

Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist- Bongaigaon, Assam

M/s Assam Petro-chemicals Limited.

Submitted by



Prepared by





Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-chemicals Limited



ASSAM PETRO-CHEMICALS LIMITED

(A Government of Assam Undertaking) | An ISO 9001:2008 Certified Company
CIN- U24116AS1971SGC001339, GSTN: 18AABCA6913A1Z6

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UNDERTAKING

I, Mr. Ratul Bordoloi, Managing Director of M/s Assam Petro-Chemicals Limited (APL), willing to submit this undertaking with respect to the TOR prescribed by State Environmental Impact Assessment Authority (SEIAA), Assam vide No. SEIAA.883/2018/11 Dated 25th February 2019 for the Proposed 200 TPD Formaldehyde Manufacturing Plant at Village- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam.

M/s Assam Petro-chemicals Limited has been complied with and the data/ information submitted are correct to best of knowledge.

For M/s Assam Petro-chemicals Limited.

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Declaration by ABC Techno Labs India Pvt. Ltd.

M/s Assam Petro-Chemicals Limited (APL) has proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam. In this regard M/s Assam Petro-Chemicals Limited appointed ABC Techno Labs India Pvt. Ltd. to conduct the Environmental Impact Assessment (EIA) study as per the Terms of Reference (TOR) for carrying out the EIA/EMP study vide No. SEIAA.883/2018/11 Dated 25th February 2019 issued by State Environment Impact Assessment Authority (SEIAA), Assam.

ABC Techno Labs has taken all reasonable precautions in the preparation of this EIA report. ABC Techno Labs also believes that the facts presented in this report are accurate as on date it was written.

ABC Techno Labs confirm that the mentioned experts prepared the EIA Report for proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam. ABC Techno Labs also confirm that the consultant organisation shall be fully accountable for any misleading information mentioned in this statement.



Name: Mr. G. Murugesh

Designation: Chairman & Managing Director

Name of the EIA Consultant Organisation: ABC Techno Labs India Pvt. Ltd.



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Quality Council of India
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CERTIFICATE OF ACCREDITATION

ABC Techno Labs India Private Limited

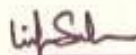
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	Mining of minerals (open cast only)			A
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4	Thermal power plants	4	1 (d)	A
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7	Petroleum refining industry	10	4 (a)	A
8	Leather/skin/hide processing industry	15	4 (f)	A
9	Chemical fertilizers	16	5 (a)	A
10	Petro-chemical complexes	18	5 (c)	A
11	Synthetic organic chemicals industry	21	5 (f)	A
12	Distilleries	22	5 (g)	A
13	Sugar industry	25	5 (j)	B
14	Oil & gas transportation pipeline	27	6 (a)	A
15	Isolated storage & handling of Hazardous chemicals	28	6 (b)	B
16	Air ports	29	7 (a)	A
17	Industrial estates/ parks, (EPZs), (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	B
18	Ports, harbours, break waters and dredging	33	7 (e)	A
19	Highways	34	7 (f)	A
20	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
21	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
22	Building and construction projects	38	8 (a)	B
23	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated Jan 13, 2017 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in NABET's letter of accreditation bearing no. QCI/NABET/ENV/ACO/17/0319 dated 29 May 2017. The accreditation needs to be renewed before the expiry date by ABC Techno Labs. Pvt. Ltd., following due process of assessment.



C.E.O.
NABET

Certificate No.
NABET/ EIA/1619/ RA 0048

Issue date
May 29, 2017

Expiry Date
May 25, 2019

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May 16, 2019

QCI/NABET/EIA/ACO/19/0982
ABC Techno Labs India Private Limited
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(Kind Attention: **Mr. Pargunan T**)

Sub: Validity of Accreditation

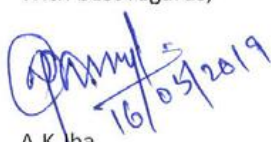
Dear Sir,

This has reference to the accreditation of your organization under QCI-NABET EIA Scheme, the validity of **ABC Techno Labs India Private Limited** is hereby extended till November 15, 2019 or completion of assessment process, whichever is earlier.

The above extension is subject to the submission of required information/documents related to assessment on time to NABET.

You are requested not to use this letter after expiry of the above stated date.

With best regards,


16/05/2019

A.K Jha
Senior Director | NABET



PROJECT DETAILS

Name of Publication *Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited.*

Project Number **Version 1 Released May 2019**

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ABC Techno Labs also believes that the facts presented in this report are accurate as on date it was written. However, it is impossible to dismiss absolutely, the possibility of errors or omissions. ABC Techno Labs therefore, specifically disclaim any liability resulting from the use or application of the information contained in this report. The information is not intended to serve as legal advice related to the individual section.



Declaration by experts contributing to the Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA/EMP.

EIA Coordinator

Name : Mr. Abhik Saha

Signature :

Abhik Saha

Period of involvement : September 2018 – Till date

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FUNCTIONAL AREA EXPERTS:

S. No.	Functional Areas	Name of the Expert/s	Involvement (Period)	Signature & Date
1.	AP	Mr. Abhik Saha	September 2018 – Till date	<i>Abhik Saha</i>
2.	WP	Mr. Abhik Saha	September 2018 – Till date	
3.	SHW	Mr. Abhik Saha	September 2018 – Till date	
4.	EB	Mr. Abhik Saha	September 2018 – Till date	
5.	SE	Dr. Geetha Shreeneevasakam	November 2018– Till date	<i>Dr. Geetha</i>
6.	HG	Dr. R.K. Jayaseelan	November 2018– Till date	<i>Dr. R.K. Jayaseelan</i>
7.	NV	Mrs. Vijayalakshmi	November 2018– Till date	<i>Mrs. Vijayalakshmi</i>
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10.	AQ	Mrs. Vijayalakshmi	November 2018– Till date	<i>Mrs. Vijayalakshmi</i>



11.	GEO	Dr. Thillai Govindarajan	November 2018– Till date	
12.	SC	Mr. Sameer Deshpande	November 2018– Till date	

Declaration by the head of the Accredited Consultant Organization

I, Mr. G. Murugesh, hereby confirm that the above mentioned experts prepared the EIA/EMP Report for the Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill-Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited. I also confirm that ABC Techno Labs India Pvt. Ltd. shall be fully accountable for any misleading information mentioned in this statement.

Signature :

Name : Mr. G. Murugesh
Designation : Chairman & Managing Director
Name of the EIA Consultant Organization: ABC Techno Labs India Private Limited
NABET Certificate No. & Issue Date: NABET/EIA/1619/RA0048 date 29th May 2017



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ABBREVIATIONS

APHA	:	American Public Health Association
ASTM	:	American Society for Testing and Materials
AWWA	:	American Water Works Association
ASPCB	:	Assam State Pollution Control Board
BDL	:	Below Detection Level
BOD	:	Biological Oxygen Demand
CI	:	Corrosion Inhibitor
COD	:	Chemical Oxygen Demand
CPCB	:	Central Pollution Control Board
DO	:	Dissolved Oxygen
EC	:	Electrical Conductivity
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
GPS	:	Geographical Positioning System
HDPE	:	High Density Poly Ethylene
HSE	:	Health Safety & Environment
ISRS	:	International Safety Rating System
MOEF&CC	:	Ministry of Environment, Forests & Climate Change
MSDS	:	Material Safety Data Sheet
NABET	:	National Accreditation Board of Education and Training
ND	:	Not Detected
OHSMS	:	Occupational Health & Safety Management System
PPE	:	Personal Protective Equipment
PVC	:	Polyvinyl Chloride
QCI	:	Quality Council of India
SS	:	Suspended Solids
TDS	:	Total Dissolved Solids
TOR	:	Terms of Reference
TSS	:	Total Suspended Solids
USEPA	:	United States Environmental Protection Agency



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Approved Terms of Reference (TOR)



Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist- Bongaigaon, Assam By M/s. Assam Petro-chemicals Limited



**STATE ENVIRONMENT IMPACT ASSESSMENT AUTHORITY, ASSAM
Ministry of Environment, Forest and Climate Change, Government of India
BAMUNIMADAM, GUWAHATI-21**

No. SEIAA.883/2018/11

Dated: 25/02/2019

To

Managing Director
Assam Petro Chemicals Limited
Namrup, P.O. Parbatpur,
Dibrugarh, Assam -786623

Ref: Your Application no. NIL, dated 08/10/2018

Sub: Proposal for sitting up 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhakanabari, Boitamari, Dist- Bongaigaon, Assam, regarding TOR.

Dear Sir

With respect to your application No. Nil, dated 08/10/2018, this is for your information that the SEAC, Assam in its meeting held on 29/12/2018 had detailed deliberations on the proposed project as presented by the project authorities outlining the salient features of the project and the existing environmental status of the proposed site. The proposed project falls under 5(f), category B1 as defined in the Schedule to the EIA Notification 2006. The SEAC, Assam had recommended for the issue of the Terms of Reference (TOR) for the EIA/EMP study to be carried out for the proposed project by the project proponent.

Accordingly, the SEIAA, Assam in its meeting held on 10/01/2019, accords its approval to the TOR for preparation of EIA & EMP report covering an area of 10 km radius of the project site as per EIA Notification 2006 and as per MoEF & CC guidelines on carrying out EIA/EMP study. The EIA/EMP study has to be carried out through a NABET-QCI accredited EIA Consultant only.

The project proponent will be required to approach the SEIAA with the required number of hard and soft copies of the EIA/EMP report, a full TOR Compliance Report and the proceedings of Public Consultation for getting Environmental Clearance after completion of the EIA/EMP study.

A copy of the approved TOR for EIA/EMP study is enclosed herewith.

Yours faithfully

Member Secretary,
SEIAA, Assam

Dated: 25/02/2019

Memo No. SEIAA.883/2018/11-A

Copy to:-

1. The Secretary to the Govt. of Assam, Environmental & Forest Department, Dispur, Guwahati-6 for favour of kind information.
2. The Chairman, PCBA for information.
3. The Regional Office, MoEF, Govt. of India, Low-U-sib, Lumbatngen, Near MTC Workshop, Shillong-21 for information.
4. Office Copy.

Sd/-

Member Secretary,
SEIAA, Assam

KGB
25/2/19
Chairman
SEIAA, Assam

Member Secretary
SEIAA, Assam

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Application No.: NIL dated 8th October, 2018

Proposal for setting up 200 TPD Formaldehyde manufacturing plant in Industrial estate at Dhaknabari – Boitamari near Bongaigaon, Assam

TERMS OF REFERENCE (TOR) FOR EIA/EMP STUDY

The approved TOR for EIA/EMP study for the proposed project are given below:

The EIA/EMP Report should conform strictly to the MoEFCC guidelines as per EIA Notification 2006 and its subsequent amendments. The Report should consist of

1. Executive Summary
2. Introduction
3. Project Description
4. Description of environment (Physical, Ecological, Socioeconomic)
5. Anticipated environmental impact & mitigation measures.
6. Analysis of alternatives (Technology & Site)
7. Environmental Monitoring Programme
8. Additional Studies
9. Project benefits
10. Environmental Cost-benefit Analysis
11. Environmental Management Plan (EMP)
12. Risk Assessment
13. Summary and Conclusions
14. Disclosures of Consultants engaged
15. TOR Compliance Report

A. STANDARD TERMS OF REFERENCE

1. Introduction

- i. Details of the EIA Consultant including NABET accreditation.
- ii. Information about the project proponent.
- iii. Importance and benefits of the project.

2. Project Description

- i. Cost of project and time of completion.
- ii. Products with capacities for the proposed project.
- iii. List of raw materials required and their source along with mode of transportation.
- iv. Other chemicals and materials required with quantities and storage capacities.
- v. Details of Emission effluents, hazardous waste generation and their management.
- vi. Requirement of water, power with source of supply, status of approval. Water balance diagram man-power requirement (regular and contract).
- vii. Process description along with major equipments and machineries process flow sheet (quantative) from raw material to be provided.
- viii. Hazard Identification and details of proposed safety systems.

3. Site Details

- i. Location of the project site covering village Taluka/Tehsil. District and State, Justification for selecting site.

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25/2/19
Chairman
SEIAA, Assam

SK
Member Secretary
SEIAA, Assam

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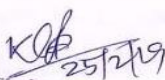
- ii. A toposheet of the study area of radius of 10km. and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)
- iii. Details w.r.t. option analysis for selection of site.
- iv. Co-ordinates (lat-long) of all four corners of the site.
- v. Google map-Earth downloaded of the project site.
- vi. Layout maps indicating proposed unit indicating storage area, plant area, greenbelt area, utilities etc. If located within an Industrial area/Estate/Complex, layout of Industrial Area indicating, location of unit within the Industrial area/Estate.
- vii. Photographs of the proposed (if applicable) plant site along with the existing Green coverage/Trees etc.
- viii. Land-use break-up of total land of the project site.
- ix. A list major industrial with name and type within study area (10km radius) shall be incorporated Land use details of the study area.
- x. Geological features and Geo-hydrological status of the study area shall be included.
- xi. Details of Drainage of the project upto 5km radius of study area. If the site is within 1 km radius of any major river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood Level of the project site and maximum Flood Level of the river shall also be provided (mega green field projects).

4. Forest and wildlife related issues (if applicable)

- i. The projects to be located within 10km of the National Parks. Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-a-vis project location and the recommendations or comments of the Chief Wildlife Warden-thereon.
- ii. Wildlife Conservation Plan duly authenticated by the Chief Wildlife Warden of the State Government for conservation of Schedule I fauna. If any exists in the study area.
- iii. Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.

5. Environmental Status

- i. Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.
- ii. AAQ data (except monsoon) at 8 locations for PM2.5, PM10, SO2, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests.

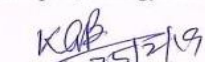

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SEIAA, Assam


Member Secretary
SEIAA, Assam

- iii. Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the MoEF & CC along with-min, max, average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report.
- iv. Surface water quality of nearby Rivers (100 m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF & CC guidelines.
- v. Ground water monitoring at minimum at 8 locations shall be included.
- vi. Noise levels monitoring at 8 locations within the study area.
- vii. Soil Characteristic as per CPCB guidelines.
- viii. Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.
- ix. Detailed description of flora and fauna (terrestrial and aquatic) existing in the study area shall be given with special reference to rare, endemic and endangered species. If schedule-I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.
- x. Socio-economic and health status of the study area.

6. Impacts and Environment Management Plan

- i. Assessment of ground level concentration from pollutants from stack emission based on site-specific meteorological features. The Cumulative impact of all sources of emissions (including transportation) on Ambient Air Quality of the area shall be assessed. Details of the model used and the input data for modelling shall also be provided. The air quality contours shall be plotted on a location map showing the location site, habitation nearby, sensitive receptors if any.
- ii. Water Quality modelling underlining water balance and wastewater discharge and action plan for achieving zero discharge.
- iii. Impact of the transport the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport.
- iv. Details of treatment of effluent from different plant operations, extent to be recycled and reused for different purposes. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules.
- v. Details of stack emission and action plan for controlling emission to meet standards.
- vi. Measures for fugitive emission control.
- vii. Details of hazardous waste generation and their storage, utilization and management.
- viii. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation and natural resource conservation.


Chairman
SEIAA, Assam


Member Secretary
SEIAA, Assam

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- ix. Action plan for the green belt development in 33% area i.e. land with not less than 1.500 trees per ha. Giving details of species, width of plantation schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated.
- x. Action plan for rainwater harvesting at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site and hence, to conserve fresh water and reduce the water requirement from other sources.
- xi. Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.
- xii. Action plan for post-project environmental monitoring shall be submitted.
- xiii. Onsite and Offsite Disaster (natural and Man-made) preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with District Disaster Management Plan.

7. Occupational health

- i. Plan and fund allocation to ensure the occupational health and safety of all contract and casual workers.
 - ii. Details of exposure specific health status evaluation of workers along with a plan for periodical medical examinations of workers to be mentioned.
 - iii. Details of existing Occupational and Safety Hazards. Enlisting of the exposure levels of hazards and whether they are within the Permissible Exposure level (PEL). If these are not within PEL, what measures the company adopted to keep them within PEL so that health of the workers are not affected.
 - iv. Annual report of health status of workers with special reference to Occupational Health and Safety.
- 8. Corporate Environment Policy shall be incorporated.** This should include measures to be taken under **Corporate Environment responsibility (CER), with appropriate budgetary provision as per MoEFCC OM F. No. 22-65/2017-IA.III dated 01/05/2018 and 19/06/2018** to be spent for health improvement, education, drinking water facilities, and other socio-economic upliftment in and around the project area (radius of 10 KM from the project site).
9. Details regarding infrastructure facilities such as sanitation fuel, restroom etc. to be provided to the labour force includes the casual workers, truck drivers, etc., during construction and operation phases.
10. Energy requirement and its source and plan for energy conservation plan. Plan for utilization of solar energy to be included.

B. Specific TOR:

1. Details of solvents to be used, measures for solvent recovery and for emission control.
2. Details of process emission from the proposed unit and its management to control.
3. Details of closed piping system for loading & unloading raw materials & product transfer points, measure for control of fugitive emission in the plant.
4. Ambient air quality data should include VOC etc.

KAB
Chairman
SEIAA, Assam

Secretary
SEIAA, Assam



Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist- Bongaigaon, Assam By M/s. Assam Petro-chemicals Limited

5. Work Zone monitoring arrangements for hazardous chemicals.
6. Details of effluent treatment scheme including segregation of effluent/ streams for units & concept for adopting zero discharge plan.
7. Action plan for odour control measures to be submitted.
8. Disposal plan for Hazardous Chemicals to be submitted.
9. Materials safety Data Sheet for all the Chemicals are being used/will be used.
10. Risk assessment for storage and handling of hazardous Chemicals/ Solvents. Action plans for handling of chemicals, safety system for Hazardous Chemicals are also to be incorporated in the report.
11. Arrangement for ensuring health & Safety of workers engaged in handling of toxic chemicals.
12. Adequate treatment scheme to be provided.

This TOR is valid for a period of 2 (two) years for the submission of EIA/EMP report from the data of issue of this letter.


Member Secretary,
SEIAA, Assam

Bamunimaidam, Guwahati-21
Dated: 25/02/2019

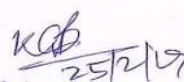
Memo No. SEIAA.883/2018/11-A

Copy to:-

1. The Secretary to the Govt. of Assam, Environmental & Forest department, Dispur, Guwahati-6 for favour of kind information.
2. The Chairman, PCBA for information.
3. The IA Cell, MoEF (IA) Cell, Govt. of India, New Delhi for information.
4. Office Copy.

Sd/-

Member Secretary,
SEIAA, Assam
Bamunimaidam, Guwahati-21


Chairman
SEIAA, Assam

Member Secretary
SEIAA, Assam

6



TOR COMPLIANCE



TOR COMPLIANCE

Compliance of TOR Issued by SEIAA, Assam vide no. SEIAA.883/2018/11 Dated 25th February 2019.

Sl. No.	Description	Details
1	Executive summary of a project	Attached separately
2	Introduction	Provided in Chapter 1
3	Project description	Provided in Chapter 2
4	Description of Environment (Physical, Ecological, Socioeconomic)	Provided in Chapter 3
5	Anticipated Environmental Impact & Mitigation Measures	Provided in Chapter 4
6	Analysis of Alternatives (Technology & Site)	Provided in Chapter 5
7	Environmental Monitoring Programme	Provided in Chapter 6
8	Additional studies	Provided in Chapter 7
9	Project Benefits	Provided in Chapter 8
10	Environmental Cost-Benefit Analysis	Not required
11	Environmental Management Plan (EMP)	Provided in Chapter 9
12	Risk Assessment	Provided in Chapter 7
13	Summary & Conclusions	Provided in Chapter 10
14	Disclosures of Consultants engaged	Provided in Chapter 11
15	TOR Compliance Report	Provided before introduction
A.	STANDARD TERMS OF REFERENCE	
1	Introduction	
i.	Details of EIA Consultant including NABET accreditation	Provided in Chapter 11
ii.	Information about the project proponent	Provided in Chapter 1, section 1.3
iii.	Importance and benefits of the project	Provided in Chapter 1, section 1.4.1 and Chapter 8
2	Project Description	
i.	Cost of project and time of completion	Provided in Chapter 2, section 2.11



Sl. No.	Description	Details
ii.	Products with capacities for the proposed project	Provided in Chapter 2, section 2.3
iii.	List of raw materials required and their source along with mode of transportation	Provided in Chapter 2, section 2.6.1
iv.	Other chemicals and materials required with quantities and storage capacities	Provided in Chapter 2, section 2.6.1
v.	Details of Emission effluents, hazardous waste generation and their management	Provided in Chapter 2, section 2.10
vi.	Requirement of water, power with source of supply, status of approval. Water balance diagram man-power requirement (Regular & Contract)	Provided in Chapter 2, section 2.6.4, 2.7, 2.8, 2.9
vii.	Process description along with major equipments and machineries process flow sheet (quantitative) from raw material to be provided	Provided in Chapter 2, section 2.6
viii.	Hazard Identification and details of proposed safety systems	Provided in Chapter 2, section 2.6.3 and chapter 7, section 7.2
3	Site Details	
i.	Location of the project site covering village, taluka/tehsil, district and state. Justification for selecting site	Provided in Chapter 2, section 2.2
ii.	A toposheet of the study area of radius of 10 km and site location on 1:50000/1:25000 scale on an A3/A2 sheet (including eco-sensitive areas and environmentally sensitive places)	Provided in Chapter 2, section 2.2.1 and fig 1.2
iii.	Details w.r.t. option analysis for selection of site	Provided in Chapter 2, section 2.2 and chapter 5, section 5.1
iv.	Co-ordinates (lat-long) of all four corners of the site	Provided in Chapter 2, section 2.2
v.	Google map-earth downloaded of the project site	Provided in Chapter 2, section 2.2, fig 2.1
vi.	Layout maps indicating proposed unit indicating storage area, plant area, green belt area, utilities etc. If located within an Industrial area/estate/complex, layout of Industrial Area indicating, location of unit	Provided in Chapter 2, section 2.6.3, Fig 2.4



Sl. No.	Description	Details
	within the industrial area/estate.	
vii.	Photographs of the proposed (if applicable) plant site along with the existing green coverage/trees etc	Annexure 5
viii.	Land use break up of total land of the project site	Provided in Chapter 2, section 2.7
ix.	A list of major Industrial with name and type within study area (10 km radius) shall be incorporated. Land use details of the study area.	Provided in Chapter 2, section 2.6.5
x.	Geological features and Geo-hydrological status of the study area shall be included	Provided in Chapter 3, section 3.6
xi.	Details of drainage of the project upto 5 km radius of the study area. If the site is within 1 Km radius of any river, peak and lean season river discharge as well as flood occurrence frequency based on peak rainfall data of the past 30 years. Details of Flood level of the project site and maximum flood level of the river shall also be provided (mega green field project)	Provided in Chapter 3, section 3.4
4	Forest and Wildlife related issues (if applicable)	
i.	The project to be located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of wild animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing features vis-à-vis project location and the recommendations or comments of the Chief Wildlife Warden thereon.	Provided in Chapter 3, section 3.8
ii.	Wildlife Conservation Plan duly authenticated by Chief Wildlife Warden of the State Government for conservation of Schedule –I fauna. If any exists in the study area.	Not applicable as no schedule 1 species observed or reported within the study area of 10 km radius
iii.	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of	Not applicable as no schedule 1 species observed or reported within the study area of 10 km radius



Sl. No.	Description	Details
	the National Board for Wildlife	
5	Environmental Status	
i.	Determination of atmospheric inversion level at the project site and site-specific micro-meteorological data using temperature, relative humidity, hourly wind speed and direction and rainfall	Provided in Chapter 3, section 3.3.1
ii.	AAQ data (except monsoon) at 8 locations for PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive receptors including reserved forests	Provided in Chapter 3, section 3.9
iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQPM Notification of Nov. 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ stations should be provided as an annexure to the EIA Report	Provided in Chapter 3, section 3.9
iv.	Surface water quality of nearby River (100m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines	Provided in Chapter 3, section 3.12
v.	Ground water monitoring at minimum at 8 locations shall be included	Provided in Chapter 3, section 3.12
vi.	Noise levels monitoring at 8 locations within the study area.	Provided in Chapter 3, section 3.10
vii.	Soil Characteristic as per CPCB guidelines.	Provided in Chapter 3, section 3.13
viii.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc.	Provided in Chapter 3, section 3.11
ix.	Detailed description of flora and fauna (terrestrial and aquatic) existing in the	Provided in Chapter 3, section 3.14 No schedule 1 species observed or



Sl. No.	Description	Details
	study area shall be given with special reference to rare, endemic and endangered species. If Schedule I fauna are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished	reported within the study area of 10 km radius
x.	Socio-economic status of the study area.	Provided in Chapter 3, section 3.15
6	Impact and Environment Management Plan	
i.	Assessment of ground level concentration of pollutants from the stack emission based on site-specific meteorological features. In case the project is located on a hilly terrain, the AQIP Modeling shall be done using inputs of the specific terrain characteristics for determining the potential impacts of the project on the AAQ. Cumulative impact of all sources of emissions (including transportation) on the AAQ of the area shall be assessed. Details of the model used and the input data used for modeling shall also be provided. The air quality contours shall be plotted on a location map showing the location of project site, habitation nearby, sensitive receptors, if any.	Provided in Chapter 4, section 4.8
ii.	Water Quality modeling - in case of discharge in water body	No waste water is discharged into any water body, therefore water quality modeling is not applicable.
iii.	Impact of the transport of the raw materials and end products on the surrounding environment shall be assessed and provided. In this regard, options for transport of raw materials and finished products and wastes (large quantities) by rail or rail-cum road transport shall be examined.	Provided in Chapter 4, section 4.8
iv.	Details of treatment of effluent from different plant operations, extent to be recycled and reused for different purposes. Complete scheme of effluent treatment. Characteristics of untreated	Provided in Chapter 2, section 2.9 and chapter 4, section 4.10



Sl. No.	Description	Details
	and treated effluent to meet the prescribed standards of discharge under E(P) Rules.	
v.	Details of stack emission and action plan for control of emissions to meet standards.	Provided in Chapter 2, section 2.10 and chapter 4, section 4.8
vi.	Measures for fugitive emission control	Provided in Chapter 4, section 4.8
vii.	Details of hazardous waste generation and their storage, utilization and management.	Provided in Chapter 4, section 4.11
viii.	EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation and natural resource conservation.	Provided in chapter 9, section 9.6.10 and 9.6.11
ix.	Action plan for the green belt development plan in 33 % area i.e. land with not less than 1,500 trees per ha. Giving details of species, width of plantation, planning schedule etc. shall be included. The green belt shall be around the project boundary and a scheme for greening of the roads used for the project shall also be incorporated	Provided in chapter 9, section 9.6.10 and 9.6.5
x.	Action plan for rainwater harvesting measures at plant site shall be submitted to harvest rainwater from the roof tops and storm water drains to recharge the ground water and also to use for the various activities at the project site to conserve fresh water and reduce the water requirement from other sources.	Provided in chapter 9, section 9.6.10 and 9.6.2
xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	Provided in chapter 9, section 9.9
xii.	Action plan for post-project environmental monitoring shall be submitted.	
xiii.	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management plan should be linked with	Provided in chapter 7, section 7.6



Sl. No.	Description	Details
	District Disaster Management Plan.	
7	Occupational health	
i.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers	Provided in chapter 7, section 7.5
ii.	Details of exposure specific health status evaluation of worker alongwith a plan for periodical medical examinations of workers to be mentioned.	Provided in chapter 7, section 7.5 and 7.6
iii.	Details of existing Occupational & Safety Hazards. Enlisting of the exposure levels of hazards and whether they are within Permissible Exposure Level (PEL). If these are not within PEL, what measures the company adopted to keep them within PEL so that health of workers are not affected.	The project is Greenfield project. However detail Occupational & Safety Hazards Provided in chapter 7, section 7.5 and 7.6
iv.	Annual report of health status of workers with special reference to Occupational Health and Safety.	The project is Greenfield project. However detail Occupational & Safety Hazards Provided in chapter 7, section 7.5 and 7.6
8	Corporate Environment Policy shall be incorporated. This should include measures to be taken under Corporate Environment Responsibility (CER), with appropriate budgetary provision as per MoEFCC OM F.No. 22-65/2017-IA.III Dated 1st May 2018 and 19th June 2018 to be spent for health improvement, education, drinking water facilities and other socio-economic upliftment in and around the project area (radius of 10 km from the project site)	Provided in chapter 9, section 9.7
9	Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force includes casual workers, truck drivers etc. during construction and operation phases.	Provided in chapter 7, section 7.5
10	Energy requirement and its source and plan for energy conservation plan. Plan for utilization of solar energy to be included.	Provided in chapter 9, section 9.6.8



Sl. No.	Description	Details
B.	SPECIFIC TERMS OF REFERENCE	
1	Details on solvents to be used, measures for solvent recovery and for emissions control.	Provided in chapter 2, section 2.6.1
2	Details of process emissions from the proposed unit and its arrangement to control.	Provided in chapter 2, section 2.10
3	Details of closed piping system for loading and unloading raw materials & product transfer points, measure for control fugitive emission in the plant	Provided in chapter 2, section 2.6.3
4	Ambient air quality data should include VOC etc.	Provided in chapter 3, section 3.9
5	Work zone monitoring arrangements for hazardous chemicals	Provided in chapter 6, section 6.3
6	Detailed effluent treatment scheme including segregation of effluent streams for units adopting 'Zero' liquid discharge	Provided in chapter 2, section 2.6.3
7	Action plan for odour control to be submitted.	Provided in chapter 4, section 4.8
8	Disposal plan for Hazardous Chemicals to be submitted	Provided in chapter 9, section 9.6.4
9	Material Safety Data Sheet for all the Chemicals are being used/will be used	Provided in chapter 7, section 7.7
10	Risk assessment for storage and handling of hazardous chemicals/solvents. Action plan for handling & safety system to be incorporated in the report.	Provided in chapter 7, section 7.3
11	Arrangements for ensuring health and safety of workers engaged in handling of toxic materials.	Provided in chapter 7, section 7.5
12	Adequate treatment scheme to be provided	Provided in chapter 2, section 2.9



CHAPTER 1

INTRODUCTION



CHAPTER 1: INTRODUCTION

1.1 PREAMBLE

Assam Petro-chemicals Limited (APL) was conceived for productive utilization of natural gas, which was being flared up in the Upper Assam oil field. Only a small quantum of natural gas was then used in fertilizer industry and power generation. To prevent this colossal wastage, the company was set up by the State Government of Assam with joint participation of Assam Industrial Development Corporation Ltd (AIDC) and the public. M/S. Assam Petrochemicals Limited (APL) have the distinction of being the first Petrochemical Plant in the country based on Natural Gas feedstock. It is a State of Assam owned Public Sector Unit (PSU) established in the year 1975 with an objective to utilize the abundantly available Natural Gas resources in the Upper Assam Oil field. The company made a modest beginning in the year 1976 by installing small capacity Methanol and Formaldehyde plants. The Methanol Technology for the Plant was provided by M/s Mitsubishi Heavy Industries (Japan). Liquid Urea Formaldehyde adhesives of 50% and 65% concentration and Urea Formaldehyde (UF) Moulding Powders were also being produced. After an initial turbulent decade of operations with very low capacities plants, APL scrapped the old units and implemented a modest expansion plan to install a new Methanol Plant of 100 TPD capacity based on ICI (UK) Technology (Steam – Hydrocarbon Reforming) and a 100 TPD Formaldehyde Plant with Technology (Excess Methanol Process – Silver Catalyst) from Formal Y. Derivados Forestalles (Spain), in the year 1986. Assam Petro-chemicals Limited (APL) was set up to utilize the huge reserve of Natural Gas in the Upper Assam oil fields and also to meet the requirement of increasing national demand for Methanol and Formalin.

APL is currently executing an ambitious Petrochemical Project at their Parbatpur works in Namrup (Assam) to manufacture 500 TPD Methanol. APL further proposes to expand and diversify their manufacturing base by installing a new grass root Petrochemical plant at Dhaknabari-Boitamari, western Assam commencing with a 200 TPD Aq. Formaldehyde (AF – 37) Plant.

ABC Techno Labs India Pvt. Ltd., NABET Accredited Environmental Consultant Organization has been engaged by Assam Petro-chemicals Limited to carry out Environment Impact Assessment (EIA) study and to prepare an Environment



Management Plan (EMP) for getting environment clearance for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist.-Bongaigaon, Assam. The study has been carried out as per the guidelines of Ministry of Environment, Forests & Climate Change (MoEF&CC).

1.2 IDENTIFICATION OF THE PROJECT

200 TPD Formaldehyde Plant Project is to be set-up within the new industrial estate allocated by Government of Assam at Dhaknabari-Boitamari, near Bongaigaon, Assam. Necessary infrastructure facilities in terms of roads, culverts and electrical power transmission lines etc. are available nearby. Project envisages production of Aqueous Formaldehyde (AF – 37) product @ 200 TPD with the following compositions:

Formaldehyde (HCHO): 37.00%

Methanol (CH₃OH): <1.0%

Formic Acid (HCOOH): <0.05%

Water (H₂O): Balance

The basic raw material for Formaldehyde Production is Methanol. Federal grade AA Methanol will be transferred from APL's existing sources and stored at the project Site in appropriately and adequately sized raw material storage tanks.

As per notification dated 14th September 2006, Proposed 200 TPD Formaldehyde Manufacturing Plant is designated as “**Category B**” project and requires environment clearance from State Expert Appraisal Committee (SEAC), Assam. The present proposal is classified under ***Schedule 5(f) - Synthetic Organic Chemical Industry (dye & dye intermediates, bulk drugs and intermediates excluding drug formulations, synthetic rubbers, basic organic chemicals, other synthetic organic chemicals and chemical intermediates), Category 'B' according to EIA Notification 2006 & subsequent amendments.***

As per the requirements of the notification, an application was submitted on 8TH October, 2018 to State Level Expert Appraisal Committee (SEAC), Assam along with Form-1, Feasibility Report and Draft Terms of Reference (TOR).

The proposal was considered by SEAC, Assam in its meeting held on 29th December, 2018 and the presentation was made to SEAC. Subsequently, the Committee issued the TOR vide no. SEIAA.883/2018/11 dated 25th February 2019. Based on the TOR points issued



by SEAC, draft Environmental Impact Assessment (EIA) report has been prepared. The purpose of the EIA study is to critically analyze the manufacturing process of formaldehyde, proposed to be manufactured with reference to types and quantity of raw materials consumption, possible source of pollution like waste water generation, air emissions, hazardous wastes generation, control measures to reduce the pollution. Subsequently, identification and evaluation of anticipated potential environmental impacts have been carried for construction and operation phases of the proposed formaldehyde plant and environment management plan to mitigate such adverse environmental impacts has been prepared.

1.3 IDENTIFICATION OF THE PROJECT PROPONENT

Assam Petro-chemicals Ltd. (APL) is a state level public sector undertaking of Govt. of Assam incorporated on 22nd April 1971. The foundation stone of the company was laid at Namrup on 15th June 1971 for production of Methanol and Formalin. Assam Industrial Development Corporation Ltd. (AIDC) promoted the company for manufacture of Methanol from Natural Gas which was abundantly available in the adjoining oil field in the Upper Assam. The Petrochemical complex of APL is the first of its kind in India, having natural gas as feedstock. Formalin is its downstream product. The company started its commercial production of Methanol and Formalin in June, 1976 from its two plants of 21 MTPD and 36 MTPD capacities respectively and a few Urea Formaldehyde resins as downstream projects with technology supplied by Mitsubishi Gas Chemicals Co., Japan. Assam Petro-Chemicals Limited was the first company whose shares were listed in Bombay Stock Exchange (Now BSE) in 1975. The shares of the company delisted from BSE w.e.f. 20.02.2017 to enable the company to allot shares to Governor of Assam, Oil India Limited and Assam Gas Company Limited through private placement. APL was subsidiary company of Assam Industrial Development Corporation Ltd. till 21st September, 2018.

APL's Experience:

Assam Petro-chemicals Ltd. is now implementing a mega project of 500 TPD Methanol and 200 TPD Formaldehyde plant as an expansion project of the company at a total cost of Rs. 1337 crore. Implementation of the 500 TPD Methanol project is going on at the adjacent plot of existing plant at Namrup in Dibrugarh district of Assam. Implementation of 200 TPD Formalin project is about to start at Boitamari in Bongaigaon District. The



Hon'ble Chief Minister of Assam laid the foundation stone of the 200 TPD Formalin Project at Boitamari, Bongaigaon on 4th March, 2019. Governor of Assam, Oil India Limited and Assam Gas Company Limited are investing in equity capital for implementation of 500 TPD Methanol and 200 TPD Formalin project. APL produces Methanol and Formalin from its plants located at Namrup and sells these products in domestic as well as exports to neighboring countries viz. Nepal, Bhutan and Bangladesh.

Project Proponent:

Name of the Company	M/s. Assam Petro-chemicals Limited.
Registered Address	Assam Petro-chemicals Limited 4 th Floor, Orion Place; Bhangagarh, G.S. Road, Guwahati, Assam- 781005, Assam
Address for correspondence	Assam Petro-chemicals Limited Namrup, P.O.- Parbatpur, Dist.- Dibrugarh, Assam- 786623
Name of the Applicant	Mr. Ratul Bordoloi
Designation (Owner/ Partner/ CEO)	Managing Director
E-mail	barman.ac@assampetrochemical.co.in
Telephone No.	+91-374-2500331
Name of the Company	M/s. Assam Petro-chemicals Limited.

1.4 BRIEF DESCRIPTION OF THE PROJECT

1.4.1 NEED FOR THE PROJECT AND ITS IMPORTANCE

The Plywood Boards and sun mica sheets market is growing very fast in India. The market is expected to continue to grow at the minimum rate of 10 to 15% per year. During the last decade India has built a very strong position as sun mica sheets and plywood boards for domestic consumption and for exports to South Asian countries & Middle East.

Formaldehyde is used by plywood and sun mica laminated sheets manufacturers, who make adhesives like Urea Formaldehyde and Phenol Formaldehyde products. Considering above, the M/s Assam Petrochemicals Ltd. is proposing to setup a manufacturing unit of Formaldehyde with the capacity of production of 200 TPD.

Demand & Supply Gap

The project is envisaged to meet the demand supply gap in the domestic market, as the gap is created due to increase in growth of Formaldehyde consumption for meeting increased demand of Plywood and Sun Mica industries.



Imports vs. Indigenous Production

Company is making its raw material in large quantities as compared to its Import Purchases. Company is also doing exports to Bhutan, Bangladesh.

Since APL is also planning more exports and hence its majority of export supplies will be against the schemes and benefits allowed/ extended by the Hon'ble Ministry of Commerce/ Hon'ble Ministry of Finance of Government of India, to the Exporters to promote the export business in North East India. In this manner and under statutory provisions and rules, APL is also utilizing the Import benefit policies allowed/ extended & allowed by the Govt. of India to the Exporters.

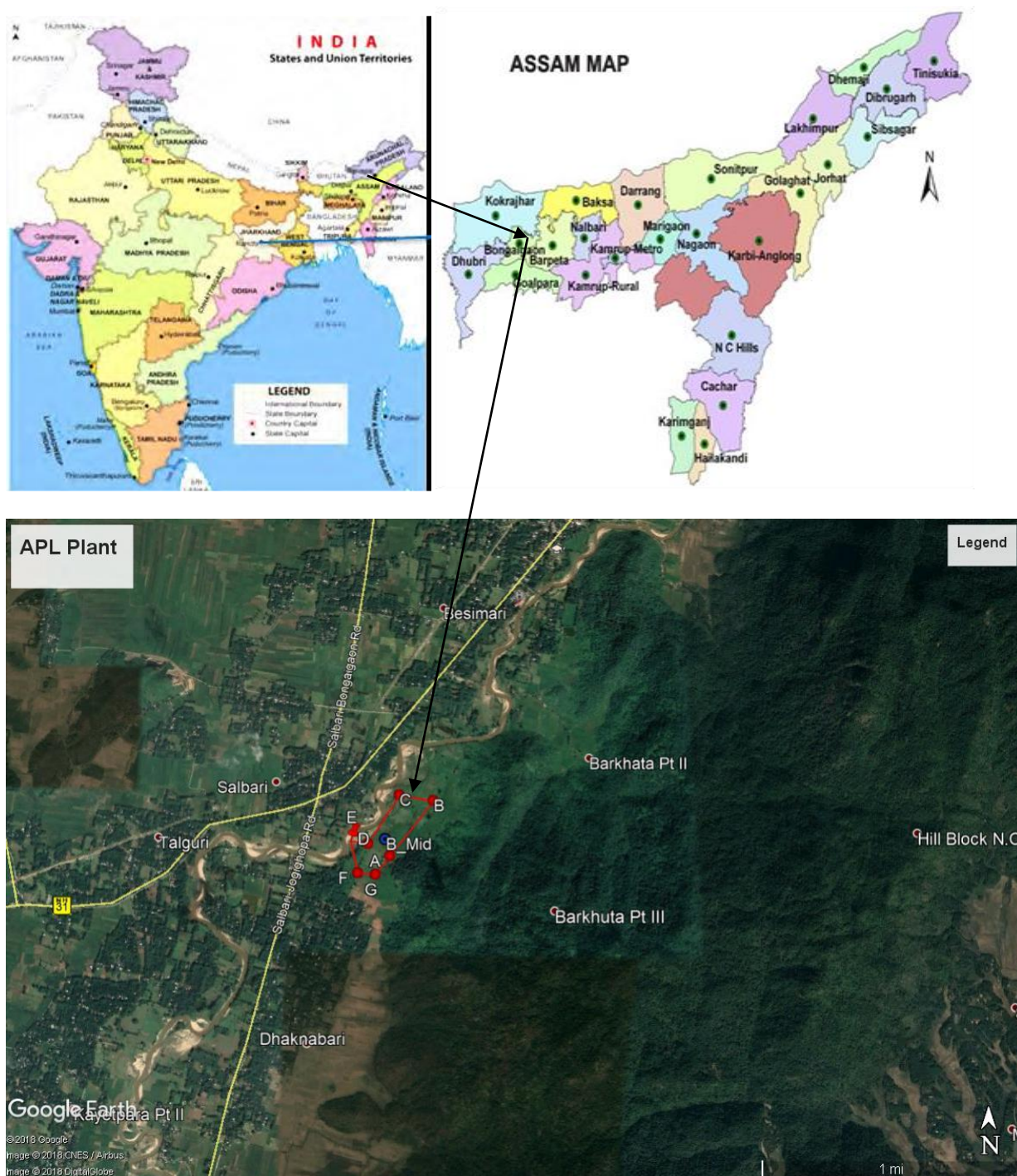
Export Possibility

Export possibility for Formaldehyde users is now growing in South Asian countries which ultimately help our country to earn the foreign currency. Also, the Plywood Boards and sun mica sheets market is growing very fast in North East India. The market is expected to grow at the minimum rate of 10 to 15% per year which gives an opportunity to fulfill the domestic market demand. Both the Domestic & Export supplies of the company will indirectly contribute to the growth of our nation.

1.4.2 DESCRIPTION OF PROJECT LOCATION

The proposed project of 200 TPD Formaldehyde Manufacturing unit will be located at Dag no. 72, 73 & 77 (Pt), Village: Dhaknabari, Boitamari; District: Bongaigaon at Assam. The total area of proposed Formaldehyde plant of APL is 36.4 Acres (147283 sq.m) and has the coordinates as per given hereunder:

The location of the project area is shown in Figure 1.1.

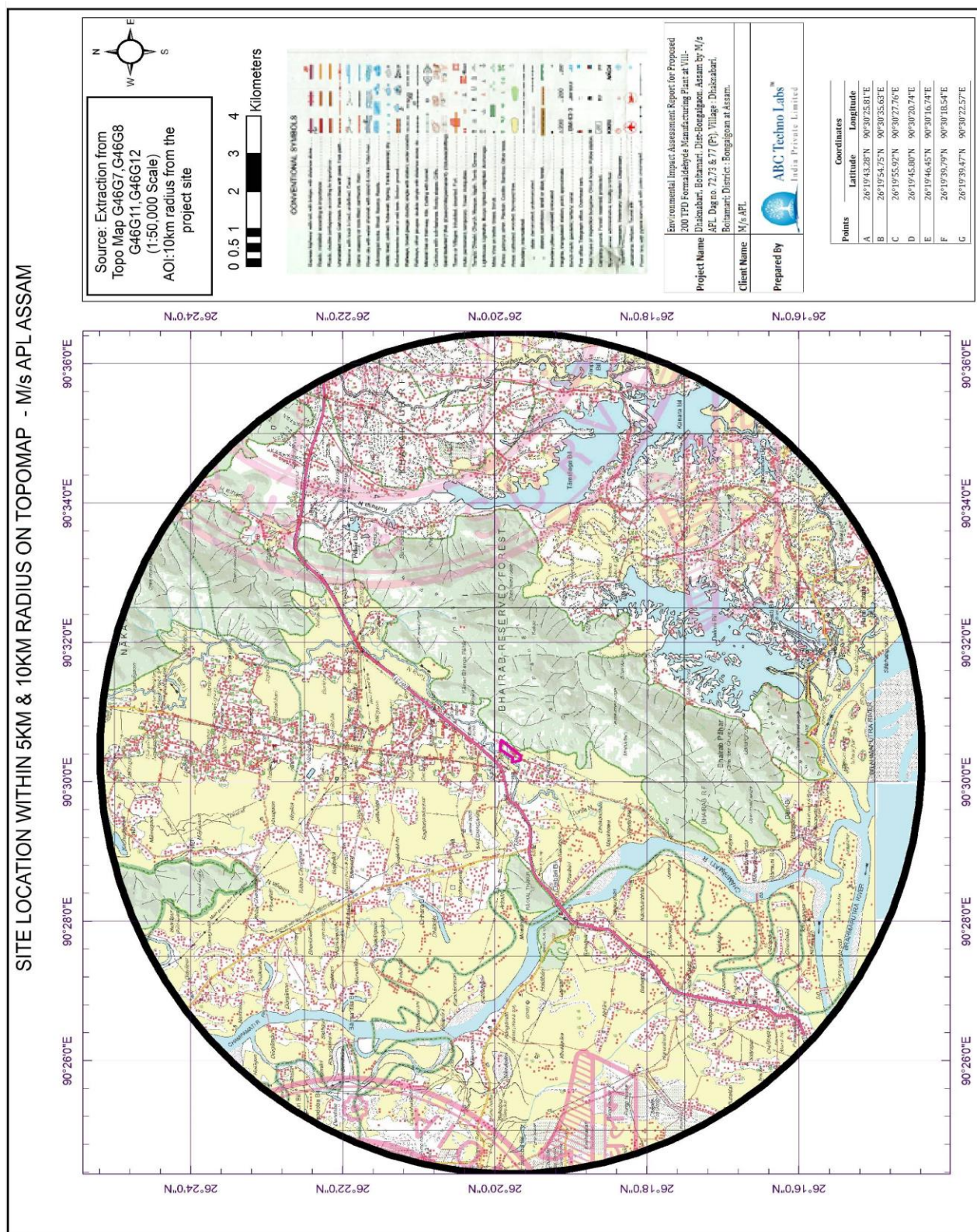


Source: Google Earth

Figure 1.1: Location map of Project site



Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist- Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited



Source: Survey of India

Figure 1.2: Toposheet of the study area

Table 1.1: Coordinates of the Plot area

Points	Coordinates	
	Latitude	Longitude
A	26°19'43.28"N	90°30'25.81"E
B	26°19'54.75"N	90°30'35.63"E
C	26°19'55.92"N	90°30'27.76"E
D	26°19'45.80"N	90°30'20.74"E
E	26°19'46.45"N	90°30'16.74"E
F	26°19'39.79"N	90°30'18.54"E
G	26°19'39.47"N	90°30'22.57"E

Source: APL

1.5 ENVIRONMENTAL STATUS

In the year 2009, the Central Pollution Control Board (CPCB) has developed a Comprehensive Environmental Pollution Index (CEPI) and revised the same in subsequent year up to April, 2016. It involved a nation-wide environmental assessment of Industrial Clusters based on CEPI and 43 such industrial clusters in 16 States having CEPI greater than 70, on a scale of 0 to 100, has been identified as Critically Polluted Area (CPA).

The proposed site location at Village – Dhaknabari, Boitamari, Dist- Bongaigoan, Assam does not fall in the list of 43 Critically Polluted Area (CPA) identified by CPCB. Hence, setting up Formaldehyde Plant at Village – Dhaknabari, Boitamari, Dist- Bongaigoan, Assam shall not constitute any statutory binding related to existing environment in and around the proposed project.

1.6 STATUTORY REQUIREMENTS AND LEGAL ASPECTS

The relevant NOC's and licenses will be obtained from the statutory agencies under the following Acts, Rules and amendments and APL will adhere to the guidelines specified in. APL will comply with the prescribed limits laid down for air, effluent and noise emissions for protection of the environment under the following Acts, Rules and amendments:

1. The Water (Prevention and Control of Pollution) Act, 1974
2. The Water (Prevention and Control of Pollution) Cess Act, 1977
3. The Air (Prevention and Control of Pollution) Act, 1981



4. The Environment (Protection) Act, 1986 which is also called umbrella act or legislation
5. The Environment Impact Assessment, Notification, 2006 issued under Environment (Protection) Act 1986 and Environment (Protection) Rules 1986 and amendments thereafter to date.

Compliance to State Rules and Notifications will also be ensured.

1.7 OBJECTIVES AND NEED OF EIA STUDY

The EIA/ EMP study is a planning tool to confirm the environmental acceptability, in addition to the statutory requirements. This report presents the results of the EIA process, which is intended to:

- ✓ Establish and review the existing baseline conditions within 10 km radius of the proposed project site and its surrounding area;
- ✓ Identify and assess the environmental impacts during proposed manufacturing of 200 TPD Formaldehyde;
- and
- ✓ Advise and assist in identification of appropriate measures, for mitigation of adverse impacts, to be adopted under the Environment Management Plan (EMP), for all specified significant environmental impacts that are likely to emerge.

The proposed 200 TPD Formaldehyde Manufacturing unit designated to be developed under the Environmental Impact Assessment (EIA) Notification and amendments under Environment (Protection) Act, 1986. All the projects related to Synthetic Organic Chemical Industry (dye & dye intermediates, bulk drugs and intermediates excluding drug formulations, synthetic rubbers, basic organic chemicals, other synthetic organic chemicals and chemical intermediates) are listed in para 5(f) of schedule of EIA Notification, 2006 covered under category 'B' and appraised by State Expert Appraisal Committee (SEAC), Assam.

1.8 APPROACH METHODOLOGY

The primary objective of the EIA studies is to internalize and integrate the environmental concerns/ aspects and mitigation measures due to the 200 TPD Formaldehyde Manufacturing unit at Village: Dhaknabari, Boitamari; District: Bongaigoan at Assam.



This EIA/ EMP report is based on the observations made by the ABC team during visits to the study area and collection of primary and secondary environmental data. Literatures were reviewed and relevant information was collected for environmental and social baseline. Reconnaissance surveys were conducted to identify the major environmental issues in the study area. The sampling locations were identified on the basis of:

- ✓ Existing topography;
- ✓ Location of water bodies;
- ✓ Location of villages/ towns/ sensitive areas;
- ✓ Accessibility, power availability, security of monitoring equipment;
- ✓ Areas which represent baseline conditions.

EIA study has been carried out with the following objectives:

- ❑ Baseline attributes as per approved TOR were collected within the study area (10 km radius of the proposed project site). The EIA covered one season baseline environmental data, as per the guidelines of MoEF&CC, New Delhi. The scope includes a collection of baseline data, identify the various environmental parameters such as Ambient Air Quality, Meteorology, Water Quality, Soil Quality, Noise levels, Biological Environment, Socio- economic factors, land use factors, within the study area of 10 km radius of the proposed project site.
- ❑ Identification, prediction, evaluation & mitigation of biophysical, social & other relevant effects of project activity on the environment during the operational phase of the 200 TPD Formaldehyde Manufacturing unit using mathematical/ simulation models as per applicable Indian law. Accordingly mitigation measures to be adopted have been recommended for critical environment impacts.
- ❑ Preparation of Risk Assessment & Emergency Preparedness/ Disaster Management Plan for the proposed 200 TPD Formaldehyde Manufacturing unit.
- ❑ Preparation of Environmental Management Plan (EMP) to be adopted for mitigation of the anticipated adverse impacts of the 200 TPD Formaldehyde Manufacturing unit during the operational phase.
 - ✓ Pollution control measures proposed to meet the emission, effluent, noise standards etc.
 - ✓ Scheme for effluent recycling, Solid/ hazardous waste management.



- ✓ Social welfare schemes.
 - ✓ Post-Project Environmental Quality Monitoring and Management Program.
 - ✓ Occupational health related mitigation measures; etc.
- ❑ Delineation of the post-project environmental quality monitoring program as per the requirements of the regulatory authorities.

The EIA/ EMP report is prepared for obtaining Environmental Clearance on the basis of Terms of Reference (TOR) prescribed by the SEAC, Assam vide **no. SEIAA.883/2018/11 dated 25th February 2019** for generation of site specific baseline data, environment monitoring and surveys within 10 km study area have been conducted for three (3) months continuously from **1st December 2018 to 28th February 2019** by ABC Techno Labs India Pvt. Ltd. and sampling locations for various environmental parameters were identified on the basis of:

- *Predominant wind direction expected during the period of baseline monitoring in the study area*
- *Topography,*
- *Location of village/ towns/ sensitive areas*
- *Identified pollution pockets, if any within the study area*
- *Areas, which represent baseline conditions;*
- *Collection, collation and analysis of baseline data for various environmental attributes.*

The study area around 10 km radius of the proposed project site could have impact on the physical, chemical and biological attributes of surrounding environment. In assessing the environmental impacts, collection, collation and interpretation of baseline data is of prime importance. Environmental impact analysis and assessment carried out at the planning stage itself.

1.9 NEED FOR EIA

As per EIA Notification dated 14th Sept., 2006 as amended from time to time, this project falls under S. No. 5 (Manufacturing/Fabrication), Project activity ***“5(f)”- Synthetic Organic Chemical Industry (dye & dye intermediates, bulk drugs and intermediates excluding drug formulations, synthetic rubbers, basic organic chemicals, other***



synthetic organic chemicals and chemical intermediates), Category 'B' according to EIA Notification 2006 & subsequent amendments.

Accordingly, the EIA Report has been prepared based on the Terms of Reference (TOR) issued by SEAC, Assam vide No. SEIAA.883/2018/11 dated 25th February 2019.

1.10 STRUCTURE OF EIA REPORT

The EIA report has been presented in order to group the environmental parameters under physical, biological, demographic & socio-economic environments, anticipated impacts and mitigation measures. The EIA report has been prepared as contents given in EIA Notification 2006 and subsequent amendments. The structure of EIA Report is as given below:

Executive Summary:	Given in the beginning of the report
Chapter 1: Introduction	This chapter provides background information, brief location settings of the area along with the scope and objectives of the EIA/ EMP study
Chapter 2: Project Description	This chapter deals project details, project layout, process details, operating parameters, power requirements, water requirement and sources of pollution and its management, cost etc.
Chapter 3: Description of the Environment	This chapter presents existing environmental status of the 10 km radius study area around the project site including topography, geological, drainage pattern, water environment, climate & meteorology, ambient air quality, noise levels, flora & fauna, socio-economic environment etc.
Chapter 4: Anticipated Environmental Impacts and its Mitigation Measures	This chapter describes the anticipated impact on the environment and its mitigation measures for proposed 200 TPD Formaldehyde Manufacturing unit. It gives the details of the impact on the baseline parameters, both during the construction and operational phases and suggests the mitigation measures to be implemented by the APL.



**Chapter 5:
Alternative Analysis**

This chapter examines alternative means for the proposed 200 TPD Formaldehyde Manufacturing unit will be located at Village: Dhaknabari, Boitamari; District: Bongaigaon at Assam.

**Chapter 6:
Environmental
Monitoring Plan**

This chapter describes Environmental Monitoring Plan for the proposed project activity during construction and operation phases.

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

This chapter spelled out hazard identification, risk analysis and disaster management plan for an unlikely event of emergency at 200 TPD Formaldehyde Manufacturing unit operations.

**Chapter 8: Project
Benefits**

This chapter includes the benefits in terms of improvement in physical and social infrastructure, employment potential, etc.

**Chapter 9:
Environmental
Management Plan**

This chapter describes environmental management plan to mitigate adverse environmental impacts and to strengthen beneficial impacts.

**Chapter 10:
Summary &
Conclusions**

This chapter provides summary and conclusion of the EIA study

**Chapter 11:
Disclosure of
Consultants**

This chapter comprises the name of consultants engaged with their brief resume and nature of consultancy rendered.



CHAPTER 2

PROJECT DESCRIPTION



CHAPTER 2: PROJECT DESCRIPTION

2.1 INTRODUCTION

Formaldehyde is a main constituent for manufacturing valuable chemicals like melamine, urea and phenolic resins. It is available in 37% aqueous solution. It is identified by some of its properties like molecular weight about 30.3, boiling point 98°C, melting point at -15°C and specific gravity 1.08. Industrial development continued from 1900-1905, when plant sizes, flow rates yields and efficiency were increased. In 1905, Badische Anilin and Soda Fabrik (BASF) started to manufacture Formaldehyde by a continuous process employing a crystalline silver catalyst.

The proposed facility will produce 200 TPD of Formaldehyde. The project will be equipped with fully diversified processing facilities.

Table 2.1: Salient Features of the proposed project

Particulars	Details
Company Name	M/s Assam Petro-chemicals Limited
Location of Project	Dag no. 72, 73 & 77 (Pt), Village : Dhaknabari, Boitamari; District : Bongaigaon at Assam
Category of the Project	Sl. No. 5 (Manufacturing/Fabrication), Project activity <i>"5(f)- Synthetic Organic Chemical Industry (dye & dye intermediates, bulk drugs and intermediates excluding drug formulations, synthetic rubbers, basic organic chemicals, other synthetic organic chemicals and chemical intermediates), Category 'B' according to EIA Notification 2006 & subsequent amendments</i>
Land required	36.4 Acres (147283 sq.m)
Coordinates(Lat-long)	Refer Table 1.2
Raw water Requirement	Domestic Requirement - 20 KLD ; Industrial Requirement – 364 KLD
Power Requirement	1400 KW (Source – Assam Power Distribution Company Limited).
Manpower Requirement	1000 (Construction Phase)/ 45 (during operation phase)
Estimated project cost	INR 5116 Lacs
Seismic zone	The proposed plant-site area falls in Seismic Zone V as per IS 1893:2002 (Part-1), which is a highly sensitive seismic zone. In case of very severe natural disaster there may be spillage of chemicals from damaged tanks and equipment. However, adequate measures will be taken for safety of workmen & materials and protection of environment during & after the occurrence of the disaster.

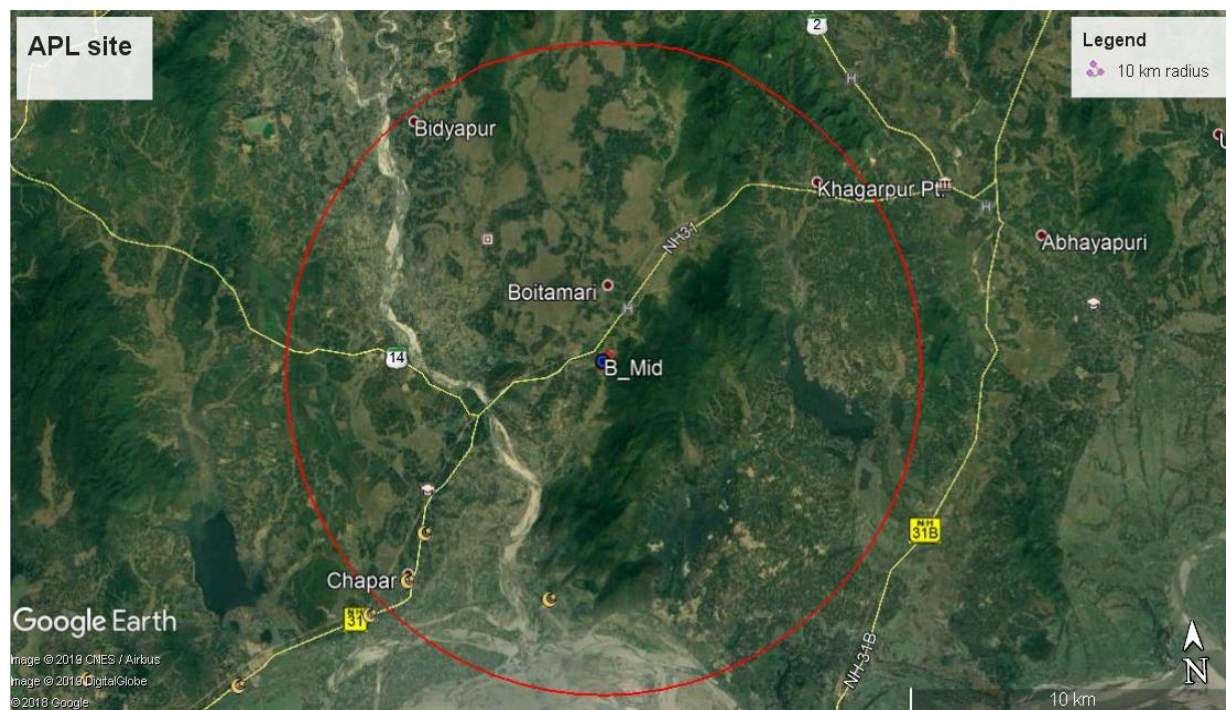
Source: APL

2.2 SITE CHARACTERISTICS

2.2.1 LOCATION

The proposed 200 TPD Formaldehyde Plant Project” is to be set-up within the new industrial estate developed by Assam Industrial Development Corporation (AIDC), Government of Assam at Dhaknabari- Boitamari, near Bongaigaon, Assam:

The location of the project area is shown in Figure 2.1.

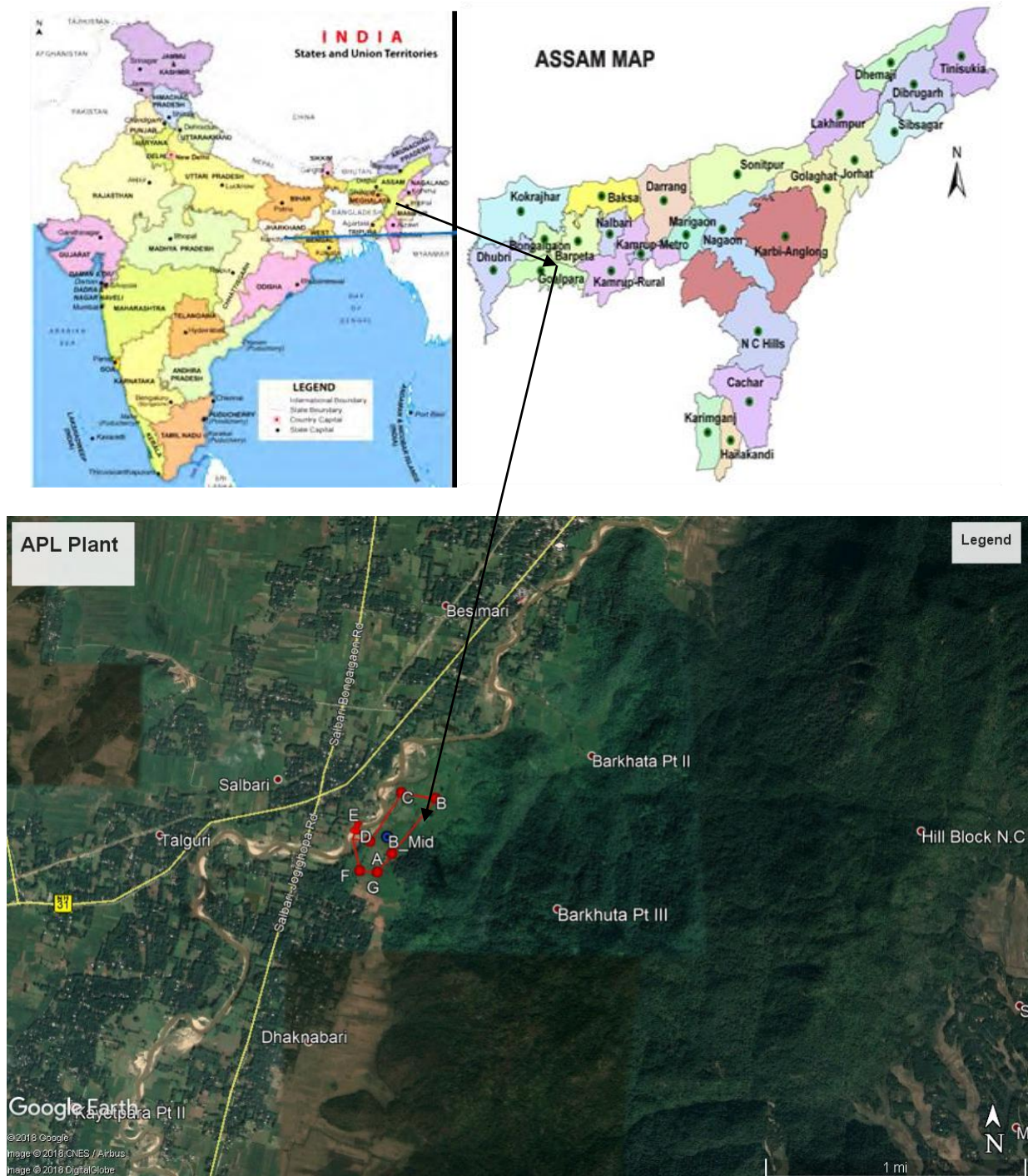


Source: Google Earth

Figure 2.1: Google image of Study Area



Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited



Source: Google Earth

Figure 2.2: Location map of Project site

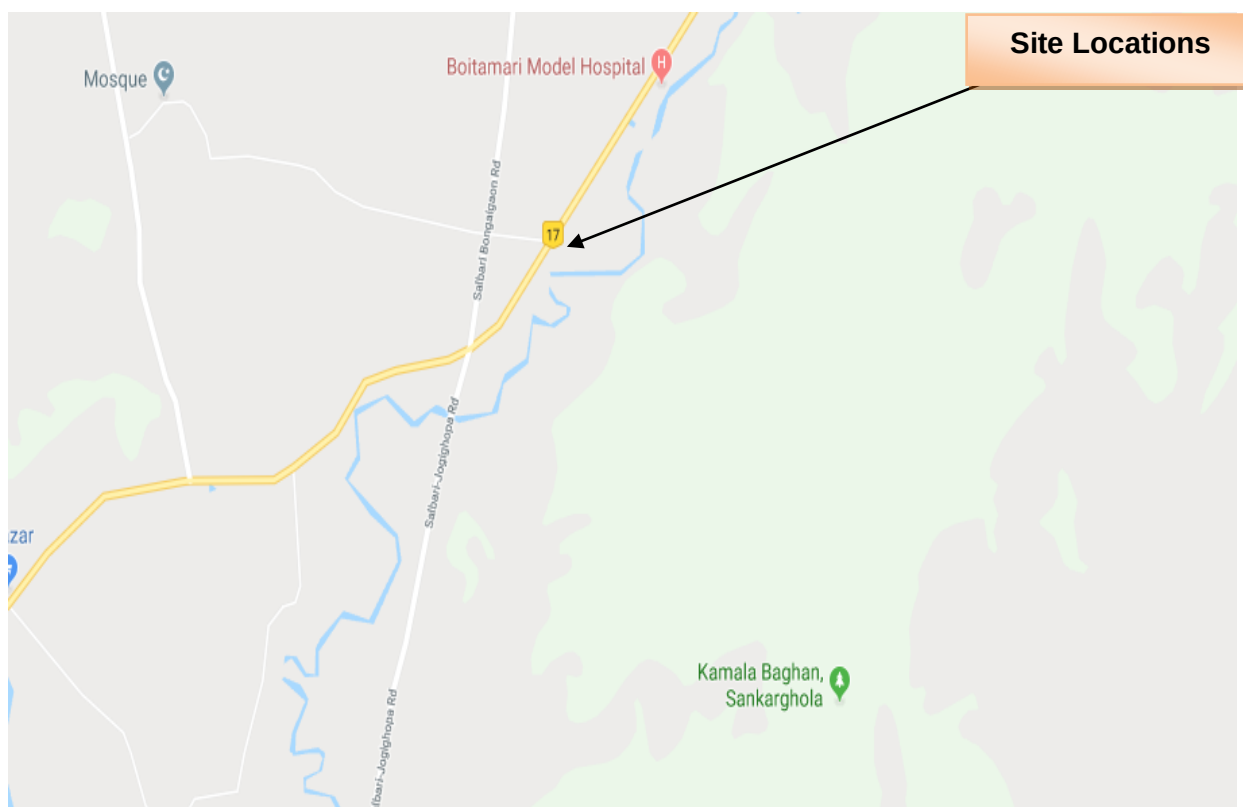


2.2.2 CONNECTIVITY

The area is well connected by all-weather roads.

- ✓ The project site of APL is connected to through Roads (Salbari- Jogighopa road which connects to NH-31).
- ✓ Nearest Town is Bongaigaon which is 17 Km towards Northern direction from the site.
- ✓ Tunia River is flowing about 40 m on Western side from site.
- ✓ Nearest Railway Station is New Bongaigaon Railway Station is 17 km (NNE).
- ✓ Nearest airport is at Guwahati which is about 111 km from site towards East.

The map showing the road network around the site is given in Figure 2.3.

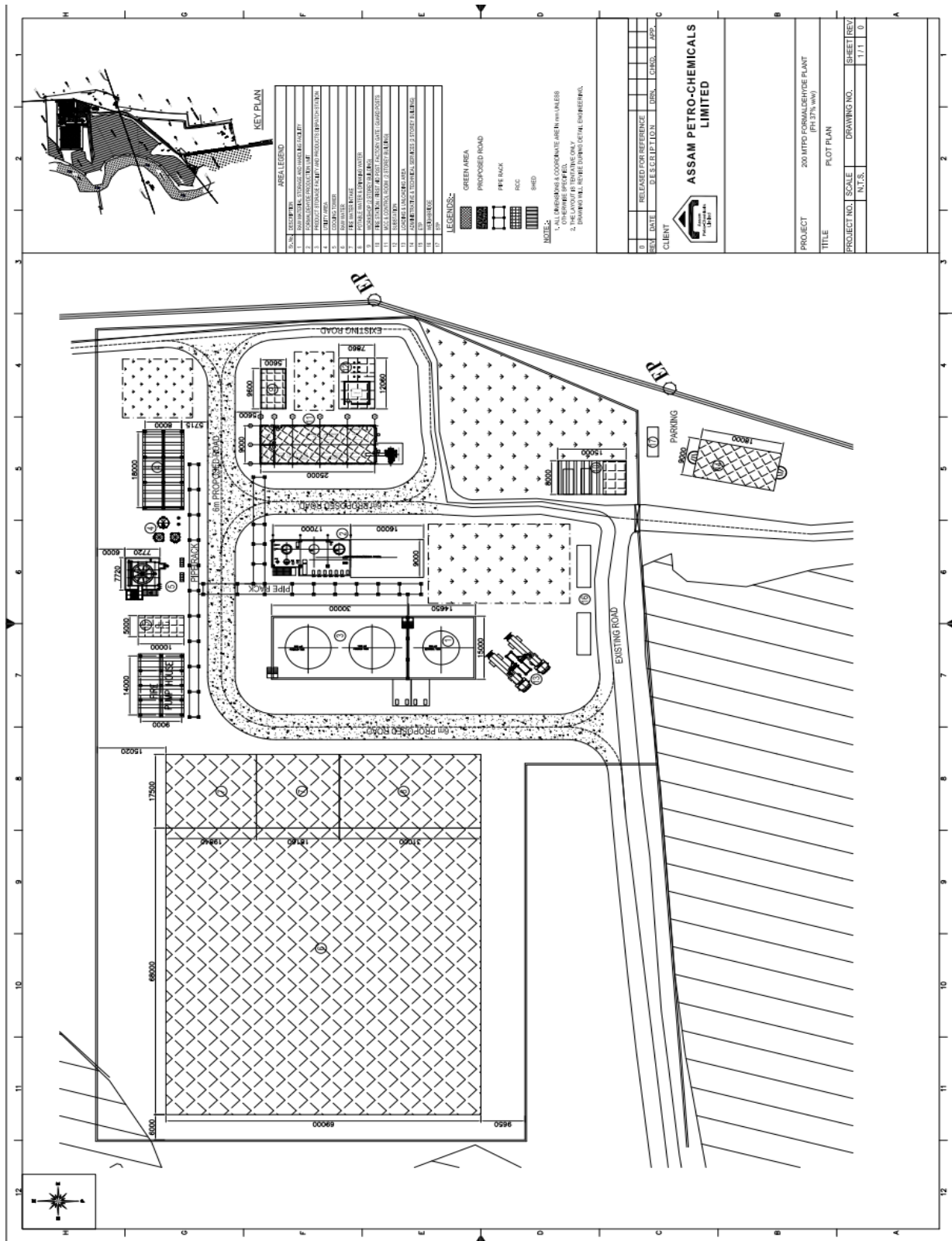


Source: Google Map

Figure 2.3: Connectivity shown in the map



Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist- Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited



Source: APL

Figure 2.4: Site Layout



2.3 MAGNITUDE OF OPERATION

M/s. Assam Petro-chemical Ltd. proposes to set up an unit to manufacture Formaldehyde of 66000 MT/ Annum (200 TPD) capacity at Dag no. 72, 73 & 77 (Pt), Village : Dhaknabari, Boitamari; District : Bongaigoan at Assam. The details about proposed capacity of the products are given in below table:

Table 2.2: Details of Product Capacity

Sl.No.	Product	Quantity (Tons Per annum)
1	Formaldehyde (37%)	66000

Source: APL

2.4 PROPOSED SCHEDULE FOR APPROVAL AND IMPLEMENTATION

The proposed project from concept stage to commissioning would take about 24 months. Since the project is being set up by the expert and experienced personnel, the planning and implementation of the project will be not much difficult. Services of experienced consultants will be utilized for detailed planning, preparation of techno-economic feasibility report and other associated activities like discussions with financial institutions, phasing of capital expenditure etc. However, the implementation primarily will depend upon the statutory environmental clearances.

2.5 ENVIRONMENTAL SETTING OF THE PROJECT SITE

The detailed environmental setting of the proposed project site and surrounding area are provided below:

Table 2.3: Environmental Setting of the study area

Particulars	Project site
Nearest Town/City	Town: Bongaigaon (17 km) - NNE
Nearest highway	Salbari- Jogighopa road which connects to NH- 31
Nearest railhead/ Railway station	New Bongaigaon Railway Station- 17 km (NNE)
Nearest airport	Nearest airport is Guwahati about 111 km towards Eastern direction from proposed site
Defence installations	None
Archaeological important places	None
Wild life sanctuaries	None
Rivers in 10-km Radius	Tunia River is flowing about 50 m on Western side from site
Other water bodies	Canals & small lakes
Hill ranges	Sankarghola Reserve forest



Particulars	Project site
Other sensitive areas	None
Seismic Zone	The proposed plant-site area falls in Seismic Zone V as per IS 1893:2002 (Part-1), which is a highly sensitive seismic zone. In case of very severe natural disaster there may be spillage of chemicals from damaged tanks and equipment. However, adequate measures will be taken for safety of workmen & materials and protection of environment during & after the occurrence of the disaster.

Source: ABC Techno Labs

2.6 PROJECT DESCRIPTION AND PROPOSED PRODUCTS

M/s. Assam Petro-chemical Ltd. proposes to set up a unit to manufacture Formaldehyde of 66000 MT/ Annum (200 TPD) capacity.

Table 2.4: Details of Product

Sl. No.	Product	Quantity (Tons Per Day)	No. of days of operation	Quantity (Tons Per annum)
1	Formaldehyde (37%)	200	330	66000

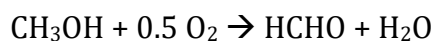
Source: APL

Formaldehyde in itself finds a wide spectrum of end-use applications in numerous industrial and non industrial sectors. Formaldehyde is a raw material for a number of downstream value added derivatives and sub-derivatives, the most major among which are Hexa Methylene Tetra Amine, Paraformaldehyde, Urea / Melamine Formaldehyde Amino resins, Melamine Urea Formaldehyde combination resins, Phenol Formaldehyde resins, Polyhydric alcohols (Pentaerythritol, Neo Pentyl Glycol, Tri Methylol Propane), superplasticizer concrete additives (Sulphonated Naphthalene Formaldehyde & Sulphonated Melamine Formaldehyde), engineering plastics (Polyacetals), Butanediol, Isoprene etc.

Aq. Formaldehyde (AF-37) finds end user application in lamination Industry, Intermediate chemical for oil field formulations, raw material for insulation/ fiberglass industry, Fumigant for poultry farms, Basic chemical for synthetic resins/ moulding compounds/ powdered and liquid resins, etc. Organic dyestuff explosives, Soil disinfection chemicals, pharmaceuticals, inorganic synthesis, leather, fur industries, metal working industries, paper processing, rubber industry, textile industry, water treatment

industry, sugar industry, photographic chemicals, foundry moulds and embalming fluids preservatives Production of Formaldehyde:

Formaldehyde results from the exothermic oxidation and endothermic dehydrogenation of Methanol:



These two reactions occur simultaneously in commercial units in a balanced reaction, called auto thermal because the oxidative reaction furnishes the heat to cause the dehydrogenation to take place.

Crude aqueous Methanol obtained by high, medium, or low pressure, synthesis can be used for “Excess Methanol (silver catalyst) process”. This Methanol contains low concentrations of inorganic impurities and limited amounts of other organic compounds. The Methanol must be first subjected to purification processes and preliminary distillation to move low- boiling components.

2.6.1 RAW MATERIAL DETAILS

Specifications of commercial Methanol used as the principal raw material for Formaldehyde production are given in Table below:

Parameters	Specifications
Methanol content	>99.85%
Relative density	0.7928 g/cm ³
Maximum boiling point range	1 Deg. C
Acetone and acetaldehyde content	<0.003 %
Ethanol content	<0.001 %
Volatile iron content	< 2 µg/L
Sulfur content	<0.001 %
Chlorine content	<0.001 %
Water content	<0.015 %
pH	7.0
KMnO ₄ test, minimum decolorization time	30 min.

The total consumption of raw materials is given in Table 2.5.

Table 2.5: Details of Raw Materials

Sl. No	Raw Materials	Form	Quantity (kg/day)	Mode of transport (rail/road/shipment)	Source	Type of Packing/ Storage/ mode of storage	Capacity of storage (Ton/month)
1	Methanol	Liquid	Approx. 90000	Road Transport	APL Namrup	Nitrogen blanketed Atmospheric storage tank	1 No. X 500 MT

Source: APL

In addition to this, there will be transshipment facility of Methanol for which 1650 KL X 2 no.s Methanol tanks will be constructed.

2.6.2 MODE OF TRANSPORT OF RAW MATERIAL

Raw materials and finished goods will be transported by road from Namrup Plant of APL.

2.6.3 PROCESS TECHNOLOGY (EXCESS METHANOL PROCESS EMPLOYING SILVER CATALYST)

The Silver Catalyst processes for converting Methanol to Formaldehyde are generally carried out at atmospheric pressure and at 600- 720°C. The reaction temperature depends on the excess of Methanol in the Methanol- air mixture. The composition of the mixture must lie outside the explosive limits. The amount of air is also determined by the catalytic quality of the Silver surface. The following main reactions occur during the conversion of Methanol to Formaldehyde:



The extent, to which each of these three reactions occurs, depends on the process parameters. By products are also formed in terms of the following secondary reactions:



Other important by products are Methyl Formate, Methane, and Formic Acid.

The endothermic dehydrogenation reaction (1) is highly temperature- dependent and conversion increases from 50% at 400°C to 90% at 500°C and to 99% at 700°C. With the Silver Catalyst, reaction (1) is a first-order reaction. Therefore, the rate of Formaldehyde formation is a function of the available Oxygen concentration and the Oxygen residence time on the Catalyst surface. The synthesis of Formaldehyde over a Silver Catalyst is carried out under strictly adiabatic conditions.

The Oxygen in the process air is shared between the exothermic reactions- primarily reaction (2) and to a lesser extent depending on the process used the secondary reactions (5) and (6). Thus, the amount of process air controls the desired reaction temperature and the extent to which the endothermic reactions (1) and (4) occur.

Another important factor affecting the yield of Formaldehyde and the conversion of Methanol, besides the Catalyst temperature, is the addition of inert materials to the reactants. Water is added to Methanol –Water-evaporated feed mixtures, and Nitrogen is added to air and air-off-gas mixtures, which are recycled to dilute the Methanol- Oxygen reaction mixture. The throughput per unit of catalyst area provides another way of improving the yield and controlling side reactions.

Percentages signify concentration in vol% and r is the ratio of moles of unreacted Methanol to moles of Formaldehyde produced. The equation takes into account the hydrogen and oxygen balance and the formation of byproducts.

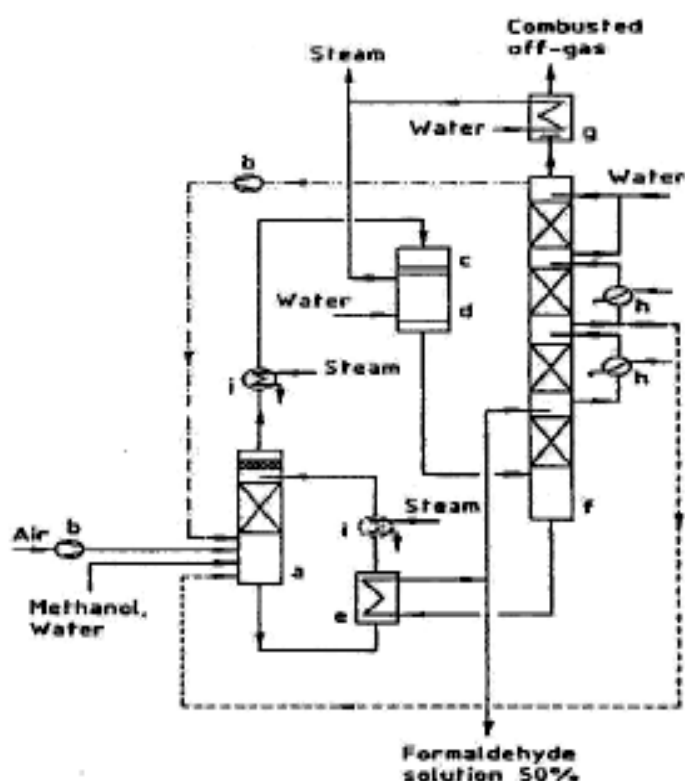
The theoretical yield of Formaldehyde obtained from Reactions (1) – (6) can be calculated from actual composition of the plant off-gas by using the following equation:

$$\text{Yield (mol\%)} = 100 \frac{1}{1 + r + \left[\frac{(\%CO_2) + (\%CO)}{0.528 (\%N_2) + (\%H_2) - 3(\%CO_2) - 2(\%CO)} \right]^{-1}}$$

A brief outline of the Silver Catalyst process is shown schematically in Figure 2.5. A mixture of Methanol and water is fed into the evaporating column. Fresh process air and (if necessary) recycled off-gas from the last stage of the absorption column enter the column separately.

A gaseous mixture of Methanol in air is thus formed in which the inert gas content (nitrogen, water and CO₂) exceeds the upper explosive limit. A ratio of 60 parts of Methanol to 40 parts of water with or without inert gases is desired. The packed

Evaporator constitutes part of the stripping cycle. The heat required to evaporate the Methanol and water is provided by a heat exchanger, which is linked to the first absorption stage of the absorption column. After passing through a demister, the gaseous mixture is superheated with steam and fed to the reactor, where it flows through a 25-30 mm thick bed of silver crystals. The crystals have a defined range of particles sizes and rest on a perforated tray, which is covered with fine corrugated gauze, thus permitting optimum reaction at the surface. The bed is positioned immediately above a water boiler (cooler), which produces superheated steam and simultaneously cools the hot reaction gases to a temperature of 150°C corresponding to that of the pressurized steam (0.5 MPa). The almost dry gas from the gas cooler passes to the first stage of a four-stage packed absorption column, where the gas is cooled and condensed.



Nomenclature:

- a) Evaporator;
- b) Blower;
- c) Reactor;
- d) Boiler;
- e) Heat exchanger;
- f) Absorption column;
- g) Steam generator;
- h) Cooler;
- i) Superheater

Source: APL

Figure 2.5: Process Flow Chart

Formaldehyde is eluted countercurrent to water or to the circulating Formaldehyde solutions whose concentrations increase from stage to stage.

The product circulating in the first stage may contain 50 wt% Formaldehyde if the temperature of the gas leaving this stage is kept at 75°C; this temperature provides sufficient evaporation energy for the feed stream in the heat exchanger. The final product



contains 40-55 wt% Formaldehyde, as desired, with an average of 1.3 wt% Methanol and 0.01 wt% formic acid. The yield of the Formaldehyde process is 89.5-90.5 mol%. Some of the off-gas is removed at the end of the fourth stage of the column and is recycled due to its extremely low Formaldehyde content (Fig. 2.5, route indicated by dashed-dotted lines). The total steam equivalent of the process is 3 Ton/ Ton of 100 wt% Formaldehyde. The yields of the two processes are similar and depend on the Formaldehyde content of the recycled streams.

The average life time of a catalyst bed depends on impurities such as inorganic materials in the air and Methanol feed; poisoning effects caused by some impurities are partially reversible within a few day. The life time of the catalyst is also adversely affected by long exposure to excessively high reaction temperatures and high throughput rates because the silver crystals then become matted and cause an increase in pressure across the catalyst bed.

This effect is irreversible and the catalyst bed must be changed/regenerated electrolytically in certain intervals.

2.6.4 AMENITIES/FACILITIES

The amenities/ facilities will be available.

- Potable drinking water
- Fire fighting/ alarm system and ambulance in case of emergency
- Drinking water, canteen and electricity facilities
- Separate sanitation facilities for men and women
- PPE's and facilities related to safety
- Occupational Health Centre with qualified doctor for periodical health check-up of employees.
- Greenbelt within 14.2 acres of area (39% of total plot area)

2.6.5 PROPOSED INFRASTRUCTURE

The proposed project will involve construction of new plant for manufacturing of Formaldehyde (37%). Total 36.4 Acres of land is identified for new Formaldehyde plant. Utilities, raw material & product storage, effluent treatment facility will be developed.



❑ Residential Area (Non Processing Area)

Residential facilities will be constructed by APL for plant employees. Plot of approximately 13379 sq. m is estimated for Housing Colony.

❑ Raw Water Intake & Distribution network

APL intends to draw raw water from the Tunia River which is located, around 50 m from the project Site. Raw water treatment unit will be set up for water supply to Plant and Township.

❑ De-mineralized Water System

Cation/ Anion/ Mixed Bed based D. M. Water Unit shall be considered. D.M. Water Storage Tank shall also receive and store Process Condensate from the Plant. As mentioned 2 nos. of D.M. plant feed pumps, each with a capacity of 120 KLD shall feed D.M. water to the Plant.

❑ Cooling Tower

Cooling Tower will have to be built for the proposed project. Motor driven Cooling Water pumps will be provided.

❑ Fire water storage and Distribution network

Adequately sized Fire Water reservoir as well as fire water pumps will be provided to store and supply fire water into the Fire Water network.

❑ Drinking Water System/Eye wash fountains

Potable water system should preferably comprise of Microfiltration, UV treatment and Disinfection unit. Potable water shall be supplied to different buildings and plant area to meet drinking/ sanitary water requirement. Plant facility shall be provided with Eyewash Fountain/ safety shower, Storage Tank, a pair of pumps driven by emergency power supply and a closed loop water circulation header will be installed. Total of about 1 m³/Hr is estimated as potable water requirement. System may have makeup from potable water supply header. These pipes are expected to be insulated to minimize heat pick up from the sunlight.

❑ Compressed Air system

The compressed air system consists of two Compressors and an Air receiver required to supply pre treated dry air to different consumers in the plant, off-sites and utilities. Normally only one compressor will run. Air pressure is controlled by a sequence controller. In case the duty compressor fails to satisfy the demands for compressed air the



standby compressor shall start automatically and share the demand. An Alumina/ Silica Gel bed Drying unit shall be included in the system.

Plant (Service) Air is required for blowing, cleaning, etc. Service air is not required to be specially dried. However for avoidance of any condensate in the piping, air moisture is to be removed by passing through efficient demisters in the compressor final stage separators.

❑ Control Room & Instrumentation

A common Control Room has been considered for the process operations of the Formaldehyde Plant and all utility/ auxiliary units comprising the Complex. A new building for the Control Room with offices for the Manager, Shift Engineer and Shift Technicians as well as Change Room and toilet facilities will be constructed.

Electronic Instrumentation based on Distributed Control Systems (DCS) shall be installed. Formaldehyde Plant and Utility units will be operated from a common DCS Unit with work stations and printer. Programmable Logic Control (PLCs) Centre shall be installed at Local Control Stations (LCS) wherever required in the plant.

❑ Quality Control & Analytical Laboratory

The Plant will require regular measurement of quality of raw materials as well as final products with necessary certifications. Besides process controls will require quality measurements of the intermediate streams to control and adjust the process parameters. Besides, some of the critical chemical analyses may be measured on continuous basis by installing on-line analyzers. Analyzer shelter will be suitably located in the plant area, where such instruments will be installed, and the analysis information will be sent to the control room consoles through DCS system.

❑ Control Service Building

Control service building shall cater to all the operational activities related to production and deliveries of the product. The control room is equipped with DCS system, marshalling racks for input and control panel.

❑ Storage & Warehouse

A warehouse is envisaged for storing spare parts of equipment and instruments of the Plant. The office of store personnel is also placed in this building.



❑ Maintenance workshops

A maintenance building is envisaged for maintenance of equipment and instruments of the Plant. The offices of maintenance personnel and documentation room are also placed in this building.

❑ Administrative Building

Customarily Administrative building block is located outside security fence of the factory premises to enable hassle-free access to the visitors, not needing factory zone access. The building shall be located close to the main entry gate of the plant at safe distance from the explosive factory zone.

❑ Security Blocks

The APL Complex shall have three separate Entry/ Exit gates for the Administration Block, Factory Area and Materials/ Products movement corridor respectively. Each of these gates shall have proper manned Guard Posts and barriers.

❑ Green belt

APL will plant trees around the boundary of the site area. About 14.2 acres of land will be used for green belt. Suitable plant species will be planted for development of green belt area.

❑ Drinking Water Management

For drinking purpose, the water quality will be maintained as per the drinking water standard.

❑ Sewerage System:

Domestic wastewater of about 20 KLD will be treated in proposed STP.

2.7 LAND REQUIREMENT

The proposed project is Greenfield project & the land is under the possession of project proponent. Salbari- Jogighopa road is adjacent to project site which connects to NH- 31. Required infrastructure facilities like road, hospital, drinking water, electricity, telephone are prevailing in the proximity of existing project site. Access roads as required for movement of man and machinery will be constructed.

The total area of proposed Formaldehyde plant of APL is 36.4 Acres (147283 sq.m) and the detailed break up of land utilization of the project site provided below:



Table 2.6: Land area breakups

Sl. No.	Details	Total Area in Sq. m	Area as % of Total
1	Plant area	38120	~25.9%
2	Road area	8050	~5.5%
3	Open space area+ township area	32570	~22.1%
4	Storage area	11103	~7.5%
5	Green Belt area	57440	~39%
	Total	147283	100

Source: APL

2.8 MANPOWER REQUIREMENT

Total Manpower requirement during construction phase will be approximately 1000 and will be sourced from local area. About 45 nos. of people will be required during operation phase.

2.9 RESOURCE REQUIREMENT

Maximum care will be taken for resource optimization, wherever possible with an aim of “Zero discharge”.

- ✓ Resource Conservation
- ✓ Elimination of Waste Streams
- ✓ Minimizing Waste
- ✓ Reuse of Wastes
- ✓ Recycle of Wastes
- ✓ Treatment and Disposal for making wastes harmless
- ✓ Wash water generated from cleaning of equipment’s will be re-used back into the process.

❑ Water requirement

The requirement of water for operation of the plant is tentatively 384 KLD. This will be fulfilled by drawing water from the nearby Tunia river which is at a distance of approximately 50 meter from the Project.



Table 2.7: Water Consumption Details for Domestic Purpose (KLD)

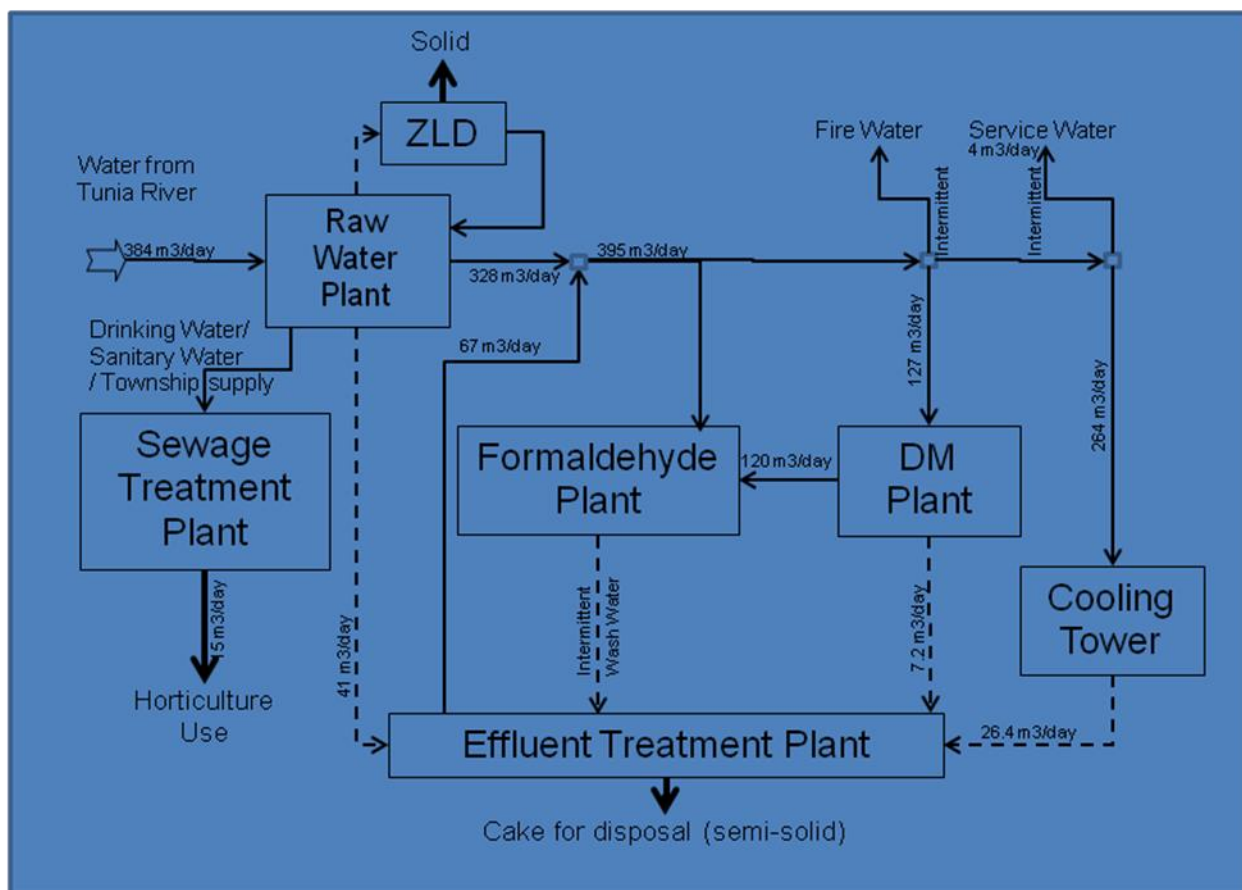
Sl. No.	Input			Output	
	Purpose	Total In KLD	Source	Total in KLD	Mode of Disposal
1	Domestic (Drinking, sanitation, Household etc)	20	Tunia river	15	Sewage will be treated in proposed STP of 20 KLD Design capacity and treated sewage will be reused for green belt development

Source: APL

Table 2.8: Water Consumption Details for Industrial Purpose (KLD)

Sl. No.	Input		Output	
	Purpose	Water Requirement In KLD	Wastewater Generation in KLD	Mode of Disposal
1	Main Formaldehyde Plant	120	No	No waste water generation from process, whole water is consumed with the process
2	Cooling Tower	264	26.4	Will be treated in ETP
3	DM plant	127.2	7.2	DM plant reject water will be treated in ETP.
4	Other Service Requirement	8.8	-	Intermittent
5	Raw water Plant	384	41	Will be treated in ETP
6	Recycled back	-	72	

Source: APL



Source: APL

Figure 2.6: Water Balance



❑ Power Requirement

The power requirement of Formaldehyde plant will be about 1400 KW (Source – Assam Power Distribution Company Limited).

❑ Electrical Distribution Network

Electrical Transmission lines are located at a distance of about 500 M away from proposed project site. Electrical Power will be available from nearby APDCL. An electrical substation building shall be constructed to house new facilities for receiving and distribution of power to main plant, offsite plants, buildings, township, road & yard lighting.

The Electrical Network/ Power distribution System shall cater to the supply requirements of plant motor drives, lighting, UPS, power sockets, Fire alarm system, Telephone system, Plant Intercom System, HVAC System, exhaust fans, blowers etc.

Power supply will be received on High Voltage Switchgear and distributed through the network of transformers, MCC, PCC and other auxiliaries required in the complex.

❑ Fuel Requirements & Storage

Normally, there will not be any requirement of fuel in the plant facility.

2.10 DETAILS OF POLLUTION CONTROL

❑ Liquid Waste

The water balance of the plant is framed based on zero liquid discharge philosophy. DM water plant of ~ 120 KLD capacities will be installed. DM water will be used in the process for the dilution/ absorption for making 37% Formaldehyde (AF-37) and BFW make up. DM water plant regeneration waste will be treated in the ETP.

Normally there is no generation of wastewater from process, however intermittent generation of wastewater will be treated in Effluent Treatment Plant (ETP). All effluent generated in the plant shall be reused with the raw material input.

Cooling Tower make up water requirement will be around ~264 KLD. Cooling tower blow down, regeneration/ backwash waste from the Raw water plant will also be treated in ETP. The capacity of ETP will be ~70 KLD.

❑ Air Pollution

There will be two sources of air emission as no boiler/ heater or DG sets are proposed for manufacturing of Formaldehyde.



A. Process tail gas

Quantity of tail gas (on dry basis): 5817 kg/hr

Water vapor in the flue gas is 32.09%.

The dry basis composition is as follows:

CO₂= 4.48 %

CO = 0.1 %

O₂= 0.19 %

H₂= 16.9 %

Inert= 78.53%

There will be no emission of SO_x, NO_x and particulate matter.

❑ Solid & Hazardous Waste

There will be no generation of solid & hazardous waste in normal operation. Spent catalyst will be sent to the specialized vendor for treatment/ regeneration/ recycle.

Table 2.9: Hazardous waste details

Sl. No.	Hazardous waste	Category	Quantity	Method of disposal
1	Used/ spent oil	5.1	1.2 KL/ Annum	Used oil will be collected in metal drums kept in secured dyked area and disposed to CPCB/ ASPCB registered used oil reprocessor
2	Wastes/ residues containing oil	5.2	1-2 Kg/ Annum	Disposed on-site in HDPE lined pits located on site

Source: APL

Table 2.10: Non Hazardous Waste details and disposal methods

Sl.No.	Non Hazardous waste	Quantity	Method of disposal
1	Kitchen Waste	10 – 20 kg per day	Will be stored in compost pits on a daily basis or disposed off nearby disposal site via local vendors
2	Recyclable waste like papers, plastics,	Small	Proper segregation and storage of recyclable waste in designated bins onsite. Recyclables will be periodically sold to local waste recyclers.
3	Packaging wastes	Small	Proper segregation and storage at designated stack yard onsite. Packaging wastes will be periodically sold to local waste recyclers.

Source: APL

2.11 PROJECT COST

The total investment for the proposed project works out to approximately INR 51.16 Crores. The estimated Investment Cost for the project is based on the requirement of fixed and non fixed assets.



Table 2.11: Details of Project cost

Sl.No.	Particulars / activities	Capital Cost in Lacs INR
1	Land and Land Development	380
2	Civil cost	1085
3	Plant & Machinery and Materials supply cost	1499
4	Others	667
5	Furnitures/fixtures	135
6	Technical Know how	255
7	Working capital margin	278
8	Contingency	211
9	Taxes & Duties	606
	Total Project cost	5116

Source: APL



CHAPTER 3

DESCRIPTION OF ENVIRONMENT



CHAPTER 3: DESCRIPTION OF ENVIRONMENT

3.1 INTRODUCTION

Generation of environmental baseline of a project area is an important phase of any Environmental Assessment process. Baseline data provides vital information on the existing environmental quality in which a development is planned. In this study, the environmental characteristics of the project area were established through extensive literature search, field sampling/measurements, laboratory analysis, consultation and data interpretation.

The reconnaissance survey of the study area around the proposed project site was carried out from **1st December 2018 to 28th February 2019** and the field studies were carried out for one season during winter season for the EIA studies to collect baseline primary and secondary data for the present environmental scenario in the study area.

A comprehensive primary and secondary data collection program were undertaken to assess the status of baseline environment conditions within the study area, as per the Terms of Reference (TOR) issued by SEAC, Assam vide **no. SEIAA.883/2018/11 dated 25th February 2019** for carrying out the EIA/EMP study for one season. The area covered by 10 km radius around the proposed project site has been considered for study.

Baseline Environmental Studies have been conducted to determine the existing status of various Environmental attributes viz., Climate and Atmospheric conditions, Air, Water, Noise, Soil, Hydrogeological, Land use pattern, Ecological and Socio-Economical environment, prior to commissioning of proposed project site of formaldehyde plant. This study would help to undertake corrective mitigation measures for the protection of the environment on account of any change, deviation of attributes due to the activities of the proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam.

3.2 SCOPE OF BASELINE STUDY

An area, covering a 10 km radius around the proposed project site for the purpose of the baseline studies has been considered. Primary data on Water, Air, Land, Flora, Fauna & Socio-Economic data were collected by a team of Engineers and Scientists. Secondary data was collected from various Departments of State/Central Government Organizations, Semi-Government and Public Sector Organizations. Table 3.1 gives various environmental



attributes considered for formulating environmental baseline and Table 3.2 gives the frequency and monitoring methodology for various environmental attributes.

Table 3.1: Environmental Attributes

Sl. No.	Attribute	Parameter	Source of Data
1	Climatology & Meteorology	Wind Speed, Wind direction, Relative humidity, Rainfall and Temperature	Indian Meteorological Department and Site specific Data
2	Water Quality	Physical and Chemical parameters	Monitored Data (Surface water – 6 locations and Ground water – 8 locations)
3	Ambient Air Quality	PM10, PM2.5, SO ₂ , NO _x , CO, NH ₃ , O ₃ , VOC, Methane & Non Methane	Monitored Data (8 locations)
4	Noise levels	Noise levels in dB (A)	Monitored Data (8 locations)
5	Ecology	Existing terrestrial flora and fauna within the study area	Field survey and Secondary sources
6	Geology	Geological history	Field survey and Secondary sources
7	Soil	Soil types and samples analyzed for physical and chemical parameters.	Analysis of soil samples at 6 locations
8	Socioeconomic Aspects	Socioeconomic characteristics of the affected area	Based on field survey and data collected from secondary sources
9	Land Use	Trend of land use change for different categories	Secondary data/ Satellite imagery/ Topo sheet etc.

Source: ABC Techno Labs India Pvt. Ltd.

Table 3.2: Frequency and Monitoring Methodology

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
A. Meteorology				
Wind Speed, Wind direction, Relative humidity, Rainfall and Temperature	Project site	Continuous for 3 months	Weather monitors with the database	
B. Air Environment				
Particulate Matter (PM10)	Requisite locations in the	24 hourly- Twice a week	Gravimetric (High- Volume with Cyclone)	As per CPCB



Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
Particulate Matter (PM2.5)	project influence area	for 3 months in Non- Monsoon season --	Gravimetric (High- Volume with Cyclone)	standards under 18 th November 2009 Notification for National Ambient Air Quality Standards (NAAQS)
Oxides of Sulphur (SO ₂)			EPA Modified West & Gaeke method	
Oxides of Nitrogen (NO _x)			Arsenite Modified Jacob & Hochheiser	
Carbon Monoxide (CO)			Gas Analyzer (NDIR)	
Ozone (O ₃)			UV photometric	
Lead (Pb)			AAS/ICP Method	
Arsenic (As)			AAS/ICP method	
Nickel (Ni)			AAS/ICP method	
Ammonia (NH ₃)			Indophenol Blue Method	
Benzene			Gas chromatography	
Benzo (a) Pyrene			Solvent extraction followed by HPLC/GC analysis	
Volatile Organic Compound (VOC)			Ion Sense PID Detector	
Methane			ABCTL/ SOP/INS/32	
Non Methane			GC-FID	
C. Noise				
Hourly equivalent noise levels	Requisite locations in the project influence area	Once in season	Instrument: Sound level meter	IS: 4954 1968
D. Water				
Parameters for water quality: pH, Temp, Turbidity, Electrical Conductivity, TDS, Total hardness, Total alkalinity, Chloride, Sulfate, Nitrate, Fluoride, Sodium, Potassium, Calcium, Magnesium, Iron, Total Arsenic, BOD, COD, Calcium, Magnesium, Total Dissolved Solids, Total	Set of grab samples At requisite locations for ground and surface water	Once in season	Samples for water quality collected and analyzed as per IS: 2488 (Part 1-5) methods for sampling and testing of Industrial effluents Standard methods for the examination of water and wastewater analysis published by American Public Health Association.	



Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
Suspended Solids, Heavy metals etc.				
E. Land Environment				
Parameter for soil quality: pH, Bulk Density, Texture, Electrical conductivity, Organic matter, Available Nitrogen, Available Phosphorous, Available Potassium, Sodium, Calcium, Magnesium	Requisite soil samples were collected as per BIS specification within project influence area	Once in season	Collected and analyzed as per soil analysis reference book, M.L.Jackson	
F. Biological Environment				
Terrestrial & Aquatic Flora and Fauna	Requisite locations in the project influence area	Once in season	Collected and analyzed as per IUCN Red Data book.	

Source: ABC Techno Labs India Pvt. Ltd.

3.3 METEOROLOGY AND CLIMATE

3.3.1 CLIMATIC CONDITION

The climate of the district is moderate in winter. It is hot humid during May to October. The temperature varies from 14° C to 36° C. Monsoon starts in April and lasts up to August. The heaviest rainfall (more than 1300 mm) occurs during the month of May to July. Humidity is much throughout the year, ranges from 70% to 98%, which favours the growth of diverse flora in the area.

A meteorological station equipped with continuous monitoring equipment was installed on at project site, at a height ~ 5.0m above ground level to record wind speed, wind direction, relative humidity and temperature.

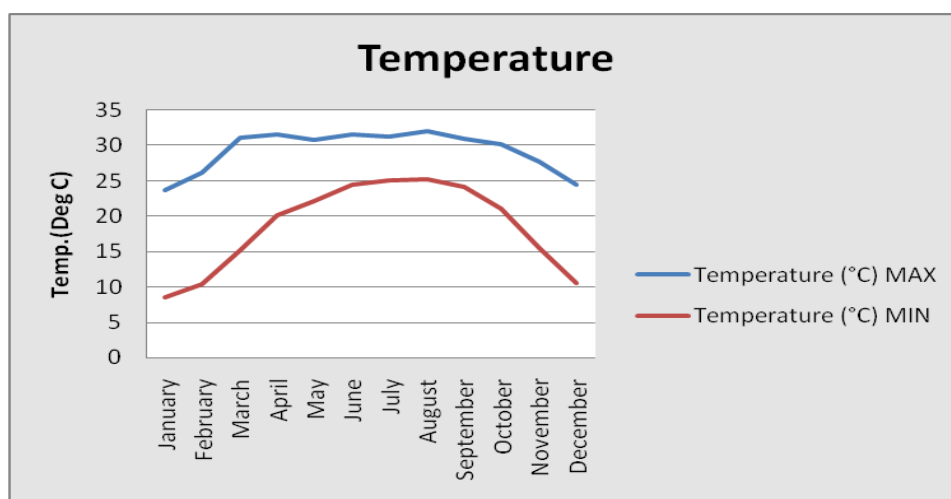
3.3.2 REGIONAL METEOROLOGY

Historical data on meteorological parameters will also play an important role in identifying the general meteorological will also play an important role in identifying the general meteorological regime of the region.

Climatological (long-term) data is obtained from the closest Indian Meteorology Department (IMD) station or from any other nearby station, which has been collecting meteorological data for more than ten years. Climatological data for the site was obtained from IMD station-Dhubri (Rupsi), which is at an aerial distance of 44 Km from Project site and the same is discussed below. The regional meteorology summary details (from 1971 to 2000) monitored at nearest IMD station at Dhubri are given below;

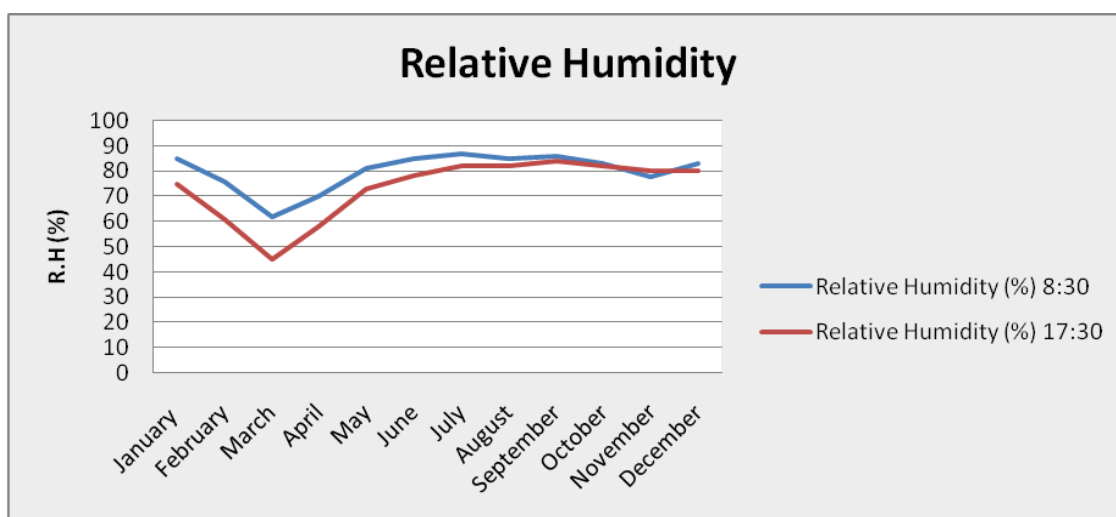
A. Temperature

The monthly mean maximum temperature varied from 23.7°C in January to 32°C in August while monthly mean minimum varied from 8.6°C in January to 25.2°C in August indicating January as the coldest while August as hottest month.



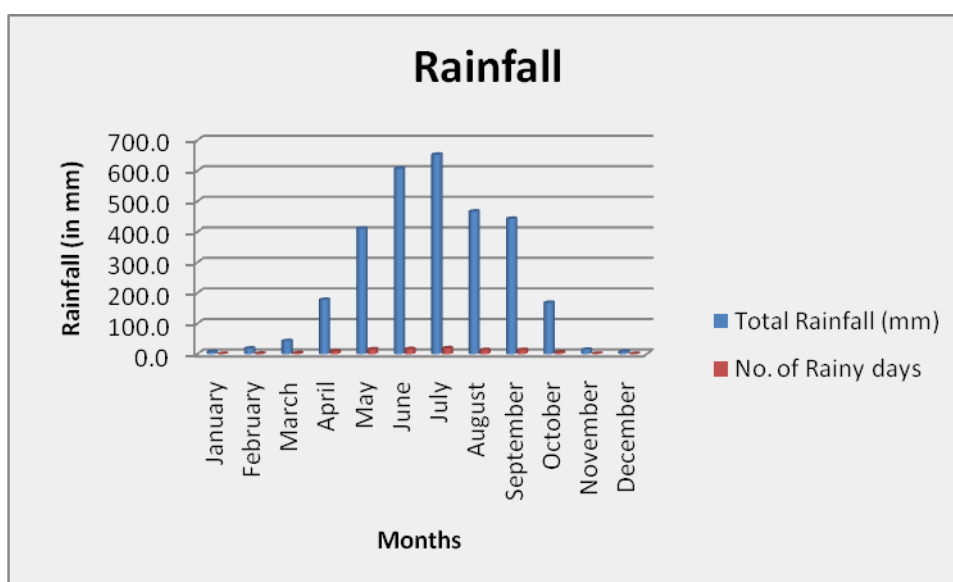
B. Relative Humidity

During the month of July the relative humidity was highest (87%). The annual average Relative humidity is 80.1% (at 0830 Hours) and 73.3% (at 1730 Hours). Generally, the weather during other seasons was observed to be Humid.



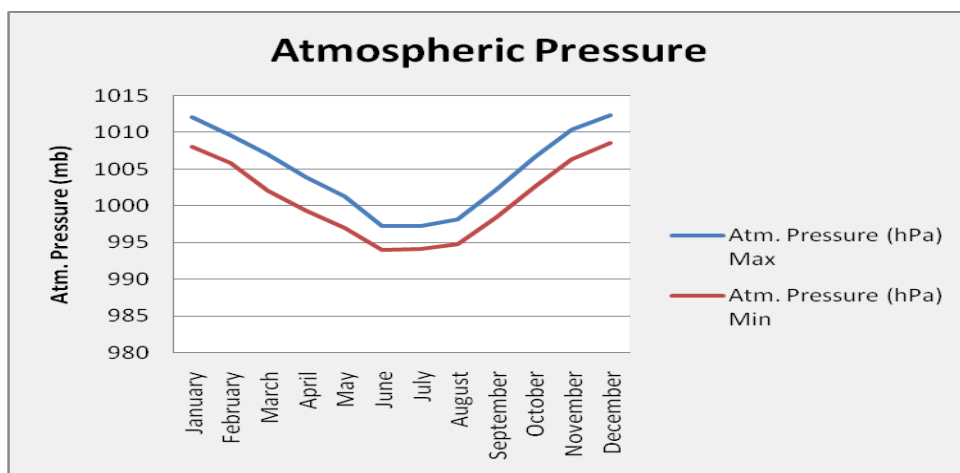
C. Rainfall

The rainfall occurred maximum in July (652.8 mm). The total rainfall received in the year is about 3017 mm. Total rainy days observed about 99.4 days. The monsoon sets in the month of June and continues till September.



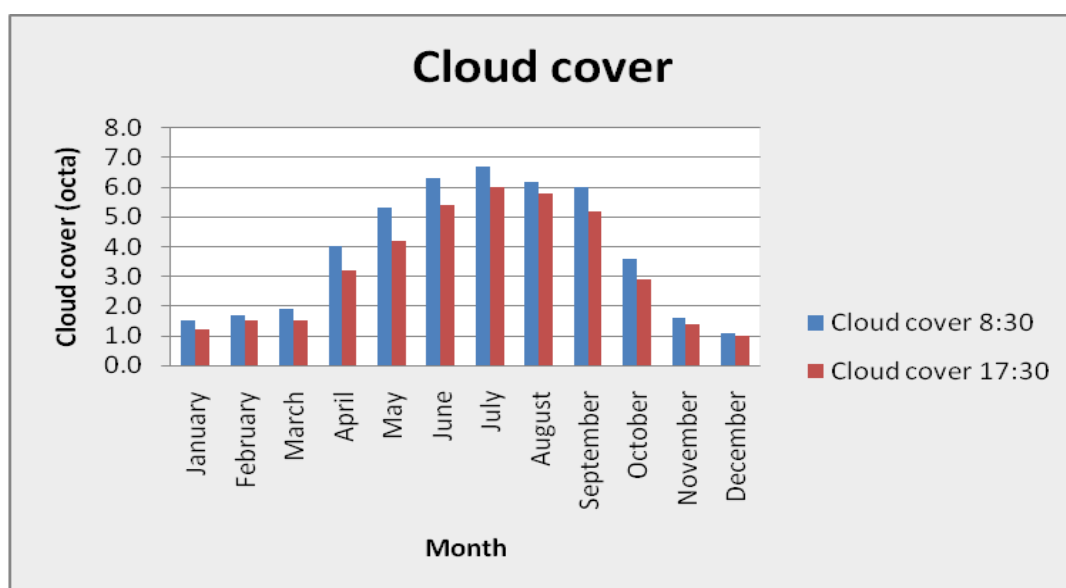
D. Atmospheric Pressure

The maximum pressure observed was 1012.4 kPa occurring during the winter season, in the month of December. The minimum pressure observed was 997.2 kPa occurring during the month of June and July in the monsoon season. The pressure levels are found to be fairly consistent over the region.



E. Cloud cover

During the month of July the cloud cover was highest (6.7 Octas). The annual average cloud cover is 3.8 Octas (at 0830 Hours) and 3.3 Octas (at 1730 Hours).



F. Wind Speed/ Direction

The maximum wind speed observed during the month of April is 8.4 kmph and minimum wind speed observed during the month of January is 3.7 kmph. The annual average wind speed calculated is 5.1 kmph.

0830 Hours:

The predominant winds are mostly from NE & East directions. Calm conditions prevailed for 19% of the total time.

1730 Hours:

The predominant winds are mostly from NE direction. Calm conditions prevailed for 20% of the total time.

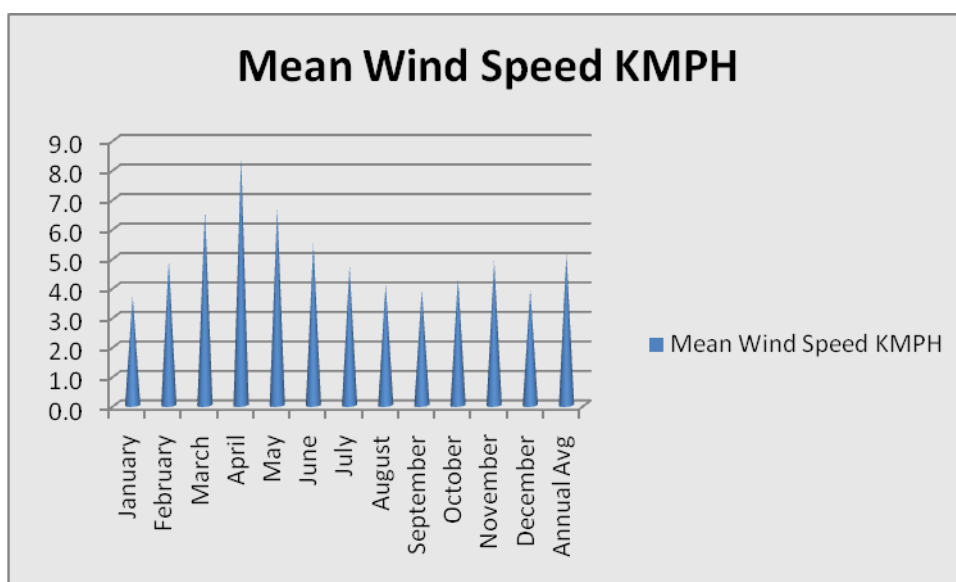


Table 3.3: Historical Meteorological Data at IMD Dhubri (Rupsi) (1971-2000)

Month	Daily mean Temp. (°C)		Relative Humidity (%)		Rainfall (mm)		Cloud cover (in Okta)		Station Level Pressure (hPa)		Mean Wind Speed (KMPH)
	Max	Min	08:30	17:30	Monthly Total	No. of Rainy days	08:30	17:30	08:30	17:30	
January	24	8.6	85	75	6.9	0.6	1.5	1.2	1012.1	1008.1	3.7
February	26	10.5	76	61	18.1	1.5	1.7	1.5	1009.7	1005.9	4.9
March	31	15.2	62	45	42.6	2.8	1.9	1.5	1007	1002.1	6.6
April	32	20.2	70	58	177.7	9.3	4	3.2	1003.9	999.3	8.4
May	31	22.2	81	73	410.9	15.7	5.3	4.2	1001.3	997	6.7
June	32	24.4	85	78	607.4	16.6	6.3	5.4	997.2	994	5.5
July	31	25.1	87	82	652.8	19.1	6.7	6	997.2	994.1	4.7
August	32	25.2	85	82	467	13.1	6.2	5.8	998.1	994.8	4.1
September	31	24.2	86	84	443	13.5	6	5.2	1002.2	998.4	3.9
October	30	21.1	83	82	167.8	5.6	3.6	2.9	1006.6	1002.6	4.3
November	28	15.5	78	80	14.3	1	1.6	1.4	1010.4	1006.4	4.9
December	25	10.6	83	80	8	0.6	1.1	1	1012.4	1008.6	3.9
Annual or Mean	29.3	18.6	80.1	73.3	3016.5	99.4	3.8	3.3	1004.8	1000.9	5.1

Source: IMD Station, Dhubri (Rupsi)



Table 3:4: Predominant Wind direction at IMD Dhubri (Rupsi) (1971 – 2000)

PERCENTAGE NO. OF DAYS WIND FROM																		
Months	N		NE		E		SE		S		SW		W		NW		Calm (%)	
	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730	AT 0830	AT 1730
January	3	2	38	5	19	5	2	1	3	1	4	3	2	5	1	2	28	76
February	3	2	29	9	25	6	3	1	4	2	12	14	4	17	1	4	19	45
March	4	3	30	9	25	8	4	1	6	4	14	19	5	21	3	5	9	30
April	3	4	32	19	29	18	5	3	8	8	9	14	4	9	1	3	9	22
May	3	3	32	16	31	17	5	5	5	9	4	8	2	5	1	2	17	35
June	4	2	26	13	21	17	7	5	9	14	7	11	3	5	2	1	21	32
July	2	1	16	6	21	12	7	5	12	14	10	16	3	3	1	1	28	42
August	2	2	18	9	24	12	7	4	9	14	8	12	3	4	2	1	27	42
September	3	2	21	9	20	12	5	4	10	9	10	8	3	3	2	2	26	51
October	2	2	36	10	25	8	2	1	3	2	4	3	4	4	2	2	22	68
November	3	3	52	10	28	7	1	1	1	0	1	1	1	1	0	1	13	76
December	2	3	51	9	24	7	2	1	1	1	2	1	0	2	0	1	18	75
ANNUAL MEAN	3	2	32	10	24	11	4	3	6	7	7	9	3	7	1	2	20	50

Source: IMD Station, Dhubri (Rupsi)

3.3.3 SITE SPECIFIC METEOROLOGY

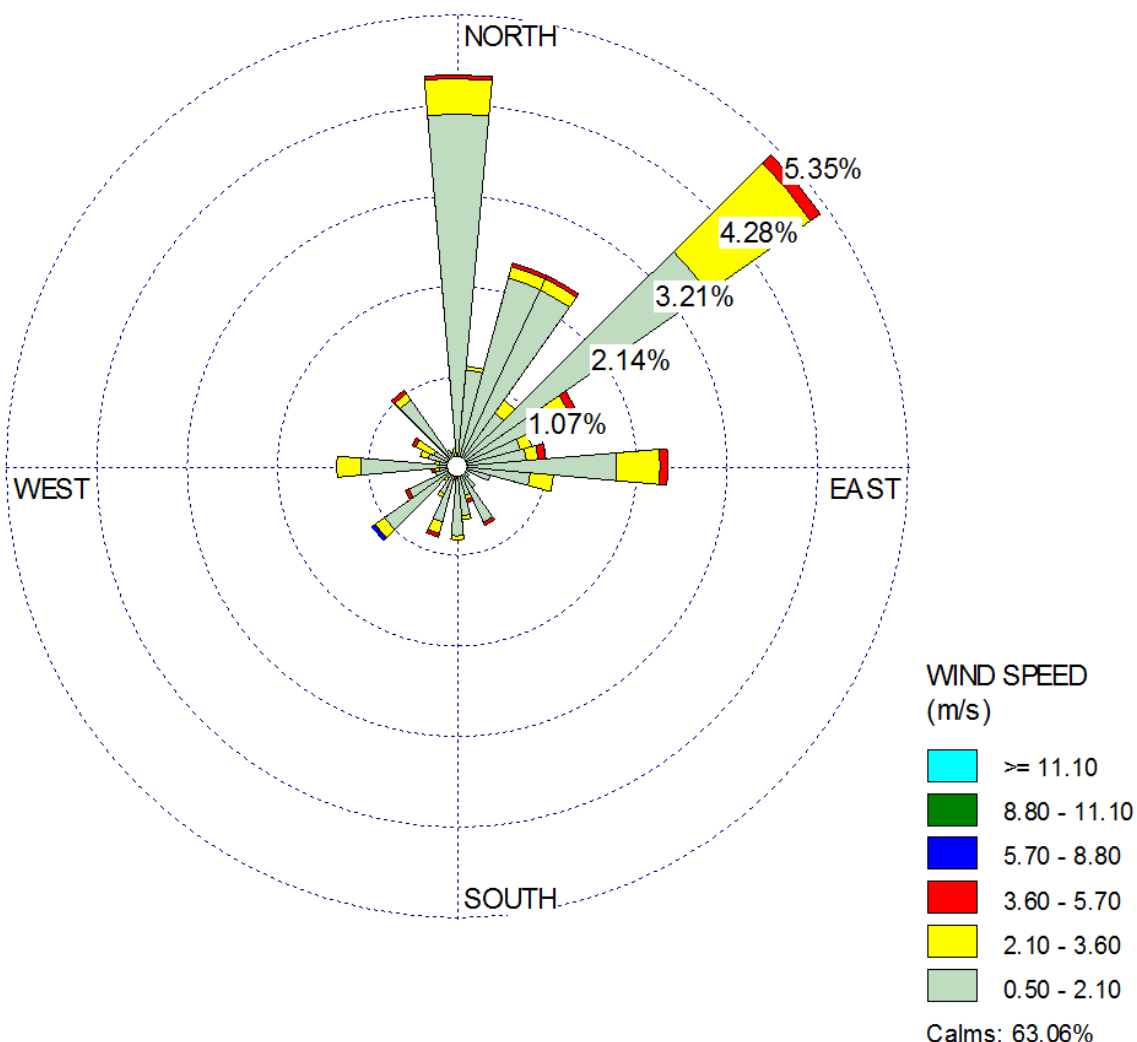
On site monitoring was undertaken for various meteorological parameters in order to generate the site specific data. The Central Monitoring Station (CMS), equipped with continuous monitoring equipment to record wind speed, wind direction, temperature, humidity and rain fall was set up at the top of the building at a height of ~ 5.0m above the ground level. The methodology adopted for monitoring surface observations was as per the Standard norms laid down by the Bureau of Indian Standards (IS: 8829:1978) and IMD. Data was collected at every hour continuously from **1st December 2018 to 28th February 2019**.

Table 3.5: Site specific Weather Report for the Study period

Sl. No.	Parameters	Observations (1st December 2018 to 28th February 2019)			
		December 2018 (1-31)	January 2019 (1-31)	February 2019 (1-28)	Seasonal
1	Dry Bulb Temperature (°C)				
	Maximum	26.4	26.2	27.5	26.70
	Minimum	9.9	5.8	11.0	8.90
	Average	18.0	16.4	18.7	17.68
2	Relative Humidity (%)				
	Maximum	99.0	99.0	99.0	99.00
	Minimum	37.0	41.0	30.0	36.00
	Average	84.2	82.6	77.6	81.44
3	Wind Speed (km/hr)				
	Maximum	3.8	6.1	5.0	4.97
	Minimum	0.0	0.0	0.0	0.00
	Average	0.4	0.5	0.8	0.55
	Predominant Wind Direction (From)	NE	NE, N	NE, N	NE
4	Rainfall (in mm)				
	Total (mm)	0	0	0	0
	No. of Rainy Days	0	0	0	0

Source: ABC Techno Labs India Pvt. Ltd.

The wind rose for the month of study period (**1st December 2018 to 28th February 2019**) is given in Figure 3.1.



Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.1: Wind rose for the Study Period

3.4 PHYSIOGRAPHY AND DRAINAGE PATTERN

The district has a Plain Topography; however, it is also having some hillocks and hilly areas in some parts of the district. The mighty river Brahmaputra flows along the southern part of the district and its tributary Aie river flows through the district besides many small rivulets and streams.

Though a number of rivers and tributaries are flowing over the district, the scenario of flow and lift irrigation is very poor. Out of total net sown area, 20% is actually under assured irrigation and remaining 80% is rainfed. No major and medium irrigation project

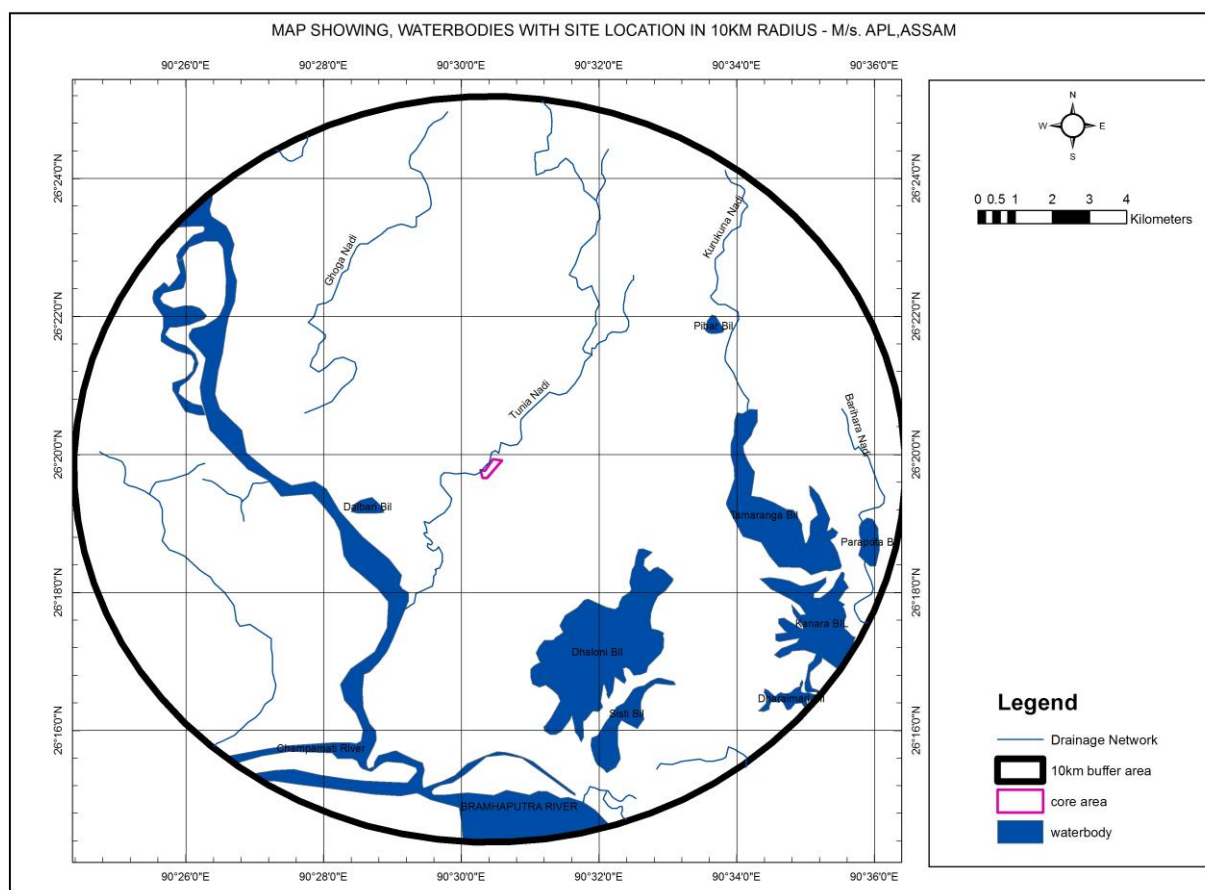


is running in the district. The district slopes down from the northern Himalayan tract to the alluvial flood plain of the mighty Brahmaputra river to the south having four distinct physical divisions (a) Few elevated tracts along northern Bhutan border, (b) The Tarai, (c) Bhabar and (d) Alluviums (old and young) having few beels and monad rocks in the south.

Although the major portion of the area of the District is almost a level plain, but a few ranges of hills are scattered irregularly on the northern bank of the Brahmaputra, southern bank of the river Aie, Eastern bank of the river Manas and also on the western boundary of the district and finally on the northern boundary of the District connecting Bhutan. These isolated hills rising above the alluvium are maintaining their heights varying from 100 to around 350 meters above mean sea level.

The topography of the study area is plain lands with few hill ranges on both banks of Brahmaputra River which flows through the southern part.

Area near site is traversed by three meandering rivers viz., Champamati, Ghoga, Tunia, Kurukuna and Barihara River. Tunia River flowing adjacent to the project site. There are also major lakes present within the study area such as- Dhaloni bil, Tamaranga bil, Kanara bil etc. The Drainage Map (10 km) of the study area is given as Figure 3.3.



Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.2: Drainage Map (10 km) of the study area

3.5 HYDROGEOLOGY

The entire area of sediments is of Recent to Sub-Recent age. The groundwater conditions as described below. Bongaigaon district is dominated by alluvial different geomorphic units represent separate

The flood plain areas along the River Brahmaputra and River Manas are represented by different grades of sand, gravel and clay. Abandoned channel, natural levees, channel bars also represent the same constituents. Ground water occurs under semi-confined to water table condition within the depth range of 2 to 4 m bgl during pre-monsoon period. The younger alluvial plain comprising sand, gravel and clays occupies the central part in the district with similar ground water condition. The depth to water level ranges from 1.30 to 3.00 m bgl during post-monsoon period.

The older alluviurn occupies the northern and north western parts of the district and is located at higher elevation. It comprises unconsolidated to semi-consolidated formations



comprising limonitic clay, unsorted boulders, pebbles, gravels and sands. Ground water occurs under water table to semi-confined condition and depth to water table varies from 0.50 to 2.53 m bgl.

The denudational hills with weathered top associated with pediment occur as isolated patches in north, west, east, amongst the older and younger alluvium. The thickness of the pediment varies from 5 to 15 m with depth to water level from 1 to 9 m bgl. The denudational hills are composed of gneissic rocks with pegmatite veins as intrusion; the water level is very deep.

□ Ground Water Occurrence:

The estimated gross annual replenishable ground water resources of the district are 1430.21 mcm against net annual ground water draft of 577.66 mcm. The projected demand for domestic and industrial uses up to 2025 is 28.84 mcm. The stage of ground water development in the district is 43%.

The district is very potential for ground water development. The state authority constructed more than 1673 STWs and 30 deep tube wells for irrigation creating a total draft of 47.842 mcm. As mentioned above, the aquifer zones down to 50 m depth are very much feasible for construction of shallow tube well. Such well can yield 30 to 40 m³/hr with a reasonable drawdown.

The district is underlain by unconsolidated formation down to 200 m depth. At Abhayapuri, Panchania and Jogishopa area, intercalation of clay beds beyond 100 m exists. Deep tube well constructed down to a maximum depth of 165 m tapping 20 to 48 m of aquifer zones can yield 33 to 180 m³/hr with transmissivity value ranging from 2110 to 3800 m²/day.

The deep tube wells are feasible throughout the middle portion of the district in southern part of Bongaigaon. However, finer aquifer materials are likely to be encountered with confining clay bands.

Both shallow and deep tube well is feasible in the district for ground water development. Dug wells are also feasible in selected area particularly in older alluvial part and the pediment zones surrounding the hillocks.

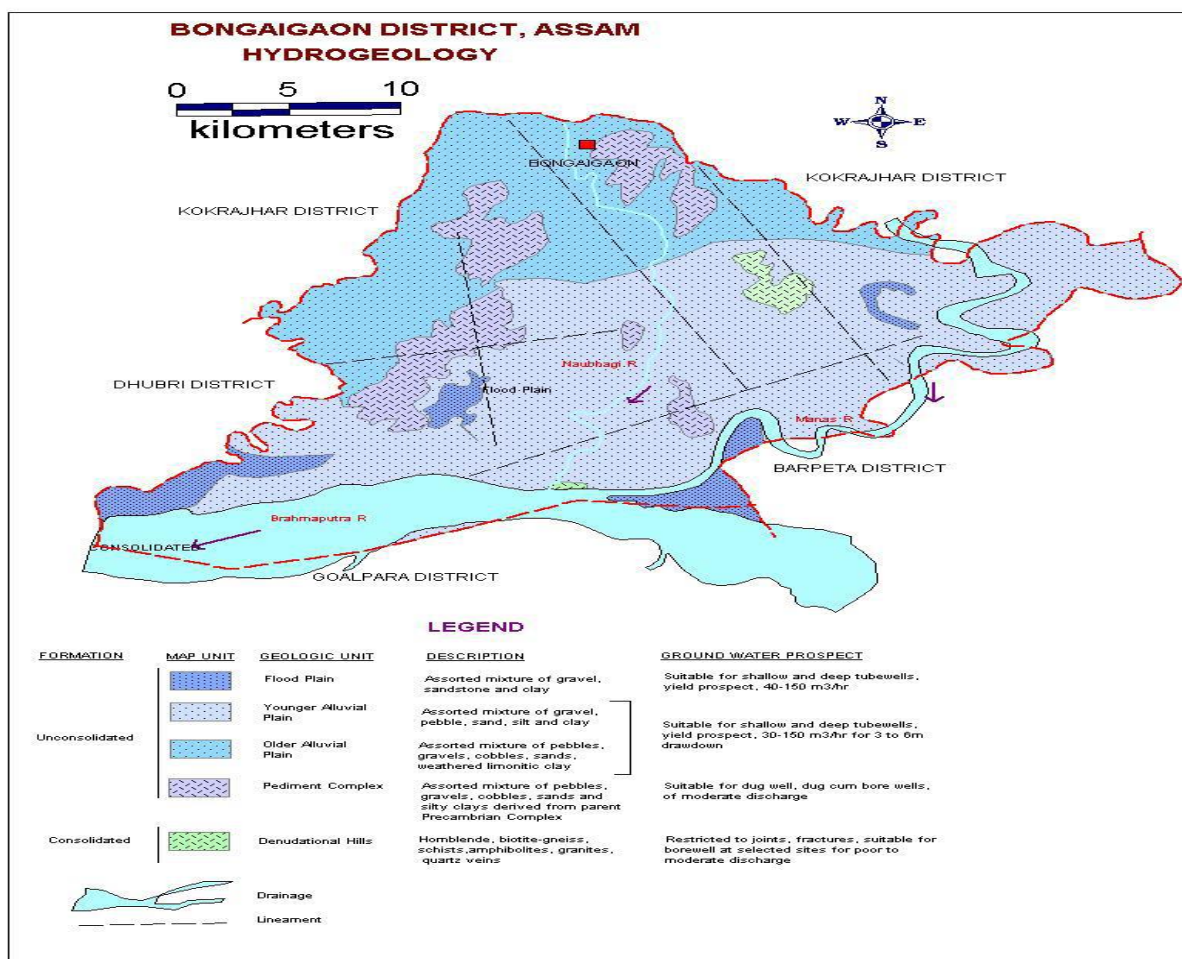


Figure 3.3: Hydrogeological map of Bongaigaon district

3.6 GEOMORPHOLOGY

The district is divided into three units. The Older alluvium is represented on northern border, followed by Younger alluvium in the middle part and the flood plain zones in the southern part along the courses of River Brahmaputra and River Manas. The northern piedmont zones attain the higher elevation while the flood plain or southern border attains the lowest elevation. The altitude difference between the inselbergs and the plain area is 20 - 460 m.

A number of perennial streams as tributaries of the River Brahmaputra flow through the district. The principal rivers are Manas, Kujia and Champavati. Among these tributaries, Manas is the largest tributary and forms eastern boundary and the river Champavati forms the western boundary of the district.

The soil of the district is broadly classified into three categories i.e. (1) Soil capping over older alluvium is sandy, highly permeable, grayish brown in colour, (2) Soil on inselberg



zones are clayey, lateritic, yellowish to reddish in colour and (3) The soil of the flood plain are sandy to silty loam and clayey loam in nature.

The Characteristic of the soil are as follows.

1. *Highly acidic to neutral, pH ranges from 4 to 7*
2. *Low in total soluble salt (0.1 to 0.61 ppm)*
3. *Low in organic carbon (0.7 to 3.00 ppm)*
4. *Low to medium phosphate content (9.8. to 158.8%)*
5. *Medium to high available potash content (45 to 365%)*

3.7 SEISMICITY

There are 4 major seismic zones (zones II, III, IV and V) in India, based on the seismotectonic parameters, history of seismicity and certain geophysical parameters. The study area is located in Zone V as shown in the Bureau of Indian Standards (BIS) 2000 seismic zone map for India is given in Fig 3.4. Zone V is defined as region which might encounter earthquakes of maximum intensity. The region has experienced a large number of earthquakes of tectonic origin. The risk probabilities of earthquake are less over the entire Brahmaputra valley. Two major earthquakes of magnitude 8.7 (occurred in 1897) and 8.6 (in 1950) causing large scale damage to lives and properties in this region.



Figure 3.4: Map showing seismic tectonic zone

3.8 LAND USE PATTERN

As per our seeking towards areas of critical concern for environmental control such as flood plains and wetlands, energy resource development and production areas, wildlife habitat, recreational lands and areas such as major residential and industrial development sites, we require the analysis of Land use Land Cover for establishing / Expansion of an Industry. The survey and studies of past several years conclude that the Remote Sensor data is acquiring a vital area in the field of land use and land cover mapping. The knowledge of Land Use/ Land Cover is important for many planning and management activities as it is considered as an essential element for modeling and understanding the earth system. The term Land Use relates to the human activity or economic function associated with a specific piece of Land, while the term Land Cover

relates to the type of feature present on the surface of the earth (Lillesand and Kiefer, 2000).

Data Acquisition:

Topographical Data: Topographical maps of Survey of India (SOI) were obtained for land use study as well to develop contour and drainages pattern of area from G46G7, G46G8, G46G11, G46G12.

Satellite Data: The Satellite IRS P-6 LISSIV images are obtained from National Remote Sensing Centre (NRSC) Hyderabad. The latitude and longitudes as observed in the site by GPS are:

Points	Coordinates	
	Latitude	Longitude
A	26°19'43.28"N	90°30'25.81"E
B	26°19'54.75"N	90°30'35.63"E
C	26°19'55.92"N	90°30'27.76"E
D	26°19'45.80"N	90°30'20.74"E
E	26°19'46.45"N	90°30'16.74"E
F	26°19'39.79"N	90°30'18.54"E
G	26°19'39.47"N	90°30'22.57"E

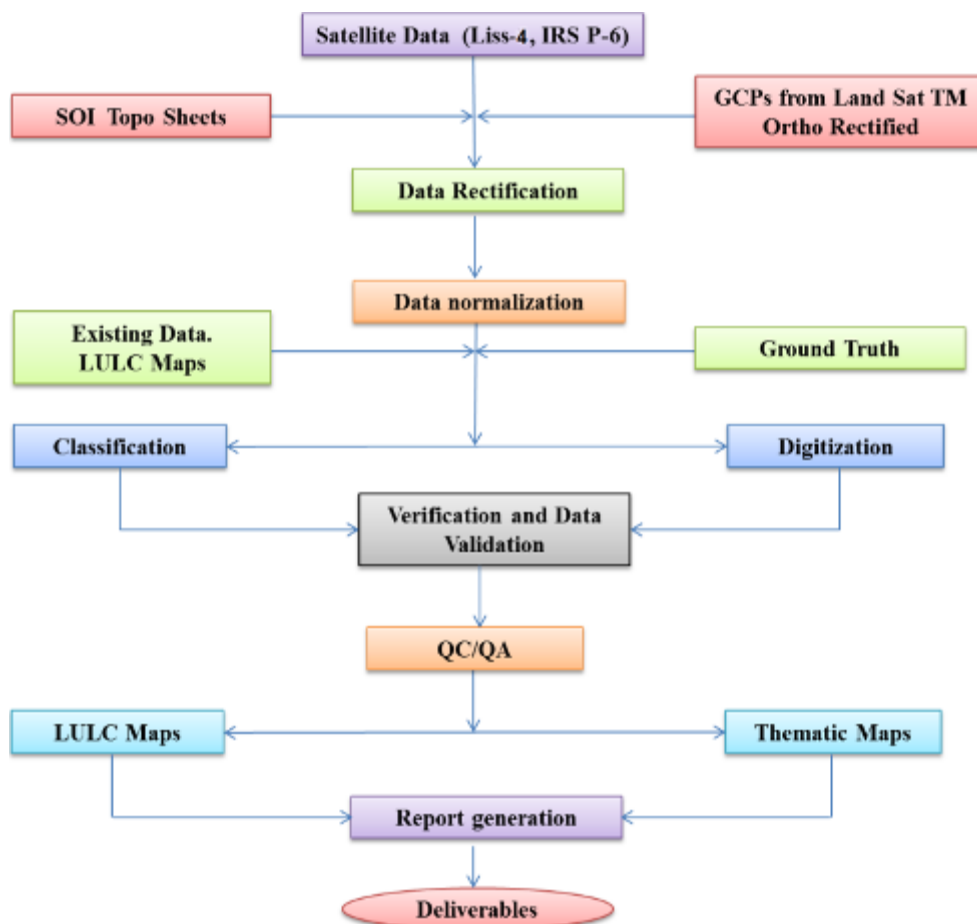
Methodology

The overall methodology adopted and followed to achieve the objectives of the present study involves the following steps:

- ✓ Collection of source data of Survey of India (SOI) toposheets. These are the main inputs for the preparation of essential layers
- ✓ Satellite data of IRS P-6 LISSIV sensor is geometrically corrected and enhanced using principal component method and nearest neighbourhood resampling technique
- ✓ Preparation of basic themes like layout map, transport & settlement map and contour map from the source data. Then updating of layout map, transport map and drainage map from the satellite image by visual interpretation
- ✓ Essential maps (related to natural resources) like Land use / Land cover map are prepared by visual interpretation of the satellite imagery. Visual interpretation is carried out based on the image characteristics like tone, size, shape, pattern, texture, location, association, background etc. in conjunction with existing maps/ literature

- ✓ Preliminary quality check and necessary corrections are carried out for all the maps prepared
- ✓ All the maps prepared are converted into soft copy by digitization of contours and drainages. In that process editing, labeling, mosaicking, quality checking, data integration etc. are done, finally Land use areas are measured in Sq.km.

Flow Chart of Methodology



Land use Map Analysis

Land use Map Analysis done based on the image color, texture, tone etc. Following steps are used to analyze the Land use pattern of project site:

- ✓ Collection of scanned toposheets and Geo-reference the scanned image using the available coordinates
- ✓ Collection of IRS LISS IV images and made fused and blended the images for colour combinations using Image interpreter-Utilities and Layer stack option available in ERDAS



- ✓ Identification Area of interest (AOI) and made a buffer of 10 km radius.
- ✓ Enhance the Fused and blended LISS IV image using the Spatial, Radiometric and Temporal options in ERDAS
- ✓ Rectified the LISS IV image using Geo-referencing technique, Toposheet to get UTM coordinate system
- ✓ Subset the LISS images and Toposheet using 10 km buffer AOI
- ✓ Automatic classifications done for LISS IV images using maximum iterations and number of options in unsupervised classification options
- ✓ Created the signature file by selecting the more samples of different features with AOI on Unsupervised classification image
- ✓ Visual interpretation and supervised classification mixed with recoding practice
- ✓ Verified through the QC / QA and finalized the data.

Spatial Data from SOI Topographical Sheets

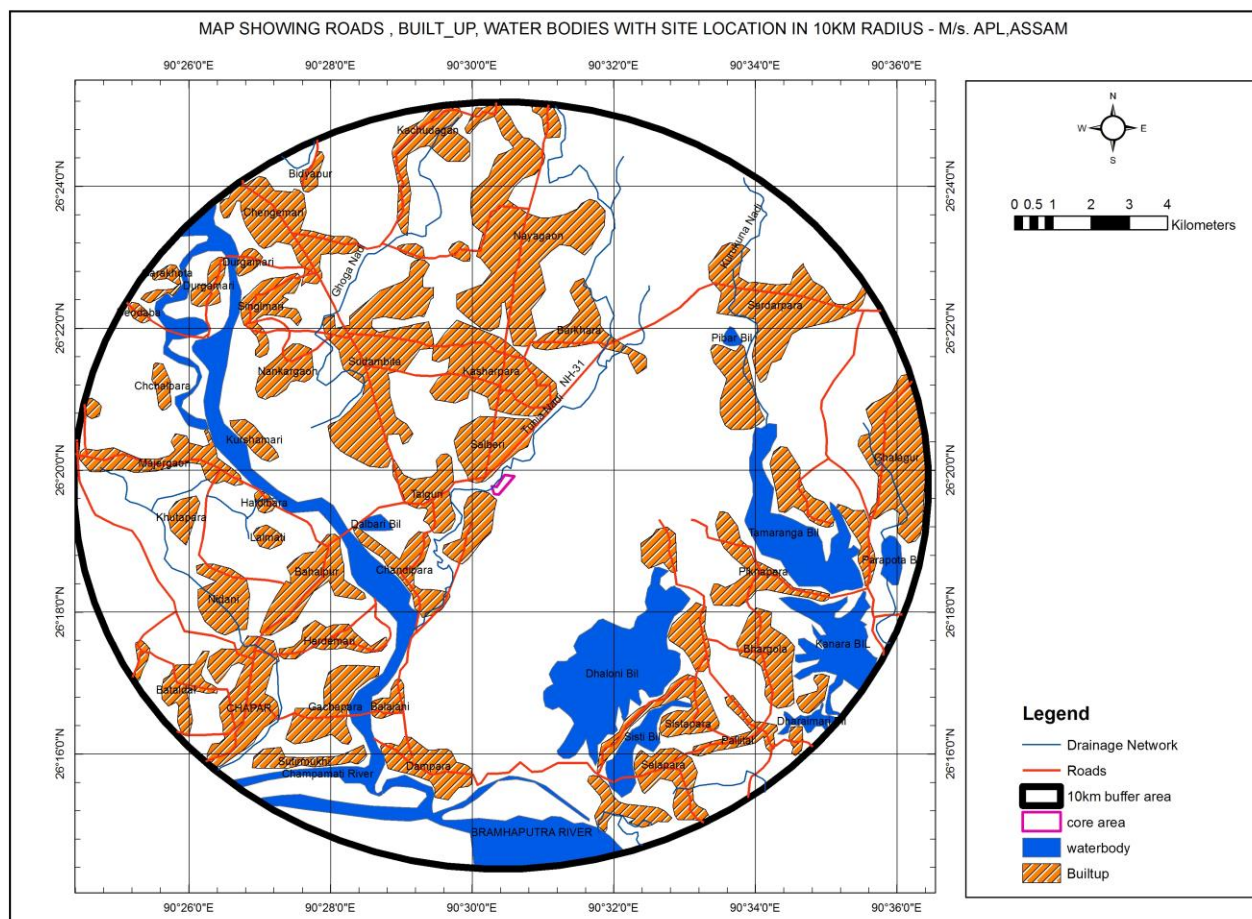
Creating a GIS spatial database is a complex operation, and is the heart of the entire work; it involves data capture, verification and structuring processes. Raw geographical data are available in many different analogue and digital form such as toposheets, aerial photographs, satellite imageries and tables. Out of all these sources, the source of toposheets is of much concern to natural resource scientist and an environmentalist.

In the present study, the essential maps generated from SOI topographical maps. Using the topographical maps, the drainage map and contour Map were also developed. The maps are prepared to a certain scale and with attributes complying with the requirement of terms of reference (ToR). The location of entities on the earth's surface is then specified by means of an agreed co-ordinate system. For most GIS, the common frame of co-ordinate system used for the study is UTM co-ordinates system. All the maps are first Geo-referenced. The same procedure is also applied on remote sensing data before it is used to prepare the Essential maps.

Map showing site location, Rivers, canals, Lakes, drains are connected to Brahmaputra River, Champamati River, Tunia river, Tamaranga Bil, Kanara Bil, Dhaloni Bil, Sista Bil.

There is a road network connecting built-up areas. As the terrain conditions are alluvial type soil and site elevation bit flat also there is a drainage network around the site location, there is no chance of flooding. Hence risk factors are less. Wild life sanctuaries located in the study area.

- Reserve Forest found around 10 km radius about 1 Km from the project site towards eastern side. However, no reserve forest area falls within the study area.
- The Reserve Forests found within study area are- Bharirab RF (E), Khagarpur RF (E), Bahalpur RF (SW), Rakhal Thakur RF (W).
- No National parks and wild life sanctuaries located in the study area.

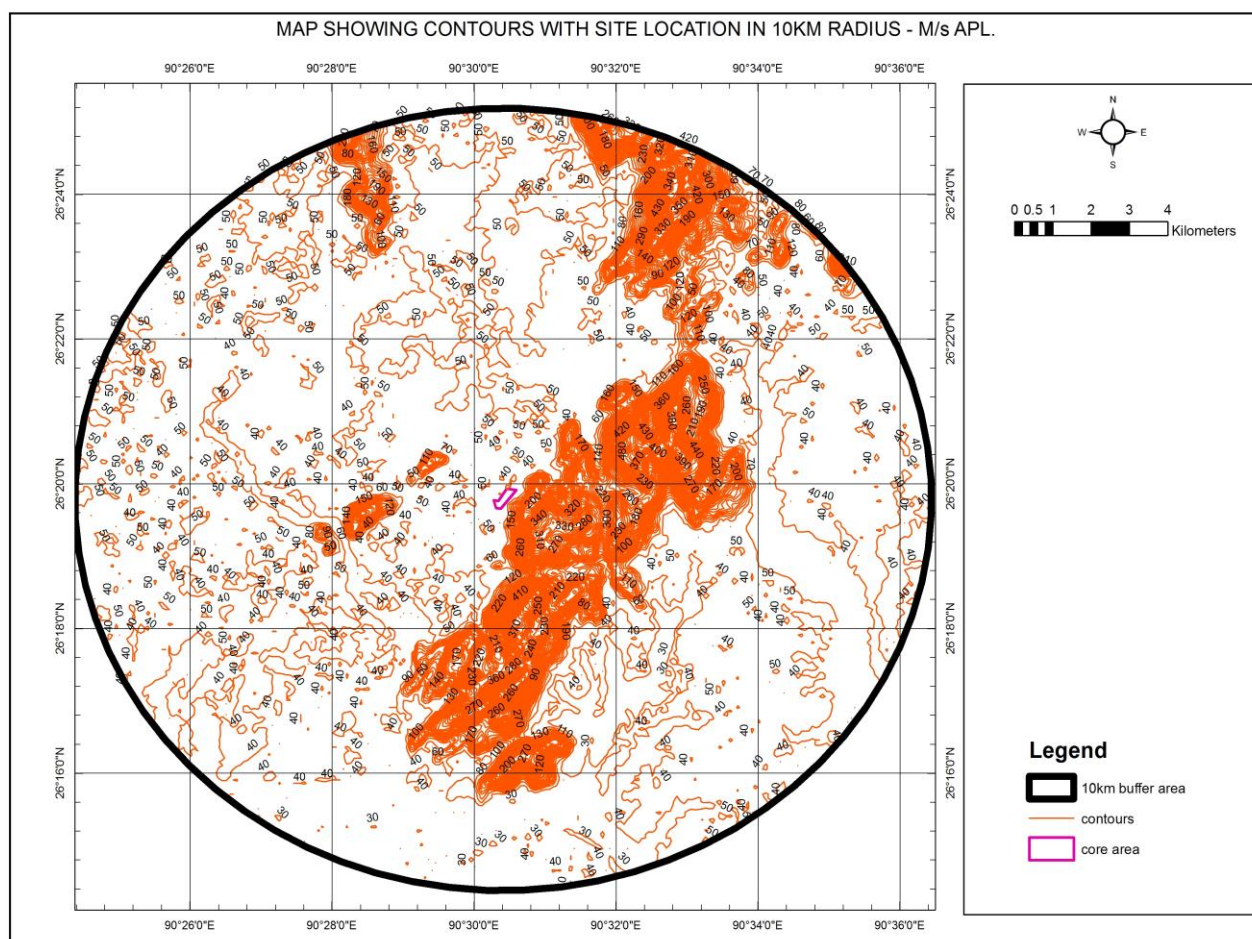


Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.5: Map showing surrounding features of study area

3.8.1 CONTOUR MAP AND ELEVATIONS OF STUDY AREA

The contours in Toposheet have been digitized in the GIS environment and assigned the respective elevation values in meters with reference to the mean sea level. Using the SRTM (Shuttle Radar Topography Mission) data, the elevation values has been verified. Thereafter final contour map has been prepared with combination of Toposheet and SRTM with contour interval of 10 m. Project site contours vary from 41m to 46 m above MSL and the study area contours vary from 30 m to 480 m above MSL. From the project site the No high range hill area were observed towards North West direction and the lowest contours were observed in South west direction. While the remaining areas showed variations with respect to contours. Contour Map and Elevations of Study Area is presented in Fig.3.6.

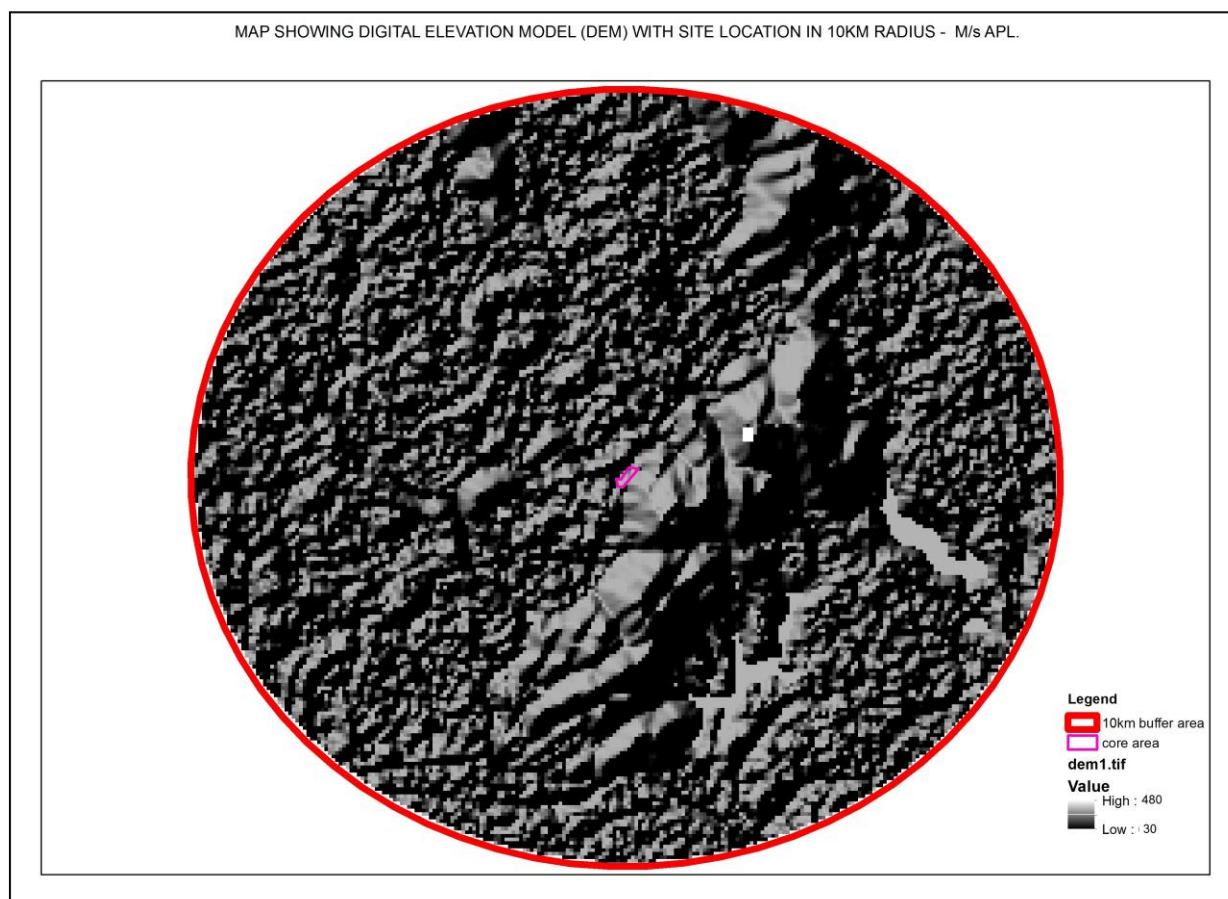


Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.6: Contour map of study area

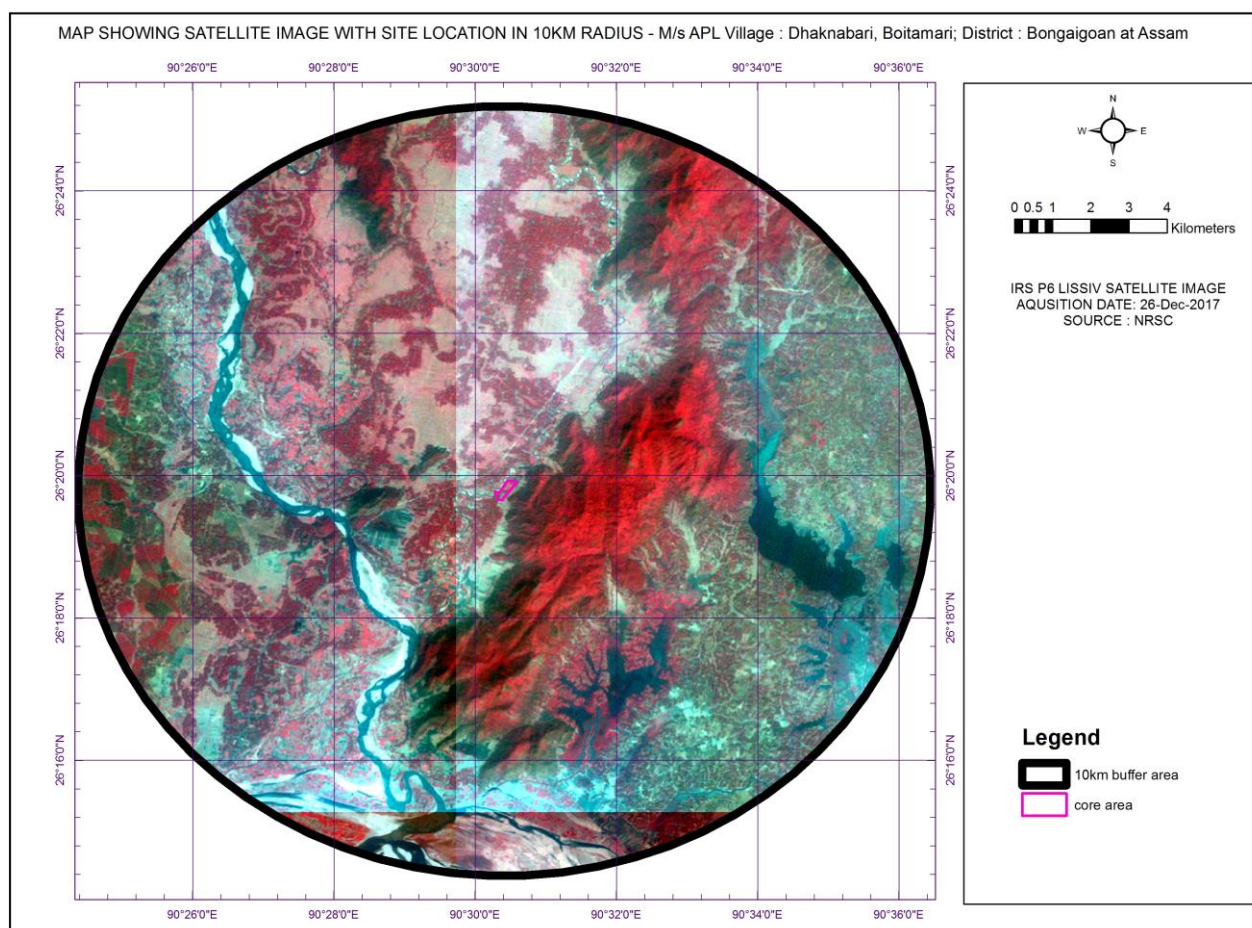
Topography (Digital Elevation Model)

A digital elevation model (DEM) is a digital representation of ground surface topography or terrain (Fig. 3.7). It is also widely known as a digital terrain model (DTM). A DEM can be represented as a raster (a grid of squares, also known as a height map when representing elevation) or as a triangular irregular network. The proposed plant location is shown in that Relief map. For the relief study of the area very higher quality SRTM (Shuttle Radar Topography Mission) and DEM is downloaded. These DEMs of the Terra represents elevation at a 30 m resolution.



Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.7: DEM of the Study Area



Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.8: Satellite Image of the study area

Map for the Land Use Land Cover in the study area of

Land use map Figure 3.9 showing the classifications of the land with different colors. While classifying many remote sensing techniques like supervisory – unsupervisory classification methodologies applied and also sampling techniques used for better results.

It is clearly that the area is covered with Agricultural Fallow around 23 % respectively of the total area. which is taken up for cultivation but is temporarily allowed to rest, un-cropped for one or more season, but not less than one year. Thus, total cultivable land is 23 %. Other class is Around the Agricultural Fallow edges the Settlement (Built-up area) is located and occupies around 12 %, and Roads 7 % of the total study area. It is an area of human habitation developed due to non-agricultural use and that has a cover of buildings, transport and communication, utilities in association with water, vegetation and vacant lands. The Open mixed jungle is 6.0 % respectively in the total study area. Open Scrub is 5%. The proposed project is on Agricultural Fallow with bit undulations terrain and does

not have any significant impact on the surrounding villages and habitation. The water bodies cover 13% of the total area. The water bodies cover Brahmaputra River, Champawati River, Tunia Nadi, Ghoga Nadi etc that connecting canals / nalas, ponds/Bills. The Forest area is 25% those are Bhairab R.F, Khakarpur R.F. Rakhal Thakur R.F, Bahalpur R.F. etc are covering around the buffer area. Open Scrub is around 5%, dense scrub is 6%. These area have a very prominent signature and can be seen as almost Dark blue and light blue in the satellite image. The statistical break-up of the land use classes of buffer zone are presented Table 3.6 and depicted in Fig. 3.9.

Table 3.6: Land use land cover statistics of Study area

Sl. No	LULC Class	Area (Ha)	Area (%)
1	Water Bodies	4100.00	13%
2	Agricultural Fallow	7200.00	23%
3	Built Up	3800.00	12%
4	Open mixed jungle	1800.00	6%
5	Open Scrub	1700.00	5%
6	Forest	7800.00	25%
7	Dense scrub	1800.00	6%
8	Roads	2100.00	7%
9	Plantation	1500.00	5%
	Total	31800.00	100%

Source: ABC Techno Labs India Pvt. Ltd.

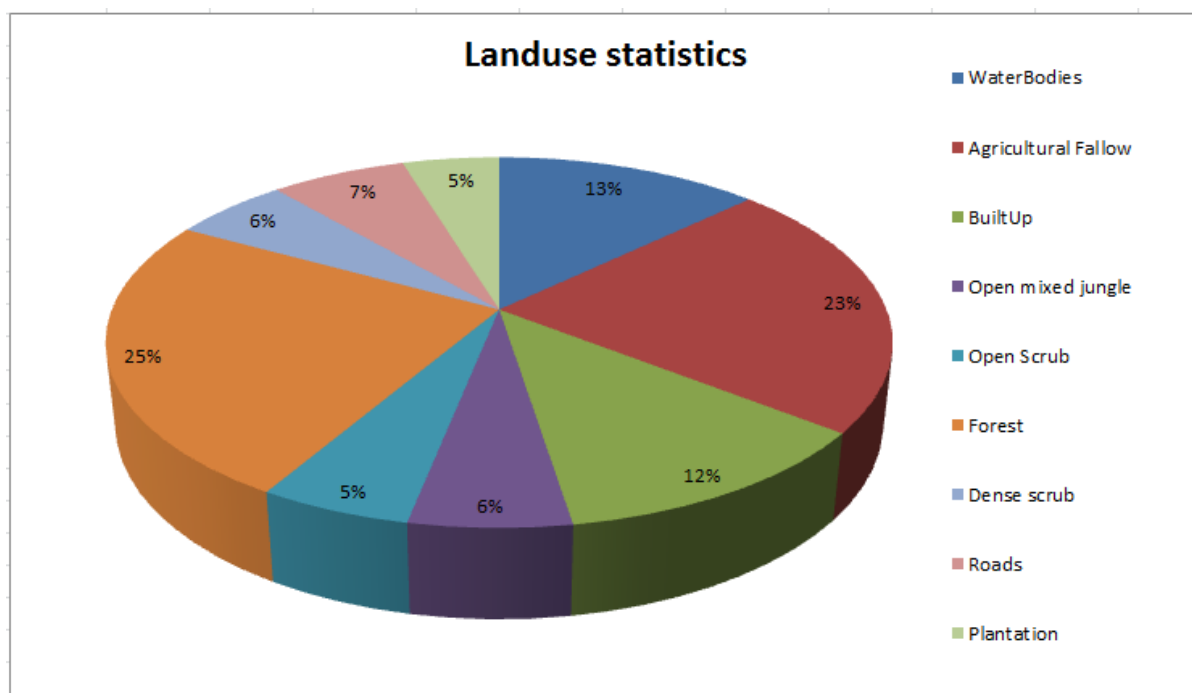
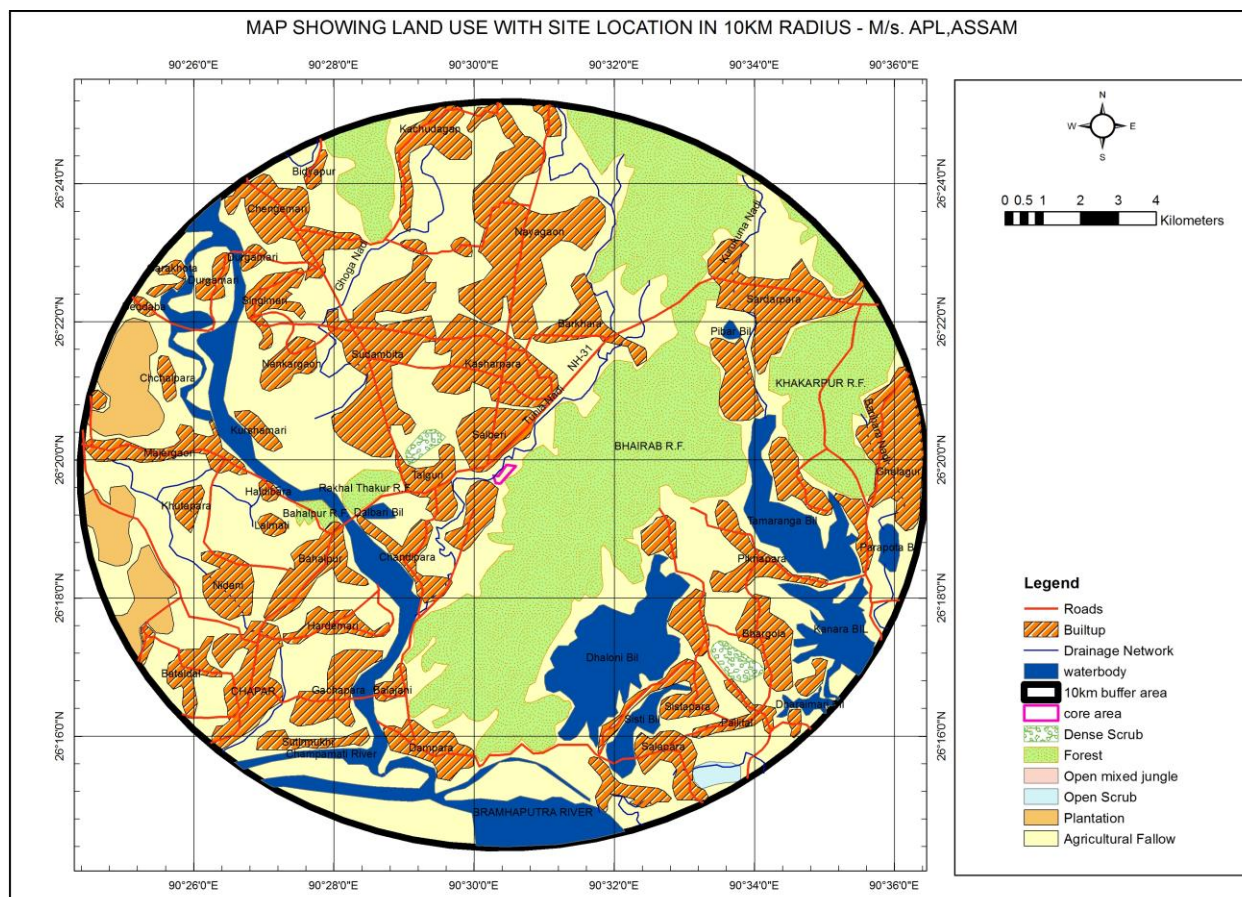


Figure 3.9: Graphical Presentation of Land use Land Cover statistics



Source: ABC Techno Labs India Pvt. Ltd.

Figure 3.10: Land Use/ Land Cover Map within 10 km Study Area

3.9 AIR ENVIRONMENT

The prime objective of baseline air monitoring is to evaluate the existing air quality of the study area around each block. This will also be useful for assessing the conformity to standards of the ambient air quality during the formaldehyde manufacturing operation at proposed project site. This section describes the selection of sampling locations, the methodology adopted for sampling, analysis techniques and frequency of sampling. The results of ambient air monitoring carried out during the study during **1st December 2018 to 28th February 2019**.

Ambient air quality of the study area has been assessed through a network of 8 ambient air quality stations designed keeping in view the meteorological conditions of the study region and others such as major habitation, environment sensitivity etc. It was observed that no habitats present near the proposed project site within the open land area. The AAQ



locations selected based on the predominant wind directions and major habitation area. The methodology adopted for the air quality survey is given below.

3.9.1 SELECTION OF SAMPLING LOCATIONS

The locations for air quality monitoring were scientifically selected based on the following considerations using climatological data.

- ✓ Topography / Terrain of the study area
- ✓ Human Settlements
- ✓ Health status
- ✓ Accessibility of monitoring site
- ✓ Resource Availability
- ✓ Representativeness of the region for establishing baseline status
- ✓ Representativeness with respect to likely impact areas.

The Ambient Air Quality monitoring locations are given in Table 3.7.

Table 3.7: Ambient Air Quality Monitoring Locations

Air sampling location code	Location	Coordinates		Direction with respect to project site	Type
AAQ1	Project Site	26°19'42.15"N	90°30'24.37"E	-	-
AAQ2	Kayetpara	26°18'56.30"N	90°29'0.05"E	SW	DW
AAQ3	Ratnapith College Rd	26°17'46.74"N	90°27'2.03"E	SW	DW
AAQ4	Haldibari	26°19'50.38"N	90°26'44.54"E	W	DW
AAQ5	Dhantola	26°21'33.32"N	90°28'24.13"E	NW	CW
AAQ6	Maligaon	26°21'32.87"N	90°30'46.73"E	N	UW
AAQ7	Khagarpur	26°22'29.16"N	90°34'14.03"E	NE	UW
AAQ8	Near Oudubi Eidgah	26°15'57.44"N	90°29'12.82"E	SSW	DW

Source: ABC Techno Labs India Pvt. Ltd.

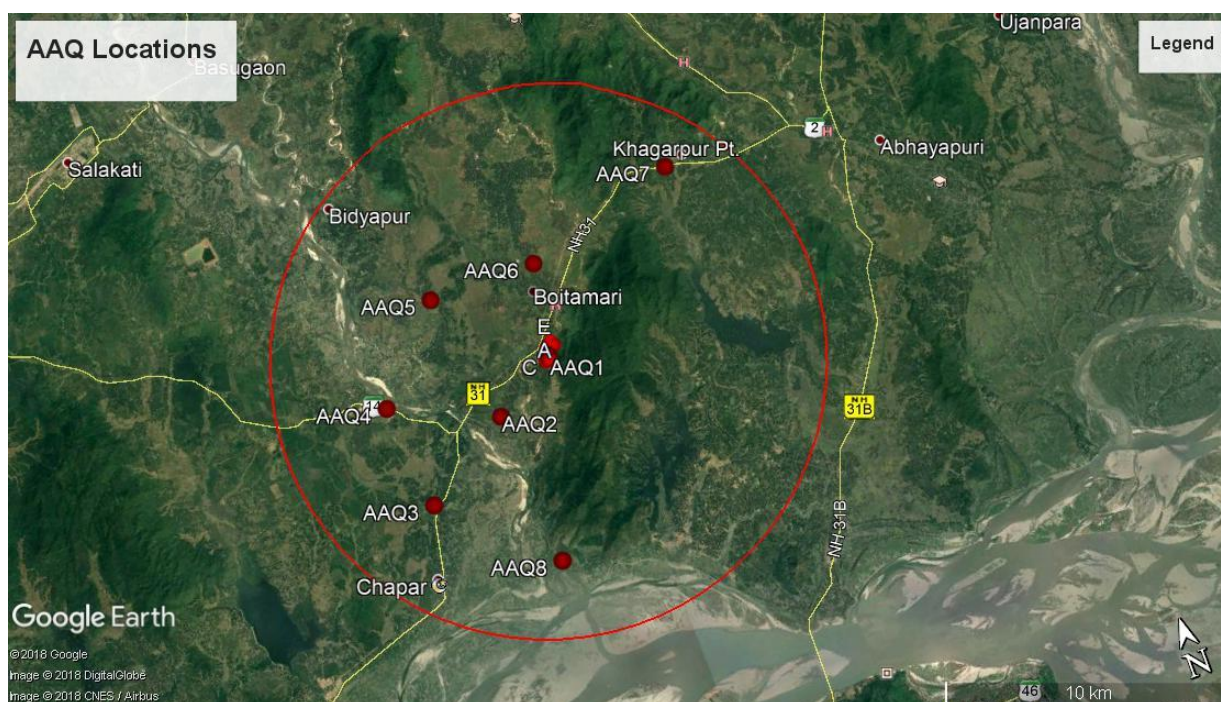


Figure 3.11: Ambient Air quality monitoring locations

3.9.2 PARAMETERS FOR SAMPLING

Ambient air quality monitoring was carried out at a frequency of two days per week at each location for continuous three months. The baseline data of air environment was generated for the parameters namely Particulate Matter size less than 10 μm (PM₁₀), Particulate Matter size less than 2.5 μm (PM_{2.5}), Sulphur dioxide (SO₂), Nitrogen dioxide (NO_x), Carbon Monoxide (CO), Ammonia (NH₃), Ozone (O₃), Lead (Pb), Benzene, BAP, Arsenic (As), Nickel (Ni), Volatile Organic Compounds (VOCs) and Hydrocarbon (Methane & Non-Methane). Concentrations of pollutant parameter monitored have been compared with National Ambient Air Quality standards.

3.9.3 INSTRUMENTS USED FOR SAMPLING

Respirable Dust Samplers APM- 460 BL of Envirotech were used for monitoring Particulate matter (PM-10), gaseous pollutants like SO₂ and NO_x. Fine Particulate Samplers APM 550 of Envirotech was used for monitoring PM_{2.5}.

3.9.4 SAMPLING AND ANALYTICAL TECHNIQUES

PM₁₀ and PM_{2.5} have been estimated by gravimetric method. In RDS, ambient air is sucked through a cyclone. Coarse and non-respirable dust is separated from the air stream by centrifugal forces acting on the solid particles, these particles fall through the cyclone's conical hopper and gets collected in the sampling cap placed at the bottom. The fine dust

(<10 microns) forming the respirable particulate matter (PM₁₀) passes the cyclone and is retained on the filter paper. A tapping is provided on the suction side of the blower to provide suction for sampling air through a set of impingers which contains absorbing solutions for SO₂ and NO_x. Samples of gases are drawn at a flow rate of 0.2 lpm.

PM_{2.5} was determined by Fine Particulate Sampler. The air inlet has a circular symmetry, so that air entry is unaffected by wind direction, and is designed to keep out rain, insects and very large particles. The inlet section immediately leads to an impactor stage designed to trap particles with an aerodynamic diameter larger than 10 microns. Thus the air stream in the down tube consists of only medium and fine particulates. The streamlined air flow of the down tube is accelerated through the nozzle of the well-shaped impactor designed to trap medium size particulates with an aerodynamic diameter between 2.5 and 10 microns. To avoid sampling errors due to the tendency of small particles to bounce off the impaction surface a 37mm diameter GF/A paper immersed in silicone oil is used as an impaction surface. The air stream leaving the WINS impactor consists of microns. These fine particles are collected on a special Teflon membrane filter of 47 mm diameter.

Modified West and Gaeke method (IS-5182 part-II, 1969) has been adopted for estimation of SO₂ and Jacobs-Hochheiser method (IS-5182 part-IV, 1975) has been adopted for the estimation of NO_x. The techniques for sampling and analysis of parameters are presented in Table 3.8. The power supply for operation of AAQ instruments were utilized from nearest available sources like college building, Schools or residential buildings at each AAQ station.

Table 3.8: Techniques used for Ambient Air Quality Monitoring

Sl. No	Parameters	Instruments/Apparatus used	Method followed	Reference
1	Particulate Matter (PM ₁₀), µg/m ³	Respirable Dust Sampler (RDS), balance	Gravimetric (High-Volume with Cyclone)	NAAQS Monitoring & Analysis Guidelines
2	Particulate Matter (PM _{2.5}), µg/m ³	PM _{2.5} Sampler (Fine dust sampler), balance	Gravimetric (Fine particulate Sampler)	NAAQS Monitoring & Analysis Guidelines
3	Oxides of Sulphur (SO ₂), µg/m ³	RDS with Impinger tubes, spectrophotometer	Improved West & Gaecke Method	NAAQS Monitoring & Analysis Guidelines
4	Oxides of Nitrogen (NO _x), µg/m ³	RDS with Impinger tubes, spectrophotometer	Jacobs & Hochheiser Modified (Sodium Arsenite) Method	NAAQS Monitoring & Analysis Guidelines



Sl. No	Parameters	Instruments/Apparatus used	Method followed	Reference
5	Carbon Monoxide (CO), mg/m ³	CO Analyzer	NDIR Method	NAAQS Monitoring & Analysis Guidelines
6	Ozone (O ₃)	Ozone analyzer	UV photometric	IS 5182 part 9, 1974
7	Nickel, Arsenic, Lead	AAS	AAS Method after sampling on EPM 2000 F.P.	IS 5182 part 10, 1999
10	Ammonia (NH ₃)	Spectrophotometer	Indophenol Method	AAFA Edition 21st
11	Benzo-a-Pyrene (BaP)	HPLC	Solvent extraction followed by HPLC	IS 5182 part 12, 2004
12	Benzene	Gas Chromatograph	Chromatography	Methods of Air Sampling & analysis; 3rd Edition 1998; Edited: J.P. Lodge Jr; Lewis Publishers
13	VOCs & BTX	GC-MS/MS	ABCTL/INS/SOP/035	1 µg/m ³
14	Methane HC	GC FID	ABCTL/INS/SOP/038	0.1 µg/m ³
15	Non-Methane HC	GC FID	ABCTL/INS/SOP/038	0.1 µg/m ³

Source: ABC Techno Labs India Pvt. Ltd.

3.9.5 NATIONAL AMBIENT AIR QUALITY STANDARDS

The national ambient air quality standards are given in Table 3.9. Monitored values for study have been compared with the National Ambient Air Quality Standards.

Table 3.9: National Ambient Air Quality Standards

Sl.No.	Pollutants	Time weighted average	Concentration in ambient air		
			Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual*	50	20	- Improved West & Gaeke
		24 hours**	80	80	- Ultraviolet fluorescence
2	Nitrogen Dioxides (NO ₂), µg/m ³	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 hours**	80	80	-



Sl.No.	Pollutants	Time weighted average	Concentration in ambient air		
			Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
					Chemiluminescence
3	Particulate Matter (size less than 10 μm) or PM10 $\mu\text{g}/\text{m}^3$	Annual*	60	60	- Gravimetric
		24 hours**	100	100	- TOEM
4	Particulate Matter (size less than 2.5 μm) or PM2.5 $\mu\text{g}/\text{m}^3$	Annual*	40	40	- Beta attenuation
		24 hours**	60	60	- Gravimetric
5	Ozone (O_3) $\mu\text{g}/\text{m}^3$	8 hours**	100	100	- TOEM
		1 hour**	180	180	- Beta attenuation
6	Lead (Pb) $\mu\text{g}/\text{m}^3$	Annual*	0.5	0.5	- UV photometric
		24 hours**	1	1	- Chemiluminescence
7	Carbon Monoxide (CO) mg/m^3	8 hours**	2	2	- Chemical method
		1 hour**	4	4	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
8	Ammonia (NH_3) $\mu\text{g}/\text{m}^3$	Annual*	100	100	- ED-XRF using Teflon filter
		24 hours**	400	400	- Non Dispersive Infra Red (NDIR) Spectroscopy

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

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

3.9.6 RESULTS

Various parameters like maximum, minimum and average have been computed from the monitored data for all the locations and summary of Ambient Air Quality test results are presented in Tables 3.10.



Table 3.10: Summary of Ambient Air Quality Result (Part 1)

Location	Statistics	PM 2.5 µg/m3	PM 10 µg/m3	SO ₂ µg/m3	NO ₂ µg/m3	CO mg/m3	NH ₃ µg/m3	O ₃ µg/m3	Lead µg/m3	As ng/m3	Ni ng/m3	Benzene µg/m3	BAP ng/m3
AAQ1	Maximum	38.0	62.3	5.6	12.3	0.2	BDL(<5)	BDL(<5)	0.2	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	21.4	40.5	BDL(<5)	8.3	0.1	BDL(<5)	BDL(<5)	0.1	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	29.5	50.5	5.4	9.9	0.1	BDL(<5)	BDL(<5)	0.1	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	37.6	62.3	5.6	12.3	0.2	BDL(<5)	BDL(<5)	0.2	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ2	Maximum	35.5	62.2	6.8	12.2	0.2	BDL(<5)	BDL(<5)	0.1	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	27.1	41.4	BDL(<5)	8.3	0.1	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	30.6	54.1	5.9	9.8	0.2	BDL(<5)	BDL(<5)	0.1	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	34.9	61.9	6.8	11.7	0.2	BDL(<5)	BDL(<5)	0.1	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ3	Maximum	32.1	62.3	6.6	14.6	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	25.4	41.5	5.4	10.6	0.2	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	28.3	54.7	6.0	12.2	0.2	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	31.8	62.3	6.6	14.4	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ4	Maximum	36.8	61.5	7.2	15.2	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	30.2	40.9	5.6	11.7	0.1	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	33.3	46.8	6.3	13.5	0.2	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	36.3	61.2	7.2	14.9	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ5	Maximum	27.5	61.5	7.8	15.3	0.4	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	21.7	35.2	5.8	10.6	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	24.3	53.4	6.7	13.2	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	27.2	61.5	7.7	15.3	0.4	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ6	Maximum	30.1	61.5	7.3	15.7	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	23.2	35.2	5.8	10.2	0.2	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	26.1	53.3	6.5	13.4	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	29.4	61.5	7.2	15.5	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ7	Maximum	32.1	54.6	7.3	15.2	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	18.3	40.1	5.1	9.8	0.1	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	26.4	47.4	5.9	12.1	0.2	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)



Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist- Bongaigaon, Assam By M/s. Assam Petro-chemicals Limited

Location	Statistics	PM 2.5 µg/m3	PM 10 µg/m3	SO ₂ µg/m3	NO ₂ µg/m3	CO mg/m3	NH ₃ µg/m3	O ₃ µg/m3	Lead µg/m3	As ng/m3	Ni ng/m3	Benzene µg/m3	BAP ng/m3
	98 th Percentile	31.7	54.6	7.0	14.4	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
AAQ8	Maximum	32.3	61.2	6.6	15.2	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Minimum	23.2	41.5	5.3	10.4	0.2	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	Average	26.1	52.7	5.9	12.0	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
	98 th Percentile	31.2	61.0	6.6	14.9	0.3	BDL(<5)	BDL(<5)	BDL (<0.1)	BDL (<1.0)	BDL (<1.0)	BDL (<0.01)	BDL (<0.1)
NAAQS Standard		60.0	100.0	80.0	80.0	2.0	400.0	100.0	1.0	6.0	20.0	5.0	1.0

Source: ABC Techno Labs India Pvt. Ltd.

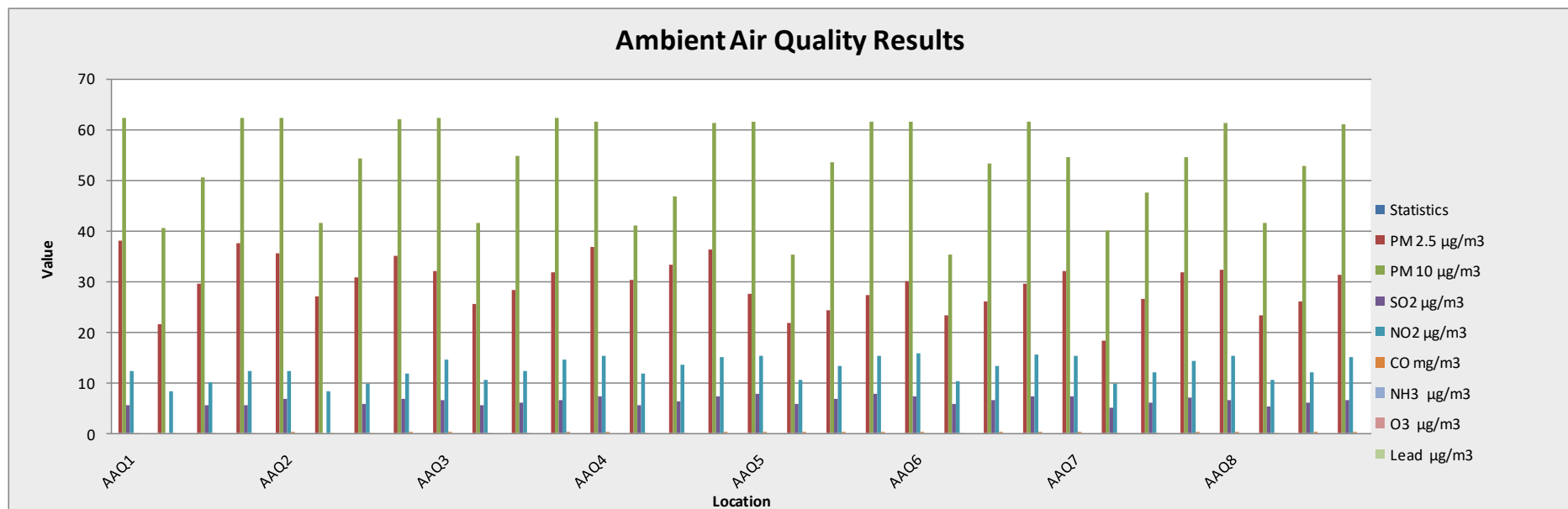




Table 3.11: Summary of Ambient Air Quality Result (Part 2)

Location	Statistics	VOC $\mu\text{g}/\text{m}^3$	Methane HC $\mu\text{g}/\text{m}^3$	Non Methane HC $\mu\text{g}/\text{m}^3$
AAQ1	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ2	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ3	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ4	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ5	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ6	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ7	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
AAQ8	Maximum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.1)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.1)	BDL(<1)
Study area	Maximum	BDL(<0.1)	BDL(<0.01)	BDL(<1)
	Minimum	BDL(<0.1)	BDL(<0.01)	BDL(<1)
	Average	BDL(<0.1)	BDL(<0.01)	BDL(<1)
	98 th Percentile	BDL(<0.1)	BDL(<0.01)	BDL(<1)
NAAQS Standard		-	-	-

Source: ABC Techno Labs India Pvt. Ltd.

3.9.7 OBSERVATIONS

PM₁₀: The maximum and minimum concentrations of PM₁₀ were recorded as 62.3 $\mu\text{g}/\text{m}^3$ and 35.2 $\mu\text{g}/\text{m}^3$ respectively. The maximum concentration was recorded at the Project site (AAQ1) and the minimum concentration was recorded at Dhantola (AAQ5). The average concentrations were ranged between 46.8 to 54.7 $\mu\text{g}/\text{m}^3$.

PM_{2.5}: The maximum and minimum concentrations for PM_{2.5} were recorded as 38 µg/m³ and 18.3 µg/m³ respectively. The maximum concentration was recorded at the Project site (AAQ1) and the minimum concentration was recorded at Khagarpur (AAQ7). The average values were observed to be in the range of 24.3 to 33.3 µg/m³.

SO₂: The maximum and minimum SO₂ concentrations were recorded as 7.8 µg/m³ and BDL (<5 µg/m³). The maximum concentration was recorded at Dhantola (AAQ5) and the minimum concentration was recorded at Project site (AAQ1). The average values were observed to be in the range of 5.4 µg/m³ to 6.9 µg/m³.

NO_x: The maximum and minimum NO_x concentrations were recorded as 15.7 µg/m³ and 8.3 µg/m³. The maximum concentration was recorded at Maligaon (AAQ6) and the minimum concentration was recorded at Project site (AAQ1). The average values were observed to be in the range of 9.8 to 13.5 µg/m³.

CO: The maximum and minimum CO concentrations were recorded as 0.4 mg/m³ and 0.1 mg/m³. The maximum concentration was recorded at Dhantola (AAQ5) and the minimum concentration was recorded at Khagarpur (AAQ7). The average values were observed to be in the range of 0.1 to 0.3 mg/m³.

HC (methane and non-methane) and Volatile Organic Compounds (VOCs): The HC and VOCs at all the location were observed below detection limit.

The concentrations of PM₁₀, PM_{2.5}, SO₂, NO_x, CO and other parameters are observed to be well within the standards prescribed by the Central Pollution Control Board (CPCB) for Industrial, Rural, Residential and Other area.

3.10 NOISE ENVIRONMENT

Noise can be defined as an unwanted sound. It interferes with speech and hearing and is intense enough to damage hearing or is otherwise annoying. The definition of noise as unwanted sound implies that it has an adverse effect on human beings and their environment. Noise can also disturb wildlife and ecological system.

The main objective of monitoring of ambient noise levels was to establish the baseline noise levels in the surrounding areas and to assess the total noise level in the environment of the study area.

3.10.1 IDENTIFICATION OF SAMPLING LOCATIONS

A preliminary reconnaissance survey was undertaken to identify the major noise sources in the area. The noise monitoring has been conducted at 8 locations within 10 km study area which are presented in Table 3.12.

Table 3.12: Noise Quality monitoring stations

Sampling Location Code & Name	Location	Coordinates	
		Latitude	Longitude
N1	Near Project Site	26°19'55.27"N	90°30'11.59"E
N2	Kayetpara Pt-1	26°19'9.05"N	90°28'31.01"E
N3	Bahalpur Jogipara Pt-1	26°17'43.56"N	90°27'12.48"E
N4	Haldibari	26°19'47.18"N	90°26'40.74"E
N5	Dhantola	26°21'42.55"N	90°28'24.30"E
N6	Maligaon Pahar	26°21'9.93"N	90°31'19.35"E
N7	Khagarpur	26°22'31.46"N	90°34'5.95"E
N8	Oudubi	26°16'0.33"N	90°29'11.88"E

Source: ABC Techno Labs India Pvt. Ltd.

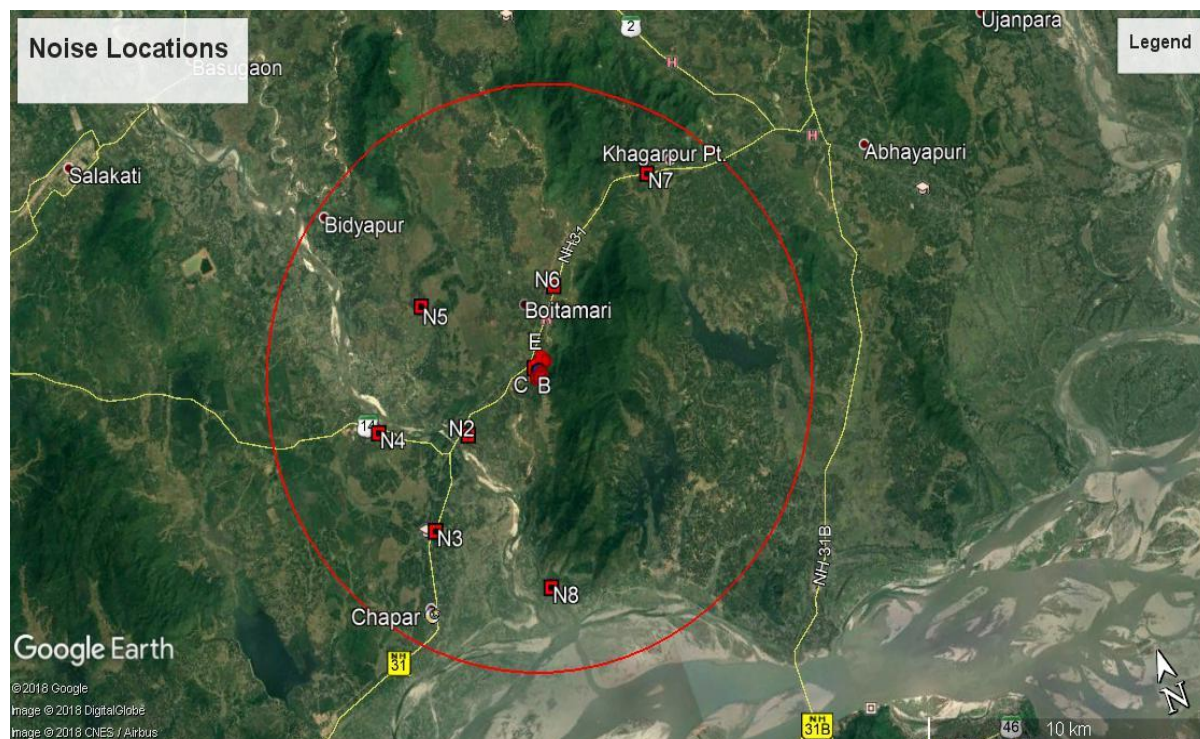


Figure 3.12: Ambient Noise monitoring locations

3.10.2 INSTRUMENT USED FOR SAMPLING

Noise levels were measured using a sound level meter. The sound level meter measures the equivalent continuous noise level (Leq) by switching to the corresponding function mode.

3.10.3 METHOD OF MONITORING

Noise, in general, is sound which is composed of many frequency components of various types of loudness distributed over the audible frequency range. Equivalent sound pressure levels of day time i.e. L_{eq} (day) and night time L_{eq} (night) are calculated from the hourly measured noise level and compared to Ambient Noise Level Standards as per the “Noise Pollution (Regulation and Control) Rules, 2000” stipulated for daytime and night time for residential land use.

Various noise scales have been introduced to describe, in a single number, the response of an average human to a complex sound made up of various frequencies at different loudness levels. The most common and universally accepted scale is the ‘A’ weighted Scale which is measured as dB (A). This is more suitable for an audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise, according to the response of a human ear.

Sound Pressure Level (SPL) measurements were measured at all locations. The readings were taken for every hour for 24 hours. The day noise levels have been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am at all the locations covered in a 10-km radius of the study area. The noise levels were measured once during the study period. These readings were later tabulated and the frequency distribution table was prepared. Finally, hourly and 24 hourly values for various noise parameters viz. L_{day} and L_{night} were calculated.

For noise levels measured over a given period of time, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time certain noise levels exceed the time interval. The notations for the statistical quantities of noise levels are described below:

L_{10} is the noise level exceeded 10 percent of the time

L_{50} is the noise level exceeded 50 percent of the time and

L_{90} is the noise level exceeded 90 percent of the time

Equivalent Sound Pressure Level (L_{eq})

The L_{eq} is the equivalent continuous sound level, which is equivalent to the same sound energy as the actual fluctuating sound measured in the same period. This is necessary because the sound from a noise source often fluctuates widely during a given period of time. This is calculated from the following equation:



$$Leq = L_{50} + (L_{10} - L_{90})^2 / 60$$

Parameters Measured During Monitoring

For noise levels measured over a given period of the time interval, it is possible to describe important features of noise using statistical quantities. This is calculated using the percent of the time, certain noise levels are exceeded during the time interval. The notation for the statistical quantities of noise levels is described below:

Hourly Leq day: Equivalent noise levels between 6.00 hours to 22.00 hours.

Leq night: Equivalent noise levels between 22.00 hours to 6.00 hours.

3.10.4 RESULTS

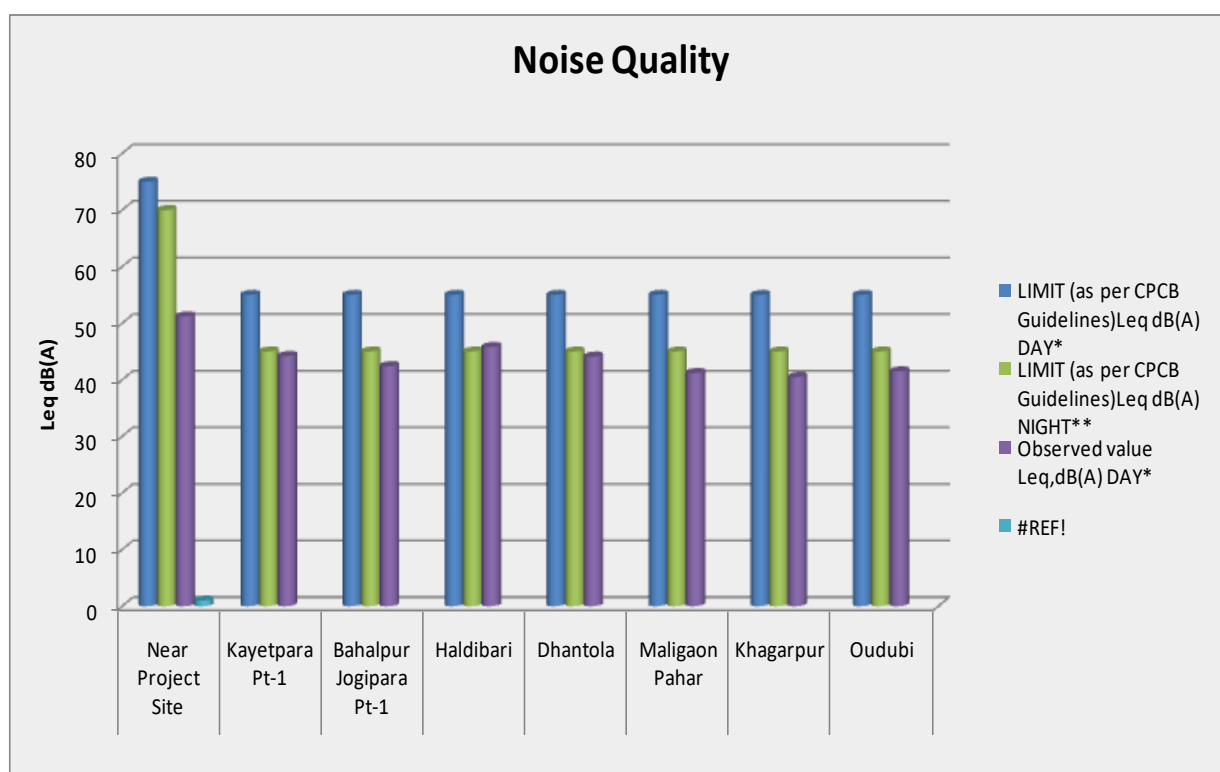
The summary of computed ambient noise level parameters like L_{day} and L_{night} are presented in Table 3.13 and compared to the standards specified by CPCB mentioned.

Table 3.13: Ambient Noise Level

S.No.	Location code	Location	Zone	LIMIT (as per CPCB Guidelines) Leq dB(A)		Observed value Leq,dB(A)	
				DAY*	NIGHT**	DAY*	NIGHT**
1	N1	Near Project Site	Industrial	75	70	51.2	42.9
2	N2	Kayetpara Pt-1	Residential	55	45	44.2	37.7
3	N3	Bahalpur Jogipara Pt-1	Residential	55	45	42.4	36.5
4	N4	Haldibari	Residential	55	45	45.8	40.1
5	N5	Dhantola	Residential	55	45	44.1	38.2
6	N6	Maligaon Pahar	Residential	55	45	41.2	32.7
7	N7	Khagarpur	Residential	55	45	40.5	31.2
8	N8	Oudubi	Residential	55	45	41.5	33.5

Note: Daytime shall mean from 6.00 a.m. to 10.00 p.m.

Night time shall mean from 10.00 p.m. to 6.00 a.m.



Source: ABC Techno Labs India Pvt. Ltd.

3.10.5 OBSERVATIONS

Daytime Noise Levels

Noise levels during daytime were found to be in the range 40.5 to 51.2 dB(A). The maximum noise level was observed to be 51.2 dB(A) at near Project site (N1) and a minimum of 40.5 dB(A) was observed at near Khagarpur (N7).

Nighttime Noise Levels

Noise levels observed to fall in the range 31.2 to 42.9 dB(A) during the night time. A maximum of 42.9 dB(A) was observed at near Project site (N1) and a minimum of 31.2 dB(A) was observed near Khagarpur (N7). Measured noise levels are observed to be in compliance with prescribed standards for ambient noise for the respective applicable categories.

3.11 TRAFFIC DENSITY

To quantify the impact of the proposed project and allied activities on traffic, it is necessary at first to evaluate the existing load of vehicular traffic near NH31 crossing and Bahalpur-Kokrajhar Road. Traffic survey was done at 2 locations. The existing traffic density for different types of vehicles was counted at 2 locations during the study on a particular day for 24 hours.



Near NH-31 (Salbari-Jogigopha Road)										
Time	Two Wheelers		Three Wheelers		Cars/Vans		Buses & Lorries		2-Axle & 3-Axle	
	Up	Dn	Up	Dn	Up	Dn	Up	Dn	Up	Dn
1	0	0	0	0	0	1	0	0	0	0
2	0	0	0	0	1	2	4	4	2	3
3	0	0	0	0	5	2	1	2	6	5
4	1	0	0	0	2	3	1	2	7	9
5	4	1	0	0	5	5	2	0	8	10
6	8	5	7	5	9	6	0	0	10	13
7	5	3	3	3	11	12	0	1	10	8
8	6	5	1	1	14	13	1	0	15	13
9	10	8	2	1	15	12	1	1	12	13
10	8	10	4	3	14	14	4	5	14	14
11	8	8	4	5	14	11	4	5	14	11
12	8	7	4	5	12	14	3	4	12	14
13	7	6	3	4	12	12	2	2	12	12
14	8	4	2	2	11	11	2	2	11	11
15	9	9	2	2	14	11	2	1	14	11
16	12	9	2	1	13	12	4	3	5	6
17	11	12	4	3	12	11	4	5	7	8
18	11	11	4	5	8	10	4	5	2	5
19	8	6	4	5	8	6	2	2	1	2
20	6	5	3	4	6	5	2	3	2	2
21	1	1	2	2	4	5	2	3	1	3
22	1	1	2	2	4	0	3	3	4	3
23	0	0	0	0	1	0	1	1	1	2
24	0	0	0	0	0	1	1	2	1	1
Total	132	111	53	53	195	179	50	56	171	179

Near Bahalpur-Kokrajhar Road										
Time	Two Wheelers		Three Wheelers		Cars/Vans		Buses & Lorries		2-Axle & 3-Axle	
	Up	Dn	Up	Dn	Up	Dn	Up	Dn	Up	Dn
1	0	0	0	0	0	1	0	0	2	4
2	0	0	0	0	1	2	4	4	7	4
3	0	0	0	0	5	2	1	2	7	4
4	0	0	0	0	2	1	1	2	8	5
5	2	1	0	0	3	1	2	0	7	6
6	2	2	1	2	3	2	0	0	9	8
7	2	1	3	3	6	4	0	1	11	8



8	5	3	2	2	14	14	1	0	10	9
9	6	5	4	5	14	11	1	1	9	8
10	10	8	4	5	12	14	2	2	8	6
11	12	10	3	4	12	12	0	1	5	5
12	13	11	2	2	11	11	2	1	8	6
13	13	11	2	2	14	11	2	1	8	4
14	17	12	2	2	13	12	4	3	5	4
15	12	9	4	3	12	11	4	5	6	3
16	15	12	4	5	8	10	4	5	4	4
17	16	12	1	2	12	7	3	4	4	2
18	14	16	1	2	5	9	2	2	3	4
19	9	12	2	2	6	7	2	2	2	1
20	8	6	2	1	4	5	2	3	1	1
21	3	5	2	2	4	6	2	3	0	0
22	6	5	2	1	2	2	3	3	0	0
23	0	0	2	1	0	0	1	1	0	0
24	0	0	0	0	0	1	1	2	0	0
Total	165	141	43	46	163	156	44	48	124	96

Source: ABC Techno Labs India Pvt. Ltd.

3.12 WATER ENVIRONMENT

The quality of ground and surface water is influenced by surface and sub-surface environmental conditions. The quantity and quality of water entering the underground regime is another important parameter which influences underground water quality.

Water sampling has been conducted to establish baseline water quality in the area. Water analysis was carried out for physical and chemical parameters as per the methods prescribed in IS and “Standard Methods for the Examination of Water and Wastewater (American Public Health Association)”. The water samples were collected as grab samples and were analyzed for physical, chemical and biological characteristics.

3.12.1 SAMPLING LOCATIONS

The sampling locations were selected based on reconnaissance survey with the following consideration:

- Location of water courses; and
- Location of residential areas representing different activities

The details of the water sampling stations are presented in the Table 3.14.

Table 3.14: Water quality monitoring locations

Location Code	Location	Geographical location		Type of water
		Latitude	Longitude	
Ground Water				
GW1	Boitamari	26°20'40.84"N	90°30'50.46"E	Bore well
GW2	Dhaknabari	26°18'49.75"N	90°29'46.82"E	Bore well
GW3	Bahalpur	26°18'8.17"N	90°27'23.47"E	Bore well
GW4	Oudubi	26°15'49.80"N	90°29'20.28"E	Bore well
GW5	Chapar	26°16'18.30"N	90°26'38.11"E	Bore well
GW6	Dhantola	26°21'52.09"N	90°28'13.81"E	Bore well
GW7	Sajnavita	26°22'28.90"N	90°30'30.96"E	Bore well
GW8	Barkhata Pt-1	26°22'5.38"N	90°31'47.29"E	Bore well
Surface Water				
SW1	Tuniya River Upstream	26°20'50.41"N	90°31'32.17"E	River
SW2	Tuniya River Downstream	26°19'40.07"N	90°29'44.77"E	River
SW3	Champabati River Downstream	26°17'30.69"N	90°28'59.91"E	River
SW4	Champabati River Upstream	26°20'21.97"N	90°26'39.02"E	River
SW5	Dolani Beel	26°15'57.65"N	90°31'17.11"E	Lake
SW6	Pond at Dhantola	26°21'7.25"N	90°28'29.92"E	Pond

Source: ABC Techno Labs India Pvt. Ltd.

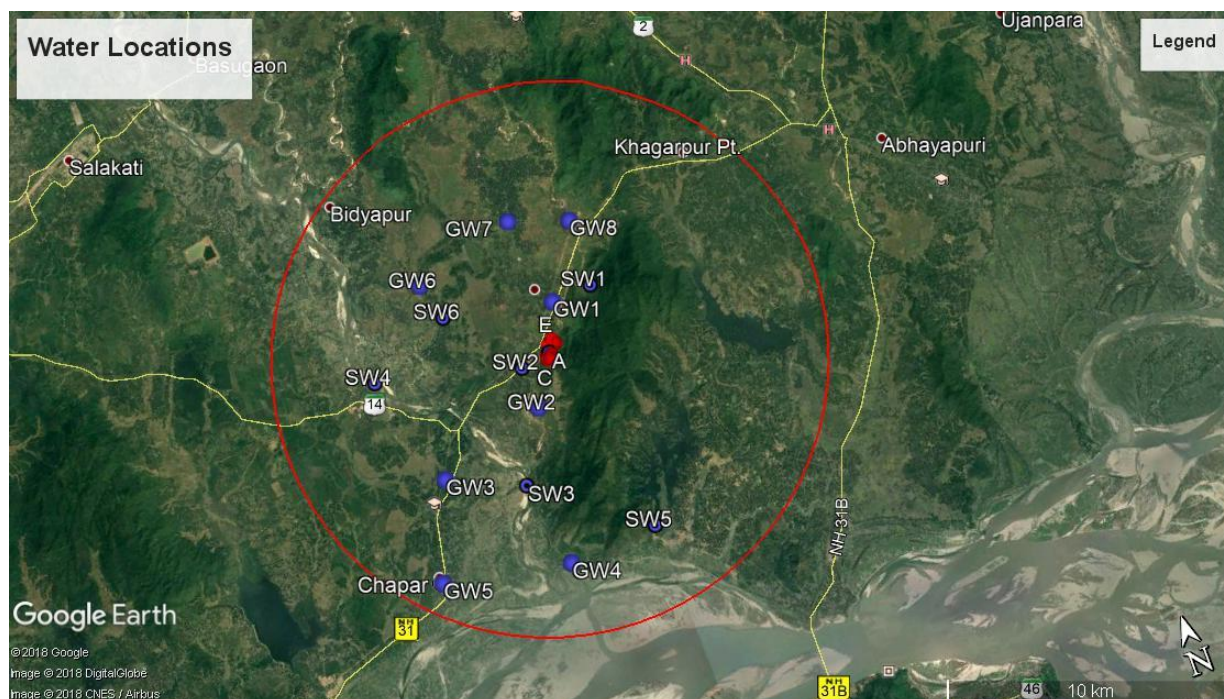


Figure 3.13: Water quality monitoring locations

Ground water samples for chemical analysis were collected in polyethylene carboys. Water samples collected for metal content were acidified with 1 ml HNO₃. Selected



physico-chemical and heavy metal have been analysed for ground water quality status in the study area.

3.12.2 RESULTS

A. Ground Water

The physicochemical characteristics of ground water in the study area are presented in the Tables 3.15 and is compared with the standards (IS 10500: Indian Standards/ Specifications for Drinking Water) reference values.

- **Colour:** The colour of ground water samples was Nil to 2 Hazen unit and meets the desirable limit of drinking water standards.
- **Odour:** Ground water samples were found odourless.
- **pH:** The pH value of all ground water samples ranges from 6.77 to 8.01 and meets the desirable limit of drinking water standards.
- **Turbidity:** The turbidity of water samples ranges from BDL (<0.5 NTU) to 2.1 NTU and meets permissible limit at all the ground water sampling locations.
- **Total Dissolved Solids (TDS):** The TDS in ground water samples range from 158 to 332 mg/l and meets desirable limit of 500 mg/l in the ground water sampling locations.
- **Total Hardness:** The total hardness of ground water samples range between 99 mg/l to 158 mg/l, and meet the desirable limit of 200 mg/l drinking water standards.
- **Total Alkalinity:** Total alkalinity in ground water samples ranges from 134 mg/l to 174 mg/l and meets desirable limit of 200 mg/l at all the ground water sampling locations.
- **Chloride:** The chloride content in ground water samples range from 18 mg/l to 26 mg/l and meets desirable limit of 250 mg/l at the ground water sampling locations.
- **Iron:** The iron content in all ground water sample ranges from 0.1 mg/l to 1.2 mg/l and meets acceptable limit of 0.3 mg/l except GW2, GW3 & GW4.
- **Calcium:** The Calcium content in ground water samples range from 32 mg/l to 52 mg/l and meets desirable limit of 75 mg/l at the ground water sampling locations.



- **Magnesium:** The Magnesium content in ground water samples range from 3.2 mg/l to 8.5 mg/l and meets desirable limit of 30 mg/l at the ground water sampling locations.
- **Sulphate:** Sulphate content in ground water sample ranges from 6 mg/l to 18.9 mg/l and meets the desirable limit of 200 mg/l at all the ground water sampling locations.
- **Nitrate:** Nitrate content in ground water samples ranges from 1.1 mg/l to 2.8 mg/l and meets the desirable limit of 45 mg/l at all the ground water sampling locations.
- **Fluoride:** Fluoride content in ground water samples ranges from BDL(<0.1 mg/l) to 0.19 mg/l and meets the desirable limit of drinking water standards.
- **Manganese:** Manganese content in ground water samples found to be Below Detection Level (<0.02 mg/l).
- **Sodium:** Sodium content in ground water samples ranges from 22 mg/l to 29 mg/l.
- **Potassium:** Potassium content in ground water samples ranges from 1.3 mg/l to 4.2 mg/l.
- **Zinc:** Zinc content in ground water samples found BDL (0.05 mg/l) and meets the desirable limit 5 mg/l at all the ground water sampling locations.
- **Lead:** Lead content in ground water samples found to be Below Detection Level (<0.01 mg/l) at all the ground water sampling locations.
- **Total Coliform:** Total coliform found to absent in all ground water samples. which meets the IS 10500:2012 standards for drinking water.
- **Other Parameters:** Alluminium, Selenium, Phenolic Compounds, Copper, Cadmium, Mercury, Nickel, Total Arsenic, Total Chromium, and Cyanide in all ground water samples were found below detection limit (BDL).

Conclusions

The results of ground water samples were compared to Indian Standard Specification of drinking water IS: 10500:2012. Analysed parameters meet the acceptable limits. All the ground water samples can be considered suitable for drinking purposes. Other ground water samples needs filtration and other treatment before usage.



**Table 3.15: Results for Ground Water Analysis
Part 1**

S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	Permissible Limit	GW1	GW2	GW3	GW4	GW5
1	Colour	Hazen	APHA 22 nd Edition	5	15	Nil	Nil	1	Nil	Nil
2	Odour	-	APHA 22 nd Edition	Agreeable	Agreeable	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed
3	Temperature	°C	---	Not Specified	Not Specified	25.2	26.2	25.1	25.4	26.1
4	pH at 25°C	-	IS : 3025 Part 11-1983 (Reaff: 2002)	6.5-8.5	No relaxation	7.13	7.71	7.25	6.98	7.07
5	Conductivity at 25 °C	µS/cm	IS : 3025 Part 14-1984 (Reaff: 2002)	Not Specified	Not Specified	321	412	276	518	383
6	Turbidity	NTU	IS : 3025 Part 10-1984 (Reaff: 2002)	1	5	BDL(< 0.5)	0.5	1.1	0.6	2.1
7	Total Dissolved Solids	mg/l	IS : 3025 Part 16-1984 (Reaff: 2003)	500	2000	204	264	178	332	244
8	Total Hardness as CaCO ₃	mg/l	IS : 3025 Part 21-1983 (Reaff: 1998)	200	600	126	122	114	101	99
9	Total Alkalinity as CaCO ₃	mg/l	IS : 3025 Part 23-1986(Reaff:2003)	200	600	145	165	148	134	136
10	Chloride as Cl	mg/l	IS : 3025 Part 32-1988 (Reaff: 2003)	250	1000	18	21	26	22	18
11	Sulphate as SO ₄	mg/l	APHA 22 nd EDI-4500- SO ₄ ²⁻ E	200	400	12	7.8	5.6	6	6.8
12	Fluoride as F	mg/l	APHA 22 nd EDI-4500-F B&D	1	1.5	BDL(<0.1)	BDL(<0.1)	BDL(<0.1)	BDL(<0.1)	BDL(<0.1)
13	Nitrate as NO ₃	mg/l	APHA 22 nd EDI-4500- NO ₃ ⁻ B	45	No relaxation	1.2	1.6	1.2	2.8	2.7



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S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	Permissible Limit	GW1	GW2	GW3	GW4	GW5
14	Ammonia as N-NH ₃	mg/l	APHA 22 nd EDI-4500- NH ₃ B&C	0.5	No relaxation	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)
15	Total Phosphorous	mg/l	IS : 3025 Part 31 1988(Reaff:2002)	Not Specified	Not Specified	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)
16	Sodium as Na	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	Not Specified	Not Specified	22	28	26	26	24
17	Potassium as K	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	Not Specified	Not Specified	2.5	2.2	1.3	2.5	4
18	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	75	200	36	38	38	32	34
19	Magnesium as Mg	mg/l	APHA 22 nd EDITION	30	100	8.5	6.5	4.5	4.7	3.2
20	Iron as Fe	mg/l	IS : 3025 Part 53-2003	0.3	No relaxation	0.1	1.1	1	1.2	1
21	Phenolic compounds as Phenol	mg/l	APHA 22 nd EDN 5530 B,C,D	0.001	0.002	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
22	Manganese as Mn	mg/l	APHA 22 nd EDN - 3500-Mn D	0.1	0.3	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)
23	Copper as Cu	mg/l	IS:3025 Part 42 (Reaff:2003)	0.05	1.5	BDL(< 0.03)	BDL(< 0.03)	BDL(< 0.03)	BDL(< 0.03)	BDL(< 0.03)
24	Mercury as Hg	mg/l	APHA 22 nd EDN - 3112B	0.001	No relaxation	BDL(< 0.001)	BDL(< 0.001)	BDL(< 0.001)	BDL(< 0.001)	BDL(< 0.001)
25	Cadmium as Cd	mg/l	APHA 22 nd EDN - 3113 B	0.003	No relaxation	BDL(< 0.003)	BDL(< 0.003)	BDL(< 0.03)	BDL(< 0.003)	BDL(< 0.003)
26	Total Arsenic as As	mg/l	APHA 22 nd EDN - 3113 B	0.01	0.05	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)



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S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	Permissible Limit	GW1	GW2	GW3	GW4	GW5
27	Cyanide as CN	mg/l	APHA 22 nd EDN - 4500-CN E	0.05	No relaxation	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)
28	Lead as Pd	mg/l	APHA 22 nd EDN - 3113 B	0.01	No relaxation	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)
29	Zinc as Zn	mg/l	APHA 22 nd EDN - 3111 B	5	15	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
30	Total Chromium as Cr	mg/l	APHA 22 nd EDN - 3113 B	0.05	No relaxation	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)
31	Nickel	mg/l	APHA 22 nd EDN - 3113 B	0.02	No relaxation	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)
32	Selenium as Se	mg/l	APHA 22 nd EDN - 3113B	0.01	No relaxation	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)
33	Aluminium as Al	mg/l	APHA 22 nd EDN - 3500-Al-B 2012	0.03	0.2	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
34	Total Coliform Count	MPN/ 100ml	IS 10500 – 1622 (1981) (Reaff – 2003)	Absent	Absent	Absent	Absent	Absent	Absent	Absent
35	Faecal Coliform Count	MPN/ 100ml	IS 10500 – 1622 (1981)(Reaff – 2003)	Absent	Absent	Absent	Absent	Absent	Absent	Absent



Part 2

S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	Permissible Limit	GW6	GW7	GW8
1	Colour	Hazen	APHA 22nd Edition	5	15	1	1	2
2	Odour	-	APHA 22nd Edition	Agreeable	Agreeable	No Odour Observed	No Odour Observed	No Odour Observed
3	Temperature	°C	---	Not Specified	Not Specified	25.3	26.1	25.3
4	pH at 25°C	-	IS : 3025 Part 11- 1983 (Reaff: 2002)	6.5-8.5	No relaxation	7.39	6.77	8.01
5	Conductivity at 25 °C	µS/cm	IS : 3025 Part 14- 1984 (Reaff: 2002)	Not Specified	Not Specified	235	348	314
6	Turbidity	NTU	IS : 3025 Part 10-1984 (Reaff: 2002)	1	5	0.7	0.8	BDL(< 0.5)
7	Total Dissolved Solids	mg/l	IS : 3025 Part 16-1984 (Reaff: 2003)	500	2000	158	224	203
8	Total Hardness as CaCO ₃	mg/l	IS : 3025 Part 21-1983 (Reaff: 1998)	200	600	106	134	158
9	Total Alkalinity as CaCO ₃	mg/l	IS : 3025 Part 23- 1986(Reaff:2003)	200	600	152	155	174
10	Chloride as Cl	mg/l	IS : 3025 Part 32-1988 (Reaff: 2003)	250	1000	21	24	25
11	Sulphate as SO ₄	mg/l	APHA 22nd EDI-4500- SO ₄ ²⁻ - E	200	400	5.5	9.2	18.9
12	Fluoride as F	mg/l	APHA 22nd EDI-4500-F B&D	1	1.5	BDL(<0.1)	BDL(<0.1)	0.19
13	Nitrate as NO ₃	mg/l	APHA 22nd EDI-4500- NO ₃ ⁻ - B	45	No relaxation	2.1	2.9	1.1
14	Ammonia as N-NH ₃	mg/l	APHA 22nd EDI-4500- NH ₃ B&C	0.5	No relaxation	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)
15	Total Phosphorous	mg/l	IS : 3025 Part 31 1988(Reaff:2002)	Not Specified	Not Specified	BDL(< 0.05)	BDL(< 0.05)	0.09
16	Sodium as Na	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	Not Specified	Not Specified	29	28	23
17	Potassium as K	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	Not Specified	Not Specified	2.4	2.2	4.2



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S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	Permissible Limit	GW6	GW7	GW8
18	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	75	200	36	42	52
19	Magnesium as Mg	mg/l	APHA 22nd EDITION	30	100	3.6	6.5	6.7
20	Iron as Fe	mg/l	IS : 3025 Part 53-2003	0.3	No relaxation	0.5	0.67	0.11
21	Phenolic compounds as Phenol	mg/l	APHA 22nd EDN 5530 B,C,D	0.001	0.002	BDL(<0.001)	BDL(<0.001)	BDL(<0.001)
22	Manganese as Mn	mg/l	APHA 22nd EDN -3500-Mn D	0.1	0.3	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)
23	Copper as Cu	mg/l	IS:3025 Part 42 (Reaff:2003)	0.05	1.5	BDL(< 0.03)	BDL(< 0.03)	BDL(< 0.03)
24	Mercury as Hg	mg/l	APHA 22nd EDN -3112B	0.001	No relaxation	BDL(< 0.001)	BDL(< 0.001)	BDL(< 0.001)
25	Cadmium as Cd	mg/l	APHA 22nd EDN -3113 B	0.003	No relaxation	BDL(< 0.003)	BDL(< 0.003)	BDL(< 0.003)
26	Total Arsenic as As	mg/l	APHA 22nd EDN -3113 B	0.01	0.05	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)
27	Cyanide as CN	mg/l	APHA 22nd EDN -4500-CN E	0.05	No relaxation	BDL(< 0.05)	BDL(< 0.05)	BDL(< 0.05)
28	Lead as Pd	mg/l	APHA 22nd EDN -3113 B	0.01	No relaxation	BDL(< 0.01)	BDL(< 0.01)	BDL(< 0.01)
29	Zinc as Zn	mg/l	APHA 22nd EDN -3111 B	5	15	BDL(<0.05)	BDL(<0.05)	BDL(<0.05)
30	Total Chromium as Cr	mg/l	APHA 22nd EDN -3113 B	0.05	No relaxation	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)
31	Nickel	mg/l	APHA 22nd EDN -3113 B	0.02	No relaxation	BDL(< 0.02)	BDL(< 0.02)	BDL(< 0.02)
32	Selenium as Se	mg/l	APHA 22nd EDN -3113B	0.01	No relaxation	BDL(<0.01)	BDL(<0.01)	BDL(<0.01)



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S. No	Parameters	Unit	Test Method	Limit as per IS 10500 : 2012	Permissible Limit	GW6	GW7	GW8
33	Aluminium as Al	mg/l	APHA 22nd EDN -3500-Al-B 2012	0.03	0.2	BDL(<0.03)	BDL(<0.03)	BDL(<0.03)
34	Total Coliform Count	MPN/ 100ml	IS 10500 – 1622 (1981) (Reaff – 2003)	Absent	Absent	Absent	Absent	Absent
35	Faecal Coliform Count	MPN/ 100ml	IS 10500 – 1622 (1981)(Reaff – 2003)	Absent	Absent	Absent	Absent	Absent

Source: ABC Techno Labs India Pvt. Ltd.

Date of sampling: 2nd January 2019



B. Surface Water

The collected surface water samples were analyzed and results of surface water analysis are given in Table 3.16.

- Colour: The colour of surface water samples was found in the range of 5 Hazen unit to 16 Hazen unit.
- Odour: Surface water samples were found odourless except SW6.
- Turbidity: The turbidity of surface water samples was found in the range 6.3 to 18.5 NTU.
- pH: The pH value of all surface water samples ranges from 6.8 to 8.21.
- Electrical Conductivity: Electrical conductivity in surface water samples ranges from 278 $\mu\text{S}/\text{cm}$ to 389 $\mu\text{S}/\text{cm}$.
- Total Dissolved Solids (TDS): The TDS in surface water samples range from 182 to 251 mg/l.
- Total Hardness: The total hardness of surface water samples range between 28 mg/l to 248 mg/l.
- Iron: The iron content in all surface water sample ranges from 1.03 to 12.8 mg/l.
- Chloride: The chloride content in surface water samples range from 7.9 mg/l to 82.2 mg/l.
- Sulphate: Sulphate content in surface water sample ranges from 4.61 to 38.6 mg/l.
- Nitrate: Nitrate content in surface water samples ranges from 0.16 mg/l to 14.6 mg/l.
- Calcium: The Calcium content in surface water samples range from 7.7 mg/l to 62 mg/l.
- Magnesium: The Magnesium content in surface water samples range from 1.7 mg/l to 22.3 mg/l.
- Fluoride: Fluoride content in surface water samples ranges from BDL(<0.1mg/l) to 0.62 mg/l.
- Sodium: Sodium content in surface water samples ranges from 12.3 mg/l to 52.6 mg/l.
- Potassium: Potassium content in surface water samples ranges from 5.6 mg/l to 22.8 mg/l.



- Zinc: Zinc content in all surface water samples found to be BDL(<0.02mg/l) to 2.51 mg/l.
- Bio-chemical Oxygen Demand (BOD): The BOD level of the SW samples found to be in the range between 2 mg/l to 8.3 mg/l.
- Chemical Oxygen Demand (COD): The COD level of the SW samples found to be in the range between 8.1 mg/l to 32 mg/l.
- Dissolved Oxygen (DO): The DO level of the SW samples found to be in the range between 3.8 mg/l to 5.8 mg/l.
- Total Coliform Count: Total Coliform Count in surface water samples ranges from 6 to 1435 MPN/ 100ml.
- Faecal Coliform: Faecal Coliform in surface water samples ranges from absent to 134 MPN/ 100ml.



Table 3.16: Results for Surface Water Analysis

S.No	Parameters	Unit	Test method	SW1	SW2	SW3	SW4	SW5	SW6	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS – C	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS –E
1	Temperature	°C	APHA 22 ND EDITION	25.6	25.7	25.3	25.2	25.4	26.1		
2	Colour	Hazen	APHA 22 ND EDITION	5	5	6	7	10	16	300	-
3	Odour	-	APHA 22 ND EDITION	No Odour Observed	No Odour Observed	No Odour Observed	No Odour Observed	Odour Observed	Odour Observed	-	-
4	pH at 25°C	-	IS : 3025 Part 11-1983 (Reaff: 2002)	6.8	7.02	7.1	7.17	7.53	8.21	-	-
5	Electrical Conductivity	µS/cm	IS : 3025 Part 14-1984 (Reaff: 2002)	389	367	312	320	278	316	-	2250
6	Turbidity	NTU		6.3	6.6	7.4	7.2	10.2	18.5		
7	Total Dissolved Solids	mg/l	IS : 3025 Part 16-1984 (Reaff: 2003)	251	236	202	208	182	206	1500	2100
8	Total Hardness as CaCO ₃	mg/l	IS : 3025 Part 21-1983 (Reaff: 1998)	28	32	31	38	188	248	-	-
9	Total Alkalinity as CaCO ₃	mg/l	IS : 3025 Part 23-1986(Reaff:2003)	45.6	51.8	43.7	62.4	166	185	-	-
10	Chloride as Cl	mg/l	IS : 3025 Part 32-1988 (Reaff: 2003)	7.9	8.5	9.3	9.2	76	82.2	600	600
11	Sulphate as SO ₄	mg/l	APHA 22 ND EDITION -4500- SO ₄ ²⁻ E	4.61	7.32	12.3	16.1	42	38.6	400	1000
12	Fluoride as F	mg/l	APHA 22 ND EDITION -4500-F B&D	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	BDL (<0.1)	0.37	0.62	1.5	-
13	Nitrate as NO ₃	mg/l	APHA 22 ND EDITION -4500- NO ₃ ⁻ B	0.16	0.19	0.21	0.24	7.8	14.6	50	-



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S.No	Parameters	Unit	Test method	SW1	SW2	SW3	SW4	SW5	SW6	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS - C	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS -E
14	Ammonia as NH ₃	mg/l	APHA 22 ND EDITION -4500- NH ₃ B&C	BDL	BDL	BDL	BDL	0.65	1.78	-	-
15	Phosphate as PO ₄	mg/l	IS : 3025 Part 31-1988 (Reaff:2002)	0.07	0.06	0.09	0.12	2.44	2.32	-	-
16	Sodium as Na	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	13.4	15.6	12.3	18	56	52.6	-	-
17	Potassium as K	mg/l	IS : 3025 Part 45-1993 (Reaff:2003)	5.6	6.7	8.6	9.2	32	22.8	-	-
18	Calcium as Ca	mg/l	IS : 3025 Part 40-1991 (Reaff:2003)	7.7	8.9	7.09	9.2	48	62	-	-
19	Magnesium as Mg	mg/l	APHA 22 ND EDITION	1.7	1.9	3.2	3.6	16.4	22.3	-	-
20	Iron as Fe	mg/l	IS : 3025 Part 53-2003	1.03	1.06	1.46	1.63	8.81	12.8	50	-
21	Manganese as Mn	mg/l	APHA 22 nd EDN - 3500-Mn D	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	1.12	3.21	-	-
22	Anionic Surfactants as MBAS	mg/l	APHA 22 ND EDITION	BDL (<0.025)	BDL (<0.025)	BDL (<0.025)	BDL (<0.025)	0.12	0.56	-	-
24	Dissolved Oxygen as O ₂	mg/l	IS:3025:Part-38:1989 (Reaff:2003)	4.55	4.7	5.6	5.8	4.1	3.8	4	-
25	Chemical Oxygen Demand	mg/l	IS:3025:Part-58:2006	8.9	8.2	8.1	8.4	24	32	-	-
26	Bio-Chemical Oxygen Demandat 27°C	mg/l	IS:3025:Part-44:1993 (Reaff:2003)	2.3	2.2	2	2.1	4.7	8.3	3	-



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S.No	Parameters	Unit	Test method	SW1	SW2	SW3	SW4	SW5	SW6	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS - C	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS -E
	for 3 days										
27	Aluminum as Al	mg/l	APHA 22 nd EDN - 3500-Al-B 2012	BDL (<0.05)	BDL (<0.05)	BDL (<0.05)	BDL (<0.05)	BDL (<0.05)	BDL (<0.05)	-	-
28	Phenolic compounds as Phenol	mg/l	APHA 22 nd EDN 5530 B,C,D	BDL (<0.001)	BDL (<0.001)	BDL (<0.001)	BDL (<0.001)	BDL (<0.001)	BDL (<0.001)	-	-
29	Copper as Cu	mg/l	IS:3025 Part 42 (Reaff:2003)	BDL (< 0.03)	BDL (< 0.03)	BDL (< 0.03)	BDL (< 0.03)	0.15	0.19	-	-
30	Mercury as Hg	mg/l	APHA 22 nd EDN - 3112B	BDL (< 0.001)	BDL (< 0.001)	BDL (< 0.001)	BDL (< 0.001)	BDL (< 0.001)	BDL (< 0.001)	-	-
31	Cadmium as Cd	mg/l	APHA 22 nd EDN - 3113 B	BDL (< 0.003)	BDL (< 0.003)	BDL (< 0.003)	BDL (< 0.003)	BDL (< 0.003)	BDL (< 0.003)	-	-
32	Selenium as Se	mg/l	APHA 22 nd EDN - 3113B	BDL (<0.01)	BDL (<0.01)	BDL (<0.01)	BDL (<0.01)	BDL (<0.01)	BDL (<0.01)	-	-
33	Total Arsenic as As	mg/l	APHA 22 nd EDN - 3113 B	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	-	-
34	Cyanide as CN	mg/l	APHA 22 nd EDN - 4500-CN E	BDL (< 0.05)	BDL (< 0.05)	BDL (< 0.05)	BDL (< 0.05)	BDL (< 0.05)	BDL (< 0.05)	-	-
35	Lead as Pd	mg/l	APHA 22 nd EDN - 3113 B	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	BDL (< 0.01)	-	-
36	Zinc as Zn	mg/l	APHA 22 nd EDN - 3111 B	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	BDL (<0.02)	1.63	2.51	-	-
37	Total Chromium as Cr	mg/l	APHA 22 nd EDN - 3113 B	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	-	-
38	Nickel	mg/l	APHA 22 nd EDN - 3113 B	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	BDL (< 0.02)	-	-



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S.No	Parameters	Unit	Test method	SW1	SW2	SW3	SW4	SW5	SW6	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS - C	Tolerance Limits For Inland Surface Waters, (IS: 2296-1982) CLASS -E
39	Total Coliform	MPN/100ml	IS 10500 - 1622 (1981) (Reaff - 2014)	6	10	12	8	1137	1435	5000	-
40	E coli	MPN/100ml	IS 10500 - 1622 (1981)(Reaff - 2014)	Absent	Absent	2	5	54	134	-	-

Source: ABC Techno Labs India Pvt. Ltd.

Date of sampling: 2nd January 2019

3.13 SOIL ENVIRONMENT

3.13.1 SOIL ANALYSIS

The present study of the soil quality establishes the baseline characteristics and this will help in future in identifying the incremental concentrations if any, due to the operation of the proposed formaldehyde plant. The sampling locations have been identified with the following objectives;

- To determine the baseline soil characteristics of the study area and
- To determine the impact of the proposed formaldehyde plant on soil characteristics

Six locations within the study area were selected for soil sampling. At each location, soil samples were collected from three different depths viz., 30 cm, 60 cm and 100 cm below the surface. The samples were analyzed for physical and chemical characteristics.

The details of the soil sampling location are presented in Table 3.17. The results are presented in Table 3.18 and compared with Standard Soil Classification presented in Table 3.19.

Table 3.17: Soil Sampling Locations

Location Code	Sample location	Geographical location	
		Latitude	Longitude
S1	Near Project site	26°19'46.25"N	90°30'29.19"E
S2	Maligaon Pahar	26°21'25.31"N	90°31'31.45"E
S3	Dhantola	26°21'24.20"N	90°28'21.98"E
S4	Rangamati	26°19'54.08"N	90°26'19.27"E
S5	Kayetpara pt 1	26°19'6.53"N	90°28'30.13"E
S6	Oudubi	26°15'45.81"N	90°29'25.63"E

Source: ABC Techno Labs India Pvt. Ltd.

3.13.2 RESULTS

The results of the soil analysis are tabulated in Table 3.18. Standard soil classification is given in Table 3.19.



Table 3.18: Soil Quality Results

Sl. No.	Parameters	Unit	Test Method	S1	S2	S3	S4	S5	S6
1	pH (1:5 Soil Suspension)	-	IS -2720(Part 26) 1987(RA 2011)	7.44	7.42	7.58	7.63	8.22	8.1
2	Moisture	%		1	0.83	1.32	1.15	1.2	1.67
3	Porosity	%		32.9	35.5	33.2	27.9	29.3	34.7
4	Bulk Density	g/cc	FAO Chapter 3, ABCTL/SOIL/SOP 1	1.4	1.45	1.36	1.69	1.53	1.51
5	Electrical conductivity (1:5 Soil Suspension)	mS/cm	IS -14767:2000 (RA 2010)	0.346	0.294	0.513	0.302	0.156	0.331
6	Available Nitrogen	kg/ha	IS -14684:1999, Reaff:2008	187.2	162.9	170.5	194.3	179.8	188.4
7	Available Phosphorous	kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 2	105	114	72	102	87	120
8	Available Potassium	kg/ha	FAO Chapter 3, ABCTL/SOIL/SOP 7	103.4	143.2	175.8	184.3	167	151
9	Exchangeable Calcium as Ca	m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 4	28.6	66.2	40.9	10.3	30.2	18.5
10	Exchangeable Magnesium as Mg	m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 5	10.1	9.7	12.4	11.7	10.5	9.8
11	Exchangeable Sodium as Na	m.eq/100g	FAO Chapter 3, ABCTL/SOIL/SOP 6	4.23	3.19	4.11	5.51	4.02	3.88
12	Organic matter	(%)	IS 2720 (Part 22) :1972, Reaff:2010	1.41	1.28	1.52	1.34	1.44	1.31
13	Texture Classification	-	Robinson Pipette Method	Sandy loam	Sandy Loam	Sandy loam	Silty Clay Loam	Silty Clay Loam	Sandy loam
14	Sand	(%)		49.8	51.5	56.9	42.6	45.4	58.1
15	Clay	(%)		28.6	29.6	22.6	33.2	32.5	22.3
16	Silt	(%)		21.6	18.9	20.5	24.2	22.1	19.6

Source: ABC Techno Labs India Pvt. Ltd.

Date of sampling: 3rd January 2019

Table 3.19: Standard Soil Classification

Chemical Parameters	Ranking				
	Very Low	Low	Moderate	High	Very High
pH	<4, very Strongly Acidic	4-5, Strongly Acidic	5-8, Ideal for Plant Growth	8-9 Strongly Basic	>9 Very Strongly Basic
Electrical conductivity (μS/cm)	<2000, Non-saline	2000-4000 Saline	4000-8000 Moderately Saline	8000-16000 Highly Saline	>16000 Extremely Saline
Total Nitrogen (%)	<0.05 Very Low	0.05-0.15 Low	0.15-0.25 Moderate	0.25-0.5 High	>0.5 Very High
Total Phosphorous (mg/kg)	<5 Very Low	5-10 Low	10-30 Moderate	30-60 High	>60 Very High
Sodium (mg/kg)	-	<200 Non Sodic	200-500 Moderate	>500 Sodic	
Potassium (mg/kg)	-	<150 Low	150-250 Moderate	250-800 High	>800 Very High
Calcium (mg/kg)	-	<1000 Low	1000-2000 Moderate	>2000 High	-
Magnesium (mg/kg)	<40 Very Low	40-100 Low	100-300 Moderate	>300 High	-
% Organic Matter	0.5-1.0 Very Low	1.0-2.0 Low	2.0-3.0 Moderate	3.0-5.0 High	>5 Very High

3.13.3 OBSERVATION

- The soil results were compared to soil standards. It has been observed that the pH of the soil was ranging from 7.42 to 8.22 indicating the soils are Moderate in nature.
- The conductivity of the soil ranges from 0.156 to 0.513 mS/cm. Since the EC value is less than 2000 μS/cm, the soil is said to be non saline in nature.
- The texture of the soil sample is predominantly Sandy Loam in most of the places with Silty Clay Loam in some locations. Sand percentage ranges from 42.6% to 58.1%.
- Soil organic content varied from 1.28 to 1.52 %, which indicates the low level of organic matter.
- The available nitrogen content ranges between 162.9 to 194.3 kg/Ha in the locality and the value of phosphorus content varies between 72 to 120 kg/Ha. This indicates that the soil has very high quantities of Nitrogen and Phosphorus.
- The potassium content varies from 143.2 to 167 kg/Ha, which indicates that the soils have very high quantities of potassium.



From the above observations, it was found that the soil in the Study area shows moderate fertility.

3.14 ECOLOGICAL ENVIRONMENT

Ecosystem shows complex inter-relationships between biotic and abiotic components leading to dependence, competition and mutualism. Biotic components comprise both plant and animal communities, interacting not only within and between themselves but also with the abiotic components of the environment. The map showing the bio-geographic provinces of India is shown in Figure 3.13.

Generally, biological communities are good indicators of climatic and edaphic factors because of their strong relationships with them. The studies on the biological aspects of the ecosystem are important in Environment Impact Assessment studies for the suitability of natural flora & fauna. Information on the impact of environment stress on the community structure serves as an inexpensive and efficient early warning system to check the damage on a particular ecosystem. The biological environment includes mainly terrestrial and aquatic ecosystem.

A change in the composition of biotic communities under stress is reflected through a change in the distribution pattern, density, diversity, frequency, dominance and abundance of natural species of fauna and flora existing in the ecosystem. These changes over a span of times can be quantified and related to the existing environment.

3.14.1 OBJECTIVES OF ECOLOGICAL STUDIES

The objectives of ecological study during the study period of EIA study may be outlined as follows:

- To characterize the environmental components like land, water, flora and fauna;
- To understand their present status;
- To understand carrying capacity of the ecosystem;
- To assess present bio-diversity; and
- To identify susceptible and sensitive areas.

This study has been carried out during the summer season during December 2018 of study period for the purpose of providing an independent and comprehensive baseline assessment of the flora, terrestrial vertebrate, aquatic fauna and associated habitat values of the site and within 10 km radius of project site and a subsequent assessment of

potential ecological impacts. The study area falls under North East category as far as the Indian biogeographical zones (Rodger, Panwar, Mathur 2000) are concerned. Under the biogeographical provinces, the study area falls under the category of **9A- Brahmaputra Valley**. The study area has some Reserved forest Bharirab RF (E), Khagarpur RF (E), Bahalpur RF (SW), Rakhal Thakur RF (W). From the primary observation, the tree species recorded in the plantation area were *Acacia nilotica*, *Cocos nucifera*, *Azadirachta indica*, *Cassia fistula*, *Psidium guajava* etc.

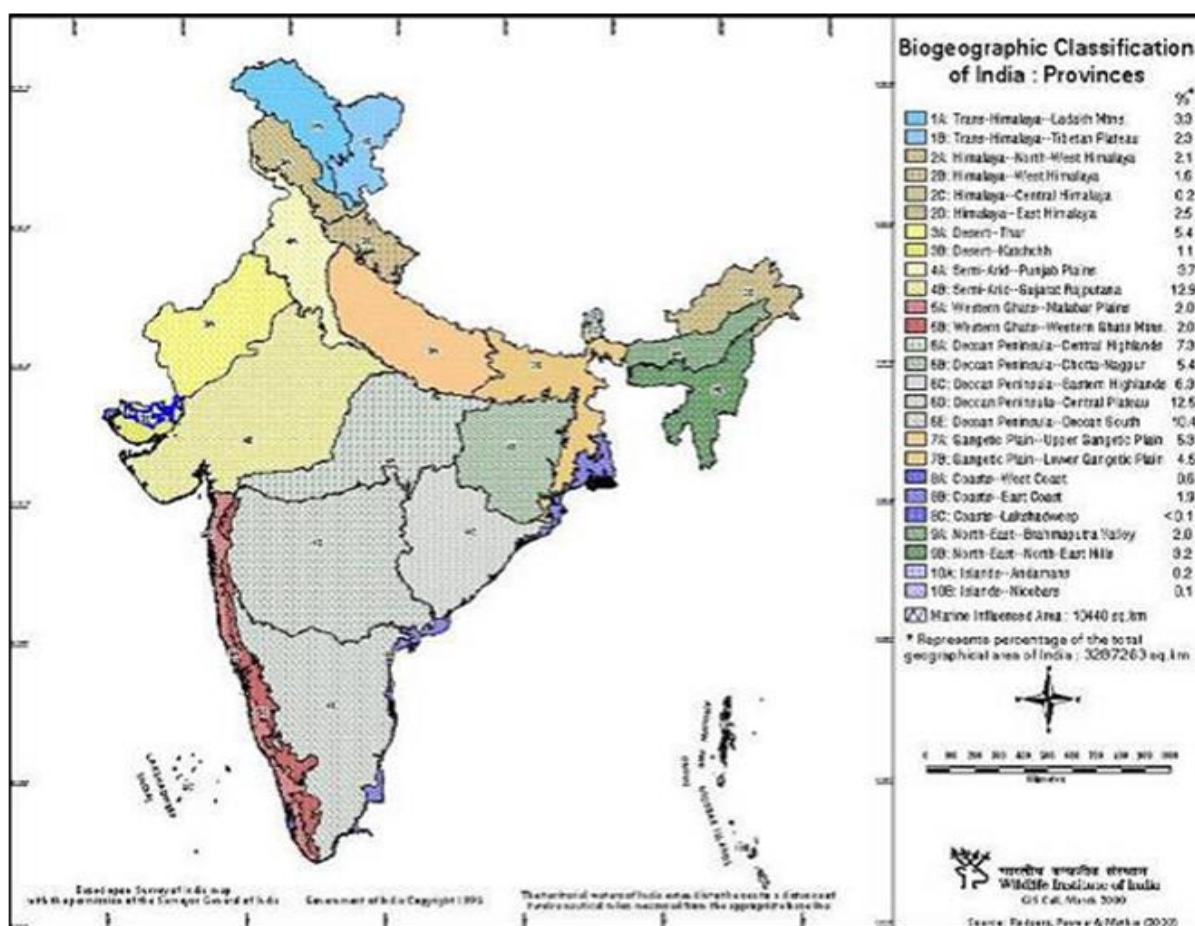


Figure 3.14: Map showing the Bio-geographic Provinces of India

The detailed ecological assessment of the study area has been carried out with the following objectives:

- To establish the present status of ecological conditions surrounding the proposed formaldehyde manufacturing plant;
- To study the existing anthropogenic stresses on the prevailing ecosystem.
- To identify and predict the likely impacts on the local ecosystem from the proposed formaldehyde manufacturing plant activities;



- To list out floral species, terrestrial vertebrate and aquatic flora and fauna present within the study area, and significance status under The Wildlife (Protection) Act, 1972;
- To define ecological/conservation status of each species as per IUCN categories (Red Data List).
- To formulate mitigatory measures and a sustainable Environmental Management Plan (EMP) basing upon the likely impacts.

During survey, following aspects were considered for ecological studies:

- Assessment of present status of flora and fauna;
- Identification of rare and endangered species of plants and animals (if any);
- Identification of ecologically sensitive areas within the study area;
- Assessment of migratory route of wildlife (if any); and
- Assessment of Aquatic Ecology with specific reference to aquatic birds and fishery resources.

3.14.2 METHODOLOGY ADOPTED FOR THE STUDY

Terrestrial investigations for flora and fauna records were collected by random field survey and a checklist was prepared. During field survey, discussions with the local people were carried-out to collect information related to local biodiversity in and around the villages. The ecological status of the study area has been assessed based on the following methodology:

- Primary field surveys to establish primary baseline of the study area;
- Compilation of secondary information available in published literatures/ working plan was referred from State Forest Department.
- Site Verification and finalization in consultation with Project proponent, local inhabitants.
- Vegetation analysis through quadrature method using sampling plots of 20m x 20m.
 - ✓ 20m X 20m for tree species (record trees >20 cm in GBHOB /species);
 - ✓ 5m X 5m [four plots] was laid along diagonals wherein all the shrubs recorded.
 - ✓ 1m X 1m [five plots], one at the centre and four at one per quadrature] was laid and herbs, grasses in five plots to be noted.



❑ Protocol for Sampling through Quadrature Method

The standard method chosen for the assessment of plant diversity involves the use of square vegetation quadrates ('plots'). These quadrates were used to measure most vegetation attributes in most vegetation types. Quadrature locations marked by pegs or sometimes by grid system.

The study area is demarcated as 10 km surrounding of proposed formaldehyde manufacturing plant based on the MoEF&CC guidelines. After demarcation, the areas which are approximately true representative of the whole area, and were sampled for the identification of plant and animal species.

A. Floral Study

The assessment of the flora of the study area is done by an extensive field survey of the area.

- Plants species were identified based on their specific diagnostics characters of family, genus and species using available floral, other related literature.
- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.
- Qualitative analysis of vegetation is made by two different methods such as floristic (by simple studying various genera and species of various plant groups i.e. herbs, shrubs, trees etc).

B. Phyto-sociology

A nested quadrates technique was used for sampling the vegetation. All the plots sampled were representative of most common types, sampling 20m x 20m for trees and 5m x 5m for shrubs, 1m x 1m for herbs square meter quadrates were laid. Selection of sites for sampling of vegetation is done by random sampling procedure. However, in general to study the phytosociological attributes, quadrates of 20 m × 20 m size for tree species are randomly laid out at each site at different elevations. Then the observation on the following parameters is recorded:

1. Name of the species.
2. Number of the occurrence of each species in each quadrature.

The field data for phytosociological studies was collected in the study area. Vegetation data was quantitatively analyzed for frequency, density and dominance using standard methodologies. The relative values of frequency, density, and dominance of all the

recorded species was summed up to represent Importance Value Index (IVI). Not only IVI facilitates comparison between species of a community, but also the data collected on dispersion, number and cover can be profitably used in comparing the vegetation structure of two or more stands or of the same stand over a period of time. Vegetation structure with respect of varying environmental factors can also be studied through such studies in sets of varying environmental conditions. The IVI was determined as the sum of the relative frequency, relative density and relative dominance. It thus incorporate three important parameters that measures of productivity and diversity of every species therefore.

$$IVI = \text{Relative frequency} + \text{Relative density} + \text{Relative dominance}$$

C. Faunal Study

Ground surveys are carried out by trekking the study area for identification of important animal groups such as birds, mammals and reptiles for sampling of animals through the following methods.

- For sampling birds/ avifauna 'point sampling' along the fixed transects (foot trails) were done to record all the species of birds with the help of binoculars; field guides and photography for more than 1 hour on each transect (n=4).
- For sampling mammals, 'direct count on open width (20 m) transect' were used on the same transects. Besides, information on recent sightings/records of mammals by the locals was also collected from the study areas.
- 'Reptiles' mainly lizards were sampled by 'direct count on open width transects'.
- Secondary information collected from local villagers, published government data etc.

❑ List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972

Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN. Various methods used for study animals are as follows:

1. Point Survey Method: Observations were made at each site for 15-20 min duration.
2. Road Side Counts: The observer travelled by motor vehicles from site to site and all sightings were recorded.

3.14.3 SAMPLING LOCATIONS

The ecology and diversity survey was conducted in 6 sampling locations within the 10 km radius of the proposed formaldehyde manufacturing plant. It is observed that human settlements present within the study area and many of villages had ponds and bils harboring moderate diversity of water birds. During site assessment several floral species encountered within the study area. The Following species were enlisted within the study area during the field visits as given in Table 3.20.

Table 3.20: Details of locations for plot survey

Sl.No.	Name of village	Plot No.	Lattitude	Longitude
1	Near Dhaknabari	EB1	26°19'38.58"N	90°30'10.95"E
2	Near Bahalpur	EB2	26°18'46.83"N	90°27'57.79"E
3	Near Oudubi	EB3	26°15'58.02"N	90°29'9.62"E
4	Near Sakumura	EB4	26°18'23.75"N	90°34'13.84"E
5	Near Khagarpur	EB5	26°22'32.34"N	90°33'18.86"E
6	Near Dhantola	EB6	26°21'30.83"N	90°28'41.00"E

Source: ABC Techno Labs India Pvt. Ltd.

3.14.4 FLORA IN THE STUDY AREA

The type of soil is sandy, highly permeable, grayish brown in colour. Apart from agriculture locals of the all the villages were involved in livestock keeping and each of the individual had a substantial number of cattle. However there is no sanctuary or national park within study area of 10 km radius. There is no notified/ protected ecologically sensitive area including national park, sanctuary, Elephant/ Tiger reserves existing in the study area covering 10 km radial distance.

Most of the study area is covered with agriculture lands and the dominant agriculture crops in these region are rice (Sali, boro and ahu), black gram, arahar, lentil, pea, Jute, Mesta, Rapeseed and Mustard, Sesamum, Buckwheat, linseed etc.

Dominant tree species in the farmland was dominated *Acacia nilotica*, *Cocos nucifera*, *Azadirachta indica*, *Cassia fistula*, *Psidium guajava*; Trees in the study area are restricted to homestead/ farmland /road side plantation.

Most dominant shrubs in the core zone and buffer zone were *Lantana camara*, *Ipomoea fistulosa*, *Bambusa pallid*, *Bambusa tulda*. Among the herb species observed are *Tridax procumbens*, *Mimosa pudica*, *Imperata arundinacea* *Cynodon dactylon*, *Saccharum spontaneum* etc.

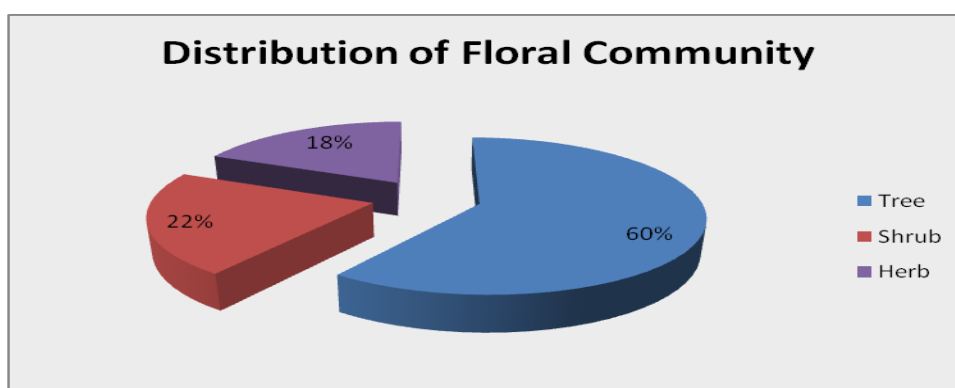
The list of flora observed in the buffer zone is given below:

Table 3.21: List of Flora observed in the study area

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
Tree				
1	<i>Aegle marmelos</i>	Bel	Rutaceae	Not Assessed
2	<i>Butea monosperma</i>	Palas	Fabaceae	Not Assessed
3	<i>Borassus flabellifer</i>	Taal	Arecaceae	Endangered
4	<i>Azadirachta indica</i>	Neem	Meliaceae	Not Assessed
5	<i>Acacia nilotica</i>	Babla	Mimosaceae	Not Assessed
6	<i>Acacia auriculoformis</i>	Setbabul	Mimosaceae	Not Assessed
7	<i>Bauhinia acuminata</i>	Kotora	Fabaceae	Least concern
8	<i>Cocos nucifera</i>	Dab	Arecaceae	Not Assessed
9	<i>Artocarpus heterophyllus</i>	Kanthal	Moraceae	Not Assessed
10	<i>Anthocephalus cadamba</i>	Kadam	Rubiacea	Not Assessed
11	<i>Delonix regia</i>	Krishnachura	Caesalpiniaceae	Least concern
12	<i>Cassia fistula</i>	Sonal	Leguminosae	Not Assessed
13	<i>Albizia chinensis</i>	Siris	Fabaceae	Not Assessed
14	<i>Areca catechu</i>	Tambul	Arecaceae	Not Assessed
15	<i>Syzygium cumini</i>	Jamun	Myrtaceae	Not Assessed
16	<i>Dalbergia sissoo</i>	Shishoo	Fabaceae	Not Assessed
17	<i>Shorea robusta</i>	Sal	Dipterocarpaceae	Least concern
18	<i>Alstonia scholaris</i>	Chatiwan	Apocynaceae	Least concern
19	<i>Mangifera indica</i>	Aam	Anacardiaceae	Not Assessed
20	<i>Cassia siamea</i>	Minziri	Caesalpiniaceae	Not Assessed
21	<i>Ficus elastica</i>	Atha bor	Moraceae	Not Assessed
22	<i>Terminalia belerica</i>	Bahera	Combretaceae	Not Assessed
23	<i>Annona squamosa</i>	Ata	Annonaceae	Not Assessed
24	<i>Ficus bengalensis</i>	Bot	Moraceae	Not Assessed
25	<i>Psidium guajava</i>	madhuri aam	Myrtaceae	Not Assessed
26	<i>Emblica officinalis</i>	Amloki	Phyllanthaceae	Not Assessed
27	<i>Eucalyptus globulus</i>	Eucalyptus	Myrtaceae	Not Assessed
28	<i>Ficus religiosa</i>	Ahot	Moraceae	Not Assessed
29	<i>Ficus racemosa</i>	Jagya-dimoru	Moraceae	Not Assessed
30	<i>Phyllanthus emblica</i>	Amlokhi	Phyllanthaceae	Not Assessed
31	<i>Gmelina arborea</i>	Gomari	Verbenaceae	Not Assessed
32	<i>Bombax malabaricum</i>	Shimlu	Malvaceae	Not Assessed
33	<i>Saraca indica</i>	Ashok-goch	Leguminosae	Not Assessed
34	<i>Tectona grandis</i>	Segun	Verbenaceae	Not Assessed
35	<i>Barringtonia acutangula</i>	Hizal	Lecythidaceae	Not Assessed
36	<i>Tamarindus indica</i>	Tetul	Leguminosae	Not Assessed
37	<i>Polyalthia longifolia</i>	Debbaru	Anonaceae	Not Assessed
38	<i>Zizyphus jujuba</i>	Kul	Rhamnaceae	Not Assessed
39	<i>Canarium bengalense</i>	Dhup	Burseraceae	Not Assessed
Shrubs				

Sl.No	Scientific Name	Common name	Family	IUCN Conservation Status
1	<i>Xanthium stromarium</i>	Gokru	Tiliaceae	Not Assessed
2	<i>Cassia tora</i>	Medeluwa	Caesalpiniaceae	Not Assessed
3	<i>Calotropis procera</i>	Aakanda	Asclepiadaceae	Not Assessed
4	<i>Zizyphus rugosa</i>	Barai	Rhamnaceae	Not Assessed
5	<i>Ipomoea fistulosa</i>	Morning Glory	Convolvulaceae	Not Assessed
6	<i>Hibiscus rosa-sinensis</i>	Jaba Phool	Malvaceae	Not Assessed
7	<i>Bambusa pallida</i>	Bans	Gramineae	Not Assessed
8	<i>Bambusa tulda</i>	Deva Bans	Gramineae	Not Assessed
9	<i>Bambusa offinis</i>	Kaich Bans	Gramineae	Not Assessed
10	<i>Hyptis suaveolens</i>	Buno tulsi	Lamiaceae	Not Assessed
11	<i>Adhatoda vasica</i>	Basuti	Acanthaceae	Not Assessed
12	<i>Hymenodictyon excelsum</i>	Ban kadam	Rubiaceae	Not Assessed
13	<i>Lantana camara</i>	Wild Sage	Verbenaceae	Not Assessed
14	<i>Musa paradisiaca</i>	Kela	Musaceae	Not Assessed
Herbs & Grasses				
1	<i>Sida acuta</i>	Boriala	Malvaceae	Not Assessed
2	<i>Catharanthus roseus</i>	Nayantara	Apocynaceae	Not Assessed
3	<i>Cynodon dactylon</i>	Bermuda grass	Poaceae	Not Assessed
4	<i>Mucuna pruriens</i>	Bandar-hola	Fabaceae	Not Assessed
5	<i>Dendrocalamus sps</i>	Pocha	Poaceae	Not Assessed
6	<i>Andropegon squarrouus</i>	Binna	Coramineae	Not Assessed
7	<i>Tridax procumbens</i>	Tridax Daisy	Asteraceae	Not Assessed
8	<i>Mimosa pudica</i>	Lajjabati	Fabaceae	Least Concern
9	<i>Datura metal</i>	Dhuttra	Solanaceae	Not Assessed
10	<i>Imperata arundinacea</i>	Ooloo	Poaceae	Not Assessed
11	<i>Saccharum spontaneum</i>	Khagra	Coramineae	Least Concern
12	<i>Desmodium triflorum</i>	Creeping Tickfoil	Fabaceae	Least Concern
Climbers				
1	<i>Spatholobus roxburghii</i>	Hati bandhalata	Fabaceae	Least Concern
2	<i>Bauhinia vahlii</i>	Sonbel	Caesalpiniaceae	Not Assessed
3	<i>Tinospora cordifolia</i>	Guduchi	Menispermaceae	Not Assessed

Source: ABC Techno Labs India Pvt. Ltd.



❑ Economically Important Flora of the study area

Agricultural & Horticultural Crops: The major field crops are rice (Sali, boro and ahu) black gram, arahar, lentil, pea, Jute, Mesta, Rapeseed and Mustard, Sesamum, Buckwheat, linseed etc. Horticultural crops including vegetables like cabbage cauliflower, brinjal, tomato, potato, chilly, cucumber, onion, garlic, turmeric, ginger etc are also grown. Important plantation crops are Areca nut, Coconut, Bamboo etc. Banana, pineapple, citrus etc. are major commercially cultivated fruit crops of the district.

Rare and Endangered Floral Species: Among the enumerated flora in the study area, none of them were assigned any threat category by RED data book of Indian Plants, (Nayar and Sastry, 1990) and Red list of threatened Vascular plants (IUCN, 2010, BSI, 2003)'. No species observed in the study region comes under the category of threatened species out of 76 plant species.

❑ Phytosociological Analysis

Regeneration of trees in the study area is better than herbs and shrubs. The density and composition of vegetation is more near the forest area whereas low in the agricultural and village areas. Grasses mainly cover open degraded land. Herbs and shrubs are abundant mostly during monsoon whereas during the summer land turns dry.

Phytosociological parameters, such as, density, frequency, basal area and importance value index of individual species were determined in randomly placed quadrats of different sizes in the study area. Relative frequency, relative basal area and relative density were calculated and the sum of these three represented Importance Value Index (IVI) for various species. For shrubs, herbs and seedlings, the IVI was calculated by summing up relative frequency, relative density and relative abundance.

Sample plots were selected in such a way to get maximum representation of different types of vegetation and plots were laid out in different part of the study area of 10 km radius. Analysis of the vegetation will help in determining the relative importance of each species in the study area and to reveal if any economically valuable species is threatened in the process. Phytosociological analysis of tree species is shown in Table 3.22.



Table 3.22: Phytosociological Analysis of Tree Species

Sl.No.	Scientific name	Local name	Total No.	Total no. of quad with sp.	Total No. of quad	Density	Relative Density	Frequency %	Relative Frequency	Abundance	Relative Abundance	IVI
Tree Species												
1	<i>Aegle marmelos</i>	Bel	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
2	<i>Butea monosperma</i>	Palas	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
3	<i>Borassus flabellifer</i>	Taal	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
4	<i>Azadirachta indica</i>	Neem	4	4	6	0.001	4.65	66.7	4.9	1.00	0.05	9.58
5	<i>Acacia nilotica</i>	Babla	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
6	<i>Acacia auriculoformis</i>	Setbabul	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
7	<i>Bauhinia acuminata</i>	Kotora	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
8	<i>Cocos nucifera</i>	Dab	6	4	6	0.002	6.98	66.7	4.9	1.50	0.07	11.92
9	<i>Artocarpus heterophyllus</i>	Kanthal	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
10	<i>Anthocephalus cadamba</i>	Kadam	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
11	<i>Delonix regia</i>	Krishnachura	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
12	<i>Cassia fistula</i>	Sonal	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
13	<i>Albizia chinensis</i>	Siris	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
14	<i>Areca catechu</i>	Tambul	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
15	<i>Syzygium cumini</i>	Jamun	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
16	<i>Dalbergia sissoo</i>	Shishoo	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
17	<i>Shorea robusta</i>	Sal	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
18	<i>Alstonia scholaris</i>	Chatiwan	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
19	<i>Mangifera indica</i>	Aam	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
20	<i>Cassia siamea</i>	Minziri	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
21	<i>Ficus elastica</i>	Atha bor	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79



Sl.No.	Scientific name	Local name	Total No.	Total no. of quad with sp.	Total No. of quad	Density	Relative Density	Frequency %	Relative Frequency	Abundance	Relative Abundance	IVI
22	<i>Terminalia belerica</i>	Bahera	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
23	<i>Annona squamosa</i>	Ata	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
24	<i>Ficus bengalensis</i>	Bot	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
25	<i>Psidium guajava</i>	madhuri aam	5	4	6	0.002	5.81	66.7	4.9	1.25	0.06	10.75
26	<i>Emblia officinalis</i>	Amloki	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
27	<i>Eucalyptus globulus</i>	Eucalyptus	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
28	<i>Ficus religiosa</i>	Ahot	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
29	<i>Ficus racemosa</i>	Jagya-dimoru	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
30	<i>Phyllanthus emblica</i>	Amlokhi	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
31	<i>Gmelina arborea</i>	Gomari	1	1	6	0.000	1.16	16.7	1.2	1.00	0.01	2.39
32	<i>Bombax malabaricum</i>	Shimlu	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
33	<i>Saraca indica</i>	Ashok-goch	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
34	<i>Tectona grandis</i>	Segun	3	3	6	0.001	3.49	50.0	3.7	1.00	0.03	7.18
35	<i>Barringtonia acutangula</i>	Hizal	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
36	<i>Tamarindus indica</i>	Tetul	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
37	<i>Polyalthia longifolia</i>	Debbaru	2	1	6	0.001	2.33	16.7	1.2	2.00	0.02	3.57
38	<i>Zizyphus jujuba</i>	Kul	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
39	<i>Canarium bengalense</i>	Dhup	2	2	6	0.001	2.33	33.3	2.4	1.00	0.02	4.79
	Total		86	82	234							
Shrubs												
1	<i>Xanthium stromarium</i>	Gokru	5	4	6	0.00	7.94	66.7	7.7	1.25	0.08	15.71
2	<i>Cassia tora</i>	Medeluwa	3	3	6	0.00	4.76	50.0	5.8	1.00	0.05	10.58
3	<i>Calotropis procera</i>	Aakanda	4	4	6	0.00	6.35	66.7	7.7	1.00	0.06	14.11



Sl.No.	Scientific name	Local name	Total No.	Total no. of quad with sp.	Total No. of quad	Density	Relative Density	Frequency %	Relative Frequency	Abundance	Relative Abundance	IVI
4	<i>Zizyphus rugosa</i>	Barai	2	2	6	0.00	3.17	33.3	3.8	1.00	0.03	7.05
5	<i>Ipomoea fistulosa</i>	Morning Glory	8	6	6	0.00	12.70	100.0	11.5	1.33	0.13	24.36
6	<i>Hibiscus rosa-sinensis</i>	Jaba Phool	4	4	6	0.00	6.35	66.7	7.7	1.00	0.06	14.11
7	<i>Bambusa pallida</i>	Bans	5	4	6	0.00	7.94	66.7	7.7	1.25	0.08	15.71
8	<i>Bambusa tulda</i>	Deva Bans	5	4	6	0.00	7.94	66.7	7.7	1.25	0.08	15.71
9	<i>Bambusa offinis</i>	Kaich Bans	3	3	6	0.00	4.76	50.0	5.8	1.00	0.05	10.58
10	<i>Hyptis suaveolens</i>	Buno tulsi	4	3	6	0.00	6.35	50.0	5.8	1.33	0.06	12.18
11	<i>Adhatoda vasica</i>	Basuti	4	3	6	0.00	6.35	50.0	5.8	1.33	0.06	12.18
12	<i>Hymenodictyon excelsum</i>	Ban kadam	2	2	6	0.00	3.17	33.3	3.8	1.00	0.03	7.05
13	<i>Lantana camara</i>	Wild Sage	9	6	6	0.00	14.29	100.0	11.5	1.50	0.14	25.97
14	<i>Musa paradisiaca</i>	Kela	5	4	6	0.00	7.94	66.7	7.7	1.25	0.08	15.71
	Total		63	52	84	0.02						
Herbs & Grasses												
1	<i>Sida acuta</i>	Boriala	4	4	6	0.00	5.63	66.7	7.8	1.00	0.06	13.53
2	<i>Catharanthus roseus</i>	Nayantara	5	4	6	0.00	7.04	66.7	7.8	1.25	0.07	14.96
3	<i>Cynodon dactylon</i>	Bermuda grass	17	6	6	0.01	23.94	100.0	11.8	2.83	0.24	35.95
4	<i>Mucuna pruriens</i>	Bandar-hola	3	3	6	0.00	4.23	50.0	5.9	1.00	0.04	10.15
5	<i>Dendrocalamus sps</i>	Pocha	4	4	6	0.00	5.63	66.7	7.8	1.00	0.06	13.53
6	<i>Andropegon squarrouis</i>	Binna	2	2	6	0.00	2.82	33.3	3.9	1.00	0.03	6.77
7	<i>Tridax procumbens</i>	Tridax Daisy	6	5	6	0.00	8.45	83.3	9.8	1.20	0.08	18.34
8	<i>Mimosa pudica</i>	Lajjabati	5	4	6	0.00	7.04	66.7	7.8	1.25	0.07	14.96
9	<i>Datura metal</i>	Dhutra	8	6	6	0.00	11.27	100.0	11.8	1.33	0.11	23.14
10	<i>Imperata arundinacea</i>	Ooloo	7	5	6	0.00	9.86	83.3	9.8	1.40	0.10	19.76



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Sl.No.	Scientific name	Local name	Total No.	Total no. of quad with sp.	Total No. of quad	Density	Relative Density	Frequency %	Relative Frequency	Abundance	Relative Abundance	IVI
11	<i>Saccharum spontaneum</i>	Khagra	6	5	6	0.00	8.45	83.3	9.8	1.20	0.08	18.34
12	<i>Desmodium triflorum</i>	Creeping Tickfoil	4	3	6	0.00	5.63	50.0	5.9	1.33	0.06	11.57
	Total		71	51	72							

Source: ABC Techno Labs India Pvt. Ltd.

The interpretation vegetation study results of the study area are presented in the following Table 3.23.

Table 3.23: Interpretation of Vegetation Results in the Study Area

Relative density	Relative density is found to be maximum for <i>Cocos nucifera</i> – 6.98	Density of primary species is found to be much higher in comparison with the other species.
Relative frequency	Maximum RF found to be 4.9 in case of <i>Cocos nucifera</i>	Vegetation community is heterogenous in nature
Relative Abundance	Maximum value observed in case of <i>Acacia nilotica</i> is about 0.07.	<i>Cocos nucifera</i> is the most common species found in the area.
Importance Value Index (IVI)	The maximum IVI value observed in case of <i>Cocos nucifera</i> is about 11.92.	The dominant species are <i>Cocos nucifera</i> .

Source: ABC Techno Labs India Pvt. Ltd.

❑ Biodiversity Indices

Biodiversity index is a quantitative measure that reflects how many different types species, there are in a dataset, and simultaneously takes into account how evenly the basic entities (such as individuals) are distributed among those types of species. The value of biodiversity index increases both when the number of types increases and when evenness increases. For a given number of type of species, the value of a biodiversity index is maximized when all type of species are equally abundant. Interpretation of Vegetation results in the study area is given in Table 3.24.

Table 3.24: Interpretation of Vegetation results in the Study Area

Community	Biodiversity indices		
	Shannon-Wiener Index (H)	Simpson Diversity Index (1/D)	Species Evenness
Tree	3.56	0.98	0.33
Shrub	2.55	0.93	0.55
Herbs	2.33	0.90	0.63

Source: ABC Techno Labs India Pvt. Ltd.

From Table 3.24, it can be interpreted that tree community has highest diversity. While the shrub community shows less diversity. It is also observed that most of the quadrates have controlled generation of plant species with older strands. Higher tree species diversity can be interpreted as a greater number of successful species and a more stable ecosystem where more ecological niches are available and the environment is less likely



to be hostile, environmental change is less likely to be damaging to the ecosystem as a whole.

3.14.5 FAUNA IN THE STUDY AREA

To prepare a detailed report on the status of faunal diversity within study area of 10 km radius around proposed project site area, field studies were conducted. Both direct (sighting) and indirect (evidences) observations methods were used to survey the faunal species around the study area. Additionally reference of relevant literatures (published/unpublished) and dialogues with local villagers were also carried out to consolidate the presence of faunal distribution in the area (*Smith 1933-43, Ali and Ripley 1983, Daniel 1983, Prater 1993, Murthy and Chandrasekhar 1988*).

Mammals: No wild mammalian species was directly sighted during the field survey. Dialogue with local villagers located within the study area also could not confirm presence of any wild animal in that area. Common Indian Mongoose, Small Indian Civet, Rhesus Monkey, Indian rabbit, Common Indian Rat, Common five Stripped Squirrel, Large Indian squirrel, Common mouse, House Shrew were observed during primary survey.

Avifauna: Since birds are considered to be the indicators for monitoring and understanding human impacts on ecological systems (*Lawton, 1996*) attempt was made to gather quantitative data on the avifauna by walk through survey within the entire block area and surrounding area. From the primary survey, a total of 36 species of avifauna were identified and recorded from the entire study area and surrounding area. The diversity of avifauna from this region was found to be quite high and encouraging. None of the bird species found to be of threatened or endangered category as per IUCN Red list.

List of animals present in the study area are given below:

Table 3.25: List of Fauna observed in the study area

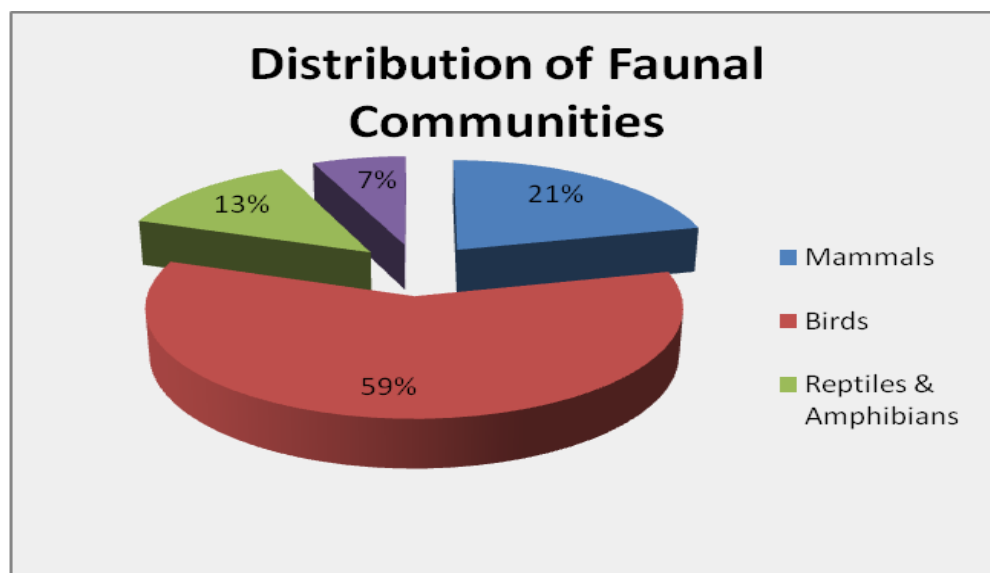
Sl.No	Scientific name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
Mammals					
1	<i>Herpestes edwardsii</i>	Common Indian Mongoose	II	Least Concern	DS
2	<i>Sus scrofa</i>	Wild Boar	III	Least Concern	NS
4	<i>Felis chaus</i>	Jungle Cat	II (Part I)	Least Concern	NS
5	<i>Vulpes bengalensis</i>	Bengal Fox	II (Part I)	Least Concern	NS
6	<i>Viverricula indica</i>	Small Indian Civet	II (Part I)	Least Concern	DS
7	<i>Macaca mulatta</i>	Rhesus Monkey	II (Part I)	Least Concern	DS
8	<i>Lepus nigricollis</i>	Indian rabbit	IV	Least Concern	DS
9	<i>Bandicoota bengalensis</i>	Common Indian Rat	V	Not assessed	DS
10	<i>Funambulus pennanti</i>	Common five Stripped Squirrel	IV	Not assessed	DS
11	<i>Ratufa indica</i>	Large Indian squirrel	II (Part I)	Least Concern	DS
12	<i>Mus musculus</i>	Common mouse	V	Least Concern	DS
13	<i>Suncus murinus</i>	House Shrew	-	Least Concern	DS
Birds					
1	<i>Milvus migrans</i>	Common kite	IV	Least Concern	DS
2	<i>Merops orientalis</i>	Common bee eaters	IV	Least Concern	DS
3	<i>Psittacula krameri</i>	Rose ringed parakeet	IV	Least Concern	DS
4	<i>Pericrocotus flammeus</i>	Scarlet Minivet	IV	Least Concern	DS
5	<i>Centropus bengalensis</i>	Lesser coucal	IV	Least Concern	DS
6	<i>Microcarbo niger</i>	Little cormorant	IV	Least Concern	DS
7	<i>Cypsiurus balasiensis</i>	Asian palm swift	IV	Least Concern	DS
8	<i>Dicrurus leucophaeus</i>	Ashy Drongo	IV	Least Concern	DS
9	<i>Alcedo atthis</i>	Common kingfisher	IV	Least Concern	DS
10	<i>Motacilla alba</i>	White Wagtail	-	Least Concern	DS
11	<i>Turdoides caudatus</i>	Common Babbler	IV	Least Concern	DS
12	<i>Passer domesticus</i>	Indian house sparrow	V	Least Concern	DS
13	<i>Dicrurus paradiseus</i>	Racket tailed Drongo	IV	Least Concern	DS
14	<i>Dendrocopas mahrattensis</i>	Yellow wood pecker	IV	Not assessed	DS
15	<i>Coracias benhalensis</i>	Indian Roller	IV	Not assessed	DS
16	<i>Dicrurus macrocercus</i>	Black Drongo	IV	Least Concern	DS
17	<i>Cuculus varius</i>	Cuckoo	IV	Least Concern	DS
18	<i>Aerodotheres tristis</i>	Common Maina	IV	Not assessed	DS
19	<i>Streptopelia chinensis</i>	Indian Spotted Dove	IV	Not assessed	DS
20	<i>Ardea intermedia</i>	Intermediate egret	IV	Least Concern	DS
21	<i>Bubulcus ibis</i>	Cattle egret	IV	Least Concern	DS
22	<i>Orthotomus sutorius</i>	Tailor bird	IV	Least Concern	DS



Sl.No	Scientific name	English Name	Schedule of Wildlife Protection Act	Status as per IUCN Red Data List	Method
23	<i>Treron phoenicoptera</i>	Common green pigeon	IV	Least Concern	DS
24	<i>Acrocephalus agricola</i>	Paddy field warbler	IV	Least Concern	NS
25	<i>Anas creaca</i>	Common Teal	IV	Not assessed	DS
26	<i>Columba livia</i>	Blue rock pigeon	IV	Least Concern	DS
27	<i>Ardeo grayeli</i>	Pond heron	IV	Not assessed	DS
28	<i>Vanellus indicus</i>	Red Wattled lapping	IV	Least Concern	DS
29	<i>Nicticorax nycticorax</i>	Night Heron	IV	Not assessed	DS
30	<i>Cotuenix coturnix</i>	Common or grey quail	IV	Not assessed	DS
31	<i>Dendrocitta vagabunda</i>	Indian Tree pie	IV	Least Concern	DS
32	<i>Corvus macrorhynchos</i>	Jungle crow	V	Least Concern	NS
33	<i>Corvus splendens</i>	House crow	V	Least Concern	DS
34	<i>Eudynamys scolopceae</i>	Koel	IV	Not assessed	DS
35	<i>Pycnonotus cafer</i>	Red vented Bulbul	IV	Least Concern	DS
36	<i>Pericrocotus cinnamomus</i>	Small minivet	IV	Not assessed	DS
Reptiles & Amphibians					
1	<i>Ptyas mucosas</i>	Yellow rat snake	II	Not assessed	NS
2	<i>Vipera russelli</i>	Russell's viper	IV	Not assessed	NS
3	<i>Bungarus caeruleus</i>	Common Krait	IV	Not assessed	NS
4	<i>Varanus varanus</i>	Tree lizard	II	Not assessed	DS
5	<i>Calotes versicolor</i>	Common Garden Lizard	-	Not assessed	NS
6	<i>Rana tigrina</i>	Common yellow frog	IV	Least Concern	NS
7	<i>Bufo melanostictus</i>	Toad	IV	Least Concern	NS
8	<i>Hoplobatrachus tigerinus</i>	Indian bull frog	-	Least Concern	DS
Butterfly					
1	<i>Junonia atlites</i>	Grey pansy	IV	Not assessed	DS
2	<i>Danaus chrysippus</i>	Plain tiger	IV	Not assessed	DS
3	<i>Neptis hylas</i>	Common Sailer	IV	Not assessed	DS
4	<i>Eurema hecabe</i>	Common Grass Yellow	IV	Not assessed	DS

N.B: NS= Not sighted but included as per the information provided by villagers, DS = Direct Sighting

Source: ABC Techno Labs India Pvt. Ltd.



Livestock like cattle, goat, poultry, duck, and pig are reared for dairy products, meat, egg and for agriculture purpose. Majority of cattles are of local variety. Backyard poultry farms are mostly common in this area; however, some commercial poultry farms are also recorded in the study area.

Some of the sighted fauna were given protection by the Indian Wild Life (Protection) Act, 1972 by including them in different schedules. Among the birds in the study area, Pea fowl (*Pavo cristatus*), is included in schedule I .of Wild life protection Act (1972), while many other birds are included in schedule IV.

There is no rare or endangered fauna observed in the 10 km radius of the eproject site. None of the sighted animal species can be assigned endemic species category of the study area.

The list of faunal species is prepared based on visual observation during site visit and through review of site literatures and secondary data available with various government offices is referred for identifying rare or endangered species in the region.

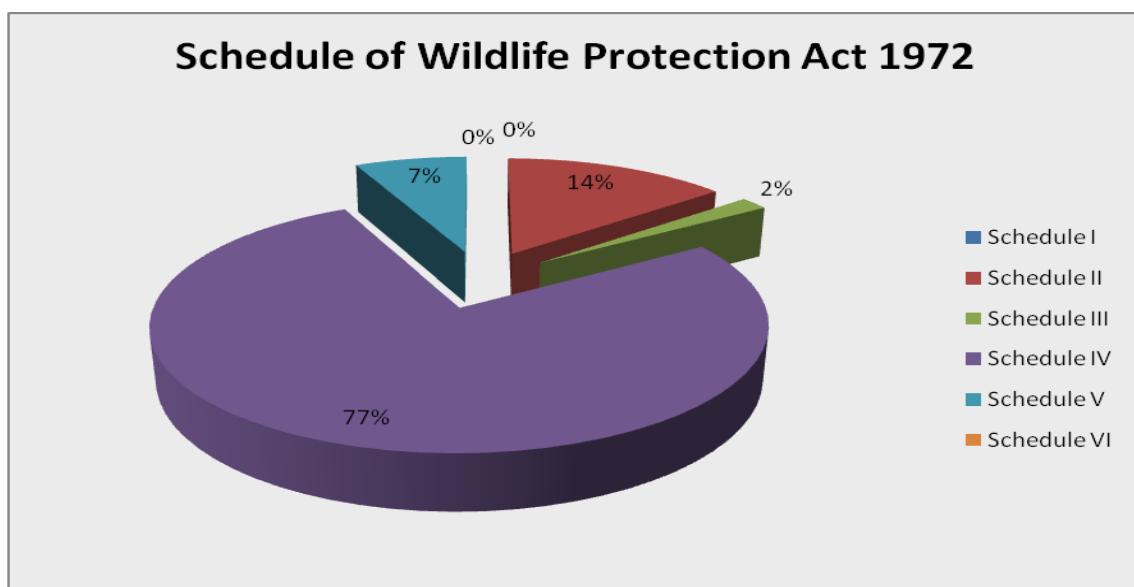
Source: ABC Techno Labs India Pvt. Ltd.

The study area is marked with moderate population of flora and fauna. With reference to the Wildlife Protection Act 1972 total number of wildlife tabulated in this study can be characterized as given in the Table 3.26.

Table 3.26: Characterization of Fauna in the Study Area (As Per W.P Act, 1972)

Sl.No.	Schedule of Wildlife Protection Act 1972	No. of species	Remark
1	Schedule I	0	-
2	Schedule II	8	-
3	Schedule III	1	-
4	Schedule IV	43	-
5	Schedule V	4	-
6	Schedule VI	0	-

Source: ABC Techno Labs India Pvt. Ltd.



The detailed interpretation of flora and fauna identified within 10 km radius of the project site are tabulated In Table 3.27.

Table 3.27: Description of Flora & Fauna

Sl.No.	Type of Species	Core Zone
Flora		
1	Endangered species	None of the species found
2	Endemic species	None of the species found
3	Grass lands	No grass lands
Fauna		
1	Endangered species	None
2	Endemic Species	Not present
3	Migratory species	None
4	Migratory Corridors & Flight Paths	No corridors & flight paths
5	Breeding & Spawning grounds	None within Study area

Source: ABC Techno Labs India Pvt. Ltd.

3.14.6 AQUATIC ECOLOGY

An essential pre requisite for the successful solution to these problems is to evaluate ecological impacts from the baseline information and undertake effective management plan. So the objective of aquatic ecological study may be outlined as follows:

- To characterize water bodies like fresh waters;
- To understand their present biological status;
- To characterize water bodies with the help of biota;
- To understand the impact of industrial and urbanization activities; and
- To suggest recommendations to counter adverse impacts, if any on the ecosystem.

To meet these objectives following methods were followed:

- Generating data by actual field sampling and analysis in these areas through field visits during study period; and
- Discussion with local people to get the information for aquatic plants and aquatic animals.

A number of samples were investigated for enumeration of aquatic fauna. In order to study aquatic flora and faunal life one time survey was conducted during the summer season. Major component of the aquatic life under the study area are listed below.

- *Aquatic macrophytes*
- *Phytoplankton and zooplankton*
- *Aquatic vertebrates like fish, amphibians etc.*

To assess the planktonic profile of Phytoplankton and Zooplankton, 2 water samples from Tuniya River, Pond at Dhantola were collected at sub surface level. The aquatic ecological study was conducted in different water bodies of the study area and the flora and fauna was recorded.

☐ Phytoplankton and Zooplankton

Planktons can be broadly grouped into two categories those with plant origin are called 'Phytoplankton' and those with animal origin are called 'Zooplankton'.

A. Phytoplankton

Phytoplanktons are the major primary producers of organic matter in the aquatic ecosystem and especially oceans whose 90% productivity is from the planktons. Collectively, they directly or indirectly support the entire animal population. When the water column becomes shallow in spring, phytoplanktons are exposed to higher light

intensity in the upper sunlight. Light is one of the major abiotic factors that favour the growth of phytoplankton. The massive build up of phytoplankton in spring directly contributes new organic carbon to support the zooplankton, which, in turn, benefits larger aquatic animals including fish, crustaceans, molluscs, birds.

Phytoplankton samples were collected without filtering the water. To preserve, 0.3 mL lugol's solution was added to 100 ml sample. Subsequently phytoplankton were concentrated by centrifugation and analysed microscopically in laboratory. Identification of phytoplankton was done using standard taxonomic keys.

The Lackey Drop (microtransect) method (Lackey 1938) is a simple method for obtaining counts of considerable accuracy (APHA 2012).

Chemicals/reagents used: Lugol's iodine

Equipments used: Centrifuge tubes of 15ml capacity, cover slips, glass slides, dropper, plastic bottles (100 ml capacity)

Instruments used: Centrifuge and Microscope.

Table 3.28: Phytoplankton Species

Sl. No.	Species	Family
1	<i>Navicula sp</i>	Bacillariophyceae
2	<i>Nitischia sp</i>	Bacillariophyceae
3	<i>Diatoma sp</i>	Bacillariophyceae
4	<i>Cyclotella sp</i>	Bacillariophyceae
5	<i>Synedra sp.</i>	Bacillariophyceae
6	<i>Spirogyra sp.</i>	Zygnemataceae
7	<i>Chlorella sp</i>	Cyanophyceae
8	<i>Nostoc sp.</i>	Nostocaceae
9	<i>Merismopidia sp</i>	Chlorophyceae
10	<i>Euglena sp</i>	Euglenophyceae
11	<i>Ulothrix sp</i>	Ulotrichaceae

Source: ABC Techno Labs India Pvt. Ltd.

B. Zooplankton

The significance of zooplanktons is found in their role in transferring biological production from phytoplankton to larger organisms in the food web. A large number of phytoplankton species are grazed upon by the microscopic protozoans, tunicates, copepods and other crustaceans. These in turn become food for other animals further linking the food web. Therefore, variability in the production of planktons would affect the survival of young fish that depend on them.

Sample collection was carried out in the similar method as that of phytoplankton. The result of the zooplankton analysis is tabulated in table 3.29.

Table 3.29: Zooplankton Species

Sl. No.	Species	Family
1	<i>Daphnia sp.</i>	Cladocera
2	<i>Cyclops sp.</i>	Copepoda
3	<i>Brachinus sp.</i>	Rotifera
4	<i>Diaptomus sp.</i>	Rotifera
5	<i>Nauplius sp</i>	Arthropoda
6	<i>Macrothrix sp</i>	Arthropoda
7	<i>Simocephalus sp</i>	Arthropoda
8	<i>Paramoecium sp.</i>	Ciliates
9	<i>Euglena sp.</i>	Phytomastigophora

Source: ABC Techno Labs India Pvt. Ltd.

☐ **Macrophytes**

The following macrophytes observed during field survey:

Sl.No	Scientific name	Common Name	Local Status
1	<i>Nymphaea lotus</i>	Shalook	Common
2	<i>Canna indica</i>	Parijat	Common
3	<i>Alternanthera sessilis</i>	Haycha	Common
4	<i>Wolffia arrhiza</i>	Sujipana	Common
5	<i>Nelumbo nucifera</i>	Padma	Common
6	<i>Salvinia cucullata</i>	Watermoss	Common
7	<i>Hydrilla verticillata</i>	Jhangi	Common
8	<i>Lemna perpusilla</i>	Khudi Pana	Common
9	<i>Pistia stratiotes</i>	Toka Pana	Common
10	<i>Nymphaea rubra</i>	Lal Shalook	Common
11	<i>Phragmites karka</i>	Nal	Common
12	<i>Monochoria vaginles</i>	Kachar	Common
13	<i>Ipomea aquatica</i>	Kalmi	Common
14	<i>Polygonum barbatum</i>	Panimarich	Common

Source: ABC Techno Labs India Pvt. Ltd.

☐ **Fish species**

The following fish species identified/reported within the study area:

Sl.No	Scientific name	Local name	English name	Local Status
1	<i>Labeo rohita</i>	Rui	Rohu	Common
2	<i>Pangasius sutchi</i>	Pungas	Pungas	Common
3	<i>Clarias batrachus</i>	Magur	Magur	Common
4	<i>Catla catla</i>	Katal	Katla	Common
5	<i>Labeo bata</i>	Bata	Bata	Common
6	<i>Cirrhinus reba</i>	Bhagna	Reba	Common
7	<i>Labeo calbasu</i>	Kalibaush	Calbasu	Common
8	<i>Anabas testudineus</i>	Koi	Climbing perch	Rare
9	<i>Clarias gariepinus</i>	Magur	African giant magur	Common
10	<i>Heteropneustes fossilis</i>	Singi	Singi	Common
11	<i>Mystus vittatus</i>	Tengra	Striped dwarf catfish	Common
12	<i>Hypophthalmichthys nobilis</i>	--	Big head	Rare
13	<i>Labeo gonius</i>	Goinya	Goania/ Kuria Labeo	Common
14	<i>Cirrhinus mrigala</i>	Mrigel	Mrigal	Common
15	<i>Oxygaster bacaila</i>	Chella	Large razorbelly minnow	Common
16	<i>Ctenopharyngodon idella</i>	--	Grass carp	Common
17	<i>Cyprinus carpio</i>	Japani rui	Common carp	Common
18	<i>Puntius javanicus</i>	Japani puti	Java Puti	Common
19	<i>Oreochromis mossambicus</i>	Tilapia	Tilapia	Common
20	<i>Hilsa ilisha</i>	Ilish	Hilsa	Common
21	<i>Rhinomugil corsula</i>	Nadi bata	Corsula mullet	Common
22	<i>Hypophthalmichthys molitrix</i>	Rupali rui	Silver carp	Common

Source: ABC Techno Labs India Pvt. Ltd.

3.15 SOCIOECONOMIC ENVIRONMENT

The assessment of the socio-economic environment forms an integral part of an EIA study. Socio -Economic status of the population is an indicator of the development of the region. Any developmental project of any magnitude will have a bearing on the living conditions and on the economic base of the population in particular and the region as a whole. Similarly, the proposed project activities will have its share of socio-economic influence in the study area. The section delineates the overall appraisal of society relevant attributes. The data collection for evaluation of the impact of the proposed project activity on socioeconomic aspects in the study area has been done through a primary household survey and through the analysis of secondary data available for the study area.

3.15.1 METHODOLOGY

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

- The primary data on socioeconomic profile was collected through site observation, interviews with the key-informants and group discussions in the selected villages. Pradhan of Gram Panchayat, respondent (male-female) and school teachers were interviewed for the collection of socio-economic baseline information during the site visit by ABC team. The secondary data includes demographic profile, and employment pattern have been sourced from Primary Census Abstract-2011 of Gujarat and Infrastructure resource base has been extracted from District Census Handbook; Census of India, 2011. (<http://www.censusindia.gov.in/2011census/dchb/DCHB.html>)
- The socio-economic survey pertaining to the subjective analysis of the socio-economic indicators was carried in 6 habitation/villages viz. Dhaknabari, Boitamari, Maligaon, Salbari, Khagarpur, Oudubi within block area.
- The survey focused on these selected 6 villages with aimed to collect relevant information for understanding the perception of the local inhabitants and affected people about the proposed project activities as these villages are located in close vicinity of project site.

3.15.2 SOURCES OF INFORMATION

As per the scope of this study, the information on socio-economic aspects has been gathered and compiled from several secondary sources. These include Taluk Office, Collectorate, Agriculture Department, Irrigation Department, Central Ground Water Board, Directorate of Census Operation, Assam etc. The demographic data have mainly been compiled from the Census of India 2011. The socio-economic details are briefly described in the following sections. This section includes the present status of the Socio-Economic Environment in the study area. To determine the baseline socio-economic pattern, at and around the project site, the required data have been obtained from the published data. Socio-economic baseline data were collected for the following indicators:

- Demographic Structure
- Economic Structure
- Availability of Basic Amenities

The major demographic and economic structure of the study area are classified into the population, literacy rate and workers details.



3.15.3 STUDY AREA

The entire study area of 10 km radius from proposed project site, villages has been categorized in core zone and buffer zone for studying the socio-economic profile.

3.15.3.1 POPULATION

According to the 2011 census, the entire study area has a population of 218484 and 43081 Households. Male population is about 72163 & female population is 69401 with sex ratio of 961 females for every 1000 males and a literacy of 68.3%; Scheduled Castes and Scheduled Tribes accounted for 4597 and 310 of the total population respectively. There were a total of 41809 main workers, 13453 marginal workers, 86302 non-workers. About 29.5% employment rate found within the entire study area.

3.15.3.2 DISTRIBUTION OF POPULATION

The distribution of the population in the study area of 10 km radius of proposed project site is given in Table 3.30.



Table 3.30: Distribution of population in the Study area

Sl.No	Name of Village	Total Household	Demography								
			Total Population	Total Male	Total Female	Total SC	SC Male	SC Female	Total ST	ST Male	ST Female
1	Sankarghola Pt I	39	187	101	86	0	0	0	187	101	86
2	Bhakarivita [Pt]	30	151	76	75	0	0	0	0	0	0
3	Jogipara	149	692	369	323	7	4	3	1	0	1
4	Nagariagaon	56	252	126	126	0	0	0	0	0	0
5	Bashbari Pt II	277	1240	618	622	0	0	0	0	0	0
6	Dewangaon	365	1626	831	795	342	165	177	111	64	47
7	Kathalguri	108	486	239	247	5	4	1	0	0	0
8	Ghilaguri	427	2079	1068	1011	303	148	155	5	5	0
9	Dholagaon	285	1332	660	672	66	31	35	0	0	0
10	Mamugaon	78	346	164	182	0	0	0	0	0	0
11	Majhigaon	65	289	140	149	76	33	43	0	0	0
12	Bidyapur	548	2760	1392	1368	480	248	232	130	67	63
13	Chengmari	171	727	356	371	51	25	26	0	0	0
14	Fulkumari	461	2086	1019	1067	187	82	105	1	0	1
15	Durgamari	472	2273	1149	1124	0	0	0	0	0	0
16	Bhandurani	200	1018	489	529	0	0	0	0	0	0
17	Nankargaon	319	1558	781	777	161	95	66	0	0	0
18	Bamuni Tilu	407	1789	889	900	70	35	35	3	2	1
19	Lingdoba	209	1055	549	506	0	0	0	0	0	0
20	Ghagpara	207	900	458	442	0	0	0	0	0	0
21	Bhitor-Chengmari	215	1120	587	533	0	0	0	2	0	2
22	Boitamari	27869	142684	72596	70088	18661	9557	9104	5122	2578	2544
23	Kharbojha	35	143	79	64	0	0	0	99	54	45



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Sl.No	Name of Village	Total Household	Demography								
			Total Population	Total Male	Total Female	Total SC	SC Male	SC Female	Total ST	ST Male	ST Female
24	Baripukhuri Pt I	205	1028	547	481	995	528	467	0	0	0
25	Baripukhuri Pt II	229	1128	579	549	551	277	274	13	6	7
26	Panchagaon Pt I	627	2889	1449	1440	90	43	47	0	0	0
27	Panchagaon Pahar	42	203	94	109	0	0	0	0	0	0
28	Talguri	208	916	459	457	0	0	0	0	0	0
29	Panchagon Pt II	162	706	345	361	0	0	0	0	0	0
30	Sudamvita	32	129	63	66	0	0	0	0	0	0
31	Bajitpara	263	1126	538	588	12	6	6	0	0	0
32	Raghunandanpur Pt I	248	1042	484	558	0	0	0	0	0	0
33	Kasharpara	132	533	269	264	0	0	0	0	0	0
34	Barkhata Pt I	143	607	314	293	10	6	4	0	0	0
35	Barkhata Pt II	44	222	125	97	0	0	0	185	103	82
36	Barkhata Pt III	102	482	249	233	81	39	42	185	97	88
37	Hill Block N.C.	0	0	0	0	0	0	0	0	0	0
38	Maligaon Pahar N.C.	0	0	0	0	0	0	0	0	0	0
39	Maligaon	389	1698	863	835	29	15	14	1	1	0
40	Salbari	352	1407	696	711	0	0	0	0	0	0
41	Dhaknabari	501	2414	1243	1171	201	94	107	129	71	58
42	Boalimari Pt I	110	623	309	314	0	0	0	0	0	0
43	Boalimari Pt II	39	270	137	133	0	0	0	0	0	0
44	Kheluapara Pt V	112	683	338	345	0	0	0	0	0	0
45	Kheluapara Pt II	208	1178	584	594	0	0	0	0	0	0
46	Kheluapara Pt IV	299	1533	792	741	0	0	0	0	0	0
47	Iswarijhari Pt I	48	277	141	136	0	0	0	0	0	0



Sl.No	Name of Village	Total Household	Demography								
			Total Population	Total Male	Total Female	Total SC	SC Male	SC Female	Total ST	ST Male	ST Female
48	Dinanathpur	0	0	0	0	0	0	0	0	0	0
49	Kheluapara Pt.I	219	1392	715	677	0	0	0	0	0	0
50	Oudubi Pt I	191	1181	614	567	0	0	0	0	0	0
51	Bhairab Pahar	69	359	184	175	168	89	79	1	1	0
52	Kachudola N.C.	32	192	96	96	76	34	42	0	0	0
53	Bhairabpur	12	86	37	49	0	0	0	0	0	0
54	Kachudola Pt I	271	1364	695	669	1065	537	528	0	0	0
55	Oudubi Pt II	198	1054	529	525	0	0	0	0	0	0
56	Kherpuji Pt II	82	433	225	208	0	0	0	0	0	0
57	Kherpuji Pt I	106	674	329	345	0	0	0	106	56	50
58	Hakodoba Pt II	61	353	183	170	0	0	0	0	0	0
59	Hakodoba Pt I	155	834	447	387	0	0	0	0	0	0
60	Korea Pt II	241	1302	654	648	0	0	0	0	0	0
61	Chedamari	890	4837	2497	2340	159	79	80	16	9	7
62	Balapara	420	2350	1223	1127	0	0	0	0	0	0
63	Dolani Beel	538	3345	1740	1605	0	0	0	0	0	0
64	Ganakghuli	17	85	46	39	6	3	3	79	43	36
65	Manikjhara	57	281	151	130	111	58	53	169	92	77
66	Barjuli	26	141	73	68	11	7	4	130	66	64
67	Majpara	52	256	134	122	16	9	7	240	125	115
68	Sankarghola Pt II	50	261	137	124	5	3	2	0	0	0
69	Sarag Duar Pt I	22	98	51	47	0	0	0	97	51	46
70	Sarag Duar Pt II	69	280	145	135	0	0	0	275	143	132
71	Bongaon	44	190	87	103	0	0	0	5	3	2



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Sl.No	Name of Village	Total Household	Demography								
			Total Population	Total Male	Total Female	Total SC	SC Male	SC Female	Total ST	ST Male	ST Female
72	Tamranga Beel	0	0	0	0	0	0	0	0	0	0
73	Maijana Beel	18	78	45	33	22	12	10	0	0	0
74	Bishnupur	155	639	310	329	388	195	193	0	0	0
75	Sristipara	102	541	286	255	407	214	193	0	0	0
76	Barpara	439	2380	1258	1122	876	468	408	0	0	0
77	Pallirtol Chedamari	548	2999	1554	1445	17	9	8	0	0	0
78	Kanara Beel	274	1435	746	689	127	66	61	0	0	0
79	Haldibari Pt I	49	313	161	152	152	73	79	0	0	0
80	Chillapara Pt II	148	683	353	330	10	7	3	0	0	0
81	Amguri	39	181	86	95	0	0	0	0	0	0
Total		43081	218484	111145	107339	25994	13298	12696	7292	3738	3554

Source: ABC Techno Labs India Pvt. Ltd.



Table 3.31: Distribution of Literacy rate & Working population in the study area

Sl. No	Name of Village	Total House hold	Literacy						Worker							
			Total Literate	Male Lit	Female Lit	Total Illeterate	Male Illet	Female Illet	Total Worker	Total Main Worker	Main Cultivator	Main Agr. Lab	Main HH worker	Main Other Worker	Total Marginal Worker	Total Non Worker
1	Sankarghola Pt I	39	148	79	69	39	22	17	92	85	78	1	0	6	7	95
2	Bhakarivita [Pt]	30	112	61	51	39	15	24	60	23	5	1	0	17	37	60
3	Jogipara	149	563	313	250	129	56	73	244	223	41	3	7	172	21	244
4	Nagariagaon	56	193	102	91	59	24	35	127	108	41	47	0	20	19	75
5	Bashbari Pt II	277	939	518	421	301	100	201	444	248	64	72	11	101	196	486
6	Dewangaon	365	1107	620	487	519	211	308	574	377	128	173	15	61	197	618
7	Kathalguri	108	362	201	161	124	38	86	201	155	78	38	8	31	46	199
8	Ghilaguri	427	939	561	378	1140	507	633	678	468	91	9	12	356	210	877
9	Dholagaon	285	900	483	417	432	177	255	392	340	19	4	1	316	52	635
10	Mamugaon	78	251	128	123	95	36	59	110	89	43	16	1	29	21	168
11	Majhigaon	65	202	107	95	87	33	54	180	69	16	24	15	14	111	59
12	Bidyapur	548	1525	805	720	1235	587	648	695	640	262	188	8	182	55	876
13	Chengmari	171	535	280	255	192	76	116	208	109	74	3	2	30	99	343
14	Fulkumari	461	1177	646	531	909	373	536	830	536	53	60	12	411	294	815
15	Durgamari	472	1053	593	460	1220	556	664	711	532	190	154	6	182	179	981
16	Bhandurani	200	512	257	255	506	232	274	263	260	165	76	4	15	3	490
17	Nankargaon	319	930	505	425	628	276	352	385	241	62	8	2	169	144	743
18	Bamuni Tilu	407	1128	621	507	661	268	393	878	388	137	20	56	175	490	527
19	Lingdoba	209	481	273	208	574	276	298	371	144	96	37	6	5	227	353
20	Ghagpara	207	470	244	226	430	214	216	236	222	145	27	0	50	14	424



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Sl. No	Name of Village	Total House hold	Literacy						Worker							
			Total Literate	Male Lit	Female Lit	Total Illeterate	Male Illet	Female Illet	Total Worker	Total Main Worker	Main Cultivator	Main Agr. Lab	Main HH worker	Main Other Worker	Total Marginal Worker	Total Non Worker
21	Bhitor-Chengmari	215	627	353	274	493	234	259	358	310	187	64	1	58	48	478
22	Boitamari	27869	77020	41743	35277	65664	30853	34811	46357	36080	13983	5172	930	15995	10277	60541
23	Kharbojha	35	92	54	38	51	25	26	42	23	16	0	1	6	19	55
24	Baripukhuri Pt I	205	605	358	247	423	189	234	489	288	191	21	2	74	201	326
25	Baripukhuri Pt II	229	739	417	322	389	162	227	637	334	164	4	63	103	303	279
26	Panchagaon Pt I	627	1730	931	799	1159	518	641	917	622	250	140	15	217	295	1261
27	Panchagaon Pahar	42	103	53	50	100	41	59	59	36	17	3	0	16	23	318
28	Talguri	208	664	349	315	252	110	142	418	192	35	65	12	80	226	320
29	Panchagon Pt II	162	541	277	264	165	68	97	190	122	66	28	1	27	68	39
30	Sudamvita	32	106	54	52	23	9	14	66	53	14	7	0	32	13	16
31	Bajitpara	263	846	406	440	280	132	148	411	337	168	19	11	139	74	456
32	Raghunandan pur Pt I	248	834	401	433	208	83	125	182	156	90	6	2	58	26	531
33	Kasharpara	132	455	239	216	78	30	48	177	151	90	4	0	57	26	230
34	Barkhata Pt I	143	500	278	222	107	36	71	188	182	104	41	3	34	6	260
35	Barkhata Pt II	44	176	105	71	46	20	26	72	44	21	6	0	17	28	90
36	Barkhata Pt III	102	360	206	154	122	43	79	154	131	97	6	1	27	23	176
37	Hill Block N.C.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	Maligaon Pahar N.C.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Sl. No	Name of Village	Total House hold	Literacy						Worker							
			Total Literate	Male Lit	Female Lit	Total Illeterate	Male Illet	Female Illet	Total Worker	Total Main Worker	Main Cultivator	Main Agr. Lab	Main HH worker	Main Other Worker	Total Marginal Worker	Total Non Worker
39	Maligaon	389	1418	749	669	280	114	166	609	415	204	27	2	182	194	664
40	Salbari	352	1103	583	520	304	113	191	439	368	233	81	3	51	71	635
41	Dhaknabari	501	1385	789	596	1029	454	575	922	723	324	229	15	155	199	876
42	Boalimari Pt I	110	306	158	148	317	151	166	311	280	193	25	1	61	31	184
43	Boalimari Pt II	39	112	53	59	158	84	74	144	142	110	28	1	3	2	68
44	Kheluapara Pt V	112	263	129	134	420	209	211	148	144	134	5	0	5	4	302
45	Kheluapara Pt II	208	590	314	276	588	270	318	353	334	229	26	1	78	19	541
46	Kheluapara Pt IV	299	704	385	319	829	407	422	643	488	250	218	1	19	155	468
47	Iswarjhari Pt I	48	85	37	48	192	104	88	69	68	53	3	2	10	1	80
48	Dinanathpur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Kheluapara Pt.I	219	462	250	212	930	465	465	691	300	82	206	0	12	391	450
50	Oudubi Pt I	191	650	347	303	531	267	264	296	147	123	7	1	16	149	347
51	Bhairab Pahar	69	167	97	70	192	87	105	102	77	5	1	0	71	25	87
52	Kachudola N.C.	32	79	47	32	113	49	64	51	50	26	5	0	19	1	70
53	Bhairabpur	12	51	24	27	35	13	22	24	21	15	0	0	6	3	20
54	Kachudola Pt I	271	853	483	370	511	212	299	432	345	18	3	0	324	87	523
55	Oudubi Pt II	198	593	318	275	461	211	250	309	294	125	23	1	145	15	498
56	Kherpuji Pt II	82	206	106	100	227	119	108	125	30	11	0	1	18	95	204
57	Kherpuji Pt I	106	381	202	179	293	127	166	184	175	137	29	0	9	9	231



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58	Hakodoba Pt II	61	121	64	57	232	119	113	94	92	85	0	0	7	2	151
59	Hakodoba Pt I	155	269	153	116	565	294	271	240	238	183	22	0	33	2	367
60	Korea Pt II	241	740	389	351	562	265	297	413	298	141	13	0	144	115	545
61	Chedamari	890	2675	1463	1212	2162	1034	1128	1416	1221	120	35	8	1058	195	1262
62	Balapara	420	1099	587	512	1251	636	615	671	570	119	139	10	302	101	634
63	Dolani Beel	538	1305	705	600	2040	1035	1005	875	829	506	140	10	173	46	1376
64	Ganakghuli	17	57	37	20	28	9	19	28	28	28	0	0	0	0	25
65	Manikjhara	57	186	108	78	95	43	52	61	55	52	1	0	2	6	98
66	Barjuli	26	85	45	40	56	28	28	34	33	21	2	0	10	1	65
67	Majpara	52	160	88	72	96	46	50	161	160	58	95	1	6	1	123
68	Sankarghola Pt II	50	163	97	66	98	40	58	80	75	67	1	0	7	5	93
69	Sarag Duar Pt I	22	41	22	19	57	29	28	40	9	7	0	1	1	31	27
70	Sarag Duar Pt II	69	121	69	52	159	76	83	175	141	46	23	2	70	34	102
71	Bongaon	44	126	65	61	64	22	42	64	43	33	0	0	10	21	76
72	Tamranga Beel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	Maijana Beel	18	59	37	22	19	8	11	26	24	0	12	1	11	2	18
74	Bishnupur	155	504	258	246	135	52	83	136	123	3	1	0	119	13	267
75	Sristipara	102	271	165	106	270	121	149	192	136	21	6	10	99	56	195
76	Barpara	439	1026	593	433	1354	665	689	670	607	241	43	0	323	63	1068
77	Pallirtol	548	1217	667	550	1782	887	895	751	704	134	62	18	490	47	1393



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			Total Literate	Male Lit	Female Lit	Total Illeterate	Male Illet	Female Illet	Total Worker	Total Main Worker	Main Cultivator	Main Agr. Lab	Main HH worker	Main Other Worker	Total Marginal Worker	Total Non Worker
	Chedamari															
78	Kanara Beel	274	573	339	234	862	407	455	605	499	120	175	60	144	106	448
79	Haldibari Pt I	49	75	48	27	238	113	125	91	67	50	8	1	8	24	127
80	Chillapara Pt II	148	425	225	200	258	128	130	201	176	45	50	3	78	25	228
81	Amguri	39	126	62	64	55	24	31	128	121	98	22	0	1	7	70
	Total	43081	119757	64978	54779	98727	46167	52560	71400	54968	21731	8313	1362	23562	16432	89450

Source: ABC Techno Labs India Pvt. Ltd.



3.15.4 AVAILABILITY OF INFRASTRUCTURE

Availability of infrastructure and facilities denote the level of overall development in the study area. The availability of community facility as education, health, potable water, electricity, communication and transport facilities are important indicators of the well being and Quality of Life (QoL) of villagers. It is observed that infrastructure facilities are poor in the project study area, which consists of education, health care, drinking water facilities, communications, transportation, etc.

❑ Education Facilities

Literacy rate found to be quite encouraging within the study area as that education level in the villages are comparatively good, i.e. more than 54.8% people are literate. Primary education and high schools are available within the villages. Government is putting up many efforts to promote primary education. In the village people mindset have been changed compare to past, parents are taking interest in their children education.

❑ Health Facilities

The number of PHCs served by a CHC is yet another indicator by which the physical accessibility can be judged. As per national norms, 1 PHCs should be served by one CHC. There is 1 primary health centre in Boitamari available. There are government hospitals in Bongaigaon town.

No major diseases were reported by local people in the study area except routine cough, cold and fever etc. Local people mentioned about the lack of equipments, infrastructure and poor coverage of the existing health services. The PHCs in the study area are lack of basic equipments and trained staffs and hence people are expecting health infrastructure with adequate staff.

❑ Sanitation and Drinking water facilities

One of the most important factors responsible for the emergence of a settlement is availability of water. Many water sources such as wells, hand pumps, tube well, tank etc. are available in rural areas. In the villages under study, the main source of water is tank, followed by tap. The water of the hand-pump is used for drinking for animals, bathing and household purposes. There are fewer ponds in the area and are mostly dry except for monsoon months. The water from the ponds is generally not used by the villagers except for bathing animals. However, more than half the hand pumps in these villages were not



functional and required repair. It is found that all villages are mostly dependent on hand pump water, tube well and borehole.

During the field study and interaction with local people, it is observed that sanitation is very poor except Dhaknabari, Maligaon and Boitamari. Government has launched the scheme for sanitation and gives subsidy for toilet construction, but still they are not ready to build toilets at home. From the data we can say that there is good facility of the drinking water in all the study villages. Awareness level about sanitation is very low because they still prefer to go outside despite of they received government subsidy to construct toilets.

3.15.5 LIVELIHOOD IN THE LOCAL VILLAGES

During survey and interaction with local people it was revealed that majority of people are engaged as agricultural works, small business etc. as a source of livelihood. Most of the farmers are taking major crops (Rice and Gram). Other horticultural plantation were also observed and practiced by small farmers.



CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

CHAPTER 4: ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 INTRODUCTION

The assessment of potential environmental impact consists of the expected changes in the environment due to the proposed formaldehyde plant. The main aim of assessment of environment impacts is to identify the nature and significance of anticipated adverse and beneficial environmental impacts. This chapter assesses nature, type and magnitude of the potential environmental impacts likely on the various relevant physical, biological, social and cultural components due to proposed project. The environmental, biological, ecological and social impacts can be direct as well as indirect. Scientific techniques and methodologies based on mathematical modeling are also available for studying impacts of various project activities on environmental parameters.

The next step is prediction of impacts which is an important component in environmental impact assessment process. Several techniques and methodologies are used for predicting anticipated impacts due to proposed project. The proposed formaldehyde plant may cause adverse environmental impacts on surrounding environment unless proper environmental management plan is adopted during construction and operation phase. Selecting suitable mitigative measures in terms of sites, technology, machinery and operations can minimize the major possible adverse environmental impacts due to the proposed formaldehyde plant.

The following environmental components have been studied to identify the possible environmental impacts due to the proposed formaldehyde plant.

- ✓ *Topography,*
- ✓ *Soil,*
- ✓ *Water Resources and Quality,*
- ✓ *Climatology and Meteorology,*
- ✓ *Air Quality,*
- ✓ *Noise Levels,*
- ✓ *Land Use Pattern,*
- ✓ *Terrestrial Ecology,*
- ✓ *Aquatic Ecology,*
- ✓ *Demographic and socioeconomic.*

The main procedural steps of environmental impact assessment can be summarized as follows:

4.2 IDENTIFICATION

This involves identification of the major project activities, environmental attributes, the impacts of the activities on the environmental attributes and formulation of 'activity-impact' matrix. The impact rating assessment matrix is presented below in Table 4.1.

Table 4.1: Impact Rating Assessment Matrix

Impact			Criteria
Nature of impact	Beneficial		Positive
	Adverse		Negative
Duration of impact	Short term		Impacts shall be confined to a stipulated time
	Long term		Impacts shall be continued till the end of life of proposal
Impacted Area	Localized		Impacts shall be confined within study area
	Regional		Impacts shall be continued beyond study area

Source: ABC Techno Labs India Pvt. Ltd.

The impact of proposed formaldehyde plant on each environmental attribute was assessed. The construction and operation phases were considered to identify the possible impacts due to plant. The matrix method has been chosen to list the potential impacts of the proposed plant. The activities have been arranged in columns and the environmental attributes in the row of the matrix. The beneficial and adverse impacts have been analyzed in the following section on prediction and evaluation of impacts.

For anticipated environmental impact identification, proposed plant activities has been divided into two phases:

1. Construction Phase
2. Operation Phase

1. Construction Phase

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

- ✓ Cleaning of site
- ✓ Leveling and internal road lying
- ✓ Foundation work and civil structure work
- ✓ Erection of mechanical equipments



- ✓ *Synchronization of various equipments/ processes and final commissioning of plant.*

The construction phase of the proposed formaldehyde plant will be for shorter duration for about 12 months only. The construction work mainly involves generation of dust, noise pollution and demand for water during excavation, civil works, erection and commissioning. Though aesthetics and socio-economic factors are also identified, impact on these will be marginal only. Mostly, local workers will be deployed during construction phase.

2. Operation Phase

Because of the potential to create long-term impacts, operation phase is very important from the environmental impact assessment point of view. The basic impacts like particulate and gaseous emissions from process and raw material handling, movement of vehicles, water consumption and waste water generation and solid waste may have potential adverse impact on air quality, water quality, noise level, soil and land. The operation phase will broadly include following direct and indirect activities.

- ✓ *Entire chain of activities related to production cycle.*
- ✓ *Storage and transportation of fuels, raw materials and finished products.*
- ✓ *Generation and supply of electricity*
- ✓ *Particulate and gaseous emissions*
- ✓ *Effluent and sewage generations*
- ✓ *Noise generation*
- ✓ *Solid and hazardous waste generation*
- ✓ *General equipment failure*
- ✓ *Occupational health and safety of workers .*

4.3 PREDICTION

This involves prediction of the nature, magnitude and significance of the impacts. It also includes analysis of the possibilities and/or probabilities of occurrences of the impacts. The matrix establishes 'Cause-effect' relationship between the activities and the environmental factors responsible for them as shown in Table 4.2 and Table 4.3 with respect to activities during construction and operation phases, respectively.

Table 4.2: Impact Prediction Matrix During Construction Phase

Activities	Environmental Attributes					
	Air	Noise	Water	Land & Soil	Socio Economics	Aesthetics
Site cleaning	✓	✓		✓		✓
Excavation	✓	✓	✓	✓		✓
Construction of Civil Works	✓	✓	✓	✓	✓	✓
Installation of Equipments	✓	✓				✓
Transportation	✓	✓				
Material Handling of Construction Materials	✓		✓	✓		
Employment					✓	

Source: ABC Techno Labs India Pvt. Ltd.

Table 4.3 Impact prediction Matrix during Operation Phase

Activities	Environmental Attribute						
	Air	Noise	Water	Land & soil	Socio Economics	Flora& Fauna	Aesthetics
Handling & Charging of Raw Materials	✓			✓			
Operation of ETP	✓		✓	✓			✓
Isolated Storage Facilities	✓		✓	✓			
Storage Facilities of Liquid Raw Materials/Products	✓	✓	✓	✓			
Storage Facilities of Solid Raw Materials/Products	✓	✓	✓	✓			✓
Transportation of Raw Materials/Products	✓	✓	✓	✓			
Development of Greenbelt	✓	✓			✓	✓	✓
Employment Generation					✓		

Source: ABC Techno Labs India Pvt. Ltd.

4.4 EVALUATION

The significance of each impact is determined by assessing the impact severity against the likelihood of the impact occurring as summarized in the impact significance assessment matrix provided below in Table 4.4.

Table 4.4: Impact Rating Assessment Matrix

Impact Severity	Impact Likelihood			
	Unlikely (e.g. Not expected to occur during project lifetime)	Low Likelihood (e.g. may occur once or twice during project lifetime)	Medium Likelihood (e.g. may occur every few year)	High Likelihood (e.g. Routine, happens several times a year)
Slight	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact
Low	Negligible Impact	Negligible Impact	Negligible to Minor Impact	Minor Impact
Medium	Negligible Impact	Minor Impact	Minor-Moderate Impact	Moderate Impact
High	Minor Impact	Moderate Impact	Major Impact	Major Impact

Notes:

- Negligible Impact* : Defined as magnitude of change comparable to natural variation
Minor Impact : Defined as detectable but not significant
Moderate Impact : Defined as insignificant; amenable to mitigation; should be mitigated where practicable
Major Impact : Defined as significant; amenable to mitigation; must be mitigated

All the potentially significant environmental impacts are evaluated and a qualitative assessment is made. An impact level is rated as “Slight”, “Low”, “Medium” or “High”. The impact rating is based on two parameters i.e. the “severity of impact” and the “likelihood of occurrence of impact”.

- *Severity of Impact: The severity of an impact is a function of a range of considerations including impact magnitude, impact duration, impact extent, compliance of prescribed legal framework and the characteristics of the receptors/resources; and*
- *Likelihood of Occurrence: How likely is the impact (this is particularly important consideration in the evaluation of unplanned/ accidental events)*

4.5 ANTICIPATED ENVIRONMENTAL IMPACTS

The anticipated impacts assessed for each parameter are discussed below:

4.6 IMPACT ON TOPOGRAPHY

4.6.1 TOPOGRAPHY AND PHYSIOGRAPHY

A. Construction Phase

The area of the plant is almost flat terrain. The proposed formaldehyde plant construction activities, such as, leveling, excavation, construction of buildings and other activities will be limited within 36.4 Acres (147283 sq.m) of land area of the proposed plant site, which is currently industrial plot. no impact is envisaged on the topography. Impact on soil

during construction would be mainly due to the left out of construction materials used. Hence, proper care shall be taken so that minimum amount of waste is produced and most of it gets recycled. The topsoil removed during the leveling will be stacked separately and will be used during the greenbelt development.

B. Operation Phase

During operation phase of proposed formaldehyde plant, no impact is anticipated on the topography and physiography of the area.

Hence, the impact on the topography and physiography of the study area is as per given below.

Impact Rating	Topography & Physiography
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

❑ Mitigation Measure

- ✓ Disruption/alteration of micro-watershed drainage pattern will be minimized to the extent possible.
- ✓ Leveling and grading operations will be undertaken with minimal disturbance to the existing contour, thereby maintaining the general slope of site;
- ✓ Loss of micro-watershed drainage, if any, is to be compensated through provision of alternate drainage.

4.6.2 IMPACT ON SOIL QUALITY

A. Construction Phase

During the construction phase, soil would be excavated at the plant site for leveling, foundations of buildings, etc. Prior to leveling and excavation, top soil will be segregated and stockpiled. Top soil will be used during the greenbelt development and landscaping at the plant site. The anticipated pollution to soil environment due to plant construction activities is as follows:

- Changes in soil texture due to settling of air borne dust or due to wash off solid particulates by surface or ground water. This may lead to change in porosity, permeability & other such physical characteristics of soil of the area.

- Changes in soil chemistry due to addition of foreign materials from polluted air and water due to plant activities in the area.

Proper mitigative measures like use of efficient pollution control systems, proper stack height and use of top soil in plantation results in no significant impact on soil of the project site. There will be no impact on soil of the study area located beyond the working area of the proposed project.

During construction phase of proposed formaldehyde plant, 20-25 kg/day solid waste may be generated by the construction workers. The type of wastes expected to be generated will be segregated into the following possible categories:

- ✓ Waste from food, etc.,
- ✓ Paper, packing, plastic bottles and polythene waste, etc.,

This will be segregated and disposed off by substantial disposal techniques. Therefore, soil at the plant site and area will not be affected by the solid waste generated at the project site during construction phase.

Hence, negligible impact on soil is anticipated during construction phase.

There will be a small amount of waste, such as, spillage of oil, grease, etc. from construction of proposed formaldehyde plant that may contaminate soils at the site. However, extent of contamination will not be significant. Hence, no significant impact is anticipated on soil during construction phase of the proposed formaldehyde plant.

☐ Mitigation Measures

- ✓ Prior to leveling and excavation, top soil will be segregated and stockpiled. Top soil will be used during the greenbelt development and landscaping at the plant site.
- ✓ Wastes and debris generated at the site will be collected time to time and disposed suitably to avoid such contamination. The debris generated during construction will be used for land filling at the site only.
- ✓ Excavation of foundations will be carried out during dry season.

B. Operation Phase

During operation phase of proposed formaldehyde plant, hazardous wastes generated from utilities can contaminate soil of site and nearby area, if not disposed properly, About 1.2 KL per annum of used oil will be generated from utilities during maintenance. It can contaminate soil of site, if not disposed properly.

Domestic waste generated by proposed plant personnel, canteen, etc, may contaminate soil of site and nearby area due to improper disposal. Hence, domestic waste generated at the site will be collected and disposed as per SWM Rules, 2016.

About 2000 kg per month sludge will be generated from effluent treatment plant (ETP), which is categorized as hazardous waste. Improper disposal of ETP waste may contaminate soil of the site and near by area.

☐ **Mitigation Measures**

- ✓ Temporary storage of hazardous wastes in impervious pit located in covered and isolated place
- ✓ Used oil generated from machineries will be collected and given to MOEF&CC/ASPCB approved used oil recyclers for recycling.
- ✓ Domestic waste generated by plant personnel, canteen, etc, will be collected and disposed as per SWM Rules, 2016.
- ✓ Sludge generated from ETP should be collected in impervious pit and sent to authorized agencies for treatment and disposal in environmental sound manner.
- ✓ In view of implementation of mitigation measures, possible soil contamination will be insignificant. Hence no significant impact is anticipated on the soil of the plant site and study area during operation phase of the proposed formaldehyde plant.

Hence, the impact on the soil quality of the study area is as per given below.

Impact Rating	Soil Quality
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.7 CLIMATOLOGY AND METEOROLOGY

The construction and operation of the proposed formaldehyde plant will have no impact on climatology and meteorology of the study area.

4.8 IMPACT ON AIR ENVIRONMENT

A. Construction Phase

The potential sources of air emissions during construction phase of the proposed formaldehyde plant will be as follows:

- ✓ Dust from earth works (during site preparation);

- ✓ Emissions from the operation of construction equipment and machines;
- ✓ Fugitive emissions from vehicles running to site;
- ✓ Fugitive emissions during the unloading of cement bags;
- ✓ Fugitive emissions during mixing of cement with other building materials;
- ✓ Air emissions other than dust arise from combustion of hydrocarbons. The pollutants of concerns are NO_x, SO₂, CO, particulate, and un-burnt hydrocarbons.

Impact of construction activity on air quality is a cause for concern mainly in the dry months due to settling of dust particles. The main sources of dust emissions during the construction period will be the movement of equipment at site and dust emitted during the levelling, grading, earthworks, foundation works and other construction related activities. The dust emitted during the above mentioned activities will depend upon the type of soil being excavated and the moisture content. The impact is likely to be for short duration and confined locally to the construction site itself. The composition of dust in this kind of operation is however mostly coarse particles, inorganic and non-toxic in nature and these are not expected to travel long distance before settling.

Exhaust emissions from vehicles and equipment deployed during the construction phase will also result in marginal increase in the levels of SO₂, NO_x, SPM, CO and un-burnt hydrocarbons. The impact will, however, be reversible, marginal, and temporary in nature.

The impact of construction activities would be temporary and restricted to the construction phase. The impact will be confined within the project boundary and is expected to be negligible outside the proposed plant boundaries. Proper upkeep and maintenance of vehicles, sprinkling of water at construction site, providing sufficient vegetation etc. are some of the proposed measures that would greatly reduce the impact on the air quality during the construction phase of the plant site.

During the excavation, unloading of cement bags and mixing of cement with other building materials, fugitive dust emissions may be emitted at the construction site. It may be noted that these emissions would be in the form of coarse particulate matter and will be settled down ultimately in the closed vicinity of construction site.

B. Operation Phase

- ***Gaseous emissions***



The proposed formaldehyde plant will not have boiler/heater for manufacturing formaldehyde from methanol. There will not be any DG sets required as entire electricity will be drawn from Assam Power Distribution Company Limited.

During manufacturing of formaldehyde process tail gas will generate of about 5817 kg/hr. Water vapour in the flue gas is 32.09%.

The dry basis composition is as follows:

- CO₂= 4.48 %
- CO = 0.1 %
- O₂= 0.19 %
- H₂= 16.9 %
- Inert= 78.53%

There will not be any type of process emission from the proposed activities and also no emission of SO_x, NO_x and particulate matter. No process emission, as most of the raw materials/products shall be in liquid/semi liquid phase and there will not be any fugitive emissions of PM. All powder/solid materials will be handled in closed system to prevent any fugitive emissions of PM. All solvents shall also be handled by closed system to prevent fugitive emissions of VOCs.

Air Pollutants Dispersion Modeling for Prediction of impacts on Ambient Air Quality

The objective of dispersion modeling is to predict the ground level concentration during the operation of proposed resin plant and its impact on ambient air quality of the area. The ground level concentrations of pollutants have been computed using computer simulation model BREEZE AIR SUITE based on Industrial Source Complex Short Term (ISCST-3) of United State Environmental Protection Agency (USEPA) and considering guidelines stipulated by CPCB for air pollution dispersion modeling.

The key emissions from the proposed plant will be Carbon Monoxide (CO).

Mathematical Model Used For Computation

Prediction of GLC values are made by using Industrial Source Complex Short Term Model Version - 3 (ISCST-3) software approved by U.S. Environmental Protection Agency (USEPA). This model uses a steady state, sector-averaged Gaussian plume equation for application in complex terrain (i.e. terrain stack or release height) and is run using stability classes developed by Pasquill and Gifford.

The following are the assumptions made while using the model:

- The plume rise is estimated by Briggs formulae, but the final rise is always limited to that of the mixing layer;
- Stack tip down-wash is not considered;
- Buoyancy Induced Dispersion is used to describe the increase in plume dispersion during the ascension phase;
- Calms processing routine is used by default;
- Complex terrain is used for computations;
- It is assumed that the pollutants do not undergo any physico-chemical transformation and that there is no pollutant removal by dry deposition;
- Washout by rain is not considered;
- Cartesian co-ordinate system has been used for computations;
- No dry and wet depletion of pollutants;
- Receptors are on flat terrain with no flag pole.

Source Characteristics

The emissions sources at the proposed formaldehy plant are as given in Table 4.5:

Table 4.5: Source and Emission Characteristics for Dispersion Modeling

Stack ID	Fuel	Release ht (m)	Dia (m)	Exit velocity (m/s)	Exit Temp (K)	Emission rate (Sox)	Emission Rete (PM)
Process Exit	-	~25 meter	~ 0.5 meter	~14 m/sec	~30 degC	NIL	NIL

Atmospheric Stability

The persistence of atmospheric stability class has been estimated using hourly monitored wind velocity data along with compiled data for sunrise, sunset, solar isolation for day-time and cloud cover for night-time for the site.

Mixing Height

The knowledge of the site specific mixing height (convective stable boundary layer and inversion height or nocturnal boundary layer) is crucial in a realistic adoption of appropriate plume rise and vertical dispersion parameters. In the absence of site specific mixing heights, “Hourly Mixing Height and Assimilative Capacity of Atmosphere in India” published by Environmental Monitoring and Research Centre, India Meteorological Department, New Delhi, 2008, has been referred for hourly mixing heights.

Maximum 24-Hourly and Seasonal Incremental GLC Isopleths

Using mathematical model as described above, the maximum 24-hourly and seasonal incremental ground level concentration (GLCs) values calculated at different grid points using 24-hourly and seasonal averaging period are used for obtaining the maximum 24-hourly and seasonal incremental ground level concentrations (GLCs) isopleths for the study period and considering that X, Y coordinates of the stack centre (0.0).

The following conclusions can be made from the air pollution dispersion modeling:

❑ Findings

Isopleths for 24 hourly average increases in GLCs are depicted in Figure 4.1 to 4.9 for all four scenarios. Overall impact on existing ambient air quality shall be as per given hereunder in Table 4.6.

Table 4.6: Overall Impact on Existing Ambient Air Quality

Particulars	Predicted 24-Hour Average Maximum Concentration ($\mu\text{g}/\text{m}^3$)	Maximum Distance (Km)
	CO	
Maximum Predicted GLC from Process stack	9.65	0.8 (SE)
Maximum Concentration Recorded in Ambient Air as Baseline	400	
Maximum Projected Concentration of CO in Ambient Air	409.65	

Source: ABC Techno Labs India Pvt. Ltd.

Figure 4.1 describes the GLC increase isopleths of PM for Scenario 1, which are drawn at an interval of $9.65 \mu\text{g}/\text{m}^3$



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Figure 4.1: Maximum GLC Increase of CO from process stack



- ***Fugitive Emissions***

As the entire proposed formaldehyde plant will be covered with good landscaping and tree/grass cover, generation of fugitive dust within the premises is not anticipated. Even the dust, outside the project will be minimal due to the proposed compound walls, and plantation which will function as barriers along the boundary. Further, all fugitive emissions are likely to be controlled to a great extent, through proper maintenance of tree plantation and the green belt development undertaken within the project.

Hence, considering these, it is envisaged that during the operation phase, impacts on air would arise due to the fugitive emission mainly from production process. Hence, the study of impacts for the fugitive & stationary emissions have been conducted to assess the potential impacts as well as to cite the efficiency of planned mitigation measures and to suggest further mitigation requirements.

- ***Impact Study Due to Proposed Traffic Density***

All the major raw materials will be transported by road ways. A road network will be provided up to site. All the tippers/ trucks will be covered by tarpaulin. Hence there will not be much fugitive dust generation during transportation of raw materials for construction. Pucca road exists up to the site.

The existing road is capable of absorbing this additional truck movement. The total raw material (Methanol) required for proposed project is 90 TPD. The increase in traffic load is very less. So there will be insignificant effect on the nearby surrounding and there will not be generation of fugitive dust during transportation of raw materials and products. The receptor villages are far away from project site so there will not be any adverse impact on vehicular traffic.

- ***Odour Management***

There will be no odour from the proposed plant as adequate measures will be implemented as given below:

- ✓ All solvent transfer will be in closed pipeline hence there will be no open handling leading to fugitive emission and it will prevent odour nuisance
- ✓ All reactor vents will be with double stage vent condenser to prevent fugitive emission into atmosphere and prevent odour nuisance
- ✓ All solvents with low flash points will be provided with nitrogen blanketing which prevent fugitive emissions and odour nuisance

- ✓ Provision of scrubbing system for reactor vents and stripping of effluent streams before treatment will result into effective odour control in the area
- ✓ Provision of greenbelt around the perimeter of the formaldehyde plant will also help in controlling fugitive emissions.

❑ **Mitigation Measures**

The following measures are proposed to mitigate negative impact on air quality due to operation phase of the proposed plant on the surrounding air environment.

- ✓ Height of stacks of process will be as per statutory requirement. The stack will have stack monitoring facility consisting of sampling port-hole, platform and access ladder.
- ✓ Transport vehicles will be properly maintained to reduce air emissions.
- ✓ Trucks transporting of the raw materials and end products to proposed formaldehyde plant will be have pollution under control certificate (PUC).
- ✓ Change of raw materials will be carried in such manner fugitive emissions area lesser.
- ✓ Regular maintenance of machinery in order to control emissions.
- ✓ A good housekeeping and proper maintenance will be practiced in the industry.

Hence, the impact on the air quality of the study area is as per given below.

Impact Rating	Air Quality
Significance and Nature of impact	Minor and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Medium
Severity of impact	Slight

4.9 IMPACT ON NOISE ENVIRONMENT

The assessment of the impacts of noise on the surrounding community depends upon:

- Characteristics of noise source (instantaneous, intermittent, or continuous in nature);
- Time of day at which noise occurs; and
- Location of noise source with respect to noise sensitive receptor.

A. Construction Phase

During the construction phase of the proposed plant, noise will be generated from various sources, such as, due to use of machinery and vehicles for transporting construction materials.

Some major sources of noise generation at the plant site are listed here:

- Generation of noise during movement of vehicles carrying materials, loading & unloading activities,
- Generation of noise from excavation machines, concrete mixer and other construction machines,
- Generation of noise during the operation of DG set,
- Generation of noise during concreting, hammering, etc,
- Noise from the mechanical operations, like, hammering fitting, etc, at site.

All the above mentioned sources at the proposed plant will be intermittent and would be experienced occasionally. It may also be noted that, most of the construction activities will be carried out only during the daytime.

The expected noise levels from these activities are given here under in Table 4.7:

Table 4.7: Typical Noise Levels of Construction Equipment

Particulars	Noise Levels dB(A)
Earth Movers	
Front End Loaders	72-84
Tractors	76-96
Scrapers, Graders	80-93
Pavers	86-88
Trucks	82-94
Material Handlers	
Concrete mixers	75-88
Concrete pumps	81-88
Stationary Equipment	
Pumps	69-71
Generators	71-82

Resultant Noise Level

The combined effect of above sources can be determined as per the following equation:

$$L_p(\text{total}) = 10 \log(10(L_{p1}/10) + 10(L_{p2}/10) + 10(L_{p3}/10) + \dots)$$

Where: L_{p1} , L_{p2} and L_{p3} are noise pressure level at a point due to different sources in dB (A).

For an approximate estimation of dispersion of noise in the ambient air from the source point, a standard mathematical model for sound wave propagation is used. The sound pressure level generated by noise sources decreases with increasing distance from the source due to wave divergence. An additional decrease in sound pressure level from the source is expected due to atmospheric effect or its interaction with objects in the transmission path. The noise level generated from a source would decrease with increase in distance from the source because of the wave divergence.

For hemispherical sound wave propagation through homogenous loss of free medium, noise levels at various locations can be calculated due to different sources using model based on the first principles as per the following equation:

$$Lp2 = Lp1 - 20 \log(r2) \quad \dots\dots\dots(1)$$

Where: Lp2 and Lp1 - Sound Pressure Level (SPLs) at points located at source and at distances of r2 from the source respectively in dB (A).

The resultant maximum noise level for the above sources as calculated using combined effect equation is 85 dB(A).

Assuming no environmental attenuation factors, noise modelling has been done, which shows noise level will mingle with the baseline noise level within short distance. Noise modelling results for construction phase have been given in Table 4.8 and shown in Figure 4.2:

Table 4.8: Noise Modeling Results

Area	Permissible Limits (Day Time)	Distance from source
Silence Zone	50 dB (A)	56.2 m
Residential	55 dB (A)	31.6 m
Commercial	65 dB (A)	10.0 m
Industrial	75 dB (A)	3.2 m

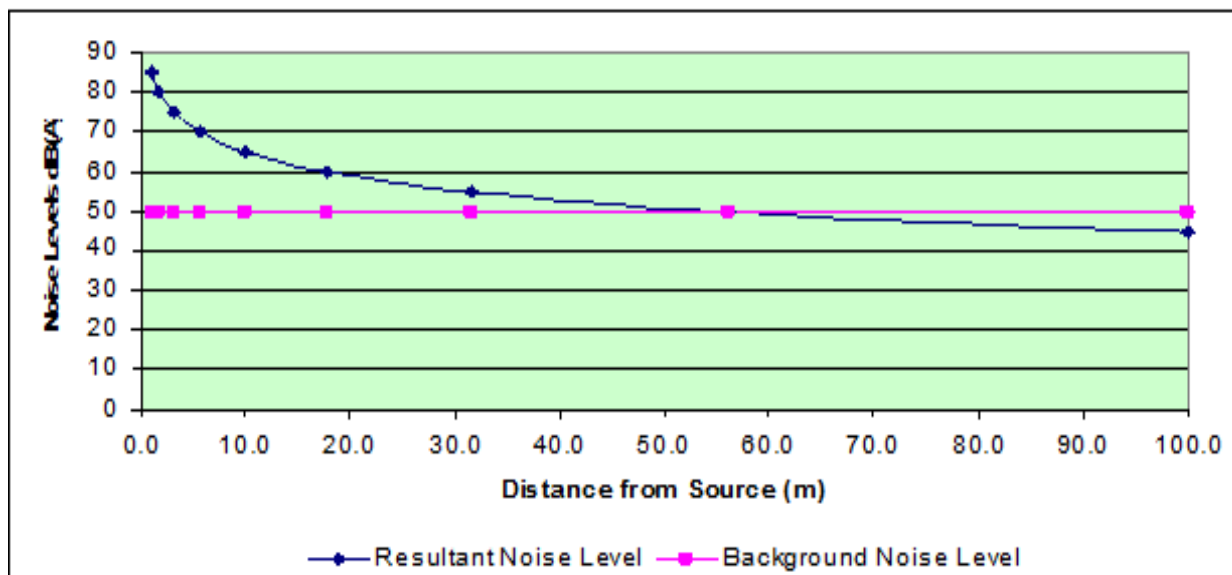


Figure 4.2: Attenuation of Noise from Source

The noise produced during construction phase will have temporary impacts on the existing ambient noise levels at the project site but restricted to small distance (maximum upto 60 m) and only during daytime and will not affect even the nearest human habitation (around 200 m from the main plant). Therefore, the impact of noise levels on surrounding area will be insignificant during the construction phase.

B. Operation Phase

During operation of the proposed plant may generate some noise. Suitable noise control system will be provided to ensure that noise at the ventilation openings does not exceed 90 dB (A) at 1 m distance in conformity with ISO: 3746. The only continuous source of noise during plant operation will be boiler as DG set will operate only during grid power failure.

Therefore, free field noise level due to all sources at the plant boundary, closest boundary is unlikely to exceed 55 dB (A) and the same will decrease to nearly 50 dB (A) at a distance of 200 m, the distance of nearest habited area from the plant boundary.

The operators, workers and other personnel within the plant, however, have to be provided with protective measures such as earplugs at the noise generating area. The noise protective enclosures shall be provided at the noise generating area. The permissible noise exposure for the workers working at the noise sources is listed in the following Table 4.9. Hence measures shall be taken to avoid such exposures.

Table 4.9: Permissible Noise Exposures for Industrial Workers

Exposure Time (in hr/day)	Limit in dB (A)
8	90
4	93
2	96
1	99
1/2	102
1/4	105
1/8	108
1/16	111
1/32	114

Therefore, no significant adverse impact is anticipated due to proposed plant operation on noise levels of area.

❑ **Mitigation Measures**

Mitigation measures to control noise levels during operation phase are as given below:

- ✓ Ear muff and plugs to workers working relatively high noise areas.
- ✓ Green belt development is planned for the attenuation of noise pollution and to maintain ambient noise quality within the statutory limit.
- ✓ The operation of high noise generating equipment shall be restricted during the night time.
- ✓ All the equipment in the formaldehyde manufacturing unit will be designed/ operated in such a way that the noise level shall not exceed 85 dBA as per the requirement of OSHA (Occupational Safety and Health Administration).
- ✓ Proper maintenance of pump, machinery, blower etc to control noise levels.

Hence, the impact on the noise levels is as per given below.

Impact Rating	Noise Levels
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.10 IMPACT ON WATER ENVIRONMENT

4.10.1 WATER RESOURCE

A. Construction Phase

The proposed plant will be located on 36.4 Acres (147283 sq.m) of land. During construction phase, proper drainage will be provided for runoff movement during rains, hence, no changes in the natural drainage pattern of the site and area is envisaged, the impact of construction of proposed plant on surface water resources is likely to be insignificant.

B. Operation Phase

The requirement of water for operation of the Plant is tentatively 384 KLD. This will be fulfilled by drawing water from nearby Tunia River which is at a distance of approximately 50 meter from the Project. There will be no treated effluent disposal to surface water. The Plant will be designed on zero discharge concept.

Hence, the impact on the surface water resources of the study area is as per given below.

Impact Rating	Surface Water Resources
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.10.2 WATER QUALITY

A. Construction Phase

The construction of proposed plant will result in increase in soil erosion during rain from the site as all vegetation will be cleared at the time of construction. The runoff from the site during rainfall may cause some increase in the quantity of suspended solids and turbidity of run off water. However, this impact will be of temporary in nature and may last after the excavated soil and construction debris are disposed off properly.

☐ Mitigation Measures

- ✓ Construction activities viz. stripping, excavation etc during monsoon season will be restricted to the extent possible.

B. Operation Phase

About 2.5 KLD effluent will be generated from the process vessel washing and cooling blow down. It may contaminate surface and ground water resources on disposal without proper treatment.

❑ **Mitigation Measures**

- ✓ Normally there is no generation of wastewater from process; however intermittent generation of wastewater will be treated in Effluent Treatment Plant (ETP). About 100% of effluent generated shall be reused with the raw material input.
- ✓ The effluent generated at the plant will be collected and treated in well designed ETP.
- ✓ The water balance of the plant is framed based on zero liquid discharge philosophy. DM water plant of ~ 128 KLD capacities will be installed. DM water will be used in the process for the dilution/ absorption for making 37% Formaldehyde (AF-37) and BFW make up. DM water plant regeneration waste will be treated in the ETP.
- ✓ Cooling Tower make up water requirement will be around ~265 KLD. Cooling tower blow down, regeneration/ backwash waste from the Raw water plant will also be treated in ETP. The capacity of ETP will be ~75 KLD.
- ✓ Sewage: It is estimated that approximately 20 KLD of sewage will be generated from project site. The sewage will be treated in Sewage Treatment Plant (STP). No impacts are thus envisaged from sewage disposal from site.
- ✓ All chemical and fuel storage areas, process areas will have proper bunds so that contaminated run-off cannot escape into the storm-water drainage system.
- ✓ Storm water drainage network will be designed so that mixing with effluent can be avoided.

Therefore, possible water quality deterioration and contamination will be insignificant. Hence, no significant impact is anticipated on the water quality during operation phase of proposed plant and the impact on the ground water quality of the study area is as per given below.

Impact Rating	Water Quality
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.11 IMPACTS DUE TO WASTE DISPOSAL

A. Construction Phase

During the construction phase, the typical solid waste will be generated from the project includes waste from canteen, labor establishment and administrative buildings land clearing activities and construction waste.

Impact from construction waste may arise owing to storage on site, transportation, workshops, etc. Proposed mitigation plan suggests maximum reuse/recycle of construction waste on site or removal of waste at the site and proper disposal, which would reduce the impact significantly.

B. Operation Phase

During operation, there will be no generation of solid & hazardous waste in normal operation. Spent catalyst will be sent to the specialized vendor for treatment/regeneration/ recycle. Safe and scientific arrangement for handling, storage and disposal of all solid wastes will be ensured for as glue sludge, cotton waste, polybags etc. The details of waste generation from the plant are given in Table below:

Table 4.10: Hazardous Waste Generation and Management

Sl. No.	Hazardous waste	Category	Quantity	Method of disposal
1	Used/ spent oil	5.1	1.2 KL/ Annum	Used oil will be collected in metal drums kept in secured dyked area and will be disposed to CPCB/ ASPCB registered used oil reprocessor
2	Wastes/ residues containing oil	5.2	1-2 Kg/Annum	Disposed on-site in HDPE lined pits located on site

Table 4.11: Non Hazardous Waste details and disposal methods

Sl. No.	Non Hazardous waste	Quantity	Method of disposal
1	Kitchen Waste	10 – 20 kg per day	Will be stored in compost pits on a daily basis or disposed off nearby municipal disposal site via local vendors
2	Recyclable waste like papers, plastics,	Small	Proper segregation and storage of recyclable waste in designated bins onsite. Recyclables will be periodically sold to local waste recyclers.
3	Packaging wastes	Small	Proper segregation and storage at designated stackyard onsite. Packaging wastes will be periodically sold to local waste recyclers.

❑ **Mitigation Measures**

- ✓ Segregation or sorting of wastes at its source will be practiced in order to encourage reuse/ recycling and to minimize the negative effects of the waste and increase its economic value. With segregation at source, recyclables do not lose their commercial value due to cross contamination.
- ✓ At every floor dedicated bins will be placed to collect biodegradable and non-biodegradable wastes in the residential area.
- ✓ At parking areas and other open areas dedicated bins will be placed.
- ✓ Daily collection of wastes shall take place from all the bins.
- ✓ Daily sweeping and collection of waste from roads and other common facility area would also be done daily in the morning by the same operator.
- ✓ For waste collection either carts or dedicated trucks will be used. Separate collection for biodegradable and non-biodegradable wastes will be ensured.
- ✓ Large storage bins will be placed in the residential and buildings areas for final storage of waste before disposal.

Hence, no negative impact on land and soil quality of the solid & hazardous waste on the project site are expected due to the proposed project activities.

4.12 BIOLOGICAL ENVIRONMENT

A. Construction Phase

The potential primary and secondary impacts from the proposed plant on the biological environment have been identified and the significant ecological impacts are evaluated based on:

- *Habitat Quality*
- *Species affected*
- *Size/abundance of habits/organisms affected*
- *Duration of Impacts*
- *Magnitude of environmental changes*

There is no National park, wildlife sanctuary or any other sensitive area located in within 10 km distance from the plant site.

Reserve Forest found around 10 km radius about 1 Km from the project site towards eastern side. However, no reserve forest area falls within the study area. The Reserve



Forests found within study area are- Bharirab RF (E), Khagarpur RF (E), Bahalpur RF (SW), Rakhal Thakur RF (W). Proper attention will be given so that no waste can be dumped near forest area.

The project will not have adverse impacts on the existing flora and fauna.

The proposed plant site is free from trees and shrubs. The proposed plant site will be cleared from all kind of vegetation in the grasses and ground flora. However, no tree needs to be cut for proposed plant construction. Therefore, some loss of vegetation in the form of ground flora is anticipated during construction phase.

The green belt plantation at the site will be started during construction phase; this will be positive and beneficial impact of project in terms of flora at the site.

B. Operation Phase

The proposed formaldehyde manufacturing unit will be small scale and therefore, there will be no adverse impact on the terrestrial ecology. However greenbelt/ plantations will be developed at the periphery of the plant premises, which will have positive impacts on flora and fauna of the area.

- ✓ The green belt will provide shelter to the faunal species and there for positive impact on the fauna due is anticipated.
- ✓ There are no significant impacts envisaged on the ecological environment of the region as the area is almost covered with fallow land devoid of any considerable ecological conditions.
- ✓ Further there would not be any considerable sources (noise, gaseous pollutants, effluent and hazardous waste) of impacts on ecology and thus, no significant impacts on ecological conditions due to operational activities are envisaged.
- ✓ The greenbelt development will significantly improve the ecological conditions of the area considering the baseline ecological status of the immediate surrounding area.

Thus the overall impacts, considering the normal hazard free operation, appreciable beneficial impacts are anticipated on the ecological conditions of the region.

Hence, the impact on the air quality of the flora and fauna levels is as per given below.

Impact Rating	Ecology
Significance and Nature of impact	Minor and Positive
Duration of impact	Long term
Impacted Area	Localized



Impact Rating	Ecology
Likelihood of occurrence	Low
Severity of impact	Slight

4.13 IMPACT ON OCCUPATIONAL HEALTH AND SAFETY

During construction and operation phases of proposed formaldehyde plant, occupational health and safety of workers may be impacted by dust, high noise levels and chemical exposures.

A. Construction Phase

During construction phase occupational health and safety may be affected by the following reasons:

- Exposure to dust during excavation
- Hazardous fumes during arc welding
- Electrical hazards by loose electrical wiring
- Exposure to high noise levels
- Working at height – falling danger
- Injuries to the workers during construction operation

To enhance the occupational health and safety during contraction phase, the following measures will be taken:

- ✓ Water sprinkling to avoid dust emission
- ✓ Use of suitable PPEs like mask during arc welding operation
- ✓ Electrical safety to be maintained as per regulations
- ✓ Use of ear muff and plug in high noise area
- ✓ Use of safety belt while working at height
- ✓ Induction training to worker to enhance safety of worker
- ✓ First aid facilities will be provided.

B. Operation Phase

During operation phase workers may be directly or indirectly exposed by chemical like formaldehyde during charging, process or material handling. Hazardous chemical have Threshold Limit Value (TLV) like phenol: 5 ppm, formaldehyde. The exposure of hazardous chemicals and work floor hazards may affect occupational health and safety of the workers. During the operation phase of necessary mitigation measures and health

checkup will be carried to ensure to enhance occupational health and safety of plant personnel.

- ✓ Process will be carried out in isolated area or closed system.
- ✓ Dilution ventilation/local exhaust ventilation system will be provided.
- ✓ Chemical handled by competent person
- ✓ MSDS of hazardous substance will be maintained by company.
- ✓ Quantity of substance will be kept to absolute minimize
- ✓ Flame proof electric fitting will be provided.
- ✓ Safety devices like temp. Control and pressure control will be provided to vessel
- ✓ Labeling and sign board will be provided.
- ✓ Fire fighting, sprinkling system and emergency exit will be provided.
- ✓ PPE will be used during handling of chemicals.

Routine health check-up will be carried out for workers engaged in hazardous operation.

Hence, the impact on the occupational health and safety is as per given below.

Impact Rating	OHS
Significance and Nature of impact	Negligible and Adverse
Duration of impact	Long term
Impacted Area	Localized
Likelihood of occurrence	Low
Severity of impact	Slight

4.14 SOCIO-ECONOMIC ENVIRONMENT

Invariably, industrial projects lead to a change in quality of life in the area and respective region. The requirements of workforce for various activities also result in demand for housing, communication facilities, education, health and recreational facilities thus contributing to changes in the quality of life in the vicinity of a proposed site also. Some of these impacts would be more effective in the immediate vicinity with short term beneficial effects, whereas the others would be of higher order or of long term in nature. It is necessary to identify the extent of these impacts for further planning of control measures leading to mitigation of the adverse impacts. The impacts due to proposed project on parameters of human interest (socio-economic) have been identified and are as follows:

A. Construction Phase

The direct beneficial impacts are involved due to the engagement of workers in construction activities.

The indirect impact beneficial to the community is the provision of skilled/unskilled workforce in associated activities.

Local contractor will be employed for construction. Hence, no other issues like social conflict etc. envisaged, economic benefits to the local contractors. As no habitation on land and hence, no displacement is required.

The relatively short-lived economic impacts of the construction phase are likely to be experienced in local area for the duration of construction phase as workers make everyday purchases from local traders in nearby areas.

Noticeable, flow-on economic impacts will be experienced in other sectors of economy as a result of purchase of construction materials and the payment of wages and salaries to the personnel engaged in the plant activities.

B. Operation phase

The operation of formaldehyde plant will create direct and indirect employment opportunities during plant operation, transportation of raw materials and transportation products as well as secondary services. Therefore, operation of the plant would have positive impact on the status of job opportunities in the study area.

Impact on Civic Amenities: During the construction period there will be short-term socio-economic impacts in the study area that may include increase in floating population (contract labourers). As number workers will be about 40 therefore, only insignificant strain is anticipated on the civic amenities like drinking water, sanitation, road transport and other facilities.

Impact on Historical, Archeological and Architectural Sites: There are no historical or archeological monuments within the study area and hence no negative impact in this regard is anticipated.

Anticipated impacts on socio-economic variables of the area during construction and operation phases are given in Table 4.12.

Table 4.12: Impacts on Socio-Economic Variables

Parameters	Construction phase	Operational Phase
Population		
Change in Population	No change	No change
Inflow/ outflow of temporary workers	Majority of unskilled workers will be from the surrounding localities	Minor outflow of temporary workers
Community and Institutional Structures		



Parameters	Construction phase	Operational Phase
Employment/ income Characteristics	Employment to construction labor and support staff	Employment to specialists, support staff within the facility
Individual and Family Changes		
Displacement and relocation concerns	No relocation /displacement	No relocation/ displacement
Residential stability	No change	No change
Attitudes Towards Policy/ Project	The proposed plant would generate goodwill if creates employment opportunities and if community can be assured that the facility shall not create health problems for the community.	The proposed plant would generate goodwill if creates employment opportunities and if community can be assured that the facility shall not create health problems for the community.
Social Well Being	The proposed plant shall provide employment opportunities to people at various levels hence shall empower them to access facilities for their well-being.	The proposed plant shall provide employment opportunities to people at various levels from the nearby villages only.
Community Resources		
Change in Community Infrastructure	Short term impact on civic amenities due to influx of workers during construction phase	No change
Landuse Patterns of the area	No noticeable change in the vicinity	No change

Conclusion of Social Impacts

Analysis of various social impacts both adverse and beneficial in the present study reveals that the implementation of the project will considerably improve the socio-economic conditions of the people. On the basis of present social study the following conclusions may be drawn.

- ✓ The project has strong positive employment and income effects, both direct as well as indirect.
- ✓ The project is going to have positive impact on consumption behavior by way of raising average consumption and income through multiplier effect.
- ✓ People perceive that the project will bring job opportunities for the people along with the development of social infrastructure.
- ✓ The project is likely to bring about positive changes in life style and quality of life for people located in that area.
- ✓ There will be overall socio-economic development of the area.

4.15 IMPACT EVALUATION

The evaluation of the impacts of the proposed project activities on the environment, both in terms of quality & quantity have been made. For quantification of impacts, matrix system as modified to some extent has been used as per given below:

For quantifying impacts on the environment, the guidelines and standards prescribed by national and international agencies are being considered. 1000 numbers are distributed as per the weightage to each parameter considered based on its importance as per given below in Table 4.13.

Table 4.13: Evaluation of Impact Prediction

Parameters	Importance Value
Air Quality	200
Water quality	100
Water resources	100
Noise and vibration	200
Soil & Solid waste	200
Land Use Pattern	50
Forest & Vegetation and wild life	50
Socio – economic	50
Employment	50

The severity has been divided in impact scores from 0-5 for calculating the severity of impacts on the environmental parameters due to various project activities as given below in Table 4.14.

Table 4.14: Impact Assessment Score

Severity criteria	Impact score
No impact	0
Significant impact-slight and short term	1
Significant impact-slight and long term	2
Moderate impact- short term	3
Moderate impact- long term	4
Major Impact - Permanent	5

The impact score can be negative or positive depending on whether the impact is adverse or beneficial.

Based on the above importance values and impact scores, the impact value (impact score x importance value) for each environmental parameters is calculated. The impact value for individual parameter is added to arrive at the total impacts value. The criterion used



to make conclusive statement is based on the total impacts value without control measures is defined as given below in Table 4.15.

Table 4.15: Impact Assessment Criterion

Total impact value	Conclusions
Upto (-)1000	No appreciable impact on environment
(-) 1000 to (-) 2000	Appreciable but reversible impact. Mitigation measures important.
(-) 2000 to (-) 3000	Significant impact which is mostly irreversible. Mitigation measures crucial.
(-) 3000 to (-) 4000	Major impact which is mostly Irreversible. Selection of process and raw material to be crucial.
Above (-) 4000	Permanent irreversible impact, alternative sites to be considered.

The environmental impact matrix based on the above principles has been attempted for the Proposed Formaldehyde Plant and are given in Table 4.16.

Table 4.16: Impact Evaluations – Proposed Formaldehyde Plant

Environmental parameters	Importance value	Impact Score		Overall Value	
		Without EMP	With EMP	Without EMP	With EMP
Air Quality	200	-1	-1	-200	-200
Water quality	100	-3	-1	-300	-100
Water resources	100	-2	-1	-400	-100
Noise and vibration	200	-2	-1	-400	-200
Soil Quality & Solid waste	200	-2	-1	-400	-200
Land Use Pattern	50	-1	-1	-50	-50
Forest & Vegetation and wild life	50	-1	1	-50	50
Socio – economic	50	1	1	50	50
Employment	50	1	1	50	50
Total				-1200	-400

Source: ABC Techno Labs India Pvt. Ltd.

Thus, it can be evaluated that there will be No appreciable impact on environment is envisaged with proper mitigation measures.



CHAPTER 5

ANALYSIS OF ALTERNATIVES

CHAPTER 5: ANALYSIS OF ALTERNATIVES

5.1 ALTERNATIVE LOCATION FOR THE PROPOSED PROJECT

No Alternative Sites are considered as the vacant land has been allocated by the Government of Assam in the said industrial belt.

5.2 ANALYSIS OF ALTERNATIVES

A number of factors related to economical, land availability, power availability and environmental aspects are involved in site selection. The important factors which influence the project site selection are given below:

- ✓ Techno-economic considerations.
- ✓ Available infrastructure.
- ✓ Environmental considerations.

5.2.1 TECHNO-ECONOMIC CONSIDERATIONS

The techno-economic considerations in the selection of proposed formaldehyde plant site are as detailed below:

- ✓ Availability of suitable land for proposed project.
- ✓ Availability of facility for receipt of raw material.
- ✓ Availability of adequate water for process.
- ✓ No displacement of people.
- ✓ Availability of construction water and power.

The proposed site of APL formaldehyde Plant has been selected, considering above alternatives.

5.2.2 AVAILABLE INFRASTRUCTURE

Available infrastructure considerations in the selection of the plant site are as detailed below:

- ✓ Availability of infrastructure facilities such as highway road access to the proposed plant site for ease of transportation of workforce, consumables, plant equipment's and fuel etc.
- ✓ Facility for interconnection with transmission and distribution systems also.
- ✓ Availability of facilities like medical, education, civic amenities and railway station within a reasonable distance from the site.

5.2.3 ENVIRONMENTAL CONSIDERATION

The environmental considerations critical to the selection of the proposed plant site are listed below:

- ✓ Avoiding the use of forest land.
- ✓ No use of cultivable land.
- ✓ Away from thickly populated town.
- ✓ No cutting of trees.
- ✓ No displacement of people
- ✓ Far away from critical polluted area
- ✓ Far away from national park and wildlife sanctuaries
- ✓ Far away from archeological sites
- ✓ Far away from defense installations

As per above, site selection of the proposed plant is most suitable for set-up the plant.

5.3 ALTERNATIVES FOR TECHNOLOGIES

5.3.1 FUEL ALTERNATIVES

The technology selected in such a way that usage of fuel is avoided and also DG sets are not proposed as the power requirement will be sourced from Assam Power Distribution Company Limited.

5.3.2 ALTERNATIVES FOR RESOURCE OPTIMIZATION/ RECYCLING AND REUSE

APL plans to utilize the available land as per byelaws. The unit will undertake following resource optimisation and cleaner production measures. The project activity has considerable environment benefits in terms of:

- ✓ Energy Conservation – Reduced power requirement
- ✓ Entire treated effluent will be re-used within process and greenery development.
- ✓ Effluent treatment plant will be installed and treated water will be reused.
- ✓ Domestic wastewater will be treated in STP.
- ✓ Enhancement of local employment
- ✓ Hazardous wastes will be sent to authorized agencies only.

☐ Zero Discharge Concepts



- ✓ Effluent generated from process will be treated in ETP and evaporated. Sludge generated will be hazardous wastes in nature and will be sent to authorized agencies

❑ ***Greenbelt development***

- ✓ APL will develop green belt around the periphery of the plant and internal areas. About 57440 sq.m of land will be used for green belt. Indigenous plant species will be planted for development of green belt on the plant.



CHAPTER 6

ENVIRONMENTAL MONITORING PROGRAMME

CHAPTER 6: ENVIRONMENTAL MONITORING PROGRAMME

6.1 INTRODUCTION

Environmental monitoring plan describes the processes and activities that need to take place to characterize and monitor the quality of the environment during life cycle of the proposed formaldehyde plant. Environmental monitoring strategies and programmes have reasons and justifications which are often designed to establish the current status of an environment or to establish trends in environmental parameters.

To ensure the effective implementation of the mitigation measures and environmental management plan during construction and operation phases of the proposed formaldehyde plant, it is essential that an effective environmental monitoring plan be designed and followed. Suitable mitigation measures will be taken in case monitored parameters are exceeding limits.

6.2 OBJECTIVES OF MONITORING PROGRAMME

The objective of carrying out environmental monitoring for the proposed plant is given below:

- ✓ To provide a database against which any short or long term environmental impacts of proposed plant can be determined.
- ✓ To provide an early indication that any of the environmental control measures fail to achieve the acceptable standards.
- ✓ To monitor the performance of the proposed plant and effectiveness of implemented mitigation measures.
- ✓ To verify the environmental impacts predicted during the EIA study.
- ✓ To determine project compliance with regulatory requirement, standards and government policies.
- ✓ To provide data to enable an environmental audit to be performed.
- ✓ To submit six monthly compliance report.

To ensure effective implementation of the mitigation measures and environmental management plan during the construction and operation phases of the proposed formaldehyde manufacturing plant of APL, it is essential that an effective environmental monitoring plan must be designed and followed. Suitable mitigation measures shall be taken in case of monitored parameters is exceeding the permissible limits. Also a system



of reporting of non-compliance / violation related to environmental norms have also prepared in consultation with project management to address the issue as per the hierarchical management cell. Environmental monitoring plan for various environmental parameters is given and discussed below.

6.3 ENVIRONMENTAL MONITORING

Environmental Management Cell (EMC) will be formulated by the management of APL to ensure proper implementation of EMP.

A. Ambient Air Quality (AAQ) Monitoring

Ambient air quality shall be monitored six monthly for PM₁₀, PM_{2.5}, SO₂, NO_x, CO and VOC. A MoEF&CC or NABL accredited laboratory may be engaged to monitor ambient air quality at the plant and adjoining area.

B. Water Quality Monitoring

The sampling and analysis of ground water quality will be carried out at the plant and two adjoining village in accordance with the Indian Standard Drinking Water Specification - IS 10500:2012 by engaging NABL approved laboratory.

C. Waste Water Quality Monitoring

The important parameters like pH, TSS, BOD, COD, Oil & Grease, phenol will be monitored monthly in treated waste water at Effluent Treatment Plant (ETP), while chlorides, sulphates, phosphates, fluorides, iron and heavy metals (Hg, Cd, Cr, Pb, Zn, As, Cu) will be analyzed half yearly by engaging NABL approved laboratory.

D. Noise Levels Monitoring

The measurement of noise level would be carried out at the boundaries of the proposed plant in accordance to the ambient noise standards formulated by Ministry of Environment, Forest and Climate Change (MoEF&CC). Noise levels would be monitored on hourly basis for twenty-four hours. Noise will be recorded at "A" weighted frequency using a slow time response mode of the measuring instrument.

E. Soil quality

During construction and operation phases of the proposed plant, soil may be contaminated if suitable mitigation measures are not taken for disposal of solid & hazardous waste, effluent and waste water generated from the plant. Therefore,

composite samples of soil will be collected and analyzed annually by engaging NABL approved laboratory during operation phase of the proposed plant.

F. Occupational Health Check-up

Occupational health check up, especially for diseases of eye, ear, lung and chest for the workers and staff who work in the plant area shall be carried out annually. If any abnormalities found after occupational health check up, person shall be extended treatment at nearby hospital in Bongaigaon depending upon on the type and severity of the health effect.

The environmental monitoring shall be periodic and comply with the promulgated standards. The frequency of monitoring of various environmental components and frequency to be monitored is given in Table 6.1.

Table 6.1: Environmental Monitoring Program During Construction Phase

Sl. No.	Attribute	Parameters	No. of Sampling Locations	Frequency of Monitoring / Data Collection	Period
1.	Ambient Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , & CO, VOC.	3	24 hourly sample	Half yearly
2.	Groundwater Quality	As per IS 10500:2012	3	One sample at each location	Half yearly
3.	Noise level	Noise levels in dB(A) Leq	At the boundary of the plant	Hourly Measurement for 24 Hours	Half yearly

Source: ABC Techno Labs India Pvt. Ltd.

Table 6.2: Environmental Monitoring Program During Operation Phase

Sl. No.	Attribute	Parameters	No. of Sampling Locations	Frequency of Monitoring / Data Collection	Period
1.	Ambient Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , & CO, VOC.	3	24 hourly sample	Half yearly
2.	Stack Emission Monitoring of process stack	SPM, SO ₂ , NO _x and CO	2	Grab Sample at Iso-sampling sampling rate	Half yearly



Sl. No.	Attribute	Parameters	No. of Sampling Locations	Frequency of Monitoring / Data Collection	Period
3.	Ground water Quality	As per IS 10500:2012	3	One sample at each location	Half yearly
4.	Analysis of Waste Water	pH, TSS, BOD, COD, oil & grease, phenol chloride, sulphate, phosphate, fluorides, iron and heavy metals (Hg, Cd, Cr, Pb, Zn, As, Cu)	1	Grab Sample	Half yearly
5.	Noise level	Noise levels in dB(A) Leq	At the boundary of the plant	Hourly Measurement for 24 Hours	Half yearly
6	Soil	Physical and chemical parameters	3	Composite Sample at each location	Half yearly
6	Occupational Health Check-up	Eye, Ear, Lung & Chest	Plant Workers	Annual check-ups	Annually

Source: ABC Techno Labs India Pvt. Ltd.

6.4 WASTE MINIMIZATION, RECYCLING-REUSE-RECOVER TECHNIQUES AND NATURAL RESOURCE CONSERVATION

- A. **Waste Minimization:** Process optimization by using latest and advance technology equipments.
- B. **Recycle-Reuse-Recover:** The wastewater collected from cleaning operation will be recycled completely in the formaldehyde manufacturing process. Other hazardous waste like spent oil, glue sludge etc. shall be given to ASPCB/CPCB approved recyclers and processors.
- C. **Natural Resource conservation:** Rain harvesting will be carried out to store rain water for future use and thus minimizing the ground water consumption.

6.5 HEALTH, SAFETY & ENVIRONMENTAL MANAGEMENT CELL

Occupational health check up, especially for diseases of eye, ear, lung and chest for the workers and staff who work in the plant area shall be carried out annually. If any abnormalities found after occupational health check up, person shall be extended treatment at nearby hospital in Bongaigaon depending upon on the type and severity of the health effect.

In order to implement the environmental management program efficiently within the organization, periodical monitoring as per statutory guidelines and mid course corrections/actions, if required based on the environmental monitoring results, management intends to establish environmental cell for successful implementation. The roles & responsibilities are clearly defined among the personnel within the environmental cell.

A well-equipped laboratory with consumable items shall be provided for monitoring of environmental parameters in the site. Alternatively, monitoring can be outsourced to a recognized reputed laboratory.

Basically, this department will undertake monitoring of the environmental pollution levels by measuring fugitive emissions, ambient air quality, water and effluent quality, noise level etc., either departmentally or by appointing external agencies wherever necessary. In case, the monitored results of environmental pollution are found to exceeding the allowable values, the EMC suggests remedial action and gets these suggestions implemented through the concerned head of activities. EMC will also co-ordinate all the related activities such as collection of statistics with respect to health of workers, restoration of site, losses to crops and ecology and compensation. APL's environmental officer for investigation will have the following responsibilities in general:

- Will modify proposed EMP as described in chapter 9 and monitoring plan as mentioned in Table 6.1 in line with the conditions stipulated by SEAC/SEIAA and ASPCB.
- Thoroughly familiarize himself with the existing information about habitat, sensitivities and baseline environment scenario etc present in the study area, making use of the EIA report;



- If applicable, liaise with the contractor in order to develop a common understanding of the goals of the EMP during execution of various activities for completion of the proposed formaldehyde plant;
- In the event presence of 'sensitive area' but not described in the EIA report, then a brief account of the nature of the sensitivity, its physical dimensions and the area of the formaldehyde plant that would be affected by avoidance of sensitive area would be prepared. It would also be discussed with the contractor's site manager as to how access to the site would be achieved without impacting on the sensitive area; etc.

Data will be recorded with respect to type of land covered by formaldehyde plant, if possible. It is also recommended to appoint a community-facilitation officer who will have the following responsibilities during planning and implementation phases;

- Identification of village sarpanch and elder citizens and appraise them about the purpose and likely effect of their operation including Dos' and Donts' during the survey by the nearby habitants;
- Inspection and documentation of the conditions preceding the formaldehyde plant area to account for any permitting/operational damage which may occur through dialogue with the owners of the resources and Village Head;
- Monitoring of project impacts and verification of damage to resources; and
- Reporting so as to required.

6.6 AUDITS AND INSPECTIONS

The environmental monitoring Cell (EMC) of APL will be responsible for environmental compliance, monitoring and environmental management programs. Regular audit and inspection shall be carried out by EMC.

A. Reporting

APL will have various reporting requirements. These include periodic reports and performance reviews. APL will also require to record and report incidents and complaints.

B. Periodic Reports

As a part of the environmental monitoring program, the following compliance reports shall be submitted to ASPCB and Regional Office of MoEF&CC:



Half yearly compliance report on 1st December and 1st June of each financial year to MoEF&CC.

- ✓ Environmental Statement for the financial year ending 31st March to ASPCB on or before 30th September every year - ASPCB
- ✓ Annual returns in Form 4 as per Hazardous Waste (Management, Handling and Transboundary movement) Rules, 2008 on or before 30th June every year - ASPCB
- ✓ Maintaining Records of Hazardous Waste, in Form 3 as per Hazardous Waste (Management, Handling and Transboundary movement) Rules, 2008.- ASPCB

C. Compliance Monitoring

The record will be kept of any complaint received by the APL Plant Management that nuisance or pollution has occurred as a consequence of operation of formaldehyde manufacturing related activities. The record will include the following details:

- ✓ The date and time of the complaint
- ✓ The name and address of the complainant, if known
- ✓ The nature of the complaint
- ✓ The likely source of the alleged pollution

Action taken in relation to the complaint, including any follow-up contact with the complainant.

- ✓ The records of complaints received from public or government will be retained for the operational lifetime of the APL's formaldehyde unit, as follows:
- ✓ Total numbers of complaints received
- ✓ Actions taken by APL's management to address the complaint;
- ✓ Actions taken to prevent recurrence;
- ✓ A description of any significant unresolved issues arising from the complaints.
- ✓ A dedicated email address will be created to receive generic complaints, while maintaining the anonymity of the complainant.



CHAPTER 7

RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN

CHAPTER 7: RISK ASSESSMENT & DISASTER MANAGEMENT PLAN

7.1 INTRODUCTION

Assam Petro-chemicals Limited (APL) is proposing a Formaldehyde Manufacturing plant. The feed as well as the product will be stored at dedicated Area. The main objective of this Risk Assessment study is to determine the damage potential of the possible hazards to living things & property and provide a scientific basis to assess safety level of the facility by preparing on- site, off site, disaster management plan for control of hazards. The secondary objective is to identify major risk in manufacturing and storage of chemicals and control it through assessment.

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

- ✓ To find out unsafe action, negligence, omission or personal fault.
- ✓ Identification of major risk areas.
- ✓ Consequential analysis of probable risk by releasing of chemical due to leakage of storage tank and catastrophic failure.
- ✓ Risk assessment on the basis of the above evacuation and risk acceptability.
- ✓ Minimum preventive and protective measures to be taken to minimize risk to maximum possible extent.

7.1.1 OBJECTIVES

The objectives of the study are to provide:

- Preliminary identification of hazards and hazardous scenarios that could produce an undesirable consequence arising from the proposed formaldehyde manufacturing plant.
- Assessment of consequences of hazards from proposed formaldehyde manufacturing plant within the facility in terms of ignition, thermal radiation, blowout etc.
- Determination of the magnitude of all major accidents arising due to the proposed formaldehyde manufacturing plant that have the potential to cause damage to life, property and environment including:
 - ✓ Effects are as where personnel may be located within the proposed formaldehyde manufacturing plant



- ✓ Effects on are as external to the formaldehyde manufacturing plant
- Estimation of frequency of occurrence of the hazards.
- Review of safety features (organizational systems & safety equipment)
- Recommendations for prevention, control and mitigation measures for any identified risk

The overall aim of the study is to provide a degree of predictability on the risk as a result of the proposed formaldehyde manufacturing plant operation at village- Dhaknabari, Boitamari, Dist-Bongaigaon.

7.1.2 METHODOLOGY & APPROACH EMPLOYED

Risk analysis consists of hazard identification studies to provide an effective means to identify different types of hazard during the operation of the proposed formaldehyde manufacturing plant. This is followed by an assessment of the impacts of these hazards.

Hazard is present in any system, plant or unit that handles or stores flammable materials. The mere existence of hazards, however, does not automatically imply the existence of risk. Screening & ranking methodologies based on Preliminary Hazard Analysis (PHA) techniques have to be adopted for risk to be evaluated.

The approach and methodology by ABC Techno Labs followed for the Risk Assessment study are described hereunder:

❑ Identification of Hazards

Various possible hazards will be identified during manufacturing of formaldehyde. The release sources and potential accidents scenarios associated with each hazards will be listed. For each selected release sources, several scenarios may be possible depending upon the failure mode causing loss of containment. The criteria used for selection of scenarios for the consequence analysis will be the **Maximum Credible Accidental (MCA)** scenarios.

❑ Effects & Consequence Estimation

Estimation of Effects & consequences is performed to determine the potential for damage or injury from the selected scenarios. The incident outcomes are analyzed using release rates, dispersion, combustion, thermal radiation from fire and spill. Damage distance computation is based on jet fire, flash fire scenarios, as applicable.

❑ Risk Mitigation Measures



Based on consequence analysis and risk summation findings, risk mitigation measures will be suggested in view of applicable standards, guidelines and best practices to reduce risk and enhance safety at the proposed formaldehyde manufacturing plant.

7.2 RISK ASSESSMENT AND HAZARD IDENTIFICATION

Hazard analysis involves the identification and quantification of the various hazards (unsafe condition) that exist in the plant. On the other hand, risk analysis deals with the identification and quantification of the risk, the plant equipment and Personnel are exposed to due to accidents resulting from the hazards present in the plant.

Risk analysis involves the identification and assessment of risks to the population exposed to as a result of hazards present. This requires an assessment of failure probability of credible accident scenario, vulnerability of population etc. Much of this information is difficult to get or generate consequently. Therefore, the risk analysis in present case is confined to maximum credible accident studies and safety and risk aspect related to proposed production of Formaldehyde plant.

Activities requiring assessment of risk due to occurrence of most probable instances of hazard and accident are both onsite and off-site.

On-site

- ✓ Exposure to fugitive dust, noise and other emissions
- ✓ Housekeeping practices requiring contact with solid and liquid wastes
- ✓ Emission/ spillage etc. from storage and handling

Off-site

- ✓ Exposure to pollutants released from offsite/ storage/related activities
- ✓ Contamination due to accidental releases or normal release in combination with natural hazard
- ✓ Deposition of toxic pollutants in vegetation/ other sinks and possible sudden releases due to accidental occurrences.

7.2.1 HAZARDOUS MATERIALS STORAGE

Raw material required for the manufacturing of Formaldehyde (i.e. Methanol) directly from APL Namrup plant by road.



Sl. No.	Raw Materials	Form	Quantity (kg/ day)	Mode of transport (rail/ road/ shipment)	Source	Type of Packing/ Storage/ mode of storage	Capacity of storage (Ton/ month)
1	Methanol	Liquid	Approx. 90000	Road Transport	APL Namrup	Nitrogen blanketed Atmospheric storage tank	1 No. X 500 MT

In addition to this, there will be transshipment facility of Methanol for which 1650 KL X 2 no.s Methanol tanks will be constructed.

The details about proposed capacity of the products are given in below table:

Sl. No.	Product	Quantity (Tons Per annum)
1	Formaldehyde (37%)	66000

Table 7.1: List of Hazardous Chemicals along with their Toxicity Levels

Sl. No	Name of Chemical	Main Properties					
		B.P. °C	Flash Point LEL UEL	% TLV	ppm mg/m ³ (i)LD50	mg/Kg (ii)LC50	Specific Gravity Water-1
1	Methanol	64.5	6 36.5	250	5628 64000	0.791	1.11
2	Formaldehyde	98	6 36.5	0.3 0.37	100 15800	1.08	1.03

Note: CC: Close Cup, OC: Open Cup

The Toxicity level of hazardous chemicals as per Manufacture, storage and import of Hazardous Chemical (Amendment) Rules, 2000 (MISHC) is considered for the study.

Table 7.2: Toxicity Index as per MISHC rules 2000

Sl.No	Toxicity	Oral Toxicity LD50 (mg/Kg)	Dermal Toxicity LD 50 (mg/kg)	Inhalation Toxicity LD 50 (mg/kg)
1	Extremely	<5	<40	<0.5
2	Highly	>5-50	>5-50	>0.5-2.0
3	Toxic	>50-200	>200-1000	>2.0-10

7.2.2 GENERAL HAZARDS & CONTROLS

Safe Practice for Handling, Storage, Transportation and Unloading of Methanol for Storage/ Handling:

1. Separate from strong oxidant & Keep it in well ventilated room.

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

For Transportation & Unloading:

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

Table 7.3: Raw material storage hazards and controls

Sl. No	Name of material stored	Quantity (max.)	Operating press/ temp	Hazard rating systems	Type of hazard or risks involved	Persons affected
1	Methanol	29700 TPA	NTP	• TLV-200 • PPM(8 hr TWA) STEL-250 • PPM • NFPA Ratings: • 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
Control measures: • 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.						
2	Formaldehyde	66000 TPA	NTP	• TLV-0.3 Ppm (1ppm) • NFPA ratings: • Health-3 • Flammability -2 • Reactivity-0 • Flash point-500° C	• Flammable • Very toxic by inhalation • Very toxic in contact with skin • Very toxic if swallowed • Causes burns • Limited evidence of carcinogenic effect • Risk of serious damage to eyes • May cause sensitization by skin	• Operators • Maintenance • Technicians
Control Measures: • Keep away from Source of ignition. • Store in Cool, dry, well-ventilated area away from incompatible substance. Keep container tightly closed and sealed until for use. • Isolated from oxidizing material, reducing agents, alkalies & acids. • Facilities storing or utilizing this material should be equipped with and eyewash facility and safety shower. • Ventilation fans and other electrical service must be non sparking and have an explosion proof design. • Good ventilation system must be provided.						

7.3 CONSEQUENCE ANALYSIS

The consequence analysis has been carried for the selected release scenarios to estimate the vulnerable zones. When the vulnerable zones are identified for failure cases, mitigation measures can be taken for risk mitigation and to eliminate/avoid damage to the plant and injury to personnel.

As a part of risk assessment study, worst case scenarios consequence analysis is carried out to determine the maximum loss scenarios. The selection of the accident scenarios is based

on engineering and professional judgment, accident descriptions of the past in similar type of plants and the expertise in risk analysis studies.

The risk presented by a combustion/accident is determined by the frequency and consequence of its possible outcomes. The consequence of igniting a hydrocarbon release during blowout depends on the type of material released, the mass release rate, the timing of the ignition, and the environment into which the hydrocarbon is released. Briefly, typical outcomes are:

- **Flash fires:** produced by igniting a gas cloud so that a fire propagates through the gas cloud (without generating a significant overpressure);
- **Jet fires:** produced by an ignited jet of gas or liquid spray released under pressure;
- **Pool fires:** produced by ignition of a liquid release that accumulates on the surface and ignites;
- **Explosions:** produced by igniting a gas cloud in conditions where the resultant accelerating flame front produces a significant overpressure.

Jet fire emanating from the release source may follow a flash fire or explosion

7.3.1 HAZARDOUS CONDITIONS DUE TO RELEASE OF HAZARDOUS MATERIALS

As a result of release of flammable liquid followed by immediate or delayed ignition, the following hazardous conditions may be encountered at and surrounding the proposed Formaldehyde plant.

☐ Thermal Effects

In case of pool/ jet fire, thermal effect is likely to cause injury or damage to people and objects. A substantial body of experimental data exists and forms the basis for thermal effect estimation. The consequence caused by exposure to heat radiation is a function of:

- ✓ Radiation energy onto the human body [kW/m^2];
- ✓ Exposure duration [s];
- ✓ Protection of the skin tissue (clothed or naked body).

The following damage distances for thermal radiation are used in the risk analysis:

- 37.5 kW/m^2 : Damage to process equipment. 100% fatality in 1min. 1% fatality in 10s.
- 12.5 kW/m^2 : First degree burn for 10 s exposure
- 4.0 kW/m^2 : First degree burn for 30 s exposure

❑ Delayed Ignition & Explosion

In case of delayed ignition of flammable inventories, two physical effects may occur in following ways:

- ✓ Flash fire over the whole length of vapor cloud;
- ✓ Vapour cloud explosion that results in blast wave with typical peak overpressures in circle around the ignition source. For vapor cloud explosion some degree of confinement essential.

TNO Multi-energy method is used to calculate the blast overpressure. The following damage criteria as given in Table 7.4 may be distinguished with respect to the peak overpressures resulting from a blast wave:

Table 7.4: Damage Effects Due to Overpressures

Peak Overpressure	Damage Type
0.830 bar	Total Destruction
0.350 bar	Heavy Damage
0.170 bar	Moderate Damage
0.100 bar	Minor Damage

In Table 7.5 given below provides an illustrative list of damage effects caused by peak overpressure.

Table 7.5: Illustrative Damage Effects due to Overpressures

Peak Overpressure (Bar)	Failure
0.005	5 % Window Shattering
0.02	50 % Window Shattering
0.07	Collapse of a roof of a tank
0.07-0.14	Connection failure of panelling
0.08-0.1	Minor Damage to Steel Framework
0.15-0.2	Concrete block wall shattered
0.2	Collapse of Steel Framework
0.2-0.3	Collapse of self framing Steel panel building
0.2-0.3	Ripping of empty oil tanks
0.2-0.3	Deformation of a pipe bridge

Peak Overpressure (Bar)	Failure
0.2-0.4	Big trees topple over
0.3	Panelling torn off
0.35-0.4	Piping failure
0.35-0.8	Damage to Distillation Column
0.4-0.85	Collapse of pipe bridge
0.5	Loaded Train Wagon overturned
0.5	Brick walls shattered
0.5-1.0	Movement of round tank, failure of connecting piping

(Source: TNO)

7.3.2 HAZARDS DUE TO LOSS OF CONTAINMENT

Hazardous materials handled and stored at the proposed formaldehyde plant are flammable and corrosive/toxic in nature. In the event of leakage or accidental release of flammable materials, these will create thermal radiations in the event of fire. In the event of release of flammable liquid, methanol, fire and flash fire hazards may take place.

Suitable safety measures including fire fighting facilities will be provided to attend any emergency due to handling and storage of these hazardous materials at formaldehyde plant. In the bulk storage of hazardous materials, adequate size of dykes will be provided at proposed formaldehyde plant for full containment of hazardous materials in an unlikely event of leakage or spillage.

The detailed release and consequence computations have been carried out for selected scenarios of potential hazardous materials to be handled and stored at the proposed formaldehyde plant.

7.3.3 SELECTED SCENARIOS FOR CONSEQUENCE ANALYSIS

The plant after construction will be dealing with many hazardous substances as described above. Most of the hazardous chemicals are flammable and toxic in nature and will not create threat to life and property beyond the boundary of plant in the event of spillage as dykes have been provided for full containment. If pool fires occur, the consequence will be confined within short distances in the form of thermal radiation.

Various scenarios for consequence analysis as a result of accidental releases of hazardous materials are given in Table 7.6.

Table 7.6: Scenarios Selected for Consequence Analysis

Isolable Section number	Isolable Section
IS 1	500 m3 Methanol Storage Tank 10 mm leak
IS 2	500 m3 Methanol Storage Tank - Rupture
IS 3	Methanol leak in Loading/Unloading area
IS 4	Methanol leak in Production area
IS 5	Formalin Tank 10 mm Leak
IS 6	Formalin Tank - Rupture

7.3.4 MODEL USED FOR CONSEQUENCE ANALYSIS

The Risk Assessment study involves a large number of calculations for which established computing aids are essential.

PHAST (Version 7.2) software of DNV has been used to perform the consequence calculations. PHAST is a consequence and risk assessment software for calculation of physical effects (fire, explosion, atmospheric dispersion) of the escape of hazardous materials. PHAST software allows detailed modeling and quantitative assessment of release of pure and mixtures of liquid and gaseous chemicals.

7.3.5 SCENARIOS WISE FINDINGS OF CONSEQUENCE ANALYSIS

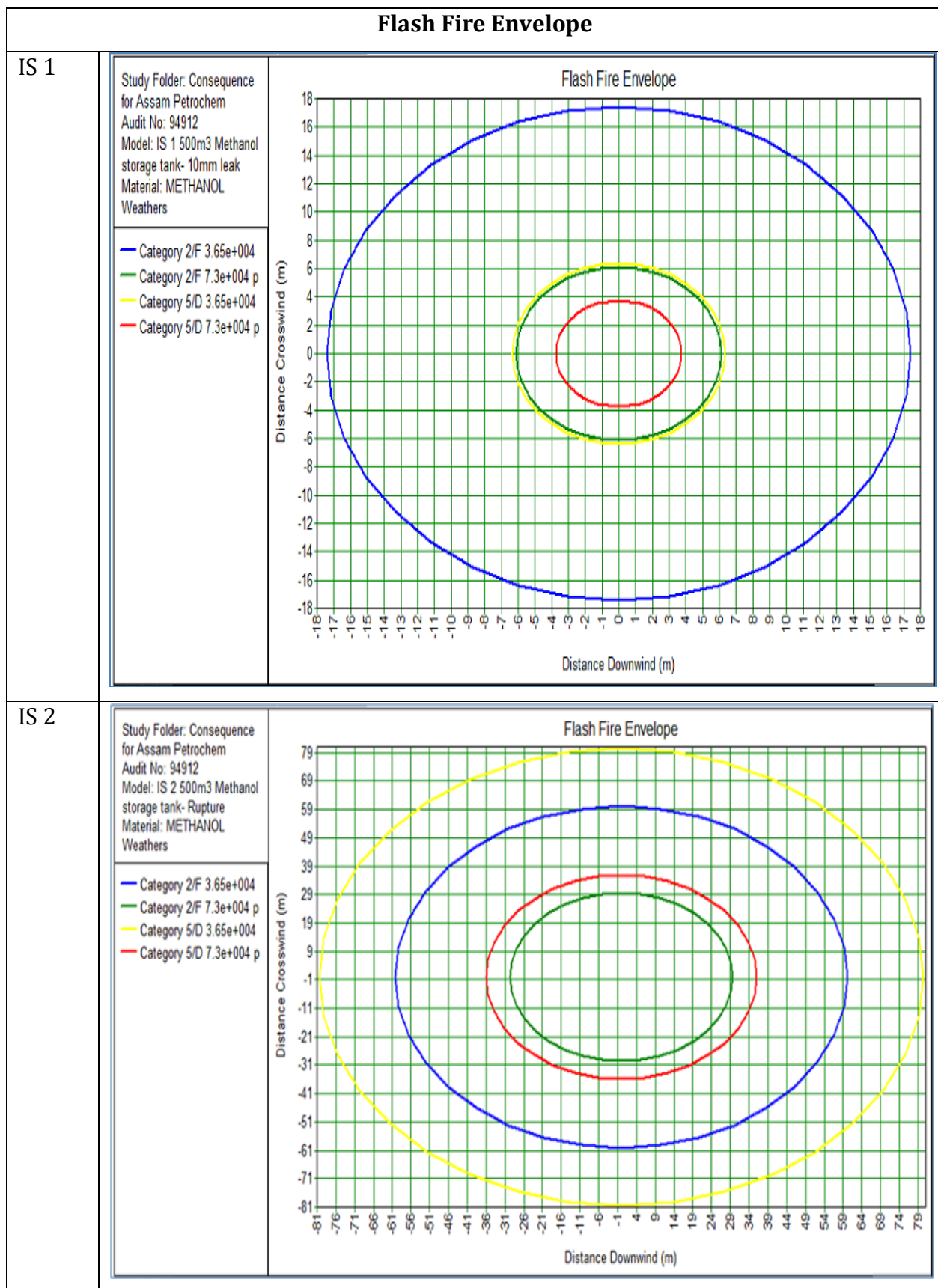
Subsequent to the accidental release of chemicals, the consequence depends on various factors e.g. type and quantity, presence and location of an ignition source, meteorological conditions, etc. The consequence analysis for the selected accident scenarios for hydrocarbon releases have been carried out to estimate the impacted distances and outcomes of same have been described in subsequent sections.



Table 7.7: Results of Consequence Analysis

Hole size (mm)	Release rate (kg/s)	Release Duration (sec)	Flammable Results										Toxic Results			Explosion Results		
			Flash Fire Envelope			Pool Radius (m)	Radiation Effects: Pool Fire Ellipse			Radiation Effects: Jet Fire Ellipse			Toxic Dispersion			Overpressure		
			Furthest Extent in ppm	Distance in meters			Radiation Levels (kW/m2)	Distance in meters		Radiation Levels (kW/m2)	Distance in meters		ERPG Levels in ppm	Distance in meters		Furthest Extent in Bar	Distance in meters	
				2F	5D			2F	5D		2F	5D		2F	5D		2F	5D
10	0.37	3600	50%	17.4	6.4	8.17	4	24.4	24.9	4	7.3	5.6	ERPG 1	397.4	104.2	0.02	24.1	NR
			100%	6.1	3.7		12.5	14.8	16.9	12.5	NR	NR	ERPG 2	98.8	40.8	0.1	12.6	NR
			-	-	-		37.5	NR	NR	37.5	NR	NR	ERPG 3	41.3	10.8	0.2	11.9	NR
R	N/A	N/A	50%	58.7	67.1	8.17	4	24.4	25.3	4	NR	NR	ERPG 1	807.0	576.0	0.02	114.6	104.6
			100%	31.7	31.3		12.5	14.8	17.1	12.5	NR	NR	ERPG 2	390.2	273.6	0.1	62.0	52.0
			-	-	-		37.5	NR	NR	37.5	NR	NR	ERPG 3	170.2	183.2	0.2	58.4	48.4
25	8.84	3600	50%	29.2	32.5	30.2	4	88.9	88.4	4	44.9	40.1	ERPG 1	1335.5	409.6	0.02	67.6	77.6
			100%	12.1	12.8		12.5	60.8	64.5	12.5	36.5	32.9	ERPG 2	486.3	171.3	0.1	28.8	38.8
			-	-	-		37.5	40.7	40.1	37.5	NR	NR	ERPG 3	182.0	105.4	0.2	26.2	36.2
10	1.5	3600	50%	11.9	14.9	6.7	4	31.3	33.3	4	37.3	31.8	ERPG 1	376.9	151.9	0.02	65.3	51.6
			100%	10.7	8.8		12.5	23.1	27.3	12.5	30.7	26.0	ERPG 2	111.7	59.5	0.1	20.3	17.7
			-	-	-		37.5	NR	NR	37.5	NR	NR	ERPG 3	15.4	14.5	0.2	17.2	15.4
10	0.71	3600	50%	7.4	5.1	6.9	4	7.9	7.9	4	NR	13.6	ERPG 1	NR	NR	0.02	NR	NR
			100%	4.0	3.9		12.5	NR	NR	12.5	NR	NR	ERPG 2	NR	NR	0.1	NR	NR
			-	-	-		37.5	NR	NR	37.5	NR	NR	ERPG 3	NR	NR	0.2	NR	NR
R	N/A	N/A	50%	123.7	130.1	33.4	4	NR	NR	4	NR	NR	ERPG 1	NR	NR	0.02	1531.9	1530.9
			100%	85.3	85.3		12.5	NR	NR	12.5	NR	NR	ERPG 2	NR	NR	0.1	470.8	470.5
			-	-	-		37.5	NR	NR	37.5	NR	NR	ERPG 3	NR	NR	0.2	386.9	386.7

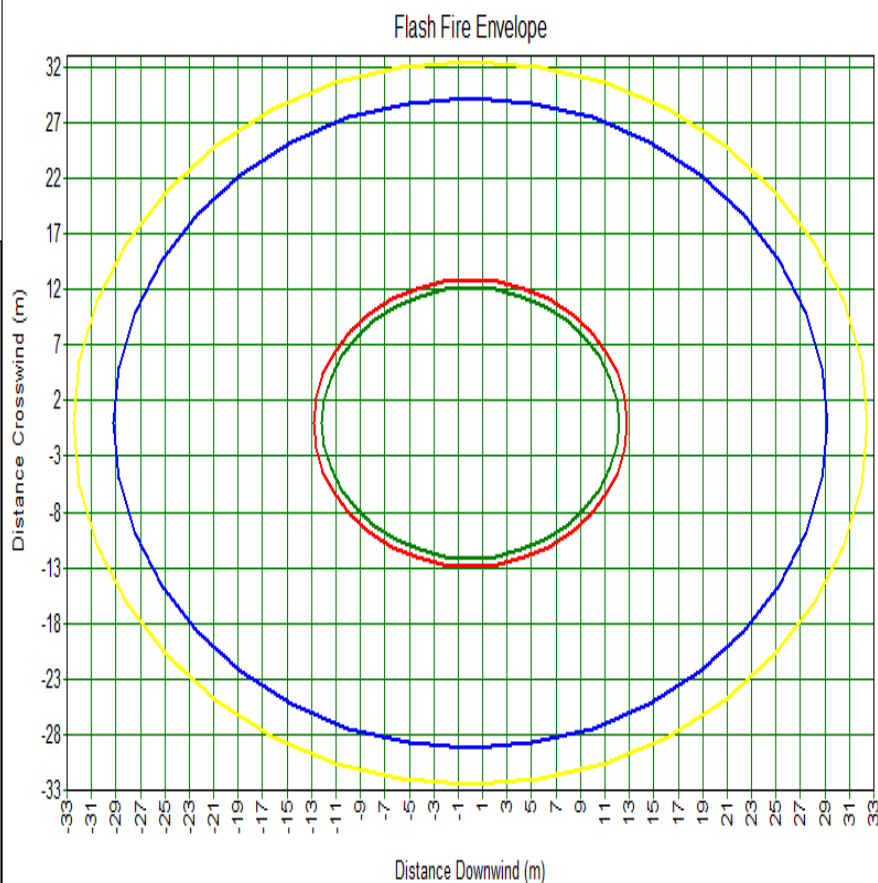
Outcome of Consequence analysis



IS 3

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in
loading / unloading area
Material: METHANOL
Weathers

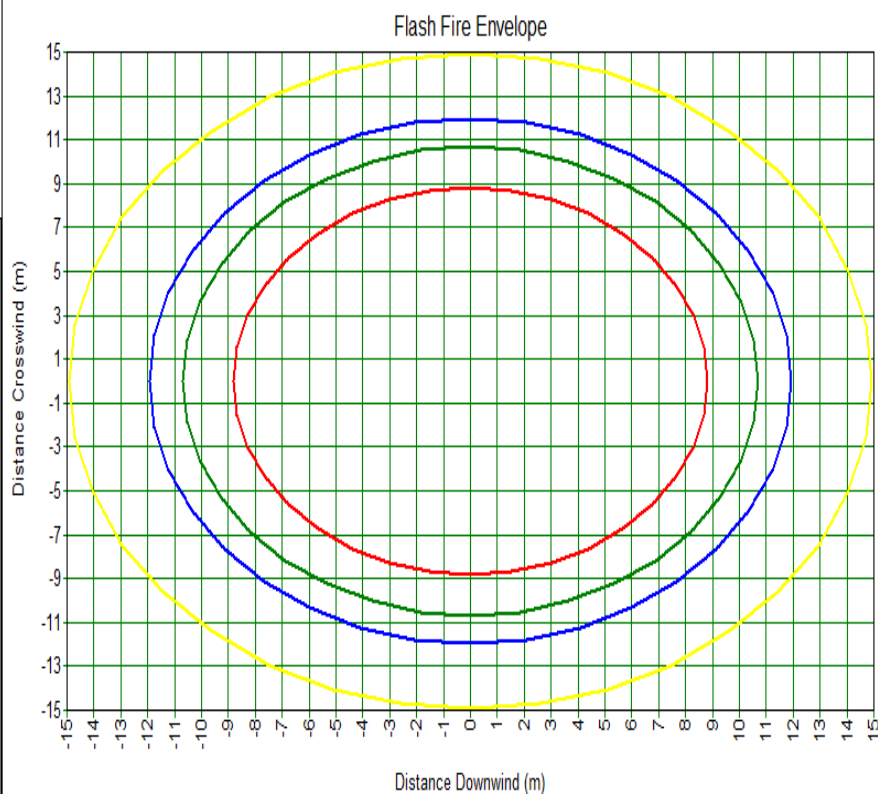
— Category 2/F 3.65e+004
— Category 2/F 7.3e+004 p
— Category 5/D 3.65e+004
— Category 5/D 7.3e+004 p



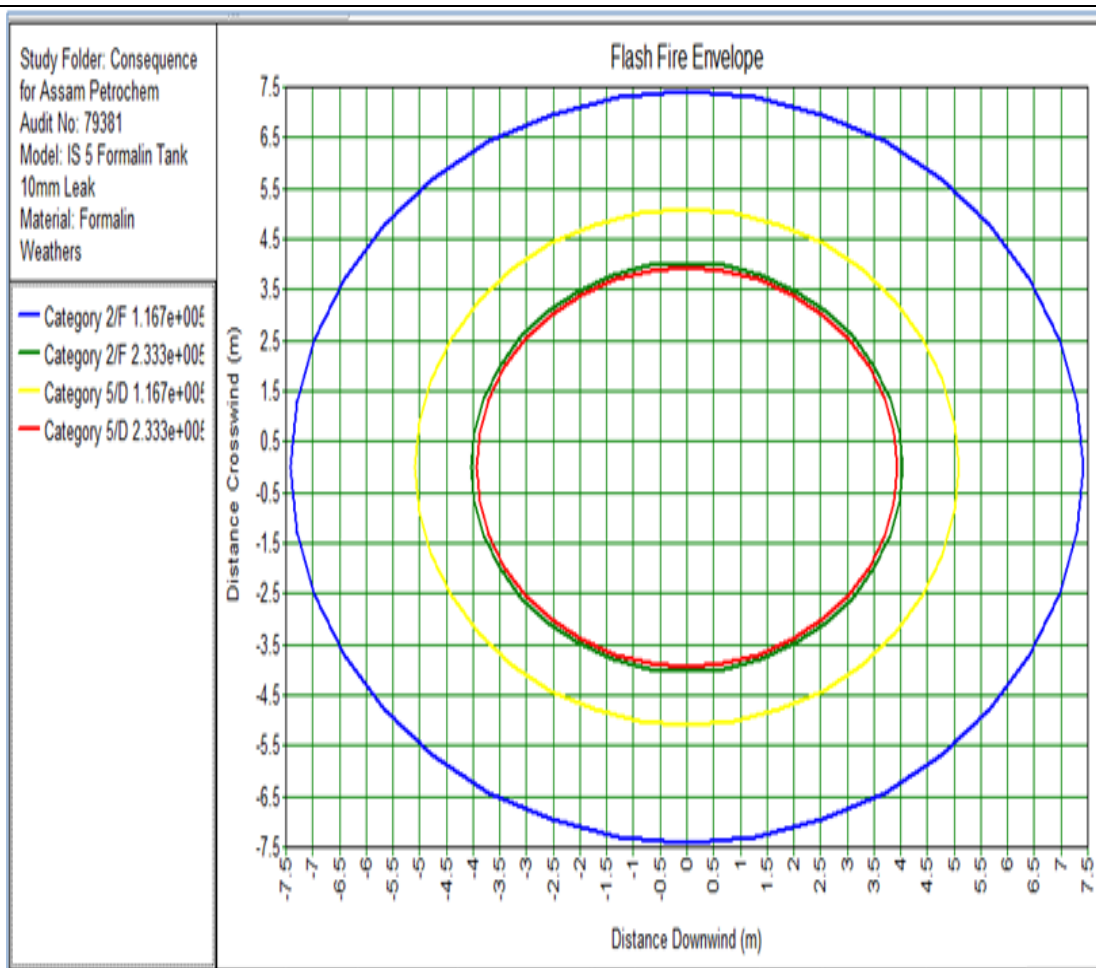
IS 4

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Material: METHANOL
Weathers

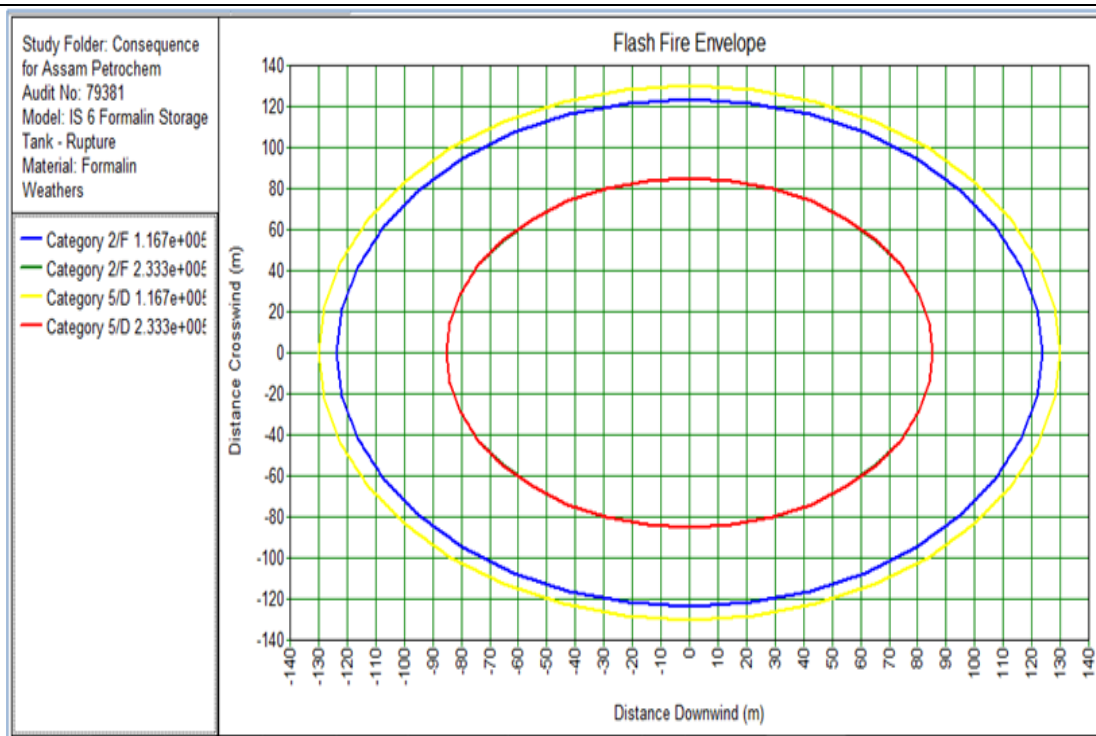
— Category 2/F 3.65e+004
— Category 2/F 7.3e+004 p
— Category 5/D 3.65e+004
— Category 5/D 7.3e+004 p



IS 5



IS 6

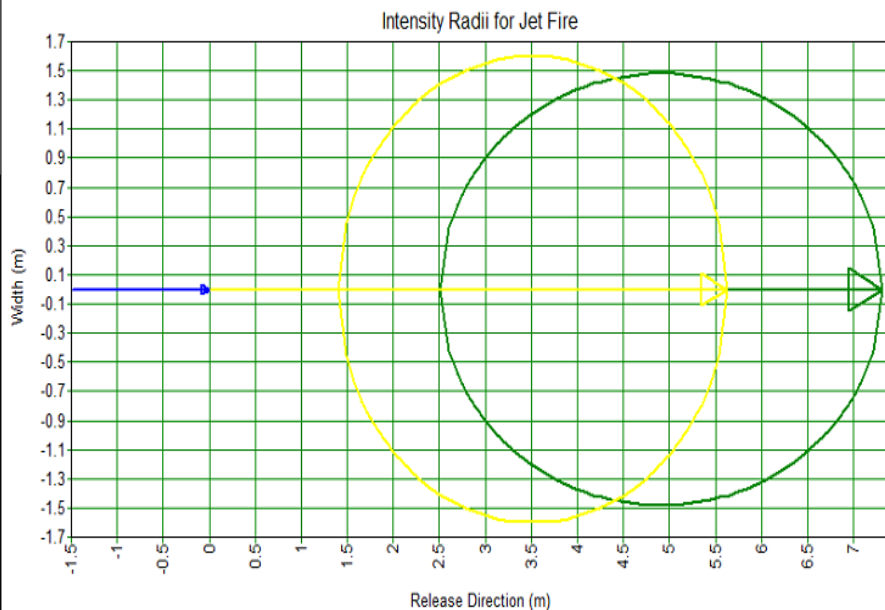


Jet fire contours

IS 1

Study Folder: Consequence for Assam Petrochem
Audit No: 94912
Model: IS 1 500m3 Methanol storage tank- 10mm leak
Material: METHANOL
Weathers

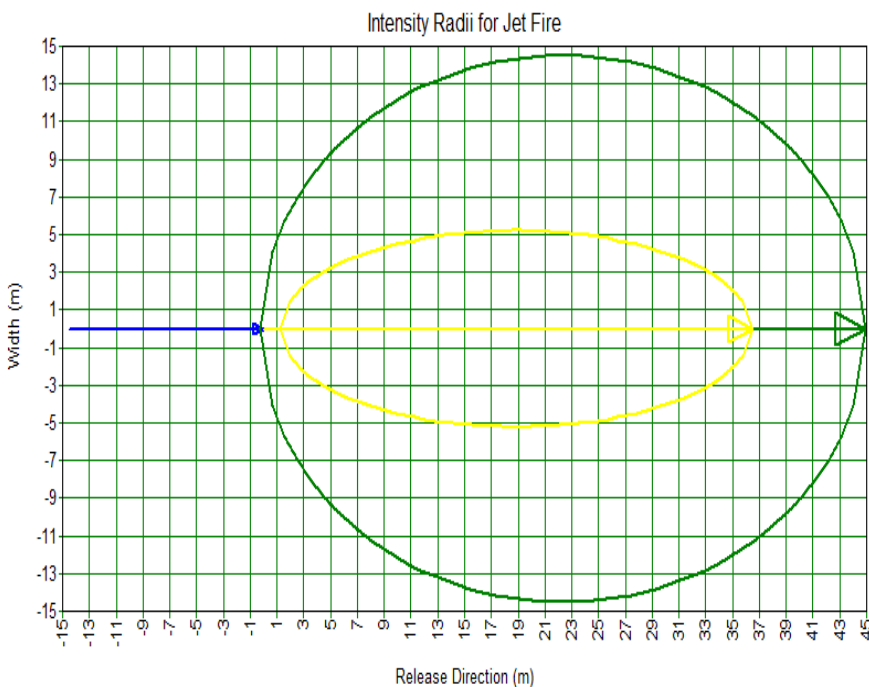
— Wind Direction
— Category 2/F 4 kW/m²
— Category 5/D 4 kW/m²



IS 3 2F

Study Folder: Consequence for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in loading / unloading area
Weather: Category 2/F
Material: METHANOL

— Wind Direction
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²

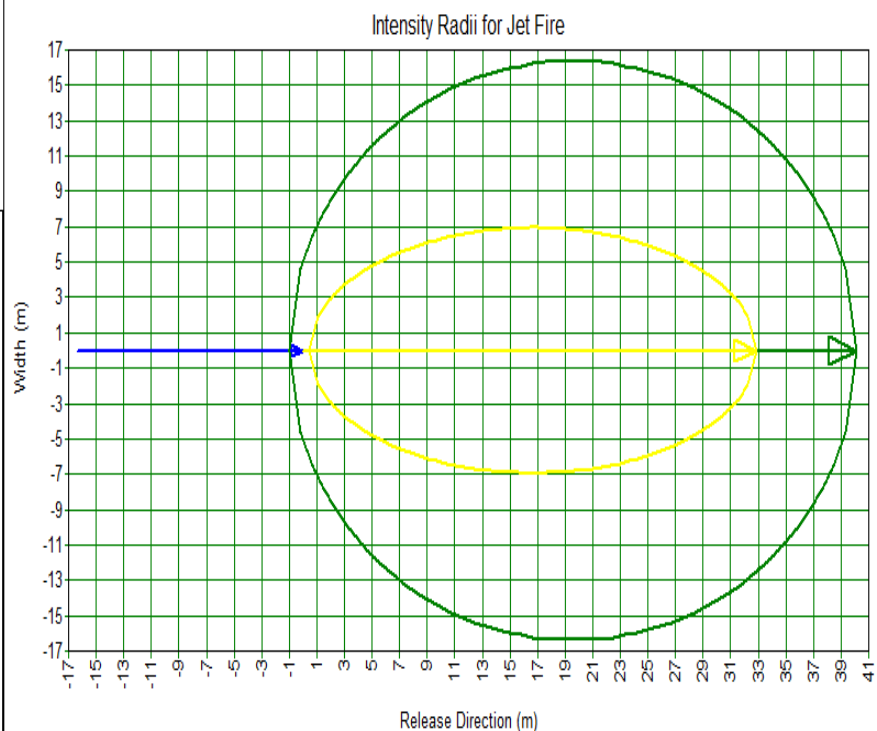




IS 3 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in
loading / unloading area
Weather: Category 5/D
Material: METHANOL

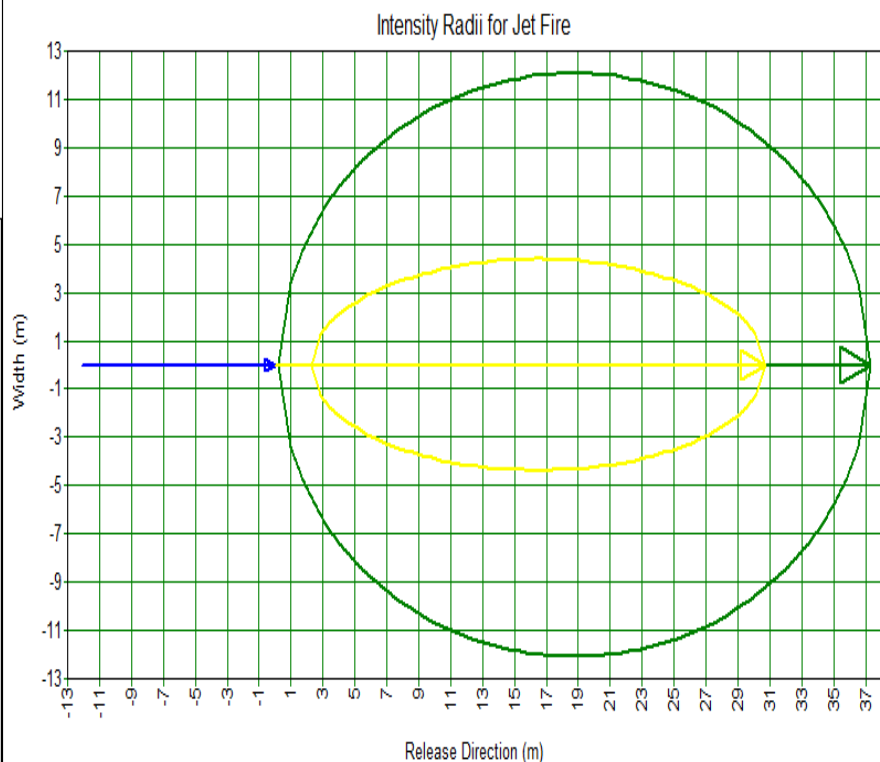
— Wind Direction
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 4 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Weather: Category 2/F
Material: METHANOL

— Wind Direction
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²

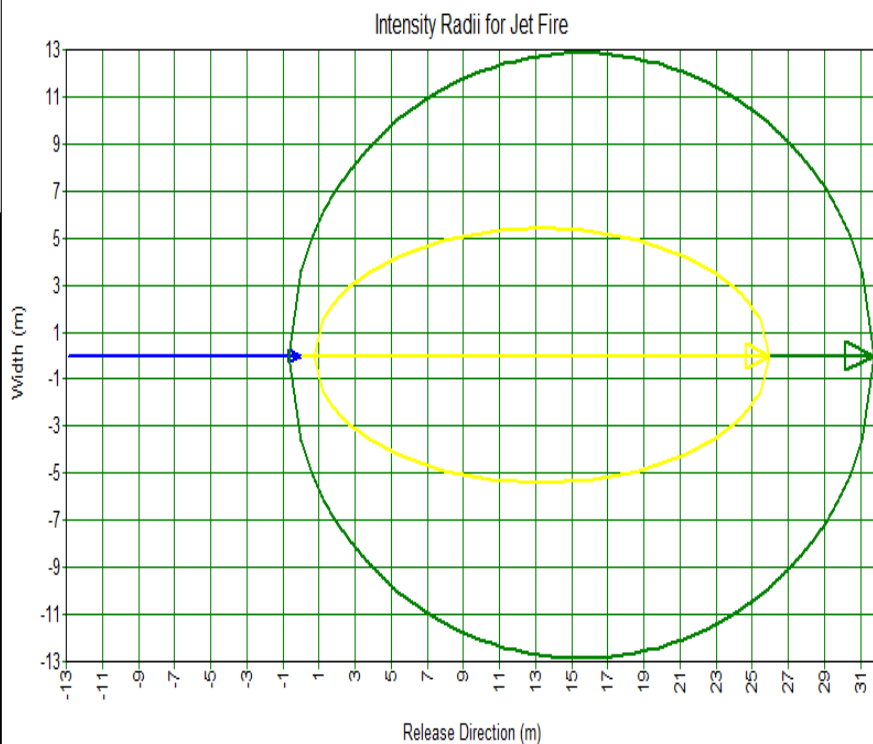




IS 4 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Weather: Category 5/D
Material: METHANOL

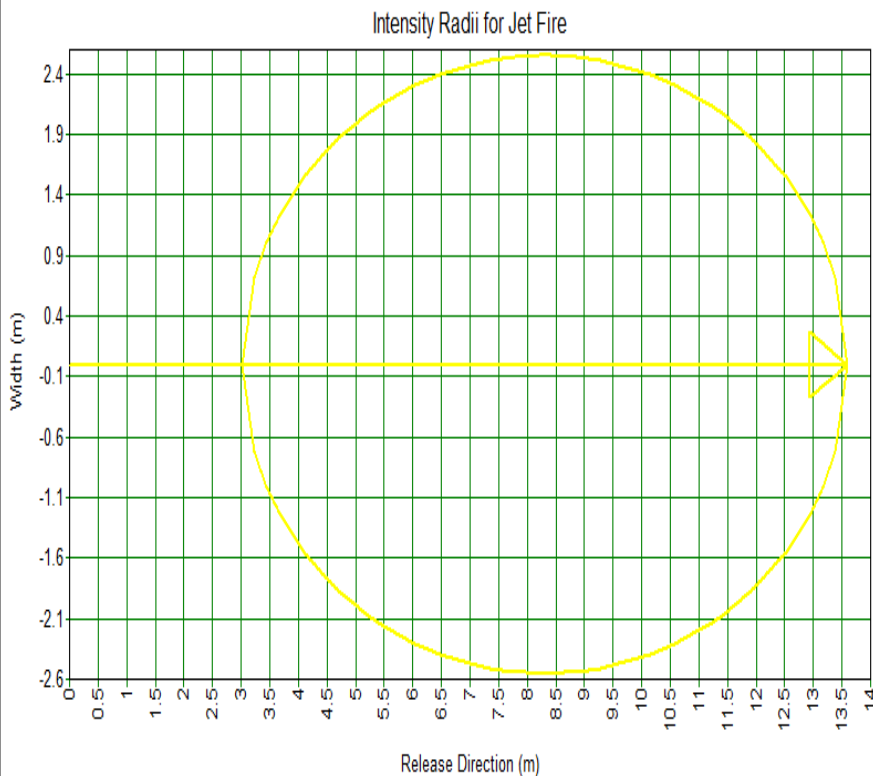
— Wind Direction
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 5

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 5 Formalin Tank
10mm Leak
Material: Formalin
Weathers

— Category 5/D 4 kW/m²

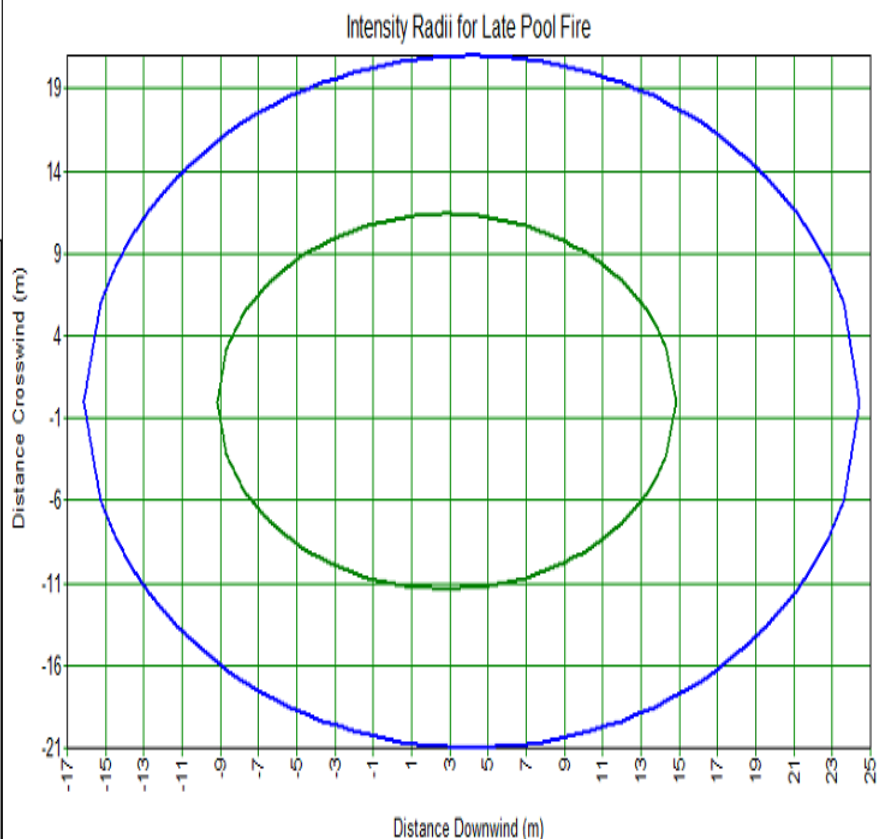


Pool Fire

IS 1 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 1 500m3 Methanol
storage tank- 10mm leak
Weather: Category 2/F
Material: METHANOL

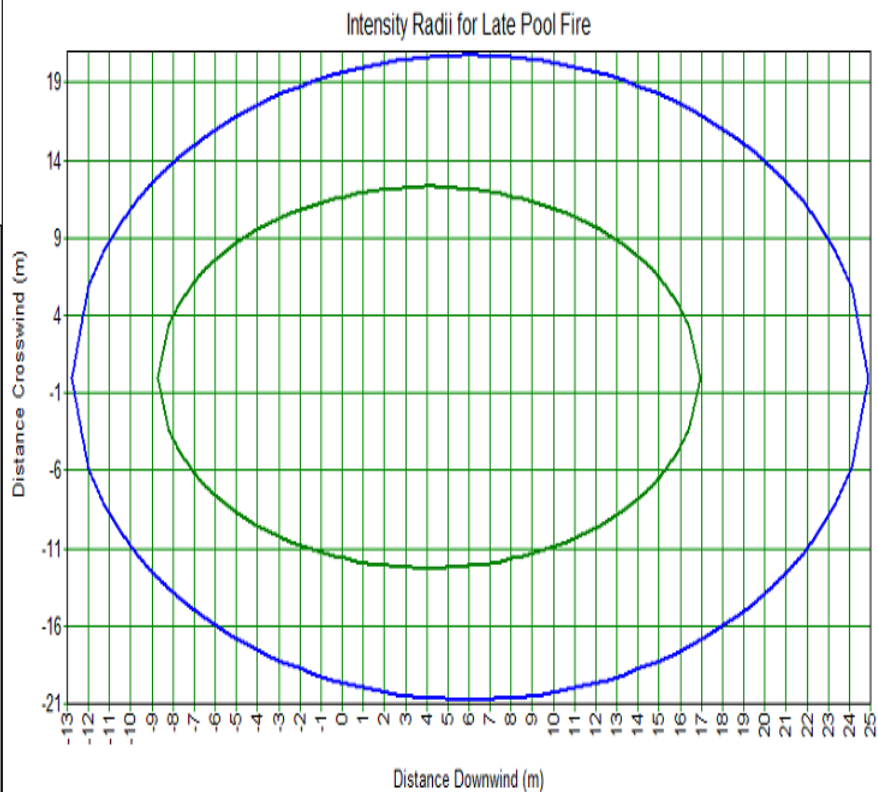
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 1 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 1 500m3 Methanol
storage tank- 10mm leak
Weather: Category 5/D
Material: METHANOL

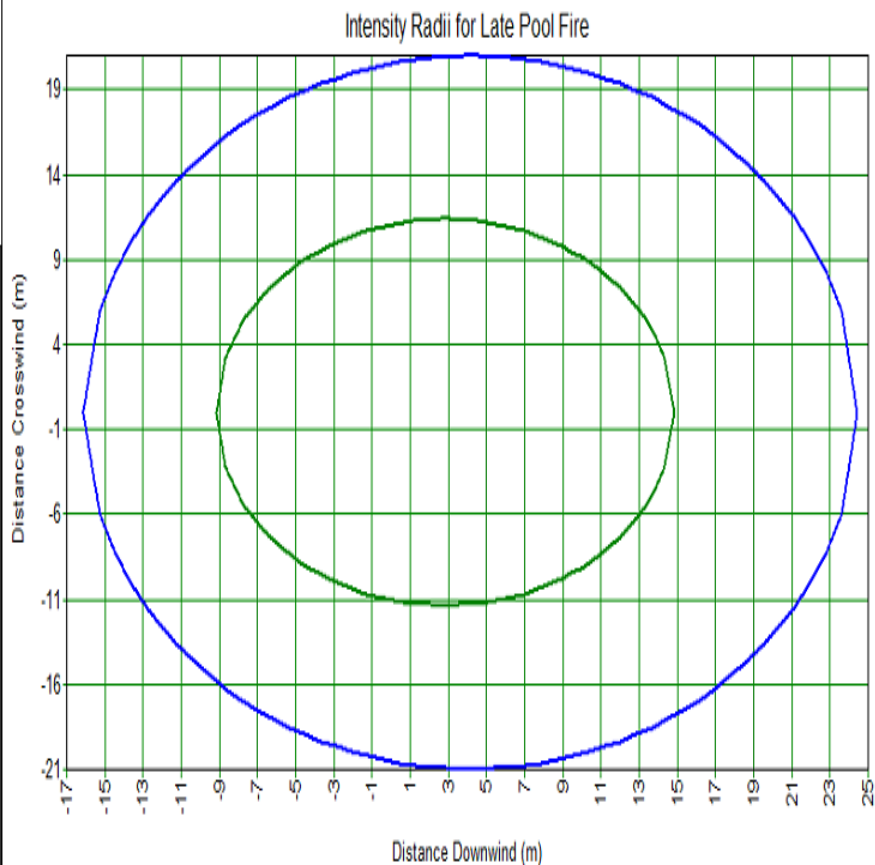
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 2 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 2 500m3 Methanol
storage tank- Rupture
Weather: Category 2/F
Material: METHANOL

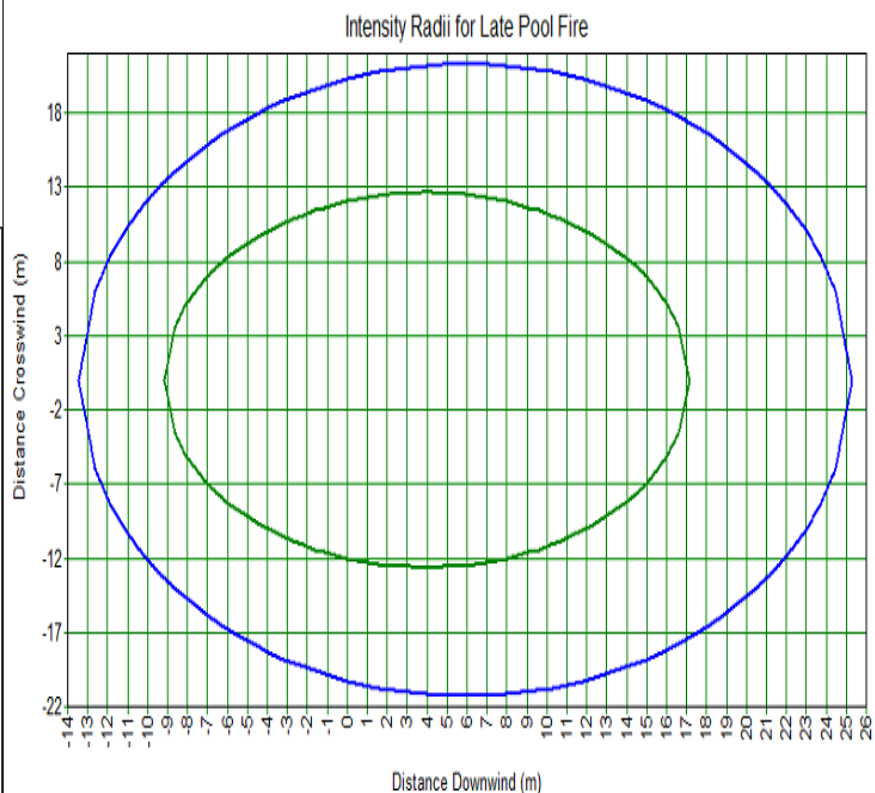
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 2 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 2 500m3 Methanol
storage tank- Rupture
Weather: Category 5/D
Material: METHANOL

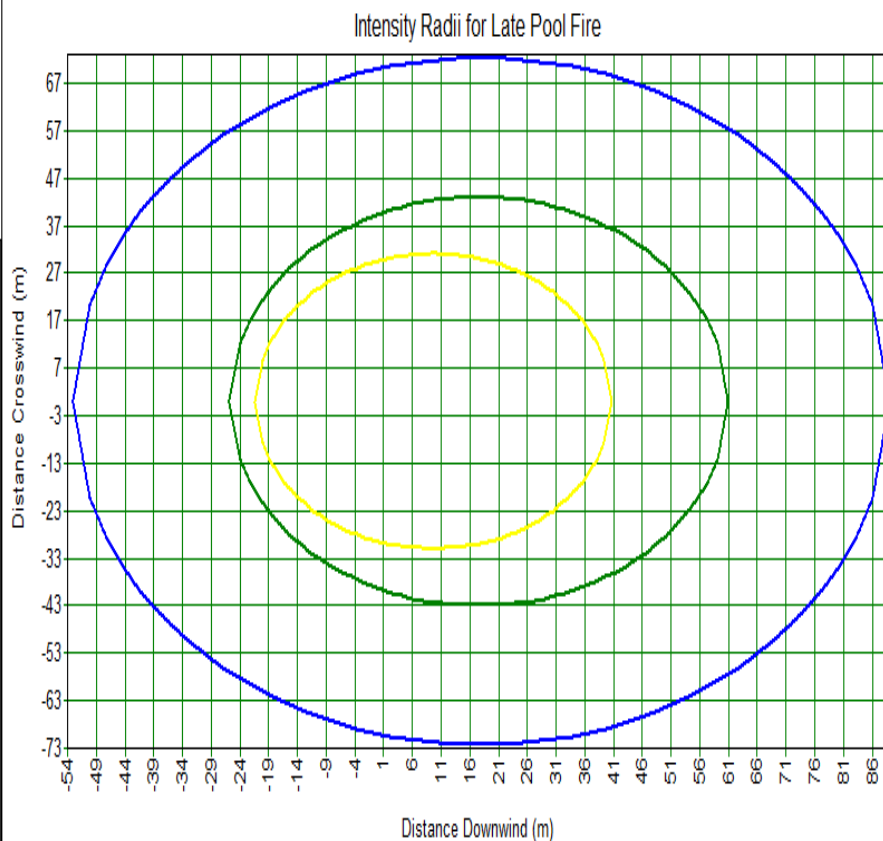
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 3 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in
loading / unloading area
Weather: Category 2/F
Material: METHANOL

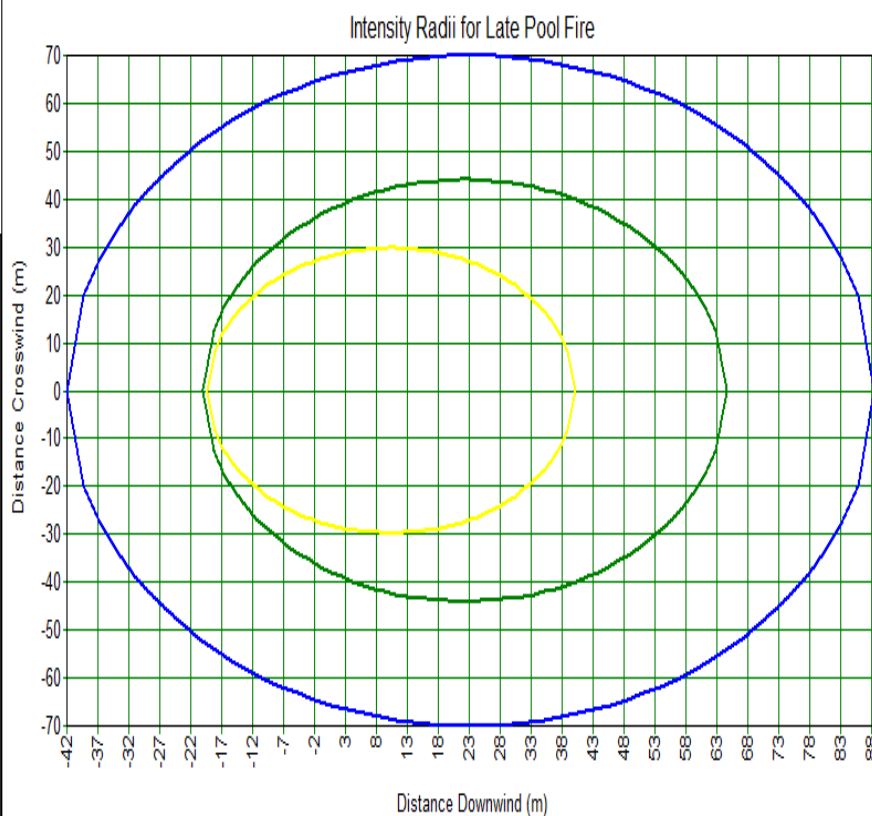
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²
— Ellipse @37.5 kW/m²



IS 3 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in
loading / unloading area
Weather: Category 5/D
Material: METHANOL

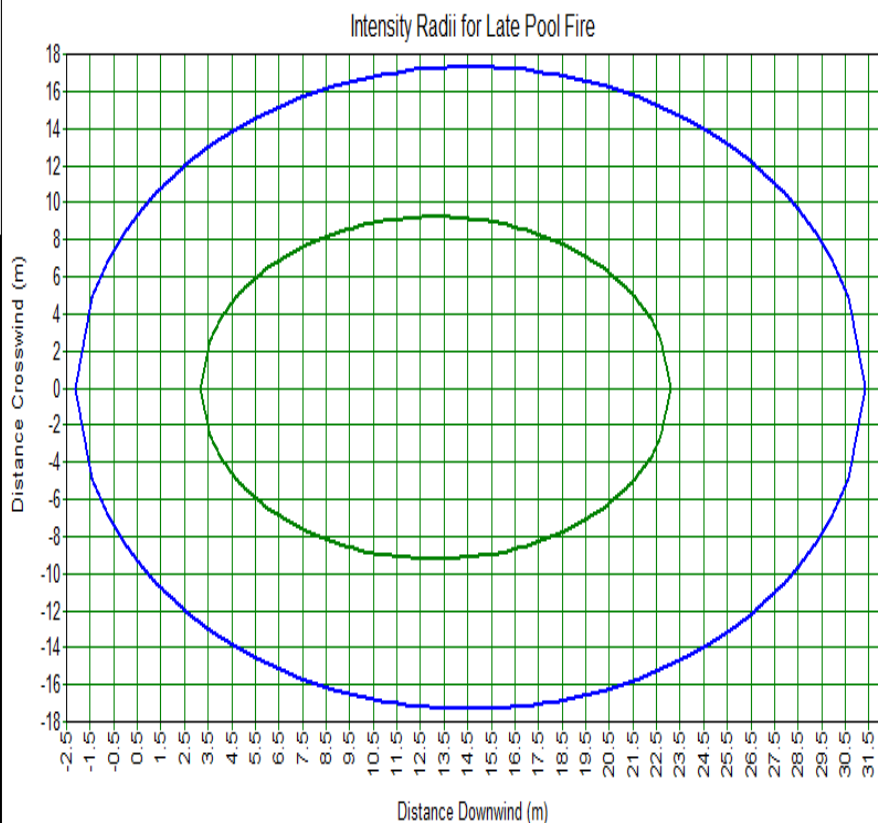
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²
— Ellipse @37.5 kW/m²



IS 4 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Weather: Category 2/F
Material: METHANOL

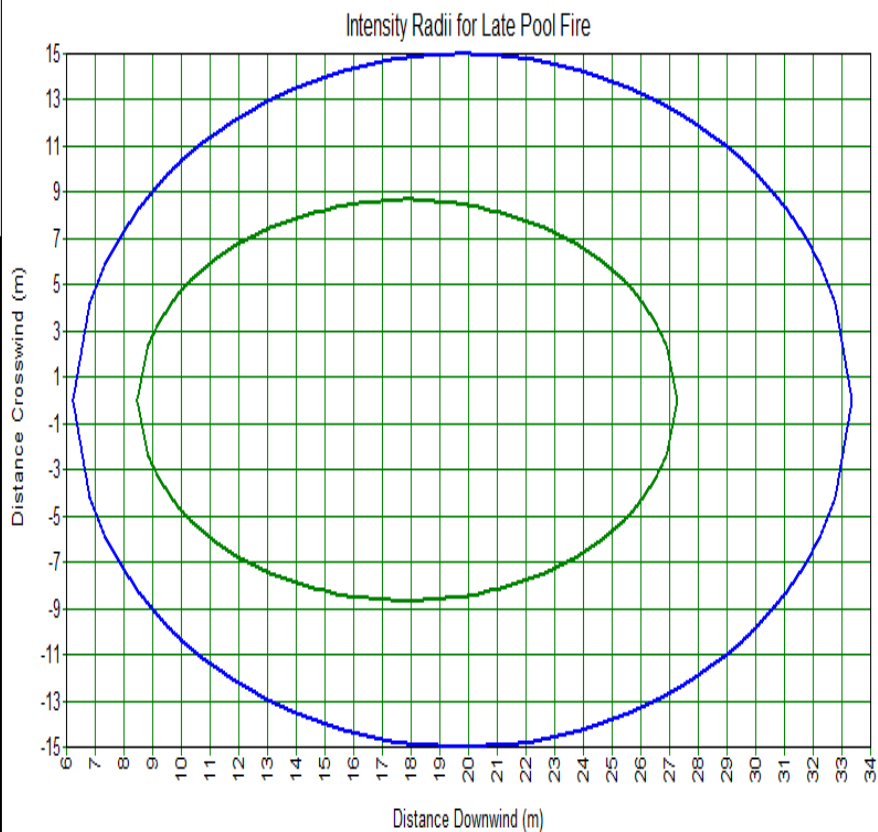
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 4 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Weather: Category 5/D
Material: METHANOL

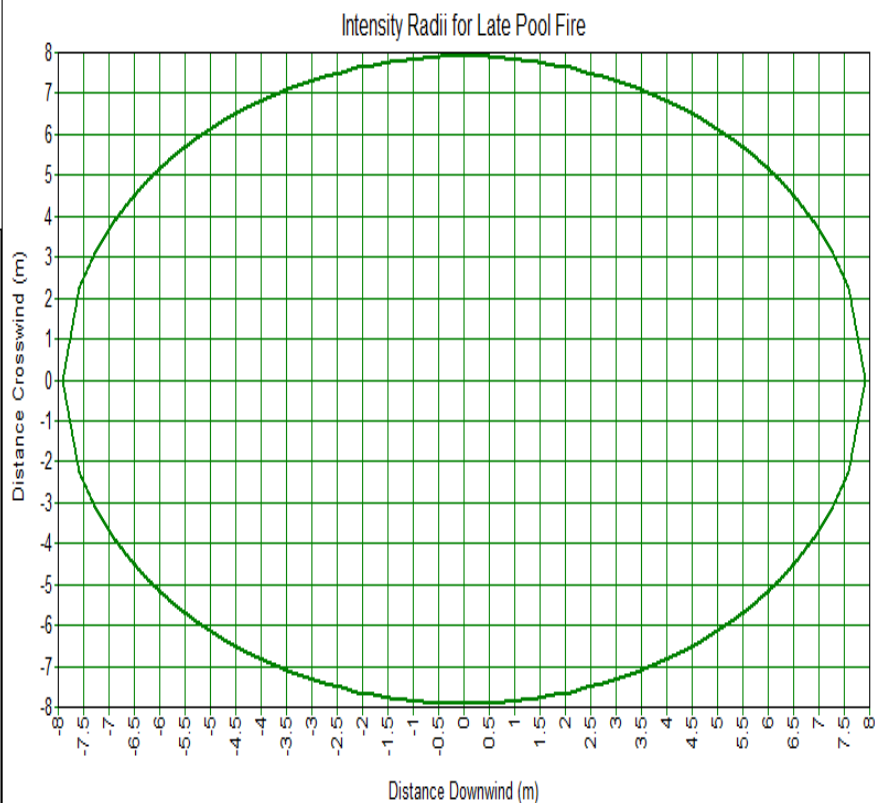
— Ellipse @4 kW/m²
— Ellipse @12.5 kW/m²



IS 5

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 5 Formalin Tank
10mm Leak
Material: Formalin
Weathers

— Category 2/F 4 kW/m²
— Category 5/D 4 kW/m²

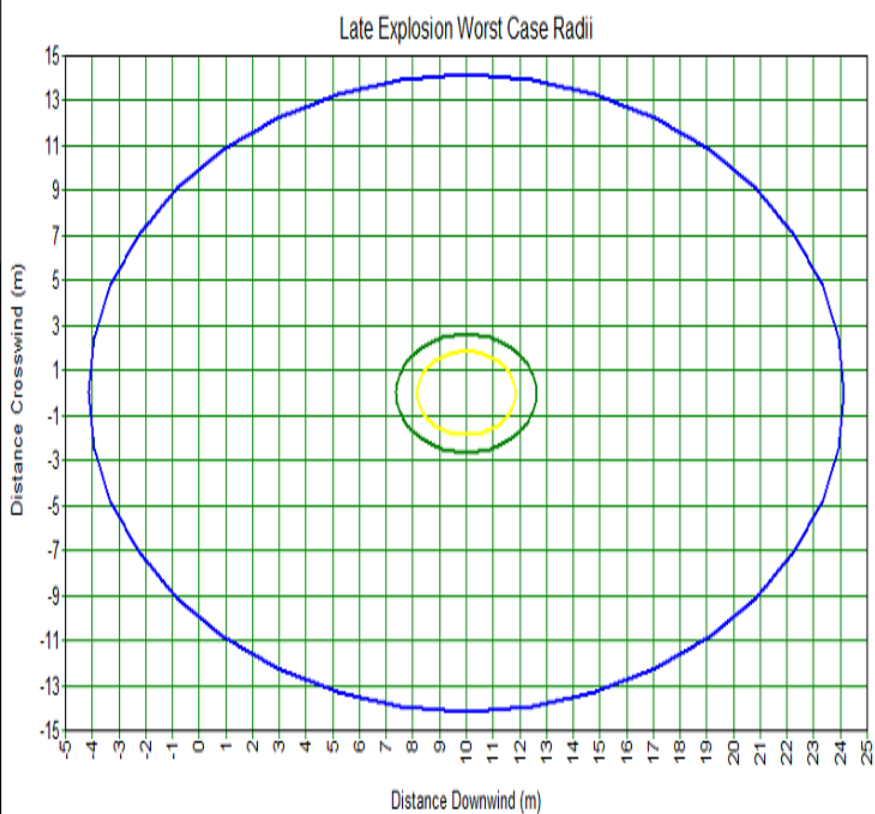


Explosion extent

IS 1 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 1 500m³ Methanol
storage tank- 10mm leak
Weather: Category 2/F
Material: METHANOL
OverPressures

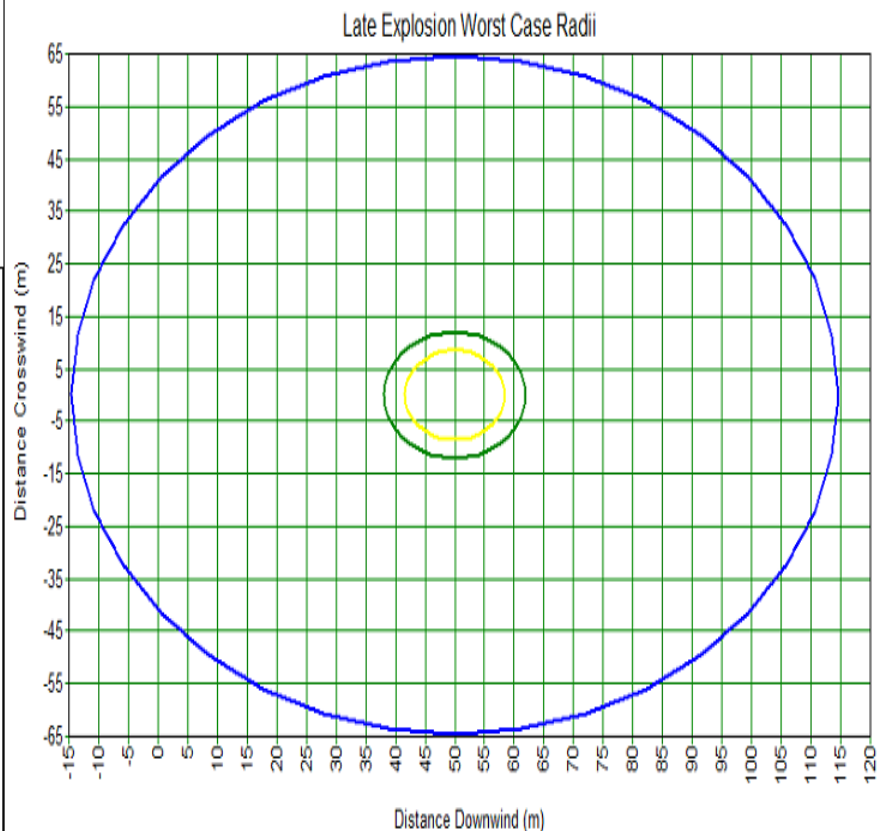
— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar



IS 2 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 2 500m3 Methanol
storage tank- Rupture
Weather: Category 2/F
Material: METHANOL
OverPressures

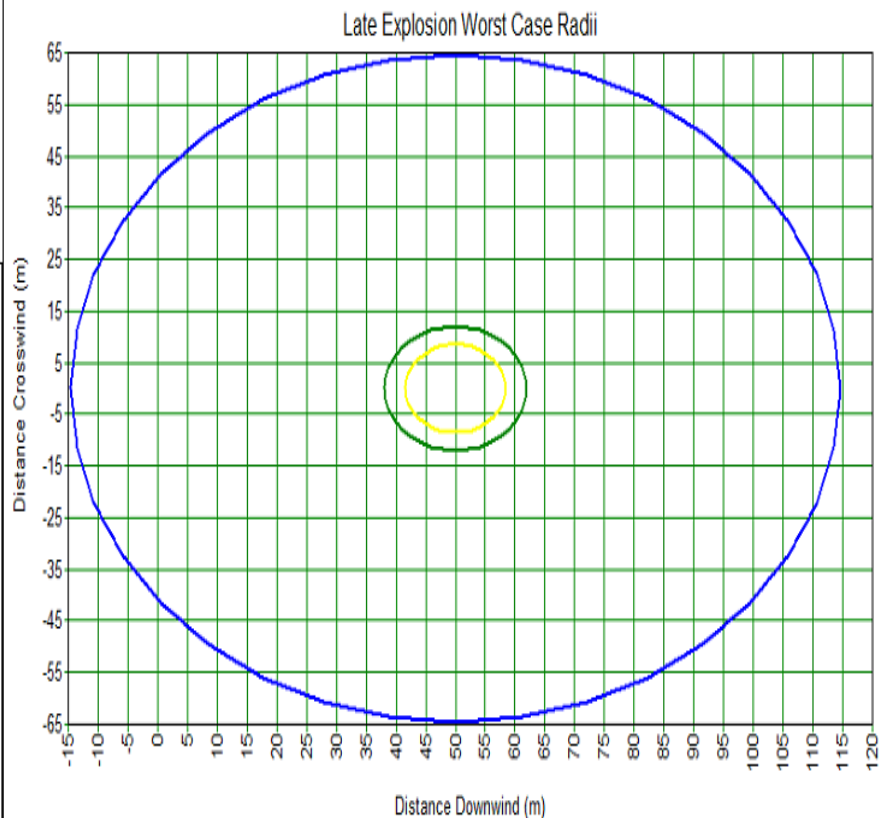
— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar



IS 2 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 94912
Model: IS 2 500m3 Methanol
storage tank- Rupture
Weather: Category 5/D
Material: METHANOL
OverPressures

— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar

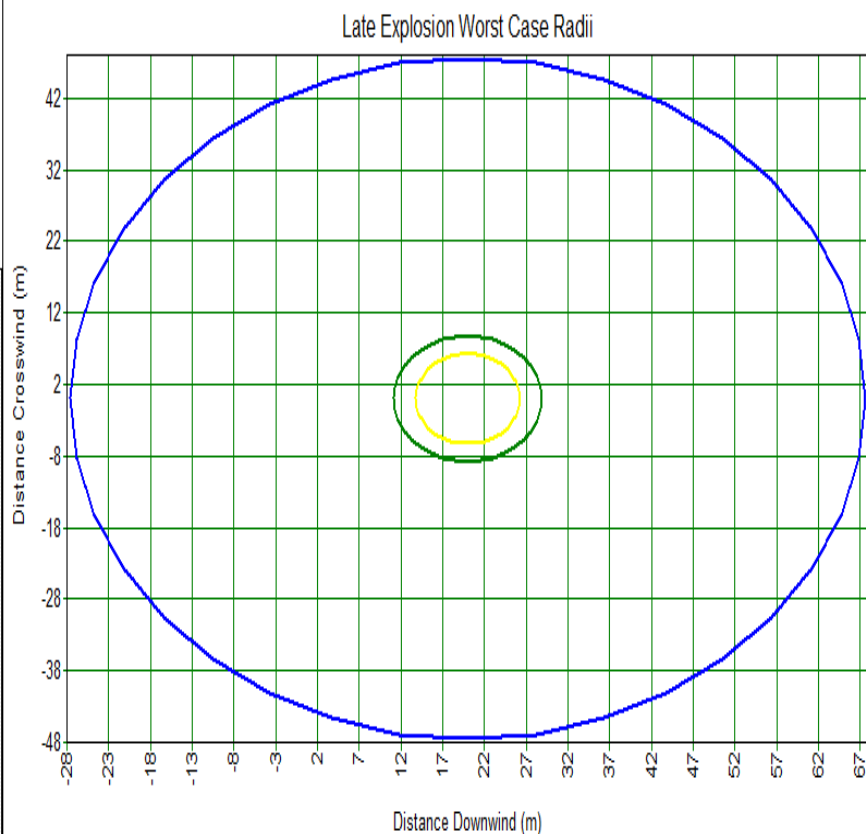




IS 3 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in
loading / unloading area
Weather: Category 2/F
Material: METHANOL
OverPressures

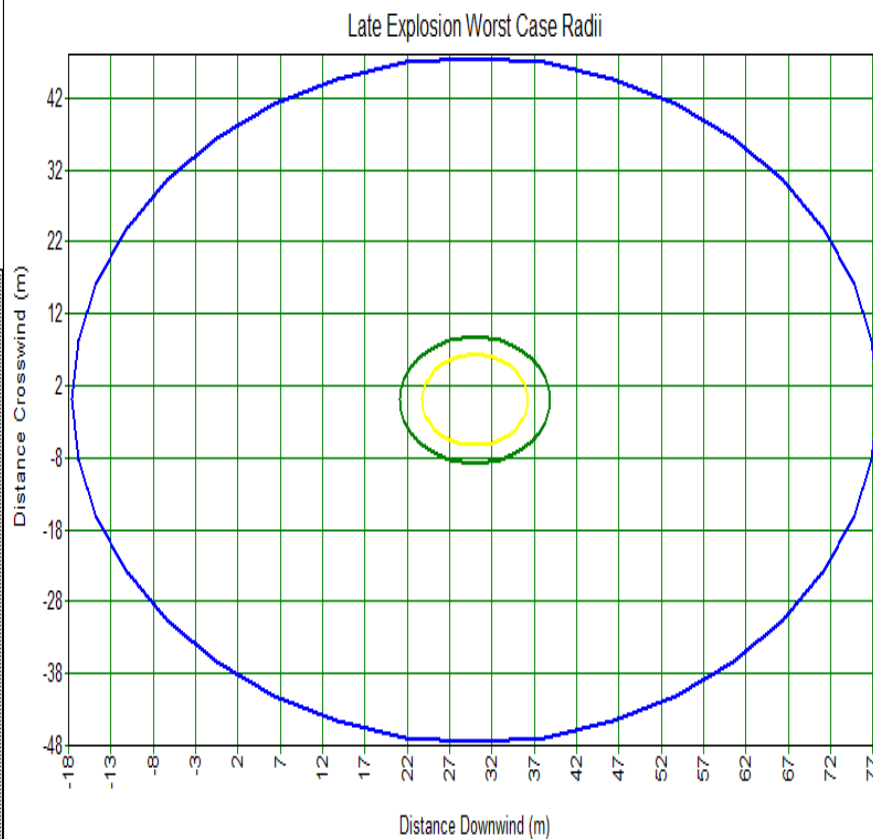
— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar



IS 3 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 3 Methanol leak in
loading / unloading area
Weather: Category 5/D
Material: METHANOL
OverPressures

— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar

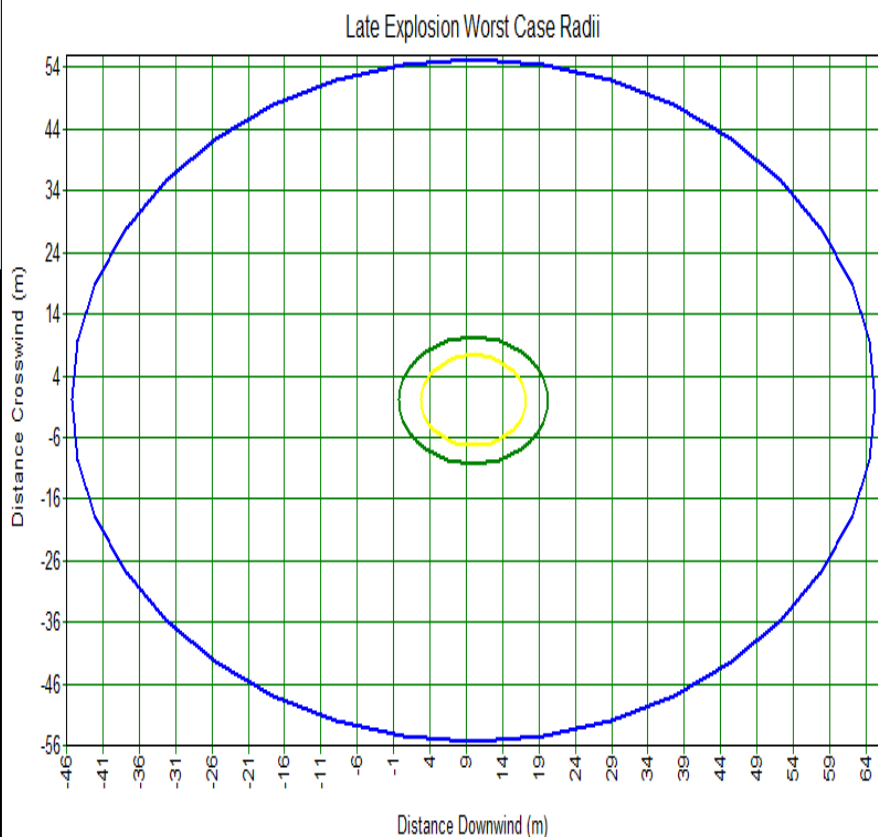




IS 4 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Weather: Category 2/F
Material: METHANOL
OverPressures

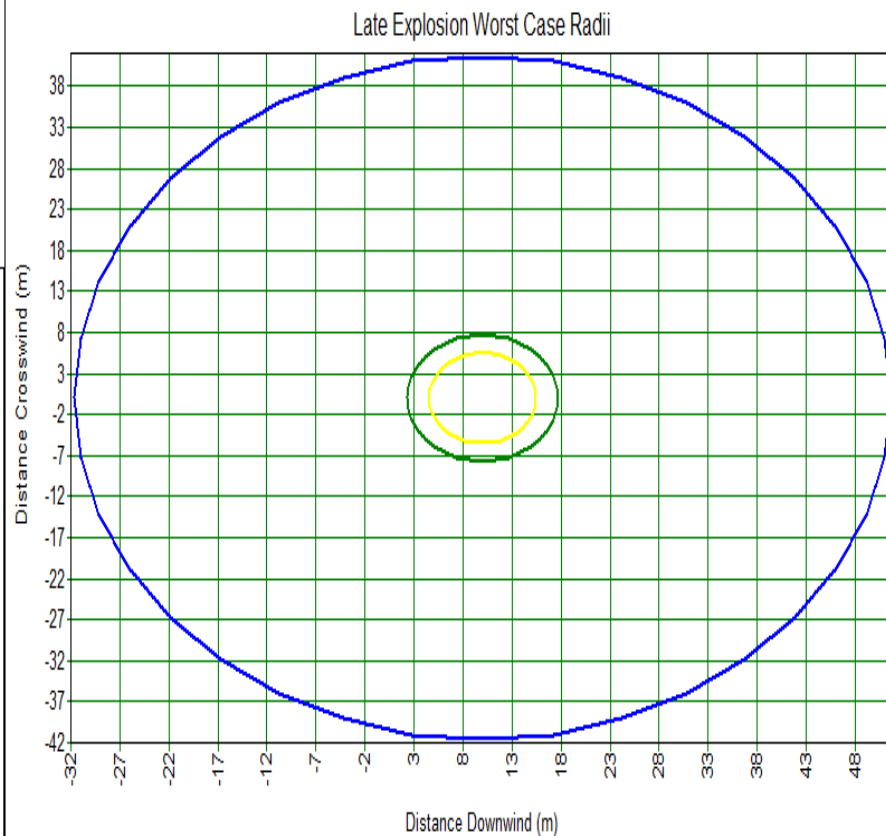
— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar



IS 4 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 4 Methanol release
in Production area
Weather: Category 5/D
Material: METHANOL
OverPressures

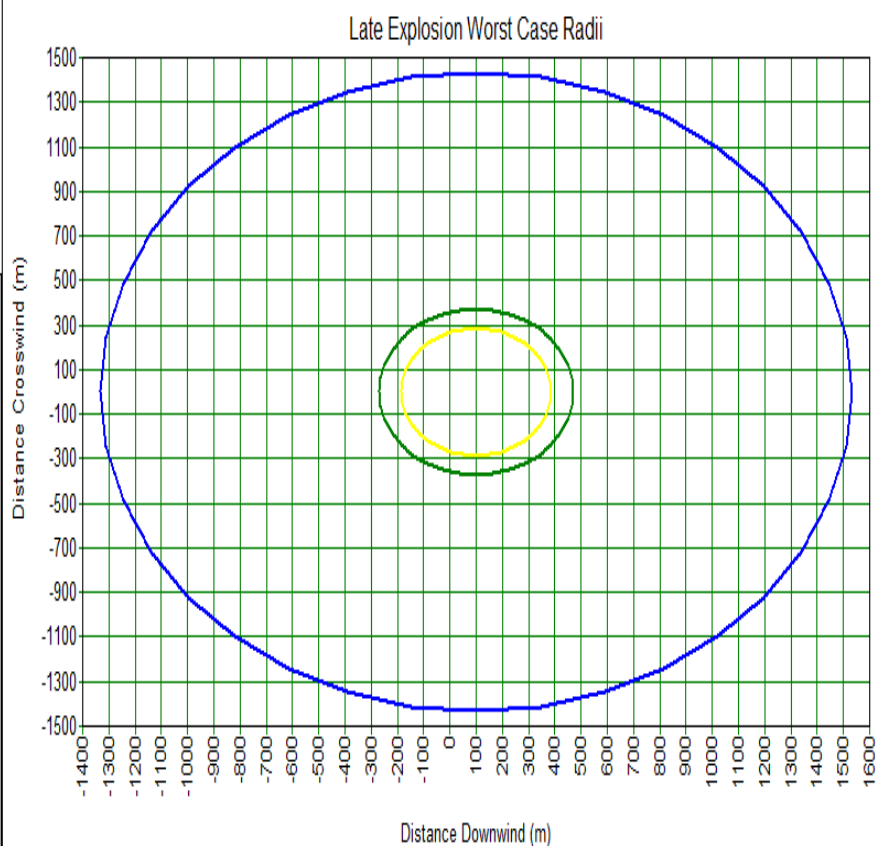
— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar



IS 6 2F

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 6 Formalin Storage
Tank - Rupture
Weather: Category 2/F
Material: Formalin
OverPressures

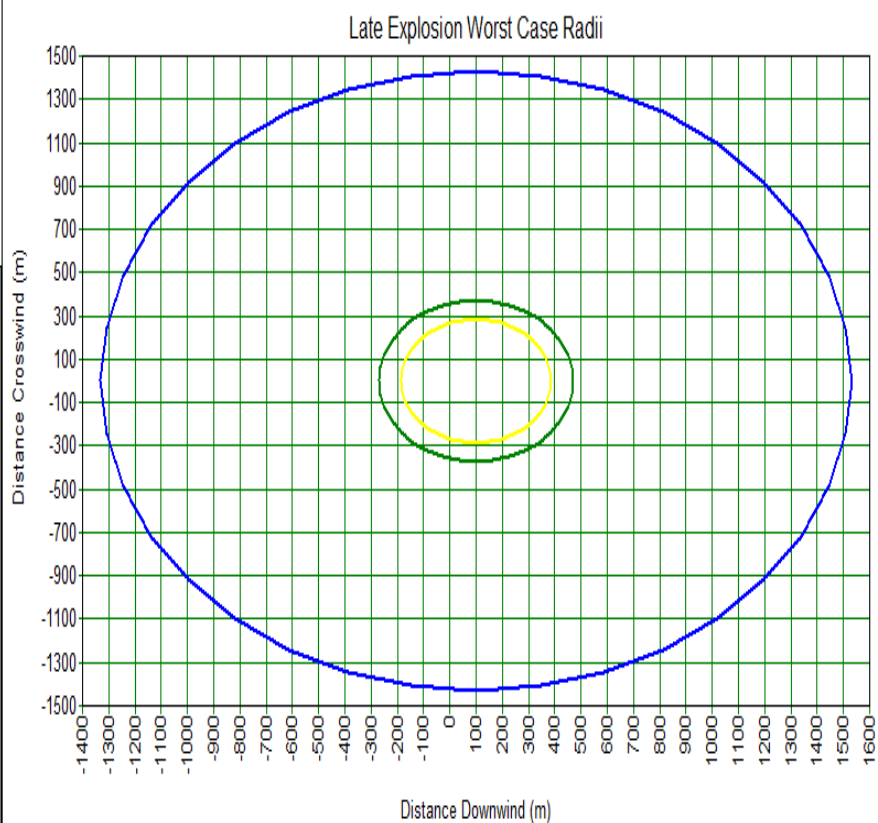
— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar



IS 6 5D

Study Folder: Consequence
for Assam Petrochem
Audit No: 79381
Model: IS 6 Formalin Storage
Tank - Rupture
Weather: Category 5/D
Material: Formalin
OverPressures

— Radius @0.02068 bar
— Radius @0.1379 bar
— Radius @0.2068 bar

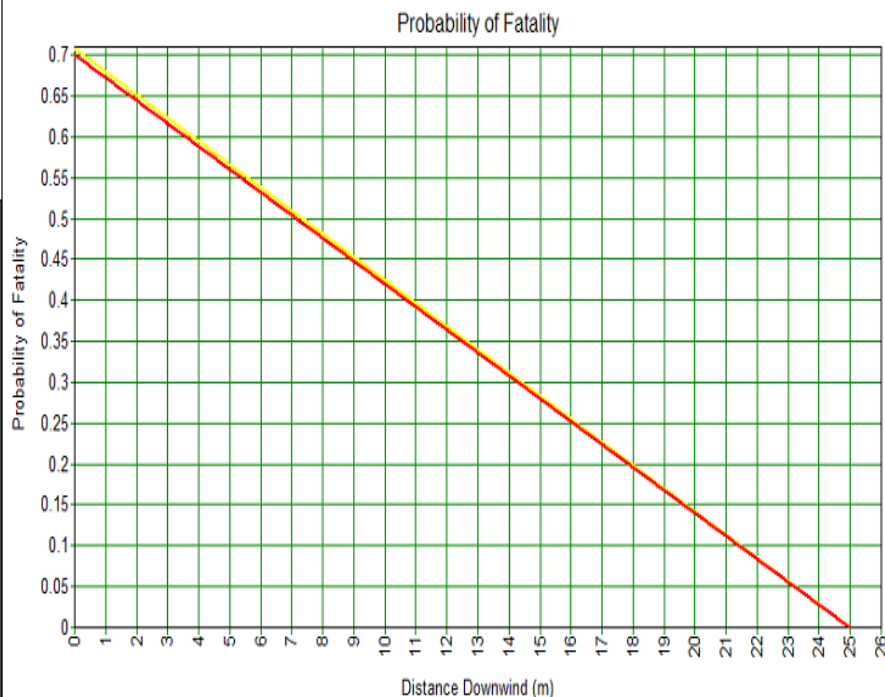


Toxic

IS 1

Study Folder: Consequence for Assam Petrochem
Audit No: 94912
Model: IS 1 500m3 Methanol storage tank- 10mm leak
Material: METHANOL
Weathers

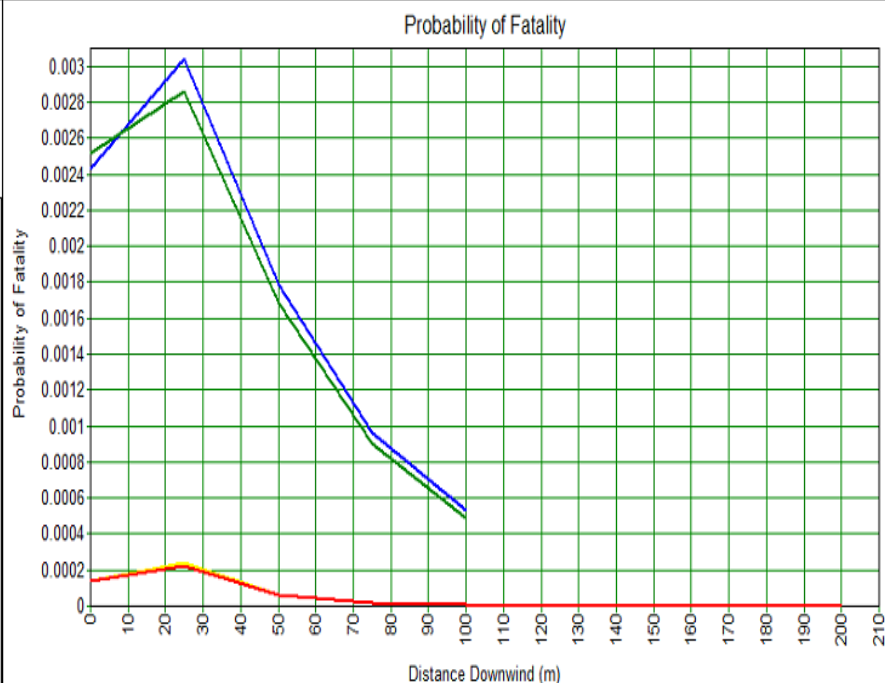
— Category 2/F:Outdoor
— Category 2/F:Indoor
— Category 5/D:Outdoor
— Category 5/D:Indoor

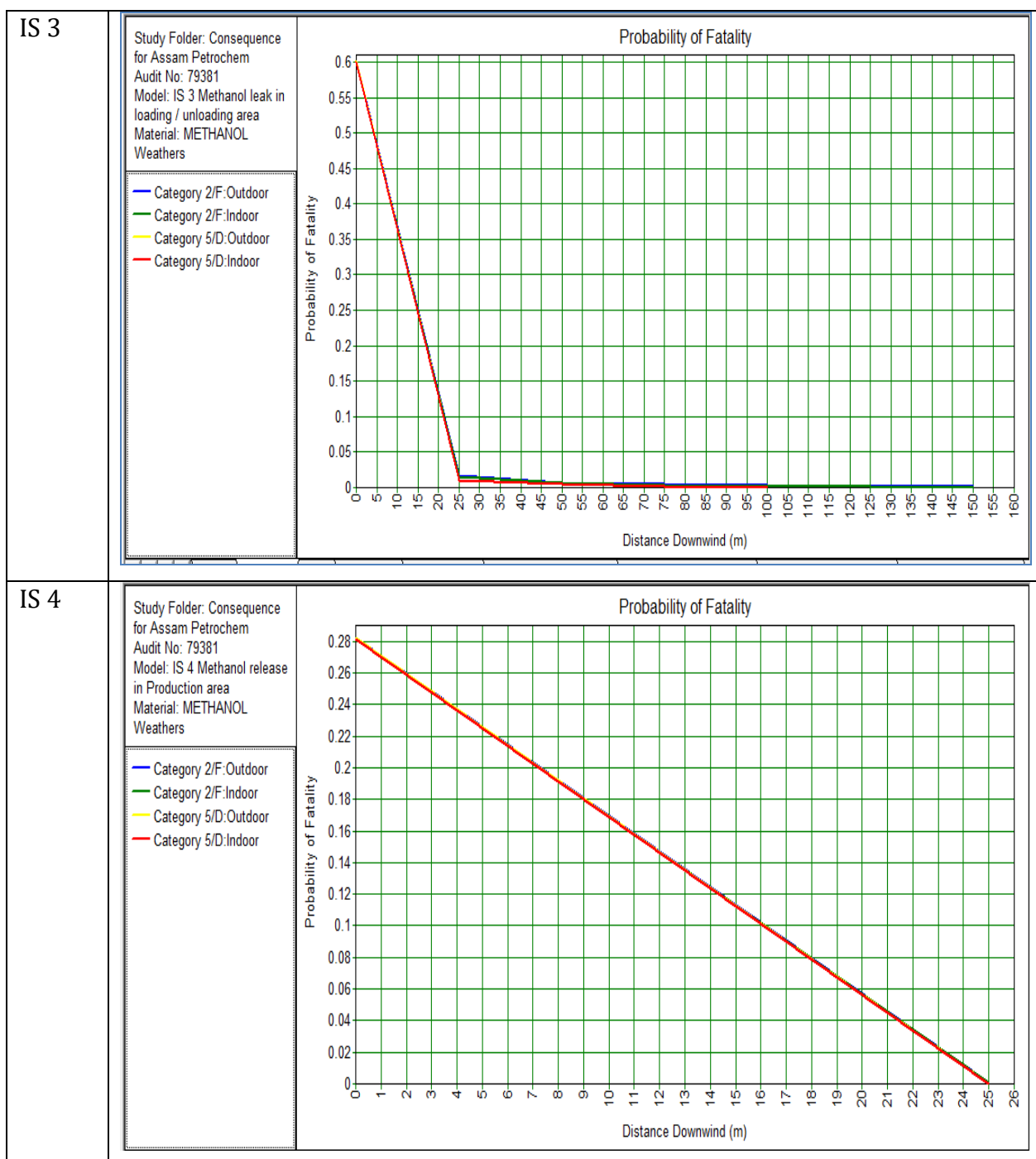


IS 2

Study Folder: Consequence for Assam Petrochem
Audit No: 94912
Model: IS 2 500m3 Methanol storage tank- Rupture
Material: METHANOL
Weathers

— Category 2/F:Outdoor
— Category 2/F:Indoor
— Category 5/D:Outdoor
— Category 5/D:Indoor





7.4 RISK REDUCTION MEASURES

For risk mitigation/reduction, attempts will be made to either reduce inventories that could get released in the event of loss of containment or failure likelihood's or both as feasible. Risk analysis identifies the risk contributors, which enables prioritization of the plant that deserve special attention in terms of inspection and maintenance in particular and over all safety management as a whole. For the risk reduction at the proposed formaldehyde plant, the following salient suggestions are made.

- A written process safety information document will be compiled for general use. The document compilation will include an assessment of the hazards presented including:
 - ✓ toxicity/flammable information
 - ✓ Permissible exposure limits.
 - ✓ Physical hazard data
 - ✓ Thermal and chemical stability data
 - ✓ Reactivity data
 - ✓ Corrosivity data
 - ✓ Information on process and mechanical design.
- The process design information in the process safety information compilation will include P&IDs/PFDs; process chemistry; maximum intended inventory; upper and lower limits, pressures, flows and compositions and process design and energy balances.
- Personnel engaged in handling of hazardous chemicals will be trained to respond in an unlikely event of emergencies.
- Safety measures in the form of Do's and Don'ts will be displayed at strategic locations especially in Assamese and English language.

Do's	Don'ts
Handling of Chemicals	
✓ Know the hazards of the chemical before handling. ✓ Know the antidotes for chemical, which is to be handled. ✓ Do keep material safety data sheet in locations where chemicals are being handled and study it. ✓ Use appropriate personal protective equipment like gloves, aprons, and respirator; face shield etc. depending upon nature of the work. ✓ Label every chemical that you use and tightly close the container. ✓ Use eye wash fountain / safety shower in case of splash of chemicals in the eye or body for at least 15 minutes. ✓ Segregate toxic, flammable chemicals and keep them under control. ✓ In addition to draining and closing valves, lines should be blanked before taking up	✓ Do not store the chemicals that are incompatible with other chemicals. ✓ Do not spill the chemicals. ✓ Do not dispose chemical without neutralizing. ✓ Do not keep large inventory of chemicals. ✓ Do not allow empty containers of hazardous chemicals to be used by others. ✓ Do not use compressed air for transferring chemicals. ✓ Do not stand near chemical transfer pump while it is in operation with temporary hose connection. ✓ Pouring of chemicals by hand or doing siphoning by mouth should never be adopted. ✓ Chemicals drums should never be moved without protection.



Do's	Don'ts
✓ maintenance work. ✓ Provide proper ventilation at the chemical handling area to limit their concentration within prescribed level.	✓ Do not use solvent for cleaning hands.
Material Handling	
✓ Use proper lifting tool and tackle having adequate capacity. ✓ Only authorized persons should operate material handling equipment's. ✓ Each tool, tackle or equipment should have number and safe working load (SWL) marked on it. ✓ Assess weight of the material, distance to be carried and hazards etc. before lifting the load. ✓ Inspect and test all the lifting tools and tackles regularly as per Factory Rules. ✓ Wear Personal Protective Equipments while handling of material.	✓ Do not use the equipment for the purpose other than its design intention. ✓ Do not allow personnel to move underneath lifted load. ✓ Do not load the equipment above its safe working load. ✓ Do not use make shift arrangements for lifting equipment without inspection and test ✓ Do not use effective tool and tackles. ✓ Keep the tools & tackles free from adverse effect of atmosphere by applying suitable protective coating.
House Keeping	
✓ Assign places for everything and maintain things at assigned places. ✓ Clean the area after completion of work. ✓ Use aisle space free for personnel and material movement. ✓ Ensure adequate illumination and ventilation for the job.	✓ Do not leave combustible materials in the work area. ✓ Do not smoke in the area of work. ✓ Do not allow dust bin to overflow. ✓ Do not generate extra waste. ✓ Do not disturb the safety equipment from assigned location. ✓ Do not block emergency switches and on/off
Fire Prevention	
✓ Follow 'NO SMOKING' sign. ✓ Deposit oily rags and waste combustible material in the identified containers and dispose them suitably. ✓ Fire Hose used for any other purpose should be permanently marked and taken out of fire hydrant system. ✓ Keep minimum inventory of flammable and combustible substances. ✓ Take permission before breaking or removal of fire barrier and ensure subsequent relocation of fire barrier. ✓ Check periodically the operability of fixed fire fighting system. ✓ Attend any abnormality/ deficiency with fire protection system promptly.	✓ Do not leave flammable material like acetone, kerosene etc. used as cleaning agent at the work area. ✓ Do not over tighten fire hydrant valves with F-lever. ✓ Do not allow wild grass growth around storage of the gas cylinders and switchyard. ✓ Do not obstruct accessibility to the fire related equipment. ✓ Do not destroy the inspection tag provided with the fire equipment. ✓ Do not misuse fire-fighting equipment other than intended purpose. ✓ Do not store the flammable material



Do's	Don'ts
✓ Provide earthing or bonding to prevent accumulation of static charges to tanks where flammable chemicals are stored / handled. ✓ Use instruments that are intrinsically safe in explosive atmosphere.	in the open container.

- The plant will check and ensure that all instruments provided in the plant are in good condition and documented.
- Safe work practices will be developed to provide for the control of hazards during operation and maintenance.
- Personnel especially contractor workers at the plant will be made aware about the hazardous substance stored at the plant and risk associated with them.
- The adequate numbers of heat and smoke gas detectors will be provided at strategic locations in the plant and indication of detectors/ sensors will be provided in main control room.
- Predictive and preventive maintenance schedule will be prepared for equipment, piping, pumps, etc. and thickness survey will be done periodically as per standard practices.

7.4.1 RISK MITIGATION MEASURES AND SAFE HANDLING OF METHANOL

Due to the flammability of methanol vapor, static electricity may ignite it. Therefore, grounding and bonding should always be applied when there is a potential for static electricity, and is required for all equipment. Carbide-tipped clamps (to ensure good contact through paint) and dip tube filling are generally used to guard against ignition from static electricity. The following safety precautions should be adopted while storage and handling methanol.

- Smoking must be prohibited.
- Vehicle access should be strictly controlled.
- Ventilation must be sufficient to cope with the maximum expected vapor levels in buildings.
- Positive pressure may be required for methanol-free areas, such as control, switch, and smoking rooms.
- Storage tank vents to atmosphere should be sized for fire-heated emergency vapor release.

- Electrical equipment must be explosion-proof to meet national electrical code requirements.
- Alcohol-resistant Aqueous Film-forming Foam (AR-AFFF) with 6% foam proportioning (with water) equipment is advised for use on methanol fires.
- Dry chemical extinguishers should be accessible for small fires. An adequate supply of handheld and wheeled types should be available.
- Hydrants should be strategically placed with adequate hoses.
- Small spills should be remediated with sand, earth, or other non-combustible absorbent material, and the area then flushed with water. Larger spills should be diluted with water and diked for later disposal.
- Lighting should be grounded. Tall vessels and structures should be fitted with lightning conductors that are securely grounded.

7.4.2 RISK MITIGATION MEASURES AND SAFE HANDLING OF FORMALDEHYDE

Formaldehyde is very water soluble it affects the mucous membranes. The effects of formaldehyde exposure can vary from person to person. Eye irritation, skin irritation and respiratory irritation are typical acute exposure effects. Long-term, chronic exposure effects may include cancers of the lung, nasopharyngeal and oropharynx, and nasal passages:

The following measures should be taken for handling of formaldehyde safely:

- Standard Operating Procedures (SOP) need to be developed used for the use of formalin / formaldehyde.
- Employees who handle formaldehyde must receive documented training on the hazards of formaldehyde and what to do in case of an exposure or spill.
- Through exposure monitoring, it should be ensured that workers are not over-exposed.
- Formaldehyde should always be used with adequate ventilation, preferably in a fume hood, to minimize inhalation of formaldehyde vapor.

☐ Workers Training for Formalin / Formaldehyde Handling

Workers who handle formaldehyde will be given documented training on the hazards of formaldehyde and what to do in case of an exposure or spill. A Material Safety Data Sheet (MSDS) for formaldehyde will be kept in the work area where formaldehyde is being used.



☐ **Exposure Monitoring**

Exposure monitoring need be carried for formaldehyde in storage and handling area.

☐ **Ventilation**

Formaldehyde should always be used in a chemical fume hood, with spot (snorkel) ventilation or in an enclosure exhausted to the outside of the building.

☐ **Eye Protection**

Always use chemical splash goggles when handling formaldehyde to minimize the risk of even a small splash or vapor exposure to the corneas.

☐ **Body Protection**

Wear a laboratory coat and appropriate footwear that covers the entire foot.

☐ **Gloves**

Medium or heavyweight nitrile, neoprene, natural rubber, or PVC gloves should be worn when handling concentrated formaldehyde. Disposable nitrile gloves may be used when handling dilute concentrations (10% or less).

☐ **Safe Work Practices**

Formaldehyde containers should be clearly labeled with the chemical name and hazards. Always wash hands thoroughly after using formaldehyde, even if gloves are worn.

☐ **Storage**

Formaldehyde should be stored in labeled, chemically compatible containers, away from heat and flame. Always place large-volume containers on a low, protected floor or in another location where they will not be accidentally spilled or knocked over. Containers larger than 4 litres should be stored in secondary containment.

7.4.3 RISK MITIGATION MEASURES FOR SPILLS

☐ **Minor spills**

The following measures will be taken in the event of minor spills of hazardous materials at the formaldehyde plant:

- Notify such area immediately.
- Limit access, prevent contamination spread.
- Survey personnel before exiting.
- Cover spill with absorbent materials (unless liquid is flammable or oxidizing).
- Remove contaminated clothing and footwear.



- Package and label clean up materials for disposal.
- Record spill details and contamination monitoring results.

❑ Major Spills

The following measures shall be taken in the event of major spills of hazardous materials at the formaldehyde plant:

- Persons not involved in the spill will leave the area immediately.
- Limit the movement of contaminated personnel until they are monitored.
- Close off and secure the spill area to prevent entry.
- Warning signs will be posted.
- Select the appropriate PPE, shielding and absorbent spill materials like absorbent paper or spill pillows if the liquid is not a flammable or oxidizing agent.

❑ Personal Protective Equipment

Personal protective equipment (PPEs) is devices that are fitted and issued to each worker personally for their exclusive use. They are intended for temporary use and emergency response action only. If a worker must enter a contaminated area, he must wear adequate protective equipment.

Employees will be taught when and how to use respiratory apparatus (SCBA) provided, and how to recognize defects in the equipment. Without SCBA entry into the contaminated area will not be attempted.

- Personal protective equipment will be kept there, where it can be accessed quickly, outside the hazardous material storage area and away from areas of likely contamination.
- Each employee will maintain his personal protective equipment in clean, working condition at all times.
- All equipment will be used and maintained in accordance with the manufacturer's instructions.
- Equipment installed for body and eye wash will be checked properly for round the clock operation.

❑ Safety Communication/Motivation/Promotion

- Safety signage and slogans will be displayed prominently in English and Assamese languages.



- Brief literature on safety and occupational health may be provided in the form of small booklet to the employees in English and Assamese languages.

❑ Safety Education And Training

Safety Training

- There will be provision at the plant for induction training for new workers. The assessment of the trainee is done to ensure the effectiveness of training.
- Classroom trainings will be organized regularly to promote safety measures as well as fire prevention and control among the employees.

Safety Communication / Motivation / Promotion

- Safety Day and Competitions on Safety are organized in the formaldehyde plant.
- The system for safety suggestion schemes will be implemented at the formaldehyde plant.

❑ First Aid

- First aid boxes are available within various locations.
- Trained first aiders are available in each shift at the formaldehyde plant.

❑ Occupational Health

- Occupational Health Center (OHC) will be established at the plant.
- Antidotes for all hazardous chemicals will be available at occupational health center at the formaldehyde plant.
- Local hospitals will be empanelled to attend any emergency.
- Well equipped ambulance facility will be available round the clock at OHC premises.

❑ Handling of Hazards

- Personal protective equipment (PPE) will be provided and PPE used by the workers during handling of hazardous chemicals will be replaced after certain time.
- If any spillage of hazardous chemicals, it will be cleaned and disposed as per standard practiced.
- Empty drums of hazardous chemicals will be neutralized immediate.
- Workers engaged in handling of hazardous chemicals will be made aware of properties of hazardous chemicals.

❑ General Working Conditions

- All the passages, floors and stairways will be maintained in good conditions.

- The system will be made available to deal with any spillage of dry or liquid chemicals at the formaldehyde plant.
- Walkways will be always kept free from obstructions.
- In the plant, precaution and instructions will be displayed at strategic locations in Assamese and English Languages.
- All pits, sumps will be properly covered or securely fenced.
- Adequate ventilation will be provided in the work floor environment.
- The work environment will be assessed and monitored regularly as local ventilation is most effective method for controlling dust and gaseous emissions at work floor.

❑ Safe Operating Procedures

- Safe operating procedures will be available for mostly all hazardous materials, operations and equipment.
- The workers will be informed of consequences of failure to observe the safe operating procedures.

❑ Work Permit System

Work permit system will be followed at the formaldehyde plant.

❑ Accident Reporting, Investigation And Analysis

Records for near-miss, incidents and accidents will be maintained and analyzed to take precautionary measures. There is no reportable accident in past years at the formaldehyde plant.

❑ Safety Inspections and Internal Audit

- At the formaldehyde plant, safety audit will be carried out by the Audit team comprising of safety professional, technical services, maintenance and process personnel.
- Safety surveillance and process safety review are being conducted on a routine basis.
- General safety inspections will be carried out regularly at the formaldehyde plant after construction and operation.

❑ Fire Protection

- The fire fighting system and equipment will be provided, tested and maintained at the formaldehyde plant after expansion as per relevant standards.

- Smoke detectors to be provided at the plant after expansion and will be calibrated and maintained properly.
- At least one diesel pump will be available in the fire pump room.
- Two reliable sources of power to fire water pumps will be available to ensure reliable power supply in the event of emergency.
- At least one hydrant point will be provided at every 30 m in the formaldehyde plant.
- Two delivery hoses of 15 m length with nozzles will be provided in a hose box for each hydrant point
- Fire pumps will be run at least 5 minutes every week.
- Emergency light will be available in fire pump room.
- No obstructions will be allowed around fire hydrant points;
- Adequate persons will be trained for use of fire extinguishers.
- Fire alarms will be kept in working conditions;
- There will be structured inspection system for fire fighting facilities and equipment.
- Adequate numbers of fire extinguishers will be provided in production area.
- Easy availability of fire extinguishers and trained personnel will be ensured to operate extinguishers.

☐ **Static Electricity**

- All equipment and storage tanks/containers of flammable chemicals will be grounded and earthed properly.
- Electrical pits will be maintained clean and covered.
- Electrical continuity for earthing circuits will be maintained.
- Periodic inspections will be done for earth pits and record will be maintained.

☐ **Hazardous Materials Handling**

- The workers will be made aware about the hazards associated with manual material handling.
- The workers will be made aware and trained about the use of personal protective equipment (PPE) while handling hazardous chemicals.

☐ **Communication System**

- Communication system including Public Address System will be provided in the provided.

- Communication facilities will be checked periodically for its proper functioning.

❑ Safety Inspections

The system will be initiated for checklist based routine safety inspection and internal audit of the formaldehyde plant. Safety inspection team will be formed from various disciplines and departments.

❑ Predictive and Preventive Maintenance

Predictive and preventive maintenance schedule will be followed in religious manner.

❑ Control of Hazards During Maintenance

- Safety permit system will be followed like hot work, cold work, confined space entry,
- Preventive maintenance will be carried out as per schedule.
- Adequate inventory of spare parts will be maintained.
- Scaffoldings/Ladders are used.
- Protective appliances will utilized for protection against fall, hand injury, head injury etc.
- Maintenance procedures will be developed and followed.
- All physical hazards will be eliminated.
- Lifting tackles will be maintained and examined periodically as per rules and regulations.
- Hand tools/power tools used will be of approved types and of good quality.

❑ Color Coding System

Color coding for piping and utility lines will be followed in accordance with IS: 2379:1990.

❑ Check for Trucks and Tankers

Before entering the tankers and trucks engaged in the transportation of hazardous chemicals to the formaldehyde plant, following documents will be checked before allowing to enter the plant premises:

- Registration certificate for transportation of hazardous materials;
- Deriver license to drive vehicles carrying hazardous materials;
- Fitness Certificate;
- Valid National permit;
- TREM Card; and

- Insurance papers.

☐ Electrical Hazards

- Earth pits will be cleaned, covered and maintained in good condition.
- Resistance test date for earth pit will be displayed.
- The system will be introduced to ensure flame proof ness of flame proof fixtures.
- Flame proof emergency lights will be made available in hazardous handing and storage area.
- During maintenance on electrical panel, electrical work permit will be followed and Electrical Inspector approved authorized person will be available for maintenance.
- Electrical maintenance will be carried under supervision of Electrical Inspector approved authorized supervisors.

7.5 OCCUPATIONAL HEALTH SURVEILLANCE PROGRAMME

- Workers can be directly or indirectly exposed by chemical like formaldehyde and methanol during process or material handling.
- Chemical have TLV like formaldehyde: 0.3 ppm.

APL will take following action to keep chemicals within PEL/ TLV.

- Process should be carried out in isolated area or closed system.
- Dilution ventilation/local exhaust ventilation system should be provided.
- Chemical handled by competent person
- MSDS of hazardous substance must be maintained by company.
- Quantity of substance should kept to absolute minimize
- Flame proof electric fitting should be provided.
- Safety devices like temp. Control and pressure control must be provided to vessel
- Labeling and sign board should be provided.
- Fire fighting, sprinkling system and emergency exit should be provided.
- PPE must be used during handling of chemicals.

7.5.1 EVALUATION OF EXPOSURE OF CHEMICAL DURING PRE-PLACEMENT AND PERIODICAL MEDICAL MONITORING

- Emergency /exposure examination and test should be carried out. Examination is based on irritation, sensitization of skin, respiratory system, eye, shortness of breath.

- Test must be carried out as per handling of chemicals as per OSHA guideline.
- Check the previous medical opinion of worker/employee as well as history.

7.5.2 LIVER FUNCTION TESTS (LFT) DURING PRE-PLACEMENT AND PERIODICAL EXAMINATION

The liver function test (lft) is blood test that gives an indication of whether the liver is functioning properly. The test is also very useful to see if there is active damage in the liver (hepatitis) or sluggish bile flow (Cholestasis).

It is also important to remember that diagnosis of liver disease depends on the combination of patient history, occupational exposures, physical examination, laboratory testing, biopsy and sometimes imaging studies such as ultrasound scans, and etc.

There are so many tests covered in LFT. They are as below with their normal values.

AST (Aspartate Aminotransferase)	: 5-40 iu/l
ALT (alaninie aminotransferase)	: 5-35 iu/l
ALP (alkaline phosphatase)	: 30-85 imu/ml
GGT (gamma-glutamyl transpepdiaze)	: 5-27 u/l
Total Serum Protein	: 6-8g/dl
Albumin	: 3.2-4.5g/dl
Total Serum Bilirubin	: 0.1-1.0mg/dl
Indirect Bilirubin	: 0.2-0.8 mg/dl
Direct Bilirubin	: 0.1-0.3 mg/dl
Urine Bilirubin	: Negative

Interpretation and follow up of the test is varying with clinical context and results. If there are minor abnormalities in the test, the repetition of the test may conduct after 1 week of test result. If test values are within the range, the repetition of the test may conduct after the one year of the test result. If there are chronic abnormalities seen in the results, the repetition of the test may conduct twice in a week and also consult with the doctors.

7.5.3 DETAILS OF OCCUPATIONAL HEALTH SURVEILLANCE PROGRAMME

Aim:

- Workplace injuries, illness can be prevented and hazard should be identified.
- Evaluation of accident analysis due to unsafe acts and condition as well as identified the health and safety problems in workplace.
- Effective Preventive measures strategies can be prepared.

- New technologies, educational activities, public awareness and regulatory and policy changes can be achieved

Mission:

The overall mission of the Occupational Health Surveillance Program is to promote the health, safety and quality of life of working people will be achieved:

Surveillance program can be improved by following action.

- Pre-placement examination and periodic examination must be carried out at workplace.
- Emergency/exposure examination and test should be carried out. Examination is based on irritation, sensitization of skin, respiratory system, eye , shortness of breath.
- Maintain the work profile and medical history of employee/workers.
- Pulmonary function test must be carried out in case handling of formaldehyde.
- Written medical opinion must be maintained by industry.
- Examination must be certify by qualified medical practitioners

7.5.4 TREATMENT OF WORKERS AFFECTED BY METHANOL

Methanol poisoning can be treated with the antidotes ethanol or fomepizole. Both drugs act to reduce the action of alcohol dehydrogenase on methanol by means of competitive inhibition, so it is excreted by the kidneys rather than being transformed into toxic metabolites. Further treatment may include giving sodium bicarbonate for metabolic acidosis, and hemodialysis or hemodiafiltration can be used to remove methanol and formate from the blood. Folinic acid or folic acid is also administered to enhance the metabolism of formate.

The initial symptoms of methanol intoxication include central nervous system depression, headache, dizziness, nausea, lack of coordination, and confusion. Sufficiently large doses can cause unconsciousness and death. The initial symptoms of methanol exposure are usually less severe than the symptoms resulting from the ingestion of a similar quantity of ethanol. Once the initial symptoms have passed, a second set of symptoms arises, 10 to as many as 30 hours after the initial exposure to methanol, including blurring or complete loss of vision, acidosis and putaminal hemorrhages, an uncommon but serious complication. These symptoms result from the accumulation of toxic levels of formate in

the blood, and may progress to death by respiratory failure. Physical examination may show tachypnea, and ophthalmologic examination may show dilated pupils with hyperemia of the optic disc and retinal edema. Small amounts of methanol are produced by the metabolism of food and are generally harmless, being metabolized quickly and completely. Prompt medical care is key to avoiding complications secondary to methanol intoxication. Supportive therapy is aimed at initiating airway management, correcting electrolyte disturbances, and providing adequate hydration.

Metabolic acidosis in methanol poisoning may necessitate the administration of bicarbonate and assisted ventilation. Bicarbonate potentially may reverse visual deficits. In addition, bicarbonate may help to decrease the amount of active formic acid.

Antidote therapy, often using ethanol or fomepizole, is directed towards delaying methanol metabolism until the methanol is eliminated from the worker's system either naturally or via dialysis. Like methanol, ethanol is metabolized by Alcohol dehydrogenases (ADH), but the enzyme's affinity for ethanol is 10-20 times higher than it is for methanol. Fomepizole is also metabolized by Alcohol dehydrogenases (ADH); however, its use is limited because of high cost and lack of availability.

Hemodialysis can easily remove methanol and formic acid. Indications for this procedure include

1. *Greater than 30mL of methanol ingested,*
2. *Serum methanol level greater than 20 mg/dL,*
3. *Observation of visual complications, and*
4. *No improvement in acidosis despite repeated sodium bicarbonate infusions.*

7.6 DISASTER MANAGEMENT PLAN

The Disaster Management Plan defines the organisation for the co-ordinated response necessary in the event of a disaster. The organisation plan shows the structure of the organisation and a brief overview of the tasks of personnel in the key roles. Role descriptions are provided for all key personnel for prompt emergency response.

7.6.1 EMERGENCY RESPONSE PLAN

For combating any emergency/disaster, a well-rehearsed plan of co-ordination is required. APL has responsibility of safety of Human, Machine, Material and Environment within and outside the premises. At the time of disaster/ emergency, everybody has a role to play.



Some to save themselves, some to save others and some key personnel will have the responsibility of saving the entire things. In order to eliminate the chaos at the time of disaster, a systematic plan of co-ordination has been prepared. It includes the general instructions and the duties of the key personnel. For any clarification with the regard to the content of this booklet, please contact EHS Department.

7.6.2 EMERGENCY CONTROL PLAN

An emergency can be defined as an accident that has potential to cause serious injury or loss of life or damage to environment. It may cause extensive property damage and adversely affect the Environment as a whole.

Emergency will generally manifest itself into the three basic forms i.e. fire, explosion or release of toxic materials.

Principle:

Recognizing that accident are possible, assessment of possible consequences of the credible accident scenarios and implementation of both onsite and offsite emergency procedures to be carried out in the event of an emergency.

7.6.3 COMMUNICATION FACILITIES

Mode of Alarm:

Work siren: 30 second on

Emergency / Disaster siren:

20 5 20 5 20 5 20 5 20

On pause on pause on pause on pause on

All Clear: 60 second on

7.6.4 DECLARING EMERGENCY

The person responsible for declaring the emergency (EMERGENCY MAIN CONTROLLER) will assess the situation and declare emergency. The main emergency controller or person authorized to give the emergency alarm will direct security to blow as maintained in mode of alarm. The situation will also be immediately declared by Coded Siren which will help to inform the people in the vicinity of the industry about the emergency situation. Local power backup has been given through UPS (Un-Interrupted Power Supply).

7.6.5 OFFICERS AUTHORIZED TO GIVE DISASTER ALARM

1. Emergency Main Controller/Production Head



2. Emergency Site Controller/Alternate Site Controller

Any of the above officers present at the scene of disaster are authorised to instruct directly the timekeeper /security guard to blow the emergency / disaster siren.

7.6.6 SHIFT IN-CHARGE OF CONCERNED PLANT

In the event of emergency in the plant after office hours and holidays the shift in charge in the plant shall immediately rush to the scene of emergency and take over the incident controller responsibility, till Incident controller arrives at the spot.

The communication to the important persons is to be made by the Admin. Officer in the shift to the following persons through telephone & walky talky.

Throughout the plant there will be an internal telephone system and a number of external telephone connections. Some of these are direct and some going through the exchange. The telephone exchange board will be manned during general shift working hours i.e. 9.00 am to 5.00 pm from Monday to Saturday. Flame proof walky talky & mobile phones will be available with all departmental heads and key personnel round the clock.

As per the instructions of the officers who are authorized to give disaster scene, the Admin Officer / security guard will operate the disaster siren as under:

20 5 20 5 20 5 20 5 20 Seconds

- i. Call out the other key personnel on walky talky or phone as per directory. If phone is engage, call next person as mentioned in the priority list and try again. Do not waste time on engaged phones.
- ii. Being informed that situation is under control by the Emergency Main Controller / Incident Controller, denote “all clear” by operating the siren as under:

60 Seconds on continuous

All key personnel are to perform their duties as per guidelines appended in the formaldehyde plant bit these are mere guidelines only. Key personnel have to do their best to control and contain the emergency as per situation demand.

7.6.7 THE OUTSIDE EMERGENCY SERVICES

The outside emergency services will be contacted on telephone Numbers Displayed in Emergency Control Center and given at the end of this Chapter. If the telephone does not function, Police Station will be requested to pass on the message to District Administration for further communication to the Emergency Services.

7.6.8 EMERGENCY CONTROL CENTER (ECC)

Considering the wind direction at the moment, the Emergency Control Center will be selected near the scene of Emergency at a safe location.

Time Office Gate (Walky Talky & Phone) will be Emergency Control Center. The Emergency Control Center Room is the place under the control of Emergency Main Controller, where the operations to handle the emergency are directed and co-ordinated.

The center of Resources Mobilisation, Informations and Media Communication, which is to be installed by the Emergency Main Controller.

Functions

The Emergency control center will be equipped to receive & transmit information and directions from Emergency Main Controller, Areas of the incident, emergency services, public, mutual aids, private organizations and other sources.

In addition to the means of communication, the center will be equipped with relevant data as well as with adequate communication facility and enable them to plan accordingly.

Essential Requirements:

- i. The Admin Room will work as directed by the Emergency Main Controller.
- ii. It will be attended by the all key personnel.
- iii. Adequate number of walky talky & external telephones. It is strongly recommended that at least one will be ex-directory or capable of use for outgoing calls only. This will avoid the telephone switchboard being overloaded with calls from anxious relatives. The latest telephone directories will have a separate list of important numbers.

24-Hour Command Center

Location-EHS Department

- i. Walky talky & direct telephone number
- ii. All relevant data including MSDS of all the raw materials and products, details and phone no. of other command centres phone nos.
- iii. Having detailed emergency response procedure with assigned responsibilities to handle roadside accidents and off-site emergencies (Specially our consignment)
- iv. Existing ECC of EHS Department having 24-hours well-trained emergency response team to attend and respond to the call and inform/redirect to responsible person.
- v. 24 x 7 hours availability of first aid services at command center.

- vi. 24 x 7 hours availability of transportation and fire rescue team and well trained experts in ready-to-go position within the approachable range.
- vii. Emergency contact Number is to be printed on TREM Card/MSDS/Tankers Emergency Information Panel.

Requirements for Emergency Control Center

1. Communication facilities

- ✓ Walky Talky & direct Telephone number
- ✓ Telephone for attending incoming calls

2. Telephone numbers of

- ✓ Plant intercom
- ✓ Outside fire services
- ✓ Medical services
- ✓ Civil Authorities

3. Address data

- ✓ All key personnel
- ✓ All nearby emergency services like fire, medical services etc.

4. List of key personnel's

- ✓ Emergency Responders
- ✓ First-aiders
- ✓ Emergency contact Nos. display board to contact with other emergency command centers in India.

5. Documented Emergency plan

- ✓ On Site
- ✓ Off Site
- ✓ Fire Manual
- ✓ MSDS

6. Office Stationary items

- ✓ Writing Pad
- ✓ Pen
- ✓ Pencil
- ✓ Camera or video to record incident and evidence of the cause and effect of the actions to control the emergency.



- ✓ Torches, umbrellas, raincoats etc
- ✓ A Public Address System (PAS), a vehicle with loud speaker

7.6.9 ROLES & RESPONSIBILITY OF KEY PERSONNEL

☐ Emergency Main Controller (EMC Unit Head)

- ✓ Assess the wind direction and select Emergency Control Center.
- ✓ Proceed to the Emergency Control Center (ECC).
- ✓ Ensure that the outside Emergency Services are called in and if required that nearby firms are informed.
- ✓ Ensure that key personnel are called in above list.
- ✓ Maintain a speculative continuous review of possible development and assess these to determine most probable course of events.
- ✓ Direct the shutting down and evacuation of plants in consultation with the incident controller.
- ✓ Ensure that casualties are receiving adequate attention. Arrange for additional help if required.
- ✓ Ensure that relatives of injured are informed.
- ✓ Ensure that Senior Officers of Civil Administration are informed.
- ✓ Ensure personnel head – count.
- ✓ If emergency is prolonged arrange for the relief of personnel and the provisions of catering facilities.
- ✓ Issue authorized statements to the news media.
- ✓ Ensure that proper consideration is given to the preservation of evidence.
- ✓ Control rehabilitation of affected areas in cessation of emergency.

☐ Emergency Site Controller (ESC Alternate Site Controller (ASC) –Manager (EHS)

- ✓ Proceed to the Emergency Area.
- ✓ Assess the scale of Emergency.
- ✓ Brief the situation to the Main Controller and Advice him to activate emergency services.
- ✓ Set up a communication point to contact with the ECC.
- ✓ Direct all operation within the affected area.
- ✓ Guide rescue and Fire fighting operation.

- ✓ Ensure that affected area is searched for casualties area evacuated to the appropriate assemble point.
- ✓ Shutting down nearby plants and evacuation of plant.
- ✓ Report all significant development to the EMC at ECC.

❑ Communication Controller – HOD-HR & ADMIN

- ✓ On hearing about the emergency report to EMC.
- ✓ He will maintain the communication link with the incident controller.
- ✓ Based on the information received he will interact with EMC and communicate the further action to the concerned.
- ✓ Maintains contact with the fire fighting crew, rescue team, security, first aid requirements, evacuation requirements etc.
- ✓ Maintain the inventory of items in the control center
- ✓ Ensures availability of runners in case of power failure
- ✓ He also obtains the prevailing meteorological data from the local offices.
- ✓ He maintains log of the events.
- ✓ All arrangements for transport.
- ✓ Co-ordinates action for additional vehicle requirements and ensure proper condition of ambulance. Also be responsible for making available cash in case of need.
- ✓ Maintain the required following Inventory in the ECC:
- ✓ Emergency Control Plan
- ✓ Site Layout Plan
- ✓ Assembly Point List
- ✓ List of Telephone Nos. of Civil Administration and other Govt. Authorities
- ✓ List of Internal Telephones, Walky talky channels & Mobile Phone Nos.
- ✓ Note pads, pens, pencils to record messages received and any instruction of or delivery by runner.
- ✓ Name of File for list of employees on duty
- ✓ List of Key personnel

❑ Emergency Electrical & Instrumentation Controller (EEIC) – Manager (ELECTRICAL & INSTRUMENTATION)

- ✓ On hearing the emergency siren, proceed to electric station and report to the EMC & ESC/ASC on walky talky/ phone.
- ✓ Ensure availability of Emergency power and normal running of Emergency electrical installation e.g. Fire pump, tube well pumps etc.
- ✓ Inform the incident controller of any likely situation that may affect continuous water supply.
- ✓ Ensure that all required personnel of Utilities section have reached to their respective work place.
- ✓ Be present with walky talky /mobiles to set up communication with all controllers.

□ Emergency Engineering Controller (EEC)–Manager Engineering/Utility

- ✓ On hearing Emergency alarm, proceed to the plant and report to the ESC/ASC.
- ✓ Be present/or depute somebody near engineering services to set up communication with the ESC/ASC.
- ✓ Stop all hot work and other maintenance work ensuring that it is safe.
- ✓ Help in controlling the situation when required by the ESC/ASC.
- ✓ Ensure that all non-essential worker/contractors workers have reached the assemble point.

Utility Services

- ✓ Shift Engg. (Utilities) on hearing Emergency Siren.
- ✓ Ensure that the fire pump is started to maintain uninterrupted water supply.
- ✓ Ensure that the tube well pumps are running.
- ✓ Inform the incident controller of any likely situation that may affect continuous water supply.

□ Emergency Commercial Services Controller (ECSC)– Manager (COMM)/SI (STORES)

- ✓ Stop the filling of all truck tankers and close all the valves properly.
- ✓ Send the filled / partially filled tankers to the parking.
- ✓ Ensure that all truck drivers/ helpers and other personnel have reached the assembly points.
- ✓ All trucks/ tankers which are on the way to the plant/ to the gate will be parked at material gate or outside.
- ✓ No truck/ tanker movement will be allowed during the emergency



- ✓ Ensure that no commercial vehicle is parked on the road.
- ✓ Ensure no hindrance to the emergency vehicle's movement.

STORES:

- ✓ On hearing Emergency Alarm, immediately report to Emergency Services Coordinator and be in touch with Incident Controller.
- ✓ Ensure supply/issue of any item / equipment / material required for handling emergency.

❑ Medical Services – Admin Officer/Manager

- ✓ On hearing Emergency alarm proceeds to First Aid center and report to the EMC & ESC/ASC on phone.
- ✓ Render medical treatment to the injured.
- ✓ Pharmacist will accompany the ambulance to carry the injured from the emergency scene to First Aid center if required.
- ✓ Keep inform to the Emergency services coordinator regarding availability of medicines, oxygen cylinders and other facilities.
- ✓ Transfer affected persons to the nearby hospitals.
- ✓ Coordinate with EMC & ESC/ASC continuously.

❑ Emergency Responders/Coordinators

- ✓ On hearing Emergency alarm, proceed to the affected area and report the ESC/ASC.
- ✓ Take instructions from ESC/ASC.
- ✓ Organize necessary safety equipment to the disaster site.
- ✓ Assess the situation and plan to the situation.
- ✓ Carryout the operation in an organized manner to control the emergency.
- ✓ Implement tactical assignments
- ✓ Ensure proper selection and use of PPE
- ✓ Continually evaluate situation, status and safety
- ✓ Monitor personnel fatigue and stress
- ✓ Aware of control zone locations
- ✓ Assure proper positioning of personnel
- ✓ Ensure water supply and backup systems are sufficient
- ✓ Ensure decontamination of exposed equipment and PPE
- ✓ Mobilize rescue equipment and conduct search and rescue operations if necessary

- ✓ Coordinate with First Aid Team
- ✓ Send the injured to first aid center by the ambulance.
- ✓ Ensure that safety measures/personal protective equipment is initiated.
- ✓ Replacing of used breathing apparatus and other safety equipment.
- ✓ Ensure the fire extinguishers/fire pumps water supply is normal.
- ✓ Ensure safety of Fire Fighting / Rescue Personnel

☐ Security Services – Security Officer

- ✓ On hearing emergency siren, report to EMC at ECC.
- ✓ Ensure that plant security measures are effective.
- ✓ Ensure all filled / partially filled tankers are taken to parking area.
- ✓ Suspend all normal gate functions (including material gate) and ensure that plant security measures are effective.
- ✓ Send Maximum security guards under a responsible person to the scene of disaster to help the emergency responder team. Advise them to report/take the instruction from ESC/ASC.
- ✓ Make arrangements to take out visitors.
- ✓ Keep the road clear for vehicles.
- ✓ Direct outside agencies who were called e.g. fire brigades to the disaster scene.
- ✓ All gates to be closed for personnel from outside.

☐ Transport Services– Admin Officer

- ✓ On hearing emergency siren, proceed to main gate and report to EMC.
- ✓ Alert all drivers to be ready on driver's seat of their vehicles at the parking site.
- ✓ Send vehicles on the advice of ESC/ASC.
- ✓ Keep one vehicle ready for use on the advice of EMC.
- ✓ Arrange for catering facilities as per advice of Emergency Services Coordinator.

☐ Abatement Coordinator – Next Senior in EHS

- ✓ He shall keep watch on entire emergency operation.
- ✓ He shall ensure that water, air and any other disaster fighting operation does not pollute the environment.
- ✓ If required he shall get the necessary test done on air/water discharge through ETP Lab/QC or through outside test laboratory.



- ✓ Make all possible arrangement for preventing or mitigating, the effects of the incident on the environment. This may include activities like containment of spillage, diversion of effluents through ETP, decision between air pollution and water pollution etc.
- ✓ Shall investigate the cause of disaster and submit a report to management.

7.6.10 EMERGENCY ASSEMBLY POINT

During the times of emergency, if an area or more than one area needs to be shut down and the personnel required to vacate such area / areas. Then, those personnel on instructions from plant / department will move to any one of the assembly point depending up on the wind direction.

In case of vapor nuisance at these places go to any other safe assemble point.

Please keep roads clear for vehicle movement.

HOD's and shift in charges will ensure that all personnel from their plants have reached the assembly point.

Emergency assembly points are:

- ✓ Emergency Assembly Point-1 located near main gate
- ✓ Emergency Assembly Point-2 located at near plant area

7.6.11 MOCK & FIRE DRILL

APL will be conducted mock drill once in six months & fire drill will be conducted once in two months on regular basis for any emergency handling salutation as per mock drill procedure.

7.6.12 CONTROLLING THE SITUATION

❑ Intimation of pre-emergency situation in time

Any person observes fire/massive release of chemical from any pipe line/ equipment/ storage tank/building will immediately inform EHS or Security Gate.

❑ Decision of declaring emergency at appropriate time

Personnel authorized to give disaster siren will make overall assessment of the situation and if he thinks that the emergency can occur, he will inform time office to declare the emergency.



❑ Quick communication of Emergency

Quick emergency will be communicated by operating emergency siren installed at time office in the wailing pitch. Outside Emergency services will be contacted over telephone or wireless sets available at local police station through District Authorities.

❑ Coordinating with outside emergency services

The Emergency Control Center (ECC) will make a close coordination with the District Authorities and Police for getting help at the site, evacuating offsite area, controlling road and rail traffic in reasonable time. Further Manager (EHS) and Manager (HR-admin) will keep effective coordination with Fire/Rescue and Medical Services respectively on their arrival.

❑ Emergency Shutdown of Process plants

As soon as In-charges of the plant (Plant Head during General shift hours and Shift In-charges beyond General Shift hours) are aware of the Emergency declared by sounding emergency siren, they would undertake emergency shutdown of their plants immediately. Utilities and Fire pump will continue to run without interruption. Similarly the loading/unloading operation of flammable liquids will also be suspended in commercial area. Area In-charges will immediately stop all hot work.

❑ Evacuation to Assembly Points

As soon as the emergency alarm sounds people in the process plants, workshops, warehouse etc. will evacuate to their respective assembly points after taking emergency shutdown of respective units. If there is an eminent danger, the evacuation will be carried out immediately.

❑ Handling of leakage before ignition and its containment

- ✓ Minimizing or stopping or containing the leakage will be achieved mainly by closing the emergency isolation valves, transferring the content from the leaking vessel to other storage tanks, containing the leakage or diverting it to a safe location etc.
- ✓ In order to minimize the ignition sources, efforts will be made to stop hot jobs, shutdown furnaces, switch off ovens and heaters.

❑ Handling of Flammable Liquid fire and its containment

- ✓ Efforts will be made to cut off the supply of flammable liquid to fire by closing emergency isolation valves.



- ✓ Cooling down the structure and equipment exposed to fire or radiant heat by activating water spray systems.
- ✓ Making an all out effort to control fire by appropriate fire extinguishing media like Carbon Dioxide, Dry Chemical Powder and Foam.

❑ Clearance of the Area Around Hazard Installation

- ✓ Ensuring that the passage is clear to facilitate free movements of emergency vehicles.
- ✓ Keeping the crowd away from the site of incident.

❑ Handling of Victims

Manager-HR & Admin will arrange to transfer the casualties from the effected area to the first -aid. He will get help in this activity from the first aid trained personnel and the external medical aid services. If required the injured personnel will be sent to hospitals, medical care centers, nursing homes etc.

❑ Accounting of Personnel

The in-charge of concerned area, after escorting people to the safe Assembly points will note down the details of the regular employees (Name, Designation and Employee code), Contractors workers (Name, Contractor's name and address) and visitors (Name, Address and age). Concerned Sis will provide assistance in taking down details of the evacuees. The information will be sent to the ECC where factory manager will compare this information with the actual attendance to make final accounting.

❑ Access to Records

Important records are kept in library/filing cabinets. These filing cabinets are marked so that access to the valuable records becomes easy.

❑ Termination of Emergency

After the hazard emergency is brought under control and there are no threats as such or the effects of the emergency are over, the Emergency Main Controller having assessed the overall situation will announce termination of emergency. On his instruction all clear alarm will be sounded. The District Authorities and other external agencies will be communicated on telephone or by special messengers about the termination of emergency.



❑ Public Relations

If an incident occurs, the Emergency Main Controller will issue the news of the emergency to the media and provide information what he can. This will reduce the likelihood of erroneous reports.

The Emergency Main Controller will be the sole authoritative source of information about emergency. However, he may provide accurate information on emergency to the general public through spokesman.

❑ Rehabilitation

If need arises temporary arrangements for stay to those affected will be made till permanent rehabilitation is stored.

❑ Re-entry Procedure

The employees injured in the disaster will be allowed to resume their duties after providing medical fitness certificates as per the prevailing rules of the company.

❑ Emergency Shutdown Procedure

Detailed emergency shutdown procedures for each process plant has already been laid down in the respective plant SOP's, which is readily available with respective plant In-charges. Moreover, all plant personnel have a thorough knowledge and experience of these procedures for immediate action as and when required.

❑ Action off-site

Inform the police, voluntary organization, local administration for rescue operation for controlling and regulating the traffic in order to save the mobile population from effect of gas leakage etc.

In the event of emergency, telephone or messenger will inform local police station. The District administration and police of Bongaigaon District may also be contacted by telephone or over wireless set available in the local police station. Similarly the out-side emergency services will be contacted on telephone or the district authorities will be requested to pass on the message. For regulating the traffic, local police will be contacted as mentioned earlier.



Table 7.8: Emergency Telephone Numbers

Sl. No	Designation	Contact Nos.
		Tele (Office)
1	District Collector, Bongaigaon District	03664-230889
2	Superintendent of Police, Bongaigaon District	03664 230 898
3	Chief Medical Officer, Bongaigaon District	9435029551
4	Fire Station	03664-228381
5	KACHUDOLA MPHC	9957460440
6	Bongaigaon Civil Hospital	03664-228940



7.7 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	
Product Name: Formaldehyde 37% solution	Contact Information:
Catalog Codes: SLF1426	Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396
CAS#: Mixture.	US Sales: 1-800-901-7247 International Sales: 1-281-441-4400
RTECS: LP8925000	Order Online: ScienceLab.com
TSCA: TSCA 8(b) inventory: Formaldehyde; Methyl alcohol; Water	CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300
CI#: Not applicable.	International CHEMTREC, call: 1-703-527-3887
Synonym: Formalin	For non-emergency assistance, call: 1-281-441-4400
Chemical Name: Formaldehyde	
Chemical Formula: HCHO	

Section 2: Composition and Information on Ingredients		
Composition:		
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
Toxicological Data on Ingredients: 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
Potential Acute Health Effects: 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.
Potential Chronic Health Effects: Hazardous in case of skin contact (sensitizer). 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
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, CO₂).

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/m³) 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/m³) [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 NO₂ 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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CHAPTER 8

PROJECT BENEFITS

CHAPTER 8: PROJECT BENEFITS

8.1 INTRODUCTION

The proposed project of manufacturing of formaldehyde unit will result in improvement of infrastructure as well as overall socio-economic development in the area. The growth of the industry significantly contributes to economic growth as it generates employment both directly and also due to development of downstream industries. Peripheral development takes place and due to more influx of money through the area, overall importance of the area increases and overall the infrastructure improves.

The people residing in the nearby areas will be benefited directly and indirectly as well. It is anticipated that the proposed project will provide benefits for the locals during operational phase of the activity.

The following benefits are expected due to the implementation of the said project:

1. The easy availability of infrastructure, man power, raw materials will reduce the production cost as well as demand supply gap. The same will bring revenue to the state exchequer by way of Duties and Taxes.
2. The development of green belt in and around the plant premises will improve on the aesthetics of the area. Moreover, it will help in reducing the noise levels within the plant boundary.
3. The setting up of the proposed plant will help in providing employment to local people.
4. There will be an increase in indirect employment & earnings of the small time shop owners like tea vendors, transporters, etc.
5. The implementation of Rain Water Harvesting Scheme will help in increasing the ground water level of the area.

8.2 EMPLOYMENT BENEFITS

- The construction work & commissioning and operation of the proposed formaldehyde plant will require man-power and resources. The proposed formaldehyde plant proposes to employ local work force for these phases.
- The proposed formaldehyde plant may lead to slight growth in the social status & improvement of the quality of life in the surrounding area.



- Considering the size of the project, the manpower requirement during operation will be 40-50.
- Priority will be given to the local people in employment.

8.3 SOCIO-ECONOMIC BENEFITS

- No resettlement and rehabilitation issue is involved in the proposed plant as the plot was purchased as industrial plot surrounded by industries.
- More business opportunity to boost in area.
- Enterprise social commitment benefits to near by villages.
- Revenue in the form of taxes will be generated from the plant production.
- The relatively short-lived economic benefits of the construction phase are likely to be experienced in local area for the duration of construction phase as workers make everyday purchases from local traders in nearby areas.
- Flow-on economic impacts will be experienced in other sectors of economy as a result of purchase of construction materials and the payment of wages and salaries to the personnel engaged in the plant activities.
- Greenbelt development will significantly improve the ecological conditions of the area.

8.4 INFRASTRUCTURE BENEFITS

The beneficial impact of formaldehyde manufacturing plant on the civic amenities will be substantial after the commencement of project activities. The basic requirement of the community needs will be strengthened by extending health care, educational facilities to the community, building/strengthening of existing roads in the area. APL will initiate the above amenities either by providing or by improving the facilities in the area, which will help in uplifting the living standards of local communities. With improved transportation facilities there is always a scope for development.

8.5 OTHER TANGIBLE BENEFITS

For several decades, formaldehyde has been used consistently in a wide range of products, ranging from personal hygiene, to medicine, to building products and much more. Many different resins are created from formaldehyde, which are in turn used to create other materials having different properties.



Formaldehyde derivatives are used as preservatives in personal hygiene products because they kill bacteria or they are used to make other products more effective in terms of foaming action such as soaps and detergents. Its versatile chemistry and unique properties have created applications for use of formaldehyde in all kinds of every day products such as plastics, carpeting, clothing, resins, glues, medicines, vaccines and the film used in x-rays.

- ✓ Formaldehyde destroys bacteria, fungi, molds, yeast & other type of germs. So it can be used as a sterilant/ disinfectant.
- ✓ Industrial adhesive use formaldehyde as a bonding agent, such as in pressed wood, plywood, fiberboards, etc.
- ✓ Formaline (mixture of water & formaldehyde) is used as a preservation of food, antiseptics, medical labs, funeral homes & cosmetic (shampoo, deodorant, toothpaste, lipsticks, soaps, lotions etc.
- ✓ It can also help stabilizing fabrics, reducing wrinkles and shrinkages.
- ✓ It is also found in cigarette smoke, kerosene space heaters & fuel burning appliances

8.6 ENVIRONMENTAL COST BENEFIT ANALYSIS

Assam Petro-chemicals Limited (APL) has proposed 200 TPD Formaldehyde Manufacturing unit will be located at Dag no. 72, 73 & 77 (Pt), Village: Dhaknabari, Boitamari; District: Bongaigoan at Assam. All the basic requirements for the production are in placed including infrastructure availability. The increase in production of chemicals will available to the needy industries. It will definitely boost the economic growth of the country; develop region and quality of life of the people in a sustainable manner without creating any environmental damage.

The project site is well connected to railways, roadways and airways. The proposed project is planned in the notified Boitamari Industrial area. Therefore, it will not involve loss of vegetation and biodiversity. The vegetation is similar in the whole area with no sensitive ecosystem or rare and endangered flora or fauna, hence no environmental loss will be there in terms of net productive value.

The total project cost is estimated to be 5116 lakhs and expenditure on implementation of the Environmental Management Plan (EMP) is presented in Chapter 10 of this report. Besides tangible benefits, the proposed project has got number of intangible benefits like



minimum emission of the generated gases, no adverse impact on environment as far as air, noise and water environmental components are concerned. Individual industry will take care of environmental management. With the establishment of proposed project, there will be socio-economic development in the area and thereby the improvement in the quality of life of the people.

More employment opportunities will be there for the local people, moreover the proposed project will help for enhancement of the economy of the country. The proposed project will provide temporary and permanent job opportunities to the local people in the neighboring area. The industry management has complete focus on quality, quantity, promptness, safe delivery and best services.

The establishment of proposed formaldehyde plant when in operation will definitely provide significant supply of products to the industries, not only in the region, state but also in India and help to increase the economic status of the country.

The developmental activities due to proposed project will increase economy of the country and also help to increase the economy of the state through products transportation, taxes, supporting economy for nation's growth.

8.7 ENVIRONMENTAL BENEFITS

- Environmental awareness in school at nearby Villages and Programs for environmental education and public participation shall be developed with the help of audio visual aids to create awareness about the activities.
- Proper awareness campaign shall be organized for water conservation.
- In order to increase the aesthetic environment, plantation program shall be carried out in the nearby villages.
- Celebration of World Environment Day every year on 5th June will be marked by plantation of number of trees in order to develop awareness in them about protecting environment from pollution and to save earth.
- APL as part of corporation wide effort for "Swachh Bharat Abhiyan" will carry out the cleaning activity periodically at the project site.

8.8 CORPORATE ENVIRONMENTAL RESPONSIBILITY (CER)

Corporate Environmental Responsibility is the commitment of businesses to contribute to sustainable economic development by working with the employees, their families, local

community and society at large to improve their lives in ways that are good for business as well as overall development. It is a voluntary activity of a company that supports social interests and environmental issues. It is a principle through which the business houses contribute to the welfare of the society and not only maximize their profits. CER, in fact, is about business giving back to the society.

Some of the CER related activities are summarized as follows:-

1. Sustainable livelihood creation – Promoting micro entrepreneurship through skills development, market linkages & women’s economic empowerment.
2. Education – Setting up schools, colleges’ curriculum development, teacher training & community involvement.
3. Health care – Healthcare awareness camps & setting up hospitals & dispensaries in areas where these are deficient and arranging equipment needed by the patients if any. Providing free treatment to poor patients in Hospitals, especially for life threatening diseases, as per recommendation of the Hospital authorities.
4. Community initiative – Need based services, project/programs for disadvantage youth, illiterate adults, socially & economically deprived sections of the society & women self help groups.
5. Rural development – Water management, housing, sheds, waste land, agriculture & animal husbandry, genetic improvement & model village development with all basic amenities.
6. Infrastructure developments – Roads, drinking water & sanitation etc.



CHAPTER 9

ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER 9: ENVIRONMENTAL MANAGEMENT PLAN

9.1 INTRODUCTION

Environmental management is concerned with a planned, integrated programme aimed at ensuring that identified and unidentified impacts of a proposed project are contained and brought to an acceptable minimum. It provides confidence on the part of project planners that a reliable scheme will be put in place to deal with any contingency that may arise during all phases of development, from preliminary study to abandonment.

Any industrial development is associated with both positive and negative impacts on the environment. The negative impacts from an industry should not hinder industrial development but they should be properly mitigated and managed. The proper Environmental Management Plan (EMP) should be prepared for the proposed industrial plant activities to minimize negative impacts on the basis of prevailing environmental conditions and likely impacts of proposed activity on various environmental parameters. Environmental Management Plan will also facilitate monitoring of environmental parameters.

Environmental Management Plan is required for the formulation, implementation and monitoring of environmental mitigation measures. EMP includes schemes for proper and scientific treatment and disposal mechanism for polluted emission, effluent, sewage, solid and hazardous wastes. Apart from this, landscaping and green belt development, safety aspect of the workers, noise control, etc. are also included in the EMP. Adequate budgetary provisions are also made for EMP implementation. The plan for implementation of environmental management plan should be framed. The detailed capital and recurring (per annum) budget should be earmarked for pollution control/monitoring equipment; operation and maintenance of pollution control facilities. This Environmental Management Plan has the following specific long-term objectives:

- *Ensure compliance with legislation and Company policy;*
- *Achieve, enhance and demonstrate sound environmental performance built around the principle of continuous improvement;*
- *Integrate environment fully into the business;*
- *Rationalize and streamline existing environmental activities to add value in efficiency and effectiveness;*

- *Encourage and achieve the highest performance and response from individual employees and contractors;*
- *Provide standards for overall planning, operation, audit and review;*
- *Enable management to establish environmental priorities;*
- *Be applicable throughout the organization.*
- *Hold early consultations with communities and regulating authorities to ensure hitch free operations.*

9.2 PURPOSE OF ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Various purposes of the Environmental Management Plan at the proposed formaldehyde plant are:

- ✓ To treat and dispose of likely pollutants viz liquid, gaseous and solid & hazardous wastes so as to meet statutory requirements with appropriate technology,
- ✓ To support and implement proposed formaldehyde plant to achieve environmental standards and to improve the methods of environmental management,
- ✓ To promote green-belt development,
- ✓ To encourage good working conditions for employees,
- ✓ To implement best practices for environmental management,
- ✓ To reduce fire and accident hazards,
- ✓ Budgeting and allocation of funds for Environmental Management System,
- ✓ To adopt cleaner production technology and waste minimization program.

The proposed formaldehyde plant of Assam Petro-chemicals Limited (APL) will have some pollution potential to cause both short term and long-term environmental degradation, if suitable mitigation measures area not implemented. While the industrial development is indispensable for the socio-economic development of the area, the environmental aspects can never be ignored because of widespread and far-reaching environmental degradation. Along with control and regulatory measures, mitigation measures will yield fruitful results at proposed formaldehyde plant of APL towards environment management.

With the availability of cost effective advanced technology and innovative environment management practices, the EMP can act as an effective management tool to provide

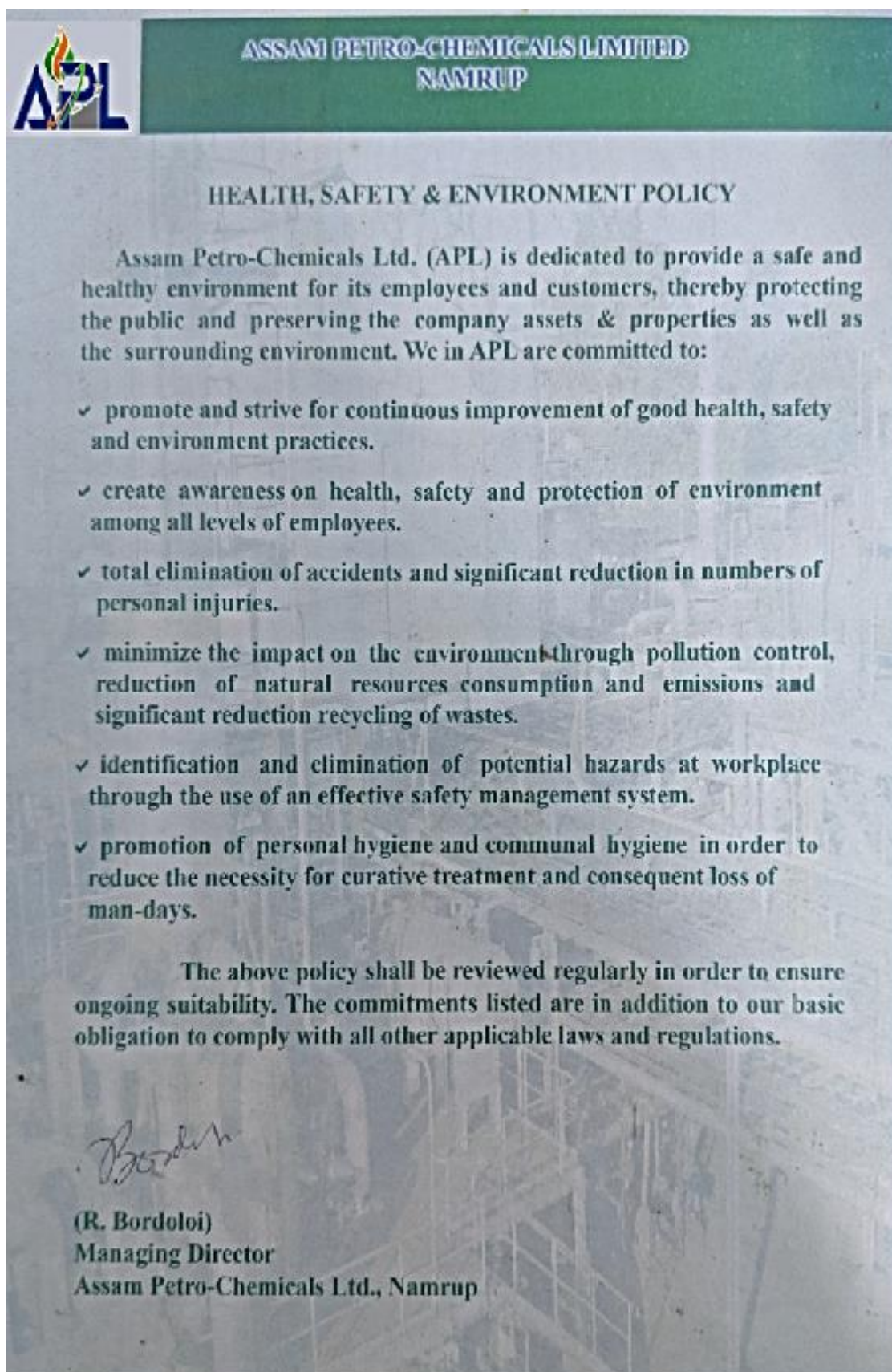


management solutions to all environmental pollution concerns including that of associated regulatory compliance.

9.3 ENVIRONMENT, HEALTH AND SAFETY (EHS) POLICY

APL will conduct its activities in a professional and responsible manner. The company, not only will comply with the laid down legislation requirements but when found inadequate will promote creative measures and internal standards for the protection of health, safety & the environment of the highest order for all who may directly or indirectly be affected by any of the activities. Personal safety and employee health will be the greatest responsibility, followed by the protection of the environment and company property.

The company will continue to take a proactive approach towards creating safe work environments for all employees and will be concerned for promoting continued safety education and training for all employees, assigning responsibility for all aspects of the program, continuously reviewing the program to identify potential areas of improvement, and ensuring a thorough evaluation of all incidents. The company will continue to address the environmental and health impact of our operations by reducing waste, emissions, and discharges and by using energy efficiently. The company will maintain awareness of EHS matters, so as to be proactive in providing a value-added service to the clients. This awareness is achieved through education, communication and definition of the goals and standards appropriate to operation and those undertaken on the client's behalf.



Source: APL

Figure 9.1: EHS Policy of APL

9.4 ENVIRONMENTAL MANAGEMENT CELL (EMC)

Apart from having an Environmental Management Plan, it is also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation of environmental mitigation measures and to conduct environmental monitoring. The proposed formaldehyde plant will appoint Environmental Management Cell to keep a close watch on the performance of the pollution control equipments, emissions from the sources and the quality of surrounding environment in accordance with the monitoring program.

The Environmental Management Cell will also include the safety cell for observing, inspecting and regulating the safety measures inside the plant premise. The Environmental Management Cell will be responsible for maintaining records of all the data, documents and information in line with the statutory requirements. The major duties and responsibilities of Environmental Management Cell shall be as given below:

- ✓ *To implement the Environmental Management Plan,*
- ✓ *To assure regulatory compliance with all relevant rules and regulations,*
- ✓ *To ensure regular operation and maintenance of pollution control devices,*
- ✓ *To minimize environmental impacts of operations as by strict adherence to the EMP,*
- ✓ *To initiate environmental monitoring as per approved schedule.*
- ✓ *Review and interpretation of monitored results and corrective measures in case monitored results are above the specified limit.*
- ✓ *Maintain documentation of good environmental practices and applicable environmental laws as ready reference.*
- ✓ *Maintain environmental related records.*
- ✓ *Coordination with regulatory agencies, external consultants, monitoring laboratories.*
- ✓ *Maintain log of public complaints and the action taken.*

Organizational Structure of Environmental Management Cell is shown below in Figure 9.1.

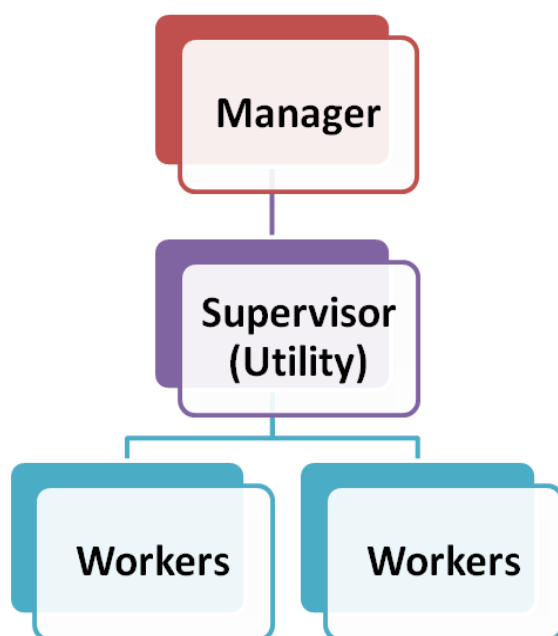


Figure 9.2: Organizational structure of Environmental Management Cell

9.5 EMP FOR CONSTRUCTION PHASE

9.5.1 EMP FOR WATER ENVIRONMENT

During the construction phase, following mitigation measures will be taken as a part EMP:

- ✓ Excavation will be carried during dry season.
- ✓ Proper and sufficient sanitary facilities will be provided to construction workers to maintain all hygienic conditions at site.
- ✓ Care will be taken during construction work and will not create any obstruction/dips which can lead to accumulation of water within premises leading to undesirable consequences like health and hygiene problems etc.

9.5.2 EMP FOR AIR ENVIRONMENT

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

- ✓ Water will be sprinkled on loose top soil to prevent re-suspension of dust into ambient air due to movement of vehicles etc.
- ✓ Separate civil construction material storage yard will be constructed within the site and it will be covered.
- ✓ Possibility of raising green belt will also be explored.

- ✓ Transport vehicles and construction equipments / machineries will be properly maintained to reduce air emissions.
- ✓ Vehicles and equipments will be periodically checked for pollutant emissions against stipulated norms. All vehicles' Pollution under Control (PUC) Certificate shall be checked regularly. Idle running of vehicles will be minimized during material loading / unloading operations.
- ✓ All construction workers will be provided appropriate PPE's like dust mask, ear plug, helmet, safety belt etc. and made to wear them during working hours.

9.5.3 EMP FOR SOLID WASTE MANAGEMENT

Main solid waste generation during construction phase should be rubble, broken, packing, debris, steel scrap, wooden scrap, gravel, etc. However, these materials will be inert in nature and will not result into leaching of any substance or constituent. These wastes will be properly sorted and shall be used within premises for filling of low lying areas. Wooden scrap, steel scrap will be given to scrap dealers. On completion of civil work, all debris etc. shall be completely removed from site to avoid any incompatibility with future use.

9.5.4 EMP FOR NOISE ENVIRONMENT

The following mitigation measures will be implemented during construction period to mitigate adverse impacts:

- ✓ Construction machinery and vehicles shall undergo periodic maintenance to keep them in good working condition.
- ✓ All machineries to be used for construction purpose shall be of highest standard of reputed make and compliance of noise pollution control norms by these equipments will be emphasized by company.
- ✓ Construction workers working in high noise areas will be provided appropriate PPEs like ear muffs and made to wear them during working hours.
- ✓ Raising green belt along with construction activity will be carried out so as to serve as a noise barrier.

9.5.5 EMP FOR SOIL & LAND ENVIRONMENT

The following steps will be taken to take care of impact of construction activity on plant land area:

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

9.5.6 EMP FOR ECOLOGICAL ENVIRONMENT

During the construction and post construction phase, no tree will be cut. Therefore, no impact is anticipated on terrestrial ecology. 33% area has been allocated for green belt development.

9.5.7 EMP FOR SOCIO-ECONOMIC ENVIRONMENT

The following steps will be taken to take care of impact of construction activity on plant land area:

- ✓ Local people from nearby villages of the surroundings of the site shall be employed for construction work to the maximum extent possible.
- ✓ Proper sanitary and drinking water facilities will be provided to workers living in the construction camps within the premises of the Proposed formaldehyde Plant.

Sanitation and Healthcare at Workers Camps

The following measures will be taken to ensure health aspects of workers:

- ✓ The contractor shall install adequate lavatories and baths at the construction site for workers.
- ✓ Community canteen to be made and contractor to provide gas cylinders and gas stoves.
- ✓ Quarterly health check-ups of construction workers should be organized at workers colony.
- ✓ Adequate provision of water supply should be made at workers colony.
- ✓ The living space at workers camp should meet the norms of Indian Labour Law.

9.6 EMP FOR OPERATION PHASE

Operation phase of the proposed formaldehyde plant being longer in duration and because of its potential to create continuous environmental impacts is quite important



from the impact point of view. Comprehensive and effective EMP has been prepared for implementation to safe-guard environmental concerns during operation phase.

9.6.1 EMP FOR AIR ENVIRONMENT

The air pollutants from the plant can be classified broadly in to release of tail gas to the atmosphere. There will not be any DG sets required as entire electricity will be drawn from Assam Power Distribution Company Limited.

During manufacturing of formaldehyde process tail gas will generate of about 5817 kg/hr. Water vapour in the flue gas is 32.09%.

The dry basis composition is as follows:

- CO₂= 4.48 %
- CO = 0.1 %
- O₂= 0.19 %
- H₂= 16.9 %
- Inert= 78.53%

There will not be any type of process emission from the proposed activities and also no emission of SO_x, NO_x and particulate matter. No process emission, as most of the raw materials/products shall be in liquid/semi liquid phase and there will not be any fugitive emissions of PM. All powder/solid materials will be handled in closed system to prevent any fugitive emissions of PM. All solvents shall also be handled by closed system to prevent fugitive emissions of VOCs.

The following measures are proposed to mitigate negative impact on air quality due to operation phase of the proposed plant on the surrounding air environment.

- ✓ Height of process stacks will be as per statutory requirement. All the stacks shall have stack monitoring facility consisting of sampling port-hole, platform and access ladder.
- ✓ Transport vehicles shall be properly maintained to reduce air emissions.
- ✓ Change of raw materials will be carried in such manner fugitive emissions are lesser.
- ✓ Regular maintenance of machinery in order to control emissions.
- ✓ A good housekeeping and proper maintenance shall be practiced in the industry.

Fugitive Emissions

From the proposed formaldehyde plant, fugitive emissions will be generated from handling of formaldehyde and methanol handling. Fugitive emissions may also be generated from leak of hazardous materials during transfer through piping, especially during the transfer of methanol & formaldehyde from tanker to storage tanks. Some fugitive emissions may be generated during charging of raw materials in the reactors.

The following measures will be adopted for control of fugitive emissions:

- ✓ Dust masks provided to working personnel,
- ✓ All production activities are to be carried out in closed conditions to minimize possibility of fugitive emission,
- ✓ Use of closed circuit system for all the process operations,
- ✓ The plant set-up is a MS structure with shed, which can provide sufficient ventilation to reduce work exposure,
- ✓ Regular predictive and preventive maintenance will be carried for piping and pumps to eliminate risk of leak and subsequently fugitive emissions,
- ✓ The fugitive emissions in terms of formaldehyde & methanol will be controlled by proper storage and handling method preferably equipped with leak proof pipes,
- ✓ Supervision shall be done at time of transfer of methanol & formaldehyde from tankers and any kind of spill, leak will be prevented by immediate actions,
- ✓ Work place monitoring at storage area as well as production area will be conducted and necessary actions for keeping risk free workplace environment will be taken on regular basis,
- ✓ Necessary PPEs like face mask with charcoal filter as well as emergency facility shall be provided at storage area of methanol & formaldehyde.

9.6.2 EMP FOR WATER ENVIRONMENT

The mitigation measures for water environment for the operation phase of proposed formaldehyde plant are as given below:

- ✓ It should be ensured that, water consumption should not exceed than committed requirement by installing water meter.
- ✓ Surplus water will be stored in water tank for future use.
- ✓ Wastes generated from the plant will be collected and disposed in environmental sound manner.

- ✓ Regular operation and maintenance of ETP should be done to achieve CPCB norms.
- ✓ Maximum reuse and recycle of water shall be carried out and zero discharge shall be followed to reduce fresh water consumption.
- ✓ The effluent generated at the plant will be collected and treated in well designed ETP.
- ✓ Hazardous waste generated from sludge from ETP will also have potential source of surface and ground water contamination in the event of improper disposal.
- ✓ Treated waste water will be reused for green belt development and other process. Sludge generated from ETP and settler will be disposed to authorized processing units.
- ✓ Sewage generated by plant personnel will treated in STP.

❑ Rain Water Harvesting

Rainwater harvesting can serve as a solution to the water problem in the water crises area by capturing the runoff. Rainwater harvesting helps in utilizing the primary source of water to prevent the runoff from going into sewer or storm drains, thereby serving dual purpose making water available for future use and reducing the load on treatment plants as well as other service lines.

Recharging water into the aquifers help in improving the quality of existing groundwater through dilution. Rainwater harvesting comprises of two components:

- Storing rainwater in groundwater reservoirs for beneficial use in future
- Rain water harvesting for artificial recharge of ground water.

Amount of water that can be effectively harvested is called the harvesting potential of the site. Efficiency of rainwater harvesting and recharging groundwater can be increased by following methods:

- ✓ Use vegetated swales and depressions to reduce runoff.
- ✓ Reduce and filter surface runoff.
- ✓ Catch drainage all along the periphery of plot to prevent surface runoff.

Rain water harvesting structures will be provided to recharge the groundwater resources in the region. The run-off water from the roof structure and paved areas will be collected through storm water drainage system and led to rain water harvesting structure.



❑ Storm Water Management

Rainwater runoff comprises of storm water, which flows into both surface water and groundwater.

Proper management of this resource ensures that storm water discharge is free of contamination. A detailed “Storm Water Management Plan” will be developed. The plan consists of best management practices, which include consideration of the following:

- ✓ Good housekeeping in the above areas.
- ✓ Conducting routine inspections to ensure cleanliness
- ✓ Secondary containment and dykes in fuel/oil storage facilities
- ✓ Preparation of spill response plans, particularly for fuel and oil storage areas.
- ✓ Provision of silt traps in storm water drains.
- ✓ Regular inspection and cleaning of storm drains.

Peak Rainfall = 0.2 mtrs.

Sl. No.	Description	Area (sq.m)	Co-eff	Max. rain (m)	Volume of water (m ³ /day)
1	Rooftop area	2500	0.9	0.2	450
2	Road & Open Space	38120	0.8	0.2	6099
3	Landscape	57440	0.5	0.2	5744
	Total				12293

Maximum quantity of rainwater that can be harvested = 450 m³.

No. of Recharge Pits: 4 (3m x 3m x 3m)

9.6.3 EMP FOR NOISE ENVIRONMENT

During the operational phase, noise generation shall be from machinery, equipment pumps, motors, etc. However, implementation of the EMP for the noise can maintain the noise level within the CPCB standards following precautionary measures should be adopted to control the noise level.

The mitigation measures to control noise levels during operation phase are as given below:

- ✓ Ear muff and plugs to workers working relatively high noise areas.
- ✓ Green belt development is planned for the attenuation of noise pollution and to maintain ambient noise quality within the statutory limit.
- ✓ The operation of high noise generating equipment shall be restricted during the night time.

- ✓ All the equipment in the formaldehyde manufacturing unit will be designed/ operated in such a way that the noise level shall not exceed 85 dB(A) as per the requirement of OSHA (Occupational Safety and Health Administration).
- ✓ Proper maintenance of pump, machinery, blower etc to control noise levels.

9.6.4 EMP FOR SOLID/HAZARDOUS WASTE

The hazardous waste such as ETP sludge, Used Oil will be generated and will be disposed as per the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 generated from the proposed formaldehyde plant, at the time of maintenance of machineries and equipments will be stored in drums and sent to registered recyclers for treatment and reuse.

- Hazardous waste i.e. used lubricating oil will be stored in 200 liter MS barrels & Used oil & lubricants will be sold to registered recyclers/re-processors on monthly basis to avoid the storage impact in factory premises.
- Records of waste generation reuse and disposal to be maintained in log book as per the format of Form-3 as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.
- Transportation of hazardous waste should be governed as per the guidelines and accompanied with Form-13.
- Annual returns of the disposal of wastes in Form-4 and Form-13 should be submitted regularly to the local office.
- Proper handling, loading & unloading of waste to avoid spillage and contamination
- The raw material and solid waste storage area will be constructed with double layered R.C.C with HDPE lining for prevention of leachate. Periodic monitoring of ground water will be done to estimate the heavy metal content and toxic elements.
- The storage area will be top covered from precipitation.
- Above stated Hazardous wastes will be stored separately in a “Hazardous Waste Storage Area” within the factory premises clearly demarcated with all applicable warning sign. It will have non -percolating R.C.C. floor with leachate collection pits and covered roof. The storage area will have proper illumination and ventilation and equipped with fire extinguisher device wherever required. A sign - board will

be put out-side the storage area marked “Hazardous Waste Storage Area” and “Danger”.

- Non - hazardous dried bio-sludge from septic tank will be rich in nutrients and hence will be used as fertilizer and nutrient within premises for gardening.
- Maintenance of records for generation and disposal of the entire solid and hazardous waste to be ensured and the storage duration onsite should not be more than 90 days.

Other hazardous wastes generated from the proposed formaldehyde plant and their disposals are given Table 9.1 & 9.2:

Table 9.1: Hazardous Waste details and disposal methods

Sl. No.	Hazardous waste	Category	Quantity	Method of disposal
1	Used/ spent oil	5.1	1.2 KL/Annum	Used oil will be collected in metal drums kept in secured dyked area and will be disposed to CPCB/ ASPCB registered used oil reprocessor
2	Wastes/ residues containing oil	5.2	1-2 Kg/Annum	Disposed on-site in HDPE lined pits located on site

Table 9.2: Non Hazardous Waste details and disposal methods

Sl. No.	Non Hazardous waste	Quantity	Method of disposal
1	Kitchen Waste	10 – 20 kg per day	Will be stored in compost pits on a daily basis or disposed off nearby municipal disposal site via local vendors
2	Recyclable waste like papers, plastics,	Small	Proper segregation and storage of recyclable waste in designated bins onsite. Recyclables will be periodically sold to local waste recyclers.
3	Packaging wastes	Small	Proper segregation and storage at designated stack yard onsite. Packaging wastes will be periodically sold to local waste recyclers.

9.6.5 EMP FOR ECOLOGICAL ENVIRONMENT

9.6.5.1 PERIPHERAL GREENBELT AND LANDSCAPING

The peripheral green belt will be developed at the proposed formaldehyde plant. Selection of the plant species will be based on their adaptability to the existing geographical conditions and the vegetation composition of the forest type of the region. During the development of the green belt within the proposed formaldehyde plant area, it

has to be emphasized that those native plant species should be planted which are having good ornamental values and are fast growing with excellent canopy cover.

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 trees and vegetation acts as a vast natural sink for the gaseous as well as particulate air pollutants due to enormous surface area of leaves. It also helps to attenuate the ambient noise level. The plantation around the pollution sources control the air pollution by filtering the air particulate and interacting with gaseous pollutant before it reaches to the ground. Tree plantation also acts as buffer and absorber against accidental release of pollutants.

9.6.5.2 GREENBELT DEVELOPMENT

A green belt is provided to mitigate various emissions. Green belts are strip of trees and shrubs planted in rows to reduce air velocity there by facilitating settling of the particles on the leaf surfaces and allowing absorption of the pollutant gases. It also serves to cool the atmosphere by transpiration from the leaf surface and also provide habitat for birds, reptiles and insects. The advantages of a green belt are given below:

- Greenbelts are important habitats for birds, which add to the aesthetic value of the environment. Generally, birds prefer to make their habitat, nest, on trees. Further trees provide shade and hiding places to wild life.
- Greenbelt helps to restore the ecological balance.
- Greenbelt helps in prevention of soil erosion.
- Greenbelt helps to improve the aesthetics in the area.
- The greenbelt also diminishes noise pollution by absorbing high degree of noise due to their spongy foliar crown.

Trees are the most important sinks for air pollution. Trees also absorb noise, act as barrier. It will improve the ecology and aesthetics of the area. They have major long-term impacts on soil quality and the ground water table. The green belt will be developed around dust generating areas like raw material storage area, conveyors of raw material handling. Approximately 1000-1500 plants will be planted during the construction phase. A greenbelt development plan will be prepared and implemented along with the project.

- The main objective of the greenbelt is to provide a barrier between the plant and the surrounding areas. The greenbelt helps to capture the fugitive emissions and to attenuate the noise generated in the plant apart from improving the aesthetics of the plant site.
- The Greenbelt will be adequately sized, 33% of plant area i.e. 14.2 acres and will have a suitable density so as to mitigate the effects of emissions from the plant. The treated effluents from the plants will be utilized for the greenbelt development.
- Total number of tree to be planted around 1500 nos. The greenbelt area will be developed within plant boundary and at the periphery of the company premises. Thus, the proposed formaldehyde project will have significant positive impact on the ambient air & will reduce pollution load from environment.
- The landscaping of the formaldehyde plant will be carried out. Roads for vehicular movement will be paved and adequate mitigation measures will be provided to prevent fugitive emissions.

It is to be noted that only indigenous species will be planted. The species will be selected in consultation with local District Forest Officer (DFO). Mixed plantations will be done keeping optimum spacing between the saplings. Kitchen waste from the plant canteen can be used as manure either after composting or by directly burying the manure at the base of the plant. The selection of plant species for the development depends on various factors such as climate, elevation and soil. The plants should exhibit the following desirable characteristic in order to be selected for plantation.

- The species should be fast growing and providing optimum penetrability.
- The species should be wind-firm and deep-rooted.
- The species should form a dense canopy.
- As far as possible, the species should be indigenous and locally available
- Species tolerance to air pollutants like PM₁₀ & PM_{2.5}, SO₂ and NO_x should be preferred.
- The species should be permeable to help create air turbulence and mixing within the belt.
- There should be no large gaps for the air to spill through.



- Trees with high foliage density, leaves with larger leaf area and hairy on both the surfaces.
- Ability to withstand conditions like inundation and drought.
- Soil improving plants (nitrogen fixing, rapidly decomposable leaf litter).
- Attractive appearance with good flowering and fruit bearing.
- Bird and insect attracting tree species.
- Sustainable green cover with minimal maintenance

The green belt development plan is shown in Figure 9.1. Suggested trees species are given in Table 9.3.

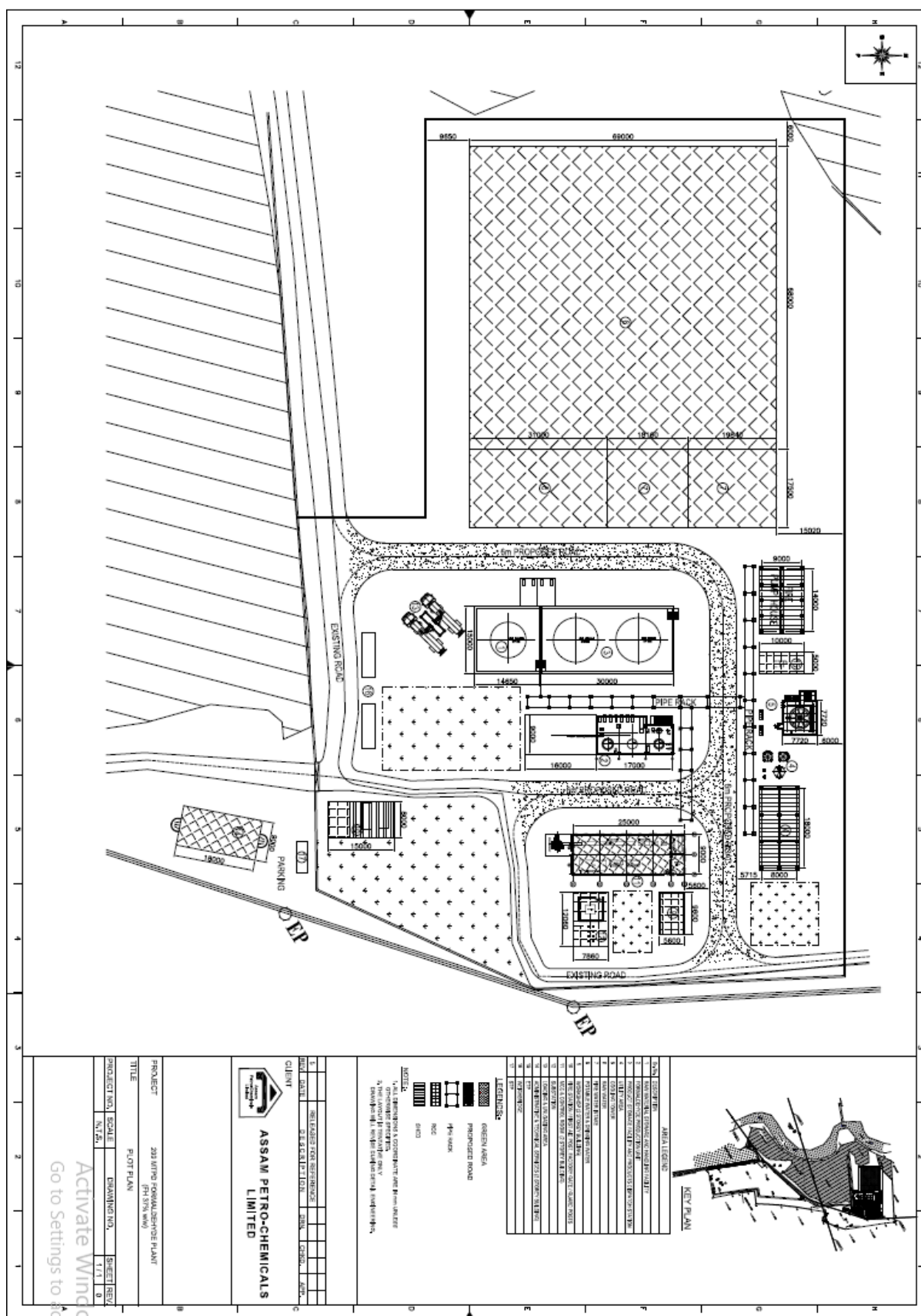


Figure 9.3: Green Belt Development Plan

Table 9.3: Suggested Trees for Peripheral Green Belt Development

Sl.No.	Scientific Name	Standard Name	Time when flowering fruiting occurs
1	<i>Azadirachta indica</i>	Neem	June-July
2	<i>Mangifera indica</i>	Aam	April-July
3	<i>Cassia fistula</i>	Amaltas	March-June
4	<i>Syzygium cumini</i>	Jamun	June-July
5	<i>Albizia lebbek</i>	Sirish	January-March
6	<i>Albizia procera</i>	Safed Sirish	January-March
7	<i>Leucaena leucocephala</i>	Subabul	February-May
8	<i>Bauhinia variegata</i>	Kanchan	May-June
9	<i>Erythrina indica</i>	Dadap	July-August
10	<i>Grevillea robusta</i>	Silver oak	February-April
11	<i>Butea monosperma</i>	Palash	February-April
12	<i>Ailanthus excels</i>	Maharuk	January-March
13	<i>Nyctanthes arbortristis</i>	Harsingar	Throughout the year
14	<i>Emblica officinalis</i>	Amla	January

9.6.6 EMP FOR SOCIO-ECONOMIC ENVIRONMENT

The social management plan has been designed to take proactive steps and adopt best practices, which are sensitive to the socio-cultural setting of the region. The proposed formaldehyde plant envisages addressing the wider goal of environmental protection through a social investment strategy for the communities. By investing in social projects in the neighboring community, seeks to increase the benefits to the local population and contribute towards meeting community's expectation of benefits from the project. In order to mitigate the impacts likely to arise out of the proposed project and also to maintain good will of local people, it is necessary to take steps for improving the social environment. Necessary social welfare measures by the industry will be useful in gaining public confidence depending on local requirement.

The adequate measures are suggested for smooth functioning of the activities is given below:

- It is estimated that about 40 construction workers on average will be involved and about 40 workforce including labours and office, security and managerial staff will be required in operation phase. The manpower required for these activities should

preferably be employed from nearby villages so that avenues of employment will be open to local people,

- Proposed formaldehyde plant will undertake social welfare programmes for the betterment of the Quality of Life of villages around in collaboration with the local bodies,
- Job oriented skill training, courses will be organized through industrial/technical training institutions for educational youth (both for male and female), like home need appliances, tailoring, plumbing, light & heavy vehicles driving,
- Enterprise social commitment of 2% of cost of the plant will be implemented in nearby area.

9.6.7 HEALTH, SAFETY & ENVIRONMENT MANAGEMENT

APL will adopt a practice of preventive and predictive maintenance. All the equipment in the formaldehyde plant areas will be inspected/ tested by an outside agency. The various safety equipment and critical instrumentation provided on various equipments will be inspected and tested frequently to ensure their operability all the time. Beside, all the first aid fire fighting devices will also be inspected, tested and maintained by a competent third party and kept all the time in ready to use condition. Occupational health of all the employees in proposed formaldehyde plant area will be regularly monitored by external physician. If any abnormality is found, necessary treatment will be given immediately. Necessary history cards, records shall also be maintained which will be up – dated regularly.

To ensure prevention of occupational hazards is delineated below:

- All pump motors shall be earthed.
- Housekeeping of the plant shall be as per prescribed norms.
- Floors, platforms, staircases, passages shall be kept free of any obstruction.
- All safety measures shall be explained to the workers. They shall be periodically trained and kept updated on the safety measures.
- Dedicated supply of fire fighting water will be available in the plant.
- Only authorized persons shall be allowed inside the plant.

- All instrument and safety devices shall be checked and calibrated during installation. They shall also be calibrated, checked at a frequent interval. Calibration records shall be maintained.
- All electrical equipments shall be installed as per prescribed standards.
- All the equipments of the plant shall be periodically tested as per standard and results shall be documented. All equipments shall undergo preventive maintenance schedule.
- Proper Earthing shall be provided to each tank.
- DG Sets would be available for emergency power supply backup.
- In addition to fire hydrant system, nos. of fire extinguishers shall be installed at different locations within premises.
- Adequate ventilation arrangement will be provided for safe and better working in the plant as per the standard.
- Protection against lightning shall be taken care in the plant.
- Precaution against ignition will be taken. Emergency response plans are developed. A similar emergency response plan shall also be developed for the particular unit.

❑ Safety Precautions

To prevent any spillage, accident and impacts of human health for safety measure will be taken while handling the raw material and products:

- Separate storage area for the raw material & product.
- Solid raw material stored in separate storage area with proper identification labeling.
- Liquid raw material is stored in suitable tanks at separate demarcated space.
- Separate area for packing of the product.
- Storage area with separate bunds for separate chemicals to contain any kind of leakage and to avoid mixing of the chemicals in case of leakages.
- Liquid raw material charging will be done with utmost care and by mechanical seal type of pump to avoid any leakages.
- Personal protective equipment (viz. dust mask, gloves, goggles & gum boots) are being provided to the workers and plant operators.

- Occupational health centre with male nurse is provided within the company premises.
- First Aid kit has been provided at various locations within the plant.
- Fire hydrant has been installed within the premises.
- Fire extinguisher has been provided at the vulnerable points within the premises.
- Medical Check-up for workers and employee at pre-employment and periodical stages.

❑ Employment Opportunities

The proposed formaldehyde project will provide job opportunities to those people from adjoining areas during construction and operation phase that fulfills the desired requirements on preferential basis.

9.6.8 ENERGY CONSERVATION

At the proposed formaldehyde plant, the following energy conservation measures will be taken:

❑ Electrical Utilities

Electricity Distribution System

- ✓ Schedule operations to maintain a high load factor,
- ✓ Shift loads to off-peak times,
- ✓ Minimize maximum demand by tripping loads through a demand controller,
- ✓ Stagger start-up times for equipment with large starting currents to minimize load peaking,
- ✓ Use standby electric generation equipment for on-peak high load periods,
- ✓ Correct power factor to at least 0.90 under rated load conditions,
- ✓ Set transformer taps to optimum settings,
- ✓ Check utility electric meter with your own meter,
- ✓ Shut off unnecessary computers, lights, fans, printers, and copiers at night,

❑ Motors

- ✓ Properly size to the load for optimum efficiency. (High efficiency motors offer of 4 - 5% higher efficiency than standard motors),
- ✓ Use energy-efficient motors where economical,
- ✓ Use synchronous motors to improve power factor,

- ✓ Check alignment of motors,
- ✓ Provide proper ventilation (For every 10 oC increase in motor operating temperature over recommended peak, the motor life is estimated to be halved),
- ✓ Check for under-voltage and over-voltage conditions,
- ✓ Balance the three-phase power supply. (An imbalanced voltage can reduce 3 - 5% in motor input power),
- ✓ Demand efficiency restoration after motor rewinding. (If rewinding is not done properly, the efficiency can be reduced by 5 - 8%),

❑ Drives

- ✓ Use variable-speed drives for large variable loads,
- ✓ Use precision alignment,
- ✓ Check belt tension regularly,
- ✓ Eliminate variable-pitch pulleys,
- ✓ Use flat belts as alternatives to v-belts,
- ✓ Use synthetic lubricants for large gearboxes,
- ✓ Eliminate eddy current couplings,
- ✓ Shut them off when not needed,

❑ Fans

- ✓ Use smooth, well-rounded air inlet cones for fan air intakes,
- ✓ Avoid poor flow distribution at the fan inlet,
- ✓ Minimize fan inlet and outlet obstructions,
- ✓ Clean screens, filters, and fan blades regularly,
- ✓ Use aerofoil-shaped fan blades,
- ✓ Minimize fan speed,
- ✓ Use low-slip or flat belts,
- ✓ Check belt tension regularly,
- ✓ Eliminate variable pitch pulleys,
- ✓ Use variable speed drives for large variable fan loads,
- ✓ Use energy-efficient motors for continuous or near-continuous operation,
- ✓ Turn fans off when not needed.

❑ Blowers

- ✓ Use smooth, well-rounded air inlet ducts or cones for air intakes,

- ✓ Minimize blower inlet and outlet obstructions,
- ✓ Clean screens and filters regularly,
- ✓ Minimize blower speed,
- ✓ Use low-slip or no-slip belts,
- ✓ Check belt tension regularly,
- ✓ Eliminate variable pitch pulleys,
- ✓ Use variable speed drives for large variable blower loads,
- ✓ Use energy-efficient motors for continuous or near-continuous operation,
- ✓ Turn blowers off when they are not needed,

❑ Pumps

- ✓ Operate pumping near best efficiency point,
- ✓ Modify pumping to minimize throttling,
- ✓ Adapt to wide load variation with variable speed drives or sequenced control of smaller units,
- ✓ Repair seals and packing,
- ✓ Balance the system to minimize flows and reduce pump power requirements.

❑ Cooling Towers

- ✓ Control cooling tower fans based on leaving water temperatures,
- ✓ Control to the optimum water temperature as determined from cooling tower and chiller performance data,
- ✓ Use two-speed or variable-speed drives for cooling tower fan control,
- ✓ Turn off unnecessary cooling tower fans when loads are reduced,
- ✓ Balance flow to cooling tower hot water basin,
- ✓ Periodically clean plugged cooling tower water distribution nozzles,
- ✓ Install new nozzles to obtain a more-uniform water pattern,
- ✓ Optimize cooling tower fan blade angle on a seasonal and/or load basis,
- ✓ Correct excessive and/or uneven fan blade tip clearance and poor fan balance,
- ✓ Divert clean air-conditioned building exhaust to the cooling tower during hot weather,
- ✓ Re-line leaking cooling tower cold water basins,
- ✓ Check water overflow pipes for proper operating level.
- ✓ Optimize chemical use,

- ✓ Consider side stream water treatment,
- ✓ Restrict flows through large loads to design values,
- ✓ Shut off loads that are not in service,
- ✓ Take blow down water from the return water header,
- ✓ Optimize blow down flow rate,
- ✓ Automate blow down to minimize it,
- ✓ Install interlocks to prevent fan operation when there is no water flow,
- ✓ Establish a cooling tower efficiency-maintenance program. Start with an energy audit and follow-up, then make a cooling tower efficiency-maintenance program.

❑ Lighting

- ✓ Reduce excessive illumination levels to standard levels using switching, delamping, etc,
- ✓ Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors,
- ✓ Install efficient alternatives to incandescent lighting, mercury vapor lighting, etc,
- ✓ Select lamps carefully with high power factor and long-term efficiency in mind,
- ✓ Upgrade obsolete fluorescent systems to Compact fluorescents,
- ✓ Consider day lighting, skylights, etc,
- ✓ Consider painting the walls a lighter color and using less lighting fixtures or lower wattages,
- ✓ Use task lighting and reduce background illumination,
- ✓ Re-evaluate exterior lighting strategy, type, and control. Control it aggressively,
- ✓ Change exit signs from incandescent to LED.

❑ Miscellaneous

- ✓ Meter any unmetered utilities. Track down causes of deviations,
- ✓ Shut down spare, idling, or unneeded equipment,
- ✓ Make sure that all of the utilities to redundant areas are turned off - including utilities like compressed air and cooling water.

9.6.9 ROAD SAFETY AND TRAFFIC MANAGEMENT PLAN

The Road Safety & Traffic Management Plan is applicable to all operation pertaining to APL and contractor vehicular movement viz. vehicle involved in the transportation of raw



materials, project and contractor personnel, Construction equipments and other heavy equipment transportation to project site.

- Project vehicular movement involved in transportation of construction material, machineries and equipment for proposed formaldehyde plant will be restricted to defined access routes to be identified in consultation with locals and concerned authorities
- The condition of roads and bridges identified for movement of vehicles will be assessed by APL/Contractors to ensure their safe movement
- Precautions will be taken by the contractor to avoid damage to the public access routes including highways during vehicular movement
- Provide safe and convenient passage for vehicles, pedestrians and livestock to and from side roads and property accesses along defined project routes
- Traffic flows will be scheduled wherever practicable during period of increased commuter movement
- Movement of vehicles during night time will be restricted. Speed limits will be maintained by vehicles involved in transportation of construction material and segregated waste.
- Proper signage will be displayed at important traffic junctions along the predefined access routes to be used by construction and operational phase traffic. The signage will serve to prevent any diversion from designated routes and ensure proper speed limits are maintained near village residential areas
- Clear signs, flagmen & signal will be set up at major traffic junctions and near sensitive receptors viz. schools, hospital, etc in discussion with Gram Panchayat and local villagers
- Adequate training on traffic and road safety operations will be imparted to the drivers of project vehicles. Road safety awareness programs will be organized in coordination with concerned authorities to sensitize target groups viz. school children, commuters on traffic safety rules and signage.
- Regular supervision will be carried out control vehicular traffic movement along defined traffic routes particularly near identified sensitive receptors.

9.6.10 NATURAL RESOURCE CONSERVATION

At the proposed formaldehyde plant, natural resource conservation will be adopted in the following ways:

- ✓ Wastes like paper, plastic, packing and used oil, etc, generated from the proposed plant, will be reused and recycled. Hazardous wastes, which cannot be used for any purpose will be sent to TSDF site,
- ✓ Energy conservation measures will be adopted to save the energy and avoid wastage of energy under the policy of "energy saved is energy produced,"
- ✓ Rain water harvesting system will be adopted to use rain water.

9.6.11 “BEST MANUFACTURING PRACTICE” AND “SAFE PRACTICE” FOR HANDLING STORAGE, TRANSPORTATION AND UNLOADING OF THE HAZARDOUS CHEMICALS

The “Best Manufacturing Practice” and “Safe Practice” for handling storage, transportation and unloading of the Hazardous Chemicals, to be adopted at the proposed formaldehyde plant are as given below:

9.6.11.1 BEST MANUFACTURING PRACTICES

The best manufacturing practice guidelines provide guidance for manufacturing, testing, and quality assurance in order to ensure that desired quality of product has been produced maintaining occupational health and safety. The best manufacturing practices for proposed formaldehyde plant are as given below:

- ✓ Proposed formaldehyde plant will maintain a clean and safety manufacturing area.
- ✓ Safe working conditions in order to prevent minimize risk and safety.
- ✓ Manufacturing process of formaldehyde will be clearly defined and controlled. All processes will be validated to ensure consistency and compliance with specifications.
- ✓ Manufacturing process of formaldehyde will be controlled, and any changes to the process will be evaluated.
- ✓ Instructions and procedures will be written in clear and unambiguous language.
- ✓ Operators will be trained to carry out and document procedures.
- ✓ Records will be made, manually or by instruments, during manufacture that the demonstrated steps required by the defined procedures and instructions are in

fact taken and that the quantity and quality of the product was as expected. Deviations will be investigated and documented.

- ✓ Records of manufacture that enable the complete history of a batch to be traced are retained in a comprehensible and accessible form.

9.6.11.2 SAFE PRACTICES

At the proposed formaldehyde plant, safety practices will be followed to minimize risk and same have been discussed in Chapter 7 in details and summarized below:

- ✓ A written process safety information document will be compiled for general use. The document compilation will include an assessment of the hazards presented toxicity/flammable information, Permissible exposure limits, physical hazard data, thermal and chemical stability data, reactivity data, corrosivity data and information on process and mechanical design.
- ✓ The process design information in the process safety information compilation will include P&IDs/PFDs; process chemistry; maximum intended inventory; upper and lower limits, pressures, flows and compositions and process design and energy balances.
- ✓ Personnel engaged in handling of hazardous chemicals will be trained to respond in an unlikely event of emergencies.
- ✓ Safety measures in the form of Dos' & Dont's will be displayed at strategic locations especially in Assamese and English language.
- ✓ The management will check and ensure that all instruments provided in the plant are in good condition and documented.
- ✓ Safe work practices will be developed to provide for the control of hazards during operation and maintenance.
- ✓ Personnel especially contractor workers at the proposed formaldehyde plant will be made aware about the hazardous substance stored at the plant and risk associated with them.
- ✓ Predictive and preventive maintenance schedule will be prepared for equipment, piping, pumps, etc. and thickness survey will be done periodically as per standard practices.
- ✓ Safety Communication/Motivation/Promotion will be implemented.



- ✓ Safety education and training will be imparted to the workers available at the plant area.
- ✓ Necessary first aid facilities will be provided at the plant at strategic locations.
- ✓ Occupational Health Centre will be established at the proposed formaldehyde plant. Antidotes for all hazardous chemicals will be available at occupational health center at the plant.
- ✓ Workers engaged in handling of hazardous chemicals will be made aware of properties of hazardous chemicals.
- ✓ In the plant, precaution and instructions will be displayed at strategic locations in Assamese and English Languages.
- ✓ Adequate ventilation will be provided in the work floor environment.
- ✓ The work environment will be assessed and monitored regularly as local ventilation is most effective method for controlling dust and gaseous emissions at work floor.
- ✓ Safe operating procedures will be available for mostly all hazardous materials, operations and equipment.
- ✓ The workers will be informed of consequences of failure to observe the safe operating procedures.
- ✓ Work permit system will be followed at the plant.
- ✓ Records for near-miss, incidents and accidents will be maintained and analyzed to take precautionary measures.
- ✓ At the proposed formaldehyde plant, safety audit will be carried out by the Audit team comprising of safety professional, technical services, maintenance and process personnel.
- ✓ Necessary fire protection facilities will be provided at the proposed formaldehyde plant
- ✓ Adequate numbers of fire extinguishers will be provided in production area.
- ✓ Easy availability of fire extinguishers and trained personnel will be insured to operate extinguishers.
- ✓ All equipment and storage tanks/containers of flammable chemicals will be bounded and earthed properly.



- ✓ The workers will be made aware about the hazards associated with manual material handling.
- ✓ Communication system including public address system will be provided.
- ✓ The system will be initiated for checklist based routine safety inspection and internal audit of the plant. Safety inspection team will be formed from various disciplines and departments.
- ✓ Predictive and preventive maintenance schedule will be followed in religious manner.
- ✓ Colour coding for piping and utility lines will be followed in accordance with IS: 2379:1990.
- ✓ Before entering the tankers and trucks engaged in the transportation of hazardous materials to the plant, Registration certificate for transportation of hazardous materials, driving license to drive vehicles carrying hazardous materials, fitness certificate, valid National permit, TREM Card, Insurance papers, will be checked before allowing to enter the plant premises:
- ✓ Electrical Hazardous and safety will be properly managed at the proposed plant.
- ✓ Electrical earth pits will be cleaned, covered and maintained in good condition.

9.7 CORPORATE ENVIRONMENT POLICY

APL is committed to continual improvement of its Environmental Management System (EMS) by adoption of appropriate pollution prevention measures and complying with all relevant environmental legislation/regulations through training, teamwork and procedures as implemented from time to time. The salient features of Corporate Environment Policy are as given:

- ✓ After commissioning of the proposed plant, APL will have a well laid down Environment Policy approved by its Board of Directors.
- ✓ The Environment policy will prescribe for standard operating process/procedures to bring into focus any infringement /deviation/ violation of the environmental or forest norms / conditions.
- ✓ The Environment Policy will prescribe for standard operating process /procedures to bring into focus any infringement/ deviation/ violation of the environmental or forest norms /conditions.



- ✓ The company will have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and stakeholders at large.

9.8 CORPORATE ENVIRONMENTAL RESPONSIBILITY (CER)

Corporate Environmental Responsibility (CER) is the commitment of businesses to contribute to sustainable economic development by working with the employees, their families, local community and society at large to improve their lives in ways that are good for business as well as overall development. It is a voluntary activity of a company that supports social interests and environmental issues. It is a principle through which the business houses contribute to the welfare of the society and not only maximize their profits. CER, in fact, is about business giving back to the society.

CER can be viewed simply as a collection of good citizen activities which shall not be taken as compulsion from Govt. rather it should be done generously to improve the structure of society. There are several issues due in the society for necessary work on it but there are limitations too, for both industries and Govt. However, whatever is possible for anybody to contribute toward social responsibility he must do.

The APL management will allocate 2% amount of the total project cost.

The rationale for CER has been articulated in a number of ways. In essence it is about building sustainable businesses, which need healthy economies, markets and communities. Annual CER plan for 5 years in the beginning is given below:

Annual ESC Plan for Next 5 Years: The total cost of the project is Rs 102 Lacs. Corporate Environmental Responsibility considering 2% of project cost has been allocated as Rs 102 Lacs for 5 years.

9.9 BUDGETARY PROVISIONS FOR EMP IMPLEMENTATION

Adequate budgetary provisions have been made by APL management for implementation environmental management plan. The APL will invest Rs. 65 Lakhs as capital investment towards implementation of Environmental Management Plan. The details of total capital and recurring (per annum) for EMP is illustrated in following Table 9.4.

Table 9.4: Budgetary Provisions For EMP

Sl. No.	Heads	Estimated Capital Cost in INR (Lakhs)	Recurring Cost Per Annum
			(Lakhs)
1	Environmental Monitoring & Management	5	3
2	Water Pollution Control (ETP, STP, RWH etc)	40	3
3	Noise Pollution Control	1	0.25
4	Waste Management	5	0.5
5	Green Belt Development	8	1.2
6	Occupational Health & Safety	6	1.5
Total		65	9.45

9.10 CONCLUSIONS

The pollution control measures will be an important integral component of the proposed plant. The formaldehyde manufacturing plant is not quit prone to air pollution due to fugitive emissions are confined within the plant premises. The APL management will spend about 3% of its capital cost towards environmental management & peripheral development plan. Diligent water management practices, water conservation measures like recycling, reuse of wastewater will help to achieve the discharge norms and water harvesting practices will considerably reduce the ground water use.

After the completion of the project with implementation of EMP, it is expected that there will be considerable reduction of the pollution level after implementation of the EMP. It will also take up plantation in subsequent years in available vacant land which will not only protect the ecosystem of the region but also further improve the ecology of the area. APL as a responsible company will take up some good work in peripheral development including green belt development, health facilities, etc. The APL will also earmark about 2% of the total cost of the project towards the Corporate Environmental Responsibility (CER) and socio-economic development activities.



CHAPTER 10

SUMMARY & CONCLUSIONS

CHAPTER 10: SUMMARY & CONCLUSIONS

10.1 BACKGROUND

Assam Petro-chemicals Limited (APL) was conceived for productive utilization of natural gas, which was being flared up in the Upper Assam oil field. Only a small quantum of natural gas was then used in fertilizer industry and power generation. M/S. Assam Petrochemicals Limited (APL) have the distinction of being the first Petrochemical Plant in the country based on Natural Gas feedstock.

APL is currently executing an ambitious Petrochemical Project at their Parbatpur works in Namrup (Assam) to manufacture 500 TPD Methanol. APL further proposes to expand and diversify their manufacturing base by installing a new grass root Petrochemical plant at Dhaknabari-Boitamari, western Assam commencing with a 200 TPD Aq. Formaldehyde (AF – 37) Plant.

M/s. Assam Petro-Chemical Ltd. proposes to set up a unit to manufacture Formaldehyde of 66000 MT/ Annum (200 TPD) capacity at Dag no. 72, 73 & 77 (Pt), Village: Dhaknabari, Boitamari; District: Bongaigaon at Assam. Necessary infrastructure facilities in terms of roads, culverts and electrical power transmission lines etc. are available nearby. The project site of APL is connected to through Roads (Salbari- Jogighopa road which connects to NH 31). Nearest Town is Bongaigaon which is 17 Km towards Northern direction from the site and Tunia River is flowing about 50 m on Western side from site.

The present proposal is classified under Schedule 5 (f) & Category 'B' according to EIA Notification 2006 & subsequent amendments and appraised by State Level Expert Appraisal Committee (SEAC), Assam. SEIAA, Assam issued Terms of Reference (TOR) for the proposed project vide Letter No. SEIAA.883/2018/11 Dated 25th February 2019.

10.2 LOCATION OF THE PROJECT

The coordinates of the site is 26°19'43.28"N latitude and 90°30'25.81"E longitude. The total area occupied by APL is approximately 36.4 Acres (147283 sq.m).

Environmental Settings of the Project Site

Sl. No.	Particulars	Details
1	Latitude	26°19'46.79"N
2	Longitude	90°30'24.78"E
3	Site Elevation above MSL	45 m
4	Topography	Undulating terrain
5	Present land use of the site	Industrial



Sl. No.	Particulars	Details
6	Nearest highway	The project site is located near Salbari- Jogighopa road which connects to NH- 31
7	Nearest railway station	New Bongaigaon Railway Station- 17 Km (NNE)
8	Nearest airport	Nearest airport is Guwahati about 111 km towards Eastern direction from proposed site
9	Nearest town/city	Town: Bongaigaon (17 Km) - NNE
10	Water body	Tunia River is flowing about 50 m on Western side from site
11	Nearest Port	Nil in 15 Km radius
12	Hills / valleys	Sankarghola Reserve forest
13	Archaeologically important places	Nil in 15 Km radius
14	National parks / Wildlife Sanctuaries/ Eco-sensitive zones as per Wild Life Protection Act, 1972	Nil in 15 Km radius
15	Reserved / Protected Forests	Sankarghola Reserve forest
16	Seismicity	The proposed plant-site area falls in Seismic Zone V as per IS 1893:2002 (Part-1), which is a highly sensitive seismic zone. In case of very severe natural disaster there may be spillage of chemicals from damaged tanks and equipment. However, adequate measures will be taken for safety of men & materials and protection of environment during & after the occurrence of the disaster.
17	Defense Installations	Nil in 15km radius

10.3 MAGNITUDE OF OPERATION

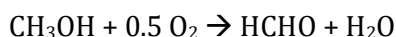
The details about proposed capacity of the products are given in below Table 2.

Product Details

Sl. No.	Product	Quantity (Tons Per annum)
1	Formaldehyde (37%)	66000

10.4 PROCESS DESCRIPTION

Formaldehyde in itself finds a wide spectrum of end-use applications in numerous industrial and non industrial sectors. Formaldehyde is a raw material for a number of downstream value added derivatives and sub-derivatives. Formaldehyde results from the exothermic oxidation and endothermic dehydrogenation of Methanol.





Crude aqueous Methanol obtained by high, medium, or low pressure, synthesis can also be used for “Excess Methanol (silver catalyst) process”. This Methanol contains low concentrations of inorganic impurities and limited amounts of other organic compounds. The Methanol must be first subjected to purification processes and preliminary distillation to move low-boiling component. The Silver Catalyst processes for converting Methanol to Formaldehyde are generally carried out at atmospheric pressure and at 600- 720°C.

10.5 RAW MATERIAL REQUIREMENTS

Methanol will be the only raw material required for production of Formaldehyde. In addition to this, there will be transshipment facility of Methanol for which 1650 KL X 2 no.s Methanol tanks will be constructed.

Sl. No.	Raw Materials	Form	Quantity (kg/ day)	Mode of transport (rail/ road/ shipment)	Source	Type of Packing/Storage/ mode of storage	Capacity of storage (Ton/ month)
1	Methanol	Liquid	Approx. 90000	Road Transport	APL Namrup	Nitrogen blanketed Atmospheric storage tank	1 No. X 500 MT

10.6 POWER REQUIREMENT

The power requirement of Formaldehyde plant will be about 1400 KW (Source – Assam Power Distribution Company Limited). An Electrical Transmission lines are located at a distance of about 500 M away from proposed project site. Electrical Power will be available from nearby APDCL.

10.7 MANPOWER REQUIREMENT

For Formaldehyde manufacturing unit about 45 personnel will be required. The employees will adopt the existing transport system available in the area.

10.8 WATER REQUIREMENT

The requirement of water for operation of the Plant is tentatively 384 KLD. This will be fulfilled by drawing water from nearby Tunia river which is at a distance of approximately 50 meter from the Project.

10.9 SALIENT FEATURES OF THE BASELINE STUDY

Primary baseline environmental monitoring studies were conducted during **1st December 2018 to 28th February 2019** and details are as follows:



Meteorology - The maximum temperature recorded and 26.7°C and minimum temperature recorded as 8.9°C. Relative Humidity was between 36% to 99% and average wind speed was 4.97 KMPH. Predominant wind direction is from NE, N.

Air Environment- To study the baseline air quality scenario in the study area, 8 ambient air quality monitoring (AAQM) stations were selected in the study area in different directions and at different distances from the project site keeping in view of the guidelines of the Ministry of Environment, Forest and Climate Change (MOEF&CC). The maximum and minimum concentrations of PM₁₀ were recorded as 62.3 µg/m³ and 35.2 µg/m³ respectively. The maximum and minimum concentrations for PM_{2.5} were recorded as 38 µg/m³ and 18.3 µg/m³ respectively. The maximum and minimum SO₂ concentrations were recorded as 7.8 µg/m³ and BDL (<5 µg/m³). The maximum and minimum NO_x concentrations were recorded as 15.7 µg/m³ and 8.3 µg/m³. The HC and VOCs at all the location were observed below detection limit. The concentrations of PM₁₀, PM_{2.5}, SO₂, NO_x, CO and other parameters are observed to be well within the standards prescribed by the Central Pollution Control Board (CPCB) for Industrial, Rural, Residential and Other area.

Noise Environment - Noise levels (8 Locations) monitored during day time were found to be in the range 40.5 to 51.2 dB(A). The maximum noise level was observed at Project site (N1) and a minimum was observed at Kharagpur (N7). Noise levels observed to fall in the range 31.2 to 42.9 dB (A) during the night time.

Water Environment - The analysis of ground water (8 Locations) results indicate that the average pH ranges in between 6.77 to 8.01, TDS ranges from 158 to 332 mg/l, Total Hardness ranges from 99 mg/l to 158 mg/l, iron content ranges from 0.1 mg/l to 1.2 mg/l, nitrate content ranges from 1.1 mg/l to 2.8 mg/l was observed. Alluminium, Selenium, Phenolic Compounds, Copper, Cadmium, Mercury, Nickel, Total Arsenic, Total Chromium, and Cyanide in all ground water samples were found below detection limit (BDL). The analysis of Surface water (6 Locations) results indicates that the average pH ranges in between 6.8 to 8.21, TDS ranges from 182 to 251 mg/l, Total Hardness ranges from 28 mg/l to 248 mg/l, DO ranges from 3.8 mg/l to 5.8 mg/l was observed. The BOD level of the SW samples found to be in the range between 2 mg/l to 8.3 mg/l. Total Coliform Count in surface water samples ranges from 6 to 1435 MPN/ 100ml.



Soil Environment: Total 6 no.s of soil samples collected from study area. It has been observed that the pH of the soil was ranging from 7.42 to 8.22 indicating the soils are basic in nature. The conductivity of the soil ranges from 0.156 to 0.513 mS/cm. Since the EC value is less than 2000 μ S/cm, the soil is said to be Non-saline in nature. The texture of the soil sample is predominantly Sandy Loam in most of the places with Silty Clay Loam in some locations. Soil organic content varied from 1.28 to 1.52 %, which indicates the low level of organic matter.

Ecological Environment: There are no endemic and endangered species of flora and fauna within the study region. Most of the study area is covered with agriculture lands and the dominant agriculture crops in these region are rice (Sali, boro and ahu), black gram, arahar, lentil, pea, Jute, Mesta, Rapeseed and Mustard, Sesamum, Buckwheat, linseed etc. The study area is mainly dominated by *Acacia nilotica*, *Cocos nucifera*, *Azadirachta indica*, *Cassia fistula*, *Psidium guajava* etc. No wild animal observed during survey but some Common Indian Mongoose, Small Indian Civet, Rhesus Monkey, Indian rabbit, Common Indian Rat, Common five Stripped Squirrel, Large Indian squirrel, Common mouse, House Shrew reported in nearby villages.

Reserve Forest found around 10 km radius about 1 Km from the project site towards eastern side. However, no reserve forest area falls within the study area. The Reserve Forests found within study area are- Bharirab RF (E), Khagarpur RF (E), Bahalpur RF (SW), Rakhal Thakur RF (W). No National parks and wild life sanctuaries located in the study area.

Socio-economic status: According to the 2011 census, the entire study area has a population of 218484 and 43081 Households. Male population is about 72163 & female population is 69401 with sex ratio of 961 females for every 1000 males and a literacy of 68.3%; Scheduled Castes and Scheduled Tribes accounted for 4597 and 310 of the total population respectively. There were a total of 41809 main workers, 13453 marginal workers, 86302 non-workers. About 29.5% employment rate found within the entire study area.

10.10 ENVIRONMENT MANAGEMENT PLAN

Air Environment Management

There will be two sources of air emission- Process tail gas and DG sets (occasionally). There will be no emission of SO_x, NO_x and particulate matter.



Adequate green belt has been developed to mitigate the pollution arising due to the movement of vehicles. Regular monitoring of DG – Stack and Ambient air quality monitoring carried out.

Water Environment Management

Normally there is no generation of wastewater from process, however intermittent generation of wastewater will be treated in Effluent Treatment Plant (ETP). About 100% of effluent generated shall be reused with the raw material input. The water balance of the plant is framed based on zero liquid discharge philosophy. DM water plant of ~ 120 KLD capacities will be installed. DM water will be used in the process for the dilution/ absorption for making 37% Formaldehyde (AF-37) and BFW make up. DM water plant regeneration waste will be treated in the ETP.

Cooling Tower make up water requirement will be around ~264 KLD. Cooling tower blow down, regeneration/ backwash waste from the Raw water plant will also be treated in ETP. The capacity of ETP will be ~70 KLD.

Noise Environment Management

All noise generating equipment's like LPG compressor, DG-Sets etc., will be provided with an acoustic enclosure to help in attenuating the noise levels, thereby the ambient noise levels are maintained below the CPCB limits of 75 dB (A) for industrial areas.

Solid & Hazardous Waste Management

There will be no generation of solid & hazardous waste in normal operation. Spent catalyst will be sent to the specialized vendor for treatment/ regeneration/ recycle.

Green belt development

At the proposed Formaldehyde Plant, green belt will be developed on 33% of total plot area. This will have positive impact on ecology of the area.

10.11 ENVIRONMENTAL MANAGEMENT COSTS

EMP Budget

Sl. No.	Heads	Estimated Capital Cost in INR (Lakhs)	Recurring Cost Per Annum
			(Lakhs)
1	Environmental Monitoring & Management	5	3
2	Water Pollution Control (ETP, STP, RWH etc)	40	3



Sl. No.	Heads	Estimated Capital Cost in INR (Lakhs)	Recurring Cost Per Annum
			(Lakhs)
3	Noise Pollution Control	1	0.25
4	Waste Management	5	0.5
5	Green Belt Development	8	1.2
6	Occupational Health & Safety	6	1.5
Total		65	9.45

10.12 PROJECT BENEFITS

- ✓ Employments to the local people
- ✓ Social activities such as women's academy, primary school, etc
- ✓ APL will implement various CSR activities and will continue to do the same.
- ✓ Social Infrastructure facilities (both public and private) such as schools, hospitals, community halls, markets, libraries, colleges and religious buildings are located in nearby villages and at Bongaigaon town, which is located at a distance of 17 km from the site.
- ✓ Road Infrastructure has been developed between villages by the State Government. Suitable transport facilities are available in the area.
- ✓ Provide & conduct the Free Eye & Health Check up Programmes.

10.13 CONCLUSION

Based on the environmental assessment, all possible environment aspects have been adequately assessed and necessary control measures have been formulated to meet with statutory requirements, in the preparation of the EIA-EMP. This proposed Formaldehyde plant is very much required to meet the rise in demand and bridge the demand supply gap for Formaldehyde, The proposed project will also contribute in the social and economic upliftment of the persons living in the vicinity of the Project i.e. of society at large.



CHAPTER 11

DISCLOSURE OF CONSULTANT



CHAPTER 11: DISCLOSURE OF CONSULTANT

This chapter describes about the environmental consultant engaged in preparation of EIA report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited.

11.1 INTRODUCTION

ABC Techno Labs India Private Limited (formerly ABC Environ Solutions Pvt. Ltd.) is an ISO 9001, ISO 14001 & OHSAS 18001 Certified Company & leading Environmental Engineering & Consultancy Company constantly striving towards newer heights since its inception in 2006. Our Company is dedicated to providing strategic services in the areas of Environment, Infrastructure, Energy, Engineering and Multilab.

It is the first firm to be accredited by NABET (National Accreditation Board for Education and Training), Quality Council of India, as an EIA Consultant, approved for carrying out EIA studies and obtaining environmental clearance for various sectors such as Thermal Power Plants, Infrastructure, Industrial Estates / Complexes/ Areas, Mining, Township & area development and Building construction projects etc. ABC Techno Labs is equipped with in-house, spacious laboratory, accredited by NABL (National Accreditation Board for Testing & Calibration Laboratories), Department of Science & Technology, Government of India.

Since establishment ABC Techno Labs focus on sustainable development of Industry and Environment based on sound engineering practices, innovation, quality, R&D and most important is satisfying customers need. The company has successfully completed more than 100 projects of a variety of industries, in the field of pollution control and environmental management solutions. The company is also dealing in the projects of waste minimization and cleaner production technology.

The team of technocrats and scientist are well experienced to deal with the design, Manufacture, Fabrication, Installation, commissioning of Effluent/ Wastewater treatment plants, Sewage Treatment plants, and Combined Treatment plants.

The company is having well-experienced team of Scientists & Engineers who are looking after environmental projects & well-equipped analytical laboratory with a facility including analysis of physical, chemical and biological parameters as per the requirements of the State Pollution Control Board and our clients.



11.2 SERVICES OF ABC TECHNO LABS INDIA PRIVATE LIMITED

11.2.1 ENVIRONMENTAL SERVICES

- Environmental Impact Assessment (EIA)
- Environmental Management Plan (EMP)
- Social Impact Assessment (SIA)
- Environmental Baseline data collection for Air, Meteorology, Noise, Water, Soil, Ecology, Socio-Economic and Demography etc;
- Environmental Monitoring
- Socio-Economic Studies
- Resettlement & Rehabilitation Plan
- Ecological & Human Health Risk Assessment Studies
- Ecological Impact Assessment
- Environmental Management Framework
- Solid Waste Management
- Hazardous Waste Management
- Internship & Training

11.2.2 TURNKEY PROJECTS

- Water Treatment Plants
- Sewage Treatment Plant
- Recycling & Water Conservation Systems
- Zero Discharge System

11.2.3 OTHER SERVICES

- Operation & Maintenance of Water & Waste Water Plants
- Water & Waste Water Treatment Chemicals
- Pilot Plant studies
- Feasibility studies & preparation of budgetary estimates

11.2.4 LABORATORY SERVICES

- Chemical Testing
- Environmental Testing
- Microbiological Testing



- Food Testing
- Metallurgical Testing

11.3 SECTORS ACCREDITED BY NABET

Sl. No.	Sector No.	Name of sectors
1	1	Mining of Minerals including Opencast & Underground Mining
2	2	Offshore Oil and gas exploration, development & productions
3	3	Irrigation Projects
4	4	Thermal Power Plant
5	7	Mineral Beneficiation including palletisation
6	8	Metallurgical Industries – (Ferrous only) Secondary
7	9	Cement Plants
8	10	Petroleum Refining Industry
9	15	Leather/Skin/hide processing industry
10	16	Chemical Fertilizers
11	17	Pesticides industry and pesticide specific intermediates
12	18	Petro-chemical Complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)
13	21	Synthetic organic chemicals industry (dyes & dye intermediates; bulk drugs and intermediated excluding drug formulations; synthetic rubbers; basic organic chemicals, other synthetic organic chemicals and chemical intermediates)
14	22	Distilleries
15	25	Sugar Industry
16	27	Oil & gas transportation pipe line (crude and refinery/ petrochemical products), passing through national parks / sanctuaries / coral reefs / ecologically sensitive areas including LNG Terminal
17	28	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of schedule 2 & 3 of MSIHC Rules 1989 amended 2000)
18	29	Airports
19	31	Industrial estates/ parks/ complexes/ areas, export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes
20	33	Ports, Harbours, Jetties, Marine terminals, break waters and dredging
21	34	Highways, Railways, Transport terminals, mass rapid transport system
22	36	Common Effluent Treatment Plants (CETPs)
23	37	Common Municipal Solid Waste Management Facility (CMSWMF)
24	38	Building and large Construction projects including shopping malls, multiplexes, commercial complexes, housing estates, hospitals, institutions
25	39	Townships and Area development projects

Source: ABC Techno Labs India Pvt. Ltd.



11.4 STUDY TEAM

ABC Techno Labs India Private Limited has carried out this Environmental Impact Assessment (EIA) study. The multidisciplinary team included expertise in Environmental Impact Assessment, Air & Water pollution & Control measures, Noise Control measures, Ecology & bio-diversity, Land use, Geology, Environmental Chemistry and Socio-Economic planner. The team members involved in EIA study area:

Sl. No.	Name	Role
1.	Mr. Abhik Saha	EIA coordinator - 5(f) - Synthetic Organic Chemical Industry (dye & dye intermediates, bulk drugs and intermediates excluding drug formulations, synthetic rubbers, basic organic chemicals, other synthetic organic chemicals and chemical intermediates), FAE – Air Pollution (AP) FAE – Ecology & Biodiversity (EB) FAE – Water Pollution (WP) FAE – Solid & Hazardous Waste (SHW)
2.	Dr. R.K. Jayaseelan	FAE – Land use, Prevention & Control and Hydrogeology
3.	Mrs. K. Vijayalakshmi	FAE – Risk Assessment, Air Quality Modelling & Prediction
4.	Dr. Thillai Govindarajan	FAE – Geology
5.	Mr. R. Rajendran	FAE – Noise & Vibration
6.	Mrs. Geetha Shreeneevasakam	FAE – Socio-Economic Expert
7.	Mr. Sameer Despande	FAE- Soil Conservation (SC)
Team Members		
8.	S. Sravanakumar	FAA- Air Pollution, Water Pollution Prevention and Control
9.	Mr. Robson Chinnadurai	Senior Chemist
10.	Mr. M. Muruganantham	Junior Chemist
11.	Mr. Sathish	Field Technician

DISCLOSURE AS PER NABET /QCI

Details as per Schedule of EIA Notification 2006, as amended till date

Name of Publication *Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited.*

Schedule as per EIA notification 2006 *5 (f)*

Category *B*

NABET Sector No. *21 - Synthetic Organic Chemical Industry (dye & dye*



intermediates, bulk drugs and intermediates excluding drug formulations, synthetic rubbers, basic organic chemicals, other synthetic organic chemicals and chemical intermediates

Declaration by experts contributing to the Environmental Impact Assessment Report for Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill- Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited.

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA/EMP.

EIA Coordinator

Name : Mr. Abhik Saha

Signature :

Period of involvement : September 2018 – Till date

Contact information : abc@abctechnolab.com

FUNCTIONAL AREA EXPERTS:

S. No.	Functional Areas	Name of the Expert/s	Involvement (Period)	Signature & Date
1.	AP	Mr. Abhik Saha	September 2018 – Till date	
2.	WP	Mr. Abhik Saha	September 2018 – Till date	
3.	SHW	Mr. Abhik Saha	September 2018 – Till date	
4.	EB	Mr. Abhik Saha	September 2018 – Till date	
5.	SE	Dr. Geetha Shreeneevasakam	November 2018– Till date	
6.	HG	Dr. R.K. Jayaseelan	November 2018– Till date	
7.	NV	Mrs. Vijayalakshmi	November 2018– Till date	
8.	LU	Dr. R.K. Jayaseelan	November 2018– Till date	



9.	RH	Mrs. Vijayalakshmi	November 2018- Till date	
10.	AQ	Mrs. Vijayalakshmi	November 2018- Till date	
11.	GEO	Dr. Thillai Govindarajan	November 2018- Till date	
12.	SC	Mr. Sameer Deshpande	November 2018- Till date	

Declaration by the head of the Accredited Consultant Organization

I, Mr. G. Murugesh, hereby confirm that the above mentioned experts prepared the EIA/EMP Report for the Proposed 200 TPD Formaldehyde Manufacturing Plant at Vill-Dhaknabari, Boitamari, Dist-Bongaigaon, Assam By M/s. Assam Petro-Chemicals Limited. I also confirm that ABC Techno Labs India Pvt. Ltd. shall be fully accountable for any misleading information mentioned in this statement.

Signature :

Name : Mr. G. Murugesh
Designation : Chairman & Managing Director
Name of the EIA Consultant Organization: ABC Techno Labs India Private Limited
NABET Certificate No. & Issue Date: NABET/EIA/1619/RA0048 date 29th May 2017



ANNEXURE 1: DECLARATION REGARDING LITIGATION



ASSAM PETRO-CHEMICALS LIMITED

(A Government of Assam Undertaking) | An ISO 9001:2008 Certified Company
CIN- U24116AS1971SGC001339, GSTN: 18AABCA6913A1Z6

Head Office & Factory Site:

Assam Petro-chemicals Ltd., Namrup, P.O. Parbatpur,
District: Dibrugarh, Assam-786623
Phone: (0374) 2500331/2500246/2500518, Fax: (0374) 2500231
Email: npapl@sanchamnet.in, admin_apl@assampetrochemicals.co.in

SELF DECLARATION

This is to certify and declare that our company M/s Assam Petro-chemicals Limited (APL) does not have any litigation pending with any court against the project or any direction / order passed by any Court of Law against the project and neither the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant sections of Air and Water Acts.

For M/s Assam Petro-chemicals Limited (APL).

Mr. Ratul Bordoloi
Managing Director
Assam Petro-chemicals Limited
Namrup, P.O.- Parbatpur,
District—Dibrugarh, Assam-786623

Ratul Bordoloi
Managing Director
Assam Petro-Chemicals Ltd.
Guwahati-781005

Regd. Office: 4th Floor, Orion Place
Mahapurush Srimanta Sankardev Path, Bhagagarh, Guwahati, Assam-781005
Phone/Fax: (0361) 2461470/2461471/2461594
Email: aplguw@bsnl.in Web: www.assampetrochemicals.co.in

ANNEXURE 2: LAND ALLOTMENT LETTER



GOVT OF ASSAM
OFFICE OF THE GENERAL MANAGER
DISTRICT INDUSTRIES & COMMERCE CENTRE: BONGAIGAON

NO.DICCBN/LA-3/Pt-I/2017 / 467

Dated New Bongaigaon the 12th March'18

To :

Deputy Secretary to the Govt. of Assam
Industries & Commerce Deptt.
Janota Bazar, Dispur, Guwahati

Sub : Handing over and taking over of the land measuring 110 Bighas covered by Dag no.72,73 & 77 (Pt) situated at village Dhaknabari under Boitamari Revenue Circle of North Bongaigaon Sub-Division in Bongaigaon District.

Ref : 1. Govt letter No. CI.277/2013/197 dtd 26th February 2018

Sir,

We the General Manager, DICC Bongaigaon and the Managing Director, Assam Petro-Chemicals Ltd. Bhangagarh, Guwahati-5 have handed over and taken over the possession of the land measuring 110 Bighas covered by Dag no.72, 73 & 77 (Pt) situated at village Dhaknabari under Boitamari Revenue Circle of North Bongaigaon Sub-Division in Bongaigaon District on today 12th March 2018 at DICC Bongaigaon Assam for establishment of a unit of Assam Petro-Chemicals Ltd.

1. General Manager
District Industries & Commerce
Centre: Bongaigaon

2. Managing Director Ratul Bordoloi
Assam Petro-Chemicals Ltd. Director
4th Floor, Orion Place
Bhangagarh, Guwahati-781005

Memo no. DICCBN/LA-3/Pt-I/2017

Dated New Bongaigaon the 12th March'18

Copy to :

1. The Commissioner of Industries & Commerce, Assam, Bamunimaidam, Ghy-21 for favour his kind information
2. The Dy. Commissioner, Bongaigaon - for favour his kind information
3. The Managing Director, Assam Petro-Chemicals Ltd. 4th Floor, Orion Place Bhangagarh, Guwahati-5
4. Office copy

General Manager
District Industries & Commerce
Centre: Bongaigaon



ANNEXURE 3: WATER PERMISSION APPLICATION



Assam Petro-Chemicals Ltd.

C1N-U24116AS1971SGC001339, GSTN : 18AABCA6913A1Z8
(A Govt. of Assam Undertaking) | An ISO 9001 : 2008 certified company
Regd. Office : 4th Floor, Orion Place
Mahapurush Srimanta Sankardev Path (Formerly G.S. Road.)
Bhangagarh, Guwahati-781005

Phone/Fax: (0361) 2461470 / 2461471 / 2461594
E-mail: aplguw@bsnl.in
web : www.assampetrochemicals.co.in

Ref.: APL/Proj/Formalin-II/2018/ 097

Date: 08.02.2018

To
The Executive Engineer,
Water Resources,
Bongaigaon, Assam

Sub: Permission for drawal of water from Tunia river for the 200 TPD Formalin Project.

Dear Sir,

Assam Petro-Chemicals Limited (APL), a PSU under Govt. of Assam, incorporated in the year 1971. This was the first petro-chemical industry in the country to produce Methanol from Natural Gas. The Existing 100TPD Methanol & 125 TPD Formalin plant have been operating smoothly ever since commissioning of the plants posting profits to the company and contributing to the national and State exchequer by way of profit taxes and duties. The 500 TPD Methanol plant & 200 TPD Formalin plant is under implementation at Namrup under District Dibrugarh and Boitamari under District Bongaigaon respectively. The design and engineering jobs for the 500 TPD Methanol plant is in final stage including commencement of procurement activities.

All the statutory clearance including drawl of water required for the 500 TPD Methanol plant at Namrup has already been received from the concerned departments, Govt. of Assam. For the 200 TPD Formaldehyde plant which will be setup at Boitamari all the statutory clearance have to be obtained.

The contract for execution of 200 TPD Formaldehyde plant is also going to be awarded very soon. The clearance for drawal of raw water from the RIVER TUNIA which is flowing along the western boundary of the said project site is therefore required urgently. The requirement of Raw water for said project is 50 m³ per hour ie 14 litre per second.

We would therefore request you to issue a No Objection Certificate in favour of Assam Petro-Chemicals Ltd. for drawl of said quantity of water from Tunia river for the aforesaid project of M/s Assam Petrochemical Limited.

Thanking you,

Yours faithfully
For Assam Petro-Chemicals Ltd.


(A.C. Barman)
General Manager-Project



Head Office & Factory Site : Assam Petro-Chemicals Ltd., Namrup, Parbatpur, Dist.-Dibrugarh, Assam-786 623
Phone : Namrup (0374) 2500331, 2500212, 2500518, Fax : 2500231, E-Mail : nrppl@sanchamel.in, admin_apl@assampetrochemicals.co.in

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ANNEXURE 4: NABL CERTIFICATE OF ABC TECHNO LABS INDIA PVT. LTD.

		National Accreditation Board for Testing and Calibration Laboratories (A Constituent Board of Quality Council of India)	
CERTIFICATE OF ACCREDITATION			
ABC TECHNO LABS INDIA PRIVATE LIMITED			
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			
ABC Tower, No:400, 13th Street, SIDCO Industrial Estate, North Phase, Ambattur, Chennai, Tamil Nadu			
in the field of			
TESTING			
Certificate Number	TC-5770	Valid Until	28/11/2019
Issue Date	29/11/2017		
This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL. (To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)			
Signed for and on behalf of NABL			
 N. Venkateswaran Program Director	 89076970100030000583	 Anil Relia Chief Executive Officer	