Environmental Impact Assessment Report

# Proposed Drug Intermediates Manufacturing Plant
## by
## M/s R. P. Intermediates
## at
## Village - Shernagar, District - Muzaffarnagar (Uttar Pradesh)

**Submitted to:**
**R. P. Intermediates**

**August 2010**

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**Client:** R. P. Intermediates

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| | | | | | |

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## ABBREVIATION

| | |
|---|---|
| AAQMS | Ambient Air Quality Monitoring System |
| AP | Assembly Points |
| Avg. | Average |
| BOD | Biological Oxygen Demand |
| CCG | Central Crisis Group |
| CGWA | Central Ground Water Authority |
| cm | Centimeter |
| COD | Chemical Oxygen Demand |
| COD | Carbon Monoxide |
| CPCB | Central Pollution Control Board |
| D Base | (1R,2R)-2-amino-1-(4-nitrophenyl) propane-1,3-diol |
| dB(A) | Decibel (A) |
| DCG | District Crisis Group |
| DG | Diesel Generator |
| DMP | Disaster Management Plan |
| E | East |
| ECC | Emergency Control Centre |
| ECO | Emergency Co-ordination Officer |
| EIA | Environmental Impact Assessment |
| EMP | Environmental Manangement Plan |
| EPO | Emergency Planning Officer |
| EQMP | Environmental Quality Monitoring Plan |
| ETP | Effluent Treatment Plant |
| EW | Essential Workers |
| E-W | East to West |
| g/cm3 | Gram per cubic centimeter |
| GLC | Ground Level Concentration |
| HCl | Hydrochloric Acid |
| HCl | Hydrocarbon |
| HDPE | High Density Polyethylene |
| HP | Horse Power |
| HSD | High Sulphur |
| HSE | Health Safety and Environment |
| IC | Incident Controller |
| IMD | Indian Meteorological Department |
| ISCST-3 | Industrial Source Complex Short Term Model |
| K | Kelvin |
| kg | Kilogram |
| KL | Kilolitre |
| KLD | Kilolitre per Day |
| km | Kilometer |
| KP | Key Personnel |

| | |
|---|---|
| KVA | Kilovolt-ampere |
| L Base | (1S,2S)-2-amino-1-(4-nitrophenyl) propane-1,3-diol |
| LCG | Local Crisis Group |
| Leq | Equivalent Noise level |
| Lmax | Mximum Noise level |
| Lmin | Minimum Noise level |
| LPD | Litre per Day |
| LT- | Long Term Negetive Impact |
| LT+ | Long Term Positive Impact |
| m | meter |
| m/s | Meter per second |
| MAH | Major Accident Hazard |
| Max. | Maximum |
| MDCA | Methyle Di Chloro Acetate |
| mg/L | Miligram per Litre |
| Min. | Minimum |
| MINAS | Minimum National Standard |
| mm | Milimeter |
| mmhos/cm | Micromhos per Centimeter |
| MoEF | Ministry of Environment and Forest |
| MSIHC | Manufactue, Storage and Import of Hazardous Chemicals Rules, 1989 |
| MT | Metric Ton |
| N | North |
| NAAQS | National Ambient Air Quality Standard |
| NaOH | Sodium Hydroxide |
| NH | National Highway |
| NOx | Oxides of Nitrogen |
| N-S | North to South |
| NT | Not Traced |
| NTU | nephelometric Turbidity Unit |
| NW | North West |
| oC | Degree Centigrade |
| P-G | Pasquile-Gifford |
| PM10 | Particulate Matter Less than 10 micron size |
| PM2.5 | particulate Matter Less than 2.5 micron Size |
| PPE | Personal Protective Equipments |
| PR&A | Public Relation and Administration |
| PVC | Polyvinyle Chloride |
| RCC | Reinforced Concrete Cement |
| S-Base | 2-amino-1-(4-nitrophenyl)-1,3-Propanediol |
| SCG | State Crisis Group |
| SE | South East |
| SGWB | State Ground Water Board |

| | |
|---|---|
| SH | State Highway |
| SMC | Site Main Controller |
| SO2 | Sulphur-di-oxide |
| sq.m. | Square Meter |
| ST- | Short Term Negetive Impact |
| ST+ | Short Term Positive Impact |
| STP | Sewage Tretment Plant |
| SWD | Side Water Depth |
| TOR | Terms of References |
| TSDF | Tratment, Storage, Disposal Facility |
| u/s | under section |
| UPPCB | Uttar Pradesh Pollution Control Board |
| USEPA | United State Environment Protection Act |
| viz. | Namely |
| VOC | Volatile Organic Compound |
| W | West |
| WNW | West North West |
| WSW | West South West |
| $\mu g/m^3$ | Microgram per cubic Meter |

## EXECUTIVE SUMMARY

### Background & Objective of the Study

M/s R.P. Intermediates proposes to establish a small scale pharmaceutical raw materials manufacturing facility at 8th km, Jansath Road, near Rana Papers, Muzaffarnagar and has acquired land for the same The proposed intermediate raw materials are L base, D base, Chloramphenicol Powder and Chloramphenicol Palmitate These raw materials are used in pharmaceutical industries and the number of pharmaceutical industries is increasing day by day due to heavy demands of Medicines by the public. The increase in population is instrumental in these demands. A large number of Pharmaceutical Units have also been established in the State of Uttarakhand recently and the proposed raw materials would also be in demand there.

### Project Description

The proposed Drug intermediate to be manufactured are L base, D base, Chloramphenicol Powder and Chloramphenicol Palmitate These intermediates are used as raw materials in pharmaceutical industries and the number of pharmaceutical industries is increasing day by day due to heavy demands of Medicines by the public.

*Land Requirement*

Land Measuring 0.179 Hectare was purchased in the year of 2001. The deed of execution of the land was done in 2001 and soon after purchase declaration u/s 143 was obtained from the district court.

*Fuel Requirement*

A list of the Raw Material required and its quantity is sketched in the following Table.

| **Raw Material** | **Quantity / Month** |
|---|---|
| S-Base | 2000Kg |
| HCl | 18 Kg |
| NaOH | 60Kg |
| M.D.C.A. | 434 Kg |
| Methanol | 603Kg |
| Powder Activated Carbon | 48Kg |
| Acetone | 480Kg |
| Pyridine | 50Kg |
| Palmitoyl Chloride | 164Kg |

*Water Requirement*

The source of water shall be tubewell that is to be installed in the unit's premise. It is estimated that a maximum of 200 litres per day will be required as process water. A part of this will be recycled. Besides 2.0 KLD is the domestic water requirement.

*Power Requirement*

A power load of 30 kva is required for functioning of proposed project. The proponent has already applied to State Electricity Board for the connection.

A DG Set of Capacity 30 KVA will be installed. The consumption of HSD in the DG Set will be around 25-30 litre per day.

A baby boiler having a rated capacity of 20 kg of steam per hour based on Diesel fuel will be installed for production of steam for process. Tha daily consumption of diesel would be around 40-50 litre per day.

*Manpower Requirement*

The details of manpower requirement are given in following Table.

| | |
|---|---|
| No. of Personnel | 9 |
| Working hours per shift | 8 |
| No. of shift per day | One |
| No. of Working Days per year | 300 |

***Sources of Pollution and Control***

*Air Pollution*

The main air pollution sources from the proposed unit are Baby boiler and DG set. The baby boiler having a rated capacity of generating 20 kg of steam per hour would be based on diesel fuel. The stack of the boiler would be kept 10 m above the roof top.

Regarding the DG Set there would not be any air pollution problem since this would be fitted with catalytic converter as OEM component and the stack height would be 10 m above the building roof top so that the Particulate Matter, $SO_2$ and $NO_x$, if any, get dissipated in the atmosphere

*Water Pollution*

The total wastewater generated from the unit shall not exceed 200 litres per day level. This will be treated in an On-site ETP. The treated effluent will be discharged in the nearby nallah. The sludge shall be dried on sludge drying beds and periodically the sludge cakes shall be removed and disposed off suitably.

Domestic wastewater shall not be allowed to mix with plant effluent and a separate septic tank along with soak pit shall be provided.

*Noise Pollution*

The main sources of noise pollution from the proposed unit are DG Set, Boiler and rotating equipments.

The DG Set shall be housed in a closed chamber having provision for the fresh air.

The blower of the boiler and all the rotating equipments shall be mounted on vibration packing.

*Waste Generation*

The solid and hazardous wastes generated from the plant operations will be of four different categories as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008. The company will provide adequate separate storage area for the storage of each type of hazardous/ solid wastes proposed to be generated from the plant. The hazardous waste storage area will have RCC flooring and covered roof to avoid rainwater mixing with the same. A leachate collection system will be provided for the treatment and disposal of leachate, which will be generated from the storage area..

**Description of the Environment**

Primary baseline environmental monitoring studies were conducted during summer season of Year 2010 (March to June) and details are as follows:

***Site Environs***

The site is located at Village : Shernagar, Muzaffarnagar on State Highway 12 A (Jansath Road) between Muzaffarnagar-Jansath Section having Latitude and Longitude of 29°25'28.12" N and 77°45'33.44" E respectively. The project area consists of Industrial, Semi Urban as well as Rural Environment.

***Topography & Geology***

The Study area is part of Alluvial Belt made up of undifferentiated quarternary sedimentation. These mainy comprise of sand and Clay with kankar. The sand beds constitute highly rich aquifers.

The area slopes towards southwest with an average gradient of 1.5m/km. The general elevation of the alignment varies between 245 m to 260 m above mean sea level. However, the elevation of the project site and surroundings varies between 242m to 248 m.

***Climate***

It is found that the Study Area has predominantly four seasons namely – Summer (mid-March to June), Monsoon (July to mid-September), Post-monsoon (mid-September to November) and Winter (December to February). It has a subtropical climate characterized by high temperature, low humidity, and medium to scanty rainfall.

***Micro-Meteorology***

As per the Secondary Data Collected from IMD for the Study Area, the month of August seems to be the most wet month and the month of April the driest month of the year. The study area receives the maximum rainfall during July and August.

As per the secondary data collected from IMD for the study Area, the hottest month in the study area is May and the coldest month is January. The Temperature of the study area varies from 5.8$^{o}$C in January to 35.4$^{o}$C in May.

The analysis of the average wind pattern shows predominant winds from W, WSW, WNW and NW with wind frequencies of 9.75 %, 10.1 %, 8.03 % and 8.15 % respectively. The calm conditions were prevailed for 18.08 % of the total time. Average wind speed of the Study Area is 2.73 m/s.

***Soil Characteristics***

In the proposed study soil quality are influenced to a very limited extent by the topography, vegetation and parent rock. However, the variations in soil profile are much more pronounced because of the regional climatic differences. The soil of this zone has developed under semi-arid condition. The sub-surface geological formations of the buffer area (7 km radius) comprise of sand, silt, clay and kankar in various proportions . Its characteristics in the districts of Uttar Pradesh is part of Gangetic alluvium while in Yamuna Nagar, Ambala, Patiala and Ludhiana these are non-calcareous and sandy loam on the surface, and loam to clayey loam at depth and placed under the classification as Udipsamments/Udorthents

Soil samples were collected from the project site as well as from nearby areas to access the soil characteristics in the study area. The soil samples collected from the project site reveal sandy loam characteristics and brown in color.

***Landuse***

The prevalent landuse of the study area is agricultural (61.73 %). Rest of the land is either fallow land or human settlements. The region has a mix of medium and high fertility soils. The soils of medium fertility are single croplands, while the highly fertile soils are suitable for double crops. The main agricultural

produce of the area is food grains (wheat, barley, gram, rice, maize), sugar cane, tilhan, and potato. Both Rabi and Khariff crops are harvested.

***Water Environment***

The proposed project site is located at Upper Ganga Basin (Upstream of Gomti in Confluence to Muzaffarnagar). The flow in the basin is largely contributed by the south-westerly monsoon winds from July to September, as well as on the flow from melting Himalayan snows in the hot season from April to June. Tropical Cyclones originating between June and October in Bay of Bengal also contribute to water flows in the basin.

Groundwater is an important resource for meeting the water requirements for irrigation, domestic and industrial uses. It is annually replenishable resource but its availability is non-uniform in space and time. The project area is underlain by thick pile of quaternary sediments which comprises sands of various grades, clays and *kankar*. The depth of ground water varied from 10-40 metre from the ground level as per the ground water survey report by Central Ground Water Authority (CGWA) conducted for different districts.

Water sampling and subsequent analysis were carried out to determine both the groundwater and surface water quality of the study area. Ground water samples were collected from 6 locations during the study period and analyzed for a number of physico-chemical parameters. The samples were taken from the borewells at Project Site, Bhandoor, Nairana, Sandhawli, Dhandara and Nai Mandi.

The pH of the Groundwater in the study are ranges from 7.15-7.44. Total Dissolved Solids ranges from 146-374. Overall it may be said that the groundwater quality of the study area is good and suitable drinking.

Surface water samples were collected from 3 locations during the study period and analyzed for a number of physico-chemical parameters. The samples were taken from the Dhandhera Datiyana Drain, Upper ganga Canal and Makhiyali Distributary.

Hardness, Dissolved Solids, COD and Coliforms are much higher than standard in Muzaffarnagar main drain. The water quality of upper ganga canal and Makhiyali Distributary are however slightly exceeds the permissible limits.

***Air Environment***

Preliminary air sampling and monitoring was carried out in the months of March, April and May, 2010 to establish the air quality of the study area. The main sources of pollution in the study area are industrial and vehicular emissions, suspended

dust from the paved and unpaved tracks, fuel burning for domestic requirements and windblown dust from the open agricultural and waste land.

Six air sampling locations were selected at Project Site, Village : Nairana, New Mandi of Muzaffarnagar Town, Village : Sandhwali, Village : Dhandhera, Village : Bhandaur

The highest $PM_{2.5}$ level was observed at the Project Site (70.4 µg/m$^3$), while the lowest level was observed at New Mandi of Muzaffarnagar Town (20.3 µg/m$^3$). $PM_{10}$ levels were found ranging from 54.0 to 162.0 µg/m$^3$. The highest RSPM levels were found at the Project Site (162.0 µg/m$^3$) while the lowest levels was found at New Mandi (54.0 µg/m$^3$). The highest level of $SO_2$ was found at the Project site (25.4 µg/m$^3$) whereas lowest level was found at Village: Bhandaur (6.6 µg/m$^3$). The SOx level of the Study area is well under the NAAQS Standard (New) of 80 µg/m$^3$. The highest level of NOx was found at the New Mandi (38.2 µg/m$^3$) whereas lowest level was found at Village: Sandhawli (14.4 µg/m$^3$). The NOx level of the Study area is well under the NAAQS Standard (New) of 80 µg/m$^3$. The highest level of HC was found at Project Site (425.0 µg/m$^3$) and the lowest level was found at Village : Dhandhera (160.0 µg/m$^3$). All values of CO at all the monitored locations were found within the permissible levels of 2000 µg/m$^3$. The highest level was found at Project Site (940.0 µg/m$^3$) and the lowest level was found at Village : Dhandhera (400.0 µg/m$^3$).

***Noise Environment***

Noise monitoring was carried out at seven locations, namely, Project Site, Near SH-12a (Jansath Road),Village : Nairana,Village : Bhandaur, Village : Dhandhera, Village : Sandhawli and Kambal wala Bagh in Muzaffarnagar Town.

The results of the monitoring are provided in. Monitored levels were compared against Ambient Noise Standards prescribed under Gazette Notification 643 of Ministry of Environment and Forests, Government of India. The project site falls in designated industrial area and the noise levels at all the locations were found within the ambient noise standards.

Maximum Sound level is observed both during Day and night is near SH-12 a. The other Noise sampling location being situated near by the highway, the noise level was observed to be on the higher side.

***Biological Environment***

The study area do not have any ecological sensitive attribute, such as, national park, wild life sanctuary/ game reserve, tiger reserve/ elephant reserve/ turtle nesting ground, breeding grounds, core zone of biosphere reserve, habitat for migratory

birds, mangrove area, area with threatened (rare, vulnerable, endangered) flora/fauna, protected corals, wetlands, zoological gardens, gene banks, reserved forests, protected forests, any other closed/ protected area under the Wild Life (Protection) Act, 1972. Flora and fauna of the study area has been studied through secondary sources data as well as from site survey.

***Socio-economic Environment***

The Study Area of 10 km radial Zone mainly falls in the Muzaffarnagar and Jansath Sub-district of District Muzaffarnagar There are Total 29 Villages in Study Area, out of which, 10 villages belongs to Jansath Sub district and rest 19 village are in Muzaffarnagar Sub-district.

Total Population of the Study area as per Census of India, 2001 is 495843, the total number of Household being 76872. Rural population constitutes 33.11 % and Urban Population constitutes 66.89 % of total population. Total Male Population of the Study area is 262578 and total Female Population of the Study Area is 233265.

Literacy Rate of the study area is 57.85%. Distribution of male and female literacy rate in the study zone is 64.18% and 50.73% respectively

As revealed from Census of India 2001, a huge percentage (72%) people is non-workers in the Study Area.

**Anticipated Environmental Impacts**

***During Construction Phase***

It shall be noted that all the civil work for establishment of proposed unit was already completed in the Year 2001. The project implementation activities involved in this project are now limited to installation of machinery and pollution control equipments along with development of greenbelt.

***Potential Impacts during Operation Phase***

Some of the potentially significant environmental impacts from the proposed project will be in Air Environment, Water Environment, Land Environment, and Socio-economics.

*Impact on Soil vis-à-vis Solid Waste*

The total plot area for the development is about 1,790 $m^2$, half of which has already been constructed for the plant. The remaining portion is at present vacant and is under green cover with tree plantation in the periphery. There is no adverse impact envisaged due to the operation of the plant.

Solid and hazardous waste generated from the plant operation will be in the form of used oil, ETP sludge, Discarded

containers/ barrels/liners used for hazardous wastes/ chemicals, packaging and domestic solid waste.

Hazardous waste generated from the facility shall be disposed off in suitable manner as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008. The used oil generated from the proposed project shall also be collected in barrels and shall be sold to the authorized recyclers identified by the UPPCB/ CPCB. Non-hazardous solid waste will be segregated and sold to the recyclers.

*Impact on Air Quality*

The main sources of air pollution due to the operation of the plant will be baby boiler with 20 kg/hr capacity and a DG set of 30 KVA capacity. In addition to that, there will be some process emissions as well from reactors, for which proper ventilation system has been provided. Major pollutants emitted from the boiler and DG set are in the form of air pollutants, *viz., NOx,* $SO_2$ and PM from the stacks.

ISCST-3 Model with the following options has been employed to predict the ground level concentrations due to the proposed plant emissions from baby boiler stack and DG set.

The contribution to GLCs for the pollutants i.e. SPM, SO2 and NOx were predicted over the study area due to the proposed project considering the worst scenario. The maximum Ground Level Concentration for NOx, SOx and PM is predicted to be 0.21,0.31 and 0.05 $\mu g/m^3$ respective at a distance of only 0.2 km at the west direction. Therefore it can be said that the impact on air environment due to the proposed project is negligible.

*Impact on Noise Levels*

Considering all the noise generating sources, the dissipation of noise away from the source points is predicted. The cumulative noise level near the sources as calculated with the help of above equations was calculated as 80 dB(A). From the predictions, it is clear that the noise drops to 40 dB(A) level at a distance of 100 m from the proposed project site. The existing ambient noise levels near the project site are in the range of 45 to 56 dB(A). Therefore, the future noise impacts on the environment are not expected to be significant. Due to the masking effect, the ambient noise level in the nearby areas will not increase during the operation of the plant. It shall also be noted that the plant will be operational only in one general shift, and hence, there would not be any noise generation at night time from the plant. Hence, there would not be any adverse impact due to the operation of the plant on the residents of the nearby areas.

*Impacts on Water Environment*

Liquid effluent will be generated from processes, utilities, equipment washings, floor washings and domestic usage. It is estimated that out of the total demand of 0.5 KLD for various industrial & domestic purposes during the operation phase of the project. Total industrial effluent generation will be about 0.2 KLD and domestic effluent of about 0.24 KLD. Remaining water will be either utilized in the processes or get evaporated.

All the industrial wastewater will be treated in an effluent treatment plant (ETP). Treated wastewater will be used for horticulture purposes. The sludge will be dried on sludge drying beds and periodically the sludge cakes will be removed and disposed off suitably.

The domestic wastewater generated from lavatories, will not be mixed with the plant effluent. A separate septic tank along with soak pit will be provided for treatment of it.

*Impacts on Socio-Economic Environment*

The proposed drug intermediates project will have a significant impact on the industrial growth in the region as there are a number of pharmaceutical units in Muzaffarnagar as well as nearby state of Uttarakhand. It is anticipated that during the operation phase, the proposed project will generate a total direct employment for 10 people. In addition to that, the project will also generate some opportunities for indirect benefits through casual work, sub contracts, transportation, trading etc.

*Impacts on Ecology and Biodiversity*

The project activity does not require tree cutting during land clearing. Also, the study zone does not have any ecologically sensitive location and hence, the plant activities are not expected to have any impact on the ecology and biodiversity.

**Environmental Management Plan**

The purpose of the environmental management plan (EMP) is to minimize the potential environmental impacts from the proposed project and to mitigate the consequences. EMP reflects the commitment of the project management to protect the environment as well as the neighboring populations.

***Construction Phase***

All the civil construction work of the project was already completed in Year 2001. However, machinery and installation of pollution control equipments has yet to be done. There would not be any signicant impact during this phase, which requires additional environmental management plan.

***Operation Phase***

*Air Environment*

In the proposed plant, there will be 2 stacks only, which will be conacted with a baby boiler and a DG set. The DG set will be used only during the power failure. Also, the plant operation will be limited for 1 shift in a day. The project site is away from human settlements. To maintain the greenery a thick betl of medium height trees have been put along with the boundary of the factory premises. A total of 20% of area will be earmarked for greenbelt. The premises would also have lawns, flower gardens.

*Noise Levels*

The statutory national standards for noise levels at the plant boundary and at residential areas near the plant will be met. The selection of all new plant equipments will be made with specification of low noise levels. Noise suppression measures such as enclosures, buffers and/or protective measures may be provided (wherever noise level is more than 90 dB(A) and exposure limits to workers is more than 8 hours a day) to limit noise levels within occupational exposure limits.

*Water Environment*

In the proposed project, the water requirement for process is of the magnitude of about 2.7 KLD. No impact of ground or surface water is envisaged due to the project and hence, no mitigation measures are required. However, use of treated water for greenbelt development and rainwater harvesting is proposed in the project.

The wastewater from the proposed project will be treated in an On-site Effluent treatment plant and the treated effluent, which will have the quality of rainwater will be discharged in nearby nallah.

Rainwater harvesting is also proposed in the project to tap effectively the rainfall runoff and subsequently recharging to the aquifer systems. 1 recharge structures will be required for the same. The probable location of these sites will be finally decided as per the layout of storm water drains.

*Land Environment*

Solid wastes like process waste and organic waste etc. in process, packaging is to be separately collected & sent for incineration. ETP Sludge and incinerable wastes are to be separately collected in polythene/HDPE bags or drums and stored temporarily onsite on an impervious floor at a specified place before final disposal.

**Environmental Monitoring Programme**

A well defined environmental monitoring programme would be employed with trained and qualified staff of EMC to monitor the ambient air as well as stack gas quality to check whether the quality of emissions/ effluents are maintained within the permissible limits or not.

# 1. INTRODUCTION

This chapter provides background information about the proposed Drug Intermediates manufacturing Plant, Need of the EIA Study, Scope and EIA Methodology adopted, TOR approved by MoEF & its compliance and Structure of the Report.

## 1.1. The Company

1. The proponent company is a partnership unit in the name of R.P. Intermediates having it's registered office at 494 Kambal wala Bagh, New Mandi, Muzaffarnagar. The deed of partnership is registered with the Registrar of Firms and Societies. The Unit is registered as a SSI unit from the Directorate of Industries, Uttar Pradesh. A brief account on promoters is attached herewith as **Annexure I**.

## 1.2. The Project

2. M/s R.P. Intermediates proposes to establish a small scale pharmaceutical raw materials manufacturing facility at 8th km, Jansath Road, near Rana Papers, Muzaffarnagar and has acquired land for the same The proposed intermediate raw materials are L base, D base, Chloramphenicol Powder and Chloramphenicol Palmitate These raw materials are used in pharmaceutical industries and the number of pharmaceutical industries is increasing day by day due to heavy demands of Medicines by the public. The increase in population is instrumental in these demands. A large number of Pharmaceutical Units have also been established in the State of Uttarakhand recently and the proposed raw materials would also be in demand there.

## 1.3. Purpose of the Study

3. The environmental study undertaken is aimed at identifying existing environmental conditions, predicting environmental impacts associated with the proposed Durg Intermediate Manufacturing Plant and suggesting mitigation measures to mitigate the adverse environmental impacts. The different activities that are likely to take place have been analyzed and proposed mitigation measures are assessed for their adequacy. Further mitigation measures have been proposed where considered necessary. The study also aims at reflecting the acceptability of the project to different stakeholders, and at incorporating the concerns raised by them into impact assessment and of the subsequent Environmental Management Plan.

## 1.4. Project Location

4. The site is located on 8$^{th}$ km Jansath Road, Khasra No. 1088/2, Village: Shernagar, tehsil & District: Muzaffarnagar, Uttar Pradesh. The project site is 7 km away from the nearest District headquarters Muzaffarnagar.

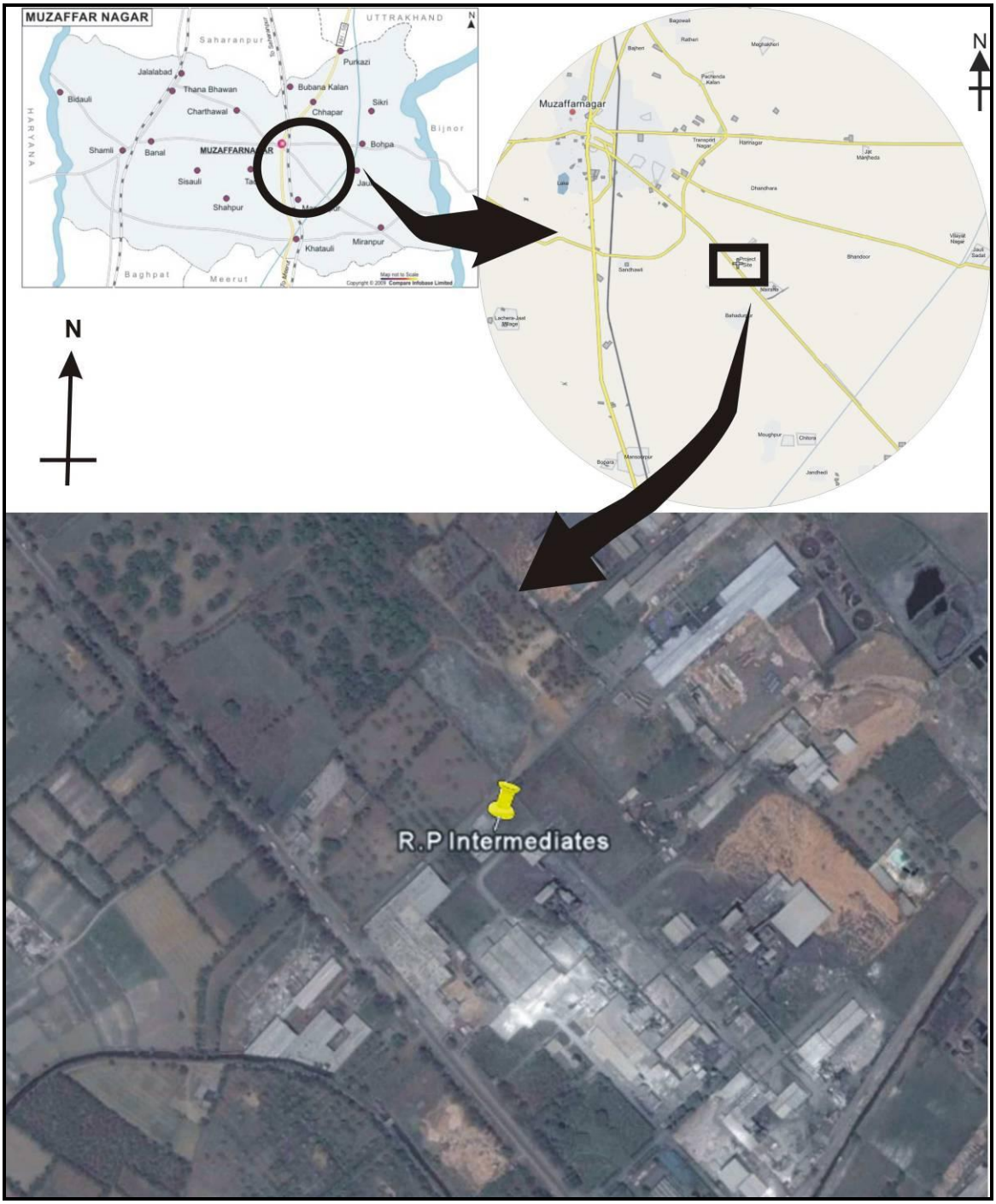



**Figure 1.1 : Location of the Project Site**

## 1.5. Need of the Study

5. The proposed project is for Manufacturing the Drug Intermediates like D Bas, L Base, Chloramphenicol Powder and Chloramphenicol Palmitate. The project falls under **Category A** of the Schedule of EIA Notification dated 14th September, 2006 as amended upto 1st December 2009 and requires prior environmental clearance from the Ministry of Environment and Forests (MoEF), New Delhi.

6. Like all other industries, the proposed project being a drug intermediates manufacturing units also contribute significantly to the economic growth

through industrialization. In addition, they bring associated ills of environmental imbalance by creating pollution. To reduce the adverse impacts of pollution, the plant activities must co-exist satisfactorily with its surrounding environment. This requires sound Environmental Management Plan (EMP) to be implemented by the plant management, which makes environmental protection as essential requirement, equal in status with production and profit requirements.

## 1.6. Scope and Methodology of the Study

7. The scope of the EIA study is based on the generic structure of environmental impact assessment document as stated in the Appendix III of the EIA Notification 2006 (S.O. 1533), Ministry of Environment and Forests, Government of India.

8. The scope of the study includes a detailed characteristic of environment in the study area associated with the proposed development on various environmental components. The proposed project is currently in the design preparation stage. For the purpose of environmental assessment, areas within 10 km radius of the project have been studied and the following methodology will be adopted:

- Generation and collection of baseline data for valued environmental components as per the EIA guidelines.
- Identification and quantification of significant environmental impacts due to the project and associated activities.
- Evaluation of impacts due to proposed activities and preparation of an environmental impact statement
- Preparation of appropriate Environmental Management Plan (EMP) encompassing strategies for minimizing identified adverse impacts along with budgetary provisions to be made by the project authorities for implementation of mitigation measures.
- Delineation of post Environmental Quality Monitoring Programme (EQMP) along with organizational setup required for monitoring the effectiveness of mitigation measures.

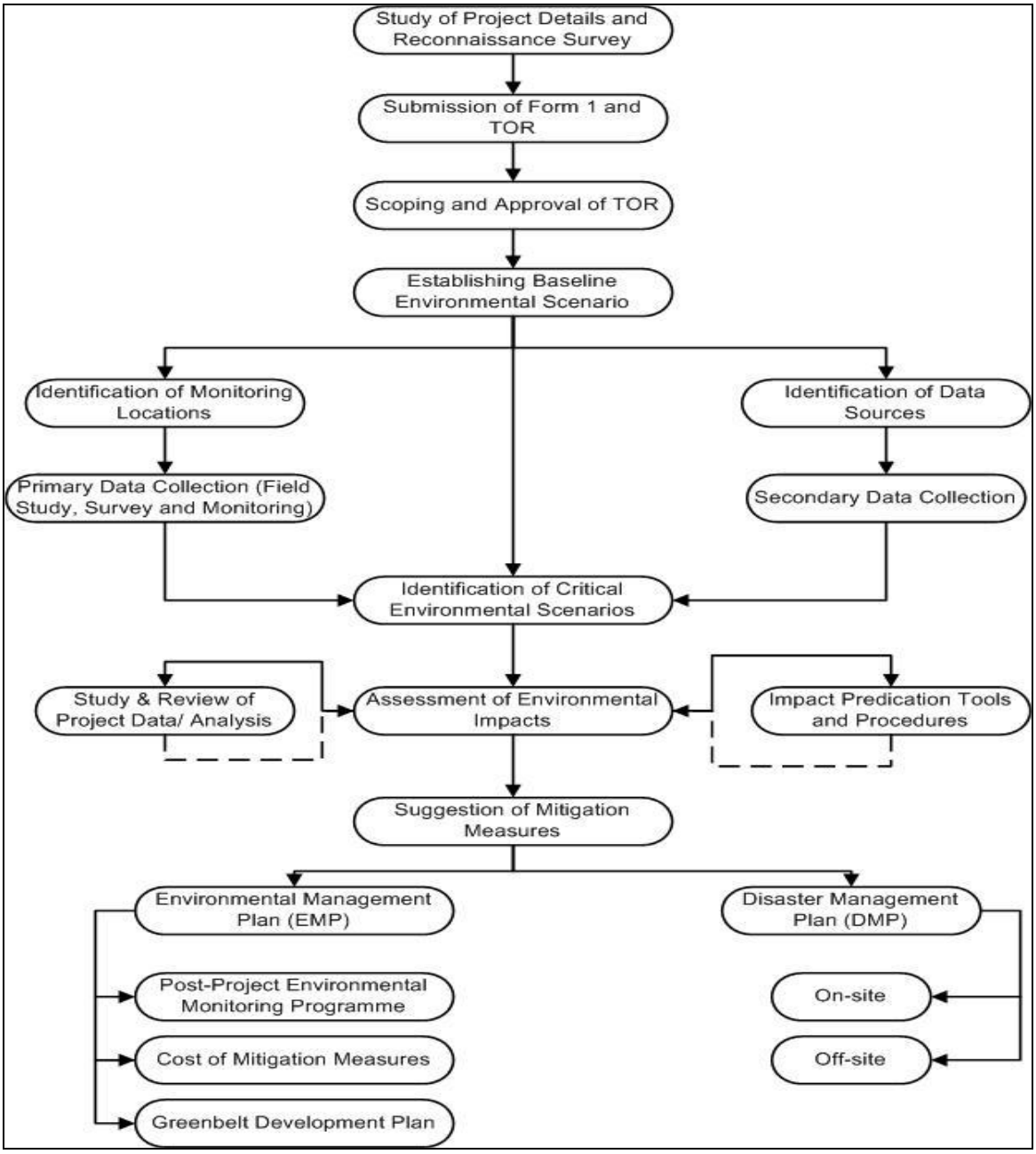



**Figure 1.2 : Methodology of EIA Study**

## 1.7. Approved TOR for EIA Study by SEAC

9. The application for the scoping of the said project has been submitted to the MoEF on April 16, 2010. Presentation for TOR approval was scheduled on June 9, 2010 at MoEF. The The MoEF has finalized the TOR for EIA Study and the same was communicated to the Project Proponent on vide letter no. J-11011/204/2010- IA II (I) dated June 29, 2010 (Refer Annexure II).

10. The EIA study has been conducted in-line with the approved TOR by MoEF and taking into consideration the structure of the report given in the EIA

Notification 2006[1]. The compliance to the approved TOR has been presented in **Table 1.1.**

**Table 1.1 : TOR Compliance Status**

| SN | TOR | Compliance Status |
|---|---|---|
| 1 | Executive summary of the project. | At the beginning of the Report |
| 2 | Promoters and their back ground | Section 1.1 & Annexure I |
| 3 | Project location and plant layout | Section 2.1 and Figure 2.7 |
| 4 | Infrastructure facilities including power sources | Section 2.5 |
| 5 | Total cost of the project alongwith cost for environment protection measures | Section 2.7 |
| 6 | Project site location along with site map of 10 km area and site details providing various industries, surface water bodies, forests etc | Section 3.2 |
| 7 | Present land use based on satellite imagery for the study area of 10 km radius. Location of National Park/Wild life sanctuary/Reserve Forest within 10 km radius of the project. | Section 3.3.5 |
| 8 | Site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall is necessary. | Section 3.3.4 |
| 9 | Details of the total land and break-up of the land use for green belt and other uses. | Section 2.5.1 |
| 10 | List of products alongwith the production capacities. | Table 2.3 |
| 11 | Detailed list of raw material required and source, mode of storage and transportation. | Section 2.3 |
| 12 | Manufacturing process details alongwith the chemical reactions | Section 2.4 |
| 13 | Design details of ETP, boiler, scrubbers/bag filter | ETP - Section 4.4.1.1<br>Boiler – Annexure III |
| 14 | Details of water and air pollution and its mitigation plan | Section 4.4.1 & Section 4.4.7 |
| 15 | Ambient air quality at 6 locations within the study area of 5 km., aerial coverage from project site. Location of one AAQMS in downwind direction | Section 3.3.8 |
| 16 | Ambient air quality modelling for plant | Section 4.4.8 |
| 17 | One season data for air, water and Noise monitoring for PM10, SO2, NOx including VOCs. | Section 3.3.7, Section 3.3.8 and Section 3.3.9 |
| 18 | An action plan to control and monitor secondary fugitive emissions as per CPCB and their control. | Section 5.4.1.2 |

[1] Appendix III (Generic Structure of Environmental Impact Assessment Document) of EIA Notification, 2006 (http://envfor.nic.in/divisions/iass/notif/notif.htm) – S.O. 1533, dated 14th September 2006, as published in the Gazette of India, Extraordinary, Part II, and Section 3, Sub-section (ii), Ministry of Environment and Forests.

| SN | TOR | Compliance Status |
|---|---|---|
| 19 | Determination of atmospheric inversion level at the project site and assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features | Section 4.4.8 |
| 20 | Permission for the drawl of ground water from the CGWA/SGWB. Water balance cycle data including quantity of effluent generated recycled and reused and discharged. | Ground Water abstraction permission is not applicable (Refer Annexure IV). |
| 21 | Ground water monitoring minimum at 6 locations should be carried out. Geological features and Geo-hydrological status of the study area and ecological status (Terrestrial and Aquatic) | Section 3.3.7 |
| 22 | The details of solid and hazardous wastes generation, storage, utilization and disposal particularly related to the hazardous waste calorific value of hazardous waste and detailed characteristic of the hazardous waste | Section 2.6.4 and Section 4.4.5 |
| 23 | Details of land fill as per CPCB guide lines | No landfill is proposed in the project |
| 24 | Ground water monitoring around the land fill site | Not applicable |
| 25 | Risk assessment for storage for chemicals/solvents and phosgenes | Chapter 7 Phosgene |
| 26 | Occupational health of the workers should be incorporated | Section 5.4 |
| 27 | An action plan to develop green belt in 33 % area | Section 5.4.1.3 |
| 28 | Scheme for rainwater harvesting | Section 5.4.2.1 |
| 29 | Socio economic development activities should be in place | This will be considered during operation phase of the project |
| 30 | A note on compliance to the recommendations mentioned in the CREP guidelines | Section 5.4.7 |
| 31 | Location of TSDF along with design details | Not Applicable |
| 32 | Detailed Environment management Plan (EMP) with specific reference to details of air pollution control system, water & wastewater management, monitoring frequency, responsibility and time bound implementation plan for mitigation measure should be provided. | Chapter 5 |
| 33 | EMP should include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation | Chapter 5 |

| SN | TOR | Compliance Status |
|---|---|---|
| 34 | Public hearing issues raised and commitments made by the project proponent on the same should be included separately in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made. | This will be included after public hearing |
| 35 | Any litigation pending against the project and /or any direction/order passed by any Court of Law against the project, if so, details thereof | No |
| 36 | A tabular chart with index for point wise compliance of above TORs | Table 1.1 |

## 1.8. Structure of the Report

11. This EIA report has been prepared on the basis of available on-site primary data (survey/ monitoring) and secondary/literature data. The EIA report contains project features, baseline environmental setup, assessment of environmental impacts, and formulation of mitigation measures, environmental management and monitoring plan with risk & disaster management plan.

12. The report includes 9 Chapters. The structure of the EIA Report with necessary tables, drawings and annexure is as follows:

**Chapter 1: Introduction**

13. This chapter provides background information on need of project, need of EIA study and brief of the project. The scope and EIA methodology adopted in preparation of EIA report have also been described in this Chapter. It also covers the identification of project & project proponent, brief description of nature, size, location of the project and its importance to the country and the region. Scope of the study details about the regulatory scoping carried out as per the generic structure given in the EIA Notification, 2006.

**Chapter 2: Project Description**

14. This chapter deals with the project details of the proposed Drug Intermediates Manufacturing Plant, with type of project, need for the project, location, size & magnitude of operation including associated activities required by and for the project, proposed schedule for approval and implementation, including technical details of raw material, quality and quantity etc.

**Chapter 3: Description of the Environment**

15. This chapter presents the existing environmental status of the study area around the proposed project including topography, drainage pattern, water environment, geological, climate, transport system, land use, flora & fauna, socio-economic aspects, basic amenities etc. Environmental assessment of the proposed project site in regard to its capability to receive the proposed new development is also discussed in this Chapter.

**Chapter 4: Anticipated Environmental Impacts and Mitigation Measures**

16. This chapter describes the overall impacts of the proposed project activities and underscores the areas of concern, which need mitigation measures. It predicts the overall impact of the proposed project on different components of the environment *viz*. air, water, land, noise, biological, and socio-economic.

**Chapter 5: Environmental Management Plan**

17. This chapter details the inferences drawn from the environmental impact assessment exercise. It describes the overall impacts of the proposed activities during construction and operation phases and underscores the areas of concern, which need mitigation measures. It also provides mitigation and control measures for environmental management plan (EMP) for minimizing the negative environmental impacts and to strengthening the positive environmental impacts of the proposed project.

**Chapter 6: Environmental Monitoring Program**

18. Technical aspects of monitoring the effectiveness of mitigation measures have been given in this Chapter.

**Chapter 7: Risk Assessment & Disaster Management Plan**

19. This chapter deals with the risk assessment carried out for the proposed drug intermediates manufacturing plant and disaster management plan.

**Chapter 8: Summary & Conclusion**

20. This chapter provides the summary and conclusions of the EIA study of the proposed project with overall justification for implementation of the project and also explanation of how, adverse effects will be mitigated.

**Chapter 9: Disclosure of Consultants Engaged**

21. This chapter provides the disclosure of consultants engaged to carryout the EIA study along with other additional studies.

# 2. PROJECT DESCRIPTION

This chapter deals with the details of the proposed drug intermediates manufacturing plant. It includes process description, utilities of plant, resources required, sources of pollution and their control.

## 2.1. The Site

22. The locations for the proposed captive power plant building, and for associated facilities area are at 8th km Jansath Road, Khasra no. 1088/2, Village Shernagar, tehsil and District : Muzaffarnagar, Uttar Pradesh. It is situated at a distance of about 7 km from Muzaffarnagar town towards Jansath. The co-ordinates of the proposed plant site are as follows:

- Latitude : 29° 25' 28.12" N
- Longitude : 77° 45' 33.44" E

23. The location of the project site on Survey of India Toposheet has been presented in **Figure 2.1** and the site plan showing nearby industries and villages has been presented in **Figure 2.2**. The Connectivity of the project site and surrounding Area profile is presented in following **Table 2.1.**

**Table 2.1 : Connectivity and Surrounding Area Profile**

| Description | Name | Distance | Direction |
|---|---|---|---|
| Nearest Road/Highway | Jansath Road (SH-12a) | Adjacent to site | West |
| Nearest National Highway | NH – 58 | 6.1 km | West |
| Nearest Railway Station | Muzaffarnagar | 7 km | North-West |
| Nearest Water Body | Upper Ganga Canal | 6.8 km | South-East |
| Nearest Populated Area | Muzaffar Nagar | 7 km | North-West |

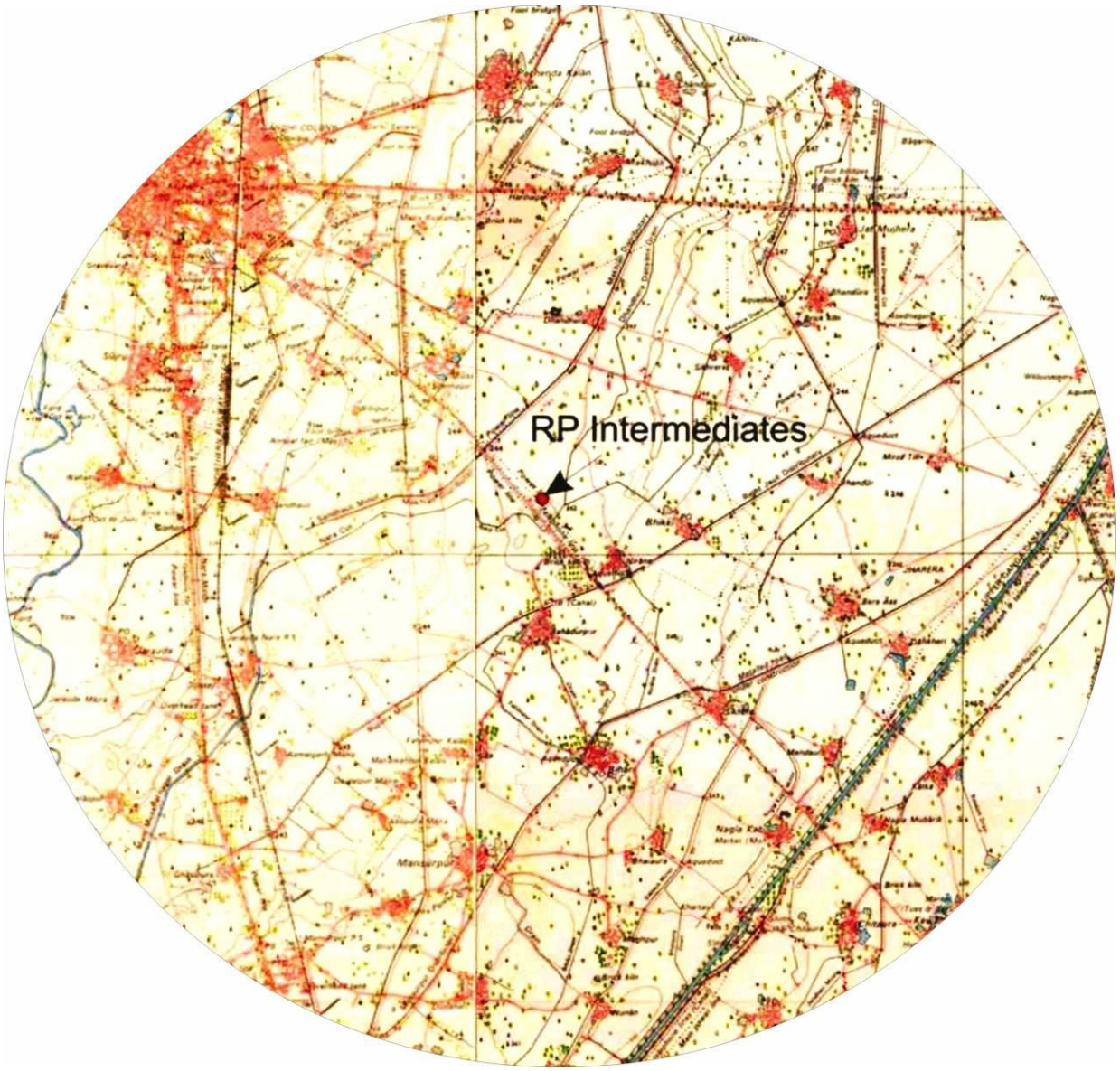



**Figure 2.1 : Project Site Marked on Toposheet**

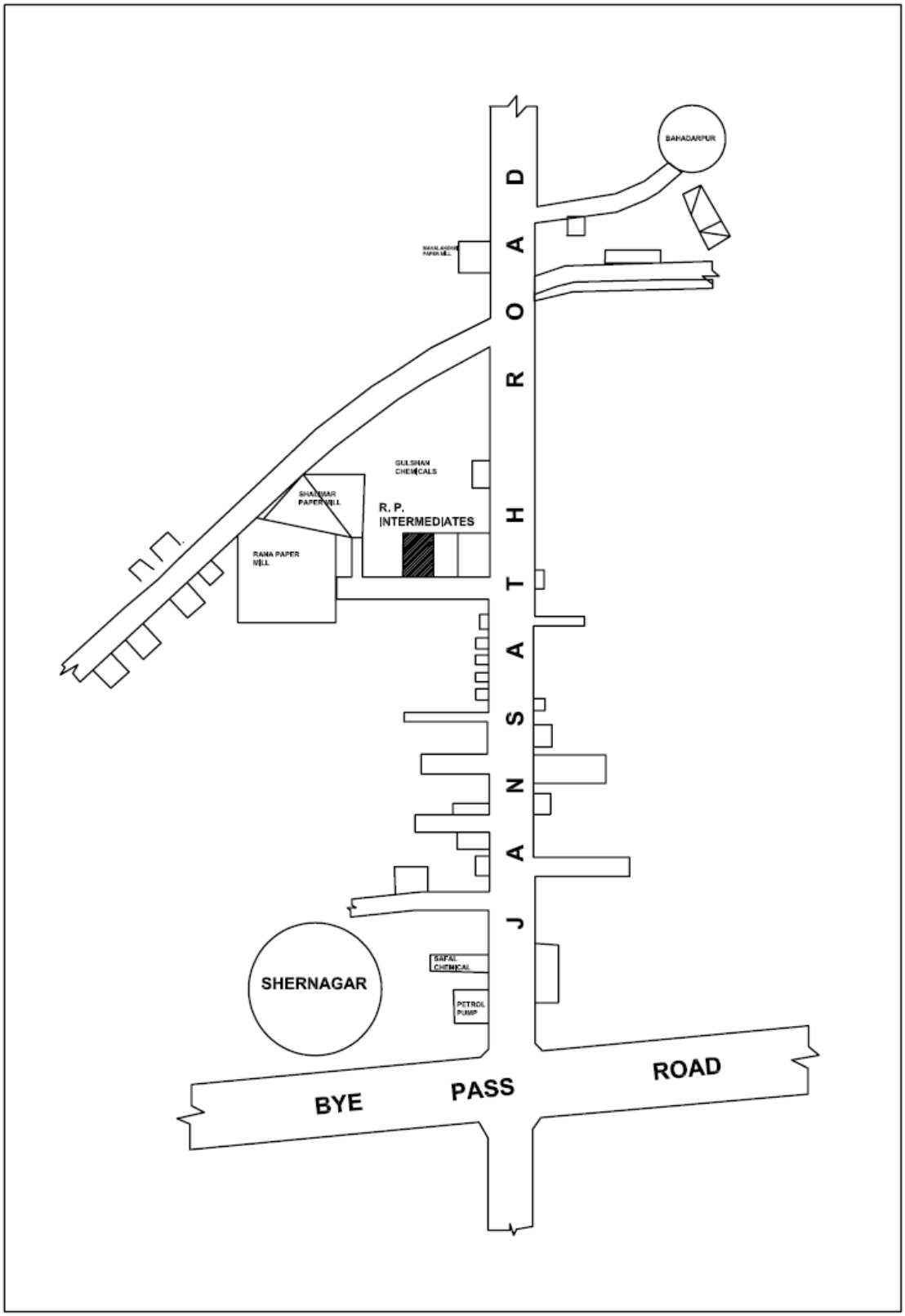



**Figure 2.2 : Site Plan**

## 2.2. Process Description

24. The proposed Drug intermediate to be manufactured are L base, D base, Chloramphenicol Powder and Chloramphenicol Palmitate These intermediates are used as raw materials in pharmaceutical industries

and the number of pharmaceutical industries is increasing day by day due to heavy demands of Medicines by the public.

## 2.3. Raw material

25. The detailed list of raw materials and it's source, quantity, mode of transportation and storage is provided in following **Table 2.2**

**Table 2.2 : Details of Raw materials**

| Raw Material | Source | Storage Quantity / Month | Mode of Transportation | Storage |
|---|---|---|---|---|
| S-Base | Imported (China) | 2000Kg | By Sea/By air | Stored in 25 kg drum packing Or As per company standard packing |
| HCl | Indian (Local) | 18 Kg | By road | Stored in 50 Kg PVC Drum Or As per company standard packing |
| NaOH | Indian (Local) | 60Kg | By road | Stored in 100 Kg PVC Drum Or As per company standard packing |
| M.D.C.A. | Imported (China) Indian (Gujrat, Maharashtra) | 434 Kg | Imp.:- By Sea/By Air Ind.:- By Road (Gujrat,Maharashtra ) | Stored in 250 Kg PVC Barrel Or As per company standard packing |
| Methanol | Indian (Local) | 603Kg | By road | Stored in 200 Kg PVC Drum Or As per company standard packing |
| Powder Activated Carbon | Indian (Local) | 48Kg | By road | Stored in 25Kg bags Or As per company standard packing |
| Acetone | Indian (Gujrat, Maharashtra) | 480Kg | By Road | Stored in 200 Kg PVC Barrel Or As per company standard packing |
| Pyridine | Indian (Gujrat, Maharashtra) | 50Kg | By Road | Stored in 25 Kg Carbay Or As per company standard packing |
| Palmitoyl Chloride | Indian (Gujrat, Maharashtra) | 164Kg | By Road | Stored in 200 Kg PVC Barrel Or As per company standard packing |

## 2.4. Manufacturing Process and product Details

26. The product and the annual production capacity is given in following **Table 2.3**.

**Table 2.3 : Annual Production Capacity**

| Product Name | Annual Capacity |
|---|---|
| L – Base | 4320 Kg per Annum |
| D – Base | 12480 Kg per Annum |
| Chloramphenicol Powder (Crude) | 7200 Kg per Annum |
| Chloramphenicol Palmitate (Crude) | 4687 Kg per Annum |

### *2.4.1. D Base [(1R,2R)-2-amino-1-(4-nitrophenyl) propane-1,3-diol]*

27. The raw material for the manufacture of D base is S Base, which would be imported from China. A schematic diagram and chemical reaction of manufacturing of D Base is given in **Figure 2.3**. The S-Base will be dissolved in water and the pH is brought down to 5.0 with the help of HCl. At this pH the crystals of D base get formed and L base remains in the liquid form. The crystals of D base are now separated with the help of centrifuge. The crystals are now dried in the tray drier and sent to the packing section. The liquid is sent for the production of L base crystals.

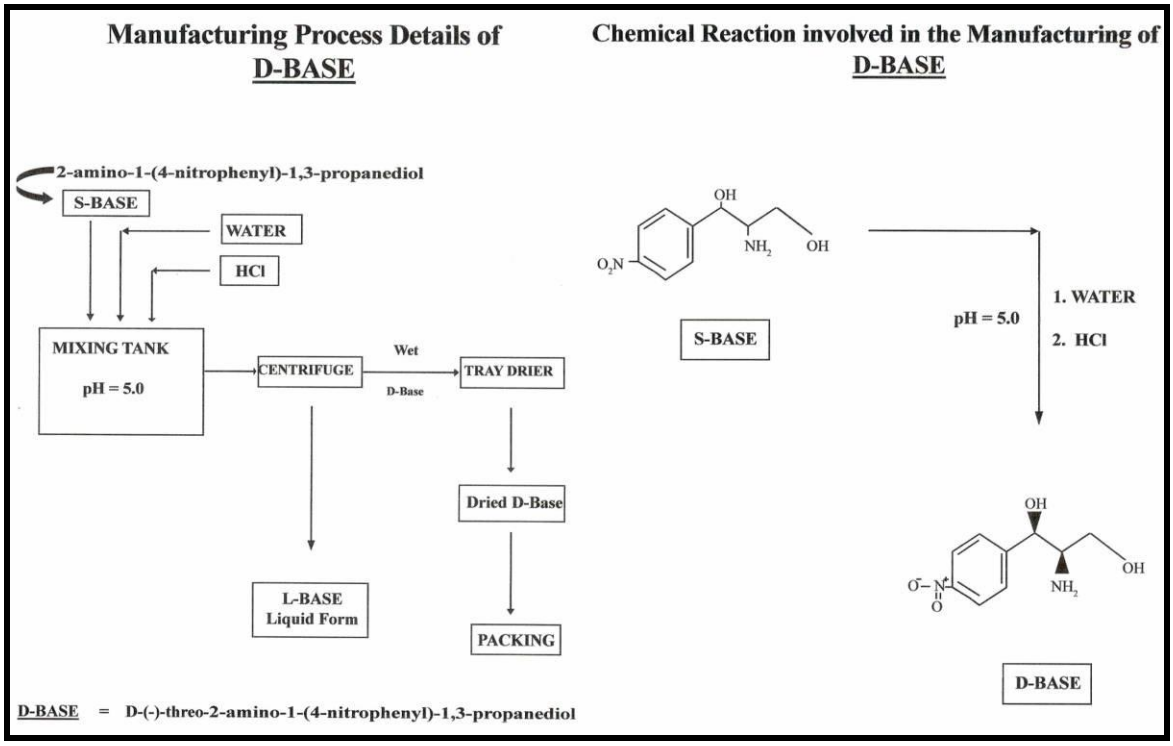



**Figure 2.3 : Manufacturing Process of D Base**

### *2.4.2. L Base [(1S,2S)-2-amino-1-(4-nitrophenyl) propane-1,3-diol]*

28. The raw material for production of L base is the liquid obtained from D base. The process flow diagram is provided in **Figure 2.4**. The pH of liquid obtained from the D base production is adjusted at 10.0 with the help of NaOH. Once the pH is brought to a level of 10, the L base gets crystallized. These Crystals are now separated with the help of centrifuge. The water thus obtained from the centrifuge is again utilized in next batch for the production of D base. The crystals of L base are dried in a tray drier and sent for packing.

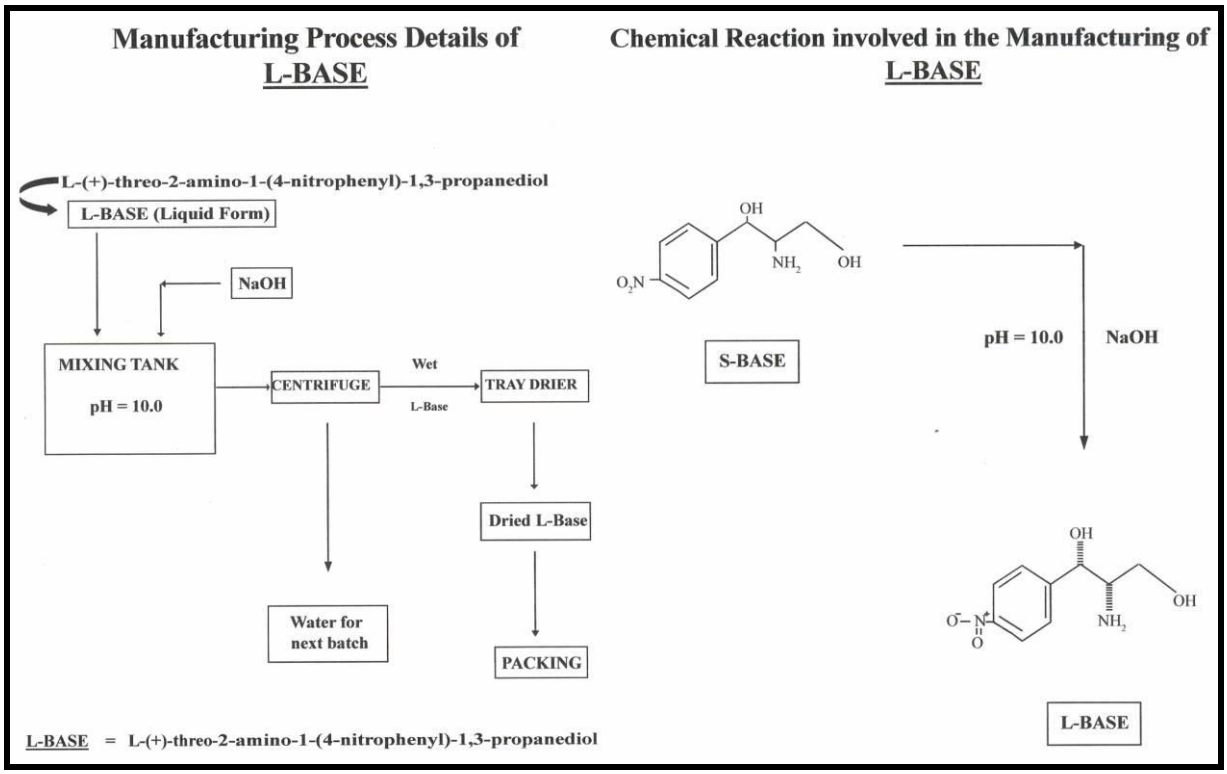



**Figure 2.4 : Manufacturing Process of L Base**

### *2.4.3. Chloramphenicol Powder [2,2-dichloro-N-{2-hydroxy-1-(hydroxyl methyl)-p-nitrophenyl}]*

29. The production method of Chloramphenicol powder is shown in **Figure 2.5**. The L base is reacted with MDCA (Methyl Di Chloro Acetate) in the presence of methanol. The reaction is carried out at a temperature of 70$^{o}$C. The heating is carried out with the help of steam in a jacked vessel. Once the reaction is completed, ice is added to bring down the temperature to around 0$^{o}$C. The crystals of the chloramphenicols are now separated with the help of centrifuge and dried in a tray drier. The dried material is now packed. The liquid from the centrifuge is sent to the wastewater treatment unit.

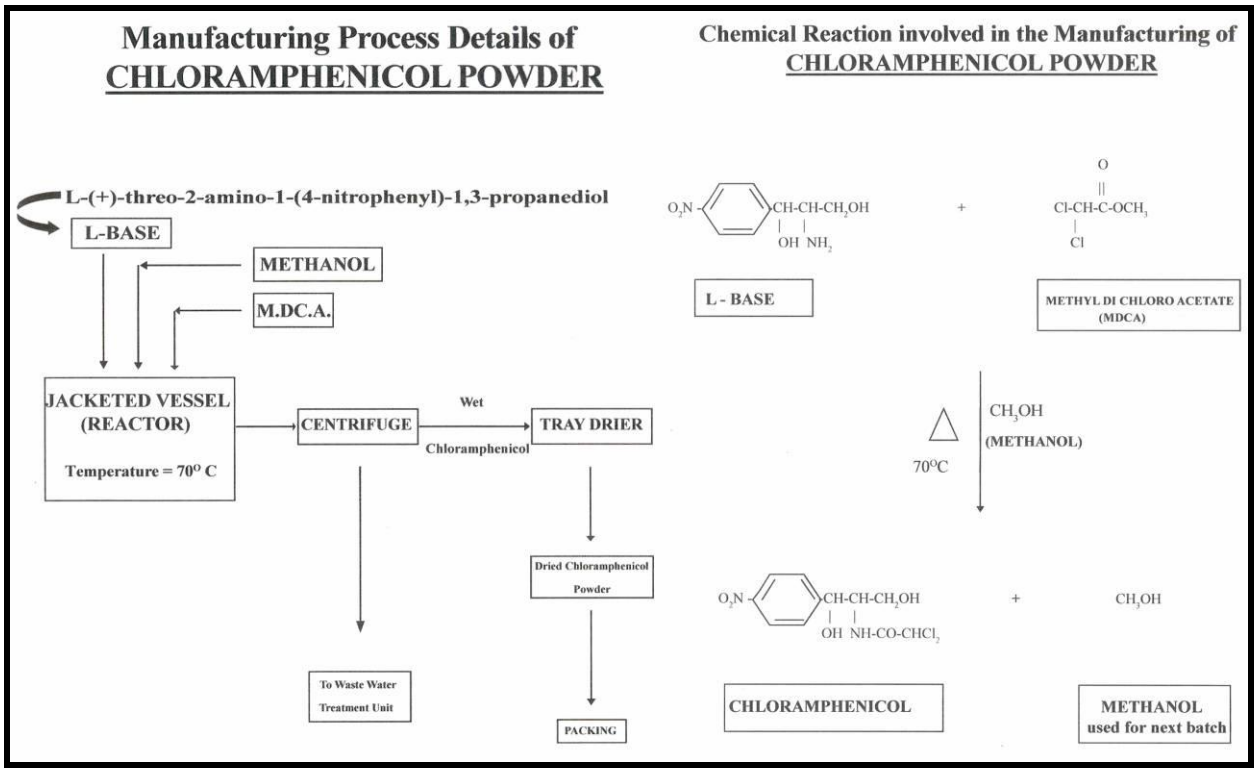



**Figure 2.5 : Manufacturing Process of Chloramphenicol Powder**

### *2.4.4. Chloramphenicol Palmitate [(2R,3R)-2-(2,2-dichloroacetamido)-3-hydroxy-3(4-nitrophenyl) propyl hexadecanoate]*

30. The production of chloramphenicol palmitate is carried out as per the flow sheet given in **Figure 2.6**. The starting material for this intermediate is chloramphenicol as obtained above. The chloramphenicol is reacted with palmitoyal chloride in the in the presence of pyridine, acetone and HCl. Water is now added in the reaction mass and put to a centrifuge. The liquid is drained and the mass is added with methanol and activated carbon. Once the adsorption process is over, the mass is again centrifuged and washed with water. The end product is now dried in tray drier and packed. The amount of all the chemicals are added as per the reaction stoichiometrically.

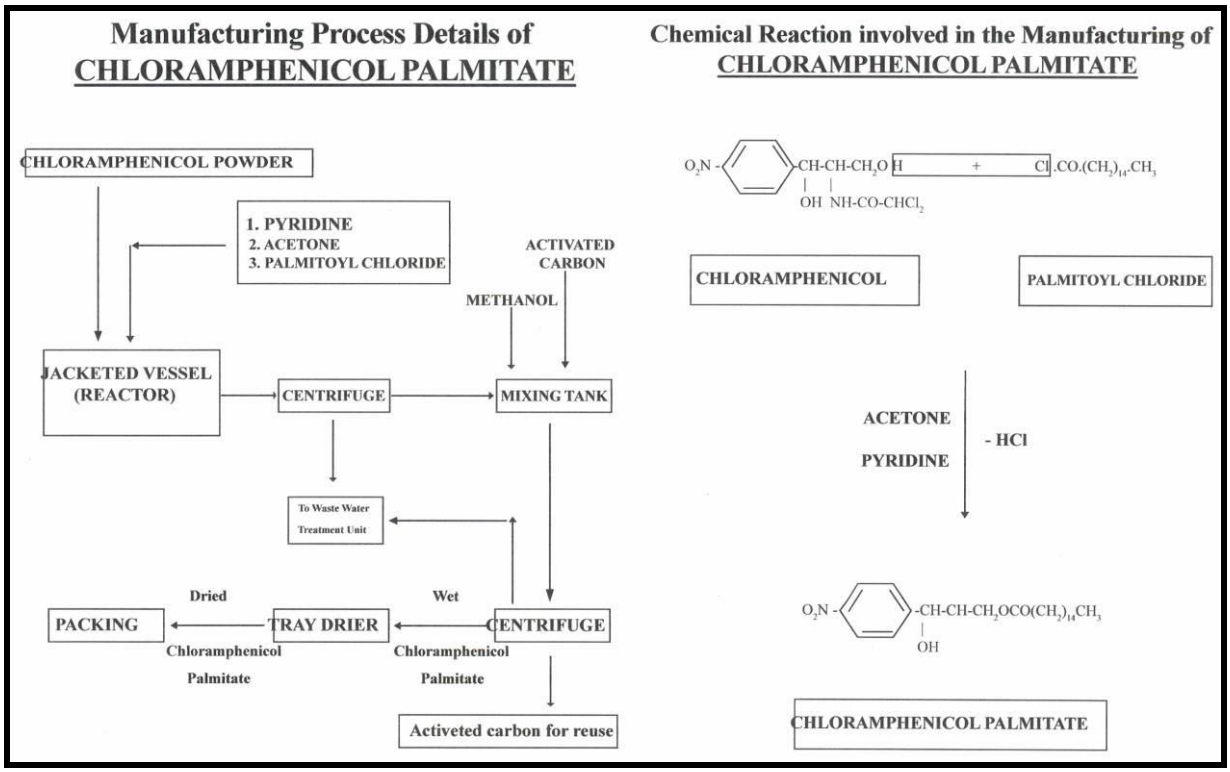



**Figure 2.6 : Manufacturing Process of Chloramphenicol Palmitate**

## 2.5. Project Requirement

### *2.5.1. Land*

31. Land Measuring 0.179 Hectare was purchased in the year of 2001. The deed of execution of the land was done in 2001 and soon after purchase declaration u/s 143 was obtained from the district court. The break-up of land is presented in **Table 2.4**: The plant layout has been presented in **Figure 2.7**.

**Table 2.4 : Break-up of Land**

| Particular | Area (sq. m.) |
|---|---|
| Plant | 159.92 |
| Office | 47.85 |
| Utilities | 63.21 |
| Garage | 21.95 |
| Roads | 226.71 |
| Open Area | 1000 |
| Green Area | 223.48 |
| Guard Room | 26.59 |

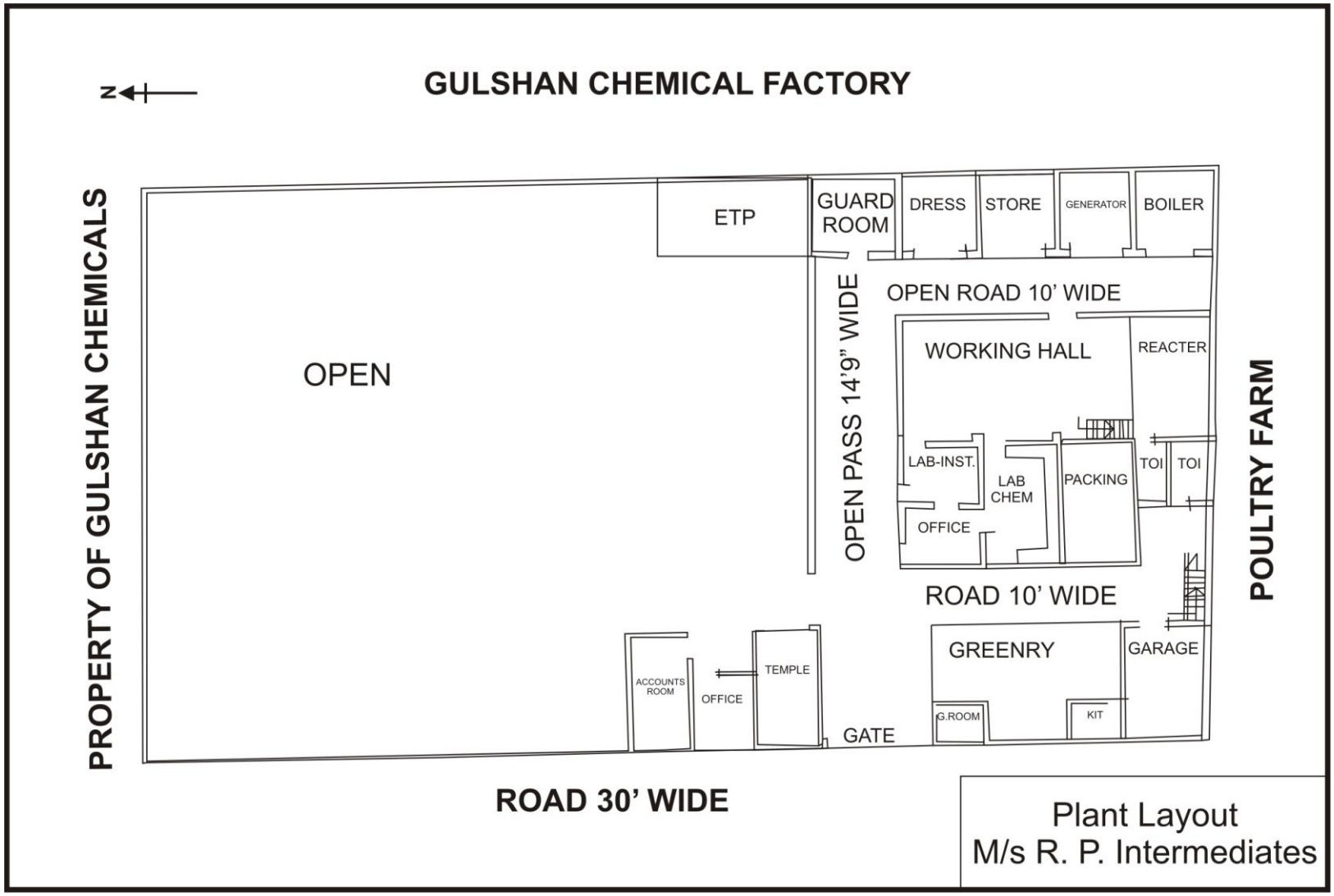



**Figure 2.7 : Plant Layout of M/s R. P. Intermediates**

### *2.5.2. Water*

32. The source of water shall be tubewell that is to be installed in the unit's premise. It is estimated that a maximum of 200 litres per day will be required as process water. A part of this will be recycled. Domestic water requirement will be about 2 KLD.

### *2.5.3. Power*

33. A power load of 30 kva is required for functioning of proposed project. The proponent has already applied to State Electricity Board for the connection.

34. A DG Set of Capacity 30 KVA will be installed. The consumption of HSD in the DG Set will be around 25-30 litre per day.

35. A baby boiler having a rated capacity of 20 kg of steam per hour based on Diesel fuel will be installed for production of steam for process. Tha daily consumption of diesel would be around 40-50 litre per day.

### *2.5.4. Manpower*

36. The details of manpower requirement are given in following **Table 2.5**.

**Table 2.5 : details of Manpower Requirement**

| | |
|---|---|
| No. of Personnel | 9 |
| Working hours per shift | 8 |
| No. of shift per day | One |
| No. of Working Days per year | 300 |

## 2.6. Environmental Aspects

37. The environmental aspects of the proposed CPP will be linked with the following attributes:

- Air Pollution Prevention
- Water Pollution Prevention
- Noise pollution Control

### *2.6.1. Air Pollution Prevention*

38. The main air pollution sources from the proposed unit are Baby boiler and DG set. The baby boiler having a rated capacity of generating 20 kg of steam per hour would be based on diesel fuel. The daily consumption of diesel would be based on diesel fuel. The daily consumption of diesel would be around 40-50 litre per day. The steam generated from this boiler would be used for the process heating requirement. The stack of the boiler would be kept 10 m above the roof top.

39. Regarding the DG Set there would not be any air pollution problem since this would be fitted with catalytic converter as OEM component and the stack height would be 10 m above the building roof top so that the Particulate Matter, $SO_2$ and $NO_x$, if any, get dissipated in the atmosphere. The consumption of diesel in the DG set would be around 25-30 litre per day.

### *2.6.2. Water Pollution*

40. The total wastewater generated from the unit shall not exceed 200 litres per day level. This will be treated in an On-site ETP. The wastewater

shall be received in an equalization tank to level out the fluctuation in respect of flow and characteristic of the wastewater. From here it shall be pumped into a channel connected to an aeration tank. As the wastewater may be deficient in nutrients, diammonium phosphate and urea shall be added to make the wastewater amenable to biochemical oxidation. The mixed liquor from the aeration tank shall be settled in two settling tanks each to be operated for about 10 days cycle. One tank would receive the effluent for 10 days while the other would be drained and dried. The dried and semi-dried material shall be manually removed and put to the sludge drying beds. The clear effluent is now routed to a nalla. The sludge shall be dried on sludge drying beds and periodically the sludge cakes shall be removed and disposed off suitably. The Flow diagram of ETP is provided in **Figure 2.8.**

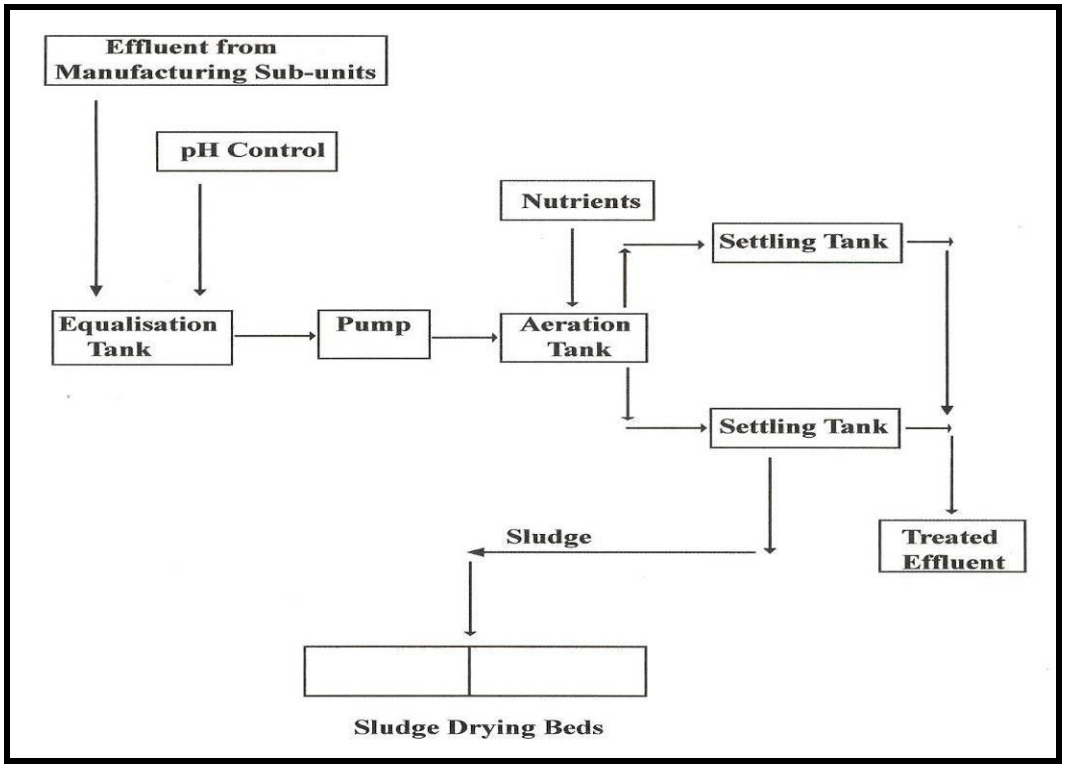



**Figure 2.8 : ETP Flow Diagram**

41. Domestic wastewater shall not be allowed to mix with plant effluent and a separate septic tank along with soak pit shall be provided. The flow diagram of Domestic wastewater Treatment process is given in **Figure 2.9**.

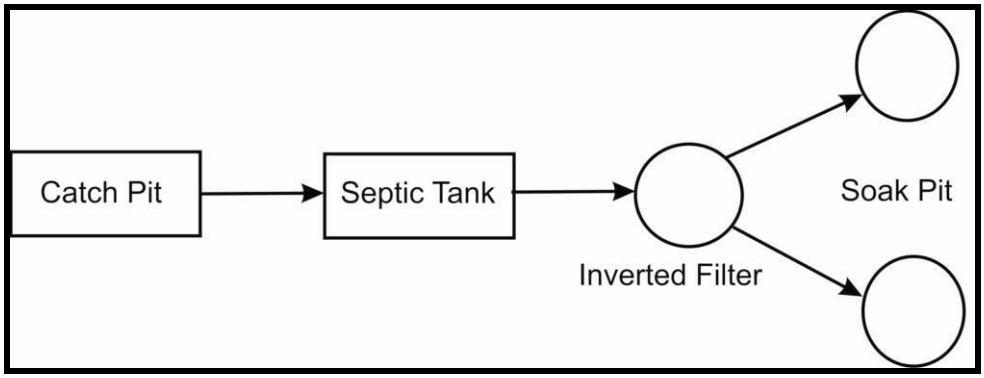


**Figure 2.9 : Domestic Wastewater Treatment**

### *2.6.3. Noise Pollution Control*

42. The main sources of noise pollution from the proposed unit are DG Set, Boiler and rotating equipments.

43. The DG Set shall be housed in a closed chamber having provision for the fresh air. The chamber housing the DG Set would also be provided with acoustic wall panels for absorption of noise. The set would be mounted on anti-vibration pads. The DG set shall also be provided with proper exhaust muffler.

44. The blower of the boiler and all the rotating equipments shall be mounted on vibration packing. This will ensure that noise levels are within permissible limits.

### *2.6.4. Hazardous/ Solid Wastes*

45. The solid and hazardous wastes generated from the plant operations will be of four different categories as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008. The different hazardous waste categories along with quantity and mode of storage and disposal have been presented in **Table 2.6.**

**Table 2.6 : Details of Hazardous/ Solid Wastes Generation, Storage and Disposal**

| S. No. | Hazardous Waste | Category No. | Mode of storage and disposal |
|---|---|---|---|
| 1 | Used oil | **5.1** | Will be collected in drums and sold to registered re-refiners |
| 2 | ETP sludge | **34.3** | Will be collected in HDPE bags and stored and Will be disposed off to TSDF site |
| 3 | Packing Waste - Discarded carboys/drums/HDPE bags | **33.3** | Will be sold to authorized scarp dealer or recyclers |

46. The company will provide adequate separate storage area for the storage of each type of hazardous/ solid wastes proposed to be generated from the plant.

## 2.7. Project Cost and Cost towards Environmental Protection

47. The total project investment will be about **Rs. 51.5 Lacs**, out of which **Rs. 2.5 Lacs** will be allocated for pollution control equipments including ETP, STP, fire protection system etc. In addition to that recurring cost towards environmental protection will be approximately **Rs. 0.6 Lacs** per annum.

# 3. DESCRIPTION OF THE ENVIRONMENT

This Chapter describes the baseline environmental conditions around the project site for various environmental attributes, viz., physical, biological and socio-economic, within the 10 km radial zone, which is termed as the study area. Topography, soil, water, meteorology, air, noise, and land constitute the physical environment, whereas flora and fauna constitute the biological environment. Demographic details and occupational pattern in the study area constitute socio-economic environment. Baseline environmental conditions are based on the field studies carried out during 15th March 2010 to 15th June 2010 at and around the proposed site and through secondary data collected from published sources.

## 3.1. Prelude

48. It is necessary for the environmental assessment studies to establish baseline status for valued environmental components, which are likely to be affected because of the developmental activities/ modernization or expansion. Hence, it is imperative to study the existing environmental conditions not only to establish the pre-project physical, biological, and socio-economic conditions, but also to predict environmental impacts caused during the construction and operation phases of the project.

49. The environmental status around the proposed expansion project site is determined by studying in detail the major environmental attributes *viz.,* Air, Water Land, Noise, and Socio-economic in a 10 km radial zone. The study was carried out during the pre-monsoon months of March 2010 – June 2010. The ambient air quality, water quality, and soil quality status within the area forms the baseline information over which the predicted impacts due to the proposed project can be super imposed in order to obtain the net impact of the proposed project on the environment.

## 3.2. Site Description and Its Environs

50. The site is located at Village : Shernagar, Muzaffarnagar on State Highway 12 A (Jansath Road) between Muzaffarnagar-Jansath Section having Latitude and Longitude of 29°25’28.12” N and 77°45’33.44” E respectively. The study area of 10 km radial zone is shown in **Figure 3.1** with main features of the study area.

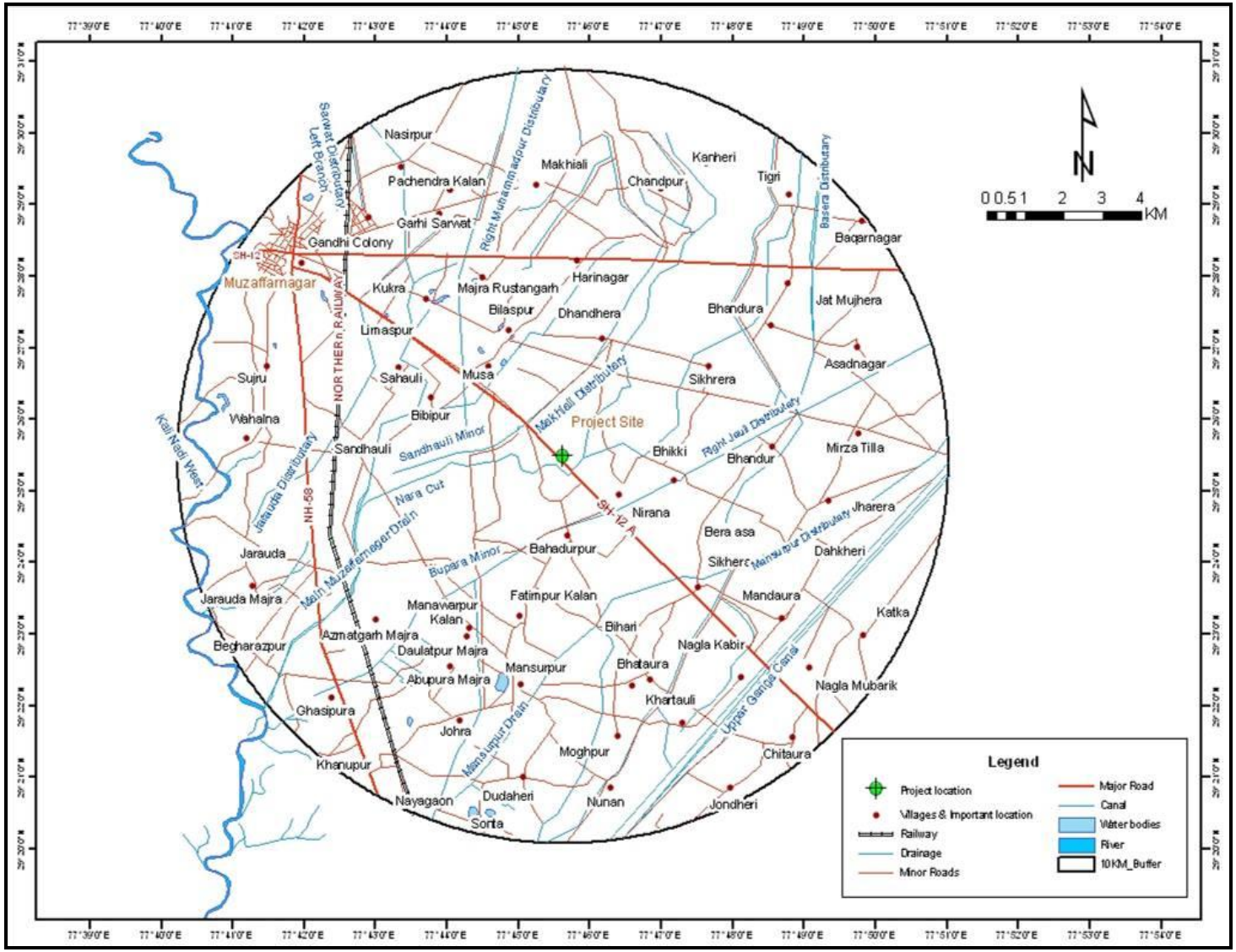



**Figure 3.1 : Study Area of 10 km Radial Zone**

## 3.3. State of the Environment

### *3.3.1. Topography & Geology*

51. The project site is situated at Great India Sedimentary basin Drained by Indus, ganga and Brahmaputra. The basin is filled with four distinct sedimentary units designated as the Siwalik, Bhabar, Terai and Alluvial formations, which are disposed in a nearly parallel fashion between themselves as well as with the Himalayan range.The Study area is part of Alluvial Belt made up of undifferentiated quarternary sedimentation. These mainy comprise of sand and Clay with kankar. The sand beds constitute highly rich aquifers. In the northern half of the Plain the aquifers maintain continuity in the N-S direction, whereas in the southern half E- W is exhibited. On a regional scale the aquifers are unconfined but subartesian conditions have developed. Physiographically the area is flat terrain. However a little part in the extreme northeastern area of the district is occupied by Siwalik hills, and falls in the zone of “Dissected Rolling Plain”. The area slopes towards southwest with an average gradient of 1.5m/km. The general elevation of the alignment varies between 245 m to 260 m above mean sea level. However, the elevation of the project site and surroundings varies between 242m to 248 m. The Geological Map of India and Uttar Pradesh showing project site is presented in **Figure 3.2.** The topograohical Map of the Study Area showing the project site is presented in Error! Reference source not found.**3.**

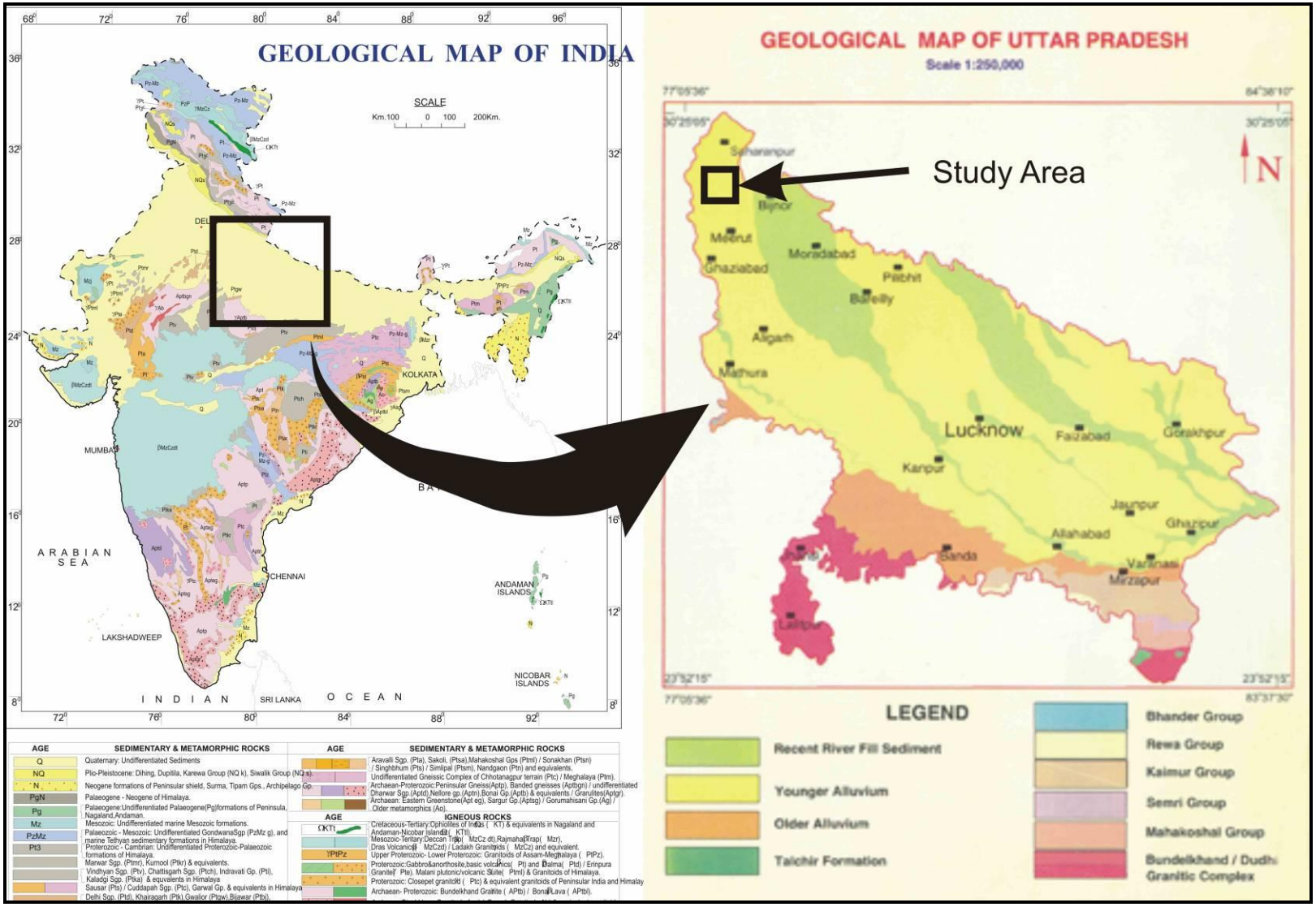



**Figure 3.2 : Geological Map of India and Uttar Pradesh showing the study Area**

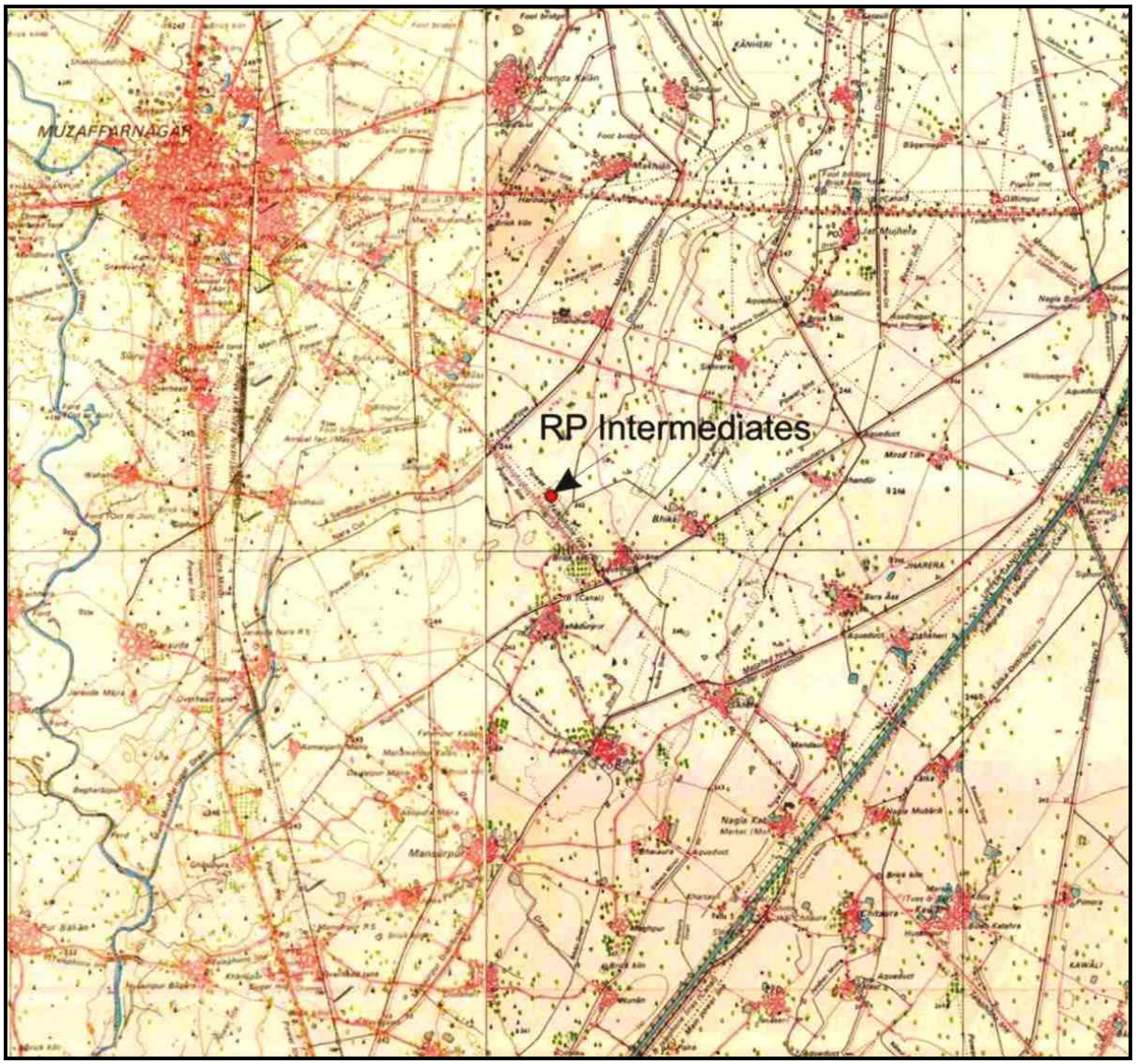



**Figure 3.3 : Toposheet of the Study Area Showing the project site.**

### *3.3.2. Seismicity of the Study Area*

52. According to the seismic-zoning map of India, the project area falls in Zone IV of seismicity (**Figure 3.4**). It thus lies among the high-risk earthquake areas.

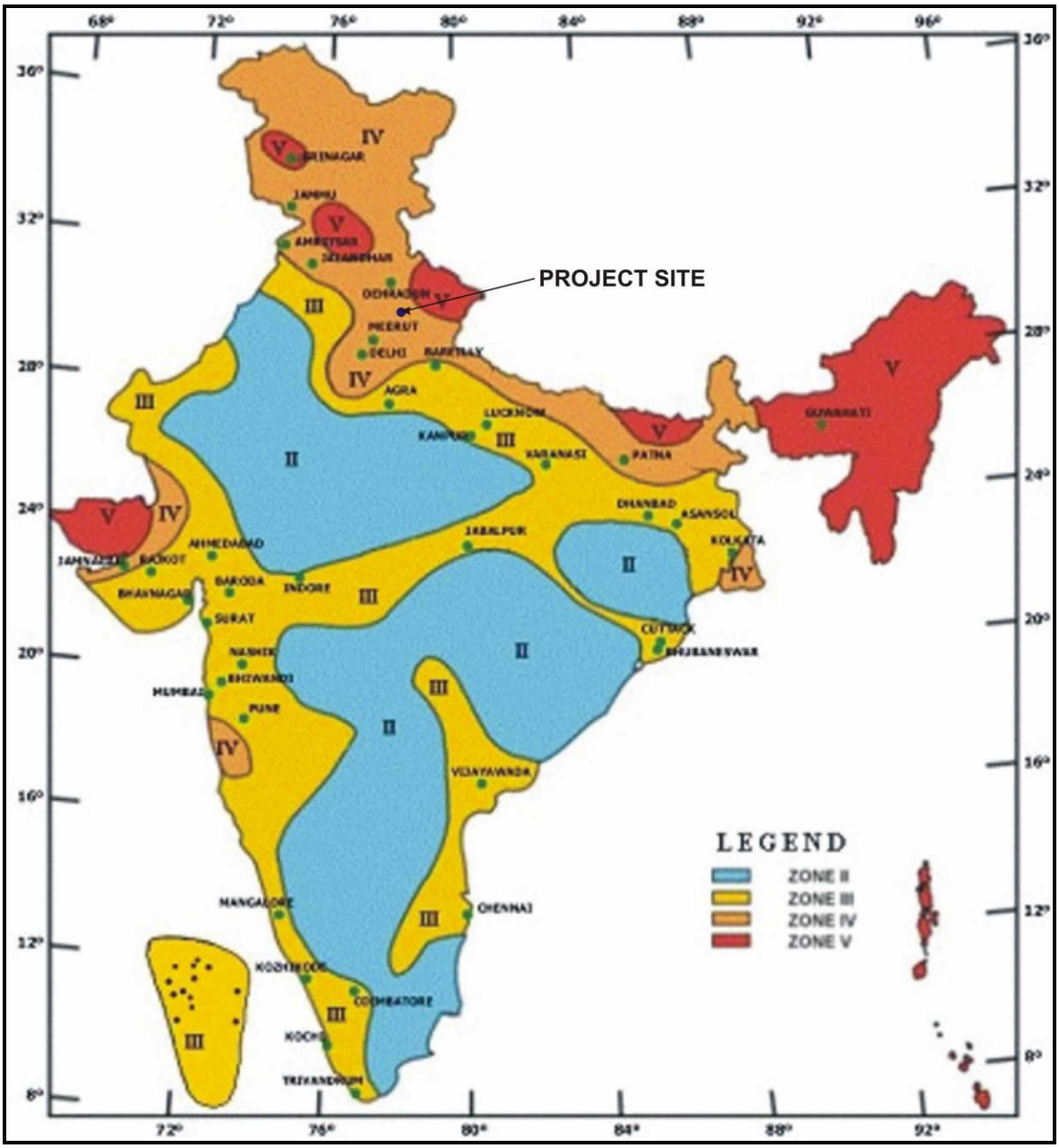



**Figure 3.4 : Seismic Zones of India [IS 1893 (Part 1): 2002]**

### *3.3.3. Hydrology*

53. The water resources, both surface and groundwater plays an important role in the development of an area. Likewise, the water resources of the area have been studied to establish the current status of water availability and quality in the area.

#### *3.3.3.1 Surface Water*

54. The proposed project site is located at Upper Ganga Basin (Upstream of Gomti in Confluence to Muzaffarnagar). The flow in the basin is largely contributed by the south-westerly monsoon winds from July to September, as well as on the flow from melting Himalayan snows in the hot season from April to June. Tropical Cyclones originating between June and October in Bay

of Bengal also contribute to water flows in the basin. Following figure shows the location of the site in Upper ganga Basin Map.

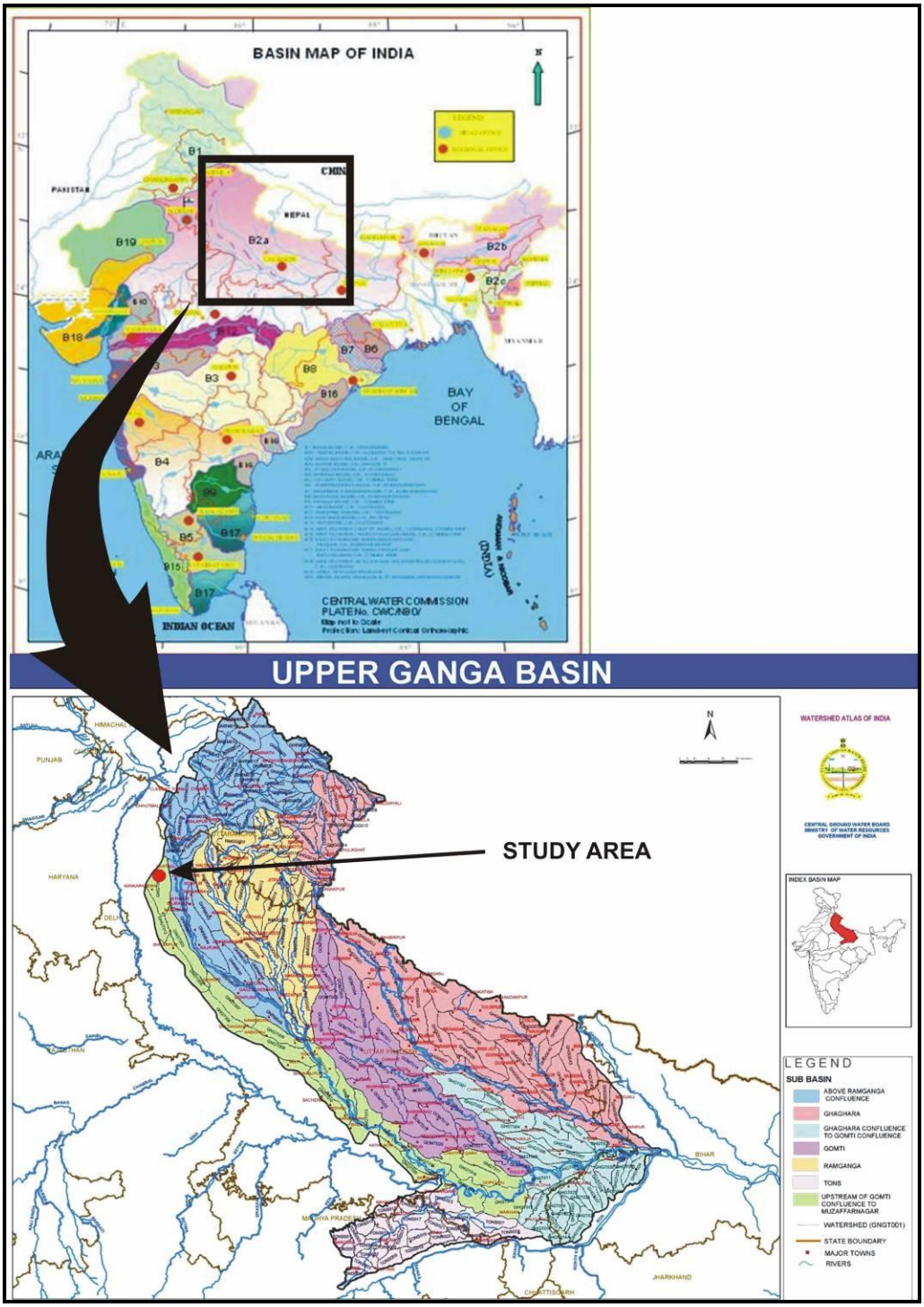



**Figure 3.5 : Yamuna Basin Map Showing The Project Site**

55. The major Canals and Distributaries that are present in the study area are listed in following Table 3.1.

**Table 3.1 : Major Canals and Distributaries in the Study Area**

| Name | Distance | Direction |
|---|---|---|
| Upper Garga Canal | 6.8 km | SE |

| | | |
|---|---|---|
| Upper Ganga Canal (Anupshar Barnch) | 8.9 km | E |
| Kali Nadi | 7.7 km | W |
| Right Jouli Distributary | 1.8 km | SE |
| Makhiali Distributary | 2.5 km | NW |
| Jarauda Distributary | 3.6 km | NW |

*3.3.3.2 Ground Water*

56. Groundwater is an important resource for meeting the water requirements for irrigation, domestic and industrial uses. It is annually replenishable resource but its availability is non-uniform in space and time. The project area is underlain by thick pile of quaternary sediments which comprises sands of various grades, clays and *kankar*. The depth of ground water varied from 10-40 metre from the ground level as per the ground water survey report by Central Ground Water Authority (CGWA) conducted for different districts.

### *3.3.4. Climate*

57. To establish the meteorological features of the project area, data has been collected from India Meteorological Department (IMD) Delhi. It is found that the Study Area has predominantly four seasons namely – Summer (mid-March to June), Monsoon (July to mid-September), Post-monsoon (mid-September to November) and Winter (December to February). It has a subtropical climate characterized by high temperature, low humidity, and medium to scanty rainfall.

58. **Rainfall:** As per the Secondary Data Collected from IMD for the Study Area, the month of August seems to be the most wet month and the month of April the driest month of the year. The study area receives the maximum rainfall during July and August. The Graph showing the monthly Rainfall profile and Maximum monthly rainfall for last 10 years is provided in Figure 3.6. It is evident from the graph of monthly maximum rainfall for last 10 years, that year of 2007 received the maximum rainfall during the Time period.

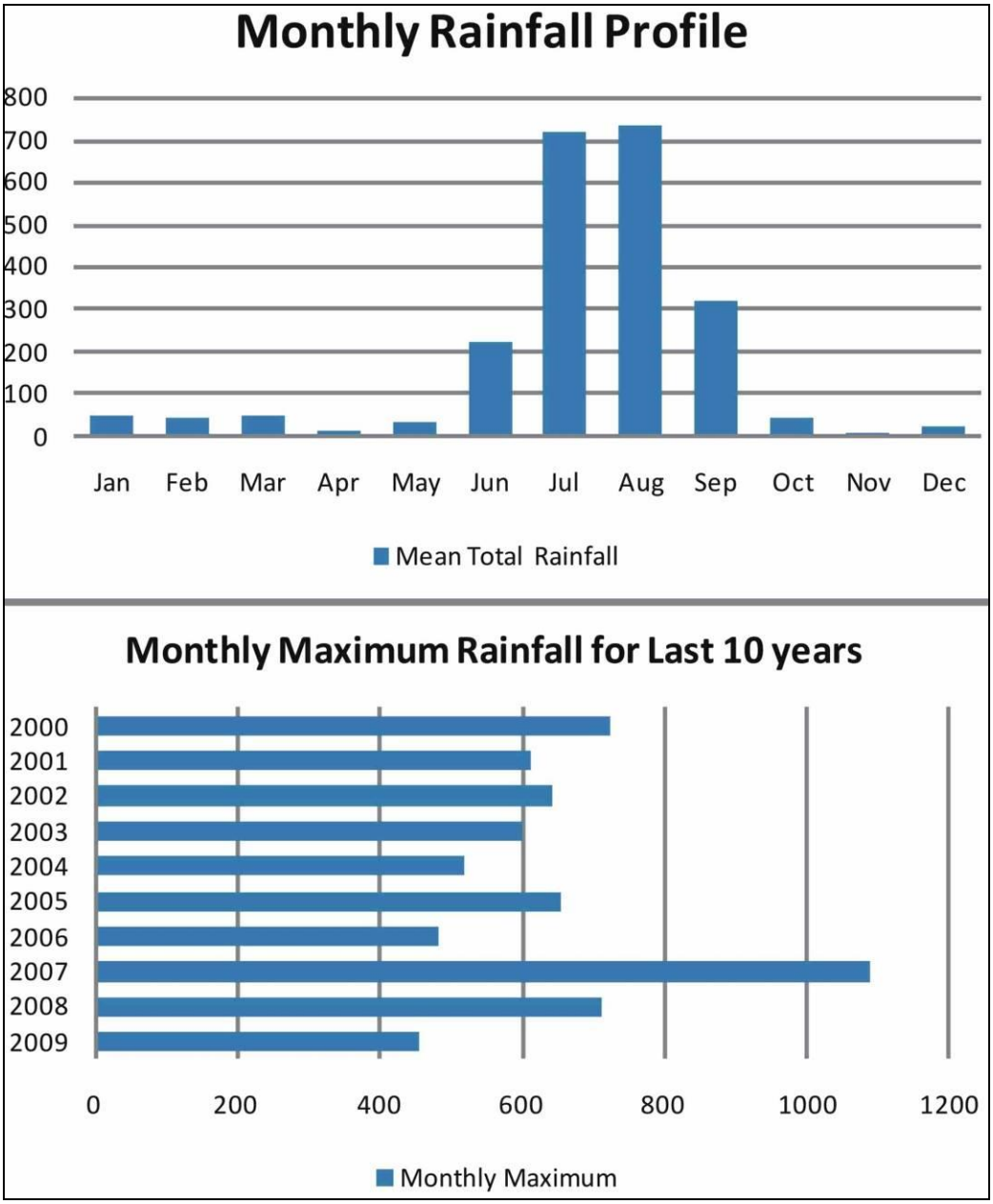



**Figure 3.6 :Rainfall Profile**

59. **Temperature:** As per the secondary data collected from IMD for the study Area, the hottest month in the study area is May and the coldest month is January. The Temperature of the study area varies from 5.8$^{o}$C in January to 35.4$^{o}$C in May. The Graph showing monthly temperature profile and maximum and Minimum Temperature for last 10 years is provided in following Figure 3.7

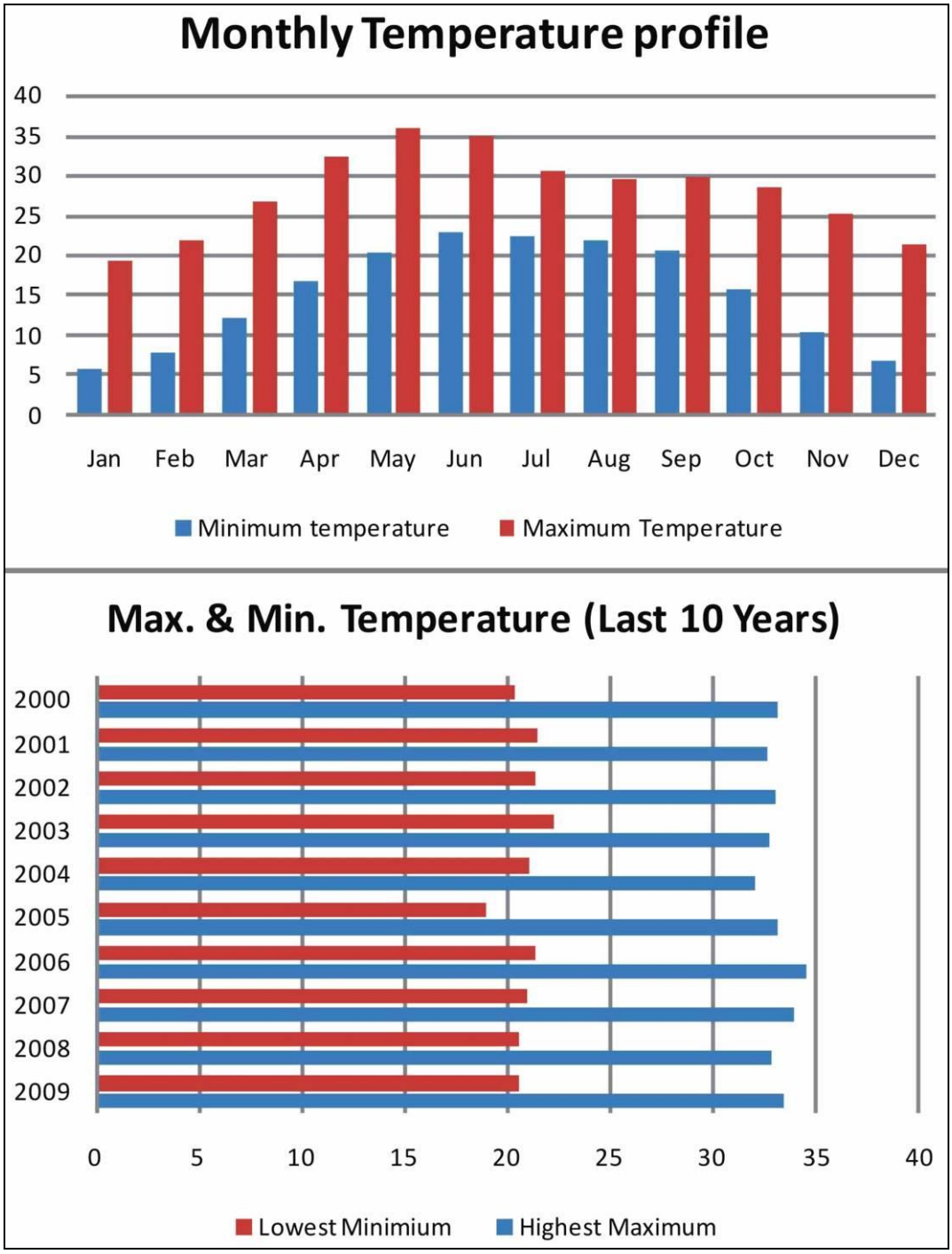



**Figure 3.7 : Temperature Profile**

60. **Wind Speed and Wind Direction :** The windrose diagram for the study area is shown in **Figure 3.8** and the wind class frequency distribution is shown in **Figure 3.9**. The analysis of the average wind pattern shows predominant winds from W, WSW, WNW and NW with wind frequencies of 9.75 %, 10.1 %, 8.03 % and 8.15 % respectively. The calm conditions were prevailed for 18.08 % of the total time. Average wind speed of the Study Area is 2.73 m/s.

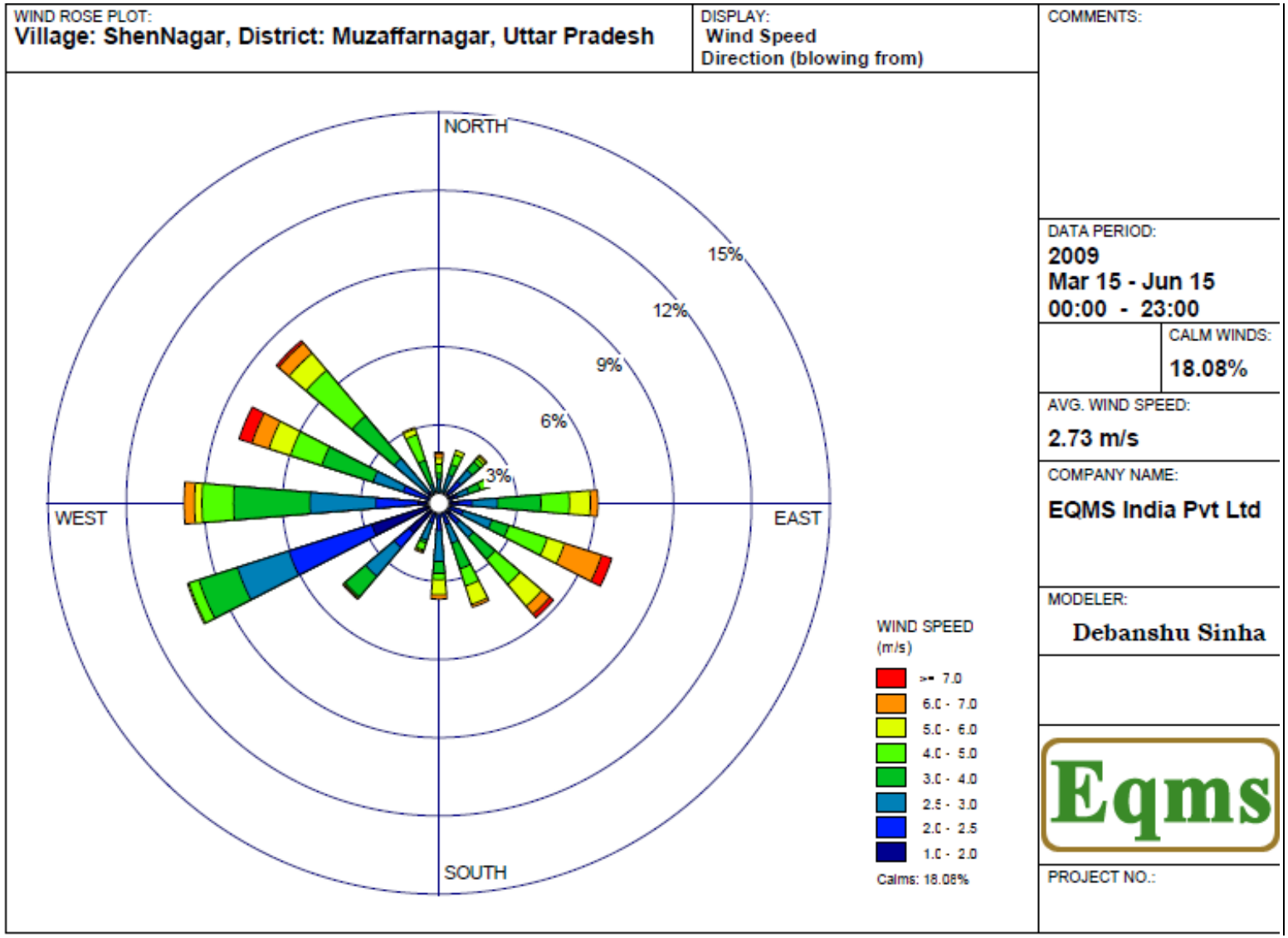



**Figure 3.8 : Wind Rose (Summer Season)**

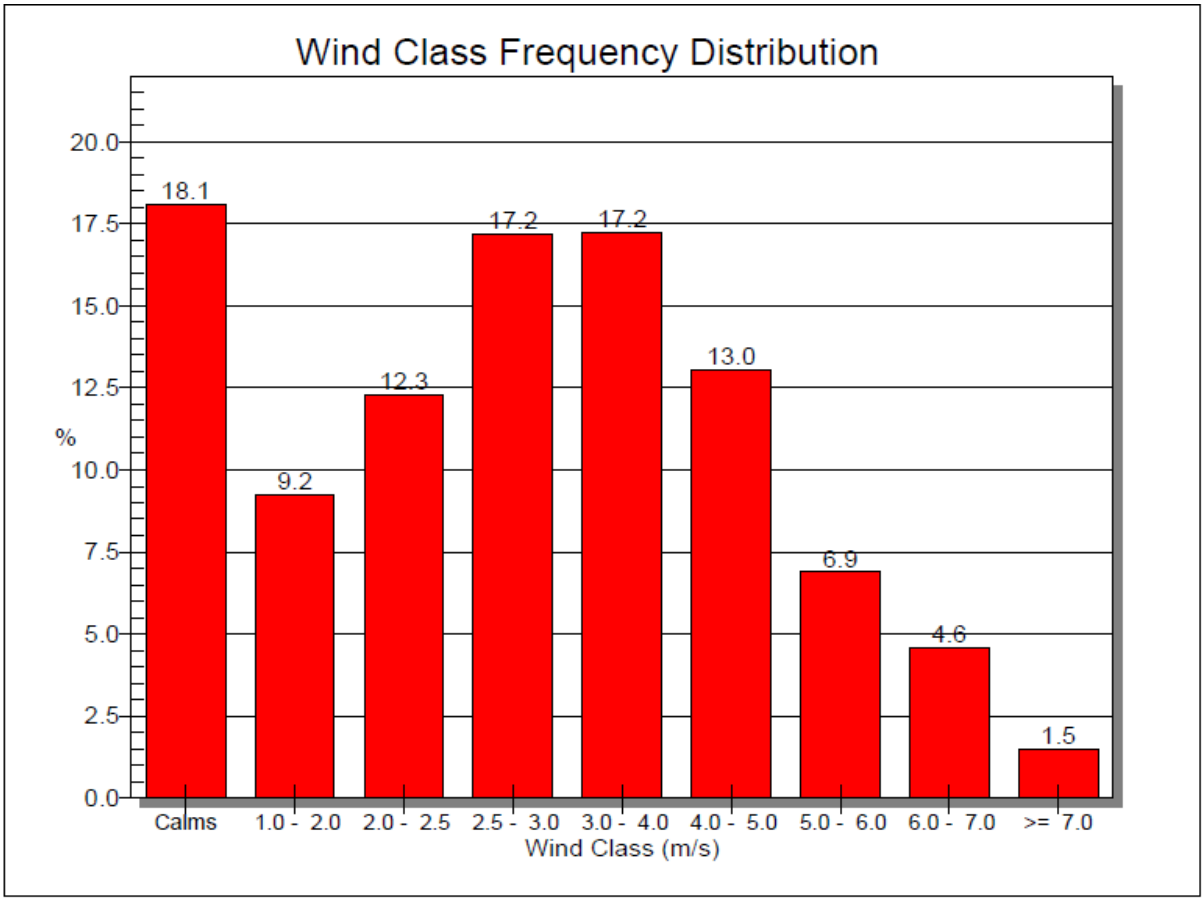
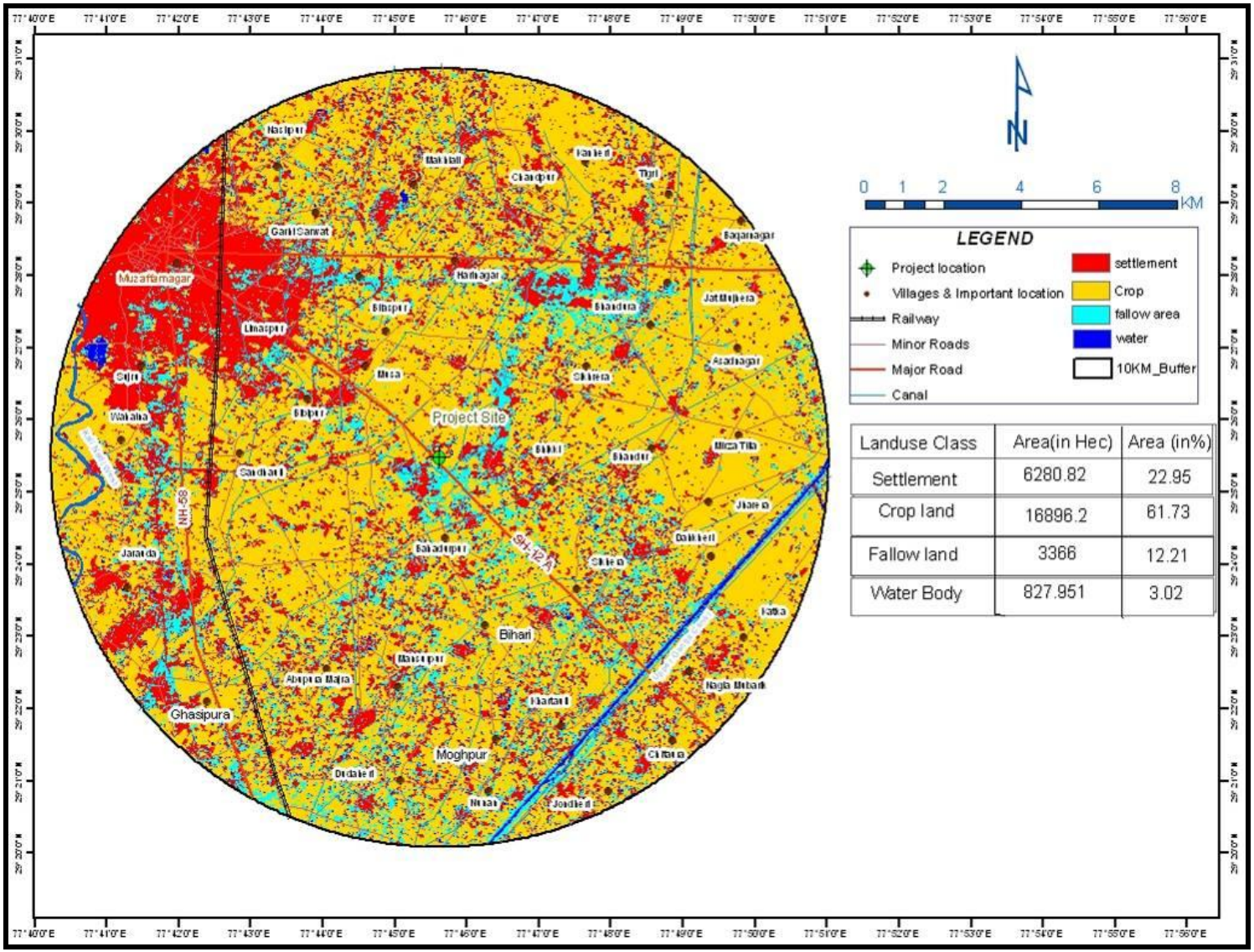



**Figure 3.9 : Wind Class Frequency Distribution**

### *3.3.5. Land Use*

61. The prevalent landuse of the study area is agricultural (61.73 %). Rest of the land is either fallow land or human settlements. The landuse Map of the Study Area is presented in following **Figure 3.10**. The region has a mix of medium and high fertility soils. The soils of medium fertility are single croplands, while the highly fertile soils are suitable for double crops. The main agricultural produce of the area is food grains (wheat, barley, gram, rice, maize), sugar cane, tilhan, and potato. Both Rabi and Khariff crops are harvested. There are no ecologically sensitive areas such as National Parks and/ or sanctuaries in this region.




| Landuse Class | Area(in Hec) | Area (in%) |
|---|---|---|
| Settlement | 6280.82 | 22.95 |
| Crop land | 16896.2 | 61.73 |
| Fallow land | 3366 | 12.21 |
| Water Body | 827.951 | 3.02 |

**Figure 3.10 : Land use map of the study area**

### *3.3.6. Soil Characteristics*

62. In the proposed study soil quality are influenced to a very limited extent by the topography, vegetation and parent rock. However, the variations in soil profile are much more pronounced because of the regional climatic differences. The soil of this zone has developed under semi-arid condition. The sub-surface geological formations of the buffer area (7 km radius) comprise of sand, silt, clay and kankar in various proportions . Its characteristics in the districts of Uttar Pradesh is part of Gangetic alluvium while in Yamuna Nagar, Ambala, Patiala and Ludhiana these are non-calcareous and sandy loam on the surface, and loam to clayey loam at depth and placed under the classification as Udipsamments/Udorthents

63. Soil samples were collected from the project site as well as from nearby areas to access the soil characteristics in the study area. The sampling locations are shown in **Figure 3.11** and the analysis results are given in Error! Reference source not found..

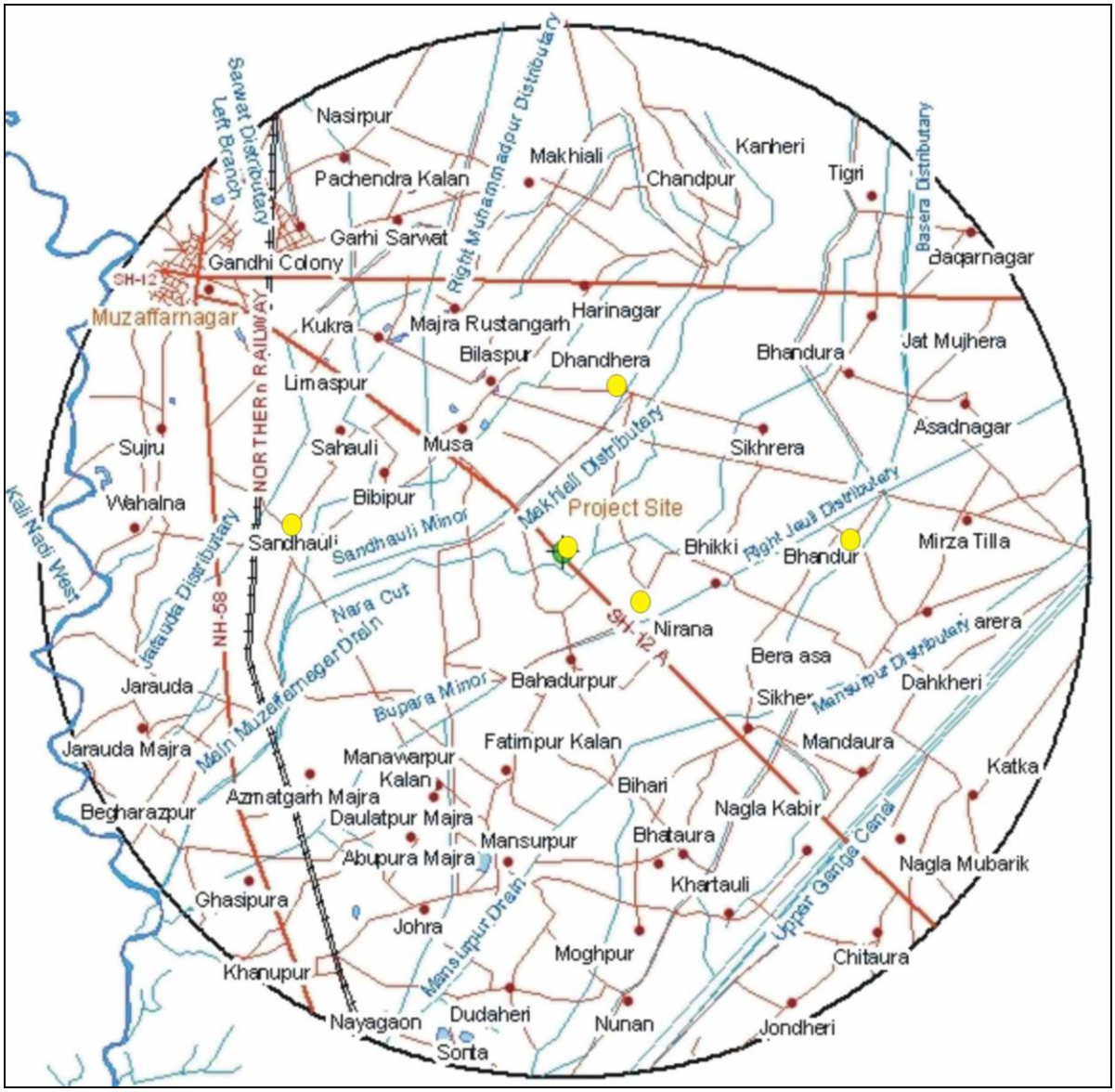



**Figure 3.11 : Soil Sampling Locations in the Study Area**

**Table 3.2 : Analysis Results of Soil Sampling**

| S. No. | Parameters | Project Site | Nairana | Sandhawali | Bhandoor | Dhandor |
|---|---|---|---|---|---|---|
| 1 | Bulk Density; g/cm3 | 1.25 | 1.25 | 1.26 | 1.26 | 1.28 |
| 2 | Color | Brown | Brown | Brown | Brown | Brown |
| 3 | Organic matter; % | 0.59 | 0.52 | 0.55 | 0.54 | 0.56 |
| 4 | Water Holding Capacity, % | 33 | 30 | 32 | 32 | 30 |
| 5 | pH (20% slurry) | 7.02 | 6.5 | 7.1 | 7 | 6.8 |
| 6 | Texture | Sandy Loam | Sandy Loam | Sandy Loam | Sandy Loam | Sandy Loam |
| 7 | Moisture % | 0.22 | 0.25 | 0.23 | 0.23 | 0.25 |
| 8 | Chloride % | 0.0025 | 0.005 | 0.005 | 0.004 | 0.004 |
| 9 | Carbonates, % | NT | NT | NT | NT | NT |
| 10 | BiCarbonates, % | 0.0061 | 0.0122 | 0.0088 | 0.0064 | 0.0125 |
| 11 | Conductivity (20% slurry), mmhos/cm | 26 | 48 | 36 | 32 | 38 |
| 12 | Potassium, % | 0.22 | 0.26 | 0.24 | 0.3 | 0.25 |
| 13 | Phosphorus, % | 0.018 | 0.021 | 0.02 | 0.016 | 0.022 |
| 14 | Nitrogen, % | 1.12 | 1.21 | 1.16 | 1.15 | 1.18 |

Source: Soil Analysis during study period

64. The soil samples collected from the project site reveal sandy loam characteristics and brown in color.

### *3.3.7. Water Environment*

65. Water sampling and subsequent analysis were carried out to determine both the groundwater and surface water quality of the study area. Ground water samples were collected from 6 locations during the study period and analyzed for a number of physico-chemical parameters. The samples were taken from the borewells at Project Site, Bhandoor, Nairana, Sandhawli, Dhandara and Nai Mandi. Sampling locations are shown in **Figure 3.12**. The results of the physico-chemical analysis of ground water are given in **Table 3.3**.

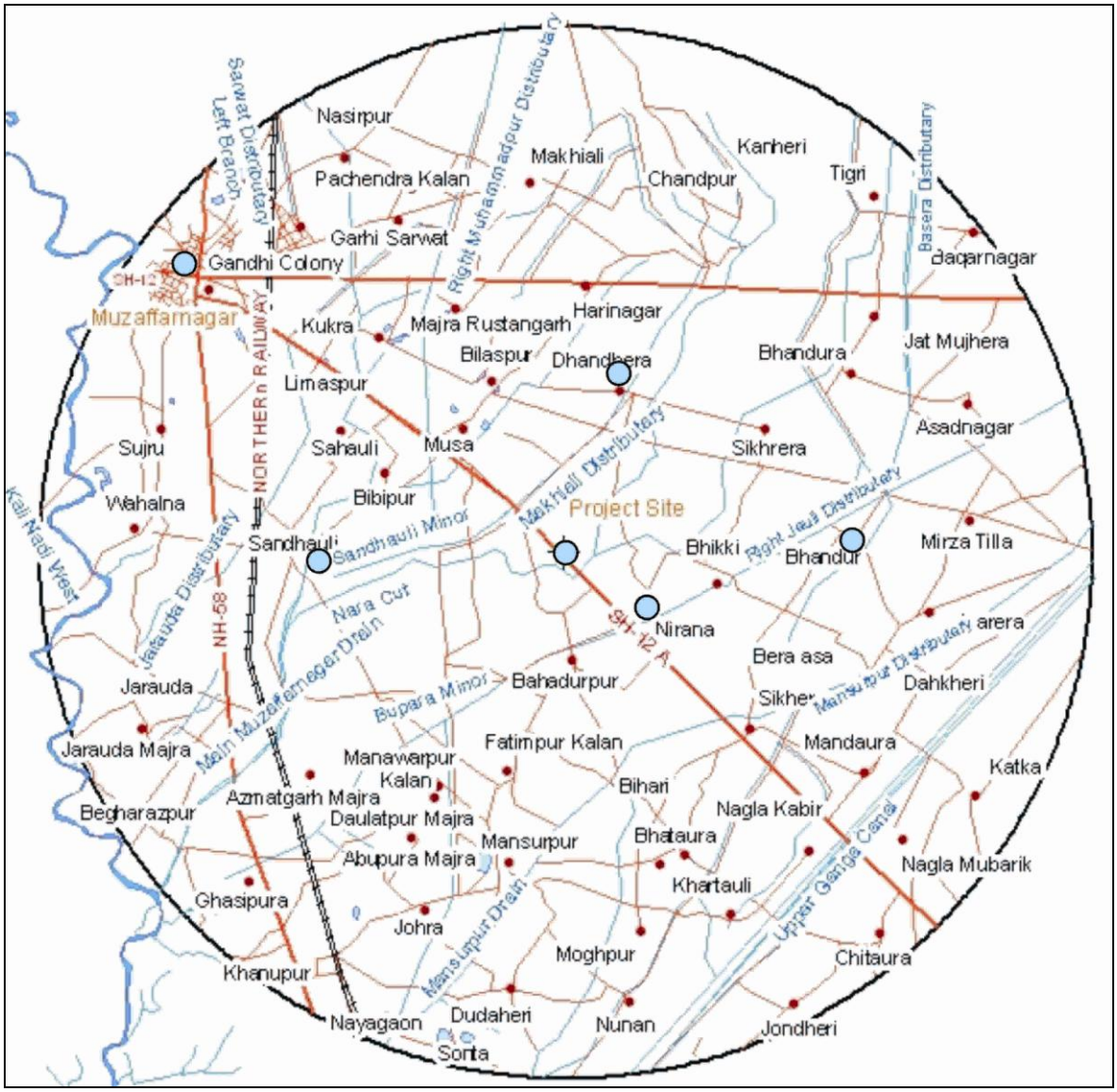



**Figure 3.12 : Groundwater Sampling Locations in the Study Area**

**Table 3.3 : Groundwater Quality in the Study Area**

| S. No | Parameters | Project Site | Bhandoor | Nairana | Sandhawali | Dhandhera | Nai Mandi |
|---|---|---|---|---|---|---|---|
| 1 | pH | 7.44 | 7.15 | 7.13 | 7.3 | 7.25 | 7.36 |
| 2 | Conductivity, mmhos/cm | 484 | 218 | 247 | 560 | 389 | 478 |
| 3 | Turbidity (NTU) | 2.3 | 2.5 | 2.2 | 2.3 | 2.4 | 2.4 |
| 4 | Dissolved solids | 324 | 146 | 172 | 374 | 289 | 367 |
| 5 | Alkalinity | 180 | 110 | 210 | 230 | 160 | 217 |
| 6 | Suspended solids | 6 | 4 | 5 | 6 | 5 | 6 |
| 7 | Total Hardness | 160 | 70 | 70 | 170 | 130 | 80 |
| 8 | Chlorides as Cl | 30 | 20 | 30 | 35 | 26 | 25 |

| S. No | Parameters | Project Site | Bhandoor | Nairana | Sandhawali | Dhandhera | Nai Mandi |
|---|---|---|---|---|---|---|---|
| 9 | Sulphates as SO4 | 34 | 16 | 18 | 30 | 29 | 27 |
| 10 | Nitrates as NO3 | 10.5 | 6.8 | 8.1 | 11.2 | 9.3 | 7.2 |
| 11 | Phosphates as PO4 | 0.022 | 0.028 | 0.021 | 0.032 | 0.026 | 0.036 |
| 12 | Fluoride as F | 0.72 | 0.66 | 0.68 | 0.76 | 0.74 | 0.7 |
| 13 | Total Iron as Fe | 0.065 | 0.032 | 0.042 | 0.054 | 0.038 | 0.046 |
| 14 | Lead as Pb | NT | NT | NT | NT | NT | NT |
| 15 | Copper as Cu | NT | NT | NT | NT | NT | NT |
| 16 | Nickel as Ni | NT | NT | NT | NT | NT | NT |
| 17 | Zinc as Zn | 0.51 | 0.26 | 0.35 | 0.47 | 0.48 | 0.39 |
| 18 | Chromium (Total Cr) | NT | NT | NT | NT | NT | NT |
| 19 | Manganese as Mn | NT | NT | NT | NT | NT | NT |
| 20 | Oil and Grease | NT | NT | NT | NT | NT | NT |
| 21 | Calcium as Ca | 60 | 24 | 8 | 56 | 19 | 49 |
| 22 | Magnesium as Mg | 24.4 | 11.2 | 10.2 | 27.8 | 16.7 | 26.5 |
| 23 | Total Coliform, MPN/100 ml | Nil | Nil | Nil | Nil | Nil | Nil |

66. Surface water samples were collected from 3 locations during the study period and analyzed for a number of physico-chemical parameters. The samples were taken from the Dhandhera Datiyana Drain, Upper ganga Canal and Makhiyali Distributary.. Sampling locations are shown in **Figure 3.112**. The results of the physico-chemical analysis of Surface water are given in **Table 3.35**.

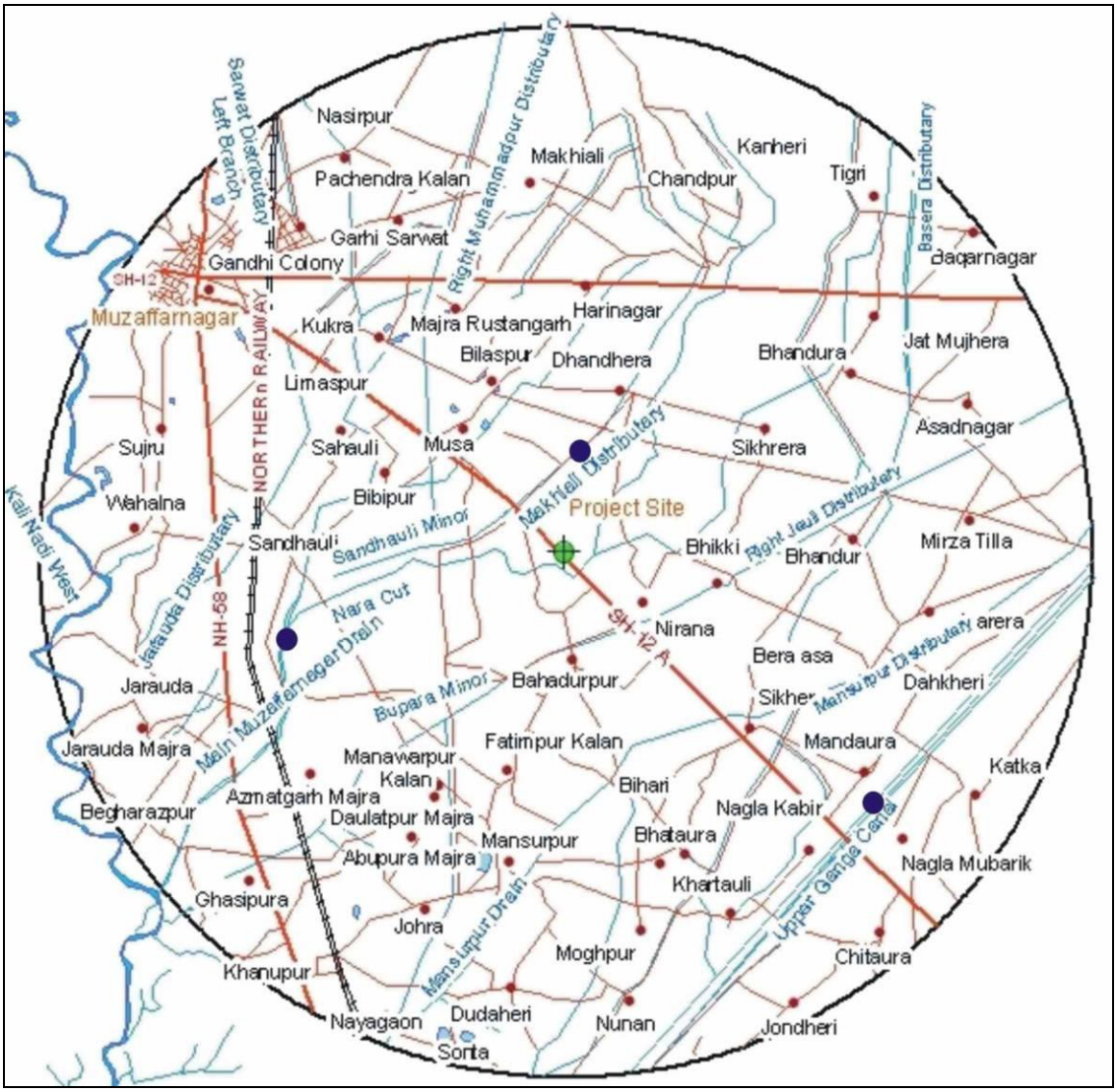



**Figure 3.13 : Surfacewater Sampling Locations in the Study Area**

**Table 3.4 : Surface water Quality in the Study Area**

| S. No. | Parameters | Muzaffarnagar Drain | Upper Ganga Canal | Makhiyali Distributary |
|---|---|---|---|---|
| 1 | pH | 7.24 | 7.4 | 7.5 |
| 2 | Conductivity, mmhos/cm | 3895 | 161 | 430 |
| 3 | Turbidity (NTU) | 15 | 3.9 | 7 |
| 4 | Dissolved solids | 2588 | 112 | 130 |
| 5 | Alkalinity | 410 | 70 | 85 |
| 6 | Suspended solids | 22 | 8 | 10 |
| 7 | Total Hardness | 500 | 50 | 115 |
| 8 | Chlorides as Cl | 775 | 25 | 31 |
| 9 | Sulphates as SO4 | 92 | 18 | 20 |
| 10 | BOD | 112 | 0.8 | 3 |
| 11 | COD | 318 | 22 | 25 |
| 12 | Nitrates as NO3 | 21.5 | 11.2 | 12.4 |
| 13 | Phosphates as PO4 | 0.28 | 0.12 | 0.16 |
| 14 | Fluoride as F | 0.82 | 0.74 | 0.8 |

| S. No. | Parameters | Muzaffarnagar Drain | Upper Ganga Canal | Makhiyali Distributary |
|---|---|---|---|---|
| 15 | Total Iron as Fe | 0.088 | 0.046 | 0.056 |
| 16 | Lead as Pb | NT | NT | NT |
| 17 | Copper as Cu | NT | NT | NT |
| 18 | Nickel as Ni | NT | NT | NT |
| 19 | Zinc as Zn | 0.68 | 0.38 | 0.45 |
| 20 | Chromium (Total Cr) | NT | NT | NT |
| 21 | Manganese as Mn | NT | NT | NT |
| 22 | Oil and Grease | NT | NT | NT |
| 23 | Calcium as Ca | 280 | 20 | 25 |
| 24 | Magnesium as Mg | 53.7 | 7.3 | 8.3 |
| 25 | Total Coli form, MPN/100 ml | 280 | 28 | 33 |

### *3.3.8. Air Environment*

67. Preliminary air sampling and monitoring was carried out in the months of March, April and May, 2010 to establish the air quality of the study area. The main sources of pollution in the study area are industrial and vehicular emissions, suspended dust from the paved and unpaved tracks, fuel burning for domestic requirements and windblown dust from the open agricultural and waste land.

68. Sampling locations were selected based upon:

- Sensitivity of site, where the construction activity and traffic due to the proposed project will take place.
- Presence of sensitive receptors such as settlements.
- Representative locations of regional air quality

69. Based on the above, Six air sampling locations were selected at Project Site, Village : Nairana, New Mandi of Muzaffarnagar Town, Village : Sandhwali, Village : Dhandhera, Village : Bhandaur and are shown in **Figure 3.1113**.

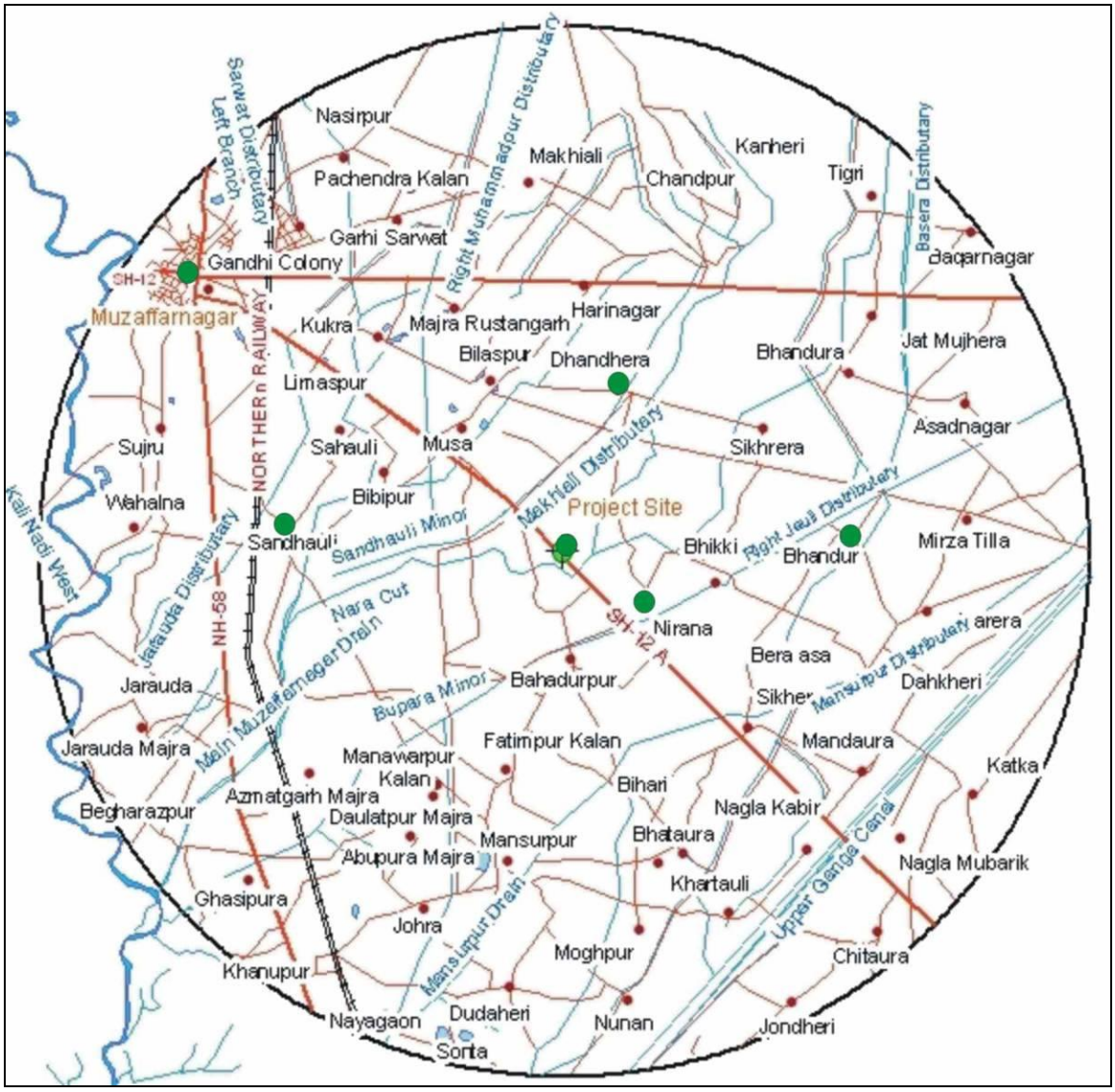



**Figure 3.14 : Air Sampling Locations in the Study Area**

70. Fine Particulate Sampler APM-550 of Envirotech Instruments, New Delhi, are being used for monitoring of Particulate matter less than 2.5 micron size ($PM_{2.5}$), Particulate Matter less than 10 micron size ($PM_{10}$) Sulphur Dioxide ($SO_2$) and Oxides of Nitrogen ($NO_x$). Samples of CO & HC were taken with the help of Vacuum Pumps. Samples were collected and analyzed for $PM_{2.5}$, $PM_{10}$, $SO_2$, $NO_x$, Carbon Monoxide (CO) and Hydrocarbon (HC). Monitoring was done twice a week for at each location during the study period (March to May 2010).

71. The average of the analytical results of air quality monitoring in the above mentioned locations are compared against the National Ambient Air Quality Standards (NAAQS). The maximum, minimum and average values at each location are given in Error! Reference source not found..

**Table 3.5 : Ambient Air Quality Analysis**

| Location | Date | PM 2.5 | PM 10 | Sox | Nox | CO | HC |
|---|---|---|---|---|---|---|---|
| Project Site | Max. | 70.4 | 162 | 25.4 | 36.6 | 940 | 425 |
| | Min. | 46.2 | 125 | 18.7 | 24.2 | 630 | 218 |
| | Avg. | 55.7 | 147 | 22.9 | 31.9 | 805 | 354 |
| Nairana | Max. | 42.6 | 121 | 15.7 | 25.2 | 790 | 375 |
| | Min. | 24.5 | 55 | 10.2 | 16.3 | 470 | 204 |
| | Avg. | 30.7 | 85 | 13 | 19 | 630 | 255 |
| New Mandi | Max. | 36.4 | 88 | 23.3 | 38.2 | 850 | 412 |
| | Min. | 20.3 | 54 | 15.2 | 20.4 | 560 | 244 |
| | Avg. | 28.5 | 71 | 20.5 | 32 | 775 | 308 |
| Sandhawali | Max. | 44.2 | 105 | 20.4 | 33.2 | 740 | 335 |
| | Min. | 24.5 | 56 | 10.5 | 14.4 | 430 | 185 |
| | Avg. | 32.5 | 69 | 14.3 | 20.8 | 650 | 226 |
| Dhandhera | Max. | 52.3 | 120 | 14.2 | 27.5 | 810 | 254 |
| | Min. | 30.6 | 67 | 8.8 | 16.3 | 400 | 160 |
| | Avg. | 40.2 | 87 | 12.4 | 20.5 | 585 | 207 |
| Bhandaur | Max. | 50 | 128 | 12.8 | 26.4 | 720 | 310 |
| | Min. | 26.4 | 76 | 6.6 | 15.2 | 430 | 175 |
| | Avg. | 33.1 | 103 | 9.2 | 20.1 | 620 | 220 |

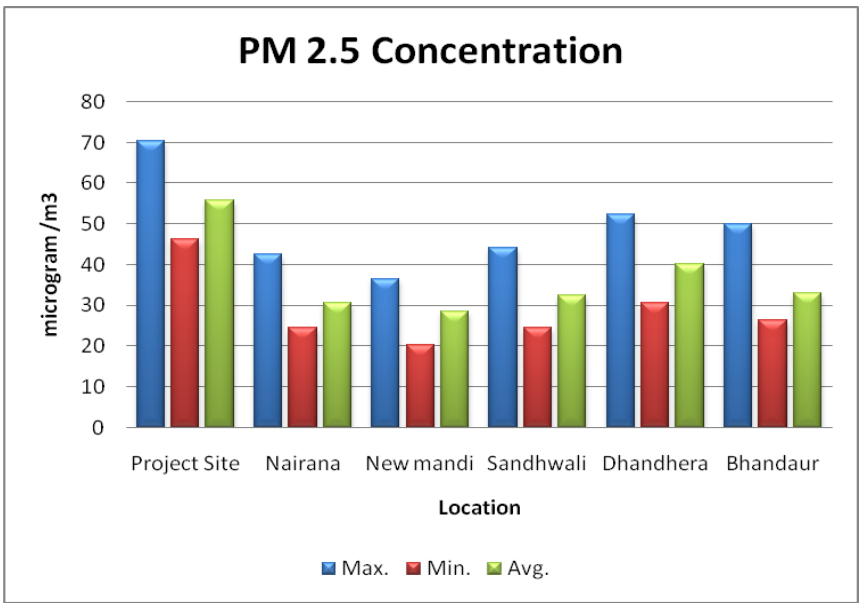



**Figure 3.15 : Graph Showing Max., Min. and Avg. Concentration of $PM_{2.5}$**

72. **$PM_{2.5}$:** The highest $PM_{2.5}$ level was observed at the Project Site (70.4 µg/m$^3$), while the lowest level was observed at New Mandi of Muzaffarnagar Town (20.3 µg/m$^3$).

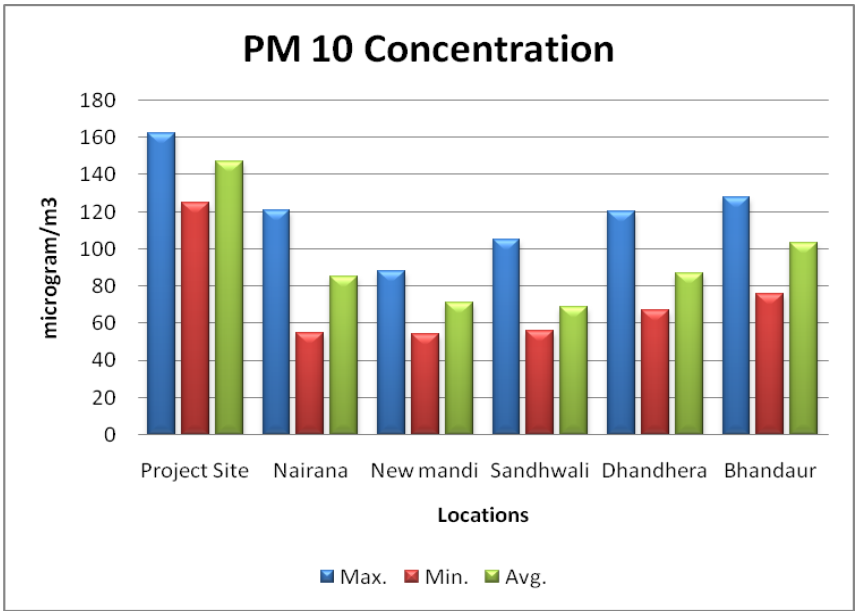



**Figure 3.16 : Graph Showing Max., Min. and Avg. Concentration of $PM_{10}$**

73. **$PM_{10}$:** $PM_{10}$ levels were found ranging from 54.0 to 162.0 µg/m$^3$. The highest RSPM levels were found at the Project Site (162.0 µg/m$^3$) while the lowest levels was found at New Mandi (54.0 µg/m$^3$). The $PM_{10}$ in the study area is contributed mainly by vehicular emissions, re-suspended dust from paved roads and open areas as well as from industrial activities.

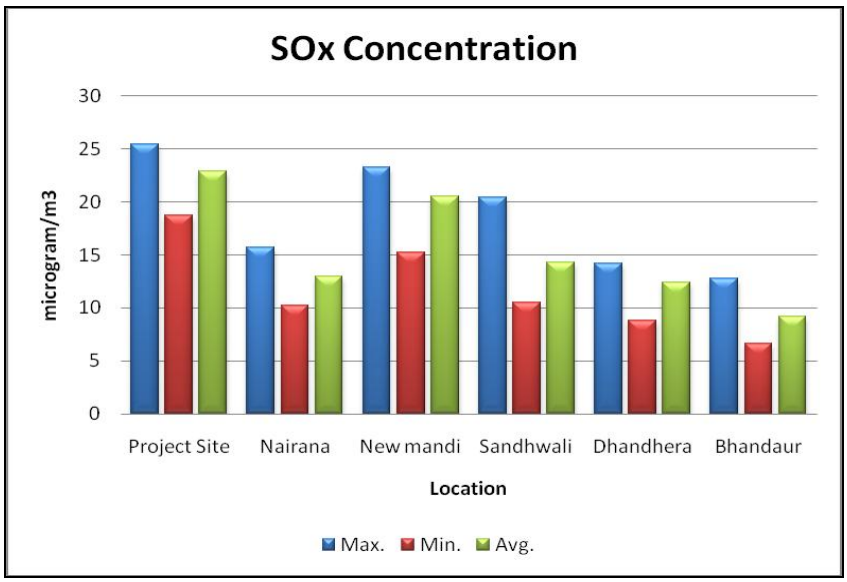



**Figure 3.17 : Graph Showing Max., Min. and Avg. Concentration of $SO_x$**

74. **Sulphur Dioxide ($SO_2$):** The highest level of $SO_2$ was found at the Project site (25.4 µg/m$^3$) whereas lowest level was found at Village: Bhandaur (6.6 µg/m$^3$). The SOx level of the Study area is well under the NAAQS Standard (New) of 80 µg/m$^3$. The main source of SO2 emission is vehicular sources.

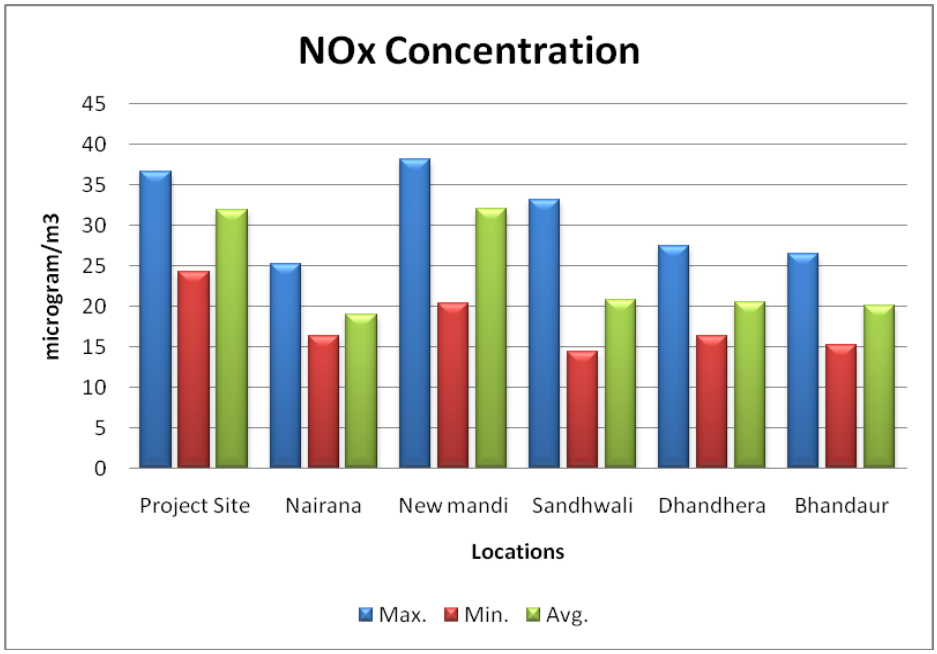



**Figure 3.18 : Graph Showing Max., Min. and Avg. Concentration of $NO_x$**

75. **Oxides of Nitrogen (NOx):** The highest level of NOx was found at the New Mandi (38.2 µg/m$^3$) whereas lowest level was found at Village: Sandhawli (14.4 µg/m$^3$). The NOx level of the Study area is well under the NAAQS Standard (New) of 80 µg/m$^3$. The main source of NOx emission is industrial & vehicular sources.

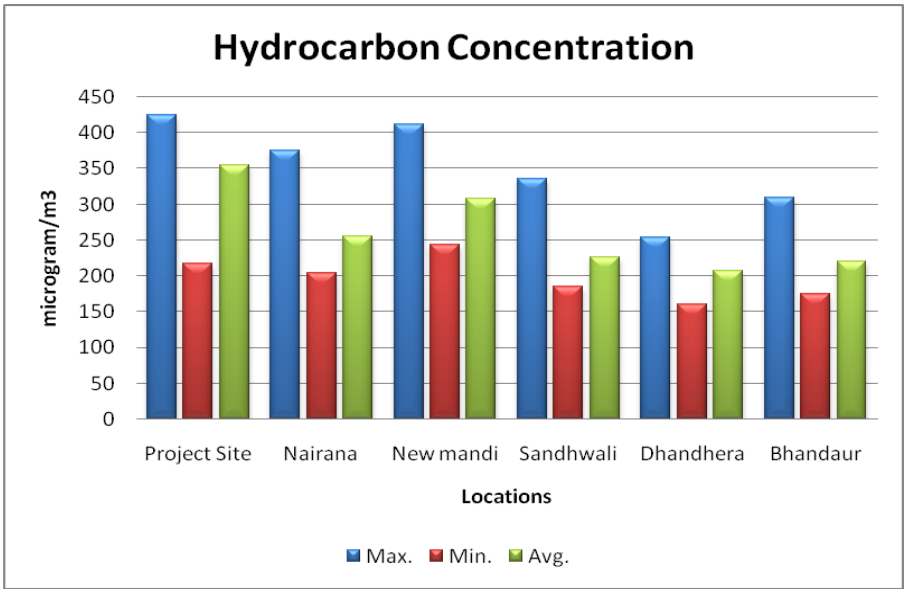



**Figure 3.19 : Graph Showing Max., Min. and Avg. Concentration of Hydrocarbons**

76. **Hydrocarbons (HC):** The highest level of HC was found at Project Site (425.0 µg/m$^3$) and the lowest level was found at Village : Dhandhera (160.0 µg/m$^3$).

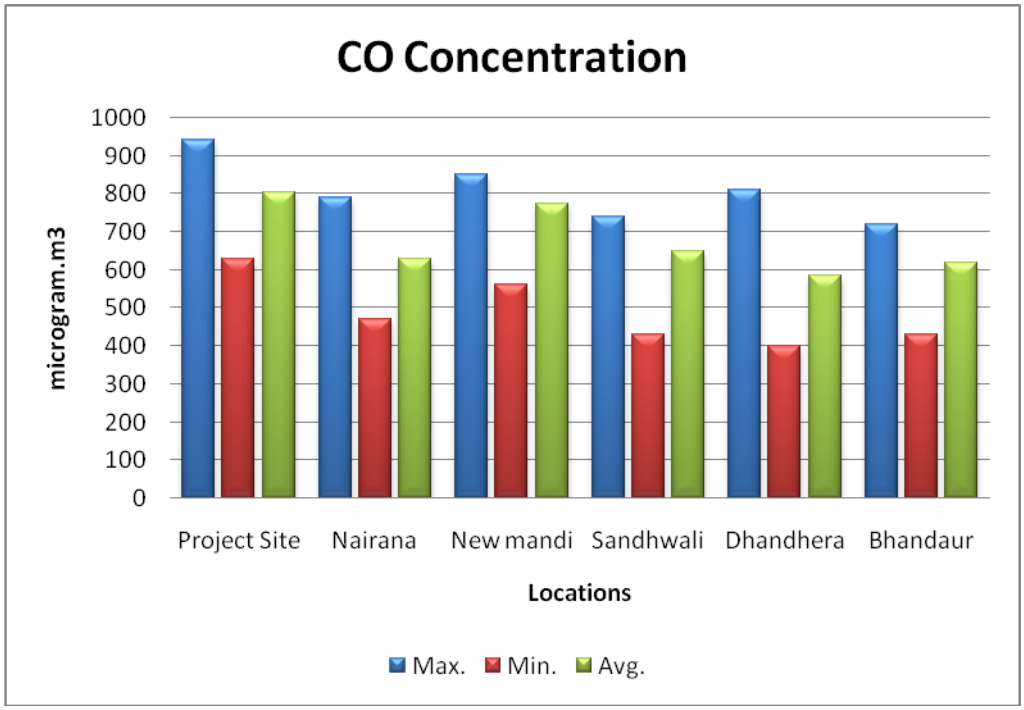



**Figure 3.20 : Graph Showing Max., Min. and Avg. Concentration of CO**

77. **Carbon Monoxide (CO):** All values of CO at all the monitored locations were found within the permissible levels of 2000 µg/m$^3$. The highest level was found at Project Site (940.0 µg/m$^3$) and the lowest level was found at Village : Dhandhera (400.0 µg/m$^3$).

78. Hence, it can be concluded that the air quality of the monitored locations in the study area are well within the permissible standards for industrial areas.

### *3.3.9. Noise Environment*

79. Noise after a certain level can have a very disturbing effect on the people and animals exposed to it. Hence, it is important to assess the present noise quality of the area in order to predict the potential impact of future noise levels due to the proposed project.

80. Noise monitoring was carried out at seven locations, namely, Project Site, Near SH-12a (Jansath Road),Village : Nairana,Village : Bhandaur, Village : Dhandhera, Village : Sandhawli and Kambal wala Bagh in Muzaffarnagar Town. The Noise Monitoring locations are shown in **Figure 3.1120**. Noise measurements were done using Cygnet Sound Level Meter Model 2031A. Monitoring was carried out both in the day and night time and accordingly Leq day and night were derived from the monitored data including the peak values.

81. The results of the monitoring are provided in Error! Reference source not found.**7**. Monitored levels were compared against Ambient Noise Standards prescribed under Gazette Notification 643 of Ministry of Environment and Forests, Government of India. The project site falls in designated industrial area and the noise levels at all the locations were found within the ambient noise standards.

**Figure 3.21 : Noise Sampling Locations**

**Table 3.6 : Ambient Noise Quality Results**

| Location | Day Time | | | Night Time | | |
|---|---|---|---|---|---|---|
| | L max | L min | Leq | L max | L min | Leq |
| Project Site | 79.7 | 46.1 | 56.7 | 65.0 | 36.7 | 45.7 |
| SH-12a | 100.9 | 48.6 | 75.2 | 92.0 | 44.3 | 67.8 |
| Nairana | 74.2 | 26.4 | 55.0 | 67.9 | 25.6 | 42.6 |
| Bhandaur | 82.0 | 30.5 | 55.0 | 69.3 | 27.8 | 43.5 |
| Dhandhera | 88.2 | 30.5 | 55.1 | 73.1 | 28.2 | 44.4 |
| Sandhawali | 80.3 | 30.5 | 55.0 | 69.8 | 26.5 | 43.2 |
| Kambal bala Bag | 68.8 | 43.3 | 50.8 | 58.6 | 35.4 | 40.5 |

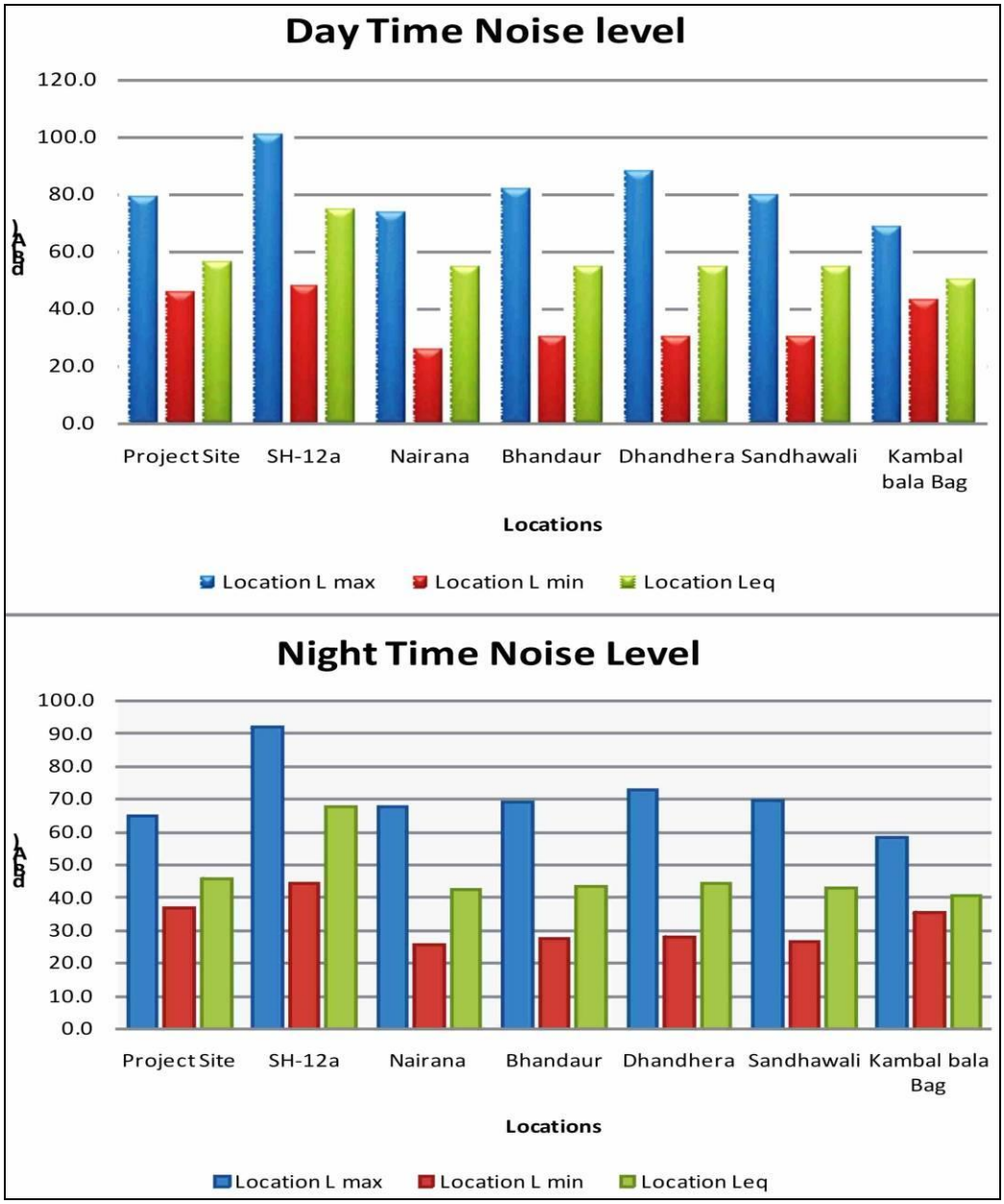



**Figure 3.22 : Comparative Graph Showing Daytime and Nighttime Noise level**

## 3.4. Biological Environment

### *3.4.1. Flora and Fauna*

82. The semi-arid hot climate of the area largely results in thorny scrub vegetation of xerophytes. The plants in the study area are sparsely distributed in heterogeneous manner.

83. A detailed List of Floral Species observed in the study area is given in Table 3.7.

**Table 3.7 : List of Floral Species observed in the Study Area**

| Botanical Name | Common Name |
|---|---|
| *Acacia auriculiformis* | Subabul |
| *Acacia catechu* | Khair |
| *Acacia nilotica* | Babul |
| *Albizia lebeck* | Siris |

| Botanical Name | Common Name |
|---|---|
| *Albizia procera* | White Siris |
| *Anthocephalus chinensis* | Kadamba |
| *Artocarpus heterophyllus* | Kathal |
| *Azadiracta india* | Neem |
| *Bambusa vulgaris* | Bans |
| *Barringtonia accutangula* | Hijal |
| *Bauhinia varigata* | Kachnar |
| *Calotropis giganta* | Akand |
| *Cassia fistula* | Amaltas |
| *Dalbergia sisoo* | Shisham |
| *Delonix regia* | Gulmohar |
| *Derris indica* | Karanja |
| *Ficus bengalensis* | Bargad |
| *Ficus benjamina* | Pakur |
| *Ficus religiosa* | Pipal |
| *Jacaranda mimosaefolia* | Nil Gulmohar |
| *Lagerstromia speciosa* | Jarool |
| *Mangifera indica* | Aam |
| *Mimusops elengi* | Bakul |
| *Polyalthia longifolia* | Devdaru |
| *Psidium guava* | Amrud |
| *Terminalia arjuna* | Arjun |
| *Tamarindus Indica* | Imli |
| *Zizyphus Mauritania* | Ber |

84. The animals observed in the area are mainly the common dogs and stray cattle (cows mainly).

### *3.4.2. Forests and Wildlife*

85. There is no forestland in the core zone or the intermediate zone around the project area. There are no wildlife areas within the outer zone of the project.

### *3.4.3. Protected Areas*

86. There are no protected areas in the vicinity of the project other than the above mentioned forests. There are also no monuments of historical or archaeological importance within the study area.

## 3.5. Socio-Economic Environment

87. The Study Area of 10 km radial Zone mainly falls in the Muzaffarnagar and Jansath Sub-district of District Muzaffarnagar There are Total 29 Villages in Study Area, out of which, 10 villages belongs to Jansath Sub district and rest 19 village are in Muzaffarnagar Sub-district.

### *3.5.1. Population*

88. Total Population of the Study area as per Census of India, 2001 is 495843, the total number of Household being 76872. Rural population constitutes 33.11 % and Urban Population constitutes 66.89 % of total population. Total Male Population of the Study area is 262578 and total Female Population of the Study Area is 233265.

89. Village-wise details of population is given in **Table 3.8.**

**Table 3.8 : Village-wise Population Details of Study Area**

| State | District | Sub-district | Village | Rural / Urban | Number of Household | Total Population | Total Male | Total Female |
|---|---|---|---|---|---|---|---|---|
| Uttar Pradesh | MuzaffarNagar | Muzaffarnagar | Shernagar | Rural | 1313 | 8581 | 4587 | 3994 |
| | | | Bahadarpur | Rural | 529 | 3333 | 1757 | 1576 |
| | | | Sandhawali | Rural | 765 | 5287 | 2835 | 2452 |
| | | | Jaroda | Rural | 1473 | 9987 | 5279 | 4708 |
| | | | Beheri | Rural | 1070 | 7783 | 4083 | 3700 |
| | | | Dhandhera | Rural | 555 | 4059 | 2152 | 1907 |
| | | | Bilaspur | Rural | 984 | 6566 | 3449 | 3117 |
| | | | Lachhera | Rural | 859 | 5474 | 2939 | 2535 |
| | | | Garhi Durganpur | Rural | 211 | 1228 | 633 | 595 |
| | | | Mustafabad | Rural | 688 | 4291 | 2284 | 2007 |
| | | | Pachenda Kalan | Rural | 330 | 2083 | 1124 | 959 |
| | | | Pachenda Khurd | Rural | 763 | 4858 | 2593 | 2265 |
| | | | Ratheri | Rural | 694 | 5501 | 2918 | 2583 |
| | | | Bajheri | Rural | 748 | 5273 | 2765 | 2508 |
| | | | Bagowali | Rural | 1415 | 10578 | 5511 | 5067 |
| | | | Tawli | Rural | 1312 | 10580 | 5845 | 4735 |
| | | | Saidpur Khurd | Rural | 531 | 3811 | 2053 | 1758 |
| | | | Chhetela | Rural | 471 | 3746 | 2012 | 1734 |
| | | | Nairana | Rural | 620 | 4585 | 2452 | 2133 |
| | | | Muzaffarnagar | Urban | 52916 | 331668 | 175283 | 156385 |
| | | Jansath | Behrhassa | Rural | 749 | 4653 | 2476 | 2177 |
| | | | Bhandur | Rural | 382 | 2639 | 1387 | 1252 |
| | | | Mansoorpur | Rural | 1430 | 9744 | 5085 | 4659 |
| | | | Nauna | Rural | 304 | 1691 | 881 | 810 |
| | | | Moghpur | Rural | 286 | 1750 | 963 | 787 |
| | | | Kawal | Rural | 1338 | 9433 | 4976 | 4457 |
| | | | Bhaleri | Rural | 367 | 2234 | 1155 | 1079 |
| | | | Sikhera | Rural | 535 | 3841 | 2040 | 1801 |
| | | | Kukra | Rural | 2553 | 15384 | 8252 | 7132 |
| | | | Kheri Ferozabad | Rural | 681 | 5202 | 2809 | 2393 |
| **Total** | | | | | **76872** | **495843** | **262578** | **233265** |

### *3.5.2. Sex Ratio*

90. The sex ratio of the study area is 888. Comparative graph of Male and Female Population of the Area is presented in Figure 3.22.

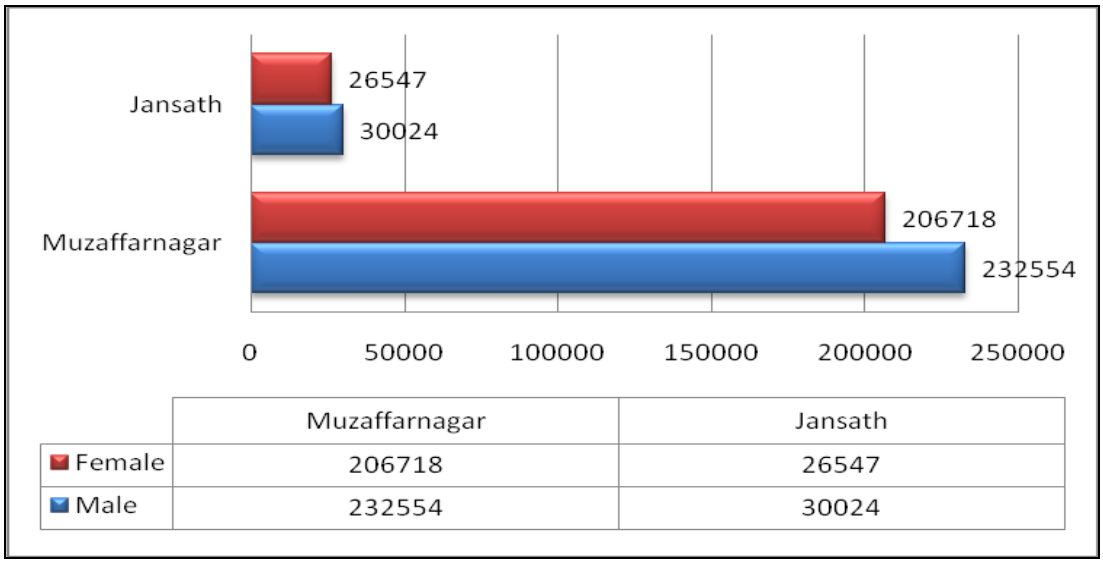



**Figure 3.23 : Male female Population of Study Area**

### *3.5.3. Literacy Rate*

91. Literacy Rate of the study area is 57.85%. Distribution of male and female literacy rate in the study zone is 64.18% and 50.73% respectively. Village-wise Details of Literacy in the study area is provided in following **Table 3.9.**

**Table 3.9 : Village-wise Details of Literacy in Study Area**

| State | District | Sub-district | Village | Total Literates | Literates (Male) | Literates (Female) |
|---|---|---|---|---|---|---|
| Uttar Pradesh | Muzaffar Nagar | Muzaffar nagar | Shernagar | 3064 | 2121 | 943 |
| | | | Bahadarpur | 1839 | 1147 | 692 |
| | | | Sandhawali | 1942 | 1327 | 615 |
| | | | Jaroda | 4492 | 2854 | 1638 |
| | | | Beheri | 3767 | 2423 | 1344 |
| | | | Dhandhera | 1385 | 1047 | 338 |
| | | | Bilaspur | 2620 | 1731 | 889 |
| | | | Lachhera | 2692 | 1749 | 943 |
| | | | Garhi Durganpur | 359 | 277 | 82 |
| | | | Mustafabad | 2156 | 1394 | 762 |
| | | | Pachenda Kalan | 1085 | 695 | 390 |
| | | | Pachenda Khurd | 2711 | 1704 | 1007 |
| | | | Ratheri | 2315 | 1506 | 809 |
| | | | Bajheri | 1659 | 1048 | 611 |
| | | | Bagowali | 4690 | 2831 | 1859 |
| | | | Tawli | 3589 | 2684 | 905 |
| | | | Saidpur Khurd | 2031 | 1299 | 732 |
| | | | Chhetela | 1592 | 1001 | 591 |
| | | | Nairana | 1325 | 960 | 365 |
| | | | Muzaffarnagar | 213500 | 121245 | 92255 |

| State | District | Sub-district | Village | Total Literates | Literates (Male) | Literates (Female) |
|---|---|---|---|---|---|---|
| | | Jansath | Behrhassa | 2331 | 1487 | 844 |
| | | | Bhandur | 1521 | 937 | 584 |
| | | | Mansoorpur | 4702 | 2933 | 1769 |
| | | | Nauna | 948 | 607 | 341 |
| | | | Moghpur | 1175 | 710 | 465 |
| | | | Kawal | 4077 | 2545 | 1532 |
| | | | Bhaleri | 1319 | 806 | 513 |
| | | | Sikhera | 1857 | 1169 | 688 |
| | | | Kukra | 8360 | 5160 | 3200 |
| | | | Kheri Ferozabad | 1765 | 1134 | 631 |
| **Total** | | | | **286868** | **168531** | **118337** |

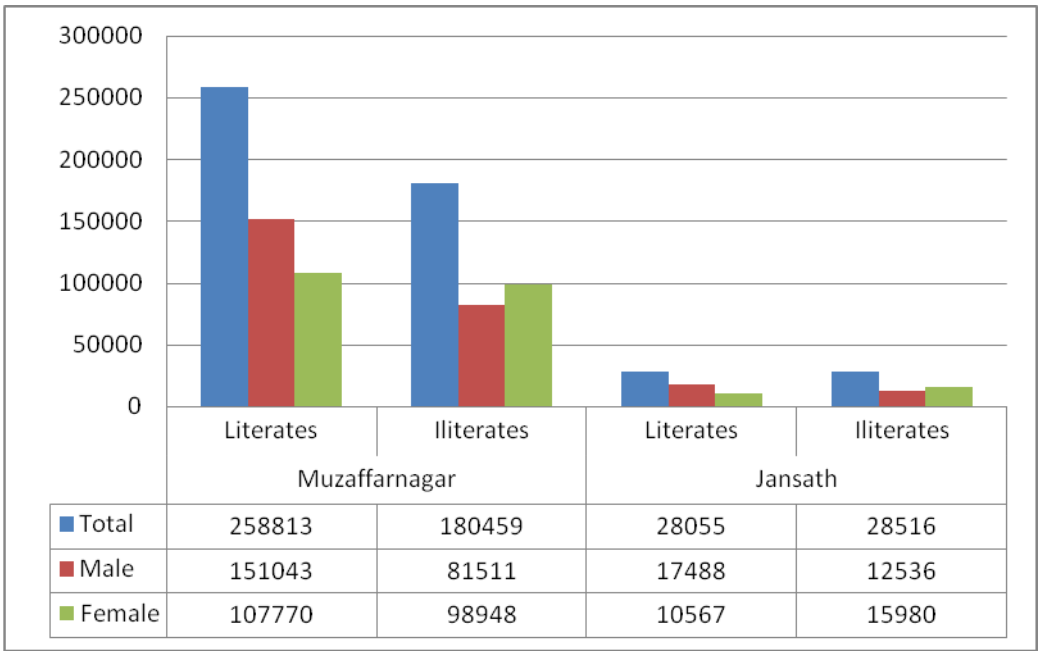



**Figure 3.24 : Gender-wise Distribution of Literacy in Study Area**

### *3.5.4. Workers Scenario*

92. As revealed from Census of India 2001, a huge percentage (72%) people is non-workers in the Study Area. Worker scenario of the study is presented in following **Table 3.10**. A Comparative Diagram showing the percentage of various workers in the study area is also given in **Figure 3.24.**

**Table 3.10 : Workers Scenario of the Study Area**

| Description | Total | Male | Female |
|---|---|---|---|
| Total Worker Population | 139203 | 122120 | 17083 |
| Main workers | 118878 | 109979 | 8899 |
| Casual Labours | 14218 | 12863 | 1355 |
| Agricultural Labours | 9595 | 8630 | 965 |
| Household Workers | 4215 | 3563 | 652 |
| Other Main Workers | 90850 | 84923 | 5927 |
| Marginal Workers | 20325 | 12141 | 8184 |

| Description | Total | Male | Female |
|---|---|---|---|
| Marginal Casual Labour | 3922 | 1367 | 2555 |
| Marginal Agricultural Labours | 5626 | 2804 | 2822 |
| Marginal Household Workers | 826 | 301 | 525 |
| Other Marginal Workers | 9951 | 7669 | 2282 |
| Non-Workers | 356640 | 140458 | 216182 |

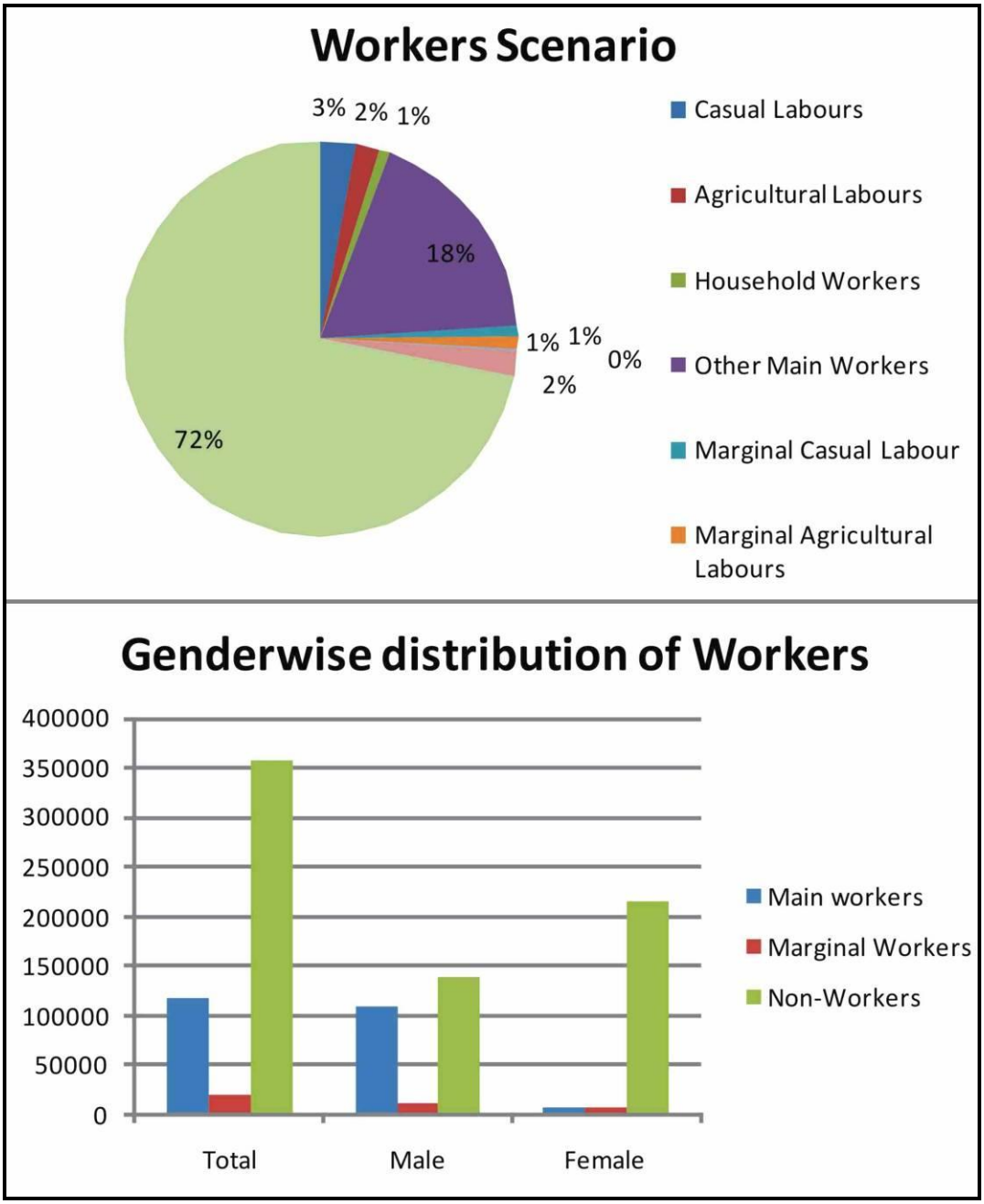



**Figure 3.25 : Worker Scenario of Study Area**

# 4. ANTICIPATED ENVIORNMENTAL IMPACTS AND MITIGATION MEASURES

This chapter details the inferences drawn from the environmental impact assessment of the proposed project. It describes the overall impacts of the project activities and underscores the areas of concern, which need mitigation measures. Predictions have been done based on the various quantitative and qualitative methods suggested by Ministry of Environment & Forests, New Delhi.

## 4.1. Prelude

93. Prediction of environmental impacts is the most important component in the impact assessment study, as it provides quantitative information on anticipated environmental impacts from a project well in advance. Several mathematical/statistical techniques and methodologies are available for predicting impacts from developmental projects on the surrounding physicochemical, ecological and socio-economic components of environment. The results obtained from the predictions are superimposed over the baseline data (pre-project) to derive the ultimate (post-project) scenario of environmental quality status in the study area around the proposed project site. The quantitative impacts derived from predictions are also essential to delineate effective environmental management plan for minimizing the adverse impacts on the surrounding environment during construction and operation phases of the project.

94. The following sections identify the potential impacts on the environment from the proposed project based on the nature and extent of the various activities associated with the project implementation and operation, as well as the current status of the environmental quality at the project site. Both beneficial (positive) and adverse (negative) impacts are considered.

## 4.2. Valued Environmental Components and Potential Impacts

95. The project activities will interact with various valued Environmental Components *viz.,* air, water, soil, land, flora & fauna, etc. The components that may be affected due to the proposed Greenfield Manufacturing Plant of drug intermediates and require focused evaluation are summarized in the following sub-sections, considering both construction phase as well as operation phase of the project:

### *4.2.1. Potential Impacts during Project Implementation*

- Impact on Air Environment
- Impact on Land Environment
- Impact on Ambient Noise Levels
- Impact on Water Quality
- Impact due to Solid Waste
- Impact on Terrestrial Ecology
- Impact on Socio-economic Environment

### *4.2.2. Potential Impacts during Project Operation*

- Impact on Air Environment
- Impact on Noise Environment

- Impact on Water Environment
- Impact due to Solid Waste/ Hazardous Waste
- Impact on Terrestrial Ecology
- Impact on Land Environment
- Impact on Socio-economic Environment

**Table 4.1 : Matrix for Various Project Activities and Associated Potential Environmental Impacts on Various Environmental Attributes**

| | Air | Land | Ambient Noise | Water Quality | Solid Waste | Flora | Fauna | Socio-economic Environment |
|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | |
| Earthwork and Excavation | - | - | - | | | | | |
| Operation of Construction Machinery | - | | - | | | | | |
| Transportation of Construction Material | - | | - | | | | | |
| Material Handling | - | - | | | - | | | |
| Influx of Workers | | - | | - | - | | | *ST+* |
| Income Generation | | | | | | | | *ST+* |
| Employment Generation | | | | | | | | *ST+* |
| **Operation Phase** | | | | | | | | |
| Operation of Industry | *LT-* | - | *LT-* | *LT-* | *LT-* | - | | *ST+* |
| Effluent Generation & Discharge | | *ST-* | | *LT-* | *ST-* | *ST-* | *ST-* | *ST-* |
| Solid Waste Generation & Disposal | | *ST-* | | | *ST-* | | | |
| Hazardous Waste Generation & Disposal | | *ST-* | | | *ST-* | | | *ST-* |
| Increase in Vehicular Movement | *ST-* | | *ST-* | | | | | |
| Transportation of Raw Material and Final Products | *ST-* | | *ST-* | | | | | |
| Storage of Hazardous Chemicals | *ST-* | *ST-* | | *ST-* | | | | *ST-* |
| Greenbelt Development | *LT+* | *LT+* | *LT+* | *LT+* | | *LT+* | *LT+* | *LT+* |
| Influx of Workers | | *ST-* | | *ST-* | *ST-* | | | *LT+* |
| Employment Generation | *ST-* | | *ST-* | | *ST-* | | | *LT+* |

***Notations:***

- ST+ : Short Term Positive
- ST- : Short Term Negative
- LT+ : Long Term Positive
- LT- : Long Term Negative

## 4.3. Potential Impacts and Mitigation Measures during Project Implementation

96. It shall be noted that all the civil work for establishment of proposed unit was already completed in the Year 2001. The project implementation activities involved in this project are now limited to installation of machinery and pollution control equipments along with development of greenbelt.

- No demolision work will be involved.
- Roads are already built within the plant. Fugitive dust emission due to movement of vehicles will be negligible.
- Electrical power will be made available through DG set and/or grid power supply.
- Water requirement during project implementation will be about 2.2 KLD only, which will be taken from the existing borewell at the site.
- No wastewater generation is anticipated during this phase. For domestic effluent, a septic tank followed by soak pit is already provided. Manpower involved during this phase will be provided with existing sanitation facilities within the premises in order to maintain adequate hygienic conditions.
- Adequate drainage system is already available within the plant premises for channelising run off water during monsoon to avoid water logging. No soil erosion is anticipated. Therefore, no long term adverse impact on water quality is anticipated during construction phase.
- No possibility of hazardous waste generation is ancipated during construction phase.
- Greenbelt on the periphery of the plant will be developed during this phase as well.

97. On the basis of the above, potential impacts during the project implementation phase will be insignificant with respect to air environment, noise environment, water environment, land environment etc.

## 4.4. Potential Impacts and Mitigation Measures during Project Operation

98. Some of the potentially significant environmental impacts from the proposed project will be in water environment, land environment, air environment, and socio-economics.

### *4.4.1. Water Environment*

**Impact:**

99. Liquid effluent will be generated from processes, utilities, equipment washings, floor washings and domestic usage. It is estimated that out of the total demand of 1.6 KLD for various industrial & domestic purposes during the operation phase of the project. Total industrial effluent generation will be about 0.2 KLD and domestic effluent of about 1.8 KLD. Remaining water will be either utilized in the processes or get evaporated.

100. The industrial and domestic effluent streams will be segregated. The process needs alkaline as well as acidic water depending upon the products. Therefore, it is expected that a near neutral pH combined wastewater may be obtained.

**Mitigation:**

101. All the industrial wastewater will be treated in an effluent treatment plant (ETP). Treated wastewater will be used for horticulture purposes. The sludge will be dried on sludge drying beds and periodically the sludge cakes will be removed and disposed off suitably.

102. The domestic wastewater generated from lavatories, will not be mixed with the plant effluent. A separate septic tank along with soak pit will be provided for treatment of it.

*4.4.1.1 Effluent Treatment Plant*

103. It is estimated that the combined wastewater may have the characteristics as given in **Table 4.2**:

**Table 4.2 : Probable Characteristics of Combined Wastewater**

| Parameter | Value |
|---|---|
| Flow Per Day | 200 L |
| Color | Turbid |
| pH | 7.0 – 9.0 |
| BOD | 450 – 950 mg/L |
| COD | 1700 – 2500 mg/L |
| Suspended Solids | 1500 – 2500 mg/L |
| Dissolved Solids | 2500 – 3000 mg/L |

104. It may be noted from the above that the wastewater from the proposed unit is likely to have high BOD, COD and solids and being devoid of essential nutrients for the growth of biota.

105. The schematic flow diagram of the proposed treatment scheme is presented in **Figure 4.1**. The combined wastewater will be received in an equalization tank to level out the fluctuations in respect of flow and characteristics of the wastewater. The pH of the combined wastewater, if required would be adjusted. Form there it will be pumped into a channel, connected to an aeration tank. As the wastewater may be deficient in nutrients diammonium phosphate and urea shall be added to make the wastewater amenable to biochemical oxidation. The mixed liquor from the aeration tank will be settled in two settling tanks each to be operated fro about 10 days cycle. One tank would receive the effluent for 10 days while the other would be drained and dried in sun. The dried and semi dried material will be manually removed and put to the sludge drying beds. The clear effluent will be used for horticulture purposes. The same cycle will be repeated for the other settling tank. The sludge will be dried on sludge drying beds and periodically the sludge cakes will be removed and disposed off suitably.

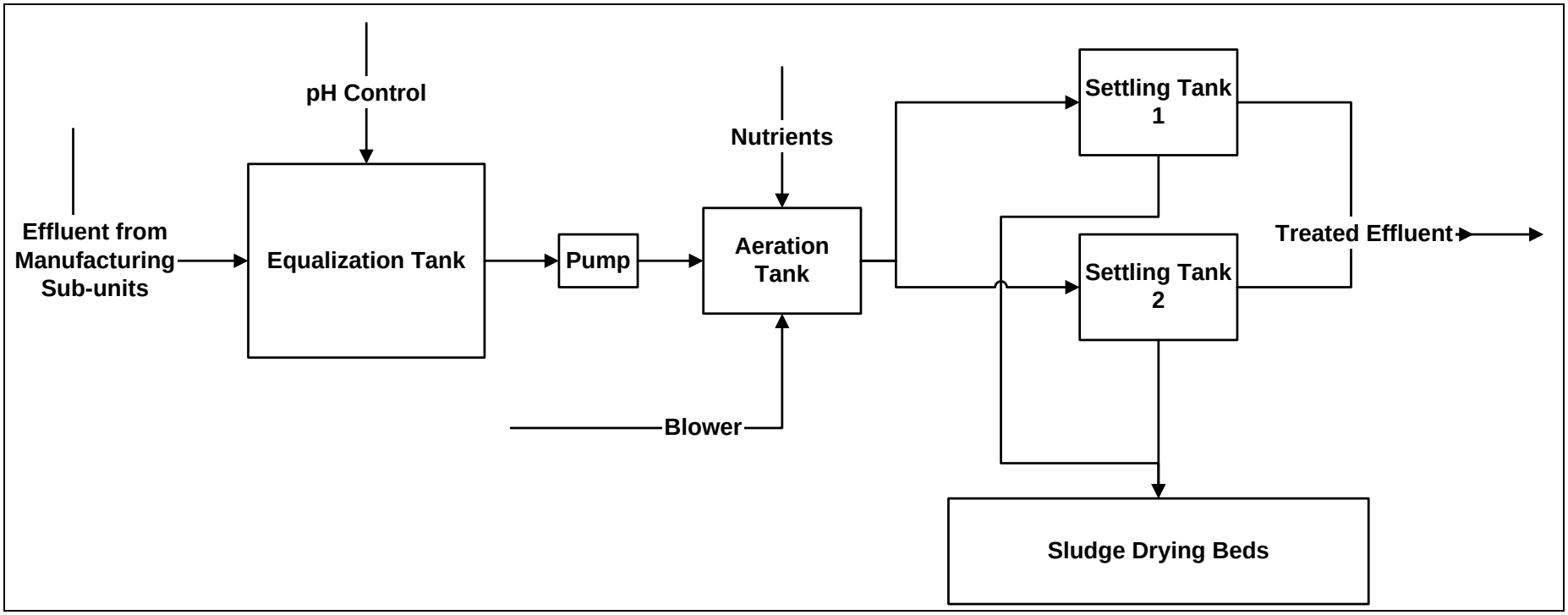



**Figure 4.1 : Treatment Scheme of the Effluent Treatment Plant**

106. The brief specifications of the ETP are as follows:

| | | | |
|---|---|---|---|
| **1.** | **Equalization tank cum sump** | | |
| | Shape | : | Rectangular |
| | Size | : | 1000 mm x 1000 mm x 1200 mm |
| | SWD | : | 400 mm |
| | Material of Construction | : | Concrete/ masonry with rich plaster |
| | **Pump** | | |
| | Number | : | One |
| | Type | : | Vertical, Non-clog, Centrigugal fitted with strainer |
| | Operation | : | Intermittant |
| | Rated discharge | : | 20 lpm |
| | Driving Motor | : | ½ HP |
| **2.** | **Aeration Tank** | | |
| | **Tank** | | |
| | Number | : | One |
| | Size | : | 2000 mm x 1000 mm x 1000 mm |
| | Liquid Depth | : | 750 mm |
| | Type of Construction | : | Concrete/ masonary with rich plaster |
| | **Aerator** | | |
| | Number | : | One |
| | Type | : | Submerged (air to be bubbled through a network of perforated pipes fitted at the bottom of the aeration tank |
| | Blower Rating | : | 1.0 HP |
| **3.** | **Settling Tank** | | |
| | Number | : | 2 |
| | Size | : | 2000 mm x 1000 mm x 1000 mm |
| | Material of Construction | : | Masonary |
| | Type | : | With a provision of draining the supernatant and V shaped bottom for the collection of sludge |
| **4.** | **Sludge Drying Beds** | | |
| **(a)** | **Beds** | | |
| | Type | : | Earthen with masonary wall |
| | Number | : | 2 |
| | Size | : | 2000 mm x 1500 mm |
| | Bed Slope | : | 0.5% |
| **(b)** | **Gravel** | | |
| | Size | : | 3 – 6 mm graded |
| | Depth | : | 30 cms |
| **(c)** | Size | : | 0.5 to 0.75 mm (effective) uniformity coefficient < 4.0 |
| | Depth | : | 15 m |

### *4.4.2. Storm Water*

**Impact:**

107. The storm water from the building roofs, paved areas and from open areas will be directed through the ditches to the covered storm water drainage. All ditches will be concrete lined and located along the plant periphery. All drainage ditches will be located to provide the shortest practical drainage path while providing efficient drainage for the plant. Rainwater harvesting system will be developed in the plant to collect the rainwater for recharging the ground water.

**Mitigation Measures:**

108. Grade level shall be contoured such that storm water run off is directed on the ground by sheet flow, to well defined drainage paths leading to the ditches. Rainwater harvesting drains shall be away from the contamination prone areas to avoid any contamination of the groundwater due to surface runoffs.

### *4.4.3. Surface Water Quality*

**Impact:**

109. It is proposed to treat all the industrial wastewater generated from the proposed plant in an ETP and treated effluents will meet the discharge standards as stipulated by the Uttar Pradesh Pollution Control Board (UPPCB) for use in irrigation purposes. Thus proposed project will not have any impact on surface or ground water resources.

**Mitigation Measures:**

110. The treated wastewater shall comply with the discharge standards (MINAS) as prescribed by the UPPCB/CPCB. Also, regular monitoring of ETP discharge shall be carried out to ensure proper treatment of the industrial wastewater.

### *4.4.4. Land Environment*

**Impact:**

111. The total plot area for the development is about 1,790 $m^2$, half of which has already been constructed for the plant. The remaining portion is at present vacant and is under green cover with tree plantation in the periphery. There is no adverse impact envisaged due to the operation of the plant.

**Mitigation Measures:**

112. The green area development and tree plantation will help in enhancing the aesthetics of the plant.

### *4.4.5. Solid and Hazardous Waste*

**Impact**

113. Solid and hazardous waste generated from the plant operation will be in the form of used oil, ETP sludge, Discarded containers/ barrels/liners used for hazardous wastes/ chemicals, packaging and domestic solid waste. All the solid and hazardous waste, if not disposed off suitably, can cause

contamination on land and water bodies. It can also create odor problem in the vicinity.

**Mitigation Measures:**

114. Hazardous waste generated from the facility shall be disposed off in suitable manner as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008. The used oil generated from the proposed project shall also be collected in barrels and shall be sold to the authorized recyclers identified by the UPPCB/ CPCB. Non-hazardous solid waste will be segregated and sold to the recyclers.

### *4.4.6. Soil Quality*

**Impact:**

115. There are no major sources of land contamination from waste spillage. The used oil shall be collected in barrels and shall be sold to the authorized recyclers identified by the UPPCB/ CPCB.

**Mitigation Measures:**

116. No further mitigation measures will be required.

### *4.4.7. Air Environment*

**Impact:**

117. The main sources of air pollution due to the operation of the plant will be baby boiler with 20 kg/hr capacity and a DG set of 30 KVA capacity. In addition to that, there will be some process emissions as well from reactors, for which proper ventilation system has been provided.

118. The baby boiler having a rated capacity of generating 20 kg of steam per hour will be based on HSD as fuel. The daily consumption of HSD will be around 40 – 50 LPD. The steam generated from this boiler will be used for the process heating requirements. The stack of the boiler would be kept 10 m above the roof top.

119. The DG set will not be having any air pollution problem, as this will be fitted with catalytic converter as OEM component and the stack height would be about 2 m above the building roof top. The consumption of HSD in the DG set would be around 25-30 LPD.

120. Computer aided mathematical models are being used to predict the increase in air pollutants concentration on ambient air quality due to any increase in the emission load in the atmosphere. For the proposed plant, computations of 24-hour average ground level concentrations were carried out using Industrial Source Complex Short Term (ISCST-3) model, which is a recommended model by CPCB for prediction of air quality from point sources. It is based on Gaussian dispersion which incorporates the Pasquile-Gifford (P-G) dispersion parameters for estimating horizontal cross wind and vertical dispersion.

121. ISCST-3 model has been developed to simulate the effect of emissions from continuous point sources on neighbourhood air quality. The ISCST-3 model was adopted from the USEPA guideline models and routinely used as a regulatory tool to predict air pollution impact from as high as 500 point sources simultaneously and at 10,000 receptors. The ISCST-3 is an hour-by-

hour steady state Gaussian model which takes into account the following special features:

- Terrain adjustments.
- Stack-tip downwash.
- Gradual plume rise.
- Buoyancy-induced dispersion, Complex terrain treatment and consideration of partial reflection.
- Plume reflection off elevated terrain.
- Building downwash.
- Partial penetration of elevated inversions is accounted for.
- Hourly source emission rate, exit velocity and stack gas temperature.

122. The impacts of primary air pollutants are predicted using ISCST-3 model, which has been selected keeping in view the terrain around the proposed project site. This model is widely recognized as predictive tool in impact assessment for air environment. The Gaussian plume dispersion formulae approved by CPCB has been incorporated in this model to meet regulatory requirements in India. The ISCST-3 model has been applied with flat terrain, gradual plume rise and buoyancy induced dispersion options in the present study.

123. ISCST-3 Model with the following options has been employed to predict the ground level concentrations due to the proposed plant emissions from baby boiler stack and DG set.

- Area being rural, rural dispersion parameters was considered.
- Predictions have been carried out to estimate concentration values over radial distance of 10 km around the sources.
- Cartesian receptor network with flat terrain was considered.
- Emission rates from the point sources were considered as constant during the entire period.
- The ground level concentrations computed are as basis without any consideration of decay coefficient.
- Calm winds recorded during the study period were also taken into consideration.
- 24-hour mean meteorological data extracted from the meteorological data collected during March 2010 to May 2010 as per guidelines of IMD and MoEF has been employed to compute the mean ground level concentrations to study the impact on study area.
- An option for creation of data file giving average ground level concentrations for the mean meteorological data of the study period has been used for post processing in SURFER – 7 graphics package.

#### *4.4.7.1 Emissions*

124. Major pollutants emitted from the boiler and DG set are in the form of air pollutants, *viz., NOx,* $SO_2$ and PM from the stacks. The emission data used in the model has been calculated based on the proposed likely emissions due to the project. The post-project stack emission details are given in **Table 4.3**.

*4.4.7.2 Meteorological Data*

125. The meteorological data recorded continuously during the month of March to May 2010 on hourly basis. Wind speed, wind direction and temperature have been processed to extract the 24 hourly mean meteorological data as per the guidelines of IMD and MoEF for application in Industrial Source Complex Short Term (ISCST-3) Gaussian plume model. Mixing heights of the project area have been taken from CPCB publication named "**Spatial Distribution of Hourly Mixing Depth over Indian Region**".

*4.4.7.3 Receptor Locations*

126. A total of about 10201 receptor grids have been considered over a 10 km radial zone around the project site in a grid size of 200 m x 200 m.

**Table 4.3 : Stack Emission Details**

| Stack Attached to | Stack No. | Stack Height (m) | Stack Diameter (m) | Stack Exit Velocity (m/s) | Flue Gas Temp (C) | Flue Gas Temp (K) | Emission Rate (g/s) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | SPM | SO2 | NOx |
| Baby Boiler (20 kg/hr) | S1 | 14 | 0.1 | 6 | 140 | 323 | 0.00063 | 0.0041 | 0.0036 |
| DG (30 KVA) | S2 | 6 | 0.05 | 21 | 400 | 673 | 0.00042 | 0.00234 | 0.00102 |

***4.4.8. Predicted GLC due to Proposed Project***

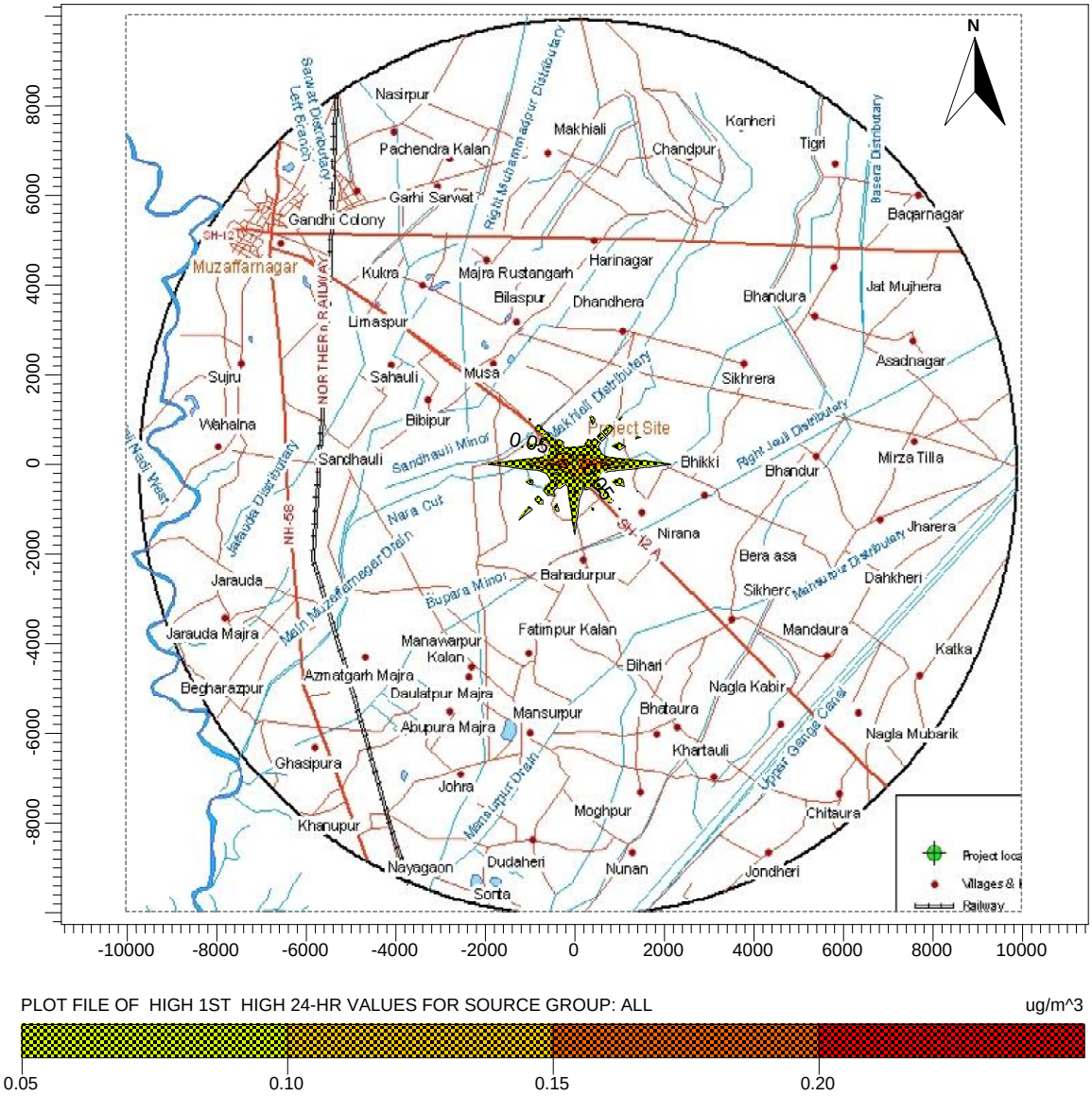
127. The contribution to GLCs for the pollutants i.e. SPM, SO2 and NOx were predicted over the study area due to the proposed project considering the worst scenario. The emission loads from proposed project are given in **Table 4.3.** The prediction (maximum) is based on the expected total emission rate from each stack and is given in isopleths **Figure 4.2** to **Figure 4.4** for proposed project. The contribution to GLCs are also given below in **Table 4.4**.

**Table 4.4 : Contribution to GLCs (maximum) due to Proposed Plant Stacks**

| Description | Maximum Ground Level Concentration (µg/m$^3$) | | |
|---|---|---|---|
| | $NO_x$ | $SO_2$ | SPM |
| Baby Boiler & DG | 0.21 | 0.31 | 0.05 |
| Distance of Occurrence (km) | 0.2 | 0.2 | 0.2 |
| Direction of Occurrence | W | W | W |

R. P. Intermediates, Muzaffarnagar

**NOx Isopleths**




PLOT FILE OF HIGH 1ST HIGH 24-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

0.05 0.10 0.15 0.20

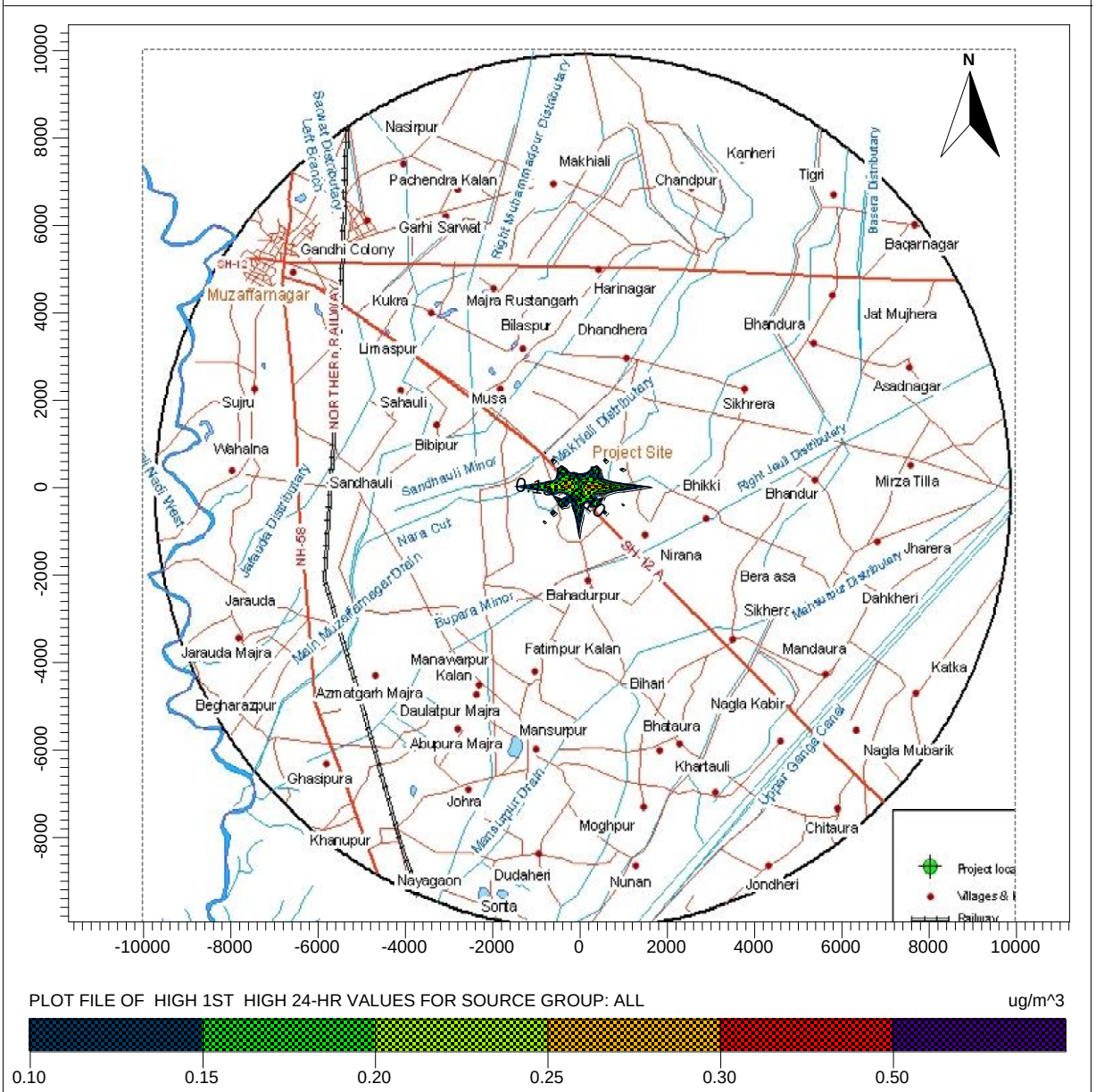
| | | |
|---|---|---|
| SOURCES: **2** | COMPANY NAME: **EQMS India Pvt. Ltd.** | |
| RECEPTORS: **10201** | MODELER: **NKC** | Eqms |
| OUTPUT TYPE: **Concentration** | SCALE: 1:140,000 0 5 km | |
| MAX: **0.21383 ug/m^3** | DATE: **8/19/2010** | |

AERMOD View - Lakes Environmental Software

**Figure 4.2 : Isopleths of NOx (Post-Project Scenario)**

R. P. Intermediates, Muzaffarnagar

**SO2 Isopleths**




| | | |
|---|---|---|
| SOURCES: **2** | COMPANY NAME: **EQMS India Pvt. Ltd.** | |
| RECEPTORS: **10201** | MODELER: **NKC** | Eqms |
| OUTPUT TYPE: **Concentration** | SCALE: 1:140,000 0 5 km | |
| MAX: **0.3065 ug/m^3** | DATE: **8/19/2010** | |

AERMOD View - Lakes Environmental Software

**Figure 4.3 : Isopleths of SO2 (Post-Project Scenario)**

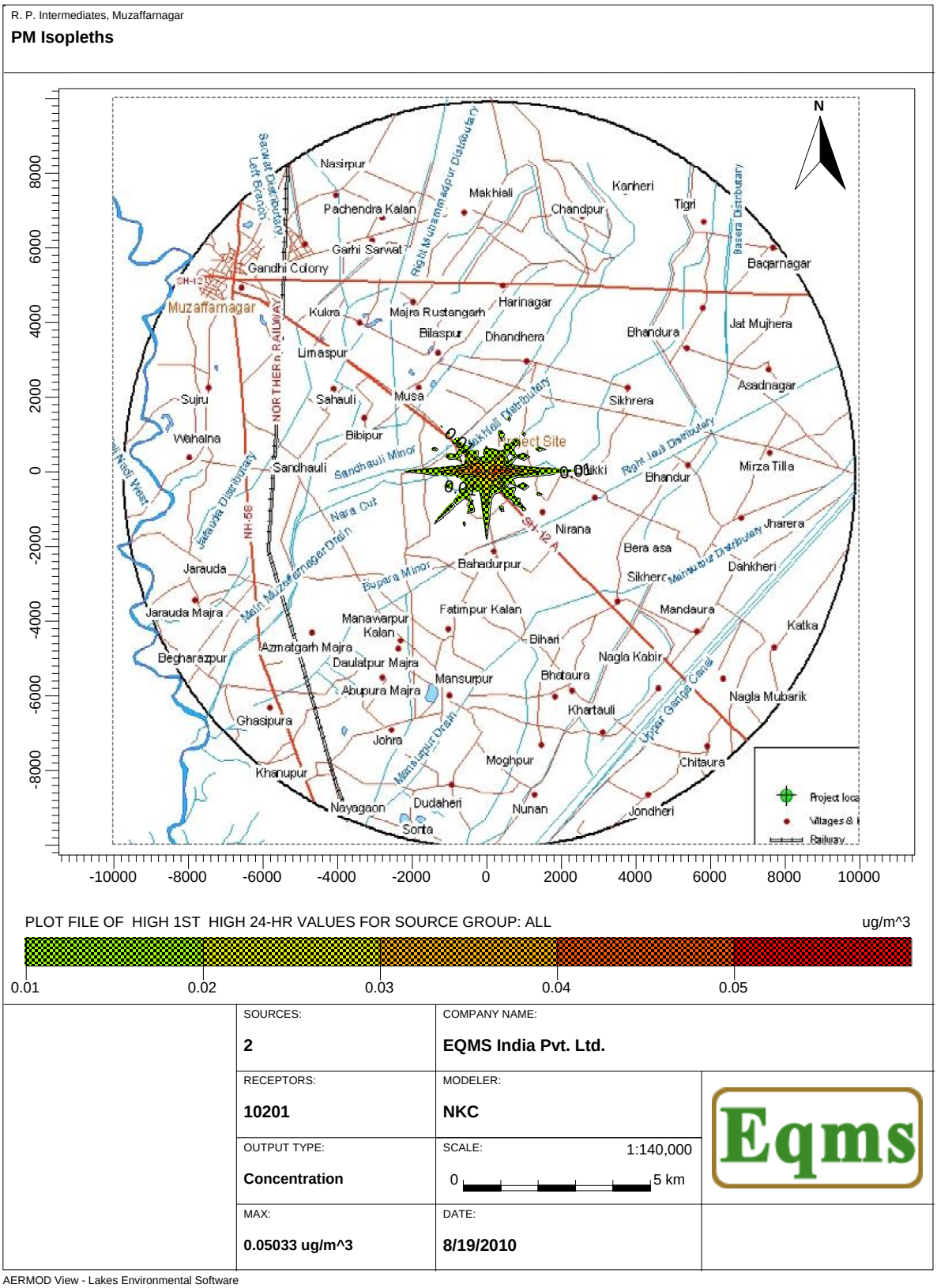



**Figure 4.4 : Isopleths of SPM (Post-Project Scenario)**

### *4.4.9. Noise Environment*

**Impact:**

128. Increase in ambient noise levels may be expected due to the operation of plant, machinery and utilities. A detailed study of the various process units were carried out to identify the noise generating sources. For an approximate estimation of dispersion of noise in the ambient from the sources, a standard mathematical model for sound wave propagation in homogeneous medium was used. The details of which are given in the following sections:

#### *4.4.9.1 Mathematical Model for Sound Wave Propagation during Operation*

129. The sound pressure levels generated by noise sources decrease with increase in the distance from the source due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected, due to atmospheric effect or its interaction with objects in the transmission path.

130. The hemispherical sound wave propagation through homogeneous loss free medium, one can estimate noise levels at various locations, due to different sources using model based on first principles, as per the following equations:

$$L_{p_2} = L_{p_1} - 20\log\left(\frac{r_2}{r_1}\right) - Ae_{1.2}$$

where, $L_{p_1}$ and $L_{p_2}$ are sound pressure levels at points located at distance $r_1$ and $r_2$ from the source and $Ae_{1.2}$ is the excess attenuation due to environmental conditions. The combined effect of all the sources then can be determined at various locations by logarithmic addition.

131. As a first approximation, one can assume that for all general population in the residential areas nearby, every noise source in the plant is a point source. The average equivalent sound power level of such a point source can be estimated for different distances and directions from a hypothetical source by applying following equation:

$$L_p = L_w - 20\log(r) - A_e - 8$$

where, $L_w$ is the sound pressure level of the source, $L_p$ is the sound pressure level at a distance r and $A_e$ is environmental attenuation factor. A combined noise level $L_p\,(\text{Total})$ of all the sources at a particular place is given by:

$$L_p\,(\text{Total}) = 10\log\left(10^{(L_{p1}/10)} + 10^{(L_{p2}/10)} + .....\right)$$

#### *4.4.9.2 Predicted Results – Noise Environment*

132. Considering all the noise generating sources, the dissipation of noise away from the source points is predicted and the noise contours are plotted and enclosed as **Figure 4.5**. The cumulative noise level near the sources as calculated with the help of above equations was calculated as 80 dB(A). From the predictions, it is clear that the noise drops to 40

dB(A) level at a distance of 100 m from the proposed project site. The existing ambient noise levels near the project site are in the range of 45 to 56 dB(A). Therefore, the future noise impacts on the environment are not expected to be significant. Due to the masking effect, the ambient noise level in the nearby areas will not increase during the operation of the plant. It shall also be noted that the plant will be operational only in one general shift, and hence, there would not be any noise generation at night time from the plant. Hence, there would not be any adverse impact due to the operation of the plant on the residents of the nearby areas.

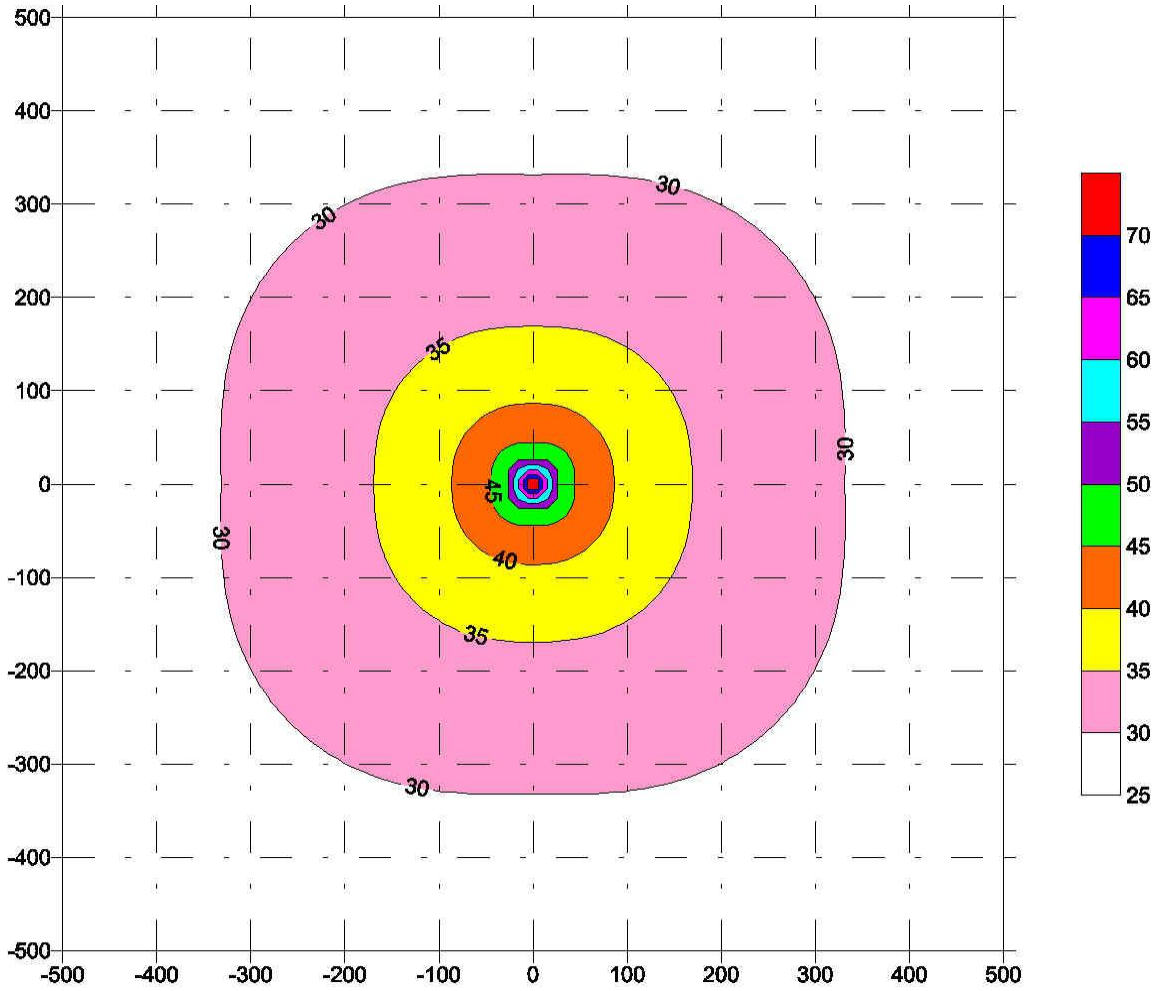



**Figure 4.5 : Predicted Noise Levels around the Proposed Project Site**

### *4.4.10. Socio-Economic Environment*

**Impact:**

133. The proposed drug intermediates project will have a significant impact on the industrial growth in the region as there are a number of pharmaceutical units in Muzaffarnagar as well as nearby state of Uttarakhand. It is anticipated that during the operation phase, the proposed project will generate a total direct employment for 10 people. In addition to that, the project will also generate some opportunities for indirect benefits through casual work, sub contracts, transportation, trading etc.

**Mitigation Measures:**

134. The overall project will have a long term benefit and hence no mitigation measure is required. However, as per the skills, preference to local people shall be given in employment.

### *4.4.11. Ecology and Biodiversity*

**Impact:**

135. The project activity does not require tree cutting during land clearing. Also, the study zone does not have any ecologically sensitive location and hence, the plant activities are not expected to have any impact on the ecology and biodiversity.

**Mitigation Measures:**

136. Greenbelt will be developed in the periphery of the project boundary. Also, green area will be developed in the open area. The indigenous plants shall be planted along with ornamental trees/ shrubs to provide an aesthetic environment within and around the plant. The maintenance of the greenbelt developed shall be ensured and survival rate of the plants shall also be studied every half yearly. Treated effluent will be used for greenbelt development and irrigation purposes.

### *4.4.12. Odour Problem*

**Impact**

137. Some of the processes and wastes generated from the plant may release high odour. Undesirable odours contribute to air quality concerns and affect human lifestyles. On the economic front, loss of property value near odour-causing operations/industries and odorous environment is partly a consequence of offensive odour. Odour is undoubtedly the most complex of all the air pollution problems. Malodours generated by the industries vary enormously since they can be generated during the production, processing, or even in the waste water treatment areas of the plants.

**Mitigation Measures:**

138. Odour mitigation plan will be required to reduce any odour problem in the area. Some of the mitigation options have been suggested below :

- The rate of work may be slowed or suspended in times of high odour release.
- Highly odoriferous processes shall be limited to specific times of day, temperatures or wind conditions.
- The in-situ waste classification and “load-and-go” approach will reduce the amount of odour generation associated with the area and duration of refuse exposure from stockpiles and from the handling of the wastes.
- Refuse that is not being actively excavated shall be covered.
- Stockpiles shall be covered with plastic.
- Trucks transporting wastes off-site shall be covered.

***Safety Provisions***

139. All the provisions as per the Factories Act, 1948, Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989 and amendments thereafter and also, the Hazardous Waste (Management, Handling & Transboundary Movement) Rules, 2008 to be followed.

# 5. ENVIRONMENTAL MANAGEMENT PLAN

This chapter provides mitigation and control measures to attenuate or eliminate environmental impacts, which are likely to be caused by the proposed project. An Environmental Management Plan (EMP) has been developed to mitigate the potential adverse impacts and to strengthen the beneficial environmental impacts during the construction and operation phases. In addition to that during the operation phase, the company will have an additional responsibility to comply with the statutory requirements as per the guidelines of Central/ State Government.

## 5.1. Prelude

140. Prediction of the potential adverse environmental and social impacts arising from project interventions during the construction and operation phases of the project is the technical heart of EIA process. An equally essential element of this process is to develop measures to eliminate, offset, or reduce impacts to acceptable levels during project implementation and operation of the project. The integration of such measures into project implementation and operation is supported by clearly defining the environmental requirements within an Environmental Management Plan (EMP). The aim of the EMP is to ensure that the various adverse impacts associated with the project are properly mitigated; either by preventing the impacts or by mitigating those to reduce the effect to an acceptable level by adopting the most suitable techno-economic option. The EMP also ensures that the positive impacts are conserved and enhanced.

## 5.2. The EMP

141. The Environmental Management Plan (EMP) consists of a set of mitigation, monitoring and institutional measures to be taken during the design, construction and operation phases of the project. The plan also includes the actions needed for implementation of these measures. Overall objective of EMP:

- **Prevention**: Measures aimed at impeding the occurrence of negative environmental impacts and/or preventing such an occurrence having harmful environmental impacts.
- **Preservation**: Preventing any future actions that might adversely affect an environmental resource or attribute.
- **Minimization**: Limiting or reducing the degree, extent, magnitude, or duration of adverse impacts.

142. The major components of the Environmental Management Plan are:

- Mitigation of potentially adverse impacts
- Monitoring during project implementation and operation
- Implementation schedule and environmental cost estimates
- Integration of EMP with project planning, design, construction and operation

143. The EMP has been designed keeping in view the regulatory and other requirements to ensure the following:

- Minimum disturbance to the native flora and fauna.

- Compliance with the air, water, soil and noise quality norms.
- Conservation of water to the extent possible.
- Encourage the socio-economic development.

144. R. P. Intermediates will incorporate all necessary steps to mitigate environmental pollution in the plant commissioning itself. In addition to that during the operation phase of the project, the company will take all the mitigation measures suggested in the environmental management plan and also comply with the statutory requirements as per the guidelines of Central and/or State Government. It also details post-project monitoring to be undertaken by the authorities to maintain the environmental quality within the stipulated standards specified by the Uttar Pradesh Pollution Control Board (UPPCB), Central Pollution Control Board (CPCB) and the Ministry of Environment & Forests (MoEF).

145. The environmental impacts due to different project activities and proposed mitigation measures have been detailed in **Chapter 4**. The mitigation measures for reducing the adverse environmental impacts together constitute a part of EMP.

## 5.3. Construction Phase

146. All the civil construction work of the project was already completed in Year 2001. However, machinery and installation of pollution control equipments has yet to be done. There would not be any signicant impact during this phase, which requires additional environmental management plan.

## 5.4. Operation Phase

### *5.4.1. Air Environment*

#### *5.4.1.1 Measures for Reducing Stack Emissions*

147. In the proposed plant, there will be 2 stacks only, which will be conacted with a baby boiler and a DG set. The DG set will be used only during the power failure. Also, the plant operation will be limited for 1 shift in a day.

*148.* As per guidelines of Central Pollution Control Board (CPCB) no pollution control equipment is required for oil fired boiler and DG set and pollution control will be achieved through natural dispersion process by providing stacks of appropriate heights.

#### *5.4.1.2 Measures for Fugitive Emissions*

149. The fugitive emissions of organic chemicals and VOCs come from leakage through valves, fittings, pumps, etc. Though this is not expected to be significant, it may be reduced further by adopting the following measures:

- Regular maintenance of valves, pumps and other equipment to prevent leakage and thus minimizing the fugitive emissions of VOCs.
- Regular monitoring of VOCs shall be conducted in the areas prone to fugitive emissions.

#### *5.4.1.3 Greenbelt Development*

150. The project site is away from human settlements. To maintain the greenery a thick betl of medium height trees have been put along with

the boundary of the factory premises. A total of 20% of area will be earmarked for greenbelt. The premises would also have lawns, flower gardens. The land, which at present would not be used will be planted with a variety of trees, which may include the following other than the local variety of the trees, which would be planted on preference basis:

- Delonix Aegia
- Silver Oak
- Palm Galinia
- Monsenia
- Ashoka Pendula
- Kikar
- Neem
- Royal palm
- Gulmohar
- Mango

### *5.4.2. Water Environment*

151. Water conservation measures shall be taken to optimize the fresh water requirement. The fresh water shall be taken from Ground Water.

152. The mitigation measures for minimizing the impacts on water environment in general includes following:

- Minimization of water use
- Segregation and collection philosophy for effluent to minimize waste generation and facilitate treatment as well as recycle and reuse
- Treatment philosophy to achieve regulatory standards
- Reuse/recycle and disposal

153. Some of the measures, which has to be implemented, include:

- Use equipment wash down waters as makeup solutions for subsequent batches, if feasible.
- Use high-pressure jet hoses for equipment cleaning to reduce the amount of water consumption and wastewater generation.
- Reducing the actual process water consumption by way of improvement in operation of processing units
- Ensuring proper operation and maintenance schedule for the ETP.

#### *5.4.2.1 Rainwater Harvesting*

154. Artificial recharge systems are engineered systems where surface water is put on or in the ground for infiltration and subsequent movement to aquifers to augment groundwater resources. Other objectives of artificial recharge are to store water, to improve the quality of the water through soil-aquifer treatment or geo-purification, to use aquifers as water conveyance systems, and to make groundwater out of surface water where groundwater is traditionally preferred over surface water for drinking.

155. Roof top rainwater harvesting, which involves the collection of rainwater from the roof of the buildings and its storage in surface tanks or recharge to sub-surface aquifer, can play an important role in conservation of water. It is proposed to implement rain water harvesting structures by

diverting the runoff that is generated from the roof sheds, paved areas, roads and green belt areas for recharging into the ground water system. Implementation of recharge mechanism shall ensure the balance between the discharge vis-à-vis recharge relationships of the aquifer system and improve in the ground water quality. The normal annual rainfall for the said area has been taken as 800 mm as per the data of IMD.

**Table 5.1 : Computation of Runoff Available for Recharge**

| Sl. No. | Land use type | Area ($m^2$) | Co-efficient of runoff | Rainfall (m) | Quantity of Rainwater ($m^3$) |
|---|---|---|---|---|---|
| 1 | Roof area | 319.5 | 0.8 | 0.800 | 204.5 |
| 2 | Road & Paved area | 226.7 | 0.6 | 0.800 | 108.8 |
| 3 | Open & Green land | 1223.5 | 0.15 | 0.800 | 146.8 |
| | Total | **1769.7** | | | **460.1** |

**Table 5.2 : Recommendations for Recharge Structures Based on Hourly Computation of Runoff – (30 mm/hr)**

| S. No. | Landuse Type | Area ($m^2$) | Co-efficient of Runoff | Intensity of Rainfall (m) | Quantity of Rainwater ($m^3$) |
|---|---|---|---|---|---|
| 1 | Roof area | 319.5 | 0.8 | 0.03 | 7.67 |
| 2 | Road & Paved area | 226.7 | 0.6 | 0.03 | 4.08 |
| 3 | Open Area and Greenbelt | 1223.5 | 0.15 | 0.03 | 5.51 |
| | **Total** | **1769.7** | | | **17.26** |

156. It has been worked out that in order to tap effectively the rainfall runoff and subsequently recharging to the aquifer systems, 1 recharge structure is required. The probable location of the site will be finally decided as per the layout of storm water drains.

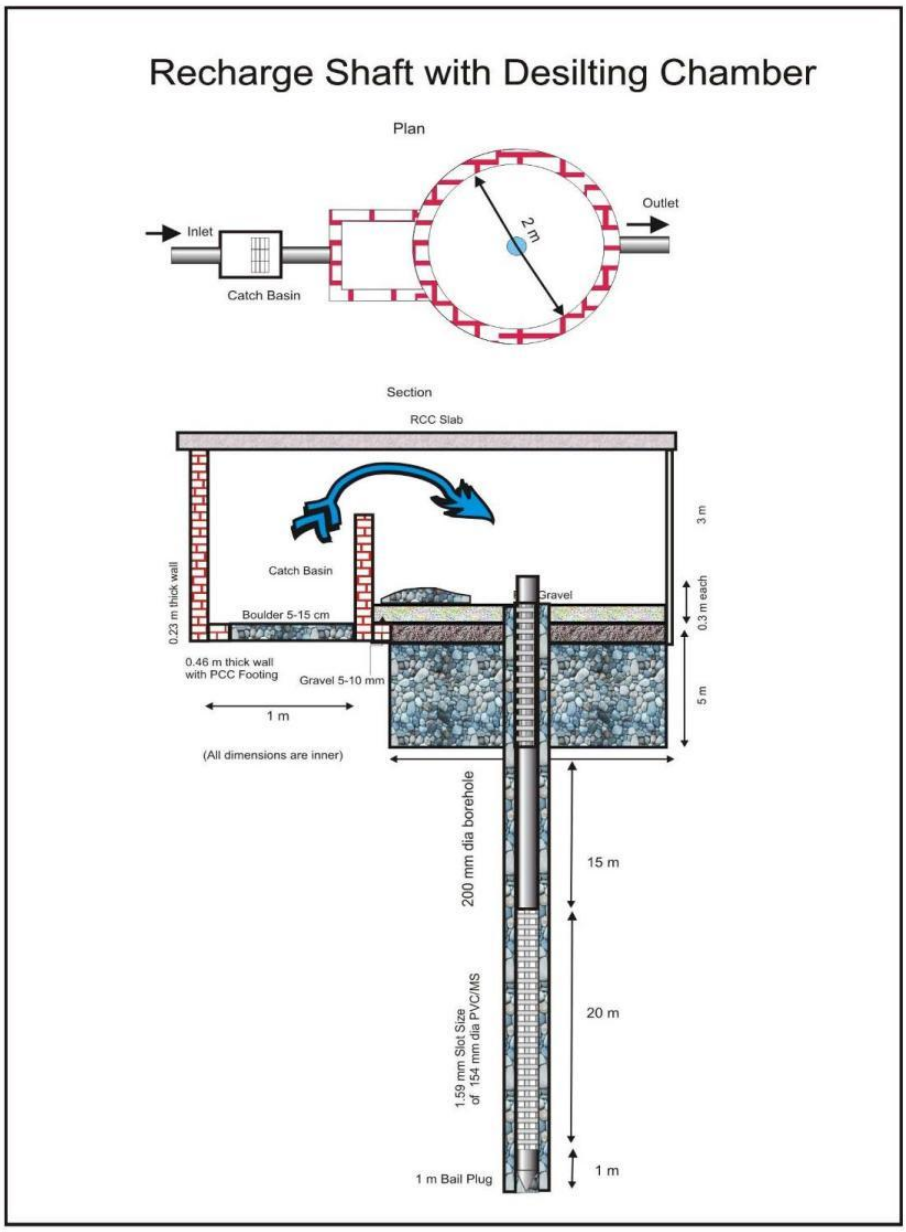



**Figure 5.1 : Design of Proposed Single Bore Recharge Well**

### *5.4.3. Solid and Hazardous Waste Management*

157. Solid waste management includes following:

- Measures to minimize waste generation
- Operation of waste handling, treatment and disposal facilities

158. Solid wastes like process waste and organic waste etc. in process, packaging is to be separately collected & sent for incineration. ETP Sludge and incinerable wastes are to be separately collected in polythene/HDPE bags or drums and stored temporarily onsite on an impervious floor at a specified place before final disposal.

159. The requirements which will be specified in the Authorization from UPPCB shall be followed. The manifest system shall also be implemented for control and record keeping.

*5.4.3.1 Resource Conservation/ Waste Minimization*

160. **Good House Keeping:** Proper house keeping practices makes the system easier and less costly. Some of these are as follows:

- Solid wastes e.g. powders, spills, etc. in process, and packaging are to be separately collected and disposed off instead of allowing these to join effluent streams. This will reduce load and increase the efficiency of treatment system.
- Liquid wastes from various sections such as bulk drugs facility, recovery and purification of final product should be collected and stored separately and released at a regulated rate so as to avoid shock loads to the treatment plant.

161. **Minimizing Solid Wastes Disposal:** The following points are suggested to facilitate solid wastes disposal:

- To investigate the large scale regionalized treatment centres for centralized disposal and reuse of solid wastes.
- Efficient collection and transportation mechanism for disposal of solid wastes.
- Search for future recycling schemes and evaluate their worth and implement such schemes wherever a promise of economic feasibility exists.

*5.4.3.2 Discarded Container/ Barrels/ Liners Management*

162. Discarded containers/ barrels/ liners will be kept at a designated place with paved surface. These will be decontaminated (washed/ cleaned) and after that will be stored in the designated area in scrap yard. Later on these will be sold to the actual users/ recyclers as per the Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008. The record of discarded containers/ barrels/ liners stored in scrap yard shall be maintained and also, inventory of their selling to the registered recyclers shall be maintained. The same shall be reviewed by the HSE Department of the project.

### *5.4.4. Noise Environment*

163. The statutory national standards for noise levels at the plant boundary and at residential areas near the plant will be met. The selection of all new plant equipments will be made with specification of low noise levels. Noise suppression measures such as enclosures, buffers and/or protective measures may be provided (wherever noise level is more than 90 dB(A) and exposure limits to workers is more than 8 hours a day) to limit noise levels within occupational exposure limits. Areas with high noise levels will be identified and segregated where possible and will include prominently displayed caution boards.

164. However, in areas where noise levels are high and exposure time is less, employees are to be provided with ear protection measures like earplugs or earmuffs. Earplugs are to be provided to all workers where exposure will be 85 dB(A) or more. The exposures of employees working in the noisy area shall be regularly monitored to ensure compliance with the regulatory requirements.

165. Monitoring of noise levels is essential to assess the efficacy of maintenance schedules undertaken to reduce noise levels and noise protection measures.

### *5.4.5. Occupational Health Programme*

166. Some of the philosophies underlining the occupational health programme in the proposed project has been discussed below:

- Annual health check for employees shall be carried out and record shall be maintained.
- Fire hydrant system networking, fire detection system, continuous monitoring system shall be running in round the clock for handling any emergency. Regular training to plant personnel in safety, fire fighting and first aid shall be provided.
- The proposed plant shall maintain a healthy work environment. This shall be accomplished through the identification, evaluation and control of workplace environmental factors, which may cause sickness, impaired health or significant discomfort and inefficiency among workers. Environmental factors such as noise, physical hazards toxicity/chemical hazard and ergonomic hazards shall be regularly monitored to assist in maintaining a healthy work environment.
- Worker's exposure to noise and toxic materials shall be evaluated against applicable recognised exposure levels in the Factories Act.
- Hearing protection aids shall be provided to workers who work in the high noise areas, during construction of the proposed facilities and also to those who will continue through the life of the facility.

### *5.4.6. Environmental Monitoring Plan (EMP)*

167. The aim of monitoring during the construction and operation phase is to compare the monitored data against the baseline condition collected during the study period and assess the change in environmental quality in the project stretch. This shall not only help in assessing the change due to the project activities, but also the potential impacts due to project activities.

168. A monitoring schedule has been drawn up based on the environmental components that may be followed during the construction and operation of the project. A comprehensive monitoring plan covering all the identified environmental attributes which may be affected due to proposed activity are provided in **Chapter 6**. Monitoring Plan has been separately suggested for construction phase and operation phase. Monitoring points have been selected based on the sensitivity of the location with respect to sensitive receptors.

### *5.4.7. Compliance to the Recommendations mentioned in CREP Guidelines*

169. The industry will comply to the recommendations mentioned in CREP Guidelines for pharmaceutical sector. The action plan for compliance of the same has been presented in **Table 5.3**.

**Table 5.3 : Action Plan for Compliance to CREP Guidelines**

| S. No. | CREP Guideline | Action Plan |
|---|---|---|
| 1. | Segregation of Waste Streams | Industrial and domestic waste streams will be segregated. Separate treatment of industrial and domestic effluent will be done in ETP and Septic Tank, respectively. |
| 2. | Detoxification and Treatment of High COD Waste Streams | There is no high COD stream in the process. COD will be in the range of 1700 – 2500 mg/L. This will be treated in the ETP. |
| 3. | Management of Solid Waste | Hazardous waste will be in the form of ETP sludge and waste oil. This will be collected and stored at the site. Waste oil will be sold to the authroized recyclers and ETP sludge will be sent to landfill. |
| 4. | Long term strategies for reduction in waste | Waste generation is very limited in the process. Adequate measures will be adopted for reduction in waste generation. Final disposal will be done as per the guidelines of UPPCB. |
| 5. | Control of Air Pollution | Adequate stack heights will be provided in boiler and DG set. Proper ventilation system will be provided in the work area to control process emissions. |
| 6. | Self – regulation by Industry through regular monitoring and environmental auditing | Regular monitoring and environmental auditing will be conducted during the operation phase of the project as per UPPCB guidelines. |
| 7. | Organistional restructuring and accreditation of Environmental Manager of Industry | Environmental management cell will be created in the industry, which will report to the Managing Director directly. |
| 8. | Optimizing the inventory of hazardous chemicals | The industry will maintain the inventory of hazardous chemicals, which will be used in the plant. |

# 6. ENVIRONMENTAL MONITORING PROGRAMME

This chapter provides the proposed environmental monitoring programme for the proposed project to access the environmental attributes after the commissioning of the project.

## 6.1. Prelude

170. Based on the findings of the Environmental Impact Assessment study, various mitigation measures have been proposed, which have been detailed out in Environmental Management Plan (EMP). In order to monitor the impacts and efficacy of these plans monitoring of various environmental attributes have been proposed during and after the completion of the management plans. A well defined environmental monitoring programme would be employed with trained and qualified staff of Environmental Management Cell of the proposed agro-chemicals, fine chemicals & intermediate chemicals manufacturing plant to monitor the environmental attributes of the area with respect to EMP as well as the guidelines of the UPPCB/ CPCB. Environmental monitoring schedule proposed to be adopted by the project authorities is as presented in **Table 6.1**:

**Table 6.1 : Matrix of Environmental Monitoring Plan**

| S. No. | Aspect | Source of Impact | Monitoring Methods and Parameters | Frequency | Executing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|
| **1.0** | **Operation Phase** | | | | | |
| 1.1 | Water Quality & Quantity | Ground Water Quality within the Project Site | Sample Collection & Analysis | Quarterly | RP Intermediates | UPPCB |
| 1.2 | Effluent Quality | Quality of effluent discharged and reused | ETP sample collection & quality analysis | Monthly (Third Party) | RP Intermediates | UPPCB |
| 1.3 | Air Quality | Emission from boiler and DG | Stack emission monitoring | Quarterly (Third Party) | RP Intermediates | UPPCB |
| 1.4 | Noise Levels | Monitoring of Occupational Noise Levels | Near the noise generating sources | Fortnightly | RP Intermediates | UPPCB |
| 1.5 | Biological Environment | Horticulture/ Greenbelt Development | Survival rate of plants and shrubs | Half Yearly | RP Intermediates | UPPCB |
| 1.6 | Solid Waste Management | Disposal of waste | Tracking of waste collection, segregation and disposal | Monthly | RP Intermediates | UPPCB |
| 1.7 | Hazardous Waste Management | Disposal of Hazardous Waste | Tracking of hazardous waste collection, | Quarterly | RP Intermediates | UPPCB |

| S. No. | Aspect | Source of Impact | Monitoring Methods and Parameters | Frequency | Executing Agency | Monitoring Agency |
|---|---|---|---|---|---|---|
| | | | segregation, storage and disposal | | | |

# 7. RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

This chapter provides the details of hazardous chemicals, which will be stored in the project site as well as risk associated with these chemicals. It also provides emergency preparedness on-site and off-site plans to be followed to handle an emergency in the unlikely event of any accident. It discusses management roles and emergency teams that may need to be developed for the same. This Disaster Management Plan has been prepared on the basis of Environmental Aspects & Impacts review as well as Hazards & Risk analysis & from the professional knowledge & experience regarding different accidents / incidents which are likely to happen in the pharmaceutical plant.

## 7.1. Introduction

171. M/s R. P. Intermediates will be engaged in handling and storage of hazardous chemicals/ materials required for the production of drug intermediates, which may pose risk to life and/or properties in an unlikely event of emergency. Therefore, the risk assessment study has been conducted for identification of hazards, to calculate effect and damage distances and to spell out risk mitigation measures to enhance safety at the plant.

## 7.2. Scope of Study

172. The scope of study is to carry out risk analysis for the proposed Drug Intermediates Plant covering all the hazardous chemicals to be handled and stored within the premises of the Plant.

173. The risk assessment study will cover identification of hazards and selection of credible scenarios, consequence analysis of selected accidents scenarios, frequency analysis and risk mitigation measures.

## 7.3. The Study Approach

174. The risk assessment study broadly comprised of the following steps:

- Identification of Hazards
- Selection of Credible Accident Scenarios
- Effect and Consequence Analysis
- Frequency Analysis
- Risk Mitigation Measures

### *7.3.1. Identification of Hazards*

175. Hazards associated at the proposed API-Bulk Drugs Manufacturing Plant will be identified and summary of relevant accident cases will be reviewed.

### *7.3.2. Selection of Accident Scenarios*

176. The release sources and potential accidents scenarios at the proposed Drug Intermediates Plant will be listed. For each selected release source several scenarios may be developed depending upon the failure mode causing loss of containment.

### *7.3.3. Effects and Consequence Analysis*

177. Effects and consequence distance estimation will be carried out to determine the potential for damage or injury form the selected scenarios. The incident outcomes will be analyzed using release rate, dispersion, combustion, heat radiation and explosion models from fires. The software 'Effect' developed by TNO based on the Revised "Yellow Book" will be used for calculation of physical effects. The TNO Green Book will be referred for estimation of consequences to persons from exposure to physical effects.

### *7.3.4. Risk Mitigation Measures*

178. Based on hazard identification and consequence analysis at the proposed Drug Intermediates Plant, risk mitigation measures will be suggested to reduce risk and enhance safety at the Plant.

## 7.4. Hazard Identification and Scenario Selection

179. The starting point of risk assessment study is the identification of hazards and selection of scenarios that are then addressed for further analysis. Hazard is defined as a chemical or physical condition that has the potential for causing damage to people, property or the environment in an unlikely event of release. A number of techniques are available for hazard identification depending upon the depth and objective of study. The most relevant to risk assessment is the review of release sources of hazardous chemicals.

### *7.4.1. Hazardous Materials to be Handled at RP Intermediates*

180. Hazards associated with proposed Drug Intermediates Plant have been identified. It is important to mention that most of the hazardous chemicals will be stored in small quantities depending upon the requirement for production. Some of the chemicals may be flammable, toxic or reactive in nature. In an unlikely event of accidental release, consequence will be localised and will be limited to storage area.

181. Details, nature and quantities of hazardous materials, which will be stored and handle at the plant, are given in Table 7.1. Characteristics of potential hazardous materials to be stored at the Plant premises are described in the following subsection.

**Table 7.1 : Details of Hazardous Material to be stored at the Proposed Drug Intermediates Plant**

| S. No. | Item | CAS # | Monthly Requirement | Storage Capacity | Storage | Type of Hazards |
|---|---|---|---|---|---|---|
| 1 | Acetone | 67-64-1 | 480 kg | 2 x 200 kg | PVC barrel | Highly Flammable Liquid, Harmful |
| 2 | Hydrochloric acid | 7647-01-0 | 18 kg | 1 x 50 kg | PVC drum | Toxic, Corrosive |
| 3 | Methanol | 67-56-1 | 603 kg | 3 x 200 kg | PVC drum | Highly Flammable Liquid, Toxic |
| 4 | Pyridine | 110-86-1 | 50 kg | 2 x 25 kg | Carbouy | Toxic, Corrosive |
| 5 | Sodium hydroxide | 1310-73-2 | 60 kg | 1 x 100 kg | PVC drum | Harmful, Corrosive |
| 6 | High Speed Diesel | | 400 kg | 2 x 200 kg | PVC drum | Flammable Liquid |

#### *7.4.1.1 Acetone*

| | |
|---|---|
| Physical Properties | Form: colourless liquid with a characteristic smell<br>Stability: Stable, but highly flammable.<br>Water solubility: miscible in all proportions<br>Appearance: colourless liquid with a fragrant, sweet odour<br>Melting point: -95°C<br>Boiling point: 56°C<br>Vapour density: 2.0<br>Vapour pressure: 181 mm Hg at 20°C<br>Specific gravity: 0.79<br>Flash point: -18°C<br>Explosion limits: 2.6% - 13.0%<br>Autoignition temperature: 538°C |
| Stability | Stable. Incompatible with halogen acids and halogen compounds, strong bases, strong oxidizing agents, caustics, amines and ammonia, chlorine and chlorine compounds, strong acids, nitrosyl compounds. Highly flammable. Readily forms explosive mixtures with air. |
| Principal Hazards | Contact with the eyes can cause serious permanent damage.<br>Propanone is highly flammable, and presents a serious fire risk.<br>Propanone is harmful if it is swallowed or inhaled. Long-term exposure, for example through breathing in the fumes, can cause liver damage.<br>Repeated skin exposure may lead to defatting and irritation. |
| Safe Handling | Always wear safety glasses. Ensure that ventilation is good so that you do not breathe in the vapour. Remove all sources of ignition from the working area. (Be aware that very flammable materials do not need a flame for combustion to start - they may be ignited by a hot plate or even a hot radiator if their flash point is low enough.) Always store bottles of propanone are a flame-proof cabinet. Do not leave propanone, or solutions containing it, standing unattended on a bench where they might get knocked over or set alight. |
| Emergency | Eye contact: Immediately flush the eye with plenty of water. Continue for at least ten minutes and call for medical help.<br>Skin contact: Wash off with plenty of water. Remove any contaminated clothing (noting that clothing soaked in propanone may present a serious fire risk). |

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| | If swallowed: Wash out the mouth with water and call for medical help. |
| Disposal | Very small amounts of propanone can be flushed down a sink with a large quantity of water, unless local rules prohibit this. Significant amounts of water must be used in order to ensure that dangerous levels of vapour do not build up in the sewer. Larger amounts should be disposed of through authorised contractors. |
| Protective Equipment | Always wear safety glasses when handling propanone. If you need gloves, butyl rubber is a suitable protective material. |

*7.4.1.2 Hydrochloric Acid*

| | |
|---|---|
| Physical Properties | Appearance: clear colourless or slightly yellow liquid with pungent odour.<br>Concentrated acid is fuming.<br>Melting point: -25°C<br>Boiling point: 109°C<br>Specific gravity: 1.19 |
| Stability | Stable. Avoid heat, flames. Incompatible with most common metals, amines, metal oxides, acetic anhydride, propiolactone, vinyl acetate, mercuric sulphate, calcium phosphide, formaldehyde, alkalies, carbonates, strong bases, sulphuric acid, chlorosulphonic acid. |
| Toxicology | Extremely corrosive. Inhalation of vapour can cause serious injury. Ingestion may be fatal. Liquid can cause severe damage to skin and eyes. TLV 5 ppm. |
| Principal Hazards | Contact with the eyes or skin can cause serious permanent damage<br>Concentrated solutions of this acid are extremely corrosive; very dilute solutions are mildly corrosive.<br>Toxic by inhalation - the concentrated solution releases dangerous quantities of hydrogen chloride vapour |
| Safe Handling | Always wear safety glasses. Do not allow the acid or a solution of it to come into contact with your skin. Wear gloves if handling the concentrated acid. The concentrated acid must always be used in an area equipped with good ventilation, never in the open laboratory. |
| Emergency | Eye contact: Immediately flush the eye with plenty of water. Continue for at least ten minutes and call for immediate medical help.<br>Skin contact: Wash off with plenty of water. Remove any contaminated clothing. If the skin reddens or appears damaged, call for |

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| | medical aid.<br>If swallowed: Drink plenty of water and call for immediate medical help. |
| Disposal | Small amounts of dilute hydrochloric acid can be flushed down a sink with a large quantity of water, unless local rules prohibit this. Larger amounts should be neutralised before disposal. Concentrated acid should not be flushed down a sink. |
| Protective Equipments | Always wear safety glasses when handling hydrochloric acid or its solutions. If you need gloves, use neoprene, butyl rubber, natural rubber, or nitrile. When handling the concentrated acid good ventilation is vital. |

*7.4.1.3 Methanol*

| | |
|---|---|
| Physical Properties | Appearance: colourless liquid with a characteristic odour<br>Melting point: -98°C<br>Boiling point: 64.7°C<br>Vapour density: 1.1<br>Vapour pressure: 97.7 mm at 20°C<br>Specific gravity: 0.791<br>Flash point: 11°C<br>Explosion limits: 6% - 36 %<br>Autoignition temperature: 464°C |
| Stability | Stable. May react violently with acids, acid chlorides, acid anhydrides, oxidizing agents, reducing agents and alkali metals. Protect from moisture. Highly flammable. |
| Toxicology | Toxic by inhalation, ingestion or skin absorption. May be a reproductive hazard. Ingestion may be fatal. Risk of very serious, irreversible damage if swallowed. Exposure may cause eye, kidney, heart and liver damage. Chronic or substantial acute exposure may cause serious eye damage, including blindness. Irritant. Narcotic. UK exposure limits: long-term 200 ppm, short term 250 ppm. |
| Principal Hazards | *** Methanol is toxic. If ingested or inhaled it can cause a wide range of harmful effects, from sickness, heart and liver damage to reproductive harm, blindess or death.<br>*** Methanol is often a component in "bootleg" liquor (illegally brewed and distilled alcohol) and there have been numerous cases in the past in which the consumption of such a drink has been fatal.<br>*** Methanol is very flammable. The pure liquid catches fire easily and aqueous solutions containing a significant amount of methanol can also catch fire. |

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| | *** The flame above burning methanol is virtually invisible, so it is not always easy to tell whether a methanol flame is still alight.<br>*** The explosion limits for methanol (the lower and upper percentage limits of methanol in an air-methanol mixture giving a vapour that can explode) are unusually wide. |
| Safe Handling | Always wear safety glasses.<br>Remove any source of ignition from the working area. Don't forget that a hot air gun, a hot plate or even a radiator may be sufficiently hot to ignite the vapour.<br>You should not breathe in the vapour, so use a fume cupboard if available. If this is not possible, ensure that the area in which you work is very well ventilated. |
| Emergency | Eye contact: Immediately flush the eye with plenty of water. Continue for several minutes and call for medical help.<br>Skin contact: A person whose clothes are soaked in methanol will be at serious risk from fire, so immediately remove any contaminated clothing and store well away from a source of ignition (preferably outside). Wash exposed skin with soap and water. If the skin reddens or appears damaged, or if methanol may have been swallowed, call for medical aid.<br>If swallowed: Call for immediate medical help; if the quantity swallowed is significant urgent medical action is vital. |
| Disposal | Trace amounts of methanol can be flushed down a sink with a large quantity of water, unless local rules prohibit this. Larger amounts should be collected in a non-chlorinated waste solvent container for disposal. |
| Protective Equipments | Safety glasses. If you need gloves, butyl rubber is a suitable material. |

*7.4.1.4 Pyridine*

| | |
|---|---|
| Physical Properties | Appearance: colourless liquid with a very unpleasant odour<br>Melting point: -42°C<br>Boiling point: 115°C<br>Vapour density: 2.7 (air = 1)<br>Vapour pressure: 16 mm Hg at 20°C<br>Flash point: 19°C (closed cup)<br>Explosion limits: 1.8 % - 12.4 % |
| Stability | Stable. Flammable. Incompatible with strong oxidizing agents, strong acids. |
| Toxicology | Harmful by ingestion, inhalation and if |

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| | absorbed through skin. May affect fertility. May cause irreversible effects. Severe eye and skin irritant - may cause burns. Long-term exposure may cause liver, kidney or CNS damage. Typical STEL 10 ppm. Typical PEL 15 ppm. |
| Principal Hazards | This material is harmful if you breathe it in or swallow it, or if it is absorbed through the skin.<br>Pyridine is known to reduce male fertility and chronic exposure may cause serious harm. |
| Safe Handling | Always wear safety glasses. Good ventilation is essential. Pyridine has a very noticeable and unpleasant smell, and even small quantities can make the working environment intolerable. It should be handled, wearing gloves, in a fume cupboard. |
| Emergency | Eye contact: Immediately flush the eye with plenty of water. Call for medical help.<br>Skin contact: Evacuate the working area if any pyridine has been spilled in the open laboratory. Wash off with soap and water. Remove any contaminated clothing. If the skin reddens or appears damaged, call for medical aid.<br>If swallowed: Call for immediate medical help. |
| Disposal | Pyridine must not be disposed of down the drains. Store in a suitable waste solvent container for disposal. |
| Protective Equipments | Safety glasses, gloves, laboratory coat. Polyethylene or butyl rubber gloves are suitable for short periods of working (up to one hour). |

*7.4.1.5 Sodium Hydroxide*

| | |
|---|---|
| Physical Properties | Appearance: odourless white solid (often sold as pellets)<br>Melting point: 318°C<br>Boiling point: 1390°C<br>Vapour pressure: 1 mm Hg at 739°C<br>Specific gravity: 2.12<br>Flash point: n/a<br>Explosion limits: n/a<br>Water solubility: High (Note: dissolution in water is highly exothermic) |
| Stability | Stable. Incompatible with a wide variety of materials including many metals, ammonium compounds, cyanides, acids, nitro compounds, phenols, combustible organics. Hygroscopic. Heat of solution is very high |

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|---|---|
| | and may lead to a dangerously hot solution if small amounts of water are used. Absorbs carbon dioxide from the air. |
| Toxicology | Very corrosive. Causes severe burns. May cause serious permanent eye damage. Very harmful by ingestion. Harmful by skin contact or by inhalation of dust. Typical STEL 2 mg $m^{-1}$. |
| Principal Hazards | *** Contact with the eyes can cause serious long-term damage<br>*** The solid and its solutions are corrosive<br>*** Significant heat is released when sodium hydroxide dissolves in water |
| Safe Handling | Always wear safety glasses. Do not allow solid or solution to come into contact with your skin. When preparing solutions swirl the liquid constantly to prevent "hot spots" developing. |
| Emergency | Eye contact: Immediately flush the eye with plenty of water. Continue for at least ten minutes and call for immediate medical help.<br>Skin contact: Wash off with plenty of water. Remove any contaminated clothing. If the skin reddens or appears damaged, call for medical aid.<br>If swallowed: If the patient is conscious, wash out the mouth well with water. Do not try to induce vomitting. Call for immediate medical help |
| Disposal | Small amounts of dilute sodium hydroxide can be flushed down a sink with a large quantity of water, unless local rules prohibit this. Larger amounts should be neutralised before disposal. |
| Protective Equipments | ALWAYS wear safety glasses when handling sodium hydroxide or its solutions. If you need gloves, neoprene, nitrile or natural rubber are suitable for handling solutions at concentrations of up to 70% |

*7.4.1.6 High Speed Diesel (HSD)*

| | |
|---|---|
| Physical Properties | HSD is a complex mixture of hydrocarbons from a variety of chemical processes blended to meet standardized product specifications.<br>Composition varies greatly and includes C9 to C20 hydrocarbons with a boiling range of about 190 - 399°C.<br>HSD is flammable and combustible hazard.<br>Flash Point: 35°C<br>At room temperature, HSD vapours have a lower flammable limit (LFL) in air of 1.4% v/v and an upper flammable limit (UFL) of 7.4% |

| | |
|---|---|
| | v/v.<br>When the concentration of vapour gas of the above petroleum products falls between these two limits, the resultant gas mixture can ignite when subject to a source of ignition. |
| Emergency | For fire extinguishing, dry chemical, carbon dioxide, foam or water spray should be used. Water may be ineffective in fighting fires of liquids with low flash points, but water should be used to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors and to protect persons attempting to stop a leak.<br>An accidental spill would result in formation of pool of oil and in case of ignition a pool fire will result. |

### *7.4.2. Hazards from Storage of Flammable Liquids*

182. Hazardous chemicals, like, acetone, hydrochloric acid, sodium hydroxide, methanol, pyridine and HSD will be stored at the Plant premises. These will be separately stored according to their flammable limits in separate storage area, having appropriate storage facility and measures and classified. Such flammable liquid chemicals will be stored in metal cans and barrels. Suitable precautions will be been taken to prevent the fire in these storage area and adequate fire fighting facilities will be provided.

183. In an unlikely event of spillage of flammable liquids, there will be no possibility of fire as there will be no source of fire in the storage area. However, in an unlikely event of fire, consequence of fire will be localised.

### *7.4.3. Hazards from Storage of HSD*

184. HSD will be stored in PVC barrels in the storage area as it will be consumed in baby boiler and in DG sets operation for power generation in case of grid power failure. In an unlikely event of release of HSD, fixed pool will be formed in the storage area and in case of getting source of ignition, pool fire will take place.

### *7.4.4. Hazards from Storage of Other Hazardous Chemicals*

185. At the Plant premises, various hazardous chemicals will be is stored in lined drums/ barrels provided by dyke for full containment.

### *7.4.5. Hazardous Conditions due to Release Quantities*

186. As a result of release of hazardous materials, various hazardous conditions which can occur are described below:

#### *7.4.5.1 Thermal Effects*

187. In the event of fire of thermal radiation will be observed. The extent of injury to people depends on the heat flux and duration of exposure to heat. The consequences caused by exposure to heat radiation is a function of:

- the radiation energy onto the human body [kW/m$^2$];
- the exposure duration [sec];

- the protection of the skin tissue [clothed or naked body].

188. The following damage criteria for 1% fatality distances has been used:

- Fires : heat radiation 12.7 kW/m$^2$ during 20 sec.
- Following effect : distances have also been calculated:
  - 10 kW/m$^2$ : high damage risk
  - 3 kW/m$^2$ : low damage risk (first degree burn)
  - 1 kW/m$^2$ : no damage risk (safe distance)

*7.4.5.2 Delayed Ignition and Explosion*

189. In case of delayed ignition of a gas cloud, two physical effects may occur:

- a flash fire over the whole length of the explosive gas cloud;
- a vapour cloud explosion that results in blast wave, with typical peak overpressure circular around the ignition source.

190. TNO Multi-energy method has been used to calculate the blast overpressure. The following damage criteria in Table 7.2 may be distinguished with respect to the peak overpressures resulting from a blast wave:

**Table 7.2 : Damage Effects due to Overpressures**

| PEAK OVERPRESSURE | PEAK OVERPRESSURE | DAMAGE TYPE |
|---|---|---|
| 0.830 bar | 12.035 psi | Total Destruction |
| 0.350 bar | 5.0751psi | Heavy Damage |
| 0.170 bar | 2.4651psi | Moderate Damage |
| 0.035 bar | 0.5075 psi | Minor Damage |

191. The Table 7.3 below gives an illustrative listing of damage effects caused by peak overpressure.

**Table 7.3 : Illustrative Damage Effects due to Overpressures**

| PEAK OVERPRESSURE (BAR) | PEAK OVERPRESSURE (PSI) | FAILURE |
|---|---|---|
| 0.005 | 0.0725 | 5 % Window Shattering |
| 0.02 | 0.2902 | 50 % Window Shattering |
| 0.07 | 1.0156 | Collapse of a roof of a tank |
| 0.07-0.14 | 2.0311-2.0301 | Connection failure of panelling |
| 0.08-0.1 | 1.1606-1.4508 | Minor Damage to Steel Framework |
| 0.15-0.2 | 2.1762-2.9016 | Concrete block wall shattered |
| 0.2 | 2.9016 | Collapse of Steel Framework |
| 0.2-0.3 | 2.9016-4.3524 | Collapse of self framing Steel panel building |
| 0.2-0.3 | 2.9016-4.3524 | Ripping of empty oil tanks |
| 0.2-0.3 | 2.9016-4.3524 | Deformation of a pipe bridge |

| PEAK OVERPRESSURE (BAR) | PEAK OVERPRESSURE (PSI) | FAILURE |
|---|---|---|
| 0.2-0.4 | 2.9016-5.8032 | Big trees topple over |
| 0.3 | 4.3524 | Panelling torn off |
| 0.35-0.4 | 5.0778-5.8032 | Piping failure |
| 0.35-0.8 | 5.0778-11.600 | Damage to Distillation Column |
| 0.4-0.85 | 5.8032-12.325 | Collapse of pipe bridge |
| 0.5 | 7.2540 | Loaded Train Wagon overturned |
| 0.5 | 7.2540 | Brick walls shattered |
| 0.5-1.0 | 7.2540-14.508 | Movement of round tank, failure of connecting piping |

(Source: TNO)

*7.4.5.3 Dispersion of Toxic Cloud*

192. In the event of release of toxic gas, toxic cloud will be formed and dispersed towards wind directions. IDLH concentrations distances are important for dispersion of toxic cloud.

### *7.4.6. Release and Outcome Scenarios*

193. The release and outcome scenarios considered for consequence analysis are tabulated below:

**Table 7.4 : Release and Outcome Scenarios**

| S. NO. | RELEASE SOURCE | FAILURE MODE | OUTCOME MODELLED |
|---|---|---|---|
| 1. | HSD Storage | Rupture in Storage | Pool Fire and Thermal Radiation |

## 7.5. Consequence Analysis

194. Subsequent the accidental release of a hazardous chemical, the consequent effects depend on a large number of factors e.g. type and quantity of released materials, presence and location of an ignition source, meteorological conditions etc. Consequence analysis for the selected accident scenarios has been carried to estimate the vulnerable zones. When the vulnerable zone is identified for failure cases, measures can be taken for risk mitigation and to eliminate damage to the property and injury to personal.

195. The risk assessment study involves a large number of calculations for which use of computing software[2] is essential. Included in EFFECTS is an extensive database with temperature dependent properties of more than 100 hazardous chemicals. The user can add the data of chemicals that are not included in the database.

[2] 'EFFECTS' software of TNO, Netherlands has been used to perform the calculations. 'EFFECTS' is a hazard identification and modeling software package for calculation of physical effects of the release of hazardous materials. It has been developed by the Department of Industrial Safety of TNO Institute of Environmental Sciences, Energy Research and Process Innovation in Apeldoom, The Netherlands.
'EFFECTS' enables users to assess the physical effects of accidental releases of toxic and flammable chemicals. 'EFFECTS' contains a series of up-to-date models that allow detailed modeling and quantitative assessment of release rate, pool evaporation, atmospheric dispersion, vapour cloud explosion and heat radiation from fires.

196. The consequence analysis has been carried out for various release scenarios as given in Table 7.4. The outcomes of various release scenarios is described below:

197. In the event of catastrophic rupture of HSD storage, pool will be formed in dyke and in the event of fire, thermal radiation will be occurred. Outcome of model is summarised below:

**Table 7.5 : Heat Radiation Distance from Pool Boundary**

| HEAT RADIATION (KW/M$^2$) | DISTANCE (M) |
|---|---|
| 12.7 | 10 m |
| 10 | 12 m |
| 3 | 27 m |
| 1 (Safe Distance) | 46 m |

198. **Vapour Cloud Explosion**: No explosive mass will be formed from fixed pool.

## 7.6. Risk Mitigation Measures

199. Risk Assessment provides a quantitative technique for assessing the significance of the impact of any facility on its external environment, a means for highlighting key areas for greater attention and a tool for comparing alternative options, though it is no substitute for close attention to the fundamentals of safety throughout the design process or for design reviews.

200. For risk reduction, attempts should be made to either reduce inventories that could get released in the event of loss of containment or failure likelihood's or both as feasible. QRA identifies the dominant risk contributors, which enables prioritisation of plants/section that deserve special attention in terms of inspection and maintenance in particular and over all safety management as a whole.

### *7.6.1. Mitigation Measures*

201. Various risk mitigation measures for proposed Manufacturing and Technical services facilities are as given below:

- The Safety Management Systems (SMS) should be introduced and followed.
- Detailed risk assessment study should be carried out on final design and operating parameters for various components of RP Intermediates facilities.
- Safety manual for storage and handling of hazardous chemicals should be prepared.
- Personnel engaged in handling of hazardous chemicals should be trained to respond in an unlikely event of emergencies.
- A written process safety information document should be compiled for general use and summary of it should be circulated to concerned personnel.
- The document compilation should include an assessment of the hazards presented including (i) toxicity information, (ii) permissible exposure limits, (iii) physical data, (iv) thermal and chemical stability data, (v) reactivity data, (vi) corrosivity data, (vii) safe procedures in process.

- Predictive and preventive maintenance schedules should be prepared for equipment, piping, etc. and thickness survey should be done periodically as per standard practices.
- Safe work practices should be developed to provide for the control of hazards during operation and maintenance such as (i) tag out, (ii) confined space entry, (iii) opening process equipment or piping, (iv) control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel.
- In the material storage area, hazardous materials should be stored based on their compatibility characteristics.
- Near miss and accident reporting system should be followed and corrective measures should be taken to avoid / minimize near miss incidents.
- Safety measures in the form of DO and Don't Do should be displayed at strategic locations especially in local language and English.
- Safety audits should be conducted regularly.
- Electrical earthing pit should be checked regularly.
- Water sprinkler system should be provided in flammable gas storage area and it must be checked regularly.
- Fire fighting system should be tested periodically for proper functioning.
- All hydrants, monitors and valves should be visually inspected every month.
- Smoke and heat detectors should be provided and these should be tested and calibrated as per schedule.
- Hydrocarbon detectors should be provided in the propane/butane/LPG storage and handling areas.
- Adequate earthing and bonding should be provided to tanks, vessels and machineries and structures, electrical motors and other facilities.
- Flame-proof electrical fitting should be provided in flammable gas and liquids areas, HSD/FO storage area.
- Only authorised persons should be allowed to enter inside the flammable storage and other hazardous chemical storage area.
- Adequate lighting in the work place should be provided with due flame proof lighting (FLP) fitting wherever required.
- 'NO SMOKING' should be declared in the entire premises.
- It must be ensured that all safety devices provided in the plant are in good condition.
- Disaster Management Plan should be prepared and available with concerned personnel department.

### *7.6.2. Handling of Hazards*

202. The mitigation measures need to be considered during the handing of hazards are as follows:

- Personal protective equipment used by the person during handling of hazardous chemicals, should be periodically replaced.
- If any spillage of hazardous chemicals, it should be cleaned and disposed as per standard practiced and procedure described in MSDS.
- Empty drums/bags of hazardous chemicals should be neutralized immediately.

- Personnel engaged in handling of hazardous chemicals should be made aware of properties of hazardous chemicals.

### *7.6.3. General Working Conditions*

#### *7.6.3.1 House Keeping*

- All the passages, floors and stairways should be maintained in good condition. The system should be available to deal with any spillage of dry or liquid chemical at the premises.
- Walkways should be clearly marked and free from obstructions.
- Precaution and instructions should be displayed at strategic locations in local language and in English language.
- All pits, sumps should be properly covered or securely fenced.

#### *7.6.3.2 Ventilation*

- Adequate ventilation should be provided in the work floor environment and storage of hazardous materials.
- The work environment should be assessed and monitored regularly.

#### *7.6.3.3 Safe Operating Procedures*

- Safe operating procedures should be available for storage and handling of Hazardous chemicals.
- The personnel should be informed of the consequences of failure to observe the safe operating procedures.

#### *7.6.3.4 Work Permit System*

203. Work permit system should be followed at proposed plant facilities. Hazardous work permit should be used for hot work, electrical works, confined space entry, etc.

#### *7.6.3.5 Emergency Preparedness*

- On-site emergency plan should be prepared and readily available for an unlikely event of emergency.
- Emergency telephone numbers should be available and displayed properly at strategic locations.

#### *7.6.3.6 Material Handling*

- Material handling areas should be clearly defined.
- The personal should be made aware about the hazards associated with manual material handling.

#### *7.6.3.7 Communication System*

- Adequate communication facilities should be available and supported with uninterrupted power supply.
- Communication facilities should be checked periodically for its proper functioning.

#### *7.6.3.8 Accident Reporting, Investigation and Analysis*

204. A system should be initiated at RP Intermediates for accident and near miss reporting, investigation and analysis.

*Safety Inspections*

205. The system should be initiated for checklist based routine safety inspection and internal audit of Hazardous materials storage area and manufacturing plants, periodically. Safety inspection team should be formed from various disciplines and departments.

*7.6.3.9 Safe Operating Procedures*

206. Safe operating procedures should be formulated and updated, specific to process & equipment and distributed to concerned plant personnel.

### *7.6.4. Risk Mitigation Measures for Spills*

*7.6.4.1 Minor Spills*

207. Following measures will be taken in the event of minor spills at the facilities:

- Notify such immediate area.
- Limit access, prevent contamination spread.
- Survey personnel before exiting.
- Cover spill with absorbent material (unless liquid is flammable or oxidizing).
- Wipe test or survey for residual contamination as appropriate.
- Wash affected areas, then resurvey.
- Remove contaminated clothing and footwear.
- Package and label clean up materials for disposal.
- Record spill details and contamination monitoring results.
- Adjust inventory and waste records as appropriate

*7.6.4.2 Major Spills*

208. Following measures will be taken in the event of minor spills at the facilities:

- Persons not involved in the spill should leave the area immediately.
- Limit the movement of contaminated personnel until they are monitored.
- If a spill occurs in a laboratory, leave the fume hood running to minimize release of volatile materials to adjacent rooms or hallways.
- Close off and secure the spill area to prevent entry.
- Post warning signs.
- Select the appropriate PPE, shielding and absorbent spill materials like absorbent paper or spill pillows if the liquid is not a flammable or oxidizing agent.

### *7.6.5. Safety Management System (SMS)*

209. The failure probabilities largely depend upon how effectively Safety is being managed. This in turn necessitates formal documented Safety Management System (SMS), one that is effective. The features of a Safety Management System are described below:

210. Analysis of industrial accidents and disasters has shown clearly that these are not simply a consequence of direct technical failure or operator tasks, which were carried out incorrectly. The underlying causes may be deeply routed in management aspects of the organisation. In some cases, the incidents could have been prevented with a formal Safety Management System (SMS). In other situations, a safety management system was in place, but did not

prevent the occurrence of the incident. This suggests the need for a wider application of "best practice" safety management system in industry. Moreover it raises the question of the quality of such systems.

211. Safety, Health and Environment (SHE) should be a function reporting at the highest management level. There is nothing unusual about this suggestion since such is the practice followed by renowned multi-nationals.

212. SHE management comprises of a number of elements. For the sake of completeness, as an example, the contents of the SHE programme covered in the current practice are given below:

- Management leadership, commitment and accountability
- Risk Analysis, Assessment and Management
- Facilities design and construction
- Process and facilities information and documentation
- Personnel safety
- Health
- Personnel
- Training
- Operation and Maintenance procedures
- Work permits
- Inspection and Maintenance
- Reliability and Control of defeat of critical systems & devices
- Pollution prevention
- Regulatory compliance
- Product stewardship
- Management of change
- Third party services
- Incident reporting, analysis and follow-up
- Emergency preparedness
- Community awareness
- Operations integrity assessment and improvement

## 7.7. Disaster Management Plan

213. In order to be in a state of readiness to face adverse effects of accidents caused by hazardous substances, a Disaster Management Plan (DMP) is prepared which includes on-site and off-site emergency plan by the individual industry as required under the Acts and Rules (Manual on Emergency Preparedness for chemical hazards, MoEF New Delhi).

214. The key elements of a DMP are as follows:

- Basis of the plan
- Accident prevention procedure / measure
- Accident / emergency response procedure / measure; and
- Recovery procedure

### *7.7.1. Basis of the Plan*

215. Identification and assessment of hazards is crucial for on-site emergency planning and requires systematically identifying what emergencies could arise in the plant. Hazard analysis or the consequence analysis (in case of catastrophic release of hazardous chemicals) is, therefore, considered as the basis of DMP.

- Explosion with little or no warning; hazards from blast wave, flying debris and high levels of thermal radiation (Vapour Cloud Explosion).
- Events involving hazardous materials.
- Slow or intermittent release of hazardous substances, e.g. from a leaking valve, rapid release for limited duration; due to plant failure, e.g. fracture of pipe; hazards from toxic cloud, limited in size, which may quickly disperse.
- It is necessary to visualize the consequences of the release of hazardous substance for the events mentioned above and the likely damage caused to the areas in and around the facility. Risk mitigation measures based on consequence analysis also form an integral part of an organized Disaster Management Plan:

### *7.7.2. Accidents Preventions Procedures/ Measures*

216. Most of the accidents can arise due to fire and toxic release:

- Major fires with no danger of explosion. Hazards from prolonged high levels of thermal radiation & smoke.
- Fire threatening plant/storage containing hazardous substances; hazards from spread of fire, explosion or release of hazardous substances.
- Explosion with little or no warning, hazards from blast wave, flying debris and high levels of thermal radiation.

#### *7.7.2.1 Fire Prevention Planning and Measures*

217. Fire is one of the major hazards that can result in disaster. Following are the important measures that require planning in the initial stage of project.

- Water supply
- Permanent fire hydrant and monitor nozzle installation
- Permanent foam system
- Permanent water fog and sprinkler system
- Permanent fire smothering system
- Mobile Fire fighting equipment
- First aid appliances

218. In addition to the foregoing physical equipment for fire fighting, arrangements for fire protection in plant should include proper organization and training of workers.

#### *7.7.2.2 Fire Water Storage*

219. Own sources of water supply and storage facility for fire protection is recommended for the facility. The amount of water flow rate to be made available for fire fighting varies with individual hazardous conditions. The water flow rate should be adequate enough for cooling a burning tank and

also adjacent tanks. Total demand on the fire water system should also consider the water requirement for spray system for each tank. Hydrants are also desirable on the roadways and around the periphery of the tank farm. The tanks for firewater storage should be religiously reserved for this service only.

*7.7.2.3 Foam System*

220. Foam as employed for fire extinguishing is a dispersion of minute bubble within tough films of a water solution containing materials which stabilize its foam making properties. The bubbles may be filled with either carbon dioxide or air. The action of foam in fire extinguishing is primarily one of blanketing or smothering the flame. It is light and will flow upon the surface of liquids, and thereby furnishes the most practical effective means of fire extinguishing in large liquid reservoirs such as tanks.

### *7.7.3. Accident/Emergency Response Planning Procedure*

221. To deal with an emergency, the arrangement for immediate deployment or appointment of key personnel with their specific duties should be clearly described and mentioned.

222. The emergency planning includes anticipatory action for emergency, maintenance and streamlining of emergency preparedness and ability for sudden mobilization of all forces to meet any calamity. Communication links that can be established with local such as factory inspectorate, police station, fire brigade, hospital etc., State and Central authorities to meet the challenges of emergencies and ensure reliability of functions of communication system. Adequacy and efficiency of fire fighting and fire detection equipment, personal protective appliances, medical services and safety and emergency training is to be ensured.

223. An in-plant road map showing linkage with different units, gates and emergency gates should be prepared. The plant management should display the chemical properties and antidotes of materials stored and handled and their locations and inventory. The management should also maintain data on weather conditions of each season of plant area (temperature, wind speed, wind direction), for reference during emergency for evacuation purposes.

*7.7.3.1 Communication*

224. An essential component of a DMP in the Communication links necessary for gathering information needed for overall co-ordination. Emergency Control Centre links with incident scene and with in-house as well as outside emergency services. Too much reliance on the Telephone system is risky as it can soon be overloaded in an emergency situation. Radio links with a special emergency wave length failing which at least hot line between the Emergency Control Centre, various critical services (fire-fighting, control rooms, medical services etc.) and hazardous locations need to be considered. A multi-user wireless paging system with selective call facility is also useful for promptly locating key operating personnel in the plant, both during normal times and during emergencies. A public address (PA) system with loud speakers installed at vital installations or corners or on jeeps can be extremely useful for guiding plant (on-site) personnel to some safe locations within the plant during emergencies. The details of the communication arrangements should include having a direct line to the fire brigade. A periodic check of this system is recommended.

225. The description of the tasks and responsibilities, reporting place, etc. for each key functionary should be, as far as possible, so drafted as to reduce the communication needs between the interacting groups.

*7.7.3.2 Emergency Control Centre*

226. As mentioned earlier, the establishment of a 'focal point' or 'EMERGENCY CONTROL CENTRE' at each unit to co-ordinate emergency response activities within a relevant area is essential.

227. The emergency control centre should be sited in an area of minimum risk and should have easy and fast access to all major hazardous installations. It is undesirable to have alternative control centres unless it is anticipated that the control centre is likely to be affected by heat load/toxic cloud or other hazards and hence an alternative.

228. Emergency control centres (including the alternative one) should be equipped with the following:

- Adequate number of external telephones. If possible, one should accept incoming calls only, in order to bypass jammed switchboards during an emergency.
- An adequate number of internal telephones.
- Radio equipments.

229. A plan of the works showing:

- Areas where there are large inventories of hazardous materials.
- Sources of safety equipment.
- Fire-fighting system and additional sources of water.
- Site entrance and roadways, including up-to-date information on road works.
- Location of the works in relation to the surrounding community.
- A nominal roll of employees.
- A list of KEY PERSONNEL with addresses, telephone numbers, etc.
- An adequate number of personal protective/safety equipment in case of hampering of smooth rescue operations.

### *7.7.4. Recovery Procedure*

230. It is extremely difficult to formulate recovery procedure by other organizations. Therefore, the contents of this section are indicative for the formulation of detailed recovery procedure.

231. The duration of recovery phase will depend upon the extent of damage caused due to disaster and the interventions initiated, thereafter. The management could restore normalcy only when speedy actions on the earlier phases are initiated. Some of the issues to be included in recovery phase are:

- Treatment of patients after the disaster due to psychological breakdown (operators/resident around facility).
- Assessment of damages and rectification.
- Lacuna experienced in intervention phase, suggestions on improvement in DMP.

*7.7.4.1 Psychological Breakdown*

232. It has been the experience that some of the workers cannot sustain trauma due to disaster. Psychological disorder of these operators/residents is a common scene. Should the situation arises, the project management should immediate arrange for the assistance from professionals.

*7.7.4.2 Assessment of Damages and Rectification*

233. The issue of insurance liability and speedy rectification of the engineering system followed by technical checks from the experts' needs attention of the management which should help in bringing normalcy. DMP and its execution should be reviewed in case of any such eventualities.

### *7.7.5. Disaster Management Plan: On-Site Crisis*

234. Identification of Personnel and Assessment of Responsibilities on specific functions of Co-coordinating Authority. In order to combat the emergencies, an organisational chart for on-site emergency should be periodically reviewed and updated.

### *7.7.6. Emergency Preparedness Programme: Off-Site*

235. An unexpected emergency could cause serious damage to people, livestock and property in the area. This naturally calls for the necessity for evolving an OFF-SITE emergency preparedness programme so as to combat any such possible eventuality.

236. Many agencies are involved in combating an emergency. These include Government Departments like Public Health, Fire Services, Police, Civil Defense, Medical Services, and other voluntary organisations. The Offsite Emergency Programme (or Plan) should aim at reducing the probability and severity of the sufferings of the people and the damage to property by clearly identifying the role of each of the agencies involved in combating an emergency.

*7.7.6.1 Scope of the Off-Site Plan*

237. The scope of the OFF-SITE plan is to:

- Protect the inhabitation around the Hazardous Areas and evacuating them, if necessary
- Ensure their subsistence during the stay in camp
- To protect and safeguard the property and belongings of the evacuated sections of the population until their return
- To take adequate measures for their rehabilitation.

*7.7.6.2 Sectorial Division of Emergency Planning Zone*

238. The Emergency Planning Zone shall be divided into convenient sectors. Depending upon the prevailing wind direction at the time of the emergency and the assessed extent of fire/explosion hazard, the protective measures will be implemented first in the sector downwind. Sectors adjacent to this sector on either side will come next.

*7.7.6.3 Emergency Information System*

239. The first person, who observes/ identifies the incident, shall inform it as per emergency reporting system.

*7.7.6.4 Evaluation of Functioning of Disaster Management Plan*

240. Emergency Preparedness, among employees of different responsibilities & levels shall be monitored through Mock Drill / Fire Drill / Emergency Evacuation Drill / Functioning of emergency reporting system, not least than once in a calendar year; to check the effectiveness of the documented Plan in the break of an actual Emergency situation.

241. Two Senior Personnel shall be designated as the observer, who will observe the effectiveness of the plan in case of an emergency situation. They will not be assigned any other responsibility in the break out of an emergency.

242. Feedback will be taken, and the training on Emergency Preparedness / Disaster Management Plan will be provided accordingly. As per the feedback the EPAP will also be updated.

- Emergency Siren Tone
- Emergency siren to be operated by security person.
- On hearing emergency siren.
- Non-essential personnel shall follow safe route for evacuation. Non-essential persons will not rush towards incident site.
- Key/Essential Personnel shall report to respective control room.

*7.7.6.5 Emergency Siren Tone*

- FIRE : Whaling sound for two minutes
- ALL CLEAR : Continuous sound for three minutes

*7.7.6.6 Post Emergency Recovery*

243. The post-emergency procedures discussed below are designed to successfully manage the damages/losses of an emergency event. The focus of these procedures is to move the plant back into normal operating mode as quickly and efficiently as possible.

*7.7.6.7 Accident Investigation*

244. The following guidelines will be followed to carry out accident investigation:

- As soon as possible after the emergency is over and plant operation has become normal, the investigation will be carried out to determine the cause of the event.
- Representatives from various disciplines will be members of the investigating team.
- The area of the event will be sealed off so that tampering or alteration of the physical evidence will not occur.
- Key components will be photographed and logged with time, place, direction, etc.
- Statements will be taken from those who were involved with the operation or who witnessed the event.

*7.7.6.8 Damage Assessment*

245. This phase of recovery establishes the quantum of replacement machinery considered necessary for bringing back the plant to normal operation, property and personnel losses, and culminates in a list of necessary repair, replacement and reconstruction work. Insurance companies will be informed of the damage and requested to pay the compensation as per claim.

*7.7.6.9 Cleanup and Restoration*

246. This phase will only begin after the investigation is complete and will involve the following:

- Reporting documentation will be prepared and forwarded to appropriate authorities.
- Repairs, restoration and cleanup will begin.
- Insurance claims will be prepared and submitted

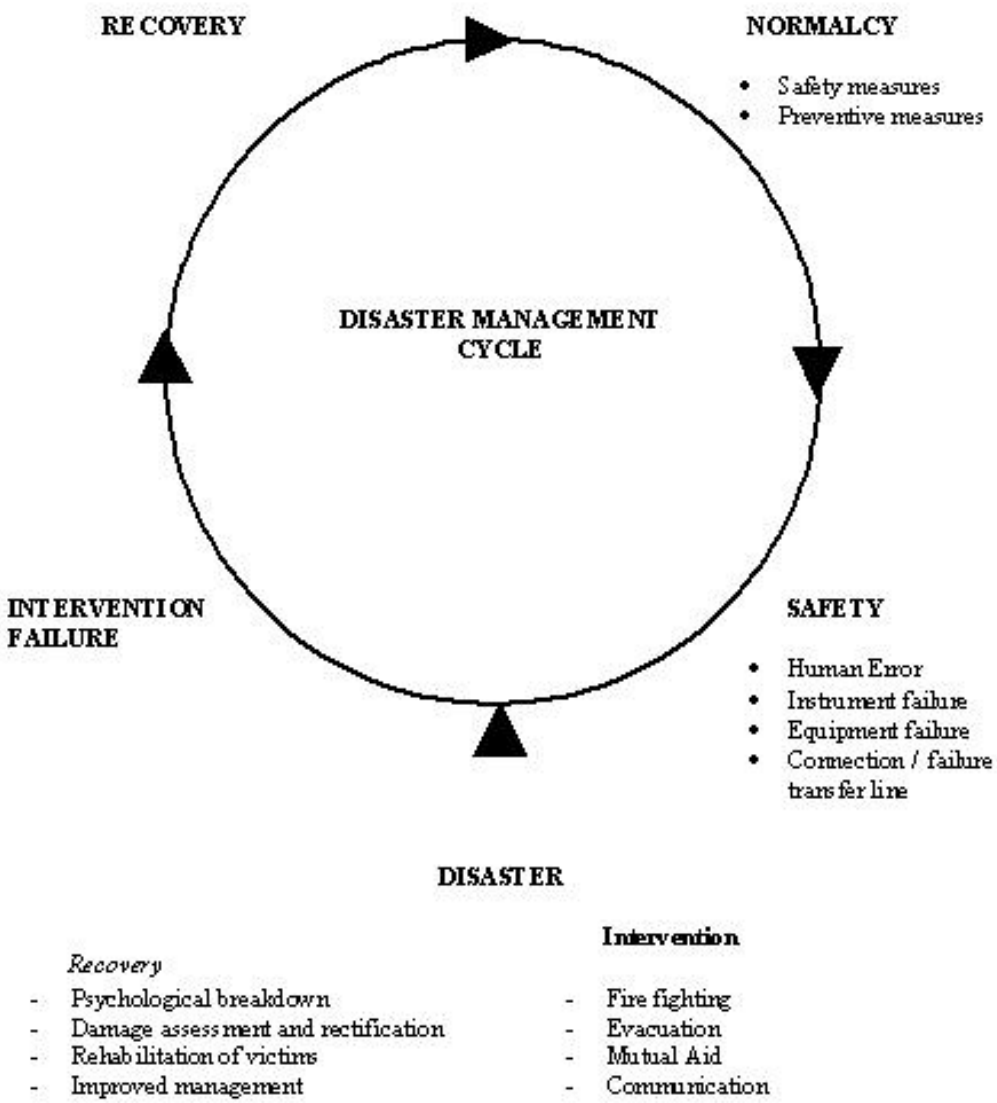


**Figure 7.1 : Disaster Management Cycle**

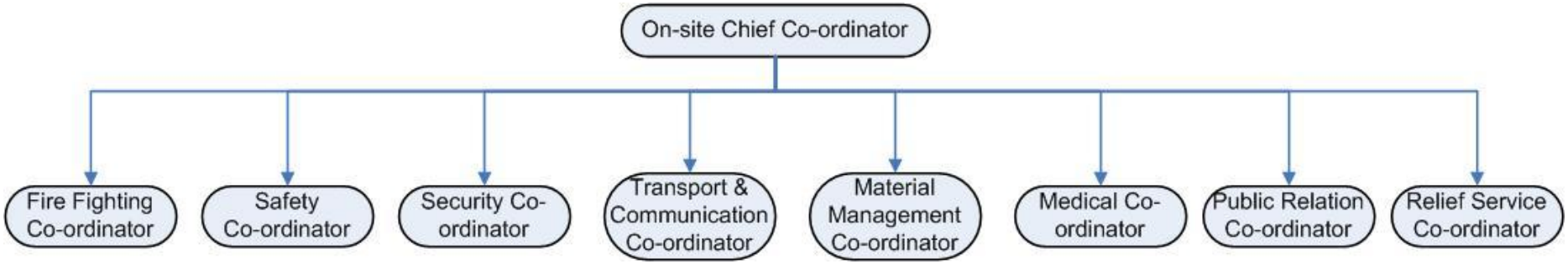


**Figure 7.2 : Organizational Chart Depicting Sequence of Actions to be taken by Concerned Persons on an On-site Crisis**

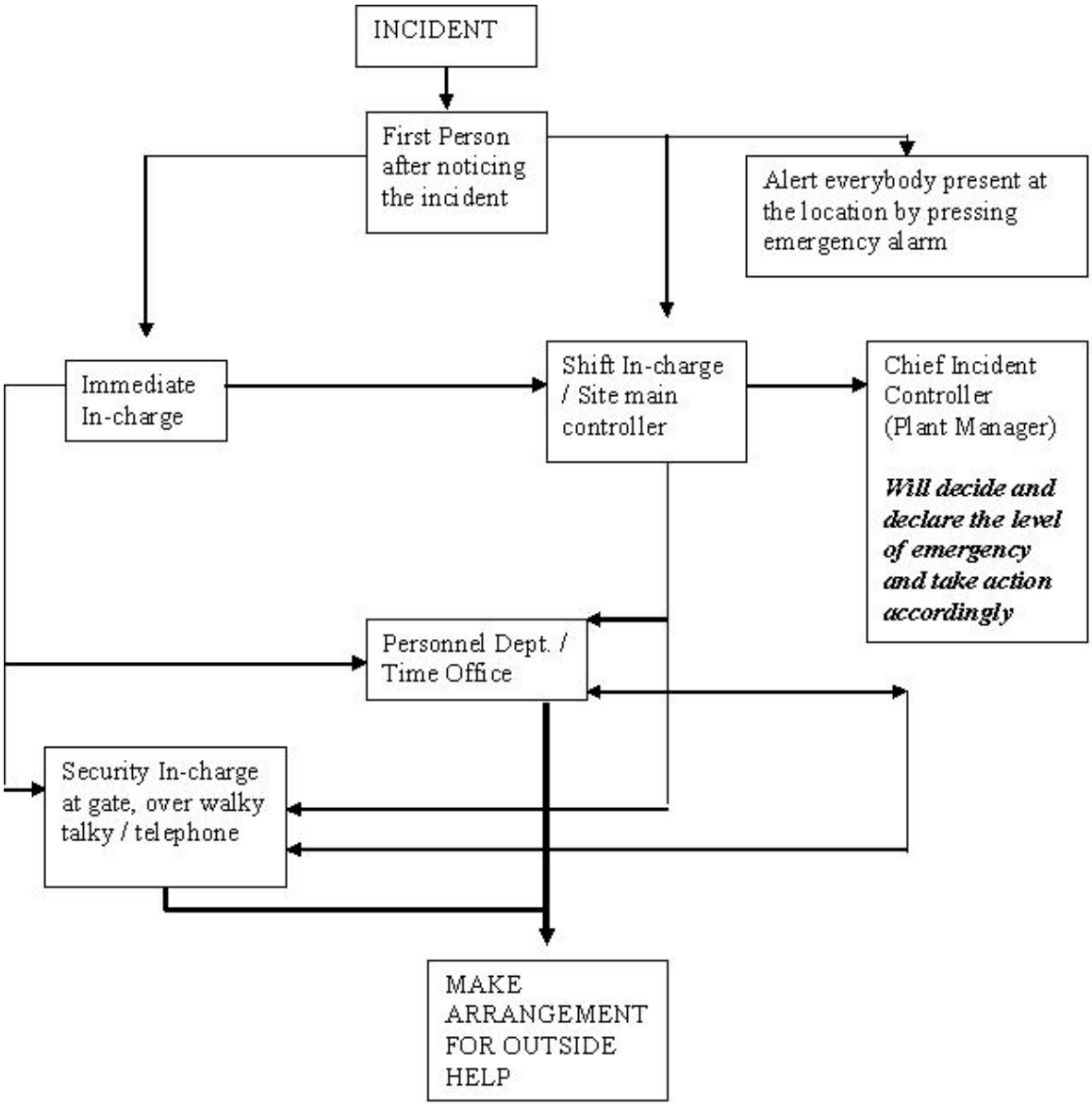


**Figure 7.3 : Emergency Reporting System**

# 8. SUMMARY AND CONCLUSION

This chapter concludes on the findings that emerged from the environmental assessment study and summarizes the key points to be addressed to ensure the environmental sustainability of the project during the construction and operation phases.

## 8.1. Prelude

247. The present study was aimed at identifying the potential environmental impacts due to the various project activities, assessment of impact, mitigation measures, and at developing an environmental management and monitoring plans for proper mitigation of any adverse environmental impact. In this study, the various activities likely to take place during the construction and operation phases of the project have been analyzed in relation to the baseline condition of different environmental components. The mitigation measures proposed for the contractors and the project proponent have also been reviewed and the potential residual impacts discussed. The key points considered in this study are described in the following sections:

## 8.2. Regulatory Compliance

248. The project is yet at its commissioning stage. Prior to its implementation, it will be necessary to acquire all the necessary clearance from the Government of India, as per the applicable national regulations. Key clearances include obtaining the ***No Objection Certificate*** from the ***Uttar Pradesh Pollution Control Board (UPPCB)*** under ***The Water (Prevention and Control of Pollution) Act, 1974*** and ***Rules, 1975***; ***The Air (Prevention and Control of Pollution) Act, 1981*** and ***Rules, 1982***. In addition to that ***Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989*** and amendments thereafter, ***Hazardous Waste (Management, Handling and Transboundary Movement) Rules, 2008***, ***Bio Medical Waste (Management & Handling) Rules, 1998*** and amendments thereafter, ***Municipal Solid Waste (Management & Handling) Rules, 2000*** and amendments thereafter will also be applicable to the industry.

## 8.3. Baseline Conditions

249. The monitoring of the existing environmental conditions of the proposed project site and of its close vicinity have been established with respect to physical, biological and human environment. The air quality of the area meets the prescribed National Ambient Air Quality Standards applicable for the Industrial, Residential & Rural Areas. The background noise levels were also found well within the standards as at present most of the area is not developed.

250. The water quality also meets all standards for use in domestic and industrial applications. The geology of the project area is of varied nature. No forest land is falling in the study area. In addition to that there is no sensitive ecosystem in the vicinity. No rehabilitation and resettlement issue is emerging with the selected project site.

## 8.4. Environmental Impacts and Mitigation Measures

251. The project entails various impacts on the study area, some negative and some positive. The impacts will be caused by the construction activities as well as by the other industrial activities during the construction and operation phases, respectively. Various impacts identified during the study have been provided mitigation measures for a better environmental management. In addition to that the roles and responsibilities of the developers have also been given in the Environmental Monitoring Programme to monitor the implementation of the environmental management plan to ensure the mitigations of adverse impacts.

## 8.5. Recommendations

252. Based on the environmental impact assessment conducted, the following recommendations are made:

- All precautionary measures suggested in the mitigation measures for operation phase of the project shall be adhered.
- Since regulations are fast changing in India, the project proponent must keep themselves updated with respect to applicable laws and take appropriate actions in case the provisions in some regulations undergo change.

# 9. DISCLOSURE OF CONSULTANTS ENGAGED

## 9.1. Team Composition

253. The team composition and their respective responsibilities are listed in Table 9.1**.**

**Table 9.1 : Team Composition and Expertise Area**

| Name | Organization | Position and Responsibility |
|---|---|---|
| Mr. S. K. Jain | EQMS | Environmental Expert & Overall Project Coordinator |
| Mr. Naval Kishor Chaudhary | EQMS | Environmental Assessment & Mathematical Modeling Expert |
| Mr. Vinod Gautam | EQMS | Risk Assessment Expert |
| Dr. Koel Kumar | EQMS | Wastewater and Hazardous Waste Management Expert |
| Mr. Sameer Deshpande | EQMS | Ecology Expert |
| Mr. Debanshu Sinha | EQMS | Primary & Secondary Data Collection |
| Mr. Omkar Singh & Mr. Mukesh Soni | EQMS | Baseline Data Collection |