RAPID ENVIRONMENTAL IMPACT ASSESSMENT

Of

CEMENT PLANT

PENNA CEMENT INDUSTRIES LTD

Talaricheruvu village, Tadipatri Mandal,
Anantapur District, Andhra Pradesh.

FOR

INCREASE OF PRODUCTION
CLINKER : FROM 0.85 TO 1.45 MTPA
CEMENT : FROM 1.50 TO 2.20 MTPA
THROUGH OPTIMIZATION
AND
UPGRADATION

Prepared By

B.S. ENVI-TECH (P) LTD
Hyderabad – 500 057

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CHAPTER - 1

INTRODUCTION

1.0 INTRODUCTION

1.1 PENNA CEMENT INDUSTRIES LTD

PENNA CEMENT INDUSTRIES LIMITED., PCIL is one of the cement producing business house having installed production capacity of about 3.0 MTPA with the following cement units located in the state of Andhra Pradesh

PCIL CEMENT PLANTS

S.NO.	CEMENT PLANT	CAPACITY (MTPA)
1	Penna Cement Industries Ltd – Nalgonda	1.50
2	Penna Cement Industries Ltd – Ananthpur	1.50

PENNA CEMENT INDUSTRIES LTD – ANANTHPUR

Penna Cement Industries Limited, (PCIL), has commissioned cement plant at Talaricheruvu village, Tadipatri mandal of Ananthapur district in Andhra Pradesh in the year 1994.

PCIL has commissioned the cement plant with an initial capacity of 0.198 MTPA. Subsequently PCIL has expanded its production capacity to 0.297 MTPA in the year 1995. And later, it has increased its production capacity from 0.297 MTPA to 0.45 MTPA by optimizing the production capacities and by undertaking the modifications in the existing stream of production in the year '98-99.

Later, in the year 2001, PCIL has enhanced the production capacity of the plant from 0.45 MTPA to 0.85 MTPA by installation of Unit – II.

PCIL has obtained Environmental Clearance for clinker production of 0.85 MTPA and Cement of 0.90 MTPA vide no J-11011/26/2000-IAII (1) dated 02-03-2001. The compliance statement of the Environmental Clearance is enclosed as **Annexure – 1 A**.

The cement production capacity of the plant was further enhanced from 0.90 to 1.50 MTPA by introducing a Slag grinding circuit at a project cost of Rs 32 crores. The plant is consuming about 0.525 MTPA of slag and 0.05 MTPA of ash. The necessary clearance from Andhra Pradesh State Pollution Control Board as per EIA guidelines of 1994 was obtained for the same as the project cost was less than Rs 50 crores.

The limestone requirement of the cement plant is met from Captive Limestone mines located within a radius of 3 km.

The current status of various units of PCIL cement plant along with installed production capacities are given below :

OVERVIEW OF INSTALLED CAPACITIES OF PCIL

		INSTALLED CAPACITY
1	**Clinker Production Capacity, MTPA**	
	UNIT – I	0.425
	UNIT – II	0.425
2	**Cement Production Capacity , MTPA**	
	Combined Capacity of UNIT– I and UNIT– II	1.5 (Ordinary Portland Cement : 0.35 Portland Slag Cement : 1.00 Portland Pozzolana Cement: 0.09

1.2 PRESENT PROPOSAL

PCIL has carried out a detailed technical audit of the plant which has indicated that upgradation of kilns and coolers and optimizing the operational hours of the process units on the upstream and down stream equipment of the existing two lines i.e Unit – I and Unit – II will increase of clinker production capacity from 0.85 MTPA (cement – 1.5 MTPA) to 1.45 MTPA (cement – 2.2 MTPA).

The present proposal pertains to increase of clinker production capacity from 0.85 MTPA (cement - 1.5 MTPA) to 1.45 MTPA (2.2 MTPA cement).

Details of existing and proposed production capacities of the cement plant before and after optimization are given below :

DETAILS OF INSTALLED CAPACITIES

		UNITS	Before optimisation	After optimization
CLINKER	Unit – I	MTPA	0.425	0.725
	Unit – II		0.425	0.725
	Total		**0.85**	**1.45**
CEMENT			**1.5**	**2.2**

1.3 NEED FOR ADDITIONAL CEMENT MANUFACTURING CAPACITY

Cement industry is one of the main beneficiaries of the infrastructure boom. While on the one hand several big and small cement companies are actively considering expansion plans in anticipation of further growth in demand for cement, on the other, a phase of acquisitions and mergers among the existing players is also going on.

In India, the south consumes maximum of 30 % followed by East at 17 %, North at 19 %, Central at 16 %, and West 18 %. Also, there is an increase in the consumption of PPC cement from 48 % to 50 per cent.

The demand is expected to increase to 17.5 million tonnes by 2006-07 in view of irrigation and infrastructure projects. About 21.5 million tonnes capacity is expected to be added by the year 2008 by expansions. This year's domestic demand will be 140 million tonnes. Now that the GDP is expected to grow to 8 per cent, growth in the cement consumption is also expected to remain above 12 per cent per year.

Weaker sections' housing, construction of public toilets, schools in rural areas apart from several private and public infrastructure projects will also give tremendous boost to the cement consumption in the state. Most importantly, irrigation projects, worth nearly Rs 1 lakh crore, will trigger unprecedented demand for the next 5-7 years.

As per the Industry sources, demand has mainly come from the construction sector with the three main cities in the South — Bangalore, Chennai and Hyderabad — witnessing hectic construction activity, be it for the information technology sector, shopping malls or integrated townships. The growth in demand has prompted many cement industries to consider expanding their capacities, both in present locations and in greenfield locations.

Continuous demand for exports to China and other South-East Asian countries along with the increased requirement of the domestic sector has lead all the cement manufacturers in the country to plan for increased capacities.

1.4 PROJECT COST:

The project cost incurred on the existing plant till date is Rs 202.30 crores (Rs 21.95 crores for EMP). The project cost involved in increase of clinker and cement production is Rs 22 crores.

1.5 LOCATION OF THE CEMENT PLANT

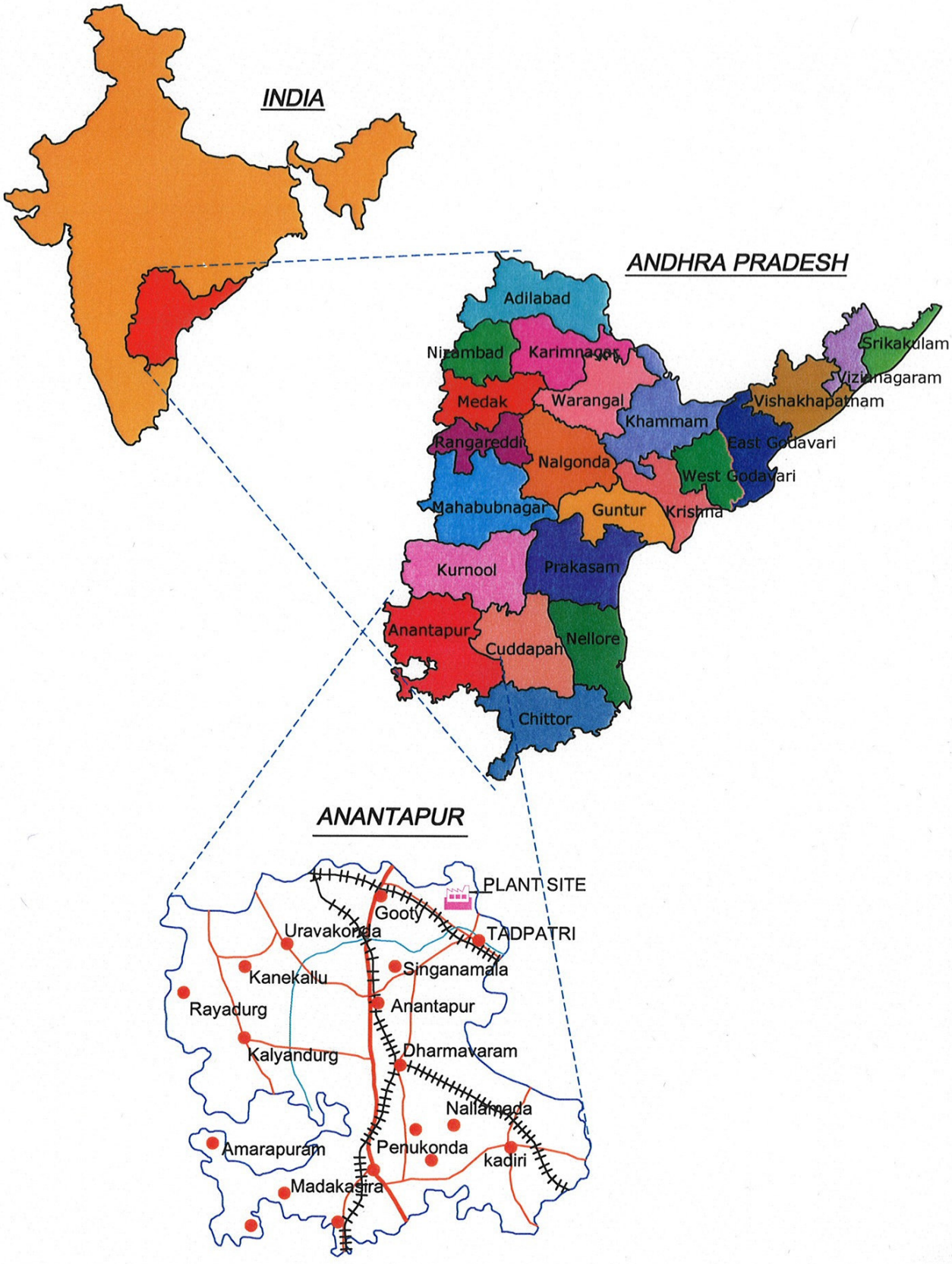
The Cement Plant is located near Talaricheruvu village, Tadipatri Mandal of Anantapur district in Andhra Pradesh. Location map of the plant is shown in **Fig – 1.1**.

The plant site falls between 15° 56' 00" - 15° 59' 00" North latitude and between 78°03'50" - 78°08'50" East Longitude and is located at an average elevation of about 360 m above MSL. The plant site is covered in Survey of India toposheet no 57 J/1. Penneru river flows at a distance of about 6 km from the plant site. The terrain around the plant site is flat with an average msl of 380 m. The surface relief of the study area of 10 km is about 212 m.

PCIL is surrounded by mine area in the Northern direction, Talaricheruvu village in the NW direction, open areas in the East and barren lands in the other directions. The Captive Limestone mines are located within 2 km distance of the plant site at Talaricheruvu

FIG - 1.1

LOCATION MAP



and & Urachintala villages. **Fig – 1.2** shows the Key Map of the plant site

Fig – 1.3 depicts the study area of 10 km radius around the plant site. The study area of 10 km is undulating.

The plant site is well connected with both road & rail. The nearest railway station to the plant site is Tadipatri, located at a distance of 12 km. The main approach road to the plant site is from Tadipatri town. Salient features of the plant site are given in **Table - 1.1**

1.6 RESOURCES AVAILABILITY

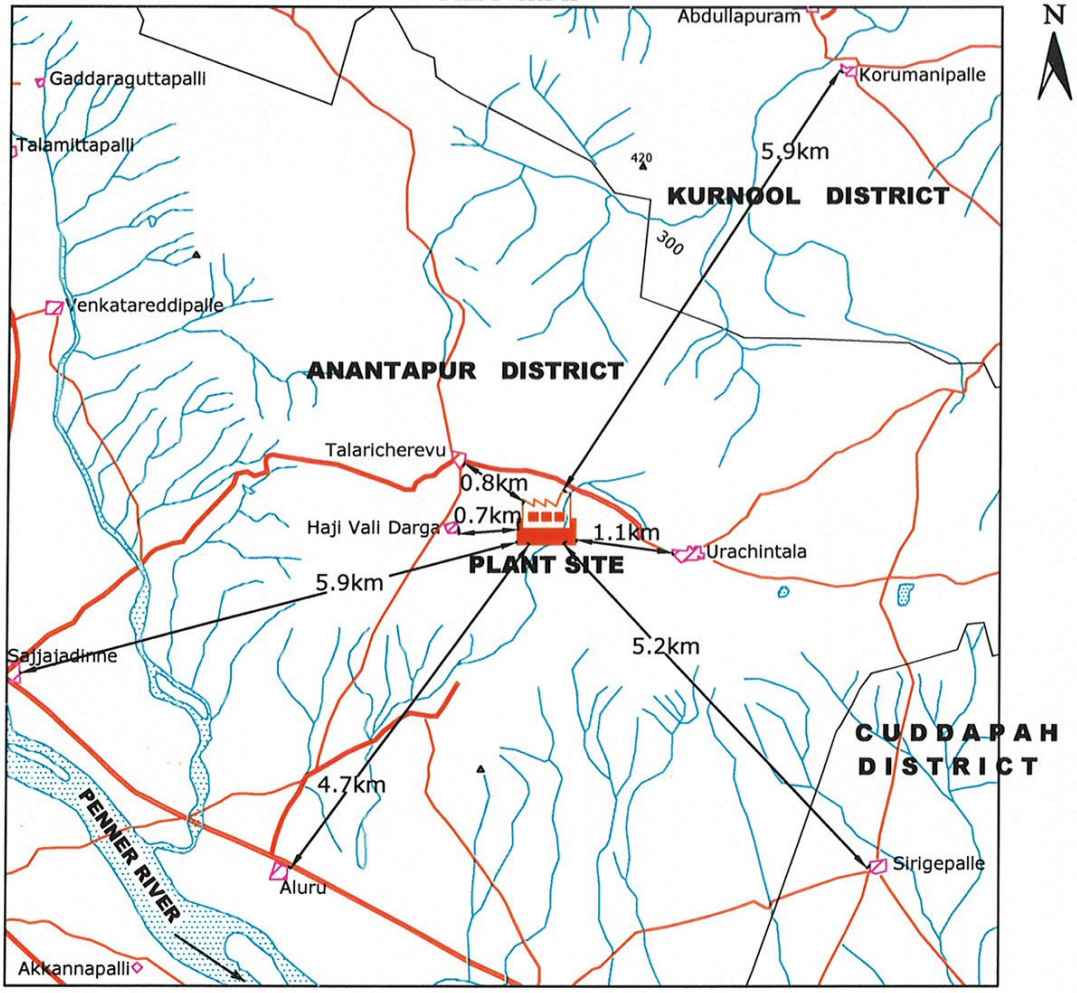
1.6.1 Raw Materials

The major raw material used in the manufacture of cement is Limestone. The captive limestone mines located within 3 km of the plant can substantiate the requirement of the existing and proposed clinker and cement production. The requirement of raw material for the existing and proposed production are given below:

REQUIREMENT OF RAW MATERIAL

RAW MATERIAL	QUANTITY IN MTPA			
	Present	Additional	Total	Source
Limestone (from captive mines of PCIL)	1.35	0.75	2.10	Captive limestone mines (Talaricheruvu & Urachintala)
Iron ore	0.022	0.028	0.050	Bellary Iron Ore Mines
Bauxite	0.022	0.038	0.06	Indian Aluminium Company, Belgaum
Gypsum	0.074	0.036	0.11	EID Parry, Chennai/FACT Tuticorin
Coal	0.158	0.092	0.25	Singareni Collieries
Slag	0.524	0.308	0.850	SJK steel
Ash	0.052	0	0.052	Rayalaseema Thermal Power Plant

FIG - 1.2
KEY MAP



SCALE

0 1 2 3 4 5km

LEGEND

- ROADS
- STREAMS / TANKS
- SETTLEMENTS
- DISTRICT BOUNDARY
- PLANT SITE

FIG - 1.2

PROJECT:
M/s. PENNA CEMENT INDUSTRIES LTD.,
Talaricherevu (V), Tadipatri (M), Anantapur (Dt.), A.P.

TITLE:
KEY MAP

PREPARED BY:
B.S.ENVI-TECH (P) LTD.,
HYDERABAD

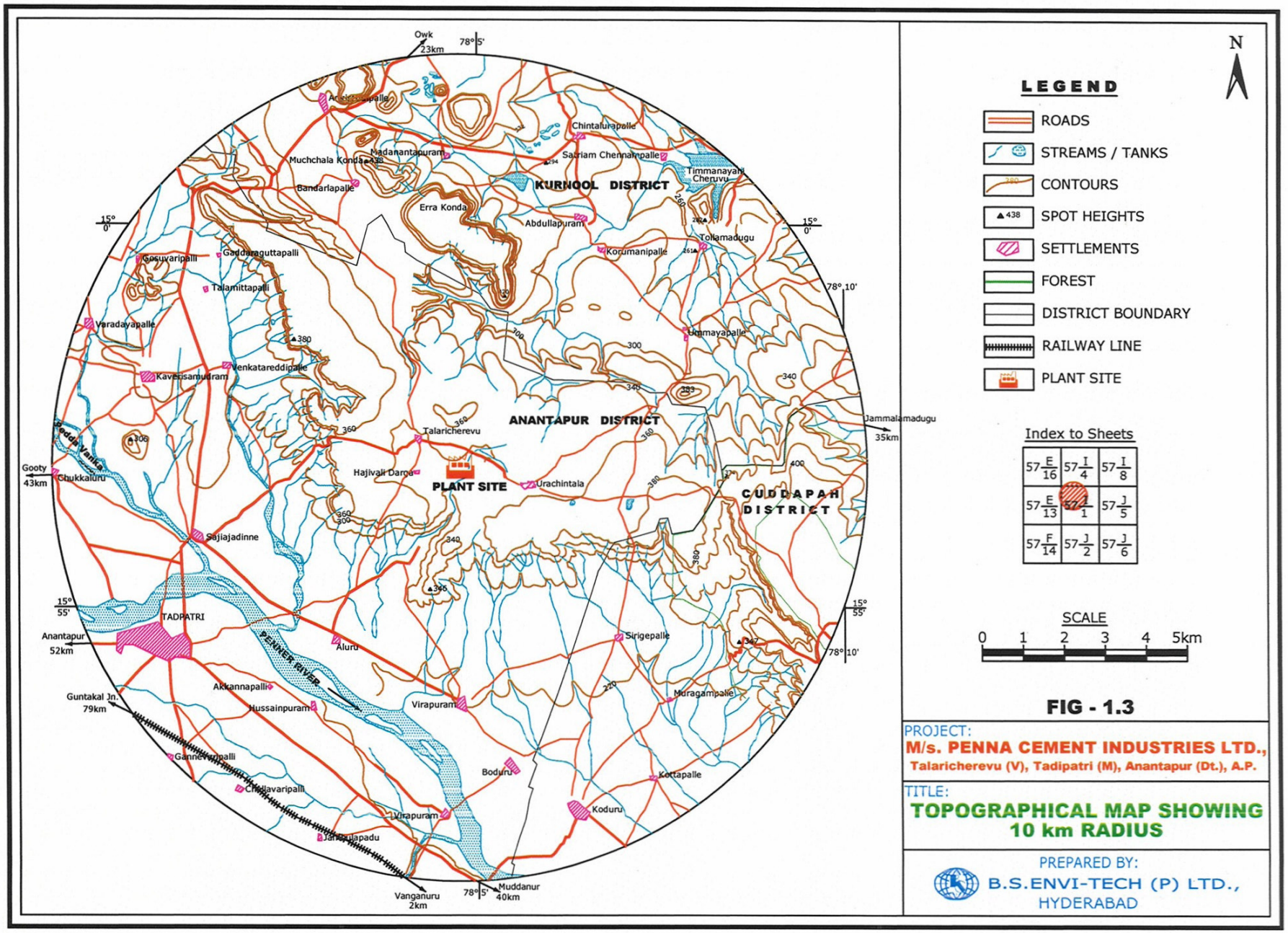


FIG - 1.3

PROJECT:
M/s. PENNA CEMENT INDUSTRIES LTD.,
Talaricherevu (V), Tadipatri (M), Anantapur (Dt.), A.P.

TITLE:
TOPOGRAPHICAL MAP SHOWING 10 km RADIUS

PREPARED BY:
B.S.ENVI-TECH (P) LTD.,
HYDERABAD

TABLE – 1.1
SALIENT FEATURES OF THE SITE

FEATURE	DETAILS
Altitude	360 m above msl
Longitude	78° 04' E
Latitude	14° 57' N
Village, Tehsil, District, State	Talaricheruvu Village, Tadipatri Mandal, Ananthapur district, Andhra Pradesh
Max. Mean Temp.	38.4 °C
Min Mean Temp.	17.2 °C
Relative Humidity	40-70 %
Annual rainfall	562.33 mm (average annual rainfall observed during the past 10 years)
Land availability	74.49 Ha
Topography	Plant area is located in a flat terrain Study area is undulating (surface relief of the area is 212 m)
Soil Type	Sandy Loam
Nearest River	Penneru river at 6.0 km from plant site
Nearest Highway	NH-7 (43 km from plant site)
Nearest Railway station	Tadipatri – 12 km - connecting Mumbai–Chennai
Nearest Railway Junction	Guntakal – 75 km Gooty – 60 km
Nearest Village	Talaricheruvu (1.2 km NW) Urachintala (2.0 km SE)
Nearest City	Ananthapur - 60 km
Nearest Industries	L & T cement plant (11.5 km NW)
Nearest Air port	Bangalore – 300 km
Nearest Forest	Dobbudapalle Reserve forest (scrub forest) – 4 km SE
Nearest State Boundaries	Karnataka – 150 km Tamil Nadu – 250 km
Sensitive places	None within 10 km radius
Historical places	None Within 10 km radius

Note : All are aerial distances

1.6.2 Land

The total land acquired by PCIL for existing cement plant and colony is about 74.4 Ha. PCIL has constructed a colony in an area of 40 Ha out of the plant area of 54 Ha. No additional land would be required as the increase in cement production capacity will be achieved only in terms extention of operational hours.

PCIL has adequate land for storage of raw material within the plant area. **Fig –1.4** shows the layout of the plant area.

1.6.3 Water:

The cement manufacturing process adopted being a dry process, the water requirement is mainly for circulating cooling water for bearings and gear boxes, for gas conditioning tower and sprays in crushers and transfer points to control dust and domestic purposes in the factory & colony. The water requirement of the existing cement plant is about 456 m^3/day. This requirement is being met from the existing bore wells located of the plant site. The additional water requirement is mainly for gas conditioning towers and dust suppression which is 50 m^3/day. This requirement will be met from the same bore wells within the plant premises.

1.6.4 Power

The power requirement of the cement plant is about 20 MW and is met from grid. The power requirement at the increased production is estimated to be an additional of 2.5 MW which is also proposed to be met from grid.

To augment the power requirement during exigencies, PCIL has installed 3 nos of 1250 KVA DG sets.. The existing DG sets are adequate to support the emergency standby power requirement of the proposed expansion. Therefore no additional DG sets are envisaged in the expansion scheme.

1.6.5 Infrastructure

PCIL has installed complete utilities and other infrastructural facilities in the existing cement plant. These facilities are adequate to support the proposed expansion.

Adequate storage facility for machinery spares and other consumable in an open yard has been provided to meet the requirements of the plant. The existing machinery stores will be utilized for the proposed expansion of the plant.

The plant has good workshop facility both for mechanical and electrical equipment repairs and maintenance. The existing workshop will be used for the proposed expansion of the plant.

1.6.6 Man Power

The existing manpower working in plant and mine is 200. No additional manpower will be required.

1.6.7 Township

A full fledged township comprising of housing facilities for plant, mines and security personnel and supporting staff and other amenities such as School, Guest House, Health Center, Hospital, Shopping Complex etc have been established in the township.

1.6.8 Communication and Transportation

PCIL has installed an independent telephone exchange to cater to the requirements of the cement plant complex, intercom network as the main communication link for internal communication of the plant, mines and the township. For external linkage, STD/ FAX facilities have been provided. The plant has a road network for transporting the raw material and product. These roads are provided with bitumen wearing course as per the recommendations of APPCB.

1.7 ENVIRONMENTAL IMPACT ASSESSMENT STUDY

As per the guidelines of MoEF, PCIL has conducted environmental impact assessment study to identify the possible environmental impacts and correspondingly to design proper Environmental Management Plan to the standards prescribed by State Pollution Control Board and MoEF.

This report highlights the Environmental Impact assessment study carried out in Summer season of 2006 covering the months of March – May, 2006 on various environmental components such as air, noise, water, soil and socio economy within an impact zone of 10 km radius around the plant site and the proposed mitigation measures.

CHAPTER - 2

SCOPE OF METHODOLOGY OF REIA

2.0 SCOPE AND METHODOLOGY OF THE REIA STUDY

2.1 SCOPE

The scope of the study includes preparation of Environmental Impact Assessment study with detailed characterisation of various environmental components such as air, noise, water, land and socio economic within an area of 10 km radius around the cement plant of Penna Cement Industries Ltd., [PCIL] located near Talaricheruvu village, Tadipatri Mandal, Anantapur District of Andhra Pradesh as per the latest guidelines of MOEF.

The main objectives of characterisation are

- To assess the existing baseline status of air, water, noise, land and socio-economic environments within the plant site (core zone) and around 10 km radius of the study area (buffer zone).

- To identify and quantify significant impacts due to various operations of the proposed increase in clinker production on various environmental components through prediction of impacts.

- To evaluate the beneficial and adverse impacts of the proposed increase in clinker production.

- To prepare an Environmental Management Plan (EMP) detailing control technologies and measures to be adopted for mitigation of adverse impacts if any, as a consequence of the proposed expansion of clinker production.

- To prepare a Post Project Monitoring Programme for checking and regulating the environmental quality in the post expansion phase of the cement plant and help in sustainable development of the area.

2.2 METHODOLOGY OF REIA

Any developmental activity is expected to cause impacts on surrounding environment during the construction and operation phases. The impacts may be adverse or beneficial. In order to assess the impacts due to increase in clinker production from 0.85 MTPA to 1.45 MTPA and cement production from 1.5 MTPA to 2.2 MTPA, a detailed Environmental Impact Assessment study has been conducted within an area of 10 km radius around the mine site.

The various steps involved in Environmental Impact Assessment study of the project site are divided into the following phases:

- Identification of significant environmental parameters and assessing the existing status within the impact zone with respect of air, water, noise, soil and socioeconomic components of environment.
- Prediction of impact on air quality taking into consideration the proposed emissions to project the overall scenario
- Prediction of impact on Water, Land and Socio Economic Environment
- Evaluation of total impacts after superimposing the predicted scenario over the baseline scenario to prepare an Environmental Management Plan

The methodology adopted for studying the various individual components of environment are described below.

2.2.1 Micro Meteorology

An auto weather monitoring station to record meteorological parameters like, Windspeed, Wind direction, maximum and minimum temperatures, relative humidity, cloud cover was recorded on hourly basis continuously for the Summer season of 2006 covering the months of March – May '06.

Windspeed & wind direction data recorded during the study period were used for computation of relative percentage frequencies of

different wind directions. The meteorological data thus collected has been used for interpretation of the existing Ambient Air Quality status, and the same data has been used for prediction of impacts of future scenario due to the activities of the expansion scheme.

2.2.2 Ambient Air Quality

Core Zone

Ambient air quality of the plant is assessed by One AAQ monitoring station located at Main gate of plant complex.

Buffer Zone

The scenario of the existing ambient air quality in the study region has been assessed through a network of seven ambient air quality stations during the study period within an area of 10 km radius around the plant. The monitoring network was so designed such that representative samples are obtained from the upwind direction, down wind and cross wind directions of the cement plant. These monitoring sites have been established keeping in view the available climatological norms of predominant wind direction and wind speed of this particular region. The following points were also taken into consideration in designing the network of sampling stations:

a) Topography / Terrain of the study area
b) Populated areas within the study area
c) Residential and sensitive areas within the study area.
d) Magnitude of the surrounding industries
e) Representation of regional background levels
f) Representation of cross sectional distribution in downward direction.

The existing Ambient Air Quality status (AAQ) has been monitored for SPM, RPM, SO_2, NO_X, and CO. SPM & RPM at each station has been monitored on 24 hourly basis and all the gaseous sampling has been done on 8 hourly basis except CO which was monitored on 4 hourly basis.

Precalibrated Respirable dust samplers have been used for monitoring of the existing AAQ status. Methodologies adopted for sampling and analysis were, as per the approved methods of Central Pollution Control Board (CPCB). Maximum, minimum, average and percentile values have been computed from the raw data collected at all individual sampling stations to represent the ambient air quality status of the study area.

2.2.3 Noise Environment

Core zone

Spot Noise levels were measured at six locations within plant area at various noise generating sources.

Buffer Zone

Noise monitoring has been carried out at nine locations to identify the impact due to the existing sources on the surroundings in the study area. Noise levels were recorded at an interval of 30 minutes during the day and night times to compute the day equivalent, night equivalent and day-night equivalent level.

2.2.4 Water Environment

Core Zone

To assess the water quality of the core zone, one sample from plant, which is located within the area, has been collected and assessed.

Buffer Zone

Seven water samples from various locations around the plant site within 10 km radius were collected for assessment of the existing physico-chemical and bacteriological quality. Methodologies adopted for sampling and analysis were according to the IS methods. Field parameters such as pH, Temperature were monitored on site. The parameters thus analysed were compared with IS 10500. The activities surrounding the source during sampling were taken into

consideration in interpretation of the water quality of that particular source.

2.2.5 Land Environment

Core Zone :

Soil samples from plant area (One sample) was collected and analysed to check physico-chemical quality.

Buffer Zone

Field surveys were conducted to identify the land use in and around 10 km radius of the plant area. Representative soil samples were collected from five sampling locations within an area of 10 km radius around plant for analysis of the physico chemical characteristics to assess the cropping pattern, microbial growth etc. Standard procedures were followed for sampling and analysis. The samples collected were also analysed to check the suitability for growth of native plant species in and around the cement plant. Information on flora and fauna has been collected in the study area during the study period within 10 km radius.

2.2.6 Socio – Economic Environment

A detail on economic status of various villages within an area of 10 km around the plant was collected.

Information on existing amenities has been collected to determine the developmental activities to be undertaken by the PCIL authorities. Such developmental activities would result in upliftment of the economic status in the area.

All the above environmental parameters have been used for identification, evaluation and prediction of significant impacts.

2.3 Prediction of Impacts & Environmental Management Plan

Various technical aspects of the expansion of the mine have been studied to identify the significant impacts which would arise from

increase of clinker and cement production. The identified impacts have been quantified through prediction of impacts to estimate the post project scenario.

Identified impacts due to expansion of the mine have been studied in detail to predict the impacts on various environmental components. Standard techniques and methodologies have been adopted to predict impacts on various environmental components. Predicted scenario has been superimposed over the baseline (pre-project) status of environmental quality to derive the ultimate (post-project) scenario of environmental conditions.

Environmental Management Plan (EMP) of the plant details the control measures which are being undertaken and which are proposed to be undertaken by PCIL for the increased production to maintain environmental quality within the stipulated limits specified by State Pollution Control Board /MOEF.

CHAPTER - 3

EXISTING CEMENT PLANT & ENVIRONMENTAL SCENARIO

3.0 CEMENT PLANT COMPLEX AND ENVIRONMENTAL SCENARIO

3.1 PRESENT PRODUCTION CAPACITIES OF PCIL

PCIL currently is manufacturing 1.5 MTPA cement. The total limestone production from the captive limestone mine at present is about 1.35 MTPA.

3.2 LAYOUT OF CEMENT PLANT COMPLEX

Cement plant and colony are located in an area of 74.49 ha including greenbelt. Layout of the cement plant along colony are shown in **Fig-3.1**. The land use break up of the total land has been discussed hereunder.

PRESENT LAND BREAKUP (Ha)

			AREA
1	Plant	Unit-I	8.21
		Unit-II	5.95
2	Colony		17
3	Greenbelt		43.33
Total			74.49

Details of each of the above is given below

Cement plant : The existing cement plant consists of a two units each of 0.448 MTPA capacity . **PCIL** is producing cement of 1.5 MTPA.

Colony: In order to facilitate the employees working in the plant, PCIL has developed a full-fledged colony. All the necessary amenities such as water, shopping complex, temple and dispensary have been provided. Colony consists of quarters to accommodate various grades of employees. About 300 people are residing in the colony.

3.3 PRODUCTION DETAILS

At present PCIL is capable of manufacturing OPC, PSC and PPC in the cement plant as given below:

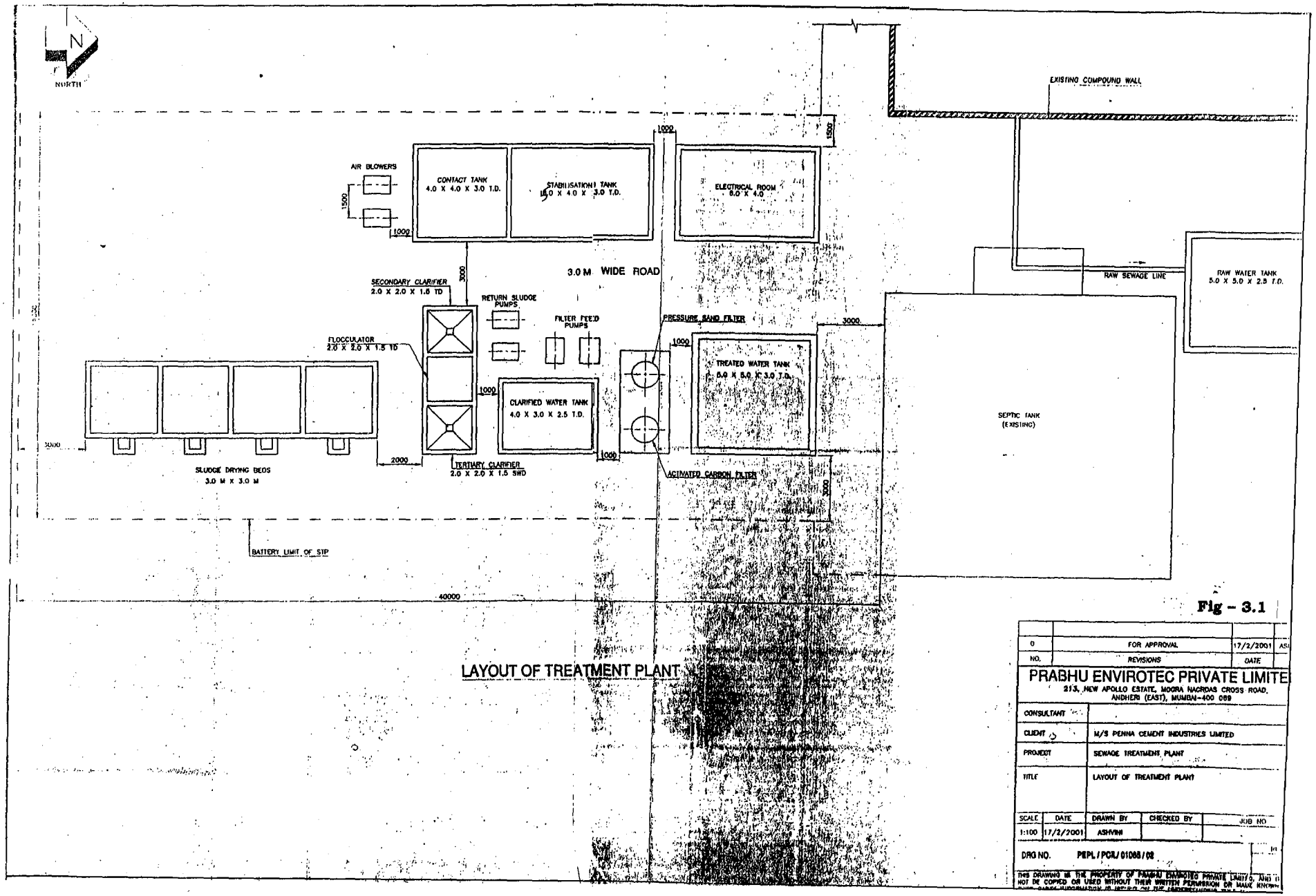


Fig – 3.1

LAYOUT OF TREATMENT PLANT

NO.	REVISIONS	DATE
0	FOR APPROVAL	17/2/2001

PRABHU ENVIROTEC PRIVATE LIMITE
213, NEW APOLLO ESTATE, MOGRA NAGRDAS CROSS ROAD,
ANDHERI (EAST), MUMBAI-400 069

CONSULTANT	
CLIENT	M/S PENNA CEMENT INDUSTRIES LIMITED
PROJECT	SEWAGE TREATMENT PLANT
TITLE	LAYOUT OF TREATMENT PLANT

SCALE	DATE	DRAWN BY	CHECKED BY	JOB NO.
1:100	17/2/2001	ASHVINI		

DRG NO. PEPL / PCR / 01088 / 02

S.NO.	TYPE OF CEMENT	PRODUCTION	
		TPD	MTPA
1	Ordinary Portland Cement	1060	0.350
2	Portland Pozzolona Cement	455	0.09
3	Portland Slag Cement	3030	1.0
Total		4545	1.50

The compositions of above three types of cement are given below.

COMPOSITION OF DIFFERENT TYPES OF CEMENT

	ORDINARY PORTLAND CEMENT	PORTLAND POZZOLANA CEMENT	PORTLAND SLAG CEMENT
Clinker	95 %	60 %	42.5 %
Gypsum	5 %	5 %	5 %
Flyash	---	35 %	---
Slag	---	---	52.5

3.4 RAW MATERIAL CONSUMPTION

The major raw material used in the manufacture of cement is Limestone. This limestone is met from the captive limestone mines.

PCIL present limestone requirement is 1.35 MTPA of limestone for its present clinker production of 0.85 MTPA. The consumption of limestone and other raw material in the cement plant are given below:

REQUIREMENT OF RAW MATERIAL

RAW MATERIAL	QUANTITY IN MTPA	
	Present	Source
Limestone (from captive mines of PCIL)	1.35	Captive limestone mines (Talaricheruvu & Urachintala)
Iron ore	0.022	Bellary Iron Ore Mines
Bauxite	0.022	Indian Aluminium Company, Belgaum
Gypsum	0.074	EID Parry, Chennai/FACT Tuticorin
Coal	0.158	Singareni Collieries
Slag	0.524	SJK steel
Ash	0.052	Jindal Thermal Power Plant

The calcination process of clinkerisation is accomplished with supply of heat. Coal required for the plant is procured from SCCL.

The average calorific value of the coal and ash content are about 4500 kcal/kg and 30 % respectively

The detail of manufacturing process of cement is given below:

3.5 CEMENT MANUFACTURING PROCESS

The following are the steps involved in manufacturing of cement:

a. Mining and Crushing of limestone
b. Preparation of Rawmeal
c. Preparation of Fine coal
d. Preparation of Clinker
e. Preparation of Cement
f. Dispatch of Cement

3.5.1 BRIEF MANUFACTURING PROCESS OF CEMENTS

A ORDINARY PORTLAND CEMENT

The basic raw materials used in the cement plant are Limestone, Iron ore, Bauxite and Gypsum. Coal received from the Singareni Collieries is being used in the process. **Fig – 3.2** shows the flow diagram of cement manufacturing process.

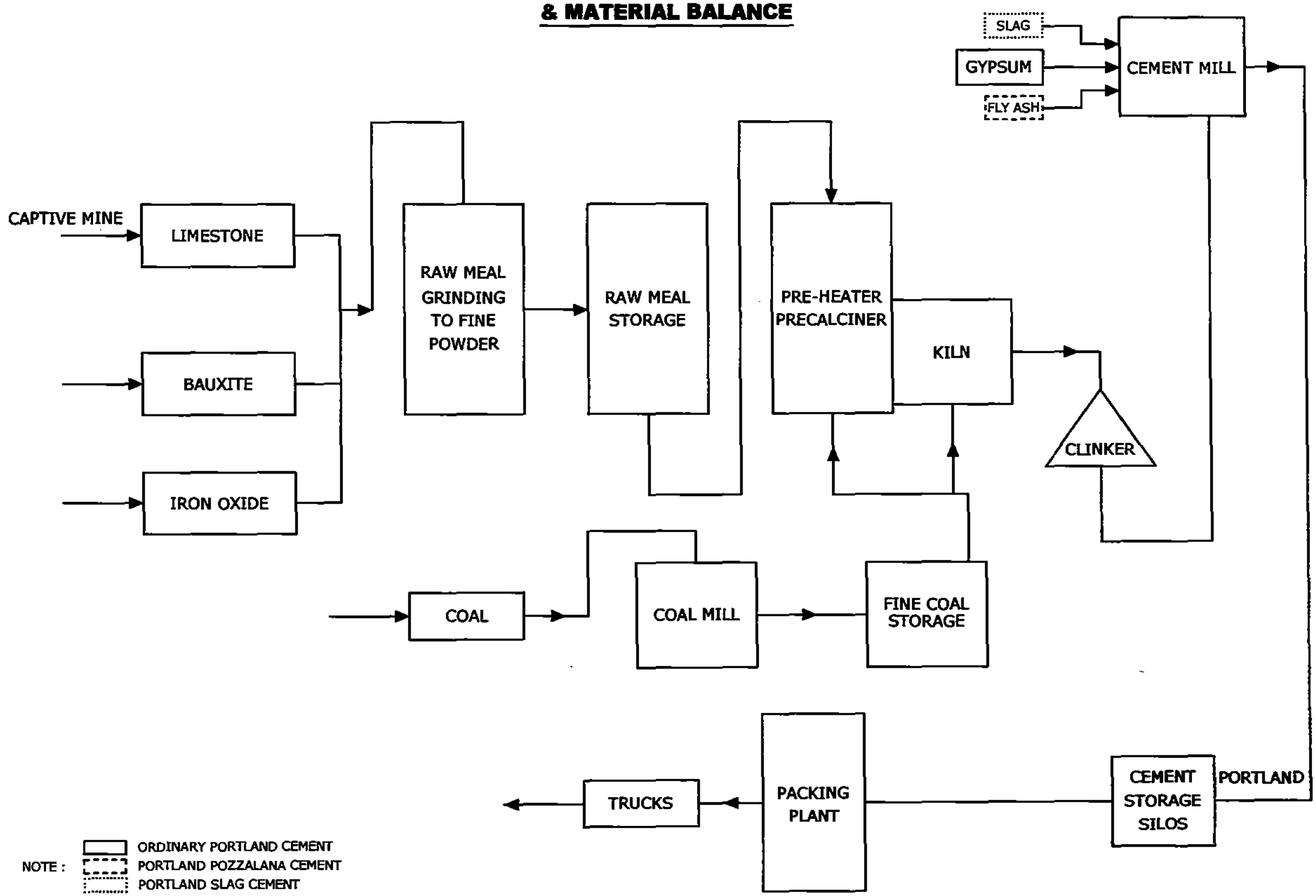
Description of each of the above operation is detailed below :

In the process, the raw materials are separately crushed and grounded in a suitable machine and dried. These are then mixed in proportions, pulverized in Ball Mills and finally homogenized, i.e., made uniform by means of compressed air mixing arrangements. The resulting mass is known as Raw Mix.

The Raw mix is introduced in the Pre heater. The raw mix gets dehydrated and pre heated by hot gases flowing in the opposite direction. The gases are generated by burning coal in kilns and by de-

FIG - 3.2

FLOW DIAGRAM OF CEMENT MANUFACTURING PROCESS & MATERIAL BALANCE



carbonation of raw meal. The pre heated raw meal from cyclones are fed into calciner where a temperature of 900 °C is maintained by firing coal. Then the raw meal undergoes de-carbonation reaction and is separated from the gases at the bottom most cyclones. The temperature in the pre-heater from top cyclone to bottom cyclone varies from 300 to 950 °C. All the cyclones and ducts are lined with refractory to prevent heat losses.

The calcined (80-85 %) material from bottom cyclone is fed into rotary Kiln. The Kiln is rotated by DC motor through a pinion and girth gear and is supported by three pair of supporting rollers.

Coal is fired from one end of Kiln through a coal burner and from the other end, calcined raw mix is taken. The raw mix undergoes various reactions in the Kiln and is converted into clinker at a temperature of 1300 – 1400 °C in the burning zone of the kiln. The hot clinker falls into a reciprocating grate cooler where it is cooled to around 100 °C by cooling air supplied by number of cooling fans. The cooled clinker from the cooler is ground in Cement Mills. 3-5 % gypsum is also added along with the clinker to control the setting time of the cement. Cement Mills are of Ball mill type in which grinding media of various sizes are filled upto 24-28 % of Mill volume.

The ground cement is stored in Cement silos and is packed into bags by using packing machines at packing plant.

Unit wise operation of cement production is given below :

3.5.2 UNIT WISE OPERATIONS

Crusher
Raw mill
Blending Silo
Pre heater, Kiln, Cooler
Coal Mill
Cement Mill
Coal Handling Unit

PCIL is utilizing VRM for grinding clinker and slag. The ground slag and the flyash is taken to the leading unit where it is blended with OPC in the defined ratio to produce PSC and PPC respectively.

Cement from cement mill passes through a closed circuit pattern and reaches storage silos.

PORTLAND POZZOLANA CEMENT [PPC]

Flyash received is unloaded into a hopper and through a bucket elevator it is unloaded into the flyash silo. From silo, it is send to blender after grinding it with gypsum in VRM/Cement mill. PPC is packed in 50 kg bags in rotary packer and loaded into trucks.

PORTLAND SLAG CEMENT [PSC]

Granulated blast furnace slag received from steel industry will be loaded through truck loader and stored in slag storage yard. Slag from storage yard is extracted, screened and transported to slag hopper.

Clinker from clinker storage yard is extracted conveyed through belt conveyor to clinker storage hopper. Similarly gypsum is stored in gypsum hopper. All the hoppers slag, clinker and gypsum are provided with electronic weigh feeder through which material is fed to vertical roller mill.

Granulated blast furnace wet slag from storage hopper is fed to vertical roller mill, where the material is dried with hot gases drawn from the clinker cooler at 350^{0}C and ground material (3000 cm^2/gm) is separated OPC in separator and collected bag house is transported and stored in separate Multi compartment silo.

Ground granulated blast furnace slag (4000 cm^2/gm) and ordinary Portland Cement from storage silo are extracted in required proportion (Approx. 50% each) through electronic weigh feeders provided and blended thoroughly to produce Portland Slag Cement. Portland Slag Cement is packed in 50 kg bags in rotary packer and loaded in trucks.

3.6 ENVIRONMENTAL SCENARIO OF CEMENT PLANT COMPLEX

Cement manufacturing process involves handling and processing of raw material and finished product in fine form. PCIL has invested about Rs 21.95 Crores for the installation of pollution control systems in Unit –1 and Unit –2. The major pollution sources from the cement plant are kiln flue gas, cooler gas, cement mills and coal mills.

Unlike other process industries, in cement plants pollution control systems will be considered as process Units. Any loss of raw material or finished product is a direct loss of revenue. Hence proper care has been taken at PCIL to maintain the process emissions far less than 50 mg/Nm^3 to minimize the material loss into the atmosphere.

- All the pollution control systems (PC) have been designed for a maximum outlet dust concentration of 75-100 mg/Nm^3 against the consent value of 150 mg/Nm^3.

- It has been found during the field studies (emissions conducted during the study period) that the outlet dust concentration at each pollution control system in the plant was found to vary between 45 and 50 mg/Nm^3 at full load conditions against the APPCB consent value of 115 mg/Nm^3.

PCIL has made all efforts to control the emissions from the plant and also have provided clean working environment inside the plant. The over all environmental quality in the cement plant has been discussed hereunder.

- The ambient air quality in the plant has been found to be well within the NAAQ standards prescribed for Industrial and mixed zones. Air quality is regularly monitored at two places in the Plant & colony and the annual average SPM concentration was found to be 270-360 µg/m^3 at plant & 135-160 µg/m^3 at Colony for the year 2006.

- Baseline air quality measured within 10 km radius was found to be less than 150 µg/m^3 and which is well within the norms of NAAQ standards prescribed for rural and residential zones.

- Stack gas emissions from the plant have been maintained in between 45 mg/Nm^3 and 50 mg/Nm^3 which meets the APPCB standards of 115 mg/Nm^3 for particulate Matter (PM) emissions.

- A full-fledged sewage treatment plant is in operation at colony. The treated waste water is being used for green belt development inside and around the plant and colony.

- The industry has planted about 39315 trees so far in the plant since 1992 and also proposed to plant about 15000 saplings every year for the next five years in the plant. The survival rate of the plants was found to be about 70%.

As part of the environmental impact assessment study of the expansion scheme, an attempt has been made to assess the environmental scenario in the plant. Under this program the following parameters have been studied to know the performance of the pollution control systems, stack gas emission tests have been conducted in two units.

3.7 EMISSION TESTS

In order to take necessary management plan, PCIL had engaged a consultancy for regularly monitoring the stack gas emission from all the pollution control systems in the plant on monthly basis. During the EIA study period, emission tests have been conducted for all the major pollution control systems to know the performance of each pollution control system in two units.

Stack gas quality tests for dust concentrations have been conducted as per the test procedures recommended by the central pollution board and also EPA method –5. Isokinetic dust samples have been colleted by using stack-monitoring kit with suitable nozzles and other accessories.

Gaseous pollutants such as SO_2 and NO_x emission have been measured in the fuel firing systems such as kilns and DG sets. Gas

samples were collected from two kilns in the cement plants and two DG sets located in the DG set based plant and have been analyzed for SO_2 and NO_x in addition to the PM concentration. The summary of result have been discussed hereunder.

- The maximum PM concentrations at the outlet of the kiln ESP in two units were found to vary between 45 and 49 mg/ Nm^3.

- Generally kiln ESP will be subjected to tripping due to occasional rise of Carbon Monoxide content in the flue gas. However, PCIL has achieved not only reduction in number of trippings but also duration of tripping at Unit-1 ESP at Unit-II it is not envisaged as PCIL had installed Bag house. This has been achieved due to effective blending of raw material and maintaining better process conditions.

- Emissions from chimneys have been measured during the study period and were compared with the values reported during the last financial year. Summary of the data is given in the following tables. It was observed from the field data that the Particulate Matter concentration at the outlet of pollution control systems was found to be less than 50 mg/nm^3.

SUMMARY OF STACK EMMISSIONS DURING STUDY PERIOD

[mg/Nm³]

Stack Attached	**Kiln/Raw**	**Cooler**	**Coal Mill**	**Cement Mill**
	UNIT-I			
Particulate matter	39	36	41	44
Sulphur-Dioxide	Traces	---	---	---
Oxides-of-Nitrogen	523	---	---	---
	UNIT-II			
Particulate matter	41	40	38	42
Sulphur-Dioxide	Traces	---	---	---
Oxides-of-Nitrogen	584	---	---	---
	DG SET-I		**DG SET-II**	
Particulate matter	67		59	
Sulphur-Dioxide	228		258	
Oxides-of-Nitrogen	467		526	

CHAPTER - 4

OPTIMISATION AND UPGRADATION OF CEMENT PLANT UNIT – I & UNIT - II

4.0 OPTIMISATION AND UPGRADATION OF CEMENT PLANT UNIT – I & UNIT - II

PCIL is presently producing clinker of 0.85 MTPA with two units i.e Unit-I and Unit-II. Both the units are of dry process, precalciner based cement plants.

PCIL has carried out a detailed technical audit of the plant which has indicated that optimization and upgradation of the existing units will increase the clinker production from 0.85 to 1.45 MTPA. The following are the production details before and after upgradation.

PRODUCTION CAPACITIES (MTPA)

	BEFORE UPGRADATION	**AFTER UPGRADATION**
UNIT – I	0.425	0.725
UNIT – II	0.425	0.725
Cement production	**0.85**	**1.45**

4.1 OPTIMISATION AND UPGRADATION

Technical audit carriedout in the plant has revealed that the optimization of the operational hours i.e extension of operational hours of upstream and downstream equipment of kiln and cooler of Unit – I and Unit – II and upgradation of Kiln and cooler can give an additional output of 0.65 MTPA and 0.70 MTPA

The equipment specifications, actual loads on each equipment, gas flows draft conditions and load on various equipment has been collected to establish the baseline status of various process units.

An attempt has been made to identify the possible increase in gas flows and dust loads on various pollution control equipments due to enhancement of production capacity in plant. This has been envisaged to suggest the modification that is required for pollution control system to meet the required emission norms.

4.1.1 OPTIMIZATION

The operational hours of the upstream and downstream equipment of kiln and cooler of Unit – I and Unit – II will be extended to achieve the total production of 1.45 MTPA of clinker and 2.2 MTPA of cement. Details of the operational hours of various units before and after expansion are given in **Table – 4.1**.

4.1.2 UPGRADATION OF PROCESS UNITS

PCIL will takeup upgradation of kilns and coolers of Unit – I and Unit – II for achieving the Clinker production of 1.45 MTPA. Details of upgradation are given below

A UPGRADATION OF THE KILNS

PCIL will undertake the following upgradation in the Kiln – I and Kiln – II for increasing the clinker output.

- Optimization of fans speed.
- Replacement of Kiln inlet seal. This modification will reduce the false air infiltration which in turn result in increase in production rate.
- Fine tuning of Pre heater fan speed. This results in further reduction in fan speed which in turn results in lower gas velocities through the system and improve the heat transfer efficiency thereby increasing the production rate.
- Usage of high ash coal instead of imported coal. This results in less oxygen requirement into the system and facilitates to reduce the Pre heater fan speed .
- Run factor improvement of Kiln by way of preventive maintenance which results in smooth operation of Kiln which in turn results in improved production rate.
- Increasing the speed of the kiln

B UPGRADATION OF COOLER

PCIL will upgrade the coolers of Unit – I and Unit – II by providing additional grate area.

4.2 CAPACITY OF UNITS

The capacities and operational hours of the units after upgradation will be as follows :

TABLE – 4.1
CAPACITY OF UNITS AND OPERATIONAL HOURS

UNIT	BEFORE UPGRADATION			AFTER UPGRADATION		
	Capacity tph	Material handled tpd	Operational Hours	Capacity tph	Material handled tpd	Operational Hours
Crusher	500	3900	8	500	7000	14
Raw Mill – I	170	1530	9	170	2720	16
Raw Mill – II	130	1170	9	130	2080	16
Raw Mill – III	130	1170	9	130	2080	16
Kiln – I	1290	1915	24	2200	3455	24
Kiln – II	1290	1915	24	2200	3455	24
Cooler – I	1290	1290	24	2200	2200	24
Cooler – II	1290	1290	24	2200	2200	24
Coal Mill – I	30	240	8	30	360	12
Coal Mill – II	30	240	8	30	360	12
Cement Mill – I Ball Mill	50	900	16	50	1100	22
Cement Mill – II Ball Mill	50	900	16	70	1540	22
Cement Mill – III Ball Mill	70	1120	16	50	1100	22
Cement Mill – III VRM	125	2000	16	125	2750	22

4.3 INCREASE OF FLOWS

There will be no increase in flows (m^3/hr) of upstream and downstream equipment i.e Crusher, Raw mill, coal mill and Cement mills. There will be increase in flows of the Kiln and Cooler of Unit – I and Unit – II due to increase in feed.

The increase of flows of various units due to upgradation are given in **Table – 4.1**

UNIT WISE INCREASE OF FLOWS DUE TO UPGRADATION

SL. No	Location	M^3/HR	
		BEFORE UPGRADATION	AFTER UPGRADATION
1	Crusher	12000	12000
2	Raw Mill – I & Raw Mill – II & Kiln - I	270000	330000
3	Raw Mill – III & Kiln - II	270000	330000
4	Cooler – I	150000	180000
5	Cooler – II	150000	180000
6	Coal Mill – I	6000	6000
7	Coal Mill – II	6000	6000
8	Cement Mill – I Ball Mill	90000	90000
9	Cement Mill – II Ball Mill	110000	110000
10	Cement Mill – III Ball Mill	-	90000
11	Cement Mill – IV VRM	210000	210000

CHAPTER - 5

BASELINE ENVIRONMENT

5.0 BASELINE ENVIRONMENT

The baseline environment quality represents the background environmental scenario of various environmental components such as air, water, noise, land, and socio economic status of the study area. The sources of emission in the study area are the above industries, vehicular traffic, agricultural fields, unpaved roads and fuel burning.

5.1 MICRO METEOROLOGY OF THE STUDY AREA

5.1.1 Regional Meteorology

The tropical climate of the region is manifested in hot and humid summer, moderate monsoon and mild winter seasons. May is generally the hottest month in the year. The maximum temperature during the daytime was recorded as 42^{0}C and December the coldest with the temperature during the daytime falling down to about 34^{0}C. The night temperature in winter can be as low as 16^0 C. The period between March and November is very humid and sticky daytime. The months of December, January and February are considered to have pleasant climate.

5.1.2 Site Meteorology

An auto weather monitoring station has been installed on top of Mines office to record micro meteorological data on Wind Speed (kmph), Wind Direction, Ambient Temperature (^{0}C), Solar Isolation (m.volts) and Relative Humidity (%) on hourly basis.

The data collected on wind speed and wind direction was used for computation of wind percentage frequencies in all the sixteen directions for wind speed in the range of 1.0 -5.0, 5.1-10.0, 10.1-15.0 and > 15 kmph. Wind speed of 0.0-1.0 kmph was considered as calm condition.

Percentage frequencies of wind in all 16 directions have been computed from the recorded data of Summer season of 2006. During

the study period the wind roses were plotted at an interval for 8 hours (00-08hrs, 08-16 hrs and 16-24 hrs) and 24 hrs (00-24hrs). **Fig – 5.1** and **5.2** represents the wind pattern of the study period.

Wind Pattern during 00:00 - 08:00 hours

The predominant wind directions during these hours were from E to S sector accounting to about 61.67 % of the time with calm winds of less than 1.7 kmph for 3.69% of the time. Wind speed during this period was varying from 1.7 to 15 kmph and during some time more than 15 kmph.

Wind pattern during 08:00 - 16:00 hours

The predominant wind directions during these hours were from the NNE to S sector accounting to about 81.93% of the time with calm winds of less than 1.7 kmph for about 5.23% of the time. Wind speed during this period was varying from 1.7 to 15 kmph, occasionally beyond 15 kmph.

Wind pattern during 16:00 – 24:00 hours

The predominant wind directions during these hours were from E to S sector accounting to about 60.12% of the time with calm winds of less than 1.7 kmph for about 8.24% of the time. Wind speed during this period was varying from 1.7 to 15 kmph, and some of the time beyond 15 kmph.

Wind pattern during the season (Summer 2006)

The predominant wind directions during these hours were from E to S sector accounting to about 64.90% of the time with calm winds of less than 1.7 kmph for about 3.08% of the time. Wind speed during this period was mostly varying from 1.7 to 15 kmph, and occasionally beyond 15 kmph.

The summary of the wind pattern is given below:

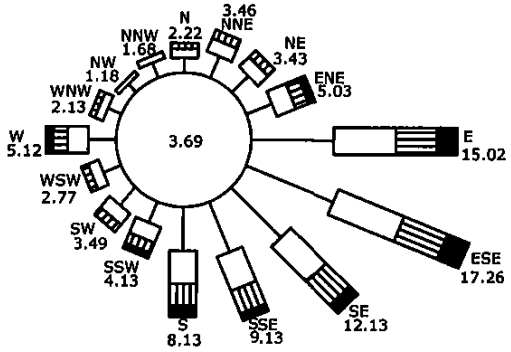
FIG - 5.1
WINDROSE DIAGRAM

PROJECT : PENNA CEMENT INDUSTRIES LTD,

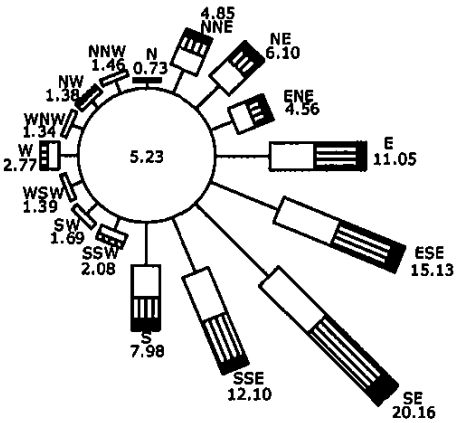
LOCATION : PLANT SITE .

PERIOD : SUMMER 2006

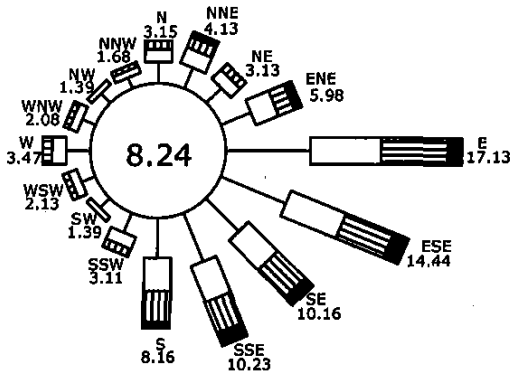
N



DURATION : 00 - 08 HRS.

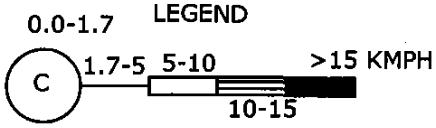


DURATION : 08 - 16 HRS.



DURATION : 16 - 24 HRS.

NOTE : All readings are in percentage occurance of wind



C = Calm Conditions in Percentage

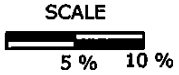
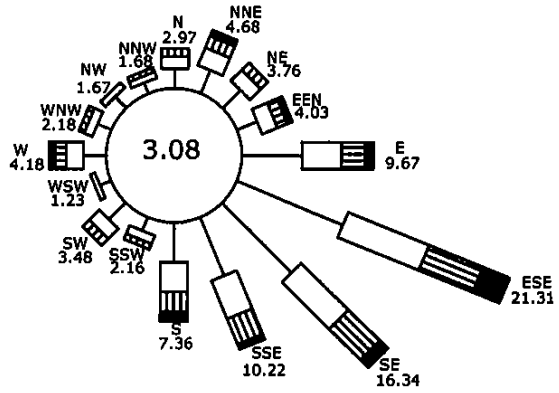


FIG - 5.2
WINDROSE DIAGRAM

PROJECT : PENNA CEMENT INDUSTRIES LTD.,

LOCATION : PLANT PERIOD : SUMMER 2006

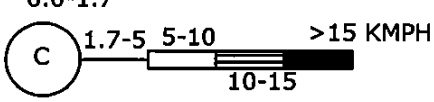
N



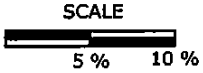
DURATION : 00 - 24 HRS.

NOTE : All readings are in percentage occurance of wind

LEGEND



C = Calm Conditions in Percentage



SUMMARY OF WIND PATTERN

Duration (Hrs)	Predominant Wind Direction	Wind Rose Enclosed as
00:00 – 08:00 hrs	E to S sector	**Fig-5.1 & 5.2**
08:00 – 16:00 hrs	NNE to S Sector	
16:00 – 24:00 hrs	E to S Sector	
00:00 – 24:00 hrs	E to S Sector	

5.2 AMBIENT AIR QUALITY

In order to identify the background air quality data and also to represent the interference from various local activities, screening techniques have been used for identification of air quality stations in the study area.

The cement plant and limestone mines of Ultra Tech Cement Ltd. are located at a distance of about 9 km in the NW direction

The air pollution-monitoring network was designed to know the complex environmental scenario that exists as of now which would serve as baseline information prevailing in the area.

5.2.1 Identification of Ambient air Quality Monitoring Stations:

Ambient air quality of the study area has been assessed through a network of 8 ambient air quality locations. **Fig –5.3** shows the locations of the air quality stations in the study area and plant area. **Table – 5.1** gives the details of ambient air quality locations:

TABLE-5.1
DETAILS OF AMBIENT AIR QUALITY MONITORING STATIONS

Station Codes	Location	Distance wrt to Plant [Km]	Direction wrt to Plant
A-1	Plant Site	-	-
A-2	Talaricheruvu	1.2	WNW
A-3	Urachintala	1.5	ESE
A-4	Sirigepalle	5.7	SE
A-5	Sajjaladinne	6.0	SW
A-6	Venkatareddi Palli	6.2	NW
A-7	Bandarlapalle	7.2	NNW
A-8	Abudullapuram	6.5	NE

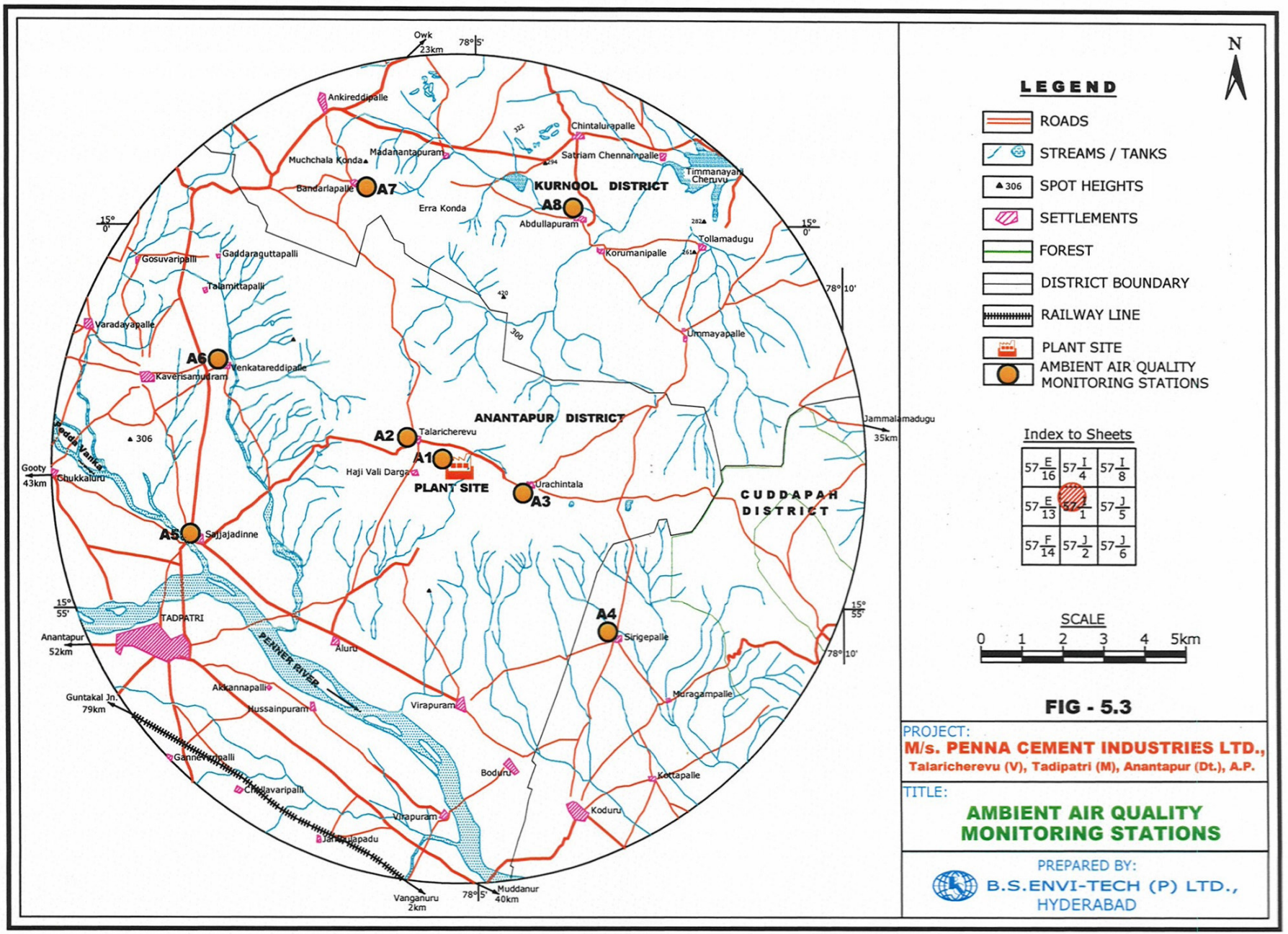


FIG - 5.3

PROJECT:
M/s. PENNA CEMENT INDUSTRIES LTD.,
Talaricherevu (V), Tadipatri (M), Anantapur (Dt.), A.P.

TITLE:
AMBIENT AIR QUALITY MONITORING STATIONS

PREPARED BY:
B.S.ENVI-TECH (P) LTD., HYDERABAD

5.2.2 ANALYSIS OF BASELINE CONCENTRATIONS

A CORE ZONE (PLANT SITE – A1)

Suspended Particulate Matter – SPM & Respirable Particulate Matter - RPM

Suspended particulate matter monitored at the Plant site showed 98th percentile value of 367.1µg/m^3. RPM showed 98th percentile value of 146.8 µg/m^3. The SPM and RPM concentration in the Plant site is found to be well within the norms of NAAQ prescribed for Industrial areas.

Sulphurdioxide - SO_2 and Oxides of Nitrogen - NOx

98th percentile value of Sulphur dioxide in the plant area from the monitored data was 16.8 µg/m^3. 98th percentile value of Nitrogen oxides is 17.6 µg/m^3. The SO_2 and NOx concentration in the Plant site is found to be well within the norms of NAAQ prescribed for Industrial areas.

Carbon Monoxide - CO

CO concentration was found to be less than 1 ppm.

Percentile values of ambient air quality in core zone are presented in **Annexure – 5 A.** The values of SPM, RPM, SO_2, NOx and CO monitored at all locations are well within the limit of AAQ standards.

B BUFFER ZONE (STATIONS A2 TO A8)

Suspended Particulate Matter - SPM

Study area: Suspended particulate matter monitored in the study area showed 98th percentile values in the range of 135.8 – 155.3 µg/m^3. The SPM concentration in the study area was found to be well within the norms of NAAQ prescribed for Rural and residential areas.

Respirable Particulate Matter - RPM

RPM values monitored at all locations showed 98th percentile values in the range of 50.0 – 60.2 µg/m³. Highest value of 60.9 µg/m³ was recorded at Sajjaladinne village. However, this value is well within the limits of NAAQ.

Sulphurdioxide - SO_2

98th percentile value of Sulphurdioxide in the study area from the monitored data was in the range of 12.8 – 15.0 µg/m³. Maximum value of sulphurdioxide of 15.2 µg/m³ obtained near the sampling station located at Bandralapalle village. The values of SO_2 monitored in the study area are well within the limits of NAAQ standards.

Oxides of Nitrogen - NOx

Ambient air quality status monitored for nitrogen oxides in the study area were in the range with 98th percentile values between 14.3 – 16.1 µg/m³. A maximum value of 16.4 µg/m³ was prevailing at the time of sampling at A3 (Urachintala village) sampling station.

Carbon Monoxide - CO

CO concentration at all the locations was found to be less than 1 ppm.

CO concentration at all the locations was found to be less than 1 ppm. Percentile values of ambient air quality in buffer zone are presented in **Annexure – 5 A.**

The values of SPM, RPM, SO_2, NOx and CO monitored at all locations are well within the limit of AAQ standards.

5.2.3 OVERALL BASELINE AMBIENT AIR QUALITY

Results of the ambient air quality at all the above locations were found to be well within the limits of National Ambient Air Quality (NAAQ) standards specified for Residential and industrial areas. Concentrations of SPM, RPM, SO_2 and NOx are mainly contributed due to vehicular traffic and local activities.

The 98th percentile values of SPM, RPM, SO_2 and NOx at all the locations in the study area during Summer Season 2006 are given below.

Summary of Ambient Air Quality (µg/m³)

CODE NO	Location Name	98TH PERCENTILE VALUES			
		SPM	RPM	SO_2	NOx
A-1	Plant Site	367.1	146.8	16.8	17.6
A-2	Talaricheruvu	149.0	52.6	14.3	15.2
A-3	Urichintala	155.3	54.5	15.0	16.1
A-4	Sirigepalle	148.4	57.2	14.3	15.7
A-5	Sajjaladinne	152.2	60.2	14.1	15.3
A-6	Venkatareddi Palli	144.3	56.7	14.7	15.5
A-7	Bandarlapalle	140.7	54.2	15.0	15.9
A-8	Abudullapuram	135.8	50.0	12.8	14.3

Note: CO values are observed less than 1 ppm during study period.

5.3 NOISE ENVIRONMENT

The acoustical environment varies dynamically in magnitude and character through out most communities. The noise level variation can be temporal, spectral and spatial. The residential noise level is that level below which the ambient noise does not seem to dropdown during the given interval of time and is generally characterized by unidentified sources. Ambient noise level is characterized by significant variations above a base or a residential noise level. The maximum impact of noise is felt on urban areas, which is mostly due to the commercial activities and vehicular movement during peak hours of the day.

Measured noise level displayed as a function of time provides a useful scheme for describing the acoustical climate of a community. Noise levels recorded at each station with a time interval of about 30 minutes are computed for equivalent noise levels. Equivalent noise level is a single number descriptor for describing time varying noise levels. The equivalent noise level is defined as mathematically

$$10\text{Log}1/T\ \Sigma\ (10^{Ln/10})$$

where L = sound pressure level a function of time dB (A)
T = Time interval of observations

Noise levels during the night time generally drop, therefore to compute Equivalent noise levels for the night time, noise levels are increased by 10 dB (A) as the night time high noise levels are judged more annoying compared to the day time.

Noise levels at a particular station are represented as Day-Night equivalent (Ldn). Day-Night equivalent is the single number index designed to rate environmental noise on daily/24 hourly basis. Mathematically Ldn is given by

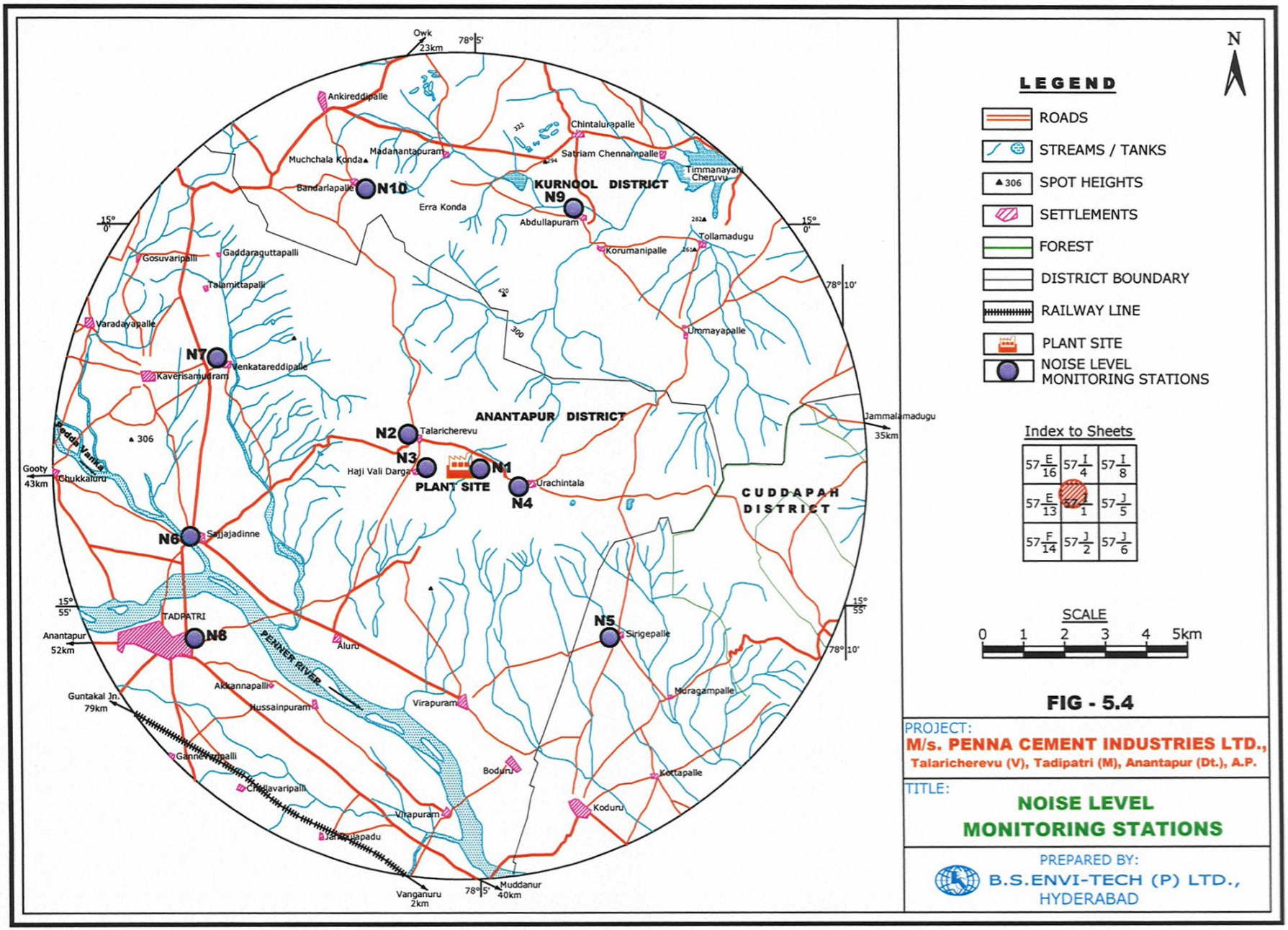
$$Ldn = 10 \log \{1/24\ (15 \text{ X } 10^{(Ld/10)} + 9 \text{ X } 10^{(Ln+10)/10)}\}$$

Where
Ld = A weighed equivalent for day time period (7 am to 10 pm)
Ln = A weighed equivalent for night time period (10 pm to 7 am)

5.3.1 NOISE LEVELS MONITORING

Noise levels were measured near residential areas and other settlements located within 10 km radius in and around the plant area.

The noise monitoring stations at study area are shown in **Fig- 5.4** and are given in the following **Table - 5.2**



N

LEGEND

- ROADS
- STREAMS / TANKS
- 306 SPOT HEIGHTS
- SETTLEMENTS
- FOREST
- DISTRICT BOUNDARY
- RAILWAY LINE
- PLANT SITE
- NOISE LEVEL MONITORING STATIONS

Index to Sheets

57 E/16	57 I/4	57 I/8
57 E/13	57 I/1	57 J/5
57 F/14	57 J/2	57 J/6

SCALE

0 1 2 3 4 5km

FIG - 5.4

PROJECT:
M/s. PENNA CEMENT INDUSTRIES LTD.,
Talaricherevu (V), Tadipatri (M), Anantapur (Dt.), A.P.

TITLE:
NOISE LEVEL MONITORING STATIONS

PREPARED BY:
B.S.ENVI-TECH (P) LTD., HYDERABAD

TABLE – 5.2
NOISE MONITORING STATIONS

Code	Station	Distance From The Plant (Km)	Direction wrt Plant Site
N 1	Plant Site	-	-
N 2	Talaricheruvu	1.2	WNW
N 3	Hajivali Darga	1.2	W
N 4	Urichintala	1.5	ESE
N 5	Sirigepalle	5.5	SE
N 6	Sajjaladinne	4.5	SW
N 7	Venkata reddi Palle	6.2	NW
N 8	Tadipatri	9.0	SW
N 9	Abudullapuram	6.5	NE
N 10	Bandarlapalle	7.2	NNW

5.3.2 AMBIENT NOISE LEVELS WITHIN 10 KM RADIUS

Noise levels recorded were found to be in the range of 50.8 – 68.2 dB (A) during day time and in the range of 45.4 – 62.3 dB (A) during night time.

NOISE LEVELS IN THE STUDY AREA (10 KM RADIUS)

Location	Noise Level dB (A)		
	Day Equivalent	Night Equivalent	Day-Night Equivalent
Plant Site	68.2	62.3	70.2
Talaricheruvu	55.4	50.1	57.8
Hajivali Darga	51.7	45.6	53.6
Urichintala	54.1	50.3	57.5
Sirigepalle	50.8	47.4	54.5
Sajjaladinne	53.6	49.5	56.8
Venkata reddi Palle	51.9	45.8	53.8
Tadipatri	68.5	60.7	69.5
Abdullapuram	52.6	48.9	56.1
Bandarlapalle	51.5	45.4	53.4

5.3.3 NOISE LEVELS IN CORE ZONE – PLANT AREA

Noise levels at the following locations were monitored to assess the spot noise level due to various operations of the plant.

SPOT NOISE LEVELS IN THE PLANT AREA

Location	Noise Level in DB(A)
Near main gate	64
Near Loading area	81
Near Packer area	77
Near crusher	86
Raw mill area	74
Cooler area	87

5.4 WATER ENVIRONMENT

Assessment of baseline data on Water environment includes

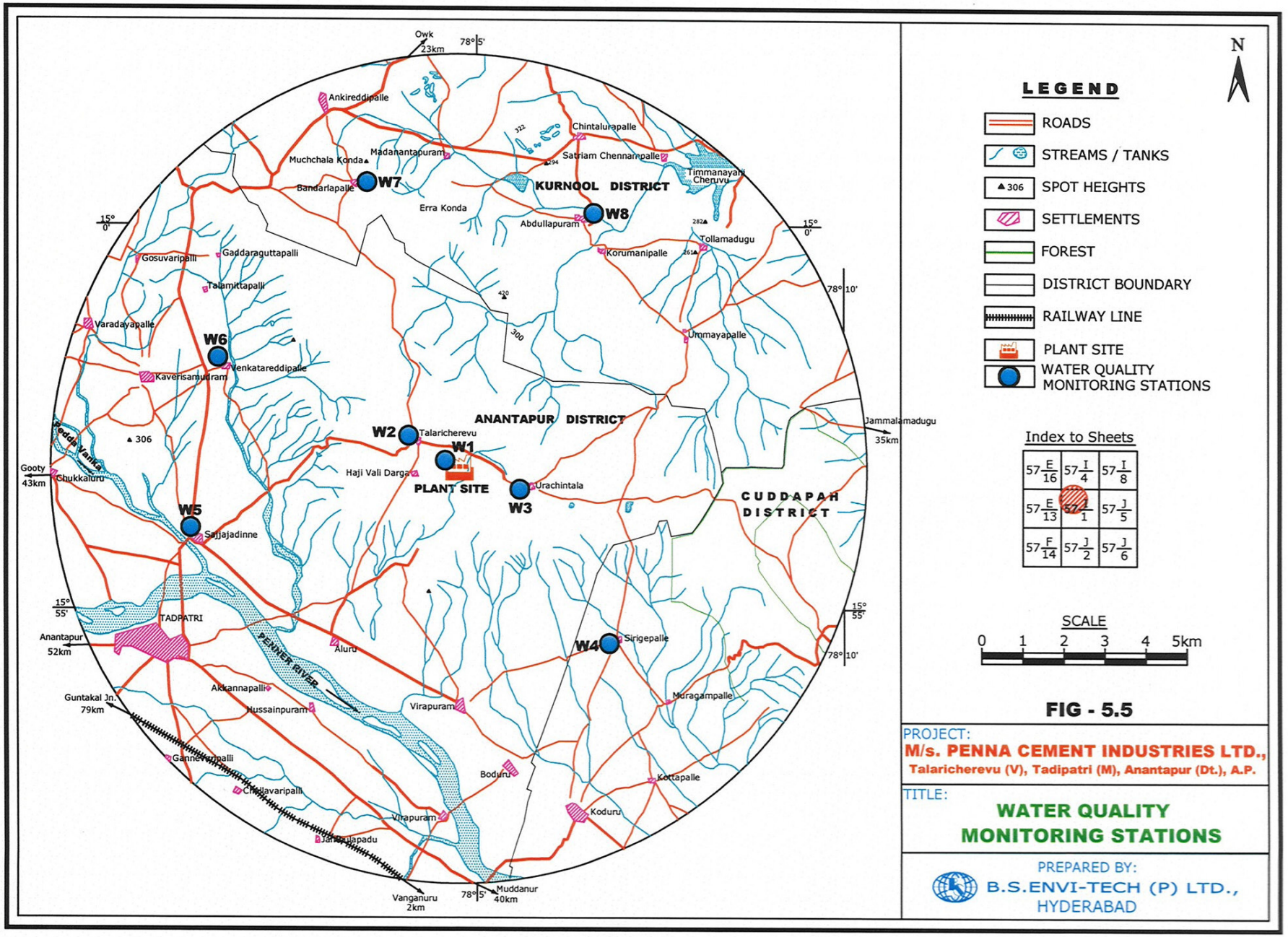
a) Identification of surface water sources
b) Identification of ground water sources
c) Collection of water samples
d) Analyzing water samples collected for physico-chemical and biological parameters

The details of the above are presented below

5.4.1 WATER QUALITY

Assessment of water quality in the study area includes the quality assessment of parameters as per the Indian standard IS 10500 (drinking water standard). About eight water samples have been collected from various locations of the study area; all samples were collected from bore wells of the surrounding villages.

The location of water sampling stations is shown in **Fig-5.5** and **Table-5.3.**



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LEGEND

- ROADS
- STREAMS / TANKS
- ▲306 SPOT HEIGHTS
- SETTLEMENTS
- FOREST
- DISTRICT BOUNDARY
- RAILWAY LINE
- PLANT SITE
- WATER QUALITY MONITORING STATIONS

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SCALE

0 1 2 3 4 5km

FIG - 5.5

PROJECT:
M/s. PENNA CEMENT INDUSTRIES LTD.,
Talaricherevu (V), Tadipatri (M), Anantapur (Dt.), A.P.

TITLE:
WATER QUALITY MONITORING STATIONS

PREPARED BY:
B.S.ENVI-TECH (P) LTD., HYDERABAD

TABLE - 5.3
WATER SAMPLING LOCATIONS

Station Code	Location	Source	Distance From Plant Site (Km)	Direction wrt Plant Site	Usage
W1	Plant Site	Borewell	-	-	
W2	Talaricheruvu	Borewell	1.2	WNW	Domestic
W3	Urichintala	Borewell	1.5	ESE	
W4	Sirigepalle	Borewell	5.7	SE	
W5	Sajjaladinne	Borewell	6.0	SW	
W6	Venkatareddi Palli	Borewell	6.2	NW	
W7	Bandarlapalle	Borewell	7.2	NNW	
W8	Abudullapuram	Borewell	6.5	NE	

Water sample collected showed compliance of all parameters with the drinking water standard of IS 10500.

WATER SAMPLES COLLECTED FROM STUDY AREA

- It is observed that the pH of the ground water samples is in the range of 7.02 – 7.81.
- Total dissolved solids in the samples were in the range between 310 – 840 mg/l.
- Total hardness of the groundwater samples was found to vary between 170 - 390 mg/l.
- Chlorides concentration was found to vary between 28 - 241 mg/l.
- Fluoride concentration was found to vary between 0.98 – 1.15 mg/l
- Sulphates concentration was found to vary between 21 - 115 mg/l
- Heavy metal concentrations in all the samples were found BDL.

Ground water samples collected from eight locations within the study area showed compliance of all parameters with the drinking water standard of IS 10500.

The water quality data of the study area is given in **Annexure – 5 B**.

5.5 LAND ENVIRONMENT

5.5.1 GEOLOGY

The study area is underlain by various geological formations from tertiaries and the quaternaries. A brief description of the various formations are as follows:

Pre-camrain Cuddapah and Kurnool formations and the recent alluvium. The carbonate rock and its facies variants, correlatable to the Narji lime stone formation of Kurnool group (Cuddapah super group) occur per force in the study and, Quartemay rocks consists of recent alluvium and soil sands, silts and clays.

The upper to lower palaeozoic of Kunools consists of peniam quartzite aukhales, narji limestone, banaganalpalli quartzite and conglomerates. Cuddapah super group consists of two groups one is chitravati group and second is papagani group. Chitravati group consists of tadipatri shales with basic intrusives and pulivendla quartzites. Papagni group consists of vempalli shales and dolomites and dolomitic lime stone with basic intrusives, gulcheruvu quartzites and conglomerates. The lower pre-camriam consists of dharwar super group with schists, phyllites, and amphibolites. The atchena group consists of penisular gneissc complex with granitic genisses and gneissic granites. Grey to dark grey limestone, and variegated (siliceous/ argillaceius) limestone with intercalations / pockets of shale.

The trend of the limestone wherever discernible, is NE-SW swerving gradually to NW-SE with northerly dips. Majority of the out crops, however, manifest sub-horizontal strata. Limestone beds confined to the hillock, between the altitudinal range of 38m, and 370m, are

essentially massive and/or thick bedded, fine grained, dark grey tending to the black, sub-horizontal and break with a conchoidal feature. Those on the flanks gradually acquire a lighter shade of grey, and medium bedded.

Limestone comprises ash grey, green, buff and chocolate coloured siliceous and / or pockets of calcareous shale.

5.5.2 HYDROGEOLOGY

The occurrence and behavior of ground water is controlled by topography climate, geology and structure of the area. The development of ground water in granite gneisses and schists of archaean to pre-cambrain in age which have been classified as hard rocks. Hard rocks and the alluvium and is being developed mostly by dug wells, dug-cum-bore wells, bore wells and in the alluvium through filter point wells. Hard rock area of the study area underlain by granites, gneisses and dharwarain schists occur in the weathered and fractured rocks under the water table and semiconfined to confined conditions deccan traps is poor and wells constructed in trap area are mostly used for domestic purposes.

The intrusions of fracturing and also due to weathering have developed secondary porosity, which has improved the chance of tapping better yields and more than often given rise to potential aquifers at depths.

Water levels in the arcena formations varies from less than one meter to more than 20.0 meters in the valley bottoms and topographic lows. This weathered zone has been tapped extensively by the dug-well and dug-cum bores. The depth of wells ranges from 3.0 to 250. m below the ground level and the depth to water vary from 1.50 to 23.0 m in granites and gneisses from 2.0 to 12.00 m in wells tapping dharwarian schists. The yield of dug well varies from 10.0 m^3/day to 250 m^3/day for pumping period of 4 to 6 hours daily. The bore wells have been drilled up to a maximum of 60 m depth and their yields varies from 1.0 m^3/hr to 23 m^3/hr.

Ground in alluvium varies from less than 10.0 m often reaching upto 15.0 m as seen near Tadipatri town. Shallow tube wells and filter point and infiltration wells have been constructed to tap the alluvium in addition to the dug wells. Their depths vary from 3.5 m to 12.0 m below ground level with yield varies from 8 to 135 m^3/h the depth of water table varies from 1.84 m to 14.0 m below ground level in general with general range around 3 m to 9.5 m.

Ground water levels in Cuddapah and Kurnool formations varies from 3.0 to 15.0 meters. In these areas depth of the dug wells varies from 4.5 to 16.00 m below ground level and depth to water vary from 3.0 to 15.0 m below ground level. The yield of dug well varies from 50.0 m^3/day to 250 m^3/day for pumping period of 4 to 6 hours daily. The bore wells have been drilled up to a maximum of 60m depth and their yields varies from 1.0 m^3/hr to 22.5 $m/^3$/hr for a period of 8 to 10 hours a day.

5.5.3 IRRIGATION

Ground water is the major source of irrigation in the study area. All the villages are provided with borewell/dugwells and tubewells to cater to the agricultural needs.

During the monsoon season substantial water flow can be seen in all the surface water bodies and also in the lean season, favourable ground water potential encourages the local farmers to go for mixed cropping pattern.

There are two cropping seasons namely Kharif from June to September and Rabi from November to March. Rabi crops cultivation is less in the area due to scarcity of water. Crops are mainly cultivated in the Kharif season due to rainfed water availability. The major crops grown under Kharif are groundnut, redgram, jowar and pulses.

Prevalence of double crops is noted in the flood plain of river Penneru and the command areas of borewells. The main crops which are included in this category are Paddy, groundnut and vegetables. The

extensive patches of double crop are seen predominantly along the flood plain of the Penneru River.

5.6 SOILS

The most dominant type of soil in the area is the Black-cotton soil which is present in thickness ranging from less than a meter to as much as 1.5m in the cultivated and agriculture lands. Thinner patches of soil are present in the open scrub covered wastelands where either sheet rock or stony of crops is absent.

5.6.1 SOIL QUALITY

Six soil samples were collected around the study area for assessing the quality. The location of the sampling stations is shown in **Fig - 5.6** and are given in **Table - 5.4.**

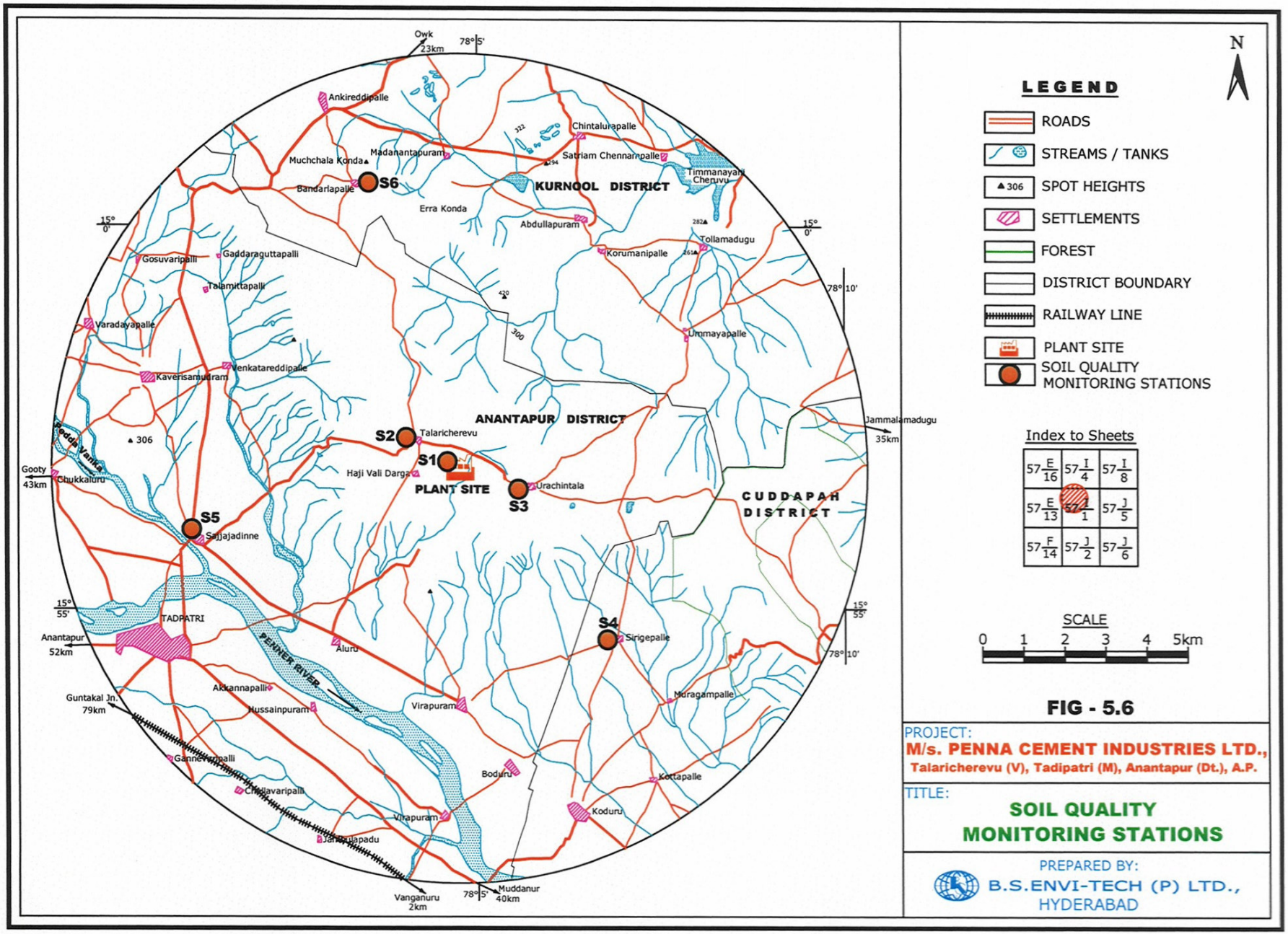
TABLE-5.4
SOIL SAMPLING STATIONS

STATION CODE	STATION	DISTANCE FROM THE PLANT (KM)	DIRECTION WRT PLANT SITE
S1	Plant site	-	-
S2	Talaricheruvu	NE	1.2
S3	Urichintala	SE	2.0
S4	Sirigepalle	SE	7.0
S5	Sajjaladinne	SW	6.0
S6	Bandarlapalle	NNW	7.2

The following are the highlights of soil quality in the study area:

Study area – Buffer Zone

- pH of the all soil samples was found to be 7.65 – 8.41.
- Organic content of the soil samples was found to be slightly good exhibiting average fertility
- Soils in the area were found to be Sandy Clay in texture with sand percentage in the range between 40-63 %, silt between 15-28% and Clay 20-32 %.



LEGEND

- ROADS
- STREAMS / TANKS
- SPOT HEIGHTS
- SETTLEMENTS
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- DISTRICT BOUNDARY
- RAILWAY LINE
- PLANT SITE
- SOIL QUALITY MONITORING STATIONS

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SCALE

0 1 2 3 4 5km

FIG - 5.6

PROJECT:
M/s. PENNA CEMENT INDUSTRIES LTD.,
Talaricherevu (V), Tadipatri (M), Anantapur (Dt.), A.P.

TITLE:
SOIL QUALITY MONITORING STATIONS

PREPARED BY:
B.S.ENVI-TECH (P) LTD., HYDERABAD

- Chloride content of the soil samples were in the range of 74-98 mg/kg

Plant area – Core Zone

- pH of the soil sample was found to be 8.84.
- Organic content of the soil samples was found to be medium exhibiting and less fertility
- Soil in the area was found to be Sandy Clay in texture with sand percentage in the range of 58 %, silt of 20 %, and Clay 22 %.
- Chloride content of the soil samples was about 82 mg/kg.

Results of soil sampling analysis are given in **Annexure – 5 C.**

5.7 FLORA AND FAUNA

5.7.1 FORESTS

Reserve forests in the study area are categorised as scrub forests. Dhodiyam RF (scrub) and Dobbudapalle RF (scrub) covers an area of 2326.3 ha, which is 3.29% of the total study area. These forests are highly degraded due to dryness and natural causes. These forests consist of mainly stunted tree or bushes/shrubs which belong to xerophytes and hardy species dominating.

The period of monsoon is very short lived in this area, which has a significant bearing apart from other biotic pressures, on the floristic composition of the forests. These are open forests in which thorny and usually hard wood species predominate. The trees have short bores and low branching crowns. There is usually a mixture of relatively few species. The vegetation is mostly spiny and often with xerophytic character, extending down to low shrub growth.

5.7.2 FLORA

The study area does not habitat any thick vegetal cover. There is usually a thin grass growth which may appear during the short rainy season in most of the study area, but more or less the soil is barren and devoid of any grass growth.

There are no forest species existing with in a 10 km radius of the plant site. The study area consists of barren hills scarcely covered by scrubs and shrubs. The common trees present in this area are palmira (T. Belliririca), and palms (A.Catechu). The common tree species prevalent in this area are prosopis and sectra. There are no natural trees present in this area. The common species are scrubs present in this area are zizyphusxylotyra, Adatodavasaka, carisa species, bamboo and randia Dumatorum. The common species of grasses present in this area are fimbristylis-ovata, aristida-funiculata, pennisetun and heteropogm.

5.7.3 FAUNA

The area hosts foxes, jackals, rabbits and other domestic animals. There are no endangered species in this area. Domesticated animals of the area includes: cattle, buffaloes, goats, cats, dogs etc. Cows and ducks are also common. The area is also well represented with various species of water birds such as Ardeols (herons), Ixobrachus etc. No endangered faunal species are found in the area.

5.8 SOCIO ECONOMIC ENVIRONMENT

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

The information on socio-economic aspects has been compiled from various secondary sources including various government and semi-government offices. Baseline information was collected from selected villages and the detailed scenario was collected from taluk and other governmental bodies. A brief summary of the same is given below.

The study area comprises 18 revenue villages with total population of 108416. The salient observations obtained as a result of the study are discussed hereunder.

- The study area consists of 108416 populations with a sex ratio of male female ratio is about 1000:967. The total population of under age 6 years is about 14785.

- The average family size of 5 persons per house hold. However the major villages are thickly populated.

- Percentage of SC and ST population in the study area is about 38.6 % and 9.2 % of the total population respectively. Details of the demographic profile of the study area are given in **Annexure-5 D.**

- The average literacy rate in the study area is observed to be satisfactorily when compared to the other parts of the area which is about 53.22 percent.

- Male literate population of study area is relatively high than the female population. Only 35445 [32.69%] males are literate where as the female literacy population is 22257 [20.53%]. Literacy level of the study area is given in **Annexure 5 E.**

- About 41.3 % of the total population is engaged in working category with main working population 40628 and marginal working population 4830.

- Percentage of non working category in study area is 58.7%. Details of the occupational structure of the study area is given in **Annexure-5 F**

- Distribution of worker based on their working category is given in **Annexure-5 G.**

- The major crops are Paddy, groundnut, red gram, jowar, pulses and vegetables. The main source of water for this activity is through canals/tanks/rivers.

- Most of the villages are electrified.

- The social activities such as literacy camps, family planning and eye camps have been organized both by the local government bodies and industries in association with voluntary agencies.

- Telephone and Telegraph facilities are available.

- Medical facilities are available at all mandal head quarters and regional medical center at Tadipatri.

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

CHAPTER - 6

PREDICTION AND IMPACTS

6.0 PREDICTION OF IMPACTS

Prediction of impacts is the most important component in the Environmental Impact Assessment studies. Several scientific techniques and methodologies are available to predict impacts of developmental activities on physical, ecological and socio-economic environments. Such predictions are superimposed over the baseline (pre-project) status of environmental quality to derive the ultimate (post-project) scenario of environmental conditions. The prediction of impacts helps to minimize the adverse impacts on environmental quality during pre and post project execution.

The proposed increase in capacity of clinker and cement production has been envisaged by upgrading kiln and coolers and extension of operational hours other equipment of Unit – I and Unit – II. The emissions from the plant are :

a. Due to the increase in emissions from raw mill/Kilns and coolers
b. Due to extension of operational hours of crusher, coal mills and cement mills .

An attempt has been made to predict the incremental rise of various ground level concentrations above the baseline status in respect of air pollution. The mathematical models used for predictions in the present study is an EPA approved ISCST3 model which is based on steady state Gaussian plume dispersion model designed for point sources and area sources for air quality.

The predicted ground level concentrations computed using EPA approved ISCST3 model and plotted as isopleths using the **SURFER – 7** package of Golden Software.

In case of water, land, biological and socio-economic environments, the predictions have been made based on available scientific knowledge and judgements.

In the earlier Chapters, various process and pollution sources were identified. In this chapter, an attempt has been made to predict the

incremental rise of ground level concentrations above the base line status due to the emissions from the proposed expansion of the cement production capacity.

6.1 AIR ENVIRONMENT

The major emissions are due to increase in gas volumes and dust loads from crusher, raw mill/kilns, coolers section, coal mills and Cement mills. Due to increase in production, emission load of various pollutants will increase as given below.

- *Increase in dust emissions from crusher, raw mill/kiln, cooler stacks, coal mills and cement mills.*
- *Increase in SO_2 emission from raw mill/kiln due to firing of additional coal in kiln (about 80% of Sulphur will be absorbed by clinker)*
- *Increase in NOx emissions from kiln due to more gas volumes handled.*

6.1.1 EMSSIONS FROM CEMENT PLANT

The increase in emission load of Particulate Matter (PM), SO_2 and NO_X concentrations due to upgradation and optimization are presented below in **Table – 6.1**

The details of dust emissions from various major units of the cement plant after expansion are detailed in **Table – 6.2**

6.1.2 STACK HEIGHTS

The existing stack heights of all the units have been checked for compliance with the following Central Pollution Control Board formula due to increase in feed material at various units and fuel firing in the kilns

TABLE – 6.1

OVERALL INCREASE IN THE EMISSIONS FROM THE PLANT

S.No.	Stack Connected To	Present Emission Rate	Emission Rate After Expansion	Increase In Emissions
		Kg/day	Kg/day	Kg/day
Particulate Mater				
1	Crusher	33.09	57.88	24.79
2	Raw Mill – I & Raw Mill – II & Kiln - I	299.98	395.71	95.04
3	Raw Mill – III & Kiln - II	299.98	389.97	89.95
4	Cooler – I	412.12	499.93	82.08
5	Cooler – II	440.64	550.8	109.26
6	Coal Mill – I	16.58	24.88	7.86
7	Coal Mill – II	16.58	24.88	7.86
8	Cement Mill – I Ball Mill	119.23	163.29	44.06
9	Cement Mill – II Ball Mill	248.4	341.53	91.58
10	Cement Mill – III Ball Mill	248.4	341.53	91.58
11	Cement Mill – IV VRM	251.94	345.60	93.65
Sulphur Dioxide (SO_2)				
Raw Mill – I & Raw Mill – II & Kiln – I		257.47	409.12	151.2
Raw Mill – III & Kiln - II		257.47	409.12	151.2
Oxides Of Nitrogen (NOx)				
Raw Mill – I & Raw Mill – II & Kiln - I		217.78	371.52	153.74
Raw Mill – III & Kiln - II		217.78	371.52	153.74

TABLE – 6.2

EMISSION DETAILS

NO	SOURCE	STACK HT	DIAMETER	VELOCITY	TEMP	EMISSION, gm/sec		
		m	m	m/sec	K	SPM	SO_2	NOx
1.	Crusher	30	0.65	8.0	323	0.28	-	-
2	Raw Mill – I & Raw Mill – II & Kiln - I	74	2.60	12.0	393	1.10	1.75	4.30
3	Raw Mill – III & Kiln - II	30	1.90	8.5	443	0.95	1.75	4.30
4	Cooler – I	30	0.45	12.0	333	0.09	-	-
5	Cooler – II	36	1.75	14.0	373	0.51	-	-
6	Coal Mill – I	85	2.60	12.0	393	1.05	-	-
7	Coal Mill – II	30	1.90	14.0	473	1.26	-	-
8	Cement Mill – I Ball Mill	30	0.45	14.0	333	0.09	-	-
9	Cement Mill – II Ball Mill	36	1.1	12.5	373	0.58	-	-
10	Cement Mill – III Ball Mill	36	1.1	12.5	373	0.58	-	-
11	Cement Mill – IV VRM	30	1.9	12	353	0.84	-	-

Based on Particulate emission rate	Based on SO_2 emission rate
$H = 74 (Q)^{0.27}$	$H= 14 (Q)^{0.3}$
H_t=Theoretical height of proposed stack in mts. Q_s = Emission rate of Particulate Matter in T/hr.	H_t = Theoretical height of proposed stack in mts. Q_s = Emission rate of SO_2 kg/hr

The emissions resulting from the upgradation and optimization of unit – I and Unit – II have been considered

PCIL has provided stacks of 85 m height for both Unit – I and Unit – II kilns. The stack height requirement based on the SO_2 are estimated to be about 32 M and SPM are estimated to be about 25 m. However, existing stacks provided 5 m above the pre heater i.e 85 m are adequate.

All other stacks connected to non fuel firing systems in the cement plant and where the emission expected are only particulate matter, stack heights are proposed based on the CPCB formula specified for Particulate Matter. However where stack heights computed from the above formula are less than 30 m, in order to comply with APPCB norms, a minimum stack height of 30 m provided are adequate.

The flue gas quantity and emission rate from these stacks will be minimum.

6.1.3 METEOROLOGICAL DATA

The meteorological data recorded continuously during the month of May '06 on hourly basis on wind speed, wind direction and temperature has been processed to extract the 24 – hourly mean meteorological data as per the guidelines of IMD and MoEF for application of ISCST3 model. Stability classes computed for the mean hours is based on guidelines issued by CPCB on modeling. Mixing heights representative of the region have been taken from the available published literature. The meteorological data inputs as per the IMD guidelines are enclosed as **Annexure –6 A.**

6.1.4 APPLICATION OF ISCST3

ISCST3 Model with the following options has been employed to predict the ground level concentrations due to emissions from the increase of production.

1. Area being rural, rural dispersion parameters are considered.
2. Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources.
3. Cartesian receptor network has been considered.
4. Emission rates from the point sources and area sources were considered as constant during the entire period.
5. Consideration of settling velocity of the particles
6. The ground level concentrations computed were as is basis without any consideration of decay coefficient.
7. Calm winds recorded during the study period were also taken into consideration.
8. 24 hourly (for 24-hour mean meteorological data as per guidelines of IMD and MoEF) mean groundlevel concentrations were estimated for the Summer season '06 using the meteorological data of May 2006.
9. An option for creation of data file giving average groundlevel concentrations for the mean meteorological data of summer season has been used for post processing in **SURFER – 7** graphics package .

6.1.5 PREDICTED GROUND LEVEL CONCENTRATIONS

Ground level concentrations due to the increase in emissions from the proposed expansion scheme have been computed and presented hereunder. Based on the mean meteorological data collected for the study post monsoon period, the maximum ground well concentrations occur in the W-NNW sector. The concentrations presented hereunder represent the maximum values that could occur in the study area.

Suspended Particulate Matter

24-hourly average ground level concentrations of SPM computed for 24-hour mean meteorological data showed maximum value of 7.3 $\mu g/m^3$ of SPM at a distance of about 0.5 km from the source in the NW direction.

The concentrations are observed within a short distance from the source due to settling velocity of particulate matter and low temperature of the flue gas of the cement plant.

The distribution of concentration due to particulate emission sources of the proposed expansion of cement plant is plotted as isopleths and are shown in **Fig – 6.1.** From the figure, it can be observed that high concentrations are obtained near to the source. Beyond 5 km, the concentrations are found be insignificant. The high fifty 24-hourly average ground level concentrations of SPM are presented in **Annexure - 6 B**

Sulphur Dioxide And Oxides Of Nitrogen

24-hourly cumulative ground level concentrations of SO_2 and NOx computed for 24-hour mean meteorological data showed maximum values of less than 1.0 $\mu g/m^3$ of SO_2 and 1.6 $\mu g/m^3$ NOx at a distance of about 1.5 km from the source in the NW direction.

The distribution of cumulative ground level concentrations due to SO_2 and NOx emission from the kiln are plotted as isopleths and are shown in **Fig–6.2 and Fig – 6.3.** High fifty 24-hourly average ground level concentrations of SO_2 and NOx due to additional emissions from the kiln are presented in **Annexure – 6 C** and **6 D.**

6.1.6 OVERALL SCENARIO

Predicted maximum average ground level concentrations considering 24-hour mean meteorological data of summer season superimposed on the downwind baseline concentrations obtained during the study period to estimate the post project scenario. The Post Project Scenario

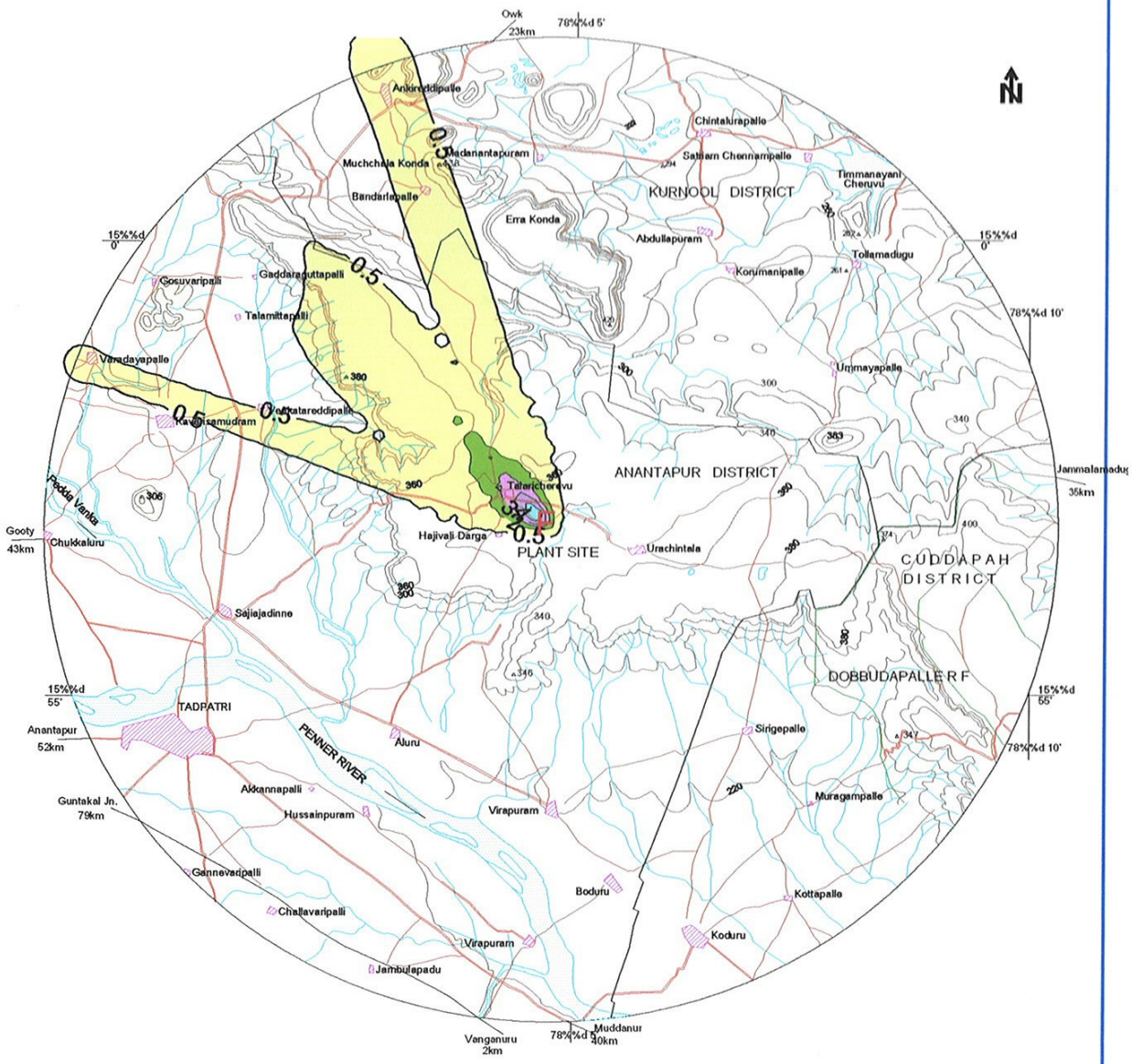


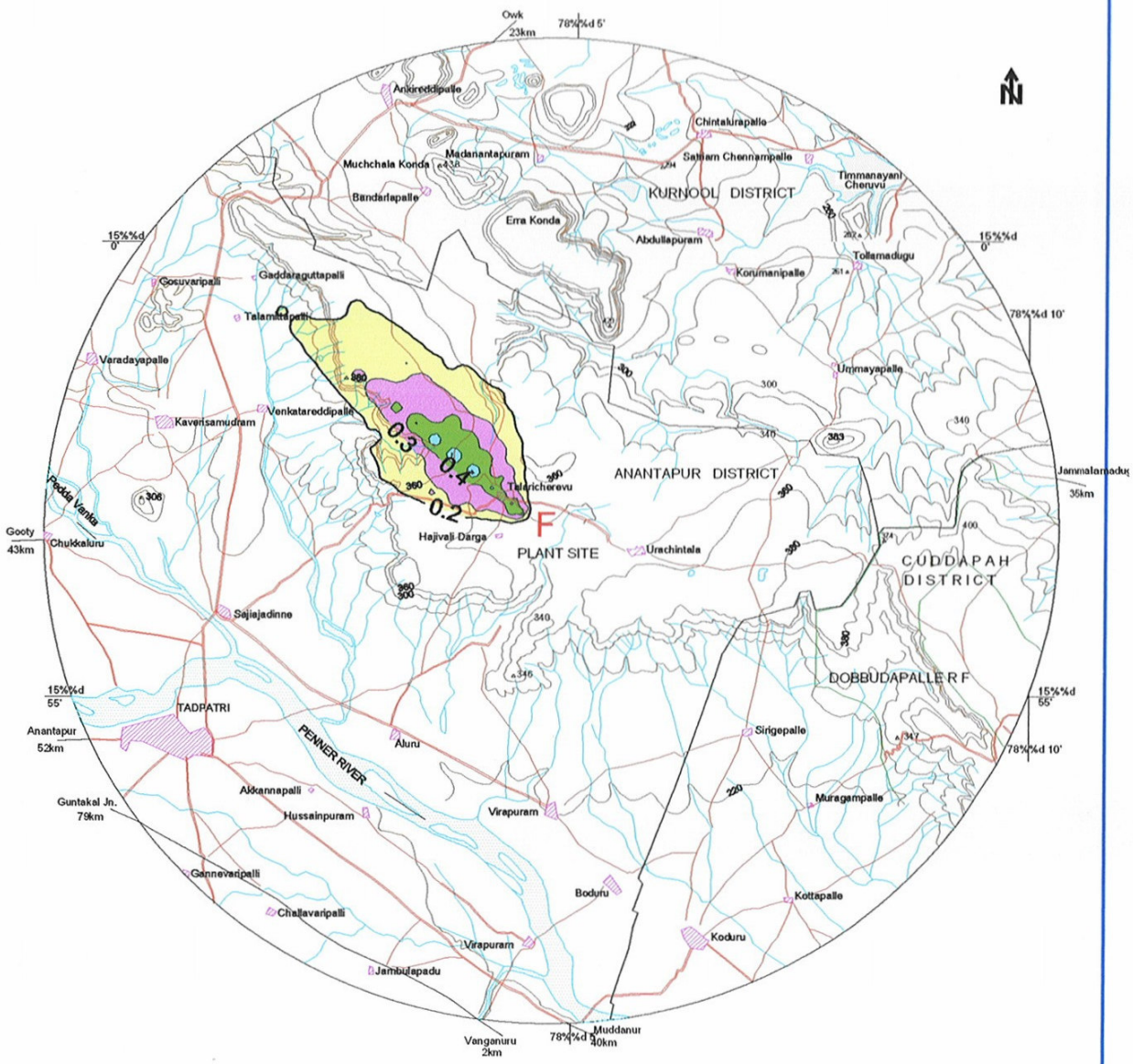
FIG - 6.1
PREDICTED GROUND LEVEL CONCENTRATIONS OF SPM DUE TO INCREASE OF PRODUCTION

SEASON : SUMMER '06

CLIENT : PENNA CEMENT INDUSTRIES LTD

PROJECT : REIA STUDY OF CEMENT PLANT

PREPARED BY
B.S. ENVI-TECH PVT. LTD., HYD.



ISOPLETH INTERVAL (ug/m3)

0.6 0.5 0.4 0.3 0.2

FIG - 6.2
PREDICTED GROUND LEVEL CONCENTRATIONS OF SO2 DUE TO INCREASE OF PRODUCTION

SEASON : SUMMER '06

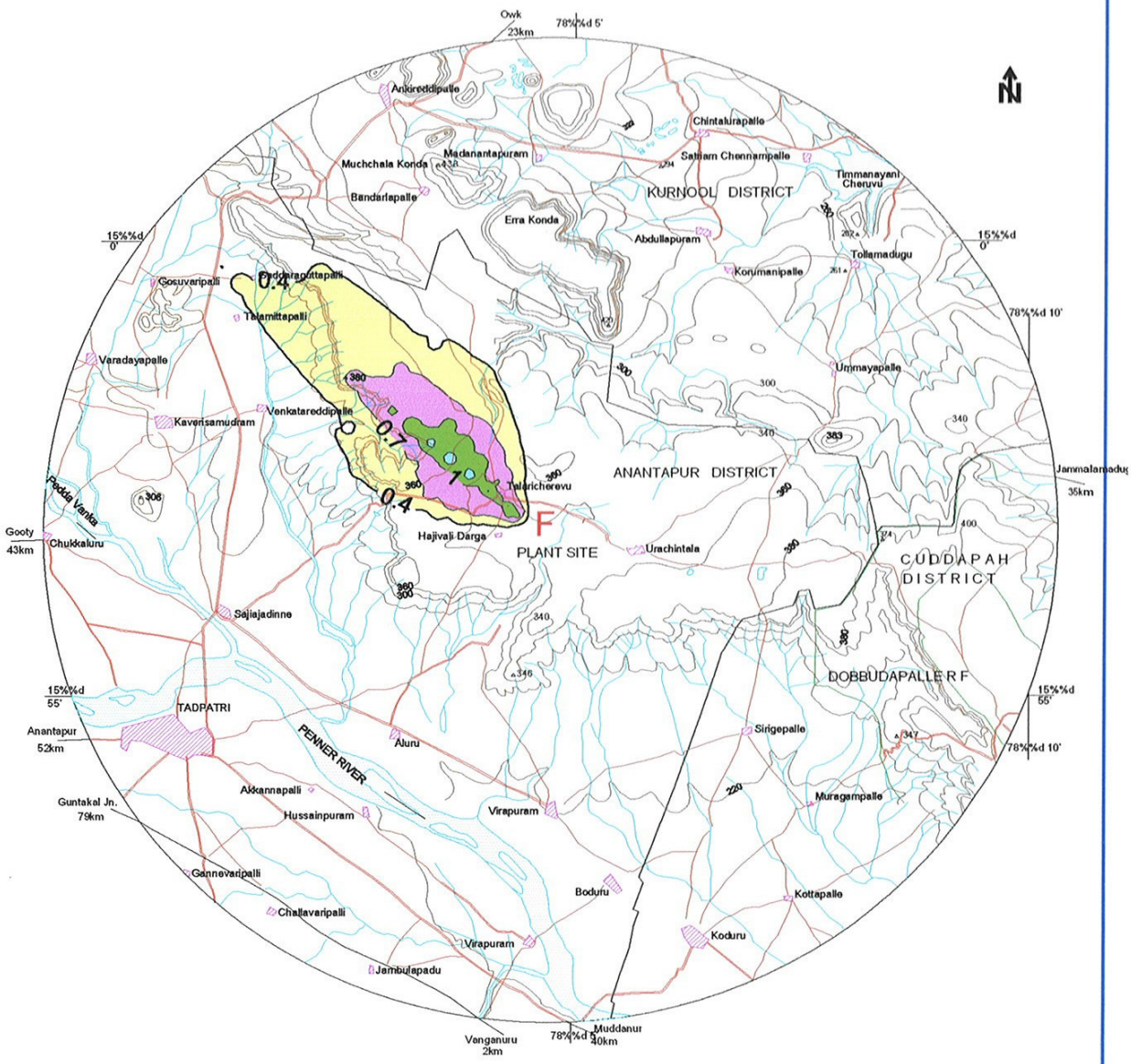
SCALE (M)

0 2000 4000

CLIENT : PENNA CEMENT INDUSTRIES LTD

PROJECT : REIA STUDY OF CEMENT PLANT

PREPARED BY
B.S. ENVI-TECH PVT. LTD., HYD.



ISOPLETH INTERVAL (ug/m3)

1.6	1.3	1	0.7	0.4

FIG - 6.3
PREDICTED GROUND LEVEL CONCENTRATIONS OF NOX DUE TO INCREASE OF PRODUCTION

SEASON : SUMMER '06

SCALE (M)

0 2000 4000

CLIENT : PENNA CEMENT INDUSTRIES LTD

PROJECT : REIA STUDY OF CEMENT PLANT

PREPARED BY
B.S. ENVI-TECH PVT. LTD., HYD.

with predicted cumulative groundlevel concentrations over the baseline is shown below.

Post Project Scenario (μg/m³)

24-Hourly Concentrations	**Suspended Particulate Matter (SPM)**	**Sulphur Dioxide (SO_2)**	**Oxides Of Nitrogen (NOx)**
Baseline Scenario, max	155.3	15.0	16.1
Predicted Groundlevel Concentration (Max)	7.3	<1	1.6
Overall Scenario (worst case)	**162.6 {200}**	**16.0 {80}**	**17.7 {80}**

NOTE: The values in parentheses is the CPCB limit for rural and residential areas.

6.2 NOISE ENVIRONMENT

Noise levels in the plant have been measured at various places within the plant to know the back ground noise levels. The major noise generating sources in the cement plant are cooler fans, compressor house and cement mill section. The noise levels at 1m from various noise generating sources were found to be less than 85 dB(A) and the noise levels out side the cement mill and raw mill rooms were found to be less than 75 d B(A). Noise levels have been measured at the plant boundary was found to be about 63 d B(A) and the same has been found to be less than 50 d B(A) in the colony, which is located at about 1.5 km from the main plant gate.

In the expansion scheme, no additional noise generating units will be installed in the plant and hence no appreciable change in the present noise levels in the plant has been envisaged.

6.3 WATER ENVIRONMENT

Water requirements of the cement plant are being met from the existing six borewells located within the plant site with an average yield of 40 m^3/hr.

Cement will be manufactured by dry process technology. In the entire process water is used only at very few stages in the process at Cement mill and for cooling. Cooling include the circulating cooling water for bearings and gear boxes, for gas conditioning towers and spray crushers, transfer point to control dust. The other areas of water consumption other than process is for domestic purposes in the plant and colony.

The water consumption in the existing plant is about 456 m^3/day. The following gives the breakup of water consumption at various units of the cement plant

WATER BALANCE

	M3/DAY		
Unit	Requirement	Loss	Effluent
Present consumption			
Industrial	160	160	-
Domestic – plant & Colony	280	55	225
Dust Suppression	16	16	-
Additional consumption			
For gas conditioning tower of unit – I	50	50	-
Total	506	281	225

It can be seen from the above table that the water consumption due to increase of production will increase by an amount of 50 m^3/day. No wastewater is generated either from the present or proposed water consumption in the cement plant. The only wastewater which is being handled is the domestic wastewater.

6.3.1 TREATMENT OF DOMESTIC WASTEWATER

Domestic wastewater is mainly sewage. A network of drains have been constructed to collect the effluent from various points of the plant and colony. The collected effluent through the network of drains is let into the sewage treatment plant.

Sewage treatment plant with an oxidation pond as per the recommendation of APPCB is in operation to handle the domestic wastewater of the cement plant and colony. The treated water after conformation with GSR 422 (E) onland discharge standards is being

used for greenbelt development. No additional dometic wastewater will be generated from the domestic use.

6.4 LAND ENVIRONMENT

The cement plant along with colony and greenbelt is located in an area of 74.4 Ha. Of the 74.4 ha, the colony is located in an area of 17 ha and the cement plant is located in an area of 14.16 ha. About 43.3 ha of the area is covered under greenbelt. No additional area for increase of production is required.

Therefore the overall impact on land environment will be minimum.

6.4.1 Solid Waste generation

The main solid waste generated from the cement plant is cement dust collected from various pollution control devices. This cement dust will be recycled to the process.

6.5 SOCIO ECONOMIC ENVIRONMENT

Socio Economic Status in the study area is found to be moderate with respect to livelihood, amenities etc. The management of PCIL has given preference to local people for recruitment in semi skilled and unskilled categories for plant operation. A total of about 200 persons are given direct employment in the cement plant. No additional manpower required.

PCIL has already constructed a full fledged township comprising of housing facilities for plant, mines and security personnel and supporting staff. The township is provided with all the amenities such as school, guest house, health center, hospital, shopping complex etc.

The overall impact on the socio economic environment will be beneficial.

CHAPTER - 7

ENVIRONMENTAL MANAGEMENT PLAN

7.0 ENVIRONMENTAL MANAGEMENT PLAN

Any developing project exerts certain adverse and beneficial impacts on immediate surroundings. PCIL has commenced the cement plant in the year 1994. PCIL strongly believes in the eco-friendly industrialization in the area. Since the inception of the cement plant, the management of PCIL had implemented Environmental Management Plan to minimize the adverse impacts on the surrounding areas.

All the process units are provided with pollution control equipment like bag filters and Electro Static Precipitators (ESPs). These dust abatement measures were installed at all the dust prone points and are working efficiently by proper maintenance and upkeep.

The present Environmental Management Plan of the cement plant details the environmental quality control measures to be taken in the post expansion phase. EMP also details the post project monitoring undertaken by the plant authorities in order to maintain environmental quality within the stipulated standard limits specified by APPCB and CPCB

7.1 ENVIRONMENTAL MANAGEMENT PLAN

Environmental management plan which is being implemented in the existing plant and which is proposed for implementation in the expansion phase to comply with APPCB and CPCB standards are detailed below :

7.1.1 AIR ENVIRONMENT

7.1.1.1 POLLUTION CONTROL SYSTEMS OF EXISTING PLANT

PCIL has integrated the Environmental management with the manufacturing process.

PCIL has invested about Rs 21.95 Crores for the installation of various pollution control systems in the cement plant. Electro Static

Precipitators has been installed in the plant for kiln stack of Unit – I and Bag house for Kiln of Unit – II to control the emissions and also to meet the emission norms. The emissions from all the chimneys are maintained well within the prescribed norms of APPCB.

PCIL is continuously monitoring the status of various pollution control systems and upgrading them from time to time.

PCIL has installed the following pollution control devices in critical areas of emission in the cement plant process line with an interlocking system.

To effectively control the emissions, the pollution control devices such as Electro static precipitator, dust collectors and bag filters with the interlocking system.

INTER LOCKING SYSTEM

PCIL has incorporated interlocking mechanism for all the pollution control equipment and process units. The details of interlocking system are given below :

INTERLOCKING SYSTEM

LOCATION	POLLUTION CONTROL EQUIPMENT	INTERLOCKING SYSTEM
Raw mill blending silo	Bag filter	Bag filter fan and purging air system are interlocked with raw mill
Kiln	Common bag house for raw mill and kiln exhaust gases	All devices, bag house and bag house fan interlocked with raw mill and kiln
Kiln feeding system	Bag filter	Bag filter fan and purging air system are interlocked with kiln
Clinker cooler	Electro Static precipitator	Cooler exhaust fan interlocked with cement mill
Coal Mill	Bag filter	Bag filter fan and purging air system are interlocked with coal mill
Cement mill	Electrostatic precipitator	ESP all devices and ESP fan interlocked with cement mill
Cement silo	Bag filter	Bag filter fan and purging air system are interlocked with cement mill

The following table gives the pollution control devices installed at Unit – I and Unit – II :

POLLUTION CONTROL DEVICES

S.NO.	LOCATION	POLLUTION CONTROL EQUIPMENT	
		UNIT – I	UNIT – II
1	Limestone crusher	Bag filter	Bag filter
2	Raw mill silo top - Blending silo	Bag filter	Bag filter
3	Kiln feed weigh feeder	Bag filter	Bag filter
4	Kiln and Raw mill	ESP	Bag House
5	Grate cooler exhaust	ESP	ESP
6	Clinker Stock pile	Bag filter	Bag filter
7	Clinker conveyor – Transfer point	Bag filter	Bag filter
8	Cement mills	ESP	ESP
9	Vertical Roller Mill	-	Bag filter
10	Cement Silo	Bag filter	Bag filter
11	Packing plant	Bag filter	Bag filter
12	Coal Mill	Bag filter	Bag filter
13	Coal Mill – dedusting	Bag filter	Bag filter

Apart from the above, PCIL has takeup the following air pollution control measures in the cement mill

a. Installation of Bag filter for the Vertical roller mill
b. Tall stack of 30 m height (3.6 m diameter) connected to Vertical roller mill
c. Installation of Bag filter to the slag storage silo
d. Installation of Bag filter to the blending plant
e. Installation of Bag filter to the Slag Cement storage silo.
f. Closed conveyor for transport of slag

PCIL is utilizing hot gases of cooler for drying of slag there by conserving the thermal/heat energy . These hot gases are routed to

atmosphere through VRM thereby utilizing the thermal energy of the flue gas which otherwise go as waste.

All the bagfilters are designed for an outlet concentration of less than 50 mg/Nm^3.

All the material handling systems are covered with aprons. Ventilation systems are provided with bag filters in the plant. About 42 bag filters have been provided at various points in the cement plant.

The dust collected from the above control equipment is recycled back to the process

In order to control SO_2 and NO_x emission of kiln, an automatic kiln control system is in place. SO_2 generated in the kiln process gets absorbed in the raw material (about 80 %). NO_x is controlled by reducing the quantity of emissions by lowering the excess air factor to a value which is compatible with oxidizing emissions of burning.

Proper clinker stock pile with sufficient storage capacity has been provided to minimize the dust loss in to the atmosphere. All the stock piles are covered for minimizing dust losses in the atmosphere.

Sprinkling of water on the haulage roads and raw material handling areas is undertaken to minimize the fugitive dust emissions.

All the stack heights are designed keeping in view of the following features.

- Minimum stack height of 30m as per APPCB recommendations
- Stack heights are determined based on the SPM and SO_2 emission rates suggested by CPCB and a proper stack will be installed.
- In order to exhaust the kiln emission, a stack of 63 m height is found adequate as per CPCB norms. However, as per the recommendations of APPCB, a tall stack of 85 m would be installed.

All the approach road will be BT topped as per the stipulated conditions of the APPCB.

UPGRADATION OF POLLUTION CONTROL EQUIPMENT

During the field studies, the dust emissions from various pollution control equipment were found much less than the designed emission levels. The increase of clinker production will result in increase of pollution load and gas flows. The following table shows the present and proposed gas flows vis-a-vis the design flows of the pollution control equipment :

POLLUTION CONTROL EQUIPMENT

		GAS FLOWS, M^3/HR			REMARK
	PC	**BEFORE UPGRADATION**	**AFTER UPGRADATION**	**DESIGN FLOW**	
1	Crusher	12000	12000	15000	
2	Raw Mill – I & Raw Mill – II & Kiln - I	270000	330000	350000	
3	Raw Mill – III & Kiln - II	270000	330000	350000	
4	Cooler – I	150000	180000	210000	
5	Cooler – II	150000	180000	210000	
6	Coal Mill – I	6000	6000	8000	Flow after upgradation are well within the design flow
7	Coal Mill – II	6000	6000	8000	
8	Cement Mill – I Ball Mill	90000	90000	100000	
9	Cement Mill – II Ball Mill	110000	110000	130000	
10	**Cement Mill – III Ball Mill**	-	90000	100000	
11	**Cement Mill – IV VRM**	210000	210000	230000	

It can be seen from the above table the gas flows after upgradation are well within the design flows of the pollution control equipment. Hence

all the pollution control equipment are adequate to handle the increased gas flows.

C FUGITIVE DUST CONTROL

Fugitive dust is generated during raw material handling (unloading, conveying, transporting, stacking etc), vehicular movement, bagging and packing. Asphalting or concreting of the work area will be done by PCIL to control fugitive dust emissions. Unloading of material will be carried out with great care by avoiding dropping of material from height, wetting the material by sprinkling water while unloading.

For control of fugitive dust, water spray arrangement is provided to spray water all round the coal stock piles to suppress the dust and to wet the coal while compacting to minimize the dust nuisance. Adequate ventilation and dust suppression systems will be implemented in the coal conveyer system.

7.2 NOISE POLLUTION CONTROL MEASURES

The noise generating sources are enclosed in the existing cement plant, wherever feasible. Plant machinery like cement mill, raw mill, ID fan, compressors are the major sources of noise pollution. The following measures have been implemented for control of noise pollution:

- Encasement of noise generating equipment wherever feasible.
- A thick greenbelt all around the cement plant site to act as noise attenuator in an area of 43.3 Ha.
- In addition, personnel working near high noise level generating sources are provided with ear muffs.
- Effective preventive maintenance and vibration measurement of all rotating equipment are helping in the improvement of plant life and also noise reduction.
- Implementation of source control measures and occupational safety measures

7.3 WATER ENVIRONMENT

The water consumption of the existing cement plant including colony is about 456 m^3/day. Due to implementation of the expansion scheme, an additional of 50 m^3/day will be required.

The total water consumption of the plant after expansion will be 506 m^3/day.

Due to adoption of dry process technology, water consumption in the cement plant will be less.

In the entire process water is used only at very few stages in the process at Cement mill and for cooling. Cooling includes the circulating cooling water for bearings and gear boxes and for gas conditioning tower of Unit – I. The other areas of water consumption other than process is for domestic purposes in the plant and colony.

7.3.1 WASTEWATER GENERATION AND DISPOSAL

Of the total water consumption of about 505 m^3/day in the plant and colony, wastewater generation is estimated to be about 225 m^3/day which is mainly from domestic use.

Domestic Wastewater from Plant and Colony

About 280 m^3/day water is being supplied to the colony. PCIL is treating domestic wastewater (225 m^3/day) in a full-fledged sewage treatment plant (STP). Flow diagram of the STP is shown in **Fig – 7.1.**

7.3.2 RAIN WATER HARVESTING & STORM WATER MANAGEMENT

PCIL will design the storm network to collect the rainwater from the plant area. The collected rainwater will be diverted to the proposed rainwater harvesting pits for recharging the ground water.

PCIL has estimated the quantity of rain water which can be harvested. The following are the details of estimate :

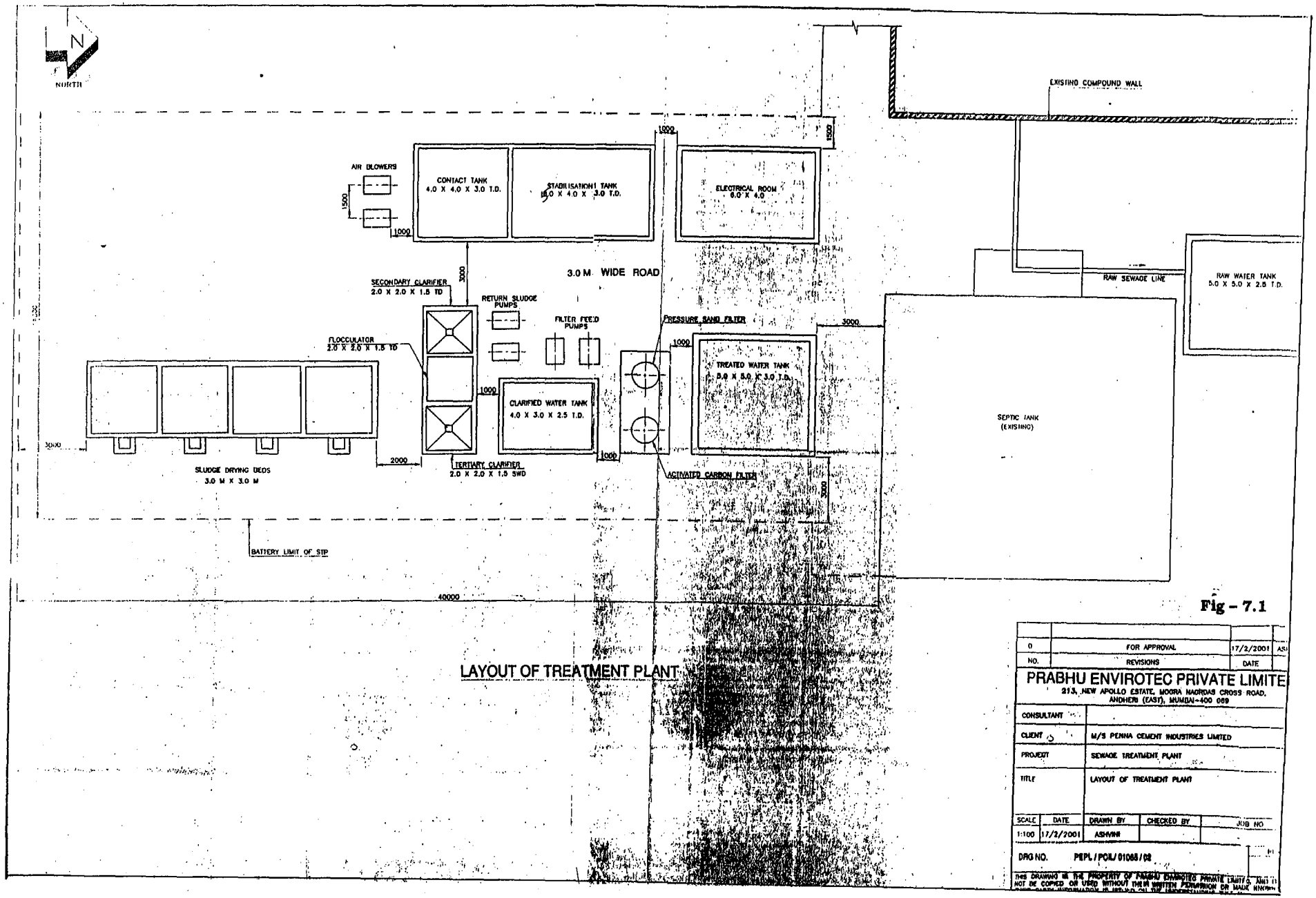


Fig – 7.1

LAYOUT OF TREATMENT PLANT

NO.	REVISIONS	DATE	
0	FOR APPROVAL	17/2/2001	ASI

PRABHU ENVIROTEC PRIVATE LIMITED
213, NEW APOLLO ESTATE, MOORA NAGRDAS CROSS ROAD,
ANDHERI (EAST), MUMBAI-400 069

CONSULTANT	
CLIENT	M/S PENNA CEMENT INDUSTRIES LIMITED
PROJECT	SEWAGE TREATMENT PLANT
TITLE	LAYOUT OF TREATMENT PLANT

SCALE	DATE	DRAWN BY	CHECKED BY	JOB NO
1:100	17/2/2001	ASHVINI		

DRG NO. PEPL/POIL/01068/02

Total plot area	: 74.4 ha
Unpaved area	: 59.4 ha
Paved area (including roof tops)	: 15 ha
Annual rainfall of the area	: 600 mm (0.6 m)
Runoff coefficient for unpaved area	: 0.80
Runoff coefficient for paved area	: 0.90
Runoff from Unpaved area	: 285120 m^3/year
Runoff from paved area	: 81000 m^3/year
Total runoff	: 366120 m^3/year

PCIL has already provided the rainwater harvesting pits measures in the plant. The rain water collected from the above areas collected through a network of drains are routed to a common storm water drain which has an outlet into a rainwater harvesting pit located at the lower level of the plot floor in the southern direction of the plant.

7.4 LAND ENVIRONMENT

The cement plant along with colony is located in an area of 74.4 Ha.

No additional land will be acquired

SOLID WASTE GENERATION AND HANDLING

PCIL has implemented the following measures for solid waste management in cement plant and the same measures will be implemented after expansion of the cement plant.

The dust collected in the air pollution control equipment in the cement plant is recycled back to the process. Hence no solid waste which requires disposal is generated from the plant.

Refractory bricks is one of the solid waste generated from the kiln section. Due to wear and tear, PCIL is replacing the refractory bricks

once in a year. These bricks due to high recycling value are disposed to outside agencies.

Solid waste generated from colony and sewage treatment plant will be disposed after segregating the waste into bio-degradable and nondegradable. Bio degradable waste is subjected to composting and non degradable waste is land filled at identified areas.

HAZARDOUS WASTE MANAGEMENT RULES

PCIL is storing the hazardous waste in a designated area. This area is isolated from the other utility areas.

Spent Oil from the gear boxes and automobile batteries are disposed to the authorized vendors as per the Hazardous Wastes (Management and Handling) Amendment Rules, 2003.

7.5 GREEN BELT DEVELOPMENT & PLANTATION PROGRAM

PCIL has already developed greenbelt in a scientific manner around the plant boundary, roadside, office buildings and stretches of open land and at colony in an area of 43.3 ha. PCIL will takeup gap filling to increase the canopy of the green cover in the same 43.3 ha in future **Fig – 7.2** shows the greenbelt plan of PCIL.

The list of species proposed for greenbelt development in the additional areas acquired are given in **Annexure – 7 A**

PCIL has developed 5 m width greenbelt all along the approach roads as per the stipulated conditions of APPCB.

7.6 SOCIO ECONOMIC ACTIVITIES

Any industrial activity can show a significantly beneficial impacts such as, employment, communication, educational and other social benefits in the regional environment . The management of PCIL has proposed to give preference to local people for recruitment in semi skilled and unskilled categories. A total of about 20 persons would be

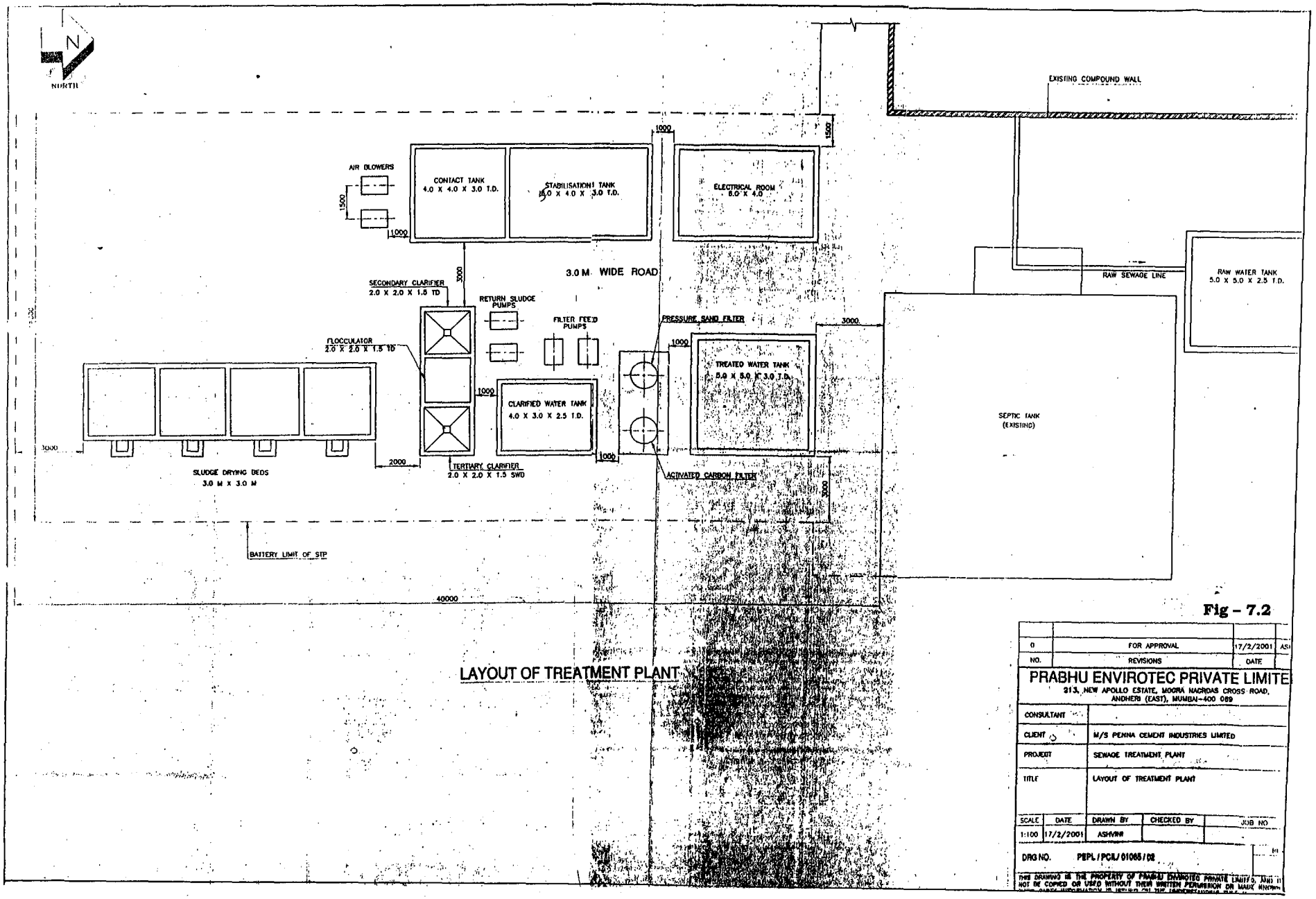


Fig – 7.2

LAYOUT OF TREATMENT PLANT

NO.	REVISIONS	DATE
0	FOR APPROVAL	17/2/2001

PRABHU ENVIROTEC PRIVATE LIMITED
213, NEW APOLLO ESTATE, MOORA NAGRDAS CROSS ROAD, ANDHERI (EAST), MUMBAI-400 069

CONSULTANT	
CLIENT	M/S PENNA CEMENT INDUSTRIES LIMITED
PROJECT	SEWAGE TREATMENT PLANT
TITLE	LAYOUT OF TREATMENT PLANT

SCALE	DATE	DRAWN BY	CHECKED BY	JOB NO
1:100	17/2/2001	ASHVINI		

DRG NO. PEPL/PCIL/01065/02

given employment opportunity during expansion of the cement plant for construction and installation of new units and an additional 20 persons will be recruited in the operational phase of the cement plant after expansion.

PCIL has provided a township consisting of 154 number of houses to accommodate the plant personnel

PCIL has undertaken the following social welfare programme for upliftment of the area.

The salient features of rural development programme are to provide :

- Health and hygiene through mobile medical clinic
- Agricultural extension
- Drinking water Project
- Educational Programme
- Woman and youth development activities
- Income generating schemes
- Sports and cultural activities

As a responsible corporate group, PCIL is supporting development of local infrastructural facilities like bus shelter, roads, school building with the active help of local NGO's and other voluntary organisation like rotary, lions etc

Some of the brief highlights of the activities undertaken by PCIL are given in **Annexure – 7A.**

7.7 OCCUPATIONAL SAFETY & HEALTH MANAGEMENT

PCIL has provided a dispensary with a full time doctor and supporting staff

Periodical health checkup are done for all the employees. Individual health cards of all the employees and their family members are maintained.

PCIL is participating in the State and central government immunization programs. Free medical camps in health center are conducted regularly.

First-aid materials are maintained in all the areas in the factory. One first- aid center in the mines 'e' stretcher, splints and torn quite is provided in the cement plant.

PCIL has also established a training department to give the need based training to the staff and workers on safety. Training programmes are conducted regularly as per training calendar based on training needs assessed by the concerned departments.

PCIL has prepared the trainer faculty list for imparting the training as and when required. Regular sponsorship of the employees for the external trainings/seminars/meetings is part of PCILs activity. The safety Policy has been made under Factory Act. The safety slogans/cartoons are displayed at strategic places in the factory premises.

7.8 ENVIRONMENTAL MONITORING

M/s. PCIL is implementing various productivity management programs in the plant to improve the work environment, effective house keeping and environmental quality. All the necessary steps were taken in the plant to meet standards prescribed the State Pollution Control Board and Central Pollution Control Board.

7.8.1 ENVIRONMENTAL MANAGEMENT CELL

In order to implement an effective environmental management plan in the plant, M/s. PCIL has constituted a full-fledged environmental cell headed by General Manager. Qualified environmental engineers are looking after the day-to-day environmental activities.

The environmental cell with well-established laboratory will regularly monitor all the pollution sources in the existing plant. Pollution

control systems have shown satisfactory performance with respect to the prescribed emission norms.

The organization setup of the Environmental cell is depicted in **Fig - 7.3**

Apart from the above, an Environmental Management Committee consisting of members like representatives from Gram Panchayat, professors, retired Govt. officials and senior citizens, has been formed to monitor various environmental activities in the plant. This is helping in promoting the environmental awareness in the public and also to a transparent environmental management system adopted by PCIL

7.8.2 ENVIRONMENTAL MONITORING

Monitoring of various environmental parameters (**Table - 7.1**) is carried out on a regular basis to ascertain the following:

- state of pollution within the plant and in its vicinity;
- generate data for predictive or corrective purpose in respect of pollution;
- examine the efficiency of Pollution Control Systems installed in the complex
- to assess and monitor environmental impacts

The following monitoring programme has been proposed to monitor various environmental components.

A METEOROLOGY

An automatic weather monitoring station has been installed within the plant premises for a proper measurement and record of meteorological parameters.

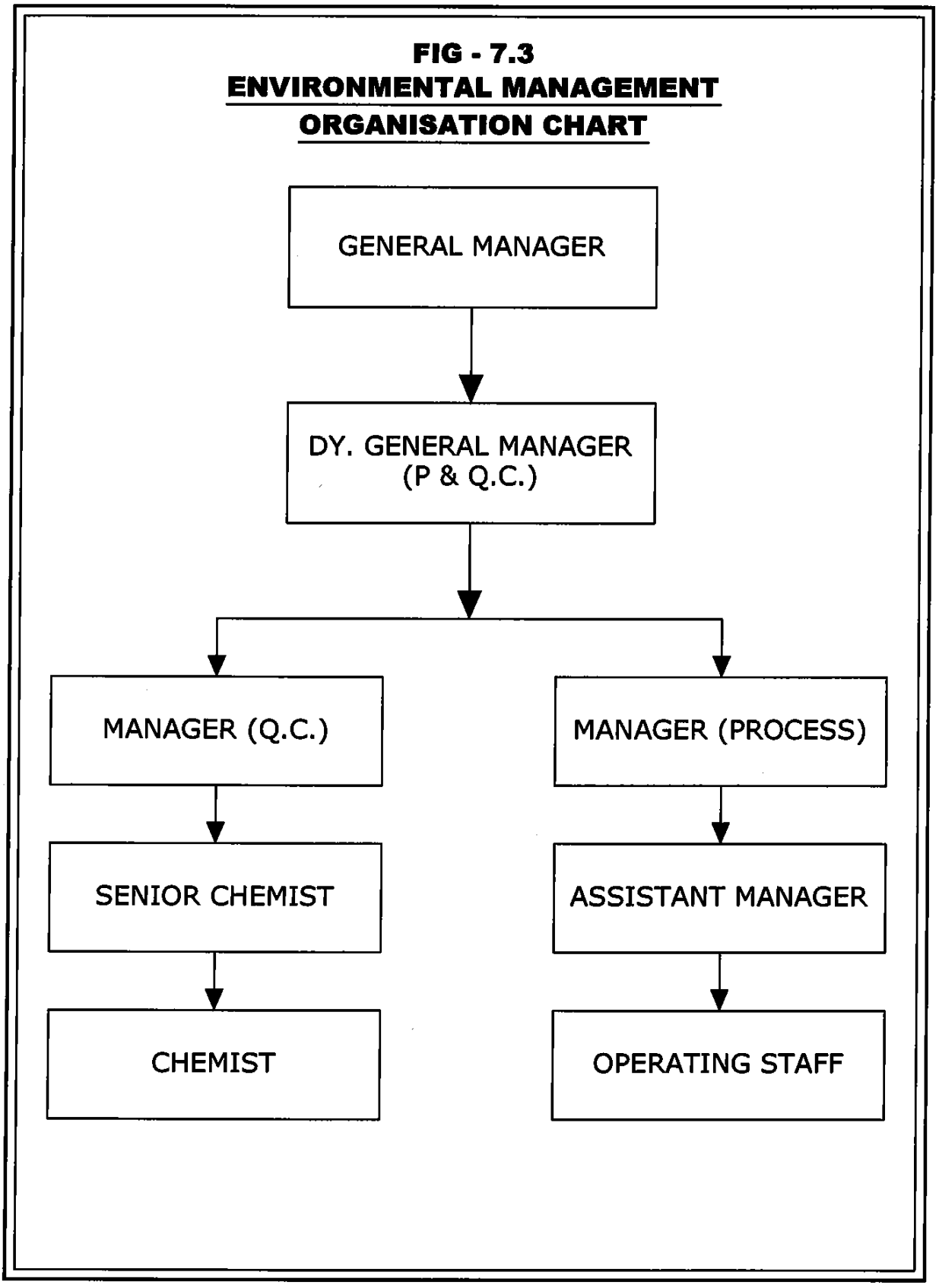
Table 7.1
Post Monitoring Programme

Discipline	Locations	Parameters	Frequency
Meteorology (Met Station	One	Max. and Min. Temp, Rainfall, Relative Humidity, Atm pressure, Windspeed and direction	Daily Auto weather station with data logging capabilities for recording with hourly intervals
Ambient Air Quality	Three (to be finalised in consultation with State Pollution Control Board)	SPM,SO_2, NOx, RPM and CO	24 hrs Twice a week
Stack Emissions	For all the emission sources	Particulate emissions for all the sources. Kiln emissions - for particulate matter, SO_2 and Nox.	Once in a 15 days
Wastewater	Sanitary Wastewater	pH, Total suspended & Dissolved solids, COD, BOD & Dissolved Oxygen, Oil & Grease	Monthly
Intake Water Quality of borewells	Atleast four (to be finalised in consultation with State Pollution Control Board)	pH, Temp, Conductivity, Total suspended & Dissolved solids, BOD & Dissolved Oxygen, MPN coliform, Iron & Heavy Metals	Quarterly
Noise	Plant area – for workzone noise levels Nearby villages	Spot Noise levels Day and Night time Noise levels	Monthly
Health Checkup	All Plant personnel	Diseases of Eye, Ear and Chest	Yearly

FIG - 7.3

ENVIRONMENTAL MANAGEMENT

ORGANISATION CHART



B CONTINUOUS EMISSION MONITORING INSTRUMENTS

PCIL has proposed to install 2 Nos of Continuous Emission Monitoring systems at Unit – I and Unit – II of cement plant to have online check on particulate emission

C AMBIENT AIR QUALITY MONITORING

PCIL has installed ambient air monitoring station for monitoring of ambient air quality in the surrounding villages.

D WASTEWATER SAMPLING

The wastewater samples are collected regularly both at inlet and outlet of sewage treatment plant to assess the performance and compliance as per the norms.

7.8.3 ENVIRONMENTAL LABORATORY

A full-fledged environmental laboratory **(Table – 7.2)** is in place in the plant with required equipment.

7.9 BUDGET FOR ENVIRONMENTAL MANAGEMENT PLAN

The following is the estimated budget for implementing various environmental measures like installation of pollution control equipment, monitoring of environmental parameters etc.

BUDGET FOR ENVIRONMENT MANAGEMENT PLAN
(amount in Rs crores)

	CEMENT PLANT
Pollution Control Equipment	Nil
Online Monitoring Equipment	0.20
Greenbelt development	0.10
TOTAL	**0.30**

Table 7.2
Equipment For Environmental Monitoring

Parameter	No. of Units
Meteorology	
1. Automatic weather monitoring station for measuring Temp. Relative Humidity, Wind speed, Wind direction and rainfall with a data logger	one
A. Stack Emission	
1. Stack monitoring kit (already available)	One
B. Ambient air quality	
1. High volume sampler (one already available)	Three
C. Water Quality	
1. pH Meter	Two
2. Dissolved Oxygen meter	One
3. BOD incubator	One
D. Noise	
1. Noise meter	One
E. Analytical Laboratory	
1. Spectrophotometer	one
2. Hot air oven	one
3. Refrigerator	one
4. Single Pan Electronic Balance	one
5. Glassware for air and water analysis	
6. Chemicals for air and water analysis	

CONCLUSION

PCIL has successfully implemented Cement Plant at Tadipatri since 1994. PCIL strongly believes in the concept of eco friendly industrilisation.

The company has successfully achieved compliance of all the standards prescribed by the State and Central Pollution Control Boards. With the same commitment and dedication, PCIL has commissioned the Unit – II with improved technology .

Apart from eco-friendly operations, PCIL is undertaking the socio economic development activities to bring about overall socio economic development in the area.

The expansion of the cement plant will be undertaken keeping in view of APPCB and MoEF standards for environmental protection. Hence the project may be accorded environmental clearance.

CHAPTER - 8

DISASTER MANAGEMENT PLAN

8.0 DISASTER MANAGEMENT PLAN

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

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

8.1 SCOPE

The aim of hazard control and disaster management is concerned with preventing accidents through good design, operation, maintenance and inspection, by which it is possible to reduce the risk of an accident, but it is not possible to eliminate it. Since, absolute safety is not achievable, an essential part of major hazard control must also include mitigating the effects of a major accident.

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

8.2 OBJECTIVES

The overall objectives of an emergency plan are:

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

Elimination of hazards will require prompt action by operators and emergency staff using, for example, fire fighting equipment, emergency shut-off values and water

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

8.3 IDENTIFICATION AND ASSESSMENT OF HAZARDS

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

Most major hazards or accidents in a Cement Plant fall within the following categories:

- Handling of coal
- Handling of fine dust
- Handling of hot clinker
- Handling of cement
- Packing areas

The Assessment of possible incidents in respect of the above should produce a report indicating

- The worst events considered
- The route to those worst events
- The time-scale to lesser events along the way
- The size of lesser events if their development is halted
- The relative likelihood of events
- The consequences of each events

8.4 GUIDELINES FOR DMP

Formulation of DMP and Emergency Services

PCIL has formulated a Disaster Management Plan for the Unit – I. This Disaster Management plan is renewed and reviewed as below for better and safe management of the plant after expansion.

The DMP is related to the final assessment and it is the responsibility of the plant management document including the following elements.

- Assessment of the size and nature of the events foreseen and the probability of their occurrence.
- Formulation of the plan and liaison with authorities, including the emergency services.
- Procedures for raising the alarm and communications both within and outside the works.
- Appointment of key personnel and their duties and responsibilities, especially for works incident controller and works main controller.
- Emergency control center.
- Action on-site
- Action off-site

The Plan is prepared to set out the way in which designated people at the site of the incident can initiate supplementary action both inside or outside the works at an appropriate time. An essential element of the plan must be the provision for attempting to make safe the affected unit, for example by shutting it down. On a complex site, the plan includes the full sequence of key personnel to be called in from other sections or from off-site.

The following management systems at various stages of manufacturing of cement will be followed:

8.4.1 Handling of Coal

A The coal at the cement plant is received through trucks and is stored in stock yard. The possible hazards are envisaged due to failure of truck and slipping of truck during unloading.

B During summer season, there is a chance of coal catching fire due to hot temperatures

To handle this situation, effective sprinkling systems is provided all round the coal stock yards by PCIL.

8.4.2 Handling of Fine Dust

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

PCIL will take sufficient care in the maintenance operations at both the units.

8.4.3 Handling of Hot Clinker

The hot clinker is transported by chain conveyors to the top of the silo where it is subjected to screening. During this operation, there is a possibility of spillout of hot clinker.

Proper care for the conveyor system and the bund wall for the clinker stock pile.

8.4.4 Handling of Cement

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

PCIL's management system provided in cement plant will avoid / minimize the disasters as detailed below:

8.5 Alarm and Communication Systems

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

Alarm systems are provided in the plant. Adequate number of points are provided from an audible warning, or indirectly, viz. a signal or message to a permanently manned location. The alarm will alert the people to implement appropriate emergency procedures. In areas where a high level of noise, more than one audible alarm transmitter or flashing lights will be provided. Automatic alarms may be appropriate on some sites.

A reliable system will be provided for informing the emergency services as soon as the alarm is raised on site.

8.6 Appointment of Personnel and Definition of Duties

Effective emergency plans require that, in the event of an accident, nominated individuals are given specific responsibilities, often separate from their day-to-day activities. The two principal people are the site incident controller and the site main controller.

The site incident controller will take control of handling the incident. He will often be the person in charge of the plant at the time of the incident and will provide 24-hours cover when shift operation applies.

8.6.1 Responsibilities of Site Incident Controller

The responsibilities of the site incident controller (Manager - Safety & Environment) include the following

- To assess the scale of incident
- To initiate the emergency procedures to secure the safety of employees, minimize damage to plant and property and minimize loss of material.

- To direct rescue and fire-fighting operations until the fire brigade arrives.
- To search for causalities
- To arrangement evacuation of non-essential workers to assembly areas
- To set up a communication point with the emergency control center
- To assume the responsibility of the site main controller pending his arrival.
- To provide advice and information as requested to the emergency services.

It is important that the site incident controller is readily recognizable at the scene of the incident. This is achieved by the wearing of a distinctive safety helmet and jacket, which is known to all concerned.

8.6.2 Responsibilities of site Main Controller

The specific responsibilities of the Site Main Controller (General Manager – Works) include

- To decide (if not decided already) whether a major emergency exists or is likely, requiring the emergency services and the off-site emergency plan.
- To exercise direct operational control of the works outside the affected area;
- Continually to review and assess possible developments to determine the most probable course of events.
- To direct the shutting down of plant and their evacuation, in consultation with the site incident controller and key personnel.
- To ensure that causalities are receiving adequate attention.
- To liaise with chief officers of the fire and police services and with the factory inspectorate
- To control traffic movement within the works
- To arrange for a log of the emergency to be maintained.
- To issue authorized statements to the news media
- To control rehabilitation of affected areas after the emergency.

Apart from the two site controllers, other works personnel with have the key roles to play in the implementation of the emergency plan. These will include Senior Manager of plant not directly involved in the emergency, first aiders, atmospheric monitoring staff causality reception staff public relation staff to liaise with the media. All need to be aware at the emergency replanning stage of the precise nature of their roles.

8.7 Emergency Control Centers

The emergency control center is the place from which the operations to handle the emergency are directed and coordinated. It will be attended by the site main controller, key personnel and the senior officers of fire and police services.

The Emergency control center will be equipped to receive and transmit information and directions from and to the incident controller and other areas of the works, as well as outside.

8.7.1 Infrastructure at Emergency Control Center

Emergency control centers will contain the following

- An adequate number of external telephones; if possible, one should accept outgoing calls only, in order to bypass jammed switchboards during an emergency.
- An adequate number of internal telephones
- Radio equipment
- A plan of the works, to show:
- Areas where there are large inventories of hazardous materials
- Sources of safety and first aid equipment
- The fire-fighting system and additional sources of water
- Site entrance and roadways,. Including up-to-date information on road traffic
- Assembly points
- The location of the plant/installations in relation to the surrounding community
- Vehicle parking an rail sidings

- Additional work and layout plans detailing alternate routes and affected areas, during an emergency
- Note pads, pens and pencils
- A nominal roll of employees
- A list of key personnel, with addresses, telephone numbers, etc.,

The emergency control center is sited in an area of minimum risk.

8.7.2 Emergency Action Onsite

The primary purpose of the on-site emergency plan of DMP is to control and contain the incident. It is not possible to conveyor to consider every eventuality in the plan and the successful handling of the emergency will depend on appropriate action and decisions beings taken on the spot. Other important aspects needing to be considered include the following:

8.7.2.1 Accounting for Personnel

It is important to account for personnel during an emergency, but it can be particularly difficult. Because of visitors, contractors, shift changes, holidays and sickness absence, it is normally right practices to maintain a detailed roll of personnel on site any one time, nominal rolls. Detailed lists of contractors on-site will be maintained, with a similar list of visitors.

At the emergency control center, a nominated person will collate the lists of personnel arriving at the assembly points with this involved in the incident. These will then be checked against the nominal roll of those believed to be on site. Updated with known changes for that day. Where it is possible that missing people might have been in the area of the emergency, the incident controller will be informed and arrangements made to organize a further search.

8.7.2.2 Access to Records

The lists of names and addresses of works personnel will be kept in emergency control center. These will be regularly updated to take account of changes in personnel, address, next of kin and so on.

8.7.2.3 Public relations

Any accident will attract the interest of media and major accident is likely to involve widespread radio and television coverage. Unless appropriate arrangements are made, this can divert personnel from the tasks of handling the emergency. It is essential to make arrangements for the authoritative release of information during any emergency of significant length, to handle this Senior Manager – Production will be the sole source of this information. Inquiries made to other employees are directed to this appointed person.

8.7.2.4 Rehabilitation

The emergency will continue until the situation is brought under control. The local factory inspectorate will be consulted regarding the collection of evidence before it is disturbed.

8.8 Planning Shutdown Procedures

Plant operations are often interlinked and the shut-down of the plant will have significant implications for other units. Emergency plans will take account of this so that ordered and phased shut-downs can take place when necessary, depending on the type of incident occurring.

8.9 Rehearsing Emergency Procedures

Emergency plan finalized was made known to all personnel so that each one knows his or her role in the event of an emergency. The plan will be regularly tested through rehearsals. Communication is a key component of handling an emergency and rehearsal of the communication system, including contingency action if a part of the system (e.g. telephones) becomes inoperative, will be undertaken.

8.10 Safety of Operation and Control

When an installation is designed to withstand all loads that can occur during normal or foreseen abnormal operating conditions, it is the

tasks of a process control system to keep the plant safety within these limits. To achieve this, use will be made of systems such as

- Manual control
- Automatic control
- Automatic shut-down systems
- Safety devices
- Alarm systems

Any major hazard installation will require some form of safety system. The form and design of the system depend on the hazards present in the plant. The following areas will be checked for safety systems and their purposes.

8.11 Systems preventing Failure of Safety Related Components

Safety related components may need to be specially equipped for additional reliability, depending on their importance in the safety system. The plant will be provided with different systems which take over the function of these components (diversity), or there are will be a second component for the same purpose, e.g. a second coolant pump (redundancy).

8.11.1 Utilities

Safety related utility supplies, such as electricity supply to control systems, compressed air for instruments or nitrogen supply as an inert gas, will be provided with a second source e.g. batteries in case of a failure in the primary system.

8.11.2 Alarm Systems

These are systems which, are based on the sensors and will operator to determine the cause of a malfunction as soon as it has occurred. Such alarm systems are provided for:

- Monitoring of process parameters such as temperature, pressure, flow rate, quantity, level, mixing ration, O_2 content

- Detection of failures of safety-related components such as pumps, compressors, stirrers, blowers
- Detection of leaks by gas detectors or explosive meters.
- Detection of fire or smoke
- Detection of failure of safety devices

8.11.3 Fire fighting systems

Fire fighting systems at the plant include

1. Hydrant system for exterior as well as internal protection facilities
2. Foam and protecto-spray
3. High velocity water spray
4. portable extinguishers and hand appliances
5. Carbon dioxide flooding system

8.11.4 Technical Protective Measures

Over and above the safety systems which help to keep the plant in a safe condition, protective measures will be taken to limit the consequences of an accident. The provided are

- Water spray systems
- Gas detectors
- Water jets
- Collecting tanks and bunds

8.11.5 Prevention of Human and Organization Errors

Human errors can be source of major accidents. For this reason, their prevention needs to be addressed as one of the key safety measures. The following preventive measures will be taken:

- Use of differently sized connection in loading stations for tank-cars to prevent mixing of reactive substances for example sulphuric acid and nitric acid
- Prevention of material mix-ups means of proper labeling, packaging, receiving inspection and analysis

- Interlocking of safety-related valves and switches which may not operate simultaneously
- Clear marking of switches, knobs and displays on control panels
- Proper communication devices for the plant personnel
- Safeguarding against inadvertent switching actions
- Training of personnel

8.11.6 Maintenance and Monitoring

The safety of the plant and the function of safety related systems can only be as good as the maintenance and monitoring of these systems. For this reason, a plant maintenance and monitoring schedule are established which includes the following tasks:

- Checking of safety related operating conditions both in the control room and on site.
- Checking of safety related parts of the plant on site by visual inspection or by remote monitoring
- Monitoring of safety related utilities such as electricity, steam, coolant compressed air
- Preparation of maintenance plan and documentation of maintenance work specifying the different maintenance intervals and the type of work to be performed.

In addition, the maintenance and monitoring schedule will specify the qualifications and experience required by the personnel to their tasks.

8..11.7 Inspection and Repairs

A plan will be formulated for on-site inspections which will include a schedule and the operations conditions to be adhered to during inspection work. Repair work can be a major sources of accidents. For this reason, strict procedures will be specified for carrying out repair work, for example welding of components containing flammable substance, these procedures will cover repair work requiring shut down of the plant and cleaning of tanks, the qualifications required by personnel quality requirements of the work to be performed and requirements for the supervision of repair work. Because of the

importance of this, many manufactures establish their own standards for repair work over and above what national standards may require.

8.11.8 Training

While technical measures are essential for the safety of the plant, no plant can be designed so that it will operate without human intervention. As people can have a negative as well as a positive influence on plant safety, it is important to reduce the negative influence and support the positive one. Both goals will be achieved by proper selection and training of the personnel, which will include information on :

- The hazards of the process and the substance used.
- Possible operating conditions, including start up and shut-down procedures
- Behaviour in the case of malfunctions or accidents
- Experience in similar plants elsewhere, including accidents and near misses.

8.12 Mitigation of Consequences

No major hazard installation can ever be absolutely safe. Even if a hazard assessment has been carried out, if the hazards have been detected and appropriate measures have been taken, the possibility of an accident and cannot be completely ruled out. For this reason, it will be part of the safety concept of plan and provides measures which can mitigate the consequences of an accident.

In order to be able to initiate counter measures in the event of an accident, the following actions will be takenup.

- Settingup and train a fire brigade, professional or voluntary
- Provide alarm systems with a direct line to the fire brigade or to public emergency forces
- Draw upon disaster management plan as described, earlier
- Notify the authorities of the nature and the scope of hazard in the event of an accident.

All of the above measures will be consistent with the hazards identified. Further more, these will be accompanied by proper training of plant personnel, the emergency forces under responsible representatives from public services. Only training and rehearsals of accident situations will make emergency plans realistic enough for them to work in real emergency.

8.13 Reporting to Authorities

Depending on local arrangements in different countries, the management of a major hazardous installation is likely to be required to report to the authorities. Reporting will be carried out in three steps. These are:

- Identification / notification of a major hazards installation
- Preparation of a safety report
- Immediate reporting of accidents

Notification to the authorities of the existence of on-site hazard in order to identify major hazards coming within the scope of the additional controls described earlier.

The preparation of a safety report, is to present the entire safety system, which gives the authorities the opportunity.

- To check/adherence to safety standards as part of any licensing decisions
- To carry out specific inspection in order to learn about hazards arising from these installations.
- To take proper siting decision for new plants, and to establish contingency plans

Finally, if any accident occurs, this may need to be reported at once to the authorities. This is in addition to informing the authorities involved in handling the emergency off-site, where immediate contact will be essential.

ANNEXURES

ANNEXURE-I

COMLIANCE STATEMENT FOR THE ENVIRONMENTAL CLEARANCE LETTER RECEIVED FROM MINISTRY OF ENVIRONMENT AND FORESTS DT. 2nd MARCH 2001.

	A. Specific conditions	**Remarks**
1	The gaseous and particulate matter emissions from various units should confirm to the standards prescribed by the State Pollution Control Board. At no time the particulate emission should exceed 50 mg/Nm^3, further, the company may also take appropriate additional measures to improve the design and operating practices of the Pollution Control equipments to achieve a load based norm of 227 gms/t of feed interlocking facility should be provided in the pollution control equipment not working, the respective unit(s) is shutdown automatically.	The pollution control equipment is designed for maximum outlet emission of 50 mg/Nm^3. Interlocking provided.
2	Ambient Air Quality including Ambient Noise levels must not exceed the standards stipulated under EPA/State authorities. Monitoring of Ambient Air quality and Stack Emissions shall be carried out regularly in consultation with SPCB and report submitted to the Board quarterly and to the Ministry (Regional office at Bangalore) half-yearly.	Already implemented.
3	The company should install adequate dust collection and extraction system to control fugitive dust emissions at various transfer points. Closed circuit grinding should be provided in all the grinding sections of the plant.	Already installed being maintained.
4	The company should develop 100mts wide Green belt in 20.2 ht.of the additional areas acquired besides 12.55 ht.of the total area already developed as greenbelt as per the Central Pollution Board guidelines. Selection of the plant species should be as per the Agro Climatic conditions.	Implemented.
5	No discharge of treated Effluent should be done outside the premises and all the treated Effluent (E.T.P & S.T.P) should be utilized for green belt development and other related activities.	Sewage treatment plant is being used and the treated water is being utilized for green belt development.
6	The company must harvest the rainwater as per the rainwater-harvesting scheme submitted to the ministry and adopt water conservation measures.	Implemented.
7	The company shall not operate at the expanded production capacity until the linked mine proposal(s) have been approved correspondingly under the provisions of EIA Notification.	-N.A-

	B. General conditions	Remarks
1	The project authority must adhere to the stipulations made by Andhra Pradesh State Pollution Control Board and State Government.	Will be adhered.
2	No further expansion or modification of the plant should be carried out without prior approval of this Ministry.	No expansion is contemplated.
3	At least four Ambient Air Quality monitoring stations be established in the downwind direction as well as where maximum ground level concentration of SPM, So_2, No_x, are anticipated in consultation with Andhra Pradesh State Pollution Control Board Data on Ambient Air Quality and Stack emissions should be regularly submitted to this Ministry including its Regional office at Bangalore and the State Pollution Control Board/Central pollution control board once in a six months.	Already identified and periodical monitoring is being done.
4	Industrial Waste Water should be properly collected, treated so as to conform to the standards prescribed under GSR 422(E) dated 19th May,1993 and 31st December 2003 as amended from time to time. The treated wastewater should be utilized for plantation purpose.	Not applicable.
5	The over all noise levels in and around the plant area should be kept well with in the standards (85Dba) by providing noise control measures including acoustic hoods, silencers, enclosures etc.on all sources of noise generations. The ambient noise levels should conform to the standards prescribed under Environmental (Protection) Act, 1986, 1989 viz. 75 dBA (day time) and 70 dBA (night time).	Noise levels measuring periodically and maintained.
6	Proper Hose keeping and adequate occupational health programs must be taken up. Occupational Health Surveillance program should be done on a regular basis and records maintained. The program must including function and sputum analysis tests once in six months.	Health survey is regularly conducted.
7	The project proponent shall also comply with all the environmental protection measures and safeguards recommended in the Environmental Impact Assessment, Environmental Management Plan.	Being maintained.
8	A separate Environmental Management cell with full fledged laboratory facilities to carryout various management and monitoring function should be set up under the control of Senior e Executive.	Already formed and it is headed by Dy.GENERAL MANAGER (P &QC)

9	The project authorities will provide adequate funds both recurring and Non-recurring to implement the conditions stipulated by the Ministry of Environment and Forests as well as the state government along with the implementation schedule for all the conditions stipulated herein. The funds so provided should not be diverted for any other purposes.	Funds are adequately provided.
10	The regional office of this Ministry at Bangalore state pollution control board will monitor the stipulated conditions. A six monthly compliance report and the monitored data along with statistical interpretation should be submitted to them regularly.	Regular reports will be prepared and submitted.
11	The project authorities should inform the Regional office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and date of commencing the land development work.	Not applicable.
12	The project proponent inform the public that project has been accorded environmental clearance by the Ministry and copies of the clearance letter are available with State Pollution Control Board/Committee and may also be seen at Website of the Ministry of Environment and Forests at http://www.envfor.nic.in. This should be advertised in at least two local newspapers that are widely circulated in the region of which one shall be in the vernacular language of the locality concerned.	Implemented.

ANNEXURE-5 A

SUMMARY OF AMBIENT AIR QUALITY IN THE STUDY AREA

CODE	µg/M³			PERCENTILE VALUES (µg/M³)									
	MAX	MIN	AVG	10	20	30	40	50	60	70	80	90	98
Suspended particulate matter (SPM)													
A-1	368.5	294.5	338.8	301.2	318.5	324.4	332.7	338.8	343.3	355.1	359.6	362.8	367.1
A-2	151.3	104.8	125.1	105.5	110.2	115.3	120.2	125.1	129.6	136.2	142.2	148.2	149.0
A-3	157.5	109.2	127.6	110.6	114.2	119.2	123.3	127.6	133.3	139.3	146.6	153.4	155.3
A-4	150.2	105.7	128.9	107.3	112.5	118.7	124.5	128.9	132.2	138.6	140.1	145.6	148.4
A-5	153.7	110.3	130.2	112.3	118.6	122.1	126.6	130.2	133.1	140.7	142.1	146.5	152.2
A-6	145.6	102.6	122.5	104.7	113.1	116.4	120.3	122.5	125.4	131.1	135.2	141.8	144.3
A-7	141.8	103.4	121.7	104.9	111.5	114.6	119.8	121.7	124.6	129.5	133.4	138.3	140.7
A-8	137.6	89.8	116.5	92.3	98.5	106.2	111.2	116.5	120.3	124.8	129.6	134.2	135.8
Respirable Particulate Matter (RPM)													
A-1	148.5	117.5	135.5	120.4	127.0	128.5	133.0	135.5	137.3	141.8	143.4	145.1	146.8
A-2	53.3	36.7	44.4	37.5	39.6	40.4	42.5	44.4	46.2	48.3	49.8	51.8	52.6
A-3	55.1	39.1	45.7	39.3	41.2	43.0	44.6	45.7	47.3	49.2	50.3	52.1	54.5
A-4	58.3	40.4	49.6	41.3	43.1	45.7	48.0	49.6	50.4	53.6	53.9	56.5	57.2
A-5	60.9	43.5	51.4	44.5	46.4	48.3	50.1	51.4	52.5	55.7	56.1	57.8	60.2
A-6	57.4	40.0	47.7	40.8	44.1	45.4	46.9	47.7	48.3	51.2	52.7	55.3	56.7
A-7	54.7	39.8	46.9	40.3	42.9	44.1	46.3	46.9	47.7	49.8	51.5	53.2	54.2
A-8	50.2	34.6	42.2	35.6	37.1	39.0	41.6	42.2	43.7	45.6	47.2	49.2	50.0
Sulfur Dioxide (SO_2)													
A-1	16.9	11.2	14.2	11.6	12.8	13.3	13.9	14.2	14.7	15.3	16.1	16.6	16.8
A-2	14.5	8.2	10.9	8.5	9.1	9.6	10.3	10.9	11.6	12.4	13.1	13.9	14.3
A-3	15.2	9.5	12.0	9.8	10.4	10.9	11.5	12.0	12.6	13.3	14.0	14.7	15.0
A-4	14.5	8.8	10.8	8.9	9.4	9.7	10.1	10.8	11.6	12.3	13.2	14.0	14.3
A-5	14.4	8.9	11.2	9.2	9.6	10.1	10.7	11.2	11.8	12.5	13.3	13.9	14.1
A-6	14.9	9.2	11.5	9.4	9.9	10.3	11.2	11.5	12.1	12.8	13.5	14.3	14.7
A-7	15.2	9.6	12,4	9.7	10.4	10.9	11.5	12.4	12.9	13.4	14.1	14.6	15.0
A-8	13.1	8.0	10.6	8.2	8.7	9.4	10.0	10.6	11.2	11.7	12.2	12.6	12.8
Oxides of Nitrogen (NO_X)													
A-1	17.8	12.1	15.3	12.4	13.3	14.1	14.6	15.3	15.6	16.0	16.8	17.2	17.6
A-2	15.6	9.4	12.2	9.6	10.3	11.0	11.6	12.2	12.9	13.6	14.3	15.0	15.2
A-3	16.4	10.8	13.3	11.0	11.6	12.2	12.8	13.3	13.9	14.6	15.2	15.9	16.1
A-4	15.8	9.4	11.3	9.6	10.2	10.5	11.0	11.3	12.3	13.1	14.3	15.2	15.7
A-5	15.5	9.8	12.1	10.1	10.5	11.2	11.8	12.1	12.9	13.6	14.4	14.9	15.3
A-6	15.7	10.1	12.4	10.5	10.8	11.2	11.7	12.4	12.8	13.3	14.2	14.8	15.5
A-7	16.1	10.5	13.2	10.9	11.3	11.9	12.7	13.2	13.8	14.3	14.8	15.4	15.9
A-8	14.5	9.5	11.7	9.7	10.3	10.8	11.2	11,7	12.3	12.8	13.4	14.1	14.3

PLANT SITE[A-1] TALARICHERUVU [A-2] URACHINTALA [A-3]

SIRIGEPALLE [A-4] SAJJALADINNE [A-5] VENKATAREDDI PALLI [A-6]

BANDRALAPALLE [A-7] ABDULLAPURAM [A-8]

ANNEXURE-5 B

WATER QUALITY DATA

SL. NO.	TESTS	RESULTS			IS 10500 [DRINKING WATER STANDARD]	
		PLANT SITE BOREWELL	TALLARI CHERUVU BOREWELL	URACHINTALA BORWELL	DESIRABLE LIMITS	PERMISSIBLE LIMITS
1	Odour	Un Objectionable	Un Objectionable	Un Objectionable	-------	-----
2	Taste	Agreeable	Agreeable	Agreeable	-------	-----
3	Colour (Hazen units)	<5	<5	<5	5	25
4	pH	7.62	7.50	7.02	6.5 to 8.5	6.5 to 8.5
5	Turbidity, NTU	2	2	1	5	10
6	Total Hardness as $CaCo_3$, mg/l	130	390	170	300	600
7	Mineral oil, mg/l	Nil	Nil	Nil	0.01	0.03
8	Iron as Fe, mg/l	0.12	0.15	0.12	0.3	1.0
9	Chlorides as Cl, mg/l	26	142	28	250	1000
10	Dissolved solids, mg/l	210	840	310	500	2000
11	Calcium as Ca, mg/l	36	124	50	75	200
12	Magnesium as Mg, mg/l	9.20	19.5	11	30	100
13	Copper as Cu, mg/l	BDL	BDL	BDL	0.05	1.5
14	Manganese as Mn, mg/l	BDL	BDL	BDL	0.1	0.3
15	Sulphate as SO_4, mg/l	43	115	21	200	400
16	Nitrate as No_3, mg/l	4	24	17	45	100
17	Fluoride as F, mg/l	0.76	1.05	1.10	0.6-1.2	1.5
18	Mercury as (Hg), mg/l	BDL	BDL	BDL	0.001	0.001
19	Cadmium as (Cd), mg/l	BDL	BDL	BDL	0.01	0.01
20	Selenium as Se, mg/l	BDL	BDL	BDL	0.01	0.01
21	Arsenic as As, mg/l	BDL	BDL	BDL	0.05	0.05
22	Cyanide as CN as mg/l	BDL	BDL	BDL	0.05	0.05
23	Lead Pb, as mg/l	BDL	BDL	BDL	0.05	0.05
24	Zinc as Zn, mg/l	BDL	BDL	BDL	5	15
25	Chromium as Cr^{+6}, mg/l	BDL	Absent	BDL	0.05	0.05
26	Pesticides	Absent	Absent	Absent	Absent	0.001
27	Alkalinity as $CaCo_3$, mg/l	82	215	140	200	600
28	Boron as B, mg/l	0.08	0.12	0.08	1	5
29	Coliform count, MPN/100 ml	Nil	Nil	Nil	10 (e-coli absent)	10 (e-coli absent)

Note: BDL: Below Detectable Limit (for Hg, 0.001 mg/l and for all other parameters, 0.01 mg/l)

ANNEXURE-5 B (CONTD)

WATER QUALITY DATA

SL. NO.	TESTS	RESULTS			IS 10500 [DRINKING WATER STANDARD]	
		SIRIGEPALLI	**SAJJALA DINNE**	**VENKATA REDDI PALLI**	DESIRABLE LIMITS	PERMISSIBLE LIMITS
1	Odour	Un Objectionable	Un Objectionable	Un Objectionable	-------	-----
2	Taste	Agreeable	Agreeable	Agreeable	-------	-----
3	Colour (Hazen units)	10	15	10	5	25
4	pH	7.45	7.81	7.63	6.5 to 8.5	6.5 to 8.5
5	Turbidity, NTU	5	30	4	5	10
6	Total Hardness as $CaCo_3$, mg/l	210	270	240	300	600
7	Mineral oil, mg/l	Nil	Nil	Nil		
8	Iron as Fe, mg/l	0.12	0.25	0.15	0.3	1.0
9	Chlorides as Cl, mg/l	102	241	124	250	1000
10	Dissolved solids, mg/l	415	835	380	500	2000
11	Calcium as Ca, mg/l	55	68	62	75	200
12	Magnesium as Mg, mg/l	18	24	21	30	100
13	Copper as Cu, mg/l	BDL	BDL	BDL	0.05	1.5
14	Manganese as Mn, mg/l	BDL	BDL	BDL	0.1	0.3
15	Sulphate as SO_4, mg/l	58	77	51	200	400
16	Nitrate as No_3, mg/l	51	74	39	45	100
17	Fluoride as F, mg/l	0.98	1.15	1.06	0.6-1.2	1.5
18	Mercury as (Hg), mg/l	BDL	BDL	BDL	0.001	0.001
19	Cadmium as (Cd), mg/l	BDL	BDL	BDL	0.01	0.01
20	Selenium as Se, mg/l	BDL	BDL	BDL	0.01	0.01
21	Arsenic as As, mg/l	BDL	BDL	BDL	0.05	0.05
22	Cyanide as CN as mg/l	BDL	BDL	BDL	0.05	0.05
23	Lead Pb, as mg/l	BDL	BDL	BDL	0.05	0.05
24	Zinc as Zn, mg/l	BDL	BDL	BDL	5	15
25	Chromium as Cr^{+6}, mg/l	BDL	BDL	BDL	0.05	0.05
26	Pesticides	Absent	Absent	Absent	Absent	0.001
27	Alkalinity as $CaCo_3$, mg/l	165	170	150	200	600
28	Boron as B, mg/l	0.10	0.10	0.09	1	5
29	Coliform count, MPN/100 ml	Nil	Nil	Nil	10 (e-coli absent)	10 (e-coli absent)

Note: BDL: Below Detectable Limit (for Hg, 0.001 mg/l and for all other parameters, 0.01 mg/l)

ANNEXURE-5 B (CONTD)

WATER QUALITY DATA

SL. NO.	TESTS	RESULTS		IS 10500 [DRINKING WATER STANDARD]	
		BANDARLA PALLE	**ABDULLAPURAM BOREWELL**	DESIRABLE LIMITS	PERMISSIBLE LIMITS
1	Odour	Un Objectionable	Un Objectionable	-------	-----
2	Taste	Agreeable	Agreeable	-------	-----
3	Colour (Hazen units)	10	10	5	25
4	pH	7.32	7.51	6.5 to 8.5	6.5 to 8.5
5	Turbidity, NTU	4	6	5	10
6	Total Hardness as $CaCo_3$, mg/l	260	280	300	600
7	Mineral oil, mg/l	Nil	Nil		
8	Iron as Fe, mg/l	0.15	0.20	0.3	1.0
9	Chlorides as Cl, mg/l	115	220	250	1000
10	Dissolved solids, mg/l	340	830	500	2000
11	Calcium as Ca, mg/l	58	61	75	200
12	Magnesium as Mg, mg/l	28	31	30	100
13	Copper as Cu, mg/l	BDL	BDL	0.05	1.5
14	Manganese as Mn, mg/l	BDL	BDL	0.1	0.3
15	Sulphate as SO_4, mg/l	72	80	200	400
16	Nitrate as No_3, mg/l	24	18	45	100
17	Fluoride as F, mg/l	1.05	1.15	0.6-1.2	1.5
18	Mercury as (Hg), mg/l	BDL	BDL	0.001	0.001
19	Cadmium as (Cd), mg/l	BDL	BDL	0.01	0.01
20	Selenium as Se, mg/l	BDL	BDL	0.01	0.01
21	Arsenic as As, mg/l	BDL	BDL	0.05	0.05
22	Cyanide as CN as mg/l	BDL	BDL	0.05	0.05
23	Lead Pb, as mg/l	BDL	BDL	0.05	0.05
24	Zinc as Zn, mg/l	BDL	BDL	5	15
25	Chromium as Cr^{+6}, mg/l	BDL	BDL	0.05	0.05
26	Pesticides	Absent	Absent	Absent	0.001
27	Alkalinity as $CaCo_3$, mg/l	170	185	200	600
28	Boron as B, mg/l	0.06	0.09	1	5
29	Coliform count, MPN/100 ml	Nil	Nil	10 (e-coli absent)	10 (e-coli absent)

Note: BDL: Below Detectable Limit (for Hg, 0.001 mg/l and for all other parameters, 0.01 mg/l)

ANNEXURE-5 C

SOIL QUALITY DATA

S.NO.	PARAMETERS	RESULTS					
		S1	S2	S3	S4	S5	S6
1	pH	8.84	7.65	7.92	8.41	7.88	8.12
2	Electrical Conductivity (micro mhos)	380	360	356	485	345	395
3	Nitrogen as N (mg/kg)	54	86	164	68	94	82
4	Sodium as Na (mg/kg)	875	790	558	580	490	465
5	Calcium as Ca (mg/kg)	3025	4280	3380	2560	2470	2890
6	Magnesium as Mg (mg/kg)	910	686	586	425	546	612
7	Phosphorous as (P_2O_5) (mg/kg)	12	30	50	18	22	15
8	Potassium as K_2O (mg/kg)	115	204	230	136	185	120
9	Chloride as Cl (mg/kg)	82	78	74	98	86	92
10	Total soluble salts, (mg/kg)	438	466	446	615	478	506
11	Organic matter %	0.32	0.52	0.68	0.44	0.48	0.42
	Texture						
	Sand %	58	40	50	63	55	59
	Silt %	20	28	24	15	25	16
	Clay %	22	32	26	22	20	25

S1	Plant Site
S2	Tallaricheruvu village
S3	Urichintala village
S4	Sirigepalle
S5	Sajjaladinne
S6	Bandarlapalle

ANNEXURE - 5D

DEMOGRAPHIC PROFILE OF THE STUDY AREA (10 km radius)

NAME	Total/ Rural/ Urban	Number of households	Total population				0-6 years aged population			SC population				ST population			
			Total	Male	Female	Sexratio	Total	Male	Female	SC%	Total	Male	Female	ST%	Total	Male	Female
0.5-3 km																	
Talaricherevu	Rural	418	1664	955	709	742	303	161	142	3.8	64	39	25	2.0	34	17	17
Urachintala	Rural	219	1023	502	521	1038	146	62	84	16.0	164	81	83	2.2	22	8	14
Total (0.5-3 Km)		**637**	**2687**	**1457**	**1230**	**844**	**449**	**223**	**226**	**8.5**	**228**	**120**	**108**	**2.1**	**56**	**25**	**31**
3-5 Km																	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5-7 Km																	
Abdullapuram	Rural	567	2505	1262	1243	985	316	153	163	30.1	755	390	365	0.2	4	0	4
Aluru	Rural	274	1160	599	561	937	132	69	63	12.9	150	78	72	0.0	0	0	0
Hussainpuram	Rural	233	901	464	437	942	113	63	50	6.4	58	33	25	13.2	119	60	59
Korumanipalle	Rural	158	655	330	325	985	117	58	59	10.7	70	39	31	1.4	9	5	4
Sirigepalle	Rural	179	784	407	377	926	103	53	50	4.1	32	17	15	25.3	198	106	92
Total (5-7 Km)		**1411**	**6005**	**3062**	**2943**	**961**	**781**	**396**	**385**	**17.7**	**1065**	**557**	**508**	**5.5**	**330**	**171**	**159**
7-10 Km																	
Ankireddipalle	Rural	170	804	390	414	1062	110	55	55	24.5	197	92	105	0.0	0	0	0
Bandarlapalle	Rural	11	70	35	35	1000	11	5	6	0.0	0	0	0	0.0	0	0	0
Challavaripelli	Rural	92	346	177	169	955	25	15	10	1.4	5	3	2	0.0	0	0	0
Chintalurapalle	Rural	506	2365	1189	1176	989	365	189	176	26.3	623	292	331	6.8	162	81	81
Jambulapadu	Rural	75	296	157	139	885	33	16	17	4.1	12	6	6	0.0	0	0	0
Kaverisamudram	Rural	227	1302	690	612	887	178	91	87	20.3	264	141	123	2.8	36	21	15
Koduru	Rural	559	2562	1312	1250	953	320	164	156	17.8	457	244	213	0.0	0	0	0
Kottapalle	Rural	829	3609	1828	1781	974	466	244	222	24.5	886	455	431	0.3	12	5	7
Satriam Chennampalle	Rural	59	295	150	145	967	50	23	27	16.9	50	26	24	0.0	0	0	0
Tadpatri	Urban	18759	86843	44047	42796	972	11843	6080	5763	11.2	9758	4910	4848	1.1	997	504	493
Tollamadugu	Rural	267	1232	629	603	959	154	80	74	8.6	106	57	49	32.1	395	198	197
Total (7-10 km)		**21554**	**99724**	**50604**	**49120**	**971**	**13555**	**6962**	**6593**	**12.4**	**12358**	**6226**	**6132**	**1.6**	**1602**	**809**	**793**
Total		**23602**	**108416**	**55123**	**53293**	**967**	**14785**	**7581**	**7204**	**38.6**	**13651**	**6903**	**6748**	**9.2**	**1988**	**1005**	**983**

Source:2001 Census Published Data

LITERACY STATUS (10 km radius)

Name	Total/ Rural/ Urban	No of Literates			No of Illiterates		
		Total	Male	Female	Total	Male	Female
0.5-3 km							
Talaricherevu	Rural	859	592	267	805	363	442
Urachintala	Rural	332	226	106	691	276	415
Total (0.5-3 Km)		**1191**	**818**	**373**	**1496**	**639**	**857**
3-5 Km							
-	-	-	-	-	-	-	-
5-7 Km							
Abdullapuram	Rural	1264	803	461	1241	459	782
Aluru	Rural	509	340	169	651	259	392
Hussainpuram	Rural	307	190	117	594	274	320
Korumanipalle	Rural	221	156	65	434	174	260
Sirigepalle	Rural	341	217	124	443	190	253
Total (5-7 Km)		**2642**	**1706**	**936**	**3363**	**1356**	**2007**
7-10 Km							
Ankireddipalle	Rural	389	257	132	415	133	282
Bandarlapalle	Rural	48	27	21	22	8	14
Challavaripelli	Rural	241	148	93	105	29	76
Chintalurapalle	Rural	999	623	376	1366	566	800
Jambulapadu	Rural	193	131	62	103	26	77
Kaverisamudram	Rural	607	396	211	695	294	401
Koduru	Rural	1210	768	442	1352	544	808
Kottapalle	Rural	1614	1013	601	1995	815	1180
Satriam Chennampalle	Rural	88	57	31	207	93	114
Tadpatri	Urban	48049	29215	18834	38794	14832	23962
Tollamadugu	Rural	431	286	145	801	343	458
Total (7-10 km)		**53869**	**32921**	**20948**	**45855**	**17683**	**28172**
Total		**57702**	**35445**	**22257**	**50714**	**19678**	**31036**

Source:2001 Census Published Data

ANNXURE - 5 F

OCCUPATIONAL STRUCTURE OF THE STUDY AREA (10 km Radius)

Name	Total/ Rural/ Urban	Total Working Population			Total Non Working Population			Total Main Worker			Total Marginal Worker		
		Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
0.5-3 km													
Talaricherevu	Rural	879	644	235	785	311	474	708	591	117	171	53	118
Urachintala	Rural	590	330	260	433	172	261	495	317	178	95	13	82
Total (0.5-3 Km)		**1469**	**974**	**495**	**1218**	**483**	**735**	**1203**	**908**	**295**	**266**	**66**	**200**
3-5 Km													
-	-	-	-	-	-	-	-	-	-	-	-	-	-
5-7 Km													
Abdullapuram	Rural	1660	828	832	845	434	411	1649	824	825	11	4	7
Aluru	Rural	612	378	234	548	221	327	584	376	208	28	2	26
Hussainpuram	Rural	627	316	311	274	148	126	255	157	98	372	159	213
Korumanipalle	Rural	410	212	198	245	118	127	376	205	171	34	7	27
Sirigepalle	Rural	470	259	211	314	148	166	469	259	210	1	0	1
Total (5-7 Km)		**3779**	**1993**	**1786**	**2226**	**1069**	**1157**	**3333**	**1821**	**1512**	**446**	**172**	**274**
7-10 Km													
Ankireddipalle	Rural	556	257	299	248	133	115	443	209	234	113	48	65
Bandarlapalle	Rural	32	23	9	38	12	26	31	22	9	1	1	0
Challavaripelli	Rural	149	106	43	197	71	126	100	93	7	49	13	36
Chintalurapalle	Rural	1343	674	669	1022	515	507	975	546	429	368	128	240
Jambulapadu	Rural	124	97	27	172	60	112	68	67	1	56	30	26
Kaverisamudram	Rural	708	431	277	594	259	335	522	395	127	186	36	150
Koduru	Rural	1269	766	503	1293	546	747	1135	741	394	134	25	109
Kottapalle	Rural	2005	1100	905	1604	728	876	1811	1046	765	194	54	140
Satriam Chennampall	Rural	183	94	89	112	56	56	175	90	85	8	4	4
Tadpatri	Urban	33023	24711	8312	53820	19336	34484	30020	23854	6166	3003	857	2146
Tollamadugu	Rural	818	405	413	414	224	190	812	403	409	6	2	4
Total (7-10 km)		**40210**	**28664**	**11546**	**59514**	**21940**	**37574**	**36092**	**27466**	**8626**	**4118**	**1198**	**2920**
Total		**45458**	**31631**	**13827**	**62958**	**23492**	**39466**	**40628**	**30195**	**10433**	**4830**	**1436**	**3394**

Source:2001 Census Published Data

CATEGORY OF WORKERS IN THE STUDY AREA (10 Km Radius)

Name	Total/ Rural/ Urban	Cultivators			Agricultural Labourers			House hold Industry Workers			Other workers		
		Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
0.5-3 km													
Talaricherevu	Rural	39	37	2	24	16	8	10	5	5	635	533	102
Urachintala	Rural	129	98	31	164	66	98	2	1	1	200	152	48
Total (0.5-3 Km)		**168**	**135**	**33**	**188**	**82**	**106**	**12**	**6**	**6**	**835**	**685**	**150**
3-5 Km													
-	-	-	-	-	-	-	-	-	-	-	-	-	-
5-7 Km													
Abdullapuram	Rural	808	414	394	700	317	383	6	0	6	135	93	42
Aluru	Rural	199	177	22	277	131	146	0	0	0	108	68	40
Hussainpuram	Rural	176	110	66	39	18	21	0	0	0	40	29	11
Korumanipalle	Rural	75	73	2	182	34	148	7	1	6	112	97	15
Sirigepalle	Rural	262	139	123	119	47	72	7	3	4	81	70	11
Total (5-7 Km)		**1520**	**913**	**607**	**1317**	**547**	**770**	**20**	**4**	**16**	**476**	**357**	**119**
7-10 Km													
Ankireddipalle	Rural	384	185	199	25	11	14	10	4	6	24	9	15
Bandarlapalle	Rural	24	16	8	3	3	0	1	1	0	3	2	1
Challavaripelli	Rural	47	45	2	10	8	2	0	0	0	43	40	3
Chintalurapalle	Rural	528	318	210	284	111	173	5	4	1	158	113	45
Jambulapadu	Rural	59	58	1	0	0	0	0	0	0	9	9	0
Kaverisamudram	Rural	188	179	9	128	74	54	52	19	33	154	123	31
Koduru	Rural	415	328	87	589	311	278	6	4	2	125	98	27
Kottapalle	Rural	674	446	228	947	468	479	29	19	10	161	113	48
Satriam Chennampalle	Rural	128	65	63	35	17	18	0	0	0	12	8	4
Tadpatri	Urban	520	473	47	1505	691	814	3536	1457	2079	24459	21233	3226
Tollamadugu	Rural	418	212	206	273	124	149	6	3	3	115	64	51
Total (7-10 km)		**3385**	**2325**	**1060**	**3799**	**1818**	**1981**	**3645**	**1511**	**2134**	**25263**	**21812**	**3451**
Total		**5073**	**3373**	**1700**	**5304**	**2447**	**2857**	**3677**	**1521**	**2156**	**26574**	**22854**	**3720**

Source:2001 Census Published Data

ANNEXURE – 6 A

MEAN METEOROLOGY
SUMMER '06

HOUR	WIND DIRECTION	WIND SPEED (M/SEC)	TEMPERATURE ^{o}K	STABILITY CLASS	MIXING HEIGHT (M)
1	SE	1.78	297.1	6	440
2	SE	1.58	299.3	6	470
3	SE	1.45	295.7	6	530
4	SE	1.56	295	6	560
5	SSE	1.39	294.6	6	670
6	SE	1.33	293.5	6	730
7	SSE	1.39	292.5	6	760
8	SE	1.39	293.4	2	840
9	SE	1.17	297.7	2	990
10	SSE	1.03	300.9	2	1060
11	SE	1.22	303.3	2	1170
12	ESE	1.11	304.8	2	1220
13	SE	1.97	305.8	1	1380
14	ESE	1.89	306.1	1	1410
15	SSE	1.78	306.3	2	1500
16	ESE	1.78	306.4	2	1540
17	SE	1.67	305.9	3	1380
18	SE	1.70	305.4	6	1270
19	ESE	1.22	303.7	6	925
20	SSE	1.28	302	6	880
21	ESE	1.36	300.4	6	680
22	SE	1.39	299.2	6	510
23	SE	1.95	298.5	6	480
24	SE	1.83	297.8	6	450

ANNEXURE – 6 B

PREDICTED HIGH 50 24-HOURLY AVERAGE GROUNDLEVEL CONCENTRATIONS OF SUSPENDED PARTICUALTE MATTER DUE TO INCREASE OF CLINKER AND CEMENT PRODUCTION

RANK	CONC	AT	RECEPTOR (XR,YR) OF	TYPE	RANK	CONC	AT	RECEPTOR (XR,YR) OF	TYPE
	µg/m3		(m,m)			µg/m3		(m,m)	
1	7.33726	AT	(-383.02, 321.39)	GP	26	4.05547	AT	(-150.00, 259.81)	GP
2	7.27296	AT	(-321.39, 383.02)	GP	27	3.93924	AT	(-606.22, 350.00)	GP
3	6.99767	AT	(-385.67, 459.63)	GP	28	3.90798	AT	(-450.00, 779.42)	GP
4	6.9435	AT	(-306.42, 257.12)	GP	29	3.81922	AT	(-136.81, 375.88)	GP
5	6.78676	AT	(-459.63, 385.67)	GP	30	3.75574	AT	(-964.18, 1149.07)	GP
6	6.74165	AT	(-257.12, 306.42)	GP	31	3.68354	AT	(-102.61, 281.91)	GP
7	6.44511	AT	(-449.95, 536.23)	GP	32	3.61912	AT	(-171.01, 469.85)	GP
8	6.02316	AT	(-536.23, 449.95)	GP	33	3.4881	AT	(-692.82, 400.00)	GP
9	5.86006	AT	(-250.00, 433.01)	GP	34	3.45903	AT	(-500.00, 866.03)	GP
10	5.84887	AT	(-514.23, 612.84)	GP	35	3.45635	AT	(-957.56, 803.48)	GP
11	5.58879	AT	(-300.00, 519.62)	GP	36	3.28475	AT	(-205.21, 563.82)	GP
12	5.38141	AT	(-200.00, 346.41)	GP	37	3.26634	AT	(-1285.58, 1532.09)	GP
13	5.32022	AT	(-578.51, 689.44)	GP	38	3.08376	AT	(-779.42, 450.00)	GP
14	5.28148	AT	(-612.84, 514.23)	GP	39	3.01567	AT	(-1149.07, 964.18)	GP
15	5.03091	AT	(-350.00, 606.22)	GP	40	2.91854	AT	(-259.81, 150.00)	GP
16	4.88459	AT	(-642.79, 766.04)	GP	41	2.91022	AT	(-239.41, 657.78)	GP
17	4.67354	AT	(-689.44, 578.51)	GP	42	2.83114	AT	(-52.09, 295.44)	GP
18	4.61631	AT	(-433.01, 250.00)	GP	43	2.75124	AT	(-1606.97, 1915.11)	GP
19	4.54313	AT	(-192.84, 229.81)	GP	44	2.75054	AT	(-866.03, 500.00)	GP
20	4.43803	AT	(-400.00, 692.82)	GP	45	2.6363	AT	(-128.56, 153.21)	GP
21	4.39149	AT	(-229.81, 192.84)	GP	46	2.63196	AT	(-625.00, 1082.53)	GP
22	4.35017	AT	(-519.62, 300.00)	GP	47	2.61069	AT	(-100.00, 173.21)	GP
23	4.34665	AT	(-346.41, 200.00)	GP	48	2.6009	AT	(-563.82, 205.21)	GP
24	4.20571	AT	(-766.04, 642.79)	GP	49	2.59301	AT	(-68.40, 187.94)	GP
25	4.15242	AT	(-803.48, 957.56)	GP	50	2.5786	AT	(-273.62, 751.75)	GP

ANNEXURE – 6 C

PREDICTED HIGH 50 24-HOURLY AVERAGE GROUNDLEVEL CONCENTRATIONS OF SULPHUR DIOXIDE DUE TO INCREASE OF CLINKER AND CEMENT PRODUCTION

RANK	CONC µg/m3	AT	RECEPTOR (XR,YR) OF (m,m)	TYPE	RANK	CONC µg/m3	AT	RECEPTOR (XR,YR) OF (m,m)	TYPE
1	0.65903	AT	(-1532.09, 1285.58)	GP	26	0.38563	AT	(-1299.04, 750.00)	GP
2	0.65858	AT	(-1915.11, 1606.97)	GP	27	0.38195	AT	(-1082.53, 625.00)	GP
3	0.63574	AT	(-612.84, 514.23)	GP	28	0.37932	AT	(-3447.20, 2892.54)	GP
4	0.60206	AT	(-689.44, 578.51)	GP	29	0.37413	AT	(-449.95, 536.23)	GP
5	0.5937	AT	(-2298.13, 1928.36)	GP	30	0.35927	AT	(-1879.39, 684.04)	GP
6	0.56681	AT	(-536.23, 449.95)	GP	31	0.35731	AT	(-1000.00, 1732.05)	GP
7	0.5484	AT	(-766.04, 642.79)	GP	32	0.34799	AT	(-2571.15, 3064.18)	GP
8	0.53978	AT	(-1149.07, 964.18)	GP	33	0.33803	AT	(-1409.54, 513.03)	GP
9	0.5156	AT	(-692.82, 400.00)	GP	34	0.33735	AT	(-2165.06, 1250.00)	GP
10	0.51475	AT	(-2681.16, 2249.76)	GP	35	0.33248	AT	(-750.00, 1299.04)	GP
11	0.50393	AT	(-1285.58, 1532.09)	GP	36	0.32873	AT	(-3830.22, 3213.94)	GP
12	0.50198	AT	(-1606.97, 1915.11)	GP	37	0.32823	AT	(-459.63, 385.67)	GP
13	0.49438	AT	(-957.56, 803.48)	GP	38	0.32093	AT	(-1250.00, 2165.06)	GP
14	0.48724	AT	(-779.42, 450.00)	GP	39	0.31312	AT	(-2349.23, 855.05)	GP
15	0.45647	AT	(-1928.36, 2298.13)	GP	40	0.30271	AT	(-2892.54, 3447.20)	GP
16	0.44568	AT	(-606.22, 350.00)	GP	41	0.28815	AT	(-4213.24, 3535.33)	GP
17	0.44142	AT	(-3064.18, 2571.15)	GP	42	0.28752	AT	(-625.00, 1082.53)	GP
18	0.43943	AT	(-866.03, 500.00)	GP	43	0.28506	AT	(-1174.62, 427.53)	GP
19	0.42953	AT	(-514.23, 612.84)	GP	44	0.27261	AT	(-2598.08, 1500.00)	GP
20	0.4266	AT	(-964.18, 1149.07)	GP	45	0.26814	AT	(-1500.00, 2598.08)	GP
21	0.42581	AT	(-578.51, 689.44)	GP	46	0.26531	AT	(-3213.94, 3830.22)	GP
22	0.40741	AT	(-642.79, 766.04)	GP	47	0.25769	AT	(-684.04, 1879.39)	GP
23	0.40065	AT	(-2249.76, 2681.16)	GP	48	0.25632	AT	(-2819.08, 1026.06)	GP
24	0.39347	AT	(-803.48, 957.56)	GP	49	0.25568	AT	(-4596.27, 3856.73)	GP
25	0.38981	AT	(-1732.05, 1000.00)	GP	50	0.24826	AT	(-855.05, 2349.23)	GP

ANNEXURE – 6 D

PREDICTED HIGH 50 24-HOURLY AVERAGE GROUNDLEVEL CONCENTRATIONS OF OXIDES OF NITROGEN DUE TO INCREASE OF CLINKER AND CEMENT PRODUCTION

RANK	CONC µg/m3	AT	RECEPTOR (XR,YR) OF (m,m)	TYPE	RANK	CONC µg/m3	AT	RECEPTOR (XR,YR) OF (m,m)	TYPE
1	1.61932	AT	(-1532.09, 1285.58)	GP	26	0.94754	AT	(-1299.04, 750.00)	GP
2	1.61822	AT	(-1915.11, 1606.97)	GP	27	0.93851	AT	(-1082.53, 625.00)	GP
3	1.56211	AT	(-612.84, 514.23)	GP	28	0.93205	AT	(-3447.20, 2892.54)	GP
4	1.47934	AT	(-689.44, 578.51)	GP	29	0.9193	AT	(-449.95, 536.23)	GP
5	1.4588	AT	(-2298.13, 1928.36)	GP	30	0.88278	AT	(-1879.39, 684.04)	GP
6	1.39274	AT	(-536.23, 449.95)	GP	31	0.87795	AT	(-1000.00, 1732.05)	GP
7	1.34749	AT	(-766.04, 642.79)	GP	32	0.85507	AT	(-2571.15, 3064.18)	GP
8	1.32632	AT	(-1149.07, 964.18)	GP	33	0.8306	AT	(-1409.54, 513.03)	GP
9	1.2669	AT	(-692.82, 400.00)	GP	34	0.82892	AT	(-2165.06, 1250.00)	GP
10	1.26482	AT	(-2681.16, 2249.76)	GP	35	0.81695	AT	(-750.00, 1299.04)	GP
11	1.23823	AT	(-1285.58, 1532.09)	GP	36	0.80775	AT	(-3830.22, 3213.94)	GP
12	1.23344	AT	(-1606.97, 1915.11)	GP	37	0.8065	AT	(-459.63, 385.67)	GP
13	1.21477	AT	(-957.56, 803.48)	GP	38	0.78857	AT	(-1250.00, 2165.06)	GP
14	1.19723	AT	(-779.42, 450.00)	GP	39	0.76938	AT	(-2349.23, 855.05)	GP
15	1.12161	AT	(-1928.36, 2298.13)	GP	40	0.7438	AT	(-2892.54, 3447.20)	GP
16	1.09511	AT	(-606.22, 350.00)	GP	41	0.70802	AT	(-4213.24, 3535.33)	GP
17	1.08463	AT	(-3064.18, 2571.15)	GP	42	0.70647	AT	(-625.00, 1082.53)	GP
18	1.07974	AT	(-866.03, 500.00)	GP	43	0.70043	AT	(-1174.62, 427.53)	GP
19	1.05543	AT	(-514.23, 612.84)	GP	44	0.66984	AT	(-2598.08, 1500.00)	GP
20	1.04823	AT	(-964.18, 1149.07)	GP	45	0.65887	AT	(-1500.00, 2598.08)	GP
21	1.04628	AT	(-578.51, 689.44)	GP	46	0.65191	AT	(-3213.94, 3830.22)	GP
22	1.00106	AT	(-642.79, 766.04)	GP	47	0.63317	AT	(-684.04, 1879.39)	GP
23	0.98445	AT	(-2249.76, 2681.16)	GP	48	0.62982	AT	(-2819.08, 1026.06)	GP
24	0.9668	AT	(-803.48, 957.56)	GP	49	0.62825	AT	(-4596.27, 3856.73)	GP
25	0.95782	AT	(-1732.05, 1000.00)	GP	50	0.61002	AT	(-855.05, 2349.23)	GP