag filter	7020	30	50
		Vibration conveyor & belt conveyor	Bag filter	12840	30	50

Sl. No.	Section	Description	Type of Pollution Control Equipment	Capacity (m^3/hr)	Dust load at inlet (gm/m^3)	Dust emission to atmosphere (mg/Nm^3)
		Air slide & bucket elevator	Bag filter	3300	30	50
		Transfer tower	Bag filter	6600	30	50
		Raw material hopper	Bag filter	14520	30	50
		Weigh feeder discharge	Bag filter	16020	30	50
		Vent gases to atmosphere	Cyclone, Bag house with Chimney	6,80,000	55	50
3	Blending silo & Kiln feed	Bucket elevator & air slide	Bag filter	7260	30	50
		Silo and kiln elevator	Bag filter	15660	30	50
		Bucket elevator & air slide	Bag filter	12060	30	50
4	Cooler	Crusher out let & pan conveyor	Bag filter	9240	30	50
		Vent gases to atmosphere	ESP with chimney	451614	15	50
5	Clinker silo	Clinker conveyor, clinker silo and drag chain conveyor	Bag filter	6960	30	50
		Silo extraction	Bag filter	3480	30	50
		Clinker conveyor	Bag filter	4140	30	50
6	Cement mill (VRM)	Cement mill conveyor & hoppers	Bag filter	11160	30	50
		Weighfeeder discharge	Bag filter	14040	30	50
		Cement transport equipment	Bag filter	19680	30	50
		Transport equipment at cement silo	Bag filter	10920	30	50
		Transport equipment at cement silo	Bag filter	4680	30	50
		Vent gases to atmosphere	Bag House with chimney	9,90,000	450	50
		Flyash silo collecting bin	Bag filter	9840	40	50
		Weigh bin & Air slides	Bag filter	5640	40	50
8	Cement storage	Silo top	Bag filter	5640	40	50
		Silo extraction	Bag filter	5640	40	50
		Silo top	Bag filter	5640	40	50
		Silo top	Bag filter	5640	40	50
9	Packing plant	Elevator and packer	Bag filter	30000	40	50
		Elevator and packer	Bag filter	30000	40	50
10	Coal mill	Coal bunker, lignite hoppers and weigh feeders	Bag filter	15540	30	50
		Transport equipment	Bag filter	3840	30	50
		Screw conveyors	Bag filter	8000	30	50
		Vent gases to atmosphere	ESP with Chimney	88,999	500	50
		Fine coal bins	Bag filter	240	30	50
		Solid flow feeder	Bag filter	1920	30	50

Note : Exact number and capacity will be worked out after detailed engineering

DETAILS OF AIR POLLUTION CONTROL EQUIPMENT FOR PROPOSED CPP

Sl. No.	Section	Description	Type of Pollution Control Equipment	Capacity (m^3/hr)	Dust load at inlet (gm/m^3)	Dust emission to atmosphere (mg/Nm^3)
1	CPP	Secondary tower	Bag filter	15000	45	50
		Transfer tower	Bag filter	10000	30	50
		Boiler bunker	Bag filter	10000	30	50
		Boiler bunker	Bag filter	10000	30	50
		Flyash silo	Bag filter	10000	30	50
		Bed ash silo	Bag filter	10000	30	50
		Bed material silo	Bag filter	10000	30	50
		Vent gases to atmosphere	ESP with Chimney	191450	55	50

Note: Exact number and capacity will be worked out after detailed engineering

4.5 WATER RESOURCES

4.5.1 Water requirement

A desalination plant of 8500 cum/day is envisaged at the cement plant site. Of this, 250 cum/day will be supplied for industrial and domestic consumption and 200 cum/day will be supplied for mine use. 3000 cum/day water will be used in Coke oven plant. 1500 cum/day industrial water will be required for cooling purposes of cement plant while 500 cum/day will be for power plant, which will be lost through evaporation. Therefore, generation of industrial wastewater from the process operations is not envisaged. Water requirement will be met from the sea water/Narmada Water Pipeline.

The sewage from the colony will be treated in the sewage treatment plant. The domestic effluents from the plant will also be treated in this STP. The treated effluent from sewage treatment will be utilised in the plantation for colony as well as in the plant green belt.Pit head domestic wastewater will be treated with septic tank and soak pit system. Waste water discharge into soak pits will not have any significant impact on ground water. As no waste water is discharged into drains, impact on surface water is not envisaged.

There will not be any industrial effluent from cement plant. However, there will be blow down water from captive power plant (@5 m^3/hr) and discharge from coke oven plant (@0.7 m^3/t). Thus, the tentative waste water quantity to be treated in ETP would be to the tune of 500 m^3/day.

4.5.2 Impact on water resources

Surface water

Only Malan river is flowing in the north eastern side of the study area at a distance of approximately 10 km from the plant and ultimately joins the

Arabian Sea outside the study area. There is a seasonal drain passing in the middle of the study area along north-south axis.

The effluent from proposed desalination plant will be discharged into the deep sea through a diffuser to avoid concentration at a single point. There will be no other effluent discharge from the proposed plant to any surface water channel. So there is no impact envisaged on the surface water resources due to the proposed plant.

Ground water

There is no withdrawal of ground water for utilisation in plant or colony. So there will not be any impact on the ground water table. Also there will not be any effluent discharge that will contaminate the ground water resources. The treated effluent will be used for plantation and will not cause any pollution of the ground water.

4.5.3 Water resources mitigation measures

Water conservation

Though the rainfall over the area is low to moderate, the rainwater storage in open wells, trenches is in practice over the area and the stored water acts as source of fresh water for couple of months after rainy season. No impact on the surface water resources is envisaged. The water regime in the region is controlled only by monsoon rain. The water accumulates in the excavated area but the water percolates into the sub-surface making the area dry after sometime.

As a result of extraction of mineral, the rate of charging of ground water is likely to be increased considerably.The proposed rainwater structures will be constructed near the cement office, workshop, and other locations as shown in the Fig 4.1. The schematic diagram of rainwater harvesting structure is given in Fig 4.2.

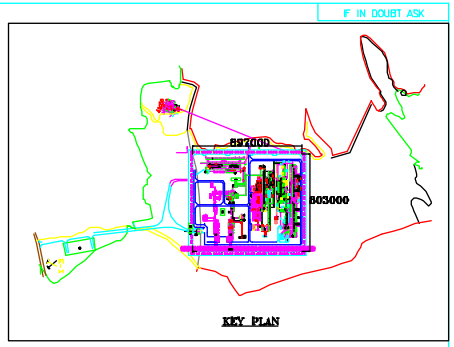
Water pollution control

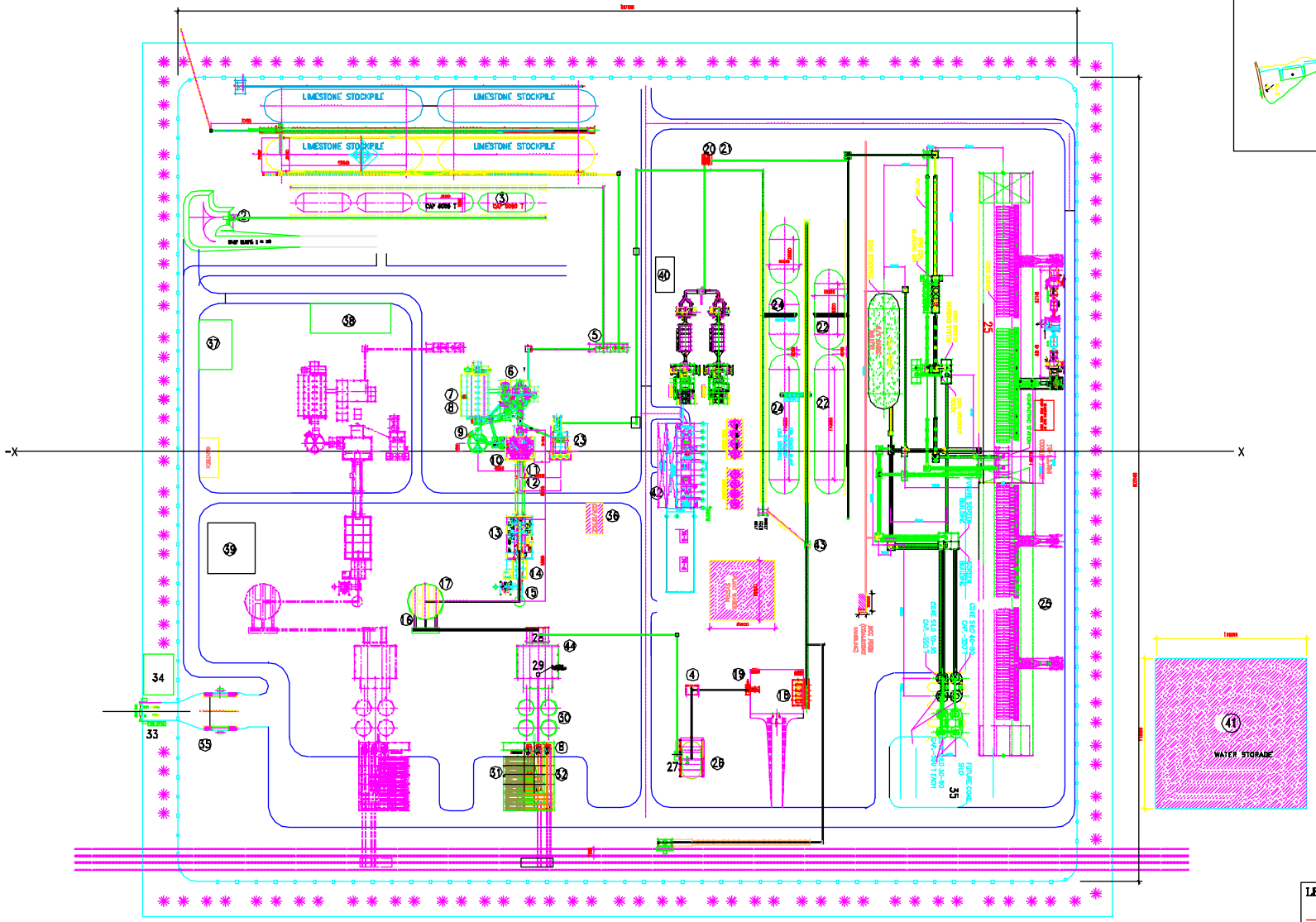
There is no generation of waste water from the operations in the cement plant. The once through return cooling seawater will be discharge in Gulf of Khambhat as per recommendation of NIO. In case of Narmada water, the cooling water will be recycled. Though no/ less liquid effluent will be generated from the Cement/CPP/Coke oven plants.There is only domestic effluent from the sanitation facilities in the plant as well as from the worker colony.

The domestic waste water will be treated in the sewage treatment plant. The treated waste water will be utilized for green belt and plantation in the plant as well as in the colony. As the locality is dry proper effort will be made for development of green area. If necessary, modern drip irrigation system will be employed for maximum utilisation of the treated waste water.

DRG. NO. 04153-00-02-01

IF IN DOUBT ASK





LEGEND	
S NO.	DESCRIPTION
1.	LIMESTONE PREBLENDING STOCKPILE
2.	CORRECTIVE DUMP HOPPER
3.	CORRECTIVE STOCKPILE
4.	GYPSUM CRUSHER
5.	RAW MAT'L HOPPERS
6.	RAW MILL HOUSE
7.	BAG HOUSE/MCC & I/O ROOM (UNDER BAG HOUSE)
8.	COMPRESSOR HOUSE
9.	CF SILO
10.	PREHEATER TOWER
11.	KILN
12.	TA DUCT
13.	COOLER HOUSE
14.	COOLER ESP
15.	CLINKER TRANSFER TOWER & UNBURNT CLINKER HOPPER
16.	CLINKER LOADING
17.	CLINKER SILO
18.	DUMP HOPPER WITH TIPPLER FOR COAL/LIGNITE
19.	DUMP HOPPER FOR GYPSUM
20.	COAL CRUSHER & SCREEN FOR POWER PLANT
21.	INTERMEDIATE BUNKER STATION
22.	COAL/LIGNITE/PETCOKE STOCKPILE
23.	COAL MILL HOUSE
24.	COAL STOCKPILE (FOR POWER PLANT)
25.	COKE OVEN PLANT
26.	GYPSUM STOCKPILE
27.	GYPSUM DUMP HOPPER / CRUSHER
28.	CEMENT MILL HOPPERS
29.	CEMENT GRINDING
30.	CEMENT SILOS
31.	PACKING PLANT
32.	TRUCK LOADING PLATFORM
33.	SECURITY
34.	CEMENT DESPATCH OFFICE
35.	WEIGH BRIDGE
36.	CCR/ LAB./ TECH. OFFICE
37.	ELECT./MECH. WORKSHOP
38.	GENERAL STORE
39.	ADMINISTRATIVE BUILDING
40.	SWITCH YARD & SUB STATION
41.	WATER STORAGE
42.	UTILITY BUILDING
43.	COAL CRUSHER
44.	FLY ASH SILO

LEGEND

NEW

FUTURE

FIG. NO. 4.1

REV	DATE	BY	CHKD	APPD	DETAILS
4A	14.05.08	KSI	AA	SDH	PYRO PROCESSING LOCATION FROZEN
4	15.03.06	BK	AA	SDH	LOCATION OF POWER PLANT FROZEN
3	22.12.04	SNR	IB	RAK	DRAWING REVISED ACCORDING TO FFE COKEOVEN PLANT LAYOUT.
2	25.11.04	SNR	IB	RAK	DRAWING GENERALLY REVISED
1	18.10.04	SNR	IB	RAK	DRAWING GENERALLY REVISED

REVISIONS

HOLTEC CONSULTING PRIVATE LIMITED

CLIENT : M/s NIRMA LIMITED

PROJECT : 04153, NIRMA

PLANT LAYOUT

4500 TPD

AT PACHARKA

DRG.NO. 04153-02-01

REV. 4A

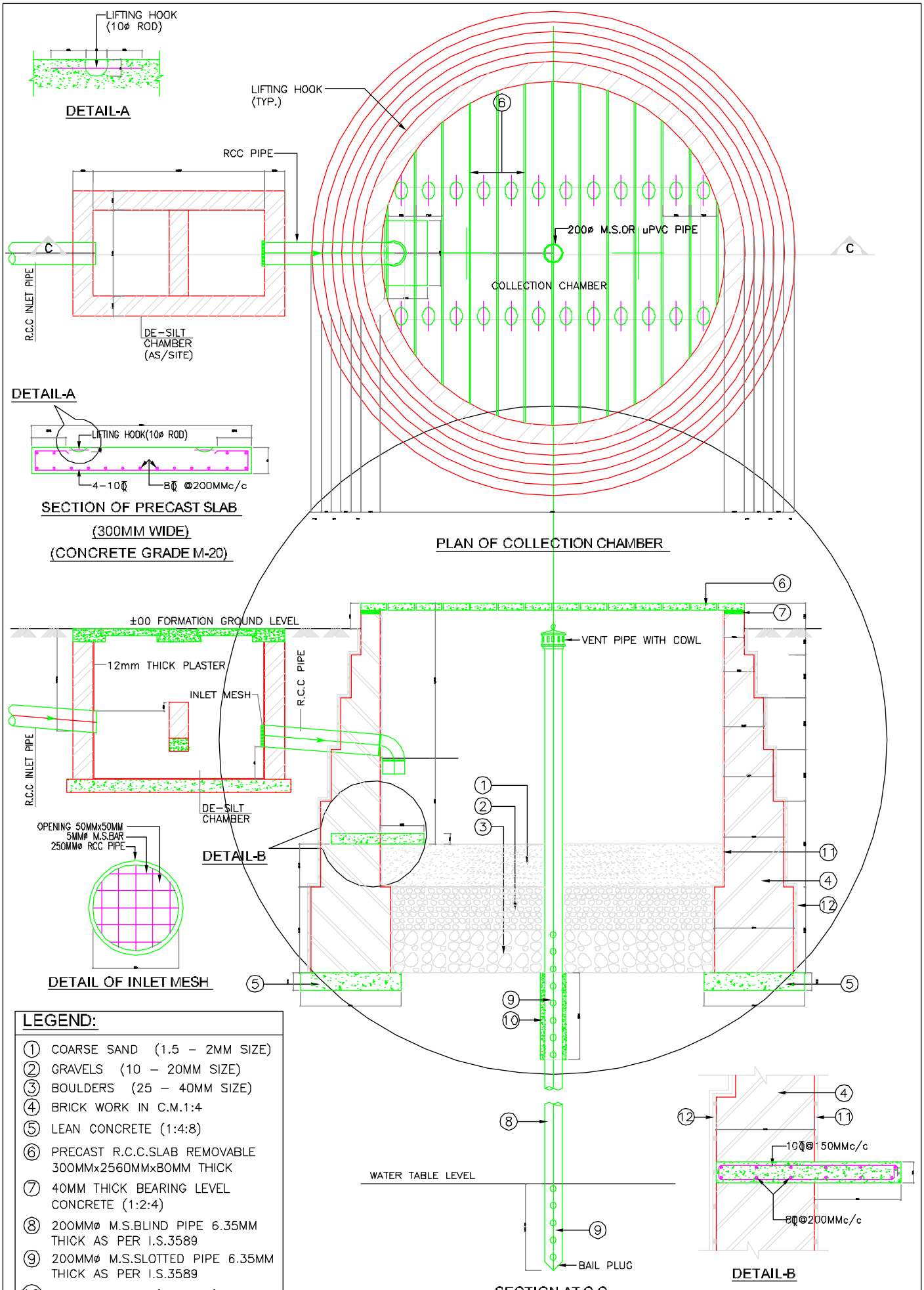
SCALE : 1:2000

REFERENCES

NOTES

NOTES

REVISIONS



LEGEND:

1. COARSE SAND (1.5 – 2MM SIZE)
2. GRAVELS (10 – 20MM SIZE)
3. BOULDERS (25 – 40MM SIZE)
4. BRICK WORK IN C.M.1:4
5. LEAN CONCRETE (1:4:8)
6. PRECAST R.C.C.SLAB REMOVABLE 300MMx2560MMx80MM THICK
7. 40MM THICK BEARING LEVEL CONCRETE (1:2:4)
8. 200MMø M.S.BLIND PIPE 6.35MM THICK AS PER I.S.3589
9. 200MMø M.S.SLOTTED PIPE 6.35MM THICK AS PER I.S.3589
10. GRAVEL PACKING(5–10MM) AROUND SLOTTED PIPE
11. 20MM THICK WATER PROOFING PLASTER IN C.M.1:4
12. BITUMEN PAINTING @1.7KG/SQ.CM OVER 20MM THICK WATER PROOFING PLASTER IN C.M.1:4

RAIN WATER HARVESTING SCHEME

FIG. NO. 4.2

IMPORTANT NOTE:

COARSE SAND, GRAVEL AND BOULDER FILLING INSIDE AND EARTH FILLING OUTSIDE THE CHAMBER SHALL BE FILLED UP SIMULTANEOUSLY ON BOTH SIDE. DIFFERENCE IN LEVELS OF FILLING, BOTH INSIDE AND OUTSIDE SHOULD NOT EXCEED 250MM IN ANY CASE

4.6 NOISE ENVIRONMENT

4.6.1 Impact on noise level

During the construction phase, some of the activities would temporarily enhance the ambient noise levels. The noise levels near the sources such as raw material mill, cement mill etc will be higher during the operational phase. In order to mitigate the noise levels during the operational phase, a green belt will be developed around the periphery of the plant to provide for a barrier against the colony.

In the power plant there is noise pollution from turbine, fans, centrifugal pumps, electric motors, safety valves, start up vents, steam jet ejectors of condenser etc. In the coke oven plant there is noise generation from turbine, generator, valves, steam pipe and boiler.

The noise levels at sources like the coal mill, cement mill are anticipated to go as high as 90 dB(A) based on the existing levels. The general noise levels within core zone are expected to remain below 75 dB(A). However, the noise levels will attenuate to the background values beyond the core zone and the levels are not expected to rise beyond 65 dB(A) in the study area.

The damage risk criteria as enforced by OSHA and CPCB to reduce hearing loss, stipulates the noise levels up to 90 dB(A) as acceptable limits for 8 hour working shift per day. Noise levels may, however, exceed the prescribed limits in certain work places. At these work places, workers will be posted for shorter durations only. Operations and maintenance personnel will not be exposed to the high levels for reasons of the control operations conducted from sealed cabins. During visits to the areas of high noise levels, the personnel will be provided with ear muffs/plugs to prevent adverse impact on the hearing.

The OSHA damage risk criteria are reproduced in **Annexure XVIII** and the Ambient Air Quality Standard in respect of noise is given in **Annexure X**.

4.6.2 Mitigation measures

The noise generation will be reduced at source by erecting noise dampening enclosures, by maintaining the machines and greasing them regularly. The vehicles will be equipped with silencers. The equipments shall be provided with acoustic shields or enclosures to limit the sound level inside the plant. Secondly protective measures will be adopted at receptor points to reduce negative impact due to high noise levels. All the workers engaged at and around high noise generating sources shall be provided with ear protection devices like ear mufflers/plugs. Their place of attending the work will be changed regularly so as to reduce their exposure duration to high levels. They will be regularly subjected to medical check-up for detecting any adverse impact on the ears.

The proposed green belt will also help to prevent noise generated within the plant from spreading beyond the plant boundary. All workers working in noise borne area will be regularly subjected to medical check-up for detecting any adverse impact on their TLV of hearing. As indicated earlier workplace ambient level is not expected to be beyond 60 dB(A) Leq which is much below the limit specified for 8 hours of exposure

4.7 IMPACT DUE TO TRAFFIC

The proposed cement plant will cause notable increase in the traffic density on the road connecting NH-8E (Coastal highway) Mahuva to Una. All the raw material required for the cement plant, power plant and coke oven plant will be transported by road/rail and sea linkage. The lignite will be brought from Kutchch lignite mine about 450 kms from the proposed plant.

The limestone and silica sand will be procured from the captive mines near Padhiarka and will be mainly transported by conveyors. Also the finished product will be mostly transported by sea route/or through rail route. Some cement produced will be transported by road for the local markets. Thus, this will also add to the traffic increase on the road. The proposed increase in traffic density will not cause significant impact on the traffic since the road is capable of handling this increase in traffic density.

However the increase in traffic for lignite transportation may cause serious impact on the air quality on the road stretch if proper mitigation measures are not adopted in advance. The spillage of material on road and the emissions from the vehicles will cause adverse impact on the ambient air quality. Also the noise produced from the vehicles will cause nuisance in the area. Proper control and mitigation measures as suggested below are to be adopted to avoid any impact due to traffic.

The anticipated increase in traffic shall be as follows:

Raw Material	Quantity (TPD)	Source	Method of transport	No. of trucks	Traffic contribution
Limestone	6935	Padhiarka (captive mines)	Mainly Conveyor as well as Trucks	100	200
Clay	110	Ghoghna, Gujarat	Trucks (10 T) from source	11	22
Sand	71	Bhavnagar, Gujarat	Trucks (10 T) from source	8	16
Gypsum	390	Barmer, Rajasthan/ Kalatalav, Bhavnagar	Trucks (10 T) from source	39	78
Coal	300	Imported	Seaport from source and then	30	60

Raw Material	Quantity (TPD)	Source	Method of transport	No. of trucks	Traffic contribution
			after in trucks (10 T)		
Lignite	500	Kutchch/ Bhavnagar	Trucks (20 T)	25	50
Fly ash	1370	CPP & Gandhi Nagar, Gujarat	Trucks (20 T)	69	138
Lignite (CPP)	1560	Kutchch/ Bhavnagar	Trucks (20 T)	78	156
TOTAL				**360**	**720**

The impact of traffic movement can be seen in **Annexure XIX**.

4.7.1 Management of traffic

Most of transporatation of raw materials and finished product transported by the road/rail and sea linkage. This way the impact due to increase in traffic density will be limited upto to sea port and source of raw material only. The increase in traffic density will not cause any serious impact as the road infrastructure is capable of handling this increase. The trucks will be properly covered with tarpaulin and overloading will not be allowed to avoid spillage of loose material on roads.

Regular maintenance and washing of vehicles will be done and the emissions from the vehicles will be kept as per norms by conducting regular PUC checks.

4.8 LAND ENVIRONMENT

4.8.1 Impact on land use

During construction, soil (which is generally absent) at the project site will be removed. The area is low lying and will require filling upto a general level of 1.5 m. The land chosen for the proposed plant is 280 ha. The existing land is barren land and only shurbs/bushes present on the land. This will have a 33% greenbelt/canal area.

4.8.2 Land degradation control measures

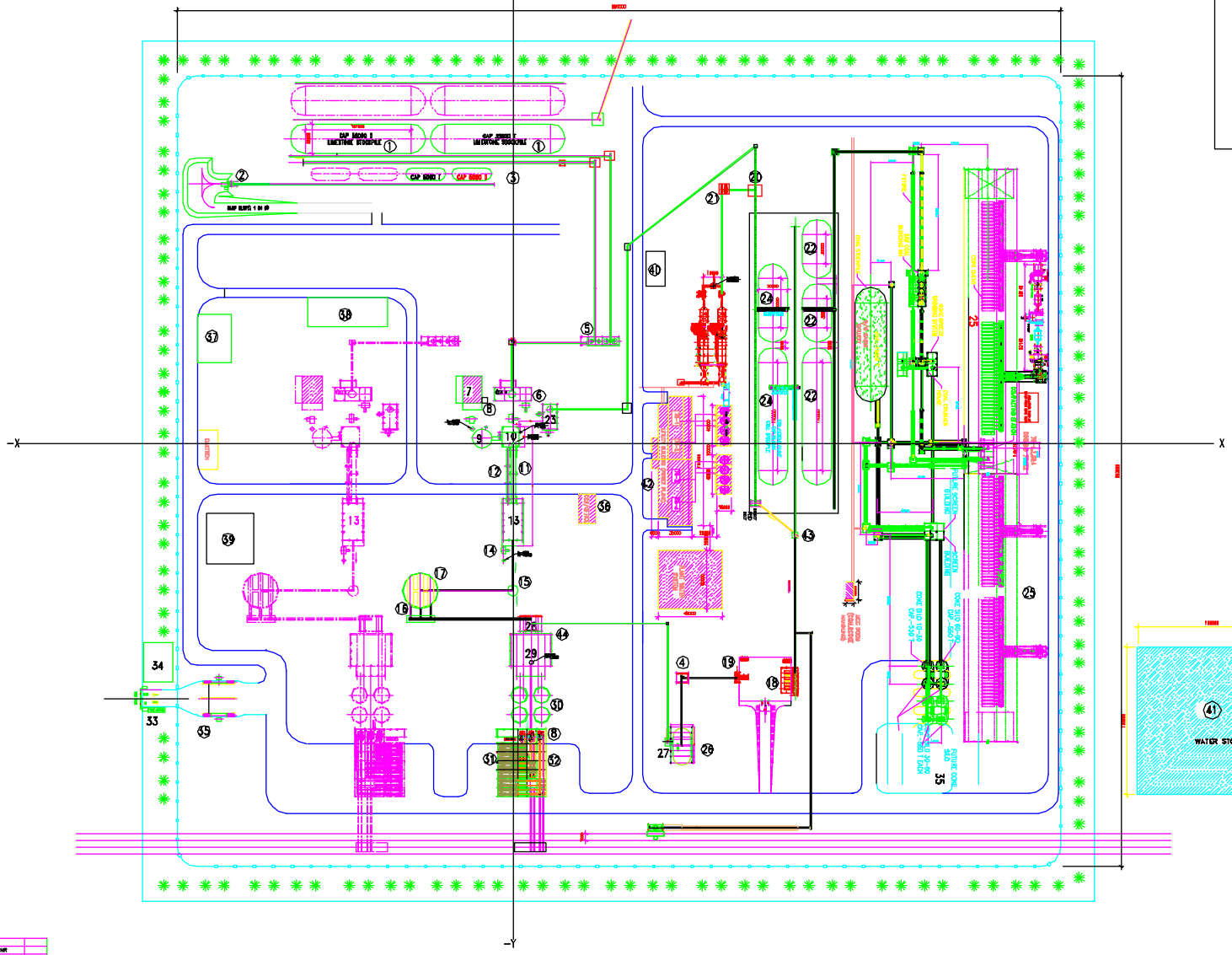
Land use

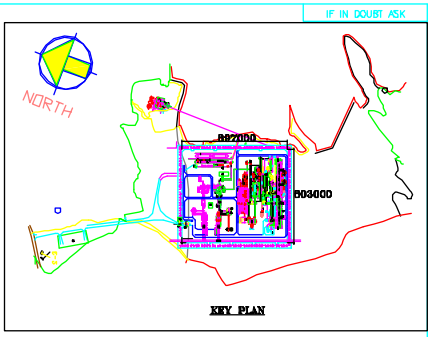
About 33% of the area has been envisaged to be covered with green belt including canal area. Since the plant species will be capable of checking soil erosion, the soil will be fully stabilised without any adverse change in erosion potential of the area. The total area under the project will be around 280 ha. out of which 92.68 ha. (33 %) will be utilised for the green belt/canal development. The green belt development is shown in Fig 4.3.

DRG. NO. 04153-00-02-01

IF IN DOUBT ASK

PROPOSED PLANTATION PROGRAME





KEY PLAN

LEGEND	
S. NO.	DESCRIPTION
1.	LIMESTONE PREBLENDING STOCKPILE
2.	CORRECTIVE DUMP HOPPER
3.	CORRECTIVE STOCKPILE
4.	GYPSUM CRUSHER
5.	RAW MAT'L HOPPERS
6.	RAW MILL HOUSE
7.	BAG HOUSE/MCC & I/O ROOM (UNDER BAG HOUSE)
8.	COMPRESSOR HOUSE
9.	CF SILO
10.	PREHEATER TOWER
11.	KILN
12.	TA DUCT
13.	COOLER HOUSE
14.	COOLER ESP
15.	CLINKER TRANSFER TOWER & UNBURNT CLINKER HOPPER
16.	CLINKER LOADING
17.	CLINKER SILO
18.	DUMP HOPPER WITH TIPPLER FOR COAL/LIGNITE
19.	DUMP HOPPER FOR GYPSUM
20.	COAL CRUSHER & SCREEN FOR POWER PLANT
21.	INTERMEDIATE BUNKER STATION
22.	COAL/LIGNITE/PETCOKE STOCKPILE
23.	COAL MILL HOUSE
24.	COAL STOCKPILE (FOR POWER PLANT)
25.	COKE OVEN PLANT
26.	GYPSUM STOCKPILE
27.	GYPSUM DUMP HOPPER / CRUSHER
28.	CEMENT MILL HOPPERS
29.	CEMENT GRINDING
30.	CEMENT SILOS
31.	PACKING PLANT
32.	TRUCK LOADING PLATFORM
33.	SECURITY
34.	CEMENT DESPATCH OFFICE
35.	WEIGH BRIDGE
36.	CCR/ LAB./ TECH. OFFICE
37.	ELECT./MECH. WORKSHOP
38.	GENERAL STORE
39.	ADMINISTRATIVE BUILDING
40.	SWITCH YARD & SUB STATION
41.	WATER STORAGE
42.	UTILITY BUILDING
43.	COAL CRUSHER
44.	FLY ASH SILO

LEGEND

NEW

FUTURE

FIG.NO. 4.3

REV	DATE	BY	CHKD	APPD	DETAILS
4	15.03.05	BK	AA	SDH	LOCATION OF POWER PLANT FROZEN
3	22.12.04	SKR	IB	RAK	DRAWING REVISED ACCORDING TO FFE COKEOVEN PLANT LAYOUT.
2	25.11.04	SKR	IB	RAK	DRAWING GENERALLY REVISED
1	19.10.04	SKR	IB	RAK	DRAWING GENERALLY REVISED

REVISIONS

REV	DATE	BY	CHKD	APPD
4	15.03.05	NIRMA		RDB
3	22.12.04	NIRMA		RAK
2	25.11.04	NIRMA		RAK
1	19.10.04	NIRMA		RAK
0	30.09.04	NIRMA		PAK

REVT. DATE | ISSUED FOR | BY

REFERENCES

REFERENCE NO.	DETAILS

NOTES

1. DO NOT SCALE, WORK TO DIMENSIONS ONLY.
2. FOR TOLERANCES REF. HOLTEC STD. DRG. NO. M-HDL-STR-1-150

NOTES

THIS DRG. IS TO BE READ IN CONJUNCTION WITH OUR FOLLOWING STD. DRG's.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED

HOLTEC CONSULTING PRIVATE LIMITED

DESIGNER : M/s NIRMA LIMITED

DES.	SDS	12.05.04
DRN.	SDS	05.09.04
CHKD.	IB NKS	05.09.04
APPD.	RAK	05.09.04

PROJECT : DA156, NIRMA | DM FILE : DA156D02R04

PLANT LAYOUT

4500 TPD.

AT PADHARRA

SCALE : 1:2000

DRG.NO. 04153-02-01 | REV. 4

4-16

4.9 SOLID WASTE

4.9.1 Impact due to solid waste

Since a large work force deployed at site and development of a shanty town with temporary establishment of commercial activities, there will be generation of sizeable amount of garbage. The organic component will be biodegradable and hence, composted. The inorganic portion will be segregated into recyclable and non recyclable. The recyclable material will be sold to recycling vendors while the non recyclable material will be disposed in solid waste disposal site earmarked for the purpose in the mine after the area devoid of mineral.

During operation phase land environment is affected by solid and liquid waste and also through change in land use pattern. Depending on the type of the industry, the problem of handling waste varies accordingly. However, the solid waste treatment and disposal are not applicable to the plant as all solid wastes generated will be recycled in the process. No net-solid wastes generated will be available for disposal. About 125 TPD ash will be generated from the captive power plant. Also there will be some solid waste (spent oil/grease etc) generation from the workshop.

Some scrap material (waste) will also be generated in the workshop. Proper solid waste management plan has to be devised for the management of all these solid wastes to prevent any impact on the environment.Some amount of solid waste contaminated with ground dust will be collected during floor sweeping.This will be disposed off as landfill. There is no use of any hazardous chemicals. Therefore there is no separate storage required for these. The anticipated amount of waste generation is given in Table 4.4.

TABLE 4.4
ANTICIPATED SOURCE AND QUANTITY OF WASTE

Sl. No.	Description of waste	Quantity	
1.	Refractory Bricks	400 TPA	
2.	Solid Waste generated from- - Regular Road Sweeping collection comprises of a mixture of limestone dust, clay and soil. - Civil and construction debris / rubbish (Occasionally)	1 TPD	
3.	Solid Waste from Colony	0.56 TPD	
4.	ETP Sludge	5 TPD	
5.	STP Sludge	10 TPD	
6.	CPP Ash	For 2% S	For 6 % S
	- Bed Ash - Fly Ash (Considering Max. Ash content for E-Grade coal as 28 %)	150 TPD 25 TPD 125 TPD	196.8 TPD 38.4 TPD 158.4 TPD

All the cement dust and clinker dust will be 100 % recycled.

Solid waste

From a canteen, about 0.56 T/ day form municipal waste, about 5 T/day of sludge from ETP and 10 T/day of sludge from STP will be generated. All theses wastes will need to be properly dealt with to avoid any environmental impact.

Horticulture waste

From lawns/ gardens, horticultural waste at the rate of 0.5 T/day (wet waste) from agricultural waste will be generated.

4.9.2 Solid waste management

The various types of wastes generated from the proposed plant and proposed management techniques are as follows:

The kiln will be designed to function as an incinerator so that high calorific hazardous waste can be utilised in the kiln as fuel. This will minimise the expenditure on fuel and also on incineration of municipal and hazardous waste. All the fly ash generated from the captive power plant will be consumed in the cement manufacturing process.

Bottom ash will be utilised by local brick manufacturing units. Solid wastes from the workshop will be used with fuel (Lignite) in the kiln as fuel. The scrap material generated in the workshop will be sold to the authorised vendors after proper classification. Solid wastes collected in different dust collection systems will be recycled in respective sections of the plant.

Process solid waste

- Cement dust collected in various air pollution control equipments will recycled back to the process

- The refractory bricks shall be replaced once in a year. It has high recycling value, hence will be sold to authorised recycling agency.

Municipal solid waste

- The municipal solid waste generated from the plant will be transported through tractor/lorry. It will be landfilled in the low lying areas, which are devoid of mineable reserves after due lining of the bottom. The area thus filled up/ reclaimed shall be used for tree plantation.

- Daily house to house collection system will be employed, collected waste will be segregated into biodegradable and non biodegradable waste. Biodegradable waste will be composted and used as manure and non biodegradable waste will be land filled at identified areas.

ETP sludge and STP sludge

- Since ETP sludge is mostly inorganic in nature, it will be, dried and landfilled at identified site.

- STP sludge will be used as manure for green belt development.

CPP Fly ash

- Fly ash shall be transported pneumatically to the cement plant fly ash silo and shall be used in manufacturing of PPC. Bed ash shall be collected from overflow spouts into ash cooler hoppers. Ash from hoppers, after sufficient cooling will be conveyed pneumatically to a bed ash storage silo for furtheruse as boiler bed material.

Liquid Effluents

- Liquid effluents will be treated in ETP and reused in dust suppression, plantation and green belt.

- Sewage will be treated in STP.

4.9.3 High calorific hazardous waste utilisation in Kiln

M/s Nirma Limited proposes to set up Cement plant. Since the Cement kilns are operated at a temperature of approximately 1450°C. There are many industries in the globe are utilizing Hazardous Waste having high Calorific value in the Cement kilns as it has the benefit of having residence time of 4-5 seconds in an oxygen rich atmosphere ensure the destruction of organic compounds found in any waste.

For making use of the above facts, M/s Nirma Limited proposes to use hazardous waste glycerin foots and waste oil if available, having High Calorific Value in Cement Kiln and ensure that the flue emission maintained below as per the SPCB guidelines.

4.10 ECOLOGY ENVIRONMENT

4.10.1 Impact on ecology

During construction phase, there will hardly be any negative impacts on terrestrial eco-system comprising birds and animals. On the contrary, with progressive growth of greenery, terrestrial eco-system will improve in course of time. Due to absence of flora around, animal life is very less, hence adverse impact on biological environment will be negligible. Presence of water and food wastes during day time will attract some birds and animals towards the site.The air pollutants will be the dust generated during earth moving activities and emissions from vehicles, portable diesel generators, etc.

Though the site is located within barren land, the impact zone is part of landscape involving rural areas. There is scarce growth of vegetation and meagre presence of fauna. Impacts on biological environment will be negligible during the operational phase. The dust emission will affect the effective photosynthesis and biological processes by covering the plant/tree leaves by thin dust layer during dry months which however will be washed away in rainy months.

4.10.2 Ecological management measure

Special care has to be taken while planting trees, as regards the type and the number, within the plant premises in order to confine the pollutants to the area and prevent their dispersal.

The number of trees to be planted as a part of the plantation programme is taken as 1000 trees per hectare for green belt as well as along roads/ canals.

The selection of trees to be planted has to be done judiciously keeping in mind the adaptability of trees to the climate of the region. As mentioned in Chapter 3, the trees which are found in relative abundance as compared to the other species as well as species with proven survival rate will be preferred. Consultation with the forest officers and experts in the field will further help to identify the exact species to be planted, and these can be obtained from the nurseries in the nearby areas. The social aspects of requirements of fodder and fuel needs of the community will require to be appropriately addressed. There are a number of flora species which can be planted successfully and a comprehensive list is given below.

The trees like Casuarina, Zizyphus mauritiana (Bordi), Acacia nilotica (desi baval), Azadirachta indica (Limdo), Butea monosperma (Kharkhro) Cassia fistula (Garmalo), Mangifera indica (Ambo), Melia azedarach (Bakain), Pongamia pinnata (karanj), Syzygium cumini (Jumbudo), Tamarindus indica (Ambli) and fruit trees like Pomegranate (Anar), Citrus lemon (Limbus), Papaya etc. are also recommended.

4.11 WILDLIFE CONSERVATION PROGRAMME

Peacock is the only schedule-I animal found in the study area. The Peacock has gorgeous plumage, piercing cries and nuptial display. It is one of the India's most beautiful bird and pride of the country being the National Bird. The company suggests adopting conservation measure for the protection of Peacock given in **Annexure XX.**

4.12 SOCIO-ECONOMIC ENVIRONMENT

During construction phase, there will be an influx of about 418 workers to the locality with ready income in cash. Some of this work force will come

from the surrounding areas. With the increased population and money supply, there will be need for daily consumption items as well as services, which have to be provided by suppliers from nearby locality. There will be growth of a temporary town with business establishments providing various items of daily necessities for sale as well as various services. These developments will have both positive and negative impacts on the local socio-economic environment.

Depending on the ability of the management of the project and local civic bodies, there could be bon-homie or acrimony between local populace and outside workers. There could be better facilities for environment and social functions, for all round improvement of social benefits. However, construction phase will be over after a short time, and having some economic inputs there would be positive impacts on socio-economic environment due to activity of the phase.

The company will also provide the helping hand in the development of the nearby villages. Socio economic facilities are described in chapter 8.

4.13 SEISMICITY

Presently, there is no scientific technique available anywhere in the world to predict occurrence of earthquakes with reasonable degree of accuracy with regard to space, time and magnitude. Hence, a major negative impact is possible if the appropriate control measures are not adopted.

The plant will be designed and constructed keeping in view the seismological conditions of the area.

4.14 OCCUPATIONAL HEALTH AND SAFETY

Workers in an cement plant, captive power plant and coke oven plant can be exposed to many health hazards. The common health hazards are mainly exposure to dust and, noise and accidental exposure to any chemicals.

All these can cause negative impact of appropriate control measures are not adopted.

The occupational safety and health are very closely related to productivity and healthy relation between employer and employee. The main factors of occupational health are dust, gases and noise. The safety of employees need to be taken care during operation as permissible under rule. Following measures are suggested:

1. Maintenance of pollution control system such as dust suppression system, safety appliances.
2. Regular maintenance of equipment.
3. Regular checking and up keeping of break down or leakage.

4. Provision of ear plugs or muffs to workers exposed to high noise levels.
5. Rotation of duties of workers.
6. Creating awareness amongst workers concerning health, pollution and safety through posters, discussion, slogan etc.
7. Periodical medical examination of workers.
8. Provision of suitable civil amenities such as plain drinking water, good service in canteen, etc.
9. Assessment of risk from health hazards at work place.
10. Monitoring of different factors leading to occupational health hazards and taking timely action to mitigate the impact.

4.15 CREP GUIDELINES

The CREP guidelines for a new cement industry as specified by CPCB give the following :

"For new cement kilns including grinding units the particulate matter emission standard is 50 mg /Nm^3"

The plant shall also follow the environmental prevention and control of fugitive emission. Compliance to the recommendations mentioned in the guidelines shall be done. Guidelines are given in **Annexure XXI**.

CHAPTER 5

ANALYSIS OF ALTERNATIVES

CHAPTER 5

ANALYSIS OF ALTERNATIVES

M/s Nirma Limited has proposed for setting up a cement plant (capacity 1.5 MTPA clinker, 1.91 MTPA Cement), captive power plant (capacity 50 MW) and a Coke Oven plant (1.5 LTPA) based on limestone deposits in the area with required infrastructure facilities. Analysis of alternatives based on site and technology are given below:

5.1 SITE ALTERNATIVES

Cement project is site-specific project and it is not possible to choose alternative sites due to restriction in mineral availability. The limestone mines are situated in nearby villages like Padhiarka, Doliya Madhiya, Gujarda, Dudheri, Dudhala, and Vangar, hence, it is natural to establish a pit-head cement plant to which mines shall be captive. These will give assured availability of limestone throughout the plant life. The other advantages are:

- Availability of adequate land for captive power plant in same premises of cement plant.
- Proximity to National highway no. NH-8 E.
- Absence of any irrigation canal or drainage channel within the selected area.
- The area chosen is not having habitation of any kind.
- No ecologically sensitive places within 10 km radius.
- Availability of sea port located at a distance of 25 km SW of the site for finished product transportation and receipt of raw material.
- Availability of workers in nearby villages.

The land required for the plant is 280 Hectares, which is a barren and low lying land not suitable for agriculture. Lignite will be procured locally from Kutchch/Bhavnagar. Limestone from the captive quarry will be utilized as raw material for clinker manufacture. Main water source for the complex would be the desalination plant/or Narmada water pipeline.

5.2 TECHNOLOGY ALTERNATIVES

Technical concepts and equipment sizing has been finalised based on determinants and industry norms for 1.5 MTPA clinker (1.91 MTPA Cement) capacity plant. Emphasis has been given on optimum layout, energy efficient, and environment friendly modern plant considering all project aspects. Space for future capacity expansion has been kept in the layout.

Major production from the plant will be handled through the proposed jetty/road/or rail linkages of the company.

It is proposed to install compressors/ root blowers, for compressed air requirements, at centralised location in the plant, near the raw mill/ kiln bag house for the sake of overall/effectiveness and ease of operation and maintenance. Auxiliary infrastructure facilities have been adequately considered to meet the plant requirements.

The laboratory shall be equipped for testing of raw materials, fuel and clinker for sample preparation as well as chemical and physical testing. Power requirement of the cement plant and coke oven plant will be met from a captive power plant (50 MW) proposed to establish along with the cement plant. The power plant will be based on CFBC boilers and the fuel used will be lignite/coal.

Desalination Plant

The water requirement of the cement plant, power plant and the coke oven plant along with the colony and limestone mine will be provided from the desalination plant to be established in the cement plant area. This will avoid the impact on the ground water. Alternatively if govt. of Gujarat approves to provide Narmada water from main pipeline line, it can be considered.

Use of non recovery coke oven plant

- Non recovery coke ovens have staged a come back with the intrinsic capacity to meet emission control norms and recover waste heat energy to generate power.
- Successful energy recovery provides valuable gains where power cost is relatively high.
- Non recovery oven cost is low compared to recovery oven plant.
- For the Coke Oven plant by adopting non-recovery type technology, no liquid effluents will be generated.

CHAPTER 6

ENVIRONMENTAL MONITORING AND BUDGETARY PROVISIONS

CHAPTER 6

ENVIRONMENTAL MONITORING AND BUDGETARY PROVISIONS

6.1 INTRODUCTION

Success of any environmental management programme depends upon the efficiency of the organisational setup responsible for the implementation of the programme. Regular monitoring of the various environmental parameters is also necessary to evaluate the effectiveness of the management programme so that necessary corrective measures could be taken in case there are some drawbacks in the proposed programme.

6.2 PROPOSED SET-UP

A full-fledged Environment Management Department (EMD) is proposed with multidisciplinary team of professionals, technical staffs and all necessary infrastructures, headed by Senior Manager. This team will be also be responsible for all environment management activities including environmental monitoring, greenbelt development, ensuring good housekeeping, ensuring statutory compliance as well as creating environmentally aware work forces for proposed cement plant, captive power plant and the coke oven plant. The organizational chart of Environment Management Department is shown in Fig 6.1.

The said team will be responsible for:

i. Monitoring of the water/ waste water quality, air quality and solid waste generated.

ii. Analysis or getting analysed the water and air samples collected.

iii. Implementation and monitoring of the pollution control and protective measures/ devices which shall include financial estimation, organize ordering through procurement department, installation of air pollution control equipment, waste water treatment plant, etc.

iv. Co-ordination of the environment related activities within the project as well as with outside agencies.

v. Collection of health statistics of the workers and population of the surrounding villages.

vi. Green belt development.

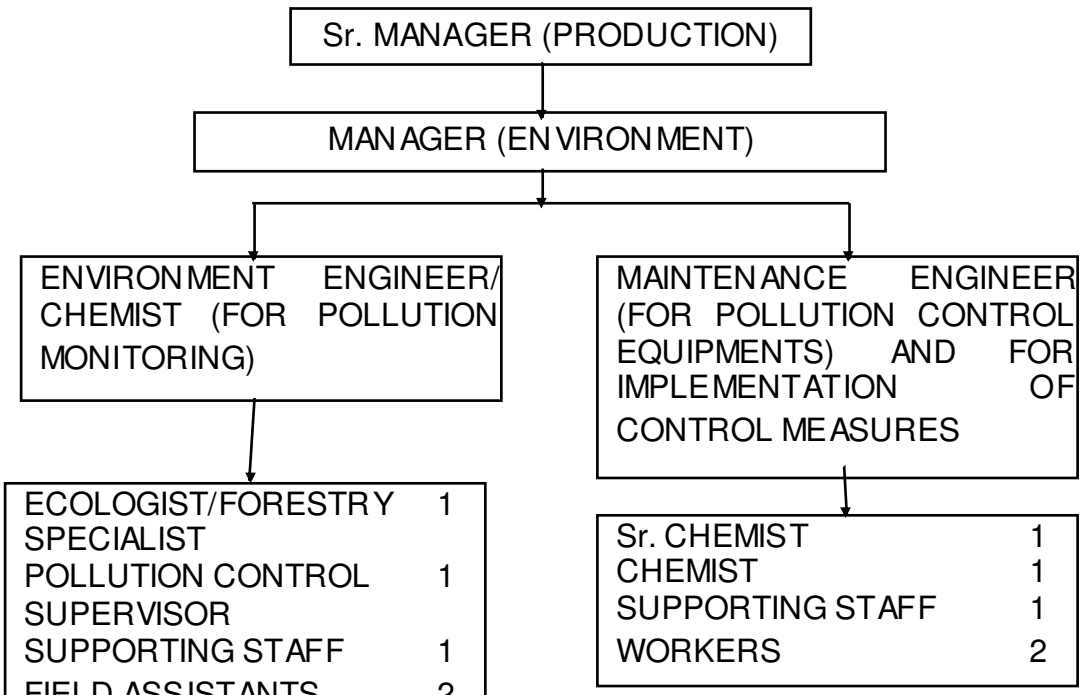
vii. Monitoring the progress of implementation of the environmental management programme.

viii. Identifying measures to prevent or reduce the wastes itself in the factory.

ix. Compliance to statutory provisions, norms of State Pollution Control Board, Ministry of Environment and Forests and the conditions of the environmental clearance as well as the consents to establish and consents to operate.

x. Execution of the environmental management systems such as ISO 14001, if opted by the company management.

FIG 6.1 : POLLUTION CONTROL MANAGEMENT



A laboratory will be established and will be suitably equipped for sampling/testing of various environmental parameters for air, water, soil. Samples requiring any special analysis may be sent to any of the recognised laboratories.

6.3 MONITORING SCHEDULE AND PARAMETERS

To evaluate the effectiveness of environmental management programme, regular monitoring of the important environmental parameters will be done. Monitoring of various environmental parameters will be carried out on a regular basis to ascertain the following;

1. Pollution status within the plant and in its vicinity
2. Generate data for predictive or corrective purpose in respect of pollution
3. Effectiveness of pollution control measures and control facilities
4. To assess environmental impacts
5. To follow the trend of parameters which have been identified as critical.

Monitoring is as important as pollution control since the efficiency of the control measures can only be determined by monitoring. The schedule, duration and parameters to be monitored are shown in Table 6.1.

TABLE 6.1
MONITORING SCHEDULE AND PARAMETERS

Sl. No.	Description of parameters	Location	Schedule and duration of monitoring
1	Air Quality		
	Parameters: SPM, RPM, SO_2, NO_x,CO, HC	One sample within plant boundary and three in the vicinity of the project with atleast two in the predominant wind direction i.e.. at 500 m and 100 m from plant.	One 24 hourly sample per day, two days per week and 4 week per season or as per the MoEF/ CPCB/ SPCB guidelines, whichever are most stringent.
	Flue gas from stacks for flow rate, SPM, SO_2 and NOx, VOC	Sampling port of stack	
2	Micro-meteorology		
	Wind velocity and direction	At site	At the time of air quality monitoring
	Temperature, humidity and rainfall	At site	Daily
3	Water Quality/effluents		
	Water quality of surface and ground as per IS: 10500, 1991 except radioactivity	One within plant, one on down gradient and up gradient of plant and three within 10 km radius	Once in a season/Quarterly
4	Ambient noise level near power house, main plant building, near main gate and at four locations around the plant		Monthly
5	Inventory of flora (Tree plantation, survival etc.)		Once in two years within the green belt of the plant
6	Soil quality		Once in two years on all planted areas
7.	Coastal Monitoring as per CRZ Notification for Sediment, water, flora, fauna etc.		Once in a year

The environmental monitoring activities should be recorded, hence, the following documents are suggested for record maintenance:

1. Log sheets for operation and maintenance of pollution control facilities/ equipment
2. Instruction manuals for operation and maintenance of pollution control facilities/ equipment
3. Manuals for monitoring of air, water and soil quality in and around factory
4. Manuals for monitoring of water, solid and gaseous discharges from the factory
5. Statutory records as per the environment related legislations
6. Monthly and annual progress report
7. Bi-annual compliance statement for Regional office, MoEF

Annual Environmental audit statements and compliance to NOC conditions for State Pollution Control Board

6.4 FISCAL ESTIMATES

The details of investment for procuring the equipment for successful monitoring of air, water and other relevant parameters and control measures are given in Table 6.2.

TABLE 6.2
ESTIMATED COST OF POLLUTION CONTROL EQUIPMENT AND ARRANGEMENTS

Sl. No.	Particulars	Qty.	Rs. Lakhs
I.	**Air Pollution control**		
1	E.S.P.	LS	1200.00
2	Bag house	LS	1000.00
3	Pre-calciner	LS	400.00
4	Cooler house	LS	264.00
5	Water sprayer	LS	10.00
6	Coal/Lignite mill& bag house with stack	LS	291.00
7	Cement Mill bag house with stack	LS	290.00
8	Raw mill bag house& stack	LS	339.00
9	Environmental studies of air	LS	10.00
	Sub-total		**3804.00**
II.	**Water Pollution control**		
1	Domestic Effluent Treatment Plant	LS	100.00
2	Environmental studies of water	LS	10.00
3	Geotechnical/hydrology/topographical studies	LS	30.0
4	Surface Drains	LS	80.00
5	Sewage &drainage	LS	80.00
	Sub-total		**300.00**
III.	**Noise pollution control (Acoustics)**	**LS**	**24.00**
IV.	**Environmental monitoring and management**		
1	High volume air sampler	6	4.20
2	Respirable dust sampler	2	1.60

Sl. No.	Particulars	Qty.	Rs. Lakhs
3	Micro-meteorological station (auto)	1	1.50
4	Laboratory for testing	1	10.00
	Sub total		**17.30**
V.	**Occupational health**		
1	Fire fighting equipment (portable)	LS	20.00
2	Fire fighting equipment (fixed)	LS	70.00
3	Personal protective equipment (gogals, gloves, helmets, safety boots etc.)	LS	4.18
	Sub total		**94.18**
VI.	**Green Belt + Garden + Future expansion plantation**		**30.00**
VII.	**Others**		
1	Preparation of EIA/EMP report	LS	10.00
2	Fencing, protection, regeneration & maintenance of safety zone	LS	5.50
	Sub total		**15.50**
	GRAND TOTAL		**4284.98**

Annual cost of monitoring and implementation of control measures is given in Table 6.3.

TABLE 6.3
RECURRING COST FOR ENVIRONMENTAL PROTECTION

Sl. No.	Particulars	Rs. Lakhs per annum
1	Air pollution control	269.35
2	Water pollution control	10.00
3	Noise pollution control	0.80
4	Environmental monitoring and management	9.06
5	Reclamation	0.00
6	Occupational health	3.84
7	Green belt	4.42
8	Others (EIA/EMP, expert advice etc.)	8.02
9	Interest on capital cost	149.97
	Overheads	12.86
	Total	**468.32**

The total investment on environmental improvement works is envisaged to be around Rs. 4284.98 lakhs and recurring expenditure during the operations is around Rs. 468.32 lakhs per annum.

The specific recurring cost therefore comes to Rs. 24.52 per tonne of cement planned to be produced.

CHAPTER 7

RISK ASSESSMENT
AND
DISASTER MANAGEMENT PLAN

CHAPTER 7

RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

All types of industries face certain types of hazards which can disrupt normal activities abruptly and lead to disaster like fires, inundation, failure of machinery, explosion to name a few. Disaster management plan formulated with an aim of taking precautionary step to control the hazard propagation and avert disaster and also to take such action after the disaster, which limits the damage to the minimum amid.

7.1 RISK ASSESSMENT

Assessment of the size and nature of the events foreseen, which may give rise to an emergency situation.

- Fire in coal/ lignite stack yard
- Fire in diesel storage tank

7.1.1 Probability of a disaster and their remediation

Such an event, which would cause probability of disaster at this works, is negligible and remote. Maximum scenario perceives is as follows:

1. Major fire in diesel storage tank : If at all fire breaks in the storage area with subsequent explosion, there is plenty of safe area besides that separate licensed storage shed to evacuate 2-3 persons maximum, they may be stationed in that area. So, they do not perceive any major consequences in terms of risk to people. Environment will not be adversely affected due to these events if risk takes place, as the quantum, handling are well below the threshold quantity set by CIMAH or MSIHC Rules. Table 7.1 indicates the sources of disaster for various substances or chemical stored in the plant.
2. Plant does not perceive any toxic release.
3. Fire and explosion, which can affect the neighbouring industry and thinly populated residential area.

However, an adequate level of resources and arrangements will be exists to handle the most serious foreseeable emergency, a networking of hydrant valves and a sufficient capacity firefighting water tank exclusively for the fighting will be provided. These arrangements are never 100°C and so they always improve and extend the system to other areas. Latest equipment and training will be provided to plant people in the subject are given in Table 7.1.

TABLE 7.1
SOURCES OF DISASTER

Sl.No.	Material	Material	Dimension	Storage capacity
1.	Diesel, Near Boiler House, above ground	Mild steel	3.8 m dia X 4.5 m height	2 nos. X 50 KL
2.	Coal/ Lignite	Nil	30 m X 110 m	2 nos. X 20,000 T
3.	Coke	Nil	30 m X 85 m	12,000 T

7.2 TYPE OF DISASTER AT CEMENT PLANT

Disaster may occur due to following hazards at the cement plants.

- Fire
- Explosion
- Electrocution
- Loose fitting

In any cement plant there are various activities or area which pose substantial threat to the workers and hence hazardous in nature. The potential hazardous areas and the likely accidents with the concerned area have been enlisted below in Table 7.2.

TABLE 7.2
HAZARDOUS AREA WITH CONCERNED ACCIDENTS

Sl. No.	Hazardous Area	Likely Accident
1.	Boiler Area	Explosion
2.	Electrical rooms	Fire and electrocution
3.	Transformer area	Fire and electrocution
4.	Cable tunnel	Fire and electrocution
5.	Storage yard	Sliding
6.	Crushing and grinding unit	Fatal accident
7.	Chimney	Air pollution

7.3 ACCIDENT LEVEL

If there is any disaster in any part of plant/work place due to any reason the classification of areas, which may be affected, and nature of accidents can be made as follows:

1	Level	I	Operator level
2	Level	II	Local community level
3	Level	III	Regional/national level
4	Level	IV	International level

Out of the above, only level-I and level - II class of accidents can be considered applicable for cement plant.

Level I Accidents

Under this level disaster may happen due to electrocution, fire, explosion, and breakage due to loose fitting and spontaneous ignition of combustible material.

This level has probability of occurrence affecting persons inside the plant. Various hazardous areas which have been mentioned above in para 7.1 as potential hazard areas will be affected during this level of accidents.

Level-II Accidents

Disaster of this level can occur in case of sabotage and complete failure of all automatic control/warning systems, and also due to failure of ESP, Bag filter and other pollution control devices. However probability of occurrence of this is very low due to adequate security, training and education of persons of plant responsible for operating such systems.

7.4 DISASTER PREVENTIVE MEASURE

In order to prevent disaster due to fire, explosion, electrocution and other accidents following preventive measures shall be adopted.

i) Design, manufacture and construction of all plant and machineries building will be as per national and international codes as applicable in specific cases and laid down by statutory authorities.
ii) Provision of adequate access way for movement of equipment and personnel shall be kept.
iii) Minimum two gates for escape during disaster shall be provided.
iv) System of fire hydrants comprising electrical motor division and diesel engine drivers fire pumps with electrical motor driver jokey pump for keeping the fire hydrant system properly pressurized for all important suspected places.

7.4.1 Site emergency control room

In order to control the disaster more effectively, a Site Emergency Control Room (SECR) shall be established at the plant site. The facilities proposed to be provided are given in following sections:

- Plant Layout
- Plant Layout with inventories and locations of fuel oil/ furnace oil storage tanks, etc
- Hazard identification chart, maximum number of people working at a time, assembly points etc.
- Population around factory
- Internal telephone connections
- External telephone connections

- Hotline connection to district collector, police control room, fire brigade, hospital etc.
- Public address system
- Torch-lights
- List of dispensaries and registered medical practitioners around factory
- Area map of surrounding villages
- Nominal roll of employees
- Note pads and ball pens to record message received and instructions to be passed through runners.
- The blown up copy of Layout plan showing areas where accident has occurred.

7.4.2 Safety department

Safety department shall be manned by experienced engineers and other supporting staff who shall bring safety consciousness amongst the work force of plant.

The safety department will conduct regular safety awareness courses by organising seminars and training of personnel among the various working levels.

7.5 CONTINGENCY PLAN FOR MANAGEMENT OF EMERGENCY

The emergency organisation shall be headed by emergency leader called Site Main Controller (SMC) who will be plant manager. In his absence senior most person available at plant shall be emergency leader till arrival of plant manager.

Besides the top officials described above, rest of the employees shall be divided into three action teams namely A, B, C, and a Non-action Group D. Action team 'A' will consist of staff of section in which accident has occurred. Action team 'B', will consist of staff of non-affected sections and maintenance department. Action team 'C' will consist of supporting staff i.e. Security supervisor, Ware house Supervisor, Shift Supervisor etc. Group 'D' will consist of people not included in those teams like contractor, labour, security men etc.

Team 'A' comprising staff of affected section will be taking up the action in case of an emergency. Team 'B' will help team 'A' by remaining in their respective sections ready to comply with specific instructions of SMC. Team 'C' consisting of supporting staff will help team 'A' as required and directed by Team 'B'. Group 'D' will be evacuated to safe region under supervision of Team 'C'.

A multichannel communication network shall connect SECR to control rooms of plant, various shops, and other departments of plant, fire station and neighbouring industrial units.

Co-ordination among key personnel and their team has been shown in Fig. 7.1.

7.5.1 Outside organizations involved in control of disaster

In the event of excess exit of emission or stored gases or occurrence of fire, population inside and outside plant boundaries, vegetation and animal etc. may be affected. In such circumstances secondary fire may also take place. In such an event, help shall be taken from outside agencies also. The organisations that shall be involved are as follows:

(a) State and local authorities: District Collector, Revenue Divisional Officer, etc

(b) Factory Inspectorate, Chief Inspector of Factories, Joint Chief Inspector of Factories, Inspector of Factories.

(c) Environmental agencies: Member Secretary of State Pollution Control Boards, District Environmental Engineer

(d) Fire Department : District Fire Officer

(e) Police Department : District Superintendent of Police, SHOs of nearby Police Stations

(f) Public Health Department :
- District Medical Officer
- Residential medical officers of PHCs around plant site

(g) Local Community Resources
- Regional Transport officer
- Divisional Engineer Telephones

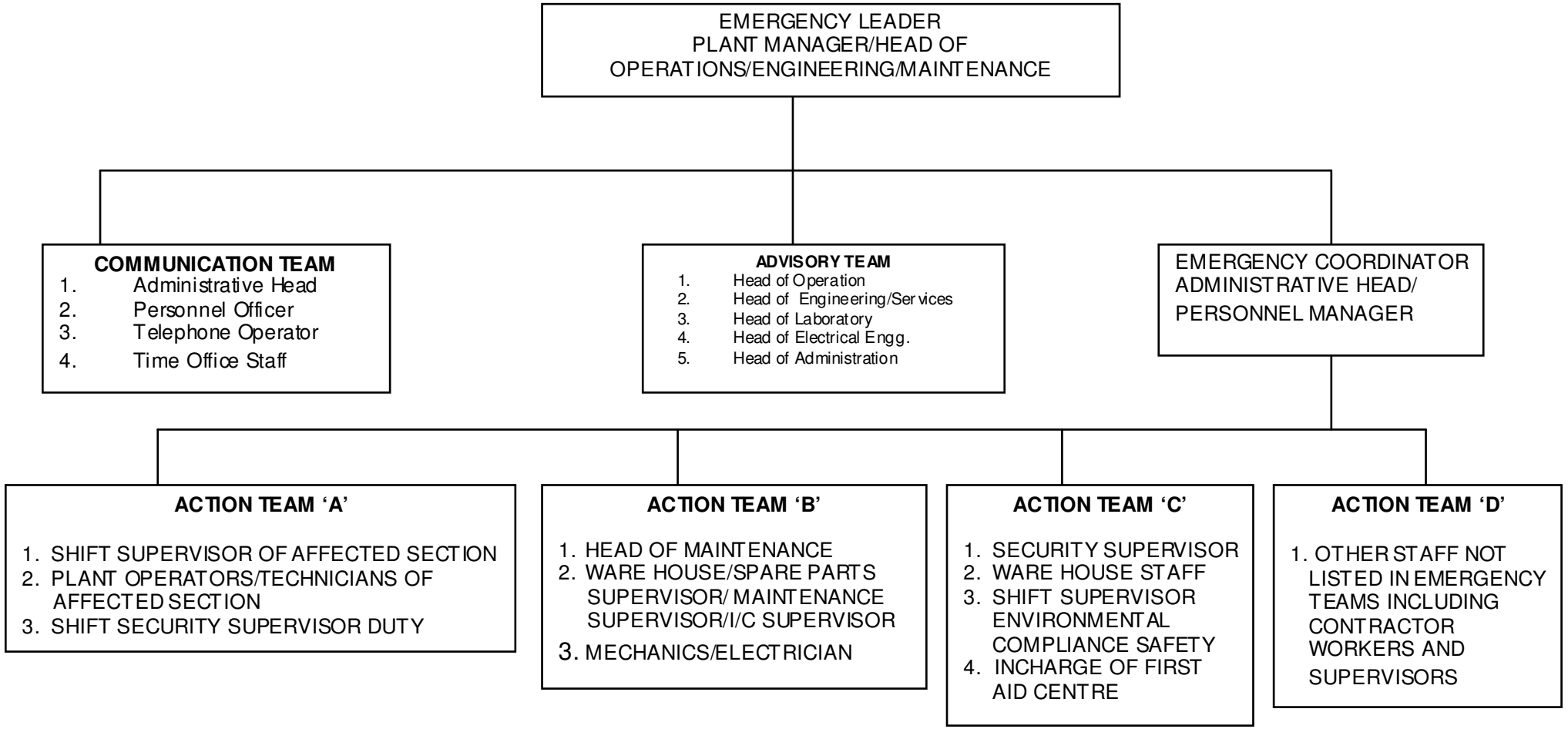
The outside organisations shall directly interact with district magistrate who in consultation with SMC shall direct to interact with plant authorities to control the emergencies.

7.5.2 Hazard emergency control procedure

The onset of emergency will in all probability, commence with a major fire or excess stack emission. The following activities will immediately take place to interpret and take control of emergency.

1. Staff member on duty will go to nearest fire alarm call point and trigger off the fire alarm.
2. On site fire crew led by fire man will arrive at the site of incident with fire foam tenders and necessary equipments.
3. Site main controller will arrive at SECR, from where he will receive information continuously from incident controller and give decisions and direction to the incident controller, plant control room, Emergency security controllers and to the site medical officer to take care of casualties.

FIG 7.1 : GENERAL COORDINATION AMONG ON SITE EMERGENCY TEAM MEMBERS



Site Main Controller will be directing and deciding a wide range of following desperate issues. In particular SMC has to decide and direct.

- Whether incident controller requires reinforcement of manpower and facilities
- Whether plant is to be shut down or more importantly kept running.
- Whether staffs in different locations are to remain indoor or to be evacuated and assembled at designated collection center.
- Whether missing staff members are to be searched or rescued.
- Whether off-site emergency plan to be activated and a message to that effect is to be sent to district headquarter.

When the incident has eventually been brought under control as declared by the Incident Controller, the SMC shall send two members of his advisory team as inspectors to incident site for:

- An assessment of total damage and prevailing conditions with particular attention to possibility of re-escalation of emergency which might, for the time being, be under control.
- Inspection of other parts of site which might have been affected by impact of incident.
- Inspection of personnel collection and roll call centers to check if all persons on duty have been accounted for.
- Inspection of all control rooms of plant to assess and record the status of respective plants and any residual action deemed necessary.

Post emergency, the inspectors will return to SECR with their observations and report of finding and will submit the same to SMC.

7.6 MISCELLANEOUS PREVENTIVE MEASURES

7.6.1 Alarm system to be followed during disaster

On receiving the message of "Disaster, from Site Main Controller, fire station control room attendant will sound SIREN I WAILING TYPE FOR 5 MINUTES. Incident controller will arrange to broadcast disaster message through public address system.

On receiving the message of "Emergency Over" from Incident Controller the fire station control room attendant will give "All Clear Signal", by sounding alarm straight for two minutes.

The features of alarm system will be explained to one and all to avoid panic or misunderstanding during disaster.

7.6.2 Actions to be taken on hearing the warning signal

On receiving the disaster message following actions will be taken:

- All the members of advisory committee, personnel manager, security controller, etc. shall reach the SECR.
- The process unit persons will remain ready in their respective units for crash shutdown on the instruction from SECR.
- The persons from other sections will report to their respective officer.
- Residents of township will remain alert.

7.6.3 Safety devices/equipments

In order to make the services more effective the workers and rescue team will be provided with the safety equipments and items like gas mask respirators, fire entry suits, fire blankets, rubber shoes or industrial shoes, rubber glove, ladders, ropes, petromax lamp torches etc.

7.6.4 Fire extinguisher

The different type of fire extinguishers have been proposed at strategic locations in the plant and given in Table 7.3.

TABLE 7.3
DIFFERENT FIRE EXTINGUISHERS AT DIFFERENT SITES

Name of Site	Type of Fire Extinguishers
Cable galleries	CO_2 & Foam type, Dry chemical powder
High voltage panel	CO_2 & Foam type, Dry chemical powder
Control rooms	CO_2 & Foam type, Dry chemical powder
MCC rooms	CO_2 & Foam type, Dry chemical powder
Pump Houses	CO_2 & Foam type, Dry chemical powder
Guest houses and offices	Dry chemical powder, foam type
Godowns	Foam type
Crusher house	CO_2, Dry chemical powder, foam type

CHAPTER 8

PROJECT BENEFITS

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The surrounding inhabitants are mainly agricultural oriented. About 7-8% of the land in the study area is wasteland as per satellite image and 63.89 % of the population in the study area is non-workers.

The upcoming project will generate direct and indirect employment opportunities for the local people. The plant and mine will create employment for about 418 (operational phase) and 133 (implementation phase) skilled as well as semi-skilled staff directly. Additionally, certain works like security will be outsourced on contract. The secondary employment in the form of providing services to the employed manpower will also be developed in the neighbouring villages.

The company will also provide the helping hand in the development of the nearby villages by following ways:

- There will not be any displacement of people from the proposed site.
- Employment opportunities / alternative arrangement of livelihood for the land losers is considered.
- Development of facilities within the villages like roads etc.
- Arranging regular free of cost of medical check up camp for the employees which will be also extended for the villagers.
- Supply of drinking water in the period of scarcity to the nearby villages.
- Canals will be developed (3 big canals) within plant premises as per the direction of the State Government so that sweet water during rainy season for farmers can be collected.
- Upgradiation of primary school in nearby villages.
- The company will also provide funds for the various development activities of the neighbouring villages as and when required

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CHAPTER 9

DISCLOSURE OF CONSULTANTS ENGAGED

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The consultants engaged for the preparation of the EIA/EMP of the project are Min Mec Consultancy Pvt. Ltd. The information about the company is as follows:

Introduction

Min Mec provides services in the field of environmental impact assessment and management for all types of industries (chemical, petrochemical, hazardous industries, power stations, infrastructure projects, on-shore and off shore, cement and mines), risk analysis, disaster management, environmental health and safety auditing, socio-economic studies, mine planning and engineering software development. Min Mec conducts studies of international standard such as those for IFC (World Bank) and CIDA sponsored projects and of national standards of MoEF.

Min Mec Consultancy Pvt. Ltd was registered in July 1983 with the Registrar of Companies, Delhi & Haryana, India. In 1994, Min Mec established a modern R & D laboratory which was accredited under Environment Protection Act (EPA) by Ministry of Environment and Forests, Government of India. On 02.02.2003, Min Mec received ISO 9001:2000 certification under ANZ-JAS. In June, 2006, the laboratory received accreditation from NABL.

Services and expertise

Services are provided to the following sectors

- Infrastructure projects such as jetties, highways, water supply pipelines projects, power stations, canals, minor dams, etc.
- Industries such as cement plants, smelters, chemicals, pharmaceuticals, petrochemicals, salt works, pesticides and other hazardous and polluting industries.
- Mines-surface and under ground for all minerals and metals

As on 20.08.07, the following projects have been executed:

	Numbers
EIA, EMP & Environmental Studies	246
RA & DMP	17
EHS	4
Socio Economics	7
Feasibility studies (sponge iron & power plants)	40
Pre Feasibility studies (coal blocks)	43

Market surveys	8
Mine Planning	41
Regional Studies	1
Hydro- geological & hydrological studies	29
Others	6

Personnel

Min Mec has a strong team of in-house experts in EIA, EMP, DMP, RA, EHS, mining, socio economics and software development. The team of experts is supported by a panel of experts comprising of over twenty specialists in various fields with an average experience of over 30 years.

Team engaged

Position	Expert Name	Qualifications	Experience
Team leader	B. D. Sharma	M. Tech (Hons), B. Tech (Min.), PG Diploma (Env. & Ecology)	Over 30 years experience in environmental impact assessment, management and planning with over 200 projects executed over last 20 years.
Hydro-geologist	R. P. Aggrawal	M.Tech (Applied Geology)	40 years work experience in hydrogeology and geology. Super-attenuated as HOD, Patna office, Central Ground Water Board
Ecology	Dr. Anita Singh	Ph.D. (Botany)	10 years of work experience in ecology
Agriculture	Dr. Ratan Kumar	Ph. D (Agri.)	5 years of work experience in agriculture and soil science.
Environmental and Social Planner	Marisha Sharma	M. Plan (Env.), BE (Civil), PG certificate in Disaster Management	Over 6 years experience in mathematical modeling of air and water pollution. Also experienced in waste water treatment, resettlement and rehabilitation studies. Certified Energy auditor
Lab Incharge	Rashmi Gupta	B.Sc.	Over 6 years experience in Laboratory and field work management

Position	Expert Name	Qualifications	Experience
Field Monitoring expert	Mahesh Dutt	B. Sc.	Over 12 years experience in environmental data collection from field
GIS	B. Ram	BCA	Over 10 years experience in GIS
Air Quality Prediction Modelling	M. S. Yadav	MCA	Over 12 years of experience in software development and modelling