

# **ENVIRONMENTAL IMPACT ASSESSMENT REPORT**

**For**

## **MANUFACTURING OF SYNTHETIC RESIN**

**Project Proponent**

**M/s. PERFECT LAMINATE**

**Survey No.28, Dhameda- Solaiya Rd.  
Village: Anandpura, Taluka: Mansa,  
District: Gandhinagar,  
GUJARAT.**

**Prepared By:**



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F. No. J-11011/248/2011- IA II (I)  
**Government of India**  
**Ministry of Environment and Forests**  
**(I.A. Division)**

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Dated 14<sup>th</sup> November, 2011

To,

✓ Shri Mukeshbhai K. Patel, Managing Director  
M/s. Perfect Laminate  
B/19, Tirupati Tulsi Bunglows, Kalol Road,  
Post Mansa, District Gandhinagar-382810, Gujarat

E-mail: [royalcrownlaminates@gmail.com](mailto:royalcrownlaminates@gmail.com) ;

**Subject:** Phenol Formaldehyde Resin, Melamine Formaldehyde, Melamine Urea Formaldehyde Resin, Phenol Urea Formaldehyde Resin (60 MTPM) at Sy. No. 28, Dhameda-Solaiya Road, Village Anandpura (Solaiya), Post Solaiya, Taluka Mansa, District Gandhinagar, Gujarat by M/s Perfect Laminate - TORs reg.

**Ref. :** Your letter no. nil dated 2<sup>nd</sup> May, 2011.

Sir,

Kindly refer your letter no. nil dated 2<sup>nd</sup> May, 2011 alongwith project documents including Form-I, Pre-feasibility Report and draft 'Terms of Reference' as per the EIA Notification, 2006. It is noted that proposal is for the Phenol Formaldehyde Resin, Melamine Formaldehyde, Melamine Urea Formaldehyde Resin, Phenol Urea Formaldehyde Resin (60 MTPM) at Sy. No. 28, Dhameda-Solaiya Road, Village Anandpura (Solaiya), Post Solaiya, Taluka Mansa, District Gandhinagar, Gujarat by M/s Perfect Laminate. Following will be manufactured:

S. N.	Name of products	Quantity
1	Phenol Formaldehyde Resin	60 MTPM
2	Melamine Formaldehyde Resin	
3	Melamine Urea Formaldehyde Resin	
4	Phenol Urea Formaldehyde Resin	

Draft Terms of Reference (TOR) have been discussed and finalized during the 28<sup>th</sup> Expert Appraisal Committee (Industry-2) meeting held during 17<sup>th</sup>-18<sup>th</sup> October, 2011 for preparation of EIA/EMP. Following are the 'TORs':

1. Executive summary of the project
2. Justification of the project.
3. Promoters and their back ground.
4. Regulatory framework
5. A map indicating location of the project and distance from severely polluted area
6. Project location and plant layout. ✓



7. Infrastructure facilities including power sources.
8. Total cost of the project alongwith total capital cost and recurring cost/annum for environmental pollution control measures.
9. Project site location alongwith site map of 10 km area and site details providing various industries, surface water bodies, forests etc.
10. Present land use based on satellite imagery for the study area of 10 km radius.
11. Location of National Park/Wild life sanctuary/Reserve Forest within 10 km radius of the project.
12. Details of the total land and break-up of the land use for green belt and other uses.
13. List of products alongwith the production capacities.
14. Detailed list of raw materials required and source, mode of storage and transportation.
15. Manufacturing process details alongwith the chemical reactions and process flow chart.
16. Site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall is necessary.
17. Ambient air quality monitoring at 6 locations (Oct.– Dec., 2011) within the study area of 5 km. aerial coverage from project site as per NAAQES notified on 16<sup>th</sup> September, 2009. Location of one AAQMS in downwind direction.
18. One season site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall and AAQ data (except monsoon) for PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>x</sub> including VOCs shall be collected. The monitoring stations shall take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests. Data for water and noise monitoring shall also be included.
19. Air pollution control measures viz. Multi-cyclone and bag filter etc. Shall be proposed for the effective control of gaseous emissions within permissible limits.
20. Data on methanol and phenol for the existing unit. Control methanol emission from drying section.
21. Details of VOC monitoring system in the working zone environment.
22. Name of all the solvents to be used in the process and details of solvent recovery system.
23. Design details of ETP, incinerator, boiler, scrubbers/bag filters etc.
24. Details of water and air pollution and its mitigation plan
25. Action plan to control ambient air quality as per NAAQES Standards notified by the Ministry on 16<sup>th</sup> September, 2009.
26. An action plan to control and monitor secondary fugitive emissions from all the sources.
27. Determination of atmospheric inversion level at the project site and assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. Air quality modelling for proposed plant.
28. Permission for the drawl of 7.30 m<sup>3</sup>/day ground water from CGWA. Water balance chart including quantity of effluent generated recycled and reused and discharged.
29. Action plan for 'Zero' discharge of effluent shall be included.
30. Treatment of phenol in the effluent.
31. Ground water quality monitoring minimum at 6 locations shall be carried out. Geological features and Geo-hydrological status of the study area and ecological status (Terrestrial and Aquatic).
32. 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. Action plan for the disposal of fly ash generated from boiler shall be included.
33. Explore the possibility to use fuel other than wood.
34. Precautions to be taken during storage and transportation of hazardous chemicals shall be clearly mentioned and incorporated.



35. A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they will utilize all the organic solid waste generated.
36. Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF.
37. List of hazardous chemicals (as per MSIHC rule) with toxicity levels.
38. Risk assessment for storage for chemicals.
39. A note on arrangement for monitoring Phenol Formaldehyde in the work zone.
40. Locating the plant in open area instead of covered to be reviewed in view of safety consideration.
41. An action plan to develop green belt in 33 % area
42. Action plan for rainwater harvesting measures at plant site shall be included to harvest rainwater from the roof tops and storm water drains to recharge the ground water.
43. Occupational health of the workers needs elaboration including evaluation of noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and steps taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc. Occupational hazards specific pre-placement and periodical monitoring shall be carried out.
44. Socio-economic development activities shall be in place.
45. 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 shall be provided.
46. EMP shall include the concept of waste-minimization, recycle / reuse / recover techniques, Energy conservation, and natural resource conservation.
47. Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof.
48. Public hearing issues raised and commitments made by the project proponent on the same shall be included separately in EIA/EMP Report in the form of tabular chart with financial budget for complying with the commitments made.
49. A tabular chart with index for point wise compliance of above TORs.

The following general points shall be noted:

- i. All documents shall be properly indexed, page numbered.
- ii. Period/date of data collection shall be clearly indicated.
- iii. Authenticated English translation of all material provided in Regional languages.
- iv. The letter/application for EC shall quote the MOEF file No. and also attach a copy of the letter.
- v. The copy of the letter received from the Ministry shall be also attached as an annexure to the final EIA-EMP Report.
- vi. The final EIA-EMP report submitted to the Ministry must incorporate the issues in this letter. The index of the final EIA-EMP report must indicate the specific chapter and page no. of the EIA-EMP Report.
- vii. While preparing the EIA report, the instructions for the proponents and instructions for the consultants issued by MoEF vide O.M. No. J-11013/41/2006-IA.II (I) dated 4th August, 2009, which are available on the website of this Ministry shall also be followed.
- viii. The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India (QCI)/National Accreditation Board of Education and Training (NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other organization/Laboratories including their



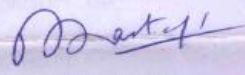
status of approvals etc. In this regard, circular no. J-11013/77/2004-IA II(I) dated 2nd December, 2009 and 30<sup>th</sup> September, 2011 available on the Ministry's website <http://www.moef.nic.in> may be referred.

- ix. Certificate of Accreditation issued by the QCI to the environmental consultant shall be included.

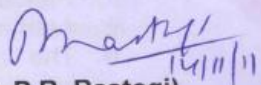
These 'TORs' should be considered for the preparation of EIA/EMP report for the Phenol Formaldehyde Resin, Melamine Formaldehyde, Melamine Urea Formaldehyde Resin, Phenol Urea Formaldehyde Resin (60 MTPM) at Sy. No. 28, Dhameda-Solaiya Road, Village Anandpura (Solaiya), Post Solaiya, Taluka Mansa, District Gandhinagar, Gujarat in addition to all the relevant information as per the 'General Structure of EIA' given in Appendix III and IIIA in the EIA Notification, 2006. The EIA/EMP as per TORs should be submitted to the Chairman, Gujarat Pollution Control Board (GPCB) for public consultation. The GPCB shall conduct the public hearing/public consultation as per the provisions of EIA notification, 2006.

You are requested to kindly submit the final EIA/EMP prepared as per TORs and incorporating all the issues raised during Public Hearing / Public Consultation to the Ministry for considering the proposal for environmental clearance **within 2 years as per the MoEF O.M. No. J-11013/41/2006-IA.II (I) dated 22<sup>nd</sup> March, 2010.**

The consultants involved in the preparation of EIA/EMP report after accreditation with Quality Council of India / National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/Laboratories including their status of approvals etc. In this regard, **circular no. J-11013/77/2004-IA II(I) dated 2<sup>nd</sup> December, 2009 and 30<sup>th</sup> September, 2011 available on the Ministry's website <http://www.moef.nic.in> may be referred.**

  
(Dr. P.B. Rastogi)  
Director

Copy to: The Chairman, Gujarat Pollution Control Board, Paryavaran Bhavan, Sector - 10, A, Gandhi Nagar - 382 010, Gujarat (E-mail: [chairman@gpcb.goe.in](mailto:chairman@gpcb.goe.in) ; Fax No.: 079-23232156)

  
(Dr. P.B. Rastogi)  
Director



**TERMS OF REFERENCE AND ITS COMPLIANCE**

Sr. No.	TOR Point	Reference		
		Chapter	Point	Page No.
1	Executive summary of the project.	Annexure – A (English) Annexure – B (Gujarati)		289-300 301-317
2	Justification of the Project.	Chapter 2	2.2	36
3	Promoters and their back ground.	Chapter 2	2.3	37
4	Regulatory framework.	Chapter 2	2.4	37
5	A Map indicating location of the Project and distance from severely polluted area.	Chapter 2	2.1 Drawing 2.3	31 34
6	Project location and Plant Layout	Chapter 2	Drawing 2.8 & 2.9	51 52
7	Infrastructure facilities including power sources.	Chapter 2	2.9 2.10.2	50 54
8	Total cost of the project along with total capital cost and recurring cost /annum for environmental pollution control measures.	Chapter 2	Table 2.3	38
9	Project site location along with site map 10 km area site details providing various industries, surface water bodies, forest etc.	Nearby industries – ch-2 – table 2.2 – pg no. 37 It may be noted that there is no forest within 10 km radius from the project site. Surface water bodies – Annexure – H – pg no. 333		
10	Present Land use based on satellite imagery for the study area of 10 km radius.	Chapter 3	3.3.5.2 (B)	138

Sr. No.	TOR Point	Reference		
		Chapter	Point	Page No.
11	Location of National park/Wild Life sanctuary/ Reserve Forest within 10 km radius of the project.	It may be noted that there is no National park/Wild Life sanctuary/ Reserve Forest within 10 km radius of the project.		
12	Details of the total land and break of the land use for green belt and other uses.	Chapter 2	2.9.1	50
13	List of products along with the production capacities.	Chapter 2	2.6 Table 2.4, 2.4.1, 2.4.2	39
14	Detailed List of raw material required and source, mode of storage and transportation.	Chapter 2	Table 2.6, Table 2.7 & Table 2.18	45 46 69
15	Manufacturing process details along with the chemical reactions and mass balance.	Chapter 2	2.7	40 – 44
16	Site-specific micro-metrological data using temperature, relative humidity, hourly wind speed and direction and rainfall is necessary.	Chapter 3	Table 3.8	83 - 120
17	Ambient air quality at 6 locations (Oct. – Dec. 2011) within the study area of 5 km, aerial coverage from project site as per NAAQES notified on 16 <sup>th</sup> September, 2009. Location of one AAQMS in downwind direction.	Chapter 3	Table 3.5	78
18	One season Site-specific micro-metrological data using temperature, relative humidity, hourly wind speed and direction and rainfall and AAQ data (except monsoon) for PM <sub>10</sub> , SO <sub>2</sub> , NO <sub>x</sub> including VOC <sub>s</sub> should be collected. The monitoring station should take into account the pre-dominant wind direction, population zone sensitive	Chapter 3	Table 3.8, Table 3.5, 3.10 & 3.11 Table 3.15	83-120 78 125 & 126 130

Sr. No.	TOR Point	Reference		
		Chapter	Point	Page No.
	receptors including reserved forests. Data for water and noise monitoring should also be included.			
19	Air pollution control measures viz. Multi – cyclone and bag filter etc. shall be proposed for the effective control of gaseous emissions within permissible limits.	Chapter 2	Table 2.15	64
20	Data on methanol and phenol for the existing unit. Control methanol emission from drying section.	Chapter 2	2.8.2 Drawing 2.7	47 48
21	Details of VOC monitoring system in the working zone environment.	Chapter 5	Table 5.1	223
22	Name of all the solvents to be used in the process and details of solvent recovery system.	Chapter 2	2.8.2 Drawing 2.7	47 48
23	Design details of ETP, incinerator, boiler, scrubbers/bag filters etc.	Chapter 2	2.11.1(B) Table 2.13 Drawing 2.11 Table 2.14 Table 2.16	58 60 62 63 64
24	Details of water and air pollution and its mitigation plan.	Chapter 2	2.11	55 - 65
25	Action plan to control ambient air quality as per NAAQES standards notified by the ministry on 16 <sup>th</sup> September, 2009.	Chapter 5	5.3.2.8 Table 5.1	223
26	An action plans to control and monitor secondary fugitive emissions from all the sources.	Chapter 5	5.3.2.7	222
27	Determination of atmospheric inversion level at the project site and assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological	Chapter 4	4.3.2.2	172

Sr. No.	TOR Point	Reference		
		Chapter	Point	Page No.
	features. Air quality modeling for proposed plant.			
28	Permission for the drawl of 7.30 m <sup>3</sup> /day ground water from the CGWA. Water balance chart including quantity of effluent generated recycled, reused and discharged.	The industry has already done application to CGWA.		
29	Action plan for 'zero discharge' of effluent as proposed should be included.	Chapter 2	Drawing 2.11	62
30	Treatment of phenol in the effluent.	Chapter 2	Drawing 2.11	62
31	Ground water monitoring minimum at 6 locations should be carried out.	Chapter 3	Table-3.9, 3.10 & 3.11	123 125, 126
	Geological features and Geo-hydrological status of the study area	Chapter 3	3.3.6	143
	Ecological status (terrestrial and Aquatic).	Chapter 3	3.3.7	145
32	The details of solid and hazardous waste generation, storage, utilization and disposal particularly related to the hazardous waste calorific value of hazardous waste and detailed characteristic of the hazardous waste. Action plan for the disposal of fly ash generated from boiler shall be included.	Chapter 4	4.3.2.3	196
		Chapter 5	5.3.2.3	219
33	Explore the possibility to use fuel other than wood.	Chapter 2	Table 2.14	63
34	Precautions to be taken during storage and transportation of hazardous chemicals shall be clearly mentioned and incorporated.	Chapter 7	7.8.4	246
35	A copy of the Memorandum of Understanding signed with cement manufacturers indicating clearly that they will utilize all	It may be noted that there will not be any type of organic solid waste		

Sr. No.	TOR Point	Reference		
		Chapter	Point	Page No.
	the organic solid waste generated.	generated from the industry		
36	Authorization/Membership for the disposal of liquid effluent in CETP and solid/hazardous waste in TSDF.	It may be noted that the industry will maintain zero discharge. The industry will obtain membership of TSDF after getting EC.		
37	List of hazardous chemicals (as per MSIHC rule) with toxicity levels.	Chapter 7	7.7	240
38	Risk assessment for storage for chemicals.	Chapter 7	Table 7.8.1	241
39	A note on arrangement for monitoring Phenol Formaldehyde in the work zone.	Chapter 7	7.8.5	249
40	Locating the plant in open area instead of covered to be reviewed in view of safety consideration.	Chapter 7	7.10.1	261
41	An Action plan to develop greenbelt in 33% Area.	Chapter 5	5.3.2.6	221
42	Action plan for rainwater harvesting measures at plant site shall be included to harvest rainwater from the roof tops and storm water drains to recharge the ground water.	Chapter 5	5.3.1.2 (A)	204
43	Occupational health of the workers needs elaboration including evaluation of noise, heat, illumination, dust, any other chemicals, metals being suspected in environment and going into body of workers either through inhalation, ingestion or through skin absorption and step taken to avoid musculo-skeletal disorders (MSD), backache, pain in minor and major joints, fatigue etc. occupational hazards specific pre-placement and periodical monitoring shall be carried out.	Chapter 5	5.3.2.5	220

Sr. No.	TOR Point	Reference		
		Chapter	Point	Page No.
44	Socio-economic development activities should be in place.	Chapter 3	3.3.8	153
45	Detailed Environmental management plan (EMP) with specific reference to the details of air pollution control system, water and waste water management, monitoring frequency, responsibility and time bound implementation plan for mitigation measure should be provided.	Chapter 5	5.3.2	216
46	EMP shall include the concept of waste minimization	Chapter 5	5.3.2.3	219
	recycle / reuse / recover techniques		Drawing 2.10	57
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	Natural resource conservation.		5.3.2.4(A)	220
47	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, There is not any litigation pending against the project		
48	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.	Will be done		
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# **CHAPTER 1:**

# **INTRODUCTION**

## **M/s. Perfect Laminate**

## 1.1 Preamble

**M/s. Perfect Laminate** is a small scale **proposed New Unit** to be located at Survey no. 28, Dhameda- Solaiya Rd. Village : Anandpura, Taluka: Mansa, District : Gandhinagar, Gujarat for production of Laminated sheet and intermediate chemical resin product like Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Melamine Urea Formaldehyde Resin and Phenol Urea Formaldehyde Resin for captive consumption and also for sale in the market. The proposed final product is Laminated sheet (40,000 Nos./Month), which will be manufacture from the intermediate resin like, Phenol Formaldehyde Resin, Melamine Formaldehyde Resin , Melamine Urea Formaldehyde Resin and Phenol Urea Formaldehyde Resin (60 MT / Month). The EIA Study is carried out as a part of process to obtain Environment Clearance Certificate for the proposed project.

The unit has obtained Consent to Establish (CTE) for manufacturing of laminated sheet from Gujarat Pollution Control Board.

## 1.2 Introduction Of Project

The proposed product Laminated sheets does not attracts environmental clearance from Ministry of Environment and Forests (MoEF), New Delhi but the intermediate product Phenol formaldehyde resin and melamine formaldehyde resin falls under clause No.5 (f) of category "A" as stated in Environment Impact Assessment Notification published on 14th September 2006 and hence the project proponent has to obtain the environmental clearance from the, New Delhi. As per the requirements of the notification, an application was submitted to Ministry of Environment and Forest in 11<sup>th</sup> May 2011 as considering Form 1. The proposal was considered by the Expert Appraisal Committee (Industry- 2) in its 1<sup>st</sup> meeting held during 20<sup>th</sup> October, 2011 and also the presentation was conducted. Subsequently The Committee prescribed has issued the approved TOR (Terms of reference) wide letter No. J-11011/248/2011-IA II (I) dated **November 14<sup>th</sup>, 2011**. All the aspects of the TOR are incorporated in to the EIA/EMP Report.

To obtain Environment Clearance for proposed expansion and to carry out Environmental Impact Assessment Study **M/s. Perfect Laminate**, has assigned responsibility to **NABET Accredited Consultant M/s. Pragathi Labs & consultants Pvt. Ltd.** The company profile of **M/s. Pragathi Labs & consultants Pvt. Ltd.** is shown in Annexure – D.

**Laboratory utilized for the Project: Gujarat Laboratory (NABL Accredited)**

F/17, Madhavpura Market, Shahibaug, Ahmedabad – 380004.

Ph: 079-25626040

### **1.3 Introduction To Project Proponent**

The Proprietor, Mr. Mukeshbhai K. Patel owns the family concern firm. The promoter family is involved in the trading and manufacturing business since long and has a very good command over the market.

The promoter group has strong hold in the laminate sheets market. Hence, the final product is saleable in the local house hold and commercial/Office market

### **1.4 Term Of Reference For EIA and Project Review**

Term of Reference (TOR) For EIA study was prepared as per guidelines of above referred notification. The unit has submitted their application to MOEF, New Delhi on 11<sup>th</sup> May 2011 to obtain the environmental clearance along with Form – I, Terms of reference to carry out EIA study and Feasibility cum detail Project report. Subsequently the presentation was conducted regarding the proposed project at New Delhi on 20<sup>th</sup> October, 2011 and MOEF has issued approved TOR on dated November 14<sup>th</sup>, 2011 Vide letter No. J.11011/248/2011-IA-II (I).

### **1.5 Need For EIA**

The proposed project falls under S No 5 (f), A Category of Schedule attached to the Environmental Impact Assessment notification, dated 14th September 2006 under the Environment Protection Act (EPA) 1986 and hence requires prior Environmental Clearance from Environmental Impact Assessment Authority (EIA), MOEF.

Purpose of the EIA study is to critically analyze activities involved in the proposed project with reference to type & quantity of different raw material to be used, their sources, possible sources of water, change in land use and its effect on biodiversity, generation of waste water, air emissions, noise pollution and solid waste and the control measures to reduce the pollution and to delineate a comprehensive environment management plan and risk & disaster management plan.

## **1.6 OBJECTIVES OF EIA STUDY**

The main objectives of the study are:

- To assess baseline environmental status.
- To identify major sources of pollution.
- To predict & evaluate impact on environment along with pollution control measures taken.
- To prepare a comprehensive Environment and Risk & Disaster Management Plan.

## **1.7 Scope Of Work**

Manufacturing of the intermediate product Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Melamine Urea Formaldehyde Resin and Phenol Urea Formaldehyde Resin requires environmental clearance from EAC (If the project is located outside the notified industrial estates) or SEAC (If the project is located within the notified industrial estates). As the concerned project involves of manufacturing of Phenol Formaldehyde Resin, Melamine Formaldehyde Resin , Melamine Urea Formaldehyde Resin and Phenol Urea Formaldehyde Resin (60 MT/Month) , the application had been submitted to MoEF, New Delhi with pre-feasibility report and draft TOR (Terms of Reference). The final TOR had been issued by MoEF on 14<sup>th</sup> November 2011. This report is based on the compliance of all relevant TORs at relevant sections of the report.

## 1.8 EIA Methodology

The methodology adopted to conduct Rapid Environmental Impact Assessment Report is described below and Rapid EIA study was conducted for the study period of October - December 2011 covering an area of 5 km radius from the project site.

**Base Line Environmental Conditions:** The samples of ambient air, ground & surface water and soil are collected and analyzed as per standard methods for establishing baseline data and to determine the impact of proposed activity on the same.

**Ambient Air Environment:** The ambient air environment around the site was studied by setting up sampling stations within the study area of 5 Km radius from project site. The meteorological data, viz. wind speed and direction, humidity, rainfall and ambient temperature were collected from nearest Meteorological station of India Meteorological Department (IMD), at Ahmedabad.

**Ground & Surface Water Environment:** To assess the Physico-chemical quality of ground water, a number of water samples were collected and analyzed for pollution parameters viz., pH, TDS, Turbidity, BOD, COD, Fluorides, Chlorides, Sulphates, Nitrates, Ammonical Nitrogen, Hardness, Alkalinity, Iron, Oil & Grease and some trace heavy metals, in order to find out the contamination, if any.

**Noise Environment:** Noise pollution survey was conducted in the study zone for evaluating existing status. The anticipated noise sources were automobile activities and operations of crusher, screens etc. Noise levels were recorded at the noise generating places and in the surrounding villages for evaluating general scenario of the study area. Hourly equivalent sound levels (Leq) were also recorded for calculating Day and Night noise levels in the surrounding villages.

**Soil Environment:** Soil sampling and analysis was carried out to assess physico-chemical characteristics of the soil and delineate existing cropping pattern, existing land use and topography, within the study area.



**Biological Environment:** Keeping in view, the importance of biological component of total environment due to proposed project, species diversity of flora and fauna was studied for impact analysis due to proposed project activity.

**Socio-economic Environment:** Demographic and related socio-economic data was collected from census handbook 2001. Assessment of impact on significant historical, cultural, and archeological sites/places in the area and economic and employment benefit arisen out from the project is given special attention.

**Impact assessment:** Detailed study was carried out to identify pollution sources from the proposed development and their impact on different components of environment.

**Environmental Management Plan:** A comprehensive Environmental Management Plan has been prepared covering all the aspects of pollution prevention measures, air and water Pollution Control measures, solid and hazardous waste management, noise control measures, environmental surveillance etc.

**Risk Management Plan:** A comprehensive risk management plan has been prepared keeping in view the likely disasters which may affect the project. Precautionary measures that need to be incorporated at design stage itself have been addressed as also the emergency preparedness measures required to meet any such disaster.

## **1.9 Structure of The EIA Report**

Structure of the current Rapid EIA Report is as discussed below:

**Chapter-1** gives an Introduction of Project and the Project Proponent. It also includes the purpose of EIA study, its scope and methodology adopted for carrying out the EIA study.

**Chapter-2** covers Project Description giving information about justification for developing the proposed scheme. The chapter discusses in detail about project location, its advantages, selection of technology, utilities requirement & other details related to the project.

**Chapter-3** gives the Base Line Environmental Status delineating meteorological details & identification of base line status of Environmental components (primary data), Socio-Economic Environment (secondary data) of surrounding area.

**Chapter-4** deals with various sources of pollution likely to be associated with the proposed project and covers Identification and Prediction of Impact, which provides quantification of significant impacts of the proposed project activities on various environmental components. Evaluation of the proposed pollution control facilities is also carried out in this chapter.

**Chapter-5** deals with Environment Management plan delineating preparation of Environment Management Plan (EMP) to be adopted for mitigation of anticipated adverse impacts if any, and to ensure acceptable impacts.

**Chapter-6** covers the Disaster Management Plan. It details out the type of disasters & precautionary measures.

**Chapter-7** covers the Risk Management Plan. It details out the type of safety measures required in times of emergency situations.

# **CHAPTER 2:**

## **PROJECT DESCRIPTION**

**M/s. Perfect Laminate**

## 2.1 LOCATION OF PROJECT SITE

**M/s Perfect Laminate** is a Small scale unit proposed to be setup at survey no. 28, Dhameda- Solaiya Road Anandpura village, Mansa Taluka, Gandhinagar District, Gujarat for manufacturing of laminated sheets with production capacity of **40,000 Nos./Month**. And the intermediate chemical resin for laminated sheet like Phenol Formaldehyde, Melamine Formaldehyde, Phenol Urea Formaldehyde and Melamine Urea Formaldehyde for the production capacity of **60 MT/Month**.

**Table 2.1** Salient features of proposed project site.

<b>1. Geographical Details</b>	:	Latitude –23°27'30.10"N Longitude - 72°37'45.24"E
<b>2. Minimum Distance from Proposed Project Site</b>		
<b>a. City</b>	:	Gandhinagar (24.89 KM) South
<b>b. Village</b>	:	Solaiya (1.53KM) West
<b>c. Town</b>	:	Mansa (5KM) South East
<b>d. District</b>	:	Gandhinagar (24.89KM)
<b>c. Railway Station</b>	:	Ahmedabad (48KM)
<b>d. High Way</b>	:	National Highway No. 8 – (20.14 KM) East National Highway No. 8C – (24.29 KM) South State Highway No. 218 – (2.31 KM) East
<b>f. Air Port</b>	:	Ahmedabad (43Km) South
<b>g. Fire Station</b>	:	Mansa (5 KM) South East
<b>3. Displacement of Population</b>	:	None
<b>4. Protected and Notified Eco-Sensitive areas within 10 km radius from the plant site ( if , Any)</b>	:	There is no Historical place, Archaeological place, National park and wild life Sanctuary.

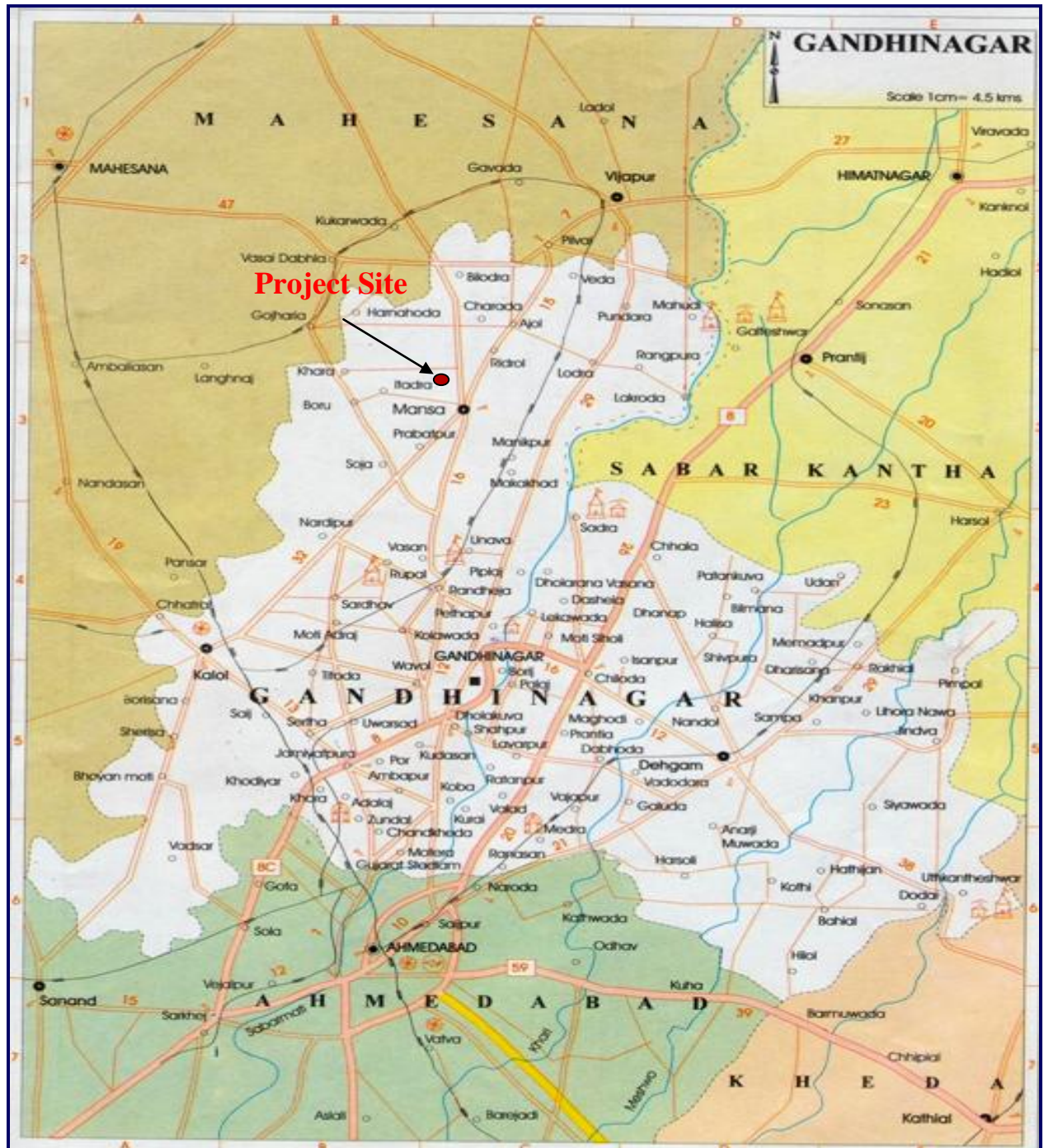
## 2.1 Location maps of Project site

### Drawing 2.1: Location Map of Gujarat State



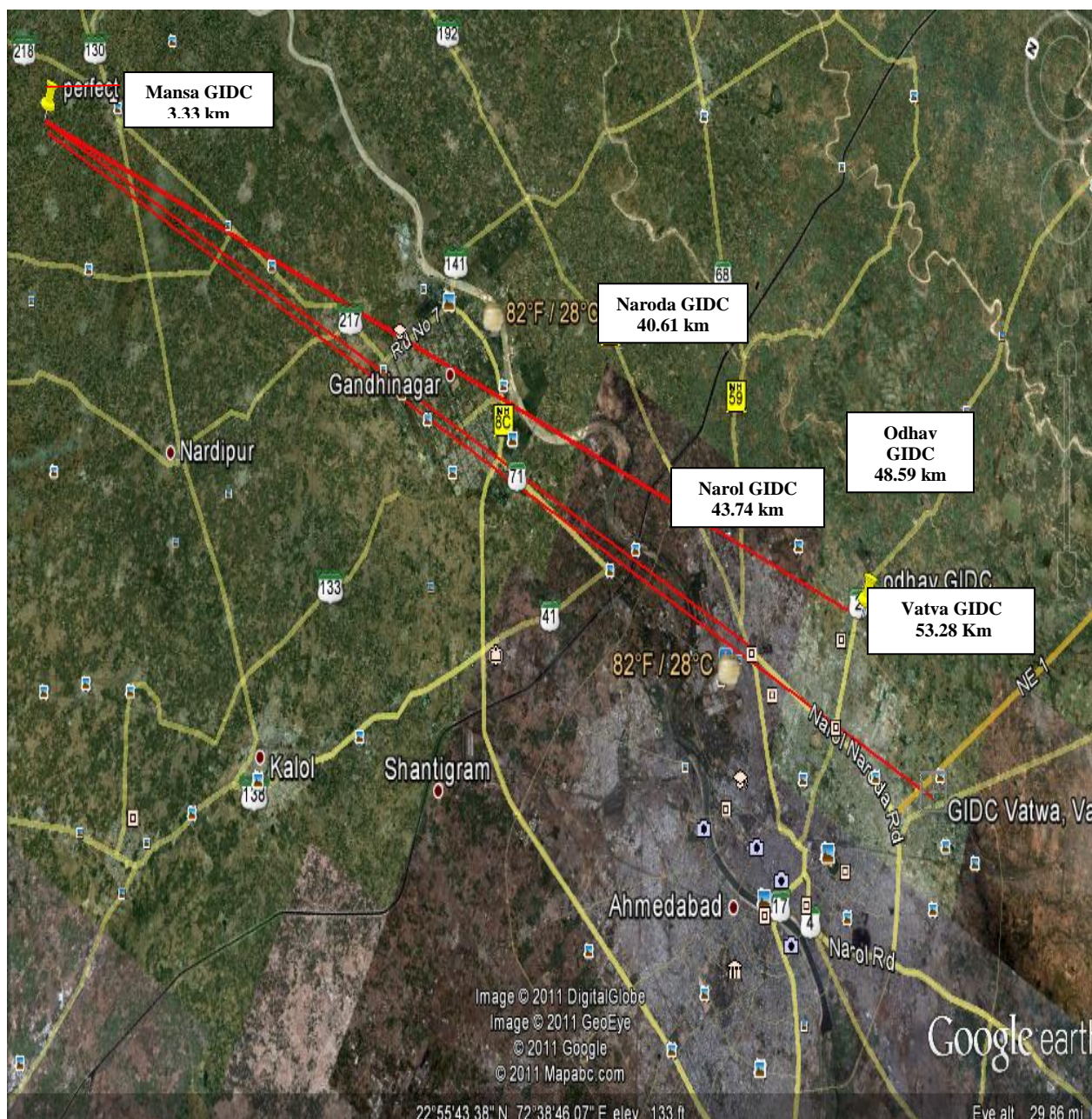
- **Location of Project site in Gandhinagar in Gujarat**

**Drawing 2.2: Map for Gandhinagar District for Proposed Project Site of M/s. Perfect Laminate**

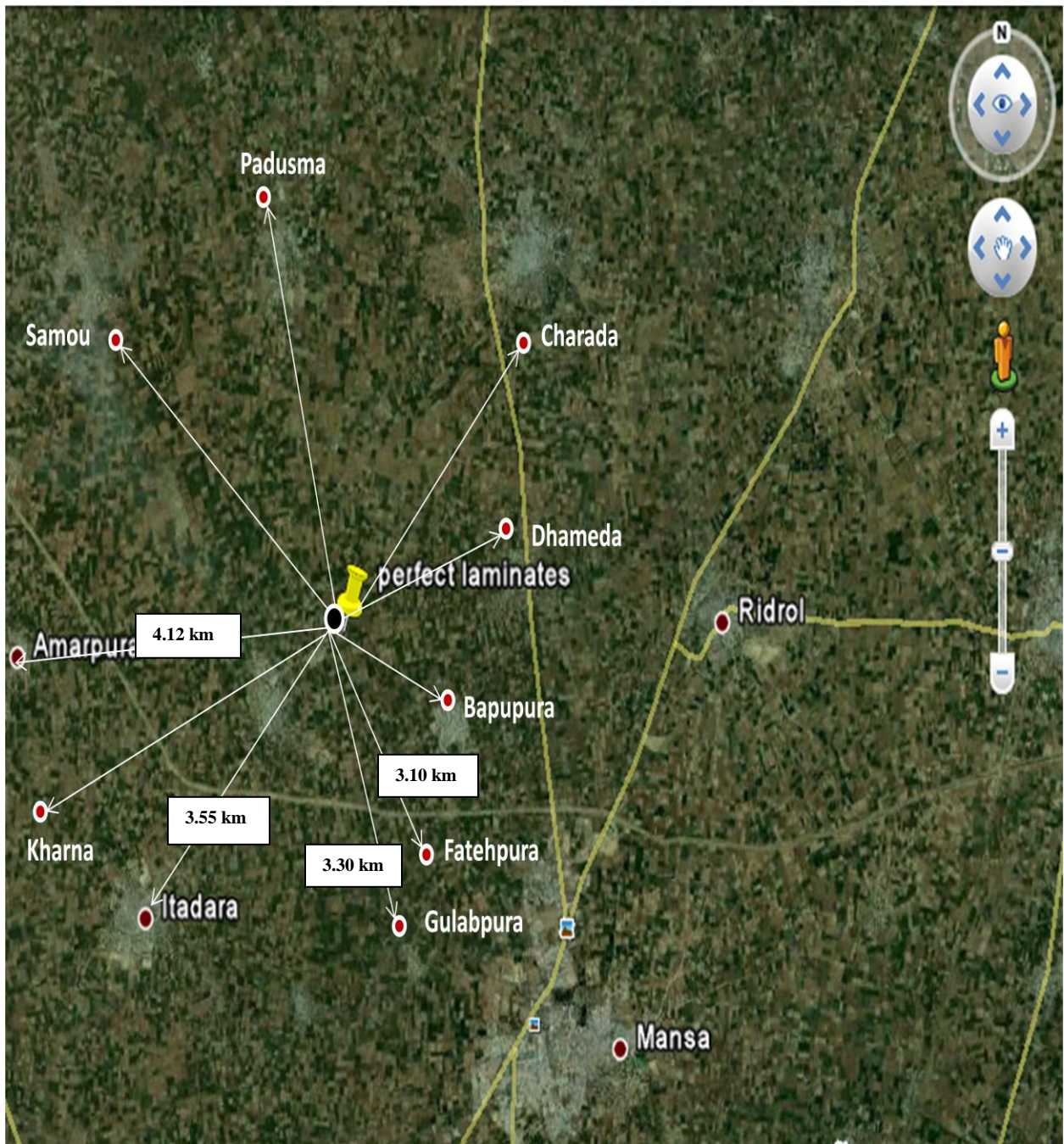




**Drawing 2.3: Google image indication location of project and distance from severely polluted area/critically polluted area**





**Drawing 2.4: Google image of surrounding villages in 5 KM.**



## **2.2 JUSTIFICATION OF PROPOSED PROJECT SITE**

The proposed product laminated sheet is having good market demand to develop the home and office for furniture. The demand of laminated sheet is constantly increasing in domestic market and as well as international market. In recent year report said that laminated sheet was largely exported in large quantities to many developed countries.

In our country, we had found the high quality of material with low rate compare to others so due to that respect we are having large exporter of lamination sheet in the world.

To meet the current market demand, **M/s Perfect Laminate** has intended to start a new unit.

Site selection was guide by many factors like existing infrastructure in the area, availability of land, water, fuel, transportation, power availability etc. Specific site selection criteria of the unit have been given below.

- Existing plot size was suitable to project requirement.
- The proposed project site is located near to State Highway No. 218, National Highway No.8& No.8 C.
- Easy availability of infrastructure facilities.
- There is enough extra land to raise required green belt/ green cover.
- Area were proposed site is to be located has no history of natural calamities like floods, cloudburst etc. except earthquake.

In addition to the above, the following factors within the study area have also been considered.

- There is no National Park or Wild life Sanctuary with in 10 Kms
- There are no metropolitan cities with in 10 Kms
- There are no ecological sensitive areas with in 10 Kms

**Table 2.2: List of Industries surrounding the proposed Project**

Sr. No.	Name
1	Perfect Polymer
2	Arjun Farms Pvt. Ltd.
3	Maruti Agro Industries
4	Vishwakarma Agriculture Works

## 2.3 PROMOTERS AND THEIR BACK GROUND

**SHRI MUKESHBHAI PATEL** aged 42 years is the Managing Director of the Company. He has more than 12 years of experience in the manufacturing of laminated sheets. He has good knowledge regarding resin production.

## 2.4 REGULATORY FRAMEWORK

The proposed product Laminated sheets does not attracts environmental clearance from Ministry of Environment and Forests (MoEF), New Delhi but the intermediate product Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Phenol Urea Formaldehyde Resin and Melamine Urea Formaldehyde Resin falls under clause No.5 (f) of category "A" as stated in Environmental Impact Assessment Notification published on 14th September 2006 and hence the project proponent has to obtain the environmental clearance from the New Delhi. As per the requirements of the notification, an application was submitted to Ministry of Environment and Forest in 11<sup>th</sup> May 2011 as considering Form 1. The proposal was considered by the Expert Appraisal Committee (Industry- 2) in its 1<sup>st</sup> meeting held during 20<sup>th</sup> October, 2011 and also the presentation was conducted. Subsequently The Committee prescribed has issued the approved TOR (Terms of reference) wide letter No. J-11011/248/2011-IA II (I) dated 14<sup>th</sup> November, 2011. All the aspects of the TOR are incorporated in to the EIA/EMP Report.

## 2.5 PROJECT COST

The unit is a proposed Small Scale industry and estimated cost for proposed production is about 150 Lacs. The detailed cost break up is shown in Table 2.2

**Table 2.3: Cost Break up for proposed unit**

<b>Sr. No.</b>	<b>Particulars</b>	<b>Cost (Lacs)</b>
<b>Laminated sheet manufacturing</b>		
1	Land	10.00
2	Building	11.00
3	Plant and Machineries	40.00
4	Working Capital Margins	7.00
5	GEB Deposit	2.00
<b>Total cost of laminated sheet</b>		<b>70.00</b>
<b>Resin manufacturing</b>		
1	Plant and Machinery	40.00
2	Building	10.00
3	EPC (Methanol Recovery)	15.00
4	ETP	6.00
5	APC System (Steam Boiler, Dust Collector, Scrubber for Controlling the Methanol Emissions)	9.00
<b>Total cost of Resin manufacturing unit</b>		<b>80.00</b>
<b>Total (Laminated Sheet Plant + Resin Manufacturing Unit)</b>		<b>150.00</b>

## 2. 6 PRODUCT DETAILS

The unit intends to produce Laminated Sheet. For production of laminated sheet it requires Intermediate Products Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Phenol Urea Formaldehyde Resin and Melamine Urea Formaldehyde Resin. The details of proposed final product and intermediate products are shown in table 2.4 and table 2.4.1.

**Table 2.4: Details of Proposed Final Product**

Sr. No.	Name of Product	Qty
1	Laminated Sheets	40,000 Nos./Month

**Table 2.4.1: List of Proposed Intermediate Product (To be consumed for preparation of laminated sheets)**

Sr. No.	Name of Intermediate Product	Qty T/Month 1month = 25 working day
1	Phenol Formaldehyde Resin	60
2	Melamine Formaldehyde Resin	
3	Phenol Urea Formaldehyde Resin	
4	Melamine Urea Formaldehyde Resin	

**Table 2.4.2: List of Proposed By-Product**

Sr. No.	Name of By-Product	Qty T/Month	Mode of disposal
1	Recovered Methanol	5.7	It will be sold to authorized dealers

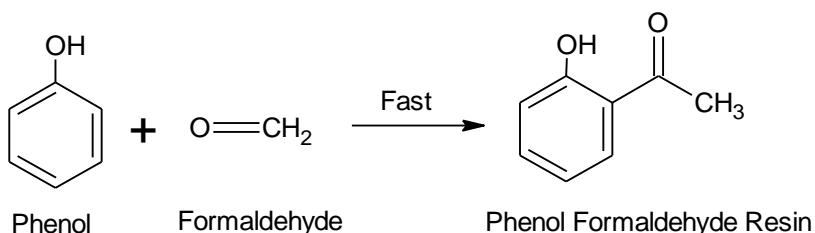
## 2.7 PRODUCTS AND MANUFACTURING PROCESS:

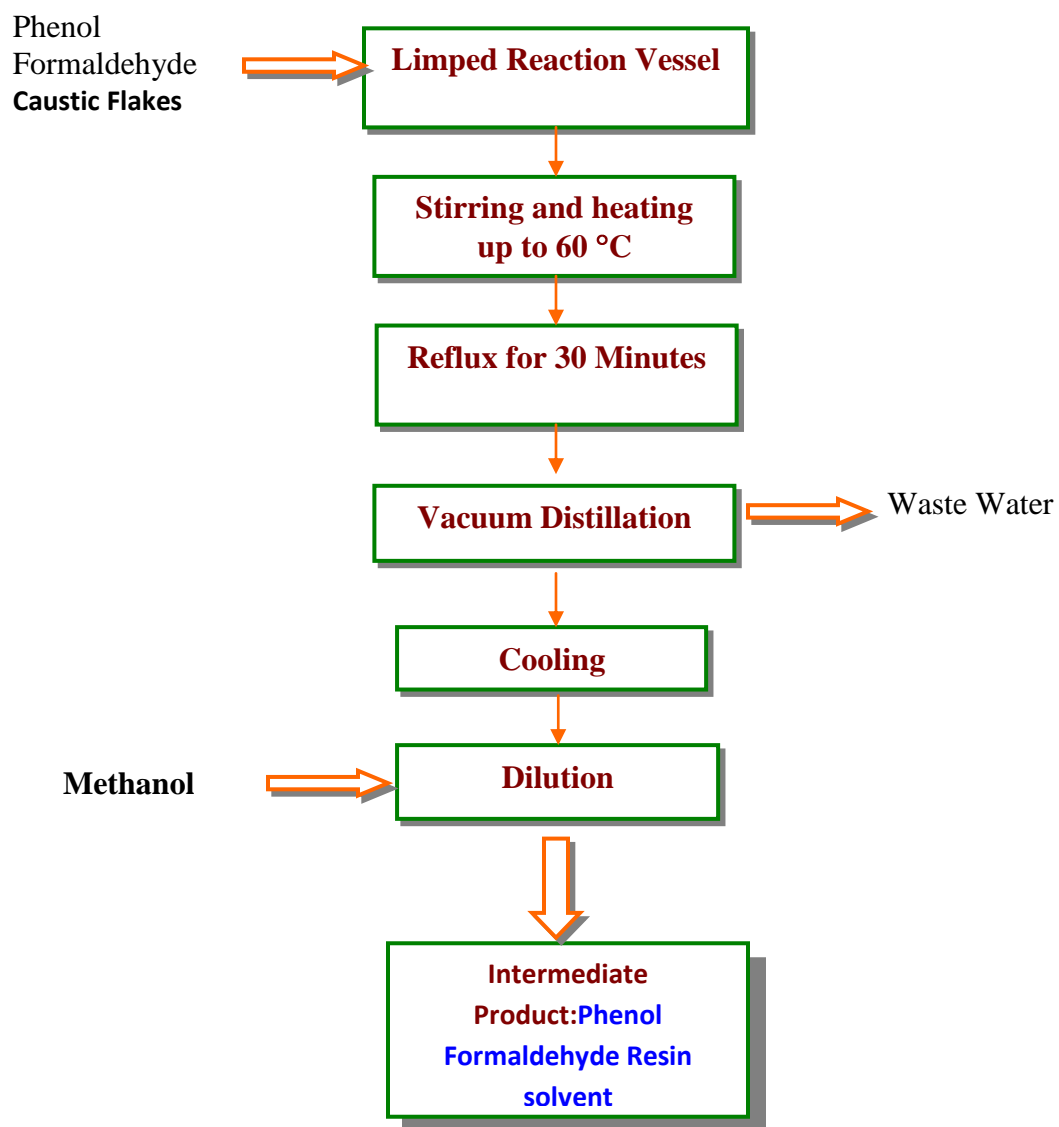
### 2.7.1 Phenol Formaldehyde Resin

#### ➤ Manufacturing Process

- First all raw materials like phenol, formaldehyde & caustic will be added into Limped reaction vessel.
- Stirring & heating will up to 60 °C. When it will reach up to 60°C maintain the temperature up to 1 hr.
- Reflux is done for 30 minutes up to 98 °C.
- Vacuum distillation will be started.
- Approximately 236 kg Water will be removed from the vessel.
- Cooling will start up at 40 °C.
- Methanol will be added for dilution purpose.
- Phenol Formaldehyde Resin will be ready for use in Laminate sheets.

#### • Reaction Chemistry



**Drawing 2.5 Process Flow Diagram of Phenol Formaldehyde resin**

**Table 2.5.1 Mass Balance of Phenol Formaldehyde Resin per Batch**  
**(Batch size = 1.005 MT)**

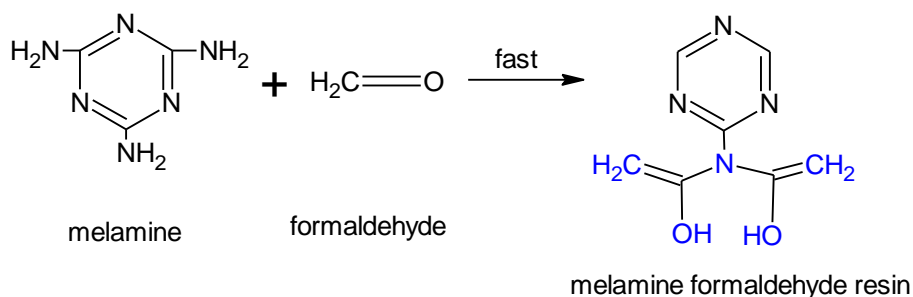
<b>Sr. No.</b>	<b>Raw materials</b>	<b>Qty In KG</b>
1	Phenol	400
2	Formaldehyde	600
3	Caustic	5
	<b>Total</b>	1005
	Waste waster generated	200
	<b>Final Total</b>	805
4	Methanol (add)	200
	Phenol Formaldehyde Resin solvent	1005

### 2.7.2 Melamine Formaldehyde Resin

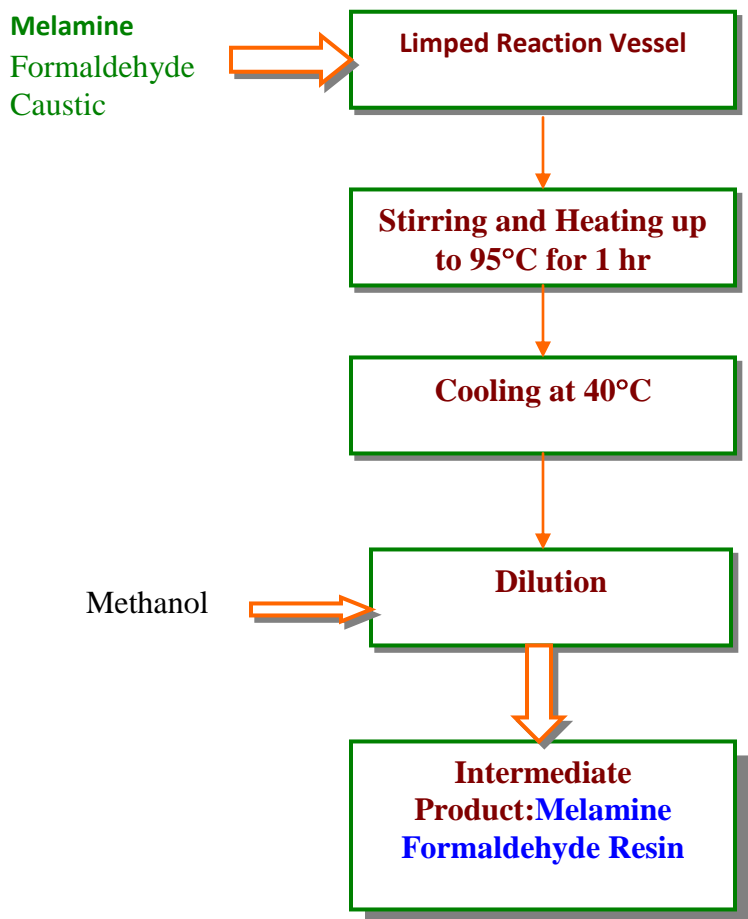
#### ➤ Manufacturing Process

- First all the raw materials melamine, formaldehyde & caustic will be added in Limped reaction vessel.
- Stirring & heating will be done up to 95 °C for 1 Hr.
- Cooling will start up at 40 °C.
- Melamine Formaldehyde Resin will be ready for use in Laminate sheets.

- Reaction Chemistry



**Drawing 2.6 Process Flow Diagram of Melamine formaldehyde resin**





**Table 2.5.2 Mass Balance of Melamine Formaldehyde Resin per batch  
(1 batch = 1MT)**

<b>Sr. No.</b>	<b>Raw Materials</b>	<b>Qty In KG</b>
1	Formaldehyde	600
2	Melamine	400
	<b>Final Total</b>	1000

**Table 2.5.3 Methanol consumption in the process for the preparation of Resin**

<b>Sr. No.</b>	<b>Name of Intermediate Product</b>	<b>Qty T/Month 1month = 25 working day</b>
1	Phenol Formaldehyde Resin	20.0
2	Phenol Urea Formaldehyde Resin	

## 2.8 MATERIAL STORAGE, HANDLING AND TRANSPORTATION

### 2.8.1 Requirement and storage of raw material

For the manufacturing of proposed intermediate product of Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Phenol Urea Formaldehyde Resin and Melamine Urea Formaldehyde Resin, various raw materials are required. Industry will provide adequate and proper storage facilities for all the raw materials and the finished product. The Quantity of Raw Material Consumption for proposed manufacturing is shown in the table 2.6 And Details regarding product and raw material storage and packing is in table 2.7.

**Table 2.6 Raw materials required for Resin Manufacturing:**

Sr. No.	Product	Raw Materials	Qty Kg/1 MT of Resin
1	Phenol Formaldehyde Resin	Phenol	335
		Formaldehyde	467
		Caustic	5
		Methanol	200
2	Melamine Formaldehyde	Formaldehyde	600
		Melamine	400
3	Phenol Urea Formaldehyde Resin	Phenol	300
		T.G.Urea	150
		Formaldehyde	550
4	Melamine Urea Formaldehyde Resin	Melamine	300
		Formaldehyde	550
		T.G.Urea	150

**Table 2.7 Packing details of Raw Material and Product**

Sr. No.	Description	Physical Form	Type of Packing/Storage/ mode of storage	Transportation	Capacity of storage
<b>➤ Raw Materials</b>					
1	Melamine	Solid	Industrial Plastic Bags	ROAD	2000 Kg
2	Formaldehyde	Liquid	Industrial Grade Plastic Tank	ROAD	1 x 10 KL
3	Phenol	Liquid	Industrial Grade Plastic Tank	ROAD	1 x 5 KL
4	Methanol	Liquid	Industrial Grade Plastic Tank	ROAD	1 x 10 KL
5	Caustic	Solid	BAGS	ROAD	200 Kg
6	T.G.Urea	Solid	BAGS	ROAD	100 Kg
<b>➤ Products</b>					
1	Phenol Formaldehyde Resin	Semi Liquid	Stored in Storage tank made of HDPE	--	2 x 200L
2	Melamine Formaldehyde Resin	Semi Liquid	Stored in reaction vessel & direct use in manufacturing laminated sheet	--	2 x 200L
3	Phenol Urea Formaldehyde Resin	Semi Liquid	Stored in Storage tank made of HDPE	--	5 x 200L
4	Melamine Urea Formaldehyde Resin	Semi Liquid	Stored in Storage tank made of HDPE	--	2 x 200L

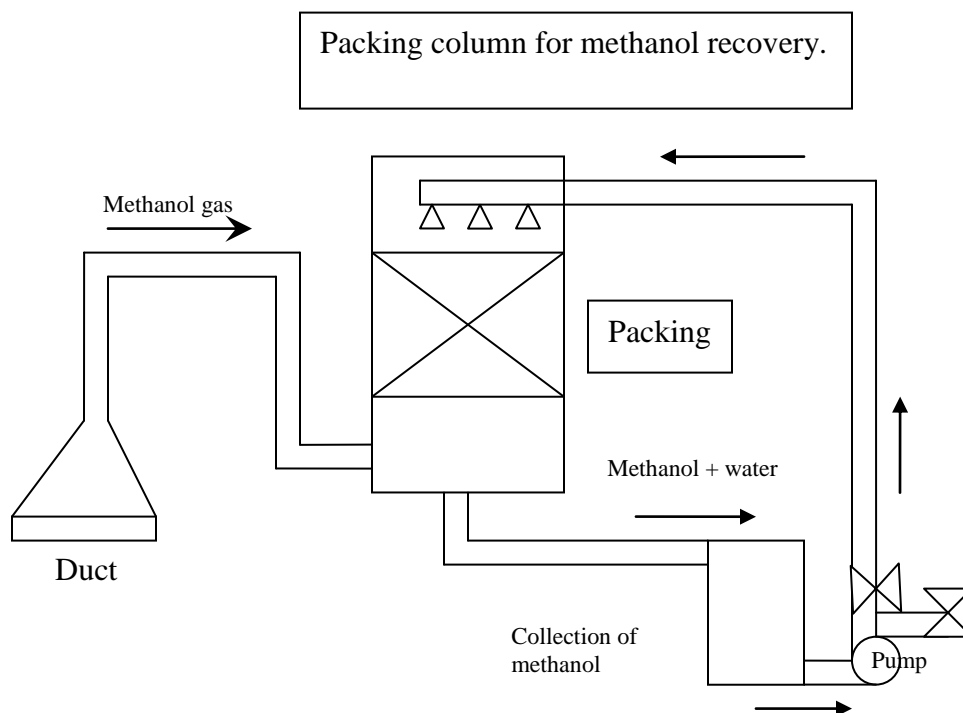
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### 2.8.2 SOLVENT CONSUMPTION AND MASS BALANCE

The unit will use Methanol, as a solvent, to manufacture laminated sheet. It will not use to manufacture resin. It will help to let down the viscosity of resin so it can float on the laminated sheet while drying. The overall requirements and mass balance of solvent consumption has been worked out which is given in Table 2.8.

- Methanol flash point is 16 °C. And while the dry temperature will remain 160 – 180 °C. So, it will evaporate from drying process.
- Methanol is not toxic but it is highly explosive so it is necessary to recover methanol.
- As shown in drawing 2.7 a methanol will transfer in water scrubber through ID fan.
- The methanol vapor gas pass into water scrubber and recollect into water collection tank and it will circulate till the water become concentrate. After this it will sell as by product.
- So, Methanol will be recovered.

### Drawing 2.7 Methanol Recovery System



**Table – 2.8: Solvent recovery in water scrubber**

Name of Solvent	Fresh	Recover	% Recovery
<i>Methanol</i>	<i>6 T/Month</i>	<i>5.7 T/Month</i>	<i>90%-95%</i>

% of recovery will be calculated as per methanol solubility and Ideal Assumption.  
Recovered Methanol will be sold to Authorized dealers.

### **2.8.3 Storage and Handling of Raw Material**

#### **Storage:**

Industry will provide adequate and proper storage facilities for all the raw materials and finished products. Corrosive substances will be stored away from the moisture. Solid raw material will be storage in covered area and liquid raw material will be storage in closed horizontal tank. Hazardous chemical and solid waste will be stored away from other plant activities. The storage yard of chemicals will be isolated and it will equip with all necessary safety measures. In cover-shed area provide natural ventilation system, which consider as 15 % open area of all covered area.

#### **Handling:**

All the raw materials, finished products and by - products will be handled as per the standard practice. For proper handling, company will adapt good housekeeping technology to entire shed. To avoid any leakage or spillage of chemicals from all storage tanks, third party inspects transfer lines, valves, fittings and every joint periodically.

## 2.8.4 Transportation

All the necessary precautions will be taken while carrying out transport of the above materials as per the Hazardous Rules of transportation, Central Motor Vehicle Act - 1988 & 1989. The vehicles for transportation of raw materials, by - products and products will be parked at specified loading facilities where there will be a provision of fire extinguishers. The finished product (Laminated Sheet) will be transported by road, rail and ship route.

## 2. 9 INFRASTRUCTURAL FACILITIES

The total available area for proposed project is 4800 Sq. meter and unit proposes to develop Green Belt area 1585 Sq. meter of total area of plot.

### 2.9.1 The detailed Area break up for proposed unit

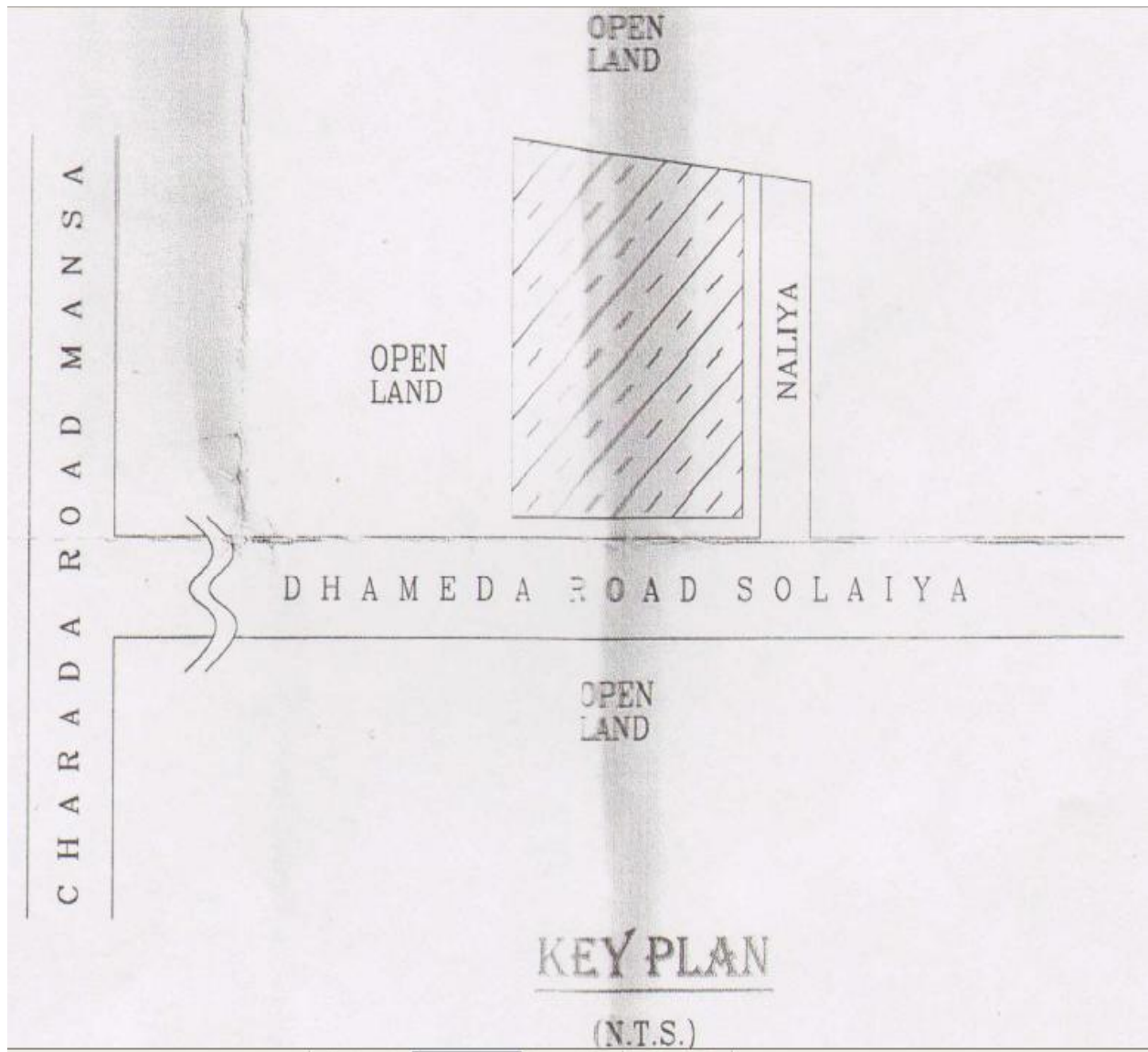
The detailed Area break up for proposed unit is shown in Table 2.9

**Table 2.9: Area Break up for proposed unit**

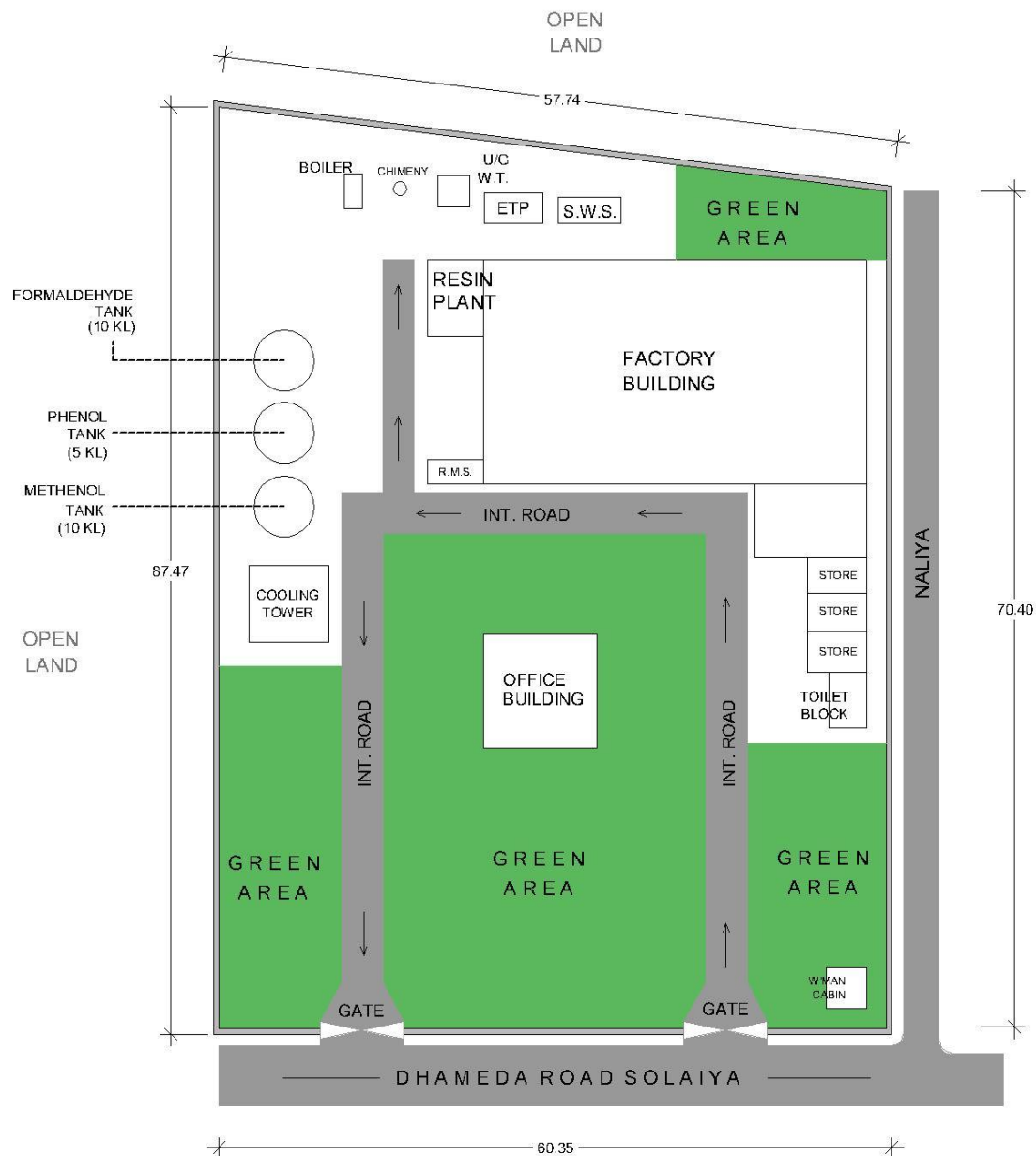
<b>Sr. No.</b>	<b>Particulars</b>	<b>Area Sq. mtr.</b>
1	Build – Up	823
2	Roads	519
3	Green Belt	1585
4	Open Area	1873
<b>Total Area</b>		<b>4800</b>

A general Key plan and plan layout are shown in drawing 2.8 and Drawing 2.9 respectively.

**Drawing – 2.8 KEY PLAN of M/s. Perfect Laminate**





**Drawing – 2.9 Plant Layout of M/s. Perfect Laminate****SITE PLAN**

1:500

R.M.S. = RAW MATERIAL STORAGE  
 S.W.S. = SOLID WASTE STORAGE



### 2.9.2 Details of Plant and Machineries

For the production of proposed laminated sheets various plants and machineries are required. The details of equipments are as mentioned in table 2.10.

**Table 2.10: Equipments required for resin plant:**

<b>Sr No.</b>	<b>Equipment</b>	<b>Qty</b>	<b>Capacity</b>
1	P.F.Vessel (Ms plate 10 mm thickness)	1 NO	1500 L
2	M.F.Vessel (SS plate 6 mm thickness)	1 NO	1200 L
3	Water condenser for PF vessel (two pass SS condenser)	1 NO	200 L
4	Steam Boiler	1 NO	1.5 MT
5	Cooling Tower	1 NO	50 TR
6	Vacuum pump (760 mm Hg)	1 NO	7.5 HP
7	D. G. Set	1 No	75 KVA

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## 2.10 REQUIREMENT OF RESOURCES

### 2.10.1 Fuel Requirement

The unit proposes to use White Coal/ Imported Coal / Lignite, as a fuel for steam boiler and HSD for DG Set and Requirement for the same is 1MT/Day and 200 L/Month respectively.

### 2.10.2 Power Requirement

Total Power requirement for the proposed project is estimated as 75 HP, which will be fulfilled from the grid power supplied by Uttar Gujarat Vij Company Ltd (Sub division of GEB).

### 2.10.3 Manpower Requirement

Manpower is the one of the important resource for efficient and better working of plant. For operation and maintenance of proposed project 55 persons will required as below,

**Table 2.11 EMPLOYMENT DETAIL**

Particular	No. of persons
Managers and Executives	1
Supervisor and Administrative Staff	1
Skilled Workers	13
Unskilled Workers	40
<b>Total</b>	<b>55</b>

---

## **2.11 ENVIRONMENTAL POLLUTION AND CONTROL MEASURES**

### **2.11.1 Water Pollution**

#### **(A) Details of Water Consumption & Wastewater Generation**

##### **Water consumption :**

The water requirement of the unit will be satisfied through Bore well. For the manufacturing of laminated sheets, there is no consumption of water. But water will be used in the Air Pollution Control Equipment in wet Scrubber for Methanol recovery & for preparation of caustic solution @ 1 KL/Day. The collected methanol will be sold to the Authorized Dealers. The Industrial water consumption for proposed unit is 6.2 KL/Day, which will be used for Cooling (make up), Boiler & for scrubbing & caustic solution. Domestic water consumption for proposed unit will be 2.25 KL/Day. The unit is developing Green Belt Area surrounding the premises hence the water requirement for gardening purpose will be 4.25 KL/day. Hence total water requirement will be 12.7 KL/Day.

##### **Wastewater generation:**

Water will not be consumed in the manufacturing process of laminated sheets, but water will be liberated from resin manufacturing process @ 0.2 KL/day. The generated wastewater will be treated in effluent Treatment Plant.

The Domestic Effluent will be generated @ 2.0 KL/day and will be sent to septic tank followed by soak pit.

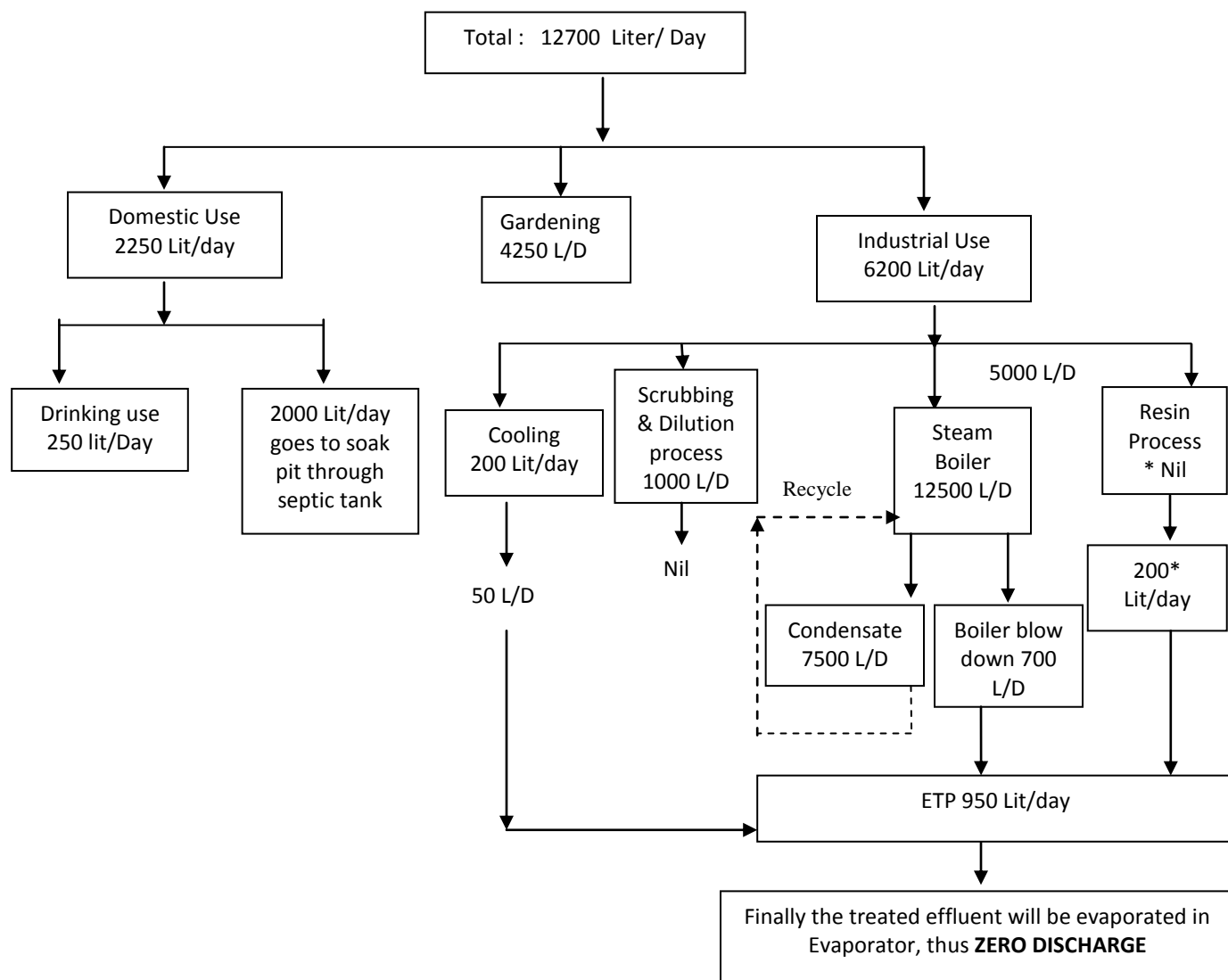
The Category wise detail of water consumption and wastewater generation is shown in Table 2.12 and in Drawing 2.10.

**Table 2.12: Water consumption and waste water Generation details**

<b>Sr. No.</b>	<b>Source</b>	<b>Water Consumption KL/Day</b>	<b>Waste Water Generation KL/Day</b>
1.	Domestic	2.25	2.0
2.	Gardening	4.25	Nil
3.	Industrial		
	a. Scrubbing & Dilution Process	1 .0*	--
	b. Resin manufacturing Process	--	0.2 #
	c. Cooling (Make up) from Cooling Tower, Capacity: 50 TR	0.2	0.05
	d. Steam boiler	5.0	0.7
	<b>Total Water Consumption/ Waste Water Generation</b>	<b>12.7</b>	<b>2.95</b>

\* : Water will be used in scrubbing process & this scrubbed Methanol will be sold to Authorized dealers.

# : It may be noted that some raw materials are containing water which will be removed from the process.

**Drawing 2.10 Water Balance Diagram****SOURCE OF WATER : BOREWELL**

Note : \* - It may be noted that some raw materials are containing water which will be removed from the process.



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## **B) Waste Water Management System (Proposed Effluent Treatment Plant)**

### **Effluent Treatment Plant Process:**

The unit will provide primary Treatment system for the treatment of the industrial effluent.

|

- (1) Effluent from the plant will be collected in collection tank.
- (2) Then effluent will be transferred in mixer where,
  - pH to be adjusted 3 to 3.5 by adding  $\text{H}_2\text{SO}_4$ .
  - $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  and  $\text{H}_2\text{O}_2$  added into the mixer tank
  - The amount of  $\text{H}_2\text{O}_2$  will be half of the phenol concentration.
  - $\text{Fe}^{+2}$  ion concentration are 1:20 of hydrogen peroxide.
- (3) Further waste water will be transferred into oxidation vessel.

### **In oxidation vessel PHOTO FENTON PROCESS**

- $\text{O}_2$  will be passed from the bottom side of the tank as shown in the figure.
- Maintain temperature between 30 to 35°C by cooling system.
- Phenol degradation will take place in presence of sun light or UV lamp.
- During rainy and winter season the photo Fenton process will occur into the closed vessel which contain UV lamp.

Further waste water to be transferred to settling tank where ETP sludge will be settled down in conical portion. It is to be removed in sludge drying beds. After drying, the dried sludge will be collected, packed in HDPE bags and stored in a separate storage area and disposed off to the TSDF site. Supernatant water will be transferred into evaporation. The capacity of evaporator will be around 1500 Litre considering worst scenario of effluent quantity.

**In evaporation,**

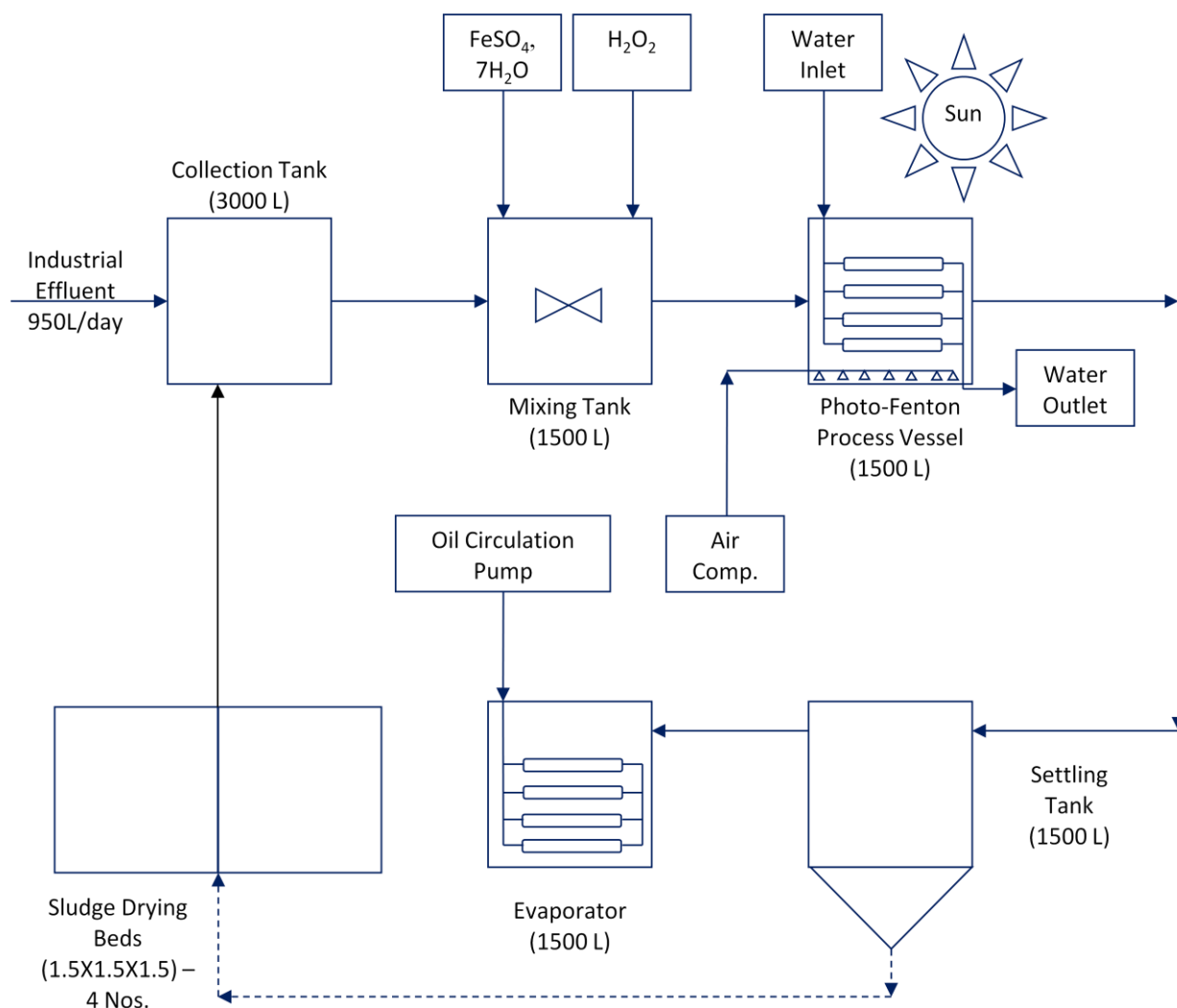
- Heating to be supplied by Steam boiler / Electric heater.

NOTE: Residual  $\text{H}_2\text{O}_2$  was consumed by enzyme catalyses to prevent interference with COD analysis.

**Table 2.13: Equipment details of Effluent Treatment Plant**

Sr. No.	Name of Unit	Description	Details
1	Collection Tank	Purpose	To store the effluent collected from different sources
		Size(m)	1.5 x 1.5 x 1.3
		Capacity (m <sup>3</sup> )	3.0
		MOC	RCC
2	Homogenizing Tank	Purpose	To mix the effluent homogeneously
		Size(m)	1 x 1 x 1.5
		Capacity (m <sup>3</sup> )	1.5
		MOC	RCC
		Accessories	Stirrer for mixing and pump for transfer effluent to Settling tank
3	Photo Fenton process vessel	Purpose	To mix the effluent homogeneously
		Size(m)	1 x 1 x 1.5
		Capacity (m <sup>3</sup> )	1.5
		MOC	RCC
		Accessories	Coil for cooling purpose
4	Settling Tank	Purpose	To settle the Settable solids from effluent at the bottom of the settling tank.
		Size(m)	Dia.1.2 x ht. 1.4
		Capacity (m <sup>3</sup> )	1.5
		MOC	MS

5	Evaporator	Purpose	To evaporate the wastewater and to achieve zero discharge
		Rating	125 L/Hr.
		Accessories	Vessel type evaporator with external heating arrangement
		MOC	MS
6	Sludge Drying Bed	Purpose	To dry the sludge generated from settling tank by evaporation
		Size (m)	1.5 x 1.5 x 1.5
		Capacity (m <sup>3</sup> )	3.375
		Nos.	4
		MOC	Brick Masonry

**Drawing 2.11 Diagram of ETP**

Note: For, 950 L/day of load. We must have more than 3 days holding time in case of ETP maintenance. So collection tank size is 3000 L.

## 2.11.2 Air Pollution

The main source of Air emission is flue gas emission from stack attached to steam boiler, DG Set and the Methanol Emissions from the Dryer. The major source for the fugitive emissions is from the vehicular movement, there is a negligible chance in fugitive emission due to handling and storage of raw material.

### Flue Gas Emission

There will be two numbers of flue gas stacks attached separately to steam boiler and DG set. The details of the same are given here under in table 2.14.

**Table 2.14: Flue Gas stacks details:**

Sr. No.	Stack attached to	Fuel used	Stack Height	Expected Pollutant	APC System
1	Steam Boiler (1.5 TPH)	White Coal/ Imported Coal / Lignite : 1 MT/day	50 meter	SPM SO <sub>2</sub> NO <sub>x</sub>	Dust Collector
2	D.G. Set	HSD= 75 Lit/Hr	15 meter		N.A.

**Note:**

1. The industry will use White Coal / Imported Coal & Lignite instead of wood as a fuel in steam boiler.
2. D.G. Set will be only used when power failure.

Stack height will be provided as per CPCB guidelines for the proper dispersion of pollutants into the atmosphere. The unit will provide Dust Collector at steam boiler as air pollution control measures to control the emission of particulate matter & the flue gas emission will remain well within gaseous emission norms prescribed by the GPCB/CPCB. The technical specifications of proposed Dust Collector are given in Table – 2.15

**Table 2.15: Technical Details of Dust Collector**

Type of Vessel	Steam Boiler FBC
Heating Capacity	1.5 TPH
Fuel used in steam boiler	White Coal/ Imported Coal / Lignite : 1 MT/day
Temperature at Inlet	140 Degree C
Specific Gravity of Dust	1.2 Kg/M <sup>3</sup>
Input Dust Load	2 Kg/24 Hr.
Efficiency	60 %
No. of Ash Discharge Cone	2-3 Nos.
Ash Discharge	Intermittent through slide gate

### Process Gas Emission

The details of process gas emission is as follows :

**Table 2.16: Process Gas stacks details**

Sr. No.	Stack attached to	Stack Height	Expected pollutant	Quality of pollutant	APC System
1	Dryer (1 No) – 3 nos. of stacks	22 Ft.	Methanol	As per GPCB Norms	Scrubber



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## **Fugitive Emission**

The chance of fugitive emission within premises is mainly due to vehicular movement and storage, handling and loading, unloading of raw materials are minimal. To control the fugitive emission following measures will be taken.

- ❖ Proper care will be taken for storage and handling of raw materials.
- ❖ Development of Greenbelt within premises will abate the chances of fugitive emission.
- ❖ Water Sprinkling system will be done at the Vehicular movement areas.
- ❖ To reduce the pollutant emission during transportation, the unit will adopt practice of regular check up and maintenance of vehicular engines for complete combustion of the fuel.

### **2.11.3 Hazardous/ solid waste Generation**

The main source of solid waste generation from manufacturing of laminated sheet is resin waste from the manufacturing process. The ancillary source of hazardous waste generation will be from raw material storage and handling, plants & machineries and ETP unit. The details of hazardous waste generation and handling / Management are given in Table-2.17.

**Table 2.17: Solid Waste/Hazardous Waste details:**

Type	Category	Quantity	Collection and Storage	Disposal
<b>Waste/ Residue (Resins)</b>	Schedule - 1, Category 23.1	7.2 MTA	Collected in drums and stored in Hazardous Waste Storage Shed	Incineration at Common Hazardous Waste Disposal Facility
<b>ETP Sludge</b>	Schedule - 1, Category 36.4	300 kg/ Year	Collected in HDPE bags and stored in Hazardous Waste Storage Shed	Secured Landfill at Common Hazardous Waste Disposal Facility
<b>Used Oil</b>	Schedule - 1, Category 5.1	50L/Yr.	Collected in drums and stored in Storage Shed	Reused within the premises &/or Sale to authorised re-refiner
<b>Discarde d drums, liners, etc.</b>	Schedule - 1, Category 33.3	27600 Nos./Yr	Collected and stored in Storage Shed	Reused within the premises &/or Sale to authorised dealer

The unit will obtain the permission from GUJARAT POLLUTION CONTROL BOARD/CPCB approved TSDF site for **disposal of solid waste** and incineration of **resin waste** which will be generated from proposed unit.

**2.11.4 Noise Pollution**

One of the potential pollutants Noise is an unwanted and excessive sound, which is harmful to health and diminishes the quality of life.

The major source of noise pollution will be DG Set and the ancillary sources will be manufacturing process within premises and transportation within and outside the premises.

The precautions taken for abatement of noise pollution will be as follows.

- ❖ In the high noise area, Ear muffs/ear plugs will be provided to curtail adverse effect on health.
- ❖ For the machineries and Equipments, timely oiling and lubricating will be done.
- ❖ The Vehicles shall be serviced periodically and maintained as per requirement of latest trend of automobile industry to reduce the noise generation due to transportation activity. Also unnecessary speeding of vehicles inside the premises will be avoided.
- ❖ All the vibrating parts will be checked periodically and serviced to reduce the noise generation. The equipment, which generates excessive noise, will be provided with enclosures etc.
- ❖ Noise monitoring will be done regularly at different parts of the plant.
- ❖ Greenbelt will be developed to lessen the effect of noise pollution.

### 2.11.5 CLEANER PRODUCTION

Focus Area	Probability of Incorporation of Cleaner Production Activity
<b>Process Vessels</b>	: <ul style="list-style-type: none"> <li>➤ Liquid raw materials will be charged by pumping and closed loops and dosing will be done by metering system to avoid fugitive emissions.</li> <li>➤ Double mechanical seals will be provided to the process vessels having agitator for reduction of fugitive emissions and leakages.</li> </ul>
<b>Storage Vessels</b>	: <ul style="list-style-type: none"> <li>➤ Storage tanks for products as well as raw materials will be fitted with appropriate control devices to avoid possible leakages.</li> </ul>
<b>Control of Reactants Used</b>	: <ul style="list-style-type: none"> <li>➤ Dedicated measuring tanks will be provided for each reactor.</li> <li>➤ Fixed transfer pipe lines will be provided and loose pipes will be avoided for handling reactants.</li> <li>➤ In our manufacturing process reactants will be used as far as possible a near to molar ratio in order to avoid use of excess chemicals, which in turn will minimize the organic load in the effluent.</li> </ul>
<b>Housekeeping</b>	: <ul style="list-style-type: none"> <li>➤ It would not be out of place to mention that we shall:               <ul style="list-style-type: none"> <li>• Follow safe work procedures and the requirements of the law</li> <li>• Keep work areas clean</li> <li>• Keep aisles clear</li> <li>• Keep exits and entrances clear</li> <li>• Keep floors clean, dry and in good condition</li> <li>• Stack and store items safely</li> <li>• Use proper waste containers</li> <li>• Store all materials in approved, clearly labeled containers in designated storage areas only</li> <li>• Keep sprinklers and fire extinguishers clear</li> <li>• Clean up spills and leaks off any type quickly and properly</li> <li>• Keep lighting sources clean and clear</li> <li>• Follow preventive and predictive maintenance</li> <li>• Mark all pathways for movement of raw materials and personnel etc.</li> </ul> </li> </ul>

**Table 2.18: Raw materials & Its Sources**

Sr. No.	Product	Raw Materials	Source (Purchase from)
1	Melamine Formaldehyde Resin	Formaldehyde	Multiscaff India Ltd., GIDC Chhatral
		Melamine	Gujarat State Fertilizer Co.
2	Phenol Formaldehyde Resin	Phenol	Hindustan Organic, Cochin
		Formaldehyde	Multiscaff India Ltd., GIDC Chhatral
		Caustic	Gujarat Alkalic Chemical Ltd., Panoli
		Methanol	GNFC, Bharuch
3	Melamine Urea Formaldehyde Resin	Phenol	Hindustan Organic, Cochin
		Formaldehyde	Multiscaff India Ltd., GIDC Chhatral
4	Phenol Urea Formaldehyde Resin	Melamine	Gujarat State Fertilizer Co.
		Formaldehyde	Multiscaff India Ltd., GIDC Chhatral

# **CHAPTER 3:**

## **BASELINE ENVIRONMENTAL STATUS**

**M/s. Perfect Laminate**

### **3.1 PREAMBLE**

An industrial Project may cause some environmental impacts on the surrounding environment. It is necessary to collect data about different environmental aspects that are likely to be affected due to the proposed industrial activity.

Various environmental conditions exist in the area surrounding the project site which is liable to be affected due to the project activities, have been assessed quantitatively as well as qualitatively. In order to assess the feasibility of the said project, a study related to the present environmental condition has been carried out by generating the baseline data.

As per the approved TOR of the Project (vide F.NO J-11011/248/2011-IA-II (I) dated on 14<sup>th</sup> November 2011 the study area to be considered as 10 km from the project site. The baseline environmental quality has been assessed during the month of October 2011 to December 2011. In order to know the cumulative impacts due to the proposed activity on the surrounding environment, it is very important to know the baseline environmental conditions that include the following features is shown in Table 3.1.



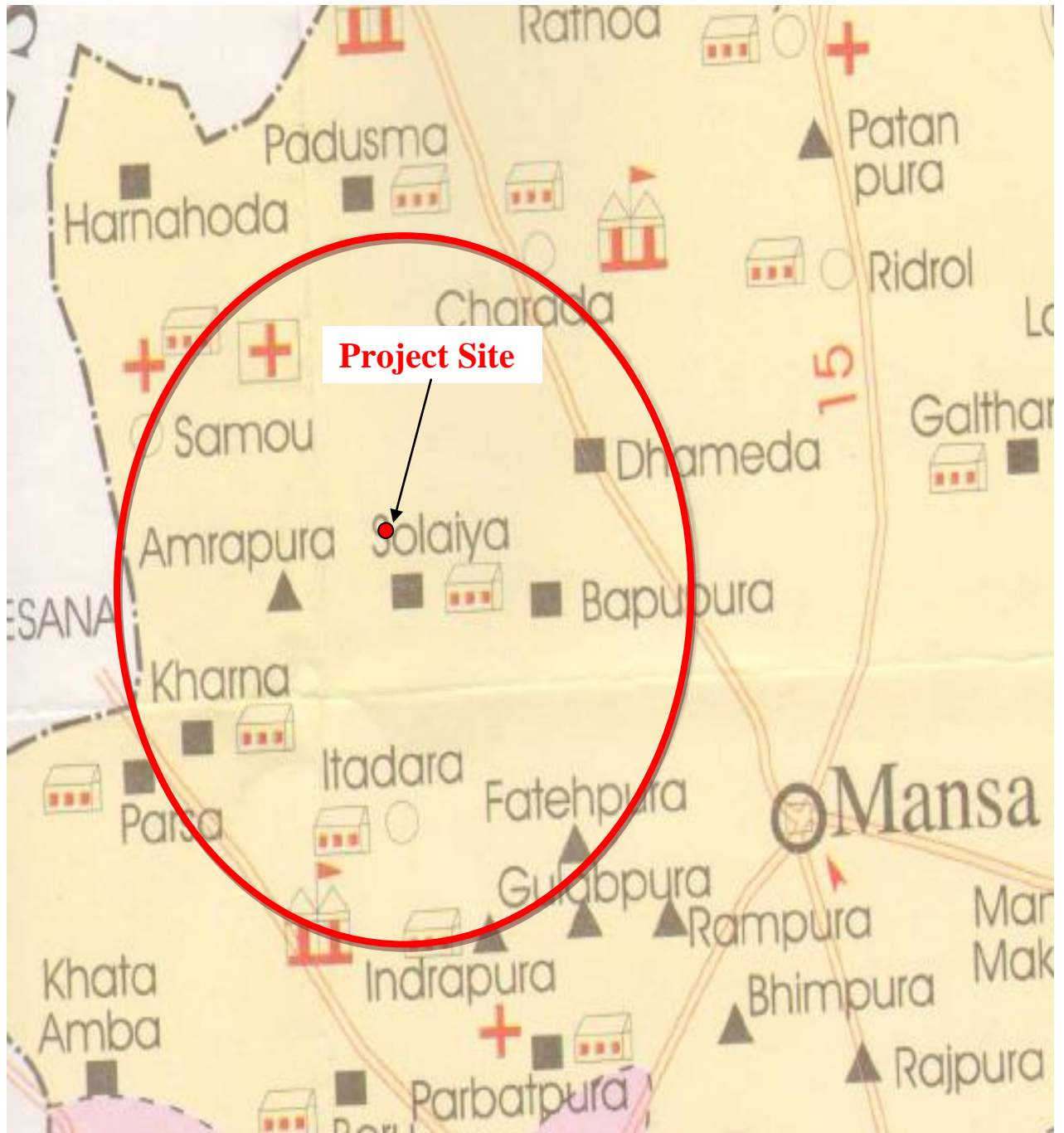
**Table 3.1 Different features of Environment**

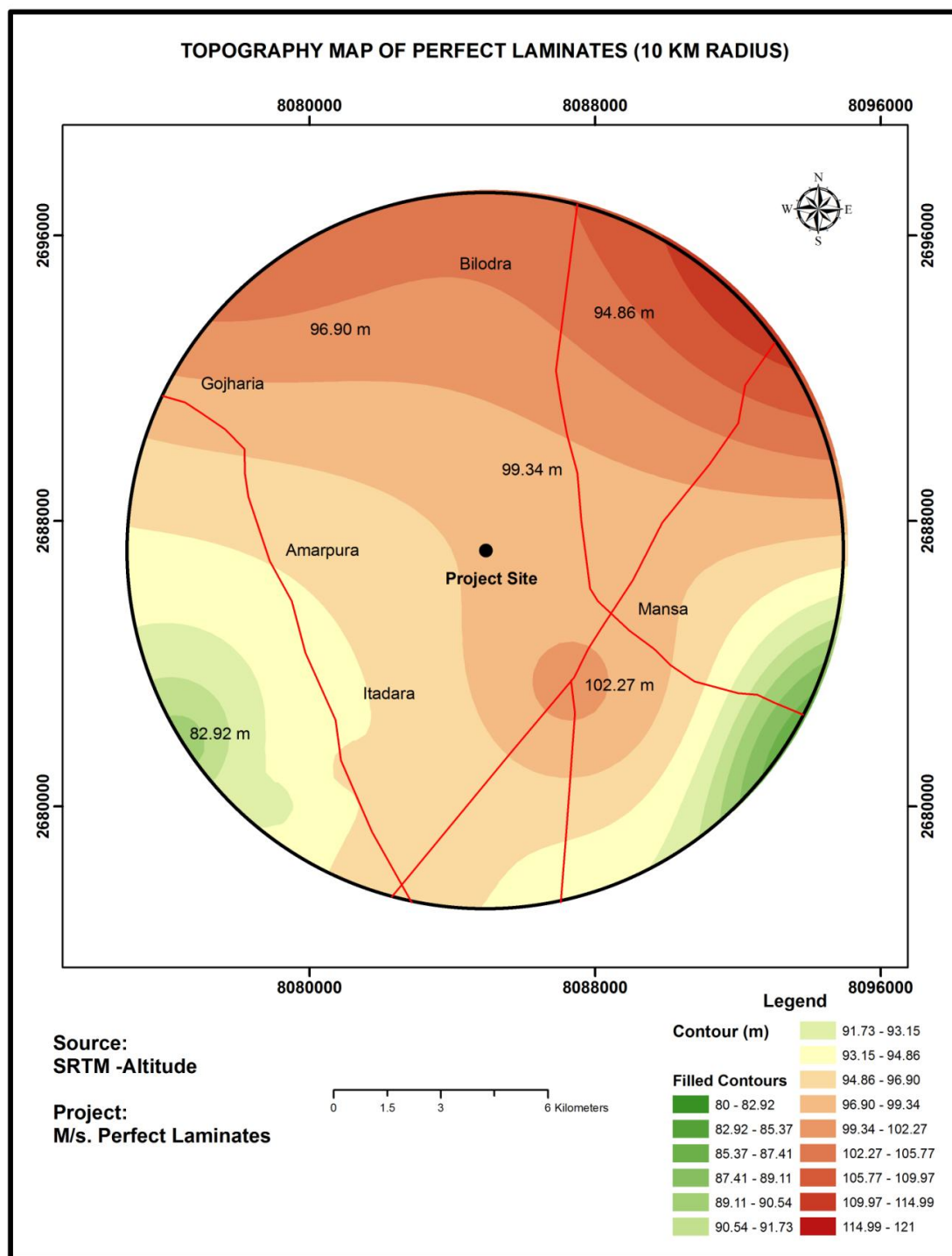
<b>Characteristics</b>	<b>Parameters</b>	<b>Data Procured from</b>
Micrometeorological Studies	Wind Speed, wind direction and temperature.	Indian Meteorological Department Ahmadabad.
Ambient Air Quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , HC, VOCs.	Primary Field Survey
Water Quality & Soil Quality in the study area	Physical, Chemical and bacteriological parameters.	Primary Field Survey
Noise environment	Noise level in db	Primary Field Survey
Land use land cover data	Land use for different Land use classification	Satellite Imagery
Socio economic and demographic data	Socio economic characteristic labor force, Characteristics population static, existing amenities in the study area and quality of life.	Census book of Gandhinagar 2001
Ecological environment data	Ecological environment including flora & fauna	Primary Field survey

### **3.2 THE STUDY AREA:**

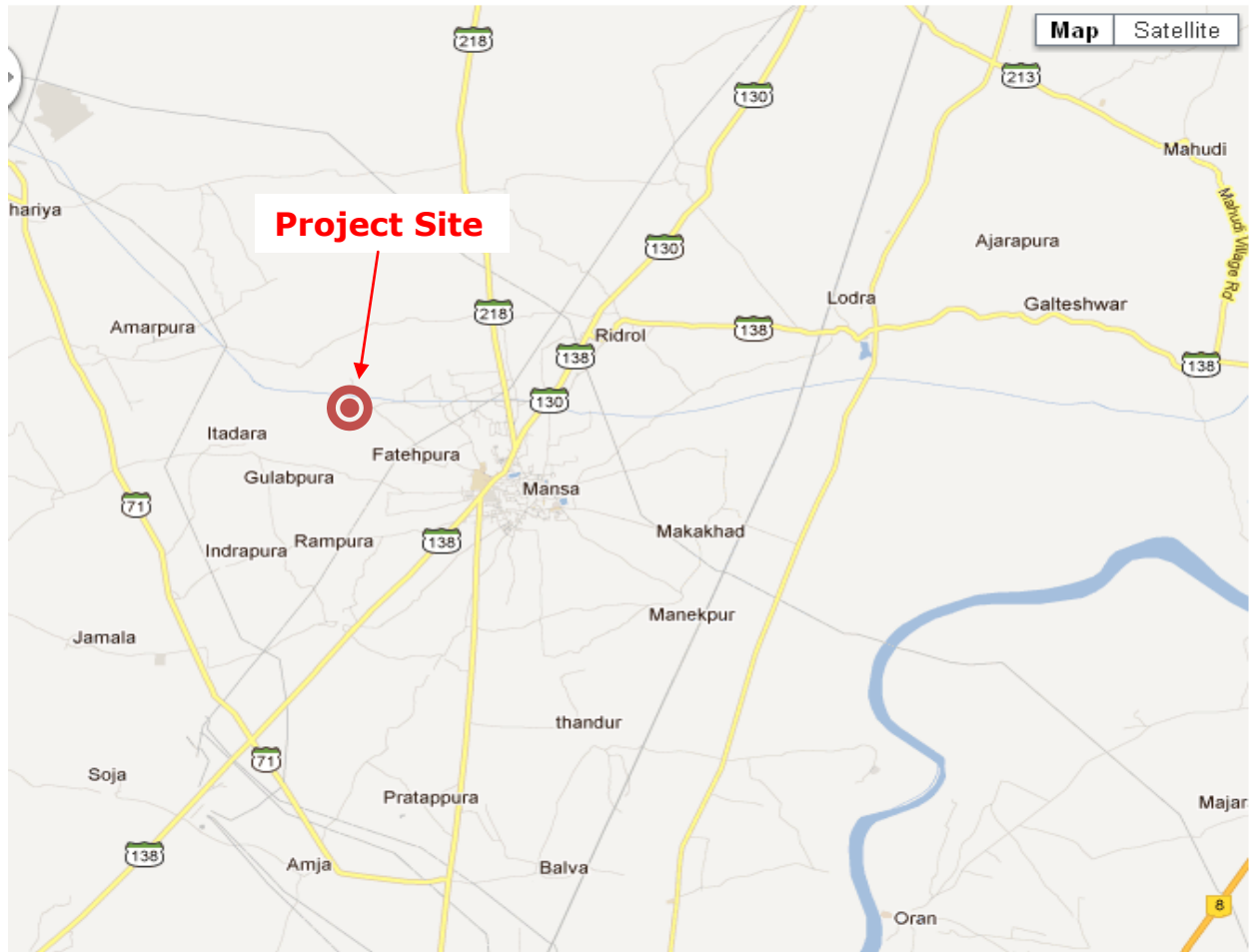
For studying the present Environmental setting, the area falling within 5 km radius from the source is considered as the study area. The study area covers villages of Mansa Taluka and Gandhinagar district. The list of 6 villages and their location from the project site are given in table No.3.2 the map depicting boundaries of Mansa Taluka, Showing location of towns and villages along with infrastructure facilities as highways, roads and railway line is shown in drawing 3.1 & 3.3.

**Drawing 3.1: Project site and nearest village**





Drawing 3.2: Topography map showing Project site and nearest villages covered within study area of 5 km radius.

**Drawing 3.3: Detail road map of M/s. Perfect Laminate**

**Table 3.2 Villages cover within Study Area of 5 km radius:**

S.No	Name of village	Distance from Project site	Direction from the project site	District
1	Solaiya	1.0 km	E	Gandhinagar
2	Amarapura	3.8 km	NW	
3	Bapupura	2.8 km	E	
4	Itadara	3.9 km	SSW	
5	Charada	4 km	NNE	
6	Dhameda	2.6 km	NE	

The detailed site survey was carried out to establish the present environmental setting with reference to the following.

- (i) Air Environment
- (ii) Water Environment
- (iii) Soil Environment
- (iv) Noise Environment
- (v) Topography & Land Use Pattern
- (vi) Geology & Hydrology
- (vii) Ecological Environment
- (viii) Socio-economic Environment

### **3.3 BASE LINE DATA COLLECTION SURVEY:**

#### **3.3.1 Air Environment**

##### **3.3.1.1 Ambient Air Quality (AAQ):**

The ambient air quality monitoring was carried out at 7 AAQM locations, with a frequency of twice a week continuously from October 2011 to December 2011 to assess the sub-regional air quality status in winter season. Collected sample tested by using analytical method prescribed by the CPCB were used for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, HC, VOCs were monitored.

Locations were chosen based following factors.

- Populated area within the study region.
- Location of existing industries.
- Meteorology of the area and

- Available infrastructure facilities like uninterrupted power supply, accessibility, safety etc.

**Table 3.3 Ambient Air Quality Monitoring Location**

S.No.	Area	Direction w.r.t. centre of the industry	Distance in KM
1	Project site	-	-
2	Solaiya	E	1.0 km
3	Amarapura	NW	3.7 km
4	Bapupura	E	2.8 km
5	Itadara	SSW	3.9 km
6	Charada	NNE	3.8 km
7	Dhameda	NE	2.6 km

**3.3.1.2 Sample Analysis****Ambient Air Quality**

The ambient air quality monitoring was carried out at 7 locations, with a frequency of twice a week continuously from October 2011 to December 2011 to assess the sub-regional air quality status in winter season. Collected sample tested by using analytical method prescribed by the CPCB were used for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, HC and VOCs. Brief details method followed for each parameter is given below:

**Table 3.4 Method of Sampling for AAQ Parameters**

S. No.	Parameter	Method Followed
1	PM <sub>10</sub>	Gravimetric method
2	PM <sub>2.5</sub>	Gravimetric method
3	SO <sub>2</sub>	Improved West and Greek method
4	NO <sub>x</sub>	Jacob and Hochheiser modified method
5	HC	Flame ionization detector
6	VOC	Gas Chromatography

The existing baseline levels with respect to PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub>, HC and VOCs are presented in Tables 3.5.

**Table 3.5 Ambient Air Quality Status in the Study Area**

Pollutant (µg/m <sup>3</sup> )	Observed Value	Limit As per NAAQ std. (µg/m <sup>3</sup> )	SAMPLING LOCATIONS						
			Project site	Solaiya	Amarapura	Bapupura	Itadra	Charada	Dhameda
<b>PM<sub>10</sub></b>	Max.	100	80.3	71.2	77	84	73.4	85.3	81.6
	Min.		55.8	49	61	59.4	47	46	56.3
	Mean		68	60.1	69	71.7	65.6	65.6	68.9
<b>PM<sub>2.5</sub></b>	Max.	60	44.3	49	45.9	49.7	53	42.9	48.6
	Min.		30.5	32.3	30.9	31.5	35.2	31	34.4
	Mean		37.4	38.5	38.4	40.6	44.1	36.9	41.5
<b>SO<sub>2</sub></b>	Max.	80	17.1	17.3	19.1	16.2	15	18.3	18.4
	Min.		7.0	7.5	7.5	7.5	8	8.2	7.5
	Mean		12.0	12.4	13.3	11.8	11.5	13.2	12.9
<b>NO<sub>x</sub></b>	Max.	80	27.8	29	27.2	25	24.2	26.3	27.1
	Min.		15.8	16.2	16.6	15.2	15.4	18.5	15.2
	Mean		21.8	22.6	21.9	20.1	19.8	22.4	21.1
<b>Hydrocarbon</b>	--		ND	ND	ND	ND	ND	ND	ND
<b>Volatile organic compound (VOC)</b>	--		ND	ND	ND	ND	ND	ND	ND

Note: ND: Not Detected

\*: down wind direction site

The 98th percentile value of each parameter at different monitoring locations during the AAQ monitoring period are given in table no.3.6.



**Table 3.6: 98<sup>th</sup> Percentile Value of ambient air (Study Period):**

S.No.	Sampling Station/Location	PM <sub>10</sub> µg/m <sup>3</sup>	PM <sub>2.5</sub> µg/m <sup>3</sup>	SO <sub>2</sub> µg/m <sup>3</sup>	NO <sub>x</sub> µg/m <sup>3</sup>
1	Project site	66.6	36.6	11.7	21.3
2	Solaiya	58.8	39.7	12.1	22.1
3	Amarapura	67.6	37.6	13.0	21.4
4	Bapupura	70.2	39.7	11.5	19.6
5	Itadra	64.2	43.2	11.2	19.4
6	Charada	64.2	36.1	12.9	21.9
7	Dhameda	67.5	40.6	12.6	20.6
CPCB Standards for Industrial, Residential, Rural, Other area in µg/m <sup>3</sup>		100	60	80	80
CPCB Standards for Ecologically Sensitive area (notify by central Govt.), µg/m <sup>3</sup>		100	60	20	30

**Conclusion:**

- The concentration of PM<sub>10</sub> and PM<sub>2.5</sub>, at all monitoring location is in the range of 60.1 µg/m<sup>3</sup> to 71.7 µg/m<sup>3</sup> and 36.9 µg/m<sup>3</sup> to 44.1 µg/m<sup>3</sup> respectively, which is below the NAAQS standards.
- The SO<sub>2</sub> concentration at all the monitoring location is in the range of 11.5µg/m<sup>3</sup> to 13.3 µg/m<sup>3</sup> which is below the NAAQS standards.
- The NO<sub>x</sub> at all the monitoring location is in the range of 20.1 µg/m<sup>3</sup> to 22.6 µg/m<sup>3</sup> which is below the NAAQS standards.

**Hydrocarbons:**

- The samplings of HC were carried out at all the locations and the concentration is not detected in all the sampling stations.

**VOC:**

- The samplings of VOC were carried out at all the locations and the concentration was observed not detected in all the sampling stations.

**98<sup>th</sup> Percentile:**

- Overall 98 percentile values were found to be within the CPCB standards for industrial, residential, rural and other area.

Conclusion : The observed values for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> are found to be within the NAAQ's standards.

**Table 3.7 National Ambient Air Quality (NAAQ) Standards:**

S.No	Pollutant	Time weighted average	Concentration in ambient air		
			Industrial, Residential, Rural and Other area	Ecologically Sensitive area (notify by central Govt)	Method of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1.	Sulphur Dioxide (SO <sub>2</sub> ) µg/m <sup>3</sup>	Annual * 24 Hours**	50 80	20 80	Improved West and Gaeke Ultraviolet Fluorescence
2.	Nitrogen Dioxide (NO <sub>2</sub> ) µg/m <sup>3</sup>	Annual * 24 Hours**	40 80	30 80	Modified Jacob & Hochheiser (Na-Arsenite) Chemiluminescence
3.	Particulate Matter (size less than 10 µm) PM <sub>10</sub> µg/m <sup>3</sup>	Annual * 24 Hours**	60 100	60 100	Gravimetric TOEM Beta attenuation
4.	Particulate Matter (size less than 2.5 µm) PM <sub>2.5</sub> µg/m <sup>3</sup>	Annual * 24 Hours**	40 60	40 60	Gravimetric TOEM Beta attenuation
5.	Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	8 Hours** 1 Hours**	100 180	100 180	UV photometric Chemiluminescence Chemical Method
6.	Lead (Pb) µg/m <sup>3</sup>	Annual * 24 Hours**	0.5 1	0.5 1	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter
7.	Carbon Monoxide (CO) µg/m <sup>3</sup>	8 Hours** 1 Hours**	2 4	2 4	Non Dispersive Infra Red (NDIR) Spectroscopy
8.	Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>	Annual * 24 Hours**	100 400	100 400	Chemiluminescence Indophenol blue method

9.	Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>	Annual *	05	05	Gas chromatography based continuous analyzer Adsorption and Desorption followed by GC analysis
10.	Benzo(0) Pyrene – Particulate Phase only, ng/m <sup>3</sup>	Annual *	01	01	Solvent Extraction followed by HPLC/GC analysis
11.	Arsenic (As) ng/m <sup>3</sup>	Annual *	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni) ng/m <sup>3</sup>	Annual *	20	20	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

\* Annual arithmetic mean of minimum 104 measurements in a year at a particulate site taken twice a week 24 hourly at uniform intervals.

\*\* 24 hourly or 08 hourly or 01 hourly monitored valves, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: - Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

**3.3.1.3 Meteorology**

The meteorological conditions at the project site will regulate the transport and diffusion of air pollutants released into the atmosphere. Knowledge of meteorological characteristics is therefore, essential to assess the effect of pollution on the receptors. Moreover, meteorological characteristics of an area are very important in deciding the project installation assessing environmental management plan. The principle meteorological variables are horizontal convective transport (average wind speed and direction), vertical convective transport (atmospheric stability, mixing height) and topography of the area. The data on surface meteorological parameters (wind speed and direction) in the study area were collected from October 2010 to October 2011.

**Table 3.8:- Meteorological Data for the period October – 2010 to October – 2011 for Ahmedabad station**

**Place: Ahmedabad Observatory**  
**Period: October 2010 to March 2011**

Hours of the Day	Wind Speed															
	2.30		5.30		8.30		11.30		14.30		17.30		20.30		23.30	
	Km/hr	m/Sec	Km/hr	m/Sec	Km/hr	m/Sec	Km/hr	m/Sec	Km/hr	m/Sec	Km/hr	m/Sec	Km/hr	m/Sec	Km/hr	m/Sec
1-Oct	0	0.00	5	0.14	5	0.14	9	0.25	5	0.14	5	0.14	0	0.00	0	0.00
2-Oct	2	0.06	0	0.00	9	0.25	9	0.25	34	0.94	2	0.06	0	0.00	0	0.00
3-Oct	0	0.00	5	0.14	7	0.19	5	0.14	7	0.19	7	0.19	0	0.00	0	0.00
4-Oct	0	0.00	0	0.00	2	0.06	0	0.00	34	0.94	0	0.00	0	0.00	34	0.94
5-Oct	36	1.00	0	0.00	34	0.94	36	1.00	34	0.94	34	0.94	0	0.00	0	0.00
6-Oct	0	0.00	34	0.94	36	1.00	36	1.00	34	0.94	34	0.94	0	0.00	36	1.00
7-Oct	0	0.00	34	0.94	36	1.00	36	1.00	32	0.89	32	0.89	0	0.00	0	0.00
8-Oct	29	0.81	34	0.94	32	0.89	36	1.00	34	0.94	29	0.81	29	0.81	32	0.89
9-Oct	34	0.94	34	0.94	29	0.81	32	0.89	32	0.89	23	0.64	23	0.64	23	0.64
10-Oct	27	0.75	29	0.81	11	0.31	29	0.81	20	0.56	11	0.31	23	0.64	23	0.64
11-Oct	23	0.64	23	0.64	0	0.00	34	0.94	18	0.50	0	0.00	20	0.56	20	0.56
12-Oct	0	0.00	0	0.00	0	0.00	9	0.25	5	0.14	0	0.00	0	0.00	14	0.39
13-Oct	0	0.00	0	0.00	0	0.00	34	0.94	14	0.39	0	0.00	23	0.64	0	0.00
14-Oct	0	0.00	0	0.00	0	0.00	0	0.00	36	1.00	0	0.00	0	0.00	23	0.64
15-Oct	0	0.00	0	0.00	0	0.00	34	0.94	27	0.75	0	0.00	0	0.00	34	0.94
16-Oct	0	0.00	0	0.00	34	0.94	32	0.89	34	0.94	32	0.89	32	0.89	32	0.89
17-Oct	32	0.89	0	0.00	34	0.94	2	0.06	36	1.00	36	1.00	0	0.00	34	0.94
18-Oct	34	0.94	2	0.06	5	0.14	9	0.25	7	0.19	2	0.06	0	0.00	0	0.00
19-Oct	36	1.00	5	0.14	7	0.19	7	0.19	7	0.19	5	0.14	0	0.00	0	0.00
20-Oct	5	0.14	7	0.19	0	0.00	27	0.75	11	0.31	0	0.00	0	0.00	0	0.00
21-Oct	0	0.00	0	0.00	23	0.64	5	0.14	0	0.00	0	0.00	20	0.56	20	0.56
22-Oct	20	0.56	0	0.00	0	0.00	0	0.00	27	0.75	29	0.81	0	0.00	20	0.56
23-Oct	0	0.00	29	0.81	29	0.81	0	0.00	29	0.81	23	0.64	0	0.00	0	0.00
24-Oct	0	0.00	0	0.00	34	0.94	34	0.94	27	0.75	27	0.75	0	0.00	0	0.00
25-Oct	0	0.00	32	0.89	32	0.89	32	0.89	32	0.89	32	0.89	0	0.00	32	0.89
26-Oct	34	0.94	32	0.89	0	0.00	36	1.00	34	0.94	0	0.00	0	0.00	34	0.94
27-Oct	0	0.00	0	0.00	0	0.00	36	1.00	36	1.00		0.00	0	0.00	32	0.89
28-Oct	0	0.00	32	0.89	0	0.00	9	0.25	34	0.94	0	0.00	0	0.00	0	0.00
29-Oct	0	0.00	36	1.00	0	0.00	34	0.94	0	0.00	32	0.89	34	0.94	0	0.00

30-Oct	0	0.00	36	1.00	34	0.94	2	0.06	32	0.89	34	0.94	32	0.89	36	1.00
31-Oct	36	1.00	36	1.00	2	0.06	5	0.14	36	1.00	5	0.14	34	0.94	22	0.61
1-Nov	36	1.00	36	1.00	7	0.19	7	0.19	11	0.31	5	0.14	0	0.00	0	0.00
2-Nov	0	0.00	5	0.14	5	0.14	9	0.25	34	0.94	34	0.94	36	1.00	2	0.06
3-Nov	2	0.06	2	0.06	5	0.14	9	0.25	5	0.14	5	0.14	0	0.00	36	1.00
4-Nov	0	0.00	5	0.14	9	0.25	9	0.25	2	0.06	7	0.19	34	0.94	34	0.94
5-Nov	0	0.00	5	0.14	7	0.19	7	0.19	11	0.31	36	1.00	0	0.00	5	0.14
6-Nov	2	0.06	36	1.00	2	0.06	11	0.31	5	0.14	5	0.14	27	0.75	0	0.00
7-Nov	2	0.06	5	0.14	7	0.19	7	0.19	36	1.00	5	0.14	0	0.00	2	0.06
8-Nov	2	0.06	0	0.00	2	0.06	7	0.19	7	0.19	5	0.14	34	0.94	36	1.00
9-Nov	36	1.00	36	1.00	7	0.19	7	0.19	11	0.31	7	0.19	0	0.00	9	0.25
10-Nov	9	0.25	23	0.64	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
11-Nov	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
12-Nov	0	0.00	0	0.00	0	0.00	0	0.00	18	0.50	23	0.64	0	0.00	0	0.00
13-Nov	0	0.00	0	0.00	0	0.00	0	0.00	18	0.50	0	0.00	0	0.00	0	0.00
14-Nov	0	0.00	0	0.00	9	0.25	9	0.25	18	0.50	0	0.00	34	0.94	0	0.00
15-Nov	0	0.00	36	1.00	0	0.00	5	0.14	32	0.89	34	0.94	34	0.94	0	0.00
16-Nov	14	0.39	14	0.39	14	0.39	0	0.00	0	0.00	34	0.94	34	0.94	36	1.00
17-Nov	0	0.00	0	0.00	0	0.00	0	0.00	32	0.89	34	0.94	34	0.94	9	0.25
18-Nov	7	0.19	9	0.25	5	0.14	5	0.14	36	1.00	26	0.72	36	1.00	36	1.00
19-Nov	36	1.00	36	1.00	5	0.14	2	0.06	34	0.94	0	0.00	0	0.00	36	1.00
20-Nov	36	1.00	2	0.06	5	0.14	5	0.14	9	0.25	9	0.25	0	0.00	36	1.00
21-Nov	2	0.06	5	0.14	5	0.14	5	0.14	9	0.25	0	0.00	9	0.25	5	0.14
22-Nov	0	0.00	5	0.14	9	0.25	9	0.25	5	0.14	36	1.00	5	0.14	5	0.14
23-Nov	5	0.14	5	0.14	36	1.00	36	1.00	5	0.14	5	0.14	0	0.00	0	0.00
24-Nov	5	0.14	5	0.14	5	0.14	5	0.14	0	0.00	34	0.94	0	0.00	0	0.00
25-Nov	0	0.00	0	0.00	29	0.81	0	0.00	0	0.00	0	0.00	29	0.81	32	0.89
26-Nov	29	0.81	0	0.00	34	0.94	34	0.94	32	0.89	0	0.00	0	0.00	32	0.89
27-Nov	0	0.00	32	0.89	23	0.64	5	0.14	0	0.00	0	0.00	32	0.89	32	0.89
28-Nov	34	0.94	34	0.94	2	0.06	5	0.14	5	0.14	0	0.00	0	0.00	5	0.14
29-Nov	5	0.14	5	0.14	5	0.14	5	0.14	36	1.00	36	1.00	32	0.89	32	0.89
30-Nov	36	1.00	36	1.00	5	0.14	5	0.14	36	1.00	0	0.00	36	1.00	36	1.00
1-Dec	36	1.00	5	0.14	2	0.06	5	0.14	36	1.00	0	0.00	32	0.89	32	0.89
2-Dec	32	0.89	32	0.89	36	1.00	5	0.14	5	0.14	5	0.14	5	0.14	2	0.06
3-Dec	5	0.14	5	0.14	5	0.14	5	0.14	36	1.00	7	0.19	2	0.06	36	1.00
4-Dec	2	0.06	5	0.14	5	0.14	5	0.14	5	0.14	36	1.00	0	0.00	5	0.14
5-Dec	5	0.14	5	0.14	5	0.14	7	0.19	5	0.14	5	0.14	2	0.06	2	0.06
6-Dec	2	0.06	2	0.06	5	0.14	7	0.19	5	0.14	5	0.14	2	0.06	5	0.14
7-Dec	5	0.14	5	0.14	5	0.14	7	0.19	2	0.06	5	0.14	9	0.25	36	1.00

8-Dec	2	0.06	5	0.14	2	0.06	7	0.19	5	0.14	36	1.00	36	1.00	36	1.00
9-Dec	36	1.00	0	0.00	36	1.00	13	0.36	0	0.00	0	0.00	29	0.81	32	0.89
10-Dec	32	0.89	0	0.00	29	0.81	0	0.00	32	0.89	27	0.75	34	0.94	34	0.94
11-Dec	0	0.00	34	0.94	0	0.00	0	0.00	34	0.94	0	0.00	0	0.00	32	0.89
12-Dec	32	0.89	0	0.00	0	0.00	0	0.00	36	1.00	0	0.00	0	0.00	0	0.00
13-Dec	0	0.00	0	0.00	0	0.00	20	0.56	0	0.00	0	0.00	0	0.00	0	0.00
14-Dec	0	0.00	0	0.00	7	0.19	2	0.06	9	0.25	7	0.19	0	0.00	0	0.00
15-Dec	0	0.00	0	0.00	11	0.31	5	0.14	0	0.00	0	0.00	0	0.00	0	0.00
16-Dec	0	0.00	5	0.14	0	0.00	0	0.00	0	0.00	36	1.00	0	0.00	0	0.00
17-Dec	7	0.19	5	0.14	0	0.00	0	0.00	9	0.25	0	0.00	0	0.00	36	1.00
18-Dec	0	0.00	0	0.00	0	0.00	9	0.25	5	0.14	0	0.00	0	0.00	0	0.00
19-Dec	0	0.00	0	0.00	5	0.14	9	0.25	5	0.14	5	0.14	0	0.00	0	0.00
20-Dec	2	0.06	5	0.14	7	0.19	11	0.31	5	0.14	5	0.14	2	0.06	2	0.06
21-Dec	0	0.00	7	0.19	0	0.00	0	0.00	25	0.69	0	0.00	5	0.14	5	0.14
22-Dec	0	0.00	0	0.00	0	0.00	0	0.00	27	0.75	27	0.75	0	0.00	0	0.00
23-Dec	0	0.00	0	0.00	0	0.00	32	0.89	27	0.75	0	0.00	0	0.00	0	0.00
24-Dec	0	0.00	0	0.00	0	0.00	0	0.00	11	0.31	5	0.14	0	0.00	0	0.00
25-Dec	0	0.00	0	0.00	0	0.00	5	0.14	9	0.25	0	0.00	0	0.00	0	0.00
26-Dec	0	0.00	0	0.00	0	0.00	0	0.00	7	0.19	0	0.00	0	0.00	0	0.00
27-Dec	0	0.00	0	0.00	5	0.14	5	0.14	5	0.14	0	0.00	0	0.00	36	1.00
28-Dec	0	0.00	0	0.00	0	0.00	0	0.00	16	0.44	14	0.39	0	0.00	7	0.19
29-Dec	0	0.00	7	0.19	0	0.00	9	0.25	0	0.00	0	0.00	0	0.00	29	0.81
30-Dec	29	0.81	0	0.00	0	0.00	27	0.75	32	0.89	32	0.89	0	0.00	0	0.00
31-Dec	5	0.14	36	1.00	36	1.00	34	0.94	34	0.94	34	0.94	0	0.00	0	0.00



1-Jan	0	0.00	0	0.00	5	0.14	5	0.14	36	1.00	36	1.00	2	0.06	34	0.94
2-Jan	0	0.00	7	0.19	36	1.00	9	0.25	2	0.06	36	1.00	0	0.00	0	0.00
3-Jan	5	0.14	5	0.14	5	0.14	7	0.19	7	0.19	7	0.19	0	0.00	5	0.14
4-Jan	0	0.00	0	0.00	7	0.19	9	0.25	7	0.19	5	0.14	0	0.00	0	0.00
5-Jan	0	0.00	0	0.00	2	0.06	5	0.14	36	1.00	5	0.14	0	0.00	7	0.19
6-Jan	7	0.19	7	0.19	5	0.14	9	0.25	9	0.25	7	0.19	0	0.00	0	0.00
7-Jan	0	0.00	5	0.14	5	0.14	9	0.25	7	0.19	5	0.14	0	0.00	0	0.00
8-Jan	0	0.00	0	0.00	0	0.00	0	0.00	32	0.89	0	0.00	0	0.00	36	1.00
9-Jan	0	0.00	2	0.06	5	0.14	5	0.14	5	0.14	36	1.00	0	0.00	5	0.14
10-Jan	5	0.14	7	0.19	5	0.14	9	0.25	2	0.06	5	0.14	0	0.00	0	0.00
11-Jan	0	0.00	5	0.14	7	0.19	2	0.06	7	0.19	0	0.00	0	0.00	0	0.00
12-Jan	0	0.00	0	0.00	0	0.00	0	0.00	32	0.89	0	0.00	0	0.00	0	0.00
13-Jan	0	0.00	0	0.00	0	0.00	32	0.89	34	0.94	34	0.94	0	0.00	0	0.00
14-Jan	0	0.00	0	0.00	0	0.00	32	0.89	32	0.89	29	0.81	0	0.00	0	0.00
15-Jan	0	0.00	0	0.00	0	0.00	34	0.94	32	0.89	34	0.94	36	1.00	32	0.89

16-Jan	36	1.00	36	1.00	9	0.25	7	0.19	9	0.25	9	0.25	0	0.00	0	0.00
17-Jan	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
18-Jan	0	0.00	0	0.00	0	0.00	34	0.94	27	0.75	32	0.89	0	0.00	32	0.89
19-Jan	34	0.94	34	0.94	0	0.00	7	0.19	32	0.89	2	0.06	0	0.00	0	0.00
20-Jan	0	0.00	0	0.00	7	0.19	7	0.19	7	0.19	2	0.06	0	0.00	0	0.00
21-Jan	0	0.00	36	1.00	5	0.14	9	0.25	36	1.00	2	0.06	0	0.00	0	0.00
22-Jan	0	0.00	0	0.00	11	0.31	11	0.31	29	0.81	29	0.81	32	0.89	32	0.89
23-Jan	0	0.00	0	0.00	0	0.00	36	1.00	2	0.06	34	0.94	0	0.00	36	1.00
24-Jan	34	0.94	0	0.00	0	0.00	7	0.19	34	0.94	34	0.94	0	0.00	36	1.00
25-Jan	0	0.00	0	0.00	34	0.94	36	1.00	34	0.94	36	1.00	32	0.89	36	1.00
26-Jan	36	1.00	36	1.00	0	0.00	2	0.06	2	0.06	2	0.06	36	1.00	34	0.94
27-Jan	2	0.06	2	0.06	5	0.14	5	0.14	7	0.19	5	0.14	36	1.00	36	1.00
28-Jan	0	0.00	0	0.00	2	0.06	7	0.19	29	0.81	32	0.89	0	0.00	34	0.94
29-Jan	0	0.00	0	0.00	0	0.00	0	0.00	5	0.14	5	0.14	0	0.00	0	0.00
30-Jan	0	0.00	0	0.00	0	0.00	5	0.14	36	1.00	36	1.00	0	0.00	36	1.00
31-Jan	6	0.17	36	1.00	2	0.06	5	0.14	5	0.14	5	0.14	34	0.94	32	0.89
1-Feb	0	0.00	5	0.14	5	0.14	7	0.19	34	0.94	36	1.00	36	1.00	0	0.00
2-Feb	0	0.00	5	0.14	5	0.14	9	0.25	5	0.14	5	0.14	0	0.00	36	1.00
3-Feb	0	0.00	5	0.14	5	0.14	9	0.25	14	0.39	36	1.00	0	0.00	0	0.00
4-Feb	0	0.00	5	0.14	5	0.14	14	0.39	7	0.19	36	1.00	0	0.00	0	0.00
5-Feb	0	0.00	0	0.00	0	0.00	32	0.89	32	0.89	34	0.94	0	0.00	0	0.00
6-Feb	0	0.00	0	0.00	0	0.00	32	0.89	32	0.89	34	0.94	0	0.00	0	0.00
7-Feb	25	0.69	27	0.75	0	0.00	23	0.64	20	0.56	23	0.64	0	0.00	27	0.75
8-Feb	32	0.89	29	0.81	0	0.00	18	0.50	20	0.56	25	0.69	34	0.94	34	0.94
9-Feb	0	0.00	0	0.00	7	0.19	9	0.25	27	0.75	34	0.94	0	0.00	0	0.00
10-Feb	34	0.94	36	1.00	7	0.19	9	0.25	9	0.25	5	0.14	0	0.00	0	0.00
11-Feb	5	0.14	5	0.14	9	0.25	14	0.39	9	0.25	0	0.00	0	0.00	0	0.00
12-Feb	0	0.00	0	0.00	0	0.00	14	0.39	23	0.64	23	0.64	0	0.00	0	0.00
13-Feb	32	0.89	32	0.89	0	0.00	0	0.00	2	0.06	0	0.00	0	0.00	0	0.00
14-Feb	32	0.89	0	0.00	0	0.00	0	0.00	18	0.50	25	0.69	0	0.00	32	0.89
15-Feb	0	0.00	0	0.00	0	0.00	27	0.75	27	0.75	27	0.75	29	0.81	32	0.89
16-Feb	32	0.89	27	0.75	0	0.00	32	0.89	0	0.00	23	0.64	0	0.00	32	0.89
17-Feb	0	0.00	0	0.00	0	0.00	7	0.19	2	0.06	5	0.14	0	0.00	36	1.00
18-Feb	36	1.00	36	1.00	5	0.14	9	0.25	14	0.39	24	0.67	0	0.00	36	1.00
19-Feb	0	0.00	0	0.00	36	1.00	34	0.94	27	0.75	36	1.00	0	0.00	32	0.89
20-Feb	32	0.89	32	0.89	34	0.94	5	0.14	34	0.94	34	0.94	34	0.94	34	0.94
21-Feb	32	0.89	0	0.00	36	1.00	9	0.25	11	0.31	34	0.94	0	0.00	5	0.14
22-Feb	36	1.00	5	0.14	7	0.19	9	0.25	9	0.25	7	0.19	34	0.94	0	0.00
23-Feb	0	0.00	0	0.00	5	0.14	5	0.14	2	0.06	32	0.89	34	0.94	36	1.00

24-Feb	36	1.00	2	0.06	5	0.14	5	0.14	32	0.89	32	0.89	0	0.00	0	0.00
25-Feb	0	0.00	5	0.14	5	0.14	9	0.25	0	0.00	0	0.00	0	0.00	0	0.00
26-Feb	36	1.00	2	0.06	0	0.00	2	0.06	11	0.31	32	0.89	0	0.00	0	0.00
27-Feb	36	1.00	2	0.06	5	0.14	5	0.14	5	0.14	27	0.75	0	0.00	2	0.06
28-Feb	36	1.00	2	0.06	7	0.19	11	0.31	9	0.25	5	0.14	34	0.94	34	0.94
1-Mar		0.00	2	0.06	1	0.03	7	0.19	29	0.81	32	0.89		0.00	36	1.00
2-Mar	36	1.00		0.00	5	0.14	9	0.25		0.00		0.00		0.00	36	1.00
3-Mar		0.00		0.00		0.00		0.00	23	0.64	23	0.64	32	0.89	23	0.64
4-Mar	27	0.75	32	0.89	27	0.75	27	0.75	23	0.64	29	0.81	32	0.89		0.00
5-Mar		0.00		0.00		0.00	9	0.25	25	0.69	32	0.89	32	0.89	36	1.00
6-Mar		0.00	32	0.89	5	0.14	9	0.25		0.00		0.00		0.00		0.00
7-Mar		0.00	5	0.14	5	0.14	14	0.39	32	0.89	36	1.00	32	0.89	34	0.94
8-Mar		0.00	34	0.94	32	0.89	32	0.89	32	0.89	27	0.75	20	0.56	23	0.64
9-Mar	29	0.81	29	0.81	34	0.94	34	0.94	32	0.89	32	0.89		0.00	36	1.00
10-Mar	36	1.00	36	1.00	32	0.89	2	0.06	32	0.89	32	0.89		0.00	34	0.94
11-Mar	2	0.06	2	0.06	19	0.53	5	0.14	5	0.14	5	0.14	32	0.89		0.00
12-Mar		0.00	5	0.14	9	0.25	9	0.25	9	0.25	9	0.25	32	0.89		0.00
13-Mar		0.00	9	0.25	9	0.25	9	0.25	5	0.14	36	1.00		0.00		0.00
14-Mar		0.00	32	0.89		0.00	36	1.00	32	0.89	32	0.89		0.00		0.00
15-Mar		0.00	32	0.89	36	1.00	2	0.06	2	0.06	5	0.14		0.00		0.00
16-Mar		0.00	5	0.14	5	0.14	9	0.25	4	0.11	14	0.39	27	0.75		0.00
17-Mar		0.00		0.00		0.00	23	0.64	32	0.89	5	0.14		0.00		0.00
18-Mar		0.00	32	0.89	32	0.89	32	0.89	29	0.81	25	0.69	36	1.00	23	0.64
19-Mar		0.00		0.00	27	0.75	23	0.64	25	0.69	25	0.69	36	1.00	29	0.81
20-Mar	29	0.81	29	0.81	29	0.81	27	0.75	29	0.81	32	0.89		0.00	29	0.81
21-Mar		0.00		0.00		0.00	23	0.64	29	0.81	29	0.81		0.00		0.00
22-Mar	27	0.75	27	0.75	32	0.89	27	0.75	23	0.64	23	0.64		0.00		0.00
23-Mar		0.00		0.00	32	0.89	32	0.89	23	0.64	29	0.81	29	0.81	39	1.08
24-Mar		0.00		0.00	32	0.89	32	0.89	34	0.94	36	1.00		0.00		0.00
25-Mar		0.00		0.00	27	0.75	36	1.00	9	0.25	9	0.25		0.00		0.00
26-Mar		0.00		0.00		0.00	36	1.00		0.00		0.00		0.00		0.00
27-Mar	29	0.81		0.00	34	0.94		0.00	27	0.75	32	0.89	27	0.75	32	0.89
28-Mar	25	0.69	29	0.81		0.00	32	0.89	32	0.89	27	0.75	32	0.89		0.00
29-Mar		0.00		0.00	32	0.89	29	0.81	23	0.64	29	0.81		0.00	27	0.75
30-Mar		0.00	27	0.75	34	0.94	32	0.89	32	0.89	32	0.89		0.00	32	0.89
31-Mar	32	0.89	29	0.81		0.00	23	0.64	32	0.89	32	0.89		0.00		0.00

## WIND DIRECTION DATA FROM OCTOBER 2010 TO MARCH 2011

Hours of the Day	Wind Direction							
	2.30	5.30	8.30	11.30	14.30	17.30	20.30	23.30
1-Oct	Calm	NE	NE	E	NE	NE	Calm	Calm
2-Oct	NNE	Calm	E	E	NNW	NNE	Calm	Calm
3-Oct	Calm	NE	ENE	NE	ENE	ENE	Calm	Calm
4-Oct	Calm	Calm	NNE	Calm	NNW	Calm	Calm	Calm
5-Oct	N	Calm	NNW	N	NNW	NWW	Calm	N
6-Oct	Calm	Calm	N	N	NNW	NNW	Calm	Calm
7-Oct	Calm	NNW	Calm	N	NW	Calm	WNW	NW
8-Oct	WNW	NNW	N	N	NNW	NW	SW	SW
9-Oct	Calm	Calm	NW	NW	NW	WNW	Calm	Calm
10-Oct	W	WNW	WNW	WNW	SSW	SW	SSW	SSW
11-Oct	SW	SW	Calm	NNW	S	Calm	Calm	SE
12-Oct	Calm	Calm	ESE	E	NE	ESE	SW	Calm
13-Oct	Calm	Calm	Calm	NNE	SE	Calm	Calm	SW
14-Oct	Calm	Calm	Calm	Calm	N	Calm	Calm	Calm
15-Oct	Calm	Calm	Calm	NNW	W	Calm	Calm	Calm
16-Oct	Calm	Calm	NNW	NW	NNW	NW	NW	NW
17-Oct	NW		NNW	NN	N	N	Calm	NNW
18-Oct	NNW	NNE	NS	E	ENE	NNE	Calm	Calm
19-Oct	N	NE	ENE	ENE	ENE	NE	Calm	Calm
20-Oct	NE	ENE	WNW	W	ESE	Calm	Calm	Calm
21-Oct	Calm	Calm	SW	NE	W	Calm	SSW	SSW
22-Oct	SSW	Calm	Calm	Calm	WNW	WNW	Calm	SSW
23-Oct	Calm	WNW	WNW	Calm	WNW	SW	Calm	Calm
24-Oct	Calm	Calm	NNW	NNW	W	W	Calm	Calm
25-Oct	Calm	NW	NW	NW	NW	NW	Calm	NE
26-Oct	NNW	NW	Calm	N	NNW	Calm	Calm	NNW
27-Oct	Calm	Calm	Calm	N	N	Calm	Calm	NW
28-Oct	Calm	NE	Calm	E	NNE	Calm	Calm	Calm
29-Oct	Calm	Calm	Calm	NW	Calm	NW	NNW	Calm
30-Oct	Calm	Calm	NNW	NN	W	NNW	NW	N
31-Oct	N	N	NE	NE	N	NNE	NNW	NNE
1-Nov	N	N	ENE	ENE	ESE	NE	Calm	Calm
2-Nov	Calm	NE	NE	E	NNW	NNW	N	NNE
3-Nov	Calm	NNE	NE	E	NE	NE		N
4-Nov	Calm	NE	E	E	NNE	ENE	NNW	NNW
5-Nov	Calm	NNE	ENE	ENE	ESE	N	Calm	NE
6-Nov	NNE	N	NNE	ESE	NE	NE	WNE	
7-Nov	ENE	NE	ENE	ENE	N	NE	Calm	NNE
8-Nov	NNE		NNE	ENE	ENE	NE	NNW	N
9-Nov	N	N	ENE	ENE	ESE	ENE	Calm	E
10-Nov	E	SW	Calm	Calm	Calm	Calm	Calm	Calm
11-Nov	Calm	Calm	Calm	Calm	Calm	Calm	Calm	Calm
12-Nov	Calm	Calm	Calm	Calm	S	SW	Calm	Calm
13-Nov	Calm	Calm	Calm	Calm	S	Calm	Calm	Calm
14-Nov	Calm	Calm	E	E	S	Calm	NNW	Calm

16-Nov	SE	SE	SE	Calm	Calm	NNW	NNW	N
17-Nov	Calm	Calm	Calm	Calm	NW	NNW	NNW	E
18-Nov	ENE	E	NE	NE	N	N	N	N
19-Nov	N	N	NE	NNE	NNW	Calm	Calm	Calm
20-Nov	N	NNE	NE	NE	E	E	Calm	N
21-Nov	NNE	NE	NE	NE	E	Calm	Calm	N
22-Nov	Calm	NE	E	E	NE	N	E	NE
23-Nov	NE	NE	N	N	NE	NE	NE	NE
24-Nov	NE	NE	NE	NE	Calm	NNW	WNW	NW
25-Nov	Calm	Calm	WNW	Calm	Calm	Calm	Calm	NW
26-Nov	WNW	Calm	WNW	NNW	NW	Calm	NW	NW
27-Nov	Calm	NW	SW	NE	Calm	Calm	Calm	NE
28-Nov	NNW	NNW	NNE	NE	NE	Calm	NW	NW
29-Nov	NE	NE	NE	NE	N	N	N	N
30-Nov	N	N	NE	NE	N	Calm	N	N
1-Dec	N	NE	NNE	NE	N	Calm	NW	NW
2-Dec	NW	NW	N	NE	NE	NE	NE	NNE
3-Dec	NE	NE	NE	NE	N	ENE	NNE	N
4-Dec	NNE	NE	NE	NE	NE	N	Calm	NE
5-Dec	NE	NE	NE	ENE	NE	NE	NNE	NNE
6-Dec	NE	NNE	NE	ENE	NE	NE	NNE	NE
7-Dec	NE	NE	NE	ENE	NNE	NE	E	N
8-Dec	NNE	NE	NNE	E	NE	N	N	N
9-Dec	N	Calm	N	N	Calm	Calm	WNW	NW
10-Dec	NW	Calm	WNW	Calm	NE	W	NWW	NNW
11-Dec	Calm	NNW	Calm	Calm	NNW	Calm	Calm	NW
12-Dec	NW	Calm	Calm	Calm	SW	Calm	Calm	Calm
13-Dec	Calm	Calm	Calm	SSW	Calm	Calm	Calm	Calm
14-Dec	Calm	Calm	ENE	NNE	E	ENE	Calm	Calm
15-Dec	Calm	Calm	ESE	NE	Calm	Calm	Calm	Calm
16-Dec	Calm	NE	Calm	Calm	Calm	N	Calm	N
17-Dec	ENE	NE	Calm	Calm	E	Calm	Calm	Calm
18-Dec	Calm	Calm	Calm	E	SNE	Calm	Calm	Calm
19-Dec	Calm	Calm	NE	E	NE	NE	NNE	NNE
20-Dec	NNE	NE	ENE	ESE	NE	NE	NE	NE
21-Dec	Calm	ENE	Calm	Calm	SW	Calm	Calm	Calm
22-Dec	Calm	Calm	Calm	Calm	W	W	Calm	Calm
23-Dec	Calm	Calm	Calm	NW	W	Calm	Calm	Calm
24-Dec	Calm	Calm	Calm	Calm	ESE	NE	Calm	Calm
25-Dec	Calm	Calm	Calm	NE	E	Calm	Calm	Calm
26-Dec	Calm	Calm	Calm	Calm	NNE	Calm	Calm	N
27-Dec	Calm	Calm	NE	NE	NE	Calm	Calm	Calm
28-Dec	Calm	Calm	Calm	Calm	SSE	SE	Calm	ENE
29-Dec	Calm	ENE	Calm	E	Calm	Calm	Calm	WNW
30-Dec	WNW	Calm	Calm	W	NW	NW	Calm	Calm
31-Dec	Calm	Calm	Calm	NNW	NNW	NNW	Calm	Calm

1-Jan	Calm	Calm	NE	NE	N	N	NNE	NNW
2-Jan	Calm	ESE	N	ESE	NNE	N	Calm	Calm
3-Jan	NE	NE	NE	ENE	ENE	ENE	Calm	NE
4-Jan	Calm	Calm	ENE	E	ENE	NE	Calm	Calm
5-Jan	Calm	Calm	NNE	NE	N	NE	Calm	ENE
6-Jan	ENE	ENE	NE	E	E	ENE	Calm	Calm
7-Jan	Calm	NE	NE	E	ENE	NE	Calm	Calm
8-Jan	Calm	Calm	Calm	Calm	NW	Calm	Calm	N
9-Jan	Calm	NNE	NE	NE	N	N	Calm	NE
10-Jan	NE	ENE	NE	E	NNE	NE	Calm	Calm
11-Jan	Calm	NE	ENE	NNE	ENE	Calm	Calm	Calm

13-Jan	Calm	Calm	Calm	NW	NNW	NNW	Calm	Calm
14-Jan	Calm	Calm	Calm	NW	NW	WNW	Calm	Calm
15-Jan	Calm	Calm	Calm	NNW	NW	NW	N	NW
16-Jan	N	N	E	ENE	E	E	Calm	Calm
17-Jan	Calm	Calm	Calm	Calm	Calm	Calm	Calm	Calm
18-Jan	Calm	Calm	Calm	NNW	W	NW	Calm	NW
19-Jan	NNW	NNW	Calm	E	NW	NNE	Calm	Calm
20-Jan	Calm	Calm	ENE	ENE	ENE	NNE	Calm	Calm
21-Jan	Calm	N	NE	E	N	NNE	Calm	Calm
22-Jan	Calm	Calm	ESE	ESE	WNW	WNW	NW	NW
23-Jan	Calm	Calm	Calm	N	NNE	NNW	Calm	N
24-Jan	NNW	Calm	Calm	ENE	NNW	NNW	Calm	N
25-Jan	Calm	Calm	NNW	N	NNW	N	NW	N
26-Jan	N	N	Calm	NNE	NNE	NNE	N	NNW
27-Jan	NNE	NNE	NE	NE	ENE	NE	N	N
28-Jan	Calm	Calm	NNE	ENE	WNW	NW	Calm	NNW
29-Jan	Calm	Calm	Calm	Calm	NE	NE	Calm	Calm
30-Jan	Calm	Calm	Calm	NE	N	N	Calm	N
31-Jan	N	N	NNE	NE	NE	NE	NNW	NW
1-Feb	Calm	NE	NE	ENE	NNW	N	N	Calm
2-Feb	Calm	NE	NE	E	NE	NE	Calm	N
3-Feb	NNE	NE	NE	E	SE	N	Calm	Calm
4-Feb	Calm	NE	NE	SE	ENE	N	Calm	Calm



5-Feb	Calm	Calm	Calm	NW	NW	NNW	Calm	Calm
6-Feb	Calm	Calm	Calm	NW	NW	NNW	Calm	Calm
7-Feb	WSW	W	Calm	W	SSW	SW	Calm	W
8-Feb	NW	WNW	Calm	S	SSW	WSW	NNW	NNW
9-Feb	Calm	Calm	ENE	E	W	NNW	Calm	Calm
10-Feb	NNW	N	ENE	E	E	NE	Calm	Calm
11-Feb	NE	NE	E	SE	E	Calm	Calm	Calm
12-Feb	Calm	Calm	Calm	SE	SW	SW	Calm	Calm
13-Feb	NW	NW	Calm	Calm	NW	Calm	Calm	Calm
14-Feb	NW	Calm	Calm	Calm	S	WSW	Calm	NW
15-Feb	Calm	Calm	Calm	W	W	W	WNW	NW

16-Feb	NW	W	Calm	NW	Calm	SW	Calm	NW
17-Feb	Calm	Calm	Calm	ENE	NNE	NE	Calm	N
18-Feb	N	N	NE	E	SE	NNW	Calm	N
19-Feb	Calm	Calm	N	NNW	W	N	Calm	NW
20-Feb	NW	NW	NNW	N	NNW	NNW	NNW	NNW
21-Feb	NW	Calm	N	E	ESE	NNW	Calm	NE
22-Feb	N	NE	ENE	E	E	ENE	NNW	Calm
23-Feb	Calm	Calm	NE	NE	NNE	NW	NNW	N
24-Feb	N	NNE	NE	N	NW	NW	Calm	Calm
25-Feb	Calm	NE	NE	E	ENE	Calm	Calm	Calm
26-Feb	N	NNE	Calm	NNE	ESE	NW	Calm	Calm
27-Feb	N	NNE	NE	NE	NES	W	Calm	NNE
28-Feb	N	NNE	ENE	ESE	E	NE	NNW	NNW
1-Mar		NNE	ENE	ENE	WNW	NW		N
2-Mar	N		NE	E			ENE	N
3-Mar					SE	SW	SW	SW
4-Mar	W	NW	W	W	SW	WNW		
5-Mar				E	WSW	NW	NNW	N
6-Mar		NW	NE	E			NNW	
7-Mar		NE	NE	SE	NW	N	NNW	NNW
8-Mar		NNW	NW	NW	NW	W	SW	SW
9-Mar	WNW	WNW	NNW	NW	NW	NW	NW	N
10-Mar	N	N	NW	NNW	NW	NW		NNW

12-Mar		NE	E	E	E	E		
13-Mar		E	E	E	NE	N		
14-Mar		NW		N	NW	NW		
15-Mar		NW	N	NNE	NNE	NE		
16-Mar		NE	NE	E	SW	SE		
17-Mar				SW	NW	NE		SW
18-Mar		WNW	NE	NW	WNW	WSW	WSW	WSW
19-Mar			W	SW	WSW	WSW	WNW	WNW
20-Mar	WNW	WNW	NNW	W	WNW	NW		
21-Mar				SW		WNW		
22-Mar	W	W	NW	W	SW	N		
23-Mar			NW	SW	sw	E		SW
24-Mar			NW	NW	NNE	N		
25-Mar			W	N	E	E		
26-Mar				N				
27-Mar	NNE		NNW		W	NW		
28-Mar	WSW	WNW		NW	NW	W		NW
29-Mar			NW	WNW	WNW	WNW	N	
30-Mar		W	NW	NW	NW	NW		W
31-Mar	NW	WNW		SW	NW	NW		NW

Place: Ahmedabad Observatory  
Period: October 2010 to March 2011

Hours of the Day	Relative Humidity							
	2.30	5.30	8.30	11.30	14.30	17.30	20.30	23.30
1-Oct	76.00	71.00	57.00	38.00	32.00	34.00	69.00	66.00
2-Oct	71.00	73.00	58.00	42.00	34.00	35.00	59.00	75.00
3-Oct	76.00	75.00	60.00	49.00	35.00	39.00	67.00	74.00
4-Oct	81.00	80.00	62.00	46.00	33.00	40.00	58.00	73.00
5-Oct	67.00	75.00	68.00	44.00	33.00	38.00	66.00	74.00
6-Oct	67.00	66.00	56.00	35.00	23.00	28.00	58.00	45.00
7-Oct	68.00	61.00	62.00	40.00	33.00	40.00	62.00	69.00
8-Oct	50.00	64.00	67.00	41.00	20.00	28.00	41.00	50.00
9-Oct	70.00	83.00	83.00	65.00	51.00	48.00	64.00	63.00
10-Oct	82.00	92.00	83.00	61.00	44.00	46.00	72.00	75.00
11-Oct	81.00	87.00	83.00	64.00	62.00	82.00	84.00	75.00
12-Oct	90.00	91.00	92.00	74.00	57.00	60.00	77.00	83.00
13-Oct	88.00	91.00	76.00	59.00	49.00	58.00	71.00	77.00
14-Oct	85.00	90.00	76.00	55.00	49.00	58.00	76.00	76.00
15-Oct	77.00	87.00	75.00	49.00	35.00	41.00	65.00	52.00
16-Oct	61.00	67.00	59.00	47.00	35.00	39.00	47.00	55.00
17-Oct	56.00	69.00	59.00	45.00	37.00	41.00	59.00	63.00
18-Oct	63.00	67.00	65.00	56.00	52.00	55.00	71.00	72.00
19-Oct	69.00	66.00	65.00	57.00	50.00	51.00	70.00	77.00
20-Oct	73.00	79.00	70.00	58.00	52.00	67.00	74.00	80.00
21-Oct	82.00	86.00	82.00	58.00	44.00	52.00	77.00	82.00
22-Oct	83.00	87.00	79.00	57.00	43.00	50.00	72.00	79.00
23-Oct	89.00	90.00	86.00	54.00	38.00	39.00	69.00	80.00
24-Oct	82.00	83.00	81.00	54.00	31.00	38.00	63.00	60.00
25-Oct	78.00	68.00	58.00	41.00	31.00	40.00	58.00	46.00
26-Oct	55.00	59.00	58.00	47.00	40.00	46.00	65.00	64.00
27-Oct	80.00	68.00	63.00	38.00	33.00	38.00	58.00	51.00
28-Oct	67.00	58.00	47.00	29.00	22.00	37.00	59.00	67.00
29-Oct	64.00	70.00	57.00	36.00	30.00	38.00	46.00	66.00
30-Oct	66.00	63.00	57.00	33.00	30.00	41.00	49.00	50.00
31-Oct	64.00	56.00	52.00	34.00	36.00	36.00	61.00	55.00



1-Nov	51.00	60.00	49.00	36.00	28.00	36.00	67.00	67.00
2-Nov	62.00	51.00	50.00	38.00	27.00	32.00	53.00	60.00
3-Nov	57.00	59.00	55.00	33.00	28.00	28.00	56.00	65.00
4-Nov	64.00	54.00	47.00	33.00	28.00	35.00	55.00	72.00
5-Nov	71.00	56.00	45.00	33.00	34.00	41.00	51.00	51.00
6-Nov	68.00	66.00	46.00	29.00	26.00	33.00	60.00	66.00
7-Nov	61.00	48.00	49.00	33.00	25.00	37.00	53.00	52.00
8-Nov	55.00	61.00	58.00	41.00	36.00	45.00	54.00	50.00
9-Nov	54.00	47.00	49.00	83.00	50.00	53.00	76.00	65.00
10-Nov	66.00	78.00	80.00	73.00	81.00	90.00	91.00	90.00
11-Nov	93.00	93.00	92.00	63.00	57.00	61.00	78.00	89.00
12-Nov	88.00	88.00	90.00	63.00	62.00	70.00	86.00	90.00
13-Nov	95.00	95.00	92.00	73.00	61.00	63.00	76.00	81.00
14-Nov	88.00	92.00	83.00	65.00	47.00	59.00	76.00	83.00
15-Nov	84.00	84.00	82.00	59.00	55.00	64.00	73.00	84.00
16-Nov	89.00	90.00	78.00	55.00	54.00	62.00	74.00	81.00
17-Nov	87.00	90.00	85.00	62.00	66.00	77.00	95.00	91.00
18-Nov	93.00	91.00	83.00	67.00	62.00	62.00	77.00	80.00
19-Nov	84.00	88.00	74.00	64.00	52.00	50.00	63.00	75.00
20-Nov	66.00	71.00	52.00	49.00	31.00	38.00	53.00	62.00
21-Nov	73.00	56.00	51.00	47.00	50.00	64.00	73.00	71.00
22-Nov	74.00	71.00	69.00	64.00	72.00	78.00	74.00	72.00
23-Nov	88.00	80.00	86.00	77.00	92.00	82.00	83.00	90.00
24-Nov	92.00	86.00	86.00	89.00	84.00	86.00	89.00	91.00
25-Nov	91.00	94.00	91.00	68.00	64.00	75.00	81.00	89.00
26-Nov	92.00	94.00	96.00	73.00	57.00	59.00	78.00	84.00
27-Nov	91.00	90.00	87.00	71.00	57.00	63.00	71.00	71.00
28-Nov	83.00	87.00	80.00	69.00	62.00	65.00	86.00	84.00
29-Nov	89.00	85.00	82.00	62.00	55.00	55.00	71.00	79.00
30-Nov	89.00	83.00	77.00	59.00	49.00	57.00	62.00	73.00
1-Dec	82.00	81.00	78.00	54.00	44.00	58.00	67.00	66.00
2-Dec	71.00	84.00	75.00	53.00	42.00	45.00	62.00	60.00
3-Dec	62.00	66.00	59.00	48.00	46.00	48.00	59.00	71.00
4-Dec	67.00	63.00	55.00	45.00	43.00	52.00	69.00	63.00
5-Dec	64.00	63.00	57.00	45.00	44.00	46.00	60.00	62.00
6-Dec	60.00	62.00	57.00	46.00	42.00	48.00	64.00	70.00
7-Dec	62.00	65.00	62.00	42.00	37.00	38.00	54.00	55.00
8-Dec	64.00	61.00	61.00	44.00	39.00	39.00	52.00	59.00
9-Dec	78.00	84.00	67.00	47.00	51.00	52.00	48.00	54.00
10-Dec	60.00	75.00	70.00	46.00	38.00	40.00	49.00	55.00
11-Dec	64.00	69.00	71.00	52.00	40.00	49.00	59.00	47.00
12-Dec	53.00	78.00	79.00	50.00	37.00	41.00	67.00	78.00
13-Dec	88.00	90.00	77.00	41.00	34.00	47.00	76.00	85.00
14-Dec	88.00	90.00	75.00	45.00	34.00	43.00	68.00	76.00
15-Dec	76.00	73.00	56.00	39.00	35.00	42.00	72.00	78.00
16-Dec	79.00	86.00	72.00	44.00	35.00	43.00	70.00	77.00
17-Dec	74.00	65.00	62.00	39.00	32.00	38.00	74.00	78.00
18-Dec	83.00	79.00	72.00	42.00	34.00	53.00	65.00	59.00
19-Dec	81.00	67.00	60.00	37.00	33.00	37.00	52.00	64.00
20-Dec	53.00	58.00	56.00	40.00	34.00	37.00	64.00	77.00
21-Dec	85.00	76.00	65.00	43.00	32.00	44.00	70.00	84.00
22-Dec	88.00	92.00	75.00	41.00	34.00	42.00	70.00	80.00
23-Dec	93.00	90.00	82.00	68.00	45.00	53.00	79.00	87.00

24-Dec	93.00	93.00	87.00	60.00	43.00	46.00	70.00	68.00
25-Dec	82.00	80.00	65.00	39.00	34.00	49.00	73.00	73.00
26-Dec	86.00	88.00	68.00	45.00	37.00	41.00	60.00	62.00
27-Dec	77.00	75.00	62.00	51.00	47.00	55.00	80.00	72.00
28-Dec	83.00	91.00	81.00	70.00	54.00	61.00	77.00	77.00
29-Dec	72.00	84.00	88.00	58.00	47.00	62.00	84.00	76.00
30-Dec	54.00	49.00	87.00	32.00	19.00	47.00	66.00	82.00
31-Dec	53.00	42.00	76.00	32.00	19.00	21.00	46.00	53.00
1-Jan	62.00	63.00	56.00	29.00	21.00	26.00	56.00	59.00
2-Jan	60.00	60.00	61.00	35.00	26.00	26.00	58.00	64.00
3-Jan	49.00	53.00	51.00	34.00	31.00	28.00	52.00	40.00
4-Jan	48.00	55.00	70.00	44.00	37.00	41.00	74.00	71.00
5-Jan	54.00	60.00	57.00	36.00	27.00	29.00	62.00	53.00
6-Jan	43.00	52.00	59.00	33.00	27.00	27.00	58.00	76.00
7-Jan	65.00	55.00	60.00	38.00	38.00	35.00	66.00	81.00
8-Jan	87.00	82.00	76.00	33.00	24.00	29.00	49.00	47.00
9-Jan	66.00	69.00	62.00	27.00	23.00	28.00	67.00	75.00
10-Jan	52.00	52.00	42.00	26.00	20.00	26.00	62.00	72.00
11-Jan	60.00	49.00	44.00	36.00	26.00	31.00	66.00	77.00
12-Jan	81.00	80.00	65.00	35.00	24.00	32.00	61.00	74.00
13-Jan	84.00	83.00	74.00	52.00	46.00	44.00	72.00	82.00
14-Jan	85.00	91.00	91.00	63.00	42.00	44.00	72.00	80.00
15-Jan	83.00	87.00	89.00	28.00	30.00	29.00	39.00	34.00
16-Jan	51.00	56.00	37.00	16.00	17.00	16.00	52.00	55.00
17-Jan	56.00	65.00	50.00	29.00	23.00	22.00	52.00	70.00
18-Jan	73.00	69.00	68.00	62.00	49.00	49.00	79.00	66.00
19-Jan	67.00	63.00	58.00	32.00	28.00	27.00	60.00	66.00
20-Jan	73.00	49.00	45.00	34.00	30.00	31.00	62.00	76.00
21-Jan	66.00	71.00	49.00	38.00	32.00	36.00	60.00	59.00
22-Jan	71.00	80.00	66.00	38.00	23.00	28.00	45.00	67.00
23-Jan	69.00	84.00	66.00	36.00	29.00	37.00	52.00	51.00
24-Jan	56.00	75.00	71.00	42.00	28.00	35.00	63.00	47.00
25-Jan	75.00	80.00	68.00	42.00	26.00	24.00	36.00	51.00
26-Jan	37.00	51.00	49.00	25.00	20.00	23.00	42.00	54.00
27-Jan	53.00	54.00	50.00	38.00	35.00	36.00	59.00	50.00
28-Jan	68.00	67.00	62.00	42.00	41.00	42.00	67.00	65.00
29-Jan	76.00	84.00	72.00	49.00	24.00	28.00	58.00	73.00
30-Jan	76.00	84.00	76.00	50.00	38.00	32.00	57.00	52.00
31-Jan	55.00	64.00	63.00	42.00	39.00	34.00	55.00	60.00

1-Feb	63.00	57.00	51.00	37.00	38.00	35.00	58.00	65.00
2-Feb	77.00	64.00	57.00	42.00	36.00	29.00	62.00	68.00
3-Feb	82.00	51.00	48.00	40.00	29.00	28.00	65.00	78.00
4-Feb	72.00	58.00	49.00	37.00	25.00	31.00	59.00	74.00
5-Feb	77.00	79.00	78.00	52.00	37.00	38.00	69.00	79.00
6-Feb	85.00	89.00	84.00	46.00	41.00	39.00	67.00	74.00
7-Feb	68.00	86.00	90.00	52.00	44.00	38.00	67.00	67.00
8-Feb	77.00	85.00	85.00	50.00	34.00	33.00	62.00	62.00
9-Feb	66.00	70.00	63.00	41.00	29.00	32.00	54.00	49.00
10-Feb	56.00	64.00	53.00	37.00	27.00	30.00	60.00	75.00
11-Feb	64.00	55.00	51.00	38.00	31.00	34.00	65.00	76.00
12-Feb	64.00	57.00	73.00	37.00	23.00	27.00	57.00	55.00
13-Feb	50.00	67.00	74.00	50.00	31.00	35.00	62.00	65.00
14-Feb	65.00	81.00	78.00	61.00	33.00	39.00	54.00	64.00

15-Feb	77.00	87.00	77.00	61.00	42.00	43.00	45.00	53.00
16-Feb	60.00	63.00	65.00	39.00	28.00	30.00	57.00	54.00
17-Feb	66.00	76.00	74.00	40.00	33.00	32.00	58.00	54.00
18-Feb	57.00	67.00	47.00	38.00	34.00	34.00	49.00	59.00
19-Feb	64.00	66.00	66.00	32.00	28.00	26.00	46.00	41.00
20-Feb	53.00	69.00	58.00	31.00	26.00	27.00	37.00	55.00
21-Feb	60.00	57.00	53.00	36.00	30.00	29.00	41.00	45.00
22-Feb	57.00	52.00	54.00	39.00	26.00	25.00	50.00	47.00
23-Feb	54.00	61.00	55.00	35.00	24.00	27.00	37.00	56.00
24-Feb	52.00	71.00	49.00	25.00	21.00	21.00	27.00	23.00
25-Feb	45.00	61.00	47.00	31.00	20.00	21.00	45.00	62.00
26-Feb	61.00	66.00	56.00	31.00	24.00	26.00	45.00	50.00
27-Feb	53.00	53.00	49.00	34.00	27.00	24.00	24.00	32.00
28-Feb	44.00	56.00	52.00	41.00	31.00	28.00	48.00	65.00
1-Mar	59.00	55.00	50.00	38.00	26.00	24.00	40.00	60.00
2-Mar	57.00	65.00	49.00	38.00	28.00	30.00	54.00	53.00
3-Mar	68.00	77.00	66.00	38.00	34.00	36.00	42.00	53.00
4-Mar	63.00	59.00	72.00	45.00	34.00	29.00	53.00	61.00
5-Mar	58.00	58.00	54.00	36.00	25.00	23.00	43.00	42.00
6-Mar	50.00	70.00	49.00	37.00	22.00	26.00	34.00	41.00
7-Mar	62.00	56.00	46.00	34.00	25.00	29.00	38.00	45.00
8-Mar	64.00	48.00	46.00	31.00	24.00	27.00	34.00	33.00
9-Mar	45.00	49.00	50.00	18.00	24.00	22.00	28.00	41.00
10-Mar	39.00	45.00	44.00	23.00	23.00	22.00	38.00	25.00
11-Mar	35.00	41.00	32.00	36.00	29.00	28.00	46.00	60.00
12-Mar	48.00	41.00	38.00	27.00	25.00	23.00	51.00	59.00
13-Mar	54.00	46.00	33.00	24.00	21.00	18.00	36.00	42.00
14-Mar	61.00	43.00	34.00	26.00	24.00	18.00	48.00	55.00
15-Mar	58.00	47.00	43.00	34.00	31.00	37.00	48.00	43.00

16-Mar	46.00	36.00	33.00	45.00	38.00	20.00	40.00	55.00
17-Mar	60.00	59.00	39.00	26.00	18.00	18.00	46.00	29.00
18-Mar	43.00	36.00	40.00	20.00	15.00	13.00	20.00	30.00
19-Mar	45.00	57.00	43.00	24.00	13.00	12.00	21.00	29.00
20-Mar	42.00	64.00	77.00	49.00	28.00	24.00	37.00	53.00
21-Mar	40.00	47.00	51.00	40.00	27.00	20.00	44.00	43.00
22-Mar	34.00	52.00	73.00	38.00	32.00	29.00	41.00	48.00
23-Mar	52.00	55.00	79.00	46.00	36.00	25.00	49.00	56.00
24-Mar	64.00	68.00	61.00	51.00	33.00	29.00	38.00	58.00
25-Mar	64.00	72.00	69.00	40.00	21.00	24.00	36.00	53.00
26-Mar	59.00	66.00	41.00	26.00	21.00	25.00	39.00	40.00
27-Mar	45.00	41.00	36.00	20.00	19.00	16.00	30.00	29.00
28-Mar	42.00	44.00	42.00	24.00	17.00	18.00	28.00	31.00
29-Mar	45.00	45.00	46.00	36.00	34.00	22.00	49.00	40.00
30-Mar	50.00	67.00	66.00	50.00	33.00	30.00	34.00	49.00
31-Mar	48.00	65.00	64.00	40.00	60.00	31.00	34.00	49.00



Place: Ahmedabad Observatory  
Period: October 2010 to March 2011

Temperature			
Parameter	Maximum	Minimum	Average
1-Oct	36.20	23.80	30.00
2-Oct	36.20	24.00	30.10
3-Oct	37.00	24.20	30.60
4-Oct	37.30	23.40	30.35
5-Oct	37.20	24.50	30.85
6-Oct	38.40	24.10	31.25
7-Oct	38.30	28.20	33.25
8-Oct	37.50	23.10	30.30
9-Oct	37.40	22.80	30.10
10-Oct	35.50	24.80	30.15
11-Oct	34.80	23.80	29.30
12-Oct	33.60	23.30	28.45
13-Oct	32.80	23.80	28.30
14-Oct	34.90	24.70	29.80
15-Oct	35.50	25.00	30.25
16-Oct	37.00	24.50	30.75
17-Oct	36.40	22.60	29.50
18-Oct	36.00	26.40	31.20
19-Oct	35.60	26.50	31.05
20-Oct	35.20	26.80	31.00
21-Oct	35.60	25.00	30.30
22-Oct	36.50	23.80	30.15
23-Oct	36.50	24.00	30.25
24-Oct	35.90	22.00	28.95
25-Oct	35.00	22.10	28.55
26-Oct	34.50	21.80	28.15
27-Oct	34.00	31.60	32.80
28-Oct	35.90	20.50	28.20
29-Oct	35.60	19.20	27.40
30-Oct	34.00	20.20	27.10
31-Oct	33.80	21.80	27.80
1-Nov	33.30	20.40	26.85
2-Nov	33.00	20.50	26.75
3-Nov	32.20	18.20	25.20
4-Nov	32.80	19.40	26.10
5-Nov	34.90	18.90	26.90
6-Nov	35.00	18.40	26.70
7-Nov	33.80	19.20	26.50
8-Nov	32.50	18.20	25.35
9-Nov	32.70	21.20	26.95
10-Nov	34.30	25.50	29.90

11-Nov	29.70	23.50	26.60
12-Nov	31.40	24.50	27.95
13-Nov	32.00	23.50	27.75
14-Nov	32.40	24.00	28.20
15-Nov	35.00	24.70	29.85
16-Nov	33.50	23.30	28.40
17-Nov	33.40	23.60	28.50
18-Nov	34.30	20.50	27.40
19-Nov	30.80	21.40	26.10
20-Nov	31.20	19.00	25.10
21-Nov	31.60	17.80	24.70
22-Nov	26.50	20.60	23.55
23-Nov	26.00	16.70	21.35
24-Nov	21.30	17.20	19.25
25-Nov	22.60	18.40	20.50
26-Nov	27.50	17.70	22.60
27-Nov	28.70	17.90	23.30
28-Nov	29.80	18.40	24.10
29-Nov	29.50	18.90	24.20
30-Nov	30.00	18.50	24.25
1-Dec	30.10	18.60	24.35
2-Dec	30.40	17.00	23.70
3-Dec	29.80	17.50	23.65
4-Dec	28.40	17.50	22.95
5-Dec	28.50	17.50	23.00
6-Dec	28.80	18.20	23.50
7-Dec	29.00	16.20	22.60
8-Dec	26.90	13.10	20.00
9-Dec	28.40	12.10	20.25
10-Dec	27.50	9.90	18.70
11-Dec	25.40	9.90	17.65
12-Dec	25.80	8.70	17.25
13-Dec	27.40	10.50	18.95
14-Dec	27.40	11.80	19.60
15-Dec	28.00	10.20	19.10
16-Dec	28.80	11.00	19.90
17-Dec	28.80	10.20	19.50
18-Dec	29.20	10.90	20.05
19-Dec	28.40	12.60	20.50
20-Dec	27.40	8.80	18.10
21-Dec	29.40	8.20	18.80
22-Dec	28.90	10.80	19.85
23-Dec	28.20	12.20	20.20
24-Dec	27.30	10.00	18.65
25-Dec	28.60	10.20	19.40
26-Dec	28.20	12.90	20.55
27-Dec	28.40	17.00	22.70
28-Dec	28.80	18.40	23.60
29-Dec	27.80	15.10	21.45
30-Dec	25.70	10.90	18.30
31-Dec	25.70	10.90	18.30

1-Jan	24.90	25.30	25.10
2-Jan	25.30	24.80	25.05
3-Jan	24.80	25.00	24.90
4-Jan	25.00	25.50	25.25
5-Jan	25.50	26.20	25.85

6-Jan	26.20	26.20	26.20
7-Jan	26.20	27.10	26.65
8-Jan	27.10	28.50	27.80
9-Jan	28.50	27.30	27.90
10-Jan	27.30	25.60	26.45
11-Jan	25.60	27.50	26.55
12-Jan	27.50	29.40	28.45
13-Jan	29.40	28.80	29.10
14-Jan	28.80	27.00	27.90
15-Jan	27.00	26.80	26.90
16-Jan	26.80	24.50	25.65
17-Jan	24.50	29.30	26.90
18-Jan	29.30	27.60	28.45
19-Jan	27.60	28.10	27.85
20-Jan	28.10	28.40	28.25
21-Jan	28.40	30.30	29.35
22-Jan	30.30	31.50	30.90
23-Jan	31.50	30.10	30.80
24-Jan	30.10	29.70	29.90
25-Jan	29.70	28.80	29.25
26-Jan	28.80	26.70	27.75
27-Jan	26.70	27.10	26.90
28-Jan	27.10	28.00	27.55
29-Jan	28.00	28.10	28.05
30-Jan	28.10	28.90	28.50
31-Jan	28.90	28.50	28.70

1-Feb	28.50	29.20	28.85
2-Feb	29.20	31.20	30.20
3-Feb	31.20	32.00	31.60
4-Feb	32.00	33.40	32.70
5-Feb	33.40	31.30	32.35
6-Feb	31.30	30.50	30.90
7-Feb	30.50	30.90	30.70
8-Feb	30.90	30.70	30.80
9-Feb	30.70	30.80	30.75
10-Feb	30.80	30.90	30.85
11-Feb	30.90	33.00	31.95
12-Feb	33.00	34.90	33.95
13-Feb	34.90	31.00	32.95
14-Feb	31.00	31.70	31.35
15-Feb	31.70	29.30	30.50

16-Feb	29.30	29.30	29.30
17-Feb	29.30	28.00	28.65
18-Feb	28.00	28.80	28.40
19-Feb	28.80	29.40	29.10
20-Feb	29.40	29.50	29.45
21-Feb	29.50	29.00	29.25
22-Feb	29.00	31.40	30.20
23-Feb	31.40	32.40	31.90
24-Feb	32.40	31.70	32.05
25-Feb	31.70	31.50	31.60
26-Feb	31.50	32.20	31.85
27-Feb	32.20	31.00	31.60
28-Feb	31.00	32.50	31.75
1-Mar	32.50	34.40	33.45
2-Mar	34.40	34.30	34.35

3-Mar	34.30	35.60	34.95
4-Mar	35.60	33.60	34.60
5-Mar	33.60	34.00	33.80
6-Mar	34.00	35.30	34.65
7-Mar	35.30	36.40	35.85
8-Mar	36.40	35.20	35.80
9-Mar	35.20	32.00	33.60
10-Mar	32.00	32.80	32.40
11-Mar	32.80	32.60	32.70
12-Mar	32.60	33.50	33.05
13-Mar	33.50	36.90	35.20
14-Mar	36.90	38.40	37.65
15-Mar	38.40	39.30	38.85
16-Mar	39.30	39.50	39.40
17-Mar	39.50	41.00	40.25
18-Mar	41.00	40.00	40.50
19-Mar	40.00	38.40	39.20
20-Mar	38.40	37.10	37.75
21-Mar	37.10	36.50	36.80
22-Mar	36.50	36.20	36.35
23-Mar	36.20	35.90	36.05
24-Mar	35.90	36.50	36.20
25-Mar	36.50	38.00	37.25
26-Mar	38.00	39.40	38.70
27-Mar	39.40	40.20	39.80
28-Mar	40.20	39.50	39.85
29-Mar	39.50	38.50	39.00
30-Mar	38.50	36.70	37.60
31-Mar	36.70	36.40	36.55



**Place: Ahmedabad Observatory**  
**Period: October 2010 to March 2011**

Cloud Cover																
Hours of the Day	2.30		5.30		8.30		11.30		14.30		17.30		20.30		23.30	
	Okta	Tenths	Okta	Tenths	Okta	Tenths	Okta	Tenths	Okta	Tenths	Okta	Tenths	Okta	Tenths	Okta	Tenths
1-Oct	0	0	0	0	4	5	0	0	0	0	0	0	0	0	0	0
2-Oct	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0
3-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Oct	0	0	0	0	2	3	0	0	1	1	1	1	0	0	2	3
6-Oct	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0
7-Oct	0	0	0	0	0	0	0	0	0	0	0	0	2	3	2	3
8-Oct	2	3	0	0	2	3	1	1	4	5	4	5	0	0	0	0
9-Oct	0	0	0	0	2	3	0	0	0	0	2	3	0	0	0	0
10-Oct	0	0	2	3	2	3	2	3	1	1	1	1	0	0	3	4
11-Oct	3	4	3	4	3	4	6	8	6	8	5	6	4	5	5	6
12-Oct	4	5	2	3	7	9	6	8	6	8	6	8	5	6	5	6
13-Oct	4	5	6	8	3	4	0	0	6	8	3	4	1	1	0	0
14-Oct	0	0	0	0	0	0	0	0	2	3	3	4	0	0	0	0
15-Oct	0	0	6	8	0	0	0	0	2	3	2	3	0	0	2	3
16-Oct	0	0	0	0	3	4	4	5	4	5	3	4	0	0	0	0
17-Oct	0	0	0	0	3	4	0	0	2	3	2	3	0	0	4	5
18-Oct	1	1	0	0	2	3	0	0	5	6	2	3	2	3	0	0
19-Oct	5	6	0	0	2	3	0	0	4	5	2	3	0	0	0	0
20-Oct	2	3	4	5	6	8	3	4	6	8	6	8	2	3	2	3
21-Oct	2	3	0	0	5	6	4	5	6	8	6	8	4	5	2	3
22-Oct	1	1	0	0	0	0	0	0	6	8	3	4	2	3	0	0
23-Oct	0	0	6	8	4	5	0	0	1	1	1	1	0	0	0	0
24-Oct	0	0	0	0	0	0	0	0	2	3	3	4	1	1	3	4
25-Oct	0	0	2	3	4	5	2	3	2	3	2	3	3	4	4	5
26-Oct	6	8	4	5	0	0	0	0	5	6	4	5	0	0	2	3
27-Oct	0	0	0	0	3	4	2	3	0	0	0	0	0	0	0	0

28-Oct	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
29-Oct	2	3	3	4	4	5	4	5	0	0	3	4	1	1	0	0
30-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-Oct	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Nov	0	0	0	0	1	1	1	1	1	1	3	4	0	0	0	0
6-Nov	0	0	0	0	0	0	0	0	3	4	2	3	1	1	0	0
7-Nov	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
8-Nov	0	0	0	0	0	0	3	4	5	6	5	6	2	3	0	0
9-Nov	4	5	4	5	5	6	4	5	6	8	7	9	7	9	5	6
10-Nov	7	9	7	9	7	9	8	10	8	10	8	10	7	9	8	10
11-Nov	7	9	7	9	7	9	7	9	7	9	7	9	0	0	5	6
12-Nov	6	8	7	9	7	9	6	8	7	9	8	10	5	6	8	10
13-Nov	5	6	5	6	5	6	6	8	6	8	3	4	0	0	5	6
14-Nov	5	6	6	8	0	0	5	6	5	6	4	5	1	1	0	0
15-Nov	0	0	2	3	6	8	5	6	7	9	8	10	5	6	4	5
16-Nov	7	9	7	9	0	0	1	1	3	4	4	5	2	3	0	0
17-Nov	0	0	0	0	7	9	1	1	7	9	8	10	8	10	7	9
18-Nov	3	4	0	0	0	0	0	0	6	8	0	0	0	0	0	0
19-Nov	0	0	0	0	0	0	0	0	3	4	2	3	0	0	2	3
20-Nov	2	3	0	0	2	3	1	1	5	6	6	8	6	8	5	6
21-Nov	4	5	6	8	7	9	7	9	7	9	8	10	8	10	8	10
22-Nov	8	10	8	10	8	10	7	9	7	9	7	9	8	10	8	10
23-Nov	8	10	8	10	8	10	8	10	8	10	8	10	7	9	8	10
24-Nov	8	10	8	10	8	10	8	10	8	10	8	10	8	10	7	9
25-Nov	7	9	7	9	2	3	4	5	6	8	5	6	3	4	2	3
26-Nov	2	3	2	3	0	0	0	0	1	1	0	0	0	0	0	0
27-Nov	0	0	0	0	0	0	6	8	4	5	3	4	0	0	2	3
28-Nov	2	3	2	3	0	0	0	0	3	4	0	0	0	0	0	0
29-Nov	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Nov	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0
1-Dec	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Dec	0	0	0	0	0	0	0	0	2	3	4	5	2	3	0	0
3-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

6-Dec	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0
7-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Dec	0	0	0	0	0	0	0	0	3	4	3	4	1	1	1	1
10-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Dec	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
12-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Dec	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0
14-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5
18-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Dec	0	0	0	0	2	3	1	1	0	0	0	0	0	0	0	0
23-Dec	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
24-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Dec	0	0	5	6	3	4	7	9	6	8	4	5	4	5	4	5
28-Dec	4	5	4	5	5	6	7	9	5	6	6	8	4	5	5	6
29-Dec	5	6	6	8	5	6	5	6	5	6	5	6	5	6	3	4
30-Dec	4	5	3	4	3	4	2	3	1	1	0	0	0	0	0	0
31-Dec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Jan	3	4	0	0	3	4	4	5	0	0	0	0	0	0	0	0
5-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Jan	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0
7-Jan	4	5	0	0	4	5	5	6	4	5	1	1	0	0	0	0
8-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

14-Jan	0	0	0	0	0	0	0	0	0	0	4	5	0	0	0	0
15-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-Jan	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0
17-Jan	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
18-Jan	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0
19-Jan	0	0	0	0	0	0	2	3	3	4	1	1	0	0	0	0
20-Jan	3	4	0	0	3	4	1	1	0	0	0	0	0	0	0	0
21-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Jan	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3	4
23-Jan	0	0	2	3	0	0	0	0	4	5	0	0	0	0	0	0
24-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Jan	0	0	0	0	0	0	0	0	4	5	0	0	0	0	0	0
31-Jan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Feb	0	0	0	0	5	6	0	0	0	0	5	6	0	0	0	0
8-Feb	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0
9-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Feb	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
11-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Feb	2	3	5	6	6	8	4	5	4	5	6	8	5	6	6	8

16-Feb	7	9	4	5	2	3	0	0	3	4	2	3	6	8	6	8
17-Feb	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0	0
18-Feb	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0
19-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

22-Feb	0	0	0	0	4	5	6	8	6	8	4	5	0	0	0	0
23-Feb	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0
24-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28-Feb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Mar		0		0		0		0	2	3	1	1		0		0
2-Mar		0		0		0	1	1		0		0		0		0
3-Mar		0		0		0		0		0		0		0		0
4-Mar		0		0		0		0	1	1		0		0		0
5-Mar		0		0		0		0		0		0		0		0
6-Mar		0		0		0		0		0		0		0		0
7-Mar		0		0		0		0		0		0		0		0
8-Mar		0		0		0		0		0		0		0		0
9-Mar		0		0		0		0		0		0		0		0
10-Mar		0		0		0		0		0		0		0		0
11-Mar		0		0		0		0		0		0		0		0
12-Mar		0		0		0		0		0		0		0		0
13-Mar		0		0		0		0		0		0		0		0
14-Mar		0		0		0		0		0		0		0		0
15-Mar		0		0		0		0		0		0		0		0
16-Mar		0		0		0		0		0		0		0		0
17-Mar		0		0		0		0	1	1		0		0		0
18-Mar		0		0		0		0		0		0		0		0
19-Mar		0		0		0		0		0		0		0		0
20-Mar		0		0		0		0		0		0		0		0
21-Mar		0		0		0		0		0		0		0		0
22-Mar		0		0		0		0		0		0		0		0
23-Mar		0		0		0		0		0		0		0		0
24-Mar		0		0		0		0	3	4	1	1		0	2	3
25-Mar		0		0		0		0	4	5	2	3		0		0
26-Mar		0		0		0		0		0		0		0		0
27-Mar		0		0		0		0		0		0		0		0
28-Mar		0		0		0		0		0		0		0		0
29-Mar		0		0		0		0		0		0		0		0
30-Mar		0		0		0		0		0		0		0		0
31-Mar		0		0		0		0		0		0		0		0

# INDIAN METEOROLOGICAL DATA FROM APRIL 2011 TO OCTOBER 2011

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:- APRIL

DATE	Temp.		Daily Total Rainfall in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperature in Deg C	Minimum. Temperature in Deg C		wind		wind			
				DIR	Speed in kmph	DIR	Speed in kmph	0830 HRS IST	1730 HRS IST
01	36.4	22.4	000.0	NW	008	NW	006	073	029
02	37.0	23.0	000.0	NW	010	CALM	000	073	029
03	37.5	21.8	000.0	N	010	WSW	006	035	017
04	36.6	17.8	000.0	NNW	006	E	006	034	022
05	36.6	20.6	000.0	CALM	000	CALM	000	033	019
06	38.3	20.4	000.0	CALM	000	CALM	000	030	024
07	39.3	20.8	000.0	CALM	000	NW	008	033	017
08	40.4	22.3	000.0	CALM	000	CALM	000	063	022
09	39.4	23.4	000.0	CALM	000	NNW	004	060	019
10	39.4	25.4	000.0	NW	006	WNW	008	039	019
11	40.0	23.6	000.0	WNW	006	NW	008	050	023
12	40.2	26.5	000.0	CALM	000	NNW	008	047	019
13	38.9	26.5	000.0	NW	004	N	004	045	024
14	38.9	26.5	000.0	WNW	008	NW	010	058	019
15	40.0	26.6	000.0	WNW	010	CALM	000	059	021
16	40.4	27.0	000.0	CALM	000	WSW	010	061	031
17	40.6	26.1	000.0	NW	004	NW	012	065	028
18	39.0	26.0	000.0	N	006	NNW	012	045	019
19	39.0	20.5	000.0	CALM	000	NW	008	036	016
20	39.5	22.6	000.0	NW	006	N	004	035	014
21	40.1	25.1	000.0	NW	006	CALM	000	036	012
22	40.8	22.6	000.0	NW	004	NNW	008	023	011

23	41.5	22.0	000.0	CALM	000	NW	010	022	008
24	42.3	23.3	000.0	CALM	000	WNW	008	023	012
25	42.2	25.6	000.0	NW	004	W	008	046	011
26	42.5	25.8	000.0	NW	010	NW	008	051	015
27	41.8	26.5	000.0	NW	012	WNW	012	052	013
28	41.9	27.3	000.0	NW	008	NW	008	040	020
29	41.5	27.4	000.0	NW	004	W	006	058	043
30	39.9	27.0	000.0	CALM	000	NW	006	064	030

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:- MAY

DATE	Temp.		Daily Total Rainfall in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperature in Deg C	Minimum. Temperature in Deg C		wind		wind		0830 HRS IST	1730 HRS IST
				DIR	Speed in kmph	DIR	Speed in kmph		
01	39.6	27.5	000.0	NW	012	W	006	057	037
02	40.1	26.0	000.0	NW	008	WSW	018	067	016
03	40.6	25.0	000.0	W	008	W	010	071	023
04	39.7	26.0	000.0	WSW	012	W	006	073	028
05	39.1	26.0	000.0	SW	014	WSW	008	075	036
06	40.2	25.2	000.0	WSW	006	WNW	006	064	016
07	39.9	27.3	000.0	SW	006	WNW	004	069	031
08	39.6	27.4	000.0	WSW	004	WSW	012	066	020
09	41.8	26.5	000.0	W	010	W	008	059	017
10	42.0	26.1	000.0	W	006	SW	012	072	022
11	41.6	26.0	000.0	CALM	000	W	008	068	019
12	41.4	26.3	000.0	W	012	SW	014	071	024
13	41.2	26.5	000.0	SW	014	SW	006	070	022
14	41.4	26.5	000.0	W	006	SW	014	074	022
15	41.4	26.8	000.0	SW	014	W	008	068	025
16	41.9	27.8	000.0	W	010	WSW	010	070	030
17	41.4	28.4	000.0	W	010	NW	010	070	037
18	42.8	28.4	000.0	WNW	008	SW	012	070	025
19	42.3	27.7	000.0	WNW	012	SSW	018	064	035
20	43.4	27.8	000.0	SW	012	SSE	022	062	047
21	41.7	28.2	000.0	SW	014	S	018	065	055
22	39.6	28.8	000.0	SW	006	S	022	067	048
23	40.0	28.2	000.0	SW	006	SW	006	076	036
24	40.4	29.0	000.0	WSW	008	SW	014	072	035



25	40.8	27.7	000.0	WSW	014	SW	008	070	027
26	41.4	28.8	000.0	WNW	004	SW	006	067	029
27	41.0	27.7	000.0	WNW	008	SW	006	065	028
28	41.0	27.8	000.0	NW	016	WNW	012	070	020
29	41.6	27.0	000.0	WNW	012	NW	008	068	025
30	41.5	27.5	000.0	W	008	SW	012	069	033
31	42.0	28.0	000.0	W	006	SW	012	072	036

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:- JUNE

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DATE	Temp.		Daily Total Rainfall in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperature in Deg C	Minimum. Temperature in Deg C		wind		wind			
				DIR	Speed in kmph	DIR	Speed in kmph	0830 HRS IST	1730 HRS IST
01	42.2	28.6	000.0	SW	010	S	018	066	041
02	41.2	29.0	000.0	WSW	010	NW	008	066	035
03	40.2	29.7	000.0	W	008	S	022	065	041
04	41.4	24.3	014.6	CALM	000	W	008	058	035
05	40.7	29.7	000.0	CALM	000	CALM	000	057	026
06	43.3	29.3	000.0	CALM	000	WNW	006	070	033
07	42.5	30.8	000.0	S	008	S	006	068	039
08	42.7	28.5	000.0	SW	006	SSW	018	062	045
09	39.8	28.4	000.0	SSE	006	SW	006	068	039
10	39.0	28.3	000.0	S	004	SW	006	067	040
11	34.2	28.0	000.0	SW	006	W	004	065	039
12	40.3	27.9	000.0	S	006	S	018	072	049
13	39.0	26.8	000.0	SE	008	SSW	014	075	044
14	38.5	27.6	000.0	CALM	000	S	008	071	042
15	40.3	28.5	000.0	SSW	010	S	022	067	049
16	39.2	28.5	000.0	SSW	008	S	022	072	049
17	39.5	28.5	000.4	SW	010	S	014	069	048
18	39.3	28.8	000.0	SW	014	S	014	071	052
19	39.5	28.8	000.0	SW	010	SSW	010	072	042
20	39.1	28.8	000.0	SW	010	SW	012	074	041
21	39.0	28.5	000.0	SW	008	WSW	020	073	044
22	38.4	28.5	000.0	W	012	W	014	075	046
23	38.6	28.8	000.0	SW	010	SW	006	073	057
24	33.9	28.5	000.0	WSW	008	SW	012	074	052

25	35.7	28.6	000.0	WSW	012	SW	014	074	042
26	37.0	27.8	000.0	SW	014	SW	008	069	039
27	37.9	28.5	000.0	SW	010	W	012	069	043
28	37.3	28.3	000.0	SW	014	W	006	075	056
29	35.3	28.4	000.0	SW	012	SW	018	074	050
30	38.6	28.3	000.0	SW	014	SW	012	078	056

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:- JULY

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DATE	Temp.		Daily Total Rainfall in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperature in Deg C	Minimum. Temperature in Deg C		wind		wind		0830 HRS IST	1730 HRS IST
				DIR	Speed in kmph	DIR	Speed in kmph		
01	38.0	27.8	000.0	S	010	S	020	081	058
02	39.4	27.8	000.0	SSW	012	SW	012	077	054
03	38.4	27.5	000.0	SW	008	SSW	018	077	067
04	38.2	27.0	000.0	SW	010	CALM	000	076	049
05	38.4	28.0	000.0	SW	008	SW	006	077	045
06	38.5	28.5	000.0	CALM	000	N	006	081	057
07	36.1	29.0	000.0	SW	004	S	014	080	065
08	38.3	24.1	038.4	N	004	W	006	095	081
09	32.3	23.5	030.1	CALM	000	CALM	000	100	095
10	27.3	24.0	004.6	SW	010	SW	004	098	095
11	27.8	24.3	104.9	SW	012	CALM	000	097	100
12	31.7	23.8	038.6	CALM	000	W	004	095	063
13	34.0	26.4	000.0	W	010	CALM	000	086	067
14	33.0	26.0	002.8	W	006	SW	006	090	068
15	33.2	26.8	000.0	SW	006	S	006	089	066
16	35.3	26.5	000.2	SSW	012	CALM	000	092	066
17	34.5	27.0	000.0	CALM	000	CALM	000	081	064
18	35.1	26.3	000.5	CALM	000	CALM	000	089	069
19	34.5	24.2	042.7	W	006	SW	010	092	083
20	31.2	26.3	000.0	SW	010	SW	012	087	063
21	33.6	26.8	000.0	SW	014	SW	006	088	070
22	33.5	26.5	000.0	SW	010	SW	010	089	064
23	33.3	26.6	000.0	SW	006	CALM	000	087	091
24	29.1	26.1	001.7	CALM	000	WNW	006	094	077

25	31.6	25.6	002.3	CALM	000	CALM	000	094	081
26	31.4	26.4	014.7	CALM	000	CALM	000	083	066
27	35.2	26.0	000.0	CALM	000	S	010	087	067
28	36.0	26.7	000.0	W	004	WSW	006	089	074
29	33.4	26.4	000.0	SW	006	CALM	000	087	069
30	34.0	27.0	000.4	W	006	CALM	000	091	075
31	33.5	26.2	019.0	SW	010	SW	006	089	069

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:- AUGUST

DATE	Temp.		Daily Total Rainfall in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperature in Deg C	Minimum. Temperature in Deg C		wind		wind			
				DIR	Speed in kmph	DIR	Speed in kmph	0830 HRS IST	1730 HRS IST
01	34.6	25.6	000.0	SW	014	SW	008	092	075
02	33.3	26.0	000.0	SSW	008	CALM	000	091	070
03	32.5	26.0	002.5	W	004	SW	006	085	067
04	33.8	26.2	000.0	SSW	010	SW	008	088	073
05	33.0	26.4	000.0	W	008	SW	008	085	068
06	34.4	26.5	000.0	SW	010	SW	006	086	065
07	34.3	26.8	000.0	SW	008	W	010	086	067
08	33.5	26.5	000.0	WSW	010	CALM	000	083	095
09	30.2	25.4	012.6	SW	006	SW	008	098	097
10	27.4	23.4	033.9	SW	008	SW	010	098	100
11	28.2	24.0	052.5	SW	010	SW	014	098	096
12	27.4	23.4	014.9	SW	006	NW	014	098	100
13	26.0	23.8	088.5	SW	008	W	008	100	085
14	31.8	24.6	011.4	S	006	W	006	100	094
15	30.0	24.5	042.6	SW	010	SW	014	100	092
16	28.0	24.8	001.2	SW	012	W	006	097	084
17	31.8	25.2	000.6	SW	008	SW	006	090	073
18	33.0	26.4	000.0	SW	006	CALM	000	090	073
19	33.4	26.2	000.0	W	006	WNW	006	091	076
20	33.3	25.6	000.2	CALM	000	NNE	006	092	097
21	31.0	24.0	028.5	CALM	000	W	006	100	092
22	29.0	24.8	003.3	SW	006	CALM	000	095	080
23	32.0	26.0	000.0	W	010	WNW	008	089	079
24	33.5	26.2	000.0	W	006	W	006	092	083
25	31.5	26.0	000.2	W	004	NE	006	089	092

26	32.2	25.0	008.5	SW	008	W	006	090	079
27	31.9	25.3	004.5	W	006	CALM	000	092	082
28	32.3	25.4	002.2	W	006	SW	006	095	097
29	34.1	24.0	014.7	N	006	NW	008	097	098
30	29.0	25.0	014.2	SE	008	CALM	000	095	081
31	33.0	25.5	000.4	SSE	006	SSE	006	092	078

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:-  
SEPTEMBER

DATE	Temp.		Daily Total Rainfal l in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperatur e in Deg C	Minimum. Temperatur e in Deg C		wind		wind			
				DIR	Speed in kmph	DIR	Speed in kmph	0830 HRS IST	1730 HRS IST
01	32.8	26.5	000.0	SSW	006	CALM	000	094	089
02	32.4	23.5	000.8	E	006	SW	006	090	092
03	33.4	25.4	000.8	CALM	000	SW	006	092	080
04	34.4	25.3	017.0	SSW	006	S	008	094	098
05	34.2	25.2	010.3	SE	008	S	010	100	088
06	31.8	25.3	006.6	SE	010	S	014	100	094
07	28.2	25.0	004.7	S	014	S	014	094	097
08	27.2	24.9	008.8	SW	006	SW	014	095	077
09	32.1	25.1	000.0	SW	012	CALM	000	090	089
10	32.4	24.8	001.1	CALM	000	S	006	094	083
11	30.6	25.0	000.9	CALM	000	S	006	097	098
12	28.2	25.0	007.0	SW	006	SW	010	095	076
13	34.0	24.5	008.0	S	008	SE	008	095	084
14	32.4	25.2	001.4	CALM	000	E	004	095	089
15	31.2	25.2	000.0	CALM	000	SSW	006	095	073
16	33.6	25.4	000.0	SW	012	SSW	014	085	083
17	33.5	25.4	002.0	SW	010	SW	008	092	076
18	32.9	23.8	004.0	SW	004	W	006	083	081
19	32.3	24.8	000.2	SW	006	S	006	090	072
20	33.4	24.0	000.0	W	004	W	006	087	071
21	32.6	24.0	000.0	W	006	WNW	008	092	070
22	32.0	23.8	000.0	W	008	SW	006	090	069
23	33.2	25.0	000.0	W	006	W	004	093	064
24	32.6	23.6	000.0	W	004	SW	006	090	065



25	34.0	24.8	000.0	WNW	006	SW	010	089	066
26	32.8	23.8	001.0	WNW	010	SSW	006	089	068
27	33.0	23.4	000.0	NW	012	SW	004	084	067
28	33.0	23.4	000.0	NW	008	SW	006	086	065
29	33.4	23.8	000.0	NW	006	CALM	000	084	065
30	33.6	23.0	000.0	NW	012	CALM	000	086	076

STATION: - AHMEDABAD

YEAR:- 2011

MONTH:-  
OCTOBER

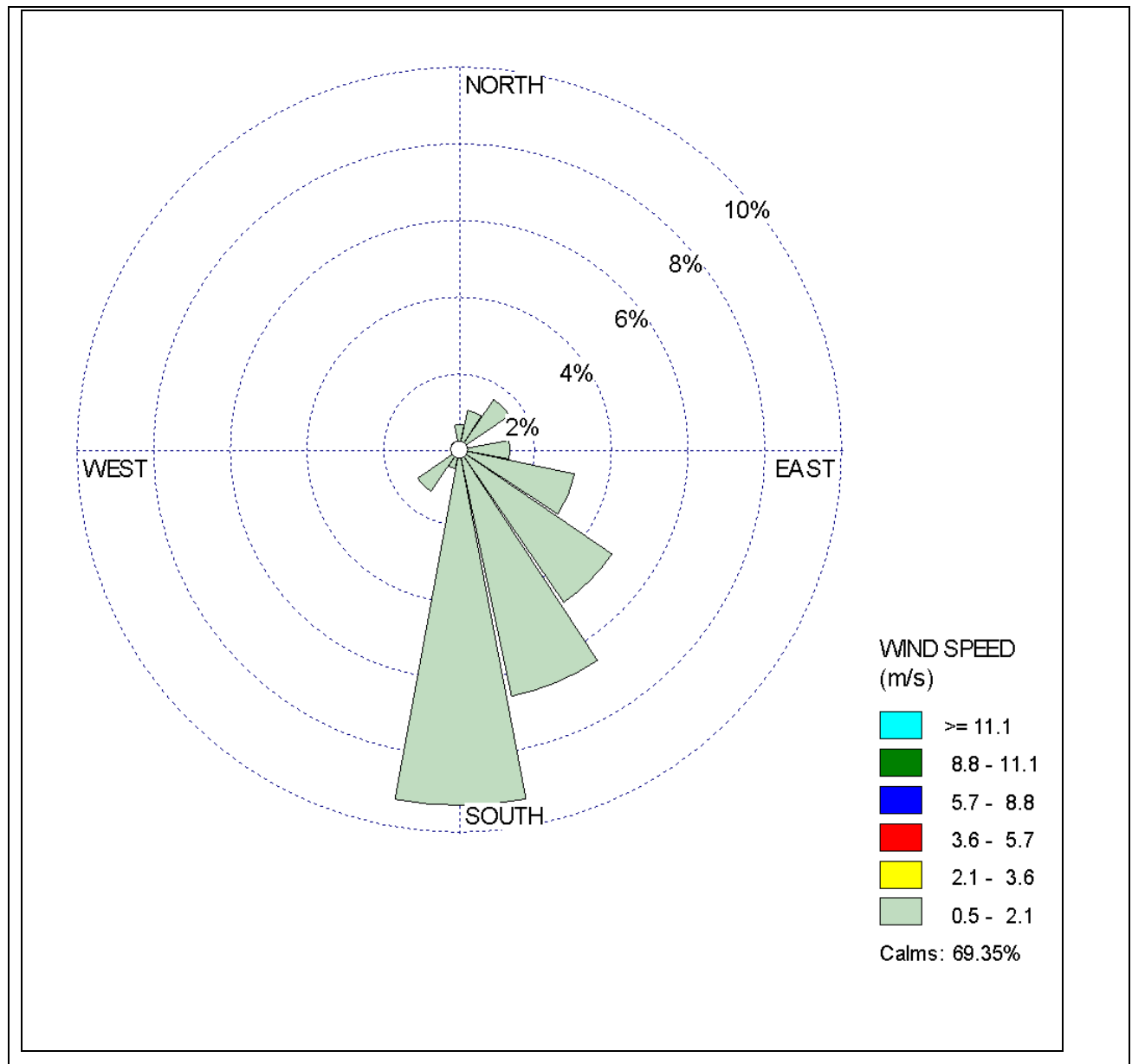
DATE	Temp.		Daily Total Rainfall in mm	0830 HRS IST		1730 HRS IST		Relative Humidity in %	
	Maximum Temperature in Deg C	Minimum. Temperature in Deg C		wind		wind			
				DIR	Speed in kmph	DIR	Speed in kmph	0830 HRS IST	1730 HRS IST
01	33.5	23.0	000.0	NW	008	W	006	078	062
02	33.8	22.8	000.0	CALM	000	CALM	000	087	059
03	33.6	22.6	000.0	NW	006	WNW	006	084	059
04	33.4	23.5	000.0	NW	010	N	004	081	052
05	33.6	21.2	000.0	CALM	000	N	004	080	049
06	34.0	22.8	000.0	N	006	NW	004	068	047
07	35.1	23.2	000.0	NNW	006	CALM	000	073	057
08	35.0	23.5	000.0	NW	010	CALM	000	077	055
09	35.9	24.1	000.0	WNW	008	NW	004	070	044
10	36.4	24.3	000.0	NW	004	CALM	000	070	041
11	36.6	23.0	000.0	E	004	ENE	006	064	036
12	36.4	22.8	000.0	NNE	004	N	006	062	043
13	36.5	23.5	000.0	CALM	000	E	004	064	035
14	37.4	25.3	000.0	CALM	000	N	006	074	042
15	36.6	24.0	000.0	N	006	CALM	000	067	034
16	37.4	23.5	000.0	NNW	004	CALM	000	067	044
17	37.4	24.8	000.0	CALM	000	CALM	000	079	043
18	36.8	23.3	000.0	N	004	NNE	008	066	031
19	37.4	19.4	000.0	E	004	CALM	000	040	044
20	37.0	19.3	000.0	CALM	000	CALM	000	059	031
21	35.8	19.8	000.0	CALM	000	CALM	000	056	040
22	36.6	19.6	000.0	CALM	000	NE	006	060	025
23	36.6	19.2	000.0	NNE	004	NE	004	053	037
24	37.4	18.8	000.0	N	004	CALM	000	066	040

25	36.8	19.8	000.0	CALM	000	CALM	000	057	041
26	35.6	19.5	000.0	ENE	006	E	006	048	037
27	35.6	20.4	000.0	NE	006	E	004	055	040
28	35.6	20.5	000.0	NE	010	N	006	049	037
29	35.2	18.7	000.0	N	004	E	004	051	032
30	34.8	18.9	000.0	ENE	006	CALM	000	052	047
31	33.1	19.2	000.0	CALM	000	CALM	000	062	050

### 3.3.1.4 Wind Rose

The 24 hourly wind rose was prepared using the data on wind direction and speed collected for winter season in the study area shown in Drawing 3.4.

**Drawing 3.4 Wind rose diagram for the study period**



**3.3.1.5 Temperature**

The mean maximum temperature of October was 38.4°C and minimum was 19.20°C recorded.

In November maximum temperature was 35.0°C and minimum was 16.7°C recorded.

In December maximum temperature was 30.4°C and minimum was 8.2°C recorded.

**3.3.1.6 Relative Humidity:**

- Maximum relative humidity was observed 92.0 and minimum relative humidity was observed 20.0 in the month of October.
- Maximum relative humidity was observed 96.0 and minimum relative humidity was observed 25.0 in the month of November.
- Maximum relative humidity was observed 93.0 and minimum relative humidity was observed 19.0 in the month of December.

**3.3.2 WATER ENVIRONMENT:**

Water Environment is an intricate system of all the living elements. Physical, chemical and biological factors influencing water quality are so interrelated that, changes in any water quality parameter causes other changes in a complex network or interrelated variables. Hence, it becomes imperative to define the water environment for the surrounding area, particularly in context to parameters, which may indicate any specific pollutant naturally present before the project and those, which are likely to be altered in the post project scenario.

## Water Bodies

Water bodies in the study area/vicinity can be classified as follows:

- i. Ground Water
- ii. Surface Water

### i. Ground Water:

The Ground Water is the source of supply at very few places among the area. The Ground water table in the study area is between 30 m. The bore-wells are the major source of supply of ground water. The units under concern and other major industrial units in the study area have their own bore-wells to cater to self-requirement. The details of ground water samples collected from study area are as follows:

**Table 3.9: Water Samples collected from the study area**

Sample No.	Location	
	Ground water	Surface water
1	Project site	Amrapura
2	Solaiya	Charada
3	Amarapura	
4	Bapupura	
5	Itadara	
6	Charada	
7	Dhameda	

### ii. Surface Water:

There is Surface water Sources like Seasonal lakes, pond like Chandrasar Talav, Malav Talav, Malav Sarovar & Malan Talav in the study area but none of them is perennial source. Surface water samples were collected from village Amrapura & Charada village.

**WATER QUALITY:**

To analyze the present quality of water from the study area, water samples were collected from different locations and analyzed for parameters as specified in IS-10500 (The drinking water standards as per Bureau of Indian Standards). Standard Methods were used to analyze the water samples. The analysis report of the water samples collected from different locations within the study area is shown in Table 3.10. The drinking water standards specified by Bureau of Indian Standards (BIS) are presented in Table 3.11.

**Table 3.10: Analysis report For Ground water samples:**

No.	Parameter	Units	Project site	Solaiya	Amarapura	IS: 10500-1991 Norms	
						Desirable	Permissible
1	Colour	Hazen	1.0	1.0	1.0	5	25
2	Odour	-	Unobj	Unobj	Unobj	Unobj-ble	Unobj-ble
3	Taste	-	Agre	Agre	Agre	Agreeable	Agreeable
4	Turbidity	NTU	0.5	0.3	1.0	5	10
5	pH	-	7.05	6.9	7.1	6.5-8.5	6.5-8.5
6	Total Hardness as CaCO <sub>3</sub>	mg/l	475	432	463	300	600
7	Calcium as Ca	mg/l	98	88	81	75	200
8	Magnesium as Mg	mg/l	55	51	63	30	100
9	Copper as Cu	mg/l	0.04	0.03	0.03	0.05	1.5
10	Iron as Fe	mg/l	0.08	0.06	0.07	0.3	1
11	Manganese as Mn	mg/l	<0.01	<0.01	<0.01	0.01	0.01
12	Chlorides as Cl	mg/l	359	321	355	250	1000
13	Total Alkalinity	mg/l	350	338	320	200	600
14	Sulphates as SO <sub>4</sub>	mg/l	35	31	32	200	400
15	Nitrate as NO <sub>3</sub>	mg/l	10.3	9.87	11.4	45	100
16	Fluoride as F	mg/l	0.25	0.25	0.75	1.0	1.5
17	Phenols as C <sub>6</sub> H <sub>5</sub> OH	mg/l	<0.001	<0.001	<0.001	0.001	0.001
18	Mercury as Hg	mg/l	<0.001	<0.001	<0.001	0.001	0.001
19	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01	0.01	0.01
20	Selenium as Se	mg/l	<0.01	<0.01	<0.01	0.01	0.01
21	Arsenic as As	mg/l	<0.05	<0.05	<0.05	0.05	0.05
22	Cyanide as CN	mg/l	<0.05	<0.05	<0.05	0.05	0.05
23	Lead as Pb	mg/l	<0.05	<0.05	<0.05	0.05	0.05
24	Zinc as Zn	mg/l	0.7	0.85	0.75	5	15
25	Chromium as Cr+6	mg/l	0.03	0.02	0.02	0.05	-
26	Mineral Oil	mg/l	-	-	-	-	-
27	Residual Free chlorine	mg/l	0.09	0.08	0.05	0.3	1
28	Total coliforms	MPN/100 ml	Absent	Absent	Absent	Absent	Absent
29	E-coli	MPN/100 ml	Absent	Absent	Absent	Absent	Absent
30	Total Dissolved Solids	mg/l	1165.45	1074	1115	500	2000

No.	Parameter	Units	Bapupura	Itadara	Charada	Dhameda
1	Colour	Hazen	1.0	1.0	1.0	1.0
2	Odour	-	Unobj	Unobj	Unobj	Unobj
3	Taste	-	Agre	Agre	Agre	Agre
4	Turbidity	NTU	0.9	0.8	1.1	1.3
5	pH	-	7.15	6.99	7.3	7.2
6	Total Hardness as CaCO <sub>3</sub>	mg/l	413	420	393	460
7	Calcium as Ca	mg/l	76	74	78	84
8	Magnesium as Mg	mg/l	54	57	78	84
9	Copper as Cu	mg/l	0.02	0.03	0.02	0.02
10	Iron as Fe	mg/l	0.07	0.06	0.08	0.06
11	Manganese as Mn	mg/l	<0.01	<0.01	<0.01	<0.01
12	Chlorides as Cl	mg/l	344	345	338	350
13	Total alkalinity	mg/l	296	296	294	313
14	Sulphates as SO <sub>4</sub>	mg/l	30	30	32	38
15	Nitrate as NO <sub>3</sub>	mg/l	9.5	11.3	10.9	11.45
16	Fluoride as F	mg/l	1.0	0.5	0.75	0.5
17	Phenols as C <sub>6</sub> H <sub>5</sub> OH	mg/l	<0.001	<0.001	<0.001	0.001
18	Mercury as Hg	mg/l	<0.001	<0.001	<0.001	0.001
19	Cadmium as Cd	mg/l	<0.01	<0.01	<0.01	<0.01
20	Selenium as Se	mg/l	<0.01	<0.01	<0.01	<0.01
21	Arsenic as As	mg/l	<0.05	<0.05	<0.05	<0.05
22	Cyanide as CN	mg/l	<0.05	<0.05	<0.05	<0.05
23	Lead as Pb	mg/l	<0.05	<0.05	<0.05	<0.05
24	Zinc as Zn	mg/l	0.83	0.68	0.7	0.9
25	Chromium as Cr+6	mg/l	0.02	0.01	0.03	0.01
26	Mineral Oil	mg/l	-	-	-	-
27	Residual Free chlorine	mg/l	0.05	0.09	0.08	0.06
28	Total coliforms	MPN/100ml	-	-	-	-
29	E-coli	MPN/100ml	-	-	-	-
30	Total Dissolved Solids	mg/l	1060.8	1063	1050	1105

The parameters for the ground water analysis are expressed in mg/l except pH and found to be within the permissible limits. Some of the compounds have the minimum value as mentioned below.

NOTE: All the parameters are in mg/l except pH

BDL= Below Detectable Limit

Detection limit for Phenolic Compound (as C<sub>6</sub>H<sub>5</sub>OH) = 0.001

Detection limit for Iron (as Fe) = 0.08

Detection limit for Chromium (as Cr) = 0.03

Detection limit for Copper (as Fe) = 0.04

Detection limit for Sulphide (as H<sub>2</sub>S) = 0.1



**Table 3.11: Analysis report For Surface water samples:**

No.	Characteristics	Amarapura	Charada	Units	IS: 2296 limits
1	Colour	1.0	1.0	Hazen	300
2	Odour	Unobj.	Unobj.	--	--
3	Taste	Agr.	Agr.	--	--
4	pH	7.5	7.8	--	6.5-9.0
5	Conductivity			µmhos/cm	--
6	DO	5	6	mg/l	4
7	COD	15	21	mg O <sub>2</sub> /l	-
8	BOD(3 days at 27 <sup>0</sup> C )	2	3	mg O <sub>2</sub> /l	3
9	TDS	1385	1424	mg/l	1500
10	Oil & Grease	Absent	Absent	mg/l	0.1
11	Mineral Oil	Absent	Absent	mg/ l	--
12	Free Carbon Dioxide			mg/l	--
13	Free Ammonia	0.4	0.5	mg/l	--
14	Cyanide	Absent	Absent	mg/l	0.05
15	Phenol as C <sub>6</sub> H <sub>5</sub> OH	Absent	Absent	mg/l	0.005
16	Total Hardness as CaCO <sub>3</sub>	310	371	mg/l	--
17	Chlorides as Cl	430	510	mg/l	600
18	Sulphate as SO <sub>4</sub>	79.5	95.2	mg/l	400
19	Nitrate as NO <sub>3</sub>	38.4	24.8	mg/l	50
20	Fluoride as F	0.5	0.75	mg/l	1.5
21	Calcium as Ca	68.1	72.4	mg/l	--
22	Magnesium as Mg	44.6	64.2	mg/l	--
23	Copper as Cu	N.D. (D.L.=0.04)	N.D. (D.L.=0.04)	mg/l	1.5
24	Iron as Fe	0.4	0.3	mg/l	50
25	Manganese as Mn	N.D. (D.L.=0.02)	N.D. (D.L.=0.02)	mg/l	--
26	Zinc as Zn	6.8	9.4	mg/l	15
27	Boron as B	N.D. (D.L.=0.05)	N.D. (D.L.=0.05)	mg/l	--
28	Barium as Ba	0.5	0.4	mg/l	--
29	Silver as Ag	N.D.	N.D.	mg/l	--
30	Arsenic as As	N.D. (D.L.=0.005)	N.D. (D.L.=0.005)	mg/l	0.2
31	Mercury as Hg	N.D. (D.L.=0.0005)	N.D. (D.L.=0.0005)	mg/l	--
32	Lead as Pb	N.D. (D.L.=0.005)	N.D. (D.L.=0.005)	mg/l	0.1
33	Cadmium as Cd	N.D. (D.L.=0.005)	N.D. (D.L.=0.005)	mg/l	0.01
34	Chromium (VI) as Cr	N.D. (D.L.=0.03)	N.D. (D.L.=0.03)	mg/l	0.05
35	Selenium as Se	N.D. (D.L.=0.001)	N.D. (D.L.=0.001)	mg/l	0.05
36	Anionic Detergents	N.D. (D.L.=0.1)	N.D. (D.L.=0.1)	mg/l/	1
37	PAH	N.D. (D.L.=0.0001)	N.D. (D.L.=0.0001)	g/lit	--
38	Pesticides	N.D.	N.D.	µg/l	--
39	Insecticides	N.D.	N.D.	mg/l	Absent
40	Percent sodium (%)			--	--
41	Sodium Absorption Ratio			meq/l	--
42	Total Coliform	< 2.0	< 2.0	MPN/100	5000

**Table 3.12 DRINKING WATER STANDARDS (IS: 10500)**

No.	Parameters	Units	IS: 10500-1991 Norms	
			Desirable	Permissible
1	Colour	Hazen	5	25
2	Odour	--	Unobj.	Unobj.
3	Taste	--	Agr.	Agr.
4	Turbidity	NTU	5	10
5	pH value	--	6.5 to 8.5	NR
6	Total Hardness (as CaCO <sub>3</sub> )	mg/l	300	600
7	Iron (as Fe)	mg/ l	0.3	1.0
8	Chlorides (as Cl)	mg/ l	250	1000
9	Residual, free chlorine	mg/ l	0.2	--
10	Dissolved solids	mg/l	500	2000
11	Calcium (as Ca)	mg/l	75	200
12	Magnesium as Mg	mg/l	30	100
13	Copper (as Cu)	mg/l	0.05	1.5
14	Manganese (as Mn)	mg/l	0.10	0.3
15	Sulfate (as SO <sub>4</sub> )	mg/l	200	400
16	Nitrate (as NO <sub>3</sub> )	mg/l	45	100
17	Fluoride (as F)	mg/l	1.0	1.5
18	Phenolic Compounds (as C <sub>6</sub> H <sub>5</sub> OH)	mg/l	0.001	0.002
19	Mercury (as Hg)	mg/l	0.001	NR
20	Cadmium (as Cd)	mg/l	0.01	NR
21	Selenium (as Se)	mg/l	0.01	NR
22	Arsenic (as As)	mg/l	0.05	NR
23	Cyanide (as CN)	mg/l	0.05	NR
24	Lead (as Pb)	mg/l	0.05	NR
25	Zinc (as Zn)	mg/l	5	15
26	Anionic detergents (as MBAS)	mg/l	0.2	1.0
27	Chromium (as Cr <sup>6+</sup> )mg/L	mg/l	0.05	NR
28	Polynuclear Aromatic Hydro carbons (as PAH)	g/lit	--	--
29	Mineral Oil	mg/l	0.01	0.03
30	Pesticides mg/l	mg/l	Absent	0.001
31	Alkalinity	mg/l	200	600
32	Aluminium (as Al)	mg/l	0.03	0.2
33	Boron	mg/l	1	5
34	Coliforms	MPN/100ml	-	10

NOTE: All the parameters are in mg/l except Turbidity, Color, pH

### 3.3.3 SOIL ENVIRONMENT

Soils may be defined as a thin layer of earth crust that serves as a natural medium for the growth of the plants. It is the unconsolidated minerals factors. Soil serves as a reservoir of nutrients of plants and crops. It also provides mechanical anchorage and favorable filth.

#### 3.3.3.1 Soil Characteristics

Samples of soils were collected from different appropriate locations during the study period and these locations are shown in Fig. 3.2. The values of important physical and chemical parameters of theses soil samples are given in Table 3.13. From the tabulated values, the following conclusions can be made about the physical and chemical characteristics of these soil samples.

**Table 3.13 Soil Analysis in the Study Area**

No	Parameters	Project site	Solaiya	Amarapura	Bapupura	Itadara	Charada	Dhameda	Units
1	EC								(uS/cm)
2	pH	7.6	7.4	7.2	7.3	7.4	7.1	7.4	--
3	Nitrogen as N	159	126	182	178	105	146	135	(mg/kg)
4	Phosphorus as PO <sub>4</sub>	162	149	134	118	157	184	139	(mg/kg)
5	Potassium as K	45	79	82	61	49	71	42	(mg/kg)
6	Organic Carbon	3.5	2.4	1.8	2.5	3.2	1.4	2.6	(mg/kg)
7	Calcium as Ca	0.06	0.11	0.09	0.08	0.08	0.096	0.096	(mg/100 gm)
8	Magnesium as Mg	0.038	0.048	0.029	0.038	0.019	0.068	0.029	(mg/100 gm)
9	Sodium as Na	14.5	10.2	13.4	12.5	15.2	9.4	12.8	(mg/100 gm)
12	Sulphate as SO <sub>4</sub>	17.2	12.8	10.7	16.5	8.4	12.5	7.3	(mg/100 gm)
13	Bulk Density	2.90	3.54	1.84	2.45	1.84	3.1	1.8	(gm/cc)

NOTE:1. All Parameters are expressed in mg/gm except pH

2. BDL: Below Detectable Limit

3. Detection Limit for Copper (as Cu) = 0.04 mg/kg

4. Detection Limit for Nickel (as Ni) = 0.01 mg/kg

**Observation:**

As per the soil analysis data range for parameter like pH, total hardness, calcium, Magnesium and Chloride is 7.1-7.6, 0.16-0.28, 0.06-0.11, 0.019-0.048 and 1.84-3.55 respectively. All the metal content is not detectable during sampling.

**3.3.4 NOISE ENVIRONMENT:**

The Study area comprises of rural area followed by industrial zone. The sources of noise pollution are mechanical equipment of the industries in addition to heavy vehicular traffic in the industrial estate and on the highway. The Ambient Noise Levels in the study area are on higher side compared to residential zone. The site study was undertaken for assessing the noise levels in decibels at 7 locations in the study area. The Noise levels of the study area are compared with the noise level standards.

**Table 3.14 Noise Level national Standards**

Sr. No.	Category of Area	Limits in dB	
		Day Time 6.00 AM to 10.00 PM	Night Time 10.00 PM to 6.00 AM
1.	Industrial Area	75	70
2.	Commercial Area	65	55
3.	Residential Area	55	45
4.	Silence Zone i.e. Hospital, Educational Institutes etc.	50	40

The analysis results of noise level within the study area are shown below Table 3.15.

**Table 3.15 Ambient Noise Level in the Study Area****Hourly Noise data (Day and Night timings in  $L_{eq}$  dB(A))**

Site code->	N-1	N-2	N-3	N-4	N-5	N-6	N-7
Day Hours							
06:00 - 07:00	47.5	53.9	57.1	53.6	76.3	52.6	61.7
07:00 - 08:00	52.4	51.7	52.4	71.5	52.2	57.1	43.6
08:00 - 09:00	49.4	42.5	71.5	65.2	47.5	64.5	58.2
09:00 - 10:00	53.9	64.7	64.8	45.3	54.6	43.1	42.1
10:00 - 11:00	67.5	58.3	52.1	67.5	58.4	46.4	55.2
11:00 - 12:00	59.2	65.1	49.7	59.1	49.6	69.5	47.2
12:00 - 13:00	77.5	68.2	68.7	55.9	46.8	58.1	52.1
13:00 - 14:00	68.9	84.6	58.2	70.4	54.7	41.7	80.7
14:00 - 15:00	81.5	56.9	42.5	55.4	55.7	69.7	82.5
15:00 - 16:00	74.5	52.4	56.9	46.4	52.4	87.4	68.1
16:00 - 17:00	56.8	47.5	72.5	40.9	47.2	51.2	55.2
17:00 - 18:00	86.3	51.8	57.4	81.1	50.1	71.6	65.1
18:00 - 19:00	71.8	42.1	78.3	78.2	41.7	68.1	56.4
19:00 - 20:00	65.2	64.8	52.6	64.3	68.1	41.3	48.1
20:00 - 21:00	57.1	69.2	48.2	55.9	41.9	59.6	52.5
21:00 - 22:00	49.4	41.3	41.9	48.5	52.1	54.8	49.2
Minimum	47.5	41.3	41.9	40.9	41.7	41.3	42.1
Maximum	86.3	84.6	78.3	81.1	76.3	87.4	82.5
$L_{Day}$	63.68	57.19	57.80	59.95	53.08	58.54	57.37
Day Limits	75	55	55	55	55	55	55
Sampling date	5-10-11	5-10-11	5-10-11	5-10-11	5-10-11	5-10-11	5-10-11
Night Hours							
22:00 - 23:00	39.7	49.5	56.3	53.9	48.4	36.8	46.8
23:00 - 24:00	43.8	58.1	49.7	48.5	38.9	51.2	36.5
24:00 - 01:00	68.4	43.6	42.1	46.5	47.2	44.6	56.4
01:00 - 02:00	51.9	62.1	49.3	58.3	40.2	32.9	40.6
02:00 - 03:00	59.4	40.5	39.8	41.8	44.5	38.6	42.5
03:00 - 04:00	71.5	35.2	43.8	45.1	51.2	46.8	49.1
04:00 - 05:00	56.8	42.8	59.6	47.6	48.5	38.4	37.5
05:00 - 06:00	75.2	54.2	47.2	51.8	54.5	42.5	49.1
Minimum	39.7	35.2	39.8	41.8	38.9	32.9	36.5
Maximum	69.5	62.1	59.6	58.3	54.5	51.2	56.4
$L_{Night}$	58.83	52.47	50.78	52.49	49.53	49.17	49.80
Limits	70	45	45	45	45	45	45
$L_{D/N}$	1.05	1.39	1.37	1.29	1.03	1.30	1.26
Sampling date	5-10-11	5-10-11	5-10-11	5-10-11	5-10-11	5-10-11	5-10-11
Area type	Project site	Near village	Near village	Near village	Near village	Near village	Near village

N-1	Project site	N-5	Itadara
N-2	Solaiya	N-6	Charada
N-3	Amarapura	N-7	Dhameda
N-4	Bapupura		

Note:

Day time: 6.00 a.m. to 10.00 p.m.,

Night time: 10.00 a.m. to 6.00 a.m.

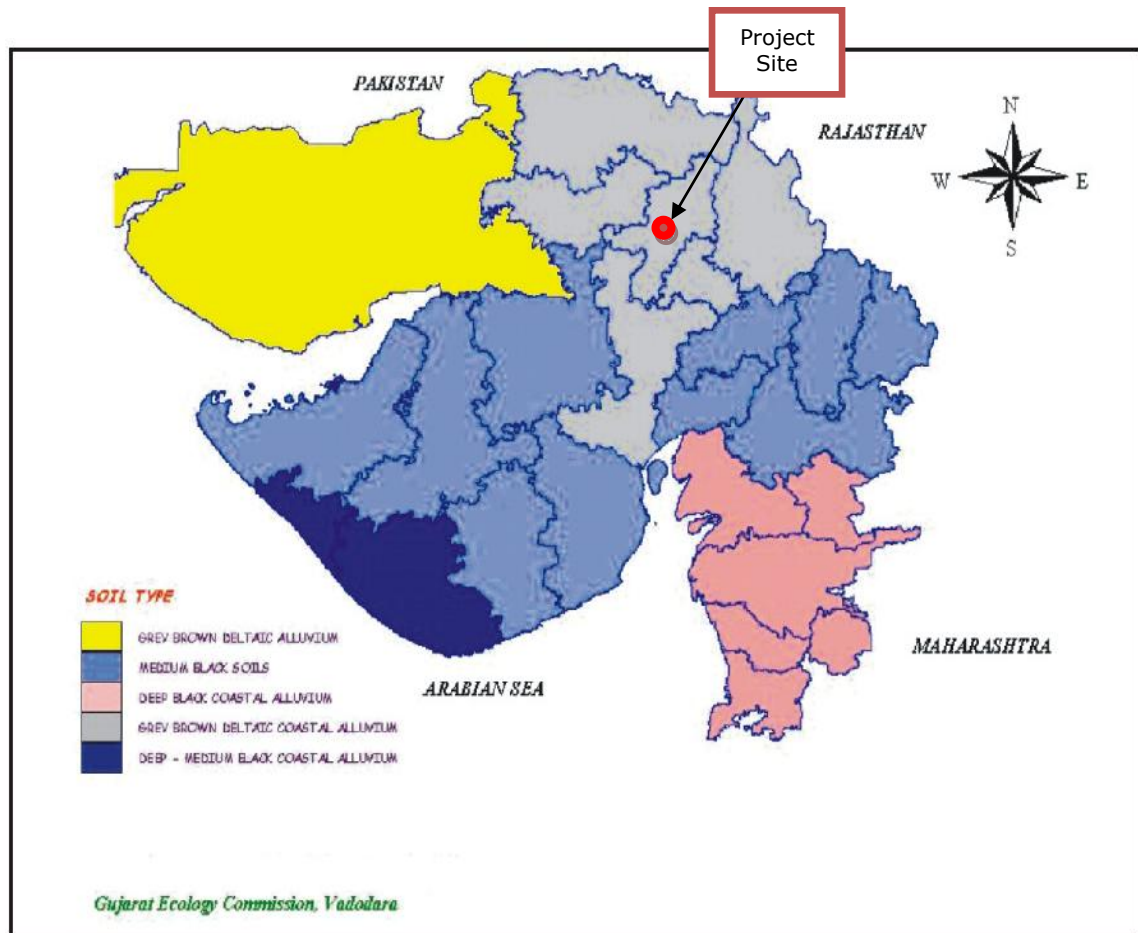
**Observation:**

The analysis report as per above table shows that the noise level in the study area is in permissible limit.

**3.3.5      TOPOGRAPHY & LAND USE PATTERN:****3.3.5.1 TOPOGRAPHY**

The soil of Gandhinagar district is alluvia plain with elevations ranging from 40 to 50 m MSL. The area is under laid by post Miocene alluvium comprising sand, gravel, silt and clay. The alluvium is about 400 m thick under laid by tertiary formation. The alluvium mainly consists of paleo deltaic, fluvial and Aeolian sediments, comprising alternate bands of fine to coarse grained sand, gravel and yellowish brownish sticky clay. There is no wild life century and forest. There is fertile Agriculture land.

The map showing soil types of Gujarat is as under:



In Gandhinagar district, the average rainfall of last ten years is 810 mm. Sabarmati Main river, which originates from Aravalli Ranges of Rajasthan and meeting to sea in the bay of Cambay.

River Sabarmati is one of the major West flowing river of Gujarat is passing through the study area. In the study area water table is around 30 m or more. The source of water in the study area is mainly tap water supplied by government. The others source of waters are tube well, hand pump, well water and canal.

### 3.3.5.2 Land use pattern

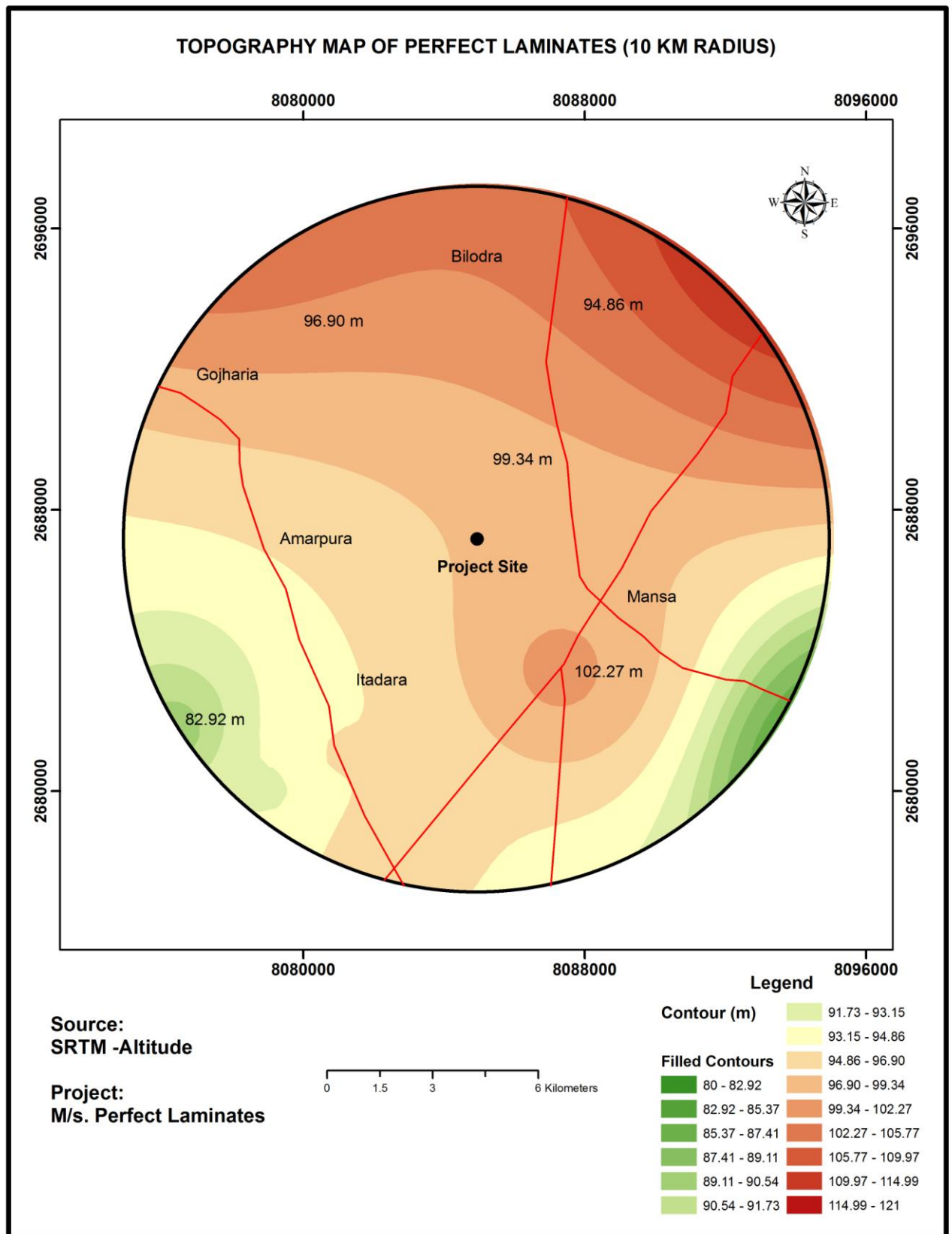
Land Cover inventories from an essential Component in land resource evaluation and environmental studies land use in general, shows the human beings activities on land, whereas the word land cover indicates the vegetation, agricultural and artificial manmade structures covering the land surfaces.

To determine the baseline land use pattern at and around the project site, the required data have been obtained from Census Handbook of District Gandhinagar (2001) Part XII – A & B, Series 25.

To determine land uses land cover pattern in the study area based on satellite image the remote Sensing method is used because of having capacity to provide synoptic and repetitive data at different scale It provides unique opportunity to study the assessment of distribution and condition of land use and land cover.



Drawing no. 3.5 Topography map within the study area



**A. Land use as per Census Record**

In order to evaluate existing land use patterns, an area covered with in 5 km. radius with proposed project site of M/s. Perfect Laminate

In census records, major land use classifications are Forests, Cultivable Area, Cultural Wasteland and Area not available for cultivation. Cultivable land is further classified as: irrigated and un-irrigated. Area not available for cultivation includes lands put to non-agriculture use as well as barren and uncultivable lands.

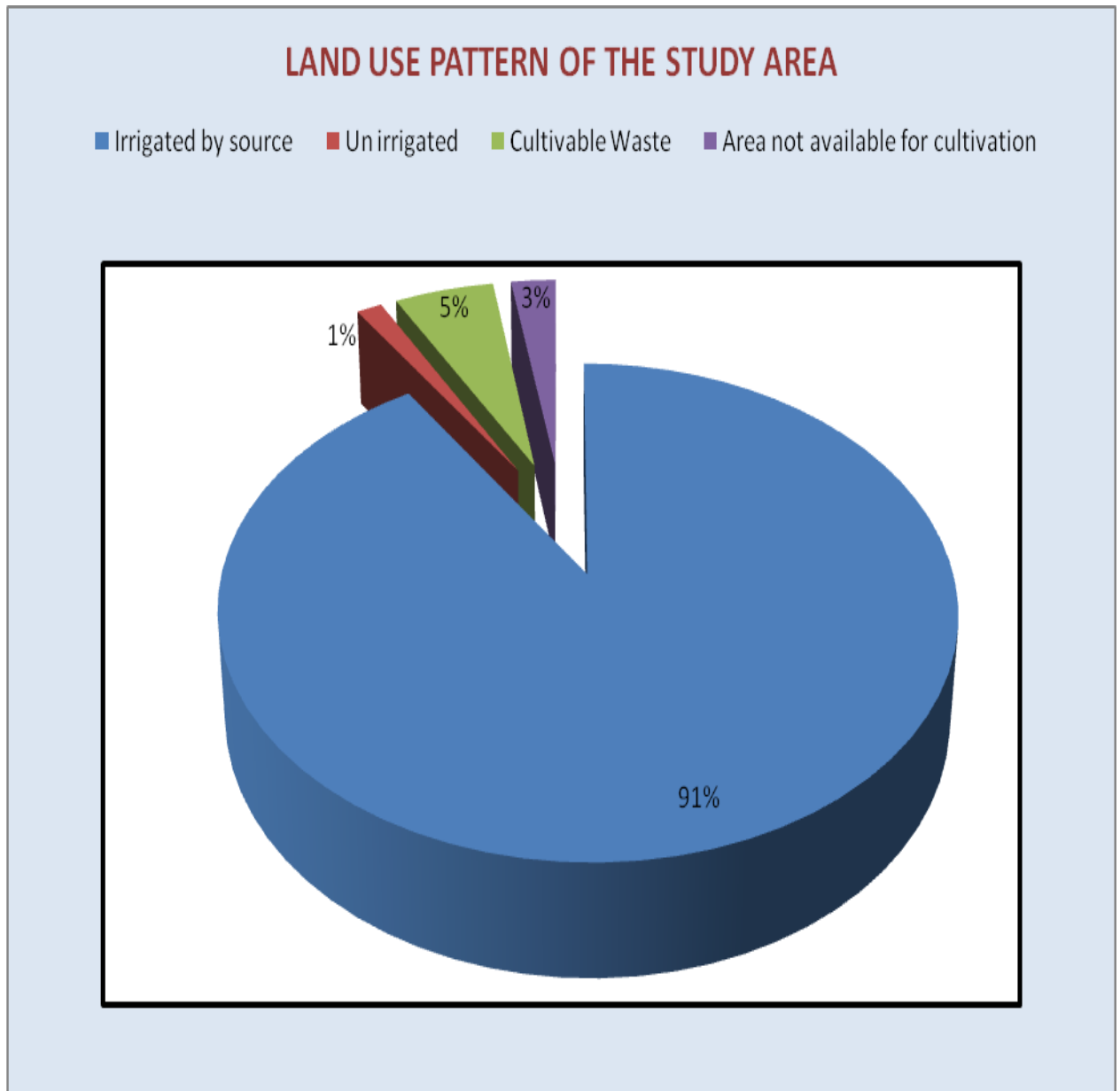
The main land use in urban areas is for dwelling, infrastructures and related activities. These are primarily based on 2001 Census (Gandhinagar District) are presented in Table 3.16.

Table 3.16 Land Use Pattern

Sr. No.	Name of Village	Total Area of the Village	Irrigated by source	Unirrigated	Cultivable Waste	Area not available for cultivation
<b>Taluka: Mansa , District : Gandhinagar</b>						
1.	<b>Solaiya</b>	544.9	TWE(497.4) T(497.4)	--	35.6	11.9
2.	<b>Itadra</b>	999.3	TWE(936.3) T(936.3)	6.4	40.0	16.5
3.	<b>Kharna</b>	980.1	TWE(686.4) T(686.4)	89.7	87.3	116.7
4.	<b>Amarpura</b>	211.9	TW(199.8) T(199.8)	--	11.4	0.7
5.	<b>Samou</b>	1441.6	TWE (1298.4) T (1298.4)	10.0	127.5	1.8
6.	<b>Padusma</b>	609.9	TWE (537.9) T (537.9)	--	53.1	18.9
7.	<b>Charada</b>	1766.6	TW(45.0) TWE(1476.3) TK(200.0) T(1721.3)	--	34.8	10.6
8.	<b>Dhameda</b>	508.9	TWE(472.9) T(472.9)	--	35.8	0.2
9.	<b>Bapupura</b>	404.1	TW(7.6) TWE(369.6) T(377.3)	--	19.6	7.2
10.	<b>Fatehpura</b>	189.3	TWE(185.7) T(185.7)	--	2.5	1.2
11.	<b>Gulabpura</b>	152.7	WE(100.0) TW(43.0) T(143.0)	--	8.1	1.6

NOTE: The area's are in Hector

Sr. No.	Type Of Land	Area , Ha	% Distribution
1	Irrigated by source	7056.1	91
2	Un irrigated	106.1	1
3	Cultivable Waste	455.7	5
4	Area not available for cultivation	187.3	3
5	Forest	4.0	0.05
Total		7809.2	100

**Drawing 3.6 Land use pattern of the study area**

## B. Land use as per Satellite Imagery

The land-use & land cover map of the 10 km radial study area from the project site has been prepared using IRS P6 LISS III satellite image with reference to NRSC Image. Land use pattern of the study area as well as the catchment area was carried out by standard methods of analysis of remotely sensed data and followed by ground truth collection and interpretation of satellite data. The outcome of land use study has been presented below in subsequent table and figures. The Land use map of the 10 Km study area is presented in Drawing 3.8.

Fig. 1: Flow chart showing the general methodology adopted in the study area



### Land use & land cover Classification results

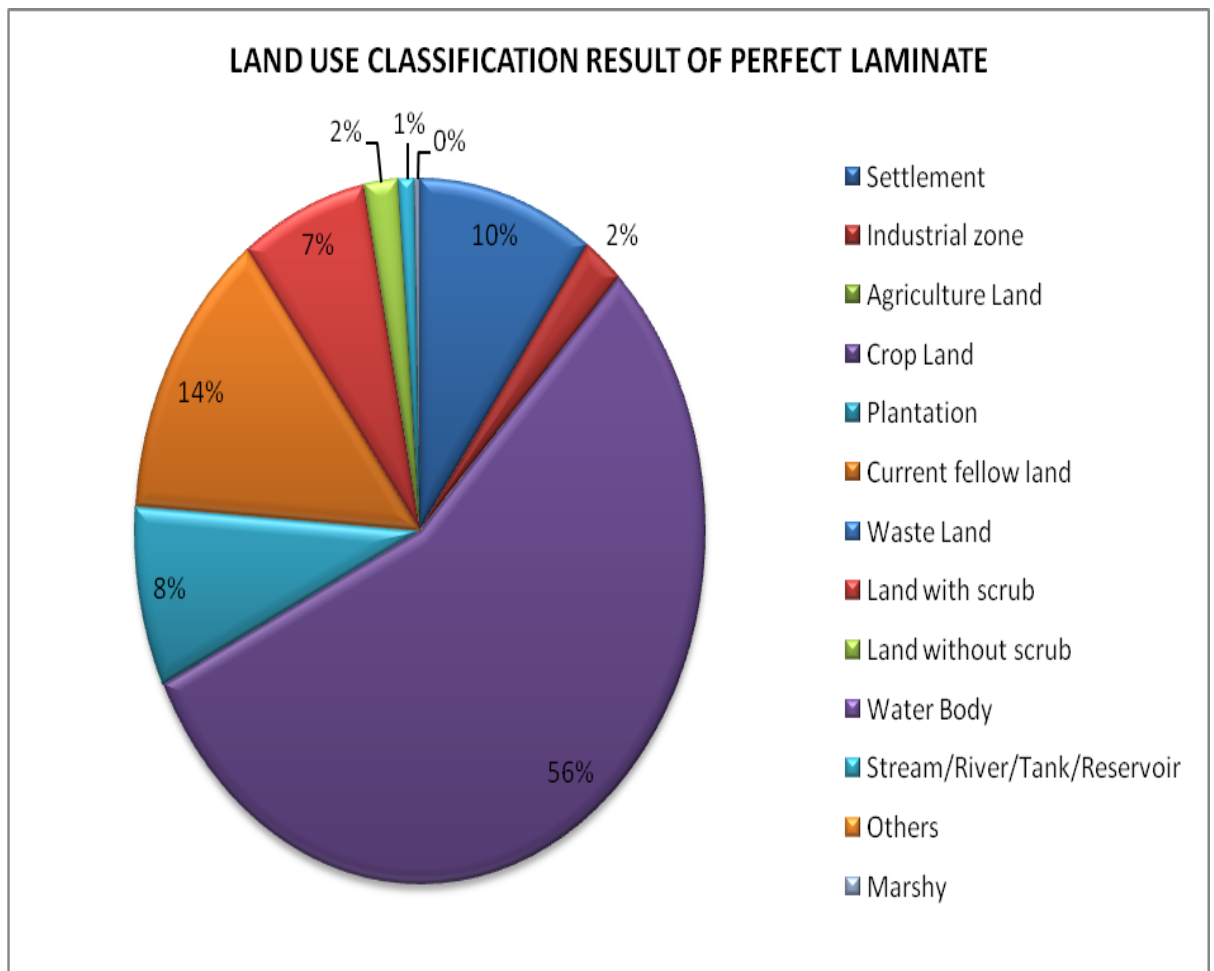
A total of nine land use/land cover classes have been demarcated in the study area following Level III classification (Table 3.17). A thematic map suitable for 1:50,000 scale map generation incorporating these classified categories has been prepared and considering that the area of the project is considerably small a large scale map is prepared (Drawing. 3.8). The area as a whole represents a plain drained by a number of east flowing canal which debouche into the (Narmada canal) canal that flows from east to west in the northern margin middle of the project site. Large crop land covered for 55.61% of the total area and water body area 0.92% of the total area and 14.5 % land with & without scrub has developed mainly in the area adjacent to the study area. The exposed part of side bars and channel bars and dried up channel beds constitute this category of land cover (Drawing 3.7, Table 3.17).

The agricultural land constitutes the dominant category of land use covering as much as 77.42 % of the total area (Table 3.16). Active channels of the Narmada canal covers about 0.92 % of the total study area. The consistently shifting nature of the eastern part to western part bank migration has resulted in large uncultivated & rural settlement along the active plain area towards the site location. The project site is located within the current fallow land area significant distribution. The land use for settlement is mostly confined to the 'rural settlement' (built up-rural) 9.94%, Industrial area 2.33% & marshy land of feature 0.3 % of the total area and scattered along the road networks.

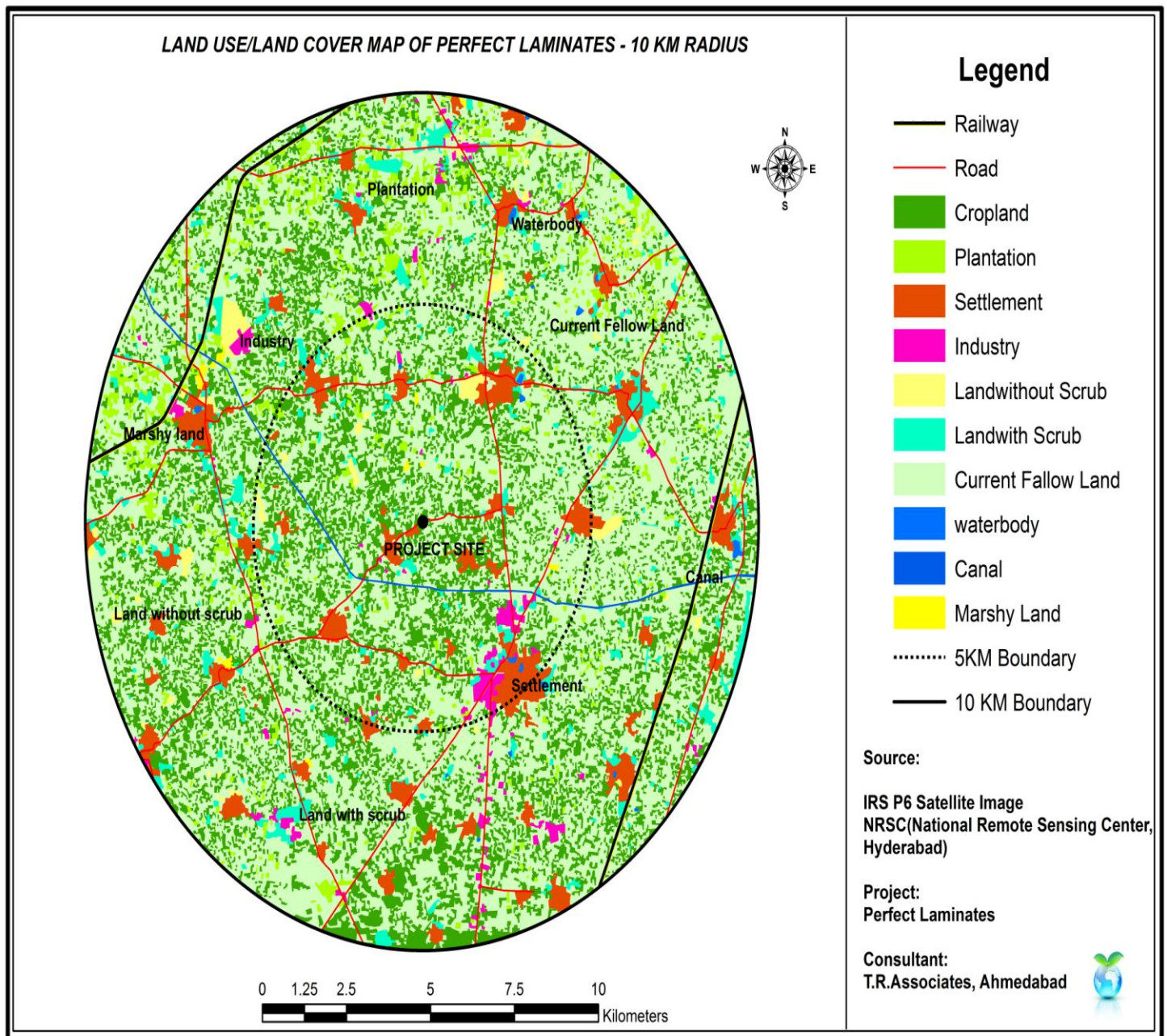
**Table no. 3.17 LAND USE CLASSIFICATION**

Land use	Area (sq km)	Percent (%)
Build-up-land		
Settlement	15.9	9.94
Industrial zone	3.72	2.33
Agriculture Land		
Crop Land	88.97	55.61
Plantation	13.2	8.25
Current fellow land	21.69	13.56
Waste Land		
Land with scrub	11.47	7.17
Land without scrub	3.12	1.95
Water Body		
Stream/River/Tank/Reservoir	1.47	0.92
Others		
Marshy	0.48	0.3
Total	160	100

**Drawing no.3.7 Chart showing Land use/ Land cover within study area of 10 km. radius area as per satellite imagery**





**Drawing No. 3.8 Land Use Map Within Study Area Of 10 Km. Radius Area as Per Satellite Imagery**

### 3.3.6 GEOLOGY & HYDROLOGY:

#### (1) Introduction:-

Rapid urban, growth and its continuous expansion around Mansa Town, Dist. Gandhinagar has created problems related to water supply, Sewerage/ effluent disposal leading to ground water depletion and pollution. The present report in corporate hydro geology and ground water scenario based on the scientific information with special reference to Recharge Activity around Mansa town to envisage appropriate remedial measures keeping environmental impact of Mansa development in view.

#### (2) Geology:-

The area forms part of North Gujarat Alluvial Plain with elevations ranging from 40 to 50 m MSL. The area is under laid by post Miocene alluvium comprising sand, gravel, silt and clay. The alluvium is about 400 m thick under lain by tertiary formation. The alluvium mainly consists of palaeo deltaic, fluvial and Aeolian sediments, comprising alternate bands of fine to course grained sand, gravel and yellowish brownish sticky clay.

#### (3) Land / Soil Characteristic :-

The sub soil condition below the existing ground level is almost uniform in nature. Sub soil is composed of Clay mixed with little fine grained silty sand, moram and Kankar with low resistivity due to clay and soil moisture. The area is covered with recent to sub recent alluvial deposits comprising of brownish clay mixed with little fine grained sand, silty sand. The Soil below ground level consist of top silty low plastic soil layer having no swelling nature. Blockish brown to yellowish brown clayey silt or sand silt layer extends to the depth of 2 to 3 mts.

#### (4) Rain Fall:-

The average annual rainfall (1980 to 1990) is 1691 mm. (10 years) average rain fall of (1991 to 2000) 10 years is 810 mm and average rain

fall of last 10 years is 806 mm contributed mainly by Southwestern monsoon active from June to Mid September. Long term average of rainfall for 30 years is 1102 mm.

**(5) Climate :-**

The climate of the area is semi arid and is characterized by a hot summers. May is the hottest month with mean daily maximum temperature of 14.3 °C. The area has semi arid climate with drought frequency of 34%.

**(6) Geohydrology :-**

The litho logical logs of exploratory bore holes, electrical logging results by govt. agencies in and around Mansa taluka have been studied to understand the subsurface geology and the aquifer system. These bore holes have penetrated the thick sequence of post Miocene sediments down to 300 + m depth.

The hydro geological cross sections have been prepared by CGWB to study the subsurface geology and aquifer system in the area. It reveals that the existence of multilayered aquifer system, within a depth of 300 + m bgl. In general three distance confined aquifer with thickness very from 12 to 30 m can be identified. The aquifer lie between,

- 45 to 90 m
- 100 to 180 m
- 180 to 260 m bgl, Separated by clays.

**(7) Ground Water Condition:-**

In the area under investigation, ground water occurs both under phreatic and confined condition in arenaceous horizons. The occurrence and movement of ground water is mainly controlled by primary porosity of intergranular pore spaces. Ground water is being developed extensively by means of Tube well from deep confined aquifers for water supply both in domestic, industrial and agricultural sector.

**(8) Depth of Ground Water Table:-**

Shallow aquifer (Phreatic) development (up to 30m depth) in the area is limited due to rapid urbanization inferior quality and low yields. Based on the data available, it is observed that depth of open wells ranges from 10 to 30 mts. bgl where as depth of shallow bores/HP in general ranges from 20 to 50 m bgl. Depth of water level in these wells ranges from 10 to 50 mts. yield of wells is moderate.

**3.3.7 ECOLOGICAL ENVIRONMENT****3.3.7.1 ABSTRACT**

The present work enumerates on true environment impact assessments of Mansa taluka & Gandhinagar District. However some plants & animals species can grow in different area. Here the diversity of plants & animals is due to availability of different types of habitats.

**3.3.7.2 AREA & TIME PERIOD FOR STUDY**

The baseline study for the floral & faunal biodiversity of the terrestrial environment within 5 km. from the project site, located near Mansa taluka was conducted during November 2011.

**Table: 3.18 List of Villages covered during baseline study**

S.No.	Name of Village	Distance from project site	District
1	Project site	--	Gandhinagar
2	Solaiya	1.0 km	
3	Amarapura	3.8 km	
4	Bapupura	2.8 km	
5	Itadara	3.9 km	
6	Charada	4 km	
7	Dhameda	2.6 km	

### 3.3.7.3 METHODOLOGY

The integrated assessment Framework also seems to address the need to optimize the benefits of using the best Scientific Techniques given the constraints of Financial, data, time and skill likely to be faced. It provides practical advice on choosing the appropriate methodology and conducting an integrated assessment study. And finally it stresses the need for a multidisciplinary team as well as the importance of the collecting and using ecological and ecosystem services data so as to enhance understanding of its functioning.

**TABLE – 3.19 List of Plants, Birds and Mammals sighted within study area**

Plants	Tree	10 meter radius circular plot
	Shrubs	10 meter radius circular plot
	Herbs	1 meter x 1 meter square plot
Birds	Terrestrial	Point centered quadrat in 10 meter radius
	Aquatic	Total count & Folk count
Mammals	Direct Count	Line transect and Round transect
	Indirect evidence	Surveys in the villages with the help of pictorial representation

### 3.3.7.4 TOPOGRAPHY DIVERSITY OF THE STUDY AREA

Topography of the region was characterized by agricultural fields & also industries. Fallow land and barren lands were less observed near project site. Several species of Trees were observed at project site. There was no any Eco Fragile Zone or Natural Forest Observed near project site in study area.

### 3.3.7.5 FLORAL DIVERSITY OF THE STUDY AREA

A detailed floral diversity based on the field survey conducted in the study area was carried in November– 2011. That time we get general pattern of vegetation of this region during the study period. The general observation of the site visit is that all species encountered are quite common found everywhere. No endangered and rare species were observed

In this site, on the road side barren land of this area was occupied by Baval, Limbdo, Bakan Limdo, Thor.

### (i) TREES

Trees encountered during the present survey are given in the following table: 3.20

**TABLE - 3.20 DOMINANT TREES SPECIES IN THE STUDY AREA**

Sr. No.	Family	Scientific name	Local name
1	Annonaceae	<i>Polyathia longifolia</i>	Asopalav
2	Bignoniaceae	<i>Tecomella undulate</i> (Sm.)	Rohida
3	Caesalpinioideae	<i>Parkinsonia aculeate</i> L	Rombaval
4	Meliaceae	<i>Azadirachta indica</i> A. juss	Limbado
		<i>Melia azedarah</i> L.	Bakain
5	Fabaceae-Mimosaceae	<i>Acacia Arabica</i> , W	Baval
		<i>Acacia leucophloea</i> (Roxb)	Haribaval
		<i>Prosopis juliflora</i> Dc	Gandobaval
		<i>Leucaena leucocephala</i> (Lam.) De	Goradio babul
		<i>Prosopis cineraria</i> (L) Druce	khijado
6	Moraceae	<i>Ficus benghalensis</i> L	Vad
		<i>Ficus religiosa</i> L	Pipdo
7	Fabeaceae	<i>Butea monosperma</i> (Lam.)	Kesudo
		<i>Derris indica</i> (Lam.)	Karanj
8	Euphorbiaceae	<i>Ricinus communis</i> , L.	Erandi

### SHRUBS

Shrubs encountered during the present survey are given in the Table – 3.21

**TABLE – 3.21 DOMINANT SHRUBS IN THE STUDY AREA**

Sr. No.	Family	Scientific name	Local name
1	Apocynaceae	<i>Thevetia peruviane</i> Merr	Pilikaren
		<i>Nerium indicum</i> Mill	Lal Karen
2	Asclepiadaceae	<i>Calotropis gigantean</i> (L) R.Br	Ankado
		<i>Calotropis procera</i> (Ait) R.Br	Ankado
3	Balanitaceae	<i>Balanites aegyptiaca</i> L.	Agori
4	Euphorbiaceae	<i>Euphorbia nivulia</i> Buch – Ham	Kalli
5	Malvaceae	<i>Gossypium herbaceum</i> L	Kapas
		<i>Hibiscus rosa-sinensis</i>	Jasud
6	Fabaceae	<i>Prosopis juliflora</i> (Sw.) DC	Gando baval
7	Solanaceae.	<i>Datura mete</i> L	Dhaturo



## (ii) HERBS

The herbaceous cover observed in this region is given in the table – 3.22. In this list of herbs, many other herbaceous species are not included which had been dried out and which were without flowers during the monitoring time November – 2011.

**TABLE – 3.22 HERBACEOUS SPECIES OBSERVED IN THE AREA**

Sr. No.	Family	Scientific name	Local name
1	Acanthaceae	<i>Hygrophila auriculata</i> (Schum.)	Kantaro Akaro
2	Amaranthaceae	<i>Amarantus paniculatus</i>	Rajagro
3	Liliaceae	<i>Aloe barbadensis</i> mill	Ghrutakumari
4	Lamiaceae	<i>Ocimum sanctum</i> L	Tulasi
		<i>O. Canam</i> Sims	Rantulsi
5	Poaceae	<i>Triticum aestivum</i> L.	Gahow
		<i>Sorghum bicolor</i> (L)	Jowar
		<i>Zea mays</i>	Makkai
		<i>Pennisetum typhoides</i>	Bajri
6	Solanaceae Fabaceae	<i>Solanum indicum</i> L.	Ringna.
		<i>Cyamopsis psoralioides</i> , D.C.	Gowar
		<i>Solanum tuberosum</i> , L.	Batata
		<i>Nicotiana tabacum</i> , L.	Desi Tamaku
7	Cruciferae	<i>Brassica oleracea</i> Var. <i>capitata</i> , L.	Cobi
		<i>Brassica oleracea</i> Var. <i>botrytis</i> , L.	Fulawar
8	Pedaliaceae	<i>Sesamum indicum</i> , L.	Tal
9	Asteraceae	<i>Tagetes patula</i> , L.	GulgotoOrange
		<i>Tagetes erecta</i> , L.	Gulgoto- Pila

## (iii) CLIMBERS AND TWINERS

The climbers and twiners observed along the agricultural hedges and roadside hedges of the area is given in the table – 3.23

**TABLE – 3.23 DOMINANT CLIMBERS IN THE STUDY AREA**

Sr. No.	Family & Scientific name	Scientific name	Local name
1	Cuscutaceae	<i>Cuscuta reflexa</i> Roxb	Makani
2	Menispermaceae	<i>Cocculus hirsutus</i> (L.) Diels	Vegai

**(iv) CULTIVATED PLANTS IN THE STUDY AREA**

Almost all the villages in the study area were actively engaged in agriculture practice. For irrigation in the non monsoon season the villagers were depending on the village ponds which are filled as temporary storage tank, through canal net work. The agricultural crops, practiced in this area were wheat, Arando, Rice, Bajra and Jowar; generally cultivated immediately after monsoon. But during winter wheat is cultivated as major crop in this part of Gandhinagar District. The other minor crops practiced at few isolated pockets were Arando, Tobacoo, Cabage, Culiflower, Kapas and Rajagro

We are also including here seasonal crops of surrounding area. Almost all the villages in the study area were actively engaged in agriculture practices. In all season include Arando, Kapas, Potato, Tobacoo, Wheat, Bajara, Jower, Makai, Tal, Gavar, Cabage, and Culiflower.

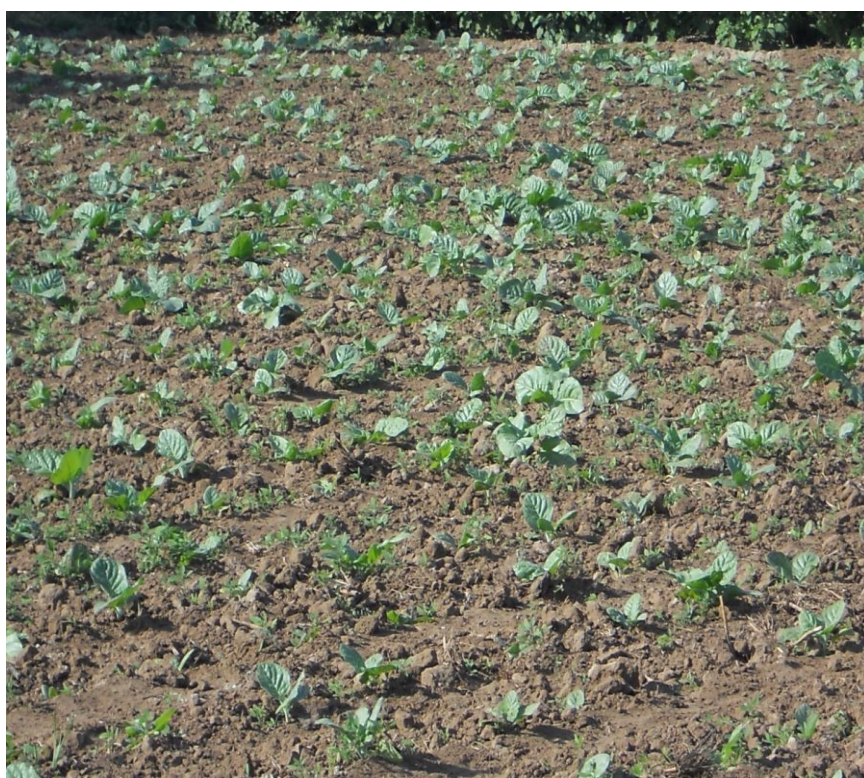


**Kapas**





**Cabbage**



**Tobacco**

### 3.3.7.6 FAUNAL BIODIVERSITY OF THE STUDY AREA

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians and butterfly spp. a baseline survey had been conducted. All together 7 villages were covered for the present biological baseline study with in 5 km radius of the project site. This report is based on short duration study. The following lists are obviously incomplete. It does not include many other species which might occur in this part of district. This data is based on the survey conducted during November, 2011.

**TABLE – 3.24 SYSTEMATIC LISTS OF BIRDS IN THE STUDY AREA**

S.No.	Family	Scientific Name	Local Name
1	Apodidae	Apus apus	Kalo Ababil
2	Accipitridae	Elanus caeruleus	Kapasi
		Accipiter nisus	Badshah Shakro
3	Anhingidae	Anhinga melanogaster	Sarpgri
4	Ardeidae	Bubulcus ibis	Dhor Baglo
		Ardeola grayii	Kani Bagli
5	Ciconiidae	Mycteria leucocephala	Painyed Strok
6	Phalacrocoracidae	Phalacrocorax fuscicollis	Indian shag
		Phalacrocorax niger	Little cormorant
7	Threskiornithidae	Pseudibis papillosa	Kali Kankansar
8	Columbidae	Columba livia	Kabuter
		Streptopelia decaocto	Kanthlavaru Holo / Holo
		Streptopelia orientalis	Rufous turtle Dove
9	Halcyonidae	Halcyon smyrnensis	Safed Chhati Kalkaliyo
10	Meropidae	Merops leschenaulti	Pithakanth pathrango
		Merops persicus	Patrango
11	Rallidae	Amaurornis phoenicurus	Safed Chhati Santakukadi
12	Corvidae	Corvus splendens	Kagad

**TABLE – 3.25 BUTTERFLIES FROM THE STUDY AREA**

S.No.	Family	Scientific name	Local name
1	Papilionidae	Papilio polgtes Linnaeus	Common Mormon
		Pachliopta aristolochiae	Common Rose
2	Pieridae	Eurema hecabe Linnaeus	Common Grass yellow
		Catopsilia Pomona Fabricius	Common Emigrant
3	Nymphalidae	Melanitis leda Linnaeus	Common evening Brown
		Junonia hierta Fabricius	Yellow Orange tip
		Mycalesis perseus	Common bush brown

**TABLE – 3.26 REPTILES IN THE STUDY AREA**

S.No.	Scientific name	Local name
1	Calotes versicolor (Daudin)	Common garden lizard
2	Hemidactylus flaviviridis	House Gecko
3	Varanus benglaensis *	Common Indian monitor
4	Ptyas mucosus(Linn.)	Common rat snake

\*Not sighted but included as per the information provided by villages.

**TABLE – 3.27 MAMMALS FROM THE STUDY AREA**

S.No.	Scientific Name	Common Name
1	Funambulus palmarum (Linnaeus)	Three striped Plam Squirrel
2	Herpestes edwardsi (Geoffory)	Common Mongoose
3	Rattus rattus (Linnaeus)	Common House rat

### **3.3.7.7 STATUS OF THE FOREST, THEIR CATEGORY IN THE STUDY AREA**

No natural forest was observed in the study area.





**Black Ibis**

### 3.3.8 Demographic and Socio-Economic Environment

The demographic and socio – economic details of the study area are discussed below. Data on number of households, population as well as literacy and employment pattern in the study area have been presented in Table – 3.28

The employment pattern in the area is an indicator of number of person employed in various sectors. It also indicates the various categories of employment flourishing in the area. Moreover, data on amenities (educational, medical, communication, etc. facilities) available within the zone of influences has been provided in the Table – 3.29.

**Table No. 3.28 Summary of Socio-Economic Status Demographic Structure**

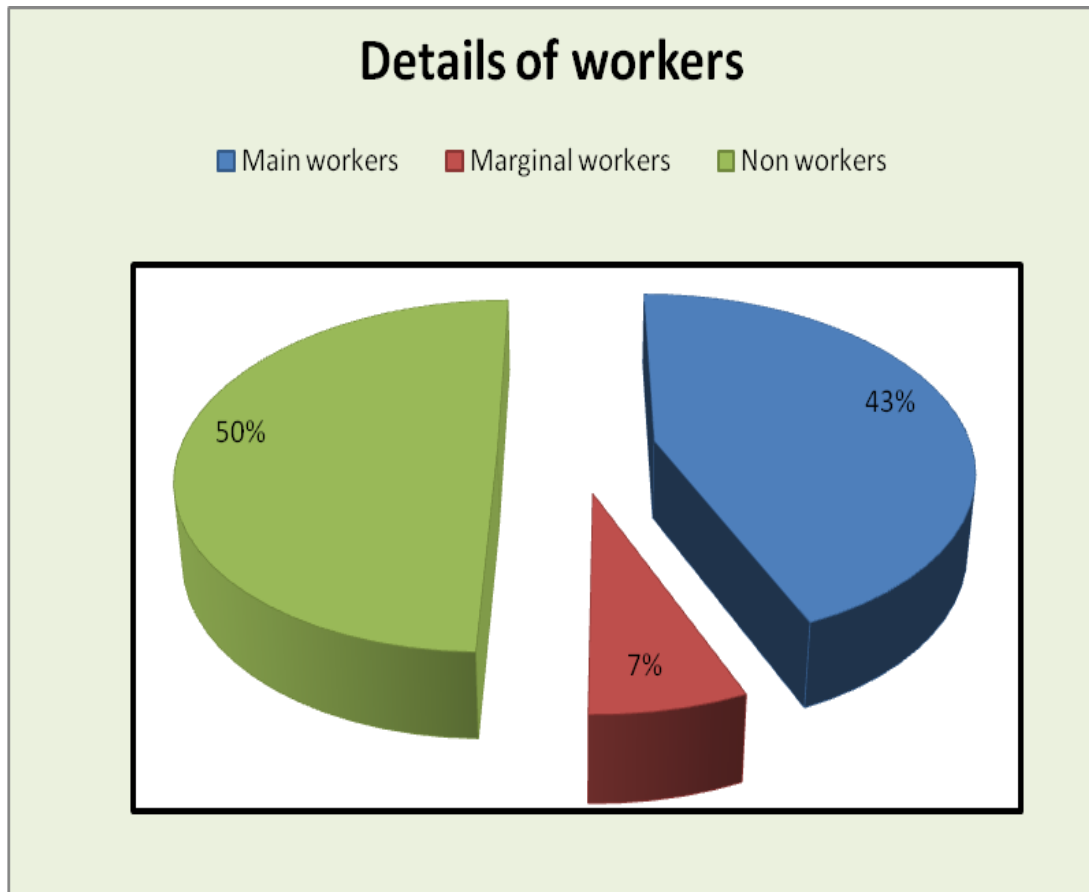
## 1. Population survey:

SNo	Village	Area of Village	No. of Households	Population			Literates	Illiterates
				Male	Female	Total		
1	Solaiya	544.9	826	2188	2068	4256	2949	1307
2	Itadra	999.3	1480	3936	3681	7617	5159	2458
3	Kharna	980.1	606	1397	1428	2825	1836	989
4	Amarpura	211.9	249	676	615	1291	906	385
5	Samou	1441.6	1266	3343	3212	6555	3978	2577
6	Padusma	609.9	668	1559	1536	3095	2243	852
7	Charada	1766.6	2053	5152	4838	9990	6323	3667
8	Dhameda	508.9	610	1629	1515	3144	1551	1593
9	Bapupura	404.1	503	1262	1184	2446	2074	372
10	Fatehpura	189.3	235	619	630	1249	769	480
11	Gulabpura	152.7	262	623	600	1223	901	322

## iii. Distribution of Workers and Non Workers

S.No.	Village	Population	Main Workers	Marginal Workers	Non-Workers
1	Solaiya	4256	1928	420	1908
2	Itadra	7617	2756	1070	3791
3	Kharna	2825	1110	169	1546
4	Amarpura	1291	869	-	422
5	Samou	6555	3006	355	3194
6	Padusma	3095	1506	220	1369
7	Charada	9990	4039	371	5580
8	Dhameda	3144	1375	196	1573
9	Bapupura	2446	1253	58	1135
10	Fatehpura	1249	671	50	528
11	Gulabpura	1223	554	1	668

S.No.	Details of workers	Total Numbers	% Distribution
1	Main workers	19067	43
2	Marginal workers	2910	7
3	Non workers	21714	50
Total		43691	100

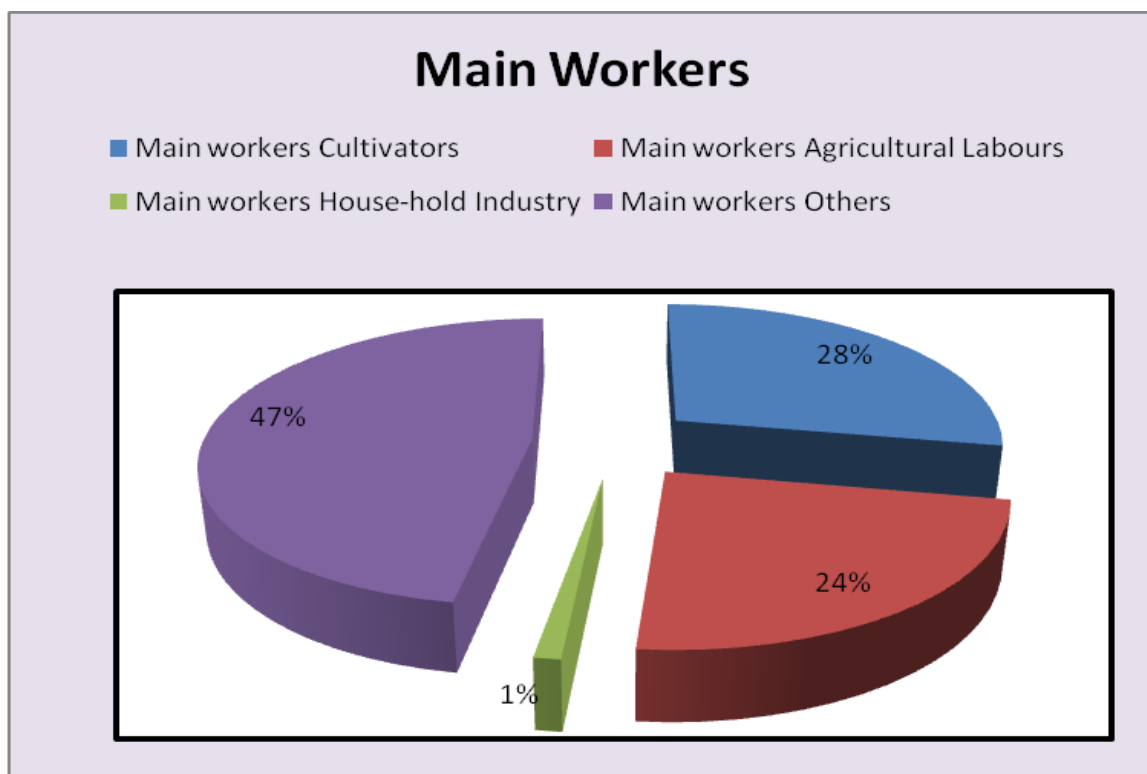
**Drawing no. 3.9 Chart showing worker details in the 5 km. study area**

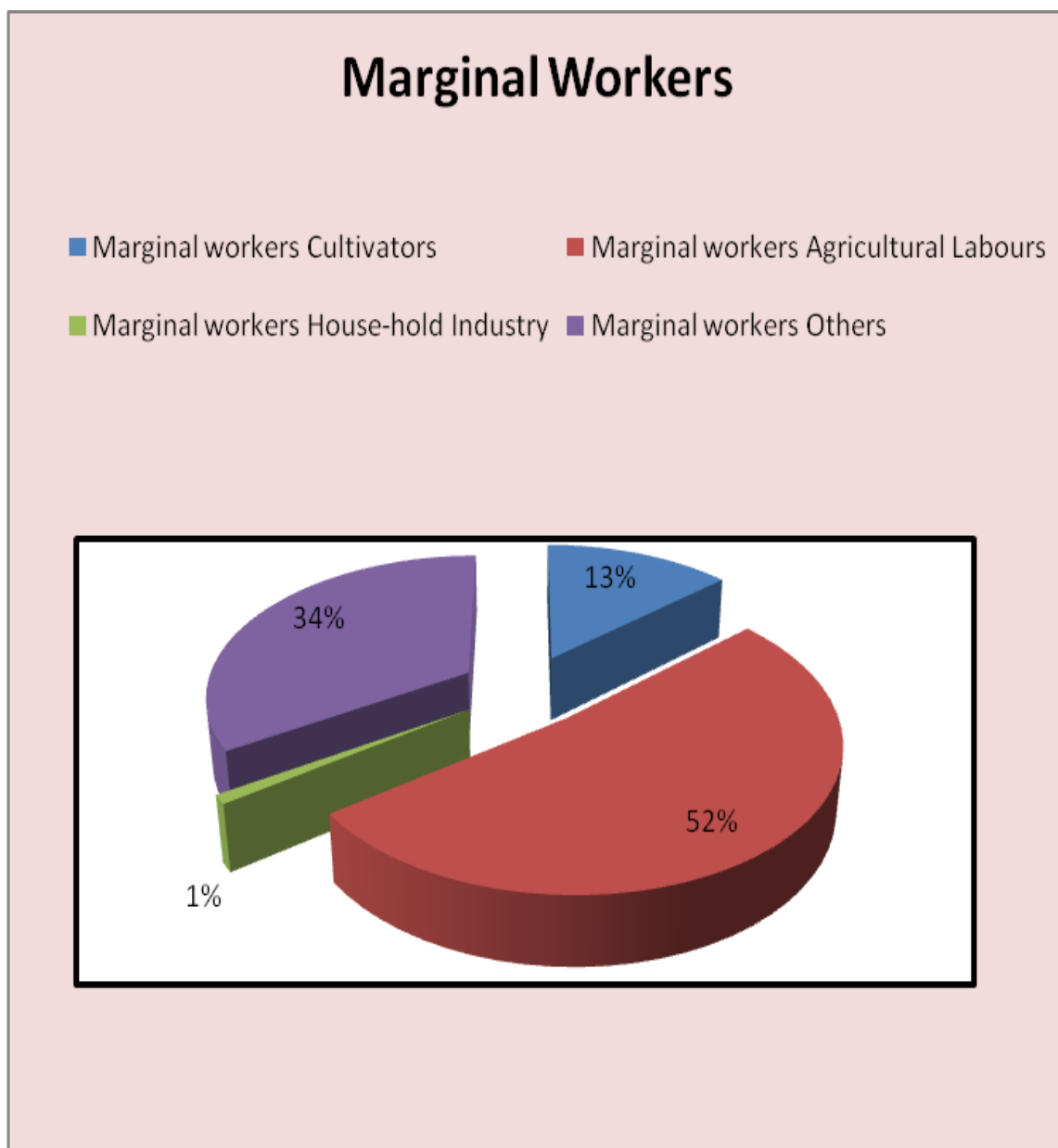
**(3) Distribution of workers in subcategories**

SNo	Village	Main Workers				Marginal Workers			
		Cultivat ors	Agricultu ral Labours	House -hold Indust ry	Othe rs	Culti va tors	Agricu- ltural Labour s	House -hold Indus try	Othe rs
1	Solaiya	734	138	11	1045	146	43	8	223
2	Itadra	766	525	32	1433	45	733	6	286
3	Kharna	240	205	22	643	7	122	2	38
4	Amarpur a	361	78	--	430	--	--	--	--
5	Samou	887	968	10	1141	58	208	--	89
6	Padusma	433	392	21	660	5	6	--	209
7	Charada	926	1018	100	1995	93	223	8	47
8	Dhameda	243	640	2	490	1	139	1	55
9	Bapupur a	480	123	13	637	15	12	3	28
10	Fatehpur a	121	280	--	270	23	14	--	13
11	Gulabpur a	129	140	1	284	--	--	1	--

Main workers				Marginal workers			
Cultivator s	Agricultura l Labors	House- hold Industry	Other s	Cultivator s	Agricultura l Labors	Household Industry	Other s
5320	4507	212	9028	393	1500	29	988



**Drawing No.3.10 Chart showing details of main workers**

**Drawing No. 3.11 Chart showing details of marginal workers**

**Table No 3.29 Basic Amenities detail for study villages covered in 5 km radius**

SNo	Village	Drinking Water	Power Supply	Educational Facilities	Medical Facilities	Approach to Village	Communication	Transportation
1	Solaiya	T TW	EA	P(5) S C(10+)	PHS RMP(2) CHW H(5-10) MCW(5-10) PHC(5-10)	PR MR FP	PO PH(75)	BS RS(5-10)
2	Itadra	T TW	EA	P(3) S PUC C(5-10)	H D MCW PHC PHS FWC RMP(3) CHW(3)	PR MR FP	PO PH(73)	BS RS(5-10)
3	Kharna	T TW	EA	P S C(<5)	DH PHS FWC RMP(4) CHW H(<5) MCW(<5) PHC(<5)	PR MR FP	PO PH(82)	BS RS(<5)
4	Amarapura	T TW	EA	P C(<5)	RMP CHW H(<5) MCW(<5) PHC(<5)	PR MR FP	PO PH(61)	BS RS(<5)
5	Samou	T TW	EA	P(5) S C(10+)	H D MH PHS FWC RMP(2) CHW(2) MCW(5-10) PHC(5-10)	PR MR FP	PO PH(86)	BS RS(5-10)

6	Padusma	T TW	EA	P S C(5-10)	PHS FWC RMP(2) CHW H(5-10) MCW(<5) PHC(<5)	PR MR FP	PO PH(10)	BS RS(5-10)
7	Charada	T TW	EA	P(3) S PUC C(5-10)	MCW MH CWC PHC PHS FWC RMP(2) CHW(5) H(5-10)	PR MR FP	PO TO PTO PH(150)	BS RS(5-10)

8	Dhameda	T TW	EA	P C(<5)	PHS FWC CHW(2) H(<5) MCW(<5) PHC(<5)	PR MR FP	PH(10) PO(<5)	BS RS(5-10)
9	Bapupura	T TW	EA	P S C(<5)	PHS FWC RMP CHW(2) H(<5) MCW(<5) PHC(<5)	PR MR FP	PO PH(61)	BS RS(5-10)
10	Fatehpura	T TW	EA	P C(<5)	RMP CHW H(<5) MCW(5-10) PHC(5-10)	PR MR FP	PO PH(15)	BS RS(5-10)
11	Gulabpura	T TW	EA	P C(<5)	CHW H(<5) MCW(<5) PHC(<5)	PR MR FP	PO PH(15)	BS RS(5-10)

Abbreviations

## Drinking Water:

T	-Tap Water
TK	-Tank Water
TW	-Tube Well Water
HP	-Hand Pump
R	-River Water
O	-others
W	-well water
C	-Canal
L	-Lake

## Educational:

P	-Primary School
C	-College
M	-Middle school
H	-High School
PUC	-Senior secondary school
S	- Higher secondary school

## Medical:

H	-Allopathic Hospital
PHC	-Primary Health Center
PHS	-Primary Health Sub-Center
CHW	-Community Health Worker
MCW	-Maternity & Child Welfare
FWC	-Family welfare center
D	-Dispensary
H	-Hospital
HD	-Homeopathtic Dispensary
TB	-T.B.Clinic

## Post, Telegraph and Telephone:

PO	-Post Office
PH	-Telephone Connection

## Transportation:

BS	-Bus
----	------

RS	-Railway Station
Approach to Village:	
PR	-Paved Road
MR	-Mud Road
FP	-Foot Path
Power Supply:	
EA	-Electricity for all purposes

# **CHAPTER 4:**

## **PREDICTION AND ASSESSMENT OF IMPACT**

**M/s. Perfect Laminate**

## **4.1 PREAMBLE**

The environmental consequences, which may get affected by activities undertaken by the industry, are identified in this section. Those aspects of the environment, which are likely to be damaged or disturbed due to implementation and continuation and up-gradation of the project, are represented as parameters. As the first step towards prediction and assessment, the various activities during the constructional and operational phase, which are likely to cause an impact on these parameters, have been listed. The next step would be to evaluate quantitatively and qualitatively the impact imposed on the various aspects of the environment. For evaluation of impacts due to proposed manufacturing activities of the unit, the baseline data of environment parameters related to ongoing/proposed industrial activity have been superimposed on the present baseline environmental status. The changes in the environmental parameters and their impact, whether short term or long term, are predicted and are discussed in detail.

## **4.2 IMPACT IDENTIFICATION**

The main objective of this section is prediction to involve determination of the nature and probable impacts due to proposed project. Here it is determined; the likely environment impacts are,

- Short term or long term
- Beneficial or adverse
- Permanent or temporary
- Site specific or Project specific
- Reversible or Irreversible
- Caused or Induced.



For the purpose of Impact identification, the entire project has been divided in to two phases:

1. Pre-operational Phase (construction and erection/ commissioning)
2. Operational Phase

#### **4.2.1 Construction Phase and commissioning phase:**

This phase will involve the activities starting with the corner stone laying and ending with mechanical and electrical erection of equipments/ machineries and commissioning of plant. The board activities during this period will be as follows:

1. Cleaning of site
2. Leveling and internal road lying
3. Foundation work and civil structure work
4. Erection of mechanical equipments
5. Synchronization of various equipments/ processes and final commissioning of plant.

Construction phase of the project will be for a shorter duration as compared to operational phase and even during construction phase, activities likely to affect environment will be carried out for a period of few months only. Construction work mainly involves generation of dust, noise pollution and demand for water. Though Aesthetics and Socio-economic factors are also identified, the impacts related to the same will be marginal only.

Mostly, local man power will be used during this phase. Similarly, there will be no displacement and rehabilitation of people due to this project.

### **4.2.2 Operational Phase:**

Because of the potential to create long-term impacts, this phase is very important from the environmental impact point of view. The basic impacts like gaseous emissions, movement of automobiles, water consumption and solid waste will have potential to adversely affect air, water, back ground noise and land.

The phase will broadly include following direct and indirect activities/ action.

- Entire chain of activities related to production cycle.
- Storage and transportation of fuels, raw materials and finished products.
- Generation and supply of electricity
- Gaseous emission
- Effluent Generations
- Noise generation
- Solid waste generation
- General equipment failure
- Industrial development of secondary unit in the area
- Green Belt development

## **4.3 PREDICTION AND ASSESSMENT OF IMPACT**

### **4.3.1 Construction and Commissioning Phase**

#### **4.3.1.1 Air Environment**

The construction of manufacturing plant involves site preparation as well as construction works including mechanical & electrical works having many potentials of air pollution starting from dusting to exhaust from utilities/machineries & construction vehicles. Hence issue of impact assessment for construction phase of a project is considered to be most important task of EIA study for such project. Hence, the assessment of impacts for construction phase impacts on air has been

started with site preparation work. As the land is almost flat and do not require major site preparation work. So issue of impacts due to site preparation work would not be major for consideration. However, minor & local impacts due to airborne dust arising from the site preparation and allied construction work is anticipated. This impact must be considered for necessary mitigations and measures like water sprinkling and adequate & properly managed stock-piling shall be implemented for minimization of dusting and the impacts thereof.

Further, the impacts on air would arise due to operation of construction machineries & equipment as well as heavy vehicles involves in the construction works. The construction of the proposed project will requires dozers, excavator, concrete mixture, Boiler and many other small equipment/machineries. Further it has been noticed that proponent has planned to use ready mix concrete wherever & whenever possible to reduce the use of concrete mixture as well as to avoid fugitive dust from preparation of concrete. These together can have minor & local impacts on air quality due to exhaust. Hence, it has been suggested that these machineries/equipment shall be maintain in good condition to reduce the pollutant levels in exhaust. It is also suggested that the unwanted idling & unusual acceleration of these machineries/equipments shall be avoided to reduce the impacts on air due to the exhaust. Besides, the construction works will requires numbers of heavy transport vehicles which may have impacts on the air quality due to acceleration as well as high exhausts due to transportation activity of heavy load materials. Hence, it is suggested to cite compulsory requirement of maintenance and PUC for maintaining low exhaust from vehicles. Non complying vehicles shall not be allowed in transportation work for construction of proposed project.

Another source of impacts on air during construction shall be the fugitive emissions from the storage area. To avoid such fugitive emission from cement storage area, proponent has planned to provide enclosed storage area which will also be used for storage of all other construction materials.

The construction activities mainly civil & mechanical works may have potential of fugitive dust & gaseous pollutants. The fugitive dust will be suppressed by sprinkling of water of construction ground as well as barricading the construction site with suitable fabric curtain as well as use of ready mix concrete for construction. Besides, the mechanical works especially welding work will be done with utmost care with efficient practices & skilled welders to avoid excessive gaseous emission from such work. However, it has been noticed that the impacts of these activities will not be significant and will have potential of impacts on local air only. Further mitigations are not possible considering the size of operations and the residual impacts would be negligible.

Thus looking to the probability of impacts on air quality as well as planned & suggested mitigation measures, it can be stated that the impacts on air quality during the construction phase would be negligible and restricted to the project site. Further the impacts would be temporary for the phase and the conditions will be restored with the end of the construction works. Hence, no major mitigation except described above are required. However, it is suggested to adopt additional suitable mitigation measures cited during the construction activities to reduce / eliminate the impacts of construction work on air quality.

#### **4.3.1.2 Water Environment**

- Bore well water will be utilized for the construction phase. The water consumption during the construction phase is very less and consumption will be for short period. Hence there will not be any major impact on availability of natural resources during this stage.
- Wastewater generation will be only from the domestic activities, which will be disposed in to soak pit through septic tank.

Thus, construction and commissioning activities are not likely to have any adverse impact on quality and availability of water in the surrounding region.

**4.3.1.3 Land Environment**

- Construction activities will bring a significant change to the topsoil of the project area due to excavation, stacking of construction material etc.
- The project will not be any significant topographical change.
- Some construction activities will disturb the soil profile but that will be temporary and having insignificant impact.
- Original form of the topsoil will be largely restore and even enhanced due to activities like beautification of premises, development of garden etc.

**4.3.1.4 Noise Environment**

- As a result of various activities like civil construction, erection, movement of vehicles and installation of machinery etc. slight increase in noise level in anticipated for short period.
- However, all majority construction and commissioning activities will take place during daytime only and consequently noise level is expected to go up during daytime only.
- Moreover, all machineries to be used for construction purpose will be of highest standard of reputed make and compliance of noise pollution control norms by these equipments will be emphasized.

**4.3.1.5 Socio- Economic Pattern**

- The construction and commissioning phase of the proposed project is likely to have certain positive and negative impacts on socio-economic environment. Setting of the project at the said site does not require displacement of any population. Local people involved during construction and commissioning work will have benefit of temporary employment and local contractors may also benefit, as supply of construction material like bricks, sand, and aggregates etc. will be from local market.

- However, there will be pressure of additional traffic on state highway no. 218 due to movement of vehicles for construction materials and equipments, but will be minor impact for a short duration.

#### **4.3.1.6 Ecology**

- The area where the proposed project is to come up does not have any forest, National Park, Sanctuaries etc. and hence there is no impact on the same.
- Project site is almost barren land with few shrub and trees. Thus, no major tree cutting exercise will be there. Since the construction and commissioning activity will be anticipated because of this phase of the project.

#### **4.3.1.7 Health and Safety**

- No health and safety problem of surrounding population is anticipated due to construction and commissioning activities of the proposed project.
- No health problems of labor force are anticipated as there will be no labor force staying at site.
- All safety measures will be incorporated during the construction and commissioning phase to ensure full safety of work-force and workers will be made aware of the safety requirements and asked to strictly follow the safety norms.

### **4.3.2 Operation Phase**

#### **4.3.2.1 Water Environment**

- Water is essential for human, agriculture, industry and commercial use. The industrial activity can have direct impact on the end users. Impact on water environment due to the proposed project will be in terms of water use, wastewater generation and its disposal.

**i) Impact of raw water usage:**

- The main source of water supply for the industrial operations is; the own bore wells. The ground water is easily available in the surrounding area as we have seen in the Chap- 3 Baseline Environmental Status of the study area. There is minor negative impact on availability of natural water resources in the study area (Ground and Surface Water).

**ii) Impact due to disposal of treated effluent**

- The effluent will be treated into the ETP and final treated effluent will be evaporated in Evaporation Pan. The plant will operate as zero discharge. It can be concluded that there will be insignificant adverse impact on the surrounding environment as it will be a "Zero Discharge Unit".

**iii) Impact due to disposal of sewage:**

- The domestic Effluent will be discharge through the soak pit. The unit will be any minor impact on ground water and surface water environment.

**4.3.2.2 Air Environment**

Air quality impact assessment is an important study; Mathematical modeling is an established and accepted technique to predict the air quality.

In this study, impact on environment due to the proposed plant has been assessed with the help of Mathematical modeling following the Central Pollution Control Boards Guidelines. The mathematical model used for conducting the study is the latest version of Industrial Source Complex. Model developed by the Environment Protection Agency of United States

(ISC-3, 1996), which is entirely in line with the requirements of Central Pollution Control Board, New Delhi.

## 1. EMISSION AND STACK DETAILS

Emission rates and stack details are as shown in Table no. 4.1.

**TABLE NO.4.1**  
**BASIS OF EMISSION RATE CALCULATIONS\***

<b>Stack attached to</b>	Boiler (IBR)
<b>Capacity</b>	1.5 MT/hr
<b>Type of Fuel</b>	Fire Wood/ White Coal/ Imported Coal / Lignite
<b>Fuel Consumption</b>	1 MT/day
<b>Dia(m)</b>	0.6
<b>Height (m)</b>	30
<b>Exit Velocity (m/sec)</b>	5.8
<b>Exit Temp. (° C)</b>	110
<b>Emission Rates (gm/s.)*</b>	
<b>SPM**</b>	0.191
<b>SO<sub>2</sub>(#)</b>	0.334
<b>NO<sub>x</sub>(**)</b>	0.120

Note: (\*) Actual stack emissions will be well below the permissible stack emissions limits, as the unit will utilize Natural Gas as Fuel. To consider worst case scenario the emission rates are considered on maximum Stack Emission Limit.

(\*\*) Based on maximum expected concentration of SPM-150 mg/Nm<sup>3</sup>



(#) Based on maximum expected concentration of SO<sub>2</sub>-100 PPM

(\*\*) Based on maximum expected concentration of NO<sub>x</sub>-50 PPM

## **2. MATHEMATICAL MODEL FOR POLLUTANTS DISPERSION**

In the present case ISC-3 (Industrial Source Complex) model has been used to assess the air impacts. This ISC model for stack uses the steady state Gaussian plume equation for a continuous elevated source. The features of this model are:

- ◆ Simulates dispersion from single/multi/area/line/volume sources.
- ◆ Allows calculations to be made at a user specified regular rectangular grids.
- ◆ Provides estimates of concentrations for any averaging time period for the entire period of input meteorology.
- ◆ Allows calculations to be underwriters for source group as selected by the uses.
- ◆ Uses the Briggs dispersion curves as selected by the user, to derive the plume spread parameters.
- ◆ Adjust dispersion curves to account for user specified information on aerodynamic roughness.
- ◆ Adjust for wind speed variation with height, using user specified default urban/rural power. Co-efficient.

- ♦ Simulates dispersion from buoyant non buoyant Point sources, non buoyant area, non buoyant volume sources and non buoyant line sources.
- ♦ User Brigg's plume rise algorithm to calculate plume height.

For a steady-state Gaussian plume, the hourly concentration at downwind distance x (meters) and crosswind distance y (meters) is given by:

$$X_{(x,y,z)} = \frac{QKVD}{2 \pi u \sigma_y \sigma_z} \exp [-0.5 (y/2 \sigma_y)^2] \dots\dots\dots \text{Equation 1.1}$$

The ISC model uses either a Polar or a Cartesian receptor network. In this case Polar receptor network has been used.

#### (i) **VERTICAL TERM**

The Vertical of the Gaussian plume. It includes the effects of source elevation, receptor elevation, plume rise, limited mixing in the vertical, and the gravitational settling and dry deposition of particulates. In addition to the plume height, receptor height and mixing height, the computation of the Vertical Term requires the vertical dispersion parameter ( $\sigma_z$ ).

#### **The Vertical Term without Dry Deposition**

In general, the effects on ambient concentrations of gravitational settling and dry deposition can be neglected for gaseous pollutants and small particulates (less than about 0.1 microns in diameter). The Vertical Term without deposition effects is then given by:

$$V = \exp[-0.5((z_r - h_e) / \sigma_z)^2] + \exp[-0.5((z_r + h_e) / \sigma_z)^2] +$$

$$\sum_{i=1}^{\infty} \{ \exp[-0.5(H_1 / \sigma_z)^2] + \exp[-0.5(H_2 / \sigma_z)^2] +$$

$$\exp[-0.5(H_3 / \sigma_z)^2] + \exp[-0.5(H_4 / \sigma_z)^2] \} \dots \dots \dots \text{Equation 1-2}$$

where:

$$h_e = h_s + \delta h$$

$$h_s = \text{stack height (mt)}$$

$$\delta h = \text{Plume rise (mt)}$$

$$z_r = \text{receptor height above ground (flagpole) (mt)}$$

$$z_i = \text{mixing height (mt)}$$

$$H_1 = z_r - (2iz_i - h_e)$$

$$H_2 = z_r + (2iz_i - h_e)$$

$$H_3 = z_r - (2iz_i + h_e)$$

$$H_4 = z_r + (2iz_i + h_e)$$

The infinite series term in Equation 1-1 accounts for the effects of the restriction on vertical plume growth at the top of the mixing layer. The method of image sources is used to account for multiple reflections of the plume from the ground surface and at the top of the mixed layer. It should be noted that, if the effective stack height  $h_e$ , exceeds the mixing height,  $z_i$ , the plume is assumed to fully penetrate the elevated inversion and the ground-level concentration is set equal to zero.

**Equation 1-2** assumes that the mixing height in rural and urban areas is known for all stability categories. The meteorological preprocessor program uses mixing heights derived from twice-daily mixing heights calculated using the Holzworth procedures. The ISC models currently assume unlimited

vertical mixing under stable conditions, and therefore delete the infinite series term in **Equation 1-2** for the E and F stability categories.

The Vertical Term defined by **Equation 1-2** changes the form of the vertical concentration distribution from Gaussian to rectangular (i.e., a uniform concentration within the surface mixing layer) at long downwind distances. Consequently, in order to reduce computational time without a loss of accuracy, **Equation 1-2** is changed to the form:

$$V = \sqrt{2\pi} \sigma_z / z_i \dots\dots\dots \text{Equation 1- 3}$$

at downwind distances where the  $\sigma_z/z_i$  ratio is greater than or equal to 1.6.

The meteorological preprocessor program, RAMMET, used by the ISC Short Term model uses an interpolation scheme to assign hourly rural and urban mixing heights on the basis of the early morning and afternoon mixing heights calculated using the Holzworth procedures. The interpolation procedures are functions of the stability category for the hour before sunrise. Because of the uncertainties about the applicability of Holzworth mixing heights during periods of E and F stability, the ISC models ignore the interpolated mixing heights for E and F stability, and treat such cases as having unlimited vertical mixing.

## (ii) THE DECAY TERM (D)

The Decay Term in Equation 1-1 is a simple method of accounting for pollutant removal by physical or chemical processes. It is of the form:

$$D = \exp(-\Psi x/u_s) \quad \text{for } \Psi > 0 \dots\dots\dots \text{Equation 1-4}$$

$$\Psi = 0.693/T_{1/2} \dots\dots\dots \text{Equation 1-5}$$

The default value of  $\Psi$  is zero. That is, decay is not considered in the model calculations unless  $\Psi$  is specified. However, a decay half life of 4 hours ( $\Psi = 0.0000481 \text{ sec}^{-1}$ ) is automatically assigned for  $\text{SO}_2$  when modeled in the urban mode.

### (iii) WIND SPEED AT STACK HEIGHT

The wind power law is used to adjust the observed wind speed,  $u_{\text{ref}}$ , from a reference measurement height,  $z_{\text{ref}}$ , to the stack or release height,  $h_s$ . The stack height wind speed,  $u_s$ , is used in the Gaussian plume equation (**Equation 1-1**), and in the plume rise formulas. The power law equation is of the form:

$$u_s = u_{\text{ref}} (h_s/z_{\text{ref}})^p \text{ .....Equation 1-6}$$

Stability Category	Rural Exponent	Urban Exponent
A	0.07	0.15
B	0.07	0.15
C	0.1	0.20
D	0.15	0.25
E	0.35	0.30
F	0.55	0.30

### (iv) EFFECTIVE STACK HEIGHT

The effective stack, height,  $h_e$  to be used in Gaussian equation is given.

$$h_e = h_s + h_{pr}$$

Where,

H<sub>pr</sub> = Plume rise due to thermal and momentum factors.

H<sub>e</sub> = Effective stack height (m)

H<sub>s</sub> = Physical stack height (m)

In the present case plume rise has been calculated by Brigg's formula (1975). The details of this equation are given below.

#### (iv-i) Plume Rise under Unstable and Neutral Conditions

##### Plume Rise Under Unstable And Neutral Conditions

##### (a) Buoyancy dominated

$$H_{pr} = 1.6 F^{1/3} (X)^{2/3} / U \dots\dots\dots \text{Equation 1-7}$$

Where  $X \leq 3.5 X^*$  and

$$X^* = 14 F^{5/8} \text{ if } F < 55 \text{ m}^4/\text{sec}^3$$

$$= 34 F^{2/3} \text{ if } F \geq 55 \text{ m}^4/\text{sec}^3 \dots\dots\dots \text{Equation 1-8}$$

In present computations X is taken equal to 3.5 X\*. For this value of X maximum plume rise under unstable and neutral conditions is governed by the following simplified equations:

$$H_{pr} (\text{max}) = \frac{21.425 F^{0.75}}{U} \quad ; F < 55 \text{ m}^4/\text{sec}^3$$

$$= \frac{38.71 F^{0.60}}{U} \quad ; F \geq 55 \text{ m}^4/\text{sec}^3 \dots\dots\dots \text{Equation 1-9}$$

Here  $F = gV_s (D_s/2)^2 [(T_s - T_a)/T_s]$  .....Equation 1-10

**(b) Momentum Dominated Plume Rise Under Unstable And Neutral Conditions:**

$H_{pr} (\max) = 3 D_s (V_s/U); V_s/U > 4$  .....Equation 1-11

**Determination of dominance of buoyancy or momentum under unstable and neutral conditions**

First  $\Delta T$  and  $(\Delta T)_c$  are calculated by following equations :

$$\Delta T = T_s - T_a$$

$$(\Delta T)_c = \frac{0.0297 T_s V_s^{1/3}}{D_s^{2/3}} ; F < 55 \text{ m}^4/\text{s}^3 \text{ .....Equation 1-12}$$

$$= \frac{0.05757 T_s V_s^{1/3}}{D_s^{2/3}} ; F \geq 55 \text{ m}^4/\text{s}^3 \text{ .....Equation 1-13}$$

If  $T_s > T_a$  and  $\Delta T > (\Delta T)_c$  assumed plume rise is buoyancy dominated and if  $T_s < T_a$  or  $\Delta T < (\Delta T)_c$  plume rise is assumed momentum dominated.

**Plume rise under stable weather conditions**

**(a) Buoyancy dominated plume rise**

$$H_{pr} = 2.6 (F/US)^{1/3} \text{ .....Equation 1-14}$$

Here

S = stability parameter

$$S = \frac{g}{Ta} \frac{\delta\theta}{\delta Z} \dots\dots\dots\text{Equation 1-15}$$

Here  $\frac{\delta\theta}{\delta Z}$  = temperature gradient

$$\frac{\delta\theta}{\delta Z} = 0.02 \text{ for stability E}$$

$$= 0.035 \text{ for stability F}$$

U = wind velocity at stack level (m/s)

**(b) Momentum dominated plume rise:**

$$H_{pr} = 1.5 \left[ \frac{Vs^2}{4} \frac{Ds^2}{T} \frac{Ta^{-1/3}}{U} \right] S^{-1/6} \dots\dots\text{Equation 1-16}$$

**(c) Determination of dominance of momentum or buoyancy for plume rise under stable weather condition:**



$$(\Delta T)_c = 0.01958 T_a V_s S^{1/2} \dots\dots\dots \text{Equation 1-17}$$

$T_s > T_a$  &  $(\Delta T) > (\Delta T)_c$  plume rise is assumed buoyancy dominated

if  $T_s < T_a$  or  $(\Delta T) < (\Delta T)_c$  plume rise is assumed momentum dominated

**Determination Of Plume Rise Under Calm Conditions (Wind Velocity At 10 M Less Than 2 Kmph)**

In case of calm winds plume rise is calculated by **equation (13)** and following equation and the lower value of two is taken as final plume rise.

$$H_{pr} = 4 F^{1/4} S^{-3/8} \dots\dots\dots \text{Equation 1-18}$$

**(v) DISPERSION CO-EFFICIENT**

In the present computations the dispersion coefficients proposed by PASQUILL and GIFFORD and reported by TURNER for Rural area have been used. The dispersion coefficients are valid up to 10 Kms. distances from pollution source. The equations are as follows:

**PARAMETERS USED TO CALCULATE PASQUILL-GIFFORD  $\sigma_y$  (m)**

Pasquill Stability Category	$\sigma_y = 465.11628 (x) \tan (TH)$ $TH = 0.017453293 (c-d \ln (x))$	
A	24.1670	2.53340
B	18.3330	1.80960
C	12.5000	1.08570

D	8.3330	0.72382
E	6.2500	0.54287
F	4.1667	0.36191

### PARAMETERS USED TO CALCULATE PASQUILL-GIFFORD $\sigma_z(m)$

Pasquill Stability Category	$\sigma_z = a(x)^b$ (x in km.)		
	X (km.)	A	b
A*	< 0.10	122.80	0.94470
	0.10-0.15	158.080	1.05420
	0.16-0.20	170.220	1.09320
	0.21-0.25	179.520	1.12620
	0.26-0.30	217.410	1.26440
	0.31-0.40	258.890	1.40940
	0.41-0.50	346.750	1.72830
	0.51-3.11	453.850	2.11660
	> 3.11	**	**
B*	< 0.20	90.673	0.93198
	0.21-0.40	98.483	
	> 0.40	109.300	
C*	All	61.141	0.91465
D*	< 0.30	34.459	0.86974
	0.31-1.00	32.093	0.81066
	1.01-3.00	32.093	0.64403
	3.01-10.00	33.504	0.60486
	10.01-30.00	36.650	0.56589
	> 30.00	44.053	0.51179
E	< 0.10	24.260	0.83660
	0.10-0.30	23.331	0.81956
	0.31-1.00	21.628	0.75660
	1.01-2.00	21.628	0.63077
	2.01-4.00	22.534	0.57154

	4.01-10.00	24.703	0.50527
	10.01-20.00	26.970	0.46713
	20.01-40.00	35.420	0.37615
	>40.00	47.618	0.29592
<b>F</b>	< 0.20	15.209	0.81558
	0.21-0.70	14.457	0.78407
	0.71-1.00	13.953	0.68465
	1.01-2.00	13.953	0.63227
	2.01-3.00	14.823	0.54503
	3.01-7.00	16.187	0.46490
	7.01-15.00	17.836	0.41507
	15.01-30.00	22.651	0.32681
	30.01-60.00	27.074	0.27436
	>60.00	34.219	0.21716

**Note:**

\* If the calculated value of  $\sigma_z$  exceed 5000 m,  $\sigma_z$  is set to 5000 m.

\*\*  $\sigma_z$  is equal to 5000 m.

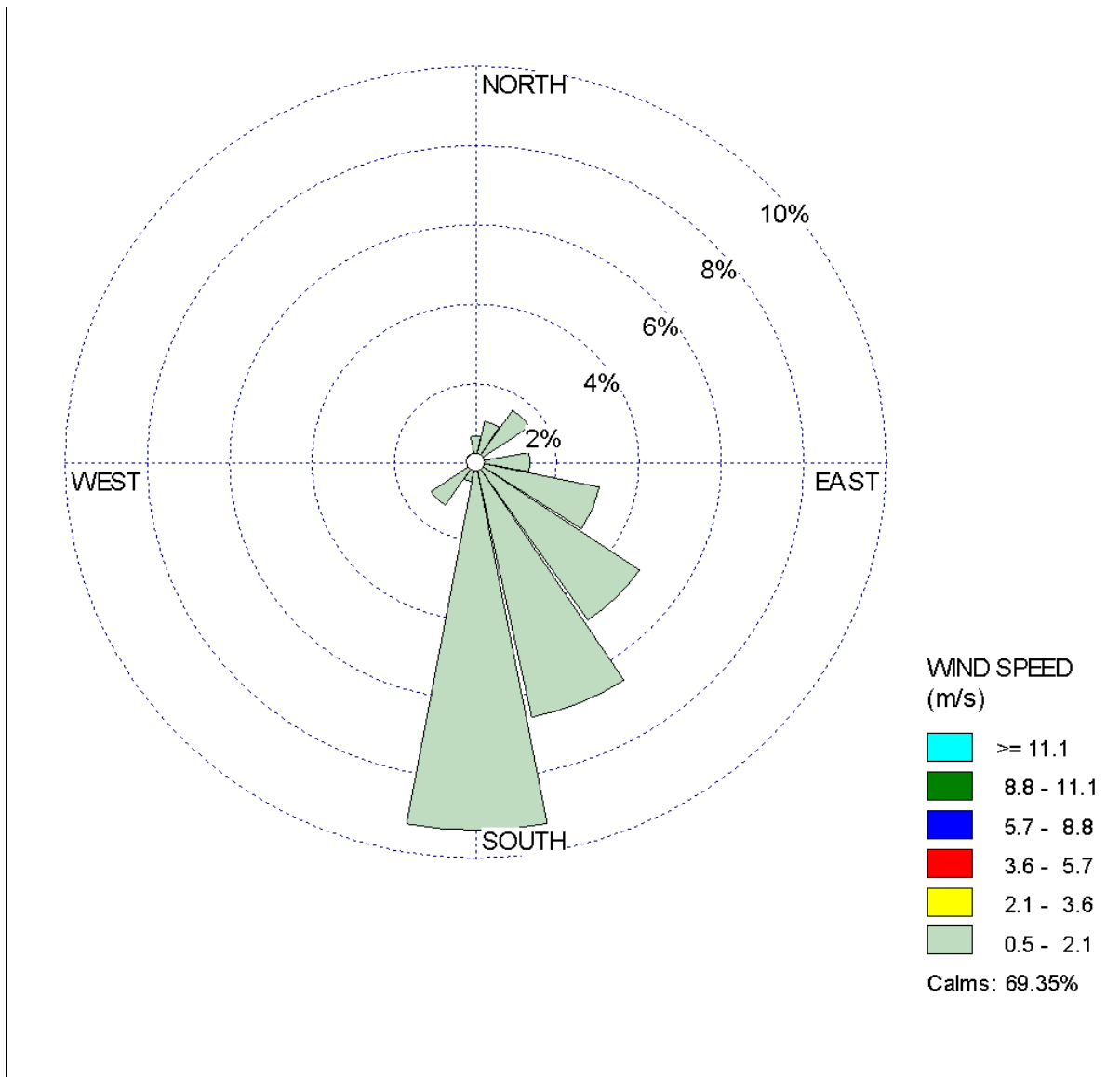
**(vi) METEOROLOGICAL DATA USED IN ASSESSMENT**

The meteorological parameters namely: ambient temperature, wind speed, wind direction and stability class were obtained from IMD Ahmedabad for the Period of October 2010 to December 2010. As specific mixing heights were not available, mixing height based on CPCB publication "Spatial Distribution of Hourly Mixing Depth Over Indian Region", PROBES/88/2002-03 has been used.

The wind rose diagram is shown in **Figure No. 4.1**

**Figure No.4.1**

**WINDROSE DIAGRAM**



**(vii) ATMOSPHERIC STABILITY**

The hourly occurrence of various stability classes at project site is determined by wind direction fluctuation method by employing on-line instrument.

The stability classification system based on wind direction fluctuation method is as follows.

Relationship between  $\sigma\theta$  and stability class as suggested by Slade (1965) is given in the below table.

<b>Stability Class</b>	<b><math>\sigma\theta</math> (degrees)</b>
A	> 22.5
B	22.4 - 17.5
C	17.4 - 12.5
D	12.4 - 7.5
E	7.4 - 3.5
F	< 3.5

**3. RESULTS OF THE ISCST-3 MODEL**

The average and maximum Ground Level Concentrations (GLCs) have been determined for SPM, SO<sub>2</sub> and NO<sub>x</sub>. The average 24hrs. concentration have been determined in polar grid of 10° up to 360° for a distance of 500m, 1000 m, 2000 m, 3000m, 4000m and 5000m.

The overlapped ISo plathes on Google Image of the same is shown as at Figure **No. 4.2 to 4.4**.

The summary of Maximum Predicted GLC is shown in **Table No. 4.3**.

TABLE NO. 4.2

THE 1<sup>ST</sup> HIGHEST 24-HR AVERAGE  
CONCENTRATION VALUES OF SPM IN MICROGRAMS/M<sup>3</sup>

Direction °	Distance (meters)					
	500	1000	2000	3000	4000	5000
10	2.40249	0.51458	0.22840	0.15296	0.11474	0.09161
20	1.22012	0.27298	0.12667	0.08514	0.06438	0.05192
30	1.03475	0.26307	0.12609	0.08370	0.06246	0.04971
40	1.31101	0.30474	0.15058	0.10241	0.07791	0.06303
50	1.24679	0.27944	0.13548	0.09388	0.07240	0.05920
60	0.82742	0.20308	0.10040	0.06723	0.05054	0.04048
70	0.80528	0.24947	0.12290	0.08269	0.06255	0.05044
80	0.94431	0.28507	0.13766	0.09137	0.06805	0.05402
90	0.93937	0.27697	0.13909	0.09599	0.07395	0.06049
100	0.64965	0.17968	0.08593	0.05746	0.04309	0.03440
110	0.36775	0.06004	0.02506	0.01695	0.01318	0.01084
120	0.32159	0.07030	0.03255	0.02054	0.01470	0.01127
130	0.26120	0.13977	0.07483	0.05195	0.04011	0.03282
140	0.26074	0.13974	0.07483	0.05195	0.04011	0.03281
150	0.14407	0.06929	0.03243	0.02049	0.01467	0.01126
160	0.08825	0.01453	0.00505	0.00259	0.00157	0.00105
170	0.15106	0.02324	0.01114	0.00744	0.00557	0.00444
180	0.22905	0.03661	0.01835	0.01261	0.00968	0.00790
190	0.26443	0.04109	0.01971	0.01307	0.00972	0.00771
200	0.42456	0.06834	0.03405	0.02351	0.01812	0.01483
210	0.52213	0.08258	0.03772	0.02522	0.01890	0.01510
220	0.50829	0.13974	0.07483	0.05195	0.04011	0.03281
230	0.38674	0.13974	0.07483	0.05195	0.04011	0.03281
240	0.21590	0.06929	0.03243	0.02049	0.01467	0.01126

250	0.17470	0.07192	0.02971	0.01720	0.01148	0.00830
260	0.41947	0.21606	0.11012	0.07384	0.05545	0.04431
270	0.56000	0.30408	0.16550	0.11621	0.09054	0.07465
280	0.48251	0.21651	0.11015	0.07386	0.05545	0.04431
290	0.81572	0.34243	0.18243	0.12736	0.09882	0.08123
300	0.93531	0.32162	0.16032	0.10904	0.08283	0.06686
310	0.82676	0.22837	0.12024	0.08337	0.06431	0.05259
320	0.86548	0.23758	0.12424	0.08585	0.06606	0.05391
330	1.21257	0.35870	0.17407	0.11865	0.09036	0.07311
340	1.85734	0.48736	0.23483	0.16150	0.12401	0.10113
350	2.28350	0.49260	0.21761	0.14589	0.10953	0.08752
360	3.03479	0.69102	0.32911	0.23075	0.17960	0.14799

**TABLE NO. 4.3**
**THE 1<sup>ST</sup> HIGHEST 24-HR AVERAGE VALUES OF SO<sub>2</sub> IN MICROGRAMS/M<sup>3</sup>**

Direction °	Distance (meters)					
	500	1000	2000	3000	4000	5000
10	4.20121	0.89984	0.39940	0.26748	0.20064	0.16019
20	2.13362	0.47735	0.22151	0.14888	0.11258	0.09079
30	1.80946	0.46003	0.22050	0.14636	0.10923	0.08693
40	2.29254	0.53290	0.26331	0.17909	0.13625	0.11023
50	2.18025	0.48866	0.23691	0.16417	0.12661	0.10352
60	1.44690	0.35513	0.17557	0.11757	0.08839	0.07079
70	1.40819	0.43624	0.21491	0.14461	0.10938	0.08820
80	1.65131	0.49851	0.24073	0.15977	0.11901	0.09446
90	1.64267	0.48433	0.24322	0.16786	0.12932	0.10578
100	1.13603	0.31420	0.15026	0.10048	0.07534	0.06016
110	0.64308	0.10499	0.04382	0.02964	0.02304	0.01896
120	0.56236	0.12292	0.05692	0.03592	0.02570	0.01971
130	0.45677	0.24442	0.13086	0.09085	0.07013	0.05738
140	0.45596	0.24437	0.13086	0.09085	0.07013	0.05738
150	0.25194	0.12116	0.05671	0.03583	0.02565	0.01968
160	0.15433	0.02541	0.00883	0.00454	0.00275	0.00183
170	0.26416	0.04065	0.01949	0.01300	0.00974	0.00777
180	0.40054	0.06401	0.03210	0.02205	0.01694	0.01382
190	0.46241	0.07185	0.03447	0.02285	0.01700	0.01348
200	0.74243	0.11951	0.05954	0.04111	0.03169	0.02593
210	0.91304	0.14441	0.06596	0.04409	0.03306	0.02640
220	0.88883	0.24437	0.13086	0.09085	0.07013	0.05738
230	0.67628	0.24437	0.13086	0.09085	0.07013	0.05738
240	0.37754	0.12116	0.05671	0.03583	0.02565	0.01968



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250	0.30550	0.12576	0.05195	0.03008	0.02008	0.01452
260	0.73353	0.37783	0.19256	0.12913	0.09696	0.07748
270	0.97926	0.53173	0.28940	0.20321	0.15832	0.13054
280	0.84377	0.37861	0.19262	0.12915	0.09697	0.07748
290	1.42644	0.59880	0.31901	0.22271	0.17280	0.14204
300	1.63557	0.56241	0.28035	0.19067	0.14484	0.11691
310	1.44576	0.39935	0.21026	0.14578	0.11246	0.09197
320	1.51345	0.41546	0.21725	0.15012	0.11551	0.09427
330	2.12041	0.62726	0.30439	0.20748	0.15800	0.12785
340	3.24791	0.85225	0.41064	0.28242	0.21685	0.17684
350	3.99314	0.86141	0.38053	0.25512	0.19154	0.15304
360	5.30690	1.20838	0.57552	0.40351	0.31406	0.25879

TABLE NO. 4.4

THE 1ST HIGHEST 24-HR AVERAGE VALUES OF NO<sub>x</sub> IN MICROGRAMS/M<sup>3</sup>

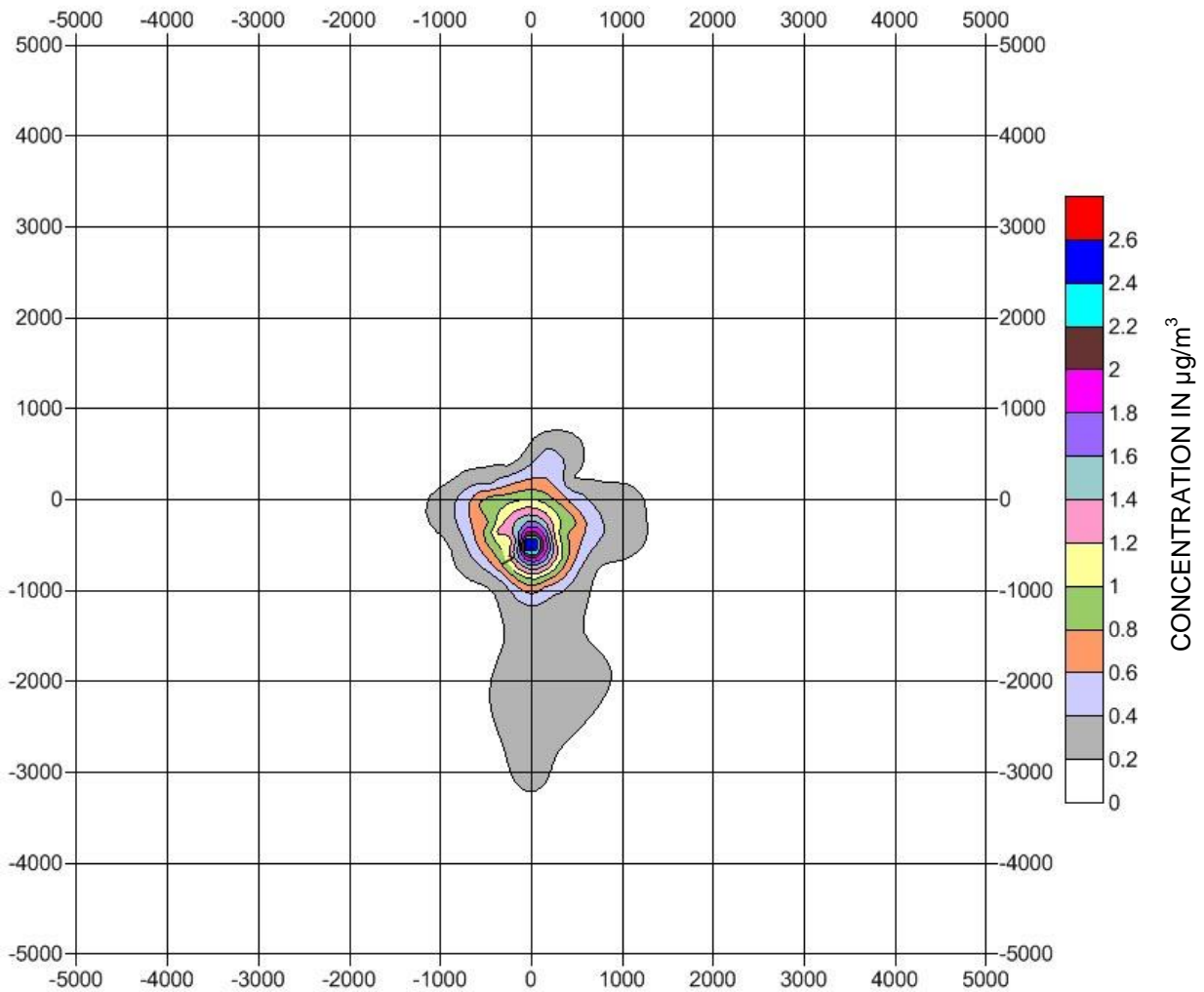
Direction °	Distance (meters)					
	500	1000	2000	3000	4000	5000
10	1.50942	0.32329	0.14350	0.09610	0.07209	0.05755
20	0.76657	0.17150	0.07959	0.05349	0.04045	0.03262
30	0.65011	0.16528	0.07922	0.05259	0.03924	0.03123
40	0.82367	0.19146	0.09460	0.06434	0.04895	0.03960
50	0.78332	0.17557	0.08512	0.05898	0.04549	0.03719
60	0.51985	0.12759	0.06308	0.04224	0.03176	0.02543
70	0.50594	0.15673	0.07721	0.05195	0.03930	0.03169
80	0.59329	0.17910	0.08649	0.05740	0.04276	0.03394
90	0.59018	0.17401	0.08739	0.06031	0.04646	0.03801
100	0.40816	0.11289	0.05399	0.03610	0.02707	0.02161
110	0.23105	0.03772	0.01574	0.01065	0.00828	0.00681
120	0.20204	0.04416	0.02045	0.01291	0.00923	0.00708
130	0.16411	0.08781	0.04702	0.03264	0.02520	0.02062
140	0.16382	0.08780	0.04702	0.03264	0.02520	0.02062
150	0.09052	0.04353	0.02038	0.01287	0.00922	0.00707
160	0.05545	0.00913	0.00317	0.00163	0.00099	0.00066
170	0.09491	0.01460	0.00700	0.00467	0.00350	0.00279
180	0.14391	0.02300	0.01153	0.00792	0.00608	0.00497
190	0.16613	0.02582	0.01239	0.00821	0.00611	0.00484
200	0.26674	0.04294	0.02139	0.01477	0.01138	0.00931
210	0.32804	0.05189	0.02370	0.01584	0.01188	0.00948
220	0.31934	0.08780	0.04702	0.03264	0.02520	0.02062
230	0.24298	0.08780	0.04702	0.03264	0.02520	0.02062
240	0.13564	0.04353	0.02038	0.01287	0.00922	0.00707
250	0.10976	0.04518	0.01867	0.01081	0.00721	0.00522
260	0.26354	0.13575	0.06918	0.04639	0.03484	0.02784
270	0.35183	0.19104	0.10398	0.07301	0.05688	0.04690
280	0.30315	0.13603	0.06921	0.04640	0.03484	0.02784
290	0.51249	0.21514	0.11461	0.08001	0.06208	0.05103
300	0.58763	0.20206	0.10073	0.06850	0.05204	0.04200
310	0.51943	0.14348	0.07554	0.05238	0.04040	0.03304
320	0.54375	0.14927	0.07805	0.05394	0.04150	0.03387
330	0.76182	0.22536	0.10936	0.07454	0.05677	0.04593
340	1.16691	0.30620	0.14753	0.10147	0.07791	0.06353
350	1.43466	0.30949	0.13672	0.09166	0.06882	0.05499
360	1.90667	0.43415	0.20677	0.14497	0.11284	0.09298

**TABLE NO. 4.5**  
**MAXIMUM COMPUTED GLCs VALUES**

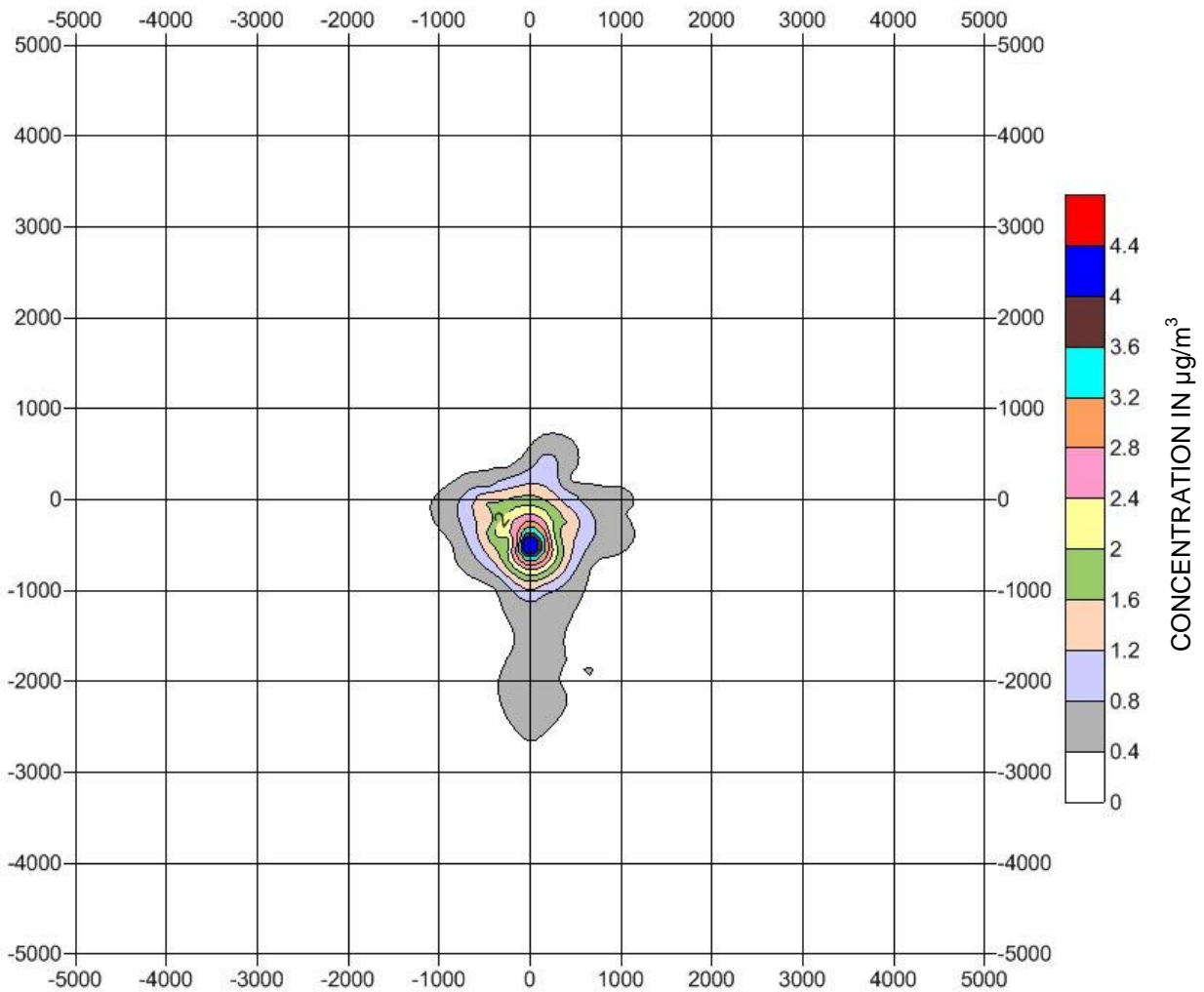
Sr. No	Description	1 <sup>st</sup> Highest Value		
		Conc <sup>n</sup> * ( µg/m <sup>3</sup> )	Co-ordinates	
			X (m)	Y (m)
<b>A</b>	<b>SPM</b>			
1	1 <sup>st</sup> Highest 24 hr. Result	3.03479	0.00	500.00
<b>B</b>	<b>SO<sub>2</sub></b>			
2	1 <sup>st</sup> Highest 24 hr. Result	5.30690	0.00	500.00
<b>B</b>	<b>NO<sub>x</sub></b>			
3	1 <sup>st</sup> Highest 24 hr. Result	1.90667	0.00	500.00

Note:-(\*) This predicted maximum Ground Level Concentration(GLC) is based on worst case scenario, considering maximum stack emission limit of SPM-150 mg/Nm<sup>3</sup>, SO<sub>2</sub> 100 PPM and NO<sub>x</sub>-50 PPM. Actual GLCs will be well below the predicted value, as the unit is going to use Fire Wood/ White Coal/ Imported Coal / Lignite as Fuel in the Boiler.

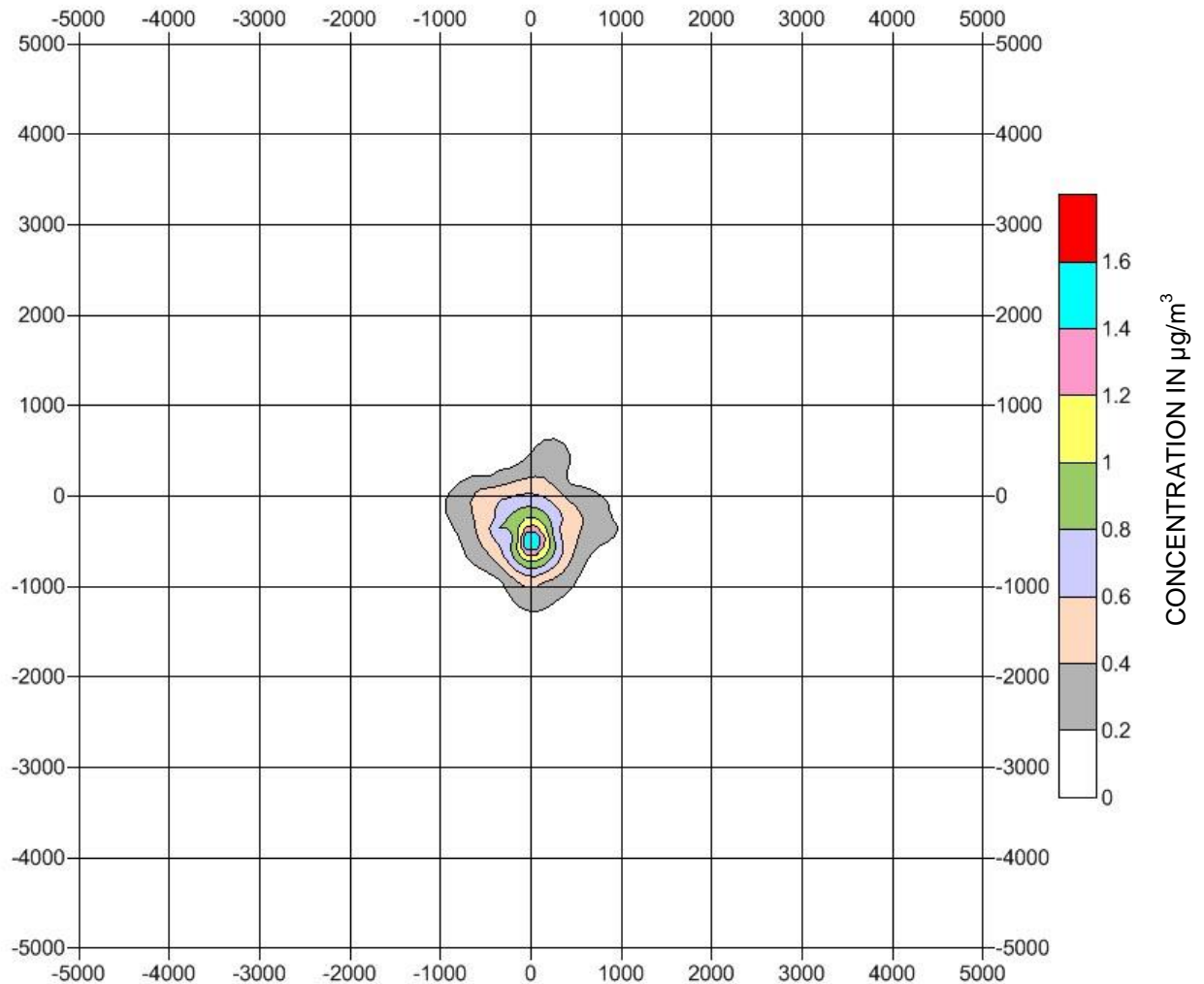
**Figure No. 4.2**  
**ISOPLATHES OF SPM CONCENTRATION FOR 24HRS**



**FIGURE NO. 4.3**  
**ISOPLATHES OF SO<sub>2</sub> CONCENTRATION FOR 24HRS**



**FIGURE NO. 4.4**  
**ISOPLATHES OF NO<sub>x</sub> CONCENTRATION FOR 24HRS**



**4.3.2.3 SOLID WASTE**

Details of anticipated solids/hazardous waste generation from the proposed project are as per table 4.6

**Table 4.6 Anticipated Solid/ Hazardous Waste Generation**

Sr. No.	Name of the solid waste	Quantity of solid waste	Mode of collection & storage
1	ETP Waste	300 Kg/ Year	Secured Landfill at Common Hazardous Waste Disposal Facility
2	Resin waste	7.2 MT/ Year	Incineration at Common Hazardous Waste Disposal Facility
3	Used Oil	50 Lit/ Year	Reused within the premises &/or Sale to authorised re-refiner
4	Discarded Plastic Liner/Drums	27600 Nos./Year	Reused within the premises &/or Sale to authorised dealer/approved scrap vendor

- Proper monthly records of the generation, storage and disposal of hazardous waste will be maintained in a registered as per the format of form-3 of Amended Hazardous Waste Rules-2003. Annual disposal of waste in form -4 and form-13 will be submitted regularly to the concern authority. There will be generation of plant dust, which is considered as non-hazards. More over, this plant dust will be collected and used as a fuel.
- Spent/ used oil which will be reused as lubricant within premises / sold to MOEF approved recyclers.

- ETP sludge generated will be sent to CHWIF site at SEPPL (Saurashtra Enviro Projects Pvt. Ltd.), Bhachau.

Thus, it can be concluded that there will be no impact on the surrounding environment due to generation and disposal of solid waste during operation phase of the project.

#### **4.3.2.4 NOISE ENVIRONMENT**

- The proposed activity will have noise generation due to construction activity. However these impacts are temporary.
- Development of Green Belt in and around the plant campus will help in reduction of noise level.
- Sufficient ear-protecting devices will be provided to personnel working in high noise generating areas.
- Hence, there shall be practically any increase in the background noise level beyond plant boundary during operation phase of the project.
- Vehicular movements during operation phase for loading /unloading of raw and finished materials and other transportation activity may also increase noise level. However the volume of transport vehicles to be handled due to proposed project is very low.



#### **4.3.2.5 SOCIO-ECONOMIC ENVIRONMENT**

- Creation of employment will have positive impact. Apart from this the infrastructural facilities that are going to come in the expansion program will benefit the surroundings and aesthetic environment.
- As there will not be any major infusion of people there will not be any negative impact due to more demand on land, houses etc. No hike in rates on regular commodities are anticipated. Apart from direct employment it will also create indirect employment which will benefit economically in the people living in the surroundings.
- In view of the above the overall impacts on socio-economic environment due to the proposed plan (including increased capacity utilization) are long term and positive in nature.

#### **4.3.2.6 DEVELOPMENT OF GREEN BELT**

- The unit will develop greenbelt within the premises which will not only improve the soil condition but will also soil erosion. The green belt will help as sink of pollutants and also noise reduction in the surroundings.

#### **4.3.2.7 ECOLOGICAL ENVIRONMENT**

- Impact of the proposed project on the ecological environment like natural vegetation, crops, species diversity is summarized here under.
- The attributes that are identified to describe ecology are especially flora and fauna. As the proposed project falls within the existing boundary, there will not be any further land required and no major change in the existing terrestrial environment.

# **CHAPTER 5:**

# **ENVIRONMENTAL MANAGEMENT PLAN**

**M/s. Perfect Laminate**

## 5.1 PERMEABLE

Environment Management is basically resource management. The main purpose of the EMP is to identify the project specific actions, which will be undertaken by the project authority to mitigate specific impacts and their identification. These actions will be incorporated into project management system and integrated into the implementation at various stages of project development. **M/s Perfect Laminate** shall be adopting a comprehensive Environmental Management Plan (EMP) which will cover several environmental protection measures, not only for abatement of environmental pollution resulting from the project, but also for the improvement in the ambient environment. The various components of the Environmental Management Plan (EMP) are outlined in subsequent sections.

Regular monitoring of important and crucial environmental parameters has immense importance and to assess the status of environment during operational phase. With the knowledge of baseline conditions, the monitoring program can be serve as an indicator to deteriorate any environmental conditions due to operational phase and also suitable mitigatory steps will be taken in time to safeguard the environment. Monitoring is an important to control the pollution and the efficiency of control only is determined by monitoring. The following routine monitoring program will be implemented under the post project monitoring. The proposed monitoring program is given below:

Environmental Management generally includes protection/mitigation / enhancement measures as well as delineation of post project monitoring program. The plan as prepared may suggest revisions in the plant layout or operational parameters to avoid adverse impacts. Sometimes additional project operations have to be incorporated in the conventional plan of operation, as per the actual requirement.

For the purpose of the Environment Management Plan (EMP) to prevention/minimization of the adverse impacts and to mitigate identified measures and implementations of various mitigative measures for environmental impacts envisaged are discussed.

## **5.2 OBJECTIVES OF EMP**

- To treat and disposal off all the pollutants viz. liquid, gaseous and solid waste so as to meet statutory requirements (relevant pollution control Act) with appropriate technology.
- To support and implement development work to achieve environmental standards and to improve the methods of environment management
- To promote green belt development.
- To encourage good working conditions for employees.
- To plan out complete strategy to take care of individual stakeholder.
- To reduce fire and accident hazards.
- Budgeting and allocation of funds for environmental management system.
- To adopt cleaner production technology and waste minimization.

As a part of the efforts for sustainable development, to identify the adverse impacts, causes and prevention and precaution measures are the most important part of the development activity of any project. For the purpose of the prevention/minimization of the adverse impacts to Environmental Management Plan (EMP) and impact mitigation measures are identified and implementations of various mitigative measures for environmental impacts envisaged are discussed.

## 5.3 COMPONENTS OF EMP

EMP for **M/s Perfect Laminate** proposed plant increased capacity utilization covers following aspects:

- Description of mitigation measures
- Description of monitoring program
- Institutional arrangements
- Implementation schedule and reporting procedures

The mitigation measures are proposed for operation for increased capacity phase only.

Institutional framework includes the responsibilities for environmental management as well as responsibilities for implementing environmental measures.

### 5.3.1 Construction Phase

#### 5.3.1.1 Air Environment

Environmental management plan for an industrial activity is an integral part of EIA and has been proved to be an effective tool to mitigate the adverse environmental impacts arising due to the establishment and operation phase of the industry. This gives a sequential approach with feasible options to ensure that the mitigation/control measures overcome the adverse impacts of the industry activity and thus achieve the sustainable operation.

Construction phase will be for a short period and hence the impacts will also be for a short and temporary period. During the construction activities, mainly emission of dust and gases from movement of vehicles and construction activity is expected. However, following measures will be taken to reduce such emission.

- Preparation of paved internal movement roads will be taken up at the initial stage of civil construction work.
- Water will be sprinkled on loose topsoil to re-suspension of dust in to ambient air due to movement of vehicles etc.
- Separate civil construction material storage yard will be created within the site and it will be closed.
- Possibility of raising green belt along with the construction activity will also be explored.

#### **5.3.1.2 Water Environment**

It is proposed to supply this quantity of water to site every day through the tanker of water private water supplier. Water quantity being small, no major impact on existing water resources of the study area is envisaged.

There will be no housing facility at site for construction workers and hence a major source of impact on water environment will be avoided. Care will be taken during construction work not to create any obstruction/ dips in the topography which can lead to accumulation of water within premises leading to undesirable consequences like health and hygiene problem etc.

To avoid water consumption Ratio Company will put adequate rain water harvesting system

**A: Rain water harvesting system****Catchment Area:-**

- Catchment area of the Project :- 4800 M<sup>2</sup>
- Rainfall :-1102mm i.e. (1.102mt.)
- Ground cover area :- 823 M<sup>2</sup>
- Available area for recharge :- 4000 M<sup>2</sup>
- Total rainwater available for Recharge /Year :- 4408 M<sup>3</sup>  
Says : - 4400 M<sup>3</sup>
- 20% evaporation & general loss i.e :- 880 M<sup>3</sup>
- Net rain water available for Recharge /year :- 3520M<sup>3</sup>
- Roof top Harvesting (RTH) area :- 823 M<sup>2</sup>
- Total rainwater available :- 907 M<sup>3</sup>  
Say : - 910 M<sup>3</sup>
- 10% General loss for R. T. H. :- 91 M<sup>3</sup>  
Say :- 90 M<sup>3</sup>
- Net Rain water for R.T.H. :- 820 M<sup>3</sup>
- Net Rain Water for Tube well Recharge water :- 3500 M<sup>3</sup>

**Rain Water Harvesting :-**

Rainwater Harvesting is generally putting back rainwater in to the underground formation, where it will be stored in underground reservoirs (Aquifer) so that we can draw it whenever we need it.

**“NEED”**

- To reduce ground water pollution.
- To augment the ground water storage and decline of Water Level
- To improve the quality of ground water.
- To reduce the soil erosion.
- To avoid flooding of rounds.

The harvested rain water can be used for flushing, washing, gardening, irrigation, fire fighting and even consumption with necessary treatment, Rain water is the purest form of water available to us.

**Components:-**

- Catchment
- Collection system
- Filtration unit
- Storage system

**Technology:-**

1. Storage in artificial above or underground tanks.
2. Recharging aquifer directly through tube wells with necessary treatment.
3. Recharging aquifer by percolation / Soakage in the ground.



Aquifers best suited for artificial recharge are those that absorb large quantities of water and do not release them too quickly.

Theoretically this means that the vertical hydraulic conductivity is high while the horizontal hydraulic conductivity is moderate. Most of the artificial recharge areas are located in the alluvial plains because of many favorable conditions like availability of infiltration waters and transmissivity of the aquifers.

**Ground Water recharge Rate:-**

The technical feasibility and economic viability of artificial recharge of Ground Water has already been established by CGWB (UNDP/CGWB 1986) by siphon method.

Salient features of experiment of state govt. and PRL in 1977:-

1. Recharge rate :- 590 LPM
2. Build up in the injection well :- 5.18 m
3. Drawdown in source well :- 0.70m
4. Build up in observation (V=40m) :-1.15m
5. Transmissivity :- 540 m<sup>2</sup> /day
6. Permeability :- 70 m / Day
7. Injection well efficiency :- 56%

No. clogging in injection well was observed after 220 hrs of experiment. This method was found more economical and cost at the time of experiment was found to be 45 paise per 1000 lits.

**Method of Recharge:-**

Artificial recharge is achieved by three methods namely by spreading by induced recharge and by injection. The suitability of particular method is based on the hydro geological condition. Our area is composed of deep aquifers with impervious over burden hence injection method is most suitable. Water is fed directly in to the depleted aquifers by providing a conduit access such as tube well. Recharge by tube well is the only method for artificial recharge of confined aquifer or deep seated aquifers. The recharge is instantaneous and there are no transit losses and evaporation losses. Artificial recharge is an important aspect of ground water management as it provides storage space free of cost, during dry period. The underground reservoirs can be used for indefinite period, if properly operated.

**Recharge Tube well :-**

Recharge tube well is constructed by drilling borehole up to desired depth with slotted pipes as per geohydrological condition of the area. After pilot bore hole drilling electrical logging process will be carried out to know litho logy & quality of aquifer water. Pipe assembly will be proposed after electrical logging process. After logging process, reaming whole process will be carried out as per specification. The annular space between the bore hole and pipe assembly is filled with suitable size of gravels (4 mm to 6 mm size). The recharge bore than develop with air compression to open the slots to maintain the recharging water in good quantity. In alluvium area, well screen is used which allows, water to enter the well freely at low velocity, prevents sand & Silt from entering the well. The aim of screen is to obtain the maximum slot screen pipe (Vee – Wire screens) is made with cold drawn wire, triangular in section, wound spirally around a circular array of longitudinal rods.

**Vee – Wire Screens:-**

- ❖ Efficient and sustainable for recharge well.
- ❖ Large % open area: - More than two times effective open area, gives maximum recharge rate at minimum frictional head loss which also reduces incrustation rate.
- ❖ Vee shaped slots: - Produces jetting effect to inject recharge water in to the aquifer.
- ❖ Non clogging slots.
- ❖ Non corrosive.
- ❖ Long life
- ❖ Higher discharge to aquifer.
- ❖ The best alternative for slotted pipes.

**Filter Pit for Recharge Tube well:-****Function:-**

- ❖ Main function is to reduce turbidity of raw water to reduce chocking of gravel pack.
- ❖ Keep feeding filtered water to recharge well.

**Importance: -**

- ❖ To sustain the recharge process.
- ❖ To maintain the recharge rate.
- ❖ The system is gravel less system, maintenance free.
- ❖ Provides effective sustainable recharge rate transparent process etc.

**Runoff Calculation :-**

The area under investigation at **M/s. Perfect Laminate** at Mansa is 4800 M<sup>2</sup>. The dependable Rainfall of the project area is 1082 mm i.e. 1.082 m. and maximum rainfall is 1500 mm i.e. 1.50m.

**Available Rain water for 4000 m<sup>2</sup> area as under:**

No.	Rainfall water in mm	Rainfall water in mts.	Total water in m3	20% evaporation & general recharge in m3	Net rainwater available for recharge in m3
1	80	0.08	320	64	256
2	250	0.25	1000	200	800
3	1102	1.102	4408	881.6	3526.4
4	1451	1.451	5804	1160.8	4643.2

If 250 mm rains in a day, total net, rain water available will be 700m<sup>3</sup> water. If 80 mm. rains (As per rain intensity) total net rain water available will be 224 m<sup>3</sup> water as per calculation of Catchment area, total 3500 m<sup>3</sup> water available for recharge in one rainy season.

3500 M<sup>3</sup> water is available for recharge in one rainy season and 820 M<sup>3</sup> water is available from roof top water harvesting. Hence total 4320 m<sup>3</sup> water will be available for recharge. As per water balance diagram total water consumption from tubewell is 4635 m<sup>3</sup> water per year hence about 315 m<sup>3</sup> water can be recharged in outside project area or 315 m<sup>3</sup> water can be recharged in one farm pond having capacity of 100 m<sup>3</sup> water. Therefore the total rain water harvesting & recharge is more than total consumption of water for the project.

### **Recommendations & Recharge Tubewell Design :-**

Looking to the Geohydrology of the area, rainfall intensity, it is proposed to drill one recharge tubewell in one farm pond, having capacity of 100 m<sup>3</sup> water for maximum recharging of rain water.

### **Specification of deep tubewell**

- 300 mm dia X 180 mts. depth
- Expected recharge- 50,000 lits/hrs
- Vee wire screen – 60 mts. for tapping zones between 100 to 180 mts. Slot size- 1.5 mm or 2.0 mm LCG.
- Reaming hole – 600 mm hole
- Gravel size – 4 to 6 mm. Gravel packing between 100 to 180 mts. depth
- Clay packing 100 m to Ground level
- Electro logging essential
- Expected cost of Recharge tubewell 10 lacs.

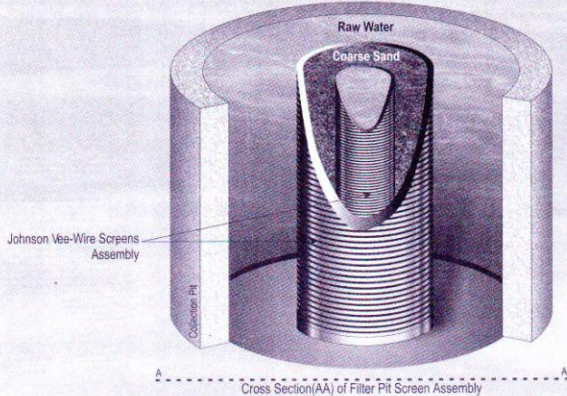
**Recharge pit around Tubewell**

- Recharge pit size 3 mts. dia X 3 mts. depth
- Recharge unit:- Vee wire screen (ss304) size 200 mm X 400 mm dia length of unit 2.0 mts.
- Provision for air vent should be done
- 200 mm size screen - Slot size 0.5 mm  
400 mm size screen – Slot size 0.75 mm
- Coarse sand packing between two screen spaces. (1.0 mm size coarse sand)
- Diagram of recharge pit is attached.



Johnson

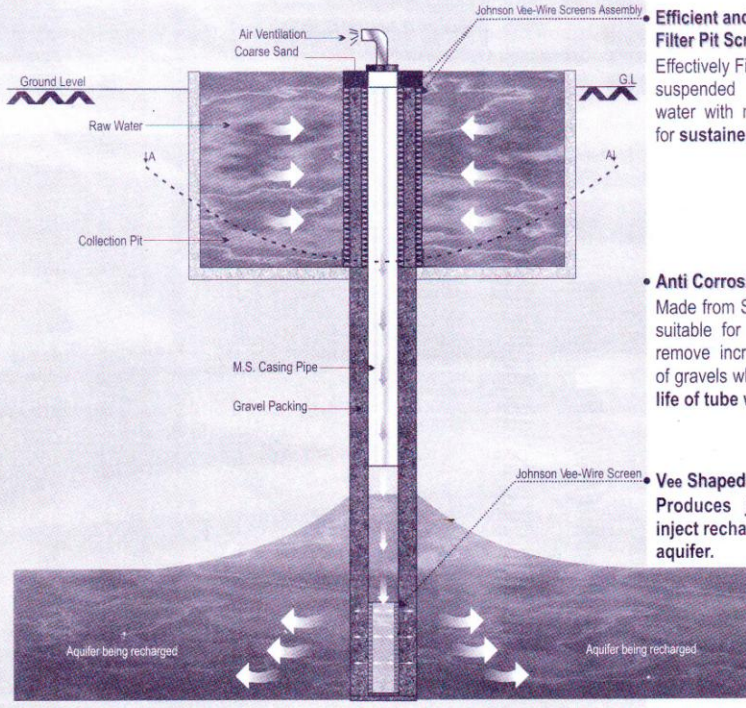
Efficient and Sustainable Recharge Well with  
Johnson "Vee-Wire" Screens



Cross Section(AA) of Filter Pit Screen Assembly

**Features & Benefits**

- Large % Open area**  
 More than 2 times effective open area (Compared to any slotted pipes) gives **maximum recharge rate at minimum frictional head loss** which also **reduces incrustation rate**.
- Efficient and Non Clogging Filter Pit Screen assembly**  
 Effectively Filters out maximum suspended solids from raw water with non clogging slots for **sustained recharge rate**.
- Anti Corrosive Material**  
 Made from Stainless Steel and suitable for acid treatment to remove incrustation, chocking of gravels which **ensures long life of tube well**.
- Vee Shaped Slots**  
 Produces jetting effect to inject recharge water into the aquifer.



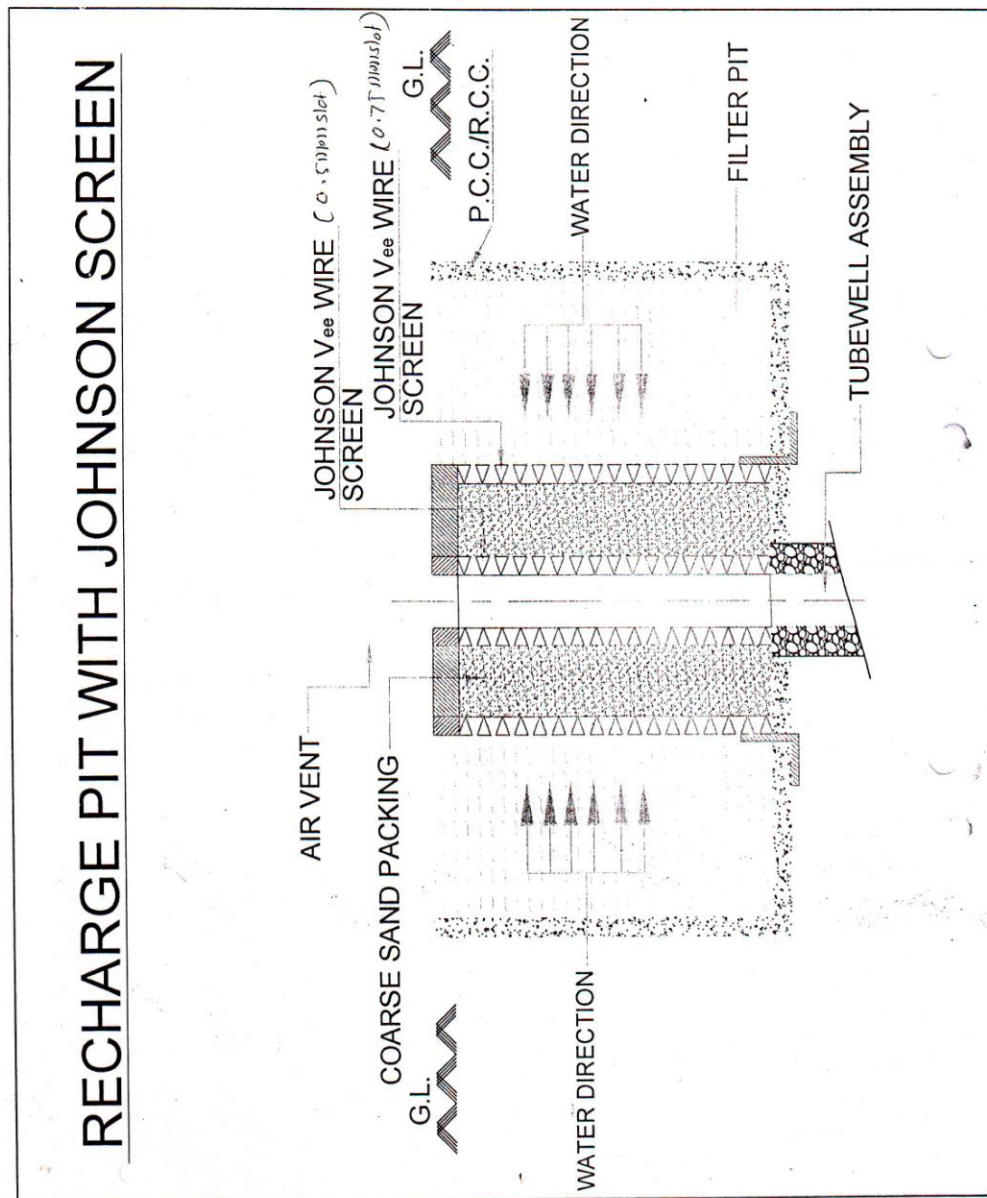
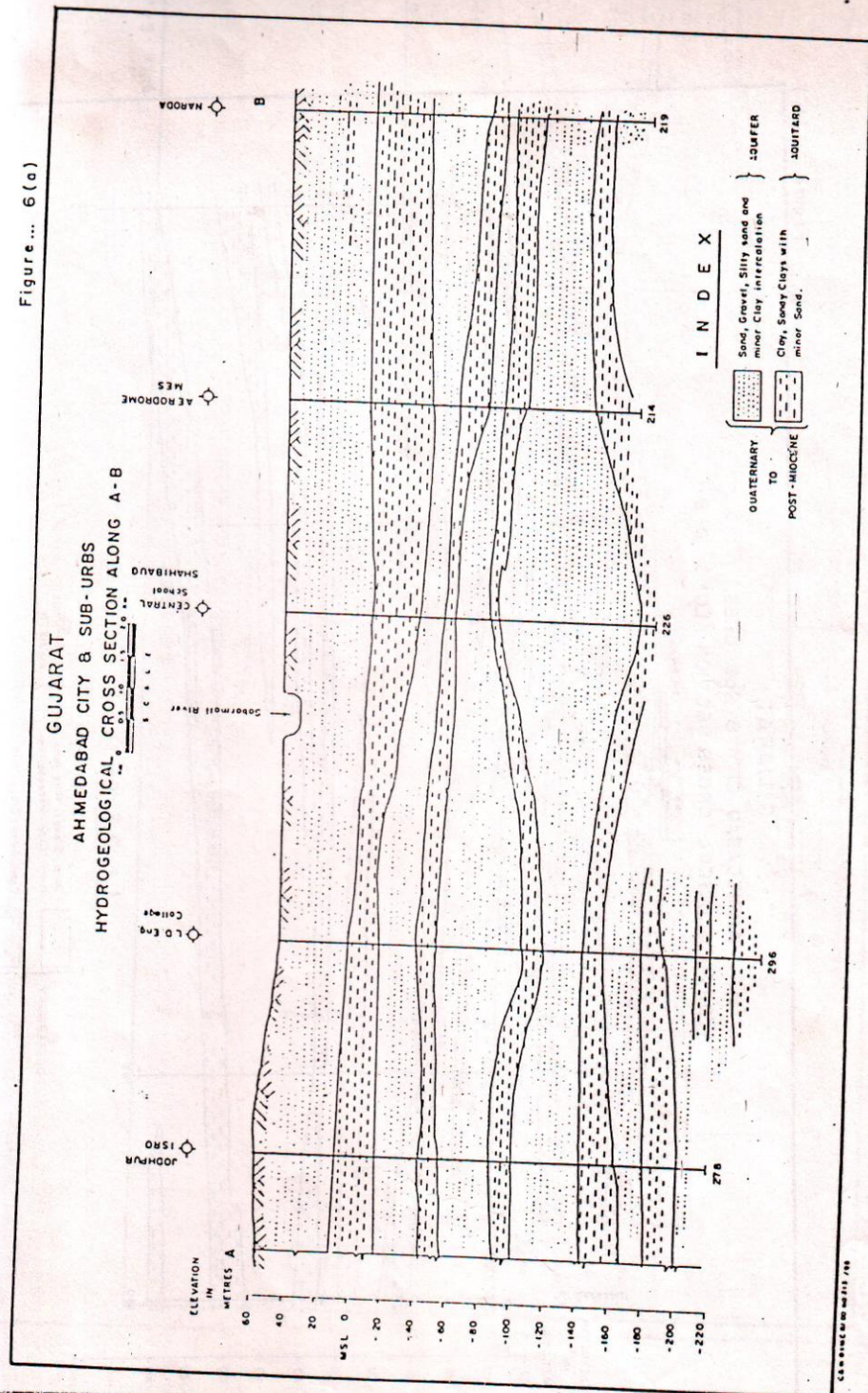




Figure ... 6 (a)



### **5.3.1.3 Solid Waste**

Main solid waste generation during construction work will be construction debris like rubble, brick bats, debris, steel scrap, wooden scrap, sand gravels etc. However these materials are inert in nature and will not leaching of any substances or constituents.

These materials will be properly stored and will be used with in premises for filling of low lying area. Wooden scrap, steel scrap will be given to scrap dealers. On completion of civil work, all debris etc. will be completely removed from site to avoid any incompatibility with future use.

### **5.3.1.4 Noise Environment**

Following measures are proposed during construction period to mitigate adverse impact:

- Construction machinery and vehicles will undergo periodic maintenance to keep them in good working condition.
- All machineries to be used for construction purpose will be of highest standard of reputed make and compliance of noise pollution control norms by these equipments will be emphasized by ACL.
- Acoustic laggings and silencers will be used in equipments wherever possible.
- Feasibility of putting up acoustic enclosure/ temporary barrier around area with high noise levels will also be explored.
- All construction workers working in high noise area will be provided appropriate Personal Protective Equipments like ear muffs and to wear them during working hours.
- Possibility of raising green belt along with construction activity will also be explored as a noise barrier.

### **5.3.1.5 Land Environment**

Following steps are proposed to take care of impact of construction activity on project land area.

- On completion of civil work, all debris etc. will be completely removed from site to avoid any incapability with future use.
- Other materials like paints, diesel etc. will be properly stored and handled by prevent any spillage on land.
- All the wastes will be stored at a designated site within the premises to prevent scattered discharge on land.

### **5.3.1.6 Ecology**

- Project site is almost barren land with few shrubs and trees. Thus, no major tree cutting exercise will be there and no major impact on ecology is anticipated. However possibility of rising of green-belt along with construction activity will be explored so that greening of area can be started at the beginning of project.

### **5.3.1.7 Socio- Economic**

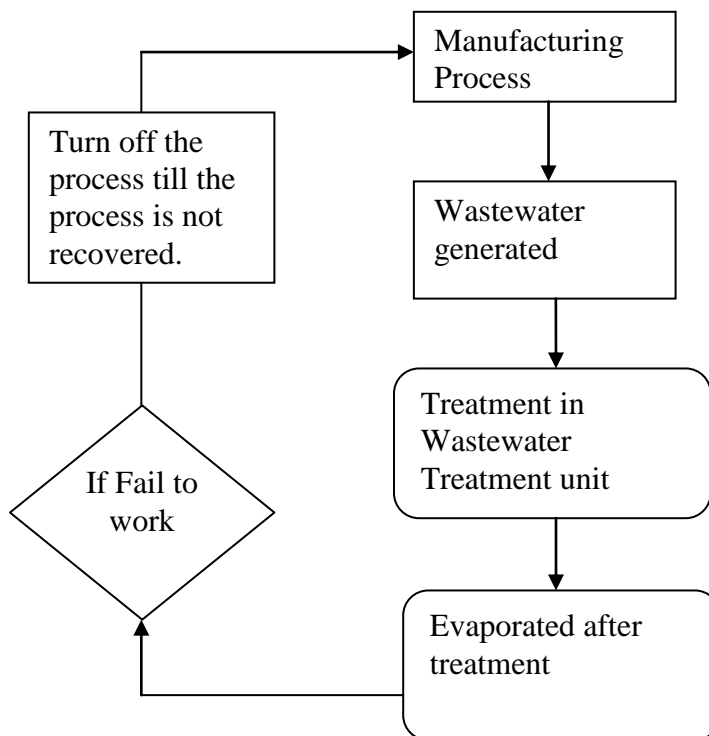
As there will be no temporary housing colony for construction workers, no socio-economic impact due to the same is envisaged.

### **5.3.2 Operation Phase**

Operation phase of any industry being longer in duration and because of its potential to create continuous impacts is much important from the environmental impact point of view and a comprehensive and effective EMP has to be prepared and implemented to safeguard environmental concern during the operation phase of any unit.

**5.3.2.1 WATER POLLUTION CONTROL SYSTEM**

- Their own bore will fulfill water requirements of proposed project well.
- All record will be keeping for water consumption and shall be maintained for each usage in future.
- The generated process wastewater will be treated in own effluent Treatment Plant and after treatment it will evaporate in evaporation system.
- Record the data of wastewater generation and disposal will be maintained.
- The manufacturing activities will be close down in case of any failure in equipments/facilities for prevention and control of water pollution.
- The domestic effluent is disposed to septic tank/soak pit system.
- Disposal system for storm water will provide separately and it is not being mixed with industrial effluent.
- Cleaner production technology will be assessed to minimize the wastewater generation and maximum possible reuse and recycling of material will be done.

**Figure No 5.1 Wastewater handling Environment Management plan**

#### 5.3.2.2 AIR POLLUTION CONTROL SYSTEM

- Since coal / lignite will be used as fuel in steam boiler, the unit is going to install dust collector as a pollution control measure to control the gaseous emission.
- High Speed Diesel (HSD) will be used as fuel at D.G. set, which will be operated rarely in case of power failure. Therefore, the gaseous emission from the D.G. set will also be well within gaseous emission norms recognized by GPCB.
- Adequate Stack height is provided for proper dispersion of pollutants into the atmosphere.

- Stack monitoring facilities like porthole, platform etc. will be provided with flue gas and process gas stack in order to facilitate sampling of gases being emitted into the atmosphere.
- In case of failure of any air pollution control equipments, the process activities will be stopped.
- Proper care will be taken to prevent any Fugitive emissions during manufacturing activity. To check fugitive emissions work area monitoring will be done periodically.
- We will recover heat from flue gas coming from boiler and by this way we will conserve natural resource.

#### **5.3.2.3 HAZARDOUS WASTE MANAGEMENT SYSTEM**

- The main source of hazardous waste generation is the ETP sludge from the effluent treatment plant, which will be sent to TSDF site for the disposal at SEPPL (Saurashtra Enviro Project Pvt. Ltd), Bhachau.
- The ancillary source of hazardous waste generation will be used/wasted oil which will be reuse or sell to MoEF approved scrap vendors, discarded barrels/ drums/ bags/ liners /carboys from the raw material handling & storage which will be decontaminated and reused or sold to GPCB approved scrap vendors. Bags are sold to GPCB approved scrap vendors.
- In the ETP the unit will use caustic flex instead of lime for neutralization to minimize the generation of solid waste.
- The unit will provide isolated area for the hazardous waste storage within premises having pucca floor, roof cover and leachate collection system which will be expanded as per the requirement.
- During monsoon season extra precautionary measures will be taken to prevent any generation of leachate.
- The leachate generated shall be taken to effluent collection tank along with effluent.

- Manifest system will be followed during transportation of hazardous waste for the disposal.
- Record of hazardous waste generation and disposal shall be maintained.

#### **5.3.2.4 NOISE CONTROL MANAGEMENT SYSTEM**

The precautions will be taken for abatement of noise pollution is as follows,

- Earplugs are provided to the workers at places where noise level may exceed 90 dBA in the process plant, DG room, etc.
- Extensive oiling, lubrication and preventive maintenance will be carried out for the machineries and equipments to reduce noise generation.
- Adequate noise control measures such as silencers at the air inlet/outlet, anti vibration pad for equipment with high vibration are provided.
- Noise monitoring shall be done regularly at different parts of the plant.
- The green belt area within industrial premises and around the periphery will prevent the noise pollution in surrounding area.

#### **5.3.2.4(A) Energy Conservation:**

- The unit will use solar light at main gate to conserve energy.
- The unit will also do energy audit every four year & according to the recommendation we will implement in our unit to save the energy.

#### **5.3.2.5 Occupational health Program**

**M/s. Perfect Laminate** is planning to follow occupational health program right from the start of Resin manufactured in the industry.

Unit maintains a healthy work environment is as follows,

- Annual medical check up shall be done for all employers once in a year.
  - Pre- employment medical check up at the time of employment.
  - First aid training shall be given to the employers.
  - First aid kit & some necessary medicines will be provided for safety of workers.
-



- A nearby hospital is engaged for emergency case.
- Onsite emergency plan will be prepared and rehearsed.
- Personal Protective Equipments like helmet, face mask, apron, gloves, goggles, ear plugs & safety shoes should be strictly to be used.
- All building plans and installation shall be as per relevant acts and duly approved by competent government authorities.
- Process equipment shall be designed by qualified and experienced professionals
- Periodically inspection and testing of all the equipments & machineries shall be done.
- Good housekeeping in factory premises shall be ensured.

#### **5.3.2.6 Greenbelt**

The Tree Plantation is one of the effective remedial measures to control the air pollution and Noise pollution. It also causes aesthetics and climatologically improvement of area as well as sustains and supports the biosphere. It is an established fact that the trees and vegetation acts as a vast natural sink for the gaseous as well as particulate air pollutants. Due to enormous surface area of the leaves, it also helps to attenuate the ambient noise level. The plantation around the pollution sources control the air pollution by filtering the air pollutant and interact with gaseous pollutant before it reaches to the ground. The tree plantation also acts as buffer and absorber against accidental release of pollutants.

The selection of tree species suitable for plantation at the industry shall be governed by guiding factors as stated below.

- The tree should be tolerant to air pollutants present in the area
- The tree should be able to grow and thrive on the soil of the area, be evergreen, inhabitant, having minimum of leaf fall.
- The tree should be tall in peripheral curtain plantation and with large and spreading canopy in primary and secondary attenuation zone.



- The tree should posse's extensive foliar area to provide maximum impinging surface for continued efficient adsorption and absorption of pollutants.
- The tree should be fast growing and indigenous, and should maintain ecological, land and hydrological balance of the region.

### **Greenbelt Development**

- The industry will provide 1585 Sq. Mt. Of green belt area.
- The industry will also provide green belt at the boundary of the plant.
- They will plant Asopalav, Neem, Ambo, Rose plant, Mogra, Jasud, Lily, Champo, Gulmohar & other plants in green belt area. We will plant 100 trees and 100-200 small and big plants.
- They will also develop lawn in some parts of the green belt.

#### **5.3.2.7 Control of fugitive emission**

- Precautionary measures will be taken during handling and loading-unloading of organic / hazardous chemicals.
- The entire manufacturing activities are carried out in the closed system.
- All the raw materials are stored in isolated storage area and containers are tightly closed.
- There is also provision of adequate ventilation system within premises.
- The unit has also developed green belt within the factory premises to control the fugitive emission from spreading in to surrounding environment also propose to expand the Green belt area after proposed expansion.

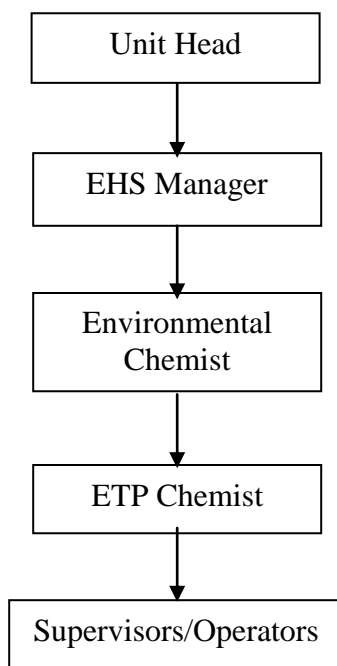
### 5.3.2.8 Environmental Monitoring Plan

As Environment monitoring plant shown in table & figure.

**Table 5.1 Environment Monitoring**

NAME OF ANALYSIS	FREQUENCY OF ANALYSIS	NUMBER OF SAMPLE
Stack Monitoring of each Stack	Once in a month	At all Stack
Ambient Air Quality Monitoring	Monthly for 24 hours or as per statutory conditions	3 Location once in a month
VOC Monitoring	Twice in a year	2 Locations in the work zone
Industrial Effluent as per Norms	Once in a month	Once in a month

**Figure 5.2 EHS Management**



# **CHAPTER 6:**

# **ONSITE DISASTER MANAGEMENT PLAN**

**M/s. Perfect Laminate**

## 6.1 INTRODUCTION

### Disaster

An emergency is said to have arisen when operations in the plant are not able to cope up with a potential hazardous situation i.e. loss of control of an incident cause the plant to go beyond its normal operating conditions, thus creating danger. When such an emergency evolves chain of events affect the normal working within the factory area and/ or which may cause injuries, loss of life, substantial damage to property and environment both inside and outside the factory and a disaster is said to have occurred.

The various steps involves in the process of Disaster Management can be summarized as:

- Minimize Risk Occurrence (Prevention)
- Rapid Control (Emergency Response)
- Effectively Rehabilitate Damaged Areas (Restoration)

Disaster Management Plan is involved by careful scrutiny and interlinking of:

- Types and causes of disaster
- Technical know-how
- Resource availability

## 6.2 TYPES OF DISASTER

The various type of Disaster that may occur are:

- Due to the fire and
- Hurricane, cyclone and other natural calamities.

### 6.2.1 Objectives of the Plan

The plan is developed to make best possible of **M/s. Perfect Laminate** to:

- Rescue the victims and treat them suitable.
- Safe guard others (evacuating them to safer places).

- Contain the incident and control it with minimum damage.
- Identify the persons affected.
- Preserve relevant records and equipment needed as evidence incase on inquiry.
- Rehabilitate the affected areas.

### **6.3 IDENTIFICATION OF MAJOR HAZARDOUS**

- From the preliminary risk assessment study presented in Chapter 6 of this report, some of the possible hazards are Methanol, phenol, melamine and caustic.

### **6.4 OBJECTIVES OF THE PLAN**

The plan will set into action immediately after a fire occurs inside the plant. However fire hazard will be restricted to fuel tank storage area only and hence to major disaster is envisage.

#### **6.4.1 Basis of Plan**

**M/s Perfect Laminate** will prepare an onsite emergency plan. The basic guidelines of the plan are as given below:

- Informative broacher on emergency will be distributed to each staff member of the plant and telephone numbers of key personnel to be contacted during an emergency will be placed at all the operator placement point in the plan.
- Workers would be trained regularly on fire hazard drill, which will be organized once in a here mock drill from the safety and fire agency.
- We will install surrounding methanol storage area.
- 24 hours vehicle for service and in-plant first aid emergency kit would be provided.

#### **6.4.2 Post Disaster Analysis and Evaluation**

When emergency is over, it is desirable to carry out a detailed analysis of the causes of the accident to evaluate the influence of various factors involved and to propose methods to eliminate them in future. Simultaneously, the adequacy of the disaster preparedness plan will be evaluated and any short comings will be rectified.

#### **6.4.3 General Recommendations**

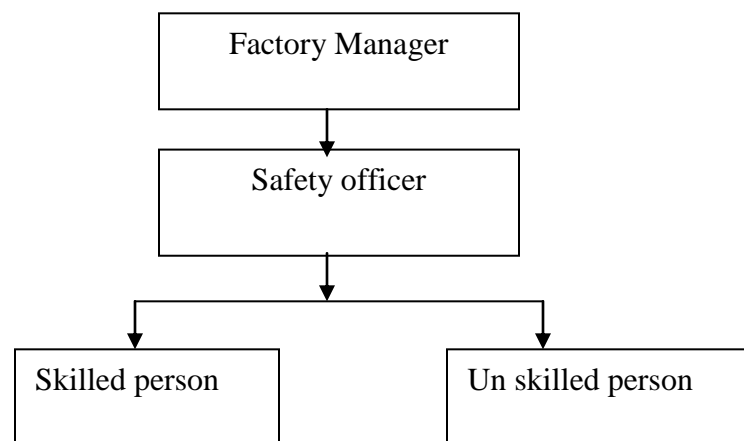
- All non-routine work etc. should be carried out under a permit system.
- Adequate number of caution boards high lighting the hazards of chemicals to be handled, eye bath and emergency showers should be provided at critical location.
- Adequate number of absorbents should be placed at accessible locations in the tank farm area as well as in the pump house that would enable to contain spills immediately.
- Adequate color coding and labeling of the pipelines should be provided for easy identification of products proposed to be handled through them.
- The damage distance due to any failure could be reduced, by reducing the time required to stop the leak, which in turn would reduce the quantity of spillage. The response time could be reduced by installing /maintaining instruments, effective communication system, etc.
- It is recommended that rubber mats be provided in front of electrical panel of the entire plant with a view to prevent employees from receiving electric shocks.
- It is suggested that all type of fire extinguishers be placed at appropriate places for easy access in case of emergency.

#### 6.4.4 The availability, organization, and utilization of resources for emergency.

The organizational set-up necessary for chain of commands during emergency situation, which may arise in the premises, is given in Fig.

6.1. The system is described in following Subsections

**Figure – 6.1 Onsite Disaster Management Plan**



Functions and Responsibilities:

##### **Factory Manager**

- He shall be the main guiding person for direct emergency operations.

##### **Safety officer**

- The main responsibility of safety officer is safety management.
- The Safety management includes the implementation of prevention methods to avoid incident or accident and handling of emergency in case of accident.

##### **Skilled person**

- He shall be responsible for the operation and maintenance.
- He shall be arranging the safety equipment accordingly.
- He shall be followed the instruction of supervisor and officer.

**6.4.5 Emergency Response Room (Safety officer room)**

The place identified as Emergency Response Center will be considered as the Security Gate Office. The location of the Emergency Response Center may change in future as per convenience. The facilities available at the Emergency Response Center shall include:

- i. Internal Telephone
- ii. External Telephone
- iii. Manual Fire/Emergency Siren
- iv. Siren Actuation Switch
- v. Important Address and Telephone Numbers
- vi. Emergency Vehicles
- vii. Confined Space Entry Procedure
- viii. List of Antidote/actions to be taken in case of hazardous chemical/materials.
- ix. Material Safety Data Sheets of chemicals
- x. A copy of On-Site Disaster Management Plan

All communications after General Shift working hours and on Sundays/Holidays are to be routed through the Security Gate Office.

**General Rules**

1. Follow sense of discipline and do not pain.
  2. Do not rush and endanger your personnel safety
  3. Use personnel protective equipment according to the situation
  4. Do not block any passages, which may hinder the movement of emergency vehicles.
  5. In case you have to shut down your plant operation, do it in an orderly manner as per standard operating procedures.
  6. In situation when you have to leave your work and evacuate to identify places out of operating areas, do it in an orderly manner.
  7. Follow instructions of the Safety officer.
-



8. Understand the Disaster Management Plan well and take interest in practice mock drill.

#### **6.4.6 Fire Fighting Facilities**

##### A. Fire Buckets / Fire Extinguishers

Fire buckets and portable fire extinguishers will be provided in all the areas depending upon the specific needs of the area. Some spare equipment will also be maintained in the inventory at an identified fire & safety equipment store.

##### B. Fire Alarm Sirens

It shall be provided to alert all the employees inside the premises about the situation of an emergency.

##### C. Safety Equipment

All types of personnel protective safety equipment required for handling the emergency are to be arranged in the M/s Perfect Laminate site. Some of the protective equipment is as follow:

- Canister/Cartridge type masks
- Dust Masks
- PVC suits, Aprons
- Safety showers/ Eye Wash fountains
- Other personnel protective appliances, like safety glasses, gumboots, helmets, hand gloves, face shields, safety belts, safety ladders, safety torches.

#### **6.4.7 Other Key Personnel**

All key personnel will wear red helmet for their identification and easy recognition. The responsibilities and duties of key personnel include.

##### **1. Safety**

The safety officer/ supervisor will carry out the following

- To provide necessary equipment like fire fighting equipment (FFE) and personal protective equipment (PEE).
- To accompany factory inspector during investigation of the emergency.
- To train workers/ supervisors in safety and safe operating procedures.
- To assist the site main controller, incident controller in preparing a brief report of the incident.

##### **2. Assembly Points:**

- The assembly points for gathering non-essentials workers / persons will be fixed and will be clearly marked as per the wind direction.

##### **3. Fire Control Arrangement:**

Fire fighting trained personnel will be made available in all the shifts. The responsibilities and duties include.

- To fight the fire with available internal fire fighting equipment and to stop leakage of liquid etc.
  - To provide personal protective equipment to the team.
  - To cordon the area and inform incident controller or site main controller about the development of emergency.
  - To train personnel (essential workers) to use personal protective equipment and firefighting equipment.
-

**4. Medical Arrangement:**

The responsibilities and duties include:

- To provide first aid to the affected persons, and, if necessary, send them to hospitals for further treatment.
- To keep a list of blood groupings ready and update.

**5. Transport Evacuation Arrangement:**

- For transportation of people, company's vehicles, cars, rickshaws etc. will be utilized.

# **CHAPTER 7:**

## **Risk Assessment**

**M/s. Perfect Laminate**

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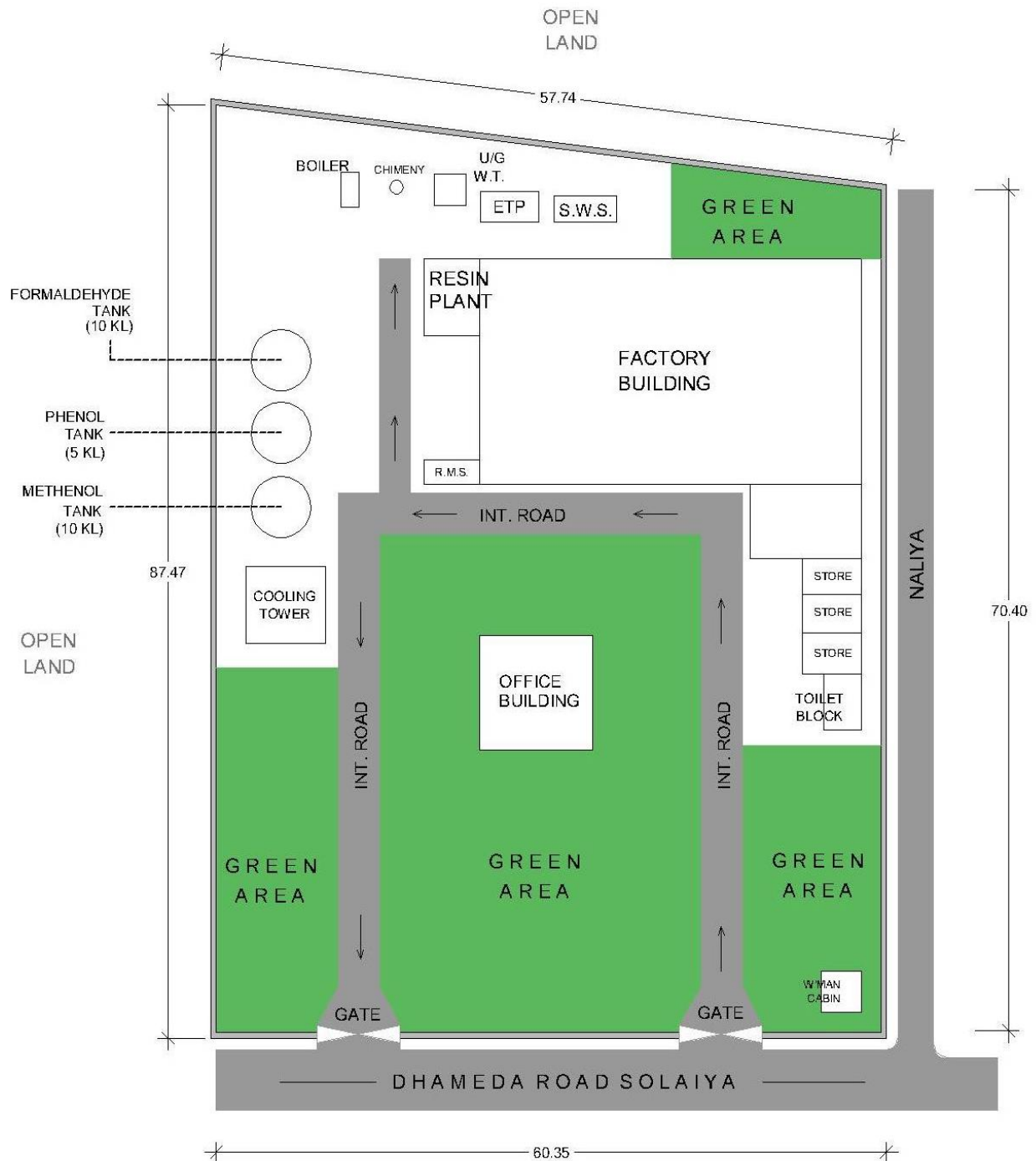
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## 7.1 INTRODUCTION OF COMPANY

**M/s. Perfect Laminate** is located at Survey No.28, Dhameda- Solaiya Road, Village: Anandpura, Taluka: Mansa, District: Gandhinagar, Gujarat. Company wish to manufacture Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Phenol Urea Formaldehyde Resin and Melamine Urea Formaldehyde Resin. Details of unit as follow.

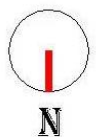
Sr. No.	Details	Compliance
1.	Full Name and Address of unit	<b>M/s. Perfect Laminate</b> Survey No.28, Dhameda- Solaiya Road , Village : Anandpura, Taluka: Mansa, District: Gandhinagar, Gujarat.
2.	Telephone No.	<b>Mr. Mukeshbhai Patel</b> Mobile No: <b>9825987547</b>
3.	Metrological Data	<b>Latitude : 23°32' N</b> <b>Longitude : 72°46' E</b> Wind Direction :North Wind Speed : <b>Min : 0.06 m/s</b> <b>Max: 1.00 m/s</b> <b>Avg : 0.72 m/s</b>
4.	Full Name and Address of the Occupier	<b>Mr. Mukeshbhai Patel</b> B/19, TirupatiTulsiBunglows, Nr. Veg. Market, Kalol Road, Post.: Mansa, Dist.: Gandhinagar
5.	No. of Shift and Shift Timing	<b>2 shifts per day.</b> Timing of Shift: a) 8 a.m. to 8 p.m. b) 8 p.m. to 8 a.m.
6.	No. of Staff	<b>8 Nos.</b>
7.	Emergency Facilities	
	Nearest Railway station	: <b>Gandhinagar</b>
	Nearest Police Station	: <b>Mansa (5.1 km)</b>
	Nearest Fire Station	: <b>Mansa (5.2 km)</b>
	Nearest Hospital/Dispensary	: <b>Mansa (5.3 km)</b>

## 7.2 PLANT LAYOUT



SITE PLAN

1:500



R.M.S. = RAW MATERIAL STORAGE  
S.W.S. = SOLID WASTE STORAGE

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### **7.3 OBJECTIVE, PHILOSOPHY & METHODOLOGY OF RISK ASSESSMENT**

#### **OBJECTIVE:**

The main objective of the Risk Assessment study is to determine damage due to major hazards having damage potential to life and property and provide a scientific basis to assess safety level of the facility.

The secondary objective is to identify major risk in manufacture of chemicals, storage of chemicals and provide control through assessment. To prepare on-site, off-site, disaster management plan for control of hazards.

#### **PHILOSOPHY:**

The main philosophy of risk assessment is to find out the real cause of accident and then based on it to suggest appropriate remedial measures to prevent its recurrence.

Also find out unsafe action, negligence, omission or personal fault.

#### **METHODOLOGY:**

To find out the quantitative Risk Assessment study as follow.

Identify Vulnerable Zone for toxic dispersion, pool fire, Tank on fire (Thermal Radiation), Flash Fire, and Explosion over pressure (Vapor Cloud Explosion) by using software.



**7.4 DETAILS OF RAW MATERIALS**

Sr. No.	Name of the Raw Material	Total Quantity MT /Month	Physical State	Capacity	Storage	Material of Construction	No.
1.	Phenol	20	Liquid	5 KL	Tank	Industrial Tank	1
2.	Formaldehyde	36	Liquid	10 KL	Tank	Industrial Tank	1
3.	Melamine	24	Solid	--	Bags	--	--
4.	T. G. Urea	9	Solid	--	Bags	--	--
5.	Methanol	12	Liquid	10 KL	Tank	Industrial Tank	1
6.	Caustic	0.5	Solid	--	Bags	--	--

**7.5 DETAILS OF FINISHED PRODUCTS**

Sr. No.	Name of the Intermediate Product	Total Quantity MT/Month	Physical State	Capacity	Storage	MOC	No.
1	Phenol Formaldehyde Resin	60 MT/M	Semi Liquid	200 L	Drum	HDPE	2
2	Melamine Formaldehyde Resin		Semi Liquid	200 L	Drum	HDPE	2
3	Phenol Urea Formaldehyde Resin		Semi Liquid	200 L	Drum	HDPE	5
4	Melamine Urea Formaldehyde Resin		Semi Liquid	200 L	Drum	HDPE	2

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## 7.6 MANUFACTURING PROCESS

### 7.6.1 Phenol Formaldehyde Resin:

- ❖ First all raw materials like phenol, formaldehyde & caustic will be added into closed vessel.
- ❖ Stirring & heating will be done up to 60 °C. After 60°C stop heating.
- ❖ Reflux is done for 30 minutes up to 98 °C.
- ❖ Vacuum distillation will be started.
- ❖ Water will be removed from the vessel as per the batch size.
- ❖ Cooling will start up at 40 °C.
- ❖ Methanol will be added for dilution purpose.
- ❖ Phenol Formaldehyde Resin will be ready for use in Laminate sheets.

### 7.6.2 Melamine Formaldehyde Resin:

- ❖ First all the raw materials melamine & formaldehyde will be added in Limped reaction vessel.
- ❖ Stirring & heating will be done upto 95 °C for 1 Hr.
- ❖ Cooling will start up at 40 °C.
- ❖ Melamine Formaldehyde Resin will be ready for use in Laminate sheets.

### 7.6.3 Melamine Urea Formaldehyde Resin

- ❖ First of all Melamine, T. G. Urea & Formaldehyde will be added in the Reaction vessel.
- ❖ pH will be adjusted to neutral by homogeneous mixing.
- ❖ Stir for 1 hr. & also maintain temperature between 70 oC to 80 oC.
- ❖ Water will be circulated & temperature should be maintained at 40 oC.
- ❖ Product Melamine Urea Formaldehyde Resin will be packed for use.

### 7.6.4 Phenol Urea Formaldehyde Resin

- ❖ First of all Phenol, T. G. Urea, Formaldehyde & Caustic will be added in the Reaction vessel.
- ❖ pH will be adjusted to neutral by homogeneous mixing.
- ❖ Stir for 1 hr. & also maintain temperature between 70 oC to 80°C.
- ❖ Water will be circulated & temperature should be maintained at 40°C.
- ❖ Product Phenol Urea Formaldehyde Resin will be packed for use.

### 7.7 LIST OF HAZARDOUS CHEMICALS ALONG WITH THEIR TOXICITY LEVEL AS PER MSIHC RULES

Sr. no.	Chemical	TLV	Toxicity Level			Flammable Limit					Chemical Class (As per MSIHC Rules)
			LD50 Oral Mg/Kgs	LD50 Dermal Mg/Kgs	LC 50 Mg/L	LE L %	UEL %	FP °C	BP °C	Class (As per petroleum classification)	
1	Phenol	5 ppm	317	669	125	1.7	8.5	79(CC) 85(OC)	182	C	Flammable, Toxic, Hazardous
2	Formaldehyde	0.3	100	270	203	6	36.5	50(CC) 60(OC)	96	B	Flammable, Toxic, Hazardous
3	Caustic	2 mg/m <sup>3</sup>	N.A	N.A	N.A	N.A	N.A	N.A	1388	--	Hazardous
4	Methanol	200	5628	15800	64000 ppm / 4 hr	6	36	12	64.5	A	Very high flammable
5	Melamine	N.A	3161	1000	N.A	N.A	N.A	93.3 (CC)	N.A	--	Slightly flammable
6	Urea	N.A	8471	N.A	N.A	N.A	N.A	N.A	N.A	--	Slightly flammable

**Note:** CC: Close Cup  
OC: Open Cup  
N.A.: Not Available

The Toxicity level of hazardous chemicals as per Manufacture, storage and import of Hazardous Chemical (Amendment) Rules, 2000 (MSIHC) is shown as below

#### Toxicity Index As per MSIHC Rule 2000

Sr. No	Toxicity	Oral Toxicity LD50 (Mg/Kg)	Dermal Toxicity LD50 (Mg/Kg)	Inhalation Toxicity LD50 (Mg/Kg)
1	Extremely Toxic	<5	<40	<0.5
2	Highly Toxic	>5- 50	>40-200	>0.5-2
3	Toxic	>50-200	>200-1000	>2-10

## 7.8 HAZARD IDENTIFICATION AND PREVENTIVE MEASURES

### 7.8.1 RAW MATERIAL STORAGE HAZARDS AND CONTROLS:

Sr. No.	Name of material stored	Quantity (Maximum)	Operating pressure/temperature	Hazard Rating Systems	Type of hazard / Risk involved	Persons Affected	Control Measures
(1)	Phenol	5 KL (1 Nos.)	NTP	TLV – 5 PPM STEL-10 PPM  <b>NFPA Ratings:</b>  Health: 4; Flammability: 2;  Instability: 0  <b>Flash Point:</b> 79.44°C	<ul style="list-style-type: none"> <li>➤ Toxic when contact with Skin</li> <li>➤ Causes burns</li> <li>➤ Toxic if swallowed</li> <li>➤ Irritating to Skin, Eyes and Respiratory System</li> </ul>	<ul style="list-style-type: none"> <li>➤ Operators</li> <li>➤ Maintenance Technicians</li> </ul>	<ul style="list-style-type: none"> <li>➤ Dyke provision to storage tank</li> <li>➤ Safety boards displayed on the tank</li> <li>➤ Good ventilation must be provided.</li> <li>➤ For accidental contact with skin, nearby provision of soap-suds</li> <li>➤ Use water spray to keep fire-exposed containers cool. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products.</li> <li>➤ Handling of Phenol with Safety glasses, hand gloves, gumboot</li> </ul>

(2)	Methanol	10 KL (1 Nos.)	NTP	TLV – 200 PPM (8-hr TWA) STEL-250 PPM <b>NFPA Ratings:</b> Health: 1 Flammability: 3	➤ Highly Flammable ➤ Toxic by inhalation ➤ Toxic when contact with Skin ➤ Toxic if swallowed ➤ Danger of very serious irreversible effects.	➤ Operators ➤ Maintenance Technicians	➤ Keep away from sources of ignition, tight closed container and dyke provision to storage tank ➤ Safety board's displayed on the tank ➤ Effective ventilation must be provided. ➤ For accidental contact if you feel unwell, seek medical advice immediately ➤ Handling of Methanol with Safety gloves and protective clothing
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(3)	Formaldehyde	10 KL (1 Nos.)	NTP	TLV – 0.3 PPM NFPA Ratings: Health - 3 Flammability - 2 . Reactivity - 0 Flash Point: 500C	➤ Flammable ➤ Very toxic by inhalation. ➤ Very toxic in contact with skin. ➤ Very toxic if swallowed. ➤ Causes burns. ➤ Limited evidence of a carcinogenic effect. ➤ Risk of serious damage to the eyes. ➤ May cause sensitization by skin contact.	➤ Operators ➤ Maintenance Technicians	➤ Dyke provision to storage tank ➤ Safety board's displayed on the tank ➤ Good ventilation must be provided ➤ Trap & collect spills with Sand or other inert solids ➤ Use an approved gas mask in un-ventilated areas if necessary because of fumes. ➤ Handling of Formaldehyde with Safety glasses, Nitrile or butyl rubber gloves
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**7.8.2 PROCESS HAZARDS AND CONTROLS:**

Name of hazardous process and operation	Material in the process / operation	Type of hazard possible toxic gas release / fire / explosion / run away reaction / rupture, etc.	Control measured provided
Condenser	Steam & Cooled Water	<ul style="list-style-type: none"> <li>•Bursting of Condensing tubes</li> <li>•Cold burns</li> </ul>	a) Licensed Condensers b) Annual inspections c) Safety interlocks to be provided d) Safety and pressure gauge valves fitted e) Properly supported and protected against corrosion f) Testing of Jackets and joints of tubes regularly
Reactor Vessel	Phenol Methanol Formaldehyde	<ul style="list-style-type: none"> <li>•Exothermic Run-away reaction</li> <li>•Release of Heat and Flammable gases</li> <li>•Fire, Toxic gas release and Explosion</li> </ul>	a) Raw Materials quantity must be controlled either volumetrically or gravimetrically. b) Process control devices must be installed includes the use of sensors, alarms, trips and other control systems that either take automatic action or allow for manual intervention to prevent the conditions for uncontrolled reaction occurring. c) High Temperature indicator valve and alarm system must be provided d) Auto cutoff system must be provided after reaching of predetermined maximum safe temperature. e) Pressure gauge is must provided. f) Safety Control valve is must be provided. g) The Vessel Emergency Relief vent should discharge to a suitably designed catch pot or should be so positioned that people working in the area and members of the public will not be in danger if the contents of the vessel are discharged. h) Use skilled worker i) Proper selection of MOC j) Mechanical seal in all pumps and reactors k) Transportation of finished product from vessel to storage tank through

**7.8.3 GENERAL HAZARDS & CONTROLS:**

Type of Emergency	Identification of Area	Possible Causes	Possible Results	Preventive/ control Measures
Fire	Tank farm area	<ul style="list-style-type: none"> <li>• Fire due to</li> <li>• Bottom nozzle failure</li> <li>• Damage of FO storage tank</li> <li>• Pump discharge nozzle failure</li> <li>• Unloading road tanker hose rupture</li> </ul>	<ul style="list-style-type: none"> <li>• Major fire in the tank farm, it may spread all over the company and surrounding area</li> <li>• May cause fatalities</li> </ul>	<ul style="list-style-type: none"> <li>• Licensed and isolated storage tank farm.</li> <li>• Flame proof fittings.</li> <li>• Earthling while unloading.</li> <li>• Spark arrestor at main gate.</li> <li>• Dip pipes on the tank for unloading.</li> <li>• Provision of dyke.</li> <li>• Earthling of tanks and pumps.</li> <li>• Get approval from an explosive department for plan approval, equipment layout &amp; emergency control measures.</li> <li>• No electrical junction box close to storage materials.</li> <li>• Hot work permit system followed for hot working in the ware house.</li> </ul>
Toxic Gas Release	Tank Farm and Reaction Vessel area	<ul style="list-style-type: none"> <li>• Cylinder blast</li> <li>• Rupture of discharge valve</li> <li>• Rupture of gas cylinder body</li> <li>• Bursting of pipelines</li> </ul>	Major gas exposure in the company and /or surrounding area of the company which resulting in irritation to respiratory track eyes and suffocation. More inhalation results in fatalities.	<ul style="list-style-type: none"> <li>• Storage Tank stored under shed and good ventilated area.</li> <li>• Procured by license holder party.</li> <li>• Fitted with valve protection cap.</li> <li>• Valve opened with special key.</li> <li>• Loading/unloading done safely.</li> <li>• Trained persons for Material Handling in Tank Farm and Storage Tank area.</li> <li>• Periodic hydraulic testing through competent person by supplier</li> <li>• Painted according to its color code.</li> </ul>
Explosion	All Material handling areas	<ul style="list-style-type: none"> <li>• Vapor explosion due to contact of spark to accumulated flammable vapor in confined area</li> </ul>	<ul style="list-style-type: none"> <li>• Improper discharge of static charge</li> <li>• Use of non FLP equipment for solvent handling</li> <li>• Metal to metal impact</li> <li>• Electrical short circuit</li> <li>• Open flame</li> </ul>	<ul style="list-style-type: none"> <li>• Flameproof electric installation areas &amp; use spark less tools</li> <li>• Isolated storage of Flammable material drums</li> <li>• Hot work permit for hot working in the plant</li> <li>• Earthling for human static charge</li> <li>• Good ventilated area for Flammable material storage</li> </ul>
Material handling	In Plant	<ul style="list-style-type: none"> <li>• Flammable, eye irritating</li> </ul>	Fire and health Hazards	<ul style="list-style-type: none"> <li>• Trained employee</li> <li>• Required PPE and Fire Protective equipment Provided</li> <li>• Good engineering practice</li> <li>• Separate storage are with dyke valve system provided</li> </ul>
Methanol, Phenol, Formaldehyde and Melamine Fire Protective System	Storage and other Operation Area	<ul style="list-style-type: none"> <li>• Spillage and overflow,</li> </ul>	Fire Hazard	<ul style="list-style-type: none"> <li>• Required Fire Extinguisher Provided</li> <li>• Flame Proof Electrical Fitting</li> <li>• Proper Earthling arrangement</li> <li>• Fire Hydrant System with Jockey Pump</li> <li>• Gas Detector</li> </ul>



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**7.8.4 : PRECAUTION FOR STORAGE AND TRANSPORTATION OF HAZARDOUS CHEMICAL:****For Storage:**

1. Dyke wall shall be provided to all above ground storage tank.
2. Fire hydrant system shall be installed.
3. Safety shower and eye washer shall be installed near storage area.
4. Flame proof light fitting shall be provided at flammable storage area.
5. Proper selection of MOC for tank.
6. Sprinkler system shall be installed at flammable material storage area
7. Earthing /bonding shall be provided for static charges..
8. Flame arrestor shall be provided on flammable material storage tank vent.
9. Level gauge and level measurement instrument shall be provided on material storage tank.
10. Lightning arrestor on all chimney and building shall be provided.
11. Hazardous material should be stored away from the plant and safe distance shall be maintained.
12. Safety permit system shall be followed for loading, unloading of hazardous chemical.
13. Fencing, caution note, hazardous identification board should be provided.
14. Only authorized person shall be permitted in storage tank area and register will be maintained.

**Precaution for storage for Formaldehyde:**

1. Formaldehyde shall be stored in a tightly closed environment with protection against physical damage.
2. Storage shall be in cool , dry well-ventilated location away from any area where the fire hazard may be acute.
3. Outside or detached storage shall be done for formaldehyde storage and separate from incompatible.
4. Container shall be bonded and grounded for transfer to avoid static sparks.
5. Storage and use area shall be No smoking area.

6. Use non-sparking type tools and equipment, including explosion proof ventilation.
7. Special protective equipment for maintenance breaks in or where exposures may exceed established exposure levels.
8. Training to workers on washing hands, face, forearms and neck while existing restricted areas.
9. Training to workers on taking shower, disposing of outer clothing, change to clean garments at the end of the day.
10. Avoiding cross contamination of street clothes.
11. Protection from freezing.

**For Transportation:**

1. Solvent shall be received by road tanker and stored in above ground storage tank in separated bulk storage area.
2. Loading and unloading procedure shall be prepared for material received through road tanker.
3. Earthing/bonding shall be provided for static charges..
4. Flexible steel hose shall be used for unloading from the road tanker.
5. Flame proof electric motor shall be used during loading/unloading.
6. NRV shall be provided on pump discharge line.
7. Fixed pipeline with pumps shall be provided for transfer to vessel.
8. TERM CARD will be provided to all transporters and shall be trained for transportation Emergency of hazardous chemicals.
9. Personal Protective Equipment (safety goggles, hand gloves, apron, masks, gum boots etc.) shall be provided.

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**Precaution for storage, transportation for Phenol. Action Plan for handling and safety system for handling hazardous chemical specially phenol. Step contemplated for dealing with transportation accident involving phenol:**

**For Storage:**

1. Separate from strong oxidant.
2. Keep it in well ventilated room.
3. Store in an area without drain or sewer access.
4. Provision to contain effluent from fire extinguisher.

**Action plan for handling and safety system:**

1. Unload by gravitational flow pumping. Never used pressurized unloading.
2. Air Vent should be provided.
3. Avoid over heating which lead spillage and cause thermal expansion.
4. Used method for unloading truck or tanker, by pumping from top of vessel.
5. Alternative vessel may be unloaded from top by pressuring with compressed nitrogen or from bottom of pumping or nitrogen pressurization.
6. Any solidified material in vessel should be melted by applying low pressure (60 psig) steam or warm water to vessel heating coil.

**For Transferring:**

1. Carbon steel piping used for transferring which better protection from corrosion. Aluminum, copper, brass should be avoided.
2. Standard ANSI – Type chemical process pump is recommended using single rotating bellow seal with carbon face running on a stationary silicon carbide seat.
3. Personal protective equipment should be used.
4. For prevention of fire : Alcohol resistant foam, powder , water spray foam , dry chemical and CO<sub>2</sub> media used for fire fighting.
5. Use of term card.
6. For prevention of explosion: Providing cooling by spraying with water.

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**Step contemplate for dealing with transportation accident with phenol**

1. Medical attention should be providing.
2. Remove contaminated cloth.
3. Rinse with water.
4. Apply antidotes.

**7.8.5 :ARRANGEMENT FOR MONITORING OF PHENOL FORMALDEHYDE AT WORK ZONE AREA:**

**Sources:** operators could be exposed due to mechanical failure of hoses or seals and failure to ensure all hatches and chutes are closed. Exposure could also occur during the following activities or events: sample collection and testing, truck loading and unloading, filling of drums, equipment cleaning and maintenance, opening of tanks and equipment, and spills. All activities from glue spreading, pre-lay and hot press operating.

**Method of Testing: NIOSH, National Institute for Occupational Safety and Health Method 2541**

**Duration of sampling: 6-10 hours**

**Method for Monitoring:** Formaldehyde and phenol will monitored in the workplace air. Formaldehyde will measured both in the breathing zones of the workers and at stationary sampling sites. Phenol was used as a marker agent for dermal exposure due to its near-non volatility at the temperatures occurring during the present study and to its ready absorption through the skin, causing systemic exposure in addition to local skin rashes. Sampling and analytical methods were developed to measure the dermal exposure to phenol. Sampling was accomplished with whole-body dosimeter using Tyvek coveralls and cotton gloves. In addition, a liquid chromatography method was developed for the analysis of phenol from dermal exposure samples

**Benefit of monitoring:**

1. To control potential risk to health.
2. The provide controls measures by using following.
  - a. Elimination
  - b. Substitution
  - c. Engineering controls
  - d. Safe work practices (Administrative practices)
  - e. Personal protective equipment

**7.8.6 :TREATING WORKMEN AFFECTED BY ACCIDENTAL PHENOL CONTACT ON SKIN :****❖ Hazards With Acute Exposure**

- Contact with skin may cause severe burns or systemic poisoning.
- Systemic effects may occur from any route of exposure, especially after skin absorption.

**❖ Hazards With Chronic Exposure**

- Repeated or prolonged skin exposure to phenol or vapors from heated phenol may cause headache, nausea, dizziness, diarrhea, vomiting, shock, convulsions, and death.
- Phenol affects the central nervous system, liver, and kidneys.

**❖ Special Safety Precautions**

- Phenol should be used with adequate ventilation to minimize inhalation. When heating phenol, use a water bath inside a chemical fume hood. **NEVER** heat or melt phenol in an incubator, microwave, drying oven, or similar appliance.

- Prevent contact with skin by wearing neoprene gloves, lab coat, and resistant apron.
- Wear safety glasses or a face shield if splashing may occur.
- Store in a cool, dry, well-ventilated area, away from heated surfaces or ignition sources.
- Skin contact requires immediate washing of the affected area with soap and water. Remove contaminated clothing and launder before wearing again.
- When phenol is heated, it can react vigorously with oxidizing agents.
- Phenol waste should be placed in a properly labeled glass bottle with a securely sealed lid.

❖ **Procedure for treating workmen after skin contact**

- Skin contact with phenol requires immediate flushing of the contaminated area with soap and water at a sink or emergency shower for a good fifteen minutes. Remove contaminated clothing. In case of eye contact, promptly flush the eyes with copious amounts of water for 15 minutes (lifting upper and lower lids occasionally) and obtain medical attention. If phenol is ingested, obtain medical attention immediately. If large amounts of phenol are inhaled, move the person to fresh air and seek medical attention at once. It is recommended to provide the safety shower and eyewash station in plant.

❖ **Antidotes for phenol**

- Poly Vinyl pyrrolidone (PVP).
- Polyethylene glycol 300 or 400
- Ethanol

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## 7.9 RISK ANALYSIS AND CONSEQUENCE ANALYSIS

### RISK ANALYSIS AND CONSEQUENCE ANALYSIS

- The consequence analysis has been done for selected scenarios. This has been done for weather conditions having wind speed 0.72 m/s.
- Software used for calculation- ALOHA (Areal locations of Hazardous atmospheres)
- Aloha is a computer program designed especially for use by people responding to chemical accidents, as well as for emergency planning and training. ALOHA can predict the rates at which chemical vapors may escape into the atmosphere from broken gas pipes, leaking tanks and evaporating puddles. It can then predict how a hazardous gas cloud might disperse in the atmosphere after an accidental chemical release.
- ALOHA is an air dispersion model, which you can use as a tool for predicting the movement and dispersion of gases. It predicts pollutant concentrations downwind from the sources of a spill, taking into consideration the physical characteristics of the spilled material. ALOHA also accounts for some of the physical characteristics of the release site, weather conditions, and the circumstances of the release. Like many computer programs, it can solve problems rapidly and provide results in a graphic, easy to use format. This can be helpful during an emergency response or planning for such a response.
- ALOHA provide output as amount of chemical discharged from the source as well as its concentration in air it takes into account different levels of concentrations for a specified chemical.

Sr. No.	Short description of scenario	Chemical Involved	Type of Risk	Probability	Concentration	Damage Distance from source
1	Release from damage of formaldehyde storage tank (10 KL)	Formaldehyde	Flammable area of Vapour Cloud	Very unlikely	0.7 ppm 4.2 ppm	Greater than 10 Kilometer
			Toxic Effect	Very unlikely	0.9 ppm 14 ppm 56 ppm	Greater than 10 Kilometer
2	Release from damage of methanol storage tank (10 KL)	Methanol	Thermal Radiation from pool fire	Very unlikely	pain within 60 sec	89 meter
					2nd degree burns within 60 sec	61 meter
					potentially lethal within 60 sec	45 meter



**INPUTE DATA FOR ALOHA ARE AS BELOW:****SITE DATA:**

Location: PERFECT LAMINATE, MANSA, INDIA

Building Air Exchanges per Hour: 0.30 (unsheltered single storied)

Time: February 11, 2012 1858 hours ST (using computer's clock)

**CHEMICAL DATA:**

Chemical Name: METHANOL                      Molecular Weight: 32.04 g/mol

AEGL-1 (60 min): 530 ppm    AEGL-2 (60 min): 2100 ppm

AEGL-3 (60 min): 7200 ppm

IDLH: 6000 ppm    LEL: 71800 ppm    UEL: 365000 ppm

Ambient Boiling Point: 64.7° C

Vapor Pressure at Ambient Temperature: 0.18 atm

Ambient Saturation Concentration: 183,687 ppm or 18.4%

**ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)**

Wind: 0.72 meters/second from N at 3 meters

Ground Roughness: open country                      Cloud Cover: 0 tenths

Air Temperature: 26.8° C                      Stability Class: F

No Inversion Height                      Relative Humidity: 78%

**SOURCE STRENGTH:**

Leak from hole in vertical cylindrical tank

Flammable chemical is burning as it escapes from tank

Tank Diameter: 7.78 meters                      Tank Length: 2.1 meters

Tank Volume: 99,832 liters

Tank contains liquid

Internal Temperature: 26.8° C

Chemical Mass in Tank: 74.3 tons

Tank is 86% full

Circular Opening Diameter: 0.6 meters

Opening is 1.25 meters from tank bottom

Max Flame Length: 23 meters

Burn Duration: 8 minutes

Max Burn Rate: 2,850 kilograms/min

Total Amount Burned: 20,671 kilograms

Note: The chemical escaped as a liquid and formed a burning puddle.

The puddle spread to a diameter of 60 meters.

**THREAT ZONE:**

Threat Modeled: Thermal radiation from pool fire

Red : 45 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

Orange: 61 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)

Yellow: 89 meters --- (2.0 kW/(sq m) = pain within 60 sec)

## Thermal Radiation Threat Zone

ALOHA® 5.4.2

Time: February 11, 2012 1858 hours ST (using computer's clock)

Chemical Name: METHANOL

Wind: 0.72 meters/second from N at 3 meters

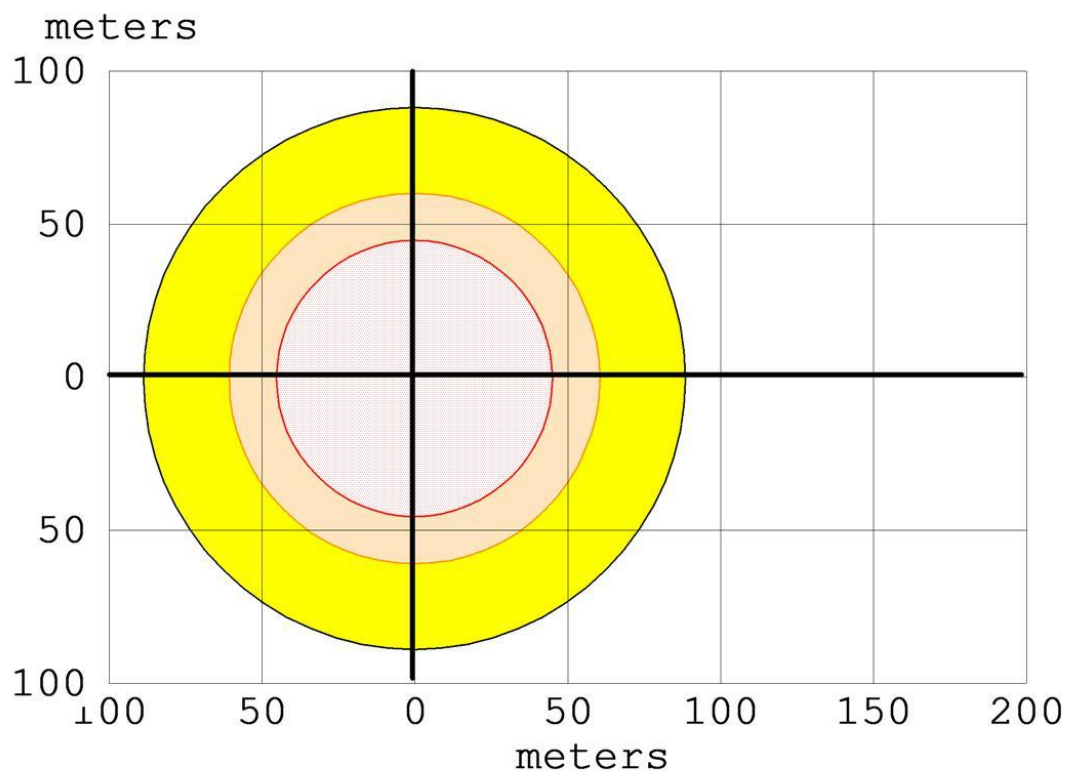
## THREAT ZONE:




Threat Modeled: Thermal radiation from pool fire

Red : 45 meters --- (10.0 kW/(sq m) = potentially lethal within 60 sec)

Orange: 61 meters --- (5.0 kW/(sq m) = 2nd degree burns within 60 sec)

Yellow: 89 meters --- (2.0 kW/(sq m) = pain within 60 sec)



-  greater than 10.0 kW/(sq m) (potentially lethal within 60 sec)
-  greater than 5.0 kW/(sq m) (2nd degree burns within 60 sec)
-  greater than 2.0 kW/(sq m) (pain within 60 sec)

**SITE DATA:**

Location: PERFECT LAMINATE, MANSA, INDIA

Building Air Exchanges Per Hour: 0.30 (unsheltered single storied)

Time: February 11, 2012 1905 hours ST (using computer's clock)

**CHEMICAL DATA:**

Chemical Name: FORMALDEHYDE                      Molecular Weight: 30.03 g/mol

AEGL-1 (60 min): 0.9 ppm    AEGL-2 (60 min): 14 ppm    AEGL-3 (60 min): 56 ppm

IDLH: 20 ppm              LEL: 7 ppm              UEL: 73 ppm

Ambient Boiling Point: 97.9° C

Vapor Pressure at Ambient Temperature: 1.01e-005 atm

Ambient Saturation Concentration: 10.1 ppm or 0.0010%

Note: Not enough chemical data to use Heavy Gas option

**ATMOSPHERIC DATA: (MANUAL INPUT OF DATA)**

Wind: 0.72 meters/second from N at 3 meters

Ground Roughness: open country              Cloud Cover: 0 tenths

Air Temperature: 26.8° C                      Stability Class: F

No Inversion Height                      Relative Humidity: 78%

**SOURCE STRENGTH:**

Direct Source: 20 liters/sec                      Source Height: 0

Source State: Liquid

Source Temperature: equal to ambient

Release Duration: 1 minute

Release Rate: 153 kilograms/sec

Total Amount Released: 9,193 kilograms

**THREAT ZONE:** (GAUSSIAN SELECTED)

Model Run: Gaussian

Red : greater than 10 km --- (56 ppm = AEGL-3 (60 min))

Orange: greater than 10 km --- (14 ppm = AEGL-2 (60 min))

Yellow: greater than 10 km --- (0.9 ppm = AEGL-1 (60 min))

## Toxic Threat Zone

ALOHA® 5.4.2

Time: February 11, 2012 1905 hours ST (using computer's clock)

Chemical Name: FORMALDEHYDE

Wind: 0.72 meters/second from N at 3 meters

THREAT ZONE: (GAUSSIAN SELECTED)

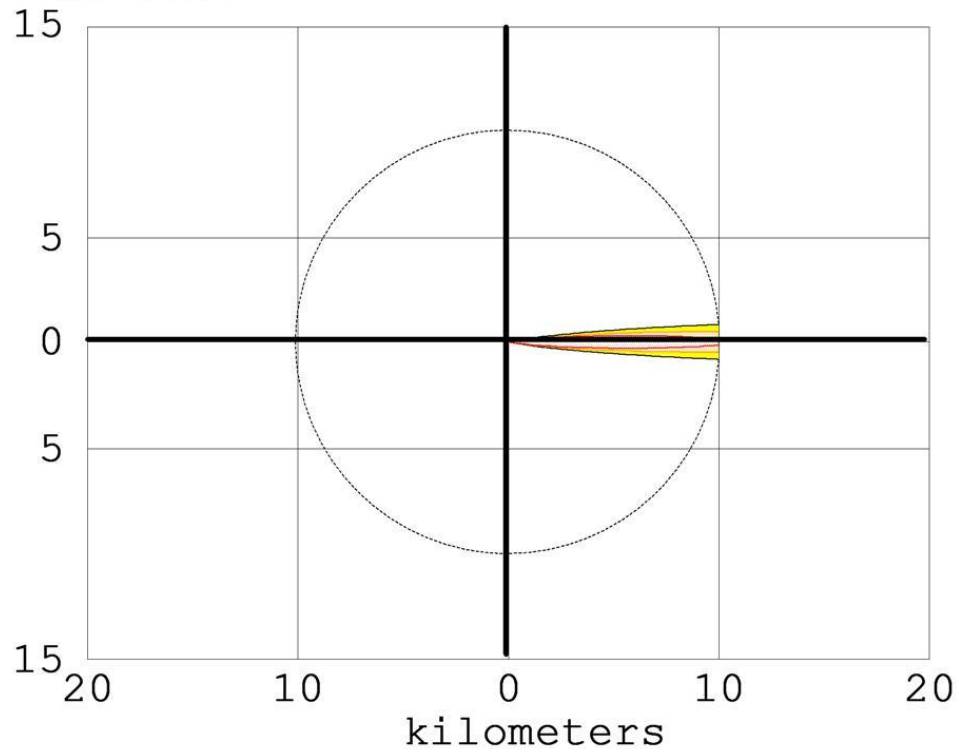
Model Run: Gaussian

Red : greater than 10 km --- (56 ppm = AEGL-3 (60 min))

Orange: greater than 10 km --- (14 ppm = AEGL-2 (60 min))

Yellow: greater than 10 km --- (0.9 ppm = AEGL-1 (60 min))

kilometers



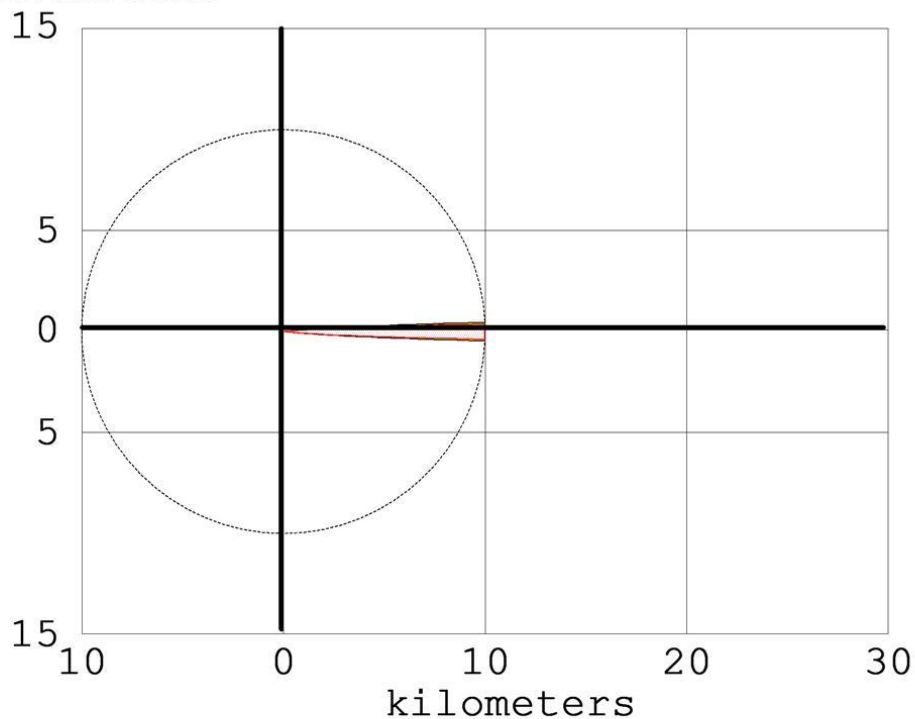
- greater than 56 ppm (AEGL-3 [60 min])
- greater than 14 ppm (AEGL-2 [60 min])
- greater than 0.9 ppm (AEGL-1 [60 min])
- Confidence Lines



## Flammable Threat Zone

ALOHA® 5.4.2

Time: February 11, 2012 1905 hours ST (using computer's clock)  
Chemical Name: FORMALDEHYDE  
Wind: 0.72 meters/second from N at 3 meters  
THREAT ZONE: (GAUSSIAN SELECTED)  
Threat Modeled: Flammable Area of Vapor Cloud  
Model Run: Gaussian  
Red : greater than 10 km --- (4.2 ppm = 60% LEL = Flame Pockets)  
Yellow: greater than 10 km --- (0.7 ppm = 10% LEL)

kilometers



-  greater than 4.2 ppm (60% LEL = Flame Pockets)  
 greater than 0.7 ppm (10% LEL)  
--- Confidence Lines

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## **7.10 RISK REDUCTION MEASUREMENT& RECOMMENDATION IN VIEW OF SAFETY CONSIDERATION**

### **7.10.1 LOCATING THE PLANT IN OPEN AREA INSTEAD OF COVERED TO BE REVIEWED IN VIEW OF SAFETY CONSIDERATION**

- Storage tank of phenol, Formaldehyde and methanol should be installed away from the plant area.
- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Automatic sprinkler system for the flammable material tanks (over ground tanks only) may be provided as knock on effect in case of fire is possible.
- Nitrogen inserting must be ensured whenever handling flammable materials or those with incompatibility with air. Similarly breaking vacuum in presence of flammable vapors MUST be with Nitrogen only and never air. This must be ensured. N<sub>2</sub> cylinders must be kept in sufficient supply.
- Containment dykes with proper sloping and collection sumps should be provided so that any spillages in the bulk storage and other handling areas shall not stagnate and shall be quickly lead away to a safe distance from the source of leakage. This reduces the risk of any major fire on the bulk storages and the risk to the environment shall be minimized/ eliminated.
- Inspection of the storage tanks as per prefixed inspection schedule for thickness measurement, joint and weld efficiency etc.
- Provision of flameproof electrical fittings / equipment's.
- Comprehensive color code scheme to identify different medium pipes.
- Proper maintenance of earth pits
- Strict compliance of security procedures like issue of identity badges for outsiders, gate passes system for vehicles, checking of spark arrestors fitted to the tank lorries etc.
- Strict enforcement of no smoking.
- Periodic training and refresher courses to train the staff in safety fire fighting.
- Many operations involve use of highly toxic/flammable materials and this need to be documented as SOPs. These must be made and kept updated on priority.



- Extensive training on use of Self Contained Breathing apparatus (SCBAs) must be ensured for emergency control.
- Small leaks could occur frequently in routine operations. They should be attended to immediately as they could escalate. This must be addressed.
- All interlocks should be kept and maintained in working condition at all times. Some interlocks, in case the need arises, requiring temporary isolation, may be only disarmed after a proper procedure is followed and action is initiated at the highest level.
- Emergency procedures should be well rehearsed and state of readiness to be achieved. This is most important.

#### **7.10.2 LOCATION OF PHENOL STORAGE SHOULD BE REVIEWED**

- Storage tank for phenol should be provided away from the plant area.
- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Separation distance should be provided.
- Dyke Wall should be provided.
- Flame arrestor should be provided.
- Earthing and bonding will be provided.
- Automatic Sprinkler system

#### **7.10.3 RECOMMENDATION**

- Many of the raw materials used for resin are either toxic or flammable. It is therefore important to ensure that these materials are stored in closed, well ventilated totally safe areas. A fire alarm system (heat and smoke detection) should be provided for the storage area where the material is stored as toxic fumes arise on combustion.
- Automatic sprinkler system for the flammable material tanks (over ground tanks only) may be provided.

- Loose drums of waste materials, often solvent laden, must be removed from the working areas and close watch kept.
- Proper Ear thing for all (particularly glass lined reactors) needs to be provided through plug type systems or through the agitators/liquid.
- Solvent lines need to be electrically continuous-this may be ensured through provision of jumpers across flanges etc. in addition, when draining into drums, electrical continuity must be ensured as the drum filling could result in static charge-necessary ear thing rods/electrodes may be provided and a safe Operating Procedure (SOPs) prepared.
- Ventilation should be provided for any enclosed are where hydrocarbon or toxic vapors may accumulate. Several such areas were noticed- these may be surveyed and tackled accordingly.
- All personnel should be trained in handling emergency situations and should be apprised of their role in handling emergency situation and to ensure adequacy of the emergency procedures simulated exercise should be carried out. This was found wanting.
- By reducing the time required to stop the leak which in turn would reduce the quantity of spillage. The response time could be reduced by installing / maintaining instruments, effective communication system etc.
- Adequate number of caution boards highlighting the hazards of chemicals should be provided at critical locations.
- In locations where flammable vapors may be present, precautions should be taken to prevent ignition by eliminating / containing source of ignition. Source of ignition may include open flames, lightening, smoking, cutting and welding operations, lighting / hot surfaces, frictional heat, sparks (static, electrical and mechanical, spontaneous and radiant heat. Housekeeping, as discussed earlier, plays major role.
- Structural fireproofing in the process area could be considered as a safety measure in the light of probable spill and fires in the area.
- Educational activities for workers and contractor staff need further efforts- in addition, disclosure of information to public is mandatory and programs aimed at educating staff, workers, public within the vulnerable area etc. must be initiated in all seriousness.

- Emergency drills should be carried out periodically to ensure preparedness must continue.
- All hot/cold work jobs should be done with proper permit system.

**FOLLOWING FIRE SAFETY DEVICES ARE PROVIDED TO PROTECT FROM ANY MALFUNCTIONING OF PLANT EQUIPMENTS.FOLLOWING FIRE PROTECTION SYSTEMS ARE PROVIDED.**

- ❖ Water storage of adequate capacity to meet the requirements of water for firefighting purposes.
- ❖ Fire hydrants and automatic sprinkler system. Diesel driven pumps and headers to supply water to fire hydrant network.
- ❖ Adequate Portable fire extinguishers, sand bucket, wheeled equipment should be provided at the required places.
- ❖ Equipment required for personal safety like blankets, gloves, apron, gum boots, face mask helmets, safety belts, first aid boxes etc. are provided. Proximity suits and self-contained breathing apparatus to be provided.

## **7.11 ON SITE EMERGENCY PLAN**

### **INTRODUCTION:**

An emergency in the premises has the potential to cause serious injury or loss of lives or extensive damage to the property and/or environment and serious disruption both inside and outside the plant. In such cases sometimes outside agencies are required to call for help in handling the situation. The causative factors like plant/equipment failure, human error, earth quake, sabotage etc. will normally manifest in various forms viz. Fire, Explosion, Toxic release, structure collapse etc.

This OEP lays down the code of conduct of all personnel in the Plants and the procedures to be adopted by them in the event of an "Emergency". These procedures have been prepared taking into account the minimum strength of manpower available at all times in the premises. The individuals under the direction of the respective Team Leaders shall carry out the responsibilities assigned.

The emergency procedures outlined are suitable for round the clock coverage including holidays. These emergency procedures shall be followed as outlined in the OEP during general shifts as well.

### **OBJECTIVES:**

The overall objectives of OEP are:

- To control the situation and if possible eliminate as quickly as possible.
- To avoid confusion/panic and to attend the emergency with clear-cut line of action.
- To minimize the loss of property to the plant as well as to our neighborhood.
- To safe guard the non-affected areas.
- To alert the neighborhood.
- To arrange head-count and rescue operations.
- Treatment of the injured.
- To safeguard others by timely evacuation.
- To prevent any cascade of emergencies.

### **DEFINITION:**

**Environment** as defined u/s 2(a) of the environment Protection Act includes water, air and land and the inter relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro organism and property.

**Environment pollutant** defined by the same Act as any solid, liquid or gaseous substances present in such concentration as may be tend to injurious to atmosphere.

**Hazardous substance** is also defined by the same Act and hazardous process is defined by sec.2 (cb) of the Factories Act. 1948.

**Hazard** is a physical situation, which may cause human injury, damage to property or the environment or any combination of these criteria.

**Chemical Hazard** is a hazard due to chemical (including its storage, process, handling etc.) and it is realized by fire, explosion, toxicity, corrosivity, radiation etc.

**Risk** is a likelihood of an undesired event (i.e. accident, injury or death) occurring within a specified period or under specified circumstances.

**Individual risk** is the frequency at which any individual may be expected to sustain a given level of harm from the realization of specific hazards.

**Social risk** is a measure of chances of a number of people being effected by a single event or set of events and is often presented as f/n curves (i.e. frequency v/s number of people effected)

**The on-site emergency plan** will deal with measures to prevent and control emergencies affecting public and the environment outside the premises. The manufacturer should provide the necessary information on the nature, extent and likely effects of such incidents.

**Disaster** is a catastrophic situation in which the day-to-day patterns of life are, in many instances, suddenly disrupted and people are plunged into helplessness and suffering and as a result need protection, clothing, shelter, medical and social care and other necessities of life, such as: -

- i. Disasters resulting from natural phenomenon like earthquake, volcanic eruptions, storm, surges, cyclones, tropical storms, floods, landslides, forest fires and massive insect infestation. Also in this group, violent draught which will cause a creeping disaster leading to famine, disease and death must be included.
- ii. Second group includes disastrous events occasioned by man, or by man's impact upon the environment, such as armed conflict, industrial accidents, factory fires, explosion and escape of toxic gases or chemical substances, river pollution, mining and other structural collapses; air, sea, rail and road transport accidents, aircraft

crashes, collision of vehicles carrying inflammable liquids, oil, spills at sea, and dam failures.

**ACCIDENT:**

An accident is an unplanned event, which has a probability of causing personal injury or property damage or both. It may result in physical harm (injury or disease) to person (s), damage to property, loss to the company, a near miss or any combination of the effect.

A Major accident is a sudden, unexpected, unplanned event, resulting from uncontrolled developments during and industrial activity, which causes or has a potential to cause

- i. Serious adverse effects immediate or delayed (death, injuries, poisoning or hospitalization) to a number of people inside the installations and/ or to persons outside the establishment.
- ii. Significant damage may be caused to crops, plants or animals or significant contamination of land waters or air.
- iii. An emergency intervention outside the establishment (evacuation of local population, stopping of local traffic).
- iv. Any combination of above.

**EMERGENCY:**

An emergency is the situation, which has potential to cause a large-scale damage or destruction to life or property or Environment or combination of these within or outside the factory. Therefore it is essential to have a laid down procedure to meet emergency systematically.

In any industry, emergency can arise at any moment and this depends on the type of:

- Structure
- Raw materials
- Machines
- Nearby Industries
- Location of the Industry etc.

**NATURE OF EMERGENCY:**

The "Emergency" specified in this plan will refer to occurrence of one or more of the following natural/manmade events.

- Fire
- Explosion
- Release of Toxic Gas/Vapour
- Spillage of flammable liquid /gas
- Deliberate Sabotage, Terrorism, Air Raid etc.
- Natural Calamities: - Lightening, Storm, Earthquake, Flood etc.
- Collapsing of structure
- Overturning of tanker containing flammable / toxic substances.

**MEDICAL HELP:**

First Aid Boxes have been provided at various strategic locations. Requisite number employees are trained about First Aid, Liaison with nearest hospitals in Kadi / Kalol.

**COMMUNICATION SYSTEM:**

- Alarm Raising for Emergency by blowing the sirens installed
- The siren will be used for raising the emergency alarm and also for all clear signals.
- Emergency Siren: The wailing alarm will be sounded intermittently at fixed interval of 30 seconds for a period of two minutes in case of emergency, such alarm will signify the employees that an emergency has occurred and that the emergency services should be put into operation.
- Incident Controller after assessing the situation will declare that emergency is over. Till the Incident Controller issues the declaration, all the leaders will adhere to the task and be present at the prescribed location.
- All clear signal will be sounded through continuous siren for 1 minute. Even after the emergency is over a skeleton staff of the Rescue/Evacuation Team will be available at the site of emergency for at least 30 minutes to ensure that the situation is absolutely free from danger.
- After the emergency is over, all the team leaders should meet at the Emergency Control Center and each team leader should submit a report to the Incident Controller about team performance and other details observed.
- In addition to the above systems, Internal telephones, P.A.System, Mobile telephones, Computer System etc. will be used for communication.
- If situation is beyond the control, the external agencies will be informed accordingly and asked for the help. Direct telephone, cell phone or messengers / runners may achieve this.

**ASSEMBLY POINT:**

In case of emergency some locations are considered as Assembly Points. Depending on the wind direction and location of emergency, Assembly Point will be declared. The employees should run across the wind direction and not against the wind direction.



Depending upon the location of the emergency the Incident Controller will fix the Assembly Point and Officer will announce the location of the Assembly Point. Employee's attendance, visitors and contractors workmen register will be made available at the Assembly Point for head count.

**EMERGENCY CONTROL CENTER:**

Factory Manager Office will be declared as an Emergency control center. Emergency control center is facilities with:

1. Address and Telephone numbers of the Factory Inspectorate, Gujarat Pollution Control Board, Police, Fire Brigade, Hospitals and OEP Team Members
2. Plant layout-indicating storage of hazardous materials, layout of fire Hydrants/extinguishers, entrances/exits, roads etc.
3. Portable P.A. System, Manual Siren, flood lights, Torches, Pickaxe, Saw, Nylon Ropes.
4. Fire Blankets / Fire Proximity Suit, Breathing Apparatus, First Aid Box etc.
5. List of employees with address, telephone number, blood group etc.
6. Material Safety Data Sheets of all chemicals handled.

**WIND SOCKS:**

Wind direction will be determined with the help of installed windsocks.

**MOCK DRILL:**

Mock drills are carried out regularly to familiarize the staff with their roles, fire protection equipment/system installed in the plant and use of personnel protective equipment. Senior officials monitor this and shortcomings are thoroughly studied and necessary corrective measures are taken.

**PROCEDURES FOR MOCK DRILLS**

- Inform all the employees about mock drills and the signal to be given.
- Fix the date and location of the emergency for mock drills.

- Mock drills will be monitored by observers.
- Raise the siren for emergency.
- After hearing the siren the Incident Controller, Site Controller, Officers and Team Members should actuate the "On-site Emergency Plan".

**PROCEDURE ON NOTICING AN EMERGENCY**

- If anybody notices any situation, which may lead to a disaster, should be immediately inform the Shift In-charge / site controller / Incident Controller / Fire & Safety Supervisor / Security.
- Take charge of the situation as Incident Controller.
- Rush to the site of emergency to get the correct picture and then to Emergency Control Center for speedy control over the situation by making an arrangement for raising the alarm.
- On arrival of Team members, he shall assign duties as required and activate the On-Site Emergency Plan.
- Ensure safety of the plant and the personnel in the plant. He will make an assessment of the emergency and decide on external assistance.
- Communicate and Coordinate among the Incidents Controller/ Site Controller/ Factory manager/ fire safety supervisor etc. and will be the final authority on all matters related with management of emergency such as:
  - Fire fighting.
  - Welfare and rescue operations.
  - Arrange for Civil/Mechanical/Electrical work during emergency.
  - Transport.

**INCIDENT CONTROLLER / SITE CONTROLLER:**

Rush immediately to the scene of the fire/emergency, select and set out appropriate fire/emergency equipment. He will take the below mentioned actions at the earliest opportunity, if the fire/emergency is not controlled.

He will,

- Call the security personnel from their residences for additional manpower if required.
- Regulate entry and exit of personal required for controlling the fire/emergency.
- Restrict exit of personal required for controlling the fire/emergency.
- Arrange for Personnel Protective Equipment required for the emergency.
- Call, the local Fire Brigade, Police in case of necessity in consultation with the Incident Controller.
- Arrange transport facilities for removal of casualties to dispensary / hospital.
- Take responsibility of law and order.
- Keep detailed records of the incident and progress of operations to fight the emergency.

**FACTORY MANAGER:**

He will rush to the Emergency Control Centre and collect the information from the Incident Controller. Further he will,

- Announce the location of the Assembly Point after getting information from Incident Controller / site controller.
- Take the list of persons to be communicated internally and externally.
- Maintain liaison with the press, government agencies i.e. Police, Fire Brigade etc. and the neighborhood regarding the emergency under instructions from Incident Controller.
- Courteously Receive officers from the State Government or neighbors to the Administration Block only and inform to Incident Controller that they can be taken care off.
- Take all the steps required for the welfare such as providing tea, snacks, emergency temporary Medical Center in consultation with the incident controller/site controller.
- Disclose all the necessary information in the plant and media so as to avoid rumors and confusion.
- Also be responsible for the head counts at the Assembly Points.

**FIRE & SAFETY SUPERVISOR/ SHIFT INCHARGE & SECURITY:**

- Proceed to the scene; establish contact with firemen and incident controller to supplement efforts in fire fighting.
- Assist in searching casualties and help to remove them to the medical center.
- Organize outside assistance in fire fighting and rescue operations if required.
- Mobilize personal protective equipment and safety appliances and assist personnel handling emergency in using them.
- Keep and check on any new development of unsafe situation and report the same to Site Main Controller.
- Collect and preserve evidence to facilitate future inquiries.
- Effectively cordon off the emergency area and will prevent unauthorized people entering the scene.
- Permit the Fire tenders or Ambulance requisitioned by Incident Controller to the plant.
- Ensure that vehicles and lorries are sent out of the plant premises.
- Ensure that all the employees are conducted out of plant and assembled at Assembly Point.
- Control Traffic Movement.
- Remove tankers, tanker drivers outside.
- Entry of unauthorized public to be prevented.
- Arrange for vehicles for shifting casualties and essential workers to safe assembly points.

**ENGINEERING/ OPERATION & MAINTENANCE:**

- Ensure the safety of the remaining part of the plant.
- Take necessary steps for plant shutdown in consultation with the site controller.
- Ensure that an Operator is immediately available at the Water Pump House for fire fighting.
- Mobilize with necessary tools and tackles to handle any repair work on an emergency basis.

**ALARM & SIREN**

EMERGENCY SIREN TONE :-

In case of emergency the siren will be blown as below

FIRE CODE ...	_____	O	_____	O	_____	O	_____	O	_____	O	Five Times
	—		—		—		—		—		
	15 sec		15 sec		15 sec		15 sec		15 sec		

Above code repeats

twice ( Ten Times)

GAS LEAK ...

\_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O \_\_\_\_\_ O  
 —  
 15 15 15 15 15 15 15 sec 15 sec 15 sec 15 sec  
 sec sec sec sec sec sec

ALL CLEAR :- Continuous sound for one minute

TESTING ...

Second Day of every month at 11.00 hrs

... Fire Code followed by All clear siren.

PLACE OF ITS LOCATION:

## 7.12. Mater Safety Data Sheets

### 7.12.1 MSDS of Formaldehyde



Health	3
Fire	2
Reactivity	0
Personal Protection	G

### Material Safety Data Sheet Formaldehyde 37% solution MSDS

Section 1: Chemical Product and Company Identification	
<b>Product Name:</b> Formaldehyde 37% solution <b>Catalog Codes:</b> SLF1426 <b>CAS#:</b> Mixture. <b>RTECS:</b> LP8925000 <b>TSCA:</b> TSCA 8(b) inventory: Formaldehyde; Methyl alcohol; Water <b>CI#:</b> Not applicable. <b>Synonym:</b> Formalin <b>Chemical Name:</b> Formaldehyde <b>Chemical Formula:</b> HCHO	<b>Contact Information:</b> <b>Sciencelab.com, Inc.</b> 14025 Smith Rd. Houston, Texas 77396 <b>US Sales: 1-800-901-7247</b> <b>International Sales: 1-281-441-4400</b> <b>Order Online: <a href="http://ScienceLab.com">ScienceLab.com</a></b> <b>CHEMTREC (24HR Emergency Telephone), call:</b> 1-800-424-9300 <b>International CHEMTREC, call: 1-703-527-3887</b> <b>For non-emergency assistance, call: 1-281-441-4400</b>

Section 2: Composition and Information on Ingredients		
<b>Composition:</b>		
Name	CAS #	% by Weight
Formaldehyde	50-00-0	36.5-38
Methyl alcohol	67-56-1	10-15
Water	7732-18-5	47-53.5
<b>Toxicological Data on Ingredients:</b> Formaldehyde: ORAL (LD50): Acute: 100 mg/kg [Rat]. 42 mg/kg [Mouse]. 260 mg/kg [Guinea pig]. MIST (LC50): Acute: 454000 mg/m 4 hours [Mouse]. Methyl alcohol: ORAL (LD50): Acute: 5628 mg/kg [Rat]. DERMAL (LD50): Acute: 15800 mg/kg [Rabbit]. VAPOR (LC50): Acute: 64000 ppm 4 hours [Rat].		

Section 3: Hazards Identification
<b>Potential Acute Health Effects:</b> Very hazardous in case of eye contact (irritant), of ingestion, . Hazardous in case of skin contact (irritant, sensitizer, permeator), of eye contact (corrosive). Slightly hazardous in case of skin contact (corrosive). Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching.
<b>Potential Chronic Health Effects:</b> Hazardous in case of skin contact (sensitizer). <b>CARCINOGENIC EFFECTS:</b> Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [Formaldehyde].

**MUTAGENIC EFFECTS:** Mutagenic for mammalian somatic cells. [Formaldehyde]. Mutagenic for bacteria and/or yeast. [Formaldehyde]. Mutagenic for mammalian somatic cells. [Methyl alcohol]. Mutagenic for bacteria and/or yeast. [Methyl alcohol].  
**TERATOGENIC EFFECTS:** Classified POSSIBLE for human [Methyl alcohol].  
**DEVELOPMENTAL TOXICITY:** Not available  
The substance may be toxic to kidneys, liver, skin, central nervous system (CNS).  
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

#### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

**Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 430°C (806°F)

**Flash Points:** CLOSED CUP: 50°C (122°F). OPEN CUP: 60°C (140°F).

**Flammable Limits:** The greatest known range is LOWER: 6% UPPER: 36.5% (Methyl alcohol)

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

**Fire Hazards in Presence of Various Substances:**

Flammable in presence of open flames and sparks, of heat.

Non-flammable in presence of shocks, of oxidizing materials, of reducing materials, of combustible materials, of organic materials, of metals, of acids, of alkalis.

**Explosion Hazards in Presence of Various Substances:** Non-explosive in presence of open flames and sparks, of shocks.

**Fire Fighting Media and Instructions:**

Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

**Special Remarks on Fire Hazards:**

Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition, it emits acrid smoke and irritating fumes. CAUTION:

MAY BURN WITH NEAR INVISIBLE FLAME (Methyl alcohol)

**Special Remarks on Explosion Hazards:**

Reaction with peroxide, nitrogen dioxide, and permformic acid can cause an explosion.

(Formaldehyde gas)

**Section 6: Accidental Release Measures****Small Spill:**

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

**Large Spill:**

Flammable liquid. Poisonous liquid.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

**Section 7: Handling and Storage****Precautions:**

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis, moisture.

**Storage:**

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

**Section 8: Exposure Controls/Personal Protection****Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection:**

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

**Personal Protection in Case of a Large Spill:**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**



Formaldehyde gas  
STEL: 0.3 (ppm) from ACGIH (TLV) [United States]  
STEL: 0.37 (mg/m<sup>3</sup>) from ACGIH (TLV) [United States]  
TWA: 0.75 STEL: 2 (ppm) from OSHA (PEL) [United States]  
TWA: 2 STEL: 2 (ppm) [United Kingdom (UK)]  
TWA: 2.5 STEL: 2.5 (mg/m<sup>3</sup>) [United Kingdom (UK)]  
Methyl alcohol  
TWA: 200 from OSHA (PEL) [United States]  
TWA: 200 STEL: 250 (ppm) from ACGIH (TLV) [United States] [1999]  
STEL: 250 from NIOSH [United States]  
TWA: 200 STEL: 250 (ppm) from NIOSH SKIN  
TWA: 200 STEL: 250 (ppm) [Canada]  
Consult local authorities for acceptable exposure limits.

#### Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Pungent. Suffocating. (Strong.)

**Taste:** Not available.

**Molecular Weight:** 30.02

**Color:** Clear Colorless.

**pH (1% soln/water):** 3 [Acidic.] pH of the solution as is.

**Boiling Point:** 98°C (208.4°F)

**Melting Point:** -15°C (5°F)

**Critical Temperature:** The lowest known value is 240°C (464°F) (Methyl alcohol).

**Specific Gravity:** 1.08 (Water = 1)

**Vapor Pressure:** 2.4 kPa (@ 20°C)

**Vapor Density:** 1.03 (Air = 1)

**Volatility:** 100% (w/w).

**Odor Threshold:** The highest known value is 100 ppm (Methyl alcohol)

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Non-ionic.

**Dispersion Properties:** See solubility in water, diethyl ether, acetone.

**Solubility:**

Easily soluble in cold water, hot water.

Soluble in diethyl ether, acetone, alcohol

#### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Heat, ignition sources (flames, sparks), incompatible materials

**Incompatibility with various substances:**

Reactive with oxidizing agents, reducing agents, acids, alkalis.  
Slightly reactive to reactive with metals.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Also incompatible with urea, phenol, isocyanates, anhydrides, amines, AZO compounds, carbonyl compounds, oxides(e.g. nitrogen dioxide), performic acid, dithiocarbamates, or peroxides.  
Polymerization can be inhibited by the addition of methanol or stabilizers such as hydroxypropyl methyl cellulose, methyl ethyl celluloses, or isophthalobisguanamine.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

### Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation.

**Toxicity to Animals:**

Acute oral toxicity (LD50): 42 mg/kg [Mouse]. (Formaldehyde)  
Acute dermal toxicity (LD50): 15800 mg/kg [Rabbit]. (Methyl alcohol).  
Acute toxicity of the mist(LC50): 454000 mg/m  
4 hours [Mouse]. (Formaldehyde)  
3

**Chronic Effects on Humans:**

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2A (Probable for human.) by IARC [Formaldehyde].  
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. [Formaldehyde]. Mutagenic for bacteria and/or yeast. [Formaldehyde]. Mutagenic for mammalian somatic cells. [Methyl alcohol]. Mutagenic for bacteria and/or yeast. [Methyl alcohol].  
TERATOGENIC EFFECTS: Classified POSSIBLE for human [Methyl alcohol].  
DEVELOPMENTAL TOXICITY: Not available  
May cause damage to the following organs: kidneys, liver, central nervous system (CNS).

**Other Toxic Effects on Humans:**

Very hazardous in case of ingestion, .  
Hazardous in case of skin contact (irritant, sensitizer, permeator), of eye contact (corrosive), of inhalation (lung corrosive).  
Slightly hazardous in case of skin contact (corrosive).

**Special Remarks on Toxicity to Animals:**

Formaldehyde:  
LD50 [Rabbit] - Route: Skin; Dose: 270 ul/kg

**Special Remarks on Chronic Effects on Humans:**

Exposure to Formaldehyde and Methanol may affect genetic material (mutagenic).  
Exposure to Formaldehyde and Methanol may cause adverse reproductive effects and birth defects(teratogenic).  
Adverse reproductive effects of Formaldehyde as well as Methanol are primarily based on animal studies. Very few human studies have been done on the adverse reproductive effects from exposure to Formaldehyde. Studies produced a weak association (limited evidence) between adverse human female reproductive effects and occupational exposure. Furthermore, no human data could be found on adverse reproductive effects from occupational exposure to Methanol.  
Exposure to Formaldehyde may cause cancer.

**Special Remarks on other Toxic Effects on Humans:**

**Acute Potential Health Effects:**

**Skin:** Corrosive. Causes skin irritation which may range from mild to severe with possible burns depending on the extent of exposure and concentration of solution. Other symptoms may include brownish discoloration of the skin, urticaria, and pustulovesicfular eruptions. May be absorbed through skin with symptoms paralleling those of ingestion.

**Eyes:** Corrosive. Contact with liquid causes severe eye irritation and burns. It may cause irreversible eye damage (severe corneal Solutions containing low formaldehyde concentrations may produce transient discomfort and irritation).

**Inhalation:** Causes irritation of the respiratory tract (nose, throat, airways). Symptoms may include dry and sore mouth and throat, thirst, and sleep disturbances, difficulty breathing, shortness of breath, coughing, sneezing, wheezing rhinitis, chest tightness, pulmonary edema, bronchitis, tracheitis, laryngospasm, pneumonia, palpitations. It may also affect metabolism weight loss, metabolic acidosis), behavior/central nervous system (excitement, central nervous system depression, somnolence, convulsions, stupor, aggression, headache, weakness, dizziness, drowsiness, coma), peripheral nervous system, and blood.

**Ingestion:** Harmful if swallowed. May be fatal. Causes gastrointestinal irritation with nausea, vomiting (possibly with blood), diarrhea, severe pain in mouth, throat and stomach, and possible corrosive injury to the gastrointestinal mucosa/ulceration or bleeding from stomach. May also affect the liver(jaundice), urinary system/kidneys (difficulty urinating, albuminuria, hematuria, anuria), blood, endocrine system, respiration (respiratory obstruction, pulmonary edema, bronchiolar obstruction), cardiovascular system (hypotension), metabolism (metabolic acidosis), eyes (retinal changes, visual field changes), and behavior/central nervous system (symptoms similar to those for inhalation). Contains Methanol which may cause blindness if swallowed.

**Chronic Potential Health Effects:**

**Skin:** Prolonged or repeated exposure may cause contact dermatitis both irritant and allergic. It may also cause skin discoloration.

**Inhalation:** Although there is no clear evidence, prolonged or repeated exposure may induce allergic asthma. Other effects are similar to that of acute exposure.

**Ingestion:** Prolonged or repeated ingestion may cause gastrointestinal tract irritation and ulceration or bleeding from the stomach. Other effects may be similar to that of acute ingestion.

**Section 12: Ecological Information**

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:**

Methanol in water is rapidly biodegraded and volatilized. Aquatic hydrolysis, oxidation, photolysis, adsorption to sediment, and bioconcentration are not significant fate processes. The half-life of methanol in surfact water ranges from 24 hrs. to 168 hrs.

Based on its vapor pressure, methanol exists almost entirely in the vapor phase in the ambient atmosphere. It is degraded by reaction with photochemically produced hydroxyl radicals and has an estimated half-life of 17.8 days. Methanol is physically removed from air by rain due to its solubility. Methanol can react with NO<sub>2</sub> in polluted to form methyl nitrate.

The half-life of methanol in air ranges from 71 hrs. (3 days) to 713 hrs. (29.7 days) based on photooxidation half-life in air. (Methyl alcohol)

**Section 13: Disposal Considerations****Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

**Section 14: Transport Information****DOT Classification:**

CLASS 3: Flammable liquid.  
Class 8: Corrosive material

**Identification:** : Formaldehyde Solution, flammable (Methyl alcohol) UNNA: 1198 PG: III

**Special Provisions for Transport:** Not available.

**Section 15: Other Regulatory Information****Federal and State Regulations:**

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute:

Formaldehyde

California prop. 65 (no significant risk level): Formaldehyde: 0.04 mg/day (inhalation)

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Formaldehyde Solution

Connecticut hazardous material survey.: Formaldehyde; Methyl alcohol

Illinois toxic substances disclosure to employee act: Formaldehyde; Methyl alcohol

Illinois chemical safety act: Formaldehyde; Methyl alcohol

New York release reporting list: Formaldehyde; Methyl alcohol

Rhode Island RTK hazardous substances: Formaldehyde; Methyl alcohol

Pennsylvania RTK: Formaldehyde; Methyl alcohol

Minnesota: Formaldehyde gas; Methyl alcohol

Massachusetts RTK: Formaldehyde; Methyl alcohol

Massachusetts spill list: Formaldehyde; Methyl alcohol

New Jersey: Formaldehyde; Methyl alcohol

New Jersey spill list: Formaldehyde; Methyl alcohol

Louisiana RTK reporting list: Formaldehyde

Louisiana spill reporting: Formaldehyde; Methyl alcohol

California Director's List of Hazardous Substances: Formaldehyde; Methyl alcohol

TSCA 8(b) inventory: Formaldehyde gas; Methyl alcohol; Water

TSCA 4(f) priority risk review: Formaldehyde, Reagent, ACS

SARA 302/304/311/312 extremely hazardous substances: Formaldehyde

SARA 313 toxic chemical notification and release reporting: Formaldehyde; Methyl alcohol

CERCLA: Hazardous substances.: Formaldehyde: 100 lbs. (45.36 kg); Methyl alcohol: 5000 lbs. (2268 kg);

**Other Regulations:**

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:****WHMIS (Canada):**

CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

**DSCL (EEC):****HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 2

**Reactivity:** 0

**Personal Protection:** G

**National Fire Protection Association (U.S.A.):**

**Health:** 3

**Flammability:** 2

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves (impervious).

Lab coat.

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

#### Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 05:35 PM

**Last Updated:** 11/06/2008 12:00 PM

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## 7.12.2 MSDS of Phenol



Health	3
Fire	2
Reactivity	0
Personal Protection	J

## Material Safety Data Sheet

### Phenol MSDS

Section 1: Chemical Product and Company Identification		
<b>Product Name:</b> Phenol <b>Catalog Codes:</b> SLP4453, SLP5251 <b>CAS#:</b> 108-95-2 <b>RTECS:</b> SJ3325000 <b>TSCA:</b> TSCA 8(b) inventory: Phenol <b>CI#:</b> Not available. <b>Synonym:</b> Monohydroxybenzene; Benzenol; Phenyl hydroxide; Phenylic acid <b>Chemical Name:</b> Carbohic Acid <b>Chemical Formula:</b> C <sub>6</sub> H <sub>5</sub> OH	<b>Contact Information:</b> <b>Sciencelab.com, Inc.</b> 14025 Smith Rd. Houston, Texas 77396 US Sales: <b>1-800-901-7247</b> International Sales: <b>1-281-441-4400</b> Order Online: <a href="http://ScienceLab.com">ScienceLab.com</a> <b>CHEMTREC (24HR Emergency Telephone), call:</b> 1-800-424-9300 <b>International CHEMTREC, call:</b> 1-703-527-3887 <b>For non-emergency assistance, call:</b> 1-281-441-4400	

Section 2: Composition and Information on Ingredients		
<b>Composition:</b>		
Name	CAS #	% by Weight
Phenol	108-95-2	100
<b>Toxicological Data on Ingredients:</b> Phenol: ORAL (LD50): Acute: 317 mg/kg [Rat]. 270 mg/kg [Mouse]. DERMAL (LD50): Acute: 630 mg/kg [Rabbit]. 669 mg/kg [Rat].		

Section 3: Hazards Identification
<b>Potential Acute Health Effects:</b> Very hazardous in case of skin contact (corrosive, irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (sensitizer, permeator). The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.
<b>Potential Chronic Health Effects:</b> CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated



exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

#### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

**Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** May be combustible at high temperature.

**Auto-Ignition Temperature:** 715°C (1319°F)

**Flash Points:** CLOSED CUP: 79°C (174.2°F). OPEN CUP: 85°C (185°F).

**Flammable Limits:** LOWER: 1.7% UPPER: 8.6%

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

**Fire Hazards in Presence of Various Substances:**

Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:**

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

**Special Remarks on Fire Hazards:**

Phenol + nitrides results in heat and flammable gas generation. Phenol + mineral oxidizing acids results in fire. Phenol + calcium hypochlorite is an exothermic reaction producing toxic fumes which may ignite.

**Special Remarks on Explosion Hazards:**

Phenol + sodium nitrite causes explosion on heating. Peroxydisulfuric acid + phenol causes explosion.

**Section 6: Accidental Release Measures**

**Small Spill:** Use appropriate tools to put the spilled solid in a convenient waste disposal container.

**Large Spill:**

Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

**Section 7: Handling and Storage****Precautions:**

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

**Storage:**

Air Sensitive. Sensitive to light. Store in light-resistant containers. Moisture sensitive. Keep container tightly closed. Keep container in a cool, well-ventilated area.

**Section 8: Exposure Controls/Personal Protection****Engineering Controls:**

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

**Personal Protection:**

Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**

Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**

TWA: 5 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 19 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 5 from NIOSH [United States] TWA: 19 (mg/m3) from NIOSH [United States] TWA: 5 (ppm) from OSHA (PEL) [United States] TWA: 19 (mg/m3) from OSHA (PEL) [United States] TWA: 5 (ppm) [Canada] TWA: 19 (mg/m3) [Canada] Consult local authorities for acceptable exposure limits.

**Section 9: Physical and Chemical Properties**

**Physical state and appearance:** Solid.

**Odor:**

Distinct, aromatic, somewhat sickening sweet and acid

**Taste:** Burning.



**Molecular Weight:** 94.11 g/mole

**Color:** Colorless to light pink

**pH (1% soln/water):** Not available.

**Boiling Point:** 182°C (359.6°F)

**Melting Point:** 42°C (107.6°F)

**Critical Temperature:** 694.2 (1281.6°F)

**Specific Gravity:** 1.057 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** 3.24 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.048 ppm

**Water/Oil Dist. Coeff.:** The product is more soluble in oil; log(oil/water) = 1.5

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, methanol, diethyl ether, acetone.

**Solubility:**

Easily soluble in methanol, diethyl ether. Soluble in cold water, acetone. Solubility in water: 1g/15 ml water. Soluble in benzene. Very soluble in alcohol, chloroform, glycerol, petroleum, carbon disulfide, volatile and fixed oils, aqueous alkali hydroxides, carbon tetrachloride, acetic acid, liquid sulfur dioxide. Almost insoluble in petroleum ether. Miscible in acetone. Sparingly soluble in mineral oil.

#### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Heat, ignition sources (flames, sparks), light, incompatible materials

**Incompatibility with various substances:** Reactive with oxidizing agents, metals, acids, alkalis.

**Corrosivity:**

Extremely corrosive in presence of copper. Slightly corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass, of aluminum.

**Special Remarks on Reactivity:**

Air and light sensitive. Prone to redden on exposure to light and air. Incompatible with aluminum chloride, peroxydisulfuric acid, acetaldehyde, sodium nitrite, boron trifluoride diethyl ether + 1,3-butadiene, isocyanates, nitrides, mineral oxidizing acids, calcium hypochlorite, halogens, formaldehyde, metals and alloys, lead, zinc, magnesium and their alloys, plastics, rubber, coatings, sodium nitrate + trifluoroacetic acid. Phenol + isocyanates results in heat generation, and violent polymerization. Phenol + 1,3-butadiene and boron trifluoride diethyl ether complex results in intense exothermic reaction. Phenol + acetaldehyde results in violent condensation.

**Special Remarks on Corrosivity:**

Minor corrosive effect on bronze. Severe corrosive effect on brass.

**Polymerization:** Will not occur.

#### Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**

Acute oral toxicity (LD50): 270 mg/kg [Mouse]. Acute dermal toxicity (LD50): 630 mg/kg [Rabbit].

**Chronic Effects on Humans:**

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.  
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, central nervous system (CNS).

**Other Toxic Effects on Humans:**

Very hazardous in case of skin contact (corrosive, irritant), of ingestion, . Hazardous in case of skin contact (sensitizer, permeator), of eye contact (corrosive), of inhalation (lung corrosive).

**Special Remarks on Toxicity to Animals:**

Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 140 mg/kg LDL [Infant] - Route: Oral; Dose: 10,000 mg/kg

**Special Remarks on Chronic Effects on Humans:**

Animal: passes through the placental barrier. May cause adverse reproductive effects and birth defects (teratogenic)  
Embryotoxic and/or foetotoxic in animal. May affect genetic material (mutagenic).

**Special Remarks on other Toxic Effects on Humans:****Section 12: Ecological Information****Ecotoxicity:**

Ecotoxicity in water (LC50): 125 mg/l 24 hours [Fish (Goldfish)]. >50 mg/l 1 hours [Fish (Fathead minnow)]. >50 mg/l 24 hours [Fish (Fathead minnow)]. >33 mg/l 72 hours [Fish (Fathead minnow)]. >33 ppm 96 hours [Fish (Fathead minnow)].

BOD5 and COD: Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:** Not available.

**Section 13: Disposal Considerations****Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

**Section 14: Transport Information**

**DOT Classification:** CLASS 6.1: Poisonous material.

**Identification:** : Phenol, solid UNNA: 1671 PG: II

**Special Provisions for Transport:** Not available.

**Section 15: Other Regulatory Information****Federal and State Regulations:**

Connecticut hazardous material survey.: Phenol Illinois toxic substances disclosure to employee act: Phenol Illinois chemical safety act: Phenol New York release reporting list: Phenol Rhode Island RTK hazardous substances: Phenol Pennsylvania RTK: Phenol Minnesota: Phenol Massachusetts RTK: Phenol Massachusetts spill list: Phenol New Jersey: Phenol New Jersey spill list: Phenol Louisiana RTK reporting list: Phenol Louisiana spill reporting: Phenol TSCA 8(b) inventory: Phenol TSCA 4(a) proposed test rules: Phenol TSCA 8(a) IUR: Phenol TSCA 8(d) H and S data reporting: Phenol: effective: 6/1/87; sunset:

6/01/97 SARA 302/304/311/312 extremely hazardous substances: Phenol SARA 313 toxic chemical notification and release reporting: Phenol CERCLA: Hazardous substances.: Phenol: 1000 lbs. (453.6 kg)

**Other Regulations:**

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:****WHMIS (Canada):**

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive solid.

**DSCL (EEC):**

R24/25- Toxic in contact with skin and if swallowed. R34- Causes burns. R40- Possible risks of irreversible effects. R43- May cause sensitization by skin contact. R52- Harmful to aquatic organisms. S1/2- Keep locked up and out of the reach of children. S24- Avoid contact with skin. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S37/39- Wear suitable gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S56- Dispose of this material and its container at hazardous or special waste collection point.

**HMIS (U.S.A.):**

Health Hazard: 3

Fire Hazard: 2

Reactivity: 0

Personal Protection: j

**National Fire Protection Association (U.S.A.):**

Health: 4

Flammability: 2

Reactivity: 0

Specific hazard:

**Protective Equipment:**

Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

**Section 16: Other Information**

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 11:17 AM

**Last Updated:** 11/01/2010 12:00 PM

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# Annexure-A

## **Executive Summary – English**

**Page No:289-300**

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# EXECUTIVE SUMMARY

## 1. INTRODUCTION

We are having an new unit in the name of M/s. Perfect Laminate, located at Survey No.28, Dhameda- Solaiya Road, Village : Anandpura, Taluka: Mansa, District : Gandhinagar, Gujarat for production of Laminated sheet and intermediate chemical resin product like Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Melamine Urea Formaldehyde Resin, Phenol Urea Formaldehyde Resin as per market demand.

The proposed product Laminated sheet (**40,000** Nos. /Year) will be manufactured from the intermediate resin products Phenol Formaldehyde Resin, Melamine Formaldehyde Resin, Melamine Urea Formaldehyde Resin, Phenol Urea Formaldehyde Resin (60 MT/Month). Proposed unit will manufacture resins for production of laminated sheets within its premises and for sale outside. In this inception, the EIA Study is carried out as a part of process to obtain Environment Clearance Certificate for the proposed project.

### LEGAL REQUIREMENT:

The proposed product Laminated sheets does not attracts environmental clearance from Ministry of Environment and Forests (MoEF), New Delhi but the intermediate product Phenol formaldehyde resin and melamine formaldehyde resin falls under clause No.5 (f) of category "A" as stated in Environment Impact Assessment Notification published on 14th September 2006 and hence the project proponent has to obtain the environmental clearance from the, New Delhi.

## **EXTENT OF STUDY AREA**

This study is a Rapid Environment Impact assessment (EIA), and based on studies carried out during the winter season (i.e. October to December) of year-2011. The environmental attributes (ambient air, water, soil, noise, flora / fauna and socio-economic environment) selected for study are those, which are likely to be affected by the project. The study area is defined as an area within 5.0 kms radius around site located. (As per the terms of reference approved by MoEF-New Delhi Vide their letter No wide latter No. J-11011/248/2010-IA II (I) dated 14<sup>th</sup> November, 2011.

## **METHOD OF STUDY**

The study is based on guidelines which are provided by MoEF. And also try to identify the impacts on environmental different parameters which are caused by nature of activities conducted for the project. It subsequently suggested mitigation measures to be executed for safeguarding against any environmental degradation. Finally, it suggests methods of implementing the environmental management plan.

## **2. PROJECT DESCRIPTION**

### **2.1 Project Cost**

- Total Project Cost: 150 Lacs
- Lamination manufacturing cost: 70 Lacs
- Resin manufacturing cost : 80 Lacs

### **2.2 Product list:**

- The proposed product is going to be manufactured along with their capacities are shown in following table.

**Details of Proposed Product.**

Sr. No.	Name of Product	Qty
1	Laminated Sheets	40,000 Nos./Month

**List of Proposed Intermediate Products**

Sr. No.	Name of Intermediate Product	Qty T/Month 1month = 25 working day
1	Phenol Formaldehyde Resin solvent	60
2	Melamine Formaldehyde Resin solvent	
3	Phenol Urea Formaldehyde Resin	
4	Melamine Urea Formaldehyde Resin	

**2.3 FUEL AND ENERGY REQUIREMENT****2.3.1 FUEL AND UTILITY**

- The unit proposes to use White Coal/ Imported Coal / Lignite as a fuel for Steam Boiler and HSD for DG Set and for the requirement they are going to utilization of Fire Wood/ White Coal/ Imported Coal / Lignite is 1 MT/Day & HSD of 200 L /Month.

**2.3.2 POWER**

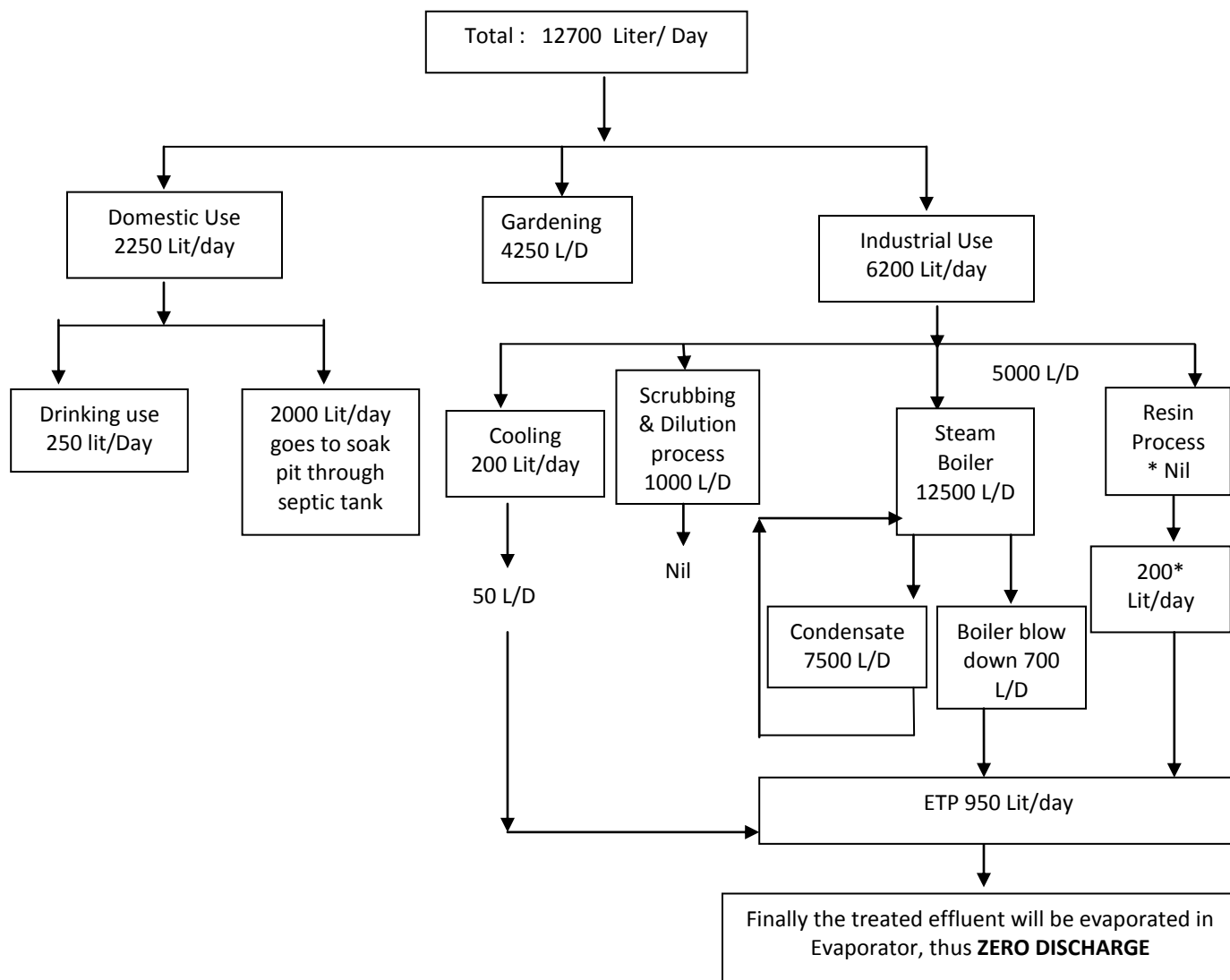
- Total Power requirement for the proposed project is estimated as 75 HP, which will be fulfilled from the grid power supplied by Uttar Gujarat Vij Company Ltd (Sub division of GEB).

**2.3.3 WATER REQUIREMENT**

- Total water required: 12700 L/Day (6200 L utilities + 2250 L domestic + 4250 L gardening)
- Source: bore well

- Industrial wastewater generation: 950 L/day is because of the water is not going to use for any production.
- Domestic wastewater: 2000 L/day

**Total water requirement shown in below diagram,**



Note : \* - It may be noted that some raw materials are containing water which will be removed from the process.



### 2.3.4 MANPOWER REQUIREMENT:

- The total Manpower requirement for the proposed project during operation phase will be 55 (50 Male + 5 Female).

## 3. BASELINE ENVIRONMENT

Baseline environment incorporates the description of the various existing environmental setting within the area encompassed by a circle of 5 km radius around the proposed project site. A total of 11 villages are fall into the specified study area. The study area comes under Taluka: Mansa in District Gandhinagar.

## DEMOGRAPHIC AND SOCIO ECONOMIC ENVIRONMENT

**POPULATION:** Total population: 43691, Male: 22384, Female: 21307

### • OCCUPATIONAL STRUCTURE:

This wide diversity in occupational structure may be broadly categorized as working and non – working population.

Total Main Workers: 19067, Total Marginal Workers: 2910 & Total Non Workers: 21714. In Rural, majority of the people are engaged in agricultural activities, forestry and allied activities.

### LAND-USE

The land use within the study area has been determined. The study area contains of forestland, irrigated agricultural land, un irrigated land, cultivable wasteland and area not available for cultivation. 11 villages fall within 5.0 km radius from the project site. The total area studied is about 7809.2 hectares.

Sr. No.	Type Of Land	Area , Ha
1	Irrigated by source	7056.1
2	Un irrigated	106.1
3	Cultural Waste	455.7
4	Area not available for cultivation	187.3
5	Forest	4.0

## **PUBLIC AMENITIES**

### **WATER SUPPLY**

Most of the villages in the study areas are provided with Basic amenities. Water supply source in the villages within the study area is ground water, water in the form of Well Water, Tap Water, Tank water, Tube well, River Water, Nallah, Canal, Hand pumps etc

### **TRANSPORTATION AND COMMUNICATION**

The study area has a well connected road network (National Highway No. 8 and State highway 218) Ahmedabad is nearest railway station and District Ahmedabad which is having international airport is 48 km away from the project site. In addition, the study area is well connected by phone line and post office.

### **HEALTH, MEDICAL AND EDUCATION FACILITY**

Various Health & medical facilities like primary health centre, dispensary available at Bavla within study area. Almost all villages of study area are having primary school.

### **AMBIENT AIR QUALITY**

Ambient air was sampled at 7 locations selected and each station was sampled for 24 hours continuously twice a week. Parameters monitored were PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>x</sub> and SO<sub>2</sub>.

Ambient air was found to be within the prescribed regularly limits. Within Study area the average Ambient air quality was found as below:

PM<sub>10</sub>: 60.1-71.7 µg/m<sup>3</sup>, PM<sub>2.5</sub>: 36.9-44.1 µg/m<sup>3</sup>

SO<sub>2</sub>: 19.8 –22.6 µg/m<sup>3</sup>, NO<sub>x</sub>: 11.5 – 13.3 µg/m<sup>3</sup>

## HYDROLOGY

The requirement of water for proposed project is satisfied from bore-well. The Ground Water is the source of supply at very few places among the area. The ground water table in the study area is between 30m. The bore-wells are the major source of supply of ground water. The units under concern and other major industrial units in the study area have their own bore-wells to cater to self-requirement. The details of ground water samples collected.

## NOISE

Noise levels within the site boundary are recorded to be within the limits stipulated by regulatory agencies for industrial areas. The equivalent Noise level during day time and Night time within study area are shown below:

During Day Time : 48.9-63.2 dB (A);

During Night Time: 57.5-38.7 dB (A)

## ECOLOGY

The flora available within study area Ambo, Asopalav, Champo, Raydo, Garmalo, Kesudo, Amli, Badam, Limdo, Bawal etc.

The predominant agricultural crops grown in the study area are Jower and Wheat. There are no endangered/endemic flora species and faunal species within the study area.

## 4. ENVIRONMENTAL IMPACTS

### AIR ENVIRONMENT

- The source of air emission from proposed production activity is from stack attached to drying chamber. To control the air emission heat exchanger scrubber is provided. The flue gas emission from steam Boiler and DG Set will be released through well designed stack with adequate height.
- **As the unit plans to put adequate multi-cyclone dust collector, there will not be any significant impact on air environment due to proposed project.**

**WATER ENVIRONMENT**

- Water requirement will be satisfied from bore-well. The water requirement is shown in above figure.
- **There will not be any significant impact on ground water environment and surface water environment due to effluent disposal from proposed project.**

**NOISE ENVIRONMENT**

- There will not be any high noise generating machines involved in the manufacturing of proposed product. Noise levels envisaged shall be within prescribed limits of GPCB at plant boundary.
- However, the unit will developed adequate green belt within plant premises, to abate the noise pollution.
- **Therefore, there will be negligible impact on noise environment of surrounding area due to proposed project activities.**

**SOIL AND LAND ENVIRONMENT**

- There will not be any significant topographical change as the unit is located on abandoned agricultural land in industrial estate.
- The main sources of hazardous waste generation from proposed production will be ETP sludge from primary treatment unit and. The ancillary source for production of solid waste is discarded bags and liners. However, adequate measures separate area with like impervious floor will be provided to avoid soil contamination.
- The units will develop green belt within and on the surrounding of the premises which will not only improve the soil conditioning but will also prevent soil erosion and the landscape & give slight beneficial impact on the land usage.
- **Thus, there will not be any noteworthy impact on land and soil environment due to effluent disposal, disposal of hazardous waste and dust deposition. There will be slight beneficial impact due to green belt development.**

## **ECOLOGICAL ENVIRONMENT**

- The Project site is almost barren land with few shrubs and trees. Thus, no major tree cutting exercise will be there and no major impact on ecology is anticipated. However possibility of rising of green-belt along with construction activity will be explored so that greening of area can be started at the beginning of project

## **SOCIO – ECONOMIC ENVIRONMENT**

- There will not be any displacement of population.
- Socio-economic benefits due to creation of direct / indirect employment. A total of 55 nos. of person is likely to get employment due to the project. Moreover due to the project other direct and indirect business will get benefited.
- **Thus, there will be a slight beneficial impact on socio-economic environment due to propose project activates.**

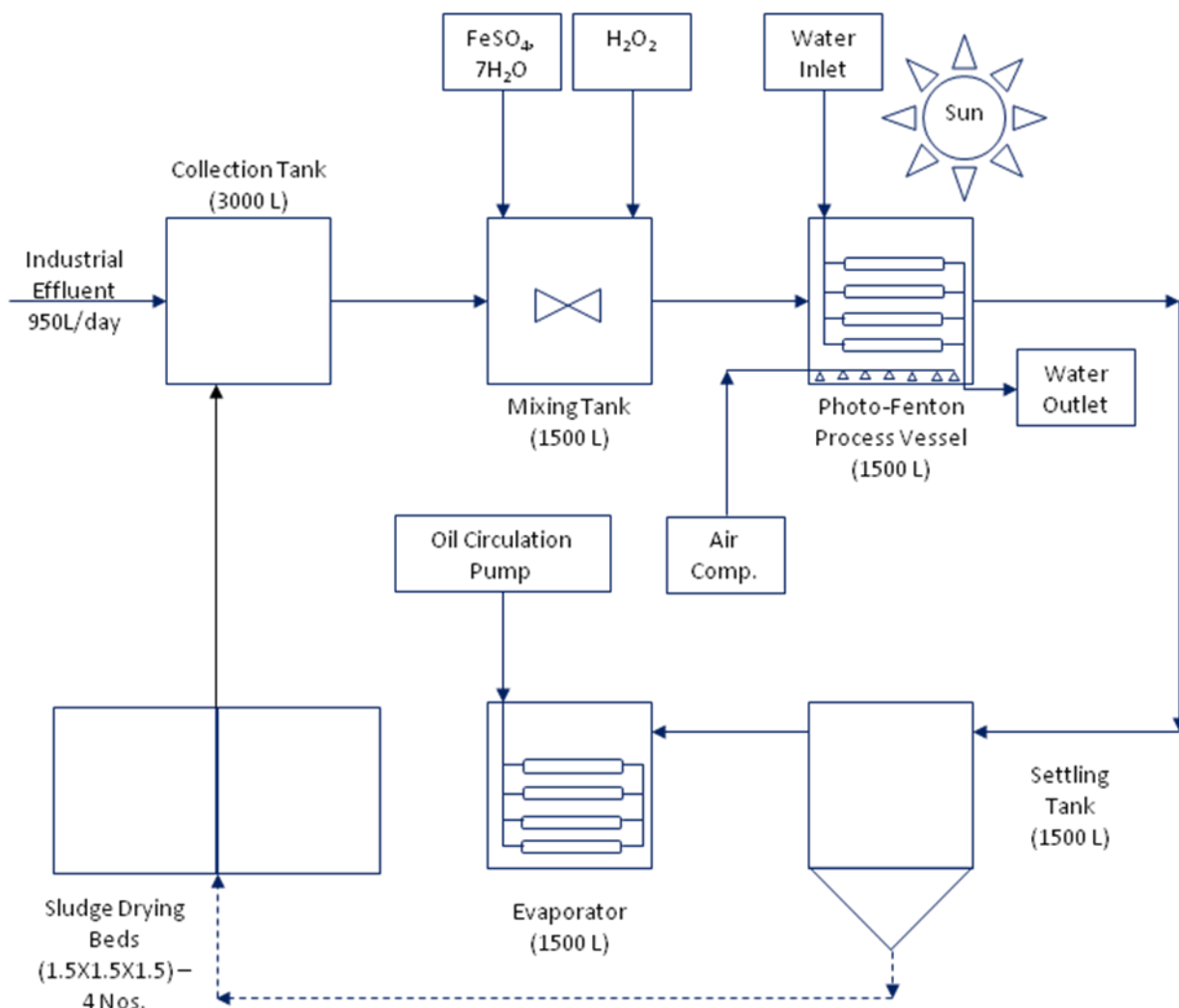
## **5. ENVIRONMENTAL MANAGEMENT PLAN**

- Environmental management plan is an important tool for managing the environmental issues effectively. The environmental parameter shall be monitored and computerized for evaluating and assessing the environmental issues. The plan ensures that the adverse environmental impacts are minimized and the beneficial impacts are maximized.

### **5.1 WATER POLLUTION CONTROL SYSTEM**

- Fresh water requirement shall be minimized.
- Process and utility effluents from the proposed plant will be treated in primary treatment unit of ETP and then treated effluent is evaporated. Hence no industrial water discharge from proposed plant activates.
- Domestic Sewage will be disposed off through septic tank to soak pit.

### ETP DIAGRAM :-



## 5.2 AIR POLLUTION CONTROL SYSTEM

- To control the process and fugitive emission, scrubber will be operated.
- Adequate stack height will be provided as per CPCB guidelines for the proper dispersion of pollutants into the atmosphere. The unit will provide Dust Collector at steam boiler as air pollution control measures to control the emission of particulate matter & the flue gas emission will remain well within gaseous emission norms prescribed by the GPCB/CPCB.
- Regular monitoring of ambient air will be carried out within factory premises for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub>.

## 5.3 HAZARDOUS WASTE MANAGEMENT SYSTEM

- The main source of solid waste generation from manufacturing of laminated sheet is resin waste. The ancillary source of hazardous waste generation will be from raw material storage and handling, plants & machineries and ETP unit.
- The unit will obtain the permission from GPCB/CPCB approved TSDF site for **disposal of solid waste and** incineration of **Resin Waste** which will be generated from proposed project.
- The main source of hazardous waste generation is the ETP sludge from the effluent treatment plant, which will be sent to TSDF site for the disposal & Resin waste, which will be sent for the incineration facility at SEPPL (Saurashtra Enviro Project Pvt. Ltd), Bhachau.

## 5.4 NOISE CONTROL SYSTEM

- **The major source of noise pollution will be DG Set and the ancillary sources will be manufacturing process within premises and transportation within and outside the premises**
- For the machineries and Equipments, timely Oiling and lubricating will be done.
- Noise monitoring will be done regularly at different parts of the plant.
- Greenbelt will be developed to lessen the effect of noise pollution.

## 5.5 GREEN BELT DEVELOPMENT

- To mitigate the air pollution and to attenuate the noise generated by plant and also to improve ecology and aesthetics of the area.
- Total area of the unit is 4800 m<sup>2</sup> and greenbelt will be developed in 1585 Sq m<sup>2</sup> which is approximately 33.02 % area of the total land and water consumption for gardening 4250 L/day for gardening of the trees. We will plant trees and small and big plants. This will reduce noise levels and dust levels by acting as a barrier between the outside environment and the inside environment of the premises. An annual budget of @ Rs 2.0 lacs will be allocated for the development and maintenance of the green belt.



# Annexure-B

## Executive Summary – Gujarati

**Page No:301-317**

## કાર્યકારી સારાંશ

### ૧) પ્રસ્તાવના :

પરફેક્ટ લેમિનેટ પ્રાઈવેટ લિમિટેડ એ નવો પ્રોજેક્ટ છે જે સર્વે નંબર ૨૮, ધમેડા-સોલેયા રોડ, આનંદપુરા ગામ, માણસા તાલુકો, ગાંધીનગર જિલ્લામાં આવેલ છે. પ્રોજેક્ટ લેમીનેટેડ શીટ, પી.એફ.રેઝિન, એમ.એફ.રેઝિન, પી.યુ.એફ.રેઝિન તથા એમ.યુ.એફ. રેઝિન નું ઉત્પાદન હાલના બજારની માંગને ધ્યાનમાં રાખીને ઉત્પાદન કરશે.

સૂચીત પ્રોડક્ટ ‘લેમીનેટેડ શીટ’ (૪૦,૦૦૦ નં./ માસ) નું ઉત્પાદન એ ફિનોલ ફોર્માલ્ડિહાઈડ રેઝિન, મેલેમાઈન ફોર્માલ્ડિહાઈડ રેઝિન, મેલેમાઈન યુરિયા ફોર્માલ્ડિહાઈડ રેઝિન, ફિનોલ યુરિયા ફોર્માલ્ડિહાઈડ રેઝિન (૬૦ ટન/માસ) જેવા મધ્યસ્થ પદાર્થમાંથી બનાવવામાં આવશે. ભાવિ ઉદ્યોગ આ રેઝિનનું ઉત્પાદન પોતાના લેમીનેટેડ શીટ બનાવવા માટે અને બહાર વેચવા માટે કરશે. ભાવિ ઉદ્યોગ સ્થળ એ ૨૩° ૨૭’ ૩૦.૧૦” ઉ. અક્ષાંશ તથા ૭૨° ૩૭’ ૪૫.૨૪” પૂ. રેખાંશ સ્થિત છે. સૂચિત પ્રોજેક્ટ માટે પર્યાવરણીય મંજૂરી લેવા માટે આકારણી કરવામાં આવી છે.

### કાયદાકીય જરૂરીયાત :

સૂચીત પ્રોડક્ટ લેમીનેટેડ સીટ માટે વન અને પર્યાવરણ મંત્રાલય, નવી દિલ્હીમાંથી મંજૂરી લેવાની આવશ્યકતા નથી પરંતુ મધ્યસ્થ પ્રોડક્ટ ફિનોલ ફોર્માલ્ડિહાઇડ રેઝિન, મેલેમાઇન ફોર્માલ્ડિહાઇડ રેઝિન, મેલેમાઇન યુરિયા ફોર્માલ્ડિહાઇડ રેઝિન, ફિનોલ યુરિયા ફોર્માલ્ડિહાઇડ રેઝિન કે જેનો એન્વાયરમેન્ટલ ઇમ્પેક્ટ એસેસમેન્ટ જાહેરનામું (૧૪ સપ્ટેમ્બર, ૨૦૦૬) માં ક્લોઝ - ૫ - (ફ) માં કેટેગરી - એ તરીકે સમાવેશ થાય છે આથી ભાવિ ઉદ્યોગનું વન અને પર્યાવરણ મંત્રાલય, નવી દિલ્હીથી પર્યાવરણની મંજૂરી લેવી ફરજિયાત છે.

### અભ્યાસ વિસ્તારનો અવકાશ :

આ અભ્યાસ ઓક્ટોબર થી ડિસેમ્બર ૨૦૧૧ શિયાળાની ઋતુમાં થયેલ અભ્યાસ આધારીત ત્વરીત પર્યાવરણીય અસર આકારણી (Rapid Environmental Impact Assessment) છે. આ અભ્યાસમાં સૂચીત ઉદ્યોગથી પર્યાવરણના જુદા જુદા મુખ્ય ઘટકો જેવા કે હવા, પાણી, જમીન, અવાજ, વનસ્પતિસૃષ્ટિ, પ્રાણીસૃષ્ટિ તથા સામાજિક અને આર્થિક પર્યાવરણ પર થતી અસરનો અભ્યાસ કરવામાં આવ્યો છે. વન અને પર્યાવરણ મંત્રાલય, નવી દિલ્હીના તા. ૧૪ નવેમ્બર ૨૦૧૧ના પત્ર નં J-11011/248/2011-IA II (I) થી મંજૂર થયેલ “Terms of Reference” પ્રમાણે ભાવિ ઉદ્યોગ સ્થળથી ૫

કિ.મી ત્રિજ્યામાં આવેલ વિસ્તારને અભ્યાસ વિસ્તાર વ્યાખ્યાયિત કરવામાં આવેલ છે.

### અભ્યાસ પદ્ધતિ:-

આ અભ્યાસ વન અને પર્યાવરણ મંત્રાલય દ્વારા આપવામાં આવેલા માર્ગદર્શન ને આધારીત કરવામાં આવ્યો છે. તથા આ અભ્યાસમાં ભાવિ ઉદ્યોગમાં થનારી જુદી જુદી પ્રવૃત્તિઓના લીધે પર્યાવરણના જુદા જુદા ઘટકો પર થતી અસર નો પણ અભ્યાસ કરવામાં આવ્યો છે. આ અભ્યાસમાં પર્યાવરણ પર થતી ખરાબ અસરને અટકાવવા માટે ઘણા સારા ઉપશમન પગલા સૂચવવામાં આવ્યા છે. છેવટે, અભ્યાસમાં પર્યાવરણીય વ્યવસ્થાપન યોજનાના અમલીકરણની જુદી જુદી પદ્ધતિઓ સૂચવવામાં આવી છે.

## ૨) સૂચીત ઉદ્યોગનું વર્ણન :

### ૨.૧ પ્રોજેક્ટ મુલ્ય:

- કુલ મુલ્ય: ૧૫૦.૦૦ લાખ
- લેમીનેટેડ સીટ્સ: ૭૦.૦૦ લાખ
- રેઝિન પ્રોડક્ટ: ૮૦.૦૦ લાખ

### ૨.૨ ભાવિ પ્રોડક્ટનું વર્ણન :

ભાવિ પ્રોડક્ટ તથા ભાવિ મધ્યસ્થ પ્રોડક્ટ નું તેમની ક્ષમતા સાથેનું વર્ણન નીચે મુજબ છે.

ક્રમાંક	પ્રોડક્ટનું નામ	ઉત્પાદન માત્રા
૧	લેમીનેટેડ સીટ્સ	૪૦,૦૦૦ નં . / માસ

### ભાવિ મધ્યસ્થ પ્રોડક્ટ ની માહિતી :

ક્રમાંક	પ્રોડક્ટનું નામ	ઉત્પાદન માત્રા (ટન/માસ)
૧.	ફિનોલ ફોર્માલ્ડિહાઇડ રેઝિન	૬૦ (ટન/માસ)
૨.	મેલેમાઇન ફોર્માલ્ડિહાઇડ રેઝિન	
૩.	ફિનોલ યુરિયા ફોર્માલ્ડિહાઇડ રેઝિન	
૪.	મેલેમાઇન યુરિયા ફોર્માલ્ડિહાઇડ રેઝિન	

## ૨.૩ બળતણ તથા ઊર્જાની જરૂરીયાત :

### ૨.૩.૧ બળતણ:

ભાવિ એકમમાં ગરમ વરાળ ઉત્પાદિત ચંત્રમાં લિગ્નાઇટ/સફેદ કોલસો/ઇમ્પોર્ટેડ કોલસો તથા આ બળતણનો કુલ વપરાશ ૧.૦ મેટ્રીક ટન/દિવસ રહેશે. આ એકમમાં DG સેટમાં બળતણ તરીકે HSD નો ઉપયોગ થશે અને જેનો વપરાશ ૨૦૦ લિ./માસ નો રહેશે.

### ૨.૩.૨ ઊર્જા :

ભાવિ એકમમાં વિદ્યુત ઊર્જાની કુલ જરૂરીયાત અંદાજિત ૭૫ HP રહેશે. આ પુરવઠો ઉત્તર ગુજરાત વિદ્યુત બોર્ડમાંથી મેળવવામાં આવશે.

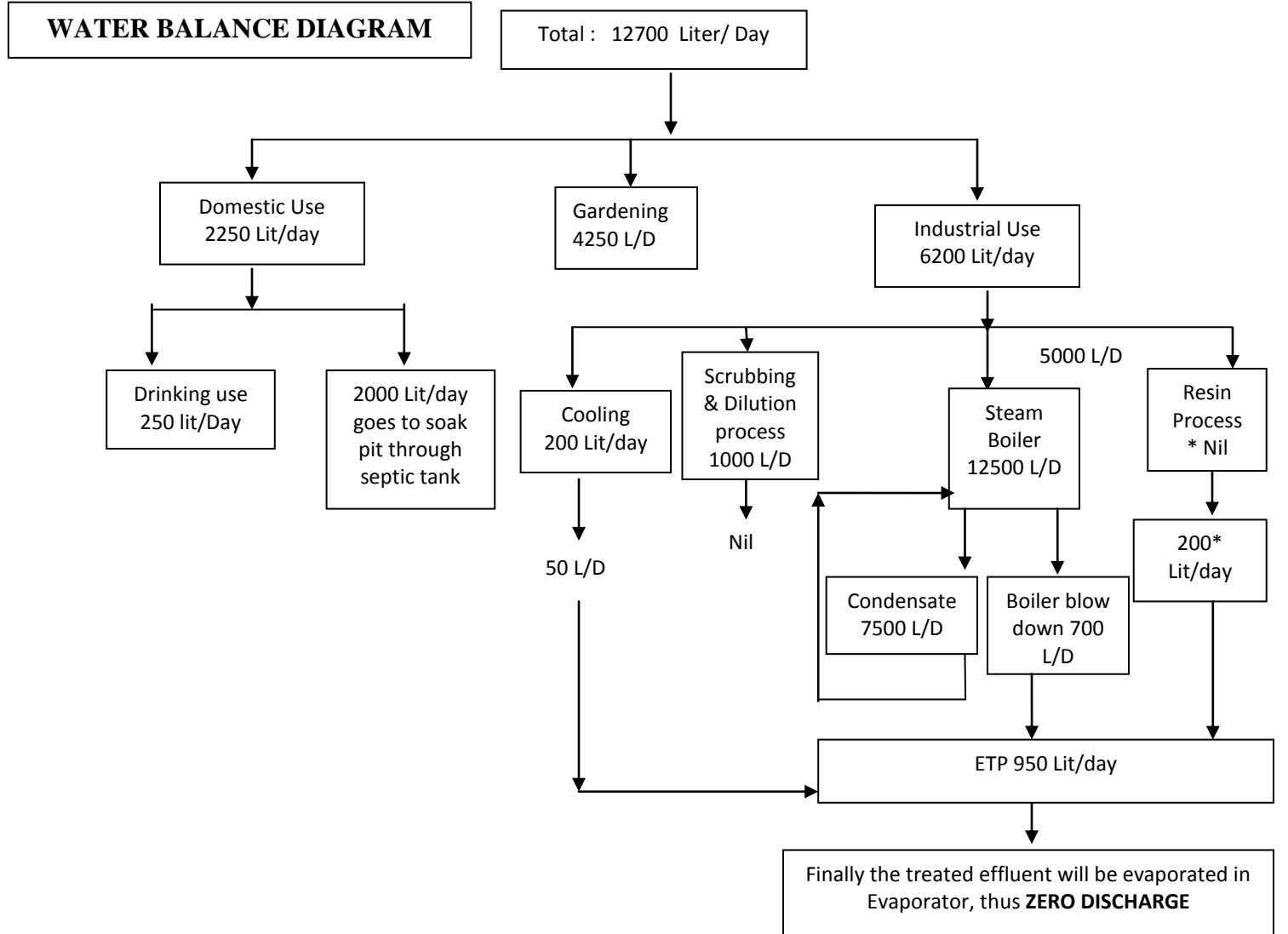
### ૨.૩.૩ પાણીની જરૂરીયાત :

- કુલ પાણીની જરૂરીયાત : ૧૨૭૦૦.૦૦ L/Day

૬૨૦૦.૦ L/Day ઔદ્યોગિક પ્રવૃત્તિ માટે + ૨૨૫૦.૦ L/Day ઘરઘથ્થુ વપરાશ માટે

+ ૪૨૫૦.૦ L/Day બગીચાના વિકાસ માટે

- સ્ત્રોત : પાણીનો કૂવો
- ઔદ્યોગિક ગંદુ પાણીનું ઉત્પાદન : ૯૫૦ L/Day
- ઘરઘથ્થુ વપરાશના લીધે ઉત્પન્ન થતું ગંદુ પાણી : ૨૦૦૦ L/Day



Note : \* - It may be noted that some raw materials are containing water which will be removed from the process.

### ૨.૩.૪ કર્મચારીઓની જરૂરીયાત:

ભાવિ એકમના ક્રિયાશીલ સમયે કુલ માણસોની જરૂરીયાત ૫૫ (૫૦ પુરૂષો અને ૫ સ્ત્રીઓ) રહેશે.

### ૩) હાલનું પર્યાવરણ :-

હાલના પર્યાવરણમાં ઉદ્યોગ સ્થળથી ૫ કિ.મી ત્રિજ્યામાં આવેલ વિસ્તારમાં હાલના પર્યાવરણના વિવિધ ઘટકોનું વર્ણન કરવામાં આવ્યું છે. જેમાં કુલ ૭ ગામ નો સમાવેશ થાય છે. અભ્યાસ વિસ્તાર ગાંધીનગર જીલ્લાના માણસા તાલુકામાં આવેલ છે.

**વસ્તી વિષયક અને સામાજિક / આર્થિક પર્યાવરણ :**

**લોકસંખ્યા**

કુલ વસ્તી : ૩૫૨૮૫

પુરૂષ : ૧૮૩૭૫

સ્ત્રી : ૧૬૯૧૦

**વ્યવસાયિક માળખું.**

વ્યવસાયિક માળખું મુખ્યત્વે બે બહોળા વર્ગ 'કામ કરતા' તથા 'બેરોજગાર' માં વિભાજિત કરવામાં આવ્યું છે.

કુલ મુખ્ય કામદારો : ૧૧૫૫૮

કુલ સીમીત કામદારો : ૨૨૭૮

કુલ બેરોજગાર : ૨૦૮૩૫

ગ્રામ્ય વિસ્તારમાં મોટાભાગના લોકો ખેતીની પ્રવૃત્તિમાં તથા જંગલના કામમાં વ્યસ્ત હોય છે.

#### જમીનનો ઉપયોગ :-

અભ્યાસ વિસ્તારમાં જમીનના ઉપયોગ નો અભ્યાસ કરવામાં આવ્યો છે. અભ્યાસ વિસ્તારમાં જંગલની જમીન, સિંચીત ખેતીની જમીન, સિંચાઈ વગરની જમીન, ખેતીલાયક વેરાન જમીન તથા બીન ખેતીલાયક જમીનનો સમાવેશ થાય છે. ઉદ્યોગ સ્થળથી ૫ કિ.મી ત્રિજ્યામાં કુલ ૧૧ ગામનો સમાવેશ થાય છે. અને કુલ અભ્યાસ વિસ્તાર આશરે ૧૪૪૮૪ હેકટર છે.

ક્રમાંક	જમીનનો પ્રકાર	ક્ષેત્રફળ, હેકટર
૧.	સિંચાઈવાળી જમીન	૧૧૯૩૨.૫
૨.	સિંચાઈ વગરની જમીન	૧૮૪૨.૬
૩.	ખેતીલાયક વેરાન જમીન	૧૮૯૩.૨
૪.	બીનખેતીલાયક જમીન	૧૨૫૦.૭

#### સાર્વજનિક સવલતો :-

##### પાણી પુરવઠો :

અભ્યાસ વિસ્તારના મોટાભાગના ગામડાઓમાં મૂળભૂત સવલતો ઉપલબ્ધ છે. અભ્યાસ વિસ્તારમાં પાણી પુરવઠાના સ્ત્રોતો ભૂગર્ભજળ, કૂવાનું પાણી, નળ દ્વારા, પાણી ના ટાંકા, ટયૂબવેલ, નદીનું પાણી, નાળા, કેનાલ અને હેન્ડપમ્પ વગેરેનો સમાવેશ છે.



**વાહનવ્યવહાર અને પત્ર વ્યવહાર :**

અભ્યાસ વિસ્તાર સારી રીતે વિકસેલ રોડ વ્યવસ્થા સાથે સંકળાયેલ છે જ્યાં રાજ્ય ધોરીમાર્ગ ૨૧૮, રાષ્ટ્રીય ધોરી માર્ગ નં. ૮એ આવેલ છે. અમદાવાદ એ ખુબ જ નજીક નું રેલ્વે સ્ટેશન છે. અમદાવાદ શહેર કે જ્યાં આંતરરાષ્ટ્રીય હવાઈ મથક આવેલ છે કે જે ઉદ્યોગ સ્થળ થી ૪૮.૦ કિ.મી દૂર છે. આ સાથે અભ્યાસ વિસ્તારમાં ટેલિફોન વ્યવસ્થા તથા પત્રવ્યવહાર વ્યવસ્થા સારી રીતે ઉપલબ્ધ છે.

**સ્વાસ્થ્ય, દવાખાના તથા શિક્ષણની વ્યવસ્થા :**

અભ્યાસ વિસ્તારમાં વિવિધ આરોગ્યને લગતી સવલતો જેમકે પ્રાથમિક આરોગ્ય કેન્દ્ર અને દવાખાનું માણસા ગામમાં આવેલું છે. હોસ્પિટલ માણસા માં આવેલ છે. લગભગ બધા ગામડાઓમાં પ્રાથમિક શિક્ષણની વ્યવસ્થા છે.

**હવાની ગુણવત્તા :**

હવાની ગુણવત્તા નક્કી કરેલા ૭ સ્થળોએ માપવામાં આવી હતી આ બધા સ્થળે હવાની માપણી સતત ૨૪ કલાક તથા અઠવાડિયામાં બે વાર કરવામાં આવી હતી. હવામાં  $PM_{10}$ ,  $PM_{2.5}$ ,  $SO_2$  તથા  $NO_x$  માપવામાં આવ્યા હતા. માપેલી હવાની ગુણવત્તાની માત્રા એ હવાના ગુણવત્તા માપદંડથી ઓછા જેવા મળ્યા છે. અભ્યાસ વિસ્તારમાં સરેરાં હવાની ગુણવત્તા નીચે મુજબ છે.

PM<sub>10</sub> : 45-72 µg/m<sup>3</sup>, PM<sub>2.5</sub>: 28-45 µg/m<sup>3</sup>

SO<sub>2</sub>: 15.2-28 µg/m<sup>3</sup>, NO<sub>x</sub>: 6.2-12.9 µg/m<sup>3</sup>

### જળ વિજ્ઞાન :-

ભાવિ એકમમાં જરૂરી પાણી એ બોરવેલમાંથી મેળવવામાં આવશે. અભ્યાસ વિસ્તારમાં ભુગર્ભજળની ઊંડાઈ ૩૦ મીટરથી છે. મુખ્ય પાણી સ્ત્રોતોમાં બોરવેલનો સમાવેશ થાય છે. ભાવિ એકમ માટે તથા બીજા મોટા ઔદ્યોગિક એકમો માટે પાણીના મુખ્ય સ્ત્રોત તરીકે બોરવેલ છે.

### અવાજ :

અભ્યાસ વિસ્તારમાં અવાજનો પ્રબળતા સ્તર માપવામાં આવેલ અવાજનું પ્રબળતા સ્તર આ બધા સ્થળો એ અધિકૃત પણે નક્કી કરેલા માપદંડથી આછું છે.

During Day Time : 47.1-61.0 dB (A);

During Night Time: 40.3-51.0 dB (A)

### પરિસ્થિતિ વિજ્ઞાન :

અભ્યાસ વિસ્તારમાં આંબો, આસોપાલવ, ચંપો, રાયડો, ગરમાળો, આમલી, કેસુડો, બદામ, લીમડો, બાવળ વગેરે જેવા વૃક્ષો જેવા મળ્યા છે. અભ્યાસ વિસ્તારમાં વધુ પડતો જુવાર અને ઘઉંનો પાક લેવામાં આવે છે. અભ્યાસ વિસ્તારમાં લુપ્ત થતી વનસ્પતિ તથા પ્રાણીની કોઈપણ પ્રજાતિઓ જેવામાં આવી ન હતી.

## ૪.) પર્યાવરણ પર થતી અસર :-

### હવાનું પર્યાવરણ :

ભાવિ ઉત્પાદન પ્રવૃત્તિઓમાં હવા પ્રદૂષક સ્ત્રોત તરીકે બોઈલર અને ડ્રાઈંગ ચેમ્બર સાથે જોડાયેલી ચિમની રહેશે. આ હવા પ્રદૂષક ને અટકાવવા માટે ડ્રાઈંગ ચેમ્બર સાથે સ્ક્રાઈન નાખવામાં આવશે અને બોઈલર સાથે ડસ્ટકલેક્ટર મૂકવામાં આવશે. સ્ટિમ બોઈલર તથા DG સેટ માંથી નીકળતા ફ્લુગેસ ને સારી રીતે ડિઝાઈન કરેલી તથા પૂરતી ઊંચાઈ ધરાવતી ચિમનીમાંથી છોડવામાં આવશે. એકમ પૂરતી ક્ષમતા વાળું મલ્ટી સાયકલોન ડસ્ટ કલેક્ટર સ્થાપશે જેથી ભાવિ ઉદ્યોગથી હવાના પર્યાવરણ પર કોઈ અસર થશે નહિ.

### પાણીનું પર્યાવરણ :

એકમ માટે પાણીની જરૂરીયાત બોરવેલ થી પૂરી પાડવામાં આવશે. કુલ પાણીની જરૂરીયાત ૧૨.૭ KL/day અને ઔદ્યોગિક પ્રવૃત્તિઓથી ૦.૯૫ KL/day ગંદુપાણી ઉત્પન્ન થશે. આ ગંદા પાણીને પ્રાઈમરી ટ્રીટમેન્ટ પછી બાષ્પીભવન કરવામાં આવશે. મળમૂત્ર દ્વારા ઉત્પન્ન થતા ગંદા પાણીને મળ-ટાંકી થી ટ્રીટ કરી શોષ-ખાડા દ્વારા નિકાલ કરવામાં આવશે. આથી આ ભાવિ યોજના ના લીધે પાણીના પર્યાવરણ ઉપર કોઈ જ ખરાબ અસર થશે નહિં.

### અવાજનું પર્યાવરણ :

સૂચીત ઉદ્યોગમાં વધુ પડતા અવાજ કરતા કોઈપણ ચંત્ર નો સમાવેશ થતો નથી અવાજની માત્રા એ ગુજરાત પ્રદૂષણ નિયંત્રણ બોર્ડ એ આપેલા ધારા ધોરણથી ઓછી રહેશે. આમ છતાં ઉદ્યોગ તેના વિસ્તારમાં પુરતો લીલો પટ્ટો વિકસાવશે. જેથી કરીને અવાજનું પ્રદૂષણ અટકશે. આથી ભાવિ યોજનાથી આજુબાજુના અવાજના પર્યાવરણ પર નજીવી અસર રહેશે.

### જમીનનું પર્યાવરણ :

- ભાવિ ઉદ્યોગ એ ઔદ્યોગિક વિસ્તારમાં આવવાથી સ્થાનીક ભૂગોળમાં કોઈ મહત્વનો ફેરફાર થશે નહિ જોખમકારક ઘનકચરાનો મુખ્ય સ્ત્રોત ETP સ્લજ કે જે પ્રાઈમરી ટ્રીટમેન્ટ થી ઉત્પન્ન થશે. તથા અન્ય ઘનકચરામાં વપરાયેલી પ્લાસ્ટીક બેગ્સ તથા ઉપયોગમાં લીધેલા લાઈનર રહેશે. આ ઘન કચરાને અલગથી બનાવેલા વિસ્તારમાં રાખવામાં આવશે કે જ્યાં અપ્રવેશ્ય ભોંય રાખવામાં આવશે જેથી કરીને માટી ને પ્રદૂષિત થતી અટકાવી શકાશે.
- ઔદ્યોગિક એકમ તેના વિસ્તારમાં તથા તેના આજુબાજુના વિસ્તારમાં લીલો-પટ્ટો વિકસાવશે. જેનાથી માટીની ગુણવત્તા માં સુધારો થશે, જમીનનું ઘોવાણ અટકશે અને જમીનના ઉપયોગમાં લાભ થશે.
- આથી ભાવિ યોજનામાં ગંદા પાણીના છોડવાથી, જોખમકારક ઘન કચરાના નિકાલ થી તથા ધૂળના સ્થાપનથી જમીન તથા માટીના

પર્યાવરણ ઉપર કોઈ ખરાબ અસર થશે નહિ અને લીલો પટ્ટો વિકસાવવાથી હિતકારક અસર જોવા મળશે.

### જૈવપર્યાવરણ :

સૂચીત ઉદ્યોગનું સ્થળ એ મોટા ભાગે ઉજ્જડ જમીન છે. કે જ્યા ખુબ જ ઓછા ક્ષુપ અને વૃક્ષ છે. જેથી વધુ વૃક્ષો કાપવાની જરૂરીયાત નહિ પડતા જૈવ પર્યાવરણ પર કોઈ ખરાબ અસર પડશે નહિ. આમ છતાં નિર્માણ કાર્ય દરમ્યાન લીલો-પટ્ટો વિકસાવવાથી યોજનાની શરૂઆતથી જ વિસ્તારમાં જૈવપર્યાવરણ માં સુધારો થશે.

### સામાજિક – આર્થિક પર્યાવરણ :

- ભાવિ ઉદ્યોગથી રહેવાસીઓનું કોઈ સ્થાળાંતર થશે નહિ
- પ્રત્યક્ષ અને પરોક્ષ રીતે રોજગાર મળવાથી અભ્યાસ વિસ્તારના લોકોને સામાજિક આર્થિક વિકાસ થશે. ભાવિ યોજનાથી ૫૫ લોકોને રોજગારી મળશે. ભાવિ ઉદ્યોગમાંથી પ્રત્યક્ષ અને પરોક્ષ રીતે વેપાર પ્રવૃત્તિઓને ફાયદો થશે.
- આથી ભાવિ યોજનાની અભ્યાસ વિસ્તારના સામાજિક-આર્થિક પર્યાવરણ પર સકારાત્મક અસર રહેશે.

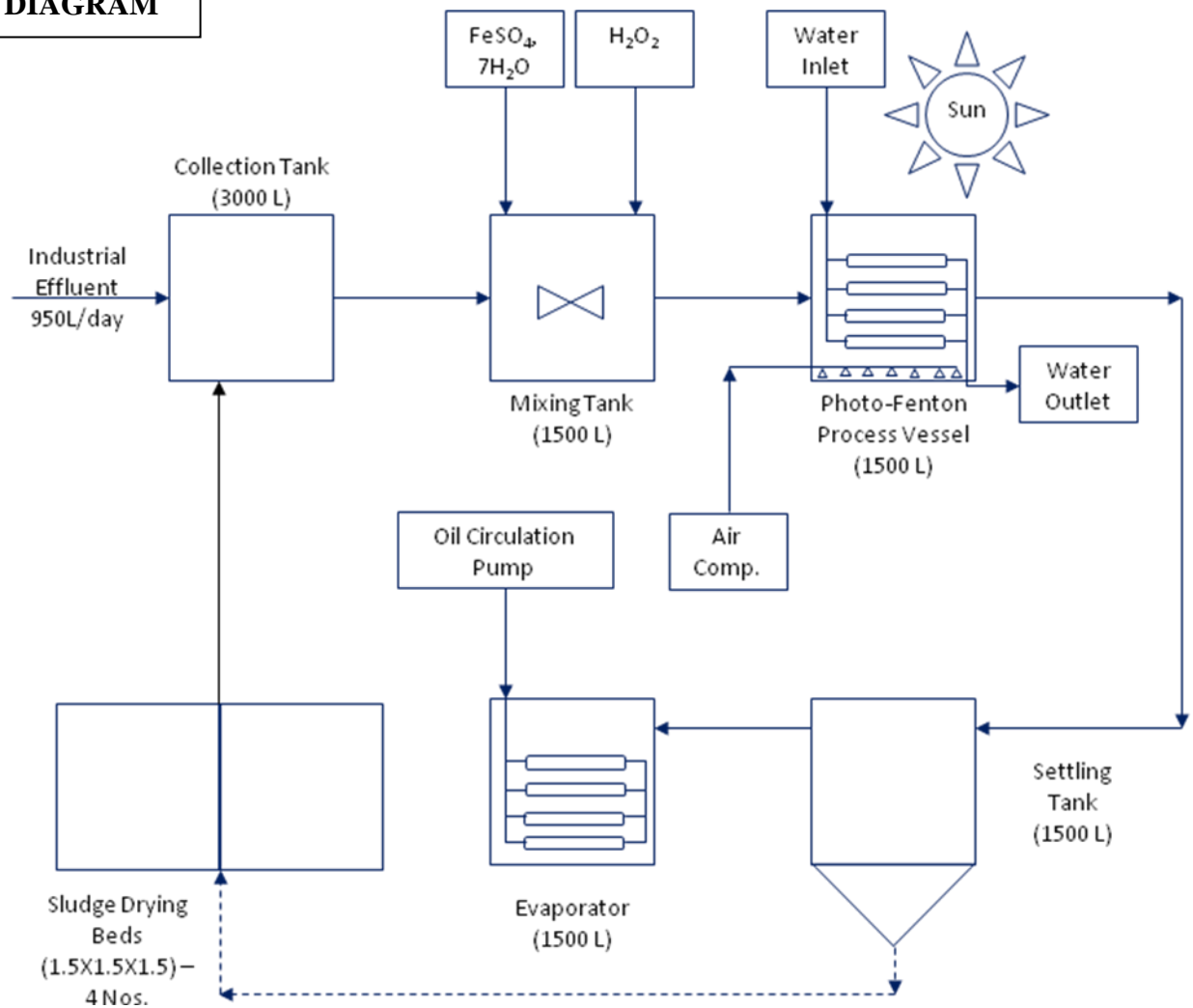
## પ) પર્યાવરણીય વ્યવસ્થાપન યોજના : -

પર્યાવરણના જૂદા જૂદા મુદ્દાઓનું અસરકારક રીતે સંચાલન કરવા ‘પર્યાવરણીય વ્યવસ્થાપન યોજના’ ખુબ જ મહત્વનું હથિયાર છે. પર્યાવરણીય પારમિતિનું માપન કરી અને તેને ગુણકયંત્રથી તૈયાર કરીને પર્યાવરણીય મુદ્દાઓનું મૂલ્યાંકન તથા આકરણી કરી શકાશે. આ યોજનાથી પર્યાવરણ પર થતી ખરાબ અસરને ઘટાડી શકાશે અને લાભદાયી અસરોને વધારી શકાશે.

### પ.૧ પાણીના પ્રદૂષણનું નિયંત્રણ માટેની પ્રણાલિ :

- ચોખ્ખા પાણીનો વપરાશ ઓછો કરવામાં આવશે.
- ઔદ્યોગીક પ્રક્રિયાઓથી ઉત્પન્ન થતા ગંદા પાણીને પ્રાઈમરી ટ્રીટમેન્ટ આપવામાં આવશે અને ટ્રીટ થયેલા પાણીનું બાષ્પીભવન કરવામાં આવશે. આથી ભાવી એકમમાં ઔદ્યોગીક પ્રક્રિયા વાળું કોઈપણ ગંદુ પાણી નીકળશે નહિ.
- મળમૂત્ર વાળા ગંદા પાણીને મળ -ટાંકીમાં ટ્રીટ કરી તેનો શોષ ખાડા દ્વારા નિકાલ કરવામાં આવશે.

## ETP DIAGRAM



#### પ.૨ હવા પ્રદૂષણ નિયંત્રણ પ્રણાલિ :

- પ્રક્રિયા માંથી તથા ક્ષણભંગુર ઉત્પન્ન થતા વાયુનું નિયંત્રણ કરવા સ્ક્રબર સ્થાપવામાં આવશે.
- CPCB માર્ગદર્શિકા પ્રમાણે પૂરતી ઊંચાઈ ધરાવતી ચિમની સ્થાપવામાં આવશે જેથી હવા પ્રદૂષકોનો વાતાવરણમાં પૂરતો ફેલાવો થઈ શકે. એકમ રજકણોના નિયંત્રણ માટે ગરમ પાણી ઉત્પાદિત ચંત્ર સાથે મલ્ટી સાયકલોન ડસ્ટ કલેક્ટર સ્થાપશે.
- એકમ વિસ્તારમાં  $PM_{10}$ ,  $PM_{2.5}$ ,  $SO_2$  અને  $NO_x$  નિયમિત રીતે માપવામાં આવશે.

#### પ.૩ જોખમકારક ઘન કચરા ની પ્રણાલિ :

એકમમાં ઘન કચરાનો મુખ્ય સ્ત્રોત લેમીનેટેડ સીટ બનાવવાની પ્રક્રિયા દરમિયાન ઉત્પન્ન થતો “રેઝિન કચરો” રહેશે. બીજા જોખમકારક ઘન કચરાના સ્ત્રોતોમાં કાચા પદાર્થનો સંગ્રહ કરવાની પ્રક્રિયા તથા ઉપયોગ કરવાનો વિસ્તાર, પ્લાન્ટ અને મશીનરી તથા ETP છે. એકમ GPCB/CPCB ની માન્યતા વાળી TSDF સાઈટનો ઘન કચરાના નિકાલ માટે તથા ઈન્સિનરેશન વ્યવસ્થાનો રેઝીન કચરા ને બાળવા માટે SEPPL (Saurashtra Enviro Projects Pvt. Ltd.) ભચાઉ, કચ્છની મંજૂરી લેશે.



- કચરાના નિકાલ તથા બાળવા માટે: SEPPL (Saurashtra Enviro Projects Pvt. Ltd.) જે ભચાઉ, કચ્છ પ્રોજેક્ટ સ્થળથી આશરે ૨૧૦ કિ.મી દૂર આવેલ છે.

#### ૫.૪ અવાજના પ્રદૂષણનું વ્યવસ્થાપન :

- અવાજનું પ્રદૂષણ ઉત્પન્ન કરતા સ્ત્રોતમાં ડી.જી.સેટ, એકમમાં ચાલતી ઉત્પાદન પ્રક્રિયા તેમજ પ્રોજેક્ટ સાઈટની અંદર તેમજ બહાર ચાલતો વાહનવ્યવહાર છે.
- અવાજનું પ્રમાણ ઘટાડવા પ્લાન્ટના બધી જ મશીનરી તથા યંત્રોમાં નિયમિત ઊંજાણ પૂરવામાં આવશે.
- એકમની વિવિધ જગ્યાએ અવાજનું પ્રમાણ માપવામાં આવશે.
- એકમમાંથી ઉત્પન્ન થતા અવાજની પ્રબળતા / ઘટાડવા માટે પ્લાન્ટની ફરેતે ગ્રીન બેલ્ટ વિકસાવવામાં આવશે.
- સુરક્ષા – નીતિ (Safety policy) પ્રમાણે પ્લાન્ટમાં વધુ અવાજ કરતા વિસ્તારમાં કામ કરનાર ને કાનનું રક્ષણ કરવા માટે કાને ધરાતુ સાધન (ear plugs) આપવામાં આવશે.

**પ.પ ગ્રીન બેલ્ટ વિકાસ :**

- હવા પ્રદુષણના નિયંત્રણ માટે ઉદ્યોગમાંથી નીકળતા અવાજને રોકવા માટે તેમજ જૈવવિજ્ઞાન તેમજ સુંદરતા વધારવા ગ્રીન બેલ્ટનો ઉદ્યોગ દ્વારા વિકાસ કરવામાં આવશે.
- સૂચિત ઉદ્યોગ ૪૮૦૦.૦૦ ચો.મી. વિસ્તારમાં આવેલ છે. અને ૧૫૮૫.૦૦ ચો.મી. વિસ્તાર ગ્રીન બેલ્ટ તરીકે વિકસાવવામાં આવશે. જે કુલ વિસ્તારના ૩૩.૦૨% છે. બગીચાના વિકાસ માટે ૪૨૫૦ લિ./દિવસ પાણી વપરાશ થશે.
- ઉદ્યોગ કેટલાક વૃક્ષો અને કેટલાંક નાના છોડ વાવશે. જે અવાજનું પ્રમાણ અને ધૂળના રજકણોનું પ્રમાણ ઘટાડાશે.
- ઉદ્યોગ વર્ષે લગભગ ૨ લાખ રૂપિયા ગ્રીનબેલ્ટના વિકાસ અને સાચવણી માટે ફાળવશે.

# Annexure-C

## **Accreditation of Environment Consultant with QCI & Company Profile**

**Page No:318 - 319**

**ANNEXURE – C****LIST OF PRAGATHI LABS & CONSULTANTS PVT. LTD. IN QCI LIST & COMPANY PROFILE**

**F. No. J-11013/77/2004 – IA II (I)**  
**Government of India**  
**Ministry of Environment and Forests**  
**(I.A.Division)**

**Dated: 30<sup>th</sup> June, 2011**

**List 'A' : Consultants with Provisional Accreditation**

32.	Intercontinental Consultants and Technocrats Pvt. Ltd.	New Delhi
33.	Kirloskar Consultants Limited	Pune
34.	L & T – RAMBOLL Consulting Engineers Limited	Andhra Pradesh
35.	LEA Associates South Asia Pvt. Ltd.	New Delhi
36.	M. N. Dastur and Company (Pvt.) Ltd.	Kolkata
37.	M/s Padmaja Aerobiologicals Pvt. Ltd.	Navi Mumbai
38.	M/s Visiontek Consultancy Services Pvt. Ltd.	Bhubaneswar
39.	Mantec Consultants Pvt. Ltd.	Delhi
40.	Mineral Engineering Services	Karnataka
41.	Mineviron Systems Pvt. Ltd.,	Nagpur
42.	MITCON Consultancy Services Ltd.	Pune
43.	Mott Mac Donald Pvt. Ltd.	Ahmedabad
44.	National Environmental Engineering Research Institute	Nagpur
45.	Perfact Enviro Solutions Pvt. Ltd.	Delhi
46.	Pollution Control Research Institute	Haridwar
47.	Pragathi Labs & Consultants Pvt. Ltd.	Secunderabad
48.	Projects & Development India Limited	Noida
49.	Pure Enviro Engineers Pvt. Ltd.	Chennai
50.	RITES Limited	Gurgaon
51.	San Envirotech Pvt. Ltd.	Ahmedabad
52.	SECON Private limited	Bangalore
53.	SGS India Pvt. Ltd	Gurgaon

**COMPANY PROFILE****Consultant organization:**      **Pragathi Labs & Consultants Pvt. Ltd.**

**Address:**    Plot No. 8, Temple Rock Enclave,  
                    Tarbund 'X' Roads,  
                    Secunderabad - 500 009

**EIA Coordinator:** Dr. Ravi Kiran**Functional Area Experts:**

Sr. No.	Names of the persons involved	Qualification
1.	Dr. Ravi Kiran	M.Sc, Ph.D
2.	Mr. Ch Vishnu Sharma	B.Tech. Chemical
3.	Ms. Shaheda Begum	M.Sc., Analytical Chemistry
4.	Mrs. Y. Latha	M.Sc., Organic Chemistry
5.	Ms. L. Priyanka	M.Sc., Organic Chemistry
6.	Ms. K. Chandrika	M.Sc., Biotechnology
7.	Ms. R. Santhosh Rani	M.Sc., Organic Chemistry
8.	Mrs. C. Pavitra	B.Sc Chemistry

# Annexure-D

## **Compliance report of CTE Conditions**

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## ANNEXURE - E

### NOC COMPLIANCE REPORT

Name of unit	M/S. PERFECT LAMINATE
NOC order no. & Issue Date	CTE NO. 43351 Dated 14/09/2011
Letter No.	GPCB/ID35488/CCA GNR 677/91611 dated 14/9/2011
Name of Product	Different Types of Laminated Sheets

SR. NO.	CONSENT CONDITION	STATUS
1	Production of different types of Laminated Sheets: 40000 Sheets / month	Complied
2	Unit shall obtain non agriculture certificate for their proposed plant	Obtained
3	You shall not manufacture resin at site. You shall procure resin from outside & shall submit detail of resin purchased & production detail of laminates.	We will not manufacture resin and purchase resin from outside. We will also submit details of resin purchased & production to GPCB.

#### CONDITIONS UNDER THE WATER ACT

1	There Shall be no generation of industrial effluent from manufacturing process and other ancillary operations	Complied
2	The quantity of the domestic waste water (sewage) shall not exceed 500 Ltrs./Day.	Complied
3	Domestic effluent shall be disposed off through septic tank / soak pit system.	Complied

CONDITIONS UNDER THE AIR ACT												
4	Coal shall be used as a fuel in boiler and quantity shall not exceed 1 MT/Day.	Complied										
5	The applicant shall install & operate an air pollution control system in order to achieve norms prescribed by board.	The industry has provided dust collector with steam boiler										
6	The flue gas emission through stack attached to boiler shall conform to the standards of board.	Complied										
7	There shall be no process emission from the manufacturing process and other ancillary emission.	Complied										
8	Stack monitoring facilities like port hole, platform / ladder etc. shall be provided with stack / vent chimney in order to facilitate sampling of gases being emitted into the atmosphere.	Complied										
9	<div>The Concentration of the following parameters in the ambient air within premises of the industry shall not exceed the limits Specified hereunder.</div> <table><tr><th>PARAMETER</th><th>PERMISSIBLE LIMIT</th></tr><tr><td>Particulate matter (PM 10)</td><td>100 Microgram per cubic meter</td></tr><tr><td>Particulate matter (PM 2.5)</td><td>60 Microgram per cubic meter</td></tr><tr><td>Oxides of Sulphur</td><td>80 Microgram per cubic meter</td></tr><tr><td>Oxides of Nitrogen</td><td>80 Microgram per cubic meter</td></tr></table>	PARAMETER	PERMISSIBLE LIMIT	Particulate matter (PM 10)	100 Microgram per cubic meter	Particulate matter (PM 2.5)	60 Microgram per cubic meter	Oxides of Sulphur	80 Microgram per cubic meter	Oxides of Nitrogen	80 Microgram per cubic meter	Complied
PARAMETER	PERMISSIBLE LIMIT											
Particulate matter (PM 10)	100 Microgram per cubic meter											
Particulate matter (PM 2.5)	60 Microgram per cubic meter											
Oxides of Sulphur	80 Microgram per cubic meter											
Oxides of Nitrogen	80 Microgram per cubic meter											
10	All measures for the control of environmental pollution shall be	Complied										



	provided before commencing production.	
<b>CONDITIONS UNDER AUTHORIZATION (M &amp; H) OF HAZARDOUS WASTE</b>		
11	Applicant shall have to comply with provisions of hazardous waste (Management, Handling & Trans boundary movement Rules-2008)	Complied
12	The applicant shall obtain membership of common TSDF site for disposal of Hazardous waste	The industry will obtain membership of M/s. NEPL, Naroda
13	The applicant shall obtain membership of common hazardous waste incinerator for disposal of incinerable waste	The industry will obtain membership of M/s. SEPPL, Kutch, Bhachau
14	The applicant shall provide temporary storage facilities for each type of hazardous waste	The industry has provided separate storage facility for hazardous waste

# Annexure-E

**Period / Date of data collection**

**Page No:323**

**Annexure – E****Period / Date of Data Collection**

Sr. No.	Details	Sampling Date
1	Water Sample	3/10/2011
2	Soil Sample	3/10/2011
3	Ambient Air sample	October, November, December 2011
4	Ecological Data	23/12/2011
5	Noise sample	3/10/2011
6	Risk Assessment Data	22/11/2011
7	Socio Economic Data	23/12/2011
8	Hydro – Geological Data	3/10/2011

# Annexure-F

**Certificate of National  
Accreditation Board for Testing  
and Calibration Laboratories**

**Page No: 324 - 331**





# NABL

## National Accreditation Board for Testing and Calibration Laboratories

Department of Science & Technology, India

### CERTIFICATE OF ACCREDITATION

## GUJARAT LABORATORY

has been assessed and accredited in accordance with the standard

**ISO/IEC 17025:2005**

"General Requirements for the Competence of Testing & Calibration Laboratories"

for its facilities at

F-17, Madhavpura Market, Nr. Police Commissioner Office, Shahibaug, Ahmedabad

in the field of

**BIOLOGICAL TESTING**

(You may also visit NABL website [www.nabl-india.org](http://www.nabl-india.org) to view the scope of accreditation)

**Certificate Number** T-1251

**Issue Date** 06/07/2011

**Valid Until** 05/07/2013

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the additional requirements of NABL.

Signed for and on behalf of NABL

Rini Narayan

Rini Narayan  
Convenor

Anil Relia

Anil Relia  
Director

Dr. T. Ramasami

Dr T. Ramasami  
Chairman





# रा.प्र.प्र.बो.

राष्ट्रीय परीक्षण और अंशशोधन  
प्रयोगशाला प्रत्यायन बोर्ड  
विज्ञान एवं प्रौद्योगिकी विभाग, भारत

प्रत्यायन प्रमाण-पत्र

## गुजरात लैबोरेटरी

का मूल्यांकन और प्रत्यायन निम्न मानक के अनुसार

आई.एस.ओ./आई.ई.सी. 17025:2005

“परीक्षण एवं अंशशोधन प्रयोगशालाओं की सक्षमता की सामान्य अपेक्षाएँ”

## अहमदाबाद

में स्थित इसकी सुविधाओं के लिए

## जैविकीय परीक्षण

के क्षेत्र में किया गया।

प्रमाण-पत्र संख्या

प-1251

जारी करने की तिथि

06/07/2011

वैधता की तिथि

05/07/2013

यह प्रमाण-पत्र उपर्युक्त मानक तथा राष्ट्रीय परीक्षण और अंशशोधन प्रयोगशाला प्रत्यायन बोर्ड की अतिरिक्त अपेक्षाओं का निरंतर संतोषप्रद अनुपालन किए जाने पर अनुबंध में निर्दिष्टानुसार प्रत्यायन के क्षेत्र के लिए वैध रहेगा।

रा.प्र.प्र.बो. की ओर से हस्ताक्षरित

रिनी नारायण

रिनी नारायण  
संयोजक

अनिल रेलिया

अनिल रेलिया  
निदेशक

डा. टी. रामसामी

डा. टी. रामसामी  
अध्यक्ष





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**Department of Science & Technology, India**

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Laboratory	Gujarat Laboratory, F-17, Madhavpura Market, Nr. Police Commissioner Office, Shahibaug, Ahmedabad		
Accreditation Standard	ISO/IEC 17025:2005		
Field	Biological Testing	Issue Date	06.07.2011
Certificate Number	T-1251	Valid Until	05.07.2013
Last Amended on	-	Page	1 of 6

S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
I.	<b>FOOD AND AGRICULTURAL PRODUCTS</b>			
1.	<b>Milk, Milk Products &amp; Ice-Cream</b>			
	(Milk Raw, Sterilized, Pasteurized, Toned, Flavoured, Cream, Butter, Infant Milk & Milk Substitutes And Other Related Products, Milk Powder, Skim, Partly Skimmed, Whole Condensed Milk, Dahi, Butter Milk, Paneer Cheese & Cheese Products, Ice-Cream, Frozen Dessert)	Total Plate count	IS:5402-2002	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm
		Yeast & Mould Count	IS:5403-1999	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm
		Coliform Count	IS:5401(P-I)-2002	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm Present/Absent in 0.1gm or ml Present/Absent in 1.0gm or ml
		E-coli(Isolation)	IS:5887(P-I)-2000	Present/Absent in 1gm or ml OR Present/Absent in 0.1gm
		Salmonella	IS:5887(P-III) -1999	Present/Absent in 25 gm or ml
		S.aureus	IS:5887(P-II)-2000	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm Present/Absent in 1gm or ml Present/Absent in 0.1gm or ml
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm or ml
		Listeria monocytogenes	IS:14988(P-II):2005	Present/Absent in 1gm or ml
		Antibacterial substances ( $\beta$ -Lactam)	Delvotest-SP	Detected/ not detected
2.	<b>Fruits &amp; Vegetable Products</b>			
	Pickles, Fruit Juices, Canned fruits,	Total Plate count	IS:5402-2002	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm
		Yeast & Mould Count	IS:5403-1999	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm
		Coliform Count	IS:5401(P-I)-2002	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm

*Rini Nozayan*  
Convenor





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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
	Fruit Pulp, Salad, Raw Vegetable, Ketchup, Jam & jellies, Sauce, Ready to serve fruit beverages	E-coli(Isolation)	IS:5887(P-I)-2000	Present/Absent in 25gm or ml
		Salmonella	IS:5887(P-III) -1999	Present/Absent in 25gm or ml
		S.aureus	IS:5887(P-II)-2000	$\geq 1\text{cfu/ml}$ OR $\geq 10\text{cfu/gm}$
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm or ml
3.	Food Grains, Pulses, Cereals, Solvent Extracted Edible Flours & Related Products	Total Plate count	IS:5402-2002	$\geq 10\text{cfu/gm}$
		Yeast & Mould Count	IS:5403-1999	$\geq 10\text{cfu/gm}$
		Coliform Count	IS:5401(P-I)-2002	$\geq 10\text{cfu/gm}$
	(Wheat, Rice, Pulses, Besan, Maida, Suji & Related products, Solvent Extracted Soya Flour, Solvent Extracted Groundnut Flour, Solvent Extracted Sesame Flour, Solvent Extracted Coconut Flour, Isabgul Husk & powder)	E-coli(Isolation)	IS:5887(P-I)-2000	Present/Absent in 25gm
		Salmonella	IS:5887(P-III) -1999	Present/Absent in 25 gm
		S.aureus	IS:5887(P-II)-2000	$\geq 1\text{cfu/ml}$ OR $\geq 10\text{cfu/gm}$
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm
		Folic Acid	ELISA	$0.16-1.28\text{ }\mu\text{g}/100\text{g} \times \text{DF}$
		Vitamin B12	ELISA	$0.03-0.18\text{ }\mu\text{g}/100\text{g} \times \text{DF}$
4.	Whole & Ground Spices & Condiments & Mix Masala	Total Plate count	IS:5402-2002	$\geq 10\text{cfu/gm}$
		Yeast & Mould Count	IS:5403-1999	$\geq 10\text{cfu/gm}$
		Coliform Count	IS:5401(P-I)-2002	$\geq 10\text{cfu/gm}$
	(Chilly, Turmeric, Coriander, Cumin, Ajwain, Fennel, Mustard, Pepper, Ginger)	E-coli(Isolation)	IS:5887(P-I)-2000	Present/Absent in 25gm

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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
	Dehydrated Onion, Dehydrated Garlic, Curry Powder, Mix Masala Chana Puri Masala, Pav Bhaji Masala)	Salmonella	IS:5887(P-III) -1999	Present/Absent in 25 gm
		S.aureus	IS:5887(P-II)-2000	$\geq 1 \text{ cfu/ml}$ OR $\geq 10 \text{ cfu/gm}$
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm
5.	Ready to Eat Products	Total Plate count	IS:5402-2002	$\geq 10 \text{ cfu/gm}$
	(Namkeen, Ready to eat food, bakery products, snacks, sweets, frozen food)	Yeast & Mould Count	IS:5403-1999	$\geq 10 \text{ cfu/gm}$
		Coliform Count	IS:5401(P-I)-2002	$\geq 10 \text{ cfu/gm}$
		E-coli (Isolation)	IS:5887(P-I)-2000	Present/Absent in 25gm
		Salmonella	IS:5887(P-III) -1999	Present/Absent in 25 gm
		S.aureus	IS:5887(P-II)-2000	$\geq 1 \text{ cfu/ml}$ OR $\geq 10 \text{ cfu/gm}$
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm
6.	Tea & Tea Product	Total Plate count	IS:5402-2002	$\geq 10 \text{ cfu/gm}$
		Yeast & Mould Count	IS:5403-1999	$\geq 10 \text{ cfu/gm}$
		Coliform Count	IS:5401(P-I)-2002	$\geq 10 \text{ cfu/gm}$
		E-coli(Isolation)	IS:5887(P-I)-2000	Present/Absent in 25gm
		Salmonella	IS:5887(P-III) -1999	Present/Absent in 25 gm
		S.aureus	IS:5887(P-II)-2000	$\geq 1 \text{ cfu/ml}$ OR $\geq 10 \text{ cfu/gm}$
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm

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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
7.	Meat & Meat Products	Total Plate count	IS:5402-2002	$\geq 10$ cfu/gm
		Yeast & Mould Count	IS:5403-1999	$\geq 10$ cfu/gm
		Coliform Count	IS:5401(P-I)-2002	$\geq 10$ cfu/gm
		E-coli(Isolation)	IS:5887(P-I)-2000	Present/Absent in gm
		Salmonella	IS:5887(P-III) -1999	Present/Absent in 25 gm
		S.aureus	IS:5887(P-II)-2000	$\geq 1$ cfu/ml OR $\geq 10$ cfu/gm
		Shigella	IS:5887(P-VII)-1999	Present/Absent in 25gm
8.	Vitamins in Premix / Food / Food Supplements / Health Food & Supplements/ Dietary Foods [Raw, Semi processed & Processed] & Cattle Feed	Folic Acid	ELISA	0.16-1.28 $\mu$ g /100g x DF
		Vitamin B12	ELISA	0.03-0.18 $\mu$ g /100g x DF
		Vitamin B6	ELISA	2-120 $\mu$ g / 100g x DF
		Vitamin B5 (Pantothenic Acid)	ELISA	0.04-0.24 mg/100g x DF
		Vitamin H (Biotin B7)	ELISA	0.08-0.72 $\mu$ g/100g x DF
II.	SWAB			
1.	Equipment, Handler, Cooking Accessories, Cooking Platform.	Total Bacterial Count	As per In-house testing method GL/WI/M-118	$\geq 1$ cfu/area

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Last Amended on	-		

S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
<b>III. WATER</b>				
1.	Drinking Water IS:10500:1991 Reaff 1993 Ice Manufacturing Water IS 3957-1966 Reaff 1989	MPN / Coliform E-Coli ( By MPN )	IS:1622-1981 Reaff. 2003 IS:1622-1981 Reaff. 2003	$\geq 2$ MPN/100 ml $\geq 2$ MPN/100 ml
	(*Please see the Note below)			
2.	Packaged Drinking Water IS:14543:2004 Packaged Natural Mineral Water IS:13428:2005	Escherichia coli Coli form bacteria Faecal streptococci Sulphite reducing anaerobes Pseudomonas aeruginosa Aerobic microbial count (at 20-22°C for 72 hrs and at 37°C for 24 hrs) Yeast & Mould Salmonella Shigella Vibrio cholerae V. parahaemolyticus	IS:15185-2002 IS:15185-2002 IS:15186-2002 IS:13428(Ann-C)-2005 IS:13428(Ann-D)-2005 IS: 5402-2002 IS: 5403-1999* / IS:15188:2002 IS:15187-2002 IS:5887(P-7)-1999* / IS:15188:2002 IS:5887(P-5):1976* / IS:15188:2002 IS:5887(P-5):1976* / IS:15188:2002	Present or Absent / 250ml Present or Absent / 250ml Present or Absent / 250ml Present or Absent / 50ml Present or Absent / 250ml $\geq 1$ cfu / ml Present or Absent / 250ml Present or Absent / 250ml Present or Absent / 250ml Present or Absent / 250ml Present or Absent / 250ml
	(*Please see the Note below)			

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Convenor





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S.No.	Product / Material of Test	Specific Test Performed	Test Method Specification against which tests are performed	Range of Testing / Limits of Detection
		Staphylococcus aureus	IS: 5887(P-2)-2000*/ IS:15188:2002	Present or Absent / 250ml
3.	Swimming Pool Water, IS: 3328-1993	Standard Plate Count	Annex A of IS 3328-1998	$\geq 1$ cfu / ml
		MPN / Coliform	IS: 1622-1981 Reaff 2003	$\geq 2$ MPN/100 ml

-X-X-X-X-X-X-X-X-X-X-X-X-X-X-

\* IS 5403 & IS 5887 for reference

**\*NOTE:** The Laboratory has demonstrated competence for the stated scope for **WATER**. This however **does not fully cover** the specification requirements of **BIS** for the **Packaged Drinking Water** as per **IS:14543** and the **Packaged Natural Mineral Water IS:13428**.

*Rini Narayan*  
Convenor

**ANNEXURE - G****EXPECTED CHARACTERISTICS OF UNTREATED EFFLUENT**

<b>Sr. No.</b>	<b>Parameter</b>	<b>Concentration in mg/l</b>
1	pH	6.1
2	TDS	672
3	SS	80
4	COD	17120
5	BOD	5806
6	Phenol	1072

**EXPECTED CHARACTERISTICS OF TREATED EFFLUENT  
(AFTER OXIDATION PROCESS)**

<b>Sr. No.</b>	<b>Parameter</b>	<b>Concentration in mg/l</b>
1	pH	7.1
2	TDS	2500
3	SS	95
4	COD	6200
5	BOD	1800
6	Phenol	72



ANNEXURE – H

GOOGLE MAP SHOWING NEARBY SURFACE WATER BODY FROM THE PROJECT SITE

Surface water body – Amarpura (canal), Charada (pond)

