REIA for the Increase in Production by Optimization & Modernization of Petrochemical Unit of APL, Visakhapatnam

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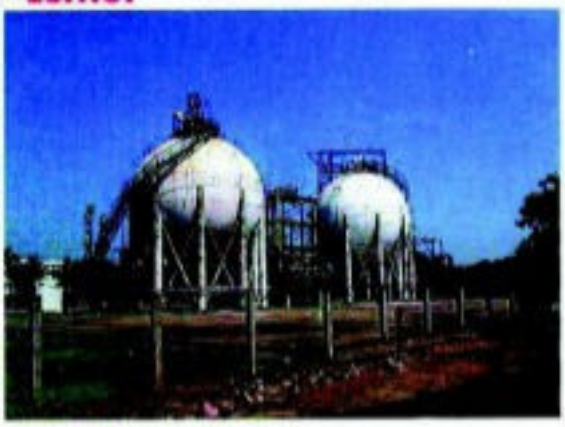

Submitted to

Andhra Pradesh State Pollution Control Board

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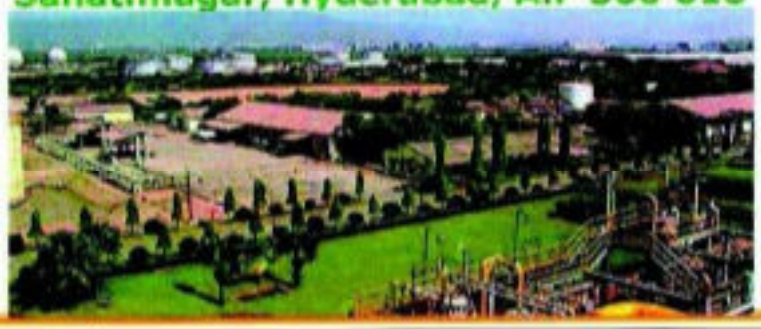

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INTRODUCTION

1.1 INTRODUCTION

M/s Andhra Petrochemicals Limited (APL) is a modern petrochemical plant being operated with the state of art technology DCS (TDC – 3000). The APL plant is in operation since 1993. The plant employs low pressure oxo technology supplied by Davy Process Technology, London, the world's largest supplier of this technology. The low pressure oxo technology has got Kirk Patrick award for excellence in chemical technology. The technology is environmentally friendly and uses low pressure and low temperature for the process.

The plant at Visakhapatnam has been producing 42,000 MTPA of Oxo alcohols. It now proposes to optimize the existing plant employing improved technology now available, taking the production level to 84000 MTPA. The main products synthesized by the APL are

1) 2 – Ethyl Hexanol
2) Normal Butanol
3) Iso Butanol

1.1.1 The Proposal

APL is now proposing to optimize the plant by enhancing the production of its existing products from 42,000 MTPA to 84,000 MTPA, keeping in view the existing market potential for these products in Plastics, Pharmaceuticals, pesticides and printing inks. The industry is intending to go about with this optimization by setting up a new MP Boiler unit and Steam Reformer for supplementing the production of its existing units to their designed limits. No negative impacts are envisaged on the environment on commissioning of this proposed plant since the proponents being environmentally conscious are proposing to employ the latest available technology in this field which ensures that the pollution loads are well within the compliance conditions.

The company proposes to optimize and modernize its existing units to augment the synthesis of Oxo alcohols i.e., 2 – Ethyl Hexanol, Normal Butanol and Iso Butanol from around 42000TPA to 84000 TPA with a total of nearly 330 working days or 8000 working hours per annum. The plant will add another syngas and

butanols unit and will be modifying the existing aldehyde plant, resulting in increase in the production capacity. The company is presently producing 110 TPD of 2 – Ethyl Hexanol and 148 TPD Normal Butanol / Iso Butanol, now proposes to optimize their production rate to 252 TPD in the proposed modernization. The products with their exsiting and proposed capacities are given in **Table 1.1 a & b.**

Table 1.1 (a)
Existing products

S. No	Product	Existing	
		TPD	TPA
1	2 – Ethyl Hexanol	110	42000
2	Normal Butanol	148	
3	Iso Butanol		

Table 1.1 (b)
Proposed products

S. No	Product	After Expansion		
		TPD	TPA	TPA
1	2 – Ethyl Hexanol	166	55200	84000
2	Normal Butanol	78	26000	
3	Iso Butanol	8.4	2800	

The existing and proposed major units and utilities inside the plant are given in **Table 1.2** below.

Table 1.2
Existing and proposed units inside the plant

S. No	Existing units	Changes and additions during proposed Modernisation
1	L.P Boiler	To be replaced with new M.P Boiler
2	M.P. Boiler	-
3	Diesel Generator unit	-
4	D.M. Plant	D.M. Plant (Expanded capacity)
5	Sea water cooling tower	One additional cell
6	Syngas unit	New Syngas unit
7	Aldehyde unit	Modified Aldehyde unit
8	2-Ethyl Hexanol unit	New Butanol unit
	(All existing units excepting LP Boiler will remain even after modernization)	

Synthesis gas, primarily a mixture of hydrogen and carbon monoxide, is the starting material for the manufacture of Butaraldehyde. It is also a source of hydrogen for hydrodesulfurization of Naphtha and hydrogenation of aldehyde to alcohol. The ever increasing demand for oxo alcohols has raised the interest in

expanding the existing synthesis gas generation capacity so as to optimize the oxo alcohol production capacity. Therefore to ensure consistent production, synthesis gas and a Butanols unit are being proposed within the existing premises.

It is to be noted that after implementation of the enhanced proposal the pollution loads are either equal or less than the existing limits/loads as prescribed in the APPCB consents. The main reason for no increase in pollution loads even after modernisation is due to the fact that the main plant including the flaring system (pollution control equipment) have been designed for anticipated higher loads but not utilized so far to the maximum design capacity. In addition to the above usage of advanced technology also reduces the pollution loads to consent levels.

No negative impact is envisaged on the environment on commissioning of this proposed modernisation since the proponents being environmentally conscious are proposing to employ the latest available technology in this field which ensures environmental quality within the prescribed limits.

The plant is spread over 75 acres (30.35 hectares) of industrial land in the Visakhapatnam port area.

1.2 PROJECT PROPOSAL

1.2.1 Justification of The Project

Keeping in view, the increased consumption of Oxo alcohols in India and the ever increasing demand supply gap due to closure of other units, in the country APL proposes to increase the production capacity of its Oxo alcohols. These will be manufactured in the existing industry by optimizing/modernising the existing units for enhanced production. By producing these Oxo alcohols, APL is not only trying to serve the nation but is also planning to conserve raw materials on account of better efficiencies, optimize the utilization of its available utilities and resources at its disposal in the existing industry.

Since Oxo alcohols are interwoven with synthesis of other important chemicals the increase in the consumption of these chemicals resulted in the augmented consumption of oxo alcohols. The main reasons one can attribute to this increase in consumption are increased usage of plasticizers in plastics and different applications. In view of the above reasons the optimization of production capacity of Oxo alcohols industry is evident and desired by all concerned.

1.2.2 Uses Of Oxo Alcohols

1) 2 – Ethyl Hexanol

2 –Ethyl Hexanol is used in Plasticizers, 44 percent; (dioctyl phthalate, 25 percent; trioctyl trimellitate, 6 percent; dioctyl adipate, 5 percent; other plasticizers, including dioctyl terephthalate, 8 percent) acrylate and methacrylate esters, 35 percent; (2-ethylhexyl acrylate, 34 percent; 2-ethylhexyl methacrylate, 1 percent) lube additives, 5 percent; surfactants, 4 percent; diesel fuel additive (2-ethylhexyl nitrate), 4 percent; solvents, 2 percent; miscellaneous, including mining applications, 6 percent.

Acrylate and methacrylate esters, which account for 35 percent of demand, have been growing at 6.5 percent annually for the past five years. Their principal markets are acrylic emulsion polymers for pressure-sensitive adhesives, textiles and surface coatings, which include high-solids automotive paint. Demand for waterborne acrylic products that replace organic solvent-based products is being driven by increasingly stringent air emission regulations. 2-Ethyl hexanol demand is projected at 8 percent annually for the forecast period, with demand being led by acrylate and methacrylate esters used in water-based coatings and adhesives

2) N- Butanol

Butanol is used in the synthesis of Butyl acrylate and methacrylate esters, 46 percent; glycol ethers, 25 percent; butyl acetate, 15 percent; direct solvent use, 7 percent; plasticizers, 2 percent; miscellaneous, including amino resins and butylamines, 5 percent. n-Butyl acrylate and n-butyl methacrylate comprise nearly half of n-butanol's demand.

The drivers for both of these are emulsified and solution polymers used in latex surface coatings, enamels and lacquers. These are water-based systems, which have benefited in recent years from the trend to move away from solvent-born coating systems. The consumption of these coatings is heavily dependent on construction and remodelling/maintenance activities. Future growth is forecast at 8 percent per year.

3) I- Butanol

Iso Butanol is used in the synthesis of i-Butyl acrylate and i-butyl methacrylate, which comprise nearly half of i-butanol's demand. The drivers for both of these are emulsified and solution polymers used in latex surface coatings, enamels and lacquers. These are water-based systems, which have benefited in recent years from the trend to move away from solvent-born coating systems. The consumption of these coatings is heavily dependent on construction and remodelling/maintenance activities. Future growth is forecast at 4 percent per year.

1.3 NEED FOR THE PROJECT

As discussed in the preceding sections, to feed the ever growing demand for plasticizers it is imperative to obtain increased production of their raw materials – Oxo alcohols. In spite of the continuous growth of Petrochemical industry, the Oxo alcohol production figures are unable to cater to the demand for the same, till date, thereby creating wide gap between demand & supply. To reduce this demand-supply gap for 2-Ethyl Hexanol and Normal Butanol, the industry has taken an initiative in this direction for enhanced production of these oxo alcohols.

Therefore any proposal to setup Oxo alcohol plants or optimization of existing plants should be treated as a welcome note by one and all, provided the proponents implement all necessary control measures to mitigate the negative impacts on the environment, if any, from the proposal.

1.4 APL vis-à-vis APPCB Consents

The plant has valid air consent, water consent and hazardous waste authorization from the AP Pollution Control Board. The details of the consent orders along with the validity dates are herewith provided in table below:

Table 1. 3
Overview of existing APPCB consents

S. No	Consent			Validity
1	**Product**	**Quantity TPD**		
	2 – Ethyl Hexanol	110		
	Normal butanol or Iso Butanol	148		
2	**Water consent**	**Max. daily discharge (liters/day)**	**Disposal point**	**28th Feb 2006**
1	Process effluent	45000	Into open channel which ultimately joins the sea.	
2	Cooling & Boiler blow down	3389000		
3	Domestic effluents	90000	Into septic tank followed by soak pit.	
3	**Air consent**			**28th Feb 2006**
	Attached to 10 TPH + 12 TPH LSHS fired boiler			
	Attached to 59962 Kg/hr HP Flare			
	Attached to 2940 Kg/hr LP Flare			
	Attached to 3 × 1.2 K cal fired heaters			
	Attached to reformer			
	Attached to 750 KVA + 3 × 2270 KVA DG sets			

4	**Hazardous waste**			**28th Feb 2006**
	ETP sludge	500 Kg/Month		
	Used / waste lubricating oil	830 Lt/month		
	Containers and container liners of Hazardous waste and chemicals	300 Numbers/year		
	Used lead acid batteries	4 Numbers/year		
	Spent catalyst	2 MT/year		
	Oxo residue	120 MT/year		

1.5 JUSTIFICATION OF THE OPTMIZATION PROPOSAL

The enhanced production is purely arising from optimization of the production from the existing infrastructure only. The design capacities of existing units with changes in hardware permit the increase of oxo alcohol production.

1.6 NEED FOR EIA

In general, Industrialization brings in its wake associated pollution and petrochemical industry is no exception. With the global policy of development in tune with the Environment conservation and also to fulfil the statutory requirements, APL has decided to study the impacts of the optimization proposal on the Environment, if any. This enables the proponents to take all the necessary precautionary measures to mitigate adverse impacts if any, from the planning stage itself.

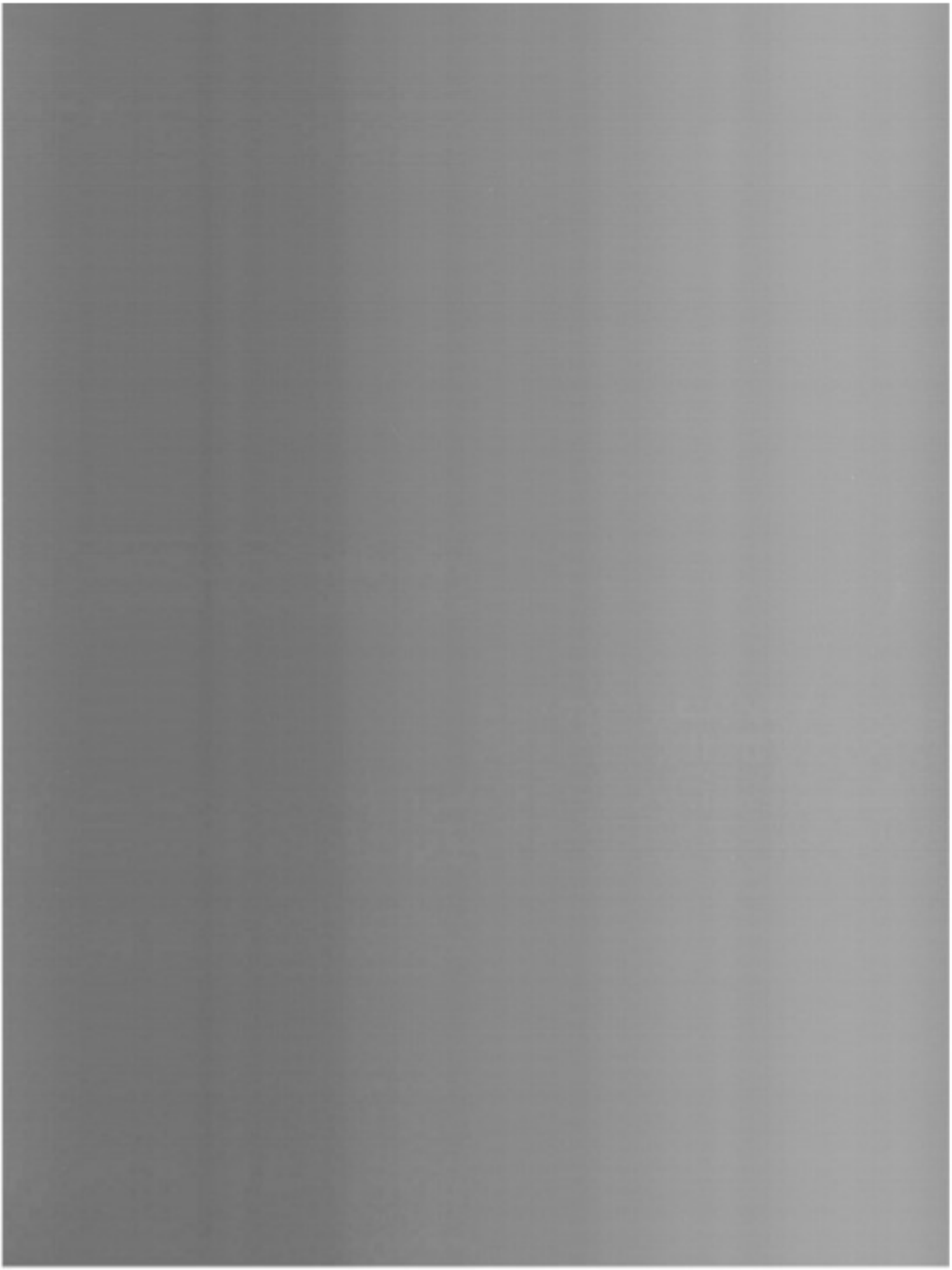
M/s APL has retained the services of M/s Ramky Infra Consulting Private Limited (a division of Ramky Group) Hyderabad to undertake Rapid Environmental Impact Assessment (REIA) Study, based on one season data (pre-monsoon-2006) for various environmental components viz. air, noise, water, land and socio-economics, which are likely to be affected, due to the present optimization proposal and to prepare a detailed Environmental Management Plan (EMP).

1.7 EIA METHODOLOGY

The EIA study encompasses 10 km radius area with the existing plant as its epicentre.

1.7.1 Scope of EIA

The scope of study includes detailed characterization of existing status of environment in an area of 10 km radius with the plant as its center for various environmental components viz. Air, noise, water, land, biological and socio-economic components and other parameters of interest. The envisaged scope of EIA is as follows:



- To assess the present status of air, noise, water, land, biological and socio-economic components of environment.
- Identification and quantification of significant impacts of the proposal operations on various components of environment.
- Evaluation of proposed pollution control facilities.
- Preparation of sound Environmental Management Plan (EMP) outlining additional control technologies to be adopted for mitigation of adverse impacts, if any.
- Delineation of the post-project environmental quality monitoring program to be followed by APL.

1.7.2 Methodology for EIA

Any developmental activity in general is expected to cause impacts on surrounding environment at the project site during its implementation and operation phases, which can be both positive and negative. The nature and intensity of impacts on different components of environment depend on the type of project activities and geographical conditions of the study area. The impacts of the project activities on environmental components can be quantified through Rapid Environmental Impact Assessment (REIA) Studies within the impact zone of the project activities. The results of REIA Studies form the basis for the preparation of a viable EMP for mitigation of the adverse impacts. The REIA Studies for the proposal deals with detailed studies for various environmental components viz. Air, noise, water, land, biological and socio-economic environment for pre monsoon season.

In the present case APL is optimizing the plant for enhanced production with existing infrastructure and addition of one Synthesis gas unit and alcohols unit.

a. Study Period

For preparation of EIA report for the proposal, data was collected for summer season during March 2006 to May 2006 for the study area. The micro climatic parameters were recorded using manual weather station for the study period. Wind speed, wind direction and relative humidity were recorded on hourly basis. Minimum & Maximum temperatures were also recorded during the study period.

b. Air Environment

For the environmental impact studies, an area covering 10 km radial distance surrounding the plant site was identified as study area (Impact Zone). The studies carried out on each individual components were briefly reported below and the details are reported in subsequent chapters.

The topographical information of project site, study area and details about different activities related to the APL plant operations are collected. Different air pollution parameters like SPM, RSPM, SO_2 and NO_x were identified as related to the project activities for representing baseline status of ambient air quality within the study area.

Pre-calibrated Respirable Dust Samplers (RDS) have been used for monitoring all the air pollutants.

c. Noise Environment

Excessive noise levels cause adverse effects on human beings and associated environment including domestic animals, wild life, natural eco-system and structures. Hence noise survey is carried out at the plant site. Noise levels were measured in the plant, and several locations in human settlements around the plant site at various times of the day. Noise levels (A-Weighted) were measured using precision sound level. The principle of propagation of sound waves was used to estimate the noise levels at various locations due to the proposed activities.

d. Water Environment

Information on water resources in the study area was collected. The water resources in the study area are mainly comprised of groundwater, surface water sources etc. The parameters of prime importance for water quality studies were selected under physical, chemical and heavy metal groups etc. were analysed in samples collected at different locations.

e. Land Environment

Soil samples were collected from the plant site, not only at its immediate vicinity but also in the surrounding villages in a 10 km radial zone. Physico-chemical properties of the soils were determined. Information on land use pattern in the study area was also collected. Information regarding existing cropping pattern, their types and yield of the crop was collected from various sources. Based on the attenuation factors for dust aerosols and air pollutants, green belt species have been identified.

f. Eco-system

Information on eco-system within 10 km radius was collected from the state Agricultural and Forest departments. The important flora species native to the area is enumerated. A test check survey was also under taken to judge the correctness of the data collected.

g. Socio-Economic Environment

A field survey was conducted within 10 km radius of the plant and the surrounding impact zone. The parameters selected under socio-economic component were demographic structure of the study area, provision of basic amenities, industries likely to come up in the study area, welfare facilities proposed by the proponent, safety training and management, community and occupational health hazards. Relevant information was collected from selected villages and analyzed.

1.8 PROJECT

The Andhra Petrochemicals Limited (APL) unit is located on 30.35 Ha of land in the industrial area of Visakhapatnam port. It is 1 Km away from the Central Ware Housing buildings. The site is surrounded by Coromandel Fertilizers, HPCL refinery and small hill as well as the Naval Dockyard.

The Industry comprises of i) Synthesis gas preparation and Hydrogen production unit (Area 01) ii) LP hydro formylation of propylene to aldehyde (Area 02) iii) Aldolisation and hydrogenation of aldehydes to alcohols (Area 03) iv) offsites (Area 04) v) utilities (Area 05) and now proposes to install another Area 01 and Area 03 within the same compound and at the same time modernising Area 02. APL has dedicated supply channels for the raw materials – Propylene and Naphtha from HPCL. The manufacture area details are given **Table 1.4.**

Table 1.4
Manufacturing Area Details

Area Number	Description	Remarks
01	Synthesis gas preparation and hydrogen production unit	Adding another Area 01
02	LP hydro formylation of propylene to aldehyde	Modernising Area 02
03	Aldolisation and hydrogenation of aldehydes to alcohols	Adding another Area 03
04	Off sites area	No change
05	Utilities area	No change

1.8.1 SITE SELECTION CRITERIA

The proposed Area 01 and Area 03 are to be setup within the existing premises in an area of 0.88 acres. As the project is considered to be a process optimization of the existing facilities with all the utilities, raw materials and manpower being drawn from the existing infrastructure and with the required land available under the APL, it is but natural that no other alternative site was considered for the project.

The main raw materials used in the manufacture are Propylene and Naphtha.

Since the Industry already has dedicated supply from HPCL refinery and is just intending to enhance the production capacity of its Oxo alcohol, the additional requirement of raw materials for enhanced production shall be supplied by HPCL. The utilities will be common for the existing and proposed project. Majority of the technical manpower and all administrative staff will be drawn from the existing resources. The siting features of the study area have been presented in **Table 1.5.**

The location map of the study area is shown as **Figure 1.1** and site plan showing neighbouring areas are shown as **Figure 1.2.**

Table 1.5
Site Features of the Proposed Project

Selection Criteria	Details
Name of the Industry	M/s The Andhra Petrochemicals Limited
Location	Visakhapatnam, Andhra Pradesh
Geographical Positions	17° 42′ N Latitude and 83° 16′ E Longitude
Elevation above Mean sea level	10 m above MSL
Maximum and minimum Temperature	36.2°C and 18°C
Maximum and minimum rainfall	204.3 and 7.7 mm
Land required for the activity	0.36 hectare out of the existing area
Present land use	Industrial
Nature of Soil	Sandy clay, red sandy, silty loam and red loamy soils
Nature of terrain	Plain
Predominant wind direction	North for the premonsoon season of 2006
Nearest Highway	NH-5 Kolkata to Chennai-2.5 Km SE
Nearest railway station	Visakhapatnam-5 km SE
Nearest Airport	Visakhapatnam-6 Km W
Nearest Habitat	Visakhapatnam city-5 km
Hills / valleys	Eastern ghats
Archeologically important places/ Monuments	Venkateswara konda and Simhachalam temple
National parks	-
Forests	Tropical forest in eastern ghats
Water bodies	Bay of Bengal- E of the plant site.
List of important industries in the study area	Hindustan Shipyard, Hindustan Petroleum Corporation limited(visakha refinery),CFL,HZL etc.

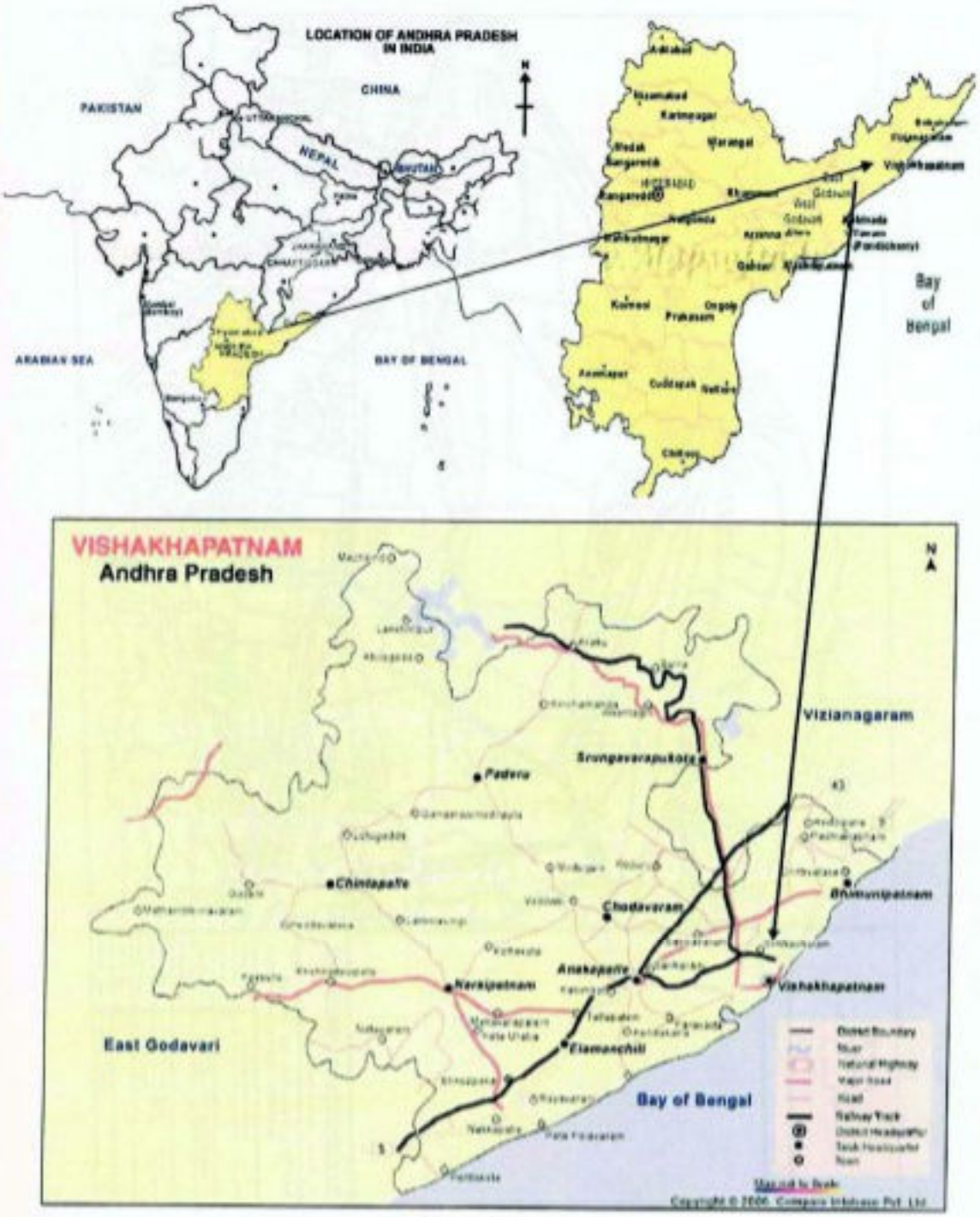


Figure 1.1
Location map of the study area

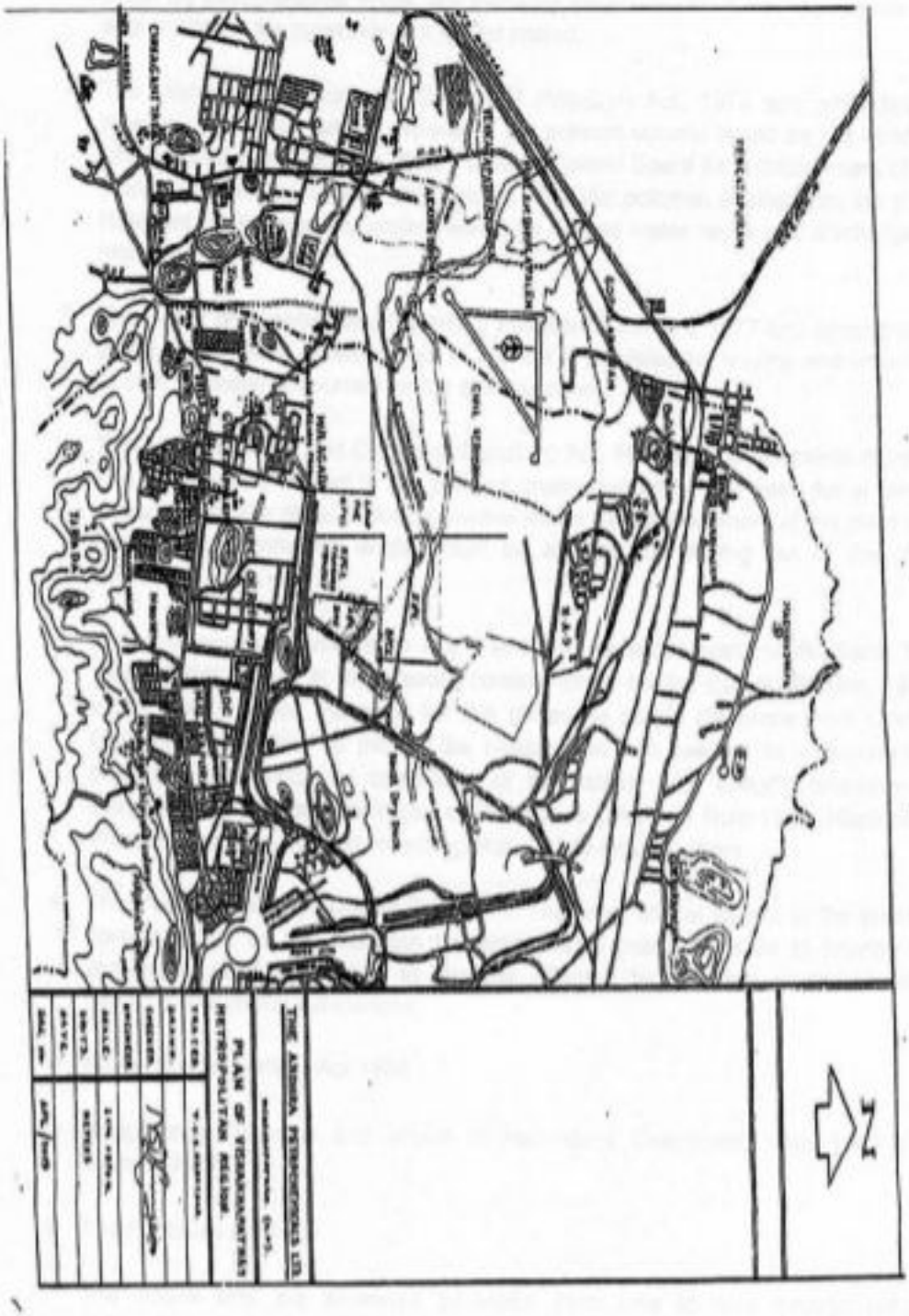


Figure 1.2
Site layout and its neighboring places

1.9 RULES FOR PREVENTION & CONTROL OF ENVIRONMENTAL POLLUTION

From an environmental angle, the following environmental rules, regulations and acts would be the most relevant for the project:

- The Water (Prevention and Control of Pollution) Act, 1974 and amendments thereon. The most critical aspects in the present context would be the need for obtaining consent from the State Pollution Control Board for establishment of the plant and in environmental angle would be water pollution arising from the plant. Relevant for the specific project would be treated water reuse and discharge on land for greenbelt.

- The Water (Prevention and Control of Pollution) Cess Act, 1977 and amendments thereon. The most critical aspect in this act is provision for levying and collection of cess on water consumed for the said purposes.

- The Air (Prevention and Control of Pollution) Act, 1981 and amendments thereon. The most critical aspect in the present context would be the need for obtaining consent from the State Pollution Control Board for establishment of the plant and from an environmental angle would be air pollution arising out of the plant operations.

- The Environment (Protection) Act, 1986 and its subsequent notifications. The most critical aspect in the present context would be the EIA notification, 1994, which clearly states the need for this project to obtain clearance from Central Government. Further to this all the notifications with respect to environmental protection are critical to operations of the facility, with specific reference to Manufacture, Storage and Import of Hazardous Chemical Rule 1989, Hazardous Wastes (Management and Handling) Rules 1998 among others.

- The Public Liability Insurance Act, 1991. The most critical aspect in the present context would be the provision for insurance of public liabilities to provide for immediate relief operations to persons affected by accident occurring while handling hazardous substances.

- Forest (Conservation) Act 1980

- Manufacture, Storage and Import of Hazardous Chemicals, rules 1989 and amended 2000

- The Factories Acts etc

The above acts are amended by MoEF from time to time through official notifications, and Environment (Protection) Act prescribes from time to time several emission and discharge standards for specific industries and also in general for all industries which has to be complied.

1.9.1 Applicable Standards

For the preparation of this report reference has been made to existing standards. The standards used in this report are reproduced herein the following section for ready reference.

1.9.1.1 Air Quality Standards

- National Ambient Air Quality Standards- Notified by the CPCB June'95
- Ambient Air quality standards with respect to noise- Notified by the Central Pollution Control Board (CPCB), June'95

1.9.1.2 Water Quality and Wastewater discharge Standards

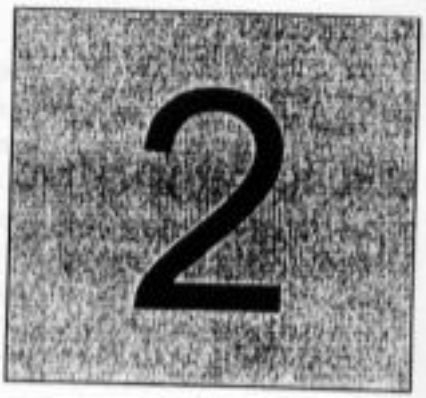
- India Standard: Drinking Water Specifications- IS 10500:1991- Bureau of Indian Standards(BIS)
- General Standards for Discharge of Environmental Pollutants-GSR 422(E)

1.9.1.3 Diesel Generator Sets

- Stack height for Diesel Generator sets and emission standards, CPCB, Emission Regulations Part IV, COINDS/26/1986-87

Chapter 2
Process Details
Resource Requirements
And Pollution Loads

PROCESS DETAILS RESOURCE REQUIREMENTS AND POLLUTION LOADS



2.1 INTRODUCTION

The LP Oxo SM Process is extensively used to produce normal and iso-butyraldehydes from propylene for subsequent conversion to the work-horse plasticizer alcohol, 2-ethylhexanol, or to butanols for solvent uses. This technology now accounts for the majority of the world's butyraldehyde production. This rhodium catalyzed process was first developed as a replacement for inefficient high pressure cobalt catalyzed processes, and since then, it has undergone continual improvement and refinement to reduce operating and capital costs. Apart from its wide use with propylene, the technology has been developed for converting normal butenes to the new plasticizer alcohol 2-propylheptanol, and it has been applied commercially to produce alcohols from higher olefins, notably the production of C11 to C14 higher alcohols from olefin cuts produced from Fischer-Tropsch synthesis.

In the most widely adopted application of the LP Oxo Process, normal and iso-butyraldehydes are produced by reacting propylene with synthesis gas (a mixture of carbon monoxide and hydrogen) in the presence of a homogeneous modified rhodium catalyst. The reactions are carried out at moderate temperature and pressure, i.e. less than 120°C and less than 20 bar g. These mild operating conditions, the catalyst characteristics and the choice of flow sheet ensure very efficient utilisation of raw materials with low by-product formation, relatively simple product work-up and low energy requirements. Different LP Oxo SELECTOR SM Technology variants are available to achieve the desired selectivity of conversion to butyraldehyde, depending on the need for the usually less desirable iso-butyraldehyde, which cannot be used to produce 2-ethylhexanol.

Plants using the LP Oxo Process are easy to operate, have shown high availability with low environmental impact and require low maintenance. The relatively simple flow sheet, moderate design conditions and absence of exotic materials of construction result in low investment costs.

2.2 OVERVIEW OF PROCESS

Synthesis gas which is produced by naphtha reforming is reacted with propylene to produce normal butyraldehyde and Iso-butyraldehye. N- butyraldehyde after aldolisation and hydrogenation produces 2 – Ethyl Hexanol. The other alcohols namely Normal Butanol & Iso Butanol are also produced , by hydrogenation reaction of individual normal and iso butyraldehydes. The hydrogen requirement is met by hydrogen production from PSA unit. Raw materials and other storage facilities are provided in off sites area, whereas all the utilities requirements are grouped in utilities area.

2.2.1 Project Area

There are different areas marked as area 01, area 02, area 03, where synthesis gas preparation and Hydrogen production, LP Hydro formylation of propylene to aldehydes, aldolisation and hydrogenation of aldehydes to alcohols take place. The ancillary sections namely offsites and utilities (Area 04 and Area 05 respectively), are installed to support main process plant of 2 – ethyl hexanol, n-butanol and Iso Butanol production.

The total area of the complex is 75 acres or 30.35 hectraes in which main plants like syngas preparation, purification and butyraldehyde synthesis are located. Boiler house, D.M plant, administrative and other ancillary utilities are also located within the plant area. The industry is rich in greenery. The plant layout is shown as **Figure 2.1**

2.2.2 Manufacturing process

The process units, off sites and utilities contained in the plant are given below:

- Synthesis gas preparation and hydrogen production- Area-01
- LP hydro formylation of propylene to aldehyde- Area- 02
- Aldolisation and hydrogenation of aldehydes to alcohol- Area-03
- Off sites- Area-04
- Utilities- Area-05

The manufacturing process includes

1) Manufacture of syngas from naphtha as feed stock
2) L.P Hydro formylation of propylene to aldehyde
3) Manufacturing of ethyl propyl acrolein from butaridehyde.
4) Butaraldehyde is further used for manufacture of N & I butanol and 2 ethyl hexanol.

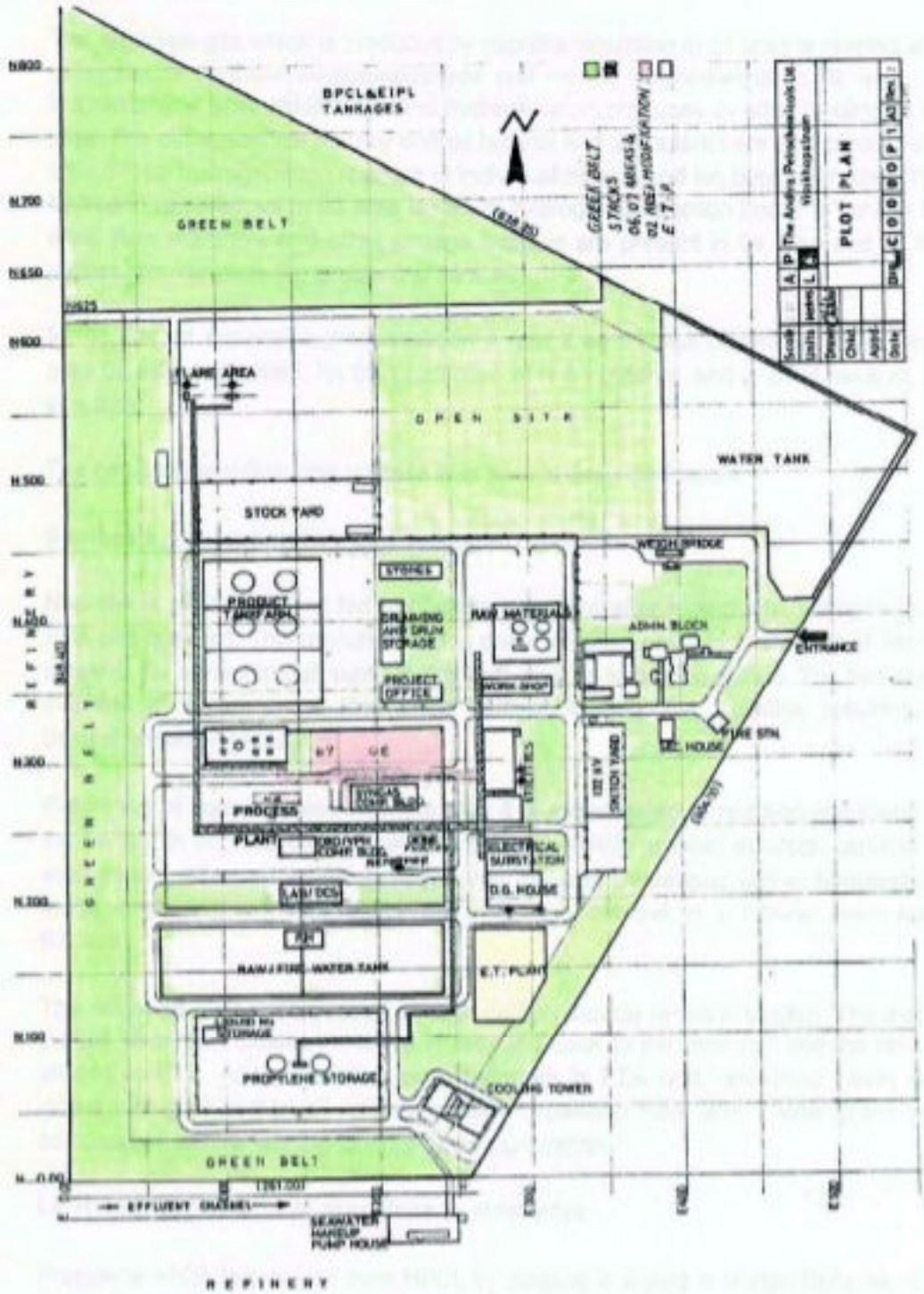


Figure 2.1
Plant Layout

The synthesis gas which is produced by naphtha reforming in 01 area is reacted with propylene to produce iso-butyraldehyde and normal butyraldehyde in 02 area. N-Butyraldehyde after aldolisation and hydrogenation produces 2- ethyl hexanol in 03 area. The other alcohols namely normal butanol and iso butanol are also produced in area 03 by hydrogenation reaction of individual normal and iso butyraldehydes. The hydrogen requirement in 03 area is met by hydrogen production from PSA unit in 01 area. Raw materials and other storage facilities are present in 04 area and all the utilities requirements are grouped in 05 area.

In the current expansion modernisation a new area 01 and 03 will be added and area 02 will be modified for the production of N & I butanol and 2- ethyl hexanol, all at a time.

The detailed manufacturing process area wise is described below.

1) Synthesis gas preparation and hydrogen production

Naphtha is preheated and fed to naphtha vaporizer after high purity hydrogen from PSA unit is mixed. This mixture is fed to desulfurization unit which consists of Nimox catalystl, for converting all sulfur in the feed stock to hydrogen sulfide. The hydrogen sulphide is absorbed on zinc oxide catalyst forming zinc sulphide resulting in desulphurised Naphtha.

Reforming of desulphurised naphtha after it is superheated to reaction conditions is carried out in two stages, the catalytic rich gas (CRG) process in which naphtha is adabatically reformed at low temperatures followed by second higher temperature stage employing a methane rich gas reforming catalyst in a tubular down fired furnace.

The reformed gases are passed through carbon dioxide removal section. The major portion of carbon dioxide removed is recycled back to the reformer and the rest is utilized in ETP. After extracting pure hydrogen in PSA unit, remaining gases are mixed with part portion of reformed gases bypassing PSA unit. These gases are compressed before feeding to Area 02 for purification.

2) LP Hydro formylation of propylene to aldehydes

Propylene which is received from HPCL by pipeline is stored in Horton Spheres. It is purified in propylene purification unit before feeding to Oxo reaction. Syngas from 01 area is purified and passed through stripper to carry out unreacted gases produced in Oxo reactor, before actually feeding to Oxo reactor. Finally Oxo reactor is fed with

propylene, syngas carrying unreacted gases and recycle gases from Oxo cycle compressor. The products from Oxo reactor are separated out between recycle gases and butyraldehydes in Oxo product catch pot. These butyraldehydes after further purification in stripper and stabilizer are distilled in isomer column to separate out Iso butyraldehyde and Normal butyraldehyde. Storage facilities are available for intermediate products in this area.

In the proposed modernization, the existing higher energy and lower conversion efficiency gas recycle process shall be converted to lower energy and higher conversion efficiency liquid recycle process. This process improves raw material conversion by approximately 6% and at the same time producing much lower quantities of less desired Iso-butyraldehyde and consequently Iso-Butanol. The reaction temperature is also lower with enhanced catalyst life practically eliminating the production of spent catalyst.

The compressor used in the present gas recycle process shall be replaced with low energy pumps in the liquid recycle process proposed. The productivity of the reactor is substantially enhanced. The existing isomer column shall separate pure Normal Butyraldehyde for 2-Ethyl hexanol production and mixture of normal and Iso Butyraldehyde for the production of mixed Butanols in the new alcohols unit (03 area).

3) Alcohols plant

Respective Normal Butyraldehyde and Iso Butyraldehyde are hydrogenated in vapour phase hydrogenating converter to produce Normal and Iso Butanol. In case of 2-Ethyl hexanol production the normal Butyraldehyde is converted to Ethyl Propyl Acrolien (EPA) employing an aldolisation step, which is then hydrogenated in a vapor phase hydrogenator to yield 2-Ethyl hexanol.

In alcohols plant the feed Butyraldehyde / EPA along with the recycle gases from VPH compressor are fed to VPH converter. The product from the converter is separated from the recycle gases in the product catch pot. The crude alcohol are refined in two stage distillation ie in a forecolumn followed by a refining column. The aqueous effluent stream is passed through a stripper to strip off organics before sending to ETP. In the modernisation the alcohols unit employs liquid recycle process .The mixture of Normal and Iso butyraldehyde hydrogenated in a liquid phase converter to produce crude N & I Butanol.

The flow chart of the existing plant and after modernization is given as **Figure 2.2 and 2.3.**

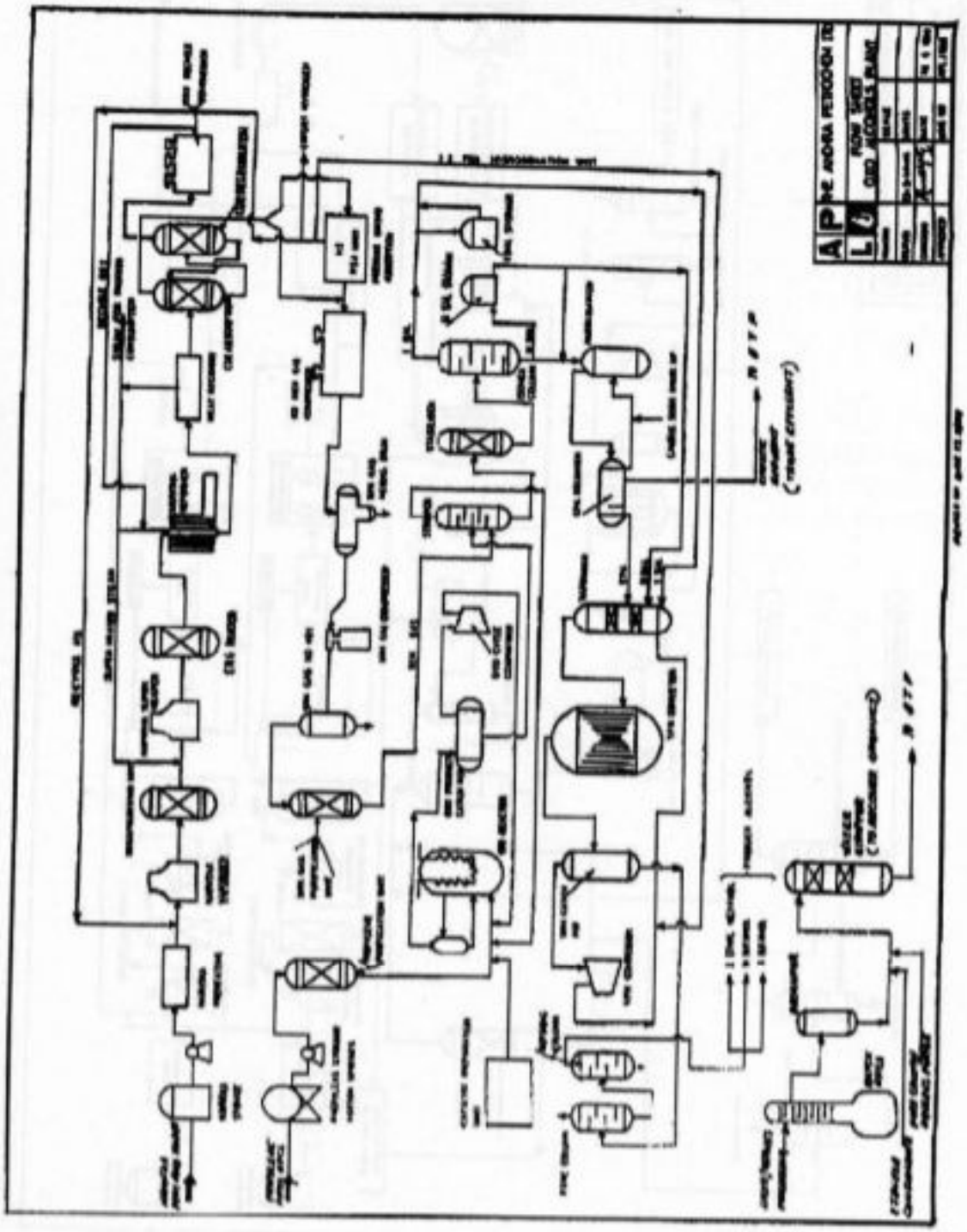


Figure 2.2
Flow chart showing Existing Plant

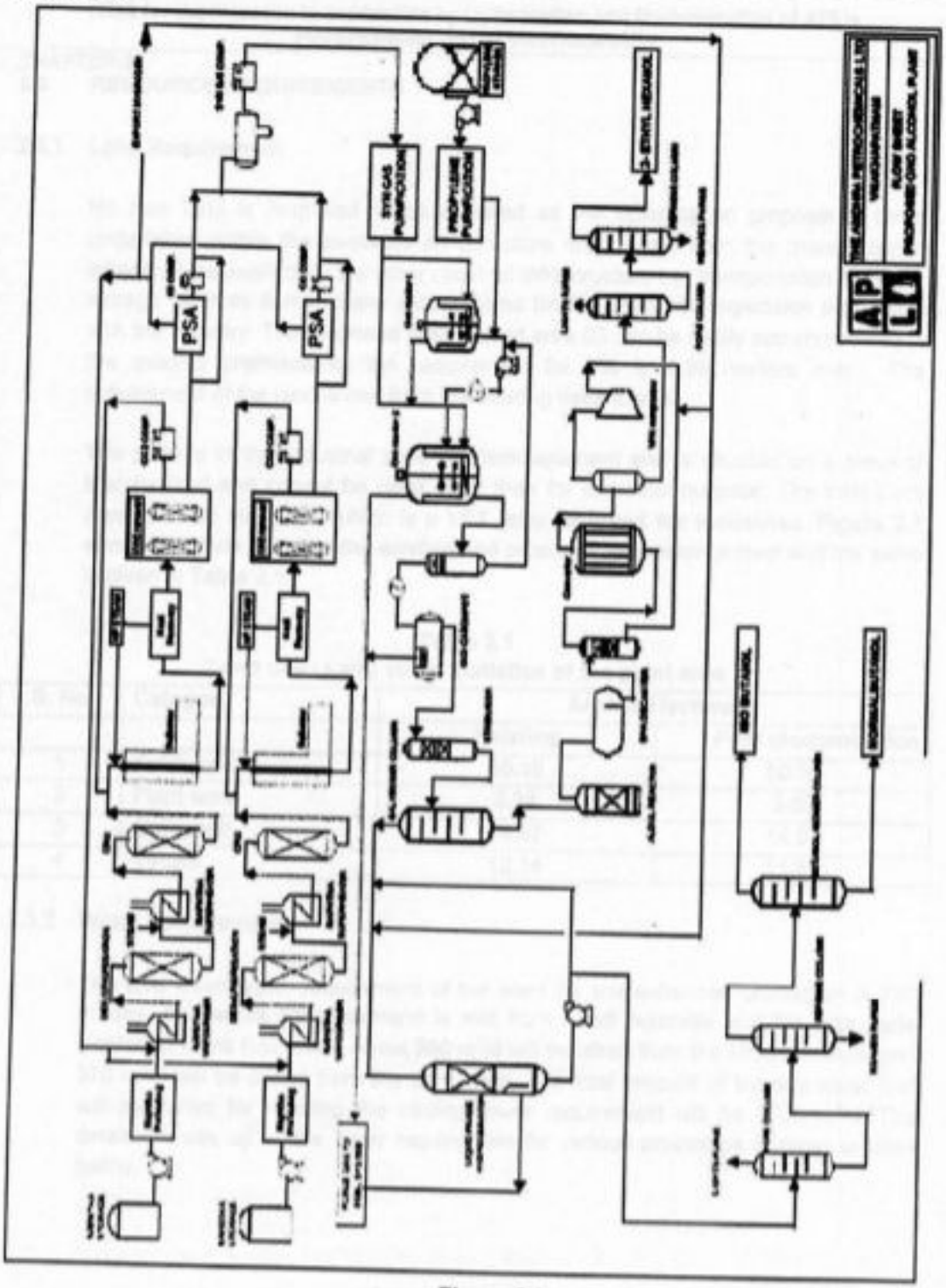


Figure 2.3
Flow chart showing Proposed Plant

CHAPTER-2

2.3 RESOURCE REQUIREMENTS

2.3.1 Land Requirement

No new land is proposed to be acquired as the optimization proposal is being undertaken within the available infrastructure only. Apart from the manufacturing infrastructure availability the other required infrastructure i.e. transportation linkages, storage facilities & manpower etc. required for the proposed expansion also exists with the industry. The proposed area 01 and area 03 can be easily accommodated in the existing premises as the requirement for this is 0.36 hectare only. The requirement of the land is met from the existing vacant land.

The plant is in the industrial zone of Visakhapatnam and is situated on a piece of Marshy land and cannot be used other than for industrial purpose. The total plant area is 30.35 Hectares, which is a **VPT land reserved for industries**. **Figure 2.1** shows the plant layout of the existing and proposed expansion project and the same is given in **Table 2.1**.

Table 2.1
Land use / Land cover statistics of the plant area

S. No	Category	Area in Hectares	
		Existing	Post modernization
1	Total area	30.35	30.35
2	Plant area	3.24	3.60
3	Greenbelt	14.97	14.97
4	Vacant	12.14	11.78

2.3.2 Water Requirement

The total fresh water requirement of the plant for the enhanced production is 730 m^3/day. The entire water demand is met from Mindi reservoir and the bore wells located at Mindi R&D unit. About 360 m^3/d will be taken from the Mindi reservoir and 370 m^3/d will be drawn from the bore wells. The total amount of the sea water that will be drawn for meeting the cooling tower requirement will be 4700 m^3/d. The detailed break up of the water requirement for various processes is given in table below.

Table 2.2

Water requirement - Existing and post modernisation -(m^3/day)

S. No	Unit	Existing	Post Modernisation
I	**Fresh water requirement**		
1	For D.M water plant	230	450
2	Potable water for domestic use	100	100
3	Potable water for cooling water system and H.P. Flare water seal	70	110
4	Potable water for civil works and gardening	50	50
5	Fire water consumption	20	20
	Total Fresh water	**470**	**730**
II	**Sea water requirement**		
1	Sea water for cooling tower	3150	4700
	Total (Fresh + Sea water requirement)	**3620**	**5430**

2.3.3 Raw materials requirement

The raw materials requirement of the industry is given in the table below. The main raw materials propylene and naphtha will be sourced from HPCL which is adjacent to the plant.

Table 2.3

Raw material requirement- Existing and post modernisation.

S. No	Raw material	Quantity (T/day)		Source
		Existing	Post modernization	
1	Naphtha	42	90	HPCL
2	Propylene	100	180	HPCL

2.3.4 Power Requirement

The power requirement of existing plant is about 3.5 MW. This requirement is met from three sources ie companies 1.5 MW share in APGPCL, 1.5 MW DG set running continuously for base load operation and the balance from AP Transco.

Post modernisation the power load is expected to be around 5 MW. This demand is proposed to be met from existing company share of 1.5 MW in APGPCL and AP Transco. The continuously running DG set(s) shall be stopped and to be used only as emergency backup in case of AP Transco power failure only. To achieve this objective the company has already installed and commissioned a large UPS system of 2.4 MVA capacity in place of continuously running DG sets, to ensure uninterrupted power supply to critical loads. This system has been commissioned in

October, 2006. The UPS system is designed to provide steady power with a backup of 20 minutes in case of AP Transco power failure. The company proposes to install necessary UPS system for critical loads under modernisation scheme, thus avoiding DG 's operation except as emergency backup in case of AP Transco power failure.

Table 2.4
Total power requirement- Existing and post modernization

S. No	Power source	Existing with DG set	Existing Post UPS	After modernization
1	DG set	1.5 MW	-	-
2	APGPCL	1.5 MW	1.5 MW	1.5 MW
3	APTRANSCO	0.5 MW	2.0 MW	3.5 MW
	Total	3.5 MW	3.5 MW	5.0 MW

2.3.5 Manpower Requirement

The total number of employees at present in APL at any given time is 260. The plant operates on 3 shifts, Shift 1, Shift 2, Shift 3 and General shift, each consisting of 8 hrs duration. In the optimization and modernization proposal an 40 employees will be recruited, at the same time plant authorities propose to optimally utilise the services of the present employees.

Table 2.5
Manpower requirement

S. No	Shift	Existing employees	Post modernisation
1	1st shift	40	45
2	2nd shift	40	45
3	3rd shift	40	45
4	General	140	165
	Total Employees	260	300

2.3.6 Auxiliary Units

In addition to the main plants, there are also the following ancillary facilities in the factory. The details of which have been given below.

i) Quality control laboratory
ii) Mechanical and electrical workshop
iii) Office building
iv) Security office and gate house
v) Stores
vi) Fire control station and Fire water safety facility
vii) Canteen and dispensary
viii) Interplant communication system
ix) Green belt etc.

2.4 POLLUTION LOADS

2.4.1 Air Emissions

The air emissions in APL plant are mainly from the fuel burning sources, process/ manufacturing activities and the Utilities.

2.4.1.1 Emissions from Utilities

The existing L.P boiler will be converted to M.P boiler which will be continued to be operated on sulphur free fuel. Continuous operation of DG sets shall be discontinued.

2.4.1.2 Emissions from Process

The process emission sources are intermittent and emitted in small magnitude. There are nearly 30 process emission vents. Out of these vents 14 vents are having emissions of steam, nitrogen, air etc which are totally harmless. Other vents will have emissions containing organics like Butanol, Ethanol, ethane, methane, butyraldehyde having 0.1 – 1% by volume in the mixtures of air, water vapor and Nitrogen etc. These emissions are burnt in LP & HP flares. Considering very high burning efficiency of flares, pollutants like SO_2, NO_x and SPM are negligible. Therefore, no effect is envisaged from the process emissions of the plant.

2.4.1.3 Fugitive Emissions

Fugitive emissions occur in a factory as a result of various operations such as loading, unloading of chemicals, evaporation and volatilization of stored substances, leakages, spillages, open storage areas etc. Minor emissions also occur from traffic movement. No fugitive emissions are envisaged from the plant after optimization and modernization of the plant as good engineering methods are being and would be practiced to reduce the emissions.

2.4.2 Wastewater Loads

Though the proposal envisages an increase in water requirement, the wastewater generated is minimum as all the water is consumed in the process. Both the existing systems and the proposed systems do not generate adverse quantities of wastewater. Makeup Water required for cooling and boiler are condensates recycled back to the process. These are acid gas condensates from carbon dioxide removal

section, process condensates etc. Therefore, it can be safely concluded that the envisaged proposal is a minimal discharge plant.

The major sources of wastewater generation in the plant are cooling water discharges, boiler blow down, process wastewater from the 2-ethyl hexanol production unit, DM plant and domestic wastewater. In the current optimization proposal there will not be any increase in the wastewater loads as the n and I butanol unit do not generate any wastewater. The total wastewater that is generated from the process is only from the 2 – ethyl hexanol unit and this will remain the same as per the consent after modernization also. Since there are no changes in this unit and its operation remain the same as at present.

2.4.3 Hazardous Wastes

The solid wastes are generated from syngas manufacturing area, butyaldehyde manufacture areas and oxo alcohol area. The hazardous wastes that would be generated from the plant includes ETP sludge, oxo residue, spent catalyst, used oils, containers of chemicals/ catalysts, lead acid batteries etc.

Chapter 3
Baseline Environmental Status of the Study Area

BASELINE ENVIRONMENTAL STATUS OF THE STUDY AREA

3.0 PREAMBLE

The present study is to establish a baseline status and assess the potential impacts from the proposed expansion of the petrochemical unit at Vishakapatnam.

The petrochemical unit depending upon the scale of operation has the potential to affect various components of environment such as air, water, noise, soil and biological settings. The impact caused on these components varies from insignificant to significant. Study of baseline environmental data in terms of parameters such as air quality, water quality, soil quality, noise levels, biological and socio-economic setting is essential to quantify the impacts of the proposed activity.

Baseline Environmental status in and around the industry depicts the existing conditions of Air, Noise, Water, Soil and Socio-economic environment. Area covering 10 km radially, with the project site as the nodal center has been selected for baseline data collection. Keeping in view with the legislative requirements, Ramky Infra Consulting Pvt Ltd has performed a REIA study based on the monitoring data collected for the summer season (March– May 2006). From the inputs generated with respect to the baseline status, an environmental management plan has been prepared to manage and mitigate likely impacts.

3.1 BASELINE ENVIRONMENTAL STATUS

This chapter gives an idea and description of the environmental status of the study area with reference to the prominent environmental attributes. The general study area covers about 10 Km radius with respect to the plant site. The impact identification always starts with the collection of primary or baseline data such as the ambient air quality, water quality, noise levels, land use patterns, flora & fauna and the socio-economic aspects within the 10 Km radius zone.

The topographical map showing all the major settlements and the existing transport networks is shown in the **Figure 3.1** and the map showing the sampling locations in **Figure 3.2.**

3.2 Site Description And Environs

The industry is located in Port area of Vishakapatnam district of Andhra Pradesh in the geographical coordinates of 17° 42' North Latitude and 83° 16' East longitude, in the notified industrial area in Sriharipuram of Vishakapatnam. The Industry is located at a distance of about 5 km from Vishakapatnam town. The elevation of the Andhra Petrochemical limited area is about 10 m above the Mean Sea Level (MSL). Politically the plant area comes under Vizag town under Vishakapatnam district of Andhra Pradesh. Vishakapatnam is a very famous for variety of Industries, which are directly under Central Government and State Government. City is a place for huge industries like Vizag Steel Plant, which is Asia's biggest steel plant.

The area is well connected by roads to nearest towns and Vishakapatnam City. Vishakapatnam is connected to major cities through railway network. The nearest airport is Vishakapatnam situated at about 6 km west of the Plant site. The nearest railway station is Vishakapatnam, which is about 5 km SE of the plant site and the plant site is well connected with the National Highway NH-5 connecting Calcutta to Chennai at a distance of 2.5 km SE from the present site.

Andhra Petrochemicals Limited is surrounded by Sri Haripuram which is located in the North at the distance of about 2.0 Km, Mindi is located in the NE at the distance of about 2.50 Km, Seethammadara village on West at the distance of about 6 Km, Old Port office is located in the SW at a distance of about 4.75 km, Kancharapalem is located in the SW at 4 kms from the plant site. The area is well developed agriculturally and industrially.

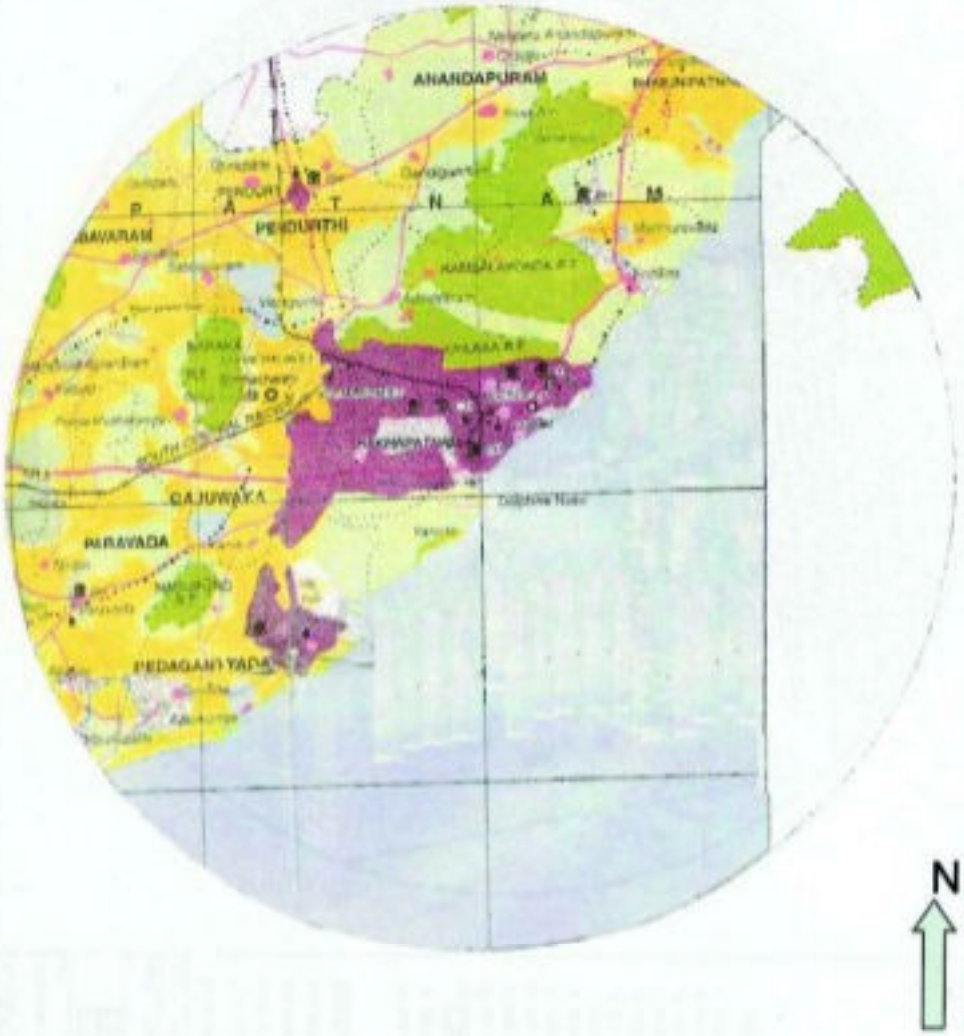


Figure 3.1
Topographical Map of the Study Area (25 Km Radius)

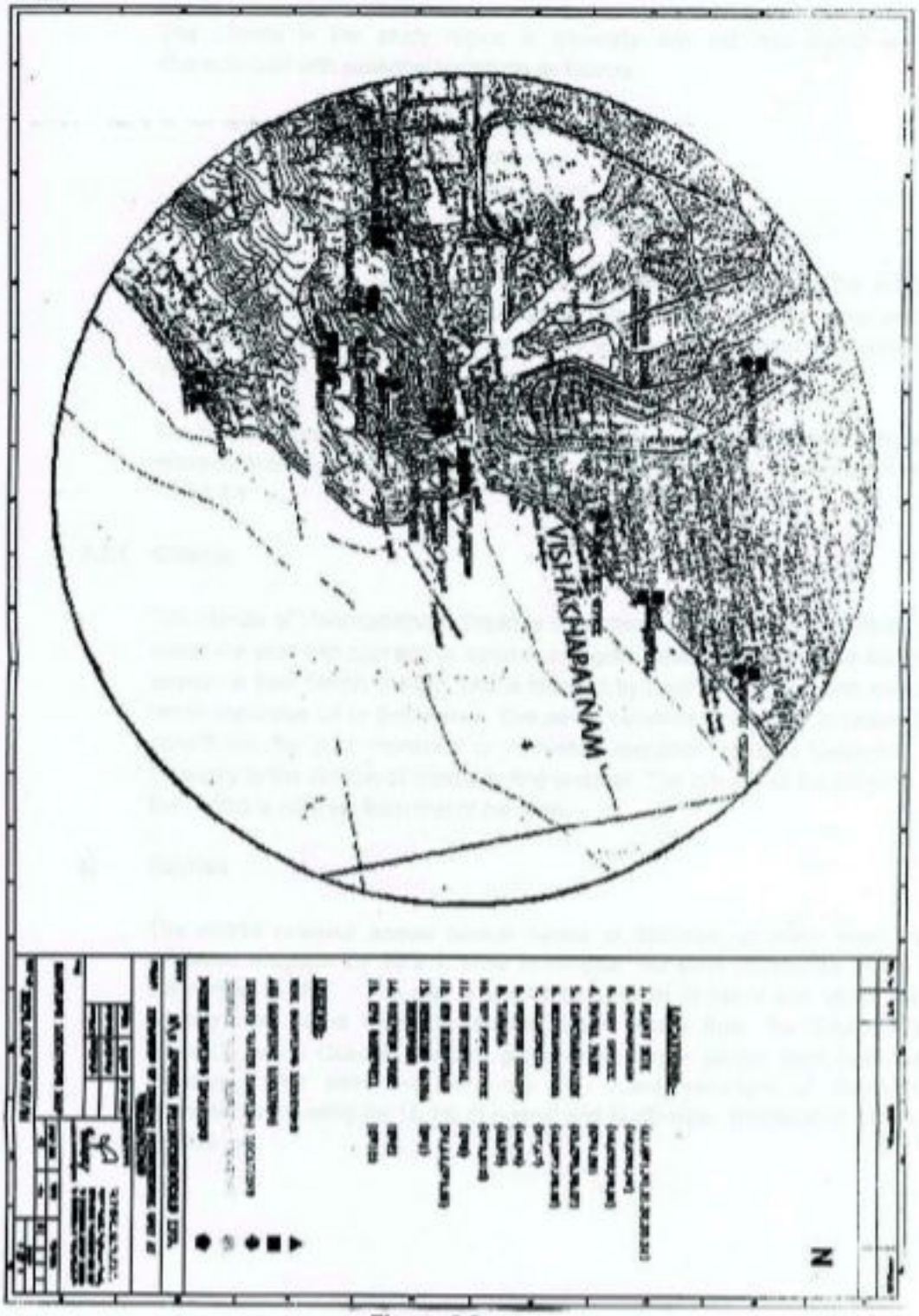


Figure 3.2
Map Showing Sampling Locations

3.3 CLIMATE AND METEOROLOGICAL CONDITIONS

The climate in the study region is generally dry, hot and humid and is characterized with seasonal variations as follows.

Winter	December to Feb.
Summer	March to May
Monsoon	June to August.
Post Monsoon	September to November

The climate setting of the area has been arrived by collecting the existing secondary data from IMD station at Vishakapatnam among other sources and by generation of primary data to ascertain the values. The nearest IMD station is Vishakapatnam airport.

The climatological data was also collected for the study period by establishing a micro-meteorological station in the study area, and the data is represented in **Table 3.1**.

3.3.1 Climate

The climate of Vishakapatnam district is characterized by high humidity nearly all round the year with oppressive summer and good seasonal rainfall. The summer season is from March to May. This is followed by South West monsoon season, which continues up to September. The period between September to December constitutes the post monsoon or retreating monsoon season. December to February is the season of generally fine weather. The climate of the hill parts of the district is different from that of the plain.

a) Rainfall

The district receives annual normal rainfall of 1202mm, of which south-west monsoon accounts for 53.9%, while North-East monsoon contributes 24.8% of the normal rainfall. The rest is shared by summer showers and winter rains. Agency and inland Mandals receive larger rainfall from the Sourth West Monsoon, while Coastal Mandals get similarly larger rainfall from North-East monsoon. But both the monsoons play truant, variations of South-west monsoon accounting for 15.3% of normal and North-west monsoon to 33.2% of normal.

b) Temperature

The minimum temperature recorded is 10.0°C and the maximum is 37.4°C. The temperature profile of this region is presented in the following table.

Table 3.1
The Climatological data of Vishakapatnam station - IMD

Month	Temperature °C				Humidity - %		Rainfall - mm	
	Mean		Month		Mean 8.30 hrs	Mean 17.30 hrs	Monthly Total	No of rainy days
	Daily Max	Daily min	Highest	Lowest				
January	28.9	18.0	31.2	14.1	74	67	11.4	0.5
February	31.3	19.9	34.8	16.3	72	64	7.7	0.5
March	33.8	23.0	37.1	18.8	70	67	7.5	0.5
April	35.3	26.1	37.9	22.0	70	74	27.6	1.2
May	36.2	27.7	40.6	23.2	69	72	57.8	3.0
June	35.3	27.3	40.7	23.5	73	71	105.8	6.4
July	32.9	26.1	36.6	23.5	79	76	134.6	8.7
August	32.7	26.0	35.9	23.6	79	76	141.2	9.3
September	32.5	25.6	35.3	23.1	79	78	174.8	9.9
October	31.7	24.3	34.5	21.3	76	75	204.3	8.7
November	30.4	21.6	32.5	17.8	68	68	66.3	2.7
December	28.9	18.6	30.9	14.6	67	65	7.9	0.6

Source: Climatological Tables, IMD

The predominant wind directions observed during different months based on the Vishakapatnam station IMD data for period of 1980-1991 is presented in table below.

Table 3.2
Predominant Wind directions as per Vishakapatnam IMD station

Month	1st Predominant		2nd predominant	
	Morning	Evening	Morning	Evening
January	NNE	E	NE	NE
February	SW	SSW	W	S
March	SW	SSW	SSW	SW
April	SW	SW	SSW	SSW
May	SW	SW	SSW	SSW
June	SW	SW	WSW	SSW
July	SW	SW	SSW	SSW
August	SW	SW	WSW	SSW
September	SW	SW	WSW	SSW
October	NNE	NE	NE	S
November	NE	NE	NNE	E
December	NNE	NE	NE	ENE

Source: Climatological Tables, IMD

From the above table it is noticed that the predominant wind direction during this summer season is SW and the second predominant observed is SSW for both morning and evening hours. During the summer and monsoon SW played the predominant role and for the post monsoon NE, NNE winds are showed their predominance.

3.4 METEOROLOGICAL SCENARIO

Regional meteorological scenario helps to understand the trends of the climatic factors. It also helps in determining the sampling stations in predicting the post project environmental impact. Meteorological Scenario exerts a critical influence on Air Quality as the pollution arises from the interaction of atmospheric contaminants with adverse meteorological conditions such as temperature inversions. Atmospheric stability and topographical features like hills, canyons and valleys.

The critical weather elements that influence air pollution are wind speed, wind direction, temperature, which together determines atmosphere stability. Hence it is an indispensable part of any air pollution studies and required for interpretation of base line information. The meteorological data was collected at the site by installing a manual weather station.

3.4.1 Monitoring period

Regional meteorological scenario helps to understand the trends of the climatic factors. It not only helps in determining the sampling stations but also in predicting the post project environmental scenario. Meteorological Scenario exerts a critical influence on Air Quality as the pollution arises from the interaction of atmospheric contaminants with adverse meteorological conditions such as temperature inversions, atmospheric stability and topographical features like hills, canyons and valleys.

The critical weather elements that influence air pollution are wind speed, wind direction, temperature, which together determines atmosphere stability. Hence it is an indispensable part of Air Pollution Studies and required for interpretation of base line information.

Micro-meteorological data within the project area during the air quality survey period is an indispensable part of air pollution study. The meteorological data recorded during the survey period is very useful for baseline information as well as for input, to predictive models for air quality impacts. The assessment of the impacts on air environment from the proposed project was carried out using ambient air quality data collected during March to May 2006.

Automatic meteorological data recorder was placed on top of Administration building of APL at a height of about 3.5 m above the ground level. Due care was taken in establishing the monitoring station to ensure free flow of winds without any obstructions. Wind Speed, Wind Direction, Temperature, Relative Humidity and Cloud cover were recorded on hourly basis for the total study period. Wind roses on Sixteen-sector basis (N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW and NNW) have been drawn for 00-24 hours.

3.4.1.1 March 2006

The detailed analysis of the wind pattern during month of March 2006 are given in **Tables 3.3,** the wind roses of the same are given in **Figures 3.3.**

(a) Total Wind Pattern during 00-24 Hours:

A glance at the average 24 hour wind rose diagram for the month of March 2006 reveals that the dominant wind direction is SW (23.52%) with the distribution of wind being 36.15% in the range of 5.7-8.8 km/h, 25.54 % in the range of 3.6-5.7 km/h and 13.17 % in the range of 2.1-3.6 km/h, of the total time. The other dominant wind directions were S with a percentage frequency recording of 13.17% of the total time. SSW, W was the other dominant directions. For about 7.13 % of the time the winds were calm.

Table 3.3
Frequency Distribution Table for 00-24 hours – March 2006

Direction	Wind speed Km/h						
	0.5-2.1	2.1-3.6	3.6-5.7	5.7-8.8	8.8-11.1	>=11.1	Total
N	0.40	0.67	0.67	0.67	0.40	0	2.82
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0.13	0.40	1.08	1.61	0.27	0	3.49
ESE	0	0	0	0	0	0	0
SE	0.54	0.40	1.48	1.75	0.27	0	4.44
SSE	0.40	0.54	1.74	2.02	0.81	0	5.51
S	1.48	1.61	3.36	5.51	1.21	0	13.17
SSW	1.21	2.15	2.56	4.70	1.75	0	12.37
SW	1.75	3.09	6.58	8.74	3.36	0	23.52
WSW	0.67	1.34	2.82	2.96	0.81	0	8.60
W	0.40	1.48	1.75	5.51	0.54	0	9.68
WNW	0	0.67	1.61	1.21	0.40	0	3.89
NW	0.54	0.81	1.88	1.48	0.67	0	5.38
NNW	0	0	0	0	0	0	0
Total	7.53	13.17	25.54	36.15	10.48	0	92.87
Calms							7.13%
Total							100 %

All Values are in percentages

3.4.1.2 April 2006

The detailed analysis of the wind pattern during month of April 2006 is given in **Tables 3.4**, and the wind roses of the same are given in **Figures 3.3.**

(a) Total Wind Pattern during 00-24 Hours:

A glance at the average 24 hour wind rose diagram for the month of April reveals that the dominant wind direction is SW (23.66 %) with the distribution of wind being 29.03 % in the range of 2.5-3.5 km/h, 25.28 % in the range of 3.5-4.5 km/h and 15.97 % in the range of 1.5-2.5 km/h, of the total time. The other dominant wind direction was S with a percentage frequency recording of 14.78 % of the total time. W with (12.9 %) is the other dominant wind direction, which is closely followed by SSW with a percentage 9.81 % of the total time. The calm percentage of the winds was 7.08 % of the total time.

Table 3.4
Frequency Distribution Table for 00-24 hours - April 2006

Direction	Wind speed Km/h						
	0.5–1.5	1.5–2.5	2.5–3.5	3.5–4.5	4.5–5.5	>=5.5	Total
N	0.42	0.97	1.11	0.83	0.28	0	3.61
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0.27	0.27	0.27	0.54	0.13	0	1.48
ESE	0	0	0	0	0	0	0
SE	0.54	0.67	0.54	1.74	0.27	0	3.76
SSE	1.08	1.88	1.61	2.15	0.67	0	7.39
S	3.49	1.74	4.17	3.63	1.75	0	14.78
SSW	0.95	2.01	2.55	3.09	1.21	0	9.81
SW	4.84	3.76	4.44	7.12	3.5	0	23.66
WSW	1.88	1.07	1.75	2.02	0.81	0	7.53
W	2.55	1.48	3.09	3.63	2.15	0	12.90
WNW	0.67	1.07	0.81	1.48	0.54	0	4.57
NW	0.40	0.27	1.08	0.40	0.13	0	2.28
NNW	0	0	0	0	0	0	0
Total	13.33	15.97	29.03	25.28	9.03	0.28	92.92
Calms							7.08 %
Total							100 %

All Values are in percentages

3.4.1.3 May 2006

The detailed analysis of the wind pattern during month of May 2006 is given in **Tables 3.5**, and the wind roses of the same are given in **Figure 3.3** below.

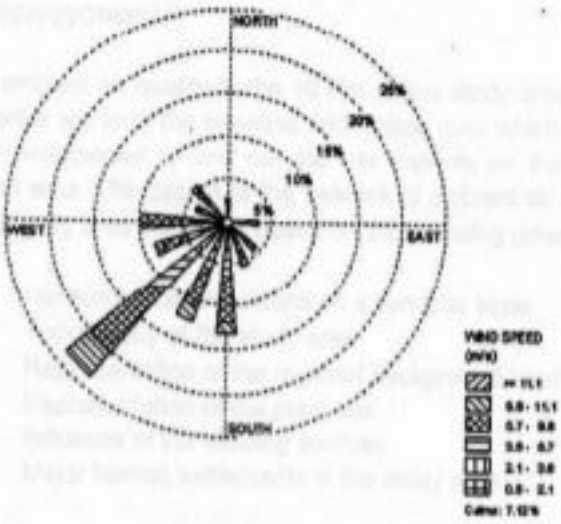
(a) Total Wind Pattern during 00-24 Hours:

A glance at the wind rose diagram reveals that the most dominant wind direction prevailed for this time period is SW with a percentage frequency recording of 23.66 % of the total time. The other dominant wind directions were observed to be S (14.78 %), W (12.9 %). The calm percentage of the winds was found to be 9.95 % of the total time. Winds were practically observed from almost all directions during this time period.

Table 3.5
Frequency Distribution Table for 00-24 hours - May 2006

Direction	Wind speed Km/h						
	0.5–1.5	1.5–2.5	2.5–3.5	3.5–4.5	4.5–5.5	>=5.5	Total
N	0.67	0.27	0.40	0.54	0	0	1.88
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0.27	0.27	0.27	0.54	0.13	0	1.48
ESE	0	0	0	0	0	0	0
SE	0.54	0.67	0.54	1.74	0.27	0	3.76
SSE	1.07	1.88	1.62	2.15	0.07	0	7.39
S	3.49	1.74	4.17	3.63	1.75	0	14.78
SSW	0.94	2.01	2.56	3.09	1.21	0	9.81
SW	4.84	3.76	4.44	7.12	3.5	0	23.66
WSW	1.88	1.07	1.75	2.02	0.81	0	7.53
W	2.55	1.48	3.09	3.63	2.15	0	12.9
WNW	0.67	1.07	0.81	1.48	0.54	0	4.57
NW	0.40	0.27	1.07	0.40	0.13	0	2.28
NNW	0	0	0	0	0	0	0
Total	17.34	14.52	20.69	26.34	11.16	0	90.05
Calm							9.95 %
Total							100 %

All Values are in percentages



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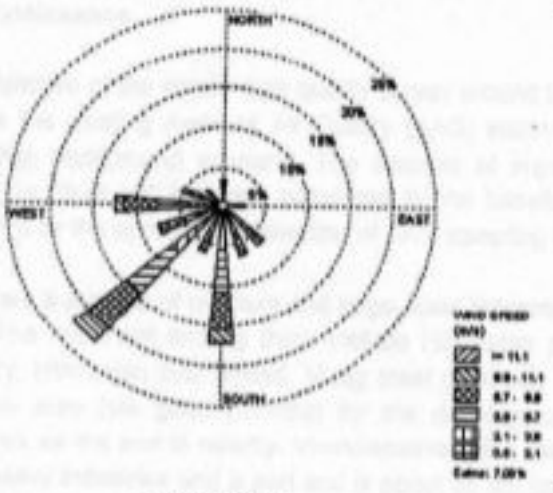

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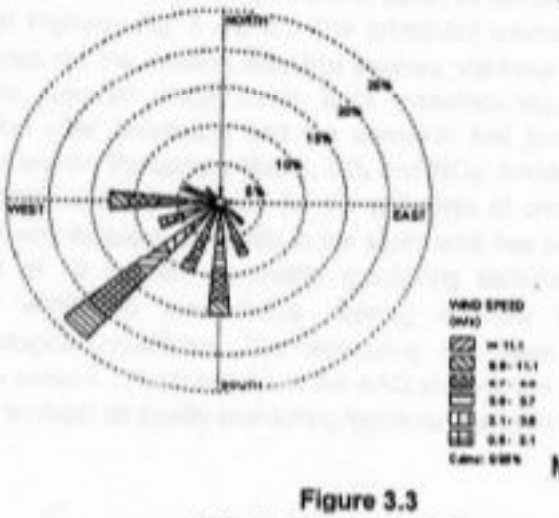

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Figure 3.3
Wind Rose for 00-24hours

3.5 AIR ENVIRONMENT

The ambient air quality in the 10 Km radius study area with the plant site as the epicenter will form the baseline information over which the predicted impacts can be superimposed to find out the net impacts on the air quality in the project impact area. The design of the network of ambient air quality monitoring stations in the study area was done based on the following criteria.

- Meteorological conditions on a synoptic scale
- Topography of the study area
- Representation of the regional background levels
- Representation of the plant site
- Influence of the existing sources
- Major human settlements in the study area

3.5.1 Reconnaissance

The objective of the ambient air quality survey around the present activity was to assess the existing Ambient Air Quality (AAQ) status in the neighborhood for projecting background scenario. The success of impact assessment exercise based on "Built up" scenario compared to the baseline ambient air quality is governed by the appropriate selection of AAQ sampling locations.

There are a number of medium and large scale industries that are located in this area. The important among them include Hindustan petroleum Limited, Vizag Refinery, Hindustan zinc limited, Vizag steel plant etc. it is pertinent to mention that this area has good potential for the development of the petrochemical industries as the port is nearby. Visakhapatnam is a major industrial area with a lot of heavy industries and a port and is about 55 km en route to Chennai on the National Highway No. 5 (NH-5). The prominent sources of air pollution in the study area are the existing industrial sources, vehicular movement, dust arising from the unpaved village roads, brick manufacturing, burning of sugar-cane plantation after harvesting and the domestic fuel burning. The pollutants of concern are the Particulate Matter, SO_2 and NO_X. Ambient air quality monitoring in the study area was carried for the pollutants of concern as per the project requirement. Ambient air quality in the study area has been assessed through a network of 10 ambient air quality monitoring stations fixed using screening models within 10 kms radius keeping in view the topographical and meteorological conditions. The monitoring has been performed during the summer season. The locations of the AAQ stations are presented in **Figure 3.2** and the ambient air quality monitoring locations are given in **Table 3.6.**

Table 3.6
Ambient Air Quality Monitoring Stations

S. No	Location	Station code	Distance from Plant Site in Km	Direction
1	Plant site	A1	0.00	Core zone
2	Gnanapuram	A2	8.08	NW
3	Old port office	A3	1.53	NE
4	Sri Haripuram	A4	3.75	SW
5	Kancharapalem	A5	4.0	SW
6	Seethammadara	A6	6.0	WSW
7	Jalaripeta	A7	6.77	NE
8	Muppidi colony	A8	9.69	NE
9	yarada	A9	5.92	S

a) Parameters For Sampling & Sampling Frequency

Ambient Air Quality Monitoring has been carried out for one season i.e. pre monsoon with a frequency of twice a week for four weeks in a month for the entire season. The base line data of air environment is generated for the following parameters:

- Total Suspended Particulate Matter (TSPM)
- Respirable Suspended Particulate Matter (RSPM)
- Sulphur Dioxide (SO_2)
- Oxides of Nitrogen (NO_x)

b) Description of Air Quality Sampling Locations

I. Plant Site

This location is selected to assess the ambient air quality levels in the existing plant representing the core zone. The sampler was placed on top of Gate House at 2.0m above the ground ensuring free flow of winds from all directions. Since the present proposal is optimization of the existing activities, the existing industry being normally operated. The baseline data monitored at this site also includes the contribution of the existing industry to the air quality.

II. Gnanapuram

Gnanapuram lies at a distance of about 8.08 Km towards NW of the Plant site in the crosswind direction. The sampler was placed on top of the residential building at a height of 3.5 m above the ground level ensuring free flow of winds from all directions.

III. Old Port office

The RDS sampler was placed on top of the community hall at a height of 3.0 m above the ground. This location was selected to assess the ambient air quality levels in the downwind direction of the industrial area considering the prevailing wind conditions. This site is located at a distance of about 1.53 kms in the NE direction of the existing industrial area.

IV. Sri Haripuram

This location was selected to assess the background air quality levels which is at a distance of 6.0 kms SW of industrial area. The sampler was placed on top of a residential building at a height of 3.5 m above the ground. The place was selected to assess the upwind air quality levels of pollutants.

V. Kancharapalem

The sampler was placed on top of Residential Building at a height of 3.2 m above the ground ensuring free flow of winds. Kancharapalem is located at a distance of 4.0 kms SW of the Plant site. This location was selected to assess the air quality levels in the upwind direction considering the prevailing meteorological conditions.

VI. Seethammadara

RDS sampler was placed on top of a residential building at a height of 3.2 m above the ground level. The sampling station is located at about 6.0 kms towards WSW of the plant site. This location was selected to assess the air quality levels in the crosswind direction considering the prevailing wind conditions.

VII. Jalaripeta

The location was selected to assess the pollutant concentration in the downwind direction considering the prevalent meterological conditions in the area. The loction lies ata distance of about 6.77 km in the NE direction from the existing industrial area. The sampler was placed at a height of about 3.5 m above ground level on top of a residential building to ensure free flow of winds.

VIII. Muppidi colony

This location was selected to assess the downwind concentration of pollutants in the study area. The sampler was placed at a height of about 3.2 m above the ground level on top of an residential building ensuring free flow of winds. The location is at a distance of about 9.69 km NE of the plant site.

IX. Yarada

The sampling location is situated at a distance of about 5.92 km S of the plant site. This site was selected at assess the concentration of the pollutants in the crosswind direction. The sampler was placed at a height of about 3.2 km above the ground level on top of a residential building ensuring free flow of winds.

At each sampling station monitoring was carried for a frequency of 2 days per week for two weeks during study period. The major air pollutants were sampled on 24 hourly averages to meet the requirements of the Department of the Environment and compared with the standards stipulated by CPCB.

The locations of the sites have been determined primarily based on the wind rose diagrams presented before and also to reflect the windward, leeward and crosswind directions of the industrial area and thus the overall AAQ scenario of the project impact area.

The range of maximum concentrations reflects the low levels of pollution in the existing status of AAQ representing the baseline scenario. An analysis of the data of the plant site with respect to downward side in particular and other monitoring sites in general represent the background levels. It can be observed from the data that the industry and the impact zone reflect a fairly clean environment with respect to the pollutants of concern.

Spatial and temporal variations in the air quality occur as a result of the air basin and the prevailing meteorological conditions of the study area. To assess the existing sub regional air status during the summer season, the above factors govern the status at all the AAQ sampling stations.

3.5.2 Data analysis of AAQ levels

The existing concentrations of the critical pollutants in the study area are represented in the **Table 3.7**. The range of maximum and minimum concentrations reflect that the pollution levels are varying depending on the prevailing activity. Background concentrations of the critical pollutants are established by comparing the concentrations at the plant site and that of the downwind locations with the pollutant concentrations at other locations.

Table 3.7

Ambient levels in the study area- µg/m³

Location	SPM			RSPM			SO_2			NO_x		
	Min	Max	98th	Min	Max	98th	Min	Max	98th	Min	Max	98th
Plant Site	110	158	154.7	30.4	89.8	84.6	20.0	33.8	32.5	22.2	36.0	34.7
Gnanapuram	50	78	76	21	55	49.2	10.1	22.9	20.1	13.9	30.7	23.9
Old Port Office	65	110	105.1	23.4	91.7	52.8	15.6	34.9	31.6	21.9	44.2	39.6
Sri Haripuram	103	170	160	22.4	113.1	82.9	20.5	35.8	34.1	22.3	41.6	35.9
Kancharapalem	61	85	85	20.9	53.3	44.4	11.3	25.9	23.5	18.0	34.9	32.6
Seethammadara	58	78	77.7	20.5	56.9	44.1	10.5	23.3	22.8	13.0	30.8	25.5
Jalaripeta	55	77	74.4	21.0	63.6	54.2	20.3	36.5	32.7	24.8	47	39.1
Muppidi colony	62	85	84.6	22.1	61.4	45.1	20.1	34.5	33.6	23.7	45.9	41.5
Yarada	52	75	74.6	20.9	59.8	44.5	11.5	27.8	26.2	18.0	38.3	32.7

3.5.3 Regional Scenario- Ambient Air Quality

The results obtained are processed for finding out the percentiles, minimum and maximum values. Close observation of the processed values reveals the following

a) Pollutant: Suspended Particulate Matter

Suspended Particulate Matter or dust in general terms is the particulate matter in suspension in ambient air. It includes dust, smoke, fly ash, and carbonaceous matter. The microorganisms responsible for causing a large number of pathogens causing respiratory eye and skin diseases, various allergens, fibrous material, heavy metals, metallic furnaces and even many organic carcinogens are present

i) Sources

In general some of the important sources of suspended particulate matter are mines, quarries, pottery and ceramic factory stacks, power plants and cement plants.

The following sources of suspended particulate matter in the study area are identified:

1. Emissions from the coal fired boilers
2. Emissions from the DG sets
3. Fugitive emissions from handling of material in the industries
4. Fugitive emissions due to vehicular movement
5. Fire wood burning
6. Dust generation flow ground

ii) Effects

Excessive exposure to dust causes breathing related diseases as it effects the lungs. Excessive concentration of smoke and dust also reduces the visibility. Particulate matter affects the plants by settling on the leaves and preventing natural growth. The chemical matter in the dust will affect the structures due to slow reaction over a period of time.

iii) SPM Levels in the study area

The minimum level of SPM recorded in the study area was 50µg/m^3 at Gnanapuram and the maximum level recorded was 170 µg/m^3 at Sri Haripuram. The 95th percentile maximum value is 160 µg/m^3.

The 24 hourly average values of SPM were compared with the national ambient air quality standards. Port area being a notified industrial area, the SPM level of 80 µg/m^3 was still within the limits of 500 µg/m^3 specified for the industrial area. The higher values in the residential areas cannot be attributed to the industrial activities alone. There are other influences like domestic, commercial, construction activities and fugitive emissions due to vehicular traffic.

b) Respirable Particulate Matter

The coarser dust collected, as part of the TSPM would result in nuisance and soiling of surfaces but is unlikely to contribute significantly to respiratory and other health effects as associated with air pollution. Primarily Respirable Particulate Matter in size range of 0.5 to 10 microns causes visibility problems and health effects. All types of control systems used in industry to reduce particulate emissions viz. cyclones, bag filters, ESP's etc. remove coarser particles more efficiently. As such emissions from industries using even rudimentary control systems are likely to contain predominantly finer particles. Similarly particulates emitted by vehicles are fine.

i) Sources

In general some of the important sources of Respirable particulate matter are mines, quarries, pottery and industrial stacks, power plants and cement plants etc.

ii) Effects

Excessive exposure to dust causes breathing related diseases as it effects the lungs. Excessive concentration of smoke and dust also reduces the visibility.

iii) RSPM Levels in the study area

The minimum level of RSPM recorded in the study area was 20.5 µg/m^3 at seethamadara and the maximum level recorded was 113.1 µg/m^3 at Sri

Haripuram. The 95th percentile maximum value is 82.9 µg/m³. The 24 hourly average values of RSPM were compared with the national ambient air quality standards and it was found that all the locations have recorded values lower than the applicable limit of 150 µg/m³ for industrial areas.

c) Pollutant: Sulfur Dioxide

Sulfur dioxide gas is an inorganic gaseous pollutant. Sulfur dioxide emissions are expected to be emitted wherever combustion of any fuel containing elemental sulfur takes place. The sulfur in the fuel will combine with oxygen to form sulfur dioxide. Sulfur trioxide and sulfuric acid mist are the other important pollutants in the sulfur group.

I) Sources

In general some of the important sources of sulfur dioxide are Power stations, sulfuric acid plants, oil refining, Boilers in utilities in any industry and domestic use of coal.

The following sources of Sulfur dioxide in the study area are identified:

1. Emissions from the coal fired boilers.
2. Emissions from the DG sets
3. Movement of vehicles

II) Effects

Information in the literature has indicated that the presence of sulfur dioxide in the photochemical smog reaction enhances the formation of visibility enhancing aerosols.

Sulfur dioxide in atmosphere is significant because of its toxicity. Sulfur dioxide is capable of producing illness and lung injury. Further it can combine with water in the air to form toxic acid aerosols that can corrode metal surfaces, fabrics and the leaves of plants. Sulfur dioxide is irritating to the eyes and respiratory system excessive exposure to sulfur dioxide causes bronchial asthma and other breathing related diseases as it affects the lungs.

III) SO_2 Levels in the study area

The minimum level of SO_2 recorded in the study area was 10.1 µg/m³ at Gnanapuram. The maximum level recorded was 36.5 µg/m³ at Jalaripeta. The 95 th percentile maximum value is 34.1 µg/m³.

The 24 hourly average values of SO_2 were compared with the national ambient air quality standards and it was found that all the sampling stations recorded

values much lower than the applicable limit of 120 µg/m³ for industrial areas. The SO_2 values in the residential areas can be attributed to the industrial activities as well as domestic burning of coal and other sulfur containing fuel.

d. Pollutant: Oxide of Nitrogen

Like Sulfur dioxide oxides of nitrogen is also an important inorganic gaseous pollutant. Oxides of nitrogen emissions are expected to be emitted wherever combustion at high temperatures takes place. Nitrous oxide and nitric acid mist are the other important pollutants in the inorganic nitrogen group.

I) Sources

In general some of the important sources of oxides of nitrogen are acid manufacture, Boilers in utilities in any industry and Auto exhaust.
The following sources of oxides of nitrogen in the study area are identified:

1. Emissions from the coal fired boilers.
2. Emissions from the DG sets
3. Emissions from automobiles.

II) Effects

Oxides of nitrogen have far greater significance in photochemical smog reaction than any of the other inorganic gaseous contaminants. NO_x in the presence of sunlight will undergo reactions with a number of organic compounds to produce all the effects associated with photochemical smog. NO_x has inherent ability to produce deleterious effects by themselves like toxicity. It acts as an asphyxiate when in concentrations great enough to reduce the normal oxygen supply from the air.

III) NO_x Levels in the study area

The minimum level of NO_x recorded in the study area was 13.0 µg/m³ at Seethammadara, and the maximum level recorded was 47 µg/m³ at Jalaripeta. The 95th percentile maximum value was 41.5 µg/m³.

The 24 hourly average values of NO_x were compared with the national ambient air quality standards and it was found that all the sampling stations recorded values much lower than the applicable limit of 120 µg/m³ for industrial area.

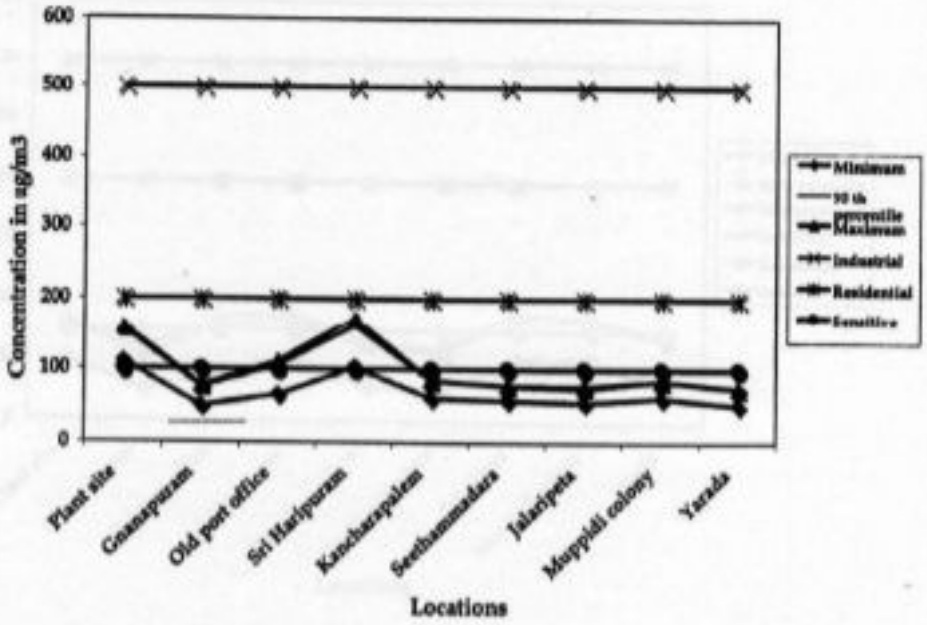


Figure 3.4 (a) SPM in the study area

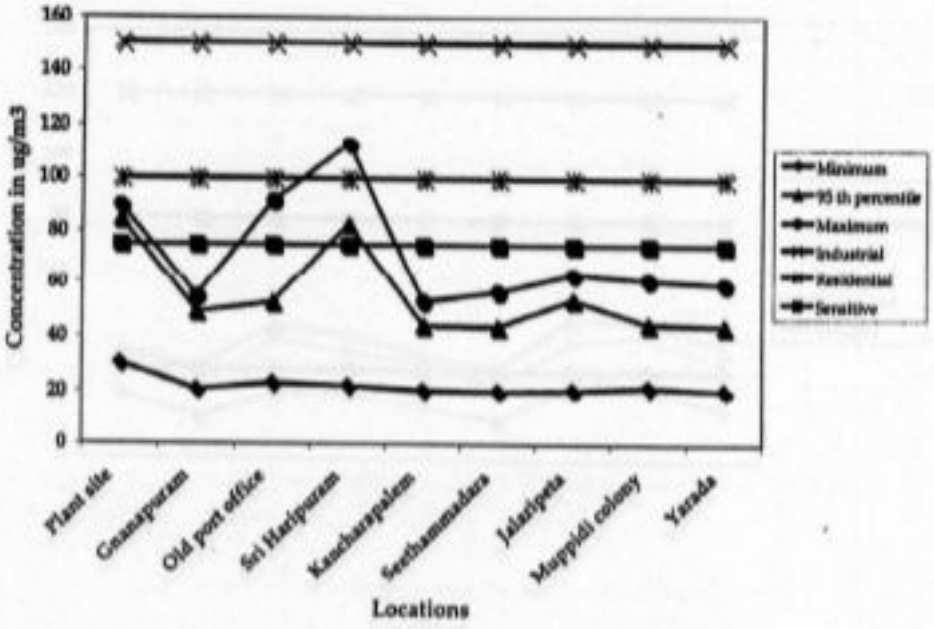


Figure 3.4 (b) RSPM in the study area

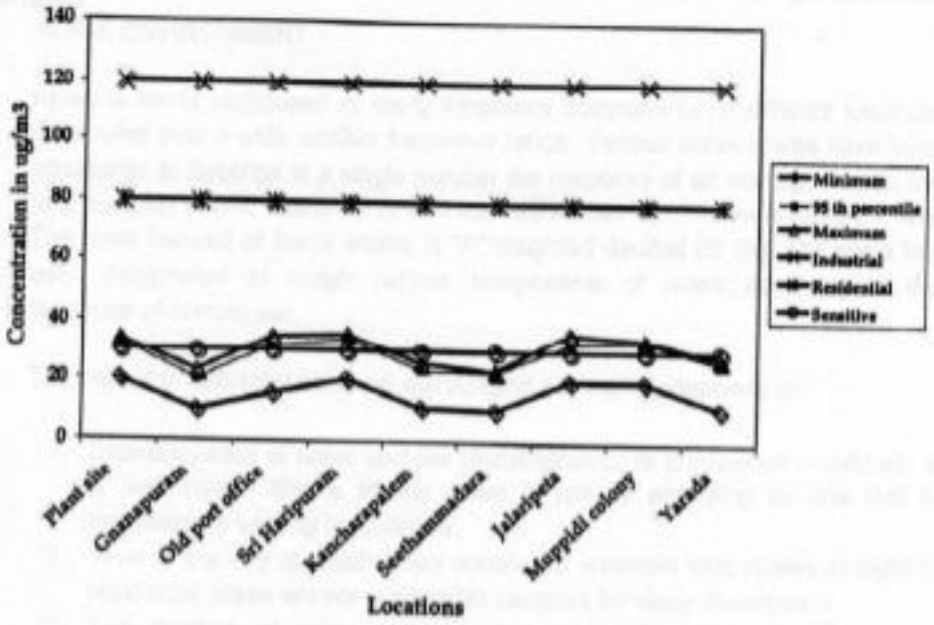


Figure 3.4 (c) SO_2 in the study area

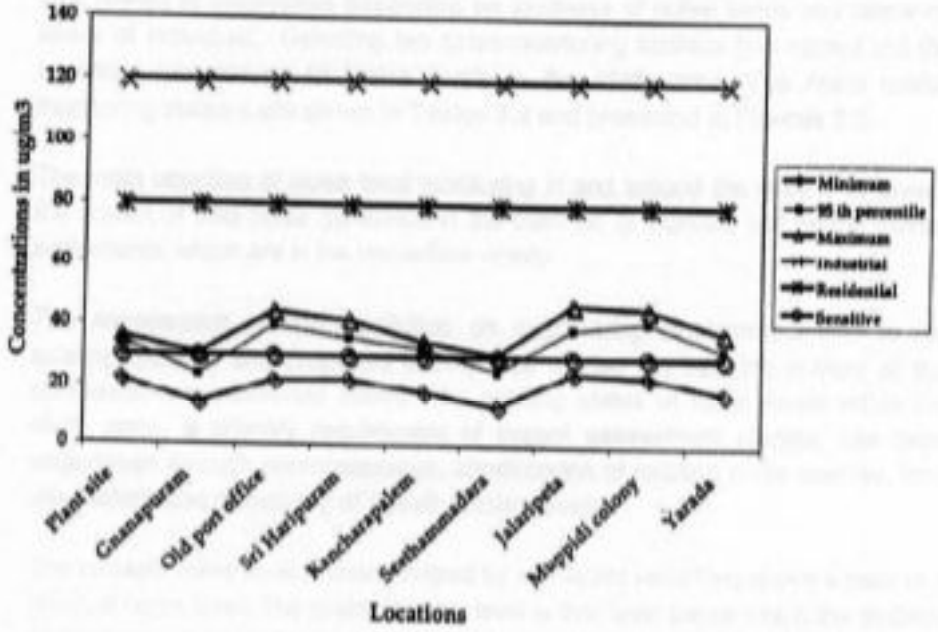


Figure 3.4 (d) NO_x in the study area

CHAPTER-3

3.6 NOISE ENVIRONMENT

Noise is found composed of many frequency components of different loudness distributed over a wide audible frequency range. Various noise scales have been introduced to describe in a single number the response of an average human ear to a complex sound, made up of various frequencies at different loudness levels. The most favored of these scales is "A" weighted decibel dB (A). The scale has been designated to weigh various components of noise according to the response of human ear.

The impact of industrial noise on surrounding community depends on

1. Characteristics of noise sources (instantaneous or continuous in nature). It is well known that a steady noise is not as annoying as one that is continuously varying in loudness.
2. Time of the day at which noise occurs, for example loud noises at night in residential areas are not acceptable because for sleep disturbance.
3. The location of noise source with respect to noise sensitive areas determines the loudness and period of noise exposure.

The Environment / health impacts of noise can vary from noise induced hearing loss (NIHL) to annoyance depending on loudness of noise levels and tolerance levels of individual. Selecting ten noise-monitoring stations has carried out the baseline data survey for noise levels in the study area. The noise quality monitoring stations are shown in **Tables 3.8** and presented in **Figures 3.2.**

The main objective of noise level monitoring in and around the plant is to assess the impact of total noise generated in the plant on its workers and on the human settlements, which are in the immediate vicinity.

The assessment of noise pollution on neighboring Environment due to the existing industry and proposed activity was carried out keeping in view all the considerations mentioned above. The existing status of noise levels within the study zone, a primary requirement of impact assessment studies, has been undertaken through reconnaissance, identification of existing noise sources, land use pattern and monitoring of baseline noise levels.

The ambient noise level is characterized by significant variations above a base or a residual noise level. The residual noise level is that level below which the ambient noise does not seem to drop during a given time interval and is generally caused by unidentified distant sources. It differs in rural and urban areas. At night, its level is low due to the lesser elements of noise. The annoyance that people experience depends upon the number of noise elements that produce noise concurrently at a given time that occur during a time interval.

A noise rating developed by Indian Standards for specification of community noise from all sources is the day night sound level, L_{dn}. It is similar to a 24-hour equivalent sound level except that during the night time period, which extends from 21.00 to 6.00 hours, a 10 dB(A)-weighing penalty is added. The penalty is added to account for the fact that noise at night when people are trying to sleep is judged more annoying than the same noise during the daytime. The noise level equivalents were calculated based on the "Ambient air quality standards in respect of Noise" as per EPA Notification [G.S.R. 1063(E), Dated 26th December 1989] as given under,

Day – Time is considered as the time interval between 6 A.M & 9 P.M, and the **Night – Time** is considered as the time interval between 9 P.M. & 6 A.M.

The Ldn (Day- Night Noise level equivalents) can be calculated from an hourly equivalent sound level from the under given equation.

$$Ldn = 10 \log (1/24 [16 (10^{Ld/10}) + 8 (10^{(Ln+10)/10})])$$

Where,
Ln is the equivalent noise level during night time
Ld is the equivalent noise level during day time

Whereas the Ln and Ld can be calculated using the following formulae

$$Ln = 10 \log [1/8\{10^{(Ln1+10)/10} + 10^{(Ln2+10)/10} + 10^{(Ln3+10)/10} + \ldots 10^{(Ln8+10)/10}\}]$$

$$Ld = 10 \log [1/16\{10^{(Ld1/10)} + 10^{(Ld2/10)} + 10^{(Ld3/10)} + \ldots 10^{(Ld16/10)}\}]$$

3.6.1 Reconnaissance Survey

To study the noise levels in the study area, noise levels were monitored at 10 randomly selected locations. The out side noise levels were monitored to represent important locations such as residential area, schools, hospitals, etc., Where the impact of noise on human beings may effect the normal functioning. The noise levels were recorded on hourly basis for a period of one-day (24 hours). The noise equivalents were calculated from the raw data collected from the monitoring locations.

Table 3.8
Noise Quality Monitoring Locations

S. No	Location	Station Code	Distance from Plant site in Km	Direction
1	Plant site	N1	-	Center
2	Gnanapuram	N 2	8.08	NW
3	Old port office	N 3	1.54	NE
4	Sri Haripuram	N 4	3.75	SW
5	Kancharapalem	N 5	4.0	SW
6	Seethammadara	N 6	6.0	WSW
7	Jalaripeta	N 7	6.77	NE
8	Muppidi Colony	N 8	9.69	NE
9	Yarada	N 9	5.92	S

3.6.2 Noise Levels

Baseline noise levels have been monitored at different points within the study zone of about 10 km with the existing industry as its center, using a spot noise measurement device. Noise level measurement locations were identified at random for assessment of existing noise level status, keeping in view the land use pattern, residential areas in villages, schools, bus stands, etc., the day levels of noise have been monitored during 6 AM to 9 PM and the night levels during 9 PM to 6 AM. The observed noise values are given in tables below.

Table 3.9
Noise levels in the study area

Location		N1	N2	N3	N4	N5	N6	N7	N8	N9
Time Duration										
Day (6.00 to 9.00 PM)	06:00 – 07:00	35.1	34.2	34.2	34.3	34.1	34.0	34.2	35.1	33.0
	07:00 – 08:00	37.3	34.3	35.0	35.2	34.2	34.0	36.1	35.1	34.1
	08:00 – 09:00	38.0	35.1	36.0	35.0	36.9	35.1	36.1	37.0	34.1
	09:00 – 10:00	38.0	37.0	37.0	36.2	38.2	37.1	38.5	37.0	36.1
	10:00 – 11:00	38.1	38.0	37.0	36.1	39.7	37.1	38.5	38.0	36.1
	11:00 – 12:00	38.1	38.0	38.0	37.1	39.7	39.0	39.0	38.1	36.1
	12:00 – 01:00	42.1	46.8	47.6	43.6	48.2	47.6	42.3	42.8	56.4
	01:00 – 02:00	47.6	48.2	49.8	48.1	50.2	53.7	46.6	46.6	52.0
	02:00 – 03:00	52.6	52.3	51.2	47.6	51.2	53.7	51.7	50.2	53.6
	03:00 – 04:00	55.4	54.6	52.3	49.8	54.6	55.8	53.1	54.2	47.2
	04:00 – 05:00	46.3	48.6	54.6	48.6	53.6	47.9	55.0	46.8	48.2
	05:00 – 06:00	45.8	44.3	52.2	44.3	48.3	47.9	50.0	49.1	51.2
	06:00 – 07:00	44.2	46.2	54.6	46.2	48.1	46.8	45.0	44.6	47.2
	07:00 - 08:00	42.6	45.9	51.3	45.9	44.3	46.2	46.1	44.2	46.9
	08:00 - 09:00	42.3	44.7	46.2	44.7	42.6	44.3	46.1	41.3	47.6
Night (9.00 to 6.00 AM)	09:00 - 10:00	46.5	46.2	48.6	46.2	45.2	46.8	50.3	48.6	49.2
	10:00 - 11:00	48.9	47.6	46.3	54.6	47.1	49.1	50.3	56.2	53.6
	11:00 - 12:00	48.9	48.9	47.7	52.2	50.9	50.6	52.4	54.8	55.8
	12:00 - 01:00	47.0	48.9	51.1	54.6	52.3	53.4	54.6	42.0	51.0
	01:00 - 02:00	42.0	36.0	42.0	45.0	35.0	45.0	45.0	38.1	42.3
	02:00 - 03:00	38.0	36.0	38.0	38.0	35.0	39.1	36.0	36.1	35.1
	03:00 - 04:00	36.0	34.0	34.1	34.0	33.0	35.1	34.1	36.0	34.1
	04:00 - 05:00	35.0	34.0	34.1	34.0	33.1	33.1	34.0	34.1	33.1
	05:00 - 06:00	35.0	34.0	34.1	34.0	33.1	33.2	34.0	34.1	33.1
Day Equivalent		48.3	48.4	50.5	49.2	49.6	50.4	50.4	49.9	51.5
Night Equivalent		36.8	36.2	36.2	35.6	37.1	36.1	37.0	36.7	35.0
Day Night		47.8	47.7	49.3	48.2	48.8	49.2	49.4	48.9	50.0

Acceptable Out door Noise Levels: dB (A)

Rural Areas:	25-35	Urban:	40-50
Suburban:	30-40	City:	45-60
Residential:	35-45	Industrial:	50-60

The high values of noise observed in many of the rural and suburban areas are primarily due to vehicular traffic and other anthropogenic activities. In rural areas even chirping of birds could have attributed to the higher noise levels especially during the nights.

3.6.3 Regional Scenario

Assessment of equivalent day and night noise levels in and around the industry reveal that noise levels are ranging from 33 to 56.4 dB (A), which can be taken as the existing baseline status. The minimum noise level 33 dB (A) was recorded at kancharapalem, Seethammadara, Yarada in the study area. The maximum noise level 56.4 dB (A) was recorded at Yarada.

The day equivalent values calculated considering the noise levels recorded from 6 AM to 9PM. The values were found to be ranging between 48.31 dB(A) at Plant site to 51.51 dB(A) at Yarada.

Similarly night equivalent noise levels were calculated using the noise levels recorded from 10 PM to 5 AM. These values are critical since they affect the sleep in the residential and sensitive areas. The night equivalent values were found to be ranging between 35.03 dB (A) at Yarada to 37.12 dB (A) at Kancharapalem.

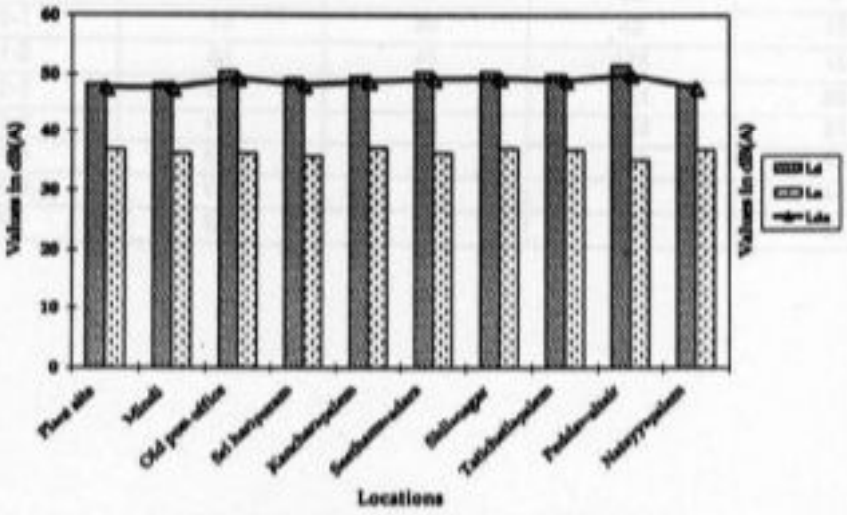


Figure 3.5 Noise equivalents in the study area

3.7 Traffic Survey

The methodology adopted for carrying out the traffic study was to select the major roads around the project site and count the various categories of vehicles moving on these roads. The traffic survey was carried out on the approach road to the project from the national highway NH5 (near main security gate), on national highway and two adjacent villages Mindi and sriharipuram industrial area roads. The details of the vehicles movement recorded are presented in tables below.

Table 3.10 (a)
Traffic Survey near Andhra Petrochemicals Limited

Time – hrs	Two wheelers	Passenger Vehicles	Medium heavy vehicles	Heavy vehicles
7-8	135	65	196	65
8-9	140	71	202	54
9-10	152	78	158	49
10-11	144	60	184	38
11-12	168	85	195	46
12-13	124	76	153	28
13-14	110	49	106	32
14-15	91	32	112	26
15-16	86	26	122	41
16-17	44	12	96	32
17-18	25	5	66	18
18-19	15	3	46	12
19-20	14	5	38	8
20-21	8	-	41	15
21-22	5	-	48	12
22-23	15	8	52	6
23-24	26	21	63	9
0-1	75	36	46	10
1-2	81	41	121	15
2-3	123	83	134	66
3-4	162	94	108	81
4-5	150	66	136	53
5-6	120	68	141	44
6-7	124	55	168	31

Table 3.10 (b)

Traffic Survey near Old Port Office

Time – hrs	Two wheelers	Passenger Vehicles	Medium heavy vehicles	Heavy vehicles
7-8	98	32	120	14
8-9	84	35	142	12
9-10	88	28	160	16
10-11	65	24	175	10
11-12	69	22	120	12
12-13	72	18	134	10
13-14	68	21	112	-
14-15	54	28	86	-
15-16	28	20	84	-
16-17	20	16	75	11
17-18	25	11	51	12
18-19	32	14	22	17
19-20	14	12	24	22
20-21	9	14	18	14
21-22	7	10	14	16
22-23	12	6	16	-
23-24	14	4	8	-
0-1	34	-	10	-
1-2	30	-	16	-
2-3	22	-	14	-
3-4	26	10	21	6
4-5	29	12	24	10
5-6	38	14	38	12
6-7	43	21	88	14

Table 3.10 (c)
Traffic Survey near Mindi

Time – hrs	Two wheelers	Passenger Vehicles	Medium heavy vehicles	Heavy vehicles
7-8	102	21	68	5
8-9	94	33	62	7
9-10	81	26	54	10
10-11	72	21	48	6
11-12	65	14	40	5
12-13	58	12	36	8
13-14	46	24	36	-
14-15	48	21	28	-
15-16	35	22	14	-
16-17	22	18	22	-
17-18	28	17	28	3
18-19	42	15	36	4
19-20	20	16	24	6
20-21	8	10	18	8
21-22	5	9	10	10
22-23	10	5	8	11
23-24	12	3	4	14
0-1	15	-	-	16
1-2	18	-	18	20
2-3	23	-	-	22
3-4	16	-	21	18
4-5	26	-	26	16
5-6	39	22	31	10
6-7	56	34	28	12

Table: 3.10 (d)
Traffic Survey near Sri Haripuram

Time – hrs	Two wheelers	Passenger Vehicles	Medium heavy vehicles	Heavy vehicles
7-8	102	38	86	10
8-9	98	40	95	8
9-10	91	14	112	14
10-11	86	20	84	2
11-12	70	26	68	6
12-13	68	19	55	4
13-14	71	21	47	4
14-15	48	25	38	2
15-16	31	24	36	1
16-17	26	18	42	14
17-18	22	16	25	6
18-19	35	12	21	12
19-20	19	8	26	10
20-21	10	10	10	11
21-22	9	9	5	14
22-23	16	12	6	-
23-24	18	5	4	-
0-1	22	6	2	6
1-2	28	2	-	-
2-3	26	10	11	-
3-4	29	14	12	8
4-5	35	16	14	12
5-6	42	19	16	14
6-7	49	28	15	16

The above table's shows lot of movement of two wheelers and other heavy vehicles during the baseline studies. The reason for movement of these vehicles is the existence of industries and residential areas near the plant site. The traffic on the national highway was also high.

3.8 WATER ENVIRONMENT

3.8.1 Reconnaissance

The study of water environment aspect in the ecosystem is to identify sensitive issues, and to take preventive measures by maintaining ecological homeostatic in the early stages of development of the project. Ground water samples were collected from different sources within the vicinity of the study area for impact assessment study. Some important physical and chemical parameters were considered for depicting the baseline status of the study area.

The physical and chemical quality of water is important as the palatability of the water and its fitness for domestic purpose largely depends on its chemical quality.

In view of the wide variations in the chemical quality of water available in different parts of the country, rigid limits cannot be laid down with regard to chemical constituents. Certain chemical substances, which may be present in natural waters, are toxic to human beings. These should not be permitted in drinking water in excess of the permissible limits. However, certain chemical substances render the water unpalatable and unfit for domestic use, if present in excessive amounts. For these substances, the highest desirable and maximum permissible levels have been prescribed. The limit designated as the highest desirable level applied to water that would generally be acceptable to consumers. Values in excess of this level will not be acceptable but may be tolerated in the absence of a better alternate source to the limit designated as the maximum permissible level. Above this level, the water source should normally be rejected.

The suitability of any water for drinking purposes with regard to its chemical quality has therefore to be determined based on the general characteristics of the water available in the locality and its freedom from toxic substances.

3.8.2 Water quality assessment

Selected water quality parameters for water resources within 10 kms of the study area have been used for describing the water environment and assessing the impacts on it. Studies on water Environment aspects of ecosystem play an important role in preparation of Environmental Impact Assessment and identify sensitive issues and take appropriate action by maintaining ecological haemostatic. To assess the water quality impacts, water resources in the impact area have been grouped into 2 classes.

a. Surface water resources including streams, tanks.
b. Ground water resources in the deeper strata of the ground.

Hand pumps and small diameter open wells form the majority means of tapping the ground water sources of the study area and are adequate for domestic and a reasonable agricultural requirements. Ground water is available at a depth not exceeding 20 mts and the wells in the area have moderate to good yields.

Based on the water sources in the project area 12 water samples were collected, 2 from Bore wells with in the plant, 8 from Bore wells in surrounding villages, 2 from surface water bodies which were subjected to detailed analysis. Water Sampling locations are shown in **Figure 3.2** and the details of the locations are given in table below. The analytical results of the water samples are shown in **Table 3.12.**

Table 3.11
Water Quality Location Details

S. No	Location	Station Code	Distance from Plant Site In Km	Direction
Ground water samples				
1	Plant site (B.W)	GW1	0.00	Center
2	Old Port Office (B.W)	GW2	1.54	NE
3	Sri Haripuram (B.W)	GW3	3.75	SW
4	Navel Park (B.W)	GW4	3.0	SW
5	Kancharapalem (B.W)	GW5	4.0	SW
6	Gnanapuram (B.W)	GW6	6.08	NW
7	Seethammadara (B.W)	GW7	6.0	WSW
8	Div Fire Office (B.W)	GW8	6.00	NE
9	ESI Hospital (B.W)	GW9	2.5	E
10	EPS Borewell	GW10	3.75	SW
Surface Water Samples				
11	Meghadri gadda Reservoir (S.W)	SW 1	8.00	NW
12	Dolphin nose (S.W)	SW 2	3.50	NE

Table 3.12

Ground Water Quality in the study area – Physico-Chemical Parameters

Parameter	Units	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	GW9	GW10	GW11	GW12	IS: 10500
Colour	Hazen	5	5	5	15	5	10	10	10	15	10	10	10	5.0 - 25.0
pH		7.3	7.06	7.15	7.86	7.25	7.49	6.8	7.3	7.03	7.02	7.75	6.55	
Turbidity	NTU	5	5	5	5	5	5	5	5	5	5	25	35	6.5 - 8.5
Elec. Cond	mhos/cm	298	4670	1615	394	565	1850	1039	2183	1568	1580	321	29480	5.0 - 10.0
Sus. Solids	mg/l	6	14	9	8	8	17	8	6	9	6	12	45	
TDS	mg/l	192	2789	1020	260	350	1245	680	1320	958	996	201	21890	500-2000
Alk as CaC03	mg/l	111	426	320	140	136	320	247	236	368	378	126	69	200-600
Chlorides as Cl	mg/l	16	93	220	28	45	401	137	368	188	190	19	10012	250-1000
Sulphates as SO4	mg/l	15	1672	95	18	40	87	50	169	79	85	8	326	200-400
Nitrate as NO3	mg/l	1	17	32	1	18	10	18	33	22	18	1	15	45-100
Phosphate as PO4	mg/l	0.2	0.6	0.3	0.3	0.9	0.4	0.4	1	0.3	0.7	0.4	14.4	
Hardness as CaCO3	mg/l	112	754	595	145	219	437	384	582	441	401	131	586	300-600
Calcium as Ca	mg/l	28	180	128	38	66	128	92	176	148	72	24	186	75-200
Magnesium as Mg	mg/l	10	73	66	12	13	28	37	34	17	53	17	29	30-100
Sodium as Na	mg/l	12	654	76	12	29	197	66	187	122	145	13	6098	
Potassium as K	mg/l	2	15	5	13	2	7	10	12	8	6	1	35	
Flouride as F	mg/l	0.05	0.55	0.11	0.03	0.1	0.3	0.1	0.06	0.1	0.2	0.1	1	1.0-1.5
Iron as Fe	mg/l	0.3	1.7	0.2	0.3	0.2	0.3	0.2	0.5	0.3	0.3	0.4	0.2	0.5-1.0
Arsenic	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.05
Cadmium	mg/l	0.008	0.01	0.006	0.009	0.008	0.009	0.008	0.003	0.009	0.007	0.006	0.02	0.01
Chromium	mg/l	0.004	0.045	0.028	0.026	0.023	0.026	0.045	0.03	0.043	0.038	0.04	0.005	0.05
Copper	mg/l	0.004	0.028	0.045	0.037	0.048	0.038	0.028	0.04	0.004	0.027	0.004	0.004	0.05-1.5
Lead	mg/l	0.003	0.04	0.039	0.028	0.029	0.01	0.036	0.045	0.003	0.045	0.005	0.003	0.05
Manganese	mg/l	0.03	0.03	0.05	0.07	0.04	0.01	0.04	0.02	0.01	0.04	0.01	0.06	0.1-0.3
Zinc	mg/l	0.003	0.028	0.032	0.088	0.042	6.9	6.9	6.9	0.35	0.45	0.42	0.42	5-15

3.8.3 Regional Scenario

Water sources are ample in the study area. A total of 12 (10 ground water and 2 surface water samples) were collected from the study area.

- The pH limit fixed for drinking water samples as per IS 10500 is 6.5 to 8.5 beyond this range the water will affect the mucus membrane and or water supply system. During the study period, the pH was varying for ground waters from 6.80 to 7.86 and in surface water the pH was varying between 6.55 to 7.75. The pH values for all the samples collected in the study area during study period were found to be within the limits.

- The desirable limit for total dissolved solids as per IS 10500 is 500 mg/l, where as the permissible limits in absence of alternate source is 2000 mg/l, beyond this palatability decreases and may cause gastro intestinal irritation. In ground water samples collected from the study area, the total dissolved solids are varying from 192 mg/l to 2789 mg/l. The TDS of three samples were below the desirable limit and 6 are above the desirable limit but with-in the permissible limit of 2000 mg/l, but one sample was above the permissible limit. In surface waters the total dissolved solids were in the range of 210 mg/l to 21800 mg/l (Dolphin Nose sea water mixed).

- The desirable limit for chloride is 250mg/l as per IS10500 where as the permissible limit of the same is 1000 mg/l beyond this limit taste, corrosion and palatability are affected. The Chloride levels in the ground water samples collected in the study area were ranging from 16 mg/l to a maximum of 401 mg/l. Except two samples all are within the desirable limits. In surface waters the chlorides were in the range of 19 mg/l to 10012 mg/l.

- The desirable limit as per IS10500 for hardness is 300 mg/l where as the permissible limit for the same is 600 mg/l beyond this limit encrustation in water supply structure and adverse effects on domestic use will be observed. In the ground water samples collected from the study area, the hardness is varying from 112 mg/l to 754 mg/l, three samples are within the desirable limits, six samples are within permissible limits, one sample is above permissible limit. In surface waters the hardness is varying between 131 mg/l to 586 mg/l.

- Fluoride is the other important parameter, which has the desirable limit of 1 mg/l and permissible limit of 1.5 mg/l. However the optimum content of fluoride in the drinking water is 0.6 to 1.5 mg/l. If the fluoride content is less than 0.6 mg/l it causes dental carries, above 1.5 mg/l it causes staining of tooth enamel, higher concentration in range of 3 - 10 mg/l causes fluorosis. In the ground water samples of study area the fluoride value were in the range of 0.03 mg/l to 0.55 mg/l. where as in the surface waters the fluoride was in range of 0.1 mg/l to 1.0 mg/l.

3.9.1.2 Geology

The project area falls under the Deccan Plateau of vast "triangular platform". The local hard crystalline rocks belong to Precambrian II, and form more or less stable parts of the Earth's Crust.

The under ground water level normally abides the surface configuration. Ground water levels are reported to be deeper in elevated areas, and shallower in low lands. The general level of water table in the area is about 10 to 20 m below the ground level.

3.9.1.3 Lithology

The lithology presented in the project area was under the influence of natural agents and thus is weathered and fractured. It can be concluded that the area is underlain by one of the oldest formations in the geological history. It is noticed that the formation is getting harder and impervious with depth. The topsoil in the area is followed by weathered rock that is underlain by fractured rock, the thickness of which is not considerable. This fractured rock is followed by a basement rock that is the fine-grained granite. The major types of rocks in the study area are Deccan trap, Laterite and unclassified rocks. The basement is normally met from a depth of about 30-60 meters below ground level.

3.9.1.4 Soil

For land environment 10 Locations were selected to understand the physico-chemical properties of the soil and the microbial quality of the soil.

The activities around the sampled sites are also taken into consideration to learn the sources of pollution if any, or factors governing the physico-chemical and biological properties of the soil. The soil is mostly red sandy comprising sandy silts and silty sand soils. The area in particular is generally sandy clay with patches of silty loam and red loamy soils. Due to this factor water quickly percolates in to the soil without causing any marshy conditions. The cultivable soils are spread over the area. The values are not abnormal and are not indicating any soil contamination.

The soil sampling locations are given in **Table 3.13** and shown in **Figure 3.2** and the results are depicted in **Table 3.14** given below.

Table 3.13
Soil sampling locations

S. No	Location	Station Code	Distance from Plant site- Kms	Direction w.r.t. to Plant site
1	Plant site (Pump House)	S1		
2	Plant site (L.P. Area)	S2		
3	Plant site (Garden Area)	S3		
4	Plant site (out side of Security Gate)	S4	-	Core zone
5	Old port office	S5	3.5	NE
6	Sri Haripuram	S6	3.75	SW
7	Kancharapalem	S7	4.0	SW
8	Seethammadara	S8	6.0	WSW
9	Navel park	S9	3.0	SW
10	Div Fire office	S10	6.0	NE

Table 3.14

Soil Quality in the Study Area – Physical Parameters

S. No	Parameter	Units	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
1	Ph	–	8.02	8.17	8.35	8.48	8.08	8.27	8.26	8.32	8.23	8.41
2	Moisture Content	%	6.7	14.4	8.7	12.6	8.6	5.8	2.9	8.6	8.1	9.8
3	Organic Matter	%	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.4
4	Ava. Nitrogen	Kg/ha	362	223	147	306	127	245	205	264	167	163
5	Ava. Phosphorus	Kg/ha	13	52	65	55	13	18	55	72	11	19
6	Ava. Pottassium	Kg/ha	105	170	136	137	166	122	89	172	168	142
7	Sodium Absorption Ratio	–	1.3	1.5	2.2	3.3	2	1.3	1.1	1.4	1.3	1.3
8	Cation Exchange Capacity	Meq/100gm	15.2	20.4	16.2	33.1	12	7.5	16.6	13.5	33.4	20.8
9	Chlorides as Cl	mg/Kg	120	230	230	140	80	100	100	100	60	100
10	Sulphates as So_4^{-2}	mg/Kg	770	820	231	136	403	135	20	222	106	289
11	Calcium as Ca	mg/Kg	2360	2840	2040	4400	840	2920	2160	1960	4320	2560
12	Magnesium as Mg	mg/Kg	100	220	120	1110	220	260	290	140	340	170
13	Sodium as Na	mg/Kg	236	311	375	949	255	284	202	237	323	253
14	Iron as Fe	mg/Kg	2147	2473	2273	2441	2003	1440	2456	2276	2062	2130
15	Lead as Pb	mg/Kg	35.7	33.0	30.1	35.4	26.3	83.8	7.3	25.7	15	20.9
16	Cadmium as Cd	mg/Kg	0.4	0.2	0.3	1.2	0.2	0.7	0.5	0.1	0.3	0.5
17	Total Chromium as Cr	mg/Kg	24.5	35.9	31.5	37.9	15.8	35.7	25.2	25.6	42.1	29.4
18	Copper as Cu	mg/Kg	13.9	22.3	22.8	21.5	8.3	26.6	9.1	38.4	30.4	12.9
19	Zinc as Zn	mg/Kg	42.5	32.4	26.9	56.8	24.6	26.9	19.3	25.2	38.7	31.8

3.9.1.5 Regional Scenario – Soil Quality

The analytical results of the soil samples collected during the study period are summarized below.

The pH of the soil is an important property; plants cannot grow in low and high pH value soils. The normal range of the soils in 6.0 to 8.5 is called as normal to saline soils. Most of the essential nutrients like N, P, K, Cl and SO_4 are available for plant at the neutral pH except for Fe, Mn and Al which are available at low pH range. The soils having pH below 7 are considered to be acidic from the practical standpoint, those with pH less than 5.5 and which respond to liming may be considered to qualify to be designated as acid soils. On the basis of pH measurements, the degree of soil acidity may be indicated. The pH values in the study area are varying from 8.02 to 8.48 indicating that the soils are falling in normal to saline class.

The organic carbon in the study area is varying from 0.1 to 0.4 %,

The other important parameters for characterization of soil for irrigation are N,P,K. Nitrogen, Phosphorus and Potassium are known as primary nutrients, Calcium, Magnesium and sulphur as secondary nutrients. The primary and secondary nutrient elements are known as major elements. This classification is based on their relative abundance, and not on their relative importance.

Nitrogen encourages the vegetative development of plants by imparting a healthy green colour to the leaves. It also controls, to some extent, the efficient utilization of phosphorus and potassium. Its deficiency retards growth and root development, turns the foliage yellowish or pale green, hastens maturity, causes the shriveling of grains and lowers crop yield. The older leaves are affected first. An excess of nitrogen produces leathery (and sometimes crinkled), dark green leaves and succulent growth. It also delays the maturation of plants, impairs the quality of crops like barley, potato, tobacco, sugarcane and fruits increases susceptibility to diseases and causes "lodging" of cereal crops by inducing an undue lengthening of the stem internodes. The available Nitrogen as N in the study area is varying from 127 to 362 kg/ha indicating that it requires addition of nitrates for proper growth. Eight samples are falling low category and 2 samples in medium category.

Phosphorus influences the vigour of plants and improves the quality of crops. It encourages the formation of new cells, promotes root growth (particularly the development of fibrous roots), and hastens leaf development, the emergence of ears, the formation of grains, and the maturation of crops. It also increases resistance to disease and strengthens the stems of cereal plants, thus reducing their tendency to lodge. It offsets the harmful effects of excess nitrogen in the plant. When applied to leguminous crops it hastens and encourages the

development of nitrogen fixing nodule bacteria. If phosphorus is deficient in the soil, plants fail to make a quick start, do not develop a satisfactory root-system, remain stunted and sometimes develop a tendency to show a reddish or purplish discolouration of the stem and foliage owing to an abnormal increase in the sugar content and the formation of anthocyanin. However the deficiency of this element is not so easily recognized as that of nitrogen. It has also been observed that cattle feeding on the produce of phosphorus deficient soils become dwarfed, develop stiff joints and lose the velvety feel of the skin. Such animals show an abnormal craving for eating bones and even soil itself. In the study area available Phosphorus is varying from 11 to 72 kg/ha, which indicates that five samples are falling in medium range and five samples in high range.

Potassium enhances the ability of the plants to resist diseases, insect attacks, and cold and other adverse conditions. It plays an essential part in the formation of starch and in the production and translocation of sugars, and is thus of special value to carbohydrates rich crops, e.g. sugarcane, potato and sugar beet. The increased production of starch and sugar in legumes fertilized with potash benefits the symbiotic bacteria and thus enhances the fixation of nitrogen. It also improves the quality of tobacco, citrus, etc. With an adequate supply of potash, cereals produce plump grains and strong straw. But an excess of the element tends to delay maturity, though not to the same extent as nitrogen. Plants can take up and store potassium in much larger quantities than what is needed for optimum growth and this excess uptake is known as luxury consumption. With the maturity or death of plants, potassium is washed out from the plant body readily. Vegetables and legumes are particularly heavy consumers of potassium. The deficiency of potassium produces the characteristic ringing of alfalfa leaves with rows of small white spots, reddish brown discolouration of cotton leaves, the drying, scorching and curbing of leaf margins of potato, and intraveinal chlorosis and flaring along the edges of maize leaves. The older leaves are affected first. The Available Potassium in the study area is varying between 89 to 170 kg/ha which indicates that nine samples are falling in medium category and one sample in low category.

3.9.1.6 Crop Land Ecosystem

This is also known as man made ecosystem or artificial ecosystem because man tries to control biotic community and physical environment to satisfy its need. The most important of these is an artificial force from man to maintain the species composition of its requirement as the producers. In addition to maintain a moisture level of the soil to get the yield the diversity of the microorganisms also changes and replenishing nutrients at times in an ecosystem. The animals diversity also changes, like the most required animal in city life is, Cows, Goats, Dogs, cats, buffaloes, etc., which could provide milk & dogs to protect their houses, cats to control rats population, etc, to meet the requirement of daily needs. Therefore, the other animals are less important and thus the diversification of animals changes. In this ecosystem a particular animal species

Finds enough food and multiplies and become a pest. Here usually single species dynamics assumes a great prominence.

The study area is predominated by industries and Govt. lands, whereas only few pockets of land being utilized for farming purposes. The normal rainfall of the district is 1082 mm. About 58.4% of the rainfall is received from SW monsoon and 27.5 % from NE monsoon. The crops grown are Kharif and Rabi, however, the crop Kharif dominates over Rabi. The crop yield is moderate to good based on the rainfall and irrigation facilities.

The economy of Visakhapatnam district is agriculture oriented since 62% of the workers eke out their livelihood from agriculture. The following **Table 3.15** indicates yield per hectare in comparison with other coastal districts of the state. For securing increased agriculture production and improving the economy of the district, local varieties have been replaced with high yielding varieties and the progress achieved in the 1981-91 decennium is given in the table below.

Table 3.15
Yield per hectare in Visakhapatnam district – kgs

S. No	Crop	Visakhapatnam District		Coastal Andhra
		1980-81	1989-90	1989-90
1	Rice	926	1840	2433
2	Bajra	775	761	966
3	Jowar	599	541	547
4	Ragi	856	837	1259
5	Ground nut	973	1079	1194
6	Sugar cane (in terms of cane)	42896	52178	69019

Source: District Census Handbook, Visakhapatnam

3.9.1.7 Terrestrial Ecosystem

The topography of the study area consist of hilly regions, covered by eastern Ghats with an altitude of 76 meters, dotted by several peaks, exceeding 1200 meters in length. Along the shores, a series of salt and sandy swamps can be seen. The coastline is broken by number of bay lands, the important of being Dolphin nose, which has afforded the establishment of Natural harbour at Visakhapatnam at Rushikonda the Polavaram rock & the Narsimha Hill at Bheemunipatnam. The soil of the area dominated by red sandy- silty loamy, poor textured and easily drained. The land utilization details of the district during 1989-90 are as follows.

Table 3.16
Land Utilization details of the Visakhapatnam during 1989-90

S. No	Classification	Area in Lakh Hectares	% Total Land area
1	Total Geographical area	11.16	100
2	Forest	4.67	41.8
3	Barren and uncultivable	1.80	16.1
4	Land put to non-agricultural uses	0.80	7.2
5	Culturable waste	0.14	1.3
6	Permananet Pastures	0.04	0.3
7	Land under miscellaneous use	0.21	1.9
8	Current fallows	0.27	2.4
9	Other fallows	0.14	1.3
10	Net sown area a) Area sown more than once b) Grass swon area	 1.04 4.13	 - -

Source: District Census Handbook, Visakhapatnam

3.9.1.8 Flora Studies

There is a marked seasonal variation in the species in different groups of Phytoplankton organisms. The following species were generally present throughout the year. The Phytoplankton organisms exhibit a bimodal abundance with a major peak during the (October – November southwest monsoon (June – September) and minor peak during northeast monsoon). Nearly half of the district is cover by forests and considerable portion of it is reserved. The list of important plant species present in the study area is given in **Table 3.17.**

Table 3.17

List of important plants present in the study area

Technical Name	Family	Local Name
Robusta		Guddilam
Xylia dolbriformis		Tangedu & Konda Tangedu
Chloroxylon Swetenia		Billu or Billudu
Anogeissus Accumiriata		Chirimanu or Yellamma
Ptero Carpus Martaplum		Yegisa
Terminalia tomctosa		Nallamaddi or Maddi
Soyamida toprijuda		Somi or Somidi
Mangefera indica	*Anacardiaceae*	Mamidi
Parthenium hysterophorus	*Asteraceae*	Congress grass
Tridax procumbens	*Asteraceae*	Gaddi chamanthi
Xanthium strumarium	*Asteraceae*	-
Polyalthia longifolia	*Annobaceae*	Naramamidi
Calotropis gigantia	*Asiepiadaceae*	Jilledu
Pongamia pinnata	*Caecalpinaceae*	Ganuga
Cassia auriculata	*Caecalpinaceae*	Tangedu
Cassia fistula	*Caecalpinaceae*	Rela
Bauhinia purpuria	*Caecalpinaceae*	Kanchanam
Ipomea palmate	*Convulvalaceae*	-
Bauhinia vahlii	*Caesalpinaceae*	-
Tamarindus indica	*Caesalpinaceae*	Chinta
Euphorbia hirta	*Euphorbiaceae*	Reddinana Brolu, bidaria
Desmodium triflorum	*Fabaceae*	Muntamandu
Lawsonia innermis	*Lythraceae*	Gorinta
Asparagus racemosus	*Liliaceae*	Pillithegalu
Aloe barbodensis	*Liliaceae*	Chinnakatabanda
Ocimum americanum	*Labiatae*	Kukkatulasi
Azadirachta indica	*Meliaceae*	Vepa
Ficus bengalensis	*Moraceae*	Peddamarri
Ficus glomarata	*Moraceae*	Atthi
Ficus religosa	*Moraceae*	Bodhi
Acacia sundra	*Mimosaceae*	-
Pithecolobium dulce	*Mimosaceae*	Simachinta
Albizia lebbek	*Mimisaceae*	Dirasana
Melia Azadirachta	*Meliaceae*	Turakavepa
Mimosa pudica	*Mimosaceae*	Attapathi
Borassus flabellifera	*Plamae*	Tadichettu
Datura Stramonium	*Solanaceae*	Ummetha
Physalis minima	*Solanaceae*	-
Ziziphus zyzuba	*Rhamnaceae*	Regu

3.9.1.9 Faunal Studies

This region once contained thick forests, which were later subjected to gradual destruction. With the increase in population the demand in land increase and the problem of producing food grains dominated and consequently large areas of jungles were cleared ruthlessly.

Most commonly found fauna in the study area are as follows.

Carnivores: Wild Jackal (Fox), Common Mongoose, Wild dogs
Herbivore Quadrupeds Rabbit, Squirrel, Hare, Wild bears, Monkeys

Birds

Pariah kite	Black winged kite
Kestrel	Vultures (white backed)
Grey partridge	Common quail
Crane (common & domeselle)	Lappings (red & yellow)
Dove (spotted, ring necked)	House martin
Blue jay	King fisher (pied)
Sun bird	Drango
Golden oriole	Shrike
Sky lark	Munia
Crow – pheasant	Red vented bul bul
Common babbler	Hoopoo
Crimson throated barbet	

Reptiles

Cobra, Korant banded, Grass snake, Green tree snake, Russels viper

From the study, it has been observed that there are no endangered, endemic or threatened species in the study area. The most commonly available fauna is only of pet origin like dogs, rabbits, hens, buffaloes, cows, cats etc.

3.10 SOCIO ECONOMIC ENVIRONMENT

3.10.1 Introduction

Socio-economic status of the population is the indicator for the development of the region. Any developmental project of any magnitude will have a bearing on the living conditions and the economic of the population in particular and the region as a whole. Similarly, the industrial development will have its share of socio-economic influence in the study area. This section delineates the overall appraisal of the socially relevant attributes.

The data collection on the impact of industrialization on socio-economic aspects in the study area has been done through analysis of the secondary data available for the study area.

3.10.2 Methodology

The methodology adopted in the assessment of socio-economic condition is given below:

- To evaluate the parameters in the assessment of socio-economic conditions of the population
- Analysis of the identified social attributes like population distribution, sex ratio, literacy rate, occupational structure, availability of public utilities etc, through literature like District Census Handbook, 2003-2004

3.10.3 Sources of Information

As per the scope of the present study, the information on socio-economic aspects has been gathered and compiled from various secondary sources like the district census, hand book for Vishakapatnam district as these documents are comprehensive and authentic.

The salient features of the district are as follows.

- The district is bound on the North partly by the Orissa State and partly by Vizianagaram District, on the South by East Godavari District, on the West by Orissa State and on the East by Bay of Bengal.
- The district has 43 mandals and has two distinct geographic divisions. The strip of the land along the coast and the interior called the plains division and hilly area of the Eastern Ghats flanking it on the North and West called the Agency Division.
- The total area of the district is 11161 sq km. which constitutes to about 4.1 % of the total area of the state.
- The district is rich in minerals, rich in forest wealth, has good number of industries, fishing harbours, port, educational institutions, universities, religious and tourist places. The district is well connected by road, rail and air networks and has good infrastructural amenities to its credit.

3.10.4 Demographic particulars

The district has a total area of 11161 sqkm which is about 4.1% of the total population of the state. The district has about 43 mandals and the total area is divided into two distinct geographic divisions namely the plains and hilly regions called agency division .the district has 10 hierarchic urban areas and 3082 villages.

The total population of the district is 38.32 lakhs. The males constitute to about 19.3 lakhs and females to about 19.02 lakhs. The increase in the population during the decennium ending in 2001 census over the 1991 is 15.36 % for the district as against 26.8 % for the state. The sex ratio of the district is 985 females per 1000 males. The population density of the area for the district is 343 persons per sq km. out of the total population the SC's population is about 7.82% while the ST's constitute to about 14.55 % of the total population. The total literacy rate of the district is 52.25 % of the total population i.e., about 20.02 lakhs of the total 38.31 lakhs population. The male literates are about 30.56 % while the female literates are about 21.69 %. The district has a work force of 16.03 lakhs constituting about 41.83 of the population besides the marginal workers to a tune of 2.97 lakhs as per 2001 Census. The cultivators constitute 36.31% Agricultural Labourers 23.60% and the balance of 40.09% engage in Primary, Secondary and Teritory sectors as per 1991 census.

3.10.5 Land utilization in the district

The total geographical area of the district is 11.34 lakh hectares of this 30.5% alone is arable area while 42.1% is forest area. The rest is distributed among "Barren and uncultivable land" which is about 11.6% and "Land put to non agricultural uses" is about 8.9%. Out of the arable area, the net area sown forms 24.4% while culturable waste and fallow (current and old) lands constitute about 6.4%.

3.10.6 Agriculture

Agriculture is the main stray of nearly 70% of the households. Though Visakhapantam city is industrially developing, the rural areas continued to be backward. Rice is a staple food of the people and Paddy is therefore the principal food crop of the district followed by Ragi, Bajra and Jowar. Cash Crops such as Sugarcane, Groundnut, Sesamum, Niger and Chillies are important.

3.10.7 Flora and fauna

More than one third of the area in the District is covered by forest. The forests are of moist and dry decidous type. The common species available are Guggilam, Tangedu, Sirimanu, Kamba, Yegisa, Nallamaddi, Gandra, Vepa etc. Bamboo shurbs are sparsely scattered. Coffee plantations have been raised in

about 10000 Acres in Chinthapalli, Minimuluru, Devarapalli and Ananthagiri regions.

Fauna the district has a livestock of 13.43 lakhs as per 1999 livestock Census. In the Livestock, Cattle form 33.4% Buffaloes 31.28%, Sheep 14.3% and Goats 17.6%. in addition to this wild Boars, Bisons Cheetas and tigers are found in Forest areas of the district.

3.10.8 Fisheries

There are about 59 fishery villages and hamlets on coastline stretching to a length of 132 Kms covering 11 coastal mandals. About 13,000 fishermen families eke out their livelihood from marine, Inland and brackish water fishing beside catching fish living around Thandava and Raiwada reservoirs.

3.10.9 Minerals

The District has mineral deposits of Bauxite Apatite (Rock Phosphate) Calcite, Crystaline limestone confined to tribal tracts. Bauxite deposits at Sapparla, Jerrila and Gudem of G.K.Veedhi Mandal are considered to be the largest in the country. Bauxite deposits are also identified at Galikonda, Katuki, Chittemgodndi of Araku group deposits, Katamrajukonda of Gurthedu sub-group of deposits. Phosphate Apatite is available in Kasipatnam village of Ananthagiri mandal. Rich deposits of Crystaline limestone and Calcite are mapped in Borra Caves and along the Valley up to Araku from Borra and around Valasi village of Ananthagiri mandal. Ruby Mica is another mineral available in the District essential for electrical and electronic industries. The mineral occurs in the form of Phologopite and is confined to Borra tract.

Quartz is another mineral found mostly in Bheemunipatnam, Padmanabham, Devarapalli, K.Kotapadu and Ananthagiri mandals. Vermiculate is found near Kasipatnam of Ananthagiri mandal. Clay deposits near Malivalasa of Araku mandal are identified. Limeshell useful for manufacture of chemical grade lime is also available in the district. Red and Yellow ochre deposits are also identified in Araku and Ananthagiri mandals.

3.10.10 Industries

Industrial Development is conspicuous in Visakhapatnam urban agglomeration with the large scale industries like Hindustan Shipyard, Hindustan Petroleum Corporation, Coromandal Fertilisers, Bharat Heavy Plates and Vessels, L.G.Polymers Ltd., Hindustan Zinc Plant and the recent giant Visakhapatnam Steel Plant and a host of other ancillary industries.

On the country side the agro based industries like Sugar Factories, Jute Mills and Rice Mills are there besides brick and tile units. The District has 1063

registered factories under factories Act functioning with a working force of about 77203 persons during 2002-2003.

3.10.11 Electrification

Power consumption by industries is 42.45 Million KWH while it is 70.17 for Agricultural purposes. All 3,335 habitations in the District have been electrified using solar power system during 2002-2003.

3.10.12 Transport and Communication

The District has a Road length of 7336 kms. of which the National Highway 5 runs to a length of 134.28 Kms., State Highways at a length of 277 Kms. and the balance forms the roads maintained by Roads and Buildings, Zilla Praja Parishad and Mandal Praja Parishads.

The number of Vehicles registered during 2002-2003 are 390322 of which 326295 are Motor Cycles. There are 660 Post Offices, 7 Telegraph Offices and 96 Telephone Exchanges with 156993 telephone connections in the District.

3.10.13 Educational and medical facilities

There are 3550 Primary Schools with 2.80 lakhs children on enrolment, 489 Upper Primary Schools with an enrolment of 1.28 lakhs, 447 High Schools with 2.04 lakhs pupils on roll, 196 Junior, Degree and Professional Institutions with 0.83 lakhs students during 2002-2003.

Regarding Medical facilities, there are 159 Government Hospitals and dispensaries both Allopathic and Indian Medicine with 2819 bed-strength and 596 Doctors.

3.10.14 Public Services (Banking)

There are 320 Bank Branches including Cooperative Banks in the district to look after the credit needs of the people.

3.10.15 Places of cultural and tourist importance

The places of cultural and tourist importance in the district includes Simhachalam konda, Kailasagiri, VUDA park, Lumbini park, Dolphin's nose, Kali temple, Kurapam tomb, Submarine museum, Araku valley, Bheemunipatnam, Borra caves, Ananthagiri hills etc and many beaches.

The study area falls under the 5 mandals i.e., Vishakapatnam (Urban & Rural), Pendurthi, Bheemunipatnam, Pedagantyada, Anandapuram. The mandal wise details like the total population (Male & Female), literacy rate, no of households, worker population etc are given in tables below.

Table 3.18
Demographic details of the study area

Name of the Mandal	Total Population	Male Population	Female Population	Total Households
Vishakapatnam (Urban)	1530899	780285	750614	350716
Vishakapatnam (Rural)	2301437	1149912	1151525	536287
Pendurthi	79515	40144	39371	18239
Bheemunipatnam	50956	25925	25031	11356
Pedagantyada	12741	6605	6136	3012
Anandapuram	55525	28028	27497	12511

Table 3.19
SC & ST population in the study area

Name of the Mandal	P_SC	P_SC	P_SC	P_ST	M_ST	F_ST
Vishakapatnam (Urban)	126813	63696	63117	18964	10141	8823
Vishakapatnam (Rural)	164406	83117	81289	538608	268258	270350
Pendurthi	6443	3063	3380	619	317	302
Bheemunipatnam	3451	1772	1679	13	7	6
Pedagantyada	103	55	48	5	2	3
Anandapuram	4891	2449	2442	832	413	419

Table 3.20
Literate/Illiterate population in the study area

Name of the Mandal	P_Lit	M_Lit	F_Lit	P_ILL	M_ILL	F_ILL
Vishakapatnam (Urban)	1058633	589762	468871	472266	190523	281743
Vishakapatnam (Rural)	943683	581320	362363	1357754	568592	789162
Pendurthi	48139	28010	20129	31376	12134	19242
Bheemunipatnam	20552	12912	7640	30404	13013	17391
Pedagantyada	6392	3970	2422	6349	2635	3714
Anandapuram	23312	14326	8986	32213	13702	18511

Table 3.21 (a)
Work force distribution in the study area

Name of the Mandal	Tot_Work_P	Tot_Work_M	Tot_Work_F
Vishakapatnam (Urban)	466090	395536	70554
Vishakapatnam (Rural)	1136671	674006	462665
Pendurthi	28271	21524	6747
Bheemunipatnam	21544	14068	7476
Pedagantyada	4436	3384	1052
Anandapuram	28427	17081	11346

Table 3.21 (b)
Work force distribution in the study area –Main workers

Name of the Mandal	Main work_P	Mainwork_M	Mainwork_F
Vishakapatnam (Urban)	405573	350213	55360
Vishakapatnam (Rural)	900011	581597	318414
Pendurthi	22139	17784	4355
Bheemunipatnam	12277	10086	2191
Pedagantyada	2123	1799	324
Anandapuram	23087	15174	7913

Table 3.21 (c)
Work force distribution in the study area –Marginal workers

Name of the Mandal	Marginal work_P	Marginal work_M	Marginal work_F
Vishakapatnam (Urban)	60517	45323	15194
Vishakapatnam (Rural)	236660	92409	144251
Pendurthi	6132	3740	2392
Bheemunipatnam	9267	3982	5285
Pedagantyada	2313	1585	728
Anandapuram	5340	1907	3433

Table 3.21 (d)
Work force distribution in the study area –Marginal workers

Name of the Mandal	Non work_P	Non work_M	Non work_F
Vishakapatnam (Urban)	1064809	384749	680060
Vishakapatnam (Rural)	1164766	475906	688860
Pendurthi	51244	18620	32624
Bheemunipatnam	29412	11857	17555
Pedagantyada	8305	3221	5084
Anandapuram	27098	10947	16151

Chapter 4
Idendification And Prediction Of Impacts

IDENTIFICATION AND PREDICTION OF IMPACTS

4.1 PREDICTION OF IMPACTS

4.1.1 Methodology

Prediction of impacts not only depends on the nature and size of activity being undertaken but also on the type of pollution control measures that are envisaged as part of the project proposal.

The potential impacts on the environment from the proposed expansion of the plant are identified not only based on the nature of the various activities associated with the operation but also on the current status of the environmental quality at the project area and its surroundings.

The prediction of impacts helps to identify and implement environmental management plan during and after the execution of developmental activities to minimise the deterioration of environmental quality. Many scientific techniques and mathematical models are available to predict the impact on physical, ecological and socioeconomic environment.

In the present study, the most probable impacts on various components of the environment due to the proposed expansion of the petrochemical unit have been predicted using scientific knowledge and methodologies.

Project

The potential impacts on the environment from the proposal were identified keeping in view the nature of the various activities associated with the production enhancement project, operation, and also the existing environmental Status Quo at the project site. Both beneficial (positive) and adverse (negative) impacts were considered for this purpose.

4.2 POTENTIAL IMPACTS

The impacts, if any from the proposed project on various environmental components are studied under the following heads:

(a) Direct Impacts

1. Air Environment
   - Impacts on ambient air quality
   - Impacts on ambient odour
   - Impacts on ambient noise

2. Water Environment
   - Impacts on ground water
   - Impacts on surface water quality
   - Impacts on aquatic life

3. Land Environment
   - Impacts on land use
   - Impacts on soil fertility
   - Impacts on agriculture

4. Socio-Economics
   - Impacts on demand-supply
   - Impacts on natural resources
   - Impacts on industry
   - Impacts on infrastructure
   - Impacts on employment

(b) Indirect Impacts

- Impacts on public health and safety
- Impacts on cultural resources
- Impacts on ecology and biodiversity
- Impacts on aesthetics

4.3 PREDICTION OF IMPACTS

a) Direct 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 physico, ecological and socio-economic environment. Such predictions are superimposed over the baseline data of environmental quality to derive the environmental scenario. The prediction of impacts helps to prepare the environmental management plan to be executed during the on-going activities of the project to minimize the adverse impacts on environmental quality.

The impact assessment is carried out for the following phases and is presented in the following paragraphs.

- ❖ Impacts during development phase
- ❖ Impacts during operation phase

4.4 IMPACTS DURING DEVELOPMENT PHASE

The important activities involved during the development phase are:

- Land Acquisition
- Site Development
- Socio economic impacts

The impacts due to above mentioned developmental activities are for short term and are limited to the construction phase of the project only.

(a) Land Acquisition

No major construction related impacts are being envisaged during the construction phase of the proposed production enhancement as this is being done within the existing factory premises. The proposed expansion will be carried out in the existing land only and no additional land is proposed to be acquired for this purpose. The necessary infrastructure required for this purpose is proposed to be drawn from the existing factory resources, which will more than suffice. No rehabilitation and resettlement plans are required as the area is within the industrial area of Vishakapatnam port trust and within the existing well developed factory premises.

b) Site Development

This activity would involve clearing the site and its surroundings for further development. As the expansion is in the existing plant this activity does not apply to the present case.

c) Socio Economic Impacts

The socio-economic impacts during the construction phase could result due to movement of migrant workers, worker camps, induced development etc. Due to the migrant workers there would be an impact on the existing infrastructure temporarily. However, since the area is well developed industrial belt no such impacts will be felt.

From the above it can be concluded that the construction phase impacts will be minimal and temporary in nature, confined to the boundaries of the plant itself.

4.5 IMPACTS DURING OPERATION PHASE

The major sources of pollution on various components of the environment during the operation phase will be from the boilers, naptha reformer, noise from motors, conveyors and other equipment, wastewater and solid waste generated due to the plant operations etc.

The various sources of air emissions are given below.

- Emissions from utilities- M.P. boiler.
- Emissions from Process- Naphtha reformer

4.5.1 Impacts On Air Environment

a) Process

The emissions from the process include CO_2, O_2, H_2O and N_2. The main sources of these emissions are naphtha reformer and fired heaters. The details of the emissions their composition is given below.

Table 4.1

Emissions from the process

S. No	Equipment	Emission		Composition	Remarks
		Normal Nm^3/hr	Maximum Nm^3/hr		
1	3 Nos. of fired heaters	715	1420	H_2O-15.1% O_2- 3.2% CO_2- 9.8% N_2- 71.9%	Purge gas generated in the process and naphtha are used as fuels for reformer/ fired heaters and boiler
2	Naptha Reformer flue gas	12,500	-	H_2O- 16.3% CO_2- 10.3% O_2- 2.5% N_2- 70.9%	

b) Fugitive

Fugitive emissions occur in a factory as a result of various operations such as loading, unloading of chemicals, evaporation and volatilization of stored substances, leakages, spillages, open storage areas etc. emissions also occur from traffic movement and wind erosion. No increase in fugitive emissions is envisaged from the plant after optimization and modernization as good engineering methods are being and would be practiced to reduce the emissions.

Table 4.2

Fugitive emissions before and after modernization of the project

S. No	Description of vent	Source	Existing Emission rate NM^3/hr	Temp °C	Composition (Mol %) (Max)	Proposed expansion Nm^3/hr
1	Decoking steam (twice in a year)	Piping separator	1500	60	Air, CO2, Steam	1500
2	Blow down flash	Steam drum	326	100	Steam	326
3	Dearator vent	Deaerator	70	107	Steam with traces of CO, CO_2, CH_4	70
4	Synthesis gas filter vent	Synthesis gas filter	5	180	H2O = 5.0 CO = 40 CH4 = 5 N2 Remaining	5
5	Purge gas	Catalyst preparation equipment	2- 6	40	Butanol 20% N2 = Balance	0
6	WFE to package vent	WFE package	35	35	Air with organics like Butanol	0
7	Flash steam during start up only	Adolisation reactor	100	100	Steam 100%	100
8	Flash steam (1/2 hour during every 8 hours)	Converter blowdown	35	100	Steam 100%	35
9	Fore column vent – vent occurs only during butanol campign	Fore column and refine column	37	37	H2 = 15 – 25% N2 = 15 – 65% CH4 = 0 – 20% H2O = 0 – 3% Butanol = 0 – 10% C3H6 = 0 – 35% C3H8 = 0 – 20% Butaryal – 0 – 1%	37
10	2EH – refining vacuum package vent – vent occurs only during ethanol campaign	Refining system and batch still vaccum packages	80	40	Air 90% H2O = 7.3% H2O + CH4 = 2.5% Organics = 0.2%	80
11	Converter steam (only during upset conditions steam is vented)	Converter	2810 kg/hr	140	Steam 100%	2810 kg/hr

c) *Air Emissions- utilities*

The air emissions from the plant are from the Manufacturing activities (process) and Utilities. The units proposed to be added during optimization and modernization is new syngas unit and alcohol unit while at the same time modifying the aldehyde unit.

The major infrastructure that is proposed to be added is one naphtha reformer unit and one Fired Heaters. The existing LP boiler is proposed to be replaced by a M.P boiler which will be run on the same previous fuels oxo residue and purge gas both of which are in-house generated fuels having negligible sulphur content and small amount of LSHS.

In addition to this the DG set which is now 24 hr power back up will be totally shutdown and replaced by a UPS. Therefore there will be no significant increase in the emission loads from the utilities after the optimization proposal.

The Oxo-residue consists of mixture of Iso – Butanol, Normal Butanol, C12 – C16 diols and C6 – C9 diols and esters. The specific gravity of the Oxo-residue is 0.89. Purge gas is a mixture of propylene, Hydrogen, Propane and Methane. The fuel consumption for various fuels used for existing and proposed units its characteristics have been presented in **Tables 4.3**.

Due to addition of one Naptha reformer, one fired heaters and replacement of the existing LP boiler with MP boiler during optimization and modernization there will not be much increase in the pollution load because the existing DG sets which used to run 24 hours are not going to be used. As UPS system having a back up of 20 minutes has replaced the DG sets. The DG sets shall not be operated and they will be emergency standby for limited use which is a rare case.

In order to ensure that the air pollution load does not increase from the existing consented loads, APL has taken various measures to minimize the concentration of pollutants arising from the respective plants. This has been based on vast practical experience of the plant operations, revamping major equipment and by increasing the efficiency of its operations.

The total pollution load from different units due to fuel consumption is found to be less than the existing pollution loads. The impact on ambient air quality is predicted to remain same or less than the previous, even after adding new units as the proposed M.P boiler and naphtha reformer will run on cleaner fuel and also since the major polluting DG set will be shutdown after expansion.

Table 4.3

Details of the various Fuels used & its Characteristics

S. No	Particulars	Fuel	Qty	Calorific value	Sulphur content
			TPD	Kcal/kg	
	Existing				
1	LP boiler	Oxo residue	8	8000	5 ppm
2	MP boiler	LSHS	18	10500	0.8 %
3	Naptha Reformer	Naptha	11.6	10500	300 ppm
		Purge gas	13.12	10250	5 ppm
4	Fired heaters	Naptha	2.4	10500	300 ppm
		Purge gas	2.88	10250	5 ppm
5	DG sets	Diesel	12	10100	0.25 %
	DG set sets (750 KVA + 3X2270 KVA) at any given time only one DG set was used rest standby				
	Proposed				
1	MP Boiler (New)	Oxo residue	10.2	8000	5 ppm
		Purge gas	11.04	10250	5 ppm
		LSHS	2.4	10500	0.8 %
2	MP boiler	LSHS	18	10500	0.8 %
3	Naptha Reformer	Naptha	11.6	10500	300 ppm
		Purge gas	13.12	10250	5 ppm
4	Naptha Reformer (new)	Naptha	11.6	10500	300 ppm
		Purge gas	13.12	10250	5 ppm
5	Fired heaters	Naptha	2.4	10500	300 ppm
		Purge gas	2.88	10250	5 ppm
6	Fired heaters (new)	Naptha	2.4	10500	300 ppm
		Purge gas	2.88	10250	5 ppm

4.5.2. Atmospheric Dispersion of Stack Emissions

Prediction of impacts for air emissions both existing and proposed units were carried out. As only clean fuel like oxo residue, purge gas, LSHS are used in the proposed units which are going to be added during modernization, where as the existing DG sets which were running continuously on diesel will be made as second stand by to the UPS system there will not be much increase in the loads.

a) Details of Mathematical Modeling

An attempt has been made to predict impacts of the plant emissions on ambient air quality by means of air quality simulation models. The ultimate step in such an approach is to run the available data through a screening model where a rough computation of the worst case scenario is obtained.

The present case, computation of 24 hour average ground level concentrations were carried out using All Terrain Dispersion Model (ATDM). ATDM is a Breeze Air product of Trinity Consultants, Texas. The model is based on algorithms contained in two US EPA dispersion models, ISCST2 and COMPLEX1 and also incorporates the procedure used in the POSTIT post processor to calculate concentrations in intermediate terrain.

ATDM is based on Gussian dispersion which incorporates the Pasquile-Gifford (P-G) dispersion parameter for estimating horizontal cross wind and vertical dispersion.

b) ATDM Model

The All Terrain Dispersion Model (ATDM) is a hybrid Gaussian dispersion model that calculates concentrations from point, area, and volume source emissions in simple, intermediate, and complex terrain.

- For receptors located in simple terrain (terrain below stack top) ATDM uses the dispersion algorithms from the ISCST2 model.
- For receptors located in complex terrain (terrain above plume centerline), ATDM uses the dispersion algorithm from the COMPLEX1 model.
- For receptors located in intermediate terrain, ATDM uses both the ISCST2 and the COMPLEX1 algorithms to estimate the one hour average concentration at each receptor location and reports the larger of the two values as the calculated concentration

ATDM calculates the plume rise and plume centerline elevation for a given source to determine whether a receptor is located in a simple, complex or intermediate terrain with respect to that source. Depending on the terrain regime of the receptor, the model then uses one of the three approaches described below to calculate the one-hour average concentration at that receptor resulting from the emissions from the source.

i. Simple Terrain

For receptors locating in simple terrain (terrain below stack top), ATDM uses the dispersion algorithms from the ISCST2 model. As in ISCST2, ATDM accounts for the effects of building downwash using the Huber-Synder and Schulman-Scire algorithms, depending on the height of the stack above the building.

User specified terrain stack base elevations are used in the ISCST2 dispersion calculations according to EPA recommended approach for simple terrain. In this approach, final plume rise is calculated to determine the plume centerline elevation above sea level, and this elevation is used for all downwind distances from the stack.

Therefore, the plume centerline remains parallel to sea level without regard to changes in the underlying terrain.

ii. Complex Terrain

For receptors located in complex terrain (above plume centerline), ATDM uses the dispersion algorithm from the COMPLEX1 model. This algorithm is similar to that of the ISCST2 model in that it uses the same Gaussian dispersion equation and plume rise equations.

iii. Intermediate Terrain

A receptor is said to be located in intermediate terrain if its elevation is greater than stack top elevation but less than plume centerline elevation. For such receptors, EPA recommends that both the ISCST2 and COMPLEX1 dispersion algorithms be used to estimate the one hour average concentration at the receptor location and the larger of the two values be used as the calculated concentration. The ATDM POSTIT post processor uses the same approach.

iv. Multiple sources

When modeling multiple sources, ATDM sums the calculated one hour average concentrations from each source to estimate the total concentration at a given receptor location. It is possible that the given receptor may be located in simple terrain with respect to one source and complex/intermediate terrain with respect to another source. In this situation ATDM calculates concentrations independently for each source using the correct approach for the particular terrain regime and sums the results. ATDM classifies the receptor as being in intermediate terrain in this situation.

e. Model Output

The output capabilities are the same as the ISCST2 model. The output file may contain the first six highest concentration values at each receptor, maximum concentration tables, and daily concentration tables for each averaging period. A terrain regime indicator appears next to each output concentration value. This flag is used to indicate the terrain regime in which each receptor was located when the concentration value was calculated.

4.5.3 Input data for the model

i. Emissions

The details of the stacks existing and proposed during modernization and stack emissions characteristics are presented in **Table 4.4**.

Table 4.4
Details of the stacks and its emissions

Stack attached	St Ht (m)	Dia. (m)	Temp (°C)	Vel (m/s)	g/sec			Remarks
					SPM	SO_2	NOx	
Existing								At any given time only one DG set is used rest all standby
LP boiler	36	1.05	170	4.5	0.158	0.001	0.95	
MP boiler	36	1.05	170	4.6	0.243	3.330	1.87	
Naptha Reformer	30	0.743	150	13.1	0.181	0.083	1.63	
Fired heaters	30	0.64	600	1.3	0.022	0.017	0.34	
DG set sets (750 KVA + 3X2270 KVA)	36	1.05	200	5.5	0.302	0.583	1.05	
Total					**0.91**	**4.01**	**5.84**	
Proposed								LP boiler replaced with MP boiler (new), one additional Naptha reformer & fired heaters added
MP boiler (New)	36	1.05	170	4.5	0.132	0.444	1.79	
MP boiler	36	1.05	170	4.6	0.243	3.330	1.87	
Naptha Reformer	30	0.743	150	13.1	0.181	0.083	1.63	
Naptha Reformer (new)	30	0.743	150	13.1	0.181	0.083	1.63	
Fired heaters	30	0.64	600	1.3	0.022	0.017	0.34	
Fired heaters (new)	30	0.64	600	1.3	0.022	0.017	0.34	
Total					**0.78**	**3.97**	**7.60**	

II. Receptors Considered

Receptors have been considered in a 10 km radial zone around the project site. A polar grid with radial interval of 10^0 starting from 0^0 to 360^0 was selected with ring distances on each radial being as given in the following table:

Table 4.5
Ring distances on each radial

Origin of polar coordinates							
Radial distance	100	200	300	400	500	600	700
Radial Distance	800	900	1000	1200	1400	1500	1600
Radial Distance	1800	1900	2000	2200	2400	2600	2800
Radial Distance	2900	3000	3200	3400	3500	3600	3800
Radial Distance	4000	4200	4400	4600	4800	5000	5200
Radial Distance	5400	5600	5800	5900	6000	6250	6500
Radial Distance	6750	7000	7250	7500	7750	8000	8250
Radial Distance	8500	8750	9000	9250	9500	9750	10000

III. Meteorological Data

For each hour the meteorological information fed into the model included the following:

- Wind direction
- Wind speed
- Amb. Temperature
- Stability class
- Mixing height

For the prediction of rise in ground level concentrations of pollutants, the actual meteorological data recorded at the project site during the study period was used. The meteorological data for this period is herewith provided. The meteorological data collected for the study period was averaged to produce one day (24 readings) met data. The meteorological data is given below in the format desired by IMD.

Table: 4.6
Meteorological Data Collected For the Study Period Averaged For a Day
(Month: May 2006)

Hour	Wind Speed m/s	Predominant Wind Direction	Humidity %	Ambient Air Temperature °K	Stability Class	Mixing height m
1	1.6	225	80.5	292.5	6	50
2	1.7	225	81.2	291.8	6	50
3	1.7	180	80.8	292.2	6	50
4	1.7	225	79.9	293.1	5	200
5	1.8	225	79.1	293.9	5	400
6	1.6	203	78.6	294.4	5	400
7	1.6	180	77.8	295.2	4	500
8	1.7	225	76.2	296.8	4	800
9	1.6	225	74.9	298.1	4	500
10	1.6	225	73.7	299.3	3	500
11	1.2	225	72.0	301.0	3	500
12	1.2	270	70.9	302.1	2	500
13	1.3	225	69.8	303.2	2	500
14	1.4	225	68.2	304.8	1	480
15	1.7	225	69.2	303.8	1	420
16	1.7	203	70.7	302.3	2	400
17	1.9	225	72.1	300.9	2	400
18	1.7	270	72.9	300.1	3	400
19	1.7	225	74.1	298.9	3	400
20	1.7	180	74.8	298.2	4	400
21	1.7	225	76.8	296.2	5	400
22	1.8	225	78.5	294.5	5	400
23	1.1	225	79.6	293.4	6	400
24	0.7	225	80.2	292.8	6	400

4.5.4 Predicted Results

Predictions were carried out as per CPCB guidelines "Assessment of Impact to Air Environment: Guidelines for conducting air quality modeling" and the first five predicted results (contribution from the plant) emissions are presented in the **Table 4.7**.

Table 4.7

Predicated First Five 24 hourly Average GLC's

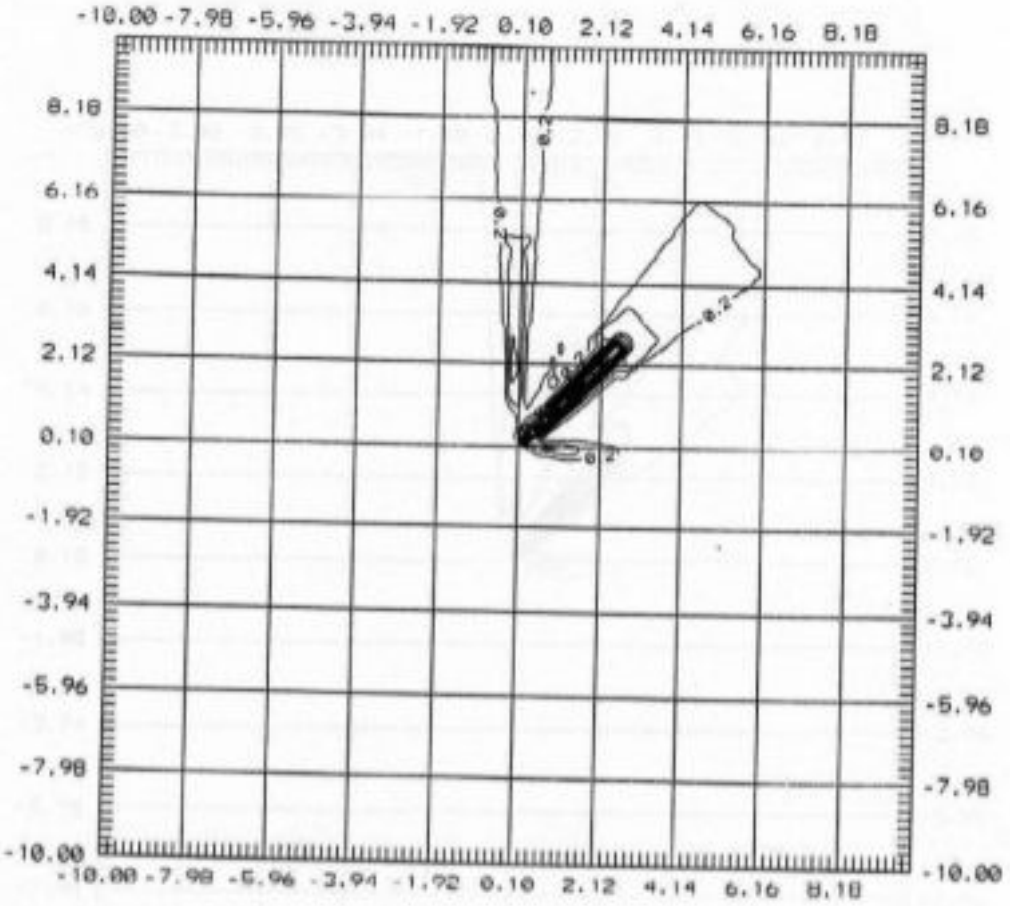
Pollutant	S. No	µg/m³		Coordinates (m)		Distance & direction
		Existing	After modernization	X axis	Y axis	
SPM	1	2.81	2.72	500	500	0.70 Km NE
	2	2.81	2.72	600	600	0.85 Km NE
	3	2.78	2.70	700	700	1.00 Km NE
	4	2.74	2.65	800	800	1.13 Km NE
	5	2.66	2.64	900	900	1.27 Km NE
SO_2	1	14.44	14.35	385	459	0.60 Km NE
	2	14.22	14.06	449	536	0.70 Km NE
	3	14.11	13.91	600	600	0.85 Km NE
	4	14.09	13.86	500	500	0.70 Km NE
	5	14.04	13.95	700	700	1.00 Km NE
NOx	1	25.07	26.47	500	500	0.70 Km NE
	2	25.01	26.47	600	600	0.85 Km NE
	3	24.80	26.38	700	700	1.00 Km NE
	4	24.31	25.95	800	800	1.13 Km NE
	5	24.13	25.70	900	900	1.27 Km NE

The future predicted concentrations are estimated by super imposing the predicted values over the base line values. However this is being an existing industry going for modernization the baseline values also includes the contribution made from the existing industry, where as during modernization only there is slight increase in the NOx value where as SPM and SO_2 are below the existing loads. The base line values and contribution to pollution loads from existing and after modernization is given in **Table 4.8** and Isopleths of the SPM, SO_2, NO_x are shown as **Figure 4.1 to 4.3** respectively

Table 4.8

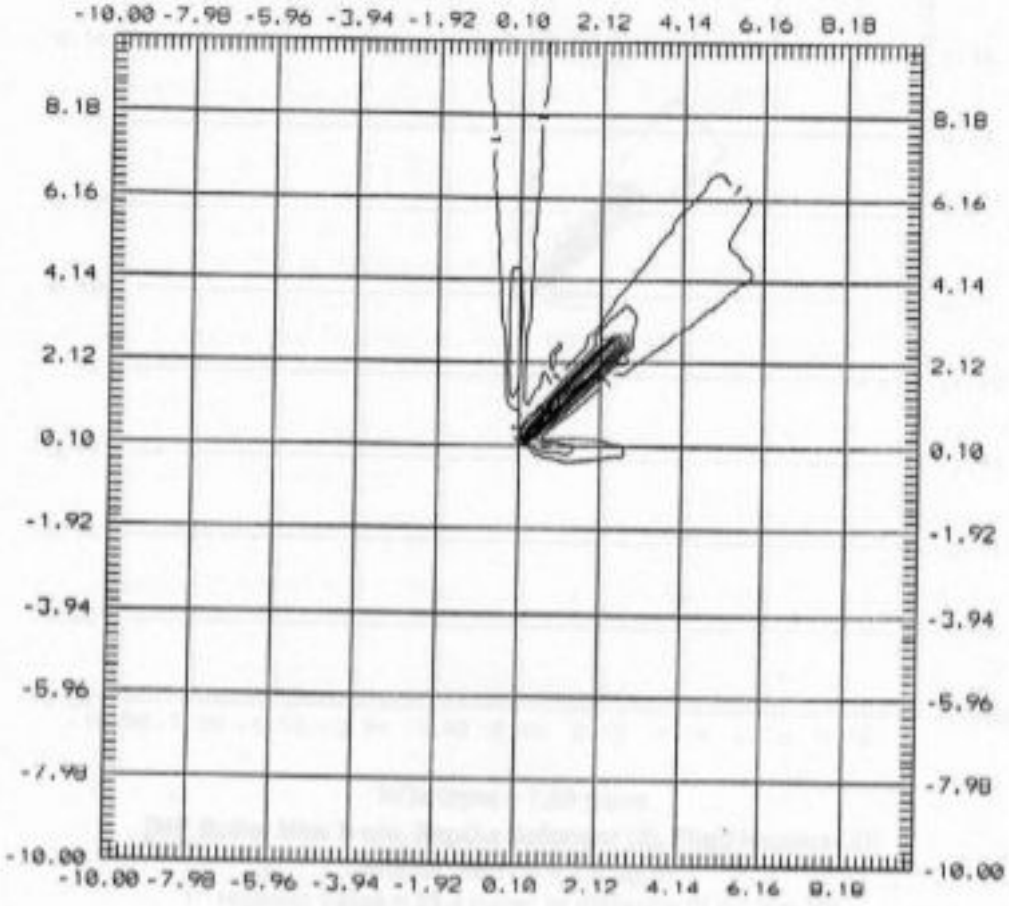
Predicted maximum contribution to GLC's from plant - Summer – May 2006

Pollutant (24 hrly average)	Maximum Baseline value (µg/m³)	Predicted Maximum contribution to GLC's - (µg/m³)		
		Existing	After modernization	Directions & distance
Particulate Matter (SPM)	170	2.81	2.72	0.70 Km NE
Sulphur dioxide (SO_2)	36.5	14.44	14.35	0.60 Km NE
Oxides of Nitrogen (NO_X)	47.0	25.07	26.47	0.70 Km NE



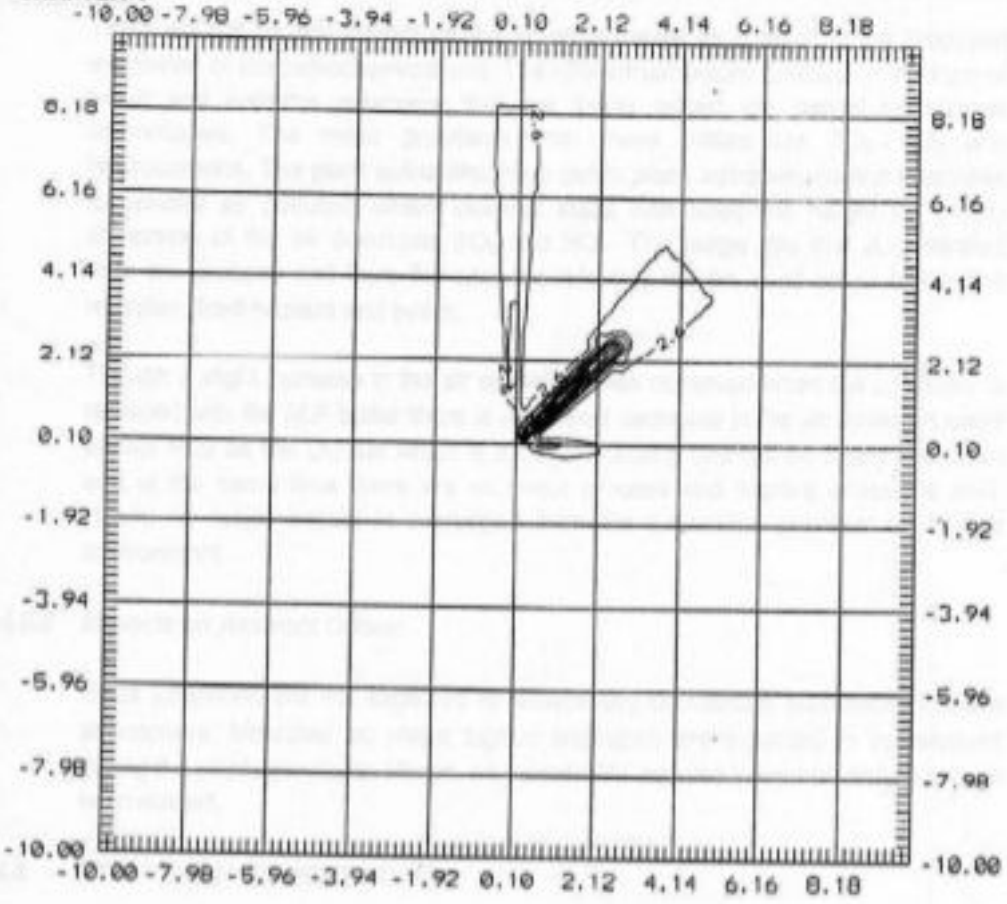
SPM input = 0.78 g/sec
[MP Boiler New & old, Naptha Reformer (2), Fired Heaters (2)]
Contour Interval = 0.2 µg/m³
1st Highest Value = 2.72 µg/m³ at distance of 0.7 Km NE

Figure 4.1
Predicted Isopleths of SPM during Summer (May 2006)



SO_2 Input = 3.98 g/sec
[MP Boiler New & old, Naptha Reformer (2), Fired Heaters (2)]
Contour Interval = 1.5 µg/m³
1st Highest Value = 14.35 µg/m³ at distance of 0.6 Km NE

Figure 4.2
Predicted Isopleths of SO_2 during Summer (May 2006)



NOx input = 7.60 g/sec
[MP Boiler New & old, Naptha Reformer (2), Fired Heaters (2)]
Contour interval = 2.6 µg/m³
1st Highest Value = 26.4 µg/m³ at distance of 0.7 Km NE

Figure 4.3
Predicted Isopleths of NOx during Summer (May 2006)

There will not be any impact on the air environment as a result of the proposed expansion of the petrochemical unit. The new infrastructure (utilities) in the form of boiler and naphtha reformers that are being added are based on cleaner technologies. The major pollutants from these utilites are SO_2, NO_X and Hydrocarbons. The plant authorities have put in place adequate control measures to prevent air pollution which includes stack with adequate height for proper dispersion of the air pollutants SO_2 and NO_X. The purge gas that is generated from the process and from the naphtha reformer will be used up as fuel in the reformer, fired heaters and boiler.

Though a slight increase in the air emissions was observed when the L.P boiler is replaced with the M.P boiler there is an overall decrease in the air emission loads except NOx as the DG set which is a major polluting unit will be totally shutdown and at the same time there are no major process and fugitive emissions also. Hence no major impact is envisaged from the expansion proposal on the air environment.

4.5.5 *Impacts on Ambient Odour*

Stack emissions are not expected to release any odoriferous substances into the atmosphere. Moreover no major fugitive emissions are expected to be released during the plant operations. Hence, no perceivable adverse impact on ambient odour is envisaged.

4.6 IMPACTS ON AMBIENT NOISE

No major noise generating units are proposed during production enhancement. Some motors and pumps will be added to the existing setup to convey the raw materials and the final product. In addition to these in the current expansion proposal the usage of DG is proposed to stopped totally which in turn reduces the noise generated by these units to a greater extent. The maximum noise level in the proposed plant is expected to be between 60 to 65 dB (A), which is well within the acceptable limits. Therefore it can be safely concluded that there will not be detrimental effect on the existing noise scenario.

Day and Night sound levels; L_{dn} is often used to describe the community noise exposure, which includes 10 dB (A) night time penalty. Most of the human settlements are at a distance of >1 km from the proposed site. Therefore the impact on general population would be insignificant. As per the WHO recommendation, there is no identified risk and damage to hearing due to the noise levels (L_{eq} =8 hours) less than 75 dBA. Most of the international damage risk criteria for hearing loss permit (L_{eq} = 12 hrs) up to 87 dBA. Further, WHO recommendation on community noise annoyance, permits day time out door noise level of 55 dBA L_{eq} and night time out door noise level of 45 dBA L_{eq} to meet the sleep criteria i.e. L_{eq} (24 hours) = 52.2 dBA and L_{dn} = 55 dBA

4.6.1 *Prediction of Impacts on Occupational Health*

The damage risk criteria as enforced by OSHA to reduce hearing loss, stipulates that noise level upto 90 dB(A) are acceptable for 8 hours working shift per day. Since the noise levels in the proposed proposal will be around 65 dB (A) in the working areas no negative impacts on the occupational health in the ambience is predicted.

4.7 PREDICTION OF IMPACTS ON WATER ENVIRONMENT

4.7.1 *Water Resources and Requirement*

The entire water demand is met from the Mindi reservoir and from the borewells which are located at Mindi R&D site. The following table shows the water requirement for various operations of the plant. The details of the water required are given in table below.

Table 4.9
Water requirement before and after modernization

S. No	Component	Water consumption- m^3/d	
		Existing	After Expansion
I	**Fresh water requirement**		
1	DM Plant	230	450
2	Potable water for domestic use	100	100
3	Potable water for cooling water system and HP flare water seal	70	110
4	Gardening	50	50
5	Fire water consumption	20	20
	Total fresh water consumption	**470**	**730**
II	**Sea water requirement**		
	Sea water required for the cooling tower	**3150**	**4700**
	Total water requirement (Fresh and Sea)	**3620**	**5430**

Table 4.10
Details of Sea cooling water

S. No	Component	
1	Capacity	5250 m^3/hr
2	Hot water temperature	40°C
3	Cooling water temperature	31°C
4	No. of Cells	3
5	Type	Induced draft/double inlet type sea water cooling tower
6	Blow down loss based on 1.5 COC	4500 m^3/day

The major uses of water are for industrial boilers and for cooling purposes, which accounts for the total water consumption, whereas the remaining percentage is used for potable purpose and for gardening. As adequate quantities of the water is available no impact is envisaged on water withdrawal for the plant operations either on surface or ground water.

4.7.2 *Wastewater generation quantities*

The wastewater that is generated is segregated into two categories

- Process & utilities effluent
- Domestic effluent

The proposed production enhancement is based on a minimum discharge concept and hence no additional effluent generation is envisaged. The plant and surrounding area is swamp and saline. The ground water table is very high and totally saline, not fit for any use. Therefore it can be concluded that by going for expansion, contamination of any sort to water sources i.e ground water and surface water is ruled out. Effluents shall be discharged as at present to the sea through the existing sea water effluent canal in view of the saline soil all around, upto the sea no negative impact on the land environment is expected on account of Effluent disposal.

The cooling water blow-down accounts for major amount of the total wastewater generated. The comparative account of the wastewater generated from both the existing and proposed plants in relation with the consented capacity as well as the pollution loads from the proposed expansion are presented in tables below.

Table 4.11
Wastewater generation M^3/d

S. No	Item	CFE condition Existing	Proposed
1	Trade effluents	45	45
2	Boiler blow down and DM plant regeneration	101	160
3	Domestic	90	90
	Sub Total	**236**	**295**
4	Cooling water system blow down	3288	4500
	Total	**3524**	**4795**

4.7.3 *Impacts On Water Environment*

The water requirement for the proposed expansion will be met partly from the ground water from the bore wells and partly from Mindi Reservoir. Adequate quantities of water are available so no impact on the ground or surface water resources is envisaged from the project.

The proposed expansion will not generate any extra effluent. The process effluent that is generated is only from the 2-Ethyl hexanol unit which is in line with the consented capacity of 45 m^3/d, while no effluent is generated from the alcohol unit (N & I butanol). The effluent generated from the process i.e., 2-ethyl hexanol manufacturing unit is given anaerobic and aerobic treatment and clarification after which it is mixed with all other waste water streams such as Boiler blow down, DM plant regeneration, cooling tower blow down etc. for final treatment by oxidation and neutralisation before finally discharging to the sea via canal.

No impact on the water environment (ground & surface) is envisaged due to the proposed expansion as all the wastewater will be treated in the ETP to the effluent discharge standards before it is let off into the sea.

4.8 PREDICTION OF IMPACTS ON LAND ENVIRONMENT

Environmental Impacts on land environment have been classified primarily into 2 broad aspects, i.e. direct impacts on the soil and land in the area and impacts on the flora and fauna of the area. Land environment in the area has potential for contamination if there are wastewater discharges directly on to the land and from impacts arising out of solid waste discharge on to the land. The land in and around the plant is highly saline and hence no environmental impact is expected.

4.8.1 *Land use and Terrestrial Life*

The proposed expansion is being carried out in the existing land area only and no additional land is proposed to be acquired for the expansion proposal. Since the area

is plain and levelled there are no major levelling/cutting activities involved during the construction phase of the proposed expansion. Further, the area comes under industrially notified area this proposal do not involve conversion of the current land use of the area. Moreover the area does not have any endangered, threatened or rare plant species within 10 km radius of the plant, so no impact is envisaged on the terrestrial life.

4.8.2 *Solid Waste Generation*

The proposed production enhancement is being carried out by implementing the latest available technology in this field, which ensures low Solid Waste Generation, so the problems associated with the disposal of solid waste from the proposed expansion do not come into the picture. The solid waste that is generated is hazardous in nature. All the hazardous waste that is generated will be sent to TSDF. The oxo residue that is formed during manufacturing process is used up for the internal consumption as a fuel for the new M.P. boiler that is being proposed along with purge gas. **Table 4.12** shows the solid waste generation from the existing and proposed expansion at APL.

Table 4.12

Comparative solid waste generation from the APL before and after modernisation

S. No	Nature	Quantity T/Annum		Mode of disposal
		Existing	After modernization	
1	ETP sludge	2 – 3	3 – 4	TSDF disposal
2	Oxo Residue	1800 – 2500	2500 – 4000	Used as fuel (Internal consumption)
3	Spent catalyst	20 – 30	30 – 50	Disposed to authorized parties
4	Used oils	10 KL	10 KL	
5	Containers of chemicals/ catalysts	300	500	
6	Non ferrous waste / Lead acid batteries	20 Nos.	100 Nos.	
7	Spent rhodium catalyst	1500 to 2000 Kg (12-18 months)	1500 to 2000 Kg (Once in 10 years)	The catalyst will be recovered at WFE facility or at reprocessor's facility

4.8.3 *Impact on Land Environment*

(a) Impact on land use

The small amount of the land of about 0.36 hectare out of the existing 30 hectares will be used for proposed expansion. This land is presently plain and industrial in

nature hence the impact envisaged on the land use due to the increase in the built up area is restricted to the APL boundary only.

(b) Impact on soil fertility

The petrochemical unit operations results in air emissions, wastewater generation and solid waste generation. Pollution when uncontrolled may have an impact on the soil fertility. However, APL has taken adequate care to control all forms of pollution from the plant with an effective environmental management plan

The air missions are controlled by providing adequate stack height to the boilers and naphtha reformers. The wastewater from the process and utilities will be adequately treated in the ETP to marine disposal standards and then let off into the sea. The domestic effluent will be sent to the septic tank followed by soak pit. The hazardous process solid waste will be stored at site temporarily before disposing off to the TSDF for secured land filling or sent to authorised parties for proper disposal. The spent catalysts will be reprocessed abroad and reused back.

In view of the above measures taken by the industry no major impact is envisaged on the fertility of the saline soil in the area.

(c) Impact on wildlife and agriculture

The impact on the forest and wildlife of the area during implementation of the new proposal is negligible. There are no impacts envisaged from the proposed project on the agriculture as no agricultural land is being converted to industrial use for the project.

4.8.4 Prediction Of Impacts On Socio-Economic Environment

The prediction of likely impacts on socio economic environment can be made by reviewing the baseline status of socioeconomic profile of the study area and project related activities. The impacts would be either beneficial (positive) or adverse (negative) and, in turn, short term or long term.

(a) Impacts on demand and supply, natural resources and employment

There will not be any major impact on the socio economic conditions of the project area as the proposed activity is merely a production enhancement of the existing Petrochemical plant inside the existing boundary. There will be certain employment potential for the local people, as the industry is planning to reengineer and optimize the utilization of existing manpower. There will be employment generation for the construction workers temporarily during the construction period.

Positive impact is envisaged by the proposed activity, as it tends to reduce the demand-supply gap, thereby impacting the economic improvement, transportation and business generation.

(ii) Indirect Impacts

(a) Impacts on public health and safety

Due to proposed expansion of the plant there will be some positive and negative impacts in the surrounding areas. The important one will be on public health and safety, to reduce the negative impacts all necessary precautions suggested by the PCB and MOEF will be taken. All safety measures suggested by government authorities will be taken and regular health check camps will be conducted in the plant. The frequency of health check up will be more for persons working near production blocks.

(b) Impacts on cultural resources

There will be marginal increase in the local population as the expansion proposal is mainly for reengineering of the existing manpower present. Some local construction labour will be employed temporarily during the construction phase. No impact is envisaged on the cultural resources of the area.

(C) Impacts on ecology and biodiversity

There are no ecologically sensitive or protected areas near to the plant site. Therefore, no impact is envisaged on the biodiversity of the region.

(d) Impacts on aesthetics

The proposed expansion will be carried out in the existing plant premises only which is located in an industrial area. Hence, no impact is envisaged from the project on the aesthetics of the place.

Chapter 5
Environmental
Managemnt Plan

ENVIRONMENTAL MANAGEMENT PLAN

5.1 OBJECTIVE

The basic objective of the Environmental Management Plan (EMP) is to extenuate the potential environmental adverse impacts arising out of the proposed proposal and to mitigate the consequences from the same, if any. EMP reflects the commitment of the Management to protect the environment as well as the neighbouring habitat. The potential environmental impacts envisaged from the project are studied on the following environmental components:

- Air pollution due to the emissions from Process and utilities
- Water pollution due to wastewater generated
- Soil pollution due to solid waste generated

5.2 PROJECT DETAILS

The present proposal of APL is to enhance the production of Oxo alcohols within the available infrastructure in existing factory premises. This endeavour of APL enables it to cater to the needs of the domestic market in a more dedicated manner. The main objective of the proposal is to:

- To reduce the heavy demand supply gap for the Oxo Alcohols, reduce imports and save foreign exchange to the nation
- To optimize production by reengineering the manpower available and by using best of the technical knowledge available

Taking advantage of the above mentioned facts, Andhra Petrochemicals Ltd., is proposing to expand its existing Oxo alcohol plant.

Preparation of Environmental Management Plan is required for formulation and monitoring of environmental protection measures during and after commissioning of the proposed expansion of the plant. The plan should indicate the details as to how various measures have been or are proposed to be taken for mitigation of adverse impacts if any from the proposed expansion project. The following

sections describe the Environmental Management Plan for the proposed expansion of the Petrochemical Industry for construction and post construction phases.

5.3 CONSTRUCTION PHASE MANAGEMENT PLAN

In the proposed expansion of the Petrochemical plant, the possibility of environmental pollution during the construction phase of the project is negligible. However, the following measures will be adopted to control any adverse situation during construction phase.

5.3.1 Site Preparation

The clearance of site will not involve any movement of soil and so no levelling operations are envisaged. There will not be any impact as the proposal will be executed on an already developed and level land. However, precautions will be taken to ensure the construction activities do not interfere with the regular activities of the adjoining communities.

5.3.2 Sanitation

The production enhancement site will be provided with sufficient and suitable toilet facilities for workers to allow proper standards of hygiene. These would be connected to the septic tank and maintained to ensure minimum environmental impact. Additionally the workers will be allowed to use the toilet facilities in the existing plant. Adequate care will be initiated so as to provide rainwater drainage facilities.

5.3.3 Noise

The noise effect on the inhabitants due to the construction activity will be minimal. The construction workers will be provided with noise protection devices like earmuffs, if required.

5.3.4 Construction equipment and Waste

The proposal being only production enhancement in the existing industry no major gasoline and diesel powered construction machinery except cranes will be required However, it will be seen that whatever machinery is used is properly maintained to meet the stringent standards of the currently operating hazardous plant areas. Unauthorized dumping of spent oil will be prohibited. The waste oil will be collected in drums and disposed off regularly to authorised dealers. The cotton waste, oil will be collected and burnt periodically.

5.3.5 Safety

The company will insist workers on using the safety gadgets like, helmets, goggles, safety belts, safety shoes, etc., during the construction phase and also mark the jeopardized areas to prohibit illegal entry into the other parts of existing plant. Proper security arrangements already exist to avoid any accidents due to unauthorized entry of workers from existing plant. Proper fire fighting facilities in the form of fire extinguishers etc. are existing and additional facilities shall be provided by the management in all sensitive areas so as to take care of all unprecedented fire accidents.

5.3.6 Hazardous Material Storage

The following hazardous materials are anticipated to be stored at the site during construction:

- Gas for Welding
- Painting Material

The above mentioned materials will be stored as per the norms of industrial safety already in practice in the plant. The excess painting material will be sold off to the authorised parties therefore no impact is envisaged.

5.3.7 Transport Vehicles

Proper maintenance of petrol and diesel vehicles carrying the construction material on regular basis will minimize the exhaust emissions to a greater extent.

5.4 POST CONSTRUCTION PHASE

5.4.1 Air Pollution Control

The major sources of air pollution from the project includes

- Emission from Utilities- New M.P. Boiler.
- Emissions from Process- syn gas unit and alcohol unit

a) Control measures for utilities

From the new proposal there is no additional increase in air pollution load (except NOx in little quantity) which goes in line with the commitment for better environment protection. The main emissions from the utilities in the new proposal are Hydrocarbons, Sulphur dioxide and oxides of nitrogen. The emissions from these sources will be controlled by having adequate stack height for proper dispersion of these pollutants. The hydrocarbons are flared.

b) Control measures for process emissions

There are vents to vent out process emissions like steam, nitrogen, air etc, which are totally harmless. Other vents will have emissions containing organics like butanol, Ethyl hexanol, butyaldehyde etc. These emissions have significant calorific value and hence they are controlled using flares. The flue gas composition from the flare is given below.

Table 5.1
Flue gas composition of flares

S. No	Equipment	Emission load	Composition
1	HP Flare	0 – 60 Kg/hr	Flow rate : 66Nm³ CO : 10% Water : 9.9% O_2 : 4% Nitrogen: 78.5
2	LP Flare	150 Kg/hr	Flow rate : 0 – 66Nm³ Water – 16.3% O_2 – 2.5% Nitrogen – 70.9% CO_2 = 10%

Other air pollution control devices in the plant include

i) Safety valves – vents from pressure control systems are connected to HP flare through Flare piping network for flaring the gases in case of plant trip or abnormal condition of the plant.

ii) Vents from low pressure storage tanks and low pressure systems are connected to LP flare through LP flare piping network for flaring the gases.

iii) All the critical storage tanks are provided with Nitrogen blanketing system, which works on automatics pressure control system.

APL has always aimed at sustainable development and in this context only it has implemented several measures to curtail pollution to maximum extent. This was achieved by deploying latest Eco- friendly technologies, viz. switching over to LP Oxo process in Oxo alcohol synthesis, recycling of effluents, installation of flares, and installation of other accessories. The industry adopted advanced optimization of process for the manufacture of the oxo alcohols, which shall employ the latest technology in vogue to ensure minimum effluent thus proving the inclination of the management towards Sustainable Development and Modernization.

5.4.2 Water Pollution Control

The proposed production enhancement is based on a minimum discharge concept. The sources of wastewater generation from the plant includes the process wastewater from the 2- ethyl hexanol manufacturing unit remaining same as at present, effluent from utilities like boiler blow down, cooling tower blow down

and DM plant effluent and domestic wastewater. The water balance in the plant is given below.

Table 5.2
Water Balance of the plant-m^3/d

S. No	Component	Water requirement	Component	Wastewater generated
1	DM Plant	450	Boiler blow down and DM plant regeneration	160
2	Potable water for domestic use	100	Domestic	90
3	Potable water for cooling water system and HP flare water seal	110	Trade effluents	45
4	Potable water for civil works and gardening	50		
5	Fire water consumption	20		
	Sub Total	**730**	**Sub Total**	**295**
	Sea water required for cooling	4700	Cooling water system blow down	4500
	Total	**5430**	**Total**	**4795**

The total wastewater generated from various processes, utilities and domestic are segregated and treated respectively before discharge.

- Process and utilities effluents
- Domestic wastewater

The details of the effluent treatment are presented below.

a) Wastewater treatment

The process effluent is filtered through a bar screen assembly where large solids and trash are removed and filtered effluent is received in equalization tank. The effluent is neutralized with CO_2 Gas and neutralized effluent flows to a primary sedimentation tank, where the sludge is settled by gravity. The Settled primary sludge in primary sedimentation tank is taken out into sludge drying beds. The overflow from primary sedimentation tank flows to anaerobic filter where a combination of down-flow followed by up-flow takes place. Microblift biological culture and nutrients are added to the anaerobic system. The effluent from anaerobic filter is taken through a collection launder to intermediate sedimentation tank. In the intermediate sedimentation tank, the sludge is further settled by gravity, which is pumped into sludge drying beds.

The overflow from intermediate tank flows to aeration tank, which is a continuous flow stirred tank reactor to achieve complete mixing and uniform oxygen transfer facilitated by 2 Nos. surface aerators. The mixed liquor from aeration tank is received in a final clarifier by gravity. In the final clarifier, effluent is separated from biological solids. The streams like DM plant effluent, cooling tower and boiler blow down and condensates from knockout drums, tempered water and converter blow down are mixed with effluent from Biological treatment in final treatment tank. Oxidation by air/hydrogen peroxide and neutralization is carried out in the final treatment tank. There is a provision for recycling offspec final effluent.

The settled sludge in the final clarifier is mechanically trapped off and pumped into sludge drying beds. The required amount of biological sludge is re-circulated back into the inlet of the aeration tank. The sludge from primary sedimentation tank and also from secondary sedimentation tank is received in sludge drying beds. The filtrate from the sludge drying beds is received in a sludge filtrate collection sump, from where it is fed into the equalization tank. The dried sludge cake is stored in a covered bed and disposed of to TSDF. The flow sheet showing the effluent treatment is given as **Figure 5.1**. The effluent characteristics before treatment and after treatment are given in **Table 5.3**.

The combined treated process wastewater and DM, CT, Boiler blow down water are discharged into sea along with cooling water (Sea water) through effluent canal passing adjacent to the factory premises canal. The domestic wastewater will be sent to septic tank followed by soak pit.

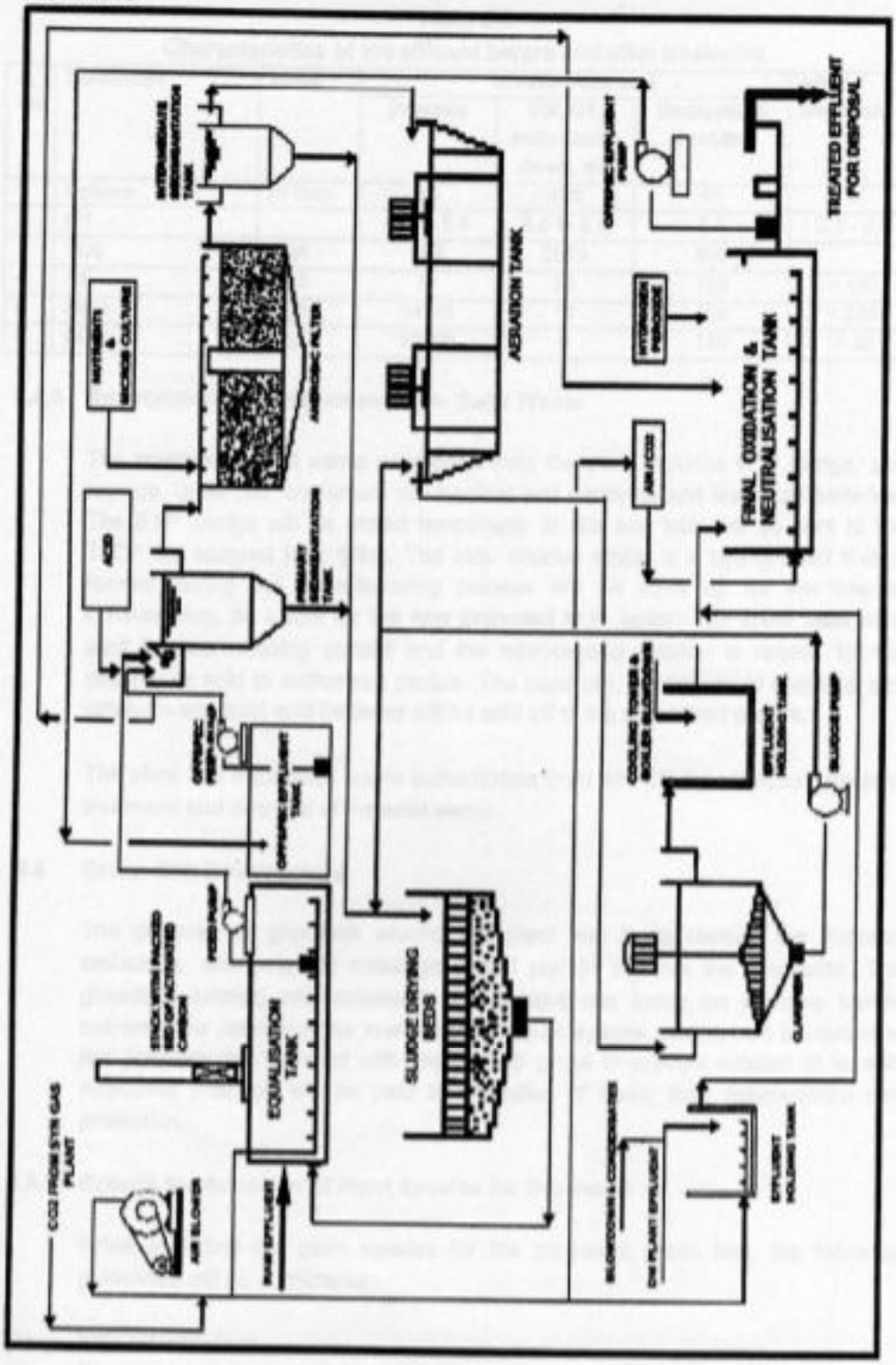


Figure 5.1
ETP process flow sheet

Table 5.3

Characteristics of the effluent before and after treatment

S. No	Parameter	Units	Before treatment			After treatment
			Process	DM, CT, boiler blow down, etc	Domestic & Canteen	
1	Volume	m^3/day	45	160	90	-
2	pH		4.0 to 5.5	6.5 to 8.0	8.5	6.5 - 8.5
3	TDS	mg/l	100	2000	800	
4	SS	mg/l	10	50	100	< 100
5	COD	mg/l	18000	10	250	< 250
6	BOD	mg/l	12000	5	150	< 30

5.4.3 Environmental Management Plan- Solid Waste

The sources of solid waste generation from the plant includes ETP sludge, oxo residue, used oils, containers of chemical and catalysts and lead acid batteries. The ETP sludge will be stored temporarily at site and later will be sent to the TSDF for secured land filling. The oxo- residue which is a bye product that is formed during the manufacturing process will be used up for the internal consumption, as a fuel for the new proposed M.P. boiler. The spent catalyst is sent for reprocessing abroad and the reprocessed catalyst is reused for the process or sold to authorized parties. The used oils, containers of chemical and catalysts and lead acid batteries will be sold off to the authorized parties.

The plant has hazardous waste authorization from APPCB for collection, storage, treatment and disposal of the solid waste.

5.5 Green Belt Development

The purpose of greenbelt around the plant site is to capture the Process emissions, attenuate the noise generated and to improve the aesthetics. The greenbelt existing and proposed at the plant site forms an effective barrier between the plant and the surroundings. Open spaces, where tree plantation is not possible, are covered with shrubs and grass to prevent erosion of topsoil. Adequate attention will be paid to plantation of trees, their maintenance and protection.

5.5.1 Criteria for Selection of Plant Species for Greenbelt

While selecting the plant species for the proposed green belt, the following guidelines will be considered:

(1) Fast growing type
(2) Should have a thick canopy cover
(3) Should be perennially green

(4) Native origin

(5) Should have a large leaf area index.

5.5.2 Design of Green Belt

As far as possible the following guidelines will be considered in green belt development.

- The spacing between the trees will be maintained slightly less than the normal spaces, so that the trees may grow vertically and slightly increase the effective height of the green belt.
- Planting of trees in each row will be in staggered orientation.
- In the front row shrubs consisting of Callistemon, Prosopis etc. will be grown
- Since the trunks of the tall trees are generally devoid of foliage, it will be useful to have shrubs in front of the trees so as to give coverage to this portion.
- Shrubs and trees will be planted in encircling rows around the project site
- The short trees (< 10 m height) will be planted in the first two rows (towards plant side) of the green belt. The tall trees (> 10 m height) will be planted in the outer three rows (away from plant side).
- Tall trees one line and short trees one line will be planted around the boiler house, DG set room and around the production blocks to control the emissions and to reduce the noise.

A list of trees generally suitable for this region is listed in the **Table 5.4.**

Table 5.4
Suggested species for green belt development

Table 5.4
Suggested species for green belt development

S.No	Botanical Name	S/T	E/D
1	*Abutilon indicum*	T	Decidious
2	*Acacia catechu*	T	Evergreen
3	*Acacia ferruginea*	T	Evergreen
4	*Acacia leucophloea*	T	Decidious
5	*Acacia mearnsii*	T	Evergreen
6	*Acacia nilotica*	T	Evergreen
7	*Acacia pennata*	T	Evergreen
8	*Acacia polyacantha*	T	Semi - Decidious
9	*Acacia senegal*	T	Decidious
10	*Acacia sinuata*	T	–
11	*Acacia tortilis*	T	Evergreen
12	*Achras sapota*	T	Evergreen
13	*Actinodaphne angustifolia*	T	Evergreen
14	*Adenanthera pavonina*	T	Decidious
15	*Adina cordifolia*	T	Decidious
16	*Aegle marmelos*	T	Evergreen
17	*Ailanthus excelsa*	T	Decidious
18	*Alangium chinese*	T	Decidious

19	*Albizia amara*	T	Decidious
20	*Albizia chinensis*	T	Decidious
21	*Albizia lebbeck*	T	Decidious
22	*Albizia moluccana*	T	Evergreen
23	*Albizia odoratissima*	T	Evergreen
24	*Albiziz procera*	T	Decidious
25	*Alstonia scholaris*	T	Evergreen
26	*Anona squamosa*	T	Evergreen
27	*Anona reticulata*	T	Evergreen
28	*Anogeissus latifolia*	T	Evergreen
29	*Anthocephalus chinesis*	T	Decidious
30	*Aphanamixis polystachya*	T	Evergreen
31	*Artocarpus heterophyllus*	T	Evergreen
32	*Artocarpus lacucha*	T	Decidious
33	*Azadirachta indica*	T	Evergreen
34	*Balantles roxburghii*	T	Evergreen
35	*Bambusa arundinacia*	T	Decidious
36	*Bambusa valgaris*	T	Decidious
37	*Barringtonia acutangula*	T	Evergreen
38	*Barringtonia racemosa*	T	Evergreen
39	*Bauhinia acuminata*	T	Decidious
40	*Bauhinia purpurae*	T	Decidious
41	*Bauhinia racemosa*	T	Decidious
42	*Bauhinia semia*	T	Decidious
43	*Bauhinia varigata*	T	Decidious
44	*Bischofia javanica*	T	Semi-Decidious
45	*Bougainvillea spectabilis*	T	Evergreen
46	*Bridelia squamosa*	T	Decidious
47	*Broussonetia papyrifera*	T	Decidious
48	*Buchanania lanzan*	T	Evergreen
49	*Butea monosperma*	T	Evergreen
50	*Callistemon citrinus*	T	Evergreen
51	*Calophyllum inphyllum*	T	Evergreen
52	*Calotrophis gigantea*	T	Evergreen
53	*Calotrophis procera*	T	Evergreen
54	*Carissa spinarum*	T	Evergreen
55	*Cassia fistula*	T	Evergreen
56	*Cassia javanica*	T	Evergreen
57	*Cassia pumila*	T	Evergreen
58	*Cassia renigera*	T	Decidious
59	*Cassia siamea*	T	Evergreen
60	*Casuarina equisetifolia*	T	Evergreen
61	*Ceiba pentandra*	T	Decidious
62	*Celtis australis*	T	Decidious
63	*Citrus aurantium*	T	Evergreen
64	*Citrus limon*	T	Evergreen
65	*Clerodendrum inerme*	T	Evergreen
66	*Clerodendrum infortunatum*	T	Evergreen
67	*Cocos nucifera*	T	Evergreen
68	*Cordia dichotoma*	T	Evergreen

69	*Dalbergia latifolia*	T	Semi-Decidious
70	*Dalbergia sisoo*	T	Evergreen
71	*Delonix regia*	S	Decidious
72	*Dendrocalamus*	T	Decidious
73	*Derris indica*	T	Evergreen
74	*Diospyros melanoxylon*	T	Decidious
75	*Dryptes roxbughii*	T	Evergreen
76	*Duranta repens*	T	Evergreen
77	*Emblica officinalis*	T	Decidious
78	*Embryopteris peregrina*	T	Decidious
79	*Erythrina variegata*	T	Decidious
80	*Eucalyptus citriodora*	T	Evergreen
81	*Eucalyptus hybrid*	T	Evergreen
82	*Ficus benghalensis*	T	Evergreen
83	*Ficus benjamin*	T	Evergreen
84	*Ficus elastica*	T	Evergreen
85	*Ficus gibbosa*	T	Evergreen
86	*Ficus glomerata*	T	Decidious
87	*Ficus hispida*	T	Evergreen
88	*Ficus religiosa*	T	Evergreen
89	*Ficus virens*	T	Evergreen
90	*Garcinia indica*	T	Evergreen
91	*Garcinia talbotii*	T	Evergreen
92	*Gardenia jasminoides*	T	Evergreen
93	*Gardenia resinifera*	T	Decidious
94	*Gliricidia sepium*	T	Decidious
95	*Grevillea robusta*	T	Evergreen
96	*Grewia subinequalis*	T	Evergreen
97	*Guazma ulmifolia*	T	Evergreen
98	*Hamelia patenis*	T	Evergreen
99	*Heteraphragma roxburghii*	T	Evergreen
100	*Hibiscus rosa-sinensis*	T	Evergreen
101	*Ixora arborea*	T	Evergreen
102	*Ixora coccinea*	T	Evergreen
103	*Ixora rosea*	T	Evergreen
104	*Ixora undulanta*	T	Evergreen
105	*Juniperous coccinea*	S	Evergreen
106	*Kigelia africana*	T	Evergreen
107	*Lagerstroemia perviflora*	T	Decidious
108	*Lagerstroemia speciosa*	T	Evergreen
109	*Lantana camara*	T	Evergreen
110	*Lawsonia inermis*	T	Evergreen
111	*Madhuca longifolia*	T	Decidious
112	*Mallotus philippenais*	T	Evergreen
113	*Mammea suriga*	T	Evergreen
114	*Mangifera indica*	S	Evergreen
115	*Melaleuca leucadendron*	T	Evergreen
116	*Millingtonia hortensis*	S	Evergreen
117	*Mimusops elengi*	T	Evergreen
118	*Mimusops hexandra*	T	Evergreen
119	*Moringa oleifera*	S	Decidious
120	*Morus alba*	S	Evergreen

121	*Murraya paniculata*	T	Evergreen
122	*Nerium indicum*	T	Evergreen
123	*Ouginia oojeinensis*	T	Decidious
124	*Peltophorum pterocarpum*	T	Evergreen
125	*Phoenix sylvestris*	T	Evergreen
126	*Phyllanthus acidus*	T	Decidious
127	*Pinus wallichiana*	S	Evergreen
128	*Pithecellobium dulce*	T	Evergreen
129	*Poinciana pulcherrima*	T	Evergreen
130	*Polyalthia longifolia*	S	Evergreen
131	*Populus nigra*	S	Decidious
132	*Prosopis cineraria*	T	Evergreen
133	*Prosopis tamaruga*	T	Evergreen
134	*Psidium guayava*	T	Evergreen
135	*Pterygota alata*	T	Semi-Decidious
136	*Ricinus communis*	T	Evergreen
137	*Salix tetrasperma*	T	Evergreen
138	*Samanea saman*	T	Evergreen
139	*Sapium sebiferum*	T	Decidious
140	*Saraca asoka*	T	Evergreen
141	*Sesbania grandiflra*	T	Evergreen
142	*Sesbania sesban*	T	Evergreen
143	*Sesbania speciosa*	T	Evergreen
144	*Soymida febrifuga*	T	Decidious
145	*Spathodea campanulata*	T	Evergreen
146	*Spondias pinnata*	T	Decidious
147	*Sterculia foetida*	T	Decidious
148	*Sterculia guttata*	T	Decidious
149	*Strychnos nux-vomica*	T	Decidious
150	*Syncarpia glomulifera*	T	Evergreen
151	*Syzygium cumini*	T	Evergreen
152	*Tabernaemontana divaricata*	T	Evergreen
153	*Tamarindus indica*	T	Evergreen
154	*Tecoma stans*	T	Evergreen
155	*Terminalia alata*	T	Decidious
156	*Terminalia arjuna*	T	Decidious
157	*Terminalia bellerica*	T	Decidious
158	*Terminalia catappa*	T	Decidious
159	*Terminalia chebula*	T	Decidious
160	*Thespesia populneoides*	T	Evergreen
161	*Thevetia peruviana*	T	Evergreen
162	*Thuja occidentalis*	T	Evergreen
163	*Trema orientalis*	T	Evergreen
164	*Zizyphus mauritiana*	T	Evergreen
165	*Zizyphus oenoplia*	T	Evergreen
166	*Zizyphus rugosa*	T	Evergreen
167	*Zizypus xylopyra*	T	Evergreen

NOTE: **S/T** S=SENSITIVE T=TOLERANT

E/D E=EVERGREEN D=DECIDIOUS

5.6 ENVIRONMENTAL MANAGEMENT CELL

An efficient environmental management cell exists at APL. The Environmental Cell is headed by the Chief Executive & Chief Operating Officer. They are supported by engineers and chemists and horticulturist along with other technicians.

The department is the nodal agency to co-ordinate and provides necessary services on environmental issues during operation of the project. This environmental group is responsible for implementation of environmental management plan, interaction with the environmental regulatory agencies, reviewing draft policy and planning. This department interacts with Andhra Pradesh State Pollution Control Board (APPCB) and other environment regulatory agencies. The department also interacts with local people to understand their problems and to formulate appropriate community development plan. The organizational structure of environmental management cell is given as **Figure 5.1**.

5.7 POST PROJECT MONITORING

A well-defined environmental monitoring program exists and the same would be followed for the expansion project. It would be ensured that trained and qualified staff supervises the monitoring of ambient air, stack gases, effluents, noise, etc. to see that prescribed standards laid down in the consent are maintained. The post project monitoring works is summarized in **Table 5.5**.

Table 5.5
Post Project Monitoring

Environmental Component	Locations	Frequency	Parameters
Ambient Air quality	Three AAQ stations located at 120° angle between each selected based on the meteorological conditions in the area	Twice a week	For SPM, RSPM, SO_2 and NO_x
Stack Emissions	Plant site	Once in month	For PM, SO_2 and NO_x and other industry specific pollutants
Wastewater quality	ETP (Inlet & Outlet)	Daily	pH, EC, TDS, SS, COD, BOD, Cl, SO_4, O & G.
Noise levels	In plant and neighboring areas	Once in month	dB(A)

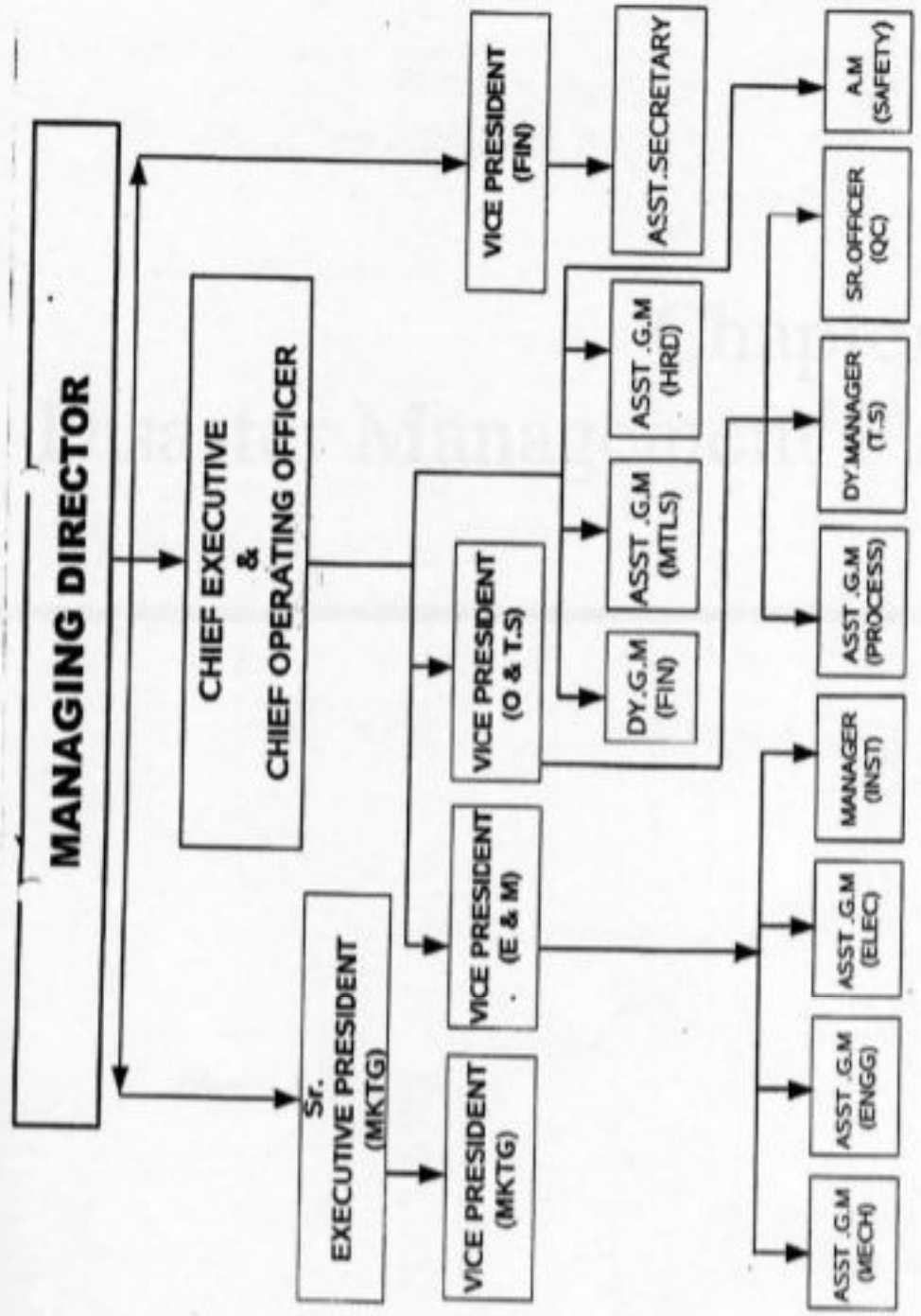


Figure 5.1
Organizational Set of Environmental Management Cell

Chapter 6
Disaster Management Plan

DISASTER MANAGEMENT PLAN

6.1. OBJECTIVES OF ON-SITE EMERGENCY PLAN:

The primary objective is to prevent any disaster that may take place by following all safety measures right from design, construction stage and followed by operation phase. However, there are certain factors like floods, cyclones or the man made disasters like rioting etc which cannot be ignored. In the event of such disasters the On-site Emergency Plan envisages to make use of all the available resources, including outside services to minimize casualties, damage to property and the environment.

The plan has been made as per the following guide lines:

1. Pre-disaster management.
2. Disaster management and control during the emergency.
3. Post disaster management.

6.1.1 Pre-disaster management

- To educate everybody about the communication procedure to be followed in case of disaster, Identification of Hazard potential, Plant environment monitoring.
- To have a clear and detailed evacuation plan in case the situation warrants.
- To assert duties and responsibilities to key personnel during emergency.
- To make all those concerned mentally prepared to face any such disaster at short notice.
- To educate the personnel on the use of available resources at the site and also out side services.
- To educate the local people regarding the plan so that there will not be panic during emergency and also cooperate with evacuation plan if needed.

6.1.2 Disaster management:

- Controlling the emergency localizing during the emergency and eliminate the hazard.
- Welfare of persons managing the disaster.
- Head count and rescue operations.
- Treatment of injured.
- Safe guarding others by timely evacuation.
- Minimizing damage to property and environment.
- Informing and assisting relatives.
- Informing and coordinating with statutory authorities.
- Informing media.

6.1.3 Post disaster management

- Preserving records and organising investigation.
- Ensuring safety of the workers before personnel re-entering and resume working.
- Investigation and taking steps to prevent re-occurrence.
- Restoring normalcy.

6.2 FIRE & SAFETY SERVICES

The fire and safety department is equipped with fire tender and portable fire extinguishers. Emergency equipments like breathing apparatus, Fire suits are also available. Fire department and Security department are thoroughly trained to fight fire or to mitigate any emergency that may arise. In addition to this the plant operating and maintenance staff is also trained in Fire fighting. Various personnel protective equipments are available for routine use as well as emergency requirement.

6.2.1 Fire Fighting Facility At The Plant

APL is provided with well established TAC approved fire protection system. The details of the fire fighting facilities available are as follows:

- Fire Staff
- Fixed fire protection
- Portable & mobile fire protection system
- Fire alarm system

6.2.2 Fire Staff:

Fire services is headed by Safety Officer, 4 Persons (Firemen/Drivers) are available round the clock shifts. In addition Laboratory staff who are trained in

fire fighting will assist the fire crew. The security personnel are also trained in Fire fighting. They will be drafted to take part in Fire fighting in emergency.

6.2.3 Fixed Fire protection:

a) All the process plants and the storage installations are covered by under ground hydrant mains. Fire hydrant points and fire escapes are provided at all critical areas. Water monitors are provided in the strategic points such as Propylene spheres, Raw material and Product storage area and Process plants.

Hose boxes are provided near each and every hydrant and fire escape point. Delivery hoses and branch pipes are positioned in the boxes.

b) **Fire water storage:**

There are two raw water reservoirs of 5,500 m^3 each out of which 7,800 m^3 is exclusively reserved for Fire fighting purpose. Sea water supply system is also connected to fire hydrant ring, which facilitates uninterrupted water supply for fire fighting during any emergency.

c) **Fire pump house:**

The following pumps are in Auto condition for meeting the requirement of fixed fire fighting system.

i) Jockey pump-1	-	10 m^3/hr capacity
ii) Jockey pump-2	-	10 m^3/hr capacity
iii) Electric pump-1	-	410 m^3/hr capacity
iv) Electric pump-2	-	410 m^3/hr capacity
v) Diesel pump	-	410 m^3/hr capacity

d) **Sprinkler system:**

All the storage tanks i.e., raw material, intermediate and final products are connected with Sprinkler system. Out of which Propylene spheres, Naphtha tank, Methanol tank, HSD tanks and Isomer column in the process plant are connected with Remote & Automatic sprinkler devices.

6.2.4 Portable and Mobile system:

The following type of portable fire extinguishers of different capacities is provided at various locations throughout the plant.

i) Water type Extinguishers
ii) DCP Extinguishers
iii) CO_2 Extinguishers
iv) Foam compound

The following mobile fire fighting facility is provided.

- Foam tender.
- Trolley mounted fire pump.

6.2.5 First Aid & Medical facilities at APL

APL is equipped with two bedded Occupational health center round the clock manned by a male nurse under the supervision of Medical Officer. Ambulance van is also provided in APL with dedicated first aid trained driver.

6.3 DETECTION SYSTEM

6.3.1 Fire Alarm System

The plant is provided with fire alarm system. This consists of control panel with audio visual indications at fire station and manual call points throughout the plant at strategic locations. Hooter provision was made in the control room and laboratory also. The emergency can be initiated by breaking the manual call point glass. The location is known to fire & safety department through the control panel. The hooter along with emergency siren is heard simultaneously at fire station, DCS and Laboratory.

6.3.2 Combustible Gas Detective System & Carbon Monoxide Gas Detection

APL has installed latest gas detection system all over the plant in the strategic areas. This helps to detect the gas leaks and acts as an early warning system.

Whenever, process gas leaks out from the process/storage system and likely to build up concentration to Lower Explosive Limit (LEL) in the atmosphere the detector system identifies any flammable gas or carbon monoxide and gives early alarm at 20% of the LEL or Threshold Limit Value (TLV). If the gas continues to leak and built up concentration second level alarm gives at 30% of the LEL. Immediately on receiving the first alarm on DCS (Digital Control System) the location of the detector is identified and further action will be taken. Whenever carbon monoxide detector activates, the alarm is received on the DCS panel. It has two levels of alarm like in the case of combustible gas detectors. A total of 73 detectors were installed out of which 15 are meant for analyzing carbon monoxide gas. This is a special feature in APL which helps to detect gas leaks at early stage and suitable/prompt action will be taken. The action to be

taken will be announced on paging system for quick communication between control room and various parts of the plant. This will help to identify any emergency at an early stage thus major disaster can be avoided.

6.3.3 Emergency Shutdown Procedures - 01 Area - Synthesis Gas section

This system has been incorporated into the plant controls to provide temporary automatic protection against a situation which would be dangerous to personnel on the plant, or would destroy the activity of the catalyst, or would damage equipment.

IMPORTANT:

It is of the utmost importance that there is immediate follow up by operating personnel to set the plant to a permanently safe condition to give the necessary safety after a trip action has occurred. Part of the follow up procedure will cover immediate safety i.e. isolation of inflammable liquids and gases, and isolation of process feed stock where leakage could cause a plant hazard through carbon deposition.

A second part of the procedure is the charging of certain automatic flow controllers to the "manual" control position and then setting the manual control to the "valve closed" position. This action is necessary to prevent flow surges when the trip actions are reset by pressing the reset switch.

6.4 RISK IDENTIFICATION AND CONTROL

The APL has considered all possible Disaster causing situations and actions envisaged to prevent the Disaster. The safety measures were taken into consideration right from the site selection, design, construction and during operation. However, there are certain factors like, natural calamities such as floods, cyclones, and earthquakes etc. which are beyond our control. The man-made disasters like rioting which cannot be ignored. In such situation the plan envisages to make use of all the available resources, including the help from outside agencies to minimize casualties and danger to the property and environment.

The process has been well established and several plants are successfully operating in various countries. The process design incorporates inbuilt safety features like trip system, alarms, fail safe shutdown, etc. These safeguard the machinery and men under plant upset conditions. The plant shutdown system is part of the DCS with uninterrupted power supply.

6.4.1 Risk Identification And Scenario

The possibility of a disaster at APL is extremely remote. The possible major emergencies are identified as below

		SCENERIO
1	Propylene	BLEEVE, Fireball, Flare, Explosion
2	Carbon Monoxide	Toxicity, Explosion
3	Inflammable liquids	Pool fire, Explosion

6.4.2 MCA Analysis

Onsite emergency planning for The APL was done on the basis of the MCA analysis results for APL which was given in the offsite emergency plan of Visakhapatnam district.

The offsite emergency plan was made by M/s. National Environmental Engineering Research Institute, Pune. This study includes emergency scenario consequence analysis, damage criteria etc. In the event of flammable/toxic material releasing to the atmosphere the following consequences is usually observed.

1. Spreading of flammable/toxic vapor with wind till it finds a source of ignition or disperses safely.
2. Pool fire of a heavy spillage causing different levels of incident thermal radiation.
3. Unconfined vapor cloud explosion which generate blast wave.
4. Fire ball or bleeve from the failure of pressurized storage of Propylene.

S.No.	Unit	Total Quantity (Tonnes)	MCA Scenario
1	Propylene	2 x 550	BLEEVE / VCE
2	Naphtha	423	Pool-Fire

Identified Hazardous Storage/Process Units

Unit	Total Qty In Tonnes	MCA Scenario
Storage Unit		
1. Propylene	2 x 550	BLEEVE / VCE
2. Naphtha	423	Pool-Fire
3. 2-Ethyl Hexanol	2 x 1589	Pool-Fire
4. Butyraldehyde	2163	Pool-Fire
5. Butanols	2 x 1589	
Process Unit		
1. Alcohol Plant	--	Fire
2. Synthesis Gas Plant	--	Leak & Fire
3. Butraldehyde	--	Leak & Fire

Consequence Analysis of MCA Scenarios

Service/Unit	Propylene	Propylene	Naphtha	Butyraldehyde
Capacity	1100 T	500 T	423 T	2163 T
Mode of release	Instanta-neous	Continuous Spill	Rupture/ Spill	Rupture/
Scenario	BLEEVE	VCE	Pool Fire	Pool Fire
Pool size (m)	--	--	width-10	width-34
Damage Distances (m)				
Heat Radiation				
a) Severe	335	270	--	
b) 100% Lethality	367	301	4	
c) 50% Lethality	446	356	8	
d) 1% Lethality	600	520	13	
e) First degree burns	1000	800	24	
No discomfort	1800	1400	40	
Pressure wave				
a) Heavy	352	279	--	
b) Repairable	1055	838	--	
Distance of Adjacent Unit (m)	NA	NA	NA	15
Distance of Factory Boundary(m)	175	175	NA	60

Off-site Scenarios - Fire Cases

Name of the Industry	Accident Spot	Total Quantity in Tons	Scenario	Damage distance (m)		Offsite Damage distance (m)		Damage distance To pressure wave	
				Fatal	First deg Burns	Fatal	First deg Burns	Heavy	Repairs
APL	Propylene Sphere	440x2	BLEVE VCE	367 301	1000 800	192 126	825 625	352 279	1050 839

Areas affected due to Off-site Emergencies

Residential areas : None

Industrial areas : BPCL
Naval Dockyard
HPCL (Refinery & ATP)
East India Petroleum

B. Summary of On-site/Off-site Plan

1. Identified Hazard

Process/Storage	Scenario	Maximum lethality distance (m)
Storage units:		
Propylene	BLEVE-fire ball	367
	Flare	100
	Explosion	352
2-Ethyl Hexanol	Fire	Within the plant
Naphtha	Fire	-do-
Methanol	Fire	-do-
Caustic soda	Fire	-do-
Butyraldehyde	Fire	-do-
Process units:		
Synthesis gas leak under pressure	Fire/toxic cloud of CO	0.5 kg/sec 360 0.75 kg/sec 1140
Desulphurisation section	Fire due to Naphtha leak	--
Propylene purification	Fire	--
2-Ethyl hexanol	Fire	--

6.5 CONTROL OF VAPOR LEAK

a) Approach the gas leak from the upwind direction.

b) Keep all persons out of vapor cloud area. If it is necessary to evacuate any area which is in the path of cloud, do so immediately, eliminating all source of ignition at the same time.

c) If escaping vapour is not in fire, close all valves that can stop the flow of gas.

d) Fire water spray is effective in dispensing vapour. It should be applied as soon as possible directing the spray stream across the normal vapour path & away from machinery and equipment to a safe place.

e) If the flow of gas cannot be stopped, the vapour may be dispersed some other means like application of steam to disperse vapour.

f) In some instances of leakage from a tank without a fire it may be desirable to move the tank or it may be desirable to move the tank product to some remote areas.

6.6 CONTROL OF FIRE

a) Approach the fire or gas leak from the upwind direction.

b) Keep all persons out of vapour cloud area. If it is necessary to evacuate any area which is in the path of cloud, do so immediately, eliminating all source of ignition at the same time.

c) If escaping vapour is not in fire, close all valves that can stop the flow of gas.

d) Fire water spray is effective in dispensing vapour. It should be applied as soon as possible directing the spray stream across the normal vapour path & away from machinery and equipment to a safe place.

e) If the flow of gas cannot be stopped, the vapor may be dispersed by some other means like application of steam to disperse vapour.

f) In some instances of leakage from a tank without a fire it may be desirable to move the tank or it may be desirable to move the tank product to some remote areas.

g) Do not extinguish unless leakage can be stopped.

h) Controlled fire condition involve application of water to keep the shell of the vessel and any exposed piping to keep cool enough to allow the fire to burn up the product without danger of causing failure of the vessel or piping.

i) Immediate and effective cooling of the exposed container can only prevent the occurrence of BLEEVE hazards. Some warning of increase in pressure may be indicated by increase in volume of fire or noise level. This should be a signal to consider withdrawer of all men to a safe place.

6.6.1 Fire on Storage Tanks (Cone Roof)

When you find storage tank catching the fire, follow the following action plan.

1. Access the situation.
2. Approach the tank and start the water sprinklers.
3. Isolate the lines leading to the tank on fire.
4. Access the foam requirement and check the stock availability prior to foam application. Access additional manpower requirement. Access assistance if required from other engineers.
5. Arrange and position the foam monitors (min.4 nos) for foam application on the tank top.
6. Arrange for dewatering pumps for removing water from tank dyke area.
7. Arrange for foam application for minimum of 2 hours.

6.6.2 Cone Roof Tank Vent Fires

1. Fire at a tank vent burning with yellow orange flame emitting black smoke indicates a vapour rich condition within the tank. The vapour mixture is above its flammable range or explosive limits.
2. Fire at a tank with a snapping blue red nearly smokeless flame indicates that vapour mixture is within the flammable limits. Then there is a chance of explosion if the flame reaches inside the tank. In this case no one should approach the vent for putting off the fire. Then the vapour of the tank can be converted into a vapour rich condition by pumping liquid into the tank thereby maintaining a positive pressure in the tank or by introduction of fuel gas or other light flammable products. When vapour rich condition is indicated by change in the flame character to a smoky yellow orange flame, extinguishment can then be attempted.

6.6.3 Precautions to be taken while fighting tank fires

a) Fire fighting personnel should go by wearing proper safety equipment and with back up of fire fighting recruiting team to be provided.

b) Keep constant vigil on that particular tank and as well as on the neighboring tanks and ensure proper cooling for the required tanks.

c) Follow the instructions of man-in-charge of fire fighting during the entire period of fire fighting exercises.

6.6.4 Oil Spillage from the tank

Cracks developed on the shell or over filling of the tank or breakage of the connecting lines may lead to sudden spillage of oils from the three storage tanks namely LSHS tank, HSD tank & LDO tank.

6.6.5 Safety measures

1. Dyke wall is provided to contain the liquid from the tank. Dyke volume is more than the volume of the storage tank.

2. Water/Foam used for extinguishing any fires will be entraped in the dyke only due to oil traps provided. Keep the oil traps free from blockage.

3. Try transferring the contents to other nearby tank by means of pipe lines connected and evacuate the tank under spillage.

4. All the drains should be free from blockages and negative gradients.

6.7 ONSITE EMERGENCY IN APL DUE TO NEIGHBOURING INDUSTRIES

APL is surrounded by HPCL Refinery on South side, Coromandel Fertilizers & HPCL additional tankage facilities on West side, Bharat Petroleum & East India Petroleum on North side and Ware houses on the East side. The emergency measures required due to the off-site emergency in the surrounding industries are discussed as below:-

6.7.1 Failure of LPG / Propylene spheres of M/s. HPCL (R):

On the south end of APL, M/s. HPCL Refinery is situated in case of failure of LPG/Propylene spheres the probable damage distances are given below, which depends on wind direction and speed. In this case the whole of APL may get affected.

Name of the Industry	Accident Spot	Total Qty. In Tons	Scenario	Damage distance (m)		Offsite Damage distance (m)		Damage distance To pressure wave	
				Fatal	First deg Burns	Fatal	First deg Burns	Heavy	Repairs
HPCL	LPG Spheres	1000x7	BLEVE	700	1847	572	1719	575	1726
			VCE	425	1123	297	995	336	1009
	Propylene	800x2	BLEVE	580	1515	460	1415	--	553
			VCE	330	860	230	760	--	313

1. Identifier should inform to Shift Incharge (Production) about the leak and simultaneously give the emergency siren through manual call point.
2. Shutdown the unit if required after confirming and assessing the situation from HPCL.
3. Ascertain the wind direction and go upward direction.
4. Evacuate all employees unconnected with emergency.
5. Keep in touch with HPCL at regular intervals through Fire & Safety Department for assessing the situation.
6. Arrange transport for personnel gathered at assembly point.

6.7.2 Failure Of Ammonia Sphere Of M/s.CFL:

On south-west end of APL, M/s. Coromandel Fertilizers Ltd (CFL) is situated. In case of failure of ammonia sphere, capacity 1400 Tons. The affected area varies, which depends on wind direction and speed. In this case, the whole of APL may get affected.

Ammonia sphere failure:

Mode of release scenario - Instantaneous release

Stability Class	Stable 1m/s	Damage distance in Meters Neutral 4m/s	Unstable 2m/s
Toxicity (mg/m2)			
7100	3100	2300	1250
3500	4550	3325	1775
1420	7050	5100	2725
497	>10000	8100	4310
354	> 1000	9350	4950

1. Identifier should inform to Shift Incharge (Production) about the leak and simultaneously give the emergency siren through manual call point.
2. Shutdown the unit if required after confirming and assessing the situation from CFL.
3. Ascertain the wind direction and go upward direction.
4. Evacuate all employees unconnected with emergency.
5. Keep in touch with CFL at regular intervals through Fire & Safety Department for assessing the situation.
6. Arrange transport for personnel gathered at assembly point for evacuation.

6.7.3 Failure at BPCL

BPCL is located on west side of APL plant. Major hazard expected in BPCL is pool fire, which will be within their premises only.

6.7.4 Failure at EAST INDIA PETROLEUM

East India Petroleum was located in the north west corner of APL plant. The major hazard expected is BLEVE due to storage of LPG. Since this is under construction, the data for the correct damage distances are not available. However, there is a chance of damage to our plant if there is an explosion due to LPG.

6.8 OPERATION PHILOSOPHY OF APL

1) APL attaches great importances to Human Resources development and it believes that only through development of people greater productivity can be achieved. The technology adopted for the key plants is the most modern and sophisticated. Very well trained personnel will man the operations and attend to maintenance.

2) The process being continuous, the operation is manned round the clock by experienced personnel from centralized control room.

3) The instrumentation has been designed to provide stable and accurate controls to ensure maximum safety during the operation. PLC system backed by relays ensures emergency shutdown.

4) All Electrical equipments and instruments installed in hazardous areas are intrinsically safe and flame proof enclosures have been provided for all electrical equipments as per area classifications. Lightening arrestors are also provided at Boiler chimney. Isomer column and DG chimney to take care of danger from lightening.

5) Alarms, pre-alarms, fail safe shutdown procedures, and uninterrupted power supply are built in during the design stages itself. All the critical loads are connected to generated power in addition to APSEB power and emergency diesel generator power.

6) In addition to all the above features a redundant back up is provided for emergency shutdown of the plant, in the event of any fire etc. The sprinkler water spray is provided on storage tanks. The trip system is provided to take care of any eventualities. In the event of deviation of critical process parameters from the normal, the trip system will get actuated and trips the plants. With all the above features like built-in-safety Proven operating practices, training programmes for developing skills, APL has laid a long way for trouble free operation.

6.9 SAFETY & HEALTH POLCIY:

The APL Management firmly believes that all accidents are preventable and the SAFETY & HEALTH of employees, safe plant operations and safety of environment are of paramount importance. To achieve this, APL will:

i) Consider safety & loss prevention are the direct responsibility of line management. It will integrate safety with operations and strive to provide safe & healthy working conditions.

ii) Ensure exigencies of work and cost consideration shall not over-ride/bypass any safety aspects.

iii) Enlist co-operation of employees at all levels to adhere to safety rules and involve them in all safety promotional activities.

iv) Comply with relevant statutory regulations in respect of safety & environment in letter and spirit. It is the responsibility of every employee to avoid risk of injury to himself, fellow employees, others and damage to the Company's property.

6.10 ENVIRONMENT POLICY

Environment protection is prime concern to the APL. We strictly adhere to environment standards demanded by Pollution Control Board to maintain ecological balance in and around of our factory. It is the policy of the company to develop green belt although the factory to the maximum extent possible. Every employee is trained to ensure a health environment inside the factory by adhering to good work culture, work practices and standard operating procedures in safe usage, transportation, processing of raw materials, treatment and disposal of gaseous emissions, liquid effluents, solid wastes, so that the manufacturing process has only lower than permissible impact on the

environment.

It is our endeavor to carry out research & development to identify chemicals cum wastes and turn them into value added products further reducing the impact of the manufacturing process on the environment.

6.11 EMERGENCY PLAN

Emergency plan is defined as a situation in which an inflammable material is leaking into open atmosphere which might have caught Fire or may catch Fire at any moment. This is a potentially dangerous situation which is beyond the control of operating group and needs services of Fire Department and Others.

6.11.1 Important Points Considered Under Emergency Plan

a) Alarm System - Communication - Telephone
- Oral
- Paging

b) Fire Fighting/Safety/Rescue Operations in the plant.
c) Plant control
d) First aid - Medical aid.
e) Security.
f) Evacuation.
g) Rehabilitation.
h) Transportation.
i) Coordination with local authorities.
j) Collection and preserving evidence.
k) To take attendance of the people.

6.11.2 Emergency Personnel

As per the onsite emergency organization, the following personnel are designated as Emergency Personnel who are given specific task to help during the Emergency.

1. Assistant Manager (Process)
2. Fire & Safety Personnel
3. Laboratory Staff
4. Security Staff
5. First-aid Staff
6. First Aiders
7. Shift Operation Staff
8. Assistant General Manager (Process)
9. Assistant General Manager (HRD)
10. Assistant Manager (safety)

11. Vice President (Operations & Technical Service)
12. Chief Executive & Chief Operating Officer.

6.11.3 Qualifications & Experience

The Management of handling hazardous chemicals is vested on Chemical Engineer (Operations). However Manager (Process) who is incharge of the production activity is the overall coordinator. All the persons handling emergency situation will be qualified and trained in respective fields.

The above personnel are qualified Chemical Engineers and they have been trained in the storage and transportation and handling of hazardous chemicals. This is in addition to the practical experience of safe operation of chemical plants.

6.11.4 Training Of Emergency Personnel

Training in emergency handling has been recognized as an important aspect. This is in addition to the training program conducted in the company. The emergency personnel have been classified into three groups.

1. Sr.Management Group
2. Middle Management Group
3. Field Staff
   a) Firemen & Security Staff.
   b) Support Staff (Laboratory)
   c) Operation Staff

By virtue of qualification and experience Senior & Middle Management Staff are conversant with the handling of emergencies. For refreshing the subject screening the films on related topics and involving them in review meetings on mock drills etc., are organised.

Field Staff, such as Firemen and Security Staff are regularly trained by conducting drills and demonstration of various emergency equipments etc.

Mock drills are conducted at regular intervals and they are analysed for identifying any lapses and making improvements if required. Film shows and Class Room lectures are conducted. The new incumbents are trained in all the safety aspects before putting them on the job. Emergency handling is one of the important aspects in all the training programme.

6.11.5 Shift Management during Emergency

The Assistant Manager(Process) who is Shift in charge of the Shift will be the Controlling Officer for all the emergency operations. He is assisted by DCS Operators in the Control Room, field operators in various sections of the plant and Mechanical, Electrical, Instrumentation technicians to deal with any emergency as per the plan given below:-

6.11.6 Internal Document relating to Emergency Plan

a) CHIEF CO-ORDINATOR:

Chief Executive & Chief Operating Officer will be the Chief Coordinator. In the absence of Chief Executive & Chief Operating Officer, Senior Most person from Operations will be the Chief co-ordinator.

b) EMERGENCY CONTROLLER:

The Shift Chemical Engineer incharge of the shift is designated as Emergency Controller. He will assume full responsibility of handling any emergency. He will wear red helmet in emergency for easy identification.

c) FIRE SIREN ALARM (WAILING FIRE ALARM):

Sounding of Fire Siren intermittently at long. High peaks with short Low peak interval for a period of 1.5minute long.

d) EVACUATION SIREN:

3 times long high peak, 3 times short low peak siren.

e) ALL CLEAR SIREN ALARM:

Sounding of Fire Siren continuously for a period of 30 sec.to indicate that the emergency is over.

g) NATURE OF EMERGENCY:

Emergency as specified under this plan refers to occurrences of one or more of the following events.

1. Fire
2. Release of toxic vapour/Flammable gases:
   Release of toxic gas like carbon monoxide or flammable gas like Propylene, Purge Gas, Methane, Hydrogen which can cause Boiling liquid Expanding Vapour Explosion (BLEVE) or vapour cloud explosion(VCE).

h) **A MAJOR FIRE IN-GENERAL IS ONE, WHICH:**

i) Is spreading to other equipment or area; or

ii) threatens to spread beyond the control of the personnel immediately engaged in fighting the fire;

iii) is a violent explosion causing a large fire;

iv) for any other reason demands supplementary fire fighting personnel in the judgement of the emergency controller.

6.12 IDENTIFICATION OF HAZARD:

There are two (2) types of possible emergencies. One is Fire & Explosion Hazard and the second one is Toxic Gas Leak. The Fire Hazard will be mainly in the storage areas of the following inflammable materials.

a) Naphtha
b) Propylene
c) Butyraldehydes
d) Oxo-Alcohols
e) Intermediates
f) Diesel
h) Fuel Oil
g) Methanol

The inflammable materials which are likely to cause the Hazard in the process area are:

a) Hydrogen
b) Carbon Monoxide
c) Propylene
d) Naphtha
e) Butyraldehydes
f) Intermediates

Keeping the above Hazards in view, the following emergency procedure is outlined. The gas leak Toxic chemical and inflammable material like Propylene will spread in the direction of wind. Thus causing Hazard of Fire and Explosion or toxicity. This is considered as major hazard.

6.12.1 Fire Prevention & Fire Fighting Facilities Provided

Petrochemicals are highly inflammable and explosive in nature. They can also create toxicity hazard. All efforts are taken to prevent fires from the very inception. Proper design, layout and safe operating procedure ensure safety. The basic elements required for starting a fire are fuel, heat, oxygen and chain reaction. In the process design, at least one of the above components is eliminated so that Fires are prevented.

Some of the salient features are:

Nitrogen blanketing on all storage tanks
Avoiding presence of free oxygen in the process gases
Provision of sprinklers on a storage tanks
Avoiding Heat or spark
Avoiding formation & accumulation of static electricity
Providing lightning arresters
Connecting vapour lines of all equipments to flare
Prevention of smoking
Maintaining Nitrogen blanketing on all process lines and equipments

6.12.2 Fire Fighting Facility

Fire Hydrant System
Fire Escape Hydrants
Fire Extinguishers
- Carbon dioxide Type
- Dry Chemical power type
- Foam Type
- Water CO2 Type

Foam Compound
Sprinkler System
Foam Tender
Fire Alarm System
Water Monitors
Trained Manpower

6.12.3 Fire Fighting Techniques

Fire extinguishment can be accomplished by four (4) methods.

a) SMOOTHERING

Removing Oxygen supply; Foam, CO2, DCP, Steam, Water fog are applied on burning surface that cuts off Oxygen supply thus fire gets extinguished. In case

of Tanker fires, closing the lid extinguishes fire.

b) **STARVATION**

This method is adopted when material leaking from a ruptured/leaky pipe. Closing or nipping the leaking pipe extinguishes fire due to starvation of fuel.

NOTE:
When fighting a pressurized gas/vapor fire, the personnel and equipment around should be protected by water spray. While the fire is being extinguished by starvation of fuel, if the fire is extinguished by other means a vapour/gas cloud will form, which may explode causing greater damage. Hence extinguishing fire is to be carefully timed. The leaking systems should be purged with Nitrogen to prevent ingress of Oxygen.

c) **COOLING:**

The burning fuel is cooled below ignition point, water spray or fog is the best cooling medium. Foam also cools the burning fuel while smothering. (Water spray and foam should not be used simultaneously on fire).

6.12.4 Discipline Expected From Employees

Do not get panic.
Do not spread rumors.
Do not approach the emergency scene as a spectator
Do not engage communication channels unnecessarily (Telephone etc.,)
Go to your assembling points immediately after hearing emergency siren.
Do not move unnecessarily from your assembling points.
Be attentive to instructions
Get actively involved when you are assigned any job
All work permits (Both hot/cold) stands cancelled & to be renewed after emergency is cleared.
Suspend all product filling and raw material unloading activities on hearing the siren. (Both Tankers/Barrels) The activity may be restarted after getting clearance from Shift Incharge.
Follow evacuation as advised.

6.12.5 Communication Procedure

Person who notices Fire will break the Fire alarm glass (or) Dial 222 (Fire Station) EPABX or Use Public address system.

The person giving the message should identify himself and give the message in short and clear about,

i) Location
ii) Nature of Emergency
iii) Extent of damage

After giving message he shall make an attempt to extinguish fire by using available appropriate extinguishers.

As the Fire Engine comes to the site, guide it to the scene of fire emergency.

Firemen will give the same message to DCS (333), Lab (427), Security (400).

The DCS Control Room operator will receive the message and arrange to record the message on the board and report the same to the emergency controller.

"EMERGENCY-NO ENTRY" Board will be displayed by the Security at the main gate.

6.12.6 Procedure In The Event Of Emergencies:

In the event of occurrences of an emergency, the shift Incharge of production departmrent will be the Emergency Controller for handling the emergency. He will take complete control of the emergency and coordinate for handling the emergency. Responsibilities mentioned below are subject to change based on the Emergency Controller judgement depending on the situation.

However, all the guidelines shall be adhered to achieve the following.

a) Effective control of emergency
b) Rescue the affected persons and provide proper treatment
c) Evacuation of personnel
d) Co-ordinate with all emergency control teams
e) Request for Fire, Medical and Ambulance services

To achieve the above, he will take complete control of the activities with emergency control teams as specified below.

A) Emergency Task Force Team.
B) Plant Protection Team.
C) Fire Water Pump House Team.
D) Communication Team.
E) Medical Team.
F) Manpower Accounting and Search Team
G) Repair Team.
H) Security Team

For the purpose of handling emergency, DCS control room is declared as the emergency control room. All communication to and fro will orginate or end at the emergency control room.

Functional responsibilities of each team:

a) **Emergency Task Force Team**

The Group Leader will be Shift Incharge. In his absence, when he is away from the site of incident, the next person from Production Department will be Group Leader.

This team directly fights the emergency under instructions from emergency controller. On hearing about the emergency the group leader will establish communications with the emergency controller and start handling the emergency directly. The Group Leader will be assisted by safety engineer.

Chief Executive & Chief Operating Officer will be the Chief Coordinator in the event of off site emergency. In his absence, Senior most person available in Operations Department will be the Chief Coordinator.

b) **Plant protection team**:

Senior person in DCS will be leader of the team. Technicians in respective areas (4 nos) will be the members of the team as per the Annexure III. This team will ensure the safety of the remaining part of the plant. They will take instructions from the Emergency Controller whether to take shutdown of the plant or not and also implement the direction of the emergency controller.

c) **Fire water pump house team**

Senior person among the two technicians will be the leader of this team. This team will take direct instructions from emergency controller. The objective of this team will be to see the water availability to the fire water pumps.

d) **Communication team:**

Instrument Dept Shift Incharge will be the leader of this team. Asst. General Manager (HRD) will be the team leader in the event of off site emergency and he will be official spokes person (no other person will communicate with any outside agency except for the purpose of handling the emergency according to the individual's role.

This team takes direct instructions from the emergency controller and will communicate with the internal and external agencies to establish a true

communication of the occurrence of the emergency.

e) **Medical team:**

Time Keeper will be the leader of this team. During an emergency in the event of any persons getting hurt the medical team will render necessary first aid assistance and contact concerned people for availing medical facilities out side the premises. The first aid and medical aid to be provided for persons affected.

f) **Manpower accounting and Search Team:**

Time Keeper will be the leader of this team. The objective of this team is to ensure that all personnel are safe and are accounted properly. Initially this team consists of two persons. While manpower accounting is being done and if some people are found missing. Search team consisting of addition of three people from Lab, Fire, Security will be drawn under Emergency Controller's instructions. This team will undertake the responsibility of searching out for those missing people with proper protective gear.

g) **Repair team:**

Mechanical Dept Senior most person available will be the leader of this team. The team will assist the emergency task force and contain the emergency within the place of occurrence.

h) **Security team:**

Security Supervisor will be the leader of this team. This team will ensure that no unauthorised personnel enter the premises.

6.13 EMERGENCY PROCEDURES & DUTIES - CONCERNED TEAMS OF PERSONNEL

When an emergency occurs in the plant, the same shall be immediately reported to the Emergency Controller and warning should be sounded through the alarm system provided in the plant. Once the information reaches the shift incharge, he takes charge of the situation as emergency controller and summons the team leaders who are required to the control room/scene through public address system and intercom. The team leaders will immediately rush to the control room/scene for taking up their respective duties. After the various team leaders assemble in the control room/scene the emergency controller will give necessary instructions to all the team leaders for handling the emergency. All communication by the various group leaders will be two way communications with the emergency controller.

6.13.1 Duties Of Emergency Controller

1. Shift Incharge will receive the emergency message on emergency phone 333.
2. He will take charge of the situation.
3. He will rush to the scene of emergency wearing red helmet (kept in DCS Room) and take stock of the situation and return to DCS.
4. He shall arrange to record the message on white board provided in DCS. The message will consist of:
   A) Nature of emergency
   B) Location
   C) Dimension of affected area
   D) Seriousness of incident etc.
5. He will contact the required leaders of various teams at their respective assembly points by telephone/PA System and give clear cut line of action to be executed.
6. The priority of communication shall be as follows:
   A) Emergency Task Force Team
   B) Plant protection Team
   C) Pump House Team
   D) Communications Team
   E) Medical Team
   F) Manpower counting & Search Team
   G) Repairs Team
   H) Security Team
7. He will ensure safety of the plant and the personnel in the plant. He will again visit the scene of emergency and make further assessment and decide on external assistance from HPCL, CFL & BPCL. (Under Mutual Aid).
8. Consider evacuation of the people from the site depending upon the situation. Ascertain the wind direction and determine the safe escape route. All non-essential persons to be directed to reach safe assembly point, i.e., Fire and Safety office or South Gate (Sea water make up Pump House) announce the safe escape route on paging system.
9. Declare the termination of emergency by sounding all clear siren and announce the same on paging.
10. Maintain diary of all important events during the emergency.
11. Send the emergency report after reviewing the incident with various team leaders who are actively involved with 24 hours of clearing emergency.

6.13.2 Emergency Task Force Team

The leader will be Shift Incharge or his representative (From Production Dept).

1. Depending upon the type of emergency, he will take the assistance of Safety Officer.
2. He will ensure that operator is immediately available at the fire water

pump house.

3. He will coordinate with repair team leader, if required for attending to any repair to contain the emergency.
4. He will take the help of security team to cordon off the area.
5. He will ensure that the emergency does not escalate and is contained within the spot of occurrence.
6. He will be in continuous contact with the Chief Coordinator Chief Executive for suitable action with his consent.

6.13.3 Plant Protection Team

The leader will be the senior person in Production Dept. available in DCS at the time of emergency. One of the Senior persons in Production Dept (in unaffected areas) will be the members of the team.

1. The leader of the team will take instruction from Emergency Controller.
2. He will contact his team members for protecting the plant in all respects.
3. If emergency escalates, he will consult Emergency Controller and with his consent, he will shut down the plant safely.

6.13.4 Communication Team

The leader will be the Shift Incharge of Instrumentation Dept. (If it is Offsite emergency, the leader will be Asst. General Manager (HRD).

1. Communication Team leader will rush to DCS on hearing the emergency siren and report to Emergency Controller.
2. He will record the message on white board after taking clear description of the emergency.
3. He will communicate the message to all persons, who are to be informed about the emergency both internally and externally.
4. He will mobilise his team and will establish internal communication with the help of his team member.
5. Asst. General Manager (HRD) will directly handle the external communication like information to statutory agencies.
6. In case external help is required by the Emergency Controller, he will approach the external agencies through Fire Station where hotline facility is available.
   A. Neighboring industries with whom we have mutual aid agreement HPCL, CFL, BPCL and other agencies like Naval Base & Govt. Fire Services.
   B. District Collector) Asst. G.M. (HRD) will contact only if essential
   C. Police Station)at the request of emergency controller
7. Communication Team will inform all workshops in the case of evacuation.

6.13.5 Medical Team

The leader will be Time Keeper

1. He will make himself available at Occupational Health Center (Ph: 444) will report to Emergency Controller for taking instructions.
2. He will mobilise his team members and keep "AMBULANCE" ready at Occupational Health Center. He will keep in continuous contact with Emergency Controller and direct the injured persons to the hospital, if required.
3. The injured person will be brought to Occupational Health Center and will be attended by Male Nurse. If the no. of persons injured are more, Male Nurse will give directions to the team members for the treatment of injured personnel.
4. He will list the names of all the personnel for whom treatment has been given and others who have been directed to the hospital along with a note on treatment given to the injured person.
5. He will mobilise additional transport for carrying any additional injured people.
6. Once the external medical team arrives at site on request against offsite emergency, the team leader will coordinate with them for better utilisation of the services.
7. Ensures that Ambulance reaches emergency site, if required.
8. Take help of First Aid Trained persons for rescue and first aid if required.
9. Shift the ambulance room and first aid kit to a safe place if the hazard in plant is affecting the existing Ambulance Room.

First Aid kit shall contain:

1. Oxygen Cylinder
2. Antidotes
3. Drugs for burn injuries
4. Stretchers
5. Bandage material etc.

6.13.6 Man power accounting/Search Team

1. Search team consists of one Laboratory Technician, One Fireman & One Security Guard. Laboratory Technnician will be the leader of the team.
2. The leader of the team will immediately ensure that the list of all personnel who have entered the plant is made available immediately.
3. After consolidation of this he will start accounting the personnel as soon as they report at the time office (when evacuation required).
4. In case any person reported missisng he will inform the same to the Emergency Controller.
5. Searching operation will be done by the Search Team.
6. He will mobilise team members and establish contact with the

manpower accounting team from time to time.

7. He will ensure that he and his team members wear the necessary protective gear.
8. He will establish communcation with Emergency Controller from time to time of missing personnel.

6.13.7 Repair team

1. The team leader will take definite instructions from the Emergency Controller and will immediately be available with the emergency task force at the place of emergency to attend to repair work.
2. He will mobilise his team with necessary tools and tackles to handle any repair as per requirement.

6.13.8 Security Team

1. Security Supervisor will be the team leader.
2. After receiving information from Fire Station about the nature of emergency location, he will record the same on black board.
3. After hearing the emergency siren, two security guards posted at Main Gate will rush to fire station and go to the emergency site.
4. The team leader will take instructions from Emergency Controller and will arrange to provide security coverage at the main security gate, plant gate near time office and emergency site.
5. He will effectively cordon off the emergency area and will prevent unauthorised people entering the same.
6. He will ensure effective guard at the main gates to prevent external people entering the premises.
7. All tanker (Lorries) should be sent to designated parking place.
8. Depute the guards who are trained in Fire fighting to the Emergency site. Call for additional staff from Barracks.
9. Do not allow visitors and off duty employees other than who are connected with fire fighting and control.
10. Receive the outside Fire Brigade, Medical team and guide them as per instruction of Emergency Controller.
11. Keep the phone only for emergency messages. Communicate the messages as advised by Emergency Controller.
12. Keep Road access to Factory clear.
13. Control vehicular traffic.
14. Prevent gathering at the emergency site.
15. Guide the evacuating people to a safe place as advised by the Emergency Controller.
16. Keep liaison with police in case police is called in by the communication team leader.
17. Maintain log of events and persons entering or leaving.
18. Security guard will be made available at the Stores with keys for taking any

material in the event of emergency.

6.13.9 Fire Man At Fire Station

i) Ensures proper fire message is received.
ii) Ensure the Fire Fighting facilities are dispatched to site of emergency.
iii) Keep sending supplies as required to the emergency location.
iv) Reach the emergency site and assist emergency controller.
v) Coordinate with external Fire & Medical services.
vi) Help Emergency Controller to deal with Evacuation/rescue and first aid.

6.13.10 Contract Workers & Tanker Drivers

i) On hearing the Fire emergency siren all the contract personnel should move to Main Security Gate and remain there till all clear siren is sounded
ii) Tankers and vehicles in the plant area must be away from emergency route to allow emergency vehicular movement.
iii) Section In-charges shall ensure the implementation of Point(i) & (ii) for contract workmen who are working in their section or visitors who had come to see them.

6.13.11 All clear signals:

1. Emergency Controller will declare after assessing the situation that emergency is over. Till the declaration is issued by the Emergency Controller all the leaders will adhere to the task and be present at the prescribed location. In case of offsite emergency, Emergency Controller will declare all clear after reviewing the situation.
2. On declaration of end of offsite emergency the communication team leader Asst. General Manager(HRD) will communicate to all external agencies that the emergency is over.
3. All clear signal will be sounded through continuous siren for at least 30 Sec. Also the emergency clear signal will be announced through the public address system to all the personnel working. Even after the emergency is over a skeleton staff of the emergency task force will be available at the incident of emergency for at least 30 min.
4. Emergency Controller will have a meeting with all the group leaders and submit a report to Safety Department within 24hrs of occurrence of emergency.

6.14 EVACUATION

In the event of Fire/Gas leak emergency it may become necessary to evacuate the people to a safer zone from various locations in the plant.

6.14.1 Possible Emergencies Requiring Evacuation:

We envisage 3 types of situations in which evacuation of people may become necessary within the plant site.

i) Leakage of unburnt propylene from propylene storages.

ii) Leakage of Carbon monoxide / process gas from the process system.

iii) Major fire in the plant or storage area. The wind directions prevailing most of the period in the year are south westerly in the morning hours and North East/East direction in the evenings.

Follow the evacuation procedure all the employees are required to go to East gate or South gate through the safe escape route.

6.14.2 Evacuation Siren

The Siren is sounded with modulation nodes i.e. 3 times of long high peak with intermittent short low peak.

SCENARIO:

1) Propylene
BLEVE-Fireball
Flare
Explosion

2) Butyraldehyde
Pool Fire
Explosion

3) Carbon monoxide
Release rate: 0.5Kgs.per sec.to 3Kgs.per sec.can form Toxic cloud.

4) Hydrogen
Explosion

CASE-I

The safe escape routes are suggested as tentative measure. In emergency use your judgement and listen to paging for announcement. In case of wind direction is towards South Westerly, the Carbon monoxide / process gas leaks out and travels in the same direction, the safe evacuation assembly point will be East Gate. Reach East gate through East side of the Utility Building or road behind intermediate product tanks. The Ambulance & Fire engine will pass through road leading to storage tanks, or the west side road utility building.

CASE-II

During the same period if the emergency arises due to propylene leak from the spheres the evacuation is to be done in the same direction i.e., East of the Utility Building or west side of intermediate tank to East gate.

CASE-III

In case the wind direction is towards East, the escape route will be the road behind the process plants i.e., West of intermediate tanks, through north side road of stores, leading to South gate.

6.14.3 Fire In The Process Plants Or Storages

In case of any liquid fires in the plant or in the storage area the main risk is only the radiant heat. It is, therefore, suggested to approach the assembly point through the road along the Boundary wall on either side.

6.14.4 Announcement Through Paging System

The paging system is provided at all the sections in the plant. The Safe evacuation route will be announced on the paging system. While deciding the Safe escape route, ascertain the prevailing wind direction by observing the position of wind socks which are located on the top most structure of the plant as given below.

Locations of wind socks:

1) CO_2 removal area (01)
2) East propylene sphere.
3) Pipe rack, west of product tanks.

Location of Assembly points

1) Fire Station
2) Sea Water Pump House

6.15 EMERGENCY REPORT

Emergency report will be prepared by the Shift Incharge in whose shift the emergency has occurred. The report must contain information about the cause of emergency and preventive measures. The report must be sent to Fire & Safety Department within 24 hours by emergency controller.

An independent investigation of the emergency will be carried out by the Accident Investigation Team consisting of Addl.Managers of Technical Services, Engineering Dept & Head of Fire & Safety Dept. The findings of the investigation will be made as a report and will be submitted to Chief

Executive with copies to AGM (TS) and Addl GM (E&M) within 48 hrs of occurrence of emergency. Safety Department head will be the coordinator for the above team.

6.16 EMERGENCY REVIEW MEETING

As soon as the normalcy is restored the Emergency Review Committee consisting of the following members will meet. The meeting will be coordinated by the Head, Fire & Safety. The objective of the meeting is to review the actions taken during the emergency and to suggest improvements to prevent the recurrence of the incident and to suggest effective steps needed to handle any such type of the emergency.

: Chief Executive & Chief Operating Officer.
: Vice President (Operations & Technical Service)
: Vice President (Engineering & Maintenance)
: Assistant General Manager (Process)
: Assistant General Manager (HRD)
: Assistant Manager (Safety)
: Shift In charge at the time of emergency occurrence.

PROPYLENE

MATERIAL DATA SHEET

Hazard code

CHEMICAL NAME	: PROPYLENE
Synonym/Common Name Formula	: Propene, Methyl ethylene CH3 CH2 = CH2 C3H6

PROPERTIES & CHARACTERISTICS:

A) Physical State Colour	: Gas
Colour	: Colorless Gas, and liquid under Pressure
Odour	: Mild - (typical of lower Hydrocarbons) often odorless
Corrosivity	: Non-corrosive
Water solubility	: Slightly soluble in water
B) Flash point	: -72°C
Auto Ignition Temp	: 927°F (497.2°C)
Flammable Limits	: Lower - 2% , Upper - 11%
Boiling Point	: -118°F (-48°C)
Specific Gravity	: 0.581 at 0°C (liquid)
Vapor Density	: 1.46 at 0°C
Vapor Pressure	: 10 atm. (at 19.8°C)
Molecular Weight	: 42.1 gm
C) Threshold Limit Values (TLV)	: Not established
MODE OF ENTRANCE into body	: Skin contact & inhalation
D) REACTIVITY	: It can react vigorously with Oxidizing materials, especially with NO2, N2O4, N2
HEALTH HAZARDS	: Moderate concentration in air Causes unconsciousness. Contact With liquefied propylene will

		Cause a 'freezing burn (cold burn) in high concentration it has Aesthetic properties.
FIRE & EXPLOSION		Moderate when exposed to heat or flame under unusual Conditions (i.e. 955 atmospheres Pressure and 327°C) it has been known to explode.
SAFE HANDLING & STORAGE		Keep away from oxidizing materials, Store in well ventilated, cool land fire resistive warehouse out door storage is preferred.
FIRE EXTINGUISHMENT		Stop flow of gas. Use water to keep fire exposed containers cool and to protect men affecting the shut off. Use Carbon dioxide, chemical and water spray. Fog, vapour, cloud will form, may explode causing greater damage. Hence, extinguishing fire is to be timed properly.
FIRST - AID		In case of Inhalation remove him to fresh air. In case of contact, remove all contaminated clothing and wash the affected part with large amount of water. In all cases report to the Medical Centre.
SPILLAGE/DISPOSAL	Spillage:	Eliminate all sources of ignition. Contain leaked/leaking liquid with sand or earth allows evaporating. Sewers must be covered and basements evacuated.
	Disposal:	All equipments should be depressurized / blow down / vented to flare. To vent the vapors area must be open and remote. Ensure dissipation of gas below its LEL.

HYDROGEN

Chemical Name	: HYDROGEN
Synonym/Common Name	: Liquefied H_2
Formula	: H_2

PROPERTIES & CHARACTERISTICS

a) Physical State	: Liquefied gas
Colour	: Colorless
Odour	: Odorless
Corrosivity	: Non-corrosive
Water Solubility	: Slightly 0.00017% wt. at 10°C
Molecular weight	: 2.016 gms.
b) Flash Point	: N.A.
Auto Ignition temp.	: 580°C
Flammable limits in air	: Lower - 4% Upper - 75%
Boiling Point : -252.8°C	
Melting Point	: -259.2°C
Specific Gravity	: 0.0695 (Air = 1)
Vapour Density	: 0.0788 at 32°F
c) Threshold Limit Values (TLV)	: Not established
MODE OF ENTRANCE into	: Inhalation body Skin contact (Liquefied H_2)
d) Reactivity	: Carbon and low alloy steels are attached by Hydrogen at elevated temp. And pressure. Reacts vigorously with oxidizing agents.
HEALTH HAZARDS	: It is non-toxic but can constitute an asphyxiation hazard. Breathing a pure hydrogen will produce immediate loss of consciousness and can cause immediate death. Poor visibility of its flame can injure any one coming in contact instantaneously.

FIRE & EXPLOSION HAZARDS	: When combined with air or other oxidizes and ignited, releases large amounts of energy in the form of heat or explosive force the degree of violence depends upon combustion conditions. A fire ball is formed if the gas could is Not ignited immediately after the first Flash evaporation. Hydrogen burns a high temperature Flame but it emits less radiant heat than propane and other hydrocarbon fuels. Liquid gas to gas expansion ratio (1:850 at room temp.) is very large.
SAFE HANDLING & STORAGE	: Cylinders should not be subjected to temps. Above 45°C. Do not subject cylinders to abnormal mechanical shocks, and never use them as rollers or supports. Store cylinders in a location away from sources of ignition and excessive heat. Shed should be well ventilated and fire resistant. Quantity of hydrogen gas stored in a building should be kept to minimum possible extent.
FIRE EXTINGUISHMENT	: 1. Evacuate the area in the vicinity in case of fire. 2. the most effective way to fight is to shut off the supply if possible. 3. When jet of flame is small enough, to be approached use Carbon dioxide or D.C.P. 4. Since Hydrogen flame is almost invisible it is advisable to take help of flammable material such as paper or cloth fixed to a handle for

detecting.

FIRST-AID : In case of suspected over exposure or skin contact, get medical attention.

SPILLAGE/DISPOSAL : It is desirable to evaporate a spill. Water spray may be used to increase the rate of evaporation. For waste disposal release slowly to an open safe atmosphere.

SPECIFIC INFORMATION : Cylinders held in storage should be periodically checked for general condition and leakage. It is recomended that persons handling gas cylinders should wear safety appliance like goggles, gloves and safety shoes.

CARBON MONOXIDE

CHEMICAL NAME : Carbon Monoxide
FORMULA : CO

PROPERTIES & CHARACTERISTICS:

A) Physical state : Gas
Colour : Colourless
Odour : Odourless
Molecular weight : 28.01

B) Auto Ignition temp. : 651°C
Boiling point : -191.3°C
Flammable Limits : 12.5 to 74.2% volume in air
Relative Density : 0.97

C) Threshold limit value : 50ppm
Mode of Entrance : Inhalation

HEALTH HAZARDS : Highly toxic, causes asphyxiation due to combination with hemoglobin. It prevents Oxygen from reaching the tissues.

1. 50 to 200 ppm can cause Headache in 2 to 3 hours.

2. 100 ppm will cause Nausea and Head-ache in one to two hours.

3. 600 to 700 ppm will cause appreciable effect in one hour.

4. 800 ppm can cause Head-ache, Nausea and Dizziness in 3/4 hour.

5. 1000 to 1200 ppm will be dangerous to life.

FIRE & EXPLOSION HAZARDS : Dangerous when exposed to flame or Heat.

SAFE HANDLING AND STORAGE : While working in environment contaminated with carbonmonoxide use appropriate Gas mask or Self

contained Breathing apparatus.

FIRE EXTINGUISHMENT : Fight Fire with Carbon Dioxide, Dry Chemical or Cool the surrounding area with water and isolate the leak. Let the fire extinguish by starvatioln.

FIRST AID : Remove the affected person to fresh air, Start artificial respiration if the Breathing is interrupted and get the help of Doctor immediately.

DISPOSAL : Burn the gas in the furnance or combustion chamber.

BUTYRALDEHYDE

Chemical Name		: Butyraldehyde
Synonym		: Butyric Aldehyde, N-BAL
Formula		: CH3 CH2 CHO
Molecular weight		: 72.11
PROPERTIES AND CHARACTERISTICS:		
A) Physical state		: Liquid
Colour		: Colourless
Odour		: Pungent odour
Water solubility		: Slightly soluble in water
B) Flash Point		: -13°C
Auto ingestion Temperature		: 218°C
Flammable limits		: LEL 1.9 UEL: 12.5
Boiling point	: 75°C	
Melting point		: -97°C
Relative density (Liquid)		: .8
Relative density (Vapour)		: 2.5
C) Mode of entrance into		: Inhalation, skin contact ingestion
D) Reactivity		: Oxidizes when exposed to air.
HEALTH HAZARDS		: Irritant to skin, Eyes mucous membrane. Remove chemical by thorough wash, Low inhalation toxicity, Eye need prolonged irrigation with water and medical.
FIRE AND EXPLOSION HAZARD		: Heavy Vapours can travel to distant ignitiion source and flash back, vapours are easily ignited.
SAFE HANDLING AND STORAGE		: Use PVC personel protective equipments. Store away from heat. Avoid mixing with alkaline catalyst such as sodium hydroxide Ammonia, Butylamine store in stainless steel equipments and maintain inert gas atmosphere.

FIRE EXTINGUISHMENT	: Use dry chemical powder, foam or carbonodioxide and the water may be used to dispersel of spills.
FIRST AID	: Flush the contaminated part with cupious quantities of water treat for chemical burns.

BUTANOL

Chemical Name		: BUTANOL
Synonyms		: I-Butanol, N-Butanol Propyl Carbonol, NBA
Formula		: CH3 CH2 CH2 CH2 OH
Molecular Weight		: 74.12 grams
PHYSICAL PROPERTIES		:
A) Physical State		: Liquid
Colour		: Clear, Colourless
Odour		: Strong Characteristic Odour
Water solubility		: Soluble upto 7.7% W/W at 20°C
B) Flash Point		: 84°F(Closed cup)/29°C
Auto Ignition Temp.		: 650°C
Flammable Limits		: Lower - 1.4% V/V Upper - 11.2% V/V
Boiling Point	: 117.7°C	
Freezing Point		: -89.3°C
Melting Point		: 128°C
Specific Gravity		: 0.8108 at 20°C
Vapour Density		: 2.55 (Air = 1)
Vapour Pressure		: 4.2 mm of Hg at 20°C
C) Threshold Limit Value		: 50 ppm (150Mg/M3) (TLV)
Mode of Entry into		: Inhalation, Ingestion, Body Skin Contact
D) Reactivity		: Stable, Strong Oxidiser
Incompatibility		: Do not use Copper or its Alloy
HEALTH HAZARDS		: Over exposure may lead to Nausea, vomiting, narcosis, corneal inflamation, irritation of throat and nose, blur visiion, Target Organs-Skin, eyes, respiratory system.
Fire.		Vapours are much prone to Catch
		For respiratory protection, use all purpose cannister mask or chemical

cartridge or self contained breathing apparatus.

Local exhaust is preferred for ventilation.

Make use of rubber gloves and face shield. Store in a cool place away from sources of heat, ignition and sparks.

For small fires - use DCP or Carbondioxide. Large fires - Alcohol foam water spray will assist in controlling the fire.

Do not use water jets.

If inhaled - Remove to fresh air if breathing stopped give artificial respiration, call a physician.

If swallowed - Induce vomitting call a Physician. Skin - Wash with water. Remove soaked clothing immediately. Eyes - Flush with large quantity of water for 15 minutes - call a physician.

Spillage - Eliminate all sources of ignition. Flush with large amounts of water or Absorb on sand or earth.

Do not allow material to enter a water source or sewer.

Disposal - Atomize into an incinerator.

ETHYL HEXANOL

CHEMICAL NAME	: 2-ETHYL HEXYL ALCOHOL
Synonyms	: Octonol, 2EH, Octyl Alcohol
Formula	: C4 H9 CH(C2H5) CH2 CH
Molecular Weight	: 130.23 grams

PHYSICAL PROPERTIES

A) Physical State	: Slightly Oily Liquid
Colour	: Clear, Colourless
Odour	: Charactristic Odour
Water Solubility	: Not miscible with water
B) Flash point	: 73°C(Closed Cup)
Auto Ignition Temp.	: 230°C
Flammable Limits	: Lower - 0.9% V/V Upper - 9.7% V/V
Boiling Point	: 179°C
Freezing Point	: -76°C
Specific gravity	: 0.834 at 20°C
Vapour Density	: 4.50 (Air = 1)
Vapour Pressure	: 0.2 mm of Hg at 20°C
U N Number	: 2282 (3.0.0) (0) III
C) Thereshold Limit Values : (TLV)	
Mody of entry into body	: Inhalation, ingestion, Contact
D) Reactivity	: Stable, Can react with Oxidising materials
HEALTH HAZARDS	: A mild skin irritant Moderately toxic
FIRE & EXPLOSION HAZARD	: Moderate when exposed to heat or flame.
SAFE HANDLING & STORAGE	: Protective clothing like gloves face marks, PVC Suit to be worn during handling operations.

Use self contained breathing apparatus or cannister gas masks. Local exhaust preferred.

Store in a cool place away from source of heat, ignition or spark.

FIRE EXTINGUISHMENT : For small fires - Use DCP or CO_2 Large fires - Alcohol foam water spray will assist in controlling the fire.

Do not use water jets.

FIRST - AID : If inhaled - Remove to fresh air if breathing stopped give artificial respiration call a physician.

If swallowed - Induce vomiting call a physician. Skin - wash with water. Remove soaked clothing immediately. Eyes - Flush with large quantity of water for 15 mts. call a physician.

SPILLAGE / DISPOSAL : Spillage - Eliminate all sources of ignition. Flush with large amounts of water or absorb on Sand or Earth. Do not allow material to enter a water source or sewer.

Disposal - Atomize into an incinerator.

Standards

APPLICABLE STANDARDS

For the preparation of this report reference for standards has been made to Indian Standards. The standards used in this report are reproduced here in the following section for ready reference.

a) Air Quality Standards

- Ambient Air quality standards with respect to noise- of the Central Pollution Control Board (CPCB) June'95, India
- Noise standards for Occupational Exposure
- National Ambient Air Quality Standards- of the CPCB June'95, India.

b) Water Quality and Wastewater discharge Standards

- India Standard-Drinking water –Specification- IS 10500:1991- Bureau of India Standards(BIS)
- General Standards for discharge of Env. Pollutants-GSR 422(E)-of CPCB, India

c) Solid waste disposal Standards

- Hazardous Wastes (Management And Handling) Rules, 1991- of Ministry of Environment & Forests, India.

d) Diesel Generator Sets

- Stack height standards for Diesel Generator sets standards, CPCB, India Emission Regulations part IV, COINDS/26/1986-87

e) Effluent Standards

- As per Industrial specific standards the treated effluent from Pharmaceuticals Industry (Bulk drugs) should not exceed the limits specified in notification GSR 176 (E) dated 2.4.1996

Table 1

Ambient Air quality standards with respect to noise-
Central Pollution Control Board (CPCB) June'95, India

SCHEDULE - III

AMBIENT AIR QUALITY STANDARDS IN RESPECT OF NOISE

Area Code	Category of Area	Limits in dB(A) Leq	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note :

1. *Day Time is recorded in between 6 a.m. and 9 p.m.*
2. *Night time is recorded in between 9 p.m. to 6 a.m.*
3. *Silence zone is defined as areas upto 100 meters around such premises as hospitals, educational institutions and courts. The silence zones are to be declared by the Competent Authority.*

   Use of vehicular horns, loudspeakers and bursting of crackers shall be banned in these zones.
4. *Mixed categories of areas should be declared as one of the four above mentioned categories by the Competent Authority and the corresponding standards shall apply.*

Source: EPA Notification [G.S.R. 1063 (E) dt. 26.12.1989 published in the Gazette No. 643 dt. 26.12.1989].

Table 2
Noise Standards for Occupational Exposure

Total Time of Exposure per day in hours (continuous or short term Exposure)	Sound Pressure level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
3/4	107

For any period of exposure falling in between any figure and the next higher or lower figure as indicated in Column (1), the permissible level is to be determined by extrapolation on a proportionate scale.

Table 3
National Ambient Air Quality Standards
Central Pollution Control Board (CPCB) June'95, India

Pollutants	Time weighted average	Concentration in Ambient Air			Method of Measurement
		Industrial Area	Resi. Rural & Other areas	Sensitive Areas	
Sulphur Dioxide (SO_2)	Annual Average *	80 µg/m³	60 µg/m³	15 µg/m³	1. Improved West and Geakemethod
	24 hours**	120 µg/m³	80 µg/m³	30 µg/m³	2. Ultraviolet fluorescence
Oxides of Nitrogen (NO_2)	Annual Average *	80 µg/m³	60 µg/m³	15 µg/m³	1. Jacob & Hochheiser modified (Na - Arsenite) Method
	24 hours* 8	120 µg/m³	80 µg/m³	30 µg/m³	2. Gas Phase Chemiluminescence
Suspended Particulate Matter (SPM)	Annual Average *	360 µg/m³	140 µg/m³	70 µg/m³	High Volume sampling, (Average flow rate not less than 1.1 m³ /minute
	24 hours**	500 µg/m³	200 µg/m³	100 µg/m³	
Respirable Particulate Matter (size > 10 mm) (RPM)	Annual Average *	120 µg/m³	60 µg/m³	50 µg/m³	Respirable particulate matter sampler
	24 hours**	150 µg/m³	100 µg/m³	75 µg/m³	
Lead (Pb)	Annual Average *	1.0 µg/m³	0.75 µg/m³	0.50 µg/m³	AAS Method after sampling using EPM 2000 or equivalent filter paper.
	24 hours**	1.5 µg/m³	1.00 µg/m³	0.75 µg/m³	
Ammonia	Annual Average *	0.1 mg/m³	0.1 mg/m³	0.1 mg/m³	
	24 hours**	0.4 mg/m³	0.4 mg/m³	0.4 mg/m³	
Carbon Monoxide (CO)	8 hours**	5.0 mg/m³	2.0 mg/m³	1.0 mg/m³	Non dispersive infrared spectroscopy
	1 hour	10.0 mg/m³	4.0 mg/m³	2.0 mg/m³	

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

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

Note :

1. National Ambient Air Quality Standard : The levels of air quality with an adequate margin of safety, to protect the public health, vegetation and property.

2. Wherever and whenever two consecutive values exceeds the limit specified above for the respective category, it would be considered adequate reason to institute regular / continuous monitoring and further investigations.

3. The State Government / State Board shall notify the sensitive and other areas in the respective states within a period of six months from the date of Notification of National Ambient Air Quality Standards.

(S.O. 384 (E), Air (Prevention & Cont. of Pollution) Act, 1981 dated April 11, 1994).

Table 4

India Standard-Drinking water –Specification- IS 10500:1991

Bureau of India Standards (BIS)

(AMENDMENT NO. 1 JANUARY 1993)

(First Revision) IS 10500: 1991

S.No.	Substance or Characteristic	Requirement (Desirable Limit)	Undesirable Effect outside the Desirable Limit	Permissible Limit in the Absence of Alternate Source	Methods of Test (Ref to IS)	Remarks
1	2	3	4	5	6	7
Essential Characteristics						
I	Color, Hazen units, Max	5	Above 5, consumer acceptance decreases	25	3025 (Part 4) : 1983	Extended to 25 only if toxic substances are not suspected, in absence of alternate sources
II	Odor	Unobjectionable	-	-	3025 (Part 5) : 1983	a. Test cold and when heated b. Test at several dilutions
III	Taste	Agreeable	-	-	3025 (Parts 7 & 8) : 1984	Test to be conducted only after safety has been established
Iv	Turbidity, NTU, Max	5	Above 5, consumer acceptance decreases	10	3025 (Part 10) : 1984	-
V	pH value	6.5 to 8.5	Beyond this range the water will affect the mucous membrane and / or water supply system	No relaxation	3025 (Part 11) : 1984	-
VI	Total hardness (as $CaCO_3$) mg/l, Max	300	Encrustation in water supply structure and adverse effects on domestic use	600	3025 (Part 21) : 1983	-
VII	Iron (as Fe) mg/l, Max	0.3	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures, and promotes iron bacteria	1.0	32 of 3025 : 1964	-
VIII	Chlorides (as Cl) mg/l Max	250	Beyond this limit, taste, corrosion and palatability are affected	1000	3025 (Part 32) : 1988	-
Ix	Residual, free chlorine, mg/l in	0.2	-	-	3025 (Part 26) : 1986	To be applicable only when water is chlorinated.

Standards

						Tested at consumer end. When protection against viral infection is required, it should be Min 0.5 mg/l.
X	Fluoride (as F), mg/l Max	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5	23 of 3025 : 1964	-
Desirable Characteristics						
XI	Dissolved solids mg/l Max	500	Beyond this palatability decreases and may cause gastro intestinal irritation	2000	3025 (Part 16) : 1984	-
XII	Calcium (as Ca), mg/l Max	75	Encrustation in water supply structure and adverse effects on domestic use	200	3025 (Part 40) : 1991	-
XIII	Magnesium (as Mg), mg/l Max	30	Encrustation to water supply structure and adverse effects on domestic use	100	16, 33, 34 of IS 3025 : 1964	-
XIV	Copper (as Cu), mg/l Max	0.05	Astringent taste, discoloration and corrosion of pipes, fitting and utensils will be caused beyond this.	1.5	36 of 3025 : 1964	-
XV	Manganese (as Mn) mg/l Max	0.1	Beyond this limit taste/ appearance are affected, has adverse effect on domestic uses and water supply structures	0.3	35 of 3025 : 1964	-
XVI	Sulphate (as SO_4) mg/l Max	200	Beyond this causes gastro intestinal irritation when magnesium or sodium are present.	400 (see col 7)	3025 (Part 24) : 1986	May be extended up to 400 provided (as Mg) does not exceed 30
XVII	Nitrate (as NO_3), mg/l Max	45	Beyond this methaemoglobinem ia takes place	100	3025 (Part 34) : 1988	-
XVIII	Phenolic compounds (as C_6H_5OH) mg/l Max	0.001	Beyond this, it may cause objectionable taste and odor	0.002	54 of 3025 : 1964	-
xix	Mercury (as Hg) mg/l Max	0.001	Beyond this, the water becomes toxic	No relaxation	(see Note) Mercury ion	To be tested when pollution is suspected

Standards

					analyzer	
Xx	Cadmium (as Cd), mg/l Max	0.01	Beyond this, the water becomes toxic	No relaxation	(See Note)	To be tested when pollution is suspected
Xxi	Selenium (as Se), mg/l Max	0.01	Beyond this, the water becomes toxic	No relaxation	28 of 3025 : 1964	To be tested when pollution is suspected
Xxii	Arsenic (as As), mg/l Max	0.05	Beyond this, the water becomes toxic	No relaxation	3025 (Part 37) : 1988	To be tested when pollution is suspected
Xxiii	Cyanide (as CN), mg/l Max	0.05	Beyond this limit, the water becomes toxic	No relaxation	3025 (Part 27) : 1986	To be tested when pollution is suspected
Xxiv	Lead (as Pb), mg/l Max	0.05	Beyond this limit, the water becomes toxic	No relaxation	(see Note)	To be tested when pollution is suspected
Xxv	Zinc (as Zn) mg/l Max	5	Beyond this limit it can cause astringent taste and an opalescence in water.	15	39 of 3025 : 1964	To be tested when pollution is suspected
Xxvi	Anionic detergents (as MBAS) mg/l Max	0.2	Beyond this limit it can cause a light froth in water	1.0	Methylen eblue extractio n method	To be tested when pollution is suspected
xxvii	Chromium (as Cr^{6+}) mg/l Max	0.05	May be carcinogenic above this limit	No relaxation	38 of 3025 : 1964	To be tested when pollution is suspected
xxviii	Polynuclear aromatic hydrocarbons (as PAH)mg/l	-	May be carcinogenic	-	-	-
Xxix	Mineral oil mg/l Max	0.01	Beyond this limit undesirable taste and odor after chlorination take place	0.03	Gas chromato graph ic method	To be tested when pollution is suspected
Xxx	Pesticides mg/l Max	Absent	Toxic	0.001	-	-
Xxxi	Radioactive materials a. Alpha emitters Bq/l, Max b. Beta emitters pci/l, Max	- -	- -	0.1 1	58 of 3025 : 1964 - -	-
xxxii	Alkalimity mg/l Max	200	Beyond this limit taste becomes unpleasant	600	13 of 3025 : 1964	-
xxxiii	Aluminum (as Al) mg/l Max	0.03	Cumulative effect is reported to cause dementia	0.2	31 of 3025 : 1964	-
xxxiv	Boron (as Bo) mg/l Max	1	-	5	29 of 3025 : 1964	-

Note : Atomic absorption spectrophotometric method may be used.

Table 5
General Standards for discharge of Environment Pollutants
GSR 422(E)-of CPCB, India

THE ENVIRONMENTAL (PROTECTION) RULES, 1986 [1][SCHEDULE - VI]

(See Rule 3A) PART - A : EFFLUENTS

S. No	Parameter	Standards			Marine Coastal Areas
		Inland Surface Water (a)	Public Sewers (b)	Land for Irrigation (c)	(d)
(1)	(2)				
1	Color and Odor	See 6 of Annexure – I	--		
2	Suspended Solids mg/l, Max.	100	600	200	a. For Process waste water - 100 b. For cooling water effluent 10 percent above total suspended matter of influent.
3	Particular size of suspended solids	Shall pass 850 micron IS Sieve	--	--	a. Floatable solids max. 3mm b. Settleable solids max. 850 microns
4	****	**	--	**	--
5	pH Value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
6	Temperature	Shall not exceed 5°C above the receiving water temperature	--	--	Shall not exceed 5°C above the receiving water temperature
7	Oil and Grease mg/l, Max.	10	20	10	20
8	Total residual chlorine mg/l, Max.	1.0	--	--	1.0
9	Ammonical Nitrogen (as N), mg/l, Max.	50	50	---	50
10	Total Kjeldahl Nitrogen (as NH_3) mg/l, Max.	100	--	--	100
11	Free Ammonia (as NH_3) mg/l, Max.	5.0	--	--	5.0
12	Biochemical oxygen demand (5 days at 20°C), mg/l Max.	30	350	100	100
13	Chemical Oxygen demand, mg/l Max.	250	-	-	250
14	Arsenic (as As), mg/l Max.	0.2	0.2	0.2	0.2
15	Mercury (as Hg), mg/l Max.	0.01	0.01	-	0.01
16	Lead (as Pb), mg/l Max.	0.1	1.0	-	2.0
17	Cadmium (as Cd), mg/l Max.	2.0	1.0	-	2.0
18	Hexavalent Chromium (as Cr+6), mg/l Max	0.1	2.0	-	1.0

Standards

19	Total Chromium (as Cr), mg/l Max	2.0	2.0	-	2.0
20	Copper (as Cu), mg/l Max.	3.0	3.0	-	3.0
21	Zinc (as Zn), mg/l Max.	5.0	15	-	15
22	Selenium (as Se.), mg/l Max.	0.05	0.05	-	0.05
23	Nickel (as Ni), mg/l Max.	3.0	3.0	-	5.0
[1]24	**	**	**	**	**
[1]25	**	**	**	**	**
[1]26	**	**	**	**	**
27	Cyanide (as CN), mg/l Max.	0.2	2.0	0.2	0.2
[1]28	**	**	**	**	**
29	Fluoride (as F) mg/l Max.	2.0	15	-	15
30	Dissolved Phosphates (as P), mg/l Max.	5.0	-	-	--
[1]31	**	**	**	**	**
32	Sulphide (as S), mg/l Max	2.0	-	-	5.0
33	Phenolic Compounds (as C_6H_5OH) mg/l Max.	1.0	5.0	-	5.0
34	Radioactive Materials a Alpha emitter micro curie/ml b. Beta emitter micro curie/ml	10^{-7} 10^{-7}	10^{-7} 10^{-7}	10^{-7} 10^{-7}	10^{-7} 10^{-7}
35	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
36	Manganese (as Mn), mg/l Max	2	2	-	2
37	Iron (as Fe), mg/l Max.	3	3	-	3
38	Vanadium (as V), mg/l Max	0.2	0.2	-	0.2
39	Nitrate Nitrogen, mg/l Max.	10	-	-	20
[1]40					

1. Schedule VI inserted by rule 2 (d) of the Environment (Protection) Second Amendment Rules, 1993 notified vide G.S.R. 422 (E) dated 19.05.1993, published in the Gazette No. 174 dated 19.05.1993.
2. Omitted by Rule 2 (d) (i) of the Environment (Protection) Third Amendment Rules, 1993 vide Notification No. G.S.R. 801 (E) dated 31.12.1993.
6 of Annexure - I All efforts should be made to remove color and unpleasant odour as far as possible.

DIESEL GENERATOR SETS: STACK HEIGHT

The minimum height of stack to be provided with each generator set can be worked out by using the following formula:

$H = h + 0.2 \times \sqrt{KVA}$

H = Total height of stack in meter

h = Height of the building I meters where the generator set is installed

KVA = Total generator capacity of the s et in KVA.

Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorized as follows:

For Generator Sets	Total Height of Stack in Meter
50 KVA	Ht. Of the building + 1.5 meter
50 – 100 KVA	Ht. Of the building + 2.0 meter
100 – 150 KVA	Ht. Of the building + 2.5 meter
150 – 200 KVA	Ht. Of the building + 3.0 meter
200 – 250 KVA	Ht. Of the building + 3.5 meter
250 – 300 KVA	Ht. Of the building + 3.5 meter

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

Evolved by CPCB
[Emission RegulationsPart IV: COINDS/26/1986-87]

STANADARDS AND GUIDELINES FOR CONTROL OF NOISE POLLUTION FROM STATIONARY DIESEL GENERATOR (DG) SETS

(A) Noise Standards for DG sets (15-500 KVA)

The total sound power level, Lw, of a DG set should be less than 94+10 log10 (KVA), dB(A), at the manufacturing stage, where, KVA is the nominal power rating of a DG set.

This level should fall by 5 dB(A) every five years, till 2007, i.e. in 2002 and then in 2007.

(B) Mandatory acoustic enclosure/acoustic treatment of room for stationary DG sets (5 KVA and above)

Noise from the DG set should be controlled by providing an acoustic enclosure on by treating the room acoustically.

The acoustic enclosure/acoustic treatment of the room should be designed for minimum 25 dB(A) Insertion Loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5m from the acoustic enclosure/room, and then averaged.

The DG set should also be provided with proper exhaust muffler with Insertion Loss of minimum 25 dB(A).

(C) Guidelines for the manufacturers/users of DG sets 5 KVA and above)

01 *The manufacturer should offer to the user a standard acoustic enclosure of 25 dB(A) Insertion Loss and also a suitable exhaust muffler with Insertion Loss of 25 dB(A).*

02 *The user should make efforts to bring down the noise levels due to the DG set; outside his premises, within the ambient noise requirements by proper siting and control measures.*

03 *The manufacturer should furnish noise power levels of the unsilenced DG sets as per standards prescribed under (A).*

04 *The total sound power level of a DG set, at the user's end, shall be within 2 dB(A) of the total sound power level of the DG set, at the manufacturing stage, as prescribed under (A).*

05 *Installation of a DG set must be strictly in compliance with the recommendation of the DG set manufacturer.*

06 *A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.*

Source : EPA, 1986
[GSR 7, dated Dec. 22, 1998]

Table 6
Rating Chart of the Soil Test Data
(Indian Council of Agricultural Research, New Delhi)

Nutrient	Units	Low	Medium	High
Organic Carbon (as measure of available Nitrogen)	%	Below 0.5	0.5 - 0.75	Above 0.75
Available Nitrogen (N)	Kg/ha	Below 280	280-560	Above 560
Available Phosphorus (P)	Kg/ha	Below 10	10-25	Above 25
Available Potassium (K)	Kg/ha	Below 110	110-280	Above 280

PH			
Acidic	Normal to saline	Tending to become alkaline	Alkaline
Below 6.0	6.0-8.5	8.6-9.0	Above 9.0
Total Soluble salts (Conductivity in Millimhos/cm)			
Normal	Critical for germination	Critical for growth of the sensitive crops	Injurious to most crops
Below 1.0	1.0-2.0	2.0-4.0	Above 4.0

Annexures

ANDHRA PRADESH POLLUTION CONTROL BOARD
2nd Floor, HUDA COMPLEX, MAITRIVANAM, S.R. NAGAR
Phone:23731130, 23734
Fax:040-23733261
Grams:Kalusya Nivaran
Web Site:www.apcpcb.org
E-Mail:apcpcb@hd2.dot.ne

CONSENT ORDER

Addl CTE

BY REGISTERED POST WITH ACKNOWLEDGEMENT DUE

Consent Order No : APPCB/VSP/VSP/26/HO/W/2004/23 225 **Date : 08/04/2004**

(Consent Order for Existing/New or altered discharge of sewage and/or trade effluents/outlet under Section 25/2(of the Act).

CONSENT is hereby granted under section 25/26 of the Water (Prevention & Control of Pollution) Act, 1974 (hereinafter reffered to as 'the Act') and the rules and orders made thereunder to

M /s. Andhra Petrochemicals Ltd
Opp Naval Dock Yard,
Post Box No 1401,
Visakhapatnam.,

(hereinafter referred to as 'the Applicant') authorising to operate the industrial plant to discharge the effluents from the following outlets as detailed below.

Outlet No	Outlet Description	Max Daily Discharge(Ltrs / day)	Point Of Disposal
1	Process Effluents after Treatment	45000.00	Into Open channel which ultimately joins to sea.
2	Cooling & Boiler Blow Down	3389000.00	Septic Tank Followed By Soak Pit.
3	Domestic Effluents	90000.00	Into Open channel which ultimately joins to sea.

This is subject to the provisions of the Act and Rules and orders made there under and further subject to the terms and conditions incorporated in the Schedule A and Schedule B enclosed to this order.

This consent order is valid to manufacture the following products along with quantities only.

1	2 Ethyl Hexanol	110.00 TPD
2	Normal Butanol Or Iso Butanol	148.00 TPD

This consent shall be valid for a period ending with the **28 th day of February 2006**

For and on behalf of the
A.P. Pollution Control Boar

THE ANDHRA PETROCHEMICALS LTD. RECEIVED on 11 MAY 2004 No 2379 VISAKHAPATNAM-16

MEMBER SECRETAR

To
M/s Andhra Petrochemicals Ltd
Opp Naval Dock Yard,
Post Box No 1401,
Visakhapatnam.,

Copy to the J.C.E.E, Zonal Office VISAKHAPATNAM for information and necessary action.
Copy to the Senior Environmental Engineer (Cess) for information and necessary action.
Copy to the Environmental Engineer Regional Office VISAKHAPATNAM for information and necessary action.

A-1

SCHEDULE - A

1 The applicant shall make an application for grant of renewal of consent atleast 30 days before the date of expiry of this consent.

2 Necessary fee as prescribed for obtaining consent shall be paid by the applicant alongwith the consent application.

3 The quality of effluent discharged shall not exceed the figures mentioned in the order.

4 The industry shall immediately submit the revised application for consent to this Board in the event of any change in the trade effluent, raw material used and processes employed.

5 The applicant shall not change or alter either the quality or the quantity or the rate of the discharge or temperature or the route of discharge without the previous written permission of the Board.

6 The effluent discharged shall not contain constituents in excess of the tolerance limits mentioned below.

Outlet No	Parameter	Limiting Standards	
1	pH	6.50 - 8.50	
	Chromium Hexavalent	0.10	mg/l
	Chromium Total	2.00	mg/l
	Total Suspended Solids (TSS at 103 - 105 oC)	100.00	mg/l
	Phenols	1.00	mg/l
	Cyanides as (C)-	0.20	mg/l
	Chemical Oxygen Demand (COD)	250.00	mg/l
	Biochemical Oxygen Demand (BOD 3 at 27 oC)	30.00	mg/l
	Sulphide (as S)	2.00	mg/l

7 The applicant shall develop the green belt around the plant by planting variety of trees in an area atleast 4 times the builtup area.

8 The applicant shall provide appropriate Rain Water Harvesting systems on the available u/s portion of the plant site.

9 Industry shall submit Environmental Statement in Form V before 30 th September every year as per Rule no: 14 of E(P) Act 1986 Rules.

10 The applicant shall display suitable caution board at the place where the effluent is entering any water body or any other place, to be indicated by the Board, indicating therein that the water body into which the effluents are being discharged is not fit for domestic usage/bathing.

11 The applicant shall

Not later than 30 days from the date of issue of this consent order, certify in writing to the Board that the applicant has installed or provided for an alternate electric power source sufficient to operate all facilities installed by the applicant to maintain compliance with the terms and conditions of the Consent. OR

Not later than 30 days from the date of this consent certify in writing to the Board that upon the reduction, loss or failure of one or more of the primary sources of electric power to any facilities installed by the applicant to maintain compliance with the terms and conditions of this consent, the applicant shall halt, reduce or otherwise control production and/or all discharges in order to maintain compliance with the terms and conditions of this consent.

12 The applicant shall at his own cost get the effluent samples collected both before and after treatment and analysed from APPCB or any other Laboratories which are established as per the guidelines of CPCB/M.OEF, GOI, every month for the parameters indicated in condition No.6 and shall submit in duplicate the report thereof to the Board.

13 The applicant shall take immediate action to install mechanical composite sampling equipment and continuous flow measuring/recording devices on the effluent drains of trade as well as domestic effluent discharge and records shall be maintained.

25 Not withstanding anything contained in this conditional letter or consent, the Board hereby reserves to it the right and power under Section 27(2) of the Water (Prevention & Control of Pollution) Act, 1974 to review any and/or all the conditions imposed herein above and to make such variations as deemed fit for the purpose of the Act by the Board.

26 At any time during the inspection of Pollution Control Board Officers or any other licencing/servicing authorities/if it is observed that the industry is not complying with any of the above conditions leading to pollution problems, this consent is liable for cancellation without further notice and all the services rendered by the servicing departments shall be withdrawn without further notice.

27 The industry is liable to pay compensation for any environmental damage caused by it, as fixed by the Collector and District Magistrate as Civil liability.

28 All the rules & regulations notified by Ministry of Environment and Forests, Government of India in respect of management, handling, transportation and storage of hazardous chemicals and waste shall be followed.

29 All the rules & regulations notified by Ministry of Environment and Forests, Government of India in respect of microorganisms, genetically engineered organisms or cells shall be followed.

30 All the rules & regulations notified by Ministry of Law and Justice, Government of India regarding Public Liability Insurance Act, 1991 shall be followed.

31 The applicant shall exhibit the consent order of the board in the factory premises at a prominent place for the information of the inspection officers of the different departments.

32 The applicant shall put up two black boards of size 6 by 4 ft. at the main entrance to their plant. One board shall contain with the specific CFE and CFO conditions, specific to the plant and other board shall carry the latest water,air,noise and solid waste monitoring data as well as the maximum vulunarable zone, if the unit is storing/handling hazardous chemicals.

SCHEDULE - B

Special Conditions:

1 The industry shall comply with Hazardous Wastes (Management and Handling) Rules, 1989 and Amendment thereof.

2 The industry shall remit water cess assessment amounts, as and when issued by the Board.

MEMBER SECRETARY

To
M/s Andhra Petrochemicals Ltd
Opp Naval Dock Yard,
Post Box No 1401,
Visakhapatnam.,

A-14

ANDHRA PRADESH POLLUTION CONTROL BOARD
2nd Floor,HUDA Complex , Ma[illegible]nagar, S.R. Nagar, HYDERABAD
Phone: 23731120, 23734(
Fax: 040-23733261
Grams: Kalaya Nivarana
Web Site: www.apcpcb.org
E-Mail: apcpcb@hd2.dot.n

CONSENT ORDER

BY REGISTERED POST WITH ACKNOWLEDGEMENT DUE

Consent Order No : APPCB/VSP/VSP/26/HO/2004/A/23 225 **Date : 08/04/2004**

(Consent Order for operation of the plant under section 21 of Air(Prevention & Control of Pollution) Act 1981).

Consent is hereby granted under section 21 of the Air (Prevention & Control of Pollution) Act ,1981 (hereinafter reffered to as 'the Act') and the rules and orders made thereunder to

M/s Andhra Petrochemicals Ltd
Opp Naval Dock Yard,
Post Box No 1401,
Visakhapatnam.,

(hereinafter referred to as ' the Applicant ') authorising to operate the industrial plant in the Air Pollution Control Areas as notified from the following Chimneys or outlets and the quantity of Emission discharged per hour on any day shall not exceed the figures as mentioned below.

Chimney No	Description of Chimney	Quantity of emissions in m3/hr. at peak flow
1	Attached to 10 TPH + 12 TPH LSHS fired boiler	-
2	Attached to 59962 kg/hr HP Flare	-
3	Attached to 2940 kg/hr LP Flare	-
4	Attached to 3 x 1.2 K.cal Fired Heaters.	-
5	Attached to Reformer	-
6	Attached to 750 KVA + 3 x 2270 KVA D.G. Sets	-

This is subject to the previsions of the Act and orders made thereunder and further subject to the terms and conditions incorporated in the schedule A and B enclosed to this order.

This consent order is valid to manufacture the following products along with quantities only.

1	2 Ethyl Hexanol	110.00 TPD
2	Normal Butanol Or Iso Butanol	148.00 TPD

This consent shall be valid for a period ending with the **28th day of February 2006**

For and on behalf of the
A.P. Pollution Control Board

MEMBER SECRETARY

To
Andhra Petrochemicals Ltd
Opp Naval Dock Yard,
Post Box No 1401,
Visakhapatnam.,

Copy to the JCEE, Zonal Office VISAKHAPATNAM for information and necessary action.
Copy to the Senior Environmental Engineer (CRSS) for information and necessary action.
Copy to the Environmental Engineer Regional Office, VISAKHAPATNAM for information and necessary action

A-5

SCHEDULE - A

1 The applicant shall make an application for grant of renewal of consent atleast 30 days before the date of expiry of this consent.

2 The industry shall immediately submit the revised application for consent to this Board in the event of any change in the raw material used, processes employed quantity of emissions etc.

3 a). All the fugitive emissions shall be controlled with proper measures.
b). The applicant shall also install the equipment such as wind speed recorder, wind direction recorder and rain fall measuring equipment.

4 The applicant shall at his own cost get the samples of emissions collected and analysed from the A.P.P.C.B. or any other Laboratories which are established as per the guidelines and norms of MoEF & F,OQI and CPCB, New Delhi, every month for the parameters indicated in the condition No.5 and shall submit in duplicate the report thereof to the Board.

5 The emissions shall not contain constituents in excess of the prescribed limits mentioned below.

Chimney No	Parameter	Emission standards (mg/Nm3)

Ambient air quality standards shall not exceed the following :-

SPM - 200 ug/m3, RSPM - 100 ug/m3, SO2 - 80 ug/m3, NOx - 80 ug/m3

Noise Levels: Day time (6 AM to 9 PM) - 75 dB (A)
Night time (9 PM to 6 AM) - 70 dB (A)

6 The applicant shall not change or alter either the prescribed quality or the rate of emission without the previous written permission of the Board.

7 The applicant shall set up three ambient air quality monitoring stations for continuous recording of relevant critical parameters.

8 The applicant shall either:
Not later than 30 days from the date of issue of this consent order certify in writing to the Board that the applicant has installed or provided for an alternative electric power source sufficient to operate all facilities installed by the applicant to maintain compliance with the terms and conditions of the consent.

OR

Not later than 30 days from the date of this consent certify in writing to the Board that upon the reduction loss or failure of one or more primary sources of electric power to any facilities installed by the applicant to maintain compliance with the terms and conditions of this consent, the applicant shall halt, reduce or otherwise control production and/or all emissions in order to maintain compliance with the terms and conditions of this consent.

9 For the emission standards fixed under item 5, the applicant shall increase the stack height so as to ensure that the ground level concentrations notified by the Board are adhered to. In any case the minimum stack height should not be less than 30 meters and as per the ground level concentrations if it works out to be more than 30 meters the calculated stack height should be provided.

10 No control equipment or chimney shall be altered or replaced, erected or re-erected except with the previous approval of this Board.

11 A quarterly progess report shall be submitted to the Board stating therein the progress made in respect of execution of emission control works stated under this consent.

12 The applicant shall provide a sampling port with removable dummy of not less than 15 cm, diameter in the stack at a distance of 5 times the diameter of the stack from the nearest constraint such as bends etc., and they should provide a platform with suitable ladder below one meter of sampling port to accomodate three persons with instruments. The applicant shall also provide a 5amp. 250 V plug point on the platform and also provide adequate personnel, equipments etc., for collecting the samples.

13 The applicant shall also monitor the stack for the prescribed parameters and frequency as approved by the Board and shall maintain records of the emissions and the records shall be made available to the Board when called for.

31 The applicant shall put up two black boards of size 6 by 4 ft. at the main entrance to their plant. One board shall contain with the specific CFE and CFO conditions, specific to the plant and other board shall carry the latest water,air,noise and solid waste monitoring data as well as the maximum vulunarable zone, if the unit is storing/handling hazardous chemicals.

32 Separate power connection with energy meter shall be provided for the Pollution Control Equipments and record of power consumption and chemicals consumption for the operation of pollution control equipment shall be maintained separately.

SCHEDULE - B

Special Conditions

1 The industry shall comply with Hazardous Wastes (Management and Handling) Rules, 1989 and Amendments thereof.

2 The industry shall remit water cess assessment amounts, as and when issued by the Board.

MEMBER SECRETARY

2/14

To
Andhra Petrochemicals Ltd
Opp Naval Dock Yard,
Post Box No 1401,
Visakhapatnam.,

A-8

ANDHRA PRADESH POLLUTION CONTROL BOARD
Paryavaran Bhavan, A-III, [illegible] Balanagar, Hyderabad-500 018
Phones : 040-238875(
040-23887505 (D
Grams : "Kalushva Nivarar
Website : www.apcb.o
E-mail : JCEE_HWM@apcb.o

RECEIVED on 20 JUN 2005 No. 1547
THE ANDHRA PETROCHEMICALS LTD. * VISAKHAPATNAM-24 *

S. Surya Prasad
Jt. Chief Environmental Engineer

Lr. No. VSP-3/PCB/HWM/98-

Dt. 7/6/05

AUTHORISATION

1. Number of Authorisation and date of issue - APPCB/VSP/VSP/26/HWM Dt. 12/05/2005

2. The Dy.General Manager (Production),, M/s. Andhra Petrochemicals Ltd., is hereby granted an authorisation to operate a facility for of Hazardous Wastes namely

(1) **ETP Sludge**	500.00	KiloGrams/Month
(2) **Used / Waste Lubricating Oil**	830.00	Litres/Month
(3) **Containers and Container Liners of Hazardous Waste & Chemicals.**	300.00	Numbers/Year
(4) **Used Lead Acid Batteries**	4.00	Numbers/Year
(5) **Spent Catalyst**	167.00	KiloGrams/Month
(6) **Oxo Residue**	10,916.00	KiloGrams/Month

on their premises located at Opp Naval Dock Yard, Post Box No 1401, Visakhapatnam. Also, The Dy.General Manager (Production), M/s. Andhra Petrochemicals Ltd is authorised to transport above Hazardous Wastes from their premises as following.

(1) **Detoxified Containers and Container Liners of Hazardous Waste & chemicals.**	Authorised Agencies of APPCB.
(2) **ETP Sludge**	TSDF, Dindigal (V), R. R. District.
(3) **Oxo Residue**	Used as Fuel in Boiler. (For Incineration)
(4) **Spent Catalyst**	Authorised Agencies of APPCB.
(5) **Used / Waste Lubricating Oil**	Authorised reprocessors of APPCB / SPCBs.
(6) **Used Lead Acid Batteries**	Authorised Agencies of APPCB.

3. The authorisation is granted for hazardous wastes only.

4. The authorisation shall be in force for a period upto 28/02/2006 from the date of issue.

5. The authorisation is subject to the terms and conditions enclosed at Schedule - A, Schedule - B and to such conditions as may be specified in the rules for the time being in force under the Environment (Protection) Act, 1986.

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SCHEDULE - A

[see rule 3(c) and 5(5)]

[FORM FOR GRANT OF AUTHORISATION FOR OCCUPIER OR OPERATOR HANDLING

1 The industry shall comply with the provisions of the Environment (Protection) Act, 1986 and the Rules made thereunder.

2 The Authorisation or its renewal shall be produced for inspection at the request of any officer authorised by A.P. Pollution Control Board.

3 Any unauthorised change in personnel, equipment and working conditions as mentioned in the application by the person authorised shall constitute a breach of this authorisation.

4 An application for the renewal of authorisation shall be made as laid down in Rule 5 (6) (II) atleast 30 days before the date of expiry of authorisation.

5 APPCB shall renew the authorisation after examining the each case on merit, subject to the following

I) On submission of annual returns by the occupier or operator of a facility in form-4.

II) On evidence of reduction in the waste generated or recycled or reused .

III) On fulfillment of conditions prescribed in the authorisation regarding management of waste in an environmentally sound manner.

6 All the hazardous wastes should be stored in a secured way so that they do not cause leachate problem or are carried away with run-off water during rains.

7 The occupier shall demarcate the secured storage area with a sign board indicating the name of hazardous waste.

8 First Aid box, Masks,Fire control equipments and other safety devices shall be provided to meet emergency situations.

9 The occupier shall educate the workers and nearby public of possible accidents and remedial measures.

10 For any accident or spillage of hazardous wastes causing damage to the Environment, the occupier or the transporter as the case shall be held responsible.

11 Weak acids, spent acids, spent chemicals, unrecovered solvents and chemicals should be collected, properly accounted and disposed to the institutions authorised by APPCB or other SPCBs. Necessary records should be maintained for this.

12 In case of closure of industry, the un-used/not consumed raw materials falling under the category of Hazardous Chemicals under Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 and Amendment Rules,2000 shall be removed and sold to other units within 90 days from the date of closure to prevent any possibilty of occurance of an accident. In case the above hazardous chemicals have lost their properties originally required, then they shall be treated as Hazardous Waste and they should be disposed off only to the APPCB authorised agencies in a safe manner.

24 Industry should maintain good housekeeping with respect to all solid wastes,liquid wastes and effluents.

25 No Hazardous Wastes shall be mixed with any other wastes or shall be discharged to a common , other internal , external sewerage or other drainage system without prior approval of APPCB.

26 If HDPE bags are used for storing Hazardous Wastes, it should be ensured that they are perfectly sealed mechanically or double hot sealed.

27 If MS/HDPE bags or drums are used for storing Hazardous Wastes, these drums / bags should be ensured that they are perfectly sealed.

28 The Hazardous Wastes packed in HDPE bags or MS / plastic drums should be stored in a covered shed on a raised platform with leachate management system.

29 The industry shall follow the Guidelines for setting up of operating facility for Hazardous Waste Mangement published by CPCB (Documents series Hazwams / 11/ 98 - 99).

30 Andhra Pradesh Pollution Control Board reserves the right to review, impose additional condition or conditions, revoke, change or alter the terms and conditions of this authorisation. Also the Board reserves the right to withdraw the authorisation without any Prejudice / Notice on receiving any complaints by the Board regarding Environmental Pollution problems caused by the industry.

31 The person authorised shall not rent, lend, sell, transfer their industrial premises without obtaining prior permission of the State Pollution Control Board.

32 The authorised person shall take prior permission of the State Pollution Control Board to close down their Hazardous waste facility.

33 The industry shall dispose / sell recyclable wastes such as waste / used oil, used lead acid batteries and non - ferrous metal scrap to only the Agencies / Industries which are having valid Authorisation of APPCB and valid registration of MoEF, GOI or CPCB.

34 The industry shall comply with the provisions of Batteries (Management & Handling) Rules, 2001.

35 The industry shall provide secured temporary storage facility for storage of hazardous wastes.

36 The industry shall ensure the sale or bulk auctions in accordance with the HWM Amendment Rules, 2003.

37 The industry shall putup two sign boards (6x4 ft. each) at publicly visible places at the main gate. The first sign board shall provide information on conditions of CFE & CFO, and the second sign board shall provide information on release of pollutants - air emissions, water discharges and solid waste with details like quantity, nature of Hazardous chemicals being used in the plant and Hazardous Wastes generated etc.

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SCHEDULE - B

[see rule 3(c) and 5(5)

[FORM FOR GRANT OF AUTHORISATION FOR OCCUPIER OR OPERATOR HANDLING HAZARDOUS WASTES]

1 Industry shall give top priority for waste minimisation and cleaner production practices. Industry shall submit action plan for minimisation of hazardous wastes within three months from the date of issue of the authorisation.

2 Industry shall dispose / sell the Catalyst to only industries / agencies authorised by State Pollution Control Boards.

3 Industry shall maintain 6 copy manifest system for transportation of waste generated and a copy shall be submitted to Board Office and concerned Regional Office.

4 Industry shall maintain good house keeping & maintain proper records for Hazardous Wastes stated in Authorisation (FORM II).

5 The industry shall immediately lift all the hazardous waste accumulated to TSDF.

6 The industry shall immediately put a stripper and strip the hydro carbons from the effluents before sending them for treatment to ETP as lot of smell (Hydro Carbons) was observed at various places within the plant, near the ETP and at the HW storage yard during inspection.

7 The industry may use antifoaming agents in the aeration pond to prevent froth formation. Further, the industry has to improve the performance of ETP.

8 The industry shall erect display boards both in English and Telugu outside the entrance gate.

9 The Industry shall submit the condition wise compliance report of the conditions stipulated in Schedule A and Schedule B of this Authorisation halfyearly basis to Board Office, Hyderabad and concerned Regional Office.

JOINT CHIEF
ENVIRONMENTAL ENGINEER

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ANNEXURE:VIII

AIR CONSENT NO.APPCB/VSP/VSP/26/HO/2004/A/23/225 DT.08.04.2004

SCHEDULE - A

1. Submission of application:
Condition noted.

2. Changes in Raw materials & Process, Air pollution Control equipment
Condition will be complied.

3. a) All fugitive emissions are monitored and controlled .

b) We have installed automatic weather monitoring equipment for wind speed and direction, rain fall measurement and recording. We are submitting monthly wind rose diagram to Regional Office, A.P.Pollution Control Board on monthly basis.

4. Submission of Analysis Reports:
- We are submitting stack emission analysis reports for MP Boiler, LP Boiler, DG Set, Reformer and analysis reports for Ambient Air Quality on monthly basis to APPCB.

5. Quality of Ambient Air
The quality of Ambient Air is within the standards as stipulated in Air Consent order in respect of SPM, SO2 & NOX.

6. Quality or rate of emissions
Condition complied.

7. Ambient Air Quality monitoring stations:
We have set up 3 high volume samplers and we are monitoring Ambient Air Quality by operating all 3 high volume samplers simultaneously for 2 days in a week.

8. Alternate Electric Power
Condition complied.

lan/ts/air&wat

A-15

(K. NARASAYYA)
General Manager (Operations & Tech. Services)

9. Stack heights
   - The heights of all stacks except for stack pertaining to 750 KVA DG set are more than 30 meters height.
   - The stack height of 750 KVA DG set is 11 meters. 750 KVA DG set is operated only in case of power failure of A.P.Transco Power and failure of 2270 KVA DG sets (3 nos) together, which is a remote possibility. 750 KVA DG set is operated for a total of 24 to 48 hours duration in one year.

10. Alteration of equipment/chimney
    Condition noted.

11. Emission Control works
    Condition noted.

12. Sampling portal
    Condition complied.

13. Records on stack monitoring:
    We are maintaining records of stack emissions for parameters prescribed by AP.Pollution Control Board.

14. Disposal of solid wastes
    We are disposing discharged catalysts to parties, who have got valid authorisation from State Pollution Control Boards for reprocessing.
    ETP sludge disposed to M/S RAMKY ENVIRO ENGINEERS LTD., (HWMP) who are the authorised representatives of APPCB.

15. Accidents/unforseen accident
    Condition noted.

16. Episodal discharge
    Condition noted.

17. House Keeping
    Condition complied.

18. Directives/Orders from AP.Pollution Control Board.
    Condition complied.

lan/ts/air&wat

19. Maintenance of Inspection books, stack emission records & Ambient Air Quality records
Condition complied.

20. Green Belt around the plant
Condition complied.

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21. Rain water Harvesting system

- Our plant is situated in the leased lands of Visakhapatnam Port Trust and the land is a reclaimed land. The total plant soil is saline and the water table underneath is brackish water. It is not possible to adopt the rain water harvesting system.

- We have constructed 2 pits of sizes 6x6x6 feet and 2 pits of sizes 3x3x6 feet at our R&D Centre, Mindi against Neeru-Meeru programme for conservation of surface & Ground water resources.

22. Submission of Environment statement
Condition complied.

23. Control equipment and efficiency of equipments for improving emission levels
Condition noted.

24. Compliance of consent condition
Condition noted.

25. Compensation for environmental damage
Condition noted.

26. Rules and regulations notified by Ministry of Environment & Forests, Govt of India, in respect of storage, handling and transportation of hazardous chemicals and hazardous wastes

Condition complied.

lan/ts/air&wat

27. Rules and regulations notified by Ministry of Environment and Forests, Government of India, in respect of micro organisms.

Condition will be complied.

28. Rules and regulations notified by Ministry of Law Justice, Govt of India, in respect of Public Liability.

Condition complied.

29. Stack height for DG sets

- Minimum stack height for 2270 KVA DG sets has been considered.

30. Display of Consent Order

Condition complied.

31. Display of CFE, CFO conditions and data on latest water air noise & solid waste pollution monitoring levels.

2 Nos Black boards have been put up.

32. Separate power connection & energy meter
Condition complied.

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1. All the rules stipulated in Hazardous Wastes (Management and handling) rules, 1989 and amended rules, 2000 - are being complied.

2. Water Cess amount is being remitted on regular basis.

lan/ts/air&wat

ANNEXURE-III

COMPLIANCE REPORT FOR WATER CONSENT ORDER NO.APPCB/VSP/VSP/26/HO/W 2004/23-225, DT.08.04.2004,
SCHEDULE = A

1. Submission of application:
   Condition will be complied.

2. PAYMENT OF FEE
   Condition will be complied.

3. Quantity of effluents:
   The quantity of effluents discharged are within the limits specified by A.P.Pollution Control Board.

4. Changes in Raw materials & Process
   Condition will be complied.

5. Changes in quantity, quality of Trade effluents, route of discharge
   a) Condition complied.

6. The parameters of treated effluents are within the tolerance limits as stipulated by APPCB.

7. Green Belt
   Condition complied.

8. Rain water Harvesting systems
   - Our plant is situated in the leased lands of Visakhapatnam Port Trust and the land is a reclaimed land. The total plant soil is saline and the water table underneath is brackish water. It is not possible to adopt the rain water harvesting system.

   - We have constructed 2 pits of sizes 6x6x6 feet and 2 pits of sizes 3x3x6 feet at our R&D Centre, Mindi against Neeru-Meeru programme for conservation of surface & Ground water resources.

9. Submission of Environment statement in Form-V
   Condition will be complied.

10. Display of caution board
    Condition complied.

11. Alternate Electric Power source to operate Effluent Treatment Plant
    Condition complied.

lan/ts/air&wat

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(K. NARASAPPA)
General Manager (Operations & Tech. Services)
The Andhra Petrochemicals Limited

12. Submission of analysis reports for Trade effluent (before and after treatment).
We are submitting the analysis reports for effluents (before and after treatment), domestic effluent, to APPCB on monthly basis.

13. Mechanical composite sampling equipment
Condition complied.

We have installed V-Notches in treated trade effluent drain and domestic effluent drain. A record of daily effluent quantity is being maintained. Effluent quantity for the quarter is being furnished in quarterly report to AP Pollution Control Board.

14. Storm water mixing with trade/domestic effluents
Condition complied.

15. Information on progress of work.
a) Quantity of discharge of effluents for the quarter has been submitted in quarterly report.

b) We are submitting analysis reports of domestic effluent, Raw effluent, Final effluent on monthly basis.

16. a/b We have installed water meters at supply point for Municipal water supply, borewell water supply and sea water make up to Cooling tower.

c. We are regularly submitting water cess returns in Form-1, on monthly basis.

17. Storage and disposal of Solid wastes
- The sludge generated from ET Plant is presently stored in one of the sludge drying beds and capacity available in dried sludge drying bed is adequate to store the sludge for minimum 2 years of plant operation. ETP sludge disposed to M/S RAMKY ENVIRO ENGINEERS LTD., (HWMP) who are the authorised representatives of APPCB.

- We have categorised waste materials and we are storing the wastes and maintaining the records as per the guidelines issued by AP Pollution Control Board.

18. Toxic materials = Disposal as per Hazardous wastes = (Management & Handling)= rules:
Condition noted.

19. Upset condition in the plant
Condition will be complied.

20. House keeping in the plant = Washings in the plant:
Condition complied.

lan/ts/air&wat

21. Directives/Orders issued by Board
Condition complied.

22. Inspection book
Condition complied.

23. Information on Operation of plant and effluent treatment plant
Condition complied.

24. Separate power meter with energy connection
Condition complied.

25. Water act. 1974 and compliance of conditions
Condition noted.

26. Compliance of consent conditions
Condition noted.

27. Compensation for any environmental damage
Condition noted.

28. Rules and Regulations notified by Ministry of Environment and Forests, Govt of India, - Storage, handling and transportation of hazardous chemicals
Condition complied.

29. Rules and Regulations notified by Ministry of Environment, Govt of India.
Micro Organisms genetically engineered Organism
Condition noted.

30. Rules & Regulations - Ministry of Law & Justice, Govt of India
Condition complied.

31. Display of consent conditions
Condition complied.

32. Display of CFE & CFO conditions
a) Black Boards have been put up. Displaying Inventory of Hazardous waste material and specific CFO condition is made.

SCHEDULE-B

1. All the rules stipulated in Hazardous wastes (Management and handling) rules, 1989 and amended rules, 2000 are being complied.

2. Water Cess amount is being remitted on regular basis.

lan/ts/air&wat

The Andhra Petrochemicals Limited

APL/TS/2006 SEPTEMBER 22, 2006

THE MEMBER SECRETARY
A.P.POLLUTION CONTROL BOARD
PARIAVARAN BHAVAN
A-3, INDUSTRIAL ESTATE
SANATH NAGAR
HYDERABAD – 500 018

Dear Sir,

Sub: Environment Statement for the year 2005 - 2006.

* * *

We are enclosing herewith 2 copies of Environment Statement in Form-V for the Financial year 2005 - 2006 as per the terms and conditions of Consent Order.

Thanking you.

Yours faithfully,
For THE ANDHRA PETROCHEMICALS LIMITED

(Dr. V.N.RAO)
CHIEF EXECUTIVE

Encl: As above.

CC: Environmental Engineer
A.P. Pollution Control Board
6th floor, Udyog Bhavan Complex
Siripuram Junction
Visakhapatnam - 530 003.

statutory / form5

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FACTORY : Opp. NAVAL DOCKYARD, POST BOX NO. 1401, VISAKHAPATNAM - 530 014
Phones : (0891) 2578340 - 43, Fax : 2577751, Grams : PETROCHEM, E-mail : andpetro@sancharnet.in
REGD. OFFICE : VENKATARAYAPURAM, TANUKU - 534 216, W. G. DIST., A.P. INDIA.

[FORM-V]
(See rule 14)

Environmental Audit report for the financial year ending the 31st March 2006.

PART-A

i) Name and address of the occupier of the industry operation or process	:	Mr . M. THIMMARAJA DIRECTOR The Andhra Petrochemicals Ltd Opp: Naval Dockyard, P.B.No.1401 VISAKHAPATNAM - 530 014
ii) Date of the last environment audit report submitted	:	September 29, 2005

PART-B

Water and Raw Material Consumptions

I) Water consumption m3/day process & steam	:	167.333 KLD (Boiler feed) + 41.295 KLD (For DM plant) on average regeneration)) basis
Cooling	:	181.95 KLD + 1759.63 KLD (Raw water) (Sea water)
Domestic	:	90 KLD

PART-C

Pollution Generated

(Parameters specified in the consent issued)

I. Pollutants	Quantity of pollution generated		Percentage of variation from prescribed standards with
	As per Consent order	Average basis reasons	
	(KLD)	(KLD)	
a) Water			
Trade effluents parameters (Process)	45	19.64	Analytical of final effluents are within standards.
Boiler blow down & DM plant regeneration	101	82.80	
Domestic	90	33.87	
Cooling water system blow down (Raw water + sea water)	3288	1189.45 KLD	
	3524	1325.76 KLD (ON AVERAGE BASIS)	
b) Air	--	Quality & quantity of stack emissions are within the limits specified in Air Consent Order.	
	--	SO2, NOX & CO in ambient air are within the limits specified in Air Consent Order.	

PART – D
HAZARDOUS WASTES
(as specified under Hazardous Wastes (Management and Handling Rules, 1989)

Hazardous wastes	Total quantity	
	during the previous financial year 2004 – 2005	during the current financial year 2005 – 2006
a) From process	---	---
b) From pollution control facilities (sludge generated from Effluent Treatment Plant)	1.50 Tonnes (Dry basis)	2.025 Tonnes
c) Waste Lube Oils	12200 litres	9800 litres
d) Empty containers of Hazardous Wastes & Hazardous chemicals	955	1351 Nos
e) Oxo Residue	2479 Tonnes	2853 Tonnes
f) Used lead Acid batteries	36 Nos.	37 Nos.

PART - E
SOLID WASTES

	TOTAL QUANTITY	
	during the previous financial year 2004 – 2005	during the current financial year 2005 – 2006
a) From process	---	---
b) From pollution control facility	---	---
c) Quantity recycled or re-utilised	---	---
d) Spent catalyst discharged from process	11.979 Tonnes	36.575 Tonnes

PART-F	Annexure enclosed
PART-G	Annexure enclosed
PART-H	Annexure enclosed

statutory / form5

PART - F

Please indicate the characteristics (in terms of concentration and quantum) of Hazardous as well as solid wastes and indicate disposal practices adopted for both these categories of wastes.

1. The sludge generated from ET Plant is dried and stored in one of the sludge drying beds.

2. Lube oils removed from plant from various machinery are stored in area earmarked for the purpose. We have taken trial runs using waste lube oils generated in the plant as fuel for boilers, while mixing in small proportion with LSHS.

3. We are storing the catalysts discharged from plant in a covered shed. We are disposing catalysts to parties, who use them in their process and who are approved by Pollution Control Boards to carry out such process involving our spent catalysts.

4. We are using Oxo Residue as fuel for our LP Boiler.

PART - G

Impact of pollution control measures on conservation of natural resources and consequently on the cost of production.

1. Purge gas generated from process is used in Reformer and excess gas flaring is minimised to the extent possible.

2. The excess gas generated from Fuel gas system after utilising it for reformer, is used as fuel for pilots of flares and thereby the consumption of Propylene/LPG Gas for pilots is minimised.

3. Development of plantations is being carried out in systematic and scientific manner. In this development 65 saplings were planted till August, 2006 and the total number of plants existing in our plant premises is 14,230.
   (Note: 100 plants fallen during the cyclone in the month of August, 2006).

4. Effluent treatment plant, HP Flare & LP Flare and Water stripper are operated on continuous basis to minimise the Water pollution and Air Pollution on environment. Improved Microbial cultures have been introduced for better performance of Effluent Treatment Plant.

5. At our R&D centre, Mindi two pits are in use for conservation of surface ground water as part of Neeru – Meeru programme.

6. Effluent Treatment Plant equalisation tank was covered with concrete slab and a stack of 8 M height was provided. This stack contains packed bed of catalyst to absorb any strong odour fumes coming from the equalization tank.

IMPACT ON COST OF PRODUCTION

The cost of production has increased by 0.35% for pollution control measures over the cost of production estimated for manufacturing and other overheads considered for process.

PART - H

Additional investment proposed for environmental protection including abatement of pollution.

1. It was planned to plant about 100 saplings as part of maintenance of existing plantation.
2. It was planned to instal the facility for recycle of off-spec effluent from final treatment tank to a separate effluent collection pit. This proposal facilitates to reprocess the final effluent during any upset and will further help us to serve for better environmental protection.

LABOURATORY ANALYSIS REPORT

SAMPLE NAME : RAW EFFLUENT
SOURCE : ETP

Parameter	Units	July	Aug	Sep	Oct	Nov	Dec
pH		11.8	12	11.8	11.9	12.1	12
COD	mg/L	16000	16800	16000	16400	15600	16200
BOD(27dec.c3days)	mg/L	7600	7900	8100	7900	8100	7800
TSS	mg/L	96	110	90	106	98	92
Sulphide as S	mg/L	0.22	0.24	0.22	0.18	0.16	0.14
Cyanide as CN	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Phenolic Comp	mg/L	0.16	0.18	0.16	0.16	0.14	0.12
Total Chromium as Cr	mg/L	0.12	0.14	0.12	0.14	0.12	0.14
Hexavalent Chromium as Cr	mg/L	BDL	BDL	BDL	BDL	BDL	BDL

NOTE:BDL=<0.03mg/L

SAMPLE NAME : DOMESTIC EFFLUENT
SOURCE : ---

Parameters	Units	July	Aug	Sep	Oct	Nov	Dec
pH	-	7.8	7	8	7.7	7.8	7.4
COD	mg/L	36	40	60	36	44	36
BOD(27dec.c3days)	mg/L	12	14	12	10	12	11
TSS	mg/L	21	10	15	12	18	15
Sulphide as S	mg/L	0.18	0.16	0.18	0.16	0.18	0.14
Cynide as CN	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Phenolic Comp	mg/l	0.16	0.14	0.16	0.14	0.16	0.12
Chromium as Cr+2	mg/L	0.08	0.06	0.08	0.06	0.08	0.06
Chromium as Cr+6	mg/L	BDL	BDL	BDL	BDL	BDL	BDL

NOTE:BDL=<0.03mg/L

STACK ANALYSIS REPORT

UNITS: ug/Nm3

	SPM ug/Nm³			
Month	DG Stack	MP Boiler Stack	LP Boiler Stack	Reformer Stack
July	110	96	26	20
Aug	105	83	24	20
Sep	NM	90	26	24
Oct	90	103	22	18
Nov	106	96	28	NM
Dec	NM	90	NM	20

NOTE:NM-Not Monitored

MONTHLY DATA REPORT FOR AMBIENT AIR QUALITY

PERIOD : 24 HOURS
PARAMETERS : SPM,SO_2.NO_x
UNITS :ug/m3

S.NO	SAMPLING STATION	MONTH & YEAR	SPM 98 PERCENTILE VALUE	SO_2 98 PERCEN - TILE VALUE	NO_x 98 PERCENTILE VALUE
1.	PLANT GATE	JUN-06	186.91	37.30	32.16
		JUL-06	175.04	25.96	22.63
		AUG-06	148.31	23.20	22.97
		SEP-06	184.45	32.42	22.89
		OCT-06	188.47	28.26	24.97
		NOV-06	182.79	23.98	26.84
		DEC-06	187.76	23.49	32.64
2.	PUMP HOUSE	JUN-06	187.18	33.11	33.89
		JUL-06	136.06	25.64	23.01
		AUG-06	111.70	26.27	24.91
		SEP-06	157.03	30.29	23.87
		OCT-06	162.07	31.37	28.95
		NOV-06	189.94	35.46	27.52
		DEC-06	169.60	28.62	33.97
3.	FLARE	JUN-06	182.57	23.38	34.84
		JUL-06	159.99	22.10	24.39
		AUG-06	150.06	23.27	25.34
		SEP-06	167.78	28.61	23.47
		OCT-06	160.01	28.62	25.88
		NOV-06	181.60	24.97	25.38
		DEC-06	190.97	27.00	26.90