FINAL EIA/EMP REPORT

FOR OBTAINING ENVIRONMENTAL CEARANCE

FOR

"Expansion of Fertilizer Unit with addition of Chemical Unit (MBAPL–Unit - II)"

{Cat. A under item '5 (a)' (Chemical Fertilizers) of Schedule of EIA Notification, 2006 and its subsequent amendments 1st December' 2009, 25th June' 2014 and 23rd November' 2016}

Location: Plot No.A-1 & A-2, Sorai Industrial Area, Village–Sorai, Tehsil - Banda, District -Sagar, Madhya Pradesh

Plant Capacity

Existing Product (MTPA)				
1.	Phosphoric Acid (expansion in capacity)	19,800	1,00,000	1,19,800
2.	SSP	1,80,000	-	1,80,000
3.	GSSP	1,80,000	-	1,80,000
4.	Triple Super Phosphate (TSP)	66,000	-	66,000
5.	Synthetic Gypsum	1,65,000	-	1,65,000
6.	Beneficiated Rock Phosphate (BRP)	1,89,000	-	1,89,000
7.	Sodium Silica Fluoride (SSF)	1,320	-	1,320
Proposed Product (MTPA)				
1.	LABSA	-	33,000	33,000
2.	Zinc Sulphate	-	13,200	13,200
3.	Di Ammonium Phosphate & Nitrogen and phosphorus complex (DAP/NPK Complex fertilizer) and water-soluble fertilizers &Fortified with Zinc, Boron, and Sulphur.	-	3,30,000	3,30,000
4.	Gypsum Granular	-	1,00,000	1,00,000
5.	Sulphuric Acid	-	2,00,000	2,00,000
6.	Vinyl Sulphone	-	2,400	2,400
7.	Ammonia	-	1,00,000	1,00,000
8.	Nitric Acid	-	66,000	66,000
9.	Calcium Nitrate & Fortified with Zinc, Boron, and Sulphur.	-	66,000	66,000
10.	Sulphate of Potash (SOP)	-	19,800	19,800

Details of ToR : **Letter No. J-11011/314/2019-IA-II (I) Dated 12.12.2019**

Baseline Data Generation : **October, November and December' 2019 (Post-monsoon Season)**

Project cost : **Total Cost Rs. 436.75 Cr. (Existing – 78.0 Cr., Proposed-358.75 Cr.)**

PROMOTER

Madhya Bharat Agro Products Limited (MBAPL)

5-0-21, .C. Vyas Colony, Bhilwara

Project In-charge: Sourabh Gupta (Director)

E-mail: sourabh@mbapl.com

ENVIRONMENTAL CONSULTANT

Gaurang Environmental Solutions Pvt. Ltd.

#102, SNG, Shree Ratna Apartment, Peetal Factory, Jhotwara road, Bani Park, Jaipur-302016

E-mail: gaurangenviro@gmail.com

NABET Accreditation: NABET/EIA/1720/IA0026 (Rev. 01) dated 18.10.2019 & NABET Extension letter no. QCI/NABET/EIA/ACO/20/1494 dated 09.10.2020 valid up to 08.01.2021

January 2021

INDEX

S. NO.	CONTENTS	PAGE NOS.
1.	INDEMNIFICATION ALONG WITH DISCLOSURE OF CONSULTANT	i
2.	NABET CERTIFICATE ALONGWITH VALIDITY CERTIFICATE	ii-iii
3.	EIA/ EMP REPORT	1-386
SECTION - I	INTRODUCTION	1-40
SECTION - II	PROJECT DESCRIPTION	41-119
SECTION - III	DESCRIPTION OF THE ENVIRONMENT	120-211
SECTION - IV	ANTICIPATED ENVIRONMENTAL IMPACT & MITIGATION MEASURES	212-269
SECTION - V	ANALYSIS OF ALTERNATIVES	270-272
SECTION - VI	ENVIRONMENTAL MONITORING PROGRAMME	273-281
SECTION - VII	ADDITIONAL STUDIES	282-345
SECTION - VIII	PROJECT BENEFITS	346-351
SECTION - IX	ENVIRONMENTAL COST BENEFIT ANALYSIS	352-353
SECTION - X	ENVIRONMENTAL MANAGEMENT PLAN	354-365
SECTION - XI	SUMMARY & CONCLUSION	366-381
SECTION - XII	DISCLOSURE OF CONSULTANTS ENGAGED	382-386
	ANNEXURE	
I.	LEASE DEED	
II.	PREVIOUS ENVIRONMENTAL CLEARANCE	
III.	TERMS OF REFERENCE	
IV.	WATER NOC (SURFACE AND GROUND)	
V.	ELECTRICITY ASSURANCE LETTER	
VI.	PREVIOUS ENVIRONMENTAL CLEARANCE	
VII.	CTO SINCE INCEPTION WITH CTE	
VIII.	MAP SHOWING LOCTION OF THE LEASE AREA, STUDY AREA AND MONITORING LOCATIONS.	

IX.	GOOGLE EARTH
X.	PLANT LAYOUT
XI.	SORAI INDUSTRIAL MAP
XII.	PHOTOGRAPHS SHOWING EXISTING AND PROPOSED PLANT SITE
XIII.	PHOTOGRAPHS SHOWING THE EXISTING PLANTATION/ GREENBELT
XIV.	LAND USE MAP BASED ON HIGH RESOLUTION SATELLITE IMAGERY (GPS) OF THE PROPOSED EXPANSION PROJECT
XV.	CONSERVATION PLAN OF SCHEDULE I SPECIES
XVI.	BASELINE MONITORING REPORT
XVII.	PHOTOGRAPHS SHOWING EFFLUENT TREATMENT PLANT
XVIII.	PHOTOGRAPHS SHOWING STACKS
XIX.	LANDSCAPE PLAN FOR THE GREEN BELT
XX.	ONSITE PLAN
XXI.	HEALTH RECORD OF WORKERS
XXII.	MAP SHOWING LOCTION OF THE LEASE AREA, STUDY AREA AND MONITORING LOCATIONS.
XXIII.	Kml FILE
XXIV.	NABET CERTIFICATE
XXV.	UNDERTAKING BY PP
XXVI.	ENVIRONMENTAL POLICY

****

INDEMNIFICATION

Utmost care has been taken in preparation of this Report vis a vis Proposed Expansion of Fertilizer Unit with addition of Chemical Unit (MBAPL – Unit – II) situated at Plot No.A-1 & A-2, Sorai Industrial Area, Tehsil - Banda, District - Sagar (M.P.) promoted by Madhya Bharat Agro Products Limited. The data incorporated in the report is generated through information received from project proponent in form of the details received through e-mail, secondary information. Due care has been taken to represent facts and figures and sources acknowledged. The purpose of this document is to facilitate environmental appraisal of the proposal and as such the exercise has been scientifically carried out. The Consultant stands indemnified against any consequences arising out of any inadvertentomissions.

REVISION HISTORY

Report No.	**GESPL_285 /EIA/2019/107**
Type of Report	**EC**
Revision No.	02
Issue to	Madhya Bharat Agro Products Limited
Issue Date	05.01.2020

INDEX

Disclosure of Consultant……383.

CHAPTER 12

DISCLOSURE OF CONSULTANTS ENGAGED

Declaration by Experts contributing to the Final Environmental Impact Assessment Report for Expansion of Fertilizer Unit with addition of Chemical Unit (MBAPL – Unit – II) by Madhya Bharat Agro Products Limited.

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

EIA Coordinator		Signature & Date
Name	Yashwant Bordia	
Period of Involvement	October' 2019 to 01.05.2021	
Contact Information	#102, SNG, Shri Ratna Apartment, Near Tambi Petrol Pump, Peetal Factory, Jhotwara Road, Jaipur – 302016 Phone No.:- 0141-4029115, 9782074776 Email id:- gaurangenviro@gmail.com	

Functional Area Experts:-

Functional Areas	Name of the Expert/s	Involvement (period and task**)	Signature and date
AP	• Yashwant Bordia • Ginni Barotia	• Identify the significant sources of air emissions. • Fugitive emission sources are quantified to the extent possible and the impact identification and suggest mitigation measures.	

WP	• Yashwant Bordia • Pooja Bunker (FAA)	• Identify the suitable treatment methodology for Industrial waste water generated from proposed as well as existing production. • Identify the possible impacts and suggest mitigation measures.	
SHW	• Yashwant Bordia • Ginni Barotia	• Identification of nature of waste, categorization and quantification • Computation and evaluation of solid waste as per applicable Rules:- ➢ Solid Waste Management Rules, 2016 ➢ Hazardous & Other Waste Management Rules, 2016 (earlier Hazardous Waste Management Rules, 2008) • Suggesting measures for handling, treatment and disposal of waste	
SE	Annesha Chakraborty Gajendra Singh Rathore	• Secondary data of Census of India, 2011. • Impact Assessment & Preventive Management Plan.	
EB	Dr. Yati Kacchhawa	• Ecological and biodiversity survey • Identification of species (flora and fauna)	
Geo	Vidya Bhushan Trivedi	• Geological structure (Fault/ fold of any other major) observation during the primary survey.	
HG	Vidya Bhushan Trivedi	• Hydrogeological assessment of aquifer distribution of the area • Water resource evaluation of the study area. • Calculation of the Rain water harvesting structure	

		• Prediction of impacts due to project site and preparation management plan for the same	
SC	Pradyumna Arvind Deshpande	• Identification of existing quality of top soil. • Prediction of Impact and its management.	
AQ	Mallikarjuna Guttula	• Study of Secondary Micro-Meteorological data. • Air quality modelling and its interpretation. • Predict the incremental GLC's AERMOD Version 8.9 model used to predict changes in air quality. • Air quality contours superimpose on toposheet, indicating the location of site, sensitive receptors, habitation and pre-dominant wind direction. • Suggest mitigation measures	Mallik.
NV	Mallikarjuna Guttula	• Identification of sources of noise emission, its impact and suggest mitigation measures.	Mallik.
LU	Annesha Chakraborty Vinod Kumar Verma (FAA)	• The change in land cover with extent of impact has been studied. • Interpretation and development of LULC map.	Annesha Vinod Verm
RH	Pawan Sut Sharma	• Identification of hazards and Mitigation measures. • Occupational health Hazards and safety measures. • Preventive measures adopted.	

*One TM against each FAE may be shown

**Please attach additional sheet if required

#Team Member

Declaration by the Head of the Accredited Consultant Organization

I, Vipul Khandelwal, hereby, confirm that the above mentioned experts prepared the final EIA of Expansion of Fertilizer Unit with addition of Chemical Unit (MBAPL – Unit – II) by Madhya Bharat Agro Products Limited. . I also confirm that I shall be fully accountable for any misleading information mentioned in this statement.

Signature	
Name	Vipul Khandelwal
Designation	Director
Name of the EIA Consultant Organization	Gaurang Environmental Solutions Pvt. Ltd.
NABET Certificate No. & Issue Date	NABET/ EIA/ 1720/ IA0026 (Rev. 01) Dated 18th October, 2019 & NABET letter no. QCI/ NABET/ EIA/ ACO/ 20/ 1494 dated 09.10.2020 valid up to 08.01.2021.

****

Quality Council of India

National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

Gaurang Environmental Solutions Pvt. Ltd.

102, SNG Shree Ratna Apartments, Near Tambi Petrol Pump,
Jhotwara Road, Banipark, Jaipur (Raj.)- 302016

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA/EMP reports in the following sectors:

Sl. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1.	Mining of minerals including opencast/underground mining	1	1 (a) (i)	A
2.	Offshore and onshore oil and gas exploration, development & Production	2	1 (b)	A
3.	Thermal power plants	4	1 (d)	B
4.	Metallurgical industries (ferrous & nonferrous)- both primary & secondary	8	3 (a)	B
5.	Cement Plants	9	3 (b)	A
6.	Chemical fertilizers	16	5 (a)	A
7.	Synthetic organic chemicals industry	21	5 (f)	A
8.	Distilleries	22	5 (g)	B
9.	Air Ports	29	7 (a)	A
10.	Isolated storage & handling of Hazardous chemicals	28	6 (b)	B
11.	Common hazardous waste treatment, storage and disposal facilities	32	7 (d)	A
12.	Bio-medical waste treatment facilities	32A	7 (da)	B
13.	Highways,	34	7 (f)	B
14.	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
15.	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
16.	Building and construction projects	38	8 (a)	B
17.	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in IA AC Minutes dated February 10 & June 2, 2017 and Supplementary AC Minutes dated June 1, 2018 & September 13, 2019 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/17/0336 dated June 12, 2017. The accreditation needs to be renewed before the expiry date by Gaurang Environmental Solutions Pvt. Ltd., Jaipur following due process of assessment.

Sr. Director, NABET
Dated: October 18, 2019

Certificate No.
NABET/EIA/1720/IA0026(Rev.01)

Valid till
Jan 22, 2020

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

National Accreditation Board
for Education and Training
(Member - International Accreditation Forum & Pacific Accreditation Cooperation)

Oct 09, 2020

QCI/NABET/EIA/ACO/20/1494

Gaurang Environmental Solutions Pvt. Ltd
SNG Shree Ratna Apartments Near Tambi Petrol Pump,
Bani Park, Jaipur, Rajasthan 302016

Sub.: Extension of Validity of Accreditation till Jan 08, 2021 - regarding

Dear Sir/Madam

In view of the outbreak of Corona Virus (COVID-19) and subsequent lockdown declared for its control vide order dated 24th March 2020, issued by Ministry of Home Affairs, Govt. of India, NABET hereby extends the Validity of your Accreditation till Jan 08, 2021.

As soon as, NABET office opens/resumes its operation necessary action regarding issuance of certificate/extension of validity letters / other may be initiated, therefore, ACO to ensure their complete application with NABET, if applicable.

Meanwhile, you may enclose this with your EIA reports along with the certificate/validity letter. The EAC/SEIAA/SEAC/Other are hereby requested to consider the same as a valid document for the preparation of EIA/EMP report.

With best regards.

(A K Jha)
Sr. Director, NABET

Institute of Town Planners India, 6th Floor, 4-A, Ring Road, I.P Estate, New Delhi-1 10 002, India
Tel. • +9 11 -233 23 4 1 6, 417, 18, 419, 420, 421 ,423 E-mail : ceo.nabet@qcin.org Website : www.qcin.org

INDEX

1.1 PURPOSE OF THE REPORT 2
1.2 IDENTIFICATION OF PROJECT & PROJECT PROPONENT 2
1.2.1 IDENTIFICATION OF THE PROJECT 2
1.2.2 IDENTIFICATION OF THE PROJECT PROPONENT 4
1.3 BRIEF DESCRIPTION OF NATURE, SIZE, LOCATION OF THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY, REGION 5
1.3.1 NATURE OF THE PROJECT 5
1.3.2 SIZE OF THE PROJECT 6
1.3.3 LOCATION OF THE PROJECT 6
1.3.4 PROJECT IMPORTANCE TO COUNTRY/ REGION 7
1.4 SCOPE OF THE STUDY – DETAILS OF REGULATORY SCOPING CARRIED OUT (AS PER TERMS OF REFERENCE) 7
1.4.1 POINT WISE COMPLIANCE OF TERMS OF REFERENCE (TOR): 8
1.4.2 DETAILS OF REGULATORY COMPLIANCES: 38
1.4.3 APPLICABLE RULES/REGULATION/ACTS 39

CHAPTER I
INTRODUCTION

1.1 PURPOSE OF THE REPORT

Gaurang Environmental Solutions Pvt. Ltd. has been assigned the job by Madhya Bharat Agro Products Limited to carry out Environmental Impact Assessment (EIA) studies and preparation of EIA report with suitable EMP for the proposed expansion of fertilizer unit ((MBAPL – Unit I) with addition of chemical unit (MBAPL – Unit II) situated at Sorai Industrial Area, Tehsil - Banda, District - Sagar (M.P.)

The project activity is listed at item 5 (a) Chemical Fertilizers in Schedule of EIA Notification, 2006 and subsequent amendments thereafter as Category "A" project and hence require prior Environmental Clearance.

The objective of the Environmental Impact Assessment (EIA) report is:

- To identify, predict and evaluate the environmental, economical, and social impact due to project activities;
- To provide information on the environmental consequences for decision making and;
- To promote environmentally sound and sustainable development through the identification of appropriate alternatives and mitigation measures.

Baseline studies for one season i.e. Post-Monsoon (October, November and December' 2019) along with field surveys were conducted and potential environmental impacts of the project activities are identified, assessed and their mitigation measures are documented in this EIA/EMP report.

1.2 IDENTIFICATION OF PROJECT & PROJECT PROPONENT

1.2.1 IDENTIFICATION OF THE PROJECT

The proposed expansion project is for Fertilizer Unit with addition of Chemical Unit (MBAPL – Unit II) situated at Plot No.A-1 & A-2, Sorai Industrial Area, Village–Sorai, Tehsil - Banda, District -Sagar, Madhya Pradesh promoted by Madhya Bharat Agro Products Limited (MBAPL). The unit proposes to enhancing its production capacity of fertilizers by addition of DAP/NPK complex fertilizer, Phosphoric acid plant with addition of new chemical production unit in existing Unit - II. The total plot area is

80.65 Acre (3,26,404 Sq. m.) and no additional land is required for the proposed expansion. The chronology of the project is given below:

PARTICULAR	DETAILS
Establishment of plant	1997
Original lease deed executed	Vide registration no 38 dated 10.4.2013 from the Office of Sub Registrar Banda, District-Sagar. Enclosed as **Annexure**- I
Environmental Clearance for Rock Phosphate beneficiation plant - 90,000T/year for unit II.	SEIAA, M.P. vide letter no. 1309/EPCO-SEIAA/12 dated 14.03.2012. Enclosed as **Annexure-II**
Environmental Clearance for existing product with production capacity for unit III.	SEIAA, M.P vide letter 7305 dated 06.11.2015 for Beneficiation of Rock Phosphate (BRP) & Manufacturing unit of SSP, GSSP, TSP, Synthetic Gypsum, Phosphoric Acid, Sodium-Silica Fluoride. Enclosed as Annexure- III
Amendment to the original Lease deed	Vide Dated 09.07.2015 (In this amendment new unit will known as Madhya Bharat Agro Products Limited Unit – II as Unit –III has merged / diversified in Unit-II) are bounded to terms and conditions of letter no. 7/IDS/B-2/2009/3216 dated 05.08.2014 of Directorate of Industries M.P. this letter and amendment is part of both original lease deeds. Enclosed as **Annexure-I**
Terms of Reference has been applied on 4.11.2019 for expansion of fertilizer unit with addition of chemical unit (MBAPL – Unit- II)	Standard TOR issued has been issued on 12.12.2019 by MoEF&CC. Enclosed as **Annexure-III.**
Public consultation	Public consultation was held on 20.08.2020 at 11:00 AM.

As per raising market demand and project techno-economic viability, the unit now intends to undergo expansion in production unit with addition of chemical unit as below:-

Table No. 1.2: Details of proposed production capacity

S. No.	Proposed Product	Capacity (MTPA)
1	Phosphoric Acid (expansion in Capacity)	1,00,000
2	LABSA Liner Alkyl Benzene Sulphonic Acid and other allied products (Alfa Olefin sulphonate (AOS), Sodium Lauryl Sulphate (SLS/ Primary Alcohol Sulphate (PAS), sodium lauryl ether Sulphate, liquid detergents, Household cleaners, Ammonium Lauryl Sulphates (ALS), Ammonium Lauryl ether Sulphates (ALES)	33,000
3	Zinc Sulphate	13,200
4	Di Ammonium Phosphate & Nitrogen and phosphorus complex (DAP/NPK Complex fertilizer) and water-soluble fertilizers& Fortified with Zinc, Boron, and Sulphur.	3,30,000
5	Gypsum Granular	1,00,000
6	Sulphuric Acid	2,00,000
7	Vinyl Sulphone	2,400
8	Ammonia	1,00,000
9	Nitric Acid	66,000
10	Calcium Nitrate & Fortified with Zinc, Boron, and Sulphur.	66,000
11	Sulphate of Potash (SOP)	19,800

1.2.2 IDENTIFICATION OF THE PROJECT PROPONENT

MBAPL- as ISO 9001:2015 Certified company, originally incorporated in the year 1997 as private sector unit for manufacturing Single super phosphate (SSP). it was converted to public limited company in the year 1999 and in the year 2004 it came under current management of "Ostwal Group of Industries.

Ostwal Group of industries is involved in manufacturing/ trading activities like Fertilizers, Mineral Beneficiation, Bio-Fertilizers, seeds and pesticides, Textile, Import and Export of agro commodities etc. The group is led by Sh. Mahendra Kumar Ostwal, Mr. Pankaj Ostwal and Mr. Praveen Ostwal. The details of the promoter for the proposed expansion project are as below:

Promoter	Madhya Bharat Agro Products Limited (MBAPL)
Authorized Signatory	Sourabh Gupta (Director)
Registered address	5-O-21,R .C. Vyas Colony, Bhilwara
Email	sourabh@mbapl.com
Contact No.	7665437112

1.3 BRIEF DESCRIPTION OF NATURE, SIZE, LOCATION OF THE PROJECT AND ITS IMPORTANCE TO THE COUNTRY, REGION

1.3.1 NATURE OF THE PROJECT

The proposed expansion project is Chemical Fertilizer with addition of Chemical Unit with proposed production as well as existing capacity is as given below:

Table No.: Existing as well as proposed production capacity

S. No	Products	Existing* (MTPA)	Proposed (MTPA)	Total (MTPA)
Existing Product				
1.	Phosphoric Acid (expansion in capacity)	19,800	1,00,000	1,19,800
2.	SSP	1,80,000	-	1,80,000
3.	GSSP	1,80,000	-	1,80,000
4.	Triple Super Phosphate (TSP)	66,000	-	66,000
5.	Synthetic Gypsum	1,65,000	-	1,65,000
6.	Beneficiated Rock Phosphate (BRP)	1,89,000	-	1,89,000
7.	Sodium Silica Fluoride (SSF)	1,320	-	1,320
Proposed Product				
1.	LABSA	-	33,000	33,000
2.	Zinc Sulphate	-	13,200	13,200
3.	Di Ammonium Phosphate & Nitrogen and phosphorus complex (DAP/NPK Complex fertilizer) and water-soluble fertilizers &Fortified with Zinc, Boron, and Sulphur.	-	3,30,000	3,30,000
4.	Gypsum Granular	-	1,00,000	1,00,000
5.	Sulphuric Acid	-	2,00,000	2,00,000
6.	Vinyl Sulphone	-	2,400	2,400
7.	Ammonia	-	1,00,000	1,00,000

8.	Nitric Acid	-	66,000	66,000
9.	Calcium Nitrate & Fortified with Zinc, Boron, and Sulphur.	-	66,000	66,000
10.	Sulphate of Potash (SOP)	-	19,800	19,800
Source: Existing Environmental Clearance dated 14.03.2012 and 06.11.2015				

1.3.2 SIZE OF THE PROJECT

The size of the project is detailed is given below:

Table No. 1.3: Size of the project

S. No.	Particulars	Description		
		Existing	Proposed	Total
1.	Plant area (Sq.m)	2,33,700	92,704	3,26,404
2.	Project cost (Rs. In Crore)	78.00	358.75	436.75
3.	Water demand (KLD)	682	2713	3395
4.	Power demand (KWH)	3000	5050	8050
5.	Power Backup (kVA)	DG Set (1 No.) - 875kVA	DG Set (1 No.) 1000kVA .	DG Set (1 No.) 875 kVA DG Set (1 No.) 1000 kVA Total DG Set (2Nos.)

1.3.3 LOCATION OF THE PROJECT

The proposed expansion unit is situated within declared Industrial area at Plot No A-1, A-2, Sorai Industrial Area, Village – Sorai, Tehsil - Banda, District - Sagar (M.P.). The project site fall on SOI Toposheet No.

Table : Access to the Project Site

Particulars	Distance (Km) & Direction (From Project Boundary)
Nearest Railway Station	Makronia - 21.1 & SE
Nearest Highway	NH – 86- Connectivity- 0.5&SE
Nearest Airport	Khajuraho – 132 Km, SE

1.3.4 PROJECT IMPORTANCE TO COUNTRY/ REGION

India is predominantly an agrarian economy. The Indian economy mainly depends upon its agricultural produce. The agricultural output contributes to about 25% of the country's GDP. As a result of the chemical fertilizers being one of the related parts of the agriculture, there is tremendous scope for the growth of the chemical fertilizer industry. India is also ranked as the third-largest exporter and producer of nitrogenous fertilizer. The chemical fertilizers industry in India has performed a significant role in enabling the increased supply of essential nutrients to plants. It has also helped India achieve the objective of being self-sufficient in the production of food grains and has accelerated the growth of agriculture. The Indian Chemical Fertilizer industry promises a great future for investments. India's demand for fertilizers is set to increase its supply manifold in the near future. Thus, there are great investment opportunities for foreign investors to invest in the Indian chemical fertilizers industry, optimize the fertilizer production through the use of modern technology, and gain valuable returns.

1.4 SCOPE OF THE STUDY – DETAILS OF REGULATORY SCOPING CARRIED OUT (AS PER TERMS OF REFERENCE)

The application for obtaining Terms of Reference (ToR) for the proposed expansion project was submitted on Parivesh portal vide dated 4.11.2019 and accordingly Standard Terms of Reference (ToR) was prescribed by MoEF& CC, New Delhi vide letter no. No. J-11011/314/2019-IA-II (I) dated 12.12.2019 to carry out EIA/EMP study. Copy of Standard TOR letter is enclosed as **Annexure III**).

Baseline data for one season i.e. post-monsoon (October, November and December' 2019) was collected within study area of 10Km radius.

Draft EIA/EMP report was prepared for conduction of public hearing as per the generic structure of EIA report prescribed as Appendix III of EIA Notification, 2006 and subsequent amendments.

The final EIA/EMP report incorporates the outcomes of public hearing and time bound action plan with budgetary allocation is prepared for appraisal before the MoEF&CC.

1.4.1 POINT WISE COMPLIANCE OF TERMS OF REFERENCE (TOR):

The point wise compliance of the conditions laid down in the ToR is detailed as under:-

Table: 1.5: COMPLIANCE OF TOR

<table>
<tr><th>S. No.</th><th>Standard Terms of Reference Points</th><th>Status of Compliance</th></tr>
<tr><td>1.</td><td>Executive Summary</td><td>Executive Summary of the project is enclosed as Chapter 11 of EIA/EMP report.</td></tr>
<tr><td>2.</td><td colspan="2">Introduction</td></tr>
<tr><td>i.</td><td>Details of the EIA Consultant including NABET accreditation</td><td>Details of EIA Consultant are as under:-
<table>
<tr><th>Particulars</th><th></th><th>Details</th></tr>
<tr><td>Name</td><td>:</td><td>Gaurang Environmental Solutions Private Limited</td></tr>
<tr><td>Address</td><td>:</td><td>102,SNG, Shri Ratna Apartment Peetal factory, Jhotwara road, Jaipur-302016</td></tr>
<tr><td>NABET Accreditation No.</td><td>:</td><td>NABET /EIA/ 1720 / IA 0026</td></tr>
</table></td></tr>
<tr><td>ii.</td><td>Information about the project proponent</td><td>
<table>
<tr><td>Promoter</td><td>Madhya Bharat Agro Products Limited (MBAPL)</td></tr>
<tr><td>Authorized Signatory</td><td>Sourabh Gupta (Director)</td></tr>
<tr><td>Registered address</td><td>5-0-21, R..C. Vyas Colony, Bhilwara</td></tr>
<tr><td>Emai</td><td>sourabh@mbapl.com</td></tr>
<tr><td>Contact No.</td><td>7665437112</td></tr>
</table></td></tr>
<tr><td>iii.</td><td>Importance and benefits of the project</td><td>Importance and benefits of the project
The need for the expansion is due to the rising demand from the existing unit and to keep its continuous supply, owing to the growth in the region.
Fertilizers are the basic required material for agricultural sector and also the basic need of the farmers in the age of agricultural development.</td></tr>
</table>

		Efforts are made to increase the food grains along with other inputs, the fertilizers consumption per hector has also improved. The efforts in this field will further increase the consumption of fertilizers. **Benefit:** The aim of proposed expansion project is to fill the demand – supply gap through optimum allocation and production of chemical fertilizer required to meet the demand effectively.
3.	**Project Description**	
i.	Cost of project and time of completion	

Cost of Project (In Crore)	**Existing**	**:**	78 .00
	Proposed	:	358.75
	Total	:	436.75
Time of completion		:	December 2020

ii. Products with capacities for the proposed project.

Products with capacities for the proposed project are as under:-

S. No.	Proposed Product	Capacity (MTPA)
1	Phosphoric Acid	1,00,000
2	LABSA Liner Alkyl Benzene Sulphonic Acid and other allied products (Alfa Olefin sulphonate (AOS), Sodium Lauryl Sulphate (SLA/ Primary Alcohol Sulphate (PAS), sodium lauryl ether Sulphate, liquid detergents, Household cleaners, Ammonium Lauryl Sulphates (ALS),	33,000

	Ammonium Lauryl ether Sulphates (ALES)	
3	Zinc Sulphate	13,200
4	Di Ammonium Phosphate & Nitrogen and phosphorus complex (DAP/NPK Complex fertilizer) and water soluble fertilizers & Fortified with Zinc, Boron, and Sulphur.	3,30,000
5	Gypsum Granular	1,00,000
6	Sulphuric Acid	2,00,000
7	Vinyl Sulphone	2,400
8	Ammonia	1,00,000
9	Nitric Acid	66,000
10	Calcium Nitrate & Fortified with Zinc, Boron, and Sulphur.	66,000
11	Sulphate of Potash (SOP)	19,800

iii. If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.

- The details of existing products with capacities are as under:-

S. No.	Existing Product	Capacity (MTPA)
1.	Single Super Phosphate (SSP)	1,80,000
2.	Granular SSP (GSSP)	1,80,000
3.	Triple Super Phosphate (TSP)	66,000
4.	Synthetic Gypsum	1,65,000
5.	Phosphoric Acid (PA)	19,800
6.	Beneficiated Rock Phosphate (BRP)	1,89,000
7.	Sodium Silica Fluoride (SSF)	1320

Source: Previous EC issued from MPSEIAA, Bhopal vide letter no. 1309/EPCO-SEIAA/12 dated 14.03.2012 and vide letter no.-7305/SEIAA/2015 dated 06.11.2015

- The total land of the project is 3,26,404 Sq.m land. No Additional land is required for the proposed expansion as open area in existing land will be used for proposed expansion.
- The earlier EC details are as under:

S. No.	Particular	Letter no.	Grant on
1.	Environmental clearance granted for unit II by MPSEIAA, Bhopal	1309/EPCO-SEIAA/12	14.03 2012
2.	Environmental clearance granted for unit III for existing capacity, MPSEIAA, Bhopal	7305/SEIAA/2015	06.11.2015

iv.	List of raw materials required and their source along with mode of transportation.	List of raw materials required and their source along with mode of transportation are as under.

S. No	Product	Raw Material	Quantity (MTPA)	Storage	Source & Mode of transportation
1.	Phosphoric acid	Rock, phosphate (20%-30%)	3,50,000	Covered shed having capacity of 10,000 MT	Imported & by Road
		Sulphuric acid (98%)	2,80,000	MS Tank of cap. 1000MT	
		Water	4,66,700	--	Closed Pipeline
2.	LABASA & Allied products	Linear Alkaline Benzene (LAB)	22,000	MS Tank of cap.500MT	Indigenous & by Road
		Sulphuric acid	33,000	MS Tank of cap. 500 MT	
		Water	1,650		Closed Pipeline
3.	Zinc Sulphate (Mono)13200 MTPA	Zinc ash (30% - 70%)	6,547	Covered shed	By Road
		Sulphuric acid (70% - 98%)	7,300	MS Tank of cap.100MT	In-house Production

		Water	10,500	--	Closed Pipeline
4.	DAP/NPK 330000 MTPA	Ammonia (99.50%)	72,600	Doubled wall storage tank 4 nos. each cap.100 MT (*) and 2 nos. each cap. 1000 MT	Imported or Indian Market from GNFC, NFL etc. / Ammonia tanker & By Road
		$H_3PO_4$100 %	1,53,450	MS Tank with rubber lining of cap. 5000 MT	Indigenous & by Road
		H_3PO_4 54%	2,84,167	MS Tank with rubber lining of cap. 5000 MT	
		MoP	30,000	Covered shed of cap. 1000 MT	
		H_2SO_4(98%)	13,200	MS Tank of cap 500 MT	
		Filler	19,800	Covered shed / open yard having capacity of of cap. 1000 MT	
5.	Gypsum granular 1,00,000 MTPA	Gypsum	1,25,000	Covered shed of cap. 5000 MT	Indigenous & by Road
		Coating oil	50	HDPE Tank of cap. 10KL	
		Water	5,000	--	Closed Pipeline
6.	Sulphuric acid 1,00,000 MTPA	Sulphur (99.5%) purity	65,600	Open yard of cap. 5000 MT	Indigenous & by Road
		Water	3,42,000	--	Closed Pipeline
7.	Vinyl Sulphone2,400 MTPA	Chlorosulphonic acid	3,755	MS Tank of cap. 50MT	Indigenous & by Road
		Acetanilide	1,252	Covered shed 200mt	
		Sodium bi sulphate	294	Covered shed	
		Caustic lye	2,003	Covered shed	
		Ethylene oxide	660	MS tank 50 MT	
		Thionyl chloride	1,127	MS tank 50 MT	
8.	Ammonia 1,00,000 MTPA	NG	1,05,000	-	Atmosphere/ Transportation not required
		Methane (CH4)	70,600	MS tank dome type 1000 MT	Indigenous & by Road

9.	Nitric acid 66,000 MTPA	NH_3	11,250	Double wall storage tank Cap 100 MT(*)	Indigenous & by Road
		Air	1,00,560	--	Atmosphere/ Transportation not req2uired
		Water	18,900	--	Closed Pipeline
10.	Calcium Nitrate& Fortified 66,000 MTPA	Lime (Calcium Carbonate)	52,800	Covered shed of cap.500 MT	Indigenous & by Road
		Nitric Acid	73,920	HDPE Tank / MS Tank with rubber lining of cap.100 MT	
		Water	13,200	--	Closed Pipeline
11.	Sulphate of potash 19,800 MTPA	Murite of Potash	19,935	Covered shed of cap. 500 MT	Indigenous & by Road
		Sulphuric Acid	7,114	Covered shed	In house production

v.	Other chemicals and materials required with quantities and storage capacities	Other chemicals and materials required with quantities and storage capacities are as under:-

S. No.	Chemicals	Quantity	Storage
1.	H_2SO_4	2,00,000	Open yard of cap. 5000 MT

vi.	Details of Emission, effluents, hazardous waste generation and their management.	Details of emissions, effluent and hazardous waste generation and their management are given below:

Air Emissions	Major air emissions from the proposed expansion project are of PM, SO_2, NOx and CO_2.	**Management**
	Single super phosphate plant • Emission of fluoride compounds from acidulation of rock phosphate • Dust emission from rock grinding and handling section • During curing of the product, dust and fluoride compounds are released	• Stack with 50m height is provided • Four Stage Scrubbing Four stage scrubbing system with water spray in 3 and caustic in 1. • Bag Filter at Ball Mill is/will be provided.

		Gypsum Granular plant • Dust emission from granular unit	• Stack with 50m height will be attached Coal fire furnace stack • Cyclone dust collector is/will be provided.
		Ammonia Plant: • Flue gas containing mainly CO_2, SO_2, NOx and particulate from primary reformer stack • CO_2 • Purge gas from synthesis gas section • H_2S from reaction wash unit	• Stack with 50m height will be attached to Primary Reformer Stack and Scrubbed gas stack separately.
		Sulphuric acid Plant • Off gases containing acid mist and SO_2 from the absorption tower stack	• Stack with 50m height is attached to Absorption Tower Stack
		Phosphoric acid Plant • Dust from rock handling and grinding section • Fluoride compounds emitted from fume scrubbers	• Stack with 20m height is attached to Rock grinding section and Stack with 40m height is attached to Gas Scrubber • Bag Filter is/will be provided at Ball mill
		Nitric Acid Plant • NOx bearing gas emitted from absorption tower stack	• Stack with 50m height is attached to Absorption Tower Stack
		NH_3 (Ammonia) Plant • Rock Phosphate dust from grinding mill • NOx, F and dust from reaction vessel • NH_3 from calcium nitrate tetra-hydrate section, acid neutralization, product cooling section, drying section, etc.	Stack with 50m height attached to-- • Primary Reformer Stack • Scrubbed gas stack
		DAP Plant • NH_3 and small quantity of fluoride compounds from neutralization and granulation operation • Dust emission from drying, screening and cooling section	• Stack with 50m height is attached to Ammonia Scrubber • Stack with 50m height is attached to HF gas scrubber • Stack with 30m height is attached to Coal fire furnace
		NPK Plant	

		• Dust from drying, screening and cooling section • Fluoride compounds & ammonia • fumes from neutralization and granulation operation	
		Steam and Power Generation • Flue gas discharged through the boiler house stack; may contain particulate matter, NOx, SO_2, etc., depending up on the fuel used like coal, NG, F.O/naphtha, etc. • PM, SOx, and NOx will be generated from DG set	• Stack with 50m height is attached to boiler house stack • Adequate Stack height 30m is attached to DG set having capacity of 875kVA and DG set having capacity of 1000kVA
	Effluent	Domestic waste water (15KLD) generated from plant and will be treated in STP based on MBBR technology with 20 KLD capacity. The total industrial waste water generation will be 119 KLD which will be treated in the existing Effluent treatment Plant of 120 KLD capacity.	STP treated water will be utilized in greenbelt development/plantation. ETP Treated water will be reused in various processes like Chilling Plant make, Floor washing, Dust suppression and green belt development etc.
	Hazardous waste	The details of Hazardous waste generation existing as well as proposed and their storage, utilization and disposal is given as under:	

Particular	Hazardous waste Quantity				Treatment Disposal
	Type of waste	Existing	Proposed	Total	
	Used Oil Category 5.1 (Consent No. AWH - 47347 & 45474)	278 Litre	500 Litre	778 Litre	Stored in drums and reuse for lubricating the open chain/ gear /roller etc.

			Hazardous Waste	Silica (Annexure II in Form-4 (19-20)	119 MT	None	119 MT	Recycle in SSP manufacturing as filler.
				H_2SiF_6 (Annexure II in Form-4 (19-20)	6466 MT (liquor)	None	6466 MT (liquor)	Recycle in SSP manufacturing for acid dilution purpose.
				Zinc Sludge from Zinc Sulphate	None	300MTPA	300MTPA	It will be reuse in SSP.
				Sludge (Schedule I category 26.2) from DAP/NPK ,Ammonia and Nitric Acid Plant	None	50MTPA	50MTPA	It will reuse in SSP
				Sludge (Schedule I category 26.2) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
				MEE Salt (Schedule I category 26.1) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
				Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP
				Vanadium Pentoxide Catalyst Waste from SAP	None	2 MTPA	2 MTPA	Stored and disposed through registered recycler only..
				Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP

vii.	Requirement of water, power, with source of supply, status of approval, water balance diagram, man-power requirement (regular and contract)	**Water:** Total water requirement for the project is 3,395KLD, out of which the fresh water demand will be 3,276 KLD and recycled water demand will be 119 KLD. Detailed water balance is elaborated in chapter 2.

S. No	Particulars	Fresh Water	Waste water	Total
1.	Industrial	3258 KLD	107 KLD	3365 KLD
2.	Domestic	18 KLD	12 KLD	30 KLD
	Total	**3276 KLD**	**119 KLD**	**3395 KLD**
Source: Surface Water from Banda Irrigation Project, Sagar				

Approval: The approval for surface water supply to the tune of 1.018m.cum per Annum has obtained from office of Chief Engineer and Member of Secretary, Water Resources Department Bhopal (M.P.) vide letter no. 537 dated 23.10.2020. Copy of Letter is enclosed as **Annexure – V**

Water Balance diagram has been given in Chapter – II, Sub-Section-2.5.2 of EIA/ EMP Report.

Power requirement: The existing and proposed power demand is given below:

Particular	Existing	Proposed	Total
Power Demand	**1200 KW**	**8050 KW**	**9250 KW**
Back -up	DG Set (1 No.) - 875kVA	DG Set (1 No.) 1000kVA.	DG Set (1 No.) 875 kVA DG Set (1 No.) 1000 kVA Total - DG Set (2Nos.)
Source: MPSEB Supply (**Annexure-IV)**			

Man-power requirement:

Construction Phase	**100 nos.**	
Operation Phase		
Existing	**235**	Local people will be given employment
Proposed	**146**	
Total	**381**	

<table>
<tr><td>viii.</td><td>Process description along with major equipments and machineries, process flow sheet (quantative) from raw material to products to be provided</td><td>Process description along with major equipment's and machineries, process flow sheet are given in Chapter- II, Sub section of EIA/EMP Report.</td></tr>
<tr><td>ix.</td><td>Hazard identification and details of proposed safety systems.</td><td>Hazard identification and details of proposed safety systems are given in Chapter- VII, Sub section 7.2 of EIA/EMP Report.</td></tr>
<tr><td>x.</td><td colspan="2">Expansion/modernization proposals</td></tr>
<tr><td>a.</td><td>Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF/SEIAA shall be attached as an Annexure. A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment and Forests as per circular dated 30th May, 2012 on the status of compliance of conditions stipulated in all the existing environmental clearances including Amendments shall be provided. In addition, status of compliance of Consent to Operate for the ongoing I existing operation of the project from SPCB shall be attached with the EIA-EMP report.</td><td>Copy of all the previous granted Environmental Clearance(s) enclosed as are as under
<table>
<tr><th>S. No.</th><th>Particular</th><th>Letter no.</th><th>Annexure No.</th></tr>
<tr><td>1.</td><td>Environmental clearance granted for unit II by MPSEIAA, Bhopal</td><td>1309/EPCO -SEIAA/12 dated 04.03.2012</td><td>V</td></tr>
<tr><td>2.</td><td>Environmental clearance granted for unit III for existing capacity, MPSEIAA, Bhopal</td><td>7305/SEIA A/2015 dated 06.11.2015</td><td>V</td></tr>
</table>
➢ Consent to operate has been obtained from MPPCB vide letter no, AW-51218 (BRP),AW-50749(SAP & Oleum) and AW-51758 (GSSP/SSP) .dated 27.02.2020(BRP), 20.11.2019 (SAP & Oleum), 30.06.2020 (GSSP/SSP) and enclosed as **Annexure- VI**
The Monitoring report (Air) from the SPCB, Regional Office, Sagar has been obtained vide letter no. 205/R.O/Sci/PCB/19 Sagar dated 30.05.2019. Copy of the same is enclosed as **Annexure-VII**</td></tr>
</table>

<table>
<tr><td>b.</td><td>In case the existing project has not obtained environmental clearance, reasons for not taking EC under the provisions of the EIA Notification 1994 and/or EIA Notification 2006 shall be provided. Copies of Consent to Establish/No Objection Certificate and Consent to Operate (in case of units operating prior to EIA Notification 2006, CTE and CTO of FY 2005-2006) obtained from the SPCB shall be submitted. Further, compliance report to the conditions of consents from the SPCB shall be submitted.</td><td>This is an existing project. Environmental clearance granted as under: -
<table>
<tr><th>S. No.</th><th>Particular</th><th>Letter no.</th><th>Annexure No.</th></tr>
<tr><td>1.</td><td>Environmental clearance granted for unit II by MPSEIAA, Bhopal</td><td>1309/EPCO-SEIAA/12 dated 04.03.2012</td><td>V</td></tr>
<tr><td>2.</td><td>Environmental clearance granted for unit III for existing capacity, MPSEIAA, Bhopal</td><td>7305/SEIAA/2015 dated 06.11.2015</td><td>V</td></tr>
</table></td></tr>
<tr><td>4.</td><td colspan="2">Site Details</td></tr>
<tr><td>i.</td><td>Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.</td><td>Location: Plot No.A-1& A-2, Sorai Industrial Area, village–Sorai, Tehsil Banda, District Sagar, Madhya Pradesh.
Justification for site selection: No additional site was identified as it is an expansion project within the same premises. No additional land is required for the proposed expansion.</td></tr>
<tr><td>ii.</td><td>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)</td><td>A toposheet of the study area of radius of 10 Km and site location on 1:50,000 on an A3 sheet including all eco-sensitive area is enclosed as Annexure - VII.</td></tr>
</table>

iii.	Details w.r.t. option analysis for selection of site	No alternative site was identified as it is an expansion project within the same premises. No additional land is required for the proposed expansion.
iv.	Co-ordinates (lat-long) of all four corners of the site.	Co-ordinates (latitude and longitude) of all four corners of the site are as under:-

1.Point 1	2.Point 2
Latitude-24^0 35’ 2.05” N Longitude-73^0 45’ 5.24” E	Latitude-24^0 35’ 57.95” N Longitude-73^0 45’ 4.06” E
3.Point 3	**4.Point 4**
Latitude-24^0 34’ 58.94” N Longitude-73^0 44’ 58”44 E	Latitude-24^0 35’ 3.09” N Longitude-73^0 44’ 59.58” E

v.	Google map-Earth downloaded of the project site.	Google earth downloaded map is enclosed as **Annexure IX**.
vi.	Layout maps indicating existing unit as well as 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.	Layout map showing various areas including storage area, plant area, greenbelt area, utilities etc is enclosed as **Annexure X**. The industry is located in declared industrial area, the industrial map showing the unit location is enclosed as **Annexure-** XI
vii.	Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of plantation/greenbelt, in particular.	Photographs showing existing and proposed plant site are enclosed as **Annexure –XII** Photographs showing the existing plantation/ greenbelt at project site are enclosed as **Annexure XIII**.
viii.	Landuse break-up of total land of the project site (identified and acquired), government/ private – agricultural, forest, wasteland, water bodies, settlements, etc shall be included. (not required for industrial area)	The total acquired land for the project is 80.65 acre (3,26,404 sq. m.), No additional land is required for the proposed expansion. Land use breakup is given in chapter 2.

Table: Land use break-up of total land of the project site

Classes	Area (Ha.)	Area (Sq. Km)	Area (%)

Crop Land	11,910.36	119.1036	37.91	
Open Land	5,711.42	57.1142	18.18	
Hilly & Stony Land	5,427.46	54.2746	17.28	
Fallow Land	3,291.27	32.9127	10.48	
Tree Cover	2,984.02	29.8402	9.50	
Water Body	1,139.89	11.3989	3.63	
Built Up Land	952.545	9.52545	3.03	
Total	**31,416.965**	**314.16965**	**100**	

ix.	A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area.	The industry is located in declared industrial area, the industrial map showing the unit location is enclosed as **Annexure- XI** Land use details of the study area are given at TOR point No. viii as above.
x.	Geological features and Geo-hydrological status of the study area shall be included.	Geological features and Geo-hydrological status of the study area is enclosed as has been given in Chapter 3
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)	This is a Brownfield project. There is no water body within 1 km of radius of the project site. Bewas River is 3.9 km towards ESE.
xii.	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	Not Applicable. The land is already acquired by the Madhya Bharat Agro Products Limited. No additional land is required for the proposed expansion. Copy of lease deed is enclosed as **Annexure I.**
xiii.	R&R details in respect of land in line with state Government policy.	R&R is not applicable as this is existing project. No additional land is required for the proposed expansion hence it is not applicable.
5.	**Forest and wildlife related issues (if applicable):**	

i.	Permission and approval for the use of forest land (forestry clearance), if any, and recommendations of the State Forest Department. (if applicable)	No forest land is involved in the proposed project.
ii.	Land use map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (in case of projects involving forest land more than 40 ha)	Land use map based on High Resolution Satellite Imagery (GPS) of the proposed expansion project is enclosed as **Annexure – XIV** No forest land is involved in the proposed expansion project.
iii.	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.	Not applicable.
iv.	The projects 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 these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden-thereon.	There is no National Parks, Sanctuaries, Biosphere Reserves, and Migratory Corridors of Wild Animals within 10 Km radius from the proposed expansion project.
v.	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.	There are three Schedule I species was found during the biological study as given below:- **S. No.** / **Name of the Specie** / **Zoological Name** 1. *Pavo cristatus* – Peacock 2. *Cuon alpinus* – Dhole Or Asian Wild Dog

		3. *Melursus ursinus* — Common Sloth Bear Conservation plan of Schedule I species has been been prepared and enclosed as **Annexure- XV**
vi.	Copy of application submitted for clearance under the Wildlife (Protection) Act, 1972, to the Standing Committee of the National Board for Wildlife.	Not applicable
6.	**Environmental Status**	
i.	Determination of atmospheric inversion level at the project site and site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall.	The mixing height data (atmospheric inversion level) at the region was taken from the data published by CPCB Probes/982002-03-Spatial Distribution of Hourly Mixing Depth Over Indian Region. Site-specific micrometeorological data using temperature, relative humidity, hourly wind speed and direction and rainfall was obtained from an automated weather station installed at the site during monitoring in Post Monsoon Season (October' 2019 to December' 2019). Enclosed as **Annexure-VII**
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	One – season data i.e. Post Monsoon (October, November and December' 2019) was collected for the parameters of PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO. AAQ Monitoring reports are enclosed as **Annexure- VII**

	zone and sensitive receptors including reserved forests.	The monitoring stations were selected taking into account the dominant wind direction, population zone and sensitive receptors etc. The monitoring station selected is as described under:-

S. No.	Monitoring location	W.r.t project site		Remarks
		Distance (Km)	Direction	
1.	Project site (Near admin Block)	-	-	--
2.	Banda	4.2	NE	
3.	Dilakhedi	1.7	ENE	
4.	Fatehpur Village	2.3	SE	
5.	Chhapri	7.4	SSW	
6.	Salaiya Ford	3.9	WSW	
7.	Khandari	4.8	WSW	
8.	Kanti	2.5	NNW	

iii.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM 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.	Raw data of all AAQ measurement for 12 weeks of all stations as per frequency given in the NAQQM Notification of November 2009 along with - min., max., average and 98% values for each of the AAQ parameters from data of all AAQ station has been given in Chapter – 3, Sub Section –3.4.2, Table No. – 3.7 of Final EIA/ EMP report. AAQ Monitoring reports are enclosed as **Annexure- VII**
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.	Three surface water samples were collected as grab sample and analyzed for various parameters as per CPCB/ MoEF&CC guidelines. Surface water monitoring results and their analysis are given in Chapter – III, Sub Section –3.5.3 Table No. – 3.10 of EIA/ EMP Report. Surface Water Monitoring report is enclosed as **Annexure- VII**

v.	Whether the site falls near to polluted stretch of river identified by the CPCB/MoEF&CC, if yes give details.	The proposed expansion project does not falls near to polluted stretch of river identified by the CPCB/ MoEF&CC, New Delhi.
vi.	Ground water monitoring at minimum at 8 locations shall be included.	Eight locations of ground water samples were collected and analyzed for various parameters as per CPCB/ MoEF&CC guidelines. The analysis has been given in Chapter – III, Sub Section – 3.5.2, Table No. – 3.9 of EIA/ EMP report. Monitoring report is enclosed as **Annexure- VII**
vii.	Noise levels monitoring at 8 locations within the study area.	Noise level monitoring was carried out at eight locations within the study area during as per CPCB/ MoEF&CC guidelines. The analysis has been given in Chapter – III, Sub section– 3.6, Table No. – 3.12 of EIA/ EMP Report. Monitoring report is enclosed as **Annexure- VII** .
viii.	Soil Characteristic as per CPCB guidelines.	Soil sampling was carried out at eight locations within the study area as per CPCB guidelines and analysis reports are enclosed as **Annexure- VII**
ix.	Traffic study of the area, type of vehicles, frequency of vehicles for transportation of materials, additional traffic due to proposed project, parking arrangement etc	Traffic study of the area is detailed in Chapter –VII, Sub section of EIA/EMP Report.
x.	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	The study of flora and fauna (terrestrial and aquatic) existing in the study area is given in Chapter -III, Sub – section 3.9 of EIA/ EMP Report. The brief of flora and fauna species are given below:-

	are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	**Core Zone** **Flora** Tree: 6 Species Shrubs: 4 Species Herbs: 3 Species Grasses: 3 Species **Fauna** Avifauna: 5 Species Mammalia: 2 Species Amphibian: 1 Species Reptiles: 4 Species **Buffer Zone** **Flora** Tree: 35 Species Shrubs: 19 Species Herbs & Grasses: 32 Species **Fauna** Avifauna: 32 Species Mammalia: 11 Species Amphibian: 8 Species Reptiles: Butterflies: Conservation plan of Schedule I species Sloth Bear, Peacock and Asian Dog has been prepared and enclosed as **Annexure-XV**
xi.	Socio-economic status of the study area.	Socio-economic status of the study area is given in Chapter-III Sub section- 3.8 of EIA/EMP Report.
7.	**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 modelling 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.	In order to predict the particulate emissions, AERMOD CLOUD Version 8.9.0 dispersion model based on study state Gaussian Plume Dispersion was for Air Quality Modeling. The inputs required for the model are:- • Hourly Meteorological Data. • Source Data • Receptor Data • Programme Control Parameters – Topography, Elevation, Terrain etc. The detail has been given in Chapter- IV, Sub- Section - 4.4 of EIA/ EMP Report.
ii.	Water Quality modelling - in case of discharge in water body	Not applicable as unit is /will be maintained zero liquid discharge.
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 or convey or cum-rail transport shall be examined.	There is/will be no major impact of transport of the raw materials and end products on the surrounding environment due to proposed expansion project as suitable mitigation measures is being/will be adopted. • All vehicles for transport of the raw materials and end products is/will have valid PUC registration. This is/will be checked periodically. • The impact of the transport of the raw material and end products on the

		surrounding environment has been assessed as a Line Source Emissions.
iv.	A note on treatment of wastewater from different plant operations, extent recycled and reused for different purposes shall be included. Complete scheme of effluent treatment. Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E (P) Rules.	• Treatment of waste water balance from different plant operations, extent recycled and reused for different purposed has been given in Chapter – II, Sub-Section-2.5.2 of EIA/ EMP Report. • Approx.119 KLD water will be recycled and reused in plantation and dust suppression and general cleaning. • The complete scheme of effluent Treatment Plant has been given in Chapter 4 of EIA/ EMP Report. Photographs showing Effluent Treatment Plant is enclosed as **Annexure XVI** • Characteristics of untreated and treated effluent to meet the prescribed standards of discharge under E(P) Rules has also been given in Chapter 4 of EIA/ EMP Report.
v.	Details of stack emission and action plan for control of emissions to meet standards.	Details of stack emission and action plan are provided in Chapter 2 & 4. The photographs showing stacks are enclosed as **Annexure-XVII**

Existing Stack details

S. No.	Existing Product	Detail (process stage involving stack)	Stack (nos.)	Stack Height (m) and Dia	Velocity m/s	Tempt
I	**Process**					
1.	Single Super Phosphate (SSP)	Process stack (scrubber stem)	01	50 X 1.00	7.5	45
2.	Synthetic Gypsum					
3.	Tripple Super Phosphate					

4.	Granular SSP (GSSP)	Process stack	01	40 X 0.60	8.5	60
5.	Phosphoric Acid (PA)	Process stack	01	40 X 1.5	5.5	55
6.	Beneficiated Rock Phosphate (BRP)	No Stack	-	-		
7.	Sodium Silica Fluoride (SSF)	Plant not installed	-	-		
8.	Ball Mill	No stack				
II	**DG Set**	Capacity: 875 KVA	01	5 X 0.20	16.13	280

Proposed Stack Details

S. No.	Plant	No. of stack	Stack attached to	Stack Height (m)
1.	Ammonia Plant	1	Primary Reformer Stack	50
		1	Scrubbed gas stack	50
2.	Sulphuric Acid	1	Absorption Tower Stack	50
3.	Phosphoric acid	1 1	Rock grinding section Gas Scrubber	20 40
4.	Nitric acid	1	Absorption Tower stack	50
5.	DAP/NPK Complex fertilizer plant	1	Ammonia Scrubber	50
		1 1	HF gas scrubber Coal fire furnce	50 30
6.	Zinc Sulphate	1	Process stack	30
7.	Calcium Nitrate	No		
8.	Gypsum Granular plant	1	Coal fire furnace stack	30
9.	LABSA Plant	No		
10.	Sulphate of potash	No		
11.	Vinyl Sulphone	1 1	Sulphonation Reduction	15
12.	Power	1	boiler house stack	30
13.	DG Set	1	Capacity 1000kVA	30 m

vi.	Measures for fugitive emission control	To control the fugitive emissions from the process in the plant following measures is being/will be adopted: - • Good House-keeping is/will maintain. • Regular water sprinkling is /will be done. • Transportation vehicles will be covered from tarpaulin sheet. • Internal paved road is/will be constructed. • Green area (33.03% at present) along the road side, plant periphery and within the

		plant premises and 36% area is proposed under the greenbelt plantation. • The action plan to achieve the 36% Green area is given in Chapter 4 EIA/EMP report.
vii.	Details of hazardous waste generation and their storage, utilization and management. Copies of MOU regarding utilization of solid and hazardous waste in cement plant shall also be included. EMP shall include the concept of waste-minimization, recycle/reuse/recover techniques, Energy conservation, and natural resource conservation.	The details of Hazardous waste generation existing as well as proposed and their storage, utilization and disposal is given as under:

Particular	Hazardous waste Quantity				Treatment Disposal
	Type of waste	Existing	Proposed	Total	
Hazardous Waste	Used Oil Category 5.1 (Consent No. AWH -47347 & 45474)	278 Litre	500 Litre	778 Litre	Stored in drums and reuse for lubricating the open chain/ gear /roller etc.
	Silica (Annexure II in Form-4 (19-20)	119 MT	None	119 MT	Recycle in SSP manufacturing as filler.
	H_2SiF_6 (Annexure II in Form-4 (19-20)	6466 MT (liquor)	None	6466 MT (liquor)	Recycle in SSP manufacturing for acid dilution purpose.
	Zinc Sludge from Zinc Sulphate	None	300MTPA	300MTPA	It will be reuse in SSP.
	Sludge (Schedule I	None	50MTPA	50MTPA	It will reuse in SSP

	category 26.2) from DAP/NPK ,Ammonia and Nitric Acid Plant				
	Sludge (Schedule I category 26.2) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	MEE Salt (Schedule I category 26.1) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP

viii.	Proper utilization of fly ash shall be ensured as per Fly Ash Notification, 2009. A detailed plan of action shall be provided.	Not applicable
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.	The existing unit has already developed approximately 33.03% (107800Sq.m) of green belt of total land area (3,26, 404 Sq.m). After proposed expansion additional 9700 Sq.M green belt will be developed approximately 2.97% (Sq.m). Landscape plan for the green belt development is enclosed as **Annexure XVII.** Action Plan for Green Belt development with budgetary allocation is given as under:

Description	Existing (Sq.M.)	Proposed (Sq.M.)	Total (Sq.M.)
Total area of Green belt	107800	9700	89.033
Percentage of Total Project area	33.03%	2.97%	36%
No. of Plants	5000	9000	14000
Funds allocated (Rs. In Lacs)	30.0	34.5	64.5

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.	Details of Rain water harvesting structures along with the ground water recharge proposal is provided in Chapter-4
xi.	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	Total capital cost and recurring cost/annum for environmental pollution control measures is given below:

S. No.	Pollution control system	Existing		Proposed	
		Capital Cost (Rs. In Lacs)	Recurring Cost (Rs. In Lacs)	Capital Cost (Rs. In Lacs)	Recurring Cost (Rs. In Lacs)
1.	Air pollution control (Bag Filter, Stack, Scrubber, CEMS, WHRB)	130	50	320	32.0
2.	Water pollution control (Expansion of ETP, Installation of STP, Online effluent Monitoring System, MEE)	25.0	2.5	536	53.0
3.	Noise pollution control (Acoustic Enclosure to Machinery)	10	5.0	20.0	2.00
4.	Waste Management (Solid and Hazardous Waste)	4.0	0.40	25.0	2.50

5.	Rainwater harvesting system and Storm water drainage system (Piezometer, RWH pit)	7.0	0.70	90.0	1.0
6.	Environment lab and Env. monitoring	30	10	60.0	15.0
7.	Occupational Health (PPE, Medical Examination)	20	5.0	30.0	6.0
8.	Firefighting system	5.0	1.0	200	2.0
9.	Green Belt/Landscaping	30	5.0	100	20.0
10.	Conservation Plan for Schedule I Species (for 3 Species)	-	-	55.0	5.0
	Total	**261**	**79.6**	**1436**	**138.5**

xii.	Action plan for post-project environmental monitoring shall be submitted.	Action plan for post-project environmental monitoring is elaborated in Chapter –66 of EIA/EMP Report.
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.	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control is elaborated in Chapter VII, 6 in EIA/EMP Report. Onsite emergency plan is enclosed as **Annexure-XVIII.**
8.	**Occupational health**	
i.	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers.	Occupational health & safety plan of all contract and casual workers is given in Chapter –7 of EIAEMP Report.
ii.	Details of exposure specific health status evaluation of worker. If the workers' health is being evaluated by pre designed format, chest x rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other ocular defect) ECG, during pre	Occupational health records of workers of existing project are enclosed as **Annexure XIX.**.

	placement and Periodical examinations give the details of the same. Details regarding last month analyzed data of above mentioned parameters as per age, sex, duration of exposure and department wise.	
iii.	Details of existing Occupational & Safety Hazards. What are the exposure levels of hazards and whether they are within Permissible Exposure level (PEL). If these are not within PEL, what measures the company has adopted to keep them within PEL so that health of the workers can be preserved,	Health Occupational health records of workers of existing project are enclosed as **Annexure XIX.**.
iv.	Annual report of health status of workers with special reference to Occupational Health and Safety.	Health Occupational health records of workers of existing project are enclosed as **Annexure XIX.**
9.	**Corporate Environment Policy**	
i.	Does the company have a well laid down Environment Policy approved by its Board of Directors? If so, it may be detailed in the EIA report.	The company has a well laid down Environment Policy enclosed as **Annexure XX.**
ii.	What is the hierarchical system or Administrative order of the company to deal with the environmental issues and for ensuring compliance with the environmental clearance conditions? Details of this system may be given.	Hierarchical system or Administrative order of the company to deal with the environmental issues for ensuring compliance with the environmental clearance conditions is given in Chapter -X, of EIA/EMP Report.
iii.	Does the company have system of reporting of non compliances / violations of environmental norms to the Board of Directors of the company and / or	Management Representative will appraise the highest authority on quarterly basis regarding the performance of the plant on environmental measures.

	shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report.	
10.	Details regarding infrastructure facilities such as sanitation, fuel, restroom etc. to be provided to the labour force during construction as well as to the casual workers including truck drivers during operation phase.	Details of facilities provided to the workers are as given below:

S. No.	Facilities provided to the workers	Details	Budgetary Allocation (in Crore)
1.	Housing facilities (Nos. & types)	Rooms with toilets - 50 Nos; for employee Rooms for labours - 47 Nos.	2.0
2.	Fuel for cooking	Clean fuel for workers-LPG Gas	18 Lac
3.	Separate toilets for male and female workers	Toilets- 20 Nos. for male workers No female worker employee in the industry.	16 Lac
4.	Rest rooms/ Break out spaces	4 Rest room available in each plant	12 Lac
5.	Others	The company has a medical health check up every month and a dress is also provided once in a year.	--
6.		Eating and lodging arrangements are provided by the company to the Bachelor staff.	--
7.		The vehicle is arranged by the company for the employees who live outside the plant premises.	--
8.		Mask, sanitizer, hand washing system is being provided by the company to all employees at the time of Covid-19	--

11.	**Enterprise Social Commitment (ESC)**	
(i)	Adequate funds (at **least** 2.5 % of the project cost) shall be earmarked towards the Enterprise Social Commitment based on Public Hearing issues and item-wise details along with time bound action plan shall be included. Socio-economic	Total amount of Rs Rs.164.48Lacs will be spent under Corporate Environment Responsibility (CER. Corporate Environment Responsibility (CER) has been given in Chapter – 8 of EIA/EMP Report.

	development activities need to be elaborated upon.	
12.	Any litigation pending against the project and/or any direction/order passed by any Court of Law against the project, if so, details thereof shall also be included. Has the unit received any notice under the Section 5 of Environment (Protection) Act, 1986 or relevant Sections of Air and Water Acts? If so, details thereof and compliance/ATR to the notice(s) and present status of the case.	No litigation pending against the project or project proponent. Undertaking on non-judicial stamp paper for the same is enclosed as **Annexure-XXI**
13.	A tabular chart with index for points wise compliance of above TOR.	Complied with.
SPECIFIC TERMS OF REFERENCE FOR EIASTUDIES FOR CHEMICAL FERTILIZER		
i.	Details on requirement of energy and water along with its source and authorization from the concerned department.	Details on requirement of energy and water along with its source and authorization has been given in Chapter - II, Sub section….. of EIA/EMP Report.
ii.	Energy conservation in ammonia synthesis for urea production and comparison with best technology.	No urea production plant is proposed. Hence it is not applicable.
iii.	Details of ammonia storage and risk assessment thereof.	Details of Ammonia Storage along with risk assessment are given Chapter- VII of EIA/EMP Report.
iv.	Measures for control of urea dust emissions from prilling tower.	There is no production of urea in the unit.
v.	Measures for reduction of fresh water requirement.	Measures for reduction of fresh water requirement are given in chapter IV.

vi.	Details of proposed source-specific pollution control schemes and equipment's to meet the national standards for fertilizer.	The proposed source-specific pollution control equipment's are given below:

S. No.	Plant	No. of stack	Stack attached to	Stack Height (m)	Pollutant	Emission Rate
1	Ammonia Plant	1	Primary Reformer Stack	50	NOX	400 mg/Nm^3
		1	Scrubbed gas stack	50	NH_3	1.1 kg/ton
					SO_2	0.0288 kg/ton
2	Sulphuric Acid	1	Absorption Tower Stack	50	SO_2	02 kg/ton
					Acid Mist	0.064 kg/ton
3	Phosphoric acid	1	Rock grinding section	20	PM	125 mg/Nm^3
		1	Gas Scrubber	40	F	20 mg/Nm^3
4	Nitric acid	1	Absorption Tower stack	50	NOX	400 mg/Nm^3
5	DAP/NPK Complex fertilizer plant	1	Ammonia Scrubber	50	NH_3	150 mg/Nm^3
		1	HF gas scrubber	50	F	20 mg/Nm^3
		1	Coal fire Furnace	30	PM	125 mg/Nm^3
					NOX	400 mg/Nm^3
					SO_2	40 mg/Nm^3
6	Zinc Sulphate	1	Process stack	30	PM	125 mg/Nm^3
					NOX	400 mg/Nm^3
7	Gypsum Granular plant	1	Coal fire Furnace stack	30	PM	125 mg/Nm^3
					NOX	400 mg/Nm^3
					SO_2	40 mg/Nm^3
8	Vinyl Sulphone	1	Sulphonation	15	SO_2	40 mg/nm3
		1	Reduction	15	HCL	20 mg/nm3
9	Power	1	Boiler house stack	30	SO_2	600 mg/Nm^3
					NOX	300 mg/Nm^3
					PM	600 mg/Nm^3
10	DG Set	1	Capacity 1000 kVA	30 m	NOX	1440 mg/Nm^3
					PM	75 mg/Nm^3
					SO_2	0.05 % in HSD

1. The Environment (Protection) Third Amendment Rules 2002, at **Serial No. 17, 95 & 96,** under the Environment (Protection) Act, 1986
2. Ministry of Environment, Forest and Climate Change (MoEF&CC) General Statutory Rules (G.S.R.) 96(E) on 29th January 2018
3. USEPA AP 42 Manual – Chapter 8

vii.	Details of fluorine recovery system in case of phosphoric acid plants and SSP to recover fluorine as hydrofluorosilicic acid (H2SiF6) and its uses.	Details of fluorine recovery system in case of phosphoric acid plants and SSP to recover fluorine as hydrofluorosilicic acid (H_2SiF_6) and its uses are given in Chapter IV,.of EIA/EMP Report.

viii.	Management plan for solid/hazardous waste including storage, utilization and disposal of bye products viz., chalk, spent catalyst, hydro fluoro silicic acid and phosphor gypsum, sulphur muck, etc.	Management plan for solid/hazardous waste is given ToR compliance point no. 7
ix.	Details on existing ambient air quality for PM_{10}, $PM_{2.5}$, Urea dust*, NH_3*, SO_2*, NOx*, HF* ,F*, Hydrocarbon (Methane and Non-Methane) etc., and expected, stack and fugitive emissions and evaluation of the adequacy of the proposed pollution control devices to meet standards for point sources and to meet AAQ standards.(*as applicable)	Details on Ambient air quality parameters in and around study area has been in Chapter-3 of EIA/EMP Report. Ambient Air Monitoring report is enclosed as **Annexure VII.**
x.	Details on water quality parameters in and around study area such as pH, Total Kjeldhal Nitrogen, Free Ammonical Nitrogen, free ammonia, Cyanide, Vanadium, Arsenic, Suspended Solids, Oil and Grease, *Cr as Cr+6, *Total Chromium, Fluoride, etc.	Details on water quality parameters in and around study have been given in Chapter3, of EIA/EMP Report Copy of Water Monitoring report is enclosed as **Annexure VII**.

1.4.2 DETAILS OF REGULATORY COMPLIANCES:

Details of regulatory compliances with respect to the project are as under:

S. No.	Regulatory compliance	Details	Annexure
1.	Land Documents	Land was leased to Madhya Bharat Agro Products Limited by District Trade and industries center Sagar. M.P	**Annexure =I**
2.	Environmental Clearance	1309/EPCO-SEIAA/12 & 7305/SEIAA/2015	**Annexure -V**

		Dated 14.03.2012 & 06.11.2015	
3.	Consent to Establish		**Annexure -VI**
4.	Consent to Operate	Obtained vide letter dated • AW-51218 (BRP) • AW-50749(SAP & Oleum) • AW-51758 (GSSP/SSP) and valid up to • 31.03.2023 (BRP) • 31.10.2022 (SAP & Oleum) • 30.06.2021 (GSSP/SSP	**Annexure -VI**
5.	Authorization from MPSPCB to handle Hazardous waste	NO: /MPPCB/SGR	**Annexure-- XXIV**
7.	Approval of conservation plan for Schedule I fauna in study area	Prepared and will be submitted	**Annexure-XV**
8.	NOC Obtained vide letter no for tune of 660KLD NOC from CGWA for ground water abstraction Surface water Permission	Application for obtaining NOC submitted to CGWA Obtained vide letter no. 537 dated 23.10.2020	Copy of receipt enclosed as **Annexure ---XXII** **Annexure -V**
9.	Certified compliance report to the conditions laid in previous EC with ATR report	18-B-80/2020(SEAC)/803	Enclosed as **Annexure - XXIII**
10	Fire NOC	Vide mo.6000006251/FNOC/CIT/2020/8329 dated 23.07.2020	**Annexure -XXVI**

1.4.3 APPLICABLE RULES/REGULATION/ACTS

The applicable rules/Act/Regulation for carry out EIA/EMP study is given below:

- Environmental Protection Act 1986

- The Wildlife Protection Act, 1972
- The Forest Conservation Act, 1980
- The Air (Prevention and Control of Pollution) Act, 1981
- The Water (Prevention and Control of Pollution) Act, 1974
- Manufacture, Storage and Import of Hazardous Chemicals Rules 1989 (MSIHC Rules);
- Construction and Demolition Waste Management Rules 2016;
- Solid Waste Management Rules, 2016;
- Hazardous and Other Waste (Management and Transboundary Movement) Rules 2016, as amended in 2019
- E-Waste (Management) Rules 2016, as amended in 2018 (E-Waste Rules);
- Plastic Waste Management Rules 2016;

****

INDEX

2.1 TYPE OF PROJECT 42

2.2 NEED FOR THE PROJECT 42

2.3 Location 43

2.4 SIZE AND MAGNITUDE OF THE PROJECT 45

2.4.1 Land requirement 45

2.4.2 Existing and Proposed Production Details 45

2.4.3 Raw material details 46

2.4.4 Water Requirement 48

2.4.5 Power 49

2.4.6 Fuel Requirement 51

2.4.7 Steam Requirement 52

2.4.8 Manpower 52

2.5 MACHINERY DETAILS 53

2.6 PROPOSED SCHEDULE FOR APPROVAL & IMPLEMENTATION 73

2.7 TECHNOLOGY AND PROCESS DESCRIPTION 74

2.7.1 Manufacturing Process along with Material Balance 74

2.8 Mitigation Measures incorporated in proposed expansion project 113

2.9 ASSESSMENT OF NEW TECHNOLOGY & UNTESTED TECHNOLOGY 119

CHAPTER - II
PROJECT DESCRIPTION

2.1 TYPE OF PROJECT

The proposed project is for the expansion in existing capacity of fertilizer by addition of DAP/NPK Complex fertilizer, Phosphoric acid plant and addition of new chemical production unit (MBAPL Unit II).

As per EIA Notification dated 14th Sep, 2006 and its subsequent amendments in the year 1st December' 2009, 25th June' 2014 and 23rd November' 2016, "***All projects including all single super phosphate with H_2SO_4 production except granulation of chemical fertilizers***", the project falls under **Category "A" Project under Activity 5 (a)- Chemical Fertilizer.** Also Ammonia (anhydrous) is classified as straight nitrogenous fertilizer as per schedule to The Fertilizer (Control) Order 1985, (Order No. No.11-3/83-STU, SCHEDULE I [See Clause 2(h) & (q)], PG: 29, point no 7), Thus fall under activity Chemical Fertilizer.

*(*Ref: Amendment to the EIA Notification dated 1st December' 2009, 25th June' 2014 and 23rd November' 2016 enclosed as **Annexure ------).***

2.2 NEED FOR THE PROJECT

In the modern farming, the use of fertilizers becomes unavoidable .The Indian farmers are fully aware of the importance of fertilizers for the basic need of the farmers in the age of agricultural development .As per available statistics, India has increased the food grains production over the last five decades and along with other inputs, the fertilizers consumption per hector has also improved .Since the need is there and the scope is identified, the efforts in this field will further increase the consumption of fertilizers .

Need for the proposed products are based on the demand and supply gap in the current market. With increasing utilization of the current products, in future, to cater to the demand of all the products, it is essential to have the proposed expansion for existing manufacturing unit.

2.3 Location

The proposed expansion of the project site is coming up in the existing unit at Plot NoA-1, A-2, Saurai Industrial Area, village – Saurai, Tehsil Banda, District Sagar (M.P.). The geographical coordinates of the proposed expansion project is:

Latitude	24^0 35’ 2.05” N to 24^0 35’ 3.09” N
Longitude	73^0 45’ 5.24” E to 73^0 44’ 59.58” E

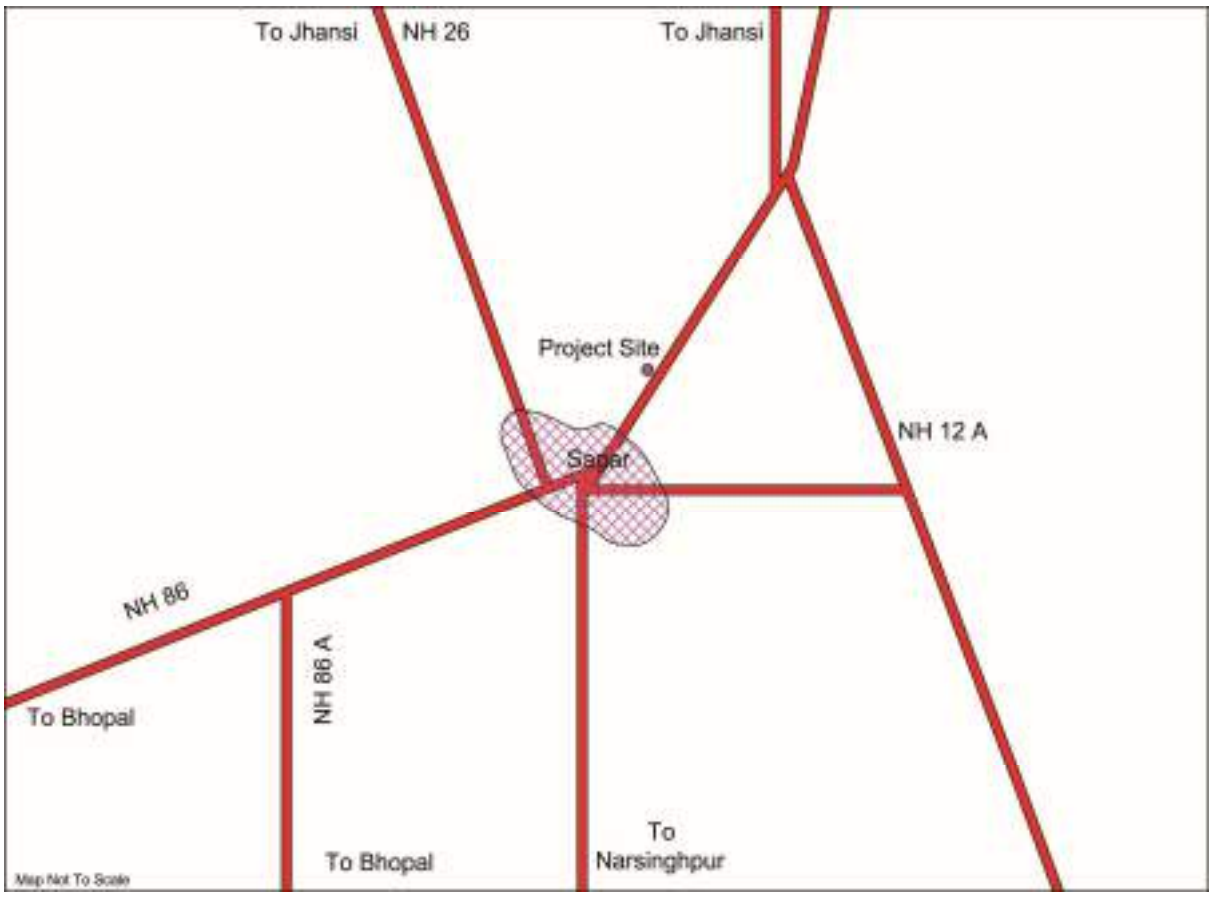


Figure 2.1: Location map

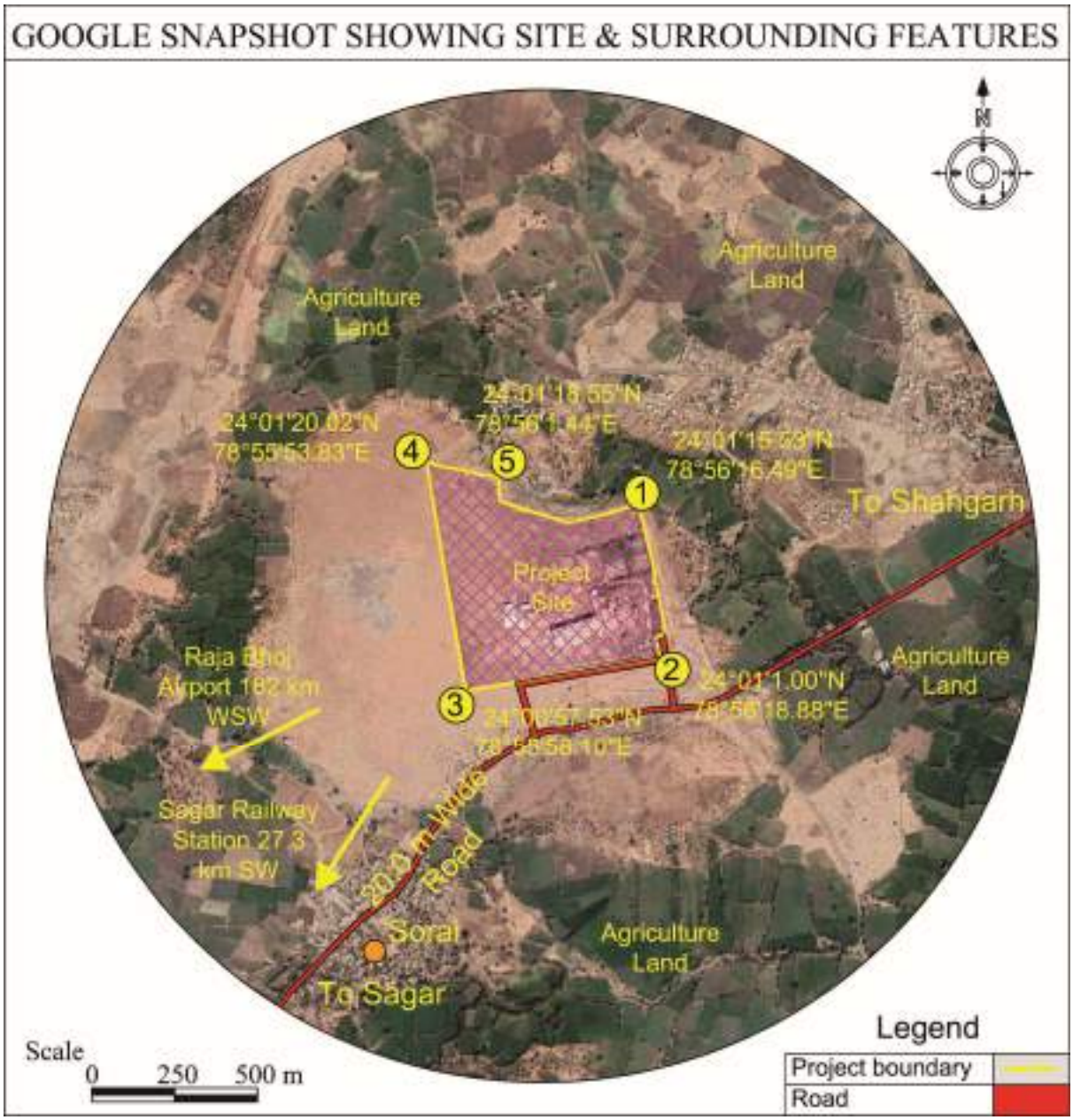


Figure 2.2: Google Map of project site with surrounding features

2.4 SIZE AND MAGNITUDE OF THE PROJECT

2.4.1 Land requirement

The proposed expansion project is located at Plot No.A-1& A-2, Saurai Industrial Area, Village - Saurai, Tehsil- Banda, District - Sagar, Madhya Pradesh by M/s Madhya Bharat Agro Products Limited (MBAPL). The proposed project is for expansion in production capacity of fertilizers by addition of DAP/NPK complex fertilizer, Phosphoric acid plant and new chemical production unit at its existing location. The plot area including existing and expansion land i.e. 80.65 acre (3, 26,404 sq. m.).

A detail of land use breakup for existing and proposed area is detailed as under:

Table 2.1: Existing and proposed land

S. No	Particulars	Existing Area (Sq. m.)	Proposed Area (Sq. m.)
1.	Plant Area, Office Area	55488	27773
2.	Paved Area (Road, Corridor, Parking and Drainage)	7560	4300
3.	Green Belt	107800	9700
4.	Open area for future expansion	155556	-41773
5.	**Total Area**	3,26, 404	41773

2.4.2 Existing and Proposed Production Details

The proposal involves enhancement in production capacity of fertilizers by addition of DAP/NPK Complex fertilizer, Phosphoric acid plant and addition of new chemical production unit (MBAPL Unit II).

The existing products and their capacity is given below:

Table 2.2: Existing EC Product details

S. No.	Product	Capacity
1.	Single Super Phosphate (SSP)	1,80,000 MTPA
2.	Granular SSP (GSSP)	1,80,000 MTPA
3.	Triple Super Phosphate (TSP)	66,000MTPA
4.	Synthetic Gypsum	1,65,000 MTPA
5.	Phosphoric Acid (PA)	19,800MTPA
6.	Beneficiated Rock Phosphate (BRP)	1,89,000MTPA

7.	Sodium Silica Fluoride (SSF)	1320 MTPA

Proposed production with their capacity

Table 2.3: Proposed Production details

S. No.	Proposed Product for Expansion	Capacity MTPA
1.	Phosphoric Acid	1,00,000
2.	LABSA Liner Alkyl Benzene Sulphonic Acid and other allied products (Alfa Olefin sulphonate (AOS), Sodium Lauryl Sulphate (SLS/ Primary Alcohol Sulphate (PAS), sodium lauryl ether Sulphate, liquid detergents, Household cleaners, Ammonium Lauryl Sulphates (ALS), Ammonium Lauryl ether Sulphates (ALES)	33,000
3.	Zinc Sulphate	13,200
4.	Di Ammonium Phosphate & Nitrogen and phosphorus complex (DAP/NPK Complex fertilizer) and water-soluble fertilizers & Fortified with Zinc, Boron, and Sulphur.	3,30,000
5.	Gypsum Granular	1,00,000
6.	Sulphuric Acid	2,00,000
7.	Vinyl Sulphone	2,400
8.	Ammonia	1,00,000
9	Nitric Acid	66,000
10.	Calcium Nitrate & Fortified with Zinc, Boron, and Sulphur.	66,000
11.	Sulphate of Potash (SOP)	19,800

2.4.3 Raw material details

Table 2.4: Raw Material details

S. No	Product	Raw Material	Quantity (MTPA)	Storage	Source & Mode of transportation
1.	Phosphoric acid	Rock, phosphate (20%-30%)	3,50,000	Covered shed having capacity of 10,000 MT	Imported & by Road
		Sulphuric acid (98%)	2,80,000	MS Tank of cap. 1000MT	

S. No	Product	Raw Material	Quantity (MTPA)	Storage	Source & Mode of transportation
		Water	4,66,700		Closed Pipeline
2.	LABASA & Allied products	Linear Alkaline Benzene (LAB)	22,000	MS Tank of cap.500MT	Indigenous & by Road
		Sulphuric acid	33,000	MS Tank of cap. 500 MT	
		Water	1,650		Closed Pipeline
3.	Zinc Sulphate (Mono)13200 MTPA	Zinc ash (30% - 70%)	6,547	Covered shed	By Road
		Sulphuric acid (70% - 98%)	7,300	MS Tank of cap.100MT	In-house Production
		Water	10,500		Closed Pipeline
4.	DAP/NPK 330000 MTPA	Ammonia (99.50%)	72,600	Doubled wall storage tank 4 nos. each cap.100 MT (*) and 2 nos. each cap. 1000 MT	Imported or Indian Market from GNFC, NFL etc. / Ammonia tanker & By Road
		$H_3PO_4$100 %	1,53,450	MS Tank with rubber lining of cap. 5000 MT	Indigenous & by Road
		H_3PO_4 54%	2,84,167	MS Tank with rubber lining of cap. 5000 MT	
		MoP	30,000	Covered shed of cap. 1000 MT	
		H_2SO_4(98%)	13,200	MS Tank of cap 500 MT	
		Filler	19,800	Covered shed / open yard having capacity of of cap. 1000 MT	
5.	Gypsum granular 1,00,000 MTPA	Gypsum	1,25,000	Covered shed of cap. 5000 MT	Indigenous & by Road
		Coating oil	50	HDPE Tank of cap. 10KL	
		Water	5,000	--	Closed Pipeline
6.	Sulphuric acid 1,00,000 MTPA	Sulphur (99.5%) purity	65,600	Open yard of cap. 5000 MT	Indigenous & by Road
		Water	3,42,000	--	Closed Pipeline

S. No	Product	Raw Material	Quantity (MTPA)	Storage	Source & Mode of transportation
7.	Vinyl Sulphone2,400 MTPA	Chlorosulphonic acid	3,755	MS Tank of cap. 50MT	Indigenous & by Road
		Acetanilide	1,252	Covered shed 200mt	
		Sodium bi sulphate	294	Covered shed	
		Caustic lye	2,003	Covered shed	
		Ethylene oxide	660	MS tank 50 MT	
		Thionyl chloride	1,127	MS tank 50 MT	
8.	Ammonia 1,00,000 MTPA	NG	1,05,000	-	Atmosphere/ Transportation not required
		Methane (CH4)	70,600	MS tank dome type 1000 MT	Indigenous & by Road
9.	Nitric acid 66,000 MTPA	NH_3	11,250	Double wall storage tank Cap 100 MT(*)	Indigenous & by Road
		Air	1,00,560	--	Atmosphere/ Transportation not req2uired
		Water	18,900	--	Closed Pipeline
10.	Calcium Nitrate& Fortified 66,000 MTPA	Lime (Calcium Carbonate)	52,800	Covered shed of cap.500 MT	Indigenous & by Road
		Nitric Acid	73,920	HDPE Tank / MS Tank with rubber lining of cap.100 MT	
		Water	13,200	--	Closed Pipeline
11.	Sulphate of potash 19,800 MTPA	Murite of Potash	19,935	Covered shed of cap. 500 MT	Indigenous & by Road
		Sulphuric Acid	7,114	Covered shed	In house production

2.4.4 Water Requirement

The project will utilize the Municipal/ground water. The daily consumption of water during operation phase will be about 3395 KLD of which 3276 KLD will be fresh water and 107 KLD will be treated water from ETP. Fresh water requirement of the

project will be met through municipal water supply. The details of water requirement are as follows:

S. No	Particulars	Fresh Water	Waste water	Total	Fresh Water KL P.A.
1.	Industrial	3258 KLD	107 KLD	3365 KLD	1075140
2.	Domestic	18 KLD	12 KLD	30 KLD	5940
	Total	**3276 KLD**	**119 KLD**	**3395 KLD**	**1081080**

Water Balance: The water is/will be used for different process is given below:

Table 2.5: Water Requirement details

S. No.	Product	Capacity	Water	Output					
		MT	Input	In Process	Gypsum	Evaporation	Effluent	Steam	Total
1	Phosphoric acid 100% P_2O_5	100000	1414	1045	225	119	25		1414
2	LABSA	33000	5	5					5
3	Sulphuric acid	200000	1036	120		215	9	692	1036
4	Dap	330000	0						0
5	Nitric acid	66000	165	60		85	20		165
6	Zinc sulphate	13200	32	2		30			32
7	Gypsum granular	100000	5			5			5
8	Ammonia	100000	470			200		270	470
9	Sulphate of potash	19800	75	6		61.5	7.5		75
10	Calcium nitrate	66000	40	20		10	10		40
11	Vinyl sulphone	2400	16			8.5	7.5		16
	TOTAL	**--**	**3258**	**1258**	**225**	**734**	**79**	**962**	**3258**

2.4.5 Power

The total connected load is 9250 KW (existing: 1200 KW; proposed: 8050 KW). The power supply is being drawn from the grid of Madhya Pradesh State Electricity Board (MPSEB).There will be power backup through D.G sets of cumulative capacity of 1875 kVA(1 No.) used in case of power cut or failure. DG set is/will be provided with an effective safe stack height for proper dispersion of pollutants that will keep the emissions

within the permissible limit. The fuel requirement will be about 3000 lt/day of HSD (as and when used).

Table 2.6: Power Requirement details

S. No	Particulars	Details	
		Existing	Proposed
1.	Electrical load demand	1200 KW (Present sanctioned load)	8050 KW
2.	Power Backup	875 kVA: 1 No.	DG Set of capacity 1000 kVA :1 No.
3.	Source of Supply	MPSEB Supply	

The detailed electricity used in machinery operation is given below:

S. No	Product	Electricity KWH	Steam quantity MT/Annum	Fuel Type	Fuel Quantity	Detail (name of machinery/equipment utilizing fuel)
1.	Phosphoric acid	3750	88880	Waste heat	No	Boiler
2.	LABASA & Allied products	60	NO			
3.	Zinc Sulphate	50	7000	Waste heat	No	Boiler
4.	DAP/NPK	1750	--	Steam coal	3300 MT	Hot Air Generator
5.	Gypsum Granular	225	-	Steam coal	3000 MT	Hot Air Generator
6.	Sulphuric acid	750	15000	Waste heat	No	Boiler
7.	Vinyl Sulphone	364	20000	Waste heat	No	Boiler
8.	Ammonia	525	No	--		
9.	Nitric acid	200	No	--		
10.	Calcium Nitrate	250	25000	Waste heat	No	Boiler
11.	Sulphate of potash	240	No	-		
Total		**8050**	**155880**			

D.G Set (Power Back Up)- Existing & Proposed

S.No	Particulars	Capacity	Number	Fuel	Quantity of fuel	Stack height	
						Above Roof	Above Ground

1.	D.G Set	875kVA(Existing) 1000 kVA(Proposed)	1 No. 1 No.	HSD	3000 lt/day/D.G set 3000 lt/day/D.G set	5m 6.3 m	30 m 30m

Stack height calculation for D.G Set of capacity 1000 kVA

Effective Stack Height (H) = Height of the building (h) + $0.2\sqrt{\text{Capacity}}$ of DG SET in kVA

= h+0.2 x (√1000)

= h+0.2 x 31.62m

= h+6.3m

However, safe stack height of 30 m will be provided as per the directions of CPCB.

i. Boiler

Boiler of capacity 10 TPH will be installed, details are as under:-

Particulars	Boiler	Boiler (Waste Heat Recovery)	APCM attached to
Number	Nil	1 No.	Multi cyclone (10,000cu.m)
Capacity	Nil	30 TPH	
Fuel	Nil	Waste heat from sulphuric acid plant will be utilized	
Fuel Consumption	Nil	-	--
Stack Height	No	-	----

2.4.6 Fuel Requirement

The proposed project will install a boiler and DG Set, for which the details of the fuel are as under:

Table 2.7: Fuel Consumption Details

Particulars	Number	Capacity	Fuel	Fuel Consumption

WHRB	1 No.	30 TPH	Waste heat from sulphuric acid plant will be utilized	Nil
Hot Air Generator in DAP/NPK	1 No.	--	Coal/bio-fuel/agro waste	500 kg/hr
Hot Air Generator in Gypsum Gr.	1 No.	--	Coal/bio-fuel/agro waste	30 kg/Ton
D.G Set	1 Nos.	1000 kVA	HSD	3000 lt/day/D.G set

2.4.7 Steam Requirement

Table 2.8: Fuel Consumption Details

Product	Steam quantity		Detail (Name of machinery/equipment utilizing Steam)
	(MTPA)	MT/Hr.	
Phosphoric acid	88,880	13.47	Boiler
Zinc Sulphate	7,000	1.06	Boiler
Sulphuric acid	15,000	2.27	Boiler
Vinyl Sulphone	20,000	3.03	Boiler
Calcium Nitrate	25,000	3.79	Boiler
Total Steam required	**1,55,880**	**23.62**	--
Less steam available from Sulphuric acid plant	2,00,000	30	-

2.4.8 Manpower

The manpower will be required in construction phase as well as in operational phase. The Manpower requirement will be as given below:

Manpower	Nos	Remarks
Construction Phase	**100 nos.**	
Operation Phase		
Existing	**235**	

Proposed	**146**	Local people will be given employment
Total	**381**	

2.5 MACHINERY DETAILS

1. Phosphoric Acid Plant

Machineries for 300 TPD Phosphoric Acid Plant			
Machine Name	**Specifications**	**Capacity**	**Qty**
Ball Mill consist liner, Feeder, Reducers, Girth Gear, Feed & Discharge Header&Sleves, Gear box, Discharge Screw, Trommel Screen, Motor+Gear Box, Air Blower etc.	6300X5000X4300	50MT/Hr	2
Air jet pulse bag filter including blower, Sleeves etc	--	14000M3/Hrs	2
Screw Conveyor	10 Mtr X 500X450mm Dia	60Mt/Hr	
Sulphuric Acid diluter	--	50 t/Hrs	2
Prayon Filter with Droplet & Mist Seprator, Filter Condenser, Acid EntrinmentSeprator, Acid Trap, Filter Pump	62m2 With 24 Filter Pans	25 MT/Hrs	2
Digestion Tank Slurry Pump, Hemi Circuit Wash Pump, Dehydration Tank Pump, HH Cake Wash Water Pump, Hot Well Tank Pump, Dh Filter Slurry Feed Pump, HH Recycle Acid Pump, HH Weak Filtrate Pump, Weak Acid Product Pump, Weak Acid Sludge Sump Pump, Weak Acid Sump Pump, Process Water Sump Pump, Nash Transfer Pump.	Horizental and Verticle, SS/MM/RL	--	--
Rock Phosphate Section			
Rock Storage Hoppper	Hoper with top Screen MOC Mild Steel	100 MT	2
Belt Conveyors complete with structure, Idler Rollers, Carrying Rollers, SA	1200mm Width and 150 Mtr Length	50Mt/Hr	150 Mtr

Rollers,Head& Tail Pully, Rubber Belt, Safety System			
Ball Mill Feeding arrangement Chutes, Hopper, Supporting Structure, Steel Foundations etc	--	--	--
Ball Mill Grinding Media Balls	--	--	50 MT
Chimney + Ductings for Bag Filter	--	--	
Reaction Section			
Weigh Feeder	--	50Mt/HR	2
Attack Tank 4 Compartment with Agitator	RCC+Rubber+Brickline 8X8X7Mtr	200m3	2
Digestion Tank + agitator	6 MtrDia X 6 Mtr Height Carbon BL+RL	150m3	2
De Sulphonation Tank + Agitator	6 MtrDia X 6 Mtr Height Carbon BL+RL	150m3	2
Cooling Tower	FRP	--	2
Scrubbing Section			
Dosing Tank + Agitator	FRP 2.2 Mtr X 3.8 Mtr	15m3	2
Scrubbing System 3 Stage	Venturi ¢ 100/450×6500 - 3 Nos ¢ 3000×6500 tower - 3 Nos with Ductings MOC FRP	FRP	1
Transfer &Cerculation Pumps	PP Pumps	50 M3/HR	8
Scrubber Water Vessels	FRP 3Mr Dia X 3Mtr H	20m3	3
Fume Stack	MS/FRP 1Mtr dia X 40M Height	--	1
Cyclone separator	3.0m dia	---	1
Filtration Section			
Hot Well Tank + Agitator	4 MtrDia X 5 Mtr Height with 5mm Rubber linner	60M3	2
Wash Tank + Agitator	SS 316L, Dia 2.5 Mtr X 2.5 Mtr H	14M3	4
Filter Seal Tank + Agitator	Concrete, rubber and CR bricks	4×2.5×1.5Mtr	2

Vaccume Pump	Limit max vacuum: -0.2MPa, Max air amount:2500m3/h t= 50 ～65℃	Steel and 316L	4
Cooling Tower		FRP	1
Zypsum Conveying and Pond Section			
Rehydrate Tank + Agitator	MS Size 4500X4500X4500	100m3	2
Conversion Tank with Agitator	MS + Rubber + brick 6 MtrDia X 5Mtr H,	150m3	2
Re Slurry Tank + Agitator	4 MtrDia X 6 MtrHeight+RL	75M3	4
Zypsum Conveyor Belt System	2 Mtr WidthX80Mtr length	50 MT/HR	2
Clarification and Storage Section			
Acid Settler Tank with Rake and accessories	MS Fabricated + RL 10M Dia X 3M Height	250M3	3
Floculant Tank with agitator	MS + FRP 3.5 MtrDia X 5 Mtr	50M3	2
Phosphoric Acid Storage Tank	10.50 M Dia*12 Meter Hight, Rubberlined and AHR Bricked on Bottom	1000MT	6
Sulphuric Acid Storage Tank	10 Meter Dia * 10 Meter Hight	1000MT	2
Water Storage Tank	RCC 10X10X3.5mtr	350KL	2
Evaporation Plant for 300 TPD			
Flash chamber	Φ8500 CS+RL+ bricks (P.A with 40～45%P2O5) t=80～90℃ Pressure:10KPa	--	1
Flash cyclone defoamer	Φ6000X6000 CS+RL	--	1
First fluorine absorber Tank	Φ6000X6000 CS+RL	--	1
First fluorine absorber Tank	Φ6000X6000 CS+RL	--	1
Fluorine recovery cyclone	Φ6000X6000 CS+RL	--	2
Graphite heat exchanger	Graphite + CS	--	1
Atmospheric condenser	Φ4000X4000 CS + RL	--	1

Monorail crane	Q=10t H=3-10m, Q=3t H=3-10m, Q=3t H=3-10m	--	3
Condensate pump	Q=55m^3/h H=60m N=22KW n=1450r/min MOC CD4MCu	--	12
Concentrated Phosphoric Acid Circulating Pump (with VFD)	Q=9600m^3/h H=5m CD4MCu	--	2
Concentrated Phosphoric Acid transfer Pump (with VFD)	Q=45m^3/h H=30m, N=18.5KW n=1450r/min CD4MCu	--	2
First fluorine & Second absorber circulating pump	Q=800m^3/h H=45m UHMWPE	--	4
Concentrated phosphoric acid discharge pump	Q=80m^3/h H=45m, N=45KW n=1450r/min MOC CD4MCu	--	2
Concentration vacuum pump	Q=230m^3/min Suction pressure ： 20KPa SS 316	--	2
Fluorosilicic acid transfer pump	Q=30m^3/h H=30m, N=18.5KW n=1450r/min UHMWPE	--	2
Underground channel pump (Vertical)	Q=60m^3/h H=35m, N=30KW n=1450r/min SS 316	--	2
Circulating filter	Φ3000 SS 316	--	1
Circulating filter	Φ3000 SS 316	--	1
Condensate collecting tank	Φ1500, SS 316	--	1
Circulation tank of first & Second fluorine absorber	Φ3000 CS+RL	--	2
Slurry mixer	Φ1500 n=43r/min, CS + RL	--	1
Water return tank	Φ3000 CS+RL	--	1
Concentration underground tank	2500x2500x2500 concrete/rubber+bricks	--	1
Fluorosilicic acid tank	Φ3500X3500 FRP	--	1
Washing acid tank	Φ10Mtr CS + RL	--	1

Cooling Tower with water pump	FRP Q=4000m^3/h H=45m, UHMWPE	--	1
Acid geosyncline	Φ3000 concrete+rubber+ bricks	--	2
Recycling water station	RCC+RL+Brick V=450m^3	--	1
Dilute Phosphoric Acid Conveyor Pump	Q=80m^3/h H=45m N=45KW n=1450r/min MOC SS 316	--	2
Fluorosilicic acid transfer pump	Q=100m^3/h H=45m, UHMWPE	--	2
Electricals& Others			
Gear box	--	**Lot**	
Electric Motors		**Lot**	
Cables & Wires		**Lot**	
Electric Panels		**Lot**	
Switchgears		**Lot**	
Instruments		**Lot**	
lightings and MiscElctricals		**Lot**	
Pipeline different sizes	(MS, SS, FRP, GI, PVC, HDPE)	**Lot**	
Valves all types	SS, CS, Ball, Control and others	**Lot**	
All Type of Pumps	SS CS	**Lot**	
Brick, Rubber, Graphite & FRP Work	**As required**	**Lot**	
Machinery Foundations	**As required**	**Lot**	

2. LABSA Plant

S. No.	Machine Name	UOM	Qty
I	**Plant and Machinery**		
A. LAB and SULPHURIC ACID TANKER UNLOADING			
1	Pumps for LAB/ Sulphuric Acid	**Set**	**1**
B. **DOSING and REACTION PROCESS**			
1	A set of pumps for transferring LAB/ SA and water to day Tanks from respective storage Tanks	**Set**	3
2	Day Tanks for LAB/SA and Water	**Set**	3

3	Reaction Vessel	No.	4
4	Settling Tank	No.	2
5	Water Chiller	No.	1
6	A set of Pipe Lines/Valves/ Fittings	**Set**	1
7	Electric Control Panel for whole plant	No.	1
C. **STORAGE TANKS**			
1	Storage Tank for LAB	No.	2
2	Storage Tank for SA	No.	2
3	Storage Tank for Water	No.	1
4	Storage Tank for LABSA	No.	1
5	Storage Tank for Spent Acid	No.	1

3. Zinc Sulphate

S. No.	Machine Name	Qty
i.	Reactors	2
ii.	Jacketed crystalizer	4
iii.	Filter Press	2
iv.	98% Acid Storage Tank with service tank	1
v.	Coal furnace with air blower, multi cyclone and chimney with reactor	1
vi.	AHR Bricklined Mother liquor tank	2
vii.	Chilling Plant with compressor	1
viii.	Water storage tank	1
ix.	Pipelines & Valves	Lot
x.	Pumps	Lot
xi.	Mud Washer, Filtration tank	2
xii.	Bagging & Packing Unit	Lot
xiii.	Pollution control Equipments	Lot
xiv.	MCC panel & Switches & cables	Lot

4. DAP/NPK Complex fertilizer Plant

Description of Machinery	Specification	Quantity
Granulator	Dia 3.0X L 7 M CS	1
Dryer	Dia 3.2X L 20 M CS	1
Coating drum	Dia 2 X L 8 Mtr CS	1
Process sieve	50t/h Type: Double Layer	2
Refined sieve	50t/h Type: single layer	1
Crusher	Capacity:35-50 t/h	2
Dry cyclone separator with dryer rotary drum, cooler rotary drum, all material handling equipment i.e. bucket elevator, screen etc.	MS Fabricated Double barrel cyclone,	3
Fluidized bed cooler	Two stages cooling Capacity:50t/h	1
Air heater	Air capacity：65000m^3/h Combined material	1
The first stage FBC fan, The second stage FBC fan	Type: Centrifugal fan, Includes inhalation baffle	2
FBC exhaust fan	Type: Exhaust fan	1
FBC Circulating fan	Includes inhalation baffle Type: Centrifugal fan	1
Return hopper elevator	Lift height:29.8m	1
Dryer outlet conveyor	Type: belt weighing conveyor Delivery capacity:180 - 220t/h t≤110℃,	1
Dryer outlet hopper elevator	Lift height:29.8m	1
Screen collecting belt conveyor	Delivery capacity:40～90t/h Type: Sealed Belt Conveyor	1
Return adjusting belt conveyor	Delivery capacity:25-40t/h Type: belt weighing conveyor	1
Product bucket elevator	Lift height:21.0m	1
Product belt conveyor	Delivery capacity:30～75t/h Type: belt weighing conveyor	1
Return belt conveyor	Belt width: 1200mm, belt horizontal length: 31000mm	1

Polishing Screen bucket elevator	Capacity:50-75t/h，	1
Screen feeder conveyor	Capacity:60t/h,belt width:800mm	2
Belt conveyor	Width:800mm Length:3300mm Capacity: 50t/h.	2
Tubular reactor	Capacity:20～30t/h Design pressure:1.0MPa Operation pressure:0.2～0.4MPa SS 316	1
Ammonia distributor	Type: plough type SS 316	1
Process sifter	Capacity:190 -210t/h CS	1
Screen feeder	Capacity：100 -120 t/h	2
Electromagnetic separator	Belt width:800mm; material temperature:～110℃;	2
Slurry pump	Q=30m^3/h, CD4MCU	2
Defoamer pump	Flow: 200L/h，H=50m Piston type metering pump CD4MCU	2
Wastewater pump	Q=30m^3/h ， H=40m CD4MCU	2
Tail gas washing pump	Q=200m^3/h ， H=45m, t=80～100℃ CD4MCU	3
Washing water pump	Q=30m^3/h ， H=50m SS 316	1
Washing liquid delivery pump	Q=50m^3/h ， H=40m, CD4MCU	1+1
Exhaust cylinder	φ2200×49500 Q=201000m^3/h MS/FRP	1
Defoamer tank	φ1500×2000 , SS 316 ,	1
Coating oil tank mixer	50r/min φ500.	2
Coating oil tank	Size:Φ15000X1520	2
Coating oil tank heater	Size:Φ900X1125, heating pipe:Φ32X3	2
Coating oil metering pump	Flow:210L/h head: 25m	2
Electric hoist	Capacity: 1t power: N=1.7kW	1
Automatic Packing Scale	Capacity: upto 700bags	2
Additional machineries		

Ebullition furnace	Hot air amount Q=9x1008 kJ/h Hot air outlet temperature: T<450, MOC MS BQ Quality, inside refractory material, CI Gratings+Beams	1
Combustion fan	Includes inhalation baffle Type: Centrifugal fan	2
Coal crusher for Eb Furnace	CI+MS+Mg Steel	2
Coal hopper for Eb Furnace	MOC - Steel	2
Coal Elevator for Eb Furnace	MOC – Steel	2
Slurry buffer tank With mixer	V=100m^3 r=1.45～1.55 SS316	2
Drying settling chamber	13×4.5×4.5m, Concrete	1
FBC settling chamber	8×3.5×4.5m Concrete	1
Dust remove settling chamber	7.5×6×4.5m Concrete	1
Granulator Pre-scrubbing unit	It consists of Venturi, trough and tower. MOC SS 316, Venturi:φ1000×6000 Tank:1000X1000,L=3500 Tower:φ5500×7500	1
The scrubber for granulator and dust collector	It consists of Venturi, trough and tower. SS 316, Venturi:φ2000×6000, Tank:2000×2000, L=3500 Tower: Dia 5500×9000	1
Dryer scrubber	It consists of Venturi, trough and tower. SS 316, Venturi:φ2000×6000,Tank:2000×2000, L=3500, Tower: Dia 5500×9000	1
Tail Gas Scrubbing Unit	It consists of Venturi, trough and tower. MOC SS 316, Venturi:φ1000×6000 Tank:1000X1000,L=3500 Tower:φ5500×7500	1

Pre-neutralizer Mixer	φ3400/φ2400, H=6900 , SS 316, Temp：100～135℃	2
Accident pool	9000×5000×3000, V=135m^3	1
Washing water pool	2500×1650×1800, V=7.4m^3	1
Product hopper	Size - 6X6X6, MOC - CS + RL	6
Structural Steel/foundations /platforms/railing/ Gratings etc.	As required	Lot
Ammonia station		
Ammonia compressor	P=450Kw Air capacity: Q=1260.6M^3/h	6
Ammonia storage tank	Q345R, P=1.6MPa, t=-33～50℃, V=10000m3	2
Ammonia separator	Q345R, ¢ 1480×20 V=0.35 M3 P=1.6MPa	2
Ammonia gas buffer	Q345R, V=5m3, P=0.8MPa	2
Liquid ammonia evaporator	F=20m2, P=1.6MPa T=130℃	1
Ammonia heater	Q345R, Φ273×2675, F=5.7 ㎡	1
Water collection tank	RCC 2000×2000×1500	2

5. Gypsum Granular

S. No	Plant & Machinery	Qty
1	**Main Equipment**	
	Drum (Granular, Dryer, Cooler)	3
	Hot Air Generator	1
	Feed & Product Hopper	2
	Dryer & Cooler Cyclone (2.5m dia double cyclone sepertor with each drum)	2
	Chimney& Ductings	1
	Dryer & Cooler Blower	2
	Furnace Blower	1
	Packing Station	1
2	**Material Handling**	
	Feed Belt Conveyor	1

	GR Belt	1
	DC Belt	1
	Cooler Belt	1
	Recycle Belt 1	1
	Recycle Belt 2	1
	Product Belt	1
3	**Screening Equipments**	
	Chain Mill	2
	V.Screen	2
4	**Electrical Installation**	
	Panels	lot
	Cables	lot
	Lighting	lot
	Earthing& general	lot
	Motors	
	Gear Box	Lot

6. Sulphuric Acid

A	SULPHUR SECTION	Specification	Quantity
	Sulphur Melter, Settler & Cleaner with Agitators inside AHR Brick lined	Concrete/Brick lined/MS	2
	Horizontal and vertical Steam coils for Melter & Settler, Clean Pit	Dia 50mm, Temperature 150 degree,	
	Sulphur Filter	Volume - 15M3, Temperature 120 degree, Overall Size -3.5 M Dia- 2.5 M, Number Of Leafs 24 Mesh, M.O.C. 316-L	
	Ms structure/ cover plate on Melter	Support. structure, railing, cover plate, Pump foundation and others	
B	**GAS SECTION**		
	Main Air Blower with motor & silencer	Rotary Air Blower 40000 M3 Air Flow/ 3000mmwc pressure	2

	Sulphur Gun	SS321Construction, Sulphur Spray gun	1
	Sulphur Burner	Diameter: 3.5m x Length: 9.5 mm, Steel with internal refractory Brick Lining- Fire bricks	1
	Hot gas filter	MOC : Mild steel, Dia- 4.5 M X 6 M ht, Brick Lined , SS316 beam & grids	1
	Converter WITH Grids & Division Plates & columns	Reactor N°1 Diameter: 3500mm x Height: 3800mm, MOC - SS 316 L	1
	Converter WITH Grids & Division Plates & columns	Reactor N°2: Diameter: 3500mm x Height 4200mm, MOC SS316L	1
	Converter WITH Grids & Division Plates &columns	Reactor N°3: Diameter: 3500mm x Height 5200mm, MOC SS316 L	1
	Converter WITH Grids & Division Plates & columns	Reactor N°4: Diameter: 3500mm x Height: 5700mm, MOC SS 316 L	1
	Catalyst	Vanadium Pentoxide (V2O5) SulfoMax RR (size 12 x 4 mm)	160 MT
	Quartz pebble for filter		60 MT
	Saddles	Intalox Saddles 50MM- 150 M3, Double Honeycomb Size 40 x 25 x 15mm - 20m3, Raschig Rings 100x100x15 - 30M3	Lot
	Hot Heat Exchanger(HHE)	3.5Mtr Dia x 9 Mtr. No. of Tubes = 1000 Nos. (50.8 mm OD x 6.10 Mtr.Long) MOC- MS	1
	Cold Heat exchanger(CHE)	3Mtr Dia x 8.5 Mtr. Length, No. of Tubes=850 Nos.(50.8mm OD x 6.10 Mtr.Long) MOC- MS	1
	Drying Tower	Diameter: 4750mm Height 14350mm	1
	Intermediate Absorption Tower	Diameter: 3700mm x Height: 14460mm	1
	Final Absorption Tower with internals	Height: 15575mm x Diameter: 3200mm	1
	Ducting, Expansion Bellows	MOC - MS	

C	**ACID SECTION**		
	Acid circulation tank	MS Fabricated with AHR Brick Lined Dia 7.5 m X 3 m Height	2
	Acid Coolers PHE/HE	Shell and Tube Type Material Haste alloy C- 276, Dia - 500mm X 6500mm length, Heat Duty-3438.8 KW, Heat transfer Coefficient -1491 W/m2K, Total Heat transfer area - 54.3 m2	5
	Product Cooler (Acid)	Shell and Tube Type	2
	Main acid storage tank	MS Fabricated 14M Dia X 10M Height	2
	Acid L.F tank	MS Fabricated	2
D	**STEAM CIRCUIT**		
	Waste Heat Boiler Complete System with Economizer # 1, Economizer # 2 and Super Heater	30 TPH Boiler (suitable for 600 TPD Plant)	1
	IBR pipes, valves & fittings, Safety Valves, PRDS, Control Valves, Piston Valves, Needle Valves etc	MS/SS/CS	
E	**WATER CIRCUIT**		
	Dosing Tank (LP & HP) with Agitator	FRP fabricated Dia 3m X 4m Height	2
	DM Plant equipments	Water Treatment Plant Consist of Cation Exchanger, Anion Exchanger, degasser, Air Compressor	lot
	Water Softener Plant	filter, softener etc.	lot
	DM & Soft water storage tank	Dia 5000 X 6000m	2
	Cooling Tower	Flow Rate: 750 m3/hr	2
F	**SCRUBBER SECTION**		
	Alkali Scrubber with Distributors	FRP Dia 3.5mX 3.5 m with Venturi and Tower	1
	Storage tank	FRP 3m Dia X 3m Height	4
	Preparation tank	FRP 3m Dia X 3m Height	4

	Plant Stack	Dia 1200mm X 40m	1
G	**Turbine Set (4 MW) with Gearbox, Alternator, Main Oil Pump (M.O.P.), Auxiliary Oil Pump (A.O.P.), Condensate Water Pumps, Vacuum Pump, Surface Condenser, Oil Cooler Heat Exchanger, Cooling Tower**	--	1
H	**Electricals**	--	--
	Electric Motors	--	--
	Electric Panels	--	--
	Electrical Wires & Cables	--	--
	Electrical Switchgear & Lightings	--	--
	Instruments	--	--
I	All Type of Valves like Ball, Needle, Steam, Trappe, Globe, Strainer, Foot etc	SS,CS,	--
J	All type of Pumps, Acid Circulation, Acid Transfer, Water transfer and other Pumps	SS, CS, PP	--
K	All Type and Sizes of Pipelines	SS,CS, Schedule etc	--
L	Insulation	--	--
M	Brick lining & Rubber lining	--	--

7. Vinyl Sulphone

S. No.	Machine Name	Specifications	Quantity
1	Sulphonator	12 KL MS & SS Welded	6
2	Dumping Vessel	10 KL MS RL BL	5
3	Reduction Vessel	20 KL MS & SS Claded with SS Coil	5
4	E O Vessel	26 KL SS Claded	3
5	SBS Vessel	12 KL SS & MS	6
6	Nutech	MS RL BL	12
7	Centrifuge	48"	10
8	Flash Dryer	1000 KG/HR	1
9	Pulvaliser	5 T/HR	1

10	Dust collector on Pulvaliser	4000Cu.m /hr	1
11	Ester	1500 KG, SS 316	6
12	Blender	10 MT, SS	1
13	Scrubbing Section	-	2
14	Measuring Tank	-	12
15	Storage Tank	75 KL, MS SS	5
16	HCL Recovery System	20 KL, HDPE	5
17	Chilling Plant	300 TR	2
18	Thermic Fluid Boiler	5 Lac KCL	1
19	Compressor	-	2
20	E O Storage Tank	26KL Capacity SS cladded Cylindrical horizontal shell with two nos. Hemispherical dished ends. It is highly flammable therefore will be insulated to protect from higher temperature.	2
21	Complete Pipe Line APPROX 3500 MTR	--	--
22	Steel Structure	--	--
23	Electric Equipment & Cable	--	--
24	Brick Lining	--	--
25	Storage of Liquid Raw MATERIAL	--	--
26	Lift	--	--

8. Ammonia

Name of Machine	UOM	Quantity
Shell and tube Heat exchanger	No.	1
Heaters	Set	1

Packed Bed Column (Absorber & Stripper)	No.	1
Centrifugal pumps	Set	1
Air Compressors	Set	1
Syn Gas Compressors	Set	1
Ammonia Compressors	Set	1
Primary Reformer	No.	1
Secondary Reformer	No.	1
Packed Bed Reactor (Methanator Convertor)	No.	1
Storage vessels (Horton Spheres, Air Reservoir)	Set	1
Fans (ID and FD)	Set	1
Cooling Tower	No.	1
Ejector System	No.	1

9. Nitric Acid

S.N.	Name of Machine	UOM	Quantity
1	Ion- Exchange Unit	No.	1
2	De-ionized water Cooler	No.	1
3	Air Compressor	No.	2
4	Ammonia Vaporizer	No.	1
5	Ammonia Super-heater	No.	1
6	Reactor	No.	1
7	Steam Super-heater	No.	1
8	Waste-heat Boiler	No.	1
9	Tail-gas Pre-heater	No.	1
10	Cooler/Condenser	No.	1
11	Oxidation Unit	No.	1
12	Secondary Cooler	No.	1
13	Absorber	No.	1
14	Stripping Column	No.	1
15	Storage Tank	No.	2

10. Calcium Nitrate

Name of Machine	UOM	Quantity
Reactors	No.	6
Candle Filters	No.	2
Falling Film Double Effect Evaporators	Set	1
Granulator	No.	1
Screen	No.	1
Belt Conveyors	Set	1
Screw Conveyors	Set	1
Bucket Elevator	No.	1
Cooler	No.	1
400 metric ton silo	No.	1
Tanks	Set	1
Pumps	Set	1
Agitators	Set	1
Vibrating Screen	No.	1
Scrubbing plant with blower (6000cu.m/hr.)	Set	1

11. Sulphate of Potash (SOP)

S. No.	Tag NO.	Specification	Equipment name	Qty	Material
Mannheim furnace (including furnace inner parts)					
1	R101	19800 tons/year	Reaction furnace	1	SIC firebrick, SIC combination
		19800 tons/year	Steel structure of furnace	1	Components
Furnace power system					
1	R102	DCY360/Y200L-8-15	Reduce (include electrical machine)	1	Components
2	R103	Φ480	Small gear wheel	1	45 Components
3	R104	φ1770*420	Big gear wheel	1	45 Components
4	R105	φ280*3705	Main shaft	1	Components
Feeding system					
1	V101	Φ5500×8400	Storage tank of H2SO4	1	Q235
2	V102	Φ1016×2000	H2SO4 unloading tank	1	Q235

3	P101	CQB50-32-125FD	Acid pump	1	Stainless steel components
4	P102AB	IMD40-25-160	Sulfuric acid pump	2	Stainless steel components
5	L101AB	CD1 3T-18m	Motor hoist	2	Q235 Components
6	V103	1500×2000×1700 δ=4mm	KCL feeding storage tank	1	Q235 Components
7	L102	3T/h	Feeder for KCL feeding storage tank	1	Q235 Components
8	L103	4T/h	KCl bucket elevator KCl	1	Q235 Components
9	L104	3T/h L=9000	KCl Scraper conveyor KCl	1	Q235 Components
10	V104	Φ1700×3170	Storage tank of KCl KCl	1	Q235 Components
11	L107	D200×1835	KCl Helical conveyer KCl	1	Alloy steel components
12	X101	JZQ0.16-1.6M^3/H DN32	Rotor flow meter B B	1	Glass
13	V105	Φ1020×1540	H_2SO_4 high level tank	1	Q235
HCL absorption system					
1	T104	Φ1200×10750	H2SO4 gas scrubber	1	FRP
2	P103	S65×50-20	Recycle pump for H2SO4 scrubber	1	FRP、Q235 Components
3	P104AB	S65×50-20	HCl mediate pump	2	FRP、Q235 Components
4	T101A-D	Φ750×4500	HCl membrane absorption tower	4	FRP+ Graphite Components
5	T102 A-D	Φ750×1250	HCl absorption tower	4	FRP
6	V106	Φ2000×3540	HCl mediate tank A A	1	FRP+Q235
7	V107	Φ2000×3540	HCl mediate tank B B	1	FRP+Q235
8	X102A-G	JZQ0.06-0.6M^3/H DN25	Rotor flow meter A A	7	Glass
9	V108	Φ1200×1600	High level water tank	1	FRP

10	T103A-E	Φ1200×10750	HCl tail gas scrubber	5	FRP Magnet ring component
11	P105A-E	S65×50-20	Recycle pump for HCl scrubber	5	FRP、Q235 Components
12	P106AB	9-19 7D	HCl exhauster	2	FRP、Q235 Components
13	X103A-F	DN200	Rubber damper	6	Q235 Rubber Components
14	P107	S65×50-20	Rare HCl pump	1	FRP、Q235 Components
15	T106	Φ1200	Absorption tower	1	FRP Magnet ring component
16	P108	9-19 7D	Fan	1	FRP、Q235 Components
17	X104	Φ300×28000	HCl tail gas chimney with dust collector	1	FRP
18	X105	DN32	Viewer A A	1	Glass
19	X106A-E		Baume meter, HCl	5	cs/Q235+Glass+PP
20	F101AB	1960×1480×2220	HCl hood	2	FRP
21			Steel structure for acid making system	1	Q235 Components
Finished system					
1	E101 AB	Φ1050×6195	Cooling propeller	2	45 Q235 Components
2	L108AB	Φ219×2700	Air sealing helical conveyer	2	Q235 Components
3	L109	W400 L=11000	Belt conveyer	1	Q235 Components
4	L110	3T/H	Small bucket elevator	1	Q235 Components
5	P109	4-72	Dust removing fan	1	Q235 Components
6	V109	MC72	Dust collector	1	Q235
7	L111	TGFY2.8L Φ159	Star-shaped distributor	1	Q235 Components
8	L112	3T/H	Helical conveyer	1	Q235 Components
9	L113	Φ89×1400	Calcia helical conveyer	1	Q235 Components
10	V110	Φ660×630	Calcia feeder	1	Q235

11	P110	JF545	Crusher	1	Components
12	L114	3T/h	Big bucket elevator	1	Q235 Components
13	L115	φ700*2700	Trommel screen	1	Q235 Components
14	L116	3T/H	Finished product helical conveyer	1	Q235 Components
15	V111AB	Φ2640×4700	Tank of finished K_2SO_4	2	Q235 Components
27	L117	5t/h	Packer	1	
Cooling water system					
1	V112	600×1200×940	Water return tank	1	Q235
2	V113	Φ300×1250/1550	Water distributor	1	FRP
3	V114	Φ3200×4000	High level water tank	1	FRP
4	X107	DN100	Viewer B (Water) B	1	Glass
5	P111AB	IS100-80-160	Recycle water pump	2	Q235 Components
6	V115.	6260×10730	Recycle water pond（By the customer	1	Cement
7	P112	Φ3400	Fan for cooling tower	1	Aluminum alloy components
8	T105	300T/H	Cooling tower	1	FRP
9	P113AB	IS100-80-125	Pump for water tower	2	Q235 Components
10	E102	JD50-9	Graphite freezer	1	Graphite Components
Combustion system					
1	X108AB		Burner	2	Components
2	D101AB	400mmx500mmx220mm	Burner control cabinet	2	
3	P114 AB		Oil pump station	2	Q235 Components
4	V116	Φ1500×2400	High Speed diesel fuel tank	1	Q235 Components
5	P115	$4m^3$/min	Air compressor	1	Q235 Components
6	V117	Φ4000×8330	Diesel fuel tank	1	Q235 Components
7	P116 AB	1 m^3/H	The oil pump	2	Q235 Components
8	P117	9-19	Air blower	1	Q235 Components
9	P118	Y8-24-8D	Lead out machine	1	Q235 Components
10	E103	Φ1012×4600	Heat exchanger	1	Q235 Components

11	X110	Φ325×18000	Burning gas stack	1	Q235 Components
HCL Storage System					
1	V118A-C	Φ4000×8330	Finished HCl tank	3	FRP
2	P119	S65×50-20	HCl loading pump	1	FRP、Q235 Components
3	X111A-C	Φ50	Breath valve	3	PVC

Waste Heat Recovery Boiler

Sulphur Di Oxide gase of 950-1100 degree centigrade generate during burning of Sulphur. These gases passes from boiler for cool down up to 450-500 degree for further process. App. 330 MT per day steam generate from boiler. App. 330 MT per day steam gene at 400-degree centigrade temperature and 50 kg/cm2 pressure. Out of 330 MT steam, 66 MT steam will consume in SAP plant and balance 264 MT will use in a turbine. App. 1.5 MW electricity will generate from turbine and turbine outlet steam of3 kg/cm2 will use in Phosphoric acid plant.

2.6 PROPOSED SCHEDULE FOR APPROVAL & IMPLEMENTATION

The construction work will be started after getting Environmental Clearance from the MoEF&CC,New Delhi and Consent to Establish (CTE) from SPCB.

Activities	Completed activities	Months						
		1	2	3	4	5	6	7
Baseline Study	Post-Monsoon 2019 (October – December 2019)							
Submission of Final EIA/ EMP report for Environmental Clearance	--							
Environmental Clearance	--							

2.7 TECHNOLOGY AND PROCESS DESCRIPTION

2.7.1 Manufacturing Process along with Material Balance

Existing Products

1. **Beneficiated BRP Manufacturing**

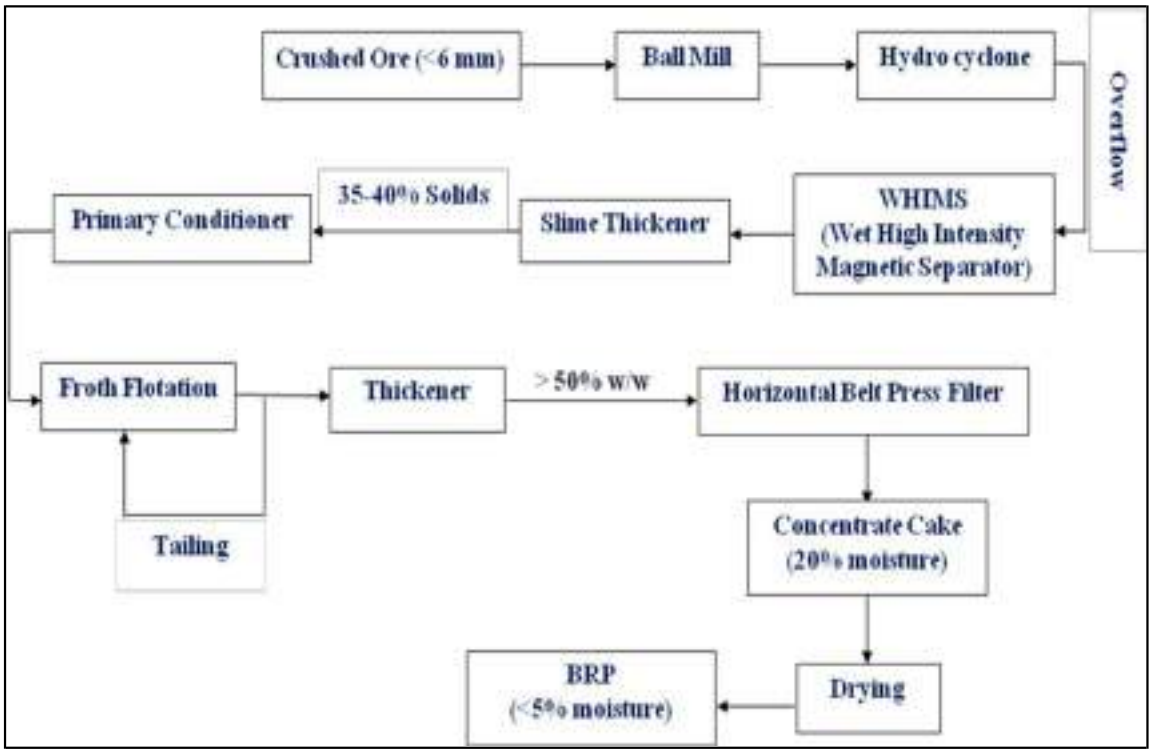


Figure 2.3: Process Flow Chart for Beneficiated BRP Manufacturing

BRP Material Balance

Input /Output	Material	MTPA	MTPA
Input	Low Grade Rock	1,74,000	-
Input	Water	261000	
Output	Water	-	187065
Output	Evaporation loss	-	45000
Output	Moisture in FG	-	6435
Output	BRP	-	99000
Output	Tailing	-	97500
Total		**435000**	**435000**

2. SSP/GSSP

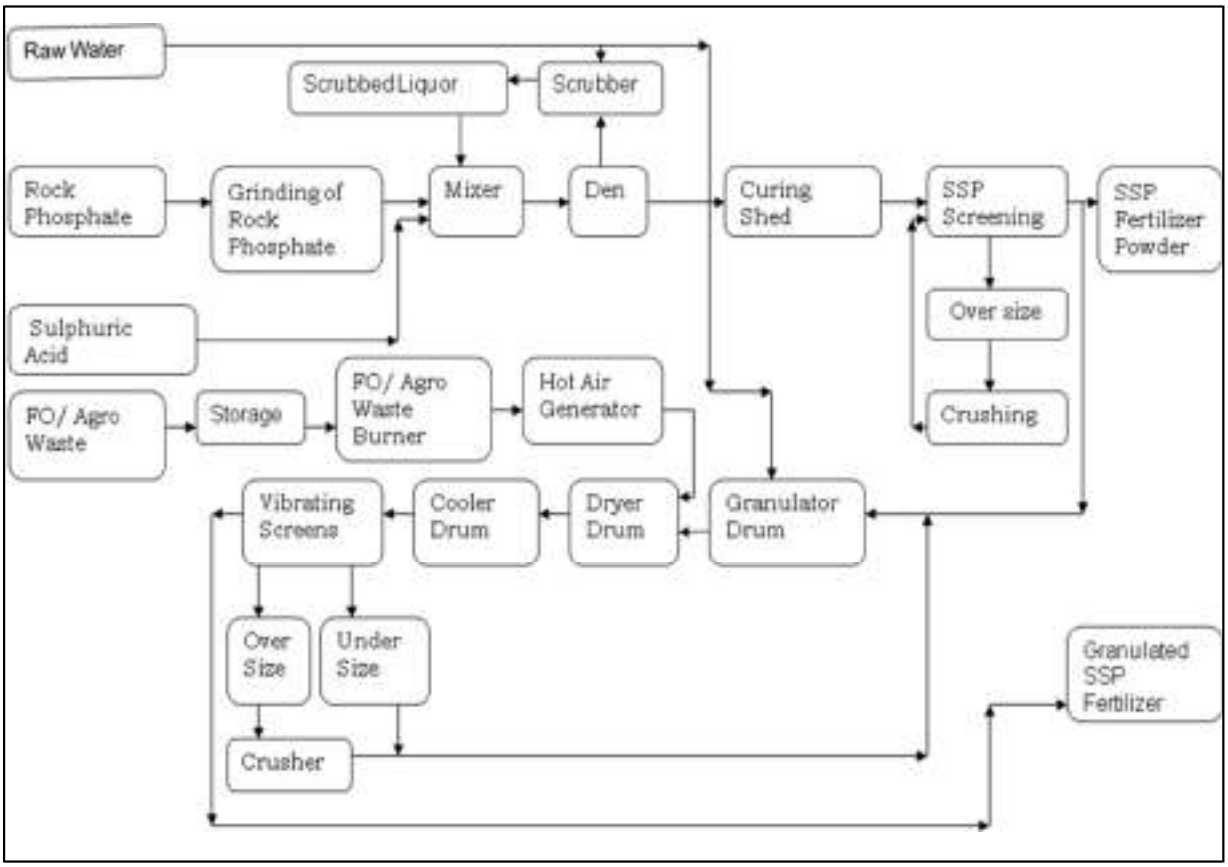


Figure 2.4: Process Flow Chart for SSP/GSSP Manufacturing

The chemical reactions involved in the SSP manufacturing process are as follows:

- SSP is the product of reaction between dilute sulphuric acid and phosphate rock.

$$3Ca_3(PO_4)_2 + 6H_2SO_4 = 3Ca(H_2PO_4)_2 + 6CaSO_4$$

Rock Phosphate Sulphuric Acid SSP Gypsum

- The Calcium Fluoride present in the rock phosphate reacts with sulphuric acid and produces corrosive hydrogen fluoride gas.

$$CaF_2 + H_2SO_4 = 2HF + CaSO_4$$

Calcium fluoride Sulphuric Acid Hydrogen fluoride Gypsum

- The HF reacts further with silica and water (scrubber system) to produce hydrofluorosililic acid or HFSA (recycled again or utilized in dilution of sulfuric acid).

$$4HF + SiO_2 = SiF_4 + 2H_2O$$

Hydrogen fluoride Silica STF Water

$$3SiF_4 + 4H_2O = 2H_2SiF_6 + SiO_2.2H_2O$$

ST F Water HFSA Hydrated Silica

SSP Material Balance

Input /Output	Material	MTPA	MTPA
Input	BRP	100800	-
Input	Su;phuric Acid	62100	
Input	Water (Acid Dilution)	35000	
Input	Water (Scrubber)	6600	
Output	Evaporation Loss	-	18164
Output	Silica Generation	-	143
Output	H_2Si_6	-	6193
Output	SSP	-	180000
Total		**204500**	**204500**

GSSP Material Balance

Input /Output	Material	MTPA	MTPA
Input	SSP	180000	-
Input	Water	9000	
Output	Evaporation Loss	-	
Output	GSSP	-	180000
Total		**189000**	**189000**

3. SSF (Sodium Silica Fluoride)

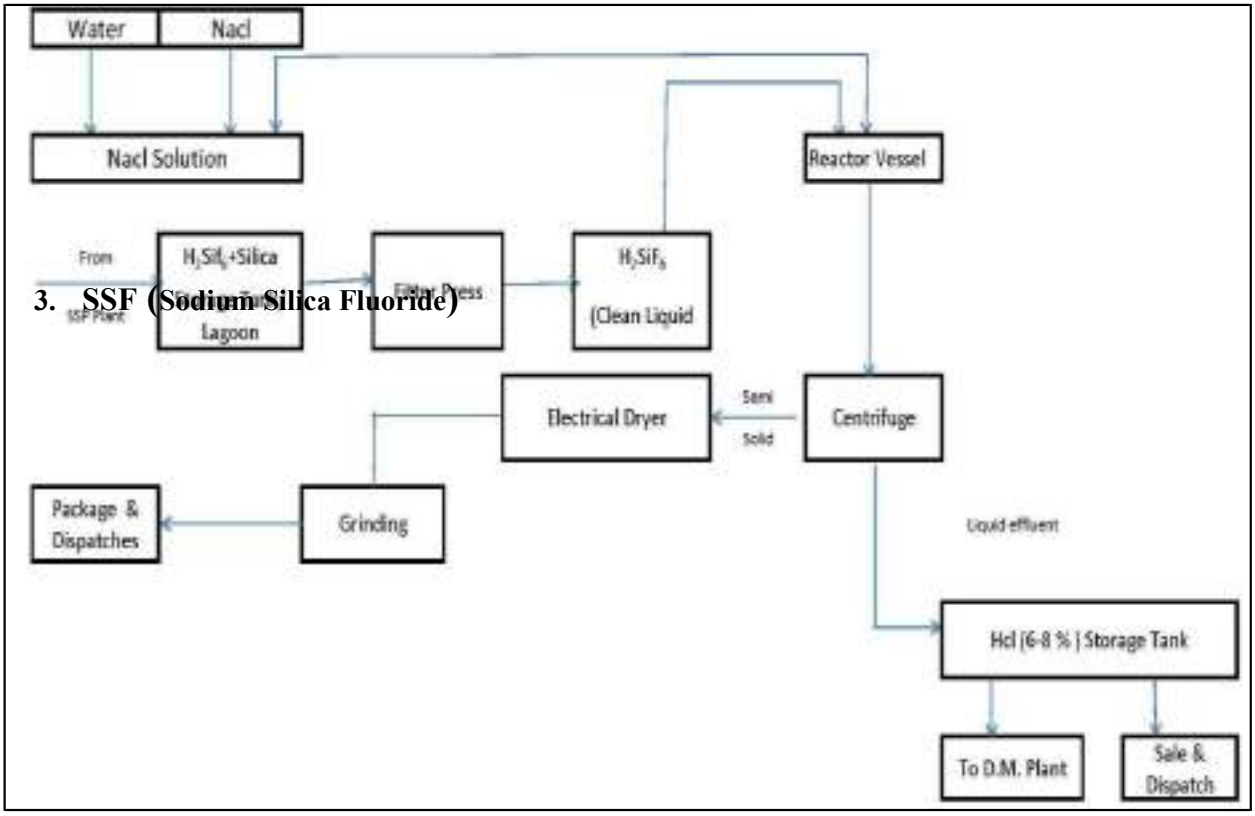


Figure 2.5: Process Flow Chart for SSF Manufacturing

SSF Material Balance

Input /Output	Material	MTPA	MTPA
Input	From SSP	6103	-
Input	From Phosphoric Acid	2815	
Input	From TSP	2252	
Input	Nacl	920	
Input	Water	1000	

Output	HCl 5%		11530
Output	Evaporation Loss		330
Output	Sodium Silica Fluoride		1320
Total		**13180**	**13180**

4. TSP

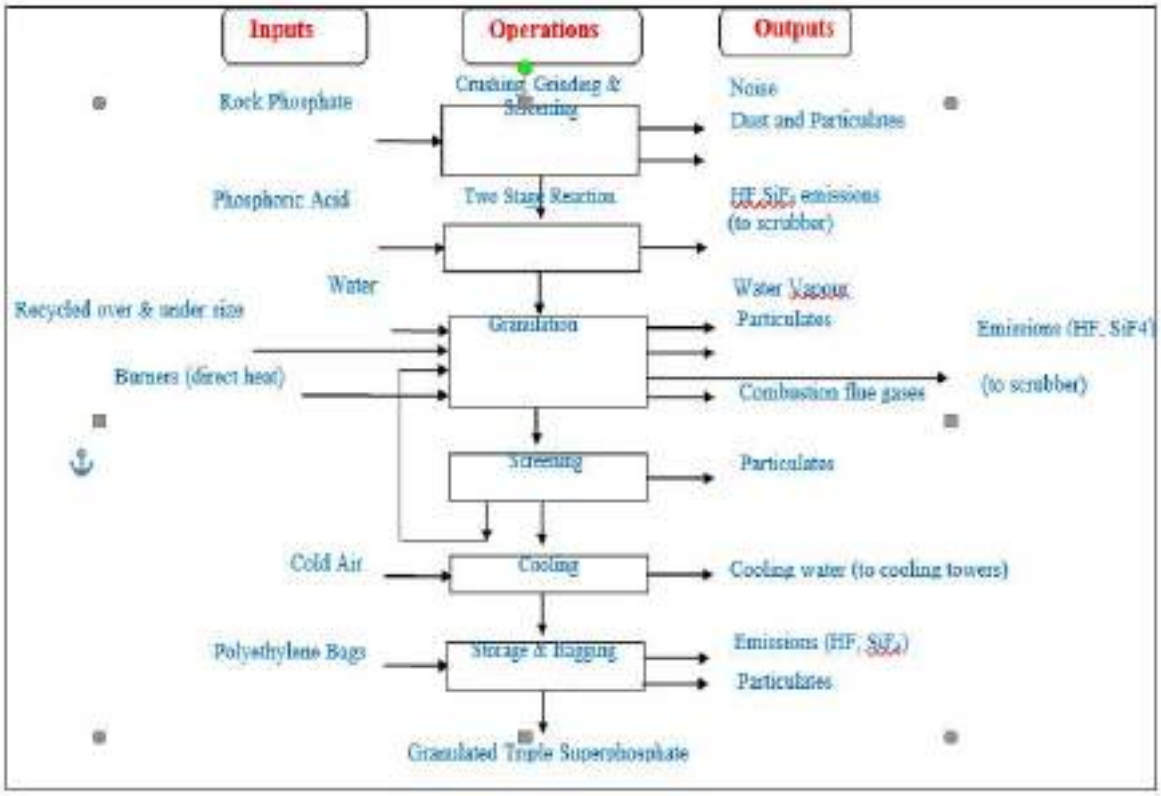


Figure 2.6: Process Flow Chart for TSP Manufacturing

TSP Material Balance

Input /Output	Material	MTPA	MTPA
Input	BRP	36960	--
Input	Phosphoric Acid 45% (Outside)	14667	--
Input	Phosphoric Acid 45%(Captive Production)	44000	--
Input	Water (Scrubber)	2800	---
Input	Evaporation Loss	--	30123

Output	Silica Generation	--	52
Output	H_2Si_6	--	2252
Output	TSP	--	66000
Total		**98427**	**98427**

Phosphoric acid Material Balance

Input /Output	Material	MTPA	MTPA
Input	Imported HGR	39498	--
Input	BRP	6240	--
Input	Sulphuric Acid 98%	39600	--
Input	Water (Acid Dilution)	25000	--
Input	Water (Scrubber)	3000	--
Input	Water (Washing)	17000	--
Output	Evaporation Loss	--	10125
Output	Moisture in FG	--	24200
Output	Gypsum	--	73333
Output	Silica Generation	--	65
Output	H_2Si_6	--	2815
Output	Phosphoric Acid	--	19800
Total		**130338**	**130338**

Proposed Products

1. **Phosphoric acid**

Manufacturing Process

Phosphate rock assaying +31% P2O5 is ground to min. 90% -100 mesh and is stored in the overhead bin. Automatic weigh scale is installed to control the feed into reaction tank. Sulphuric acid (96%-98%) is pumped to overhead tank to facilitate gravity feeding to a Reactor tank. Strong Sulphuric Acid is metered with an automatic control meter which maintains acid-rock ratio at the pre-determined setting. Process parameters are maintained for the optimum and efficient conversion efficiency of +95% for the di-hydrate process technology.

Alternatively, HCL can be used in place of Sulphuric acid. Reaction is completed in 4-6 hours in a single or multiple Reactors having adequate number of baffles and agitators

allowing intimate mixing and residence time. Heat of reaction is controlled by pulling cooling air across.

The slurry admixed with gypsum and phosphoric acid (Dilute) is feed to Tilting Pan Filter through gravity feed system. Dil. PhosphoricAcidis filtered out and is stored in M.S.R.L. storage tank of adequate capacity. T.P.F. has three washing system for the extraction of phosphoric acid from the dehydrate gypsum. Each washing is stored separately for digesting rock again in the Reactor(s). The collected liquid is evaporated in force draft circulation system and concentrated phosphoric acid is stored in storage tank.

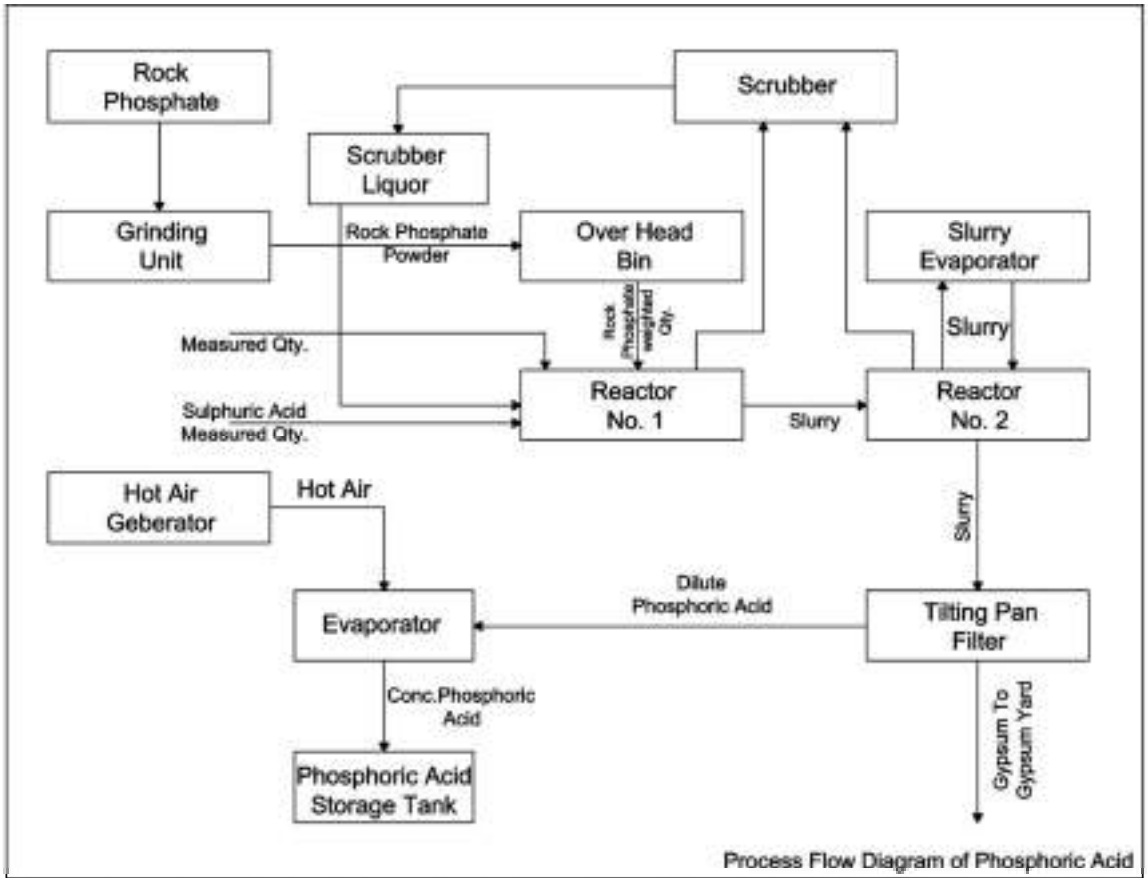
TPF is designed for complete automatic control using pneumatic/electronic control system.

Chemical Reaction

$$Ca_3(PO4)_2 + 3H_2SO_4 \longrightarrow 2H_3PO_4 + 3CaSO_4$$

Or

$$Ca3(PO4)_2 + 6HCl \longrightarrow 2H_3PO_4 + 3CaCl_2$$



Process Flow Diagram of Phosphoric Acid

Fig 2.3: Process Flow Diagram of Phosphoric Acid

Material Balance

Mass Balance For Phosphoric Acid of 100% P_2O_5			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
Rock Phosphate 30% P_2O_5	350000	Phosphoric Acid 29% P_2O_5	345000
Sulphuric Acid 98%	280000	Gypsum Dehydrate With Moisture	736700
Water	466700	Water evaporation.	15000
		Phosphoric Acid 100% P_2O_5	100000
Total	**1096700**		**1096700**

- **Fluorine recovery system**

During the production of phosphoric acid from fluorapatite (3Ca3(PO4)2CaF2) and a strong mineral acid, the calcium fluoride present in the rock is converted, by reaction with the silica also present, into fluosilicic acid according to the following equations:

$$CaF_2 + 2H+ (H_2SO_4, HNO_3, H_2PO_4, HCl) >$$

$$(1)\ 2HF + Ca++$$

$$(2)\ 4HF + SiO_2 > SiF_4 + 2H_20$$

$$(3)\ 3SiF_4 + 2H_2O > 2H_2SiF_6 + SiO_2$$

The hydrogen fluoride and silicon tetrafluoride are partly evolved directly as vapours and partly form fluosilicic acid which, under the influence of heat, decomposes again into volatile SiF4 and HF, leaving the reaction vessel together with the water vapour.

As the heat of the reaction evolved in the attack stage is much less than that required for evaporation, the major portion of the volatile fluorine compounds is obtained during subsequent concentration of the phosphoric acid.

In the production of single and triple superphosphate or weak (28-32%) phosphoric acid, silicon tetra fluoride is preferentially volatilized because under the conditions prevailing its vapour pressure is higher than that of hydrogen fluoride. As the phosphoric acid is concentrated up to 54% P2O5, more and more hydrogen fluoride escapes. The molar ratio HF:SiF4 in the vapours increases sharply with the concentration of the phosphoric acid

and surpasses 2 when the acid concentration is 50% P2O5 or more. At molar ratios below 2, reaction (3) will take place when the vapours are scrubbed, and surplus silica will be precipitated in the scrubber liquor, an effect that has to be considered when designing equipment for fluorine recovery.

There are two distinct basic types of process in use:

- Fluorine recovery under atmospheric pressure (as used in single and triple superphosphate and weak phosphoric acid production)
- Fluorine recovery under vacuum (used in the concentration of phosphoric acid from 30%-50% P_2O_5 and in evaporative cooling of reaction slurry during phosphoric acid production)

  Typical descriptions of the two process types are given below. The second is of greater importance, as it represents the larger recoverable fluorine source.

2. Di Ammonium Phosphate& Nitrogen and phosphorus complex (DAP/NPK Complex fertilizer)

Manufacturing process

Proposed plant is to be designed to manufacture different grades of DAP based NPK fertilizers with an option of producing fortified grades from the same units. Both units shall be capable to produce any grade of fertilizer at a time and therefore shall be designed for worstcasescenario.Theproposedplantshallbebasedontypicalpipereactortechnology.

All raw material feed like AN melt, ammonia, Phosphoric acid, MOP, Sulphuric Acid will be fed to pipe reactor. A typical block diagram is attached (Figure) for the unit configuration. The plant will be operational for 22 working hour's per day basis, with allowances of 2 hours/day for cleaning and adjustment. The plant since handles large amount of solid recirculation, 2 hours of allowance as stated above is practices as industry norms.

The modern high capacity plant has the advantage of economy of scale as well as lower energy consumption thereby resulting in lower production cost.

Basis of Design (Process Description)

The neutralization liquid Ammonia and Phosphoric acid takes place in a Pipe Reactor. The required N/P ratio is reached in the Granulator by injection of ammonia into the solids bed, through an Ammonization System.

Solid Circuit

All solid raw materials are loaded in powder form in respective bins. There will be a common raw material Rotary Diverter to feed the different solid raw material to their correspondent bin. Raw material Belt conveyor will be equipped with elevator and a magnetic separator, to remove any iron material in the raw material or recovered spillages before entering in the production area. Solid feed stock and recycle are brought together to the granulator, where the granulation will take place.

Granulation

Granulation is mainly accomplished by a series of chemical and physical reactions between the recycle, solid and liquid raw materials, concentrated AN solution and the Pipe reactor slurry. 96% AN solution is sprayed directly on granulator solid bed using a jacketed distributor pipe and spray nozzles.

The phosphoric acid required is partially neutralized with ammonia till reaching a molar N/P ratio of 1.8-1.85, depending on the grade and the granulation conditions

The neutralization reaction mainly takes place in the Pipe reactor in such a way that the slurry of ammonium phosphate is poured directly onto the granulator's solids bed.

An Ammonization System is designed to provide complete phosphoric acid neutralization. It consists on a number of independent rubber hoses supported from the granulator's main beam. This system avoids the formation of lumps, provides a homogeneous distribution of ammonia and reduces granulator power consumption. Rotary drum type Granulator is used for NPK manufacturing process.

Drying

The granulated product is directly discharged to the dryer drum by gravity, through a very steep chute. Dryer uses controlled amounts of air flows, blown from the atmosphere, and

heated up with natural gas in the combustion chamber, to achieve the required reduction on granules moisture.

There will be two fans supplying air to the dryer; combustion fan (to provide the stoichiometry quantity of air for the combustion); and Quench air fan (to cool down the furnacebricklinedareaandtoadjusttherequiredairconditionspriortothedryerdruminlet).

Moisture of the product is decreased up to a value<1%w/w on the dryer. Dried granules are then conveyed and elevated to the top of the screening section.

Screening section

The plant utilizes two double deck vibrating Process Screens. All through put is passed over these screens. The Dryer elevator feeds the Screens Splitter which splits the dryer outlet material between Screens. By-pass Diverters are used for feeding homogenously both screening lines. Screen splitter is designed with a motor actuated blade whose positions are controlled and adjusted with the corresponding positions of detector and actuator.

Directly installed at the outlet branches of the Screens Splitter are two Screen Diverters, with electrical motor actuator, They are used for by-passing the corresponding screen and process crusher for maintenance and cleaning or when a partial (or total) emptying of the unit is required in a relatively short period of time.

While emptying the unit, Reclaim Diverter is positioned in such a way that product falls to Final Product Elevator which in turns send non desired product towards the off-spec area. Desired quality material is sent to of Final Product Storage. Off spec product is gradually re- introduced to the process by means of pay-loader, through the spillages recovery system.

The screening section is designed in such a way that in case of failure of one of the screening/crushing lines, it is still possible to continue with the normal operation of the plant using the other parallel line.

Screen feeders are provided to optimize the distribution of the product all along the screen width. In the vibrating screens, oversized fines and on-size products are separated. The oversize material will be sent to the crushers, chain mill type, and then to recycle. On-size

product falls on the recycle regulator belt conveyor, which regulate the amount of on-size product to be sent to the final treatment section. The rest of on-size product, which will normally be in excess to the required quantity, is sent back to the recycle belt conveyor, by overflowing from the recycle regulating hopper. The recycle conveyor will collect:

The dust coming from all cyclones, the crushed product from the pulverizes, fines coming from screens.

Cooling section (using a rotary cooler)

On size product from the Recycle Regulator Conveyor is fed by gravity to the Cooler Drum. Cooler is counter current rotary type and the cooling air comes from Air Cooler Impulsion Fan. The cooling air is chilled and dehumidified. The closed loop ammonia vaporization system is used for chilling of the air.

The Rotary Cooler Fines Screw Conveyor , a small screw conveyor installed at the product feed end of rotary cooler is used to convey the fines , granules and gross particulates of dust entrained by the counter-current air leaving the cooler which are collected in the cooler feed end hopper.

Rotary Cooler discharges cooled product, which goes directly to final product elevator which lift it to the single desk Polishing Screen. Here, lessthan1mmdiametermaterialisseparated and returned back to recycle, whereas product between 1-4 mm diameters falls by gravity to the Coater drum D2-D-103. Coating oil is added to the Coater Drum for caking control.

Polishing screen is equipped with a vibrating feeder. This improves the screening efficiency to evenly distribute the feed across its whole width.

Product Coating

Coating is particularly necessary in AN containing formulation, due to the hygroscopic nature of the raw material as it can easily promote caking, mostly when variations of air temperature and moisture occur. Coating agent is preferably constituted by an coating wax specific for such a purpose. The coating oil is fed to the coater drum by using metering pumps. After coating, the product is weighed and sent to storage.

Liquid Circuit

AN concentrated solution (96-98%) is fed directly to granulator using a jacketed distribution header and it is sprayed on the solid bed with spray nozzles. Liquid ammonia at nearly ambient temperature is simultaneously fed to the Pipe Reactor and the Granulator Ammonization System, both of them fitted inside the granulator drum. The amount of liquid ammonia is measured through mass flow meters, Coriolis type.

Fresh phosphoric acid is fed to the granulator pre-scrubber tank, to the scrubber tank and to the pipe reactor tank. Tanks are provided with agitators to assure the required liquids homogeneity. Defoamer may be added to this equipment if needed.

Sulphuric acid is fed to the granulator pre-scrubber tank and sometimes to the scrubber tank. Also, a small amount of sulphuric acid is fed to the tail-gas scrubber to adjust the pH of the scrubbing liquid (process water) in that point.

The scrubber tank also receives the liquids from dryer, granulator and de-dusting and cooler scrubbers and the water make-up from tail-gas scrubber. Scrubbing liquid is advanced to the granulator fumes pre-scrubber. After scrubbing granulator fumes, washing liquid is advanced to the PR Feed Tank. All transfer flows are controlled by LIC.

Phosphoricandsulphuricacidsareaddedtothedifferentscrubbingsectionstoadjustwashin liquid concentration and N/P ratio, flows being controlled by magnetic flowmeters. There is also provision for process water make up to both tanks; although in normal operation the process water will be only added through the tail gas scrubber. Liquid spillages around the plant are collected in a sump tank and pumped back to the process via the pipe reactor, the scrubberandthepre-scrubbertanks.Liquidemissionsoutsidetheplantarenotenvisaged.

The Pipe Reactor receives the required scrubbing phosphoric liquid from its corresponding tank by variable speed pump. The slurry produced by the reaction with liquid ammonia is distributed over granulator's solids bed. A steam flushing system is provided on the Pipe Reactor for occasional cleaning.

Ammonia is injected deep into the solid's bed till reaching the final required N/P ratio. Reaction heat helps to evaporate a large portion of the water in the slurry, thus reducing the heat requirements of the dryer.

The plant has a series of gas scrubber connected to the different equipment for a double purpose: to retain as much as possible all recoverable products, and to minimize emissions (especially ammonia, fertilizer dust and fluorine) to the atmosphere. The scrubbing liquid will be diluted phosphoric / sulphuric acids or water, depending on the scrubber. The scrubbing system has a first scrubbing step composed of a Venturi-Type fume prescriber for the granulator. The pre-scrubbing liquid is the result of mixing fresh phosphoric acid and sulphuric acid with scrubbing liquid coming from scrubber tank. From the granulator pre-scrubber, the liquid is sent to the pipe reactor tank, where the concentration of P2O5 required for feeding the Pipe Reactor is adjusted with additional fresh concentrated phosphoric acid. The pre-scrubbing step objective is to retain most of the ammonia and dust leaving from the granulator. Occasional additions of sulphuric acid can be done to the scrubber tank.

The gases coming out of the pre-scrubber will be sent to the ventury type scrubber, where they are using as scrubbing liquid fresh phosphoric acid diluted with the slightly polluted water coming from tail gas scrubber. The objective of this scrubber is to complete the recovery of ammonia and dust. From the same common tank the scrubbing liquid is also re- circulated to the venture dryer scrubber, where the dust which has been not retained by the dryer cyclones is recovered; and the venture cooler and de-dusting scrubber where a part of the gases coming out from the cooler cyclones are jointly washed with the de-dusting gases coming from cyclones.

All exhaust gases from the above scrubber shall be sent to the final washing step: The Tail Gas Scrubber, which shall include a multi-spraying system in the horizontal feed in garmanda packed section in the vertical tower. Gases are washed with water, to avoid the fluorine emissions created during phosphoric acid washing as well as to recover dust and NH_3.

The first washing consists of a duct multi-spraying system and uses the water advanced from the second one. A pH controlling system, using sulphuric acid as acidic media, assures the best pH to achieve both ammonia and fluorine recovery. The second step includes a packed section, to efficiently complete the dust, ammonia and fluorine removal.

Scrubbing liquid is basically composed of water, which is sprayed on top of the packing. Scrubbed liquor shall be re circulated to the process.

Gases, after washing, are finally released to the atmosphere through a common stack. The lastsectionofTGSisequippedwithademistertoavoiddropletentrainment.Theliquidfrom the tail gas will contain water, a small quantity of ammonia, fertilizer dust and fluorine retained during the scrubbing. This liquid will be recovered into the scrubber tank; where with the addition of phosphoric acid will constitute the scrubbing liquid. The flow chart for NPK manufacturing process is shown in Figure.

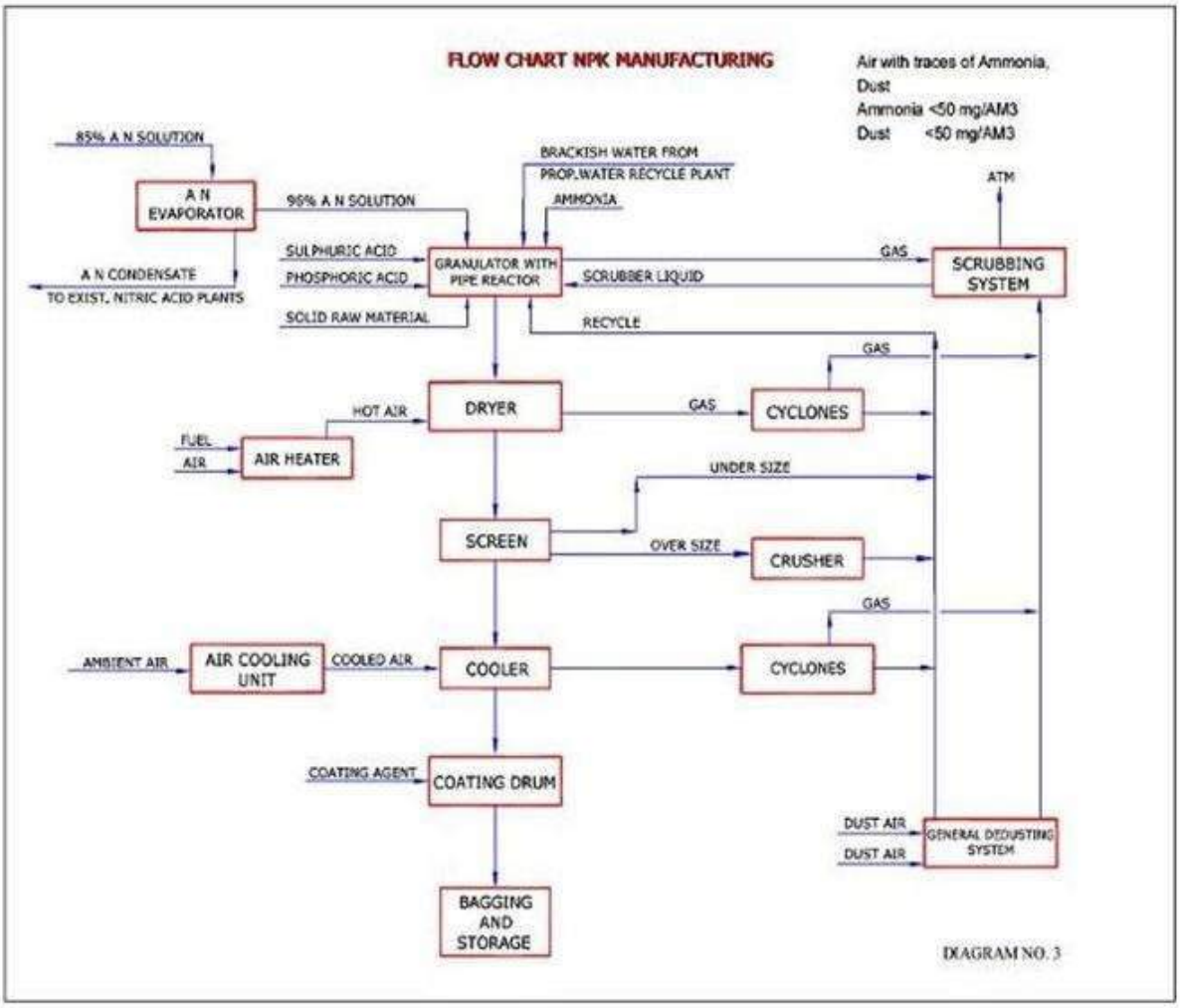


Fig2.4: Flow Chart for NPK Manufacturing Process

Process Description Ammonia Plant

Steam reforming

Presently, the steam reforming concept based on natural gas is considered to be the most dominating and best available technique for production of ammonia.

Overall conversion

The theoretical process conversions, based on methane feedstock, are given in the following approximate formulae:

$$0.88CH_4 + 1.26\ Air + 1.24H_2O \rightarrow 0.88CO_2 + N_2 + 3H_2\ N_2 + 3H_2 \rightarrow 2NH_3$$

The synthesis gas production and purification normally take place at 25 to 35 kilograms per square centimeter (kg/cm2) pressure. The ammonia synthesis pressure is in the range of 100-250 kg/cm2. The block diagram of the steam reforming is given in Figure 3-1.

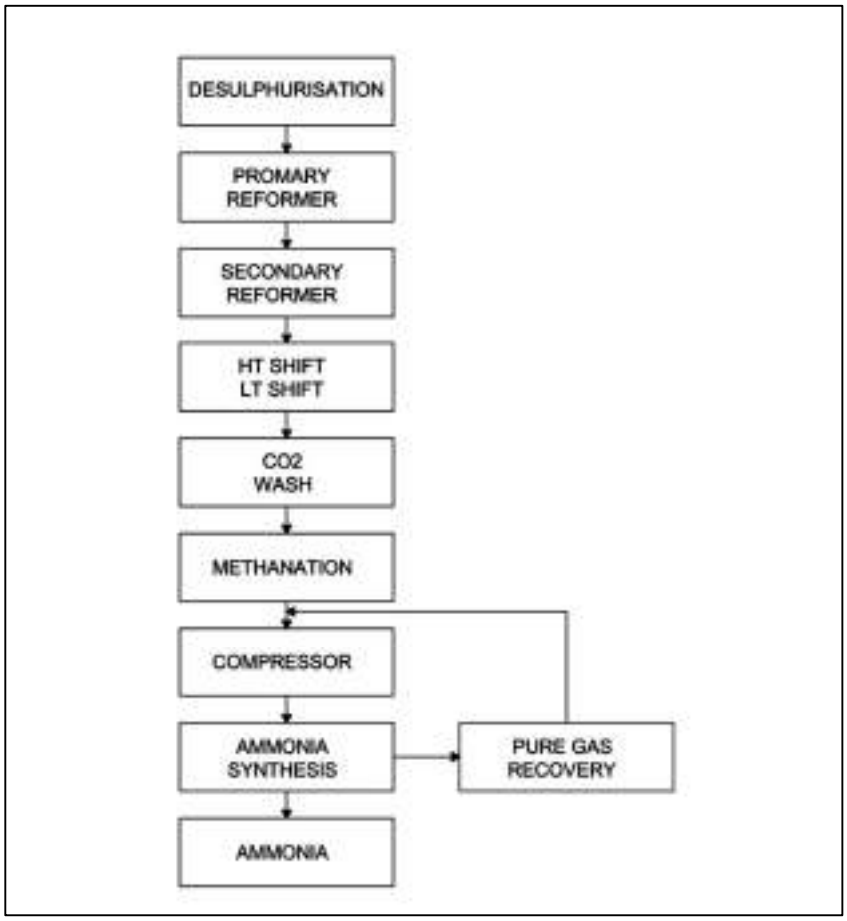


Fig2.5: Block Diagram of Steam Reforming Process

Step 1: Feedstock desulphurization: This part of the process removes sulphur from the feedstock over a zinc oxide catalyst-bed, as sulphur is poison to the catalysts used in

subsequent processes. The sulphur level is reduced to less than 0.1 parts per million (ppm) in this part of the process.

Step 2: Primary reforming: The gas from the de-sulphurated is mixed with process steam, usually coming from an extraction turbine, and steam gas mixture is then heated further to 500-600° C in the convection section before entering the primary reformer. In some new or revamped plants, the preheated steam/gas mixture is passed through an adiabatic pre-reformer and reheated in the convection section before entering the primary reformer.

The process steam is added to adjust steam to carbon-molar ratio (S/C- ratio), which should be around 3.0 for the reforming processes. The optimum ratio depends on several factors, such as feedstock quality, purge gas recovery, primary reformer capacity, shift operation and the plant steam balance. In new plants, S/C ratio may be less than 3.0.

The primary reformer consists of a large number of high nickel chromium alloy tubes filled with nickel-containing reforming catalyst in a big chamber (radiant box) with burners to provide heat. The overall reaction is highly endothermic and additional heat is provided to raise the temperature to 780-830°C at the reformer outlet.

The composition of gas leaving the reformer is given by close approach to the following chemical equilibrium:

$$CH_4 + H_2O \longleftrightarrow CO + 3H_2$$

$$CO + H_2O \longleftrightarrow CO_2 + H_2$$

The heat for the primary reforming is supplied by burning natural gas or other fuels, in the burners of a radiant box containing catalyst filled tubes.

The flue gas leaving the radiant box has temperature in excess of 900°C, after supplying the high-level heat to the reforming process. About 50-60% of fuel's heat value is directly used in the process itself. The heat content (waste heat) of the flue-gas is recovered in the reformer convection section, for various process and steam duties.

The flue-gas leaving the convection section at 100-200°C is one of the main sources of emissions from the plant. These emissions are mainly CO2, NOx, with small amounts of SO2 and CO.

Step 3: Secondary reforming: Only 30-40% of the hydrocarbon feed is reformed in the primary reformer because of the chemical equilibrium at the actual operating conditions. The temperature must be raised to increase the conversion. This is done in the secondary reformer by internal combustion of part of the gas with process air, which also provides the nitrogen for the final synthesis gas. In the conventional reforming process the degree of primary reforming is adjusted so that the air supplied to the secondary reformer meets both the heat and the stoichiometric synthesis gas requirement.

The process air is compressed to the reforming pressure and heated further in the primary reformer convection section to about 600°C. The process gas is mixed with air in a burner and then passed over a nickel-containing secondary reformer catalyst. The reformer outlet temperature is around 1000°C, and up to 99% of the hydrocarbon feed (to primary reformer) is converted, giving a residual methane content of 0.2-0.3% (dry gas basis) in the process gas leaving the secondary reformer.

The process gas is cooled to 350-400°C in a waste heat boiler/super heater downstream from the secondary reformer.

Step 4: Shift conversion: The process gas from secondary reformer contains 12-15% CO (dry gas basis) and most of the CO is converted in the shift section according to the reaction:

$$CO + H_2O \longleftrightarrow CO_2 + H_2$$

In the high temperature shift conversion (HTS), the gas is passed through a bed of iron oxide/chromium oxide catalyst at around 400°C, where the CO content is reduced to about 3% (dry gas basis). The gas from the HTS is cooled and passed through the low temperature shift (LTS) converter.

The LTS is filled with a copper oxide/zinc oxide-based catalyst and operates at about 200-220°C. The CO content is reduced to around 0.2%.

Step 5: Carbon dioxide (CO2) Removal: The process gas from the low temperature shift converter contains mainly Hydrogen, (H2) N2, CO2, and excess process steam. The gas is cooled and most of the excess steam is condensed before it enters the CO2 removal section. This condensate usually contains 1500-2000 ppm of ammonia, 800-1200 ppm of methanol

and minor concentration of other chemicals. All these are stripped, and the condensate is recycled. The heat released during cooling/condensation is used for:

- Regeneration of CO2 scrubbing solution
- Driving the absorption refrigeration units
- Boiler water preheating

The amount of heat released depends on the process steam to carbon ratio. The CO2 is removed in a chemical or physical absorption process. The solvents used in chemical absorption process are mainly aqueous amine solutions such as mono ethanolamine (MEA), activated methyl di -ethanol amines (aMDEA) or hot potassium carbonate solutions. Physical solvents are glycol, di-methy lethers (Selexol), propylene carbonates and others.

Residual CO2 content is usually in the range 100-1000 ppmv, depending on the process used. Contents of CO2 down to 50 ppmv are achievable.

Step 6: Methanation: The small residual amount of CO and CO2 in the synthesis gas, are poisonous for the ammonia synthesis catalyst and must be removed by conversion to methane (CH4) in the methanation.

$$CO + 3H_2 \longrightarrow CH_4 + H_2O$$

$$CO_2 + 4H_2 \longrightarrow CH_4 + H_2O$$

The reaction takes place at around 300°C in a reactor filled with nickel containing catalyst. CH4 is an inert gas but water must be removed before it enters the converter.

Step 7: Synthesis gas compression and ammonia synthesis: Modern ammonia plants use centrifugal compressors for synthesis gas compression, usually driven by steam turbines, with steam being produced within the ammonia plant from exothermic heat of reactions. The refrigeration compressor, needed for condensation of product ammonia, is also driven by a steam turbine.

The synthesis of ammonia takes place over an iron catalyst at pressure usually in the range of 100-250 kg/cm2 and temperatures in the range of350-550°C:

$$N_2 + 3H_2 \longleftrightarrow 2NH_3$$

Only 20-30% of synthesis gas is converted to ammonia per pass in multi-bed catalyst filled converter. Ammonia that is formed is separated from the product gas mixture by cooling/condensation, and the un-reacted gas is recycled with the addition of freshly make up synthesis gas, thus maintaining loop pressure. In addition, extensive heat exchange is required due to exothermic reaction and large temperature range in the loop.

Synthesis loop arrangements differ with respect to (w.r.t.) the points in the loop at which the make-up gas is delivered while ammonia and purge gas are taken out.

Conventional reforming with methanation as the final purification step, produces synthesis gas containing inert (CH4 and argon) in quantities that don't dissolve in the condensed ammonia. Major part of these is removed by taking out a purge stream from the loop. Size of this purge stream controls the level of inert in the loop to about 10-15%. The purge gas is scrubbed with water to remove ammonia before being used as fuel or before being sent to hydrogen recovery unit.

Vaporizing ammonia is used as a refrigerant in most ammonia plants, to achieve sufficiently low ammonia concentration in the recycled gas. Ammonia vapors are liquefied by compression in the refrigeration compressor.

Steam reforming with some modifications will continue to be used for new plants for years to come. Developments are expected to go in the following directions.

- Lowering steam carbonration
- Shifting duty from primary to secondaryreformer
- Improved final purification
- Improved synthesis loop efficiency
- Improved power energy system
- Low NOx burners
- Non-iron based ammonia synthesis catalyst

In India almost all NG (Natural gas) based plants use conventional steam reforming process. Some newer plants have introduced adiabatic pre- reforming, low steam carbon ratio operation, purge gas recovery to control inert, low NOx burners and improved steam and power system resulting in better performance.

CO2 is removed by using an absorption agent. Residual traces of absorption agent and CO2 are then removed from the process gas, before final purification by a liquid nitrogen wash. In this unit practically all the impurities are removed and N2 is added to give the stoichiometric H2 to N2 ratio.

Ammonia synthesis is quite similar to steam reformation plants, but more efficient due to high purity of synthesis gas from liquid N_2 wash unit and the loop does not require a purge. The process block diagram is given in Figure 2.6.

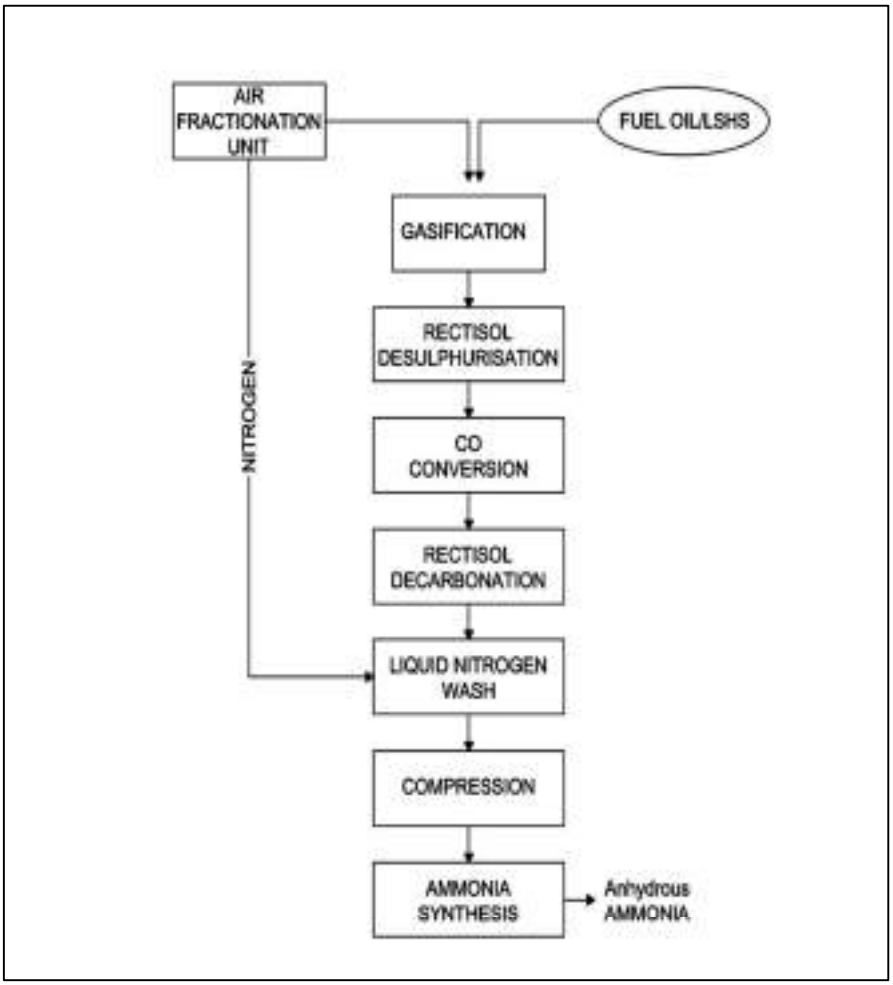


Figure 2.6: Block Diagram of the Partial Oxidation Process

(C) Storage of ammonia

Liquefied ammonia from production plants is used either directly in downstream plants or transferred to storage tanks. The storage tanks are of three types namely:

Tanks are fully refrigerated atmospheric tanks with a capacity up to 50000 tones. The tanks can be single containment, single-wall tanks with bunding (OPTECH make above ground type ammonia storage tank, capacity 215 KL X 6 Nos., MOC: SA 537 Class 1 / SA 516 Gr 70, ID 4000 mm, Overall Length 18365); double containment tanks with two vertical walls; or full containment closed storage tanks with twowalls. Pressurized storage spheres or cylinders are at ambient temperature with a capacity up to about 1700tones.

Material Balance

MASS BALANCE FOR DAP			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
Phosphoric Acid 100% P_2O_5	153450		
Phosphoric Acid OF 54 % P_2O_5	284167	DAP	330000
Sulphuric Acid 98%	13200	Water evaporation.	59767
Ammonia 99.50%	72600		
Filer	19800		
Total	**389767**		**389767**

3. SULPHURIC ACID

Manufacturing Process

Sulphur dioxide is first obtained either by burning the molten sulphur in the presence of air or by roasting the pyrites:

$$S + O_2 \rightarrow SO_2$$

$$FeS_2 + 11O_2 \rightarrow 8SO_2 + 2Fe_2O_3$$

$$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$$

The sulphur dioxide after catalytic conversion to sulphur trioxide is absorbed in water to form sulphuric acid.

$$2SO_2 + O_2 \quad 2SO_3$$

$$SO_3 + H_2O \quad H_2SO_4$$

Contact process

Sulphuric acid (H_2SO_4) is mostly manufactured by the contact process. Elemental sulphur of 99.5 % purity and containing less than 0.25 % carbon is burnt in an excess of dry air at a temperature 950°-1100°C to form Sulphur dioxide. The gases containing SO_2 are cooled to 450°- 500°C and then passed over vanadium pentoxide catalyst charged in a converter. The catalytic oxidation of SO_2 to SO_3 is carried out in three or more catalyst beds. The gases are cooled further in heat exchanger and sent to an absorption tower containing re circulating acid to produce stronger acid. Water is added to the strong acid to restore the original strength and the temperature is maintained in the range of 70°-90°C by cooling the re-circulating acid. The product acid of 97-98 % is withdrawn. Unabsorbed gases are vented to the atmosphere.

To increase the conversion of SO_2 to SO_3 the double catalyst / double absorption (DCDA) system is introduced. In this system, the process flow is modified so that the gas after passing through three catalyst beds is withdrawn and passed through the first absorber to remove SO3. The remaining gases are reheated to about 420°C and then sent through the fourth catalyst bed for further conversion and then sent to second absorption tower. In the DCDA system, conversion of SO_2 to SO^3 to the tune of 99.7% can be obtained and the SO2 loss is reduced to less than 2 kg of SO_2 per tons of H_2SO_4. High efficiency mist eliminators are used to maintain the acid mist at less than 50mg / NH_3. A flow sheet for the process is shown in Figure.

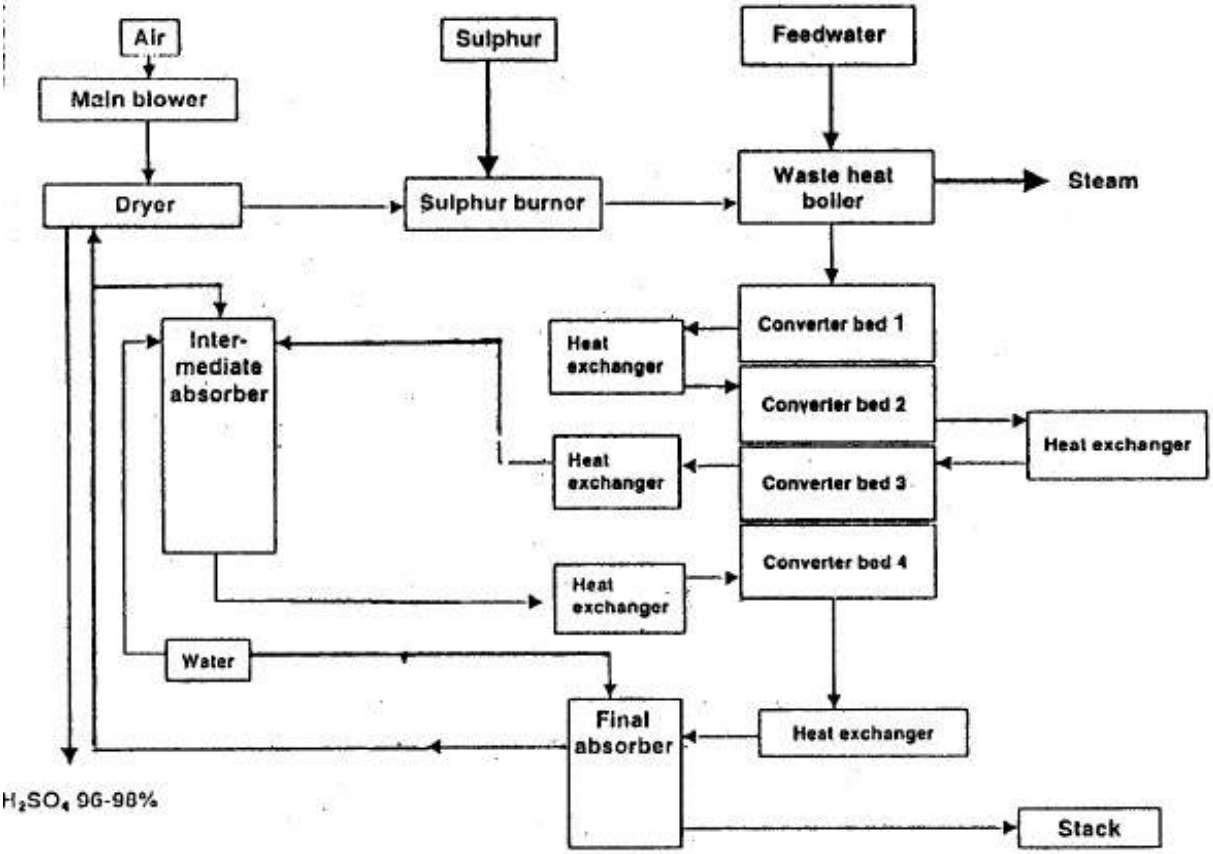


Figure 2.7: Process of Manufacture of Sulphuric Acid

Material balance

MASS BALANCE FOR SULPHURIC AICD			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
Sulphur	65600	Sulphuric acid	200000
Water	342000	Steam generation	228360
Oxygen (Air)	98400	Water evaporation	74670
		Effluent Water	2970
Total	**506000**	**--**	**506000**

4. CALCIUM NITRATE FERTILIZER PRODUCTION UNIT

Manufacturing Process

The calcium nitrate crystals from the nitro phosphate process can be processed to a solid calcium nitrate (CN) fertilizer, using prilling or pan-granulation technology, as an alternative to the combination of CNTH conversion and subsequent processing to CAN.

Neutralization and evaporation

The CNTH crystals from the nitro phosphoric acid unit are heated to form a melt which is pumped to a two-stage atmospheric tank reactor system for neutralization with gaseous ammonia. The reaction between ammonia and the remaining acids in the CNTH melt is exothermic. The ventilation gases from the two reactors are scrubbed with water before being discharged to atmosphere. The total discharge from the scrubbers is <0.3kg.h-1 (NO_3-N andNH4-N) for a 100t.h-1 plant and the concentration are<35mg N.Nm-3 of off-gas.

The 60% CNTH melt, containing small amounts of ammonium nitrate is evaporated in one or two stages to a final concentration of 85% and this concentrated solution is then transferred to the prilling or pan granulation process.

The process steam containing ammonia is scrubbed with condensate and compressed forenergyrecoveryforuseintheevaporators.Partofthecondensateisdischargedintowaterand the remainder is returned to the process. The discharge of NO_3 and NH_4 nitrogen into water from a 100t.h-1CNplant is around 30kg.h-1, when a spillage collection system is installed in the wet part of the process. The collected spillage is returned to the process.

Pan granulation

The concentrated melt from the evaporator system is sprayed into the pan granulator together with the recycled fines. The granules are smoothed in a smoothing drum and air-cooled in a fluid bed. The cooled product is screened in two stages and the on-size product is transferred to a coating drum and finally to storage. The over-size material is crushed, mixed with the fines and recycled to the granulator.

The ventilation gases from the granulation and dry part of the process are scrubbed with water and process condensate from the wet part of the process, in a lamella separator before discharge to atmosphere. The emission of CN-containing aerosols to air is normally<4mg NO3-N.Nm-3 of off-gas. The volume of ventilation air from a pan granulator producing 50t.h-1 CN fertilizer is 170,000Nm3.h-1.

The condensate from the lamella separator, containing calcium nitrate, is mixed with collected spillage from the dry part of the process and returned to the neutralization section. There is no discharge of NO3-N into water from the dry part of the process.

Prilling

The concentrated melt from the evaporators is mixed with recycled fines and fed to a rotating prill bucket. The melt leaving the bucket solidifies due to the heat exchange with counter-current air in the prill tower. Air from the prill tower is discharged to atmosphere without dust removal. The volume of air from a 40t.h-1 CN plant is 370,000Nm3.h-1, normally with a CN dust concentration of 20mg.Nm-3. The prills from the base of the tower are cooled with air in a fluid bed cooler and screened to remove off-size material. The product-size prills are coated before storage. Over-size material is dissolved in neutralized CN solution and returned to the evaporator feed tank. Under- size material is mixed into the evaporated melt before prilling. Dust from the fluid bed cooler is removed in a cyclone separator and returned to the evaporator feed tank. The volume of air leaving the cyclones is 32,000Nm3.h-1, with a dust concentration of 300mg.Nm-3.

Material Balance

MASS BALANCE FOR CALCIUM NITRATE			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
Lime	52800	Calcium nitrate	66000
Nitric acid	73920	Water evaporation	57920
Water	13200	Silica	16000
Total	**139920**		**139920**

5. ZINC SULPHATE

Manufacturing process

A measured quantity of water / wash water is filled in the Digester. The measured quantity of Sulphuric acid is slowly added to the digester. The measured quantity of Zinc ash calculated on stylometric ratio is added slowly with agitation. The addition is continued till the completion of the reaction. As the reaction is complete the suspension is drained in the filtration tank for storage. The suspension is taken to Filter Press with the help of a pump.

The suspension is filtered with the filter press. The rescue is washed and filtered again for better recovery. After wash the residue remains is good quality Carbon. It is dried and sent to the TSDF. The filtrate is fed to crystallizer. The cooling is provided by circulating chilled water generated with freezing system. The solution is stirred continuously. As the required temperature is reached the Zinc Sulphate crystals separate out in the mother liquor. The mother liquor is drained into the recycling tank. The separated crystals are centrifuged with the help of centrifuge to remove any liquor remaining. The Zinc Sulphate hepta-hydrate is ready for filling in bags of required size to be sent to market. For mono hydrate the filtrate is dried in a spray Drying system and collected in a hopper and packed in bags to be sent to the market.

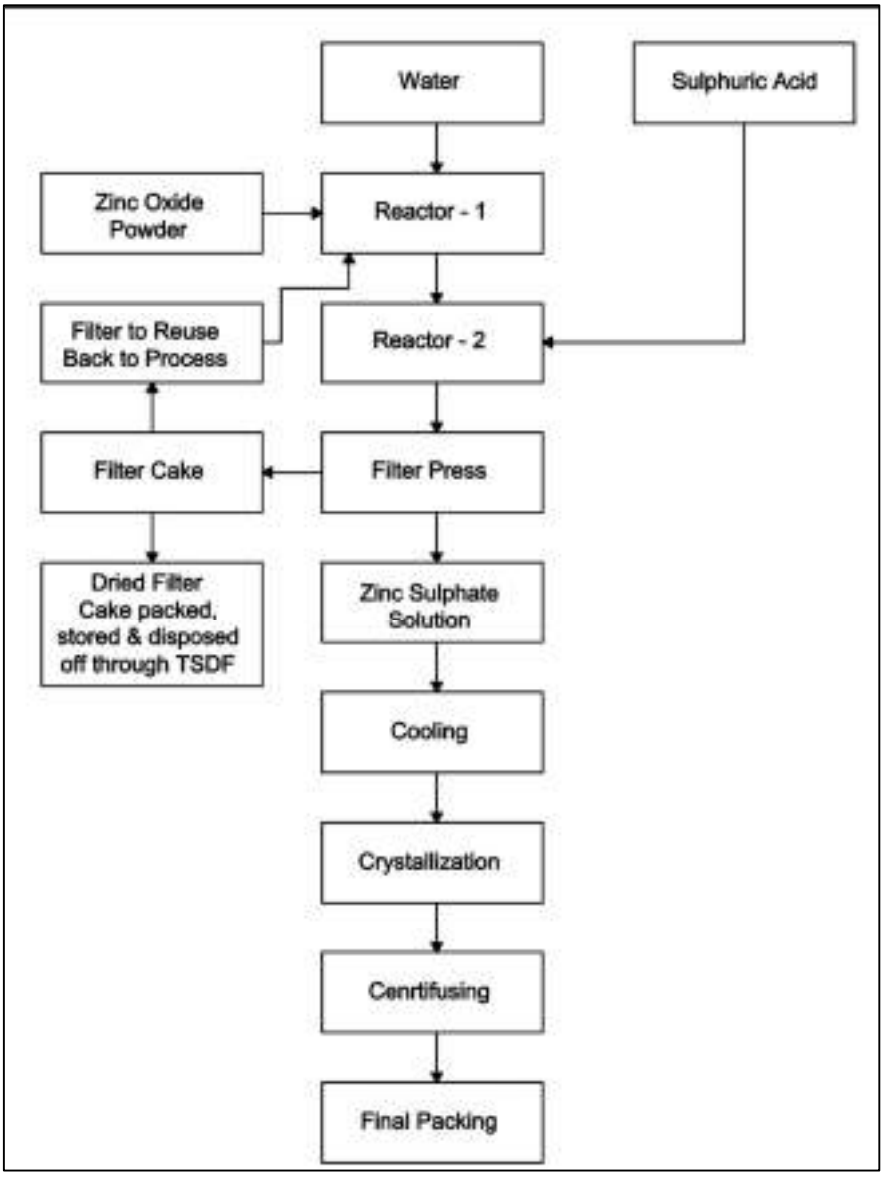


Figure 2.8 : Flow diagram of Zinc Sulphate

Material Balance

MASS BALANCE FOR ZINC SULPHATE (MONO)			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
Zinc Ash 70%	6547	Zinc Sulphate (MONO)	13200
Sulphuric Acid 98%	7300	Water Evaporation	11147
WATER	10500		
Total	**24347**		**24347**

6. PRODUCTION PROCESS OF VINYL SULPHONYL

Manufacturing process

Chloro Sulphonation

Chloro Sulphonic Acid is charged into the sulphonation reactor .Acetanilide is then slowly added to maintain the temperature below 80° C .The temperature is then maintained between 50-60 °C .The batch thus prepared is transferred to the storage tank.

Dumping

Sulphonated mass is charged into the Reactor cooled with brine .Ice water is then added slowly to remove all the HCl formed due to decomposition of excess ChloroSulphonic Acid .The HCl is scrubbed and absorbed in water to make HCl .Further Ice water is added to dilute the concentrated Sulfuric Acid formed due to the decomposition of Chloro Sulphonic Acid .Here Sulfuric Acid is of 30-40 % strength. The mass is then filtered out)ASC Cake.

Reduction

Sodium Bi Sulphite slurry is added to the reactor .The pH is maintained neutral by adding Caustic Lye .The ASC wet cake is then charged under controlled temperature and pH .After addition is over the temperature is raised up to 50 °C .The mass is then filtered and transferred to condensation vessel.

Condensation:

The reduction mass in condensation vessel is maintained at 50°C .Ethylene Oxide is slowly added .The pH is maintained to 5-7 by adding dilute sulphuric acid .The material after condensation is transferred to the Nutsch Filter .The Mother liquor is stored in storage tank . The condensed product is then washed and dried.

Esterification:

The condensed product is charged in esterification reactor .Concentrated Sulphuric Acid is added .The temperature is then raised and maintained at 160°C for 4 hours. Vacuum is applied to take out acetic acid vapors and being condensed .The product is then collected in a tank .The dried Vinyl Sulphone is pulverized and packed in PVC bags .

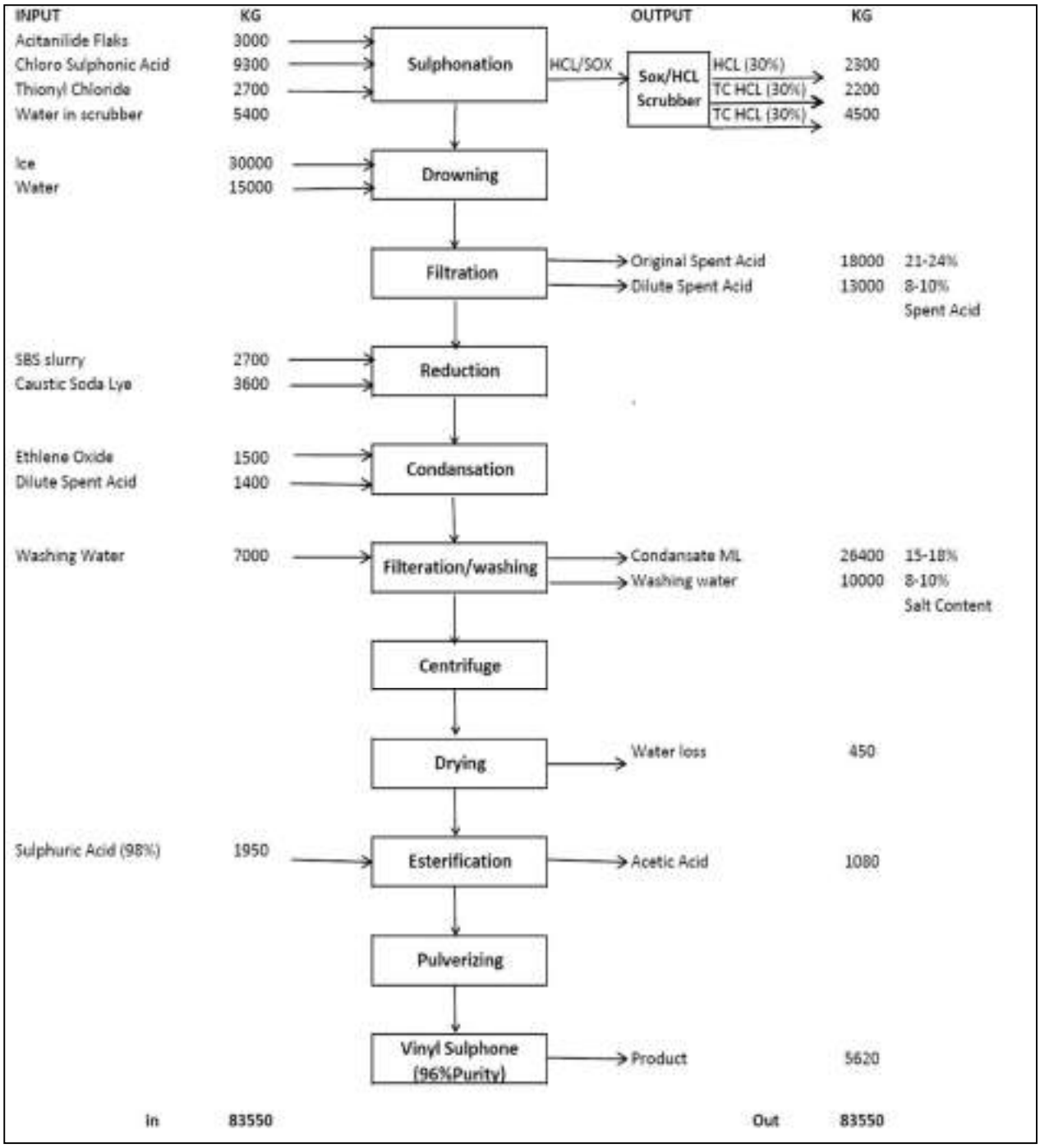


Figure 2.9: Process flow diagram of vinyl sulphonyl production

Material balance

Input	Output

Particulars	Qty (MT)	Particulars	Qty (MT)
Acetanilide	1251.60	Vinyl sulphone	2400
Chlorosulphonic acid	3754.80	HCL	719.7
Thionyl chloride	1126.50	Spent acid	7910
Ice	7822.50	Acetic acid	525.7
Ethylene oxide	660.20	Ml water	10394.5
Sulphuric acid	938.70	Moisture	1282.9
SBS	294.20		
Caustic lye	2002.50		
Water	5382.00		
Total	**23233.00**		**23233**

7. Nitric Acid Plant

Manufacturing process

The technology for the Nitric Acid plant is already decided based on performance evaluation of different Licensors technology by our internal core team who hold professional operating experience of operating such plants. Basically, there are three types of process involved for manufacturing of Nitric Acid.

- Mono Medium Pressure
- Mono High-pressure
- Dual Pressure

Each process is not substantially different from the others and hence there is little difference in overall cost due to process adopted. The outline of the process flow description and process flow diagram are given below:

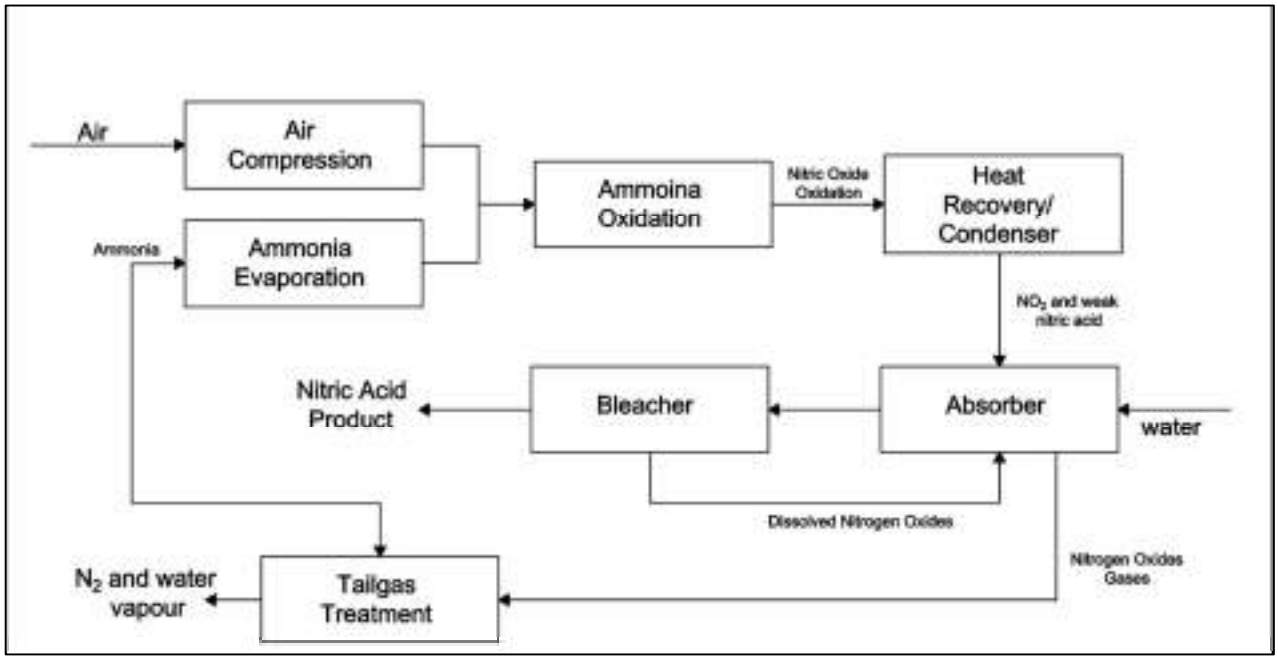


Fig 2.10: Process flow Diagram for Nitric Acid Plant

The process steps involved in production of Nitric Acid plant can be divided into (8) eight main sections described as follows:

- Air Compression
- Ammonia Evaporation
- Ammonia Oxidation
- Heat Recovery of low-pressure nitrous gas
- Nitrous gas compression
- Absorption
- Acid Bleaching
- Tail gas treatment and NOx abatement
- Steam and Condensates

Air Compression

At this section, air is compressed in air compressor and mixed with ammonia. A small part of air, called secondary air, is used during the bleaching process.

Ammonia Evaporation

Liquid ammonia coming from battery limit is filtered to eliminate any unwanted particles present and evaporates in evaporator. Ammonia Gas coming from evaporator is superheated and mixed with them.

Ammonia Oxidation

The ammonia combustion in the Oxidation Reactor produces nitric oxide, following this equation:

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$

Other secondary and undesired reactions in the reactor are:

$$NH_3 + 3\ O_2 \rightarrow 2\ N_2 + 6\ H_2O\ NH_3 + 2\ O_2 \rightarrow N_2O + 3\ H_2O$$

The ammonia oxidation takes place over a set of Platinum-Rhodium gauzes at a temperature around 890 ºC. The efficiency of this reaction varies between 96.7% (with new gauzes, beginning of campaign) to 94-95% (end of campaign, just before changing the gauzes).

Heat Recovery of LP Nitrous Gases

From the reactor, the gases are sent to a train of heat exchangers, where its temperature is reduced. While cooling of the Nitrous gases, two reactions are taking place inside the exchangers in the gas phase:

$$2\ NO + O_2 + NO_2\ NO_2 + N_2O_4$$

Both reactions, nitric oxide oxidation and nitric dioxide dimerization, are exothermic, producing an additional heat, also recovered in the exchangers.

Absorption

The absorption of the nitrous dioxide and nitrous tetra oxide in water to produce nitric acid at 60- 62 %w/w takes places in the upper trays of the Absorption Tower. These are perforated trays with refrigeration coils to reduce the temperature of the gases, improving the absorption process.

The nitric acid production is achieved through the following reactions:

$$2\ NO_2 \text{ or } N_2O_4 + H_2O + HNO_3 + HNO_2\ HNO_2 + HNO_3 + 2\ NO + H_2O$$

This could be merged in a single reaction:

$$3\ NO_2 + H_2O + 2\ HNO_3 + NO$$

The nitric oxide (NO) produced in the reaction is oxidized inside the column, to nitric dioxide (NO2), which is absorbed in the column.

The process water needed for the absorption can be added as de-mineralized water or as clean condensate from Ammonium Nitrate Solution Plant.

Acid Bleaching

Nitric acid coming from the bottom of the absorption tower flows to the bleaching tower where NOx gases dissolved in the acid are removed. To do this operation, secondary air is flow counter current, removing the dissolved gases. Bleached Nitric Acid goes to the Battery Limit.

Tail Gas Treatment and NOx Abatement

Tail gas comes out from the absorption tower having a residual content of nitrogen oxides of 500 ppm v. It is heated in heat exchanger to recover its energy. The heated tail gas from the absorption tower with NOx content about 500 ppmv, are mixed with a stoichiometric amount of ammonia in the Ammonia/ Tail Gas Mixer and sent to the DE NOx Abettor, where a Selective Catalyst Reduction takes place decreasing the nitrogen oxides concentration in the tail gas below 50 ppmv.

Gas coming out from the DE NOx unit is superheated in normal operation in Tail Gas Super heater and is sent to the expander that supplies around 57% of the required energy to compress the air. The additional energy required in the process is supplied by the steam turbine. Once tail gas is cleaned and expanded it is sent to the atmosphere through stack. The entire steam produced in the Nitric Acid Plant is sent to the steam turbine coupled to an electric generator, to generate power for the Nitric Acid plant and/or toexport.

Steam and Condensate

High pressure steam is required for Air compressor steam turbine. In normal operation HP steam is produced in the nitric acid plant during the cooling of nitrous gases from converter. But during start-up it is necessary to import steam to move the turbine.

Steam condensate is generated in the surface condenser of turbine and transported by means of turbine condensate pumps to the de-aerator.

Material Balance

Input		Output	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**

NH_3	12500	Nitric acid 70%	66000
Air	24000	Water evaporation	18350
Water	54450	Effluent water	6600
Total	**90950**		**90950**

8. SULPHONIC ACID (LABSA)

Manufacturing plant

Benzene and Sulphuric acid are feed in proportioned controlled manner through a recycle venturi water added slowly during recycle Recycled mass in further digested and sulphonic acid and spent acid separated by gravity separation.

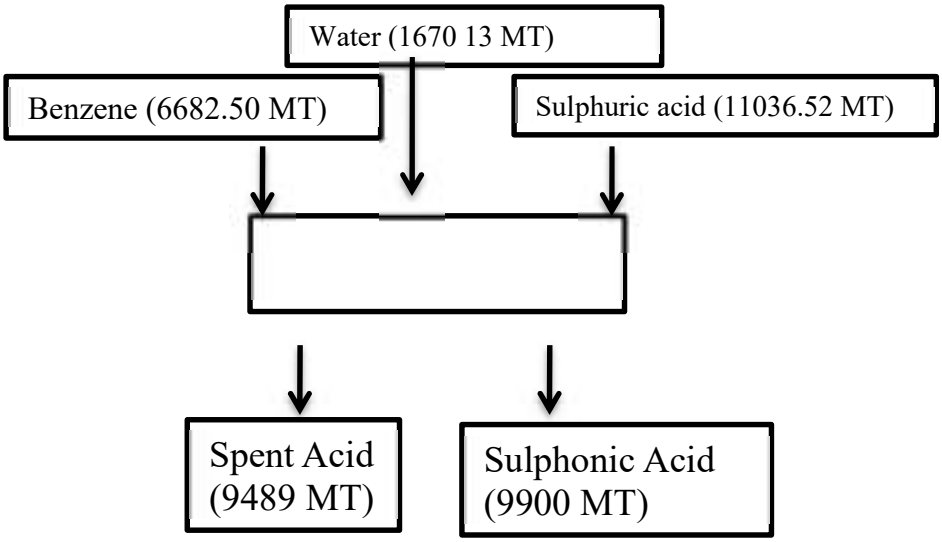


Fig 2.11: Manufacturing process of Sulphonic Acid (LABSA)

Material Balance

MASS BALANCE FOR LABSA			
Input		Output	
Particulars	Qty (MT)	Particulars	Qty (MT)
Benzene	22000	LABSA	33000
Sulphuric acid 98%	33000	SPENT ACID	23650
Water	1650		
Total	**56650**		**56650**

9. SULPHATE OF POTASH

Manufacturing Process

The sulphate of potash or potassium sulphate is produced by several processes as follows:

Decantation Process or Langbeinite Process. Langbeinite is treated with concentrated solution of potassium chloride to yield precipitates of potassium sulphate.

$$K_2SO_4.\ 2Mg.\ 2Mg\ SO_4 + 4K\ Cl = 3K_2SO_4 = 2MgCl_2$$

The precipitate of potassium sulfate is separated from solution by decantation. As langbeinite is used, the process is termed Langbeinite process, and as decantation is involved in the process, it is also termed decantation process.

Note: In Lieu of langbeinite, double sulphate of potassium and magnesium may be reacted with potassium chloride to yield potassium sulphate.

Glascrite Process. In this process sodium sulphate is reacted with potassium chloride to yield potassium sulphate.

$$Na_2SO_4 + 2K\ Cl = K_2SO_4 + 2Nacl$$

This reaction occurs in two steps as follows:

First Step: Here, an intermediate compound, glaserite is formed

$$4Na_2SO_4 + 6KCl = Na2SO_4.\ 3K2SO_4 + 6NaCl$$

Second Step

Here, potassium chloride reacts with glascrite, to yield potassium sulphate.

$$2KCl + Na_2SO_4.3K_2SO_4 = 2Nacl + 4K_2SO_4$$

As glascrite is formed as an intermediate compound, this process is termed glascrite process.

Mannheim Process

Sulphuric acid reacts with potassium chloride to yield potassium sulphate.

$$H_2SO_4 + 2KCl = K_2SO_4 + 2HCl$$

Hargreaves Process

Sulphur is burnt to yield sulphur dioxide

$$S + O_2 = SO_2$$

Sulphur dioxide is reacted with air (O_2), water vapor (H_2O) and hot potassium chloride to yield potassium Sulphate.

$$SO_2 + 1/2O2 + H_2O + 2KCl = K_2SO_4 + 2HCl$$

Material Balance

MASS BALANCE FOR SULPHATE OF POTASH			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
MOP	19935	Sulphate of potash	19800
Langbeinite	7114	Magnesium chloride	7249
Water	24750	Water losses	24750
Total	**51799**		**51799**

10. Gypsum granular

Material Balance

MASS BALANCE FOR GYPSUM GRANULAR			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
Gypsum	125000	Gypsum granular	100000
Coating oil	50	Water evaporation	26700
Water	1650		
Total	**126700**		**126700**

11. Ammonia

Manufacturing process:

Ammonia plant has the following sections:

- Naphtha Pre-treatment
- Reforming
- Shift Conversion
- CO2 Removal

- Methanation
- Compression
- Synthesis
- Purge Gas Recovery

S. No	Sections	Details
a.	Naphtha Pre-treatment	In this section the feed naphtha is purified of sulfur from 200 ppm to <1 ppm. The naphtha is heated to 380°C and reacted with hydrogen to convert all the sulfur into hydrogen sulfide in the reactor filled with CoMox Catalyst of volume. H2S rich stream is separated from naphtha and mixed with fuel in primary reformer.
b.	Reforming section	Steam Reforming of the feed naphtha is carried out in primary and secondary reformer. In the primary reforming, de-sulphurised naphtha is reacted with the steam in the reformer tubes where the hydrocarbon is converted to hydrogen, methane, carbon dioxide, carbon monoxide in the presence of the nickel catalyst. The overall reaction is endothermic and heat is supplied by means of burners on the top of the reformer. In the secondary reformer, process gas from the primary reformer is made to react with the preheated air. Here the methane content is reduced to 0.30% and the nitrogen which is required for the ammonia synthesis is added to the process.
c.	Shift Conversion	The hot process gas from secondary reformer gives heat for steam generation in the waste heat boilers and enters the high temperature and the low temperature shift conversion vessels where Carbon monoxide in the process gas reacts with steam and converts to carbon dioxide while producing Hydrogen, in two steps. The catalyst used is copper promoted iron oxide. At the end of the shift conversion, the CO in the process gas is reduced below 0.20%.
d.	CO_2 Removal Section	In this section, Benfield process is adopted. The gas coming out of the shift converter contains hydrogen, nitrogen, carbon dioxide, carbon monoxide, methane, argon and excess of the steam added in the reformer. Only hydrogen and the nitrogen are desirable for the production of the ammonia. CO is separated from gas mixture in this section in absorption – stripping process using Benfield solution (potassium carbonate) as solvent and sent to the DAP/NPK plant where

		it is used as one of the raw materials. Process gas, called Synthesis gas here after, containing H2 and N_2 in desired ratio, essentially free of CO-CO_2 goes to methanation.
e.	Methanation	In this process the residual, Carbon monoxide and CO_2 slipped in CO_2 removal process are converted to methane in the nickel catalyst bed as these are poisons for the synthesis catalyst.
f.	Compressors	Synthesis gas compressor increases the pressure of the make-up gas to the synthesis pressure as well as it is used to recirculate the recycle gas. The synthesis section operates at pressure of 200 kg/cm² as the ammonia reaction is favored by high pressure. Air compressor is used to compress the air and supply it to the secondary reformer. A refrigeration compressor is used to cool the synthesis convertor outlet gases to condense and separate the product ammonia.
g.	Synthesis	Here the process gas containing hydrogen and nitrogen in the molar ratio of 3.0 is passed over the iron catalyst in the two beds arranged in series with intercoolers and quenches to control the reaction temperatures. The conversion to ammonia is only partial and hence the unconverted reactants are recirculated to converter after separation of product.
h.	Purge gas recovery	As the process in synthesis section is a circulating process, to avoid build up inert, purge gas is taken from circulating stream. Purge gas recovery is a cryogenic process, where in the hydrogen from the purge gas is recovered and recycled to the compressor suction. This helps to increase the process efficiency.

Fig 2.12: Process flow diagram of Ammonia Manufacturing

Material Balance

MASS BALANCE FOR AMMONIA			
Input		**Output**	
Particulars	**Qty (MT)**	**Particulars**	**Qty (MT)**
CH_4	70600	Ammonia	100000
Air	105000	Co2	194150
Water	155000	Water evaporation	36450
Total	**330600**		**330600**

2.8 Mitigation Measures incorporated in proposed expansion project

The mitigation measures is/will be adopted for the following:

- Air pollution Mitigation measures
- Noise pollution Mitigation measures
- Water pollution Mitigation measures
- Soil contamination Mitigation measures
- Solid waste generation Mitigation measures

Air Pollution Control Mitigation measures adopted

The major gaseous emissions generated inside the plant are usually from Process stacks, Prilling Towers, product handling in Bagging Plant, vehicle movement etc. The SPM levels from the Prilling towers top and the Ammonia concentration from Prilling towers top and high pressure section vent is within the norms. The emissions from stack will conform to the regulatory requirement.

- Stack of adequate height for Phosphoric acid plant and D.G.Sets
- Elevated stack for venting of gases from the scrubbers to atmosphere

The adequate stack height is/will propose for the dispersion of air pollutants. The existing and proposed stack height details are given below:

Table 2.9: Details of Plant Stacks – Existing EC Products

S. No.	Existing Product	Detail (process stage involving stack)	Stack (nos.)	Stack Height (m) and Dia	Velocity m/s	Temp	Air pollution control device
I	**Process**						
1.	Single Super Phosphate (SSP)	Process stack (scrubber stem)	01	50 X 1.00	7.5	45	1. Four stage scrubbing system with water spray in 3 and caustic in 1. 2. Bag Filter in ball mill
2.	Granular SSP (GSSP)	Process stack	01	40 X 0.60	8.5	60	Cyclone dust collector

3	Sulphuric Acid	Process Stack	01	50 X 0.80	7.5	45	Alkali Scrubber
3.	Triple Super Phosphate (TSP)	Commercial production yet not commenced.					Same as Sr. No. 1
4.	Synthetic Gypsum	Commercial production yet not commenced.					Same as Sr. No. 1
5.	Phosphoric Acid (PA)	Plant under construction	01	40 X 1.5	5.5	55	1. Wet Scrubber in process 2. Bag filter in ball mill
6.	Beneficiated Rock Phosphate (BRP)	No Stack					Water sprinkler in crusher system.
7.	Sodium Silica Fluoride (SSF)	Plant not installed					
8.	Ball Mill	No stack					Bag filter
II	**DG Set**	Capacity: 875 KVA	01	5 X 0.20	16.13	280	Acoustic Enclosure

Table 2.11: Details of proposed point sources of emission (stack)

S. No.	Plant	No. of stack	Stack attached to	Stack Height (m)
Process				
1.	Ammonia Plant	1	Primary Reformer Stack	50
		1	Scrubbed gas stack	50
2.	Sulphuric Acid	1	Absorption Tower Stack	50
3.	Phosphoric acid	1 1	Rock grinding section Gas Scrubber	20 40
4.	Nitric acid	1	Absorption Tower stack	50
5.	DAP/NPK Complex fertilizer plant	1	Ammonia Scrubber	50
		1 1	HF gas scrubber Coal fire furnace	50 30
6.	Zinc Sulphate	1	Process stack	30
7.	Gypsum Granular plant	1	Coal fire furnace stack	30
8.	Vinyl Sulphone	1 1	Sulphonation Reduction	15

S. No.	Plant	No. of stack	Stack attached to	Stack Height (m)
9.	Calcium Nitrate	No stack Required		
10.	LABSA Plant			
11.	Sulphate of potash			
I.	Boiler	1	boiler house stack	30
II.	DG Set 1000 kVA	1	D.G House	30

The control measures employed for controlling air pollution are:-

Phosphoric acid plant

In the Phospheric acid plant exhaust gas from reactors is drawn by exhaust fan through series of Scrubbers in which the gas is washed with water to remove fluorine compound in exhaust gas before venting to atmosphere and there by fluorine is recovered from reaction stage itself and in turn reducing fluorine emission through acid& gypsum. Fluorine gas generated from the Phosphoric Acid process will be transferred in rubber lined ducts to the multistage scrubbers and Fluorine from scrubber liquor will be recovered as Hydroflourosilcic acid which is used for the production of Aluminium Flouride.

The following air pollution control equipment are used to control the emissions to atmosphere

- Venturi Gas scrubbers,
- Cyclonic Mist Eliminators,
- Bag filters

Photographs showing the Air Pollution Control equipment attached to process plant are enclosed as **Annexure-**

Fugitive Emission Mitigation measures adopted

As Rock Phosphate has to be imported or to be acquired from captive mines /other domestic sources or imported, and most of it would be transported with the help of trucks and heavy vehicles, hence, a special plan for the handling & transportation of the raw material within the premises which are as mentioned below:

- All trucks will be transported after covering from the top.
- Raw material unloading will be done by mechanized truck unloading system.

- Dust collectors will be in line with unloading hoppers.
- Material handling in the plant will be done in closed conveyors.
- All the trucks being used for transportation of raw material and final product shall be checked for "Pollution under Control" certificate prior to their entry to the plant premises.
- Storage of raw material in dedicated sheds to avoid fugitive emissions.
- Speed of vehicles inside the factory premises will be controlled

Noise Pollution

The plant will have various rotating machines including blowers, vacuum pumps, process pumps, grinding mills etc. along with DG sets, which will generate noise.

- These machines will be provided with appropriate acoustic enclosures to maintain the noise levels within limits.
- During operation/construction phase minor noise is envisaged.
- The statutory national standards for noise levels at the plant boundary and at residential areas near the plant are being and shall be met.

Water Pollution Control Mitigation measures adopted

Water is being/will be required for industrial use, domestic & gardening purposes. Although, there is being/will be wastewater generation due to industrial process and domestic, the water generated from washing and scrubbing will be recycled back in the process. The industrial waste water to the tune of 75 KLD will be treated in the Effluent treatment Plant of capacity 100 KLD and the treated water will be reused in various processes like Chilling Plant make, Floor washing, Dust suppression, Industrial activity ,green belt development etc. Domestic waste water to the tune of 15 KLD will be treated in the STP of capacity20 KLD.

Treatment technology adopted

Sewerage Treatment Plant

MBAPL will put up a sewage treatment unit with the capacity of 20 KLD. The combined sewage from the factory is collected in the sump tanks and pumped to the bar screen chamber and oil trap to remove floating solids and oil traces respectively. After this preliminary treatment the effluent is fed to equalization tank. Effluent from the equalization tank is fed to the MBBR tank at constant flow rate.

Effluent treatment Plant

Approx 107 KLD industrial waste water will be generated and the same will be treated in the ETP of capacity 120 KLD.

Land /Soil Pollution Mitigation Measures adopted

The impact on land environment will be mainly due to generation & improper management of debris/construction material during construction phase & solid waste & hazardous waste during operation phase. Construction waste will be properly collected and disposed off as per C&D waste rules & various measures to be adopted for mitigating any adverse impact on land environment are detailed in Chapter 4.

Solid Waste Management

In practice, Unit operations encounter various types of waste, including: Municipal Solid Waste (MSW); compostable waste; hazardous and industrial waste. Collection and handling of domestic solid waste is being done in line with the provisions of the Solid Waste Management Rules 2016.

- Municipal solid waste to the tune of 120 kg/day will be generated including the waste from existing operations and will be sent to Municipal Council, Banda, District-Sagar, M.P.
- Hazardous waste like spent oil from DG set operations is being/will be generated from the operations which is being/will be sent to CPCB/SPCB approved recyclers.

Generation of Municipal Solid Waste

Particulars	Population	Basis	Quantity of waste generated (in kg/day)
Workers	381	@0.3 kg/day	114
Landscaping	28.29	@0.2kg/acre/day	6
		Total	**120kg/day**

Details of Non- Hazardous waste

Particulars	Quantity	Management
Scrap/ Plastic packing material wood, card board, gunny bags etc	3870 damaged bags	Repair and reuse in packing of SSP/GSSP.

The solid waste generated is being/will be first segregated and then handled, stored &disposed off as per applicable Rules i.e. SWM Rules, HW Rules, C&D Rules etc.

Details of hazardous waste Generation from the process and treatment

Particular	Hazardous waste Quantity				Treatment Disposal
	Type of waste	Existing	Proposed	Total	
Hazardous Waste	Used Oil Category 5.1 (Consent No. AWH -47347 & 45474)	278 Litre	500 Litre	778 Litre	Stored in drums and reuse for lubricating the open chain/ gear /roller etc.
	Silica (Annexure II in Form-4 (19-20)	119 MT	None	119 MT	Recycle in SSP manufacturing as filler.
	H_2SiF_6 (Annexure II in Form-4 (19-20)	6466 MT (liquor)	None	6466 MT (liquor)	Recycle in SSP manufacturing for acid dilution purpose.
	Zinc Sludge from Zinc Sulphate	None	300MTPA	300MTPA	It will be reuse in SSP.
	Sludge (Schedule I category 26.2) from DAP/NPK ,Ammonia and Nitric Acid Plant	None	50MTPA	50MTPA	It will reuse in SSP
	Sludge (Schedule I category 26.2) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	MEE Salt (Schedule I category 26.1) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP

2.9 ASSESSMENT OF NEW TECHNOLOGY & UNTESTED TECHNOLOGY

No new technology & untested technology is being adopted for the proposed expansion. Hence no risk of technological failure is envisaged.

****

INDEX

3.1 INTRODUCTION 121
3.2 ENVIRONMENTAL SETTING 122
3.3 COLLECTION OF BASELINE DATA 124
3.4 LAND ENVIRONMENT 125
3.4.1 SOURCE OF INFORMATION 126
3.4.2 DATA BASE 126
3.4.3 LAND USE/ LAND COVER OF THE AREA 126
3.4.4 DESCRIPTION OF LAND USE 128
3.4.5 SOIL ENVIRONMENT 129
3.4.6 RESULT & DISCUSSION 132
3.5 WATER ENVIRONMENT 132
3.5.1 WATER SAMPLE ANALYSIS 133
3.5.2 RESULT 140
3.5.3 HYDROGEOLOGICAL STUDY 140
3.6 AIR ENVIRONMENT 144
3.6.1 MICRO-METEOROLOGICAL DATA 146
3.6.2 WIND PATTERN 146
3.6.3 AMBIENT AIR QUALITY DATA 148
3.6.4 OBSERVATION 150
3.6.5 Air Quality Index (AQI) 151
3.6.5.1 Air Quality Index of Study Area 153
3.7 NOISE ENVIRONMENT 156
3.7.1 AMBIENT NOISE LEVEL DATA 156
3.7.2 RESULT 157
3.8 BIOLOGICAL ENVIRONMENT ..... ……..157
3.9 SOCIO-ECONOMIC ENVIRONMENT 185
3.9.1 OBJECTIVES 185
3.9.6 SOCIAL STRUCTURE 192
3.9.7 LITERACY STATUS OF THE STUDY AREA 193
3.9.8 Worker's Profile & Occupational Structure 195
3.9.9 Dependency Ratio 200

CHAPTER-3
DESCRIPTION OF ENVIRONMENT

3.1 INTRODUCTION

The anthropogenic activities related to chemical Fertilizer sector cause impacts on environmental components in and around the project site. However, the intensity of environmental impacts vary from project to projects, depends upon several factors like; Physical, Chemical, & other etc., Involved in the project, processing capacity (scale / size of the project), type and extent of pollution control measures, project location surrounding geomorphology etc. To assess environmental impacts from proposed project (specific), it is essential to monitor the environmental quality prevailing in the surrounding area prior to implementation of the proposed project. The environmental status (baseline status) within the study area is used for prediction of anticipated environmental impact assessment study. A comprehensive primary and secondary data collection program was undertaken toassess the status of baseline environment conditions within the study area, as per theTOR issued by MoEF&CC for carrying out the EIA/EMP study. The area covered by 10 Km radius around the airport has been considered for the baseline study.

The criteria based on wind profile, habitation, sensitive area, if any etc.adopted while selecting the monitoring locations representing the whole study area has been described under**:-**

Table 3.1: Details of Monitoring Stations

S.No.	Sampling Location	Distance (Km)	Direction	Component	Remarks
1.	Project site (Near admin Block)	-	-	Air, Water Noise, Soil	--
2.	Banda	4.2	NE	Air, Water Noise, Soil	Sensitive (Nearest Highway)
3.	Dilakhedi	1.7	ENE	Air, Water Noise, Soil	Upwind
4.	Fatehpur Village	2.3	SE	Air, Water Noise, Soil	Crosswind
5.	Chhapri	7.4	SSW	Air, Water Noise, Soil	Sensitive (Nearest Highway)
6.	Salaiya Ford	3.9	WSW	Air, Water Noise, Soil	Downwind

S.No.	Sampling Location	Distance (Km)	Direction	Component	Remarks
7.	Khandari	4.8	WSW	Air, Water Noise, Soil	Downwind
8.	Kanti	2.5	NNW	Air, Water Noise, Soil	Crosswind
9.	Bankrai River	5.4	NW	Surface Water	--
10.	Bewas River Up Stream	4.0	ESE	Surface Water	--
11.	Bewas River Down Stream	3.9	ESE	Surface Water	--

Baseline data generation was carried out by NABL approved laboratory M/s Winmet Technology Private Limited, Noida U.P. Environmental Monitoring Report is enclosed as **Annexure - VII**

3.2 ENVIRONMENTAL SETTING

S. No.	Particulars	Details
1.	Name of the Project	Expansion of Fertilizer unit with addition of chemical unit (MBAPL – Unit II)
2.	Project Proponent	Madhya Bharat Agro Products Limited
3.	Location	Plot No. A – 1 & A – 2, Saurai Industrial Area, Tehsil – Banda, District – Sagar (MP)
4.	Geographical Coordinates	**Cordinates / Latitude (N) / Longitude (E)** 1 / 24°01'15.53" / 78°56'16.49" 2 / 24°01'1.00" / 78°56'18.88" 3 / 24°00'57.53" / 78°55'58.10" 4 / 24°01'20.02" / 78°55'53.83" 5 / 24°01'18.55" / 78°56'1.44"
5.	Toposheet No.	54L/16, 54P/4, 55I/ 13 & 55M/ 1
6.	Elevation	Highest -489; Lowest - 475 MSL
7.	Nearest Habitation	**S. No. / Habitation / Distance (Km) & Direction (From Project Boundary)** 1. / Saurai / 1.1 & SE ***Source: - All distances are taken with respect to S.O.I. Toposheet, which is pertinent to this project.***
8.	Nearest Major Town	

S. No.	Particulars	Details
9.	Nearest Highway	**S. No.** / **Highway** / **Distance (Km) & Direction (From Project Boundary)** 1. / NH - 86 / 0.5 & SE ***Source: - All distances are taken with respect to S.O.I. Toposheet, which is pertinent to this project.***
10.	Nearest Railway Station	**S. No.** / **Railway Station** / **Distance (Km) & Direction (From Project Boundary)** 1. / Makronia / Aprox.19.82 km, SE ***Source: - All distances are taken with respect to S.O.I. Toposheet, which is pertinent to this project.***
11.	Nearest Airport	Khajuraho – 132 Km, SSW
12.	Eco-Sensitive Zones/Area	None within 15Km radius
13.	Reserved/ Protected Forest	**S.No.** / **Name of RF/ PF** / **Distance (Km) & Direction (From Project Boundary)** **RF** 1. / Chauka RF / 6.9 & ENE 2. / Sonpur RF / 7.4 & NE 3. / Prashladpura RF / 9.7 & ESE 4. / Bherakhas RF / 10.0 & ENE 5. / Matiya RF / 10.6 & WSW 6. / Zalampur RF / 10.9 & NNW 7. / Patrikota RF / 12.7 & NNE **PF** 1. / Mahuna PF / 8.2 & NNW 2. / Serandant PF / 8.7 & W 3. / Hardauni PF / 10.0 & NNE 4. / Ratanpur PF / 11.2 & NNW 5. / Tetwara PF / 14.2 & ESE ***Source: All distances are taken with respect to S.O.I. Toposheet, which is pertinent to this project.***
14.	Nearest Streams/ Rivers/ Water Bodies	**S.No.** / **Name of Water Bodies** / **Distance (Km) & Direction (From Project Boundary)** 1. / Bewas River / 3.9 & ESE 2. / BankraiNadi / 5.4 & WNW

S. No.	Particulars	Details
		Source: All distances are taken with respect to S.O.I. Toposheet, which is pertinent to this project.
15.	Nearest Education and Medical Facilities	As given below:-

S. No.	Particulars	Distance (Km) & Direction (From Project Boundary)	
Educational Facilities			
1.	Govt. Primary School, Dilakhedi	1.85	ENE
2.	Govt. Primary School, Saurai	1.2	SSW
Medical Facilities			
1.	Arihant Hospital & Nursing Home	3.3	NE
2.	Govt. Hospital, Banda	4.1	NE
Source: - Google Earth			

16.	Places of Worship	As given below:-

S. No.	Particulars	Distance (Km) & Direction (From Project Boundary)	
1.	Maachandimata Temple	3.3	NE
2.	Shri PrannathJi Temple	3.6	NE
Source: - Google Earth			

17.	Other Industries/ Mines	Details are as below:-
18.	Seismic Zone	Zone – II (Low risk zone) as per the BIS Classification.

3.3 COLLECTION OF BASELINE DATA

Baseline environmental data has been collected with respect to the expansion proposal for:-

1. Land Environment;
2. Water Environment;
3. Air Environment;

4. Noise Environment;
5. Biological Environment;
6. Socio-Economic Environment.

The topographical map showing monitoring locations for collection of primary data of soil, air, water &noise is enclosed as **Annexure - XIX.**

Figure 3.1: Map showing study area and Location of Monitoring Stations

3.4 LAND ENVIRONMENT

Objective of the study is to provide a baseline status of the study area covering 10 Km radius around the fertilizer unit, so that temporal land changes due to the proposed expansion proposal on the surroundings can be assessed.

3.4.1 SOURCE OF INFORMATION

The data in this work has been collected from the following sources:-

1. Topographical data - Survey of India Open Series Map (OSM) G43T.

2. Remotely Sensed Data - LISS III

3. Ground Truthing of the area

The Indian Remote Sensing satellite IRS-1C/1D/P6 LISS III was used for present analysis. Four scenes of IRS P6 LISS III covered the entire study area.

3.4.2 DATA BASE

The detail of the primary data in the form of digital data on LISS-III for interpretation and analysis is given below in Table 3.2. The mask of the entire project area including the influence zone was generated from the IRS-1C/1D/P6 LISS III.

The raw LISS III spectral information's wascollected in the three bands as detailed below:-

Band 2: Green region, 520-570 nm

Band 3: Red region, 620-680 nm and

Band 4: Near infrared region, 770-860 nm

Data & Methodology

For the present landuse study LISS-III sensor data of IRS-P6 satellite has been used which has a spatial resolution of 5.8 m, which is good enough for Level-II classification. National Remote Sensing Centre (NRSC), Hyderabad classification scheme has been followed for present landuse study. Unsupervised classification method has been adopted followed by visual interpretation technique for 10 km radius and a total of 6 classes have been obtained.

3.4.3 LAND USE/ LAND COVER OF THE AREA

Classification scheme adopted for the preparation of land use/ land cover maps on 1:50,000 scale:

- Land Use/ Land Cover classification standardized by NRSC/ ISRO.
- The land use/ land cover area of the study area.

Map showing land use of the study area is given below as Figure 3.2.The following land use classes have been observed in the study area:-

Table3.2: Land-use/land-cover distribution within study area

Classes	Area (Ha.)	Area (Sq. Km)	Area (%)
Crop Land	11,910.36	119.1036	37.91
Open Land	5,711.42	57.1142	18.18
Hilly & Stony Land	5,427.46	54.2746	17.28
Fallow Land	3,291.27	32.9127	10.48
Tree Cover	2,984.02	29.8402	9.50
Water Body	1,139.89	11.3989	3.63
Built Up Land	952.545	9.52545	3.03
Total	**31,416.965**	**314.16965**	**100**

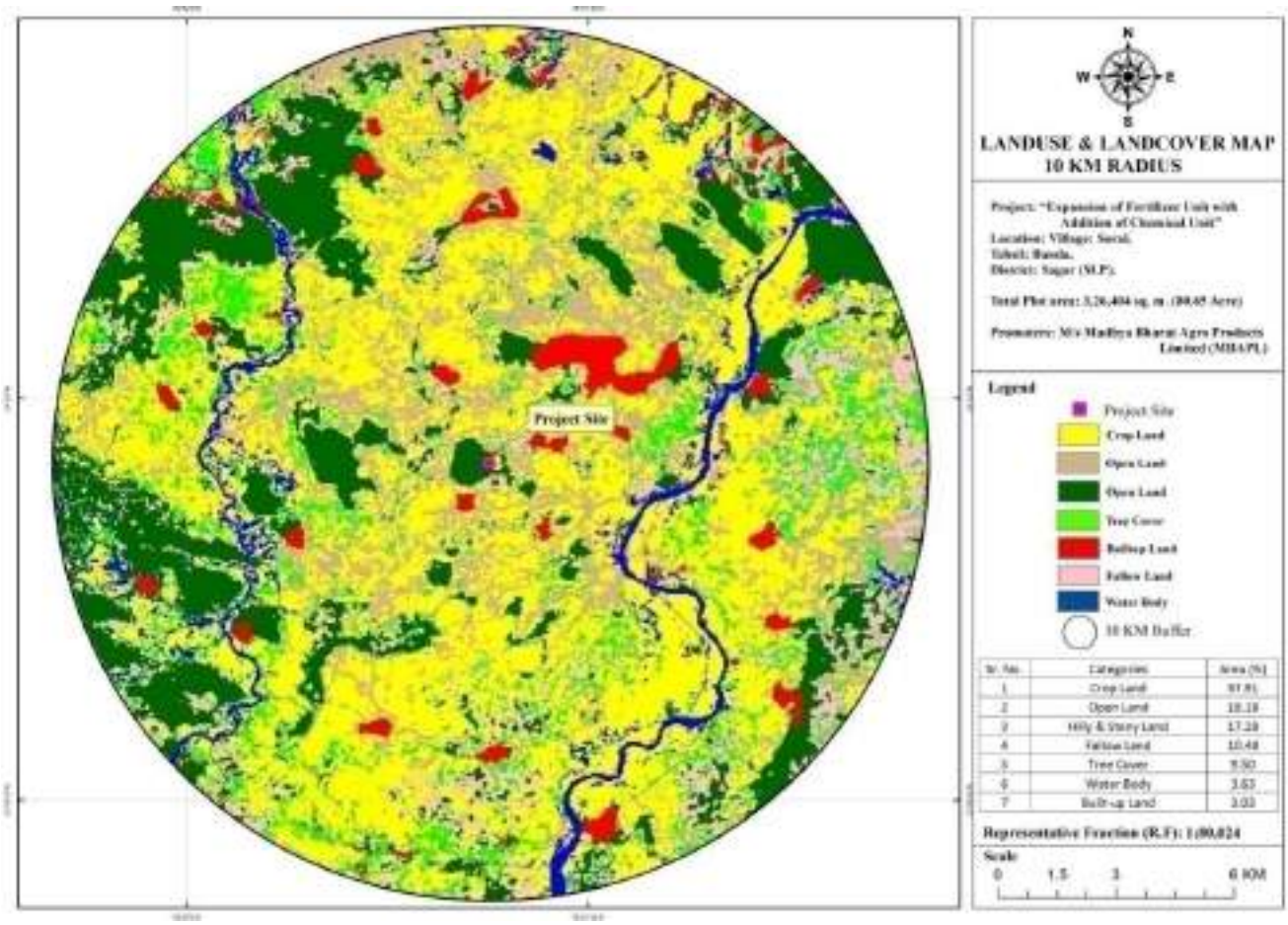


Figure 3.2: Land use/ Landcover Map of Study area

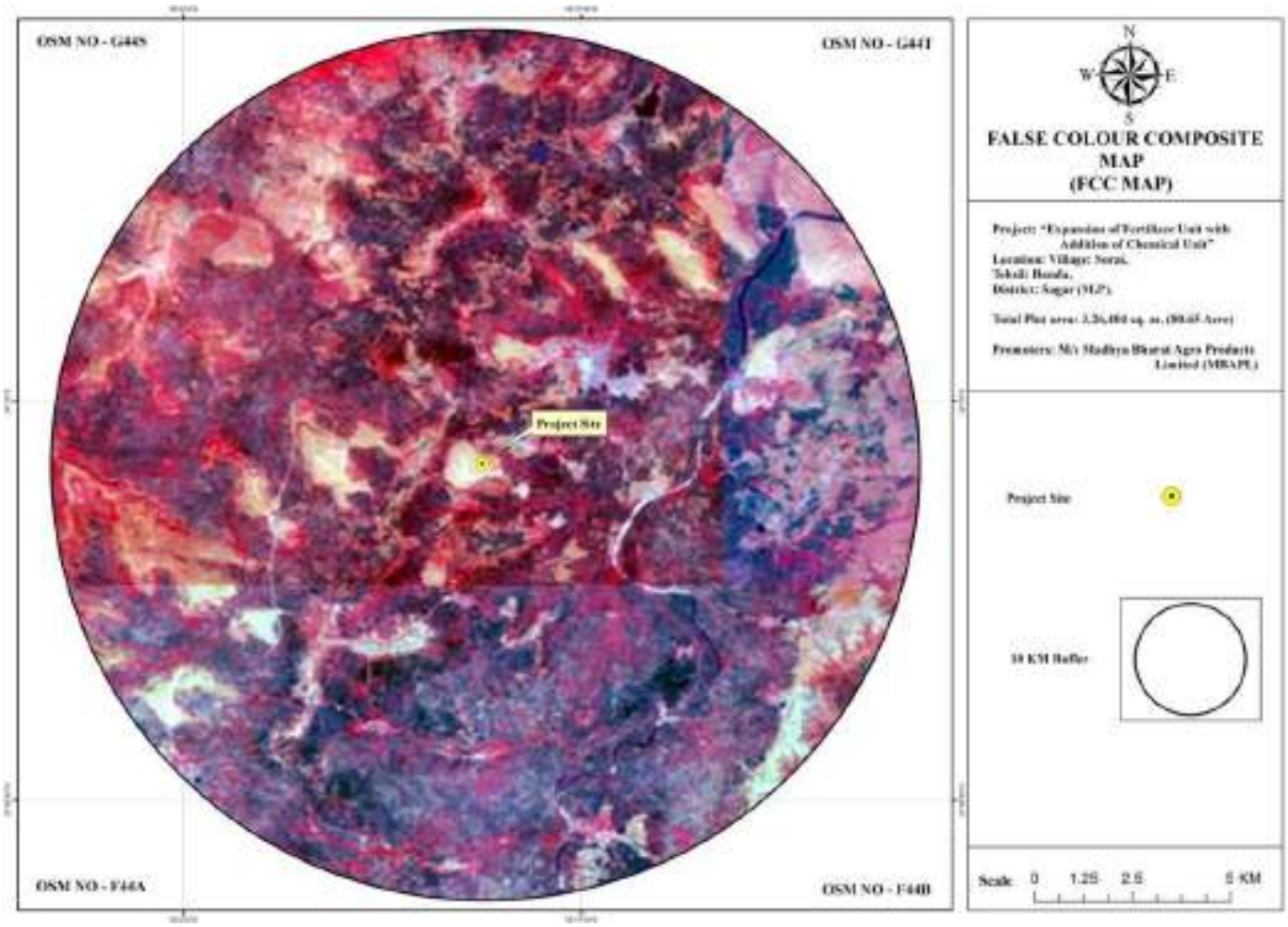


Figure 3.3: False Color Composite Map of Study area

3.4.4 DESCRIPTION OF LAND USE

1. **Crop Land** covers a geographical area 11,910.36ha. (37.91%) this land primarily used for farming and for production of food, fiber and other commercial and horticultural crops**.**
2. **OpenLand**covers a geographical area of 5,711.42ha. (18.18%)
3. **Built-up Land** covers a geographical area with a total of 9,52.545ha. (3.03%) this land primarily used for Rural and Urban settlement, 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 that.
4. **Tree Cover**covers a geographical area of 2,984.02ha (9.50%)

5. **Fallow Land** covers a geographical area 3,291.27ha. (10.48%) Agriculture fallow is the lands, 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**.**
6. **Hilly & Stony Land** covers a geographical area of 5,427.46 ha (17.28%)
7. **Water Bodies** covers a geographical area 1,139.89 (3.63%) in the study area

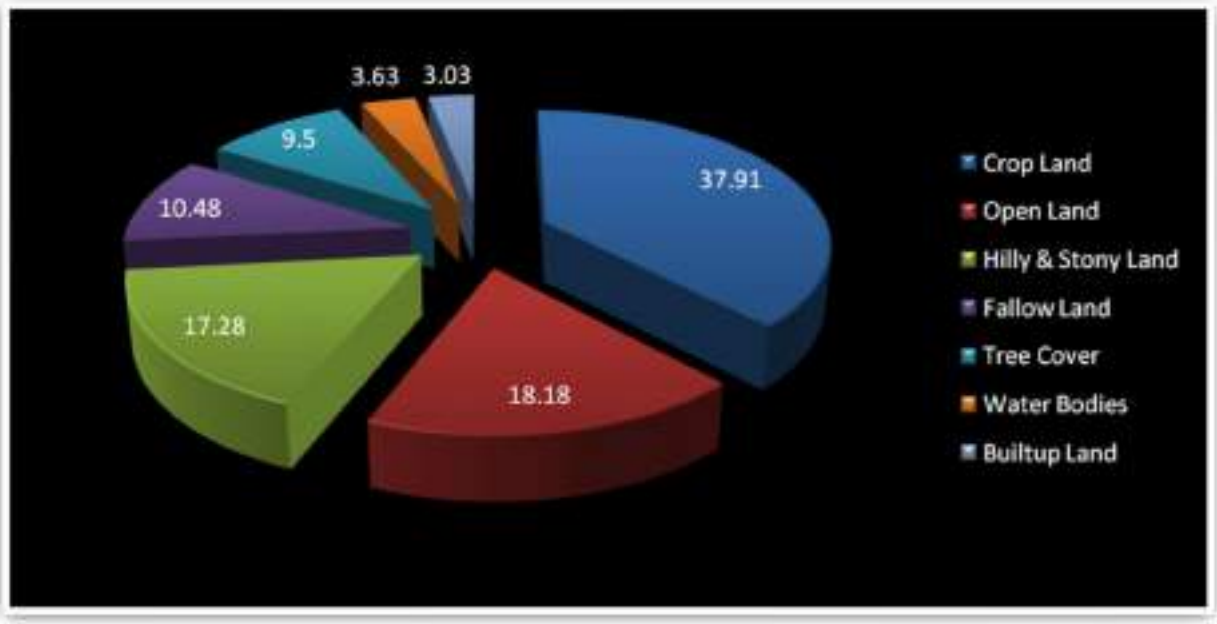


Figure 3.4: Chart showing the landuse distribution

3.4.5 SOIL ENVIRONMENT

The objectives of the soil sampling are:-

- To determine the baseline soil characteristics of the study area;
- To determine the impact due to proposed expansion activity on soil characteristics and;
- To determine the impact on soil more importantly with agriculture production point of view.

Data Generation Methodology

For studying soil profile of the region, sampling locations were selected to assess the existing soil conditions in and around the plant area representing various land use

Conditions. The physical, chemical and heavy metal concentrations were determined. The samples (composite) were collected by ramming a core-cutter into the soil at three different depths viz. 30 cm, 60 cm and 90 cm. The samples was then packed in a

polythene plastic bag and sealed and sent for analysis. The soil analysis results are given below:-

Table 3.3: Geographical Coordinates of Soil Monitoring Locations

Sampling Location	Location	Geographical Coordinates	
		Latitude (N)	Longitude (E)
S-1	Project site	24° 1'6.52"	78°56'7.55"E
S-2	Banda	24° 2'22.10"	78°57'44.91"
S-3	Dilakhedi	24° 1'20.84"	78°57'3.96"
S-4	Fatehpur Village	24° 0'10.31"	78°56'53.60"
S-5	Chhapri	23°57'29.80"	78°54'40.37"
S-6	Salaiya Ford	24° 1'46.30"	78°54'25.33"
S 7	khandari	24° 0'2.87"	78°53'31.12"
S 8	Kanti	24° 2'17.90"	78°55'38.36"

Table 3.4 : Results of Soil Analysis

S. No.	Parameters	Units	Project Site	Banda	Dilakheri	Fatehpur	Kanti	Kandari	SalaiyaFord	Chhapri
1	pH	--	8.56	8.32	8.15	7.96	8.11	7.78	8.22	7.68
2	Soil Texture/ Type	--	Loam	Clay Loam	Clay	Clay	Clay Loam	Clay	Clay Loam	Clay
3	Electrical conductivity at 25 °C	µmhos/ cm	432	319	465	388	291	310	410	396
4	Water holding capacity	%	33.4	36.2	38.1	36.8	35.2	37.1	34.8	36.4
5	Sand	%	49.6	43.6	34.6	36.1	43.6	36.1	44.1	36.5
6	Silt	%	29.6	20.0	22.8	23.3	18.8	20.7	25.7	20.9
7	Clay	%	20.8	36.4	42.6	40.6	37.6	43.2	30.2	42.6
8	Moisture Content	%	10.6	12.9	15.2	13.2	14.6	16.1	13.6	11.5
9	Bulk Density	gm/cc	1.18	1.22	1.26	1.24	1.19	1.27	1.23	1.21
10	Chloride (as Cl)	mg/kg	2690	3360	3560	3278	3628	3398	3558	2980
11	Organic Carbon	%	0.55	0.69	0.71	0.65	0.73	0.59	0.68	0.72
12	Organic Matter	%	0.95	1.19	1.22	1.12	1.26	1.02	1.17	1.24
13	Available Phosphorous (as P)	mg/kg	175	241	326	226	196	302	278	319
14	Copper (as Cu)	mg/kg	2.5	1.6	1.2	2.0	1.5	1.8	2.1	1.6
15	Iron (as Fe)	mg/kg	26.2	15.6	14.6	18.6	13.6	17.2	19.6	14.8
16	Sodium (as Na)	mg/kg	556	610	578	745	690	598	630	739
17	Potassium (as K)	mg/kg	189	210	196	310	246	195	218	294
18	Zinc (as Zn)	mg/kg	16.5	9.6	8.5	10.2	9.2	7.8	8.6	9.6
19	Cadmium	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
20	Lead (as Pb)	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
21	Available Nitrogen (as N)	%	0.048	0.065	0.053	0.062	0.057	0.069	0.071	0.059

Standard soil classification as per Indian Council of Agricultural Research (ICAR) is as below:-

Table 3.5: Standard Soil Classification

S. No.	Soil Test	Classification
1.	pH	<4.5 Extremely acidic 4.51- 5.50 Very strongly acidic 5.51-6.00 moderately acidic 6.01-6.50 slightly acidic 6.51-7.30 Neutral 7.31-7.80 slightly alkaline 7.81-8.50 moderately alkaline 8.51-9.0 strongly alkaline 9.01 very strongly alkaline

S. No.	Soil Test	Classification
2.	Salinity Electrical Conductivity (Mmhos/cm) (1ppm = 640 Mmho/cm)	Up to 1.00 Average 1.01-2.00 harmful to germination 2.01-3.00 harmful to crops (sensitive to salts)
3.	Organic Carbon (%)	Up to 0.2: very less 0.21-0.4: less 0.41-0.5 medium 0.51-0.8: on an average sufficient 0.81-1.00: sufficient >1.0 more than sufficient
4.	Nitrogen (Kg/ha)	Up to 50 very less 51-100 less 101-150 good 151-300 Better >300 sufficient
5.	Phosphorus (Kg/ha)	Up to 15 very less 16-30 less 31-50 medium 51-65 on an average sufficient 66-80 sufficient >80 more than sufficient

Source: Hand Book of Agriculture, Indian Council of Agricultural Research

3.4.6 RESULT & DISCUSSION

The result obtained is compared with thestandard soil classification given in Agriculture Soil Limits. It has been observed that the soil ismoderatley alkalinein nature. The Electrical Conductivity of the eight soil samples is between 291µs/cm to 465µs/cm. The nutrient and organic matter contents are medium and the soil is normally fertile.

3.5 WATER ENVIRONMENT

The purpose of the study is to:-

1. Assess the water quality characteristics for critical parameters;
2. Evaluate the impacts on agriculture productivity, habitat conditions, recreational resources and aesthetics of the vicinity; and
3. Predict the likely impacts on water quality due to mining and other related activities.

Methodology

Reconnaissance survey was undertaken and monitoring locations were finalized based on:

- Drainage pattern and main water bodies;
- Location of industrial and residential areas representing different activities/likely impact areas; and
- Areas likely to represent baseline conditions.

3.5.1 WATER SAMPLE ANALYSIS

Eight ground water and three surface water samples were collected as grab samples and were analyzed for various parameters as per the procedures specified in "*Standard Methods for the Examination of Water and Wastewater*" published by American Public Health Association (APHA). Different physico-chemical parameters of ground water during study period were compared with standard at each monitoring stations and shown in the Table 3.6 and 3.7.

Analytical Techniques

Table 3.6: Analytical Protocol followed for Water Quality Monitoring and Analysis

S. No.	Parameter	Protocol Followed
1.	pH	APHA (22nd Edition) 4500-H^+
2.	Temperature, ºC	APHA (22nd Edition) 2550 B
3.	Turbidity, NTU	APHA (22nd Edition) 2130
4.	Total Hardess as $CaCO_3$, mg/l	APHA (22nd Edition) 2340 C
5.	Total alkalinity as $CaCO_3$, mg/l	APHA (22nd Edition) 2320
6.	Chloride as Cl, mg/l	APHA (22nd Edition) 4500 Cl-B
7.	Sulphateas SO_4, mg/l	APHA (22nd Edition) 4500 E
8.	Nitrate as NO_3, mg/l	APHA (22nd Edition) 4500 B
9.	Fluoride as F, mg/l	APHA (22nd Edition) 4500 F D
10.	Sodium as Na, mg/l	APHA (22nd Edition) 3500 Na B
11.	Potassium as K, mg/l	APHA (22nd Edition) 3500 K B
12.	Total Nitrogen as N, mg/l	APHA (22nd Edition) 4500 N_{org} B & C
13.	Total Phosphorus asPO_4, mg/l	APHA (22nd Edition) 4500 P-C
14.	Phenolic compounds asC_6H_5OH, mg/l	APHA (22nd Edition) 5530 C
15.	Lead as Pb, mg/l	APHA (22nd Edition) 3111 B

S. No.	Parameter	Protocol Followed
16.	Iron as Fe, mg/l	APHA (22nd Edition) 3111 B
17.	Arsenic as As, mg/l	APHA (22nd Edition) 3114 B
18.	Cadmiumas Cd, mg/l	APHA (22nd Edition) 3111 B
19.	Total Chromium as Cr, mg/l	APHA (22nd Edition) 3111 B
20.	Chromium Hexavalent as Cr^{+6}	APHA (22nd Edition) 3500 Cr B
21.	Mercury as Hg, mg/l	APHA (22nd Edition) 3112 B
22.	Copper (as Cu), mg/l	APHA (22nd Edition) 3112 B
23.	Zinc (as Zn), mg/l	APHA (22nd Edition) 3111 B
24.	Selenium (as Se), mg/l	APHA (22nd Edition) 3111 B
25.	Color, Hazen	APHA (22nd Edition) 2120 B
26.	Total Dissolved solids, mg/l	APHA (22nd Edition) 2540 B
27.	Free residual chlorine, mg/l	APHA (22nd Edition) 4500 B
28.	Boron as B, mg/l	APHA (22nd Edition) 4500 B-B
29.	Sulphide as S, mg/l	APHA 4500 S^{-2}-F
30.	Calcium (as Ca), mg/l	APHA (22nd Edition) 3500 Ca B
31.	Magnesium (as Mg), mg/l	APHA (22nd Edition) 3500 Mg B
32.	Dissolved oxygen, mg/l	APHA (22nd Edition) 4500 DO C
33.	Biological Oxygen Demand, mg/l (27ºC, for 3 days)	IS:3025 (Part-44)-1993
34.	Chemical Oxygen Demand, mg/l	APHA (22nd Edition) 5220 B
35.	Cynaide as CN, mg/l	APHA (22nd Edition) 4500 CN^-F
36.	Anionic detergents as MBAS*, mg/l	Annexure K of IS 13428
37.	Total Coliform, CFU/100 ml	IS:1622-1981

Table 3.7: Primary Water Quality Criteria for Designated-Best-Use-Classes

Designated-Best-Use	Category	Criteria Description
Drinking Water Source without conventional treatment but after disinfection	A	• Total Coliforms Organism MPN/100ml shall be 50 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 6mg/l or more • Biochemical Oxygen Demand (5 days 20ºC) 2mg/l or less
Outdoor bathing (Organized)	B	• Total Coliforms Organism MPN/100ml shall be 500 or less • pH between 6.5 and 8.5 • Dissolved Oxygen 5mg/l or more

		• Biochemical Oxygen Demand (5 days 20ºC) 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	• Total Coliforms Organism MPN/100ml shall be 5000 or less • pH between 6 to 9 • Dissolved Oxygen 4mg/l or more • Biochemical Oxygen Demand (5 days 20ºC) 3mg/l or less
Propagation of Wild life and Fisheries	D	• pH between 6.5 to 8.5 • Dissolved Oxygen 4mg/l or more • Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	• pH between 6.0 to 8.5 • Electrical Conductivity at 25oC micro mhos/cm Max.2250 • Sodium absorption Ratio Max. 26 • Boron Max. 2mg/l
	Below-E	Not Meeting A, B, C, D & E Criteria

Source: CPCB

Table 3.8: Result of Surface water analysis

S. No.	Parameter	Unit	Limits as per IS: 2296 Class C	Bankrai River	Bewas River Up Stream	Bewas River Down Stream
1.	pH	-	6.50 – 8.50	7.22	7.42	7.51
2.	Dissolved Oxygen	mg/l	>4	5.8	5.6	5.4
3.	BOD (3 Days at 27°C)	mg/l	<3	2.5	3.5	5.0
4.	Free Ammonia (as N)	mg/l		Nil	Nil	Nil
5.	Sodium Adsorption Ratio	mg/l		0.10	0.14	0.20
6.	Boron	mg/l	--	0.10	0.20	0.20
7.	Conductivity	µmhos/cm		462	558	596
8	Temperature	(°C)		18	19	18
9.	Turbidity	NTU	NTU	4	5	7
10	Magnessium Hardness (as $CaCO_3$)	mg/l	--	65	77	87
11	Total Alkalinity (as $CaCO_3$)	mg/l	--	212	236	245
12.	Chloride (as Cl)	mg/l		18	25	32
13.	Sulphate (as SO_4)	mg/l	<400	4	6	9
14.	Nitrate (as NO_3)	mg/l	<50	1.1	1.5	1.8

15.	Fluoride (as F)	mg/l	<1.5	0.58	0.64	0.71
16.	Sodium (as Na)	mg/l		3	4.5	7.0
17.	Potassium (as K)	mg/l		1.1	1.4	1.8
18	TKN (as N)	mg/l		1.2	2.1	2.3
19	Total Phosphorous (as P)	mg/l		0.05	0.11	0.14
20.	COD	mg/l		10	12	16
21.	Phenolic compounds (as C_6H_5OH)	mg/l		<0.001	<0.001	<0.001
22.	Lead (as Pb)	mg/l		<0.001	<0.001	<0.001
23.	Iron (as Fe)	mg/l		0.25	0.31	0.35
24.	Cadmium (as Cd)	mg/l	<0.01	<0.002	<0.002	<0.002
25.	Zinc (as Zn)	mg/l	<15	0.1	0.13	0.14
26.	Arsenic (as As)	mg/l	<0.2	<0.01	<0.01	<0.01
27.	Mercury (as Hg)	mg/l	--	<0.001	<0.001	<0.001
28.	Chromium (as Cr)	mg/l	<0.05	<0.02	<0.02	<0.02
29.	Nickel (as Ni)	mg/l		<0.01	<0.01	<0.01
30.	TDS	mg/l		310	351	385
31.	Total Coliform	MPN/ 100ml		140	170	200
32.	Faecal Coliform	MPN/ 100ml		50	70	90

3.5.1.1 Observation

The results obtained for the collected samples indicate that the surface water quality was found to be well within the prescribed standards limit (Class A) as per 'Primary water quality criteria for designated best-use classes' by CPCB. The analysis results indicate that:-

- pH of the surface water are in range of 7.22 – 7.51.
- The TDS were found to be in the range of 377 – 735 Mg/l.
- Total Hardness(as $CaCO_3$) was in the range of160-356 Mg/l,
- Total Alkalinity was in the range of 212 - 245 Mg/l.
- Calcium (as Ca) was in the range of 33.6 – 88 Mg/l,
- Magnesium (as Mg) was in the range of 18.47-33.05 Mg/l,
- Chloride (as Cl) was in the range of 69.98-123.97 Mg/l,
- Sulphate (as SO_4) was in the range of27.2-112.6 Mg/l;and
- Fluoride (as F)was in the range of 0.4-0.87 Mg/l

Dissolved oxygen (D.O.) content in surface water quality of monitored locations in study area except for monitoring station SW5 i.e. Nallah in Oda village, was found to be adequate for Class B i.e. *outdoor bathing (organized)*. D.O. atNallah in Oda village was found suitable for Class A.

Table 3.9: Results of Ground Water Analysis

S. No	Parameter	Unit	Desirable Limits as per IS: 10500 - 2012	Permissible Limits as per IS: 10500 - 2012	Banda	ilakheri	Fatehpur	Salaiya Ford	Kanti	Near Project Site	Khandari	Chhapri
1	Colour	Hazen	5	15	<5	<5	<5	<5	<5	<5	<5	<5
2	Odour	--	--	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	--	--	--	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity	NTU	1	5	1.3	<1.0	<1.0	1.5	<1.0	<1.0	1.5	<1.0
5	pH	-	6.5 – 8.5	NR	6.82	7.29	7.36	7.41	7.25	7.51	7.49	7.38
6	Total Hardness (as $CaCO_3$)	mg/l	200	600	615	244	261	284	272	251	285	236
7	Iron (as Fe)	mg/l	0.3	NR	0.16	0.12	0.14	0.13	0.14	0.11	0.13	0.12
8	Chlorides (as Cl)	mg/l	250	1000	276	136	156	174	162	155	172	148
9	Fluoride (as F)	mg/l	1.0	1.5	0.65	0.45	0.62	0.68	0.58	0.66	0.49	0.53
10	TDS	mg/l	500	2000	922	568	639	701	618	596	678	566
11	Calcium(as Ca^{2+})	mg/l	75	200	147	58	63	68	65	60	68	57
12	Magnesium (as Mg^{2+})	mg/l	30	100	59	24.0	25	27	26	24	28	22
13	Copper (as Cu)	mg/l	0.05	1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
14	Manganese(as Mn)	mg/l	<0.1	<0.3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
15	Sulphate (as SO_4)	mg/l	200	400	80	56	64	75	59	49	66	45

16	Nitrate(as NO_3)	mg/l	45	NR	3.0	1.9	2.2	1.5	1.3	2.0	1.2	1.4
17	Phenolic Compounds (as C_6H_5OH)	mg/l	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
18	Mercury (as Hg)	mg/l	0.001	NR	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
19	Cadmium (as Cd)	mg/l	<75	<200	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20	Selenium (as Se)	mg/l	0.01	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
21	Arsenic (as As)	mg/l	<0.01	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Cyanide (as CN)	mg/l	0.05	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
23	Lead (as Pb)	mg/l			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
24	Zinc (as Zn)	mg/l	5	15	0.07	0.06	0.05	0.06	0.07	0.05	0.06	0.07
25	Anionic Detergent (as MBAS)	mg/l	<0.2	<1.0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
26	Chromium (as Cr^{6+})	mg/l	<0.05	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
27	Mineral oil	mg/l	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
28	Alkalinity as $CaCO_3$	mg/l	200	600	205	170	188	201	168	175	196	161
29	Aluminum (as Al)	mg/l	<0.03	<0.2	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
30	Boron (as B)	mg/l	0.5	1.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bacteriological Parameter												
1	Total Coli form	MPN/ 100ml	ND/ 100 ml sample	<2 MPN/100 ml	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
2	E.coli	E.coli/ 100ml			Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent

3.5.2 RESULT

The analysis results indicate that pH of the groundwater were found to be in range of 6.82-7.51. The TDS were found to be in the range of 566 – 922 mg/l. Other parameters like Total Hardness as $CaCO_3$ (236 Mg/l - 615Mg/ l), Total Alkalinity (161 – 205Mg/ l), Calcium as Ca (57 – 147 Mg/ l), Magnesium as Mg (22– 59.0 Mg/ l), Chloride as Cl (136-276 Mg/ l), Sulphate as SO_4(45 -80 Mg/l) and Fluoride as F- (0.45-0.68 Mg/l) were found within the prescribed limits in absence of alternate source except Total Hardness as $CaCO_3$ in Banda. The water quality is potable in nature.

3.5.3 HYDROGEOLOGICAL STUDY

Sagar District forms the central part of the Vindhyan basin. The northern part of the district is occupied by the Bundelkhand massif. The Southwestern parts of the Area are covered by the Deccan traps. This district also limits the Northeasterly extension of the Deccan trap flows. Major rock types in the area are:-

- **Grainte:-**The granites and granitic gneisses in the area are quite hard and generally devoid of any primary porosity.The tube wells sustain a maximum discharge of about two litres per second (lps) for appreciable drawdowns. The yield of open wells ranges between 20 to 100 m 3 day.
- **Bijawar:-**The Bijawars are exposed in a tiny patch in the north eastern extremity of the district. These are composed of siliceous lime stones, breacia and shales. These formations have any significant ground water occurrence.
- **Vindhyans:-**In the vindhyan sandstones, primary porosity varies from negligible to as high as 30% depending on the degree of compaction. The storage and movement of ground water in these formation is controlled mainly by the secondary porosity and permeability created due to weathering jointing and fractured.
- **Deccan Traps:-**Deccan traps are the most important formations in the district due to their large aerial extent. The weathered jointed, fractured and vesicular units of basalts form moderately potential aquifers. The zeolitic basalt in weathered form also makes good aquifer.
- **Laterites:-**Laterite, a by product of weathering of basalt (at some places). In found only to the west of Sagar town. This formation has not attained significant thickness in the area.

- **Alluvium:-**The alluvial deposits are confined mostly to the area along the river courses and in the eastern parts of the district. It is composed of five to medium sand, silt, clay and kankar. The alluvium 17 supports tube wells and dug wells wherever thick and can sustain tube wells with discharge up to 10 lps.

  Sagar district lies mainly in Ganga basin and partly in Narmada basin. Almost 97% of the district falls in the Ganga basin out of which 44% falls in the Ken sub-basin and 56% in the Betwa sub-basin. The surface water divide between the Ganga and the Narmada basin running almost in a east- west direction in the southern parts of the district also acts as a ground water divide in the area. The main rivers in the district are Upper Sonar, Bewas, Kopra, Bearma in the Ken sub-basin and Bina, Jamni, Naren and Dhasan in the Betwa sub-basin. Sindhor is the only river in the Narmada basin

Ground water in unconsolidated sediments:-

About 60% of the district area is covered by Quaternary sediments overlying the hard rock formations. Ground water occurs under phreatic conditions in the shallow aquifers and under semi-confined conditions in the deeper aquifer, which is the principal water bearing zone.

Depth to Water Level – (Pre-monsoon May-2016) -The Pre-monsoon depth to water level ranged between 1.92 mbgl in to 36.52 mbgl. However, in major part the DTW ranged between 5 to 10 mbgl. Deeper water levels of more than 20 mbgl are observed in isolated patches in western part and are presented in figure 3.5.

Depth to Water Level – (Post monsoon Nov-2016)-The Post-monsoon depth to water level map is presented in figure 3.6. It varies from 1.09- 22.00 mbgl. In major part the DTWL was less than 10 mbgl. Deeper water levels of more than 10 mbgl are observed in isolated patches in north western, south eastern and in few pockets central part.

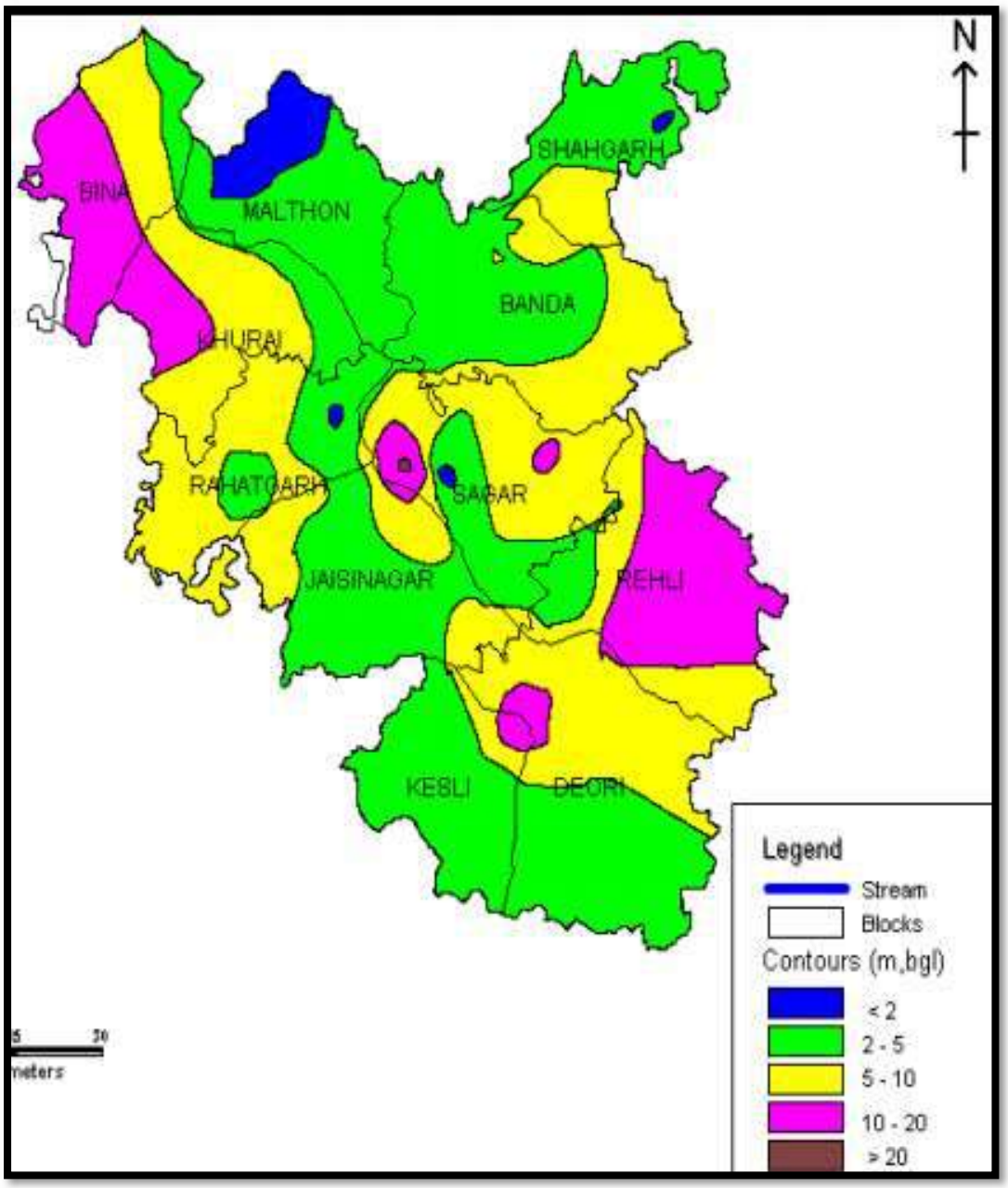


Figure 3.5: - Depth to Water Level – (Pre-monsoon)

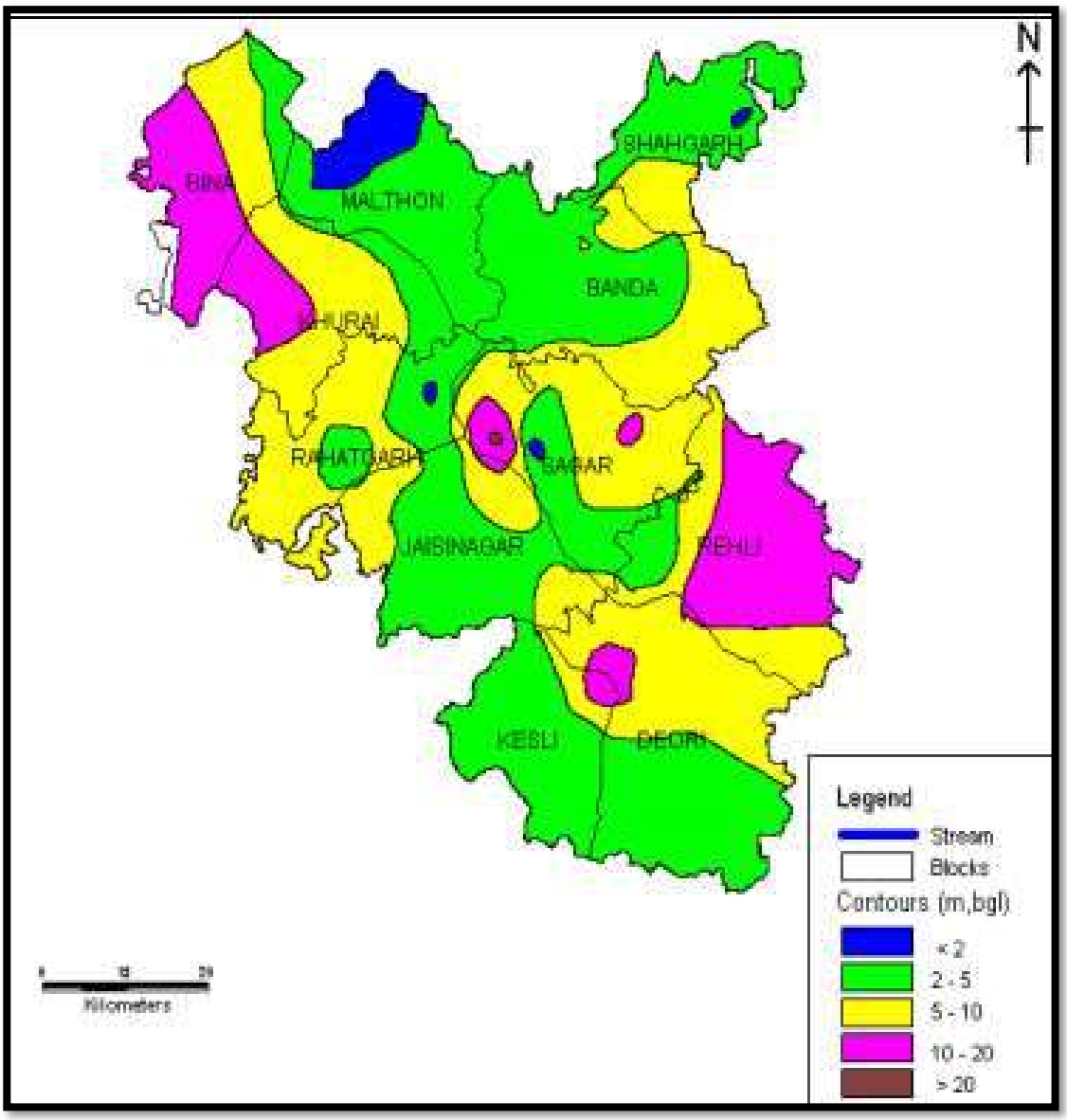


Figure 3.6: - Depth to Water Level – (Post-monsoon)

Physiography

Sagar district lies at the South part of the Bundelkhand region, which widens in the south and south west. It lies northern boundary of the Narmada River and is separated from tis valley by a steep escarpment towards the south. The area is large and covered by the Deccan trap lava flows whereas at places like vindhayan sandstone also shown. The average elevation of the district is about 452 to 533 mamsl. It ranges from 353 mamsl in the Dhasan river bed in the north to 683 mamsl at Naharmau peak in the southwest.

The physical divisions of the district are represented by the basins of several rivers. The area in the North West falling under Khurai tehsil is almost a level tract with an elevation of about 411 to 427 mamsl and is drained towards north-west by Thimpa, Parasasi and Bina rivers. These rivers are tributaries of the Betwariver. The Khurai plain is separated from the rest of the district 7 by a series of steeply rising hills. These hills attain an elevation of upto 533 mamsl and also act as a water divide.

To the east and south-east of the above discussed hills are the five parallel valley of Dhasan, Bewas, Sonar, Kopra and Bamnerrivers. These basins are separated by hills rising 91 to 153 meters above the general ground surface. The highest hill range of TenduDabar attains a height of 665 mamsl.

Geomorphology

Generally Sagar district, landforms have been classified on the basis of genetic factor and the geomorphic processes involved. Further, the geomorphic units have been classified on the basis of differential erosion of rock material, process and relief amplitude.

Three groups of landforms have been identified in the area:

1. Denudational Landforms
2. Depositional Landforms
3. Structural Landforms

Status of Ground Water Development

Development of ground water in the Banda Block is mainly through dug wells, Hand Pumps–India Mark-II and Tubewells.

Net annual GW availability	9654.52 Ham
Existing Ground Water Draft for all uses	7554.84 Ham
Stage of GW development	78.25 %
Area Type Category	Non- Notified – Safe

3.6 AIR ENVIRONMENT

The prime objective of the baseline air monitoring was to evaluate the existing (background emissions) air quality of the area. This will also be useful for assessing the conformity to standards of the ambient air quality during the operation of the proposed mine.

The baseline status of the air quality has been assessed though a scientifically designed ambient air quality monitoring network based on the following considerations:-

- Meteorological conditions on synoptic scale
- Topography of the study area
- Representatives of regional background air quality for obtaining baseline status; and
- Representatives of likely impact areas.

Frequency and Parameters for Sampling

The baseline data of air environment was monitored for parameters mentioned below as per latest Gazette Notification of the Central Pollution Control Board (CPCB) on NAAQ dated 18th November 2009.

Table 3.10: Parameters and frequency of Air Sampling

S.No.	Parameters	Sampling Frequency	Protocol
1.	Particulate Matter (PM_{10}),µg/m^3	24 hourly sample twice a week for three months	IS : 5182 Part-23: 2006
2.	Respirable Particulate Matter ($PM_{2.5}$), µg/m^3	24 hourly sample twice a week for three months	CARB SOP MLD 055 $PM_{2.5}$ Gravimetric analysis-revision 9, July 2008 page 1 of 32
3.	Sulphur dioxide (SO_2), *µg/m^3*	24 hourly sample twice a week for three months	IS : 5182 (Part-2)-2001 RA 2006
4.	Oxides of Nitrogen (NO_x), µg/m^3	24 hourly sample twice a week for three months	IS : 5182 (Part-6)-2006
5.	Carbon Mono-oxide, µg/m^3	8 hourly samples twice a week for three months	IS : 5182 (Part-10) 1999 RA 2003
6.	Ammoniua (NH_3), µg/m^3	24 hourly sample twice a week for three months	IS : 5182 (Part-22)-2004 RA 2009
7.	Benzene (C_6H_6),µg/m^3	24 hourly sample twice a week for three months	IS : 5182 (Part-11)-1993 RA 2006
8.	Benzo(α)Pyrene (BaP) Particulate phase only, ng/m^3	24 hourly sample twice a week for three months	IS : 5182 (Part-12)-1974 RA 2004
9.	Ozone (O_3), µg/m^3	8 hourly samples twice a week for three months	IS : 5182 (Part-9)-1974 RA 2009

10.	Lead (Pb), ng/m^3	24 hourly sample twice a week for three months	IS: 5182 (Part-22)-2004 RA 2009
11.	Arsenic, ng/m^3	24 hourly sample twice a week for three months	IS: 5182 (Part-22)-2004 RA 2009
12.	Nickel (Ni),ng/m^3	24 hourly sample twice a week for three months	IS: 5182 (Part-22)-2004 RA 2009

3.6.1 MICRO-METEOROLOGICAL DATA

The methodology adopted for monitoring surface observations is as per the standard norms laid down by Bureau of Indian Standards (IS: 8829) and India Meteorological Department (IMD). The data on meteorological parameters in the study area were monitored for the period October 2019 to December 2019.

Summary of micro-meteorological parameters on hourly basis to understand the wind pattern, temperature variation and relative humidity variation for Post-monsoon season, 2019 is given below in Table 3.11. The hourly meteorological data recorded.

3.6.2 WIND PATTERN

Wind rose is the diagrammatic representation of wind speed in a specified direction with its arms representing sixteen directions. Each arm gives a clear frequency distribution of wind speed in a particular direction for a given period of time.

Wind speed and direction data recorded during the study period is useful in identifying the influence of meteorology on the air quality of the area.

Based on the meteorological data obtained from the region, percentage frequencies of wind in 16 directions have been computed from the recorded data during the study period

The wind rose diagram for the study period is presented in Figure 3.7.

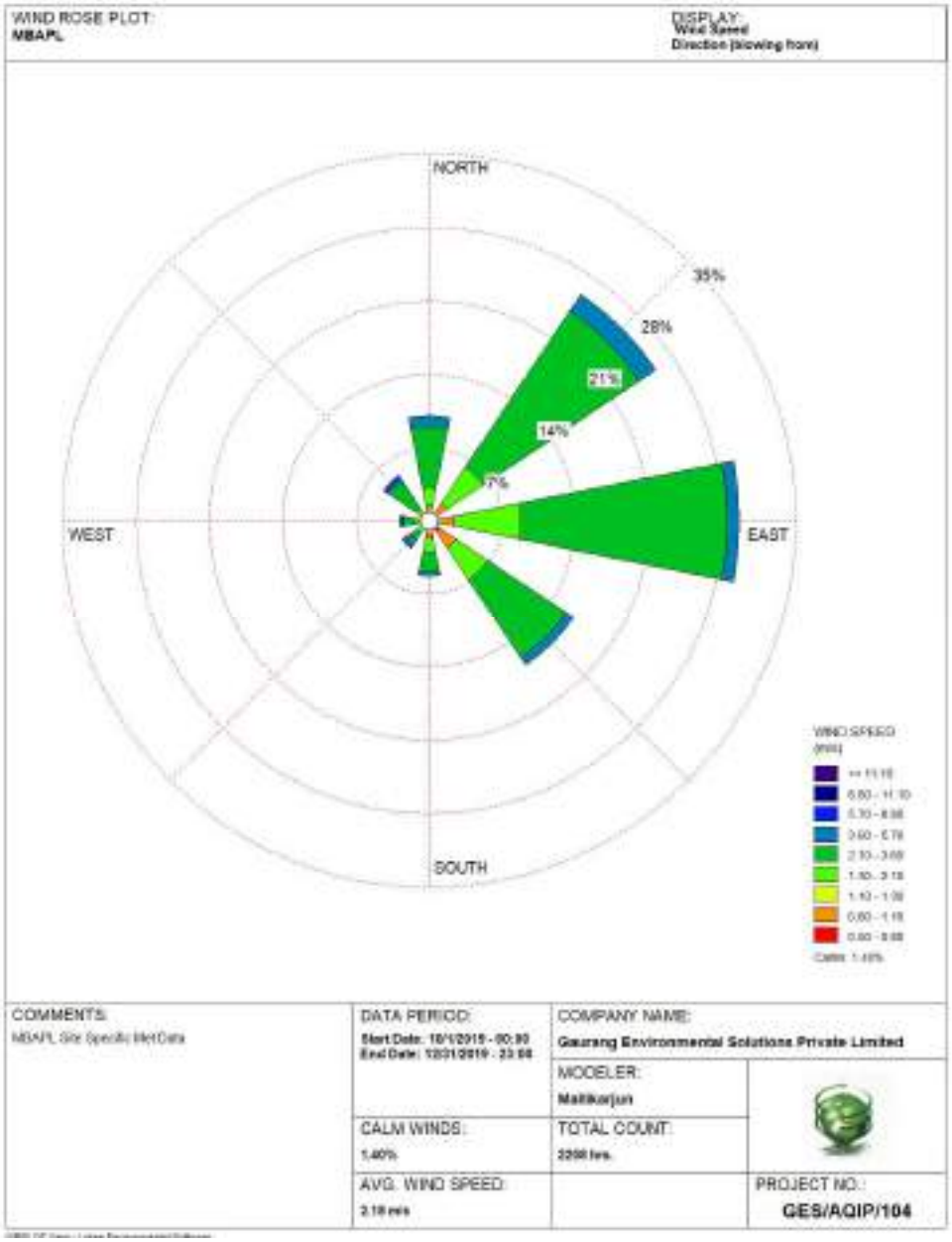


Fig. 3.9: Wind Rose Diagram

The prominent wind direction during this period was from East to West. Calm conditions prevailed for 1.40%winds

3.6.3 AMBIENT AIR QUALITY DATA

Ambient air quality monitoring stations were selected on the basis of surface influence, demographic influence and meteorological influence. The ambient air monitoring has been carried out with a frequency of two days in a week at eight locations covering one complete season i.e.post-monsoon (October' 2019 to December' 2019).

Various statistical parameters like 98th percentile, average, maximum and minimum values have been computed from the observed raw data for all the AAQ monitoring stations. The results are of monitoring carried out for study period representing pre-monsoon season. The summary of these results for each location is presented in follow-up sections. The resultshave been compared with the national ambient air quality standards prescribed by CPCB for industrial and rural /residential zone.

Table 3.12: Geographical Coordiantes of Air Monitoring Locations

Station Code	Location	Geographical Coordinates	
		Latitude (N)	Longitude (E)
A-1	Project site	24° 1'6.52"	78°56'7.55"
A-2	Banda	24° 2'22.10"	78°57'44.91"
A-3	Dilakhedi	24° 1'20.84"	78°57'3.96"
A-4	Fatehpur Village	24° 0'10.31"	78°56'53.60"
A-5	Chhapri	23°57'29.80"	78°54'40.37"
A-6	Salaiya	24° 1'46.30"	78°54'25.33"
A-7	Khandari	24° 0'2.87"	78°53'31.12"
A-8	Kanti	24° 2'17.90"	78°55'38.36"

Table 3.13: Statistical Summary of Concentration Levels of Criteria Pollutants

(Unit: -µg/m^3)

S. No.	Criteria Pollutant	Locations	Arithmetic Mean	Minimum	Maximum	98thPercentile
1	PM_{10}	Project site	72.8	67.2	78.3	77.9
		Banda	56.4	50.1	63.9	62.7
		Dilakhedi	64.4	60.9	68.4	68.0
		Fatehpur Village	64.5	59.0	71.5	70.9
		Chhapri	62.4	56.7	56.7	71.2

S. No.	Criteria Pollutant	Locations	Arithmetic Mean	Minimum	Maximum	98th Percentile
		Salaiya	57.4	51.4	65.2	64.0
		Khandari	58.3	50.7	64.0	64.2
		Kanti	65.3	58.2	72.0	71.3
2	$PM_{2.5}$	Project site	41.9	37.5	45.6	45.4
		Banda	28.4	23.1	32.3	32.1
		Dilakhedi	34.9	31.9	39.0	38.3
		Fatehpur Village	32.9	28.2	37.0	37.0
		Chhapri	34.1	29.1	37.9	37.9
		Salaiya	32.3	27.0	36.2	36.0
		Khandari	32.3	27.2	36.4	36.2
		Kanti	36.3	31.0	40.2	40.0
3	SO_2	Project site	7.0	6.4	7.6	7.6
		Banda	5.8	5.3	6.3	6.3
		Dilakhedi	6.0	5.3	7.1	6.9
		Fatehpur Village	7.1	6.2	7.9	7.8
		Chhapri	6.3	5.7	7.1	7.0
		Salaiya	6.1	5.4	6.7	6.7
		Khandari	5.8	5.2	6.5	6.5
		Kanti	6.5	5.7	7.1	7.1
4	NO_X	Project site	19.7	18.1	20.7	20.7
		Banda	16.4	14.9	18.1	17.9
		Dilakhedi	18.2	16.6	20.1	20.1
		Fatehpur Village	18.6	17.1	19.8	19.8
		Chhapri	18.3	16.8	19.8	19.8
		Salaiya	17.9	16.4	19.0	19.0
		Khandari	19.8	18.0	21.2	21.1
		Kanti	17.4	20.0	20.1	20.0
5	CO	Project site	700.4	600.0	780.0	775.4

S. No.	Criteria Pollutant	Locations	Arithmetic Mean	Minimum	Maximum	98th Percentile
		Banda	582.9	470.0	690.0	680.8
		Dilakhedi	556.7	480.0	620.0	620.0
		Fatehpur Village	670.4	570.0	750.0	745.4
		Chhapri	675.4	580.0	760.0	750.8
		Salaiya	650.4	550.0	730.0	725.4
		Khandari	675.4	580.0	750.0	745.4
		Kanti	730.4	630.0	810.0	805.4

3.6.4 OBSERVATION

The analysis results for the study period are presented in above monitoring tables. Various statistical parameters like 98th percentile, average, maximum and minimum values have been computed from the observed raw data for all the AAQ monitoring stations. These are compared with the standards prescribed by Central Pollution Control Board (CPCB) for rural, residential Industrial and other area.

The observation based on the perusal of the results is summarized below:-

PM_{10}:- The maximum value for PM_{10} observed at Project Site78.3µg/m^3 and minimum value for PM_{10} at Banda50.1 µg/m^3. The 24 hours applicable limit for industrial, residential rural and other areas is 100 µg/m^3.

$PM_{2.5}$:- The maximum value for $PM_{2.5}$ observed at Project Site is 45.6µg/m^3 and minimum value for $PM_{2.5}$ at Banda is 23.1 µg/m^3. The 24 hours applicable limit for industrial, residential rural and other areas is 60µg/m^3.

SO_2:- The maximum value for SO_2 observed at Project Site is 7.6 µg/m^3 and minimum value for SO_2 at Khandariis 5.2 µg/m^3. The 24 hours applicable limit for industrial, residential rural and other areas is 80µg/m$^{3.}$

NO_x: - The maximum value for NO_x observed at Khandari is 21.2µg/m^3 and minimum value for NO_X at Banda14.9µg/m^3. The 24 hours applicable limit for industrial, residential rural and other areas is 80µg/m^3.

CO: - The maximum value for CO observed at Khandari 810 µg/m^3 and minimum value for CO at Banda is 470 µg/m^3. The eight hours applicable limit for Industrial, residential rural and other areas is 2000µg/m^3.

Conclusion

The results of the monitored data indicate that the ambient air quality of the region in general is in conformity with respect to norms of National Ambient Air Quality standards of CPCB, at all locations monitored in the study area of the MBAPL.

3.6.5 Air Quality Index (AQI)

In 2014, CPCB developed uniform air quality index for the Indian cities. The CPCB method utilizes the use of USEPA methodology for determination of the AQI with different breakpoint indices for Indian conditions (CPCB, 2014). The methodology involves the determination of sub-index and then agglomeration of this sub-index for final AQI. The breakpoint concentrations are calculated for different pollutants based on the NAAQS (National Ambient Air Quality Standards) standards and the potential health impacts of the criteria pollutants. The CPCB method of AQI also tells about the pollutant responsible for AQI. The health effectS associated with different AQI Categories are given in below.

The sub-index (*Ip*) for a given pollutant concentration (*Cp*), as based on 'linear segmented principle' is calculated as:

$$I_p = \left[\left\{\left(\frac{I_{HI} - I_{LO}}{B_{HI} - B_{LO}}\right)\right\} \times (C_P - B_{LO})\right] + I_{LO}$$

B_{HI}= Breakpoint concentration greater or equal to given conc shown in table S4.

B_{LO}= Breakpoint concentration smaller or equal to given conc shown in table S4.

I_{HI} = AQI value corresponding to B_{HI}

I_{LO} = AQI value Corresponding to B_{LO}

Finally;

AQI = Max (*Ip*) (where; p= 1, 2,...,n; denotes n pollutants)

Tanle 3.14: Health Statements for AQI Categories

AQI	Associated Health Impacts	Condition/Color
(0–50)	Minimal Impact.	**Good**
(51–100)	May cause minor breathing discomfort to sensitive people.	**Satisfactory**
(101–200)	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults.	**Moderately polluted**
(201–300)	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease.	**Poor**
(301–400)	Maycauserespiratoryillnesstothepeopleonprolongedexposure.Effectmaybemore pronounced in people with lung and heartdiseases.	**Very Poor**
(401-500)	May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced even during light physical activity.	**Severe**

Table 3.15: Breakpoints for AQI Scale 0-500

AQI Category (Range)	PM_{10} 24-hr µg/m^3	$PM_{2.5}$ 24-hr µg/m^3	NO_2 24-hr µg/m^3	O_3 8-hr µg/m^3	CO 8-hr (mg/ m^3)	SO_2 24-hr µg/m^3	NH_3 24-hr µg/m^3	Pb 24-hr µg/m^3
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5 –1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+	34+	1600+	1800+	3.5+

Source: CPCB 2014

3.6.5.1 Air Quality Index of Study Area

Air Quality Index of the study are has been calculated and given below:

Table: 3.16:Air Quality Index of Study area

Project Site				
Pollutants		**concentration in µg/m³ (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	78.3	78	**78 Satisfactory**
$PM_{2.5}$	24-hr avg	45.6	76	
SO_2	24-hr avg	7.6	10	
NO_2	24-hr avg	20.7	26	
CO (mg/m³)	max 8-hr	0.78	39	

Banda				
Pollutants		**concentration in µg/m³ (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	63.90	64	**64 Satisfactory**
$PM_{2.5}$	24-hr avg	32.30	54	
SO_2	24-hr avg	6.30	8	
NO_2	24-hr avg	18.10	23	
CO (mg/m³)	max 8-hr	0.69	35	

Dilakheri				
Pollutants		**concentration in µg/m³ (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	68.40	68	**68 Satisfactory**
$PM_{2.5}$	24-hr avg	39.00	65	
SO_2	24-hr avg	7.10	9	
NO_2	24-hr avg	20.10	25	

CO (mg/m^3)	max 8-hr	0.62	31	

Fatehpur				
Pollutants		**concentration in µg/m^3 (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	56.70	57	**63 Satisfactory**
$PM_{2.5}$	24-hr avg	37.90	63	
SO_2	24-hr avg	7.10	9	
NO_2	24-hr avg	19.80	25	
CO (mg/m^3)	max 8-hr	0.75	38	

Chhapri				
Pollutants		**concentration in µg/m^3 (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	56.7	57	**63 Satisfactory**
$PM_{2.5}$	24-hr avg	37.9	63	
SO_2	24-hr avg	7.1	9	
NO_2	24-hr avg	19.8	25	
CO (mg/m^3)	max 8-hr	0.76	38	

Salaiya				
Pollutants		**concentration in µg/m^3 (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	65.20	65	**65 Satisfactory**
$PM_{2.5}$	24-hr avg	36.20	60	
SO_2	24-hr avg	6.70	8	
NO_2	24-hr avg	19.00	24	
CO (mg/m^3)	max 8-hr	0.73	37	

Khandari				
Pollutants		**concentration in µg/m^3 (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	64.00	64	**64 Satisfactory**
$PM_{2.5}$	24-hr avg	36.40	61	
SO_2	24-hr avg	6.50	8	
NO_2	24-hr avg	21.20	27	
CO (mg/m^3)	max 8-hr	0.75	38	

Kanti				
Pollutants		**concentration in µg/m^3 (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	72.00	72	**72 Satisfactory**
$PM_{2.5}$	24-hr avg	40.20	67	
SO_2	24-hr avg	7.10	9	
NO_2	24-hr avg	20.10	25	
CO (mg/m^3)	max 8-hr	0.81	41	

Overall AQI of the study area based upon data collected from selected monitoring locations is as below:-

Pollutants		**concentration in µg/m^3 (except for CO)**	**Sub-Index**	**Air Quality Index**
PM_{10}	24-hr avg	78	78	**78 Satisfactory**
$PM_{2.5}$	24-hr avg	45.6	76	
SO_2	24-hr avg	7.9	10	
NO_x	24-hr avg	21.2	27	
CO (mg/m^3)	max 8-hr	0.81	41	

3.7 NOISE ENVIRONMENT

The main objective of noise monitoring in the study area is to establish the baseline noise level and assess the impact of the total noise expected to be generated during the project operations around the project site.

Table 3.17: Noise (Sound) Measuring Instrument

Instrument	Make	Model No.	Instrument Identification	Detection Limit
Integrated Sound Level Measurement Instrument Standard Accessories	HTC	SL-1352	SAL/NOISE/INT/05	Lo 35-80 dB Hi 80-130 dB

Table 3.18: Testing Method to be followed

Particular		Testing Method to be Followed
Noise Level Measurement		
A	Noise Level in dB (A) for continuous 24 hours at 1 Hour Interval	Operational Manual of Noise level Meter, Model No. DT - 805 issued by Mextech

3.7.1 AMBIENT NOISE LEVEL DATA

The statistical analysis is done for measured noise level at ten locations. The parameters are analyzed for L_{eq}(day), L_{eq} (night) andL_{eq} (day-night). The statistical analysis results are given in below:-

Table 3.19: Ambient Noise Level Data

S. No.	Locations	Area Type	Location Code	Day Time		Night Time	
				Standard	Leq Day	Standard	Leq Night
1.	Project Site	Industrial	N-1	75	68.5	70	53.6
2.	Banda	Residential	N-2	55	52.8	45	40.1
3.	Dilakhedi	Residential	N-3	55	54.6	45	38.9
4.	Fatehpur	Residential	N-4	55	50.6	45	38.9
5.	Chhapri	Residential	N-5	55	51.8	45	40.8
6.	Salaiya Ford	Residential	N-6	55	53.6	45	43.2
7.	Khandari	Residential	N-7	55	51.7	45	41.6

8.	Kanti	Residential	N-8	55	49.6	45	38.5

3.7.2 RESULT

A) Day time Noise Levels L_{eq}(day)

The day time L_{eq}(day) noise levels at all the residential locations were observed to be in the range of 49.6-54.6 dB(A). The maximum noise level of 54.6 dB (A) was observed at Dilakhedi and the minimum noise level of 49.6dB (A) was observed at Kanti during the study period. It is observed that the day time noise levels are in accordance to the prescribed limit of 55dB (A).

B) Night time Noise Levels L_{eq}(night)

The night time L_{eq}(night) noise levels at all the residential locations was observed to be in the range of 38.5 – 40.1dB (A). The maximum noise level of 44.1dB (A) was observed at Banda the minimum noise level of 38.5 dB (A) at Kantiduring the study period. It is observed that the night time noise levels are in accordance to the prescribed limit of 45dB (A).

C) Noise levels within project site

The day time L_{eq}(day) noise levels and night time L_{eq}(night) noise levels at project site were observed to be 68.5 dB(A) and 53.6 dB(A) respectively. It is observed that the day and night time noise levels are in accordance to the prescribed limit of 75dB (A) and 70dB(A).

3.8 BIOLOGICAL ENVIRONMENT

Biodiversity study of the proposed project area was carried out to understand the status of predominant floral and faunal groups *i.e.* trees, shrubs, herbs, grasses, herpetofauna, avifauna and mammals. To collect data and information on specific components of the ecological system and pertinent issues widely used standard scientific methods were adopted. Rapid field surveys were undertaken during October 2019, November 2019-December 2019 for collecting relevant data.

The objectives of the present study were as follows:

- To identify the floral and faunal diversity,
- To assess nature and distribution of the vegetation in the area,

- To identify the endangered species of flora and fauna, if any
- To prepare conservation plan for Schedule I fauna , if any

a. Methodology

Extensive literature review was carried out to identify the representative spectrum of threatened species, population and ecological communities listed by IUCN, WCMC, ZSI, BSI and Indian wild Life Protection act, 1972. Biodiversity study of the proposed expansion project of MBAPL Unit-II situated Village Banda Tehsil & District Sagar, Madhya Pradesh carried out to understand the status of predominant floral and faunal groups i.e. trees, shrubs, herbs, grasses, herpetofauna, avifauna and mammals.

Table 3.21: Methods used for study of flora & fauna

Taxa	Sampling Methods
Plants	Quadrate sampling and enumeration
Butterflies	Transect, Visual encounter survey
Amphibians	Visual encounter survey (search)
Reptiles	Visual encounter survey (search)
Birds	Point count, opportunistic observation
Mammals	Tracks and signs, and visual encounter survey

a. Fauna

i. Avifauna

Species search and census: Standard methods were followed to survey the avifauna. Point count method was followed for counting the birds. Opportunistic surveys were also carried out with respect to avifaunal checklist. Identification by calls was also made for species which were not directly encountered or were hidden in the vegetation or canopy. Secondary data collected from the literature was also included in the present given list.

ii. Herpetofauna

Amphibians and reptiles recorded during area searches were identified by visual characteristics. Aquatic searches involved examining each type of aquatic habitat.

iii. Mammals

Presence of mammals was documented by using both direct sightings and indirect evidences i.e. animal burrows/holes, scats, pellets, droppings and tracks Opportunistic sightings were also included. Circular Plots were used to search indirect evidences.

Floristic studies were conducted during October - December. 2019 to know the presence of any endangered/threatened/endemic plant species study area of the existing industry (10-km radius).

The data collected in the field was analyzed for secondary parameters such as density, frequency and abundance following standard phyto-sociological methods. Shannon-Wiener diversity index (Shannon and Wiener, 1963) was calculated for all life forms as follows:

Table 3.21: Estimation of phyto-sociological parameters

1	Frequency (%) = (No. of quadrats of occurrence of the species X 100) / Total No. of quadrats sampled
2	Abundance = Total No. of individuals of the species / No. of quadrats of Occurrence
3	*Density = Total No. of individuals of the species / Total No. of quadrats sampled
4	Relative Frequency = (Frequency of the given species X 100) / Sum of all frequencies
5	Relative Density = (Density of the given species X 100) / Sum of all densities
6	Relative Abundance = (Abundance of species X 100) / Sum of all abundances
7	Basal Area = $(GBH)^2 / 4\Pi$
8	Dominance = Total Basal Area / Total area sampled
9	Relative Dominance = (Dominance of given species X 100) / Dominance of all species
10	Important Value Index (I.V.I.) = Relative Density + Relative Frequency + Relative Dominance
Note: *Density refers to the number of individuals per unit area of a site.	

b. Statistical Analysis

Shannon-Wiener diversity index (Shannon and Wiener, 1963) was calculated for all life forms following:

Shannon- Wiener Information Function: $D = -\Sigma\ pi \ln pi$

Where: i = an index for the number of species sampled, $p_i = n_i/N$ =percentage of species i in the entire sample (N) of individuals, and ln = natural log. Multiply the percentage (or

proportion) of each species in the sample times the natural log of that same value, sum the products across all species, and then multiply by minus 1.

I. Biodiversity Profile of the core zone (Project Site)

Only planted trees (for green belt development) were observed along with the boundary wall and within the project site.

Table 3.22: List of the Plants reported from Core Zone (Project site)

Tree			
S.No.	**Common name**	**Scientific Name**	**Family**
1.	Siris	*Albizia lebbeck*	Fabaceae
2.	Neem	*Azardirachta indica*	Meliaceae
3.	Kachnar	*Bauhinia variegata*	Fabaceae
4.	Peepal	*Ficus religiosa*	Moraceae
5.	Chilbill	*Holoptelea integrifolia*	Ulmaceae
6.	Bakain	*Melia azedarch*	Meliaceae
Shrub			
7.	Harshringar	*Nyctanthes arbor-tristis*	Oleaceae
8.	Jharberi	*Ziziphus nummularia*	Rhamnaceae
9.	Kaner	*Thevetia peruviana*	Apocynaceae
10.	Champa	*Plumeria alba*	Apocynaceae
Herb			
1	Pili Kantili	*Argemone mexicana*	Papaveraceae
2	Tarwar	*Cassia auriculata*	Caesalpinioideae
3	devil's horsewhip	*Achyranthes aspera*	Amaranthaceae
Grass			
1	Doobghas	*Cynodon dactylon*	Poaceae
2	Sheda Grass	*Dichanthium annulatum*	Poaceae
3	Makra	*Dactyloctenium aegyptium*	Poaceae

Gudhal (*Hibiscus rosa-sinensis*)

Ber (*Ziziphus mauritiana*)

Figure: Photographs showing the existing plantation at plant site

Avifauna

A total of 5 species were recorded in the core zone (Project site) during the field survey. The dominant species was Jungle Babbler (*Turdoidesstriatus) and* Indian Robin *(Saxicoloides fulicaata).*

Mammalia

A total of 2 species were observed in the core zone (Project site) during the field survey. i.e. five stripped palm squirrel (*Funambulus pennantii)* and common house rat *(Rattus rattus).*

Table 3.23: Mammalian Recorded

S. No.	Vernacular Name	Scientific Name	Family	Category	
				Status (IWPA)	IUCN
1	Five stripped palm squirrel	*Funambulus pennantii*	Sciuridae	IV	LC
2	Common House rat	*Rattus rattus*	Muridae	V	LC

Table 3.24: Amphibian Recorded

S. No.	Vernacular Name	Scientific Name	Family	Category	
				Status (IWPA)	IUCN
1	Indian Bullfrog	*Hoplobatrachus tigerinus*	Dicroglossidae	IV	LC

Table 3.25: Reptiles Recorded

S. No.	Vernacular Name	Scientific Name	Family	Category	
				Status (IWPA)	IUCN
1	Keeled Grass Skink,	*Eutropis carinata*	Mabuyidae	IV	LC
2	Indian Garden Lizard	*Calotes versicolor*	Agamidae	IV	LC
3	Yellow-Green House Gecko	*Hemidactylus flaviviridis*	Gekkonidae	IV	LC
4	Punctate Supple Skink	*Lygosoma punctata*	Lygosomidae	IV	LC

II. BUFFER ZONE (i.e. 10 km radius from the periphery of the project)

i. Flora

The floral species recoreded in the buffer zone is as given below:

Table 3.25: List of floral species recorded in the Buffer Zone

Trees				
S. No.	**Vernacular Name**	**Scientific name**	**Family**	**Habitat**
1.	Mango	*Mangiferaindica*	Anacardiaceae	Forest/Agriculture
2.	Babool	*Acacia nilotica*	Fabaceae (Mimosoideae)	Forest/Agriculture
3.	Gulmohar	*Delonixregia*	Fabaceae (Mimosoideae)	Forest
4.	Eucalyptus	*Eucalyptus hybrid*	Myrtaceae	Forest/Agriculture
5.	Siris	*Albizialebbeck*	Mimosaceae	Forest/Agriculture/Sub Urban
6.	Dhaora/ dhau	*Anogeissussericea*	Combretaceae	Forest
7.	Neem	*Azadirachtaindica*	Meliaceae	Agriculture/Sub Urban
8.	Peepal	*Ficusreligiosa*	Moraceae	Agriculture/Sub Urban
9.	Banyan	*Ficusbenghalensis*	Moraceae	Forest
10.	Dhak	*Butea monosperma*	Fabaceae (Papilionaceae)	Forest/Agriculture
11.	Amaltash	*Cassia fistula*	Caesalpiniaceae	Forest/Agriculture/Sub Urban
12.	Siddha	*Lagerstromiaparviflora*	Lythraceae	Forest/Agriculture
13.	Shesham	*Dalbergiasissoo*	Fabaceae (Papilionaceae)	Agriculture/Sub Urban
14.	Jhingan	L*anneacoromandelica*	Anacardiaceae	Agriculture/Sub Urban
15.	Piyar	*Buchananialanzan*	Anacardiaceae	
16.	Tendupatta	*Diospyros melanoxylon*	Ebenaceae	Forest/Agriculture
17.	Semal	*Bombax ceiba*	Malvaceae	Forest
18.	Pangri,dadak	*Erythrina indica*	Fabaceae (Papilionoideae)	Forest/Agriculture
19.	Khair	*Acacia catechu*	Fabaceae	Agriculture/Sub Urban
20.	Asna	*Terminalia tomentosa*	Combretaceae	Agriculture/Sub Urban
21.	Chiraul	*Wrightiatomentosa*	Apocynaceae	Agriculture/Sub Urban
22.	Subabul	*Leucaenaleucocephala*	Fabaceae (Mimosoideae)	Forest/Agriculture
23.	Lasora	*Cordia dichotoma*	Boraginaceae	Forest/Agriculture
24.	Shahtoot	*Morus alba*	Moraceae	Forest/Agriculture
25.	Khajoor	*Phoenix sylvestris*	Arecaceae (Palmae)	Forest/Agriculture
26.	Kurlu	*Sterculiaurens*	Malvaceae	Forest/Agriculture
27.	Karanj	*Pongamiapinnata*	Fabaceae (Papilionaceae)	Forest/Agriculture
28.	Arjun	Terminalia arjuna	Combretaceae	Forest/Agriculture/Sub Urban
29.	Sagaun	*Tectonagrandis*	Lamiaceae	Forest
30.	Jamun	*Syzygiumcumini*	Myrtaceae	Agriculture/Sub Urban
31.	Imli	*Tamarindusindica*	Fabaceae (Leguminosae)	Agriculture/Sub Urban
32.	Ghont	*Zizyphusxylopyra*	Rhamnaceae	Forest/Agriculture
33.	Papad	*Gardenia latifolia*	Rubiaceae	Forest
34.	Mahua	*Madhucaindica*	Sapotaceae	Forest

35.	Ber	*Ziziphusmauritiana*	Rhamnaceae	Forest/Agriculture/Sub Urban

Shrubs			
S.No.	**Vernacular Name**	**Scientific name**	**Family**
1	Adusa	*Justiciaadhatoda*	Acanthaceae
2	Aak	*Calotropisprocera*	Asclepiadaceae
3	Kair	*Capparis decidua*	Capparaceae
4	Behaya	*Ipomoea carnea*	Convolvulaceae
5	Aakda	*Calotropisgigantea*	Apocynaceae
6	Nag phani	*Opuntia elatior*	Cactaceae
7	Karaunda	*Carissa congesta*	Apocynaceae
8	Awal, Tarwar	*Cassia auriculata*	Fabaceae
9	Dhatura	*Datura stramonium*	Solanaceae
10	Vilayatimehdi	*Dodonaeaviscosa*	Sapindaceae
11	Jharberi	*Ziziphusnummularia*	Rhamnaceae
12	Aenthi	*Helicteresisora*	Malvaceae
13	Raimuniya	*Lantana camara*	Verbenaceae
14.	Bander-Ki-Rakhi	*Mimosa hamata*	Mimosaceae
15.	Makoi	*Zizyphusoenoplia*	Rhamnaceae
16.	Kataiya	*Flacourtiaindica*	Salicaceae
17.	Pili Kaner	*Thevetia peruviana*	Apocynaceae
18.	Nirgundi	*Vitex nigundo*	Lamiaceae
19.	Harshringar	*NyctanthesArbortristis*	Oleaceae
Herbs & Grass			
1	Muktajhuri	*Acalyphaindica*	Euphorbiaceae
2	Latjira	*Achyranthes aspera*	Amaranthaceae
3	Janglichaulai	*Amaranthus spinosus*	Amaranthaceae
4	Pili Kantili	*Argemonemexicana*	Papaveraceae
5	Janglimulli	*Blumealacera*	Asteraceae
6	Parva	Heteropogoncontortus	Poaceae
7	Charota	*Cassia tora*	Fabaceae
8	Buffel grass	*Cenchrusciliarias*	Panicoideae
9	Hurhur	*Cleome viscosa*	Cleomaceae

10	Wild jute	*Corchorustridens*	Malvaceae
11	Ban Tulsi	*Croton bonplandianum*	Euphorbiaceae
12	Unthkanta	*Echinopsechinatus*	Asteraceae
13	Sen	Sehimanervosum	Poaceae
14	Badi Dudhi	*Euphorbia hirta*	Euphorbiaceae
15	Ganer	Themedaquadrivalvis	Poaceae
16	Dandathor	*Euphorbia neriifolia*	Euphorbiaceae
17	Gokhru	*Indigoferacordifolia*	Fabaceae
18	Nili	*Indigoferatinctoria*	Fabaceae
19	Bhanjura	*Apludamutica*	Poaceae
20	Jharasi	*Mollugocerviana*	Molluginaceae
21	Tulsi	*Ocimumamericanum*	Lamiaceae
22	GajarGhas	*Parthenium hysterophorus*	Asteraceae
23	Bada gokhru	*Pedalium murex*	Pedaliaceae
24	Kura	Desmostachyabipinnata	Poaceae
25	Khareti	*Sidacordifolia*	Malvaceae
26	Indian Cupscale Grass	*Sacciolepisindica*	Poaceae
27	Kantakari	*Solanum xanthocarpum*	Solanaceae
28	Sarphonk	*Tephrosiapurpurea*	Fabaceae
29	Sarapunkha	*Tephrosiavillosa*	Fabaceae
30	Gokharu	*Tribulusterrestris*	Zygophyllaceae
31	Savai	Eulaliopsisbinata	Poaceae
32	Chotadhtura	*Xanthium strumarium*	Asteraceae

Table 3.26: Important Value Index (IVI) of Herb and Grass species in the buffer zone

Vernacular Name	Scientific Name	Total No of quadrate studied	#	@	F (%)	D	A	RF	RD	RA	IVI	ln pi	pi (ln pi)	pi(ln pi)2
Bada gokhru	*Pedalium murex*	70	17	41	24.29	0.59	2.41	1.83	2.17	3.62	7.63	-3.32	-0.12	0.40
Badi Dudhi	*Euphorbia hirta*	70	41	102	58.57	1.46	2.49	4.42	5.39	3.74	13.56	-3.29	-0.12	0.40
Ban Tulsi	*Croton bonplandianum*	70	22	37	31.43	0.53	1.68	2.37	1.96	2.53	6.86	-3.68	-0.09	0.34
Bhanjura	Apludamutica	70	41	53	58.57	0.76	1.29	4.42	2.80	1.94	9.17	-3.94	-0.08	0.30
Buffel grass	*Cenchruscilia rias*	70	15	35	21.43	0.50	2.33	1.62	1.85	3.51	6.98	-3.35	-0.12	0.39
Charota	*Cassia tora*	70	36	51	51.43	0.73	1.42	3.88	2.70	2.13	8.71	-3.85	-0.08	0.32

Chotadhtura	*Xanthium strumarium*	70	19	30	27.14	0.43	1.58	2.05	1.59	2.37	6.01	-3.74	-0.09	0.33
Dandathor	*Euphorbia neriifolia*	70	33	71	47.14	1.01	2.15	3.56	3.75	3.23	10.55	-3.43	-0.11	0.38
GajarGhas	*Parthenium hysterophorus*	70	35	87	50.00	1.24	2.49	3.78	4.60	3.74	12.11	-3.29	-0.12	0.40
Ganer	Themedaquadrivalvis	70	7	16	10.00	0.23	2.29	0.76	0.85	3.44	5.04	-3.37	-0.12	0.39
Gokharu	*Tribulusterrestris*	70	24	37	34.29	0.53	1.54	2.59	1.96	2.32	6.86	-3.77	-0.09	0.33
Gokhru	*Indigoferacordifolia*	70	36	81	51.43	1.16	2.25	3.88	4.28	3.38	11.55	-3.39	-0.11	0.39
Hurhur	*Cleome viscosa*	70	18	47	25.71	0.67	2.61	1.94	2.49	3.92	8.35	-3.24	-0.13	0.41
Indian Cupscale Grass	*Sacciolepisindica*	70	23	49	32.86	0.70	2.13	2.48	2.59	3.20	8.27	-3.44	-0.11	0.38
Janglichaulai	*Amaranthus spinosus*	70	39	92	55.71	1.31	2.36	4.21	4.87	3.55	12.62	-3.34	-0.12	0.40

Janglimulli	*Blumealacera*	70	21	45	30.00	0.64	2.14	2.27	2.38	3.22	7.87	-3.44	-0.11	0.38
Jharasi	*Mollugocerviana*	70	23	36	32.86	0.51	1.57	2.48	1.90	2.35	6.74	-3.75	-0.09	0.33
Kantakari	*Solanum xanthocarpum*	70	31	52	44.29	0.74	1.68	3.34	2.75	2.52	8.62	-3.68	-0.09	0.34
Khareti	*Sidacordifolia*	70	28	53	40.00	0.76	1.89	3.02	2.80	2.84	8.67	-3.56	-0.10	0.36
Kura	Desmostachyabipinnata	70	41	79	58.57	1.13	1.93	4.42	4.18	2.90	11.50	-3.54	-0.10	0.36
Latjira	*Achyranthes aspera*	70	25	88	35.71	1.26	3.52	2.70	4.65	5.29	12.64	-2.94	-0.16	0.46
Muktajhuri	*Acalyphaindica*	70	51	86	72.86	1.23	1.69	5.50	4.55	2.53	12.58	-3.67	-0.09	0.34
Nili	*Indigoferatinctoria*	70	16	56	22.86	0.80	3.50	1.73	2.96	5.26	9.95	-2.95	-0.15	0.46
Parva	Heteropogoncontortus	70	28	52	40.00	0.74	1.86	3.02	2.75	2.79	8.56	-3.58	-0.10	0.36
Pili Kantili	*Argemonemexicana*	70	33	63	47.14	0.90	1.91	3.56	3.33	2.87	9.76	-3.55	-0.10	0.36

Sarapunkha	*Tephrosiavillosa*	70	27	59	38.57	0.84	2.19	2.91	3.12	3.28	9.32	-3.41	-0.11	0.38
Sarphonk	*Tephrosiapurpurea*	70	44	102	62.86	1.46	2.32	4.75	5.39	3.48	13.62	-3.36	-0.12	0.39
Savai	Eulaliopsisbinata	70	45	87	64.29	1.24	1.93	4.85	4.60	2.91	12.36	-3.54	-0.10	0.36
Sen	Sehimanervosum)	70	22	33	31.43	0.47	1.50	2.37	1.75	2.25	6.37	-3.79	-0.09	0.32
Tulsi	*Ocimumamericanum*	70	29	47	41.43	0.67	1.62	3.13	2.49	2.44	8.05	-3.72	-0.09	0.34
Unthkanta	*Echinopsechinatus*	70	23	45	32.86	0.64	1.96	2.48	2.38	2.94	7.80	-3.53	-0.10	0.37
Wild jute	*Corchorustridens*	70	34	79	48.57	1.13	2.32	3.67	4.18	3.49	11.34	-3.36	-0.12	0.39
					1324.29	**27.014**	**66.53**	**100.00**	**100.00**	**100.00**	**300.00**	-3.67	-0.09	0.34

#: Total no of quadrate in which species occurred, F: Frequency (%), D: Density, A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important Value Index *Shannon Wiener Diversity Index (H') for herb & grass was observed: 3.1*

The herb & grass species commonly occurring in the study area were*Tephrosiapurpurea*(Sarphonk), *Parthenium hysterophorus(*Gajarghas*),Echinopsechinatus (*Unthkanta*), Argemonemexicana*(Pili Kantili), *Acalyphaindica*(Muktajhuri) and*Achyranthes aspera* (Latjira).Among the herbs, highest IVI values were seen for *Tephrosiapurpurea*(13.62), *Euphorbia hirta*(13.56),*Achyranthes aspera*(12.64), *Acalyphaindica*(12.58) and *Parthenium hysterophorus*(12.11) respectively.

Table 3.27: Important Value Index (IVI) of Shrub species in the buffer zone

Life Form: Shrubs (3x3m.) Vernacular name	Scientific Name	Total No of quadrate studied	#	@	F (%)	D	A	RF	RD	RA	IVI	ln p_i	p_i (ln p_i)	p_i(ln p_i)^2
Aakda	*Calotropis gigantea*	70	33	39	47.14	0.56	2.29	6.85	4.05	4.05	14.95	-3.21	-0.13	0.42
Aak	*Calotropis prosera*	70	41	87	58.57	1.24	5.12	8.51	9.04	9.04	26.59	-2.40	-0.22	0.52
Kair	*Capparis decidua*	70	7	12	10.00	0.17	0.71	1.45	1.25	1.25	3.95	-4.38	-0.05	0.24
Karaunda	*Carissa congesta*	70	11	23	15.71	0.33	1.35	2.28	2.39	2.39	7.06	-3.74	-0.09	0.33
Karaunda	*Carissa spinarum*	70	7	17	10.00	0.24	1.00	1.45	1.77	1.77	4.99	-4.04	-0.07	0.29

Awal, Tarwar	*Cassia auriculata*	70	36	81	51.43	1.16	4.76	7.47	8.42	8.42	24.31	-2.48	-0.21	0.52
Dhatura	*Datura stramonium*	70	23	35	32.86	0.50	2.06	4.77	3.64	3.64	12.05	-3.31	-0.12	0.40
Vilayatimehdi	*Dodonaeaviscosa*	70	5	17	7.14	0.24	1.00	1.04	1.77	1.77	4.57	-4.04	-0.07	0.29
Kataiya	*Flacourtiaindica*	70	28	38	40.00	0.54	2.24	5.81	3.95	3.95	13.71	-3.23	-0.13	0.41
Aenthi	*Helicteresisora*	70	16	21	22.86	0.30	1.24	3.32	2.18	2.18	7.69	-3.82	-0.08	0.32
Behaya	*Ipomoea carnea*	70	28	72	40.00	1.03	4.24	5.81	7.48	7.48	20.78	-2.59	-0.19	0.50
Adusa	*Justiciaadhatoda*	70	17	36	24.29	0.51	2.12	3.53	3.74	3.74	11.01	-3.28	-0.12	0.40
Raimuniya	*Lantana camara*	70	52	115	74.29	1.64	6.76	10.79	11.95	11.95	34.70	-2.12	-0.25	0.54
Bander-Ki-Rakhi	*Mimosa hamata*	70	27	39	38.57	0.56	2.29	5.60	4.05	4.05	13.71	-3.21	-0.13	0.42

Harshringar	*Nyctanthes Arbortristis*	70	29	71	41.43	1.01	4.18	6.02	7.38	7.38	20.78	-2.61	-0.19	0.50
Nagphani	*Prosopis juliflora*	70	45	111	64.29	1.59	6.53	9.34	11.54	11.54	32.41	-2.16	-0.25	0.54
Pili Kaner	*Thevetia peruviana*	70	24	41	34.29	0.59	2.41	4.98	4.26	4.26	13.50	-3.16	-0.13	0.42
Nirgundi	*Vitex nigundo*	70	19	40	27.14	0.57	2.35	3.94	4.16	4.16	12.26	-3.18	-0.13	0.42
Jharberi	*Zizyphusnummularia*	70	31	57	44.29	0.81	3.35	6.43	5.93	5.92	18.28	-2.83	-0.17	0.47
Makoi	*Zizyphusoenoplia*	70	3	10	4.29	0.14	0.59	0.62	1.04	1.04	2.70	-4.56	-0.05	0.22
					688.57	**13.74**	**56.59**	**100.00**	**100.00**	**100.00**	**300.00**	-3.28	-0.12	0.40

#: Total no of quadrate in which species occurred, F: Frequency (%), D: Density, A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important Value Index Shannon Wiener Diversity Index (H') for herb & grass was observed: 2.79

The shrub species commonly occurring in the study area were *Lantana camara,Prosopis juliflora, Ipomoea carnea, Calotropisprosera, Cassia auriculata, and Zizyphusnummularia.* Among the shrubs, highest IVI values were seen for *Lantana camara*(34.70), *Prosopis juliflora*(32.41), *Calotropisprosera*(26.59), Cassia auriculata(24.31), *Ipomoea carnea*(20.78)and NyctanthesArbortristis(20.78) respectively.

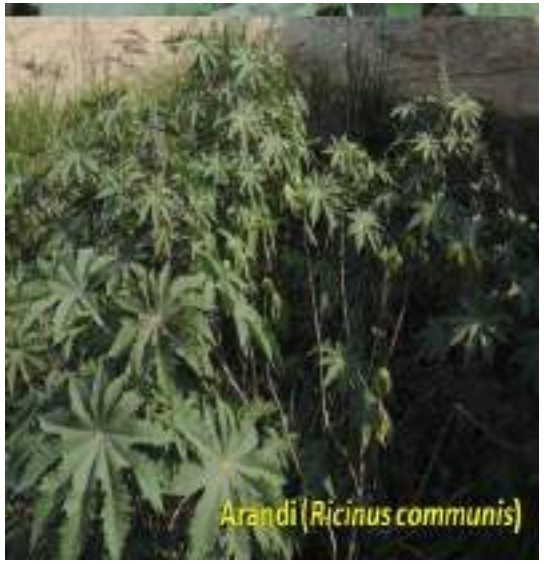


Table 3.28: Important Value Index (IVI) of tree species in the buffer zone

Vernacular name	Scientific Name	Total No of quadrate studied	#	@	F (%)	D	A	RF	RD	RA	IVI	ln p_i	p_i (ln p_i)	p_i(ln p_i)^2
Khair	*Acacia catechu*	70	24	36	34.29	0.51	1.50	4.36	4.17	3.38	11.90	-3.38687	-0.11452	0.38788
Babool	*Acacia nilotica*	70	19	33	27.14	0.47	1.74	3.45	3.82	3.91	11.18	-3.23845	-0.12703	0.41137
Siris	*Albizialebbeck*	70	12	23	17.14	0.33	1.92	2.18	2.66	4.32	9.16	-3.14001	-0.13591	0.426749
Dhaora/ dhau	*Anogiessislatifolia*	70	19	29	27.14	0.41	1.53	3.45	3.36	3.44	10.24	-3.36707	-0.11613	0.391025

Neem	*Azadirachtaindica*	70	33	43	47.14	0.61	1.30	5.99	4.98	2.94	13.90	-3.52997	-0.10345	0.36517
Semal	Bombax ceiba	70	4	4	5.71	0.06	1.00	0.73	0.46	2.25	3.44	-3.79234	-0.08549	0.324207
Piyar	*Buchananialanzan*	70	11	28	15.71	0.40	2.55	2.00	3.24	5.74	10.97	-2.85624	-0.16419	0.468964
Dhak	*Butea monosperma*	70	42	69	60.00	0.99	1.64	7.62	7.99	3.70	19.31	-3.29764	-0.12191	0.402031
Amaltash	*Cassia fistula*	70	39	67	55.71	0.96	1.72	7.08	7.75	3.87	18.70	-3.25001	-0.12601	0.40955
Shesham	*Dalbergiasissoo*	70	32	55	45.71	0.79	1.72	5.81	6.37	3.87	16.05	-3.25001	-0.12601	0.40955
Gulmohar	Delonixregia	70	5	9	7.14	0.13	1.80	0.91	1.04	4.06	6.01	-3.20455	-0.13003	0.416692
Tendupatta	*Diospyros melanoxylon*	70	39	58	55.71	0.83	1.49	7.08	6.71	3.35	17.14	-3.39356	-0.11399	0.386818
Eucalyptus	*Eucalyptus hybrid*	70	19	21	27.14	0.30	1.11	3.45	2.43	2.49	8.37	-3.68798	-0.09228	0.340336
Banyan	*Ficusbenghalensis*	70	11	13	15.71	0.19	1.18	2.00	1.50	2.66	6.16	-3.62682	-0.09648	0.3499
Peepal	*Ficusreligiosa*	70	7	12	10.00	0.17	1.71	1.27	1.39	3.86	6.52	-3.25584	-0.12551	0.408632
Siddha	*Lagerstromiaparviflora*	70	22	28	31.43	0.40	1.27	3.99	3.24	2.87	10.10	-3.55332	-0.10173	0.361477
Jhingan	L*anneacoromandelica*	70	2	2	2.86	0.03	1.00	0.36	0.23	2.25	2.85	-3.79234	-0.08549	0.324207
Subabul	*Leucaenaleucocephala*	70	11	15	15.71	0.21	1.36	2.00	1.74	3.07	6.81	-3.48485	-0.10684	0.37232
Mahua	*Madhucaindica*	70	34	61	48.57	0.87	1.79	6.17	7.06	4.04	17.27	-3.21012	-0.12953	0.415819
Mango	*Mangiferaindica*	70	12	27	17.14	0.39	2.25	2.18	3.12	5.07	10.37	-2.98141	-0.15122	0.450852
Khajoor	*Phoenix sylvestris*	70	14	23	20.00	0.33	1.64	2.54	2.66	3.70	8.91	-3.29764	-0.12191	0.402031
Karanj	*pongamiapinnata*	70	33	56	47.14	0.80	1.70	5.99	6.48	3.82	16.30	-3.26171	-0.125	0.407707
Jamun	*Syzygiumcumini*	70	31	42	44.29	0.60	1.35	5.63	4.86	3.05	13.54	-3.49223	-0.10628	0.371149
Imli	*Tamarindusindica*	70	20	25	28.57	0.36	1.25	3.63	2.89	2.82	9.34	-3.56919	-0.10057	0.358971
Arjun	Terminalia arjuna	70	9	13	12.86	0.19	1.44	1.63	1.50	3.26	6.39	-3.4277	-0.11127	0.381395
Asna	*Terminalia tomentosa*	70	7	18	10.00	0.26	2.57	1.27	2.08	5.80	9.15	-2.84843	-0.16502	0.47006
Chiraul	Wrightiatomentosa	70	12	19	17.14	0.27	1.58	2.18	2.20	3.57	7.95	-3.33491	-0.11878	0.396127

Ber	*Ziziphusmauritiana*	70	28	35	40.00	0.50	1.25	5.08	4.05	2.82	11.95	-3.56919	-0.10057	0.358971
				864	**787.14**	**12.343**	**44.37**	**100.00**	**100.00**	**100.00**	**300.00**	**ln p_i**	**p_i (ln p_i)**	**p_i(ln p_i)^2**

#: Total no of quadrate in which species occurred, F: Frequency (%), D: Density, A: Abundance, RF: Relative Frequency, RD: Relative Density, RA: Relative Abundance, IVI: Important Value Index Shannon *Wiener Diversity Index (H') for herb & grass was observed: 3.3*

The tree species commonly occurring in the study area were*Cassia fistula,Dalbergiasissoo,Diospyros melanoxylon,Madhucaindica,and Pongamiapinnata.* Among the tree, highest IVI values were seen for *Butea monosperma*(19.31), *Cassia fistula*(18.70), *Madhucaindica*(17.27), and *Diospyros melanoxylon*(17.14)respectively.

ii. Fauna

Totally 37 species of the birds belonging to 19 families were recorded from the buffer zone of the study area. A Schedule I species, *Pavo cristatus* (Indian peafowl) was reported from the buffer zone (forest and other habitats) located close vicinity of the human habitation / villages. For the same, conservation plan is given at the end of this chapter. All the bird species reported from the study area enlisted in the following table:

Table 3.29:List of Avifauna Recorded in Buffer Zone

S. No.	Common Name	Scientific name	Family	Status (IWPA 1972)
1.	Red-wattled lapwing	*Vanelluscinereus*	Charadriidae	No mention
2.	Baya weaver	*Ploceusphilippinus*	Ploceidae	Schedule IV
3.	Grey francolin	*Francolinuspondicerianus*	Phasianidae	Schedule IV
4.	**Indian peafowl**	***Pavocristatus***	**Phasianidae**	**Schedule I**
5.	Common hoopoe	*Upupaepops*	Upupidae	No mention
6.	Indian Roller	*Coraciasbenghalensis*	Coraciidae	Schedule IV
7.	White-throated kingfisher	*Halcyon smyrnensis*	Alcedinidae	Schedule IV
8.	Green bee-eater	*Meropsorientalis*	Meropidae	No mention
9.	Lesser coucal	*Centropusbengalensis*	Cuculidae	Schedule IV
10.	Rose-ringed parakeet	*Psittaculakrameri*	Psittacidae	Schedule IV
11.	House swift	*Apus affinis*sub sp. *affinis*	Apodidae	No mention

12.	Rock Pigeon	*Columba livia*	Columbidae	Schedule IV
13.	Laughing dove	*Streptopelia senegalensis*	Columbidae	Schedule IV
14.	Eurasian Collared dove	*Streptopeliadecaocto*	Columbidae	Schedule IV
15.	Red Collared dove	*Streptopeliatranquebarica*	Columbidae	Schedule IV
16.	Long-tailed shrike	*Laniusschach*	Laniidae	No mention
17.	Southern grey shrike	*Laniusmeridionalis*	Laniidae	No mention
18.	House crow	*Corvussplendens*	Corvidae	Schedule V
19.	Black drongo	*Dicrurusmacrocercus*	Dicruridae	Schedule IV
20.	White-bellied drongo	*Dicruruscaerulescens*	Dicruridae	Schedule IV
21.	Indian robin	*Saxicoloidedfulicata*	Turdinae	No mention
22.	Brahminy starling	*Sturnuspagodarum*	Sturnidae	Schedule IV
23.	Asian Pied starling	*Sturnus contra*	Sturnidae	Schedule IV
24.	Common myna	*Acridotherestristis*	Sturnidae	Schedule IV
25.	Bank myna	*Acridotheresginginianus*	Sturnidae	Schedule IV
26.	Wire-tailed swallow	*Hirundosmithii*	Hirundinidae	No mention
27.	White-eared bulbul	*Pycnonotusleucotis*	Pycnonotidae	Schedule IV

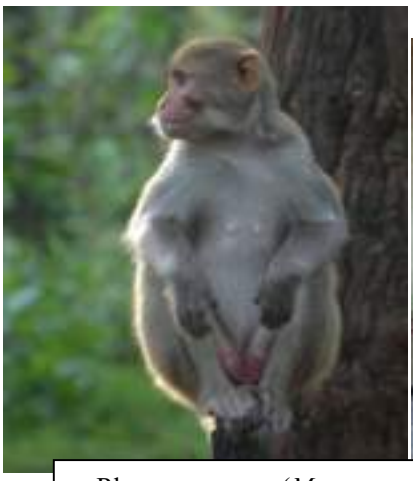
28.	Red-vented bulbul	*Pycnonotuscafer*	Pycnonotidae	Schedule IV
29.	Large grey babbler	*Turdoidesmalcolmi*	Timaliinae	Schedule IV
30.	Jungle babbler	*Turdoidesstriatus*	Timaliinae	Schedule IV
31.	Purple sunbird	*Nectariniaasiatica*	Nectariniidae	Schedule IV
32.	House sparrow	*Passer domesticus*	Passerinae	Schedule IV

Green bee-eater (Merops orientalis)

Indian silverbill or white-throated munia (*Euodice malabarica*)

Table 3.30: List of mammalian species recorded in Buffer Zone

S. No.	Vernacular Name	Scientific Name	Family	Status (IWPA)
1	Mongoose	*Herpestesedwardsi*	Herpestidae	II
2	Five stripped palm squirrel	*Funambuluspennantii*	Sciuridae	IV
3	Common House rat	*Rattusrattus*	Muridae	V
4	Grey Musk Shrew	*Suncusmurinus*	Soricidae	--
5	Indian Hare	*Lepus nigricollis*	Leporidae	IV
6	Indian field mouse	*Mus booduga*	Muridae	V
7	Common Fox	*Vulpes bengalensis*	Canidae	II
8	Nilgai	*Boselaphustragocamelus*	Bovidae	III
9.	Dog	*Canis lupus familiaris*	Canidae	-
10.	Jackal	*Canis aureus*	Canidae	Schedule II
11.	Rhesus macaque	*Macacamulatta*	Cercopithecidae	Schedule II



Rhesus macaque (*Macaca mulatta*)

Gray langur (Semnopithecus entellus)

Fig. 2: Photographs showing fauna of the study area

Table 3.31: Butterflies recorded in Buffer Zone

S.No.	Species	Scientific Name	Family
1	Common Rose	*Atrophaneura aristolochiae*	Papilionidae
2	Plain Orange Tip	*Colitis eucharis*	Pieridae
3	Plain Tiger	*Danaus chrysippus*	Nymphalidae
4	Common Grass Yellow	*Eurema hecabe*	Pieridae
5	Blue Pansy	*Junonia orithya*	Nymphalidae
6	Lime Butterfly	*Papilio polymnestor*	Papilionidae
7	Common Leopard	*Phalanta phalantha*	Nymphalidae
8	common jezebel	Delias eucharis	Pieridae

A total of 08 species of butterflies were recorded during the field survey. Among the species plain tiger as the dominant species found in the buffer zone.

Common Grass Yellow (*Eurema hecabe*)

Blue moon (*Hypolimnas bolina*) and common Jezebel (*Delias eucharis*)

Birds: The most commonly spotted bird species of this area were; Indian robin, Red-wattled Lapwing, Rock Pigeon, Eurasian Collared-Dove, Bank Myna and Common Myna. Grey Francolin are very common to this place and people used to hunt them for eating. The Indian Peafowl was observed which is listed as schedule –I as per IWPA, 1972 and others listed as schedule IV as per IWPA, 1972.

Rare or endangered fauna in the study area

Among the birds in the study area, Peafowl (*Pavocristatus)* is included in schedule I of Wild life protection Act (1972), while many other birds are included in schedule IV. Among mammals; there are no species found under schedule-I while Common Mongoose (*Herpestesedwardsi)*, Jackal (*Canis aureus*) are a schedule –II animals. Nilgai (*Boselaphustragocamelus*) is protected as Schedule-III animal and hares and five stripped squirrels are included in schedule IV of Wild Life Protection act1972.

Table 3.32: List of schedule–I and II fauna observed during the study

S.No.	Scientific Name	Local Name	Schedule as perIWPA, 1972
1	*Pavocristatus*	Indian Peafowl	Schedule I
2	*Herpestesedwardsii*	Common Mongoose	Schedule II
3	*Macacamulatta*	Rhesus macaque	Schedule II

Conclusion: The area falls under **agro-climatic zone VI.** The plantation on road side and domesticated plants in villages were scattered. The study area belongs to plain, undulating, fallow land and some grazing land. In Buffer Zone of Project the dominant trees are *Azadirachtaindica*(Neem), Babool*(Acacia nilotica),* Mahua (*Madhucaindica*) Palash *(Butea monosperma),*Amaltash (*Cassia fistula)*a nd Tendu*(Diospyros melanoxylon)*. No reptiles reported during site visit (because of brumation) but as per secondary data among reptile, Common Garden Lizard and House Gecko and India cobra has been observed in the region. Among mammals, Monkey and Common Mongoose (*Herpestesedwardsii*) were observed which are protected under schedule II while Nilgai (*Boselaphus tragocamelus*) is Schedule-III animal as per Wildlife Protection Act 1972. The sighting of bird species was very less during the study period. The most commonly spotted bird species of were; Indian robin, , Red-wattled Lapwing, Rock Pigeon, Eurasian Collared-Dove, Bank Myna and Common Myna. Grey Francolinare very common to this place and people used to hunt them for eating. The biological study conducted for the core as well as buffer zone of the project reveals that there is no Schedule-I species (as per Wildlife Protection Act, 1972) apart from Indian Peafowl in the study area. Also, none of the species recorded during the study period, falls under category of threatened species according to IUCN Red Data List of India. Some of the sighted fauna was given protection by the Indian Wild Life (Protection) Act, 1972 by including them in different schedules.

3.9 SOCIO-ECONOMIC ENVIRONMENT

3.9.1 OBJECTIVES

The broad objectives of the socio-economic impact assessment are:-

1. To study the socio-economic status of the people living in the study area.
2. To assess the impact on socio-economic environment due to the project concerned.
3. To evaluate the community development measures proposed to be taken up by the Project Proponent, if any.
4. To suggest community development measures that needs to be taken for the study area with stakeholder engagement.
5. The studies carried out are descriptive and exploratory in nature.

3.9.2 STUDY AREA

The proposed project location is Saurai village, Tehsil Banda, District Sagar, Madhaya Pradesh, India.

India & Madhya Pradesh

Madhya Pradesh is the Central Province and its capital is Bhopal, and the largest city is Indore, with Jabalpur, Gwalior, Rewa, Ujjain are the other major cities. Madhya Pradesh is the second largest Indian state by area and the fifth largest state by population with over 75 million residents. It borders the states of Uttar Pradesh to the northeast, Chhattisgarh to the southeast, Maharashtra to the south, Gujarat to the west, and Rajasthan to the northwest.

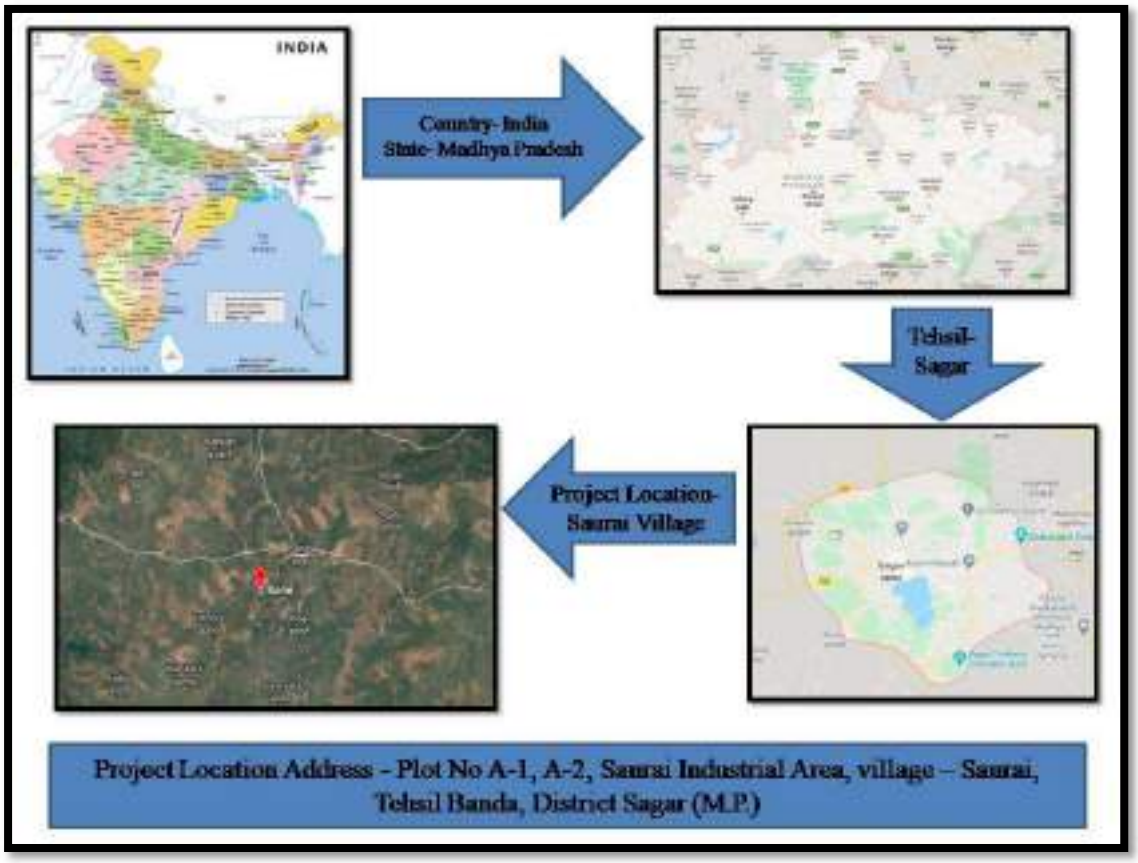
Sagar District

Sagar is a city in the state of Madhya Pradesh in central India. The city is around 172 km. northeast of state capital, Bhopal. Sagar has been selected as one of the hundred Indian cities to be developed as a smart city under PM Narendra Modi's flagship Smart Cities Mission and listed top safest city of India 2018.

The Sagar University was founded on 18 July 1946, and was renamed to Dr. Hari Singh Govt. University in February 1983.

TEHSIL –BANDA:-

Banda is a Tehsil / Block (CD) in the Sagar District of Madhya Pradesh. Total area of Banda is 1,020 km² including 1,010.01 km² rural area and 10.02 km² urban area. Banda has a population of 2,02,594 peoples. There are 46,788 houses in the sub-district. There are about 179 villages in Banda block. Banda is a Town in Banda Tehsil in Sagar District of Madhya Pradesh State, India. It belongs to Sagar Division . It is located 36 KM towards East from District head quarters Sagar. It is a Tehsil head quarter.



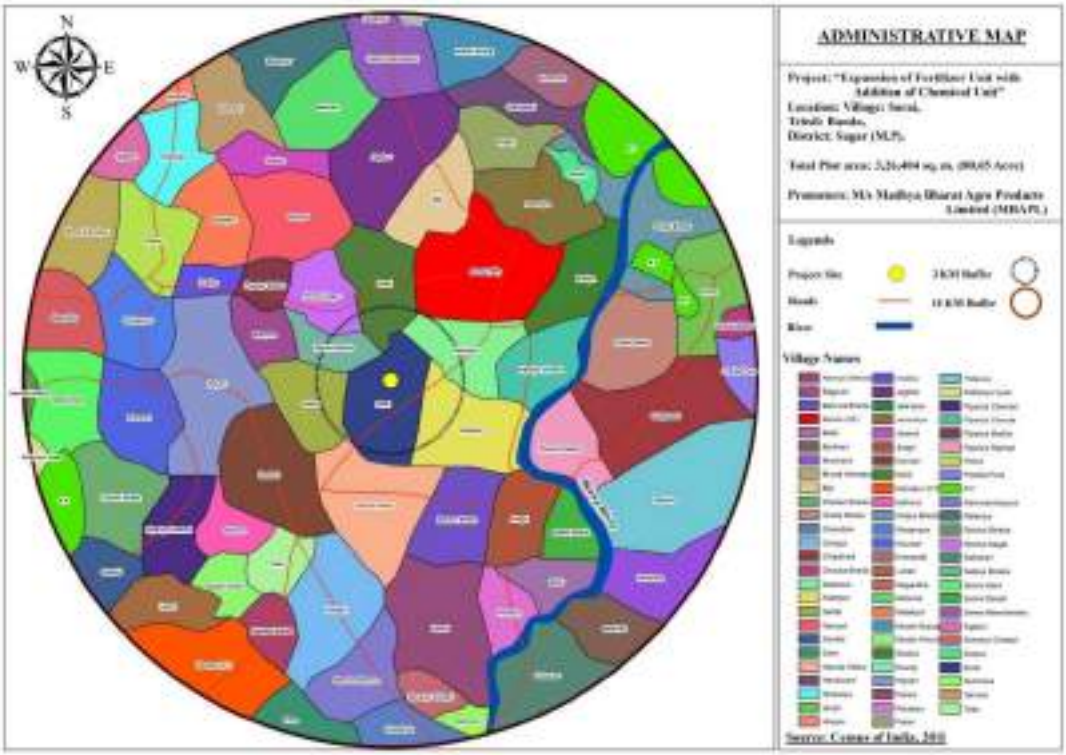


Figure3.10: Thematic Map depicting Distribution of Sex-ratio

The proposed project area lies in Saurai village, Tehsil Banda, District Sagar, Madhaya Pradesh, India. The study area is located in Saurai village area in Banda Tehsil in Madhya Pradesh. In the Banda region, MBAPL is located in an industrial area and it appears to be instrumental in enhancement of its infrastructure facilities. The proposed project is an expansion project in the vicinity of the acquired area. In this project no additional land or asset or property is being acquired for expansion. The villages in the study area are indirectly impacted as there is no rehabilitation and resettlement required. The study area is of 10.0 km from the project location. The list of villages falling in the study area is 64 villages, the segregation is present in Table into the following manner:

i. 3 villages are falling are from 0.0 km to 2.0 km radius boundary
ii. 17 villages are falling are from 2.0 km to 5.0 km radius boundary
iii. 44 villages are falling from 5.0 km to 10.0 km radius boundary

The villages in the 10.0 km of the study area from the project site are given in Table .

Table 3.34 Villages in Study Area

Sl. No.	0 to 2 km	Sl. No.	2 to 5 km	Sl. No.	5 to 10km
1.	Dilakhedi	1.	Bagpura	1.	Alampur Bheda
2.	Salaiya Bineka	2.	Bamura Bheda	2.	Berkheri
3.	Sorai	3.	Banda	3.	Bhusa Kamalpur
		4.	Fatehpur	4.	Bijri
		5.	Gadar	5.	Chakeri Bineka
		6.	Hanota Patkui	6.	Chakk Bheda
		7.	Jhagri	7.	Chandhok
		8.	Kandari	8.	Chhapri
		9.	Kanti	9.	Chilpahadi
		10.	Panari	10.	Chouka Bheda
		11.	Pipariya Chouda	11.	Ganeshganj
		12.	Pipariya Rajman	12.	Ganyari
		13.	Richhai Sagar	13.	Gondai

14.	Salaiya Bineka	14.	Gora
15.	Salaiya Kalan	15.	Hindoriya
16.	Salaiya Khurd	16.	Hinoti
17.	Singrawan	17.	Imaliya
		18.	Jagthar
		19.	Jamuniya
		20.	Jawara
		21.	Kethora
		22.	Khojampur
		23.	Khuwari
		24.	Kuwayala
		25.	Luhari
		26.	Mahuna
		27.	Malakpur
		28.	Mudari Bujurg
		29.	Mudari Khurd
		30.	Mudiya
		31.	Pajnari
		32.	Panari
		33.	Parasiya
		34.	Patari
		35.	Pipariya Chamari
		36.	Pitholi
		37.	Ramchandrapura
		38.	Ratanpur
		39.	Sahawan
		40.	Semra Dant

41.	Semra Daulat
42.	Semra Ramchandra
43.	Summera
44.	Toda

Table 3.35: Population

Km	HH	Tot Pop	Male Pop	Female Pop	Sex Ratio Tot Pop	0-6 Pop	0-6 Male Pop	0-6 Female Pop	Sex Ratio 0-6 Pop
0 - 2	733	3228	1708	1520	890	517	267	250	936
2 - 5	3930	16723	8976	7747	863	2814	1453	1361	937
5 - 10	11157	47592	25303	22289	880	8071	4173	3898	934
Total	**15820**	**67543**	**35987**	**31556**	**877**	**11402**	**5893**	**5509**	**935**

*HH- Household; Pop- Population **Source: Census of India, District Handbook 2011*

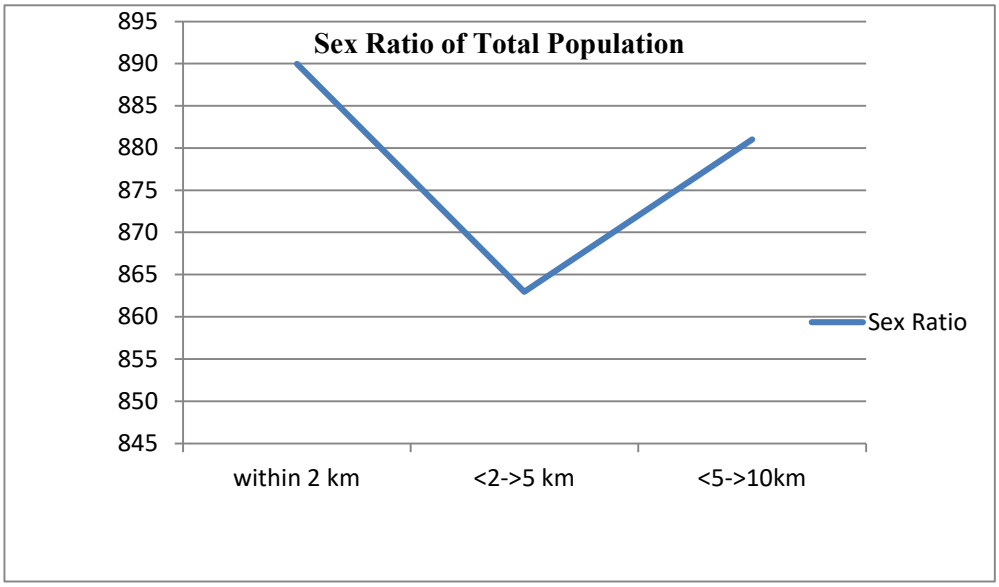


Figure 3.10 Sex Ratio of Total Population within 10.0 km from Project Site

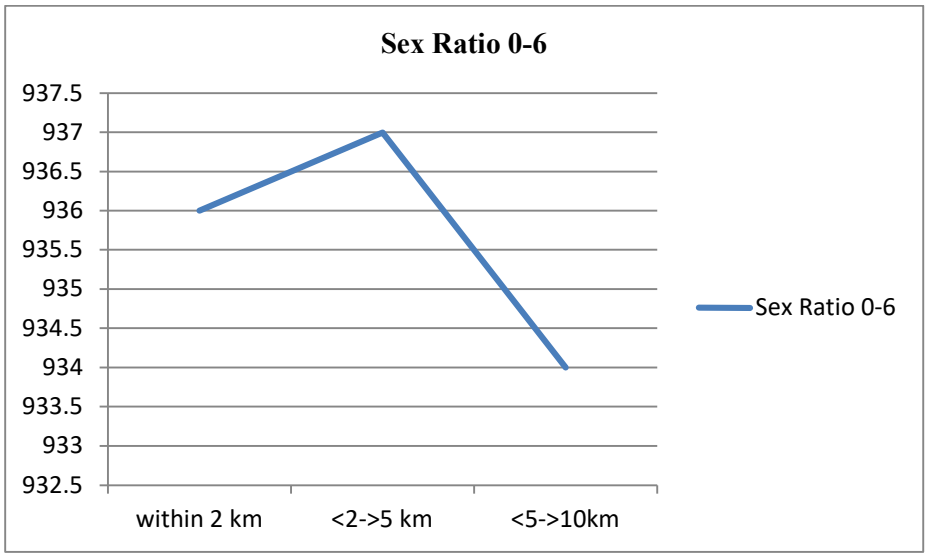


Figure 3.11 Sex Ratio of 0-6 Population within 10.0 km from Project Site

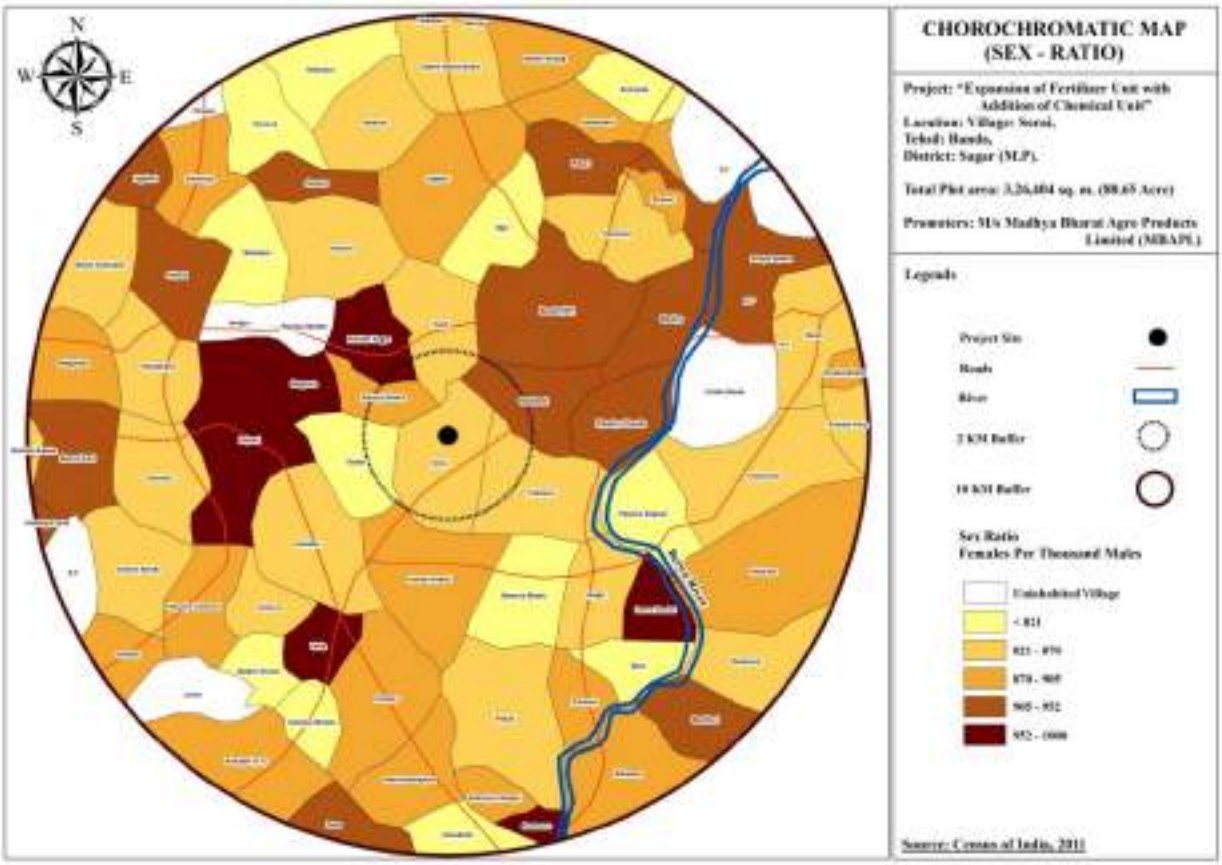


Figure 3.11 Thematic Map depicting Distribution of Sex-ratio

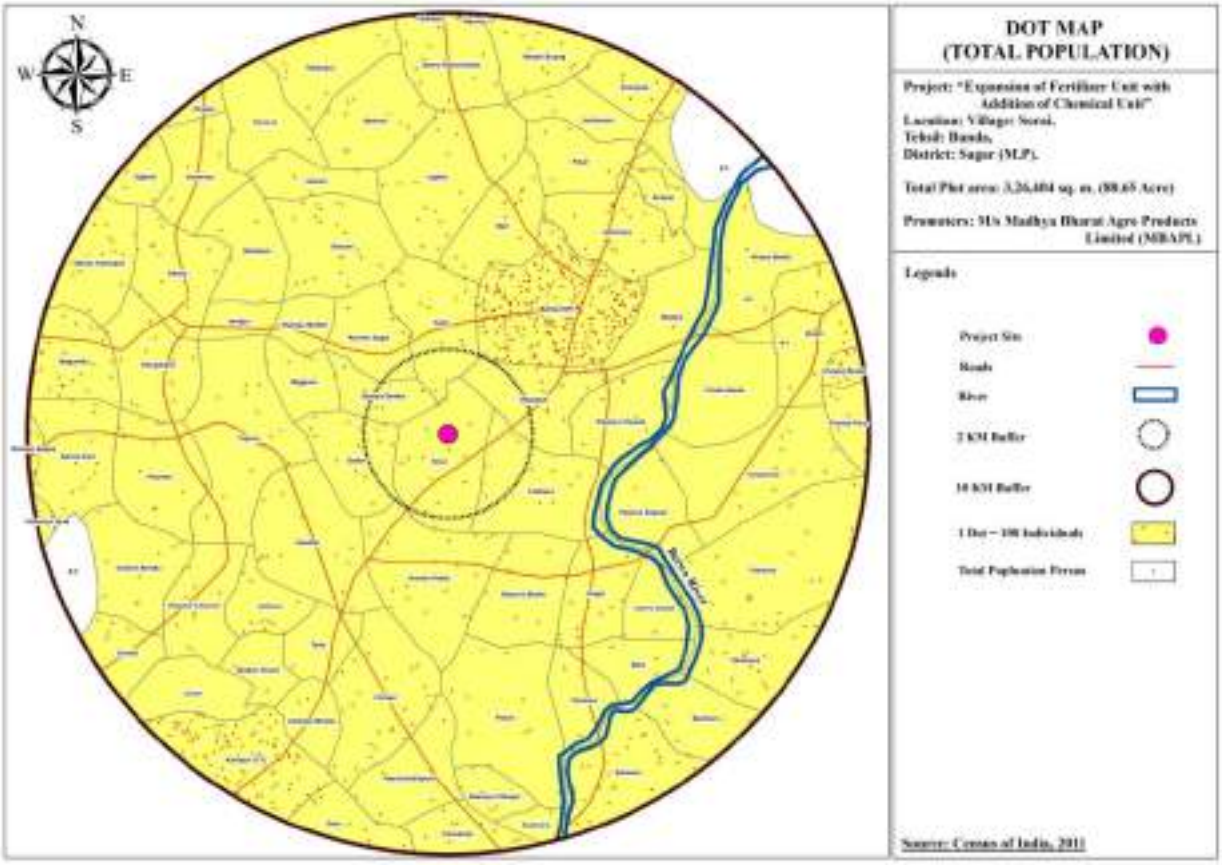


Figure 3.12: Thematic Map depicting Population Distribution

3.9.6 SOCIAL STRUCTURE

In the study area, Schedule Caste population is 23.65% which is 15971of the total population. The males are 23.70% of the total male population and females account for 23.57% of the total female population. The sex ratio of the SC population is 872 females over thousand males.

In the study area, Schedule Tribe population is 7.59% which is 5130 of the total population. The males are 7.51% of the total male population and females account for 7.69% of the total female population. The sex ratio of the ST population is 897 females over thousand males.

The major SC/ST caste in the study area is Chandar, dahait, dahayat , khatik , chikwa , sansi Basor , Gandi , Mang Gaurdi etc. Table shows the Social Stratification of Schedule Caste and Schedule Tribe in the project study area. Table shows the social stratification in the project area. Figure shows the sex ratio of SC & ST in the project area segregated in the 10.0 km.

Table 3.36Social Stratification

Km	SC Male Pop	SC Female Pop	ST Male Pop	ST Female Pop
0-2	512	421	35	37
2-5	2318	1974	224	189
5-10	5702	5044	2445	2200
Total	**8532**	**7439**	**2704**	**2426**
	15971		**5130**	

**Source: Census of India, District Handbook 2011*

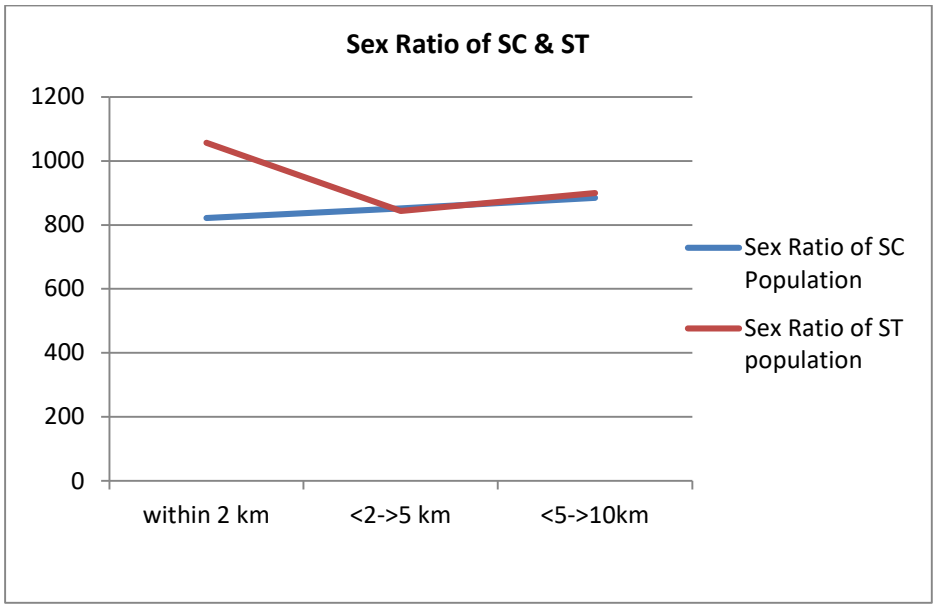


Figure 3.13 Sex Ratio within 10.0 km of the study area

3.9.7 LITERACY STATUS OF THE STUDY AREA

Persons aged seven years and above, who can both read and write with understanding in any language are considered as literates. In the study area the literate persons are 40358, which is 59.75% of the total population. The male literates are 69.38% of the total male population and female literates are 48.76% of the total female population. Table presents the literate population of the study area. Figure shows the literacy rate in the study area.

Table 3.37 Literate Population in the Study Area

Km	Male Literates	Female Literates
0-2	1247	773
2-5	6301	3829
5-10	17422	10786
Total	**24970**	**15388**

**Source: Census of India, District Handbook 2011*

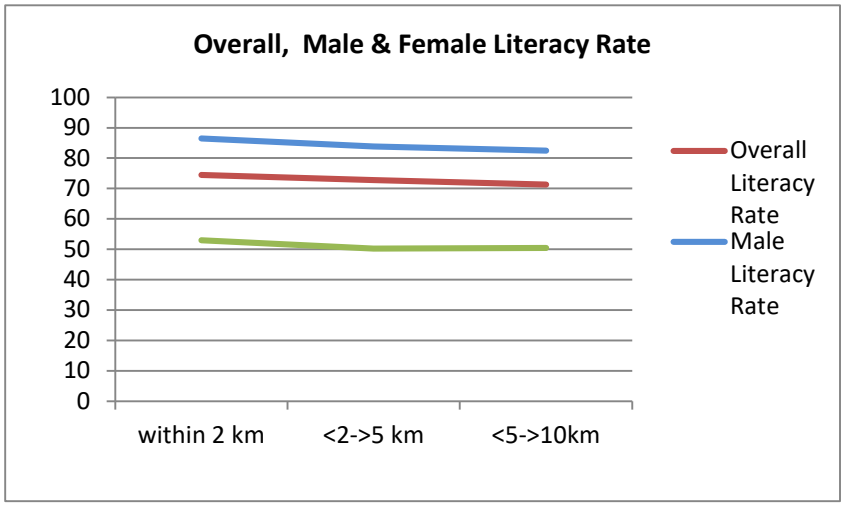


Figure 3.14 Overall, Males & Female Literacy Rate

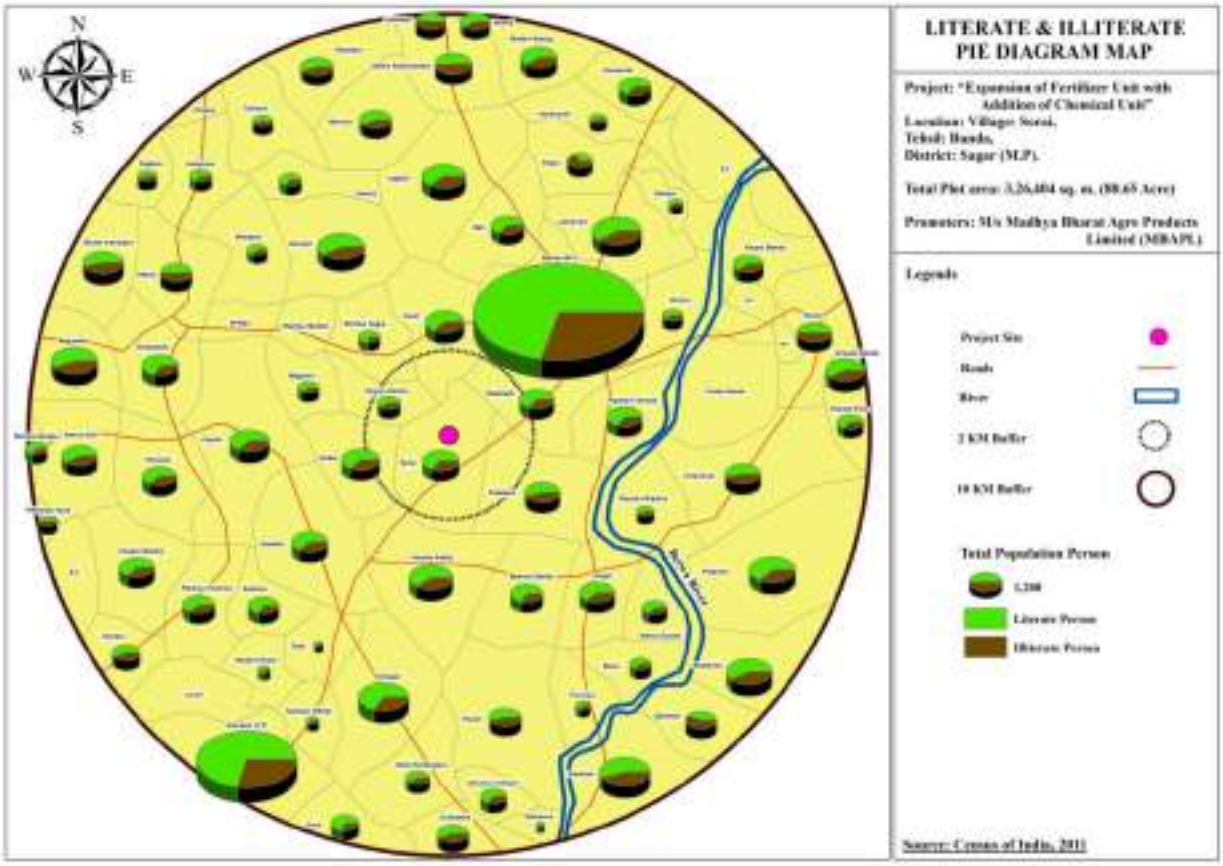


Figure3.15: Thematic Map depicting Literate & Illiterate

3.9.8 Worker's Profile & Occupational Structure

The work participation in the study area is 30119 which account to be 44.6% of the total population. The male work participation is 55.73% with respect to male population and female work participation accounts to be 31.88% with respect to female population in the study area. Table shows the gender wise distribution of work participation in the study area. Figure shows the Total work participation population over the total population and Figure presents the total male & female work participation

Table 3.38 Gender wise Distribution of Workers in the Study Area

Km	Male Work Participation	Female Work Participation	Total workers
0-2	892	505	1397
2-5	5109	2468	7577
5-10	14057	7088	21145
Total	**20058**	**10061**	**30119**

**Source: Census of India, District Handbook 2011*

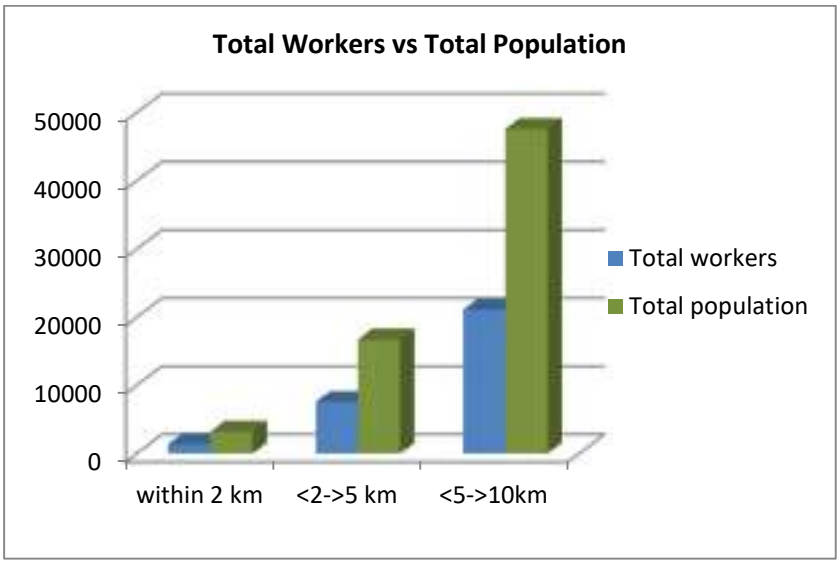


Figure 3.16 Total Work Participation versus Total Population

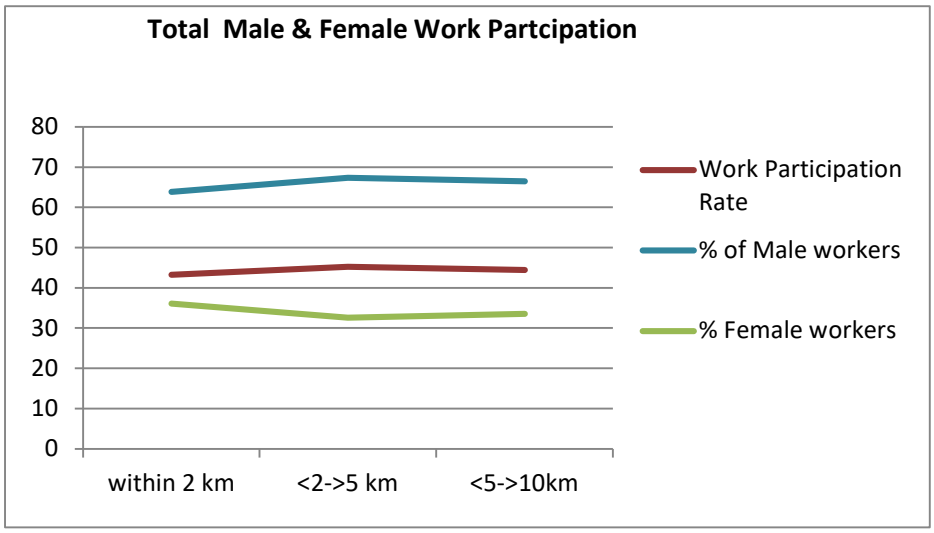


Figure 3.17: Work Participation of Males & Females

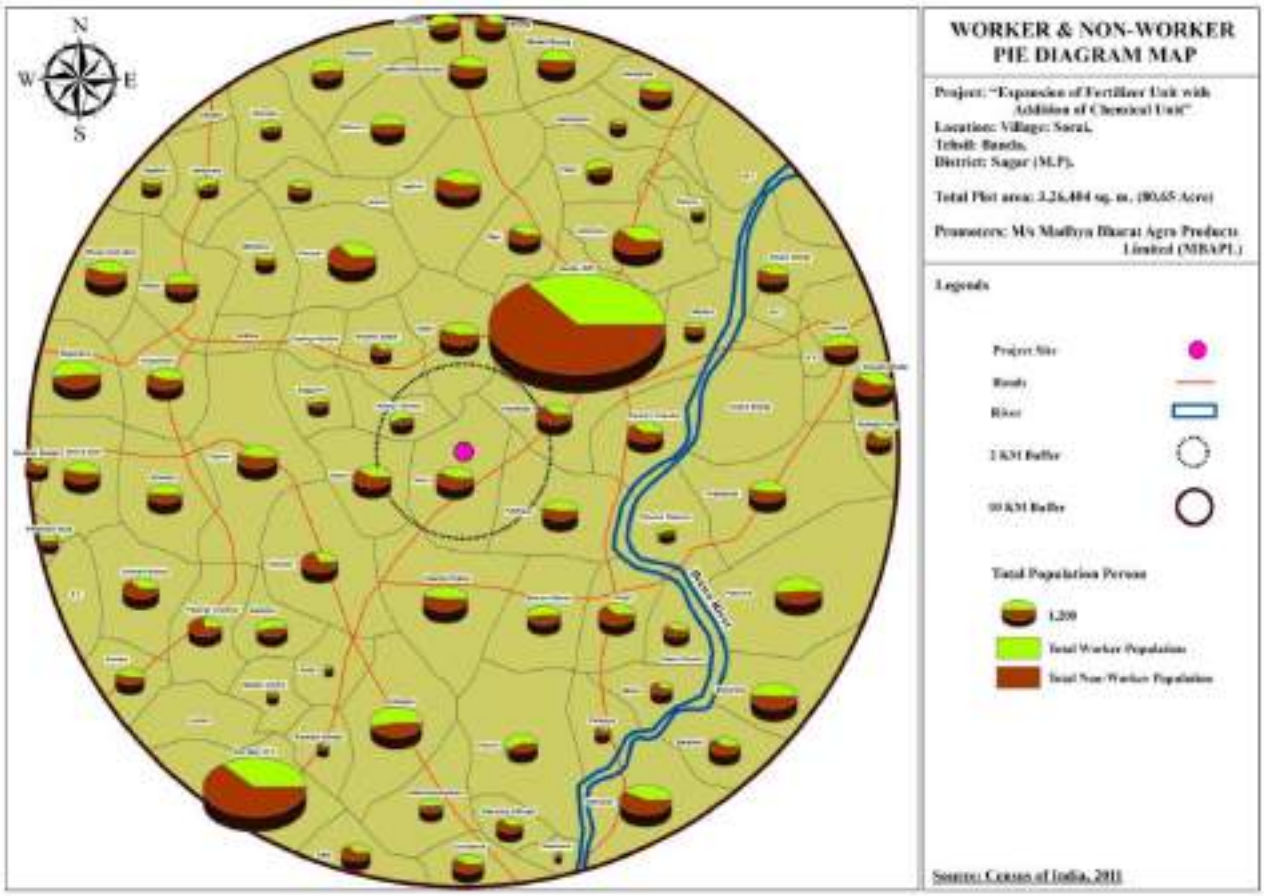


Figure 3.18: Thematic Map depicting Distribution of Worker & Non Worker

The main work participation is 73.4% and marginal work participation is 26.6% of the total working population. Further analysis of data has revealed that there exists male dominancy of 75.00% in main work participation. Marginal work participation shows women dominancy which is 56.4% while marginal male work participation is 43.6%. The males are working in the nearby industries, agriculturist, labourers, etc as main workers. Women on the other hand work as marginal workers due to their occupancy in household and domestic chores. Women work mostly as marginal cultivators in their fields.

Table 3. presents the main and marginal work participation of the study area population.

Table 3.39 Main & Marginal Work Participation

Km	Main Workers		Marginal Workers	
	Male	Female	Male	Female
0-2	632	140	260	365
2-5	4656	1567	453	901
5-10	11272	3827	2785	3261
Total	**16560**	**5534**	**3498**	**4527**
	22094		**8025**	

**Source: Census of India, District Handbook 2011*

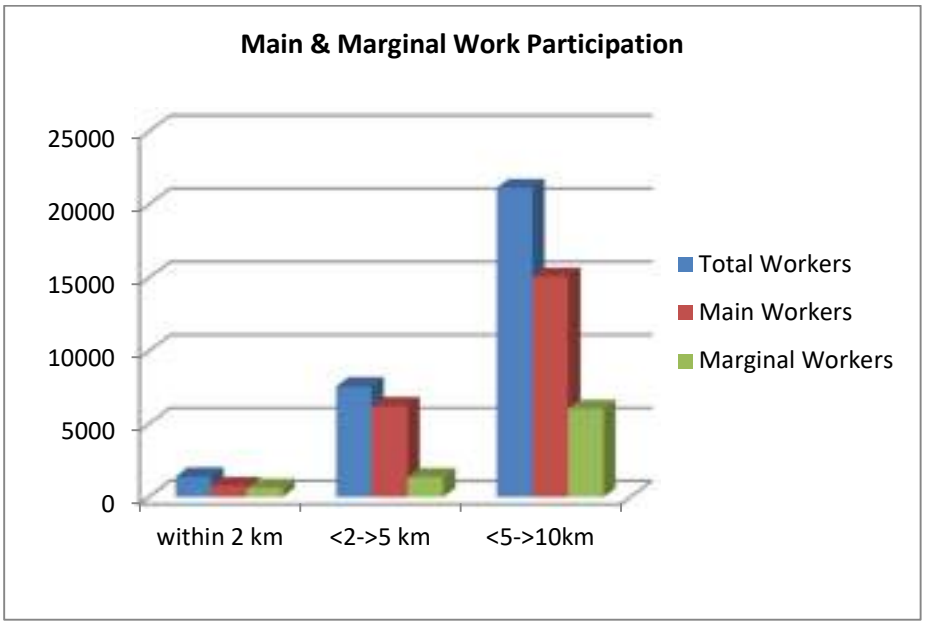


Figure 3.17 Main & Marginal Work Participation

The total agricultural work participation includes cultivates which are 18.92%, agricultural labourers which accounts to be 28.32%, Household Industrial Workers are 4.36% and Other Workers are 48.38%. The female work participation is very less as compared to the males.

Table shows the Occupation Pattern in the study area.

Table 3.41 Occupation Pattern

Km	Cultivators		Agricultural Labourers		Household Industrial Workers		Other Workers	
	Male	Female	Male	Female	Male	Female	Male	Female
0-2	329	7	115	57	2	2	280	61
2-5	1773	207	2285	729	750	272	7320	1063
5-10	3698	384	5099	1291	254	195	5755	1877
Total	**5800**	**598**	**7499**	**2077**	**1006**	**469**	**13355**	**3001**
	6398		**9576**		**1475**		**16356**	

**Source: Census of India, District Handbook 2011*

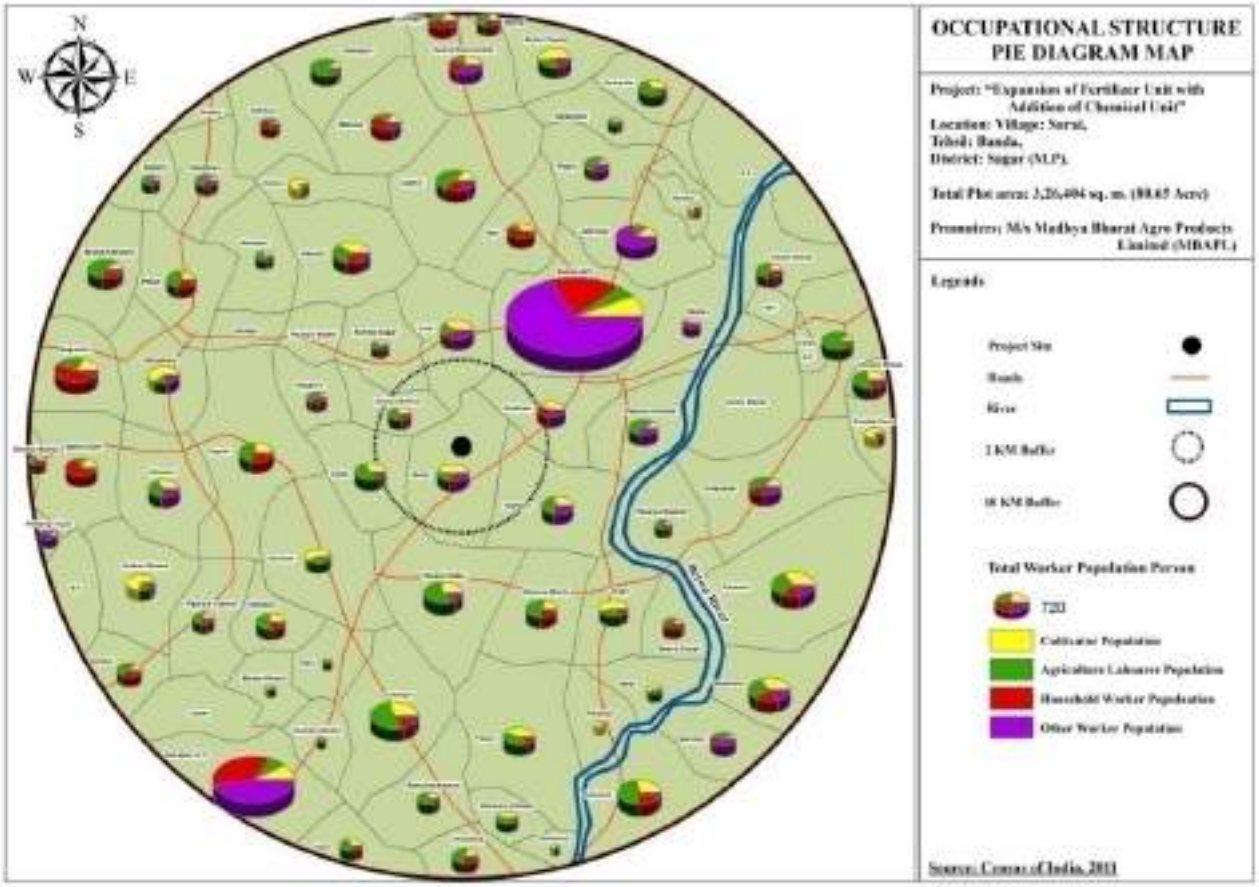


Figure 3.18:Thematic Map depicting Distribution of Occupational Structure

3.9.9 Dependency Ratio

What is Dependency ratio

Based on total number of workers in the study area the overall dependency ratio has been worked out at 124.3%. Of this 131.1% is in the 1st zone, while 120.7% is seen in the 2nd zone and is the highest and 3rd zone has 125.1% of dependency rate. This indicates that unemployment situation in the study area is far from satisfactory.

Km	Dependency Rates		
	Non Workers	Total workers	Dependency Rate
0-2	1831	1397	131.1
2-5	9146	7577	120.7
5-10	26447	21145	125.1
Total	**37424**	**30119**	**124.3**

Focus Group Discussion Observations: -

Focus Group Discussion Observations are conducted with the likely impacted stakeholders, given as below:

Components	Description	Remarks/Suggestions
Village Set up	Mostly joint family set up in the villages and the most dominant are Hindus. Yadav or Thakur belonging to the OBC / General are prominent in the vicinity of the buffer area of 5 km radius. Most of the people houses are of permanent structure or temporary structure. The literacy standards have increased. However, preference is given to men in the study area to receive higher education. For higher education especially in technical or professional education locals study in the Sagar city. Ground water is used for domestic purposes, but water scarcity is reported by the people. Drinking water facilities needs to be improved. Villages have electricity supply and are satisfied with	• More Employment opportunities need to be established • More vocational training programs to be introduced

it. Local are opting for different occupations such as govt, pvt Jobs other than agriculture or related works which were earlier predominant. The occupations of the villagers in the study area are small scale businessmen, contract laborers or small farmers. The agriculture land is unirrigated. Some farmers have Kishan Credit cards to avail loan from Govt Gramin Banks under Kishan Awas Vikas Yojna. The farmers have cows in their house to meet the daily necessity of milk. Some locals rear cattle to earn their living. Locals use public transport such as buses, shared autos for commute to other village for work or leisure. They have their own vehicles as well.

Comments/ Suggestions:-

- Economic status of the locals needs to be improved
- More trained labour needs to be increased
- New ways of farming methods needs to be introduced
- Employment opportunities needs to be increased
- Water facilities needs to be improved

Women Status	Women are mostly engaged in household work. Generally girls get married at age of 16-20 years and are not allowed to work and earn. However, some girls get the opportunity to work but are not allowed to study or make living in other cities. Women do not participate in decisions related to family matters, financial or at community. Gender Ratio is very low which means women aren't given preference. Comments/ Suggestions:- • Women gender ratio is very low • Women needs empowerment • Education needs to be imporved	• Opportunity for women in education and employment should be increased • Women needs to be empowered • Women should be made aware about the government schemes which benefit women • Encouragement for Self Help Group
Education	In the study area there are primary and secondary schools. The schools have basic facilities but lack maintenance and enhancement. Schools have less drop outs and girls study in the village school. Exposure to the new ways of teaching method is also less known. Comments/ suggestions:- •	• Enhancement in educational facilities • Improvement in school facilities
Health Facilities		•
Project Proponent	The industry is an expansion project, which will facilitate the increase in production. The manpower will increase. Residential facilities will be provided for the employees. The proponent is committed towards betterment of the village around the project location and nearby study area. The company has its own CSR policy and the activities conducted under it has been mentioned. **Comments/ Suggestions:-**	• Project proponent is committed towards the betterment of the study area • Locals have appreciated the industries

	• Betterment of the villages around the study area in sectors like education, skill development etc. • Women Empowerment programs	

Project Location Photographs

PRIMARY DATA (Use)

Amenities/Infrastructure

The study area is located in Saurai village area in Banda Tehsil in Madhya Pradesh. In the Banda region, MBAPL is located in an industrial area and it appears to be instrumental in enhancement of its infrastructure facilities. Hence, the said study area is provided with various places such as transport services, educational institutions, institutional health services, hospitals, nursing homes etc., places of worship etc., although the area within the range of 2–5 km of the proposed project. The site lacks some basic facilities such as healthcare facility sanitation and adequate drinking water facilities.

Some of the existing basic facilities (as provided by the Govt.) available near to the project site within the study area are listed in the Table below :

Table3.42 : Amenities Data within the Study Area

Sl. No	Basic Amenities Components	Description
	Education :	
1	**Middle School m Secondary Schools** **Higher Secondary Schools**	Shaskiya Madhyamik Vidyalaya Sorai Shaskiya prathmik Vidyalaya Delakhdi Shaskiya Madhyamik Vidyalaya Banda Anganwari Kendra NMC English School Banda

Sl. No	Basic Amenities Components	Description

Fig. Shaskiya prathmik Vidyalaya "delakhdi" village sagar mp

Fig. Shaskiya Kanya Uchh Madhyamik Vidyalaya , Banda Sager .

Sl. No	Basic Amenities Components	Description
Fig. Shaskiya Madhyamik Vidyalaya, Sarai		
2	**Primary Health Centers**	Upper Primary Health center within 2-3 km (village -Delakhdi) Radius.
3	**Hospital**	The government hospital is in the nearest tehsil Banda. The people need to go Sagar city for major illness. This is approximately 10 kilometers from at Sori village.
4	**Drinking Water**	There is a shortage of drinking water in the surroundings area. The water level here is 450-700 feet. There are some facilities have been proposed of hand pump and Panchayat water supply for sorai, dilakhedi salaiya bineka , banda town & fatehpur .

Sl. No	Basic Amenities Components	Description
	Fig. Water facility (Core Zone Area photo) village Sori .	
5	**Irrigation**	Irrigation due to mostly dependent on rain water.
6	**Power Supply**	All villages are electrified. There is no power cut in the all most villages.
	Fig. Power (Core Zone Area photo)	
8	**National Highway & Roads**	NH-86 approx. 0.500 Meter in NE direction Metaled Roads inside Villages
9	**Transportation**	Govt. Buses at frequent intervals, Autos, Private vehicles

Site Visit Observations:

The project is located in an undeveloped industrial area. The nearby respective villages are Saurai and Banda. Infrastructure can be developed such as connecting roads to the villages. Facilities such as Primary school and transport facilities are available within a 2–5 km radius around the project area. Saurai village has a secondary school, in which nearby children of working class study higher education. Educational facilities and infrastructure are well maintained in the village. Students have regular supply of study material, medical assistance, mid day meal etc.

i. Finalizing the Data and Analysis & Interpretation of the same.

SINGH GENERAL STORE

Fig. 3.17: Socioeconomic Survey with Questionnaire to Local Villagers

Table 3.42 Site Surroundings and Connectivity Details

S. No	**Description**		**Distance and Direction**
1.	Nearest Railway Station	LidhoraKhurd Railway Station	18.95 km towards South West
2.	Nearest Airport	Dhana Airport	29.85 Km towards South West
3.	Nearest Village	Sorai Kanti Dilakhedi SalaiyaBineka	0.50 km towards South 1.50 km towardsNorth 1.35km towards East 1.95km towards West
4.	State Boundary	Madhya Pradesh –	21.30 km towards NorthWest.

		Uttar Pradesh Border	
5.	Nearest Highway	NH-86	0.15km towards SouthEast
6.	Water Bodies	Betwa River	3.32 km South East
7.	Nearest School & College	Govt Primary School Govt Primary School Sorai Anganwari Kendra NMC English School Banda	1.50 km towardsEast 0.75km towards South 0.80 km towards South 2.10 km towardsNorth
8.	Nearest Hospital	Arihant Hospital Dr Babulal Anuj Hospital Govt Hospital Banda	2.95 km towards North East 3.65km towards North East 3.75 km towards North East
9.	Places of worship	Shri Jay Ma Abar Mata Mandir Hanuman Ji Mandir Khar Mata Mandir Shiv Mandir	1.40km towards North East 2.85km towards North East 2.75 km towards North East 2.90km towards North East

* Source: Google Earth

*****

INDEX

4.1. INTRODUCTION 213
4.2. IMPACT DURING CONSTRUCTION PHASE 214
4.2.1. SITE PREPARATION/ ERECTION / FABRICATION / CONSTRUCTION STAGE IMPACT 214
4.2.2. Impact on land use 214
4.2.3. Impact on Soil 214
4.2.4. Impact on Water Quality 215
4.2.5. Impact on Air Quality 217
4.2.6. Impact on Noise Levels 218
4.2.7. Impact on Terrestrial Ecology 219
4.2.8. Impact on demography and socio-economy 219
4.3. IMPACT DURING OPERATIONAL PHASE 220
4.3.1. Land Environment 220
4.3.1.1. Impact Prediction & Mitigation Measures 220
4.3.2. Water Environment 222
4.3.2.1. Impact Prediction & Mitigation Measures 223
4.3.2.2. Characteristics of Treated and Untreated Effluent 233
4.3.3. Impact on Air Quality 233
4.3.3.1. Potential Proposed Project Air Emissions 234
4.3.3.2. Air dispersion modelling methodology 237
4.3.3.3. Meteorological Data 242
4.3.3.4. Presentation of Results 247
4.3.3.5. Mitigation Measure 256
4.3.4. NOISE ENVIRONMENT 258
4.3.4.1. Noise Emission Sources 259
4.3.4.2. Methodology 260
4.3.4.3. Model Results and Discussion 263
4.3.5. BIOLOGICAL ENVIRONMENT 266
4.3.6. SOCIO ECONOMIC ENVIRONMENT 268

CHAPTER 4
ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1. INTRODUCTION

This involves identification of impacts which may have adverse or beneficial due to existing and proposed expansion activity on various environmental attributes. Accordingly, predict and assess the environmental impacts; observe each environmental aspect- their impact relationship and identify its degree of significance. The project expansion is likely to create impact on environment, hence identify possible mitigation measures for the project activities and proposed most appropriate mitigation measures to make impacts less in degree, based on the reduction in significance achieved and practicality in implementation.

The proposed expansion project phases for which impacts are identify:

- **Construction phase:** Temporary or short term impact; and,
- **Operation phase:** long term impacts

Identification of possible impacts due to an activity is very important while this helps to construct implementation measures and focusing attention upon relevant environmental parameters with the activities involved.

The following attributes are of utmost significant to carry out the Environmental Impact Assessment of the proposed expansion project and are being discussed in detail for each attributes in construction and operation phase

1. Land Environment.
2. Water Environment.
3. Air Environment.
4. Noise Environment.
5. Solid Waste.
6. Biological Environment.
7. Socio economic

4.2. IMPACT DURING CONSTRUCTION PHASE

The expected date of start of construction will be soon after the grant of all required clearances such as Environmental clearance, CTE expansion etc. The likely date of completion / time required for the procurement of machinery would take 9 months, and for the construction foundation for fixed structures, machinery installation would take another 4 months. The proposed expansion will initiate operations after successful installation. The impacts due to construction phase has been assessed and given below:

4.2.1. SITE PREPARATION/ ERECTION / FABRICATION / CONSTRUCTION STAGE IMPACT

4.2.2. Impact on land use

The new installation of machinery for chemical plant (Unit-II) will not create any significant impact on land use, the changes will be limited to plant premise only. The land use pattern of the proposed expansion project is under industrial category. The total plant area is about 80.65 acre (3, 26,404 sq. m.). The open land earmarked for future expansion in the existing plant will be utilized for the proposed expansion project. Hence,

- There will be no change in the land use as this land is designated for industrial Category.
- No changes in the topography of the site and the nearby area.
- Traffic load will be increased due to the production expansion. For this, traffic study has been conducted to find out the impact. The traffic study has been given in **Chapter VII.**

4.2.3. Impact on Soil

Impact on soil vegetation: It has been observed that the soils are clay loam in texture and slightly alkaline in nature. Topsoil will be scrapped prior to initiation of bulk earthwork. No vegetation is found on the expansion area. Hence, no vegetation removal is envisaged.

Except for local constructional impacts at the proposed plant site, no significant adverse impact on the soil in the project site as well as in the surrounding area is likely.

Mitigation Measures: Top soil/ scrapped soil will be restoring for the gardening and plantation purpose after foundation work completed. The excavated remaining soil will be spread in low laying area to level them or disposed off as per Construction and Demolition Waste Management Rules'2016. All necessary control measures will be adopted for handling, storage and safe disposal of solid/hazardous waste generated from the proposed project as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 & Solid Waste Management Rules, 2016.

With taking effective mitigation measure and proper implementation there will not be any significant impact of solid waste/ Hazardous waste on the soil environment.

4.2.4. Impact on Water Quality

During the construction phase, water will be required for civil works and for the domestic purposes. In civil work water will be used for preparation & mixing of concrete, cooling of construction equipment, curing the structures, for dust suppression etc.

During construction phase, impact on water quality may be:

- Surface runoff Surface runoff from the construction site and labor sheds from project site;
- Oil/ fuel and waste spills; improper debris disposal;
- Discharge of sewage from labour temporary site (construction work force stationed at the site).

Mitigation Measures:

Surface run off during rainy season will be collected in to rain water harvesting structure inside the project premises as per drainage. Paved surfaces will minimize the storm water runoff volume. The some measure for storm water will be adopted as given below:

- The run-off from the site to enter the drain/nallah only through designated points.
- The storm water channels based on the contour of the land will be constructed for channelizing the run-off from the site and from the upstream side outside the project site.

- The storm water channels before disposal from the site will be passed through de-siltation traps attached with oil separator.

Sewage Treatment plant will be used for disposal of sanitary sewage generated by the work force through contractors. Furthermore, the construction will be more related to mechanical fabrication, assembly and erection and installation of machinery; hence the water requirement will be less. Groundwater will not be drawn for the construction activities; hence impact on groundwater resources is not anticipated. The construction will be carried out on the flat area; the soil losses will be negligible. Further, the construction will be more related to mechanical fabrication, assembly and erection; hence the water requirement will be less.

The overall impact on water environment during construction phase due to proposed project is likely to be short term and insignificant.

There will be no effluent generation during the construction phase; hence concern of effluent disposal & impacts will not come up.

The construction equipment will be washed properly only at designated washing area will be monitored. The identified impacts on water during the construction phase will be managed by implementation of proper and effective Environmental Management Plan to minimize the temporary effects by proper conservation and sanitation practices.

The impacts will be temporary and limited to the construction phase only. These measures will ensure that the run-off from the site after development will not have minimal impact or chances of flooding or water logging in the stream, within the site or in the downstream areas.

4.2.5. Impact on Air Quality

During construction phase, fugitive dust will be the main pollutant and would generate by:

- Site development activities
- Vehicular movement for raw material for construction
- Slightly increase in NOx and CO may also be due to vehicular traffic movement

Mitigation Measures:

To mitigate dust generation impacts, regular sprinkling of water will be done at the construction site. The approach roads will be paved with tar and vehicles will be kept in good order to minimize automobile exhaust.

However, the impact of such activities would be temporary and restricted to the construction phase and will be confined to the project boundary and is expected to be negligible outside the plant boundaries. These are some of the measures that would greatly reduce the negative impacts during the construction phase given below:

- Proper maintenance of vehicles,
- Sprinkling of water on roads,
- Sufficient vegetation

Due to gaseous emissions from equipment/ machineries engaged in construction activities, minor impacts on ambient air quality are envisaged. Dust emissions due to construction

vehicles within the premises will be minimized. Impacts on air due to the construction & erection activities will be minimal or negligible

4.2.6. Impact on Noise Levels

The major sources of noise during the construction phase are:

- Vehicular traffic;
- Construction equipment like dozers, scrapers, concrete mixers, cranes, generators, pumps, compressors, rock drills, pneumatic tools, saws, vibrators etc.
- The construction equipment may have high noise levels, which can affect the personnel operating the machinery as operation of this equipment will generate noise ranging between 70-85 dB (A).

Mitigation Measure:

The noise generation during the construction will have significant impact on the existing ambient noise levels however it will restrict to plant premises. The major work will be carried out during the daytime. Use of proper personal protective equipment (Ear plugs) shall be provided to the workers working in high noise level areas will mitigate any significant impact of the noise generated by such equipment.

Impacts of noise during the construction phase will be restricted to the construction site only and will be only temporary. Other precautionary measures are given below:

- Provision of silencers on noise generating machinery;
- Construction equipment with minimum noise shall be chosen;
- Vehicles and construction equipment with internal combustion engines without proper silencer shall not be allowed to operate at the site;
- Regular maintenance of equipment& vehicles;
- Ensuring that DG sets are provided with acoustic enclosures and exhaust mufflers; and
- Avoiding continuous (more than 8 hrs) exposure of workers to high noise areas.
- Ensuring preventive maintenance of equipment.
- Ensuring vehicle movement is avoided at night.

Overall, the impact of noise generated on the environment is likely to be low, reversible and localized in nature. Community noise levels are not likely to be affected because of the vegetation and likely attenuation due to the physical barriers.

4.2.7. Impact on Terrestrial Ecology

The proposed expansion project is coming up within an area of 80.65 acre (3, 26,404 sq. m.) at existing plant premises. Hence, no additional land is required for the expansion. The open land is earmarked for future expansion in the existing plant and will be used for the proposed expansion.

Mitigation Measure:

No cutting of trees/ shrubs will be done to clean the area. However, greenbelt development will be done within premises and along the roads.

There is no ecological sensitive area within 10 km of area and the proposed expansion project is situated in declared Industrial Area, hence, impact on flora and fauna during the construction phase is not significant.

It is envisaged that there will have beneficial impacts due to the greenbelt development. Therefore, the impact on terrestrial ecology will be insignificant. No adverse impacts on the ecology/ biological environment due to the construction of proposed project is envisaged

4.2.8. Impact on demography and socio-economy

The impact identified on the basis of some points due to proposed expansion project is:

- Workforce;
- Income;
- Population changes;
- Effects of increased traffic on the regional road network;
- The short-term impacts (the direct effect of the particular industrial project);
- The long-term impacts (due to the general industrialization of the area);
- The problems faced by them in the past due to industrial projects and
- Awareness and perception about the proposed project;

Positive Impacts: The construction phase is short term phase and start-up of the construction activities approx. 100 workers will be hired locally from villages fall within the study area which is direct and positive impact of proposed project. There will be requirement of skilled and semi-skilled workers for construction activities, supply of raw materials & auxiliary facilities. It would marginally improve the economic status of the people. The increased traffic will be only day time and will be intermittent. Hence no impact due to traffic increased is envisaged.

Mitigation Measures:

Work force hired locally from villages fall within the study area which is direct and positive impact of proposed project. There will not be major changes in the land use pattern as it is existing project situated in declared industrial area.

4.3. IMPACT DURING OPERATIONAL PHASE

4.3.1. Land Environment

- Change in Land Use/ Land Cover;
- Change in topography

4.3.1.1. Impact Prediction & Mitigation Measures

S. No	Impact	Mitigation Measure & Management
1.	Change of Land Use/ Land Cover.	• No change in land use is envisaged as existing land lies in declared for industrial area and proposed expansion is coming up within existing plant premises. no additional land is required for the present expansion. • The open land earmarked for future expansion in the existing plant will be utilized for the proposed expansion. • Hence, the impact on land use and land cover will not alter significantly as it is an existing project.
2.	Change in Topography	• The land area for the proposed expansion is flat area. • The highest and lowest elevation of the project site is 489 MSL and 475MSL. • As, it is an expansion project, the impact on the physical environment will be confined within the project site.

		• The increase in production will not cause any change in the topography at the site.

Solid and Hazardous Waste

	Impact	Mitigation Measure and Management
1.	**Solid Waste** I. Domestic Waste • Disposed of untreated municipal solid wastes (MSWs) onto land/on soil quality and water pollution • Create foul odor and Nuisance in surrounding area	• The total municipal waste generation will be 120kg/day from the proposed project and will be segregate in biodegradable and non biodegradable waste and will store in separate dustbin and sent to Municipal Council Tehsil – Banda, District- Sagar.

Particulars	Workers	Quantity of waste generated (in kg/day)	Disposal and Management
Workers	381	114	Segregate in two dustbins and Sent to Municipal Council Tehsil - Banda
Landscaping	28.29	6	
Total		**120kg/day**	
Workers @0.3 kg/day/ person Landscaping : @0.2kg/acre/day			

II. Industrial Non-Hazardous Waste • No impact is envisaged as it will be reused.	

Particulars	Quantity	Management
Scrap/ Plastic packing material wood, card board, gunny bags etc.	3,870 damaged bags	Repair and reuse in packing of SSP /GSSP.

Hazardous Waste generated from industrial process may have impact on Land/Soil, Water Quality if not properly stored and dispose off.	The hazardous waste mitigation measure is as follows: • The soil will be scrapped off if oil / waste oil spill on the land and soil will be stored and sent to TDSF site for further treatment • The area of oil / waste oil storage will be made concrete to reduce the land and water pollution. • Liner will be placed where the hazardous waste is stored. • The Hazardous waste is /will be stored at hazardous waste storage room at designated place with hording and specifying the Hazardous waste generation per day. • Log book will be maintained. The records of hazardous waste manifest will be maintained • Hazardous waste will be dispose off as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 .

	Hazardous waste Details	

Particular	Type of waste	Existing	Proposed	Total	Treatment Disposal
Hazardous Waste	Used Oil Category 5.1 (Consent No. AWH -47347 & 45474)	278 Litre	500 Litre	778 Litre	Stored in drums and reuse for lubricating the open chain/ gear /roller etc.
	Silica (Annexure II in Form-4 (19-20)	119 MT	None	119 MT	Recycle in SSP manufacturing as filler.
	H_2SiF_6 (Annexure II in Form-4 (19-20)	6466 MT (liquor)	None	6466 MT (liquor)	Recycle in SSP manufacturing for acid dilution purpose.
	Zinc Sludge from Zinc Sulphate	None	300MTPA	300MTPA	It will be reuse in SSP.
	Sludge (Schedule I category 26.2) from DAP/NPK ,Ammonia and Nitric Acid Plant	None	50MTPA	50MTPA	It will reuse in SSP
	Sludge (Schedule I category 26.2) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	MEE Salt (Schedule I category 26.1) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP
	Vanadium Pentoxide Catalyst Waste from SAP	None	2 MTPA	2 MTPA	Stored and disposed through registered recycler only..
	Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP

4.3.2. Water Environment

- Industrial Waste Water;
- Domestic Waste Water.

4.3.2.1. Impact Prediction & Mitigation Measures

S. No.	Project Activity	Impact	Mitigation measure
1.	• Raw material handling, storage and processing • Product handling, storage & dispatch	There may be possibility of surface water contamination if the water used for cleaning the unit and reaction vessel and waste water disposed-off in surface water without treating it.	The waste water generated from the washing area and cleaning of vessels is/ will be diverted in well-designed internal drainage system with adequate slope connected to ETP for waste water treatment
2.	Sewage and Effluent generation	Contamination of surface water, ground water and land / soil if not treated properly also create odour problem and nuisance to surrounding environment .	• Presently sewage water is being treated in soak pit followed by septic tank. In proposed expansion phase generated sewage water (15 KLD) will be sent to STP of having capacity KLD for treatment and reused for plantation. • Tota107KLD waste water from industrial process will be generated which will be treated in ETP of 120 KLD capacity and used for gardening and recycled back to process to achieve Zero Liquid Discharge (ZLD).
3.	Discharge of effluent or sewage on surface water and land	Change in water bodies and contamination of water bodies and ground water too.	No prominent stream or seasonal nallah is passing through the project area. Bawas river lies in a distance of 3.9 Km towards ESE direction from the project site. It is not a perennial river.

			No waste water will be disposed of outside the premises. Generated waste water will be treated and reused for plantation and in process No water is being/will be discharged on land and water bodies as ZLD is being/will be maintained. The reject water generated from process, washing, boiler blow down, will be treated in ETP and reused in process.
4.	Ground water abstraction	Depletion of ground water resource	Present ground water and municipality supply water is being used for industrial and domestic purposes. To reduce the impact on ground water resources no ground water will be abstracted for industrial and domestic purposes as surface water will be sourced from Banda Irrigation Project for the estimated water demand.

Management:

I. Domestic: For Domestic sewage treatment, STP will be installed of 20 KLD capacity based on MBBR technology. The flow diagram is given below:

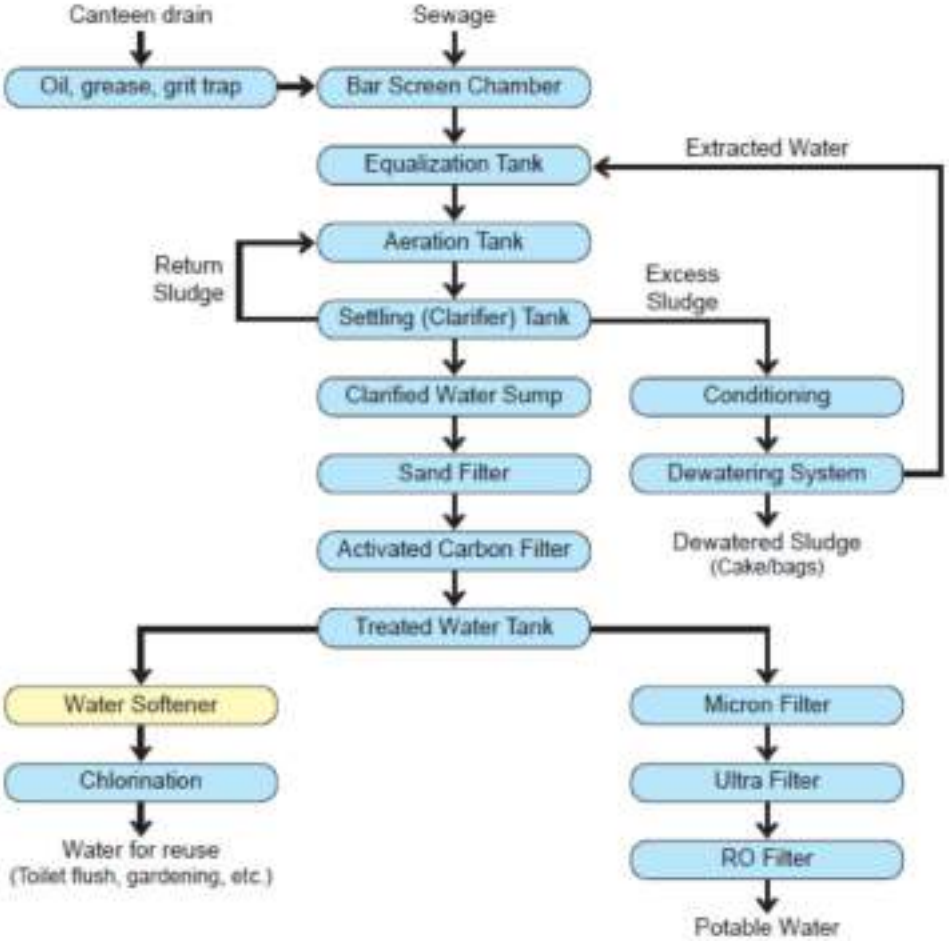


Figure 4.0 Flow Diagram of Sewage Treatment Plant

The Waste Water Treatment System will be based on MBBR technology followed by ultrafiltration system

OPERATING PRINCIPLE: MBBR Technology is a combination of activated sludge process (suspended growth) and bio filter processes (attached growth). Moving Bed Biofilm Bioreactor (MBBR) process uses the whole tank volume for biomass growth. It uses simple floating media, which are carriers for attached growth of biofilms. Biofilm carrier movement is caused by the agitation of air bubbles. This compact treatment system is effective in removal of BOD as well as nitrogen and phosphorus while facilitating effective solids separation.

In order to conserve water, Sewage Treatment Plant has been designed to ensure that treated effluent characteristics are well below the permissible limits of local/national pollution

control norms even under varying flow conditions which are typical for such systems. This implies that the selected process shall be able to withstand the shock load situation.

We propose to use MBBR treatment Technology for STP followed by ultrafiltration along with SCADA System. This has the following advantages:

a) The process has long retention time and can absorb shock load situation.
b) The process produces a well-oxidized sludge in small quantities only, which can be removed and used as manure.
c) Ultra filtration: It is a membrane filtration in which forces like pressure or concentration gradients lead to a separation through a semi permeable membrane.

a) Raw Sewage / Influent

pH : 6.5 – 8.5
BOD : 250 – 350 mg/l
S. Solids : 100 – 450 mg/l
COD : 400 – 600 mg/l

b) Effluent Discharge Characteristics after Treatment

pH : 6.5 – 7.5
BOD : < 5 mg/l
S. Solids : < 10 mg/l
COD : < 30 mg/l

PROCESS DESCRIPTION:

- Sewage generated from various sources after passing through an oil & grease trap will be carried through battery of manholes inter connected through soil pipes under gravity flow and will be collected in the collection cum equalization tank after passing through screen chambers near the STP.
- Manually cleaned bar screens will be installed in the screen chamber to screen of any large pieces.
- Coarse bubble aeration system will be provided to keep the sewage in homogeneous condition.

- From the Collection cum Equalization Tank, the waste water will be pumped via two submersible solids handling pumps (1 working + 1 standby) into adjoining aeration tank.
- In the aeration tank waste water will be mixed with micro-organisms in presence of dissolved oxygen.
- Micro-organisms will assimilate organic impurities. The mixed liquor suspended solids (MLSS) will be maintained at levels of 3,000 mg/l – 4,000 mg/l. The bottom of the aeration tank will be covered with submerged air diffusers. Submerged air diffusers will provide mixing and oxygen for the needs of micro-organisms.
- Compressed air will be supplied through two common air blowers (1 working + 1 standby) for collection cum equalization tank, aeration tank & sludge holding tank.
- From the aeration tank mixed liquor will flow by gravity into adjoining clarifier tank (Secondary settling tank). The solids will settle in the clarifier tank. Sludge Recirculation pumps will pump the settled sludge from the bottom of clarifier tank to sludge holding tank and the aeration tank for maintaining desired MLSS level.
- Overflow weir with scum baffle will be provided in the clarifiers to take treated waste water out of the clarifier.
- From the clarifier, treated waste water will flow via gravity into adjoining treated effluent cum filter feed tank.
    - Treated waste water after treated effluent cum Filter Feed tank will be clear, odorless, low BOD and low suspended solids.
    - For improving the treated waste water quality, treated waste water after Filter Feed tank will be passed through Pressure Sand Filter followed by Activated Carbon Filter for further reduction of Suspended Solids, BOD, COD, etc. so as to make it suitable for Irrigation purpose/ultrafiltration process.
    - Water will be passed through the ultrafiltration system comprising of U/F feed & backwash pump, cartridge filter, U/F membrane for further reduction of suspended solid, BOD, COD etc as to make it suitable for flushing purpose.

- After ultrafiltration system the treated effluent will be collected/stored in the flushing cum ultrafiltration permeate storage tank from where it can be used for flushing, horticulture and other requirements.

II ETP Plant

The treatment scheme is as under:

The raw effluent from all the sections will be collected in to the collection sump. The effluent from the collection sump will be pumped to the oil & grease trap. The effluent free of oil & grease and floating matter will be taken to the equalization cum neutralization tank

The equalization cum neutralization tank with adequate residence time has been provided for equalizing the organic as well as hydraulic load. There will be two compartments in the equalization cum neutralization tank so as to have the ease of operation and saving the chemical consumption for neutralization. The effluent will be checked for the pH and it will be neutralized with the chemicals. The chemicals will be mixed with the coarse aeration provided at the bottom. After the chemical treatment is over, the effluent will be pumped to the primary clarifier where sludge settles at the bottom & clarified effluent overflows to next stage. The sludge settled at the bottom of the primary clarifier will be taken to the sludge drying bed. The overflow of the primary clarifier is taken to intermediate collection tank.

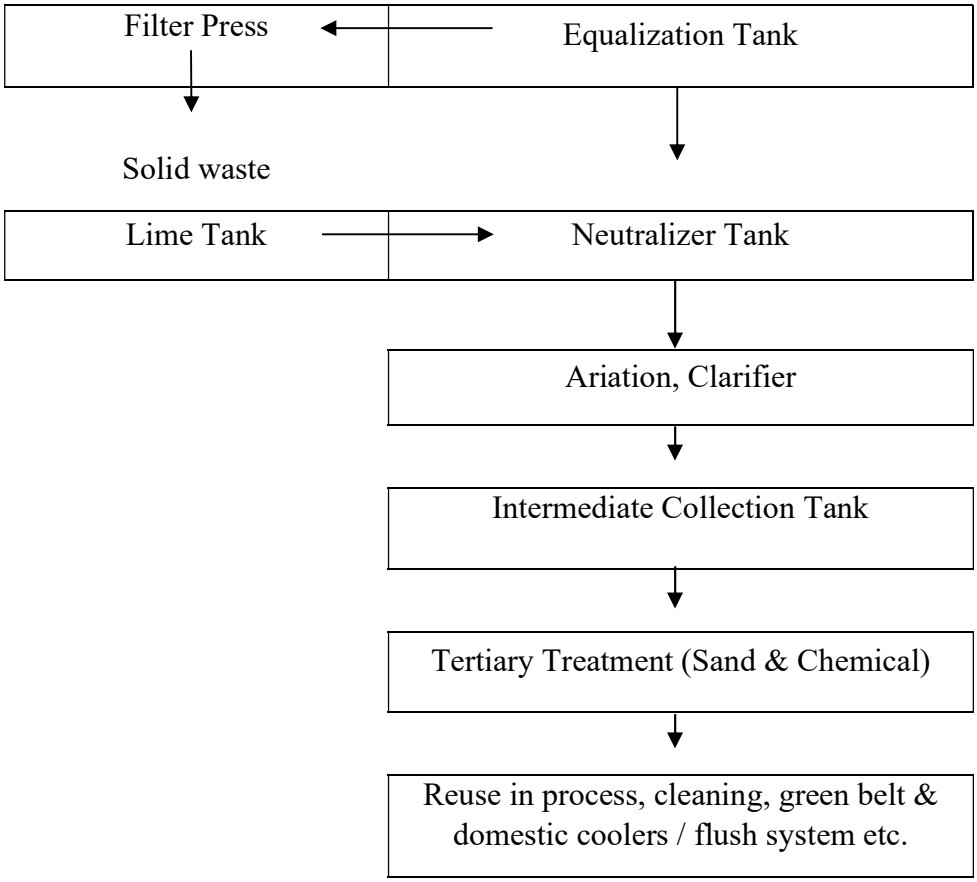
Tertiary treatment in the form of Sand Filtration & Carbon Treatment will be followed. The treated wastewater from the tertiary treatment is collected in final collection tank and finally utilized for gardening and firefighting use. The biological treatment comprises of activated sludge process. The ETP will be designed for treating 150 KL/day of effluent.

EFFLUENT TREATMENT PLANT UNITS:

The method of treatment followed will be as follows:

Collection Tank

↓



SIZING OF ETP UNITS

S.No.	Units	Nos.	Size	Total Unit Volume, KL
1	Raw Effluent Collection Tank	2	5.0 m x 5.0 m x 4.0 m	100
2	Filter Press	1	-	-
3	Equalisation cum Neutralisation Tank	2	2.0 m x 2.0 m x2.5 m	20.00
4	Ariation tank	1	4.0 m x 2.0 m x2.5 m	20.00
5	Primary Clarifier	1	3.0 m Dia x 2.5 m SWD	17.66
6	Intermediate Collection Tank	1	3.5 m x 3.5 m x 2.5 m	30.65
7	Sand Filter	1	-	20 M3
8	Carbon Filter	1	-	20 M3
9	Final Collection Tank	1	5.0 m x 5.0 m x 4.0 m + 0.5 SWD	100.00

10	Chemical Dosing Tank	1	1.5 m x 1.5 m x 1.5 m	6.75
11	Sludge Drying Bed	2	8.0 m x 6.0 m x 1.1 m	211.20

CHARACTERISTICS OF WASTEWATER BEFORE & AFTER TREATEMENT

The Characteristics of before & after treatment will be as follows:

S. No.	Category of waste water	Before Treatment	After Treatment
1	pH	3.5-6.5	6.5-8.5
2	COD	500-750	50-100
3	BOD	100-300	10-30
4	TDS	1000-2000	200-1000

III. FLUORINE RECOVERY SYSTEM AT MADHYA BHARAT AGRO PRODUCTS LIMITED, UNIT-II

Main raw materials for manufacturing of Single Super Phosphate (SSP) are "RockPhosphate" and "Sulphuric Acid". Rock phosphate contains fluorine as a CaF2. HF gases generates when reaction take place between rock phosphate and sulphuric acid in mixer. Recovery of this gaseous product being done through scrubbing system. The chemical reaction is given below:-

$CaF_2 + H_2SO_4$ $CaSO_4 + 2HF$

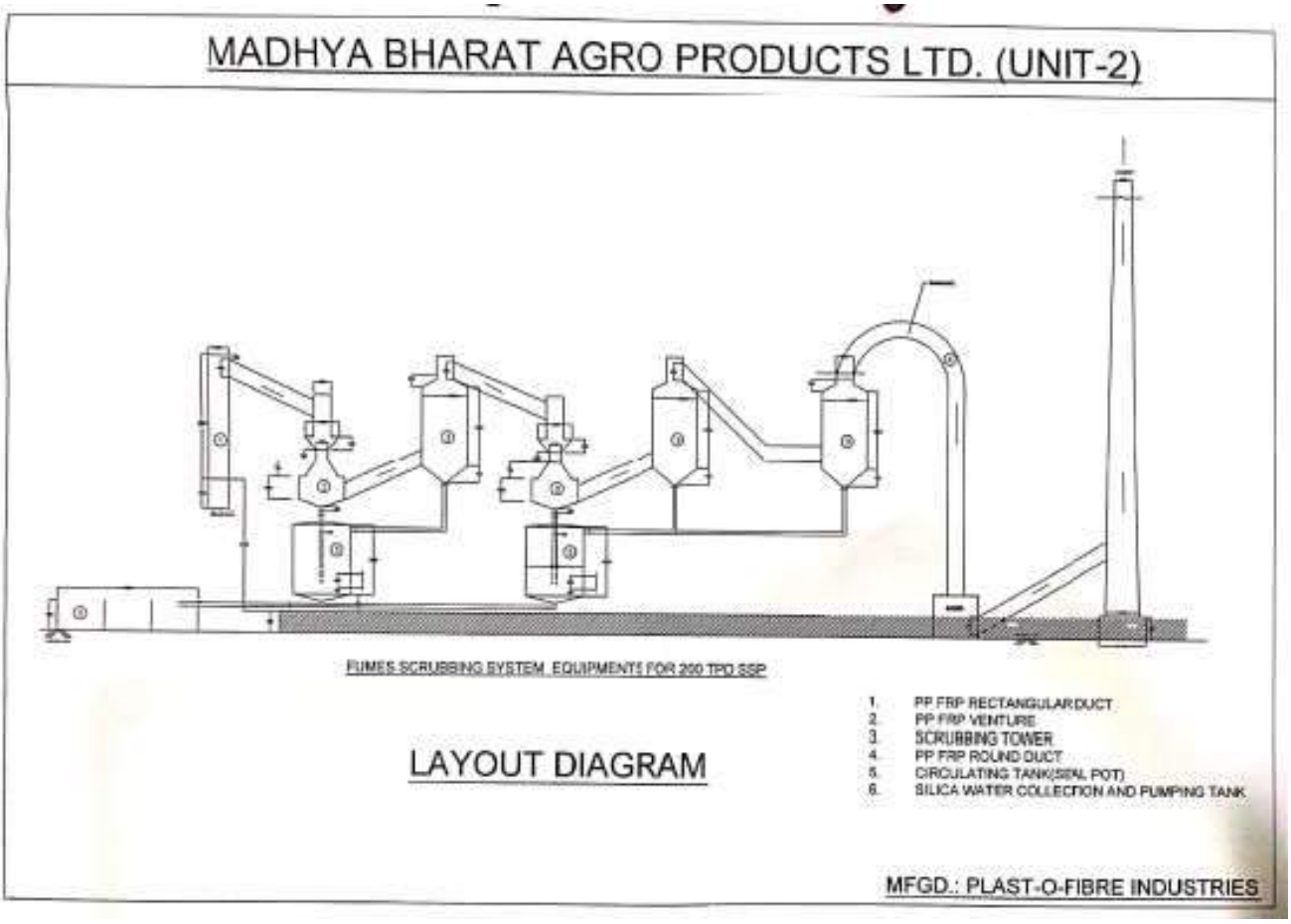
These HF gases quickly react with SiO2 which is already present in phosphate rock resulting generation of SiF4. The chemical reaction is given below:-

4HF + SiO2 SiF4 + 2H2O (in vapour form due to high temperature) Above gases and water vapour are sucked from reaction equipments using ID fan and passed through series of scrubbers. MBAPL has installed 3 stage scrubbing towers having

two towers with water spraying and one is alkali scrubber (Annexure-I) for above purpose. Whole system of gas scrubbing internally protected by fibre lining to protect equipment from gas attack. SiF4 mostly soluble in water so we spraying water in two towers resulting generation of Silica (Sio2) and clear liquor (H2SiF6). The chemical reaction is given below:-

3SiF4 + 2H2O 2H2SiF6 + SiO2

Silica is separating through filter press and used in plant as a filler, while clear liquor (H2SiF6) recycle to plant for acid dilution purpose. Fresh water is added to maintain the efficiency of scrubbing system. Remaining gases SiF4 and HF is scrubbed in alkali scrubber and there after gas stream discharged through stack. MBAPL maintain the HF level 7 to 12 Mg/Nm3 and PM value 80 to 100 Mg/Nm3 in gas stream being discharging to stack.



IV. Rain water harvesting at the plant site:

a. Rooftop Rain Water Harvesting

Rain water harvesting is process of collecting, storing rain water for reuse and recharging subsoil. The resultant effects of recharging ground water are:

- To increase the stability of the surface;
- To avoid surface flooding;

- To reduce the humidity in the immediate vicinity of the building;
- Remove bacteriological and suspended impurities during the surface water transition within the soil;
- Maintain the natural balance of the ground water and its usage as the rain-water is a renewable supply source. A well-managed and controlled tapping of the aquifers will provide a constant, dependable and safe water supply;
- Improve the quality of the existing ground water through dilution; and
- Enhancement of sustainable yield in areas where there is over development and depletion of the aquifers.

It is proposed to conserve, store and to utilize the same for various uses in the project area. The surface soil at the site is sandy and hence percolation is more and rapid resulting in absence of surface flow or run-off even during reasonably heavy precipitation.

The details of run-off computations are given in Table below:

Table 4.1: Calculation for Rain Water Harvesting

S. No.	Type of Structure/ Surface	Area [A] (Sq. m.)	Run off Coefficient[C]	Intensity of rainfall [I] (m/annum)	Total discharge [Q= CIA] (m^3/ annum)
1.	Roof Top	37779	0.85	0.06	1926.729
2.	Landscape	114500	0.15	0.06	1030.5
3.	Paved or open area	174125	0.65	0.06	6790.875
Grand Total (1-3)		**3,26,404**	-		**9748.104**

Total Rain Water Flow : 9748.104 m^3/hr

Considering 15 minutes of peak rainfall,

Runoff volume : 2437.02m^3/hr

Volume of each pit : 27 m^3 (3 m x 3 m x 3 m)

Total no. of rain water harvesting pits required : Total run-off volume/volume of each pit

: 2437.02/27

: 90.26 say 90 no.

Therefore, 90 No. rain Water Harvesting pit of size 3 m length x 3 m width x 3 m depth with PVC slotted pipe upto minimum depth of 30 m. Out of 90 pits 18 pits has already been constructed at the site.

The storm water collected from all area will care with the help of these catch basins will flow through a well-designed underground piped flow network based on non-silting and non-scouring velocities. The storm water from last catch basin will be brought to sedimentation chambers before rain water harvesting system. The overflow from the sedimentation chamber will pass through inverted graded medium filtration in the harvesting chamber from where it will percolate down to unsaturated zone in the aquifers thus enhancing the water quality and quantity both simultaneously.

4.3.2.2. Characteristics of Treated and Untreated Effluent

The characteristics of treated and untreated effluent are as given below:-

Table:4.2: Characteristics of treated and untreated effluent

Characteristic	Treated	Limits as per GSR 422 (E)for on Land Irrigation
pH	7.5	5.5-9.0
Appearance	Clear	--
Suspended Solids (mg/l)	<100	200
BOD (3 days at 27$_o$C)	<30	100
Oil and Grease	<10	10
TDS (mg/l)	2100	--
Chloride (mg/l)	1000	--
Phosphate (mg/l)	5	
Fluoride (mg/l)	10	

4.3.3. Impact on Air Quality

During the operational phase of the plant, the continuous air emissions are expected to be from operation of various process equipment in the plant along with the emergency power generator sets, movement of vehicles, etc. The air pollutants of concern from the unit will be PM10, Acid Mist, NOX, SO_2, HF and NH_3. The details of plant specific emissions are discussed below.

4.3.3.1. Potential Proposed Project Air Emissions

The major air pollutants expected to be emitted from the proposed expansion project are from the following units within the project premises.

- Phosphoric acid plant
- Linear Alkylbenzene Sulfonic acid plant
- Zinc Sulphate
- DAP/NPK complex
- Gypsum granular
- Sulphuric acid plant
- Vinyl Sulphone plant
- Ammonia plant
- Nitric acid plant
- Calcium Nitrate plant
- Sulphate of Potash plant

Major emissions from phosphoric acid production includes gaseous fluorides, mostly silicon tetrafluoride (SiF_4) and hydrogen fluoride (HF). Phosphate rock contains 3.5 to 4.0 percent fluorine. In general, part of the fluorine from the rock is precipitated out with the gypsum, another part is leached out with the phosphoric acid product, and the remaining portion is vaporized in the reactor or evaporator. The relative quantities of fluorides in the filter acid and gypsum depend on the type of rock and the operating conditions. Final disposition of the volatilized fluorine depends on the design and operation of the plant. In the proposed expansion of the MBAPL project, scrubbers will be used to control fluorine emissions.

Sources of air emissions from the production of ammonium phosphate fertilizers include the reactor, the ammoniator-granulator, the dryer and cooler, product sizing and material transfer, and the gypsum pond. The reactor and ammoniator-granulator produce emissions of gaseous ammonia, gaseous fluorides such as hydrogen fluoride (HF) and silicon tetrafluoride (SiF4), and particulate ammonium phosphates. These 2 exhaust streams are generally combined and passed through primary and secondary scrubbers.

Exhaust gases from the dryer and cooler also contain ammonia, fluorides, and particulates and these streams are commonly combined and passed through cyclones and primary and secondary scrubbers. Particulate emissions and low levels of ammonia and fluorides from product sizing and material transfer operations are controlled the same way.

Emissions from nitric acid manufacture consist primarily of NO, NO2 (which account for visible emissions), trace amounts of HNO3 mist, and ammonia (NH3). By far, the major source of nitrogen oxides (NOx) is the tailgas from the acid absorption tower. In general, the quantity of NOx emissions is directly related to the kinetics of the nitric acid formation reaction and absorption tower design. NOx emissions can increase when there is (1) insufficient air supply to the oxidizer and absorber, (2) low pressure, especially in the absorber, (3) high temperatures in the cooler-condenser and absorber, (4) production of an excessively high-strength product acid, (5) operation at high throughput rates, and (6) faulty equipment such as compressors or pumps that lead to lower pressures and leaks, and decrease plant efficiency.

The 2 most common techniques used to control absorption tower tail gas emissions are extended absorption and catalytic reduction. Extended absorption reduces NOx emissions by increasing the efficiency of the existing process absorption tower or incorporating an additional absorption tower.

Emission factors for the controlled process are provided below in **Table 4.3.**

Table 4.3: Emission Factors

No.	Plant	No. of stack	Stack attached to	Stack Height (m)	Pollutant	Emission Rate
1	Ammonia Plant	1	Primary Reformer Stack	50	NOX	400 mg/Nm^3
		1	Scrubbed gas stack	50	NH_3	1.1 kg/ton
					SO_2	0.0288 kg/ton
2	Sulphuric Acid	1	Absorption Tower Stack	50	SO_2	02 kg/ton
					Acid Mist	0.064 kg/ton
3	Phosphoric acid	1	Rock grinding section	20	PM	125 mg/Nm^3
		1	Gas Scrubber	40	F	20 mg/Nm^3

4	Nitric acid	1	Absorption Tower stack	50	NOX	400 mg/Nm^3
5	DAP/NPK Complex fertilizer plant	1	Ammonia Scrubber	50	NH_3	150 mg/Nm^3
		1	HF gas scrubber	50	F	20 mg/Nm^3
		1	Coal fire Furnace	30	PM	125 mg/Nm^3
					NOX	400 mg/Nm^3
					SO_2	40 mg/Nm^3
6	Zinc Sulphate	1	Process stack	30	PM	125 mg/Nm^3
					NOX	400 mg/Nm^3
7	Gypsum Granular plant	1	Coal fire Furnace stack	30	PM	125 mg/Nm^3
					NOX	400 mg/Nm^3
					SO_2	40 mg/Nm^3
8	Vinyl Sulphone	1	Sulphonation	15	SO_2	40 mg/nm3
		1	Reduction	15	HCL	20 mg/nm3
9	Power	1	Boiler house stack	30	SO_2	600 mg/Nm^3
					NOX	300 mg/Nm^3
					PM	600 mg/Nm^3
10	DG Set	1	Capacity 1000 kVA	30 m	NOX	1440 mg/Nm^3
					PM	75 mg/Nm^3
					SO_2	0.05 % in HSD

1. The Environment (Protection) Third Amendment Rules 2002, at **Serial No. 17, 95 & 96,** under the Environment (Protection) Act, 1986
2. Ministry of Environment, Forest and Climate Change (MoEF&CC) General Statutory Rules (G.S.R.) 96(E) on 29th January 2018
3. USEPA AP 42 Manual – Chapter 8

Regional Emissions

The Air Quality Model Guidelines by US EPA requires that all significant emission sources within 5 km of the Project be identified and included in the modelling. There are no industrial facilities located within this distance. The closest source of air emissions (Particulate Matter) are from the NH 86 road which is on the south side of the project. The details of existing stacks and their details which have contributed to the baseline air quality results are presented below in **Table 4.4.**

The max ambient air quality concentrations of various pollutants in the 10 km study area of the project are presented in the Section 3.4 of Chapter 3 of this EIA report. These maximum

concentrations are considered for the calculating the cumulative ground level concentration post project expansion.

Table 4.4. Details of Existing Stacks

No.	Existing Product	Detail (process stage involving stack)	Stack (Nos.)	Stack Height (m)	Diameter (m)	Velocity m/s	Temp
I	**Process**						
1	Single Super Phosphate (SSP)	Process stack (scrubber stem)	01	50	1.0	7.5	45
2	Triple Super Phosphate (TSP)						
3	Synthetic Gypsum						
4	Granular SSP (GSSP)	Process stack	01	40	0.60	8.5	60
5	Phosphoric Acid (PA)	Process Stack	01	40	1.5	5.5	55
6	Beneficiated Rock Phosphate (BRP)	No Stack	-	-	-	-	-
7	Sodium Silica Fluoride (SSF)	Plant not installed	-	-	-	-	-
8	Ball Mill	No stack	-	-	-	-	-
II.	**DG Set**	Capacity: 875 KVA	01	5	0.20	16.13	280

4.3.3.2. Air dispersion modelling methodology

Modelling Approach

The assessment methodology for the air dispersion modelling exercise follows the guidance specified in the US EPA user guide for AERMOD. The model of selection is the commercially available AERMOD View dispersion model, developed by Lakes Environmental. This model is used extensively to assess pollution concentration and deposition from a wide variety of sources. AERMOD View is a true, native Microsoft Windows application and runs in Windows applications. The AMS/EPA Regulatory Model (AERMOD) was specially designed to support the EPA's regulatory modelling programs. AERMOD is a regulatory steady-state plume modelling system with three separate components:

AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD Terrain Pre-processor), and AERMET (AERMOD Meteorological Pre-processor). The AERMOD model includes a wide range of options for modelling air quality impacts of pollution sources, making it a popular choice among the modelling community for a variety of applications. Some of the modelling capabilities of AERMOD include the following:

- The model can account for the effects of aerodynamic downwash due to buildings that are nearby point source emissions.
- The model may be used to analyze primary pollutants and continuous releases of toxic and hazardous waste pollutants
- Source emission rates can be treated as constant or may be varied by month, season, hour-of-day, or other optional periods of variation. These variable emission rate factors may be specified for a single source or for a group of sources. For this project all emission rates were treated as constant.
- Receptor locations can be specified as gridded and/or discrete receptors in a Cartesian or polar coordinate system.
- For applications involving elevated terrain, the U.S. EPA AERMAP terrain pre-processing program is incorporated into the model to generate hill height scales as well as terrain elevations for all receptor locations.
- The model contains algorithms for modelling the effects of settling and removal(through dry and wet deposition) of large particulates and for modelling the effects of precipitation scavenging for gases or particulates.
- AERMOD requires two types of meteorological data files, a file containing surface scalar parameters and a file containing vertical profiles. These two files are provided by the U.S. EPA AERMET meteorological pre-processor programme.

Model Inputs

- **Source Emissions**

  A critical step for conducting air dispersion modelling is to quantify the emissions from the various sources at the project. Emission rates should be estimated in the following order of preference:

- Continuous emissions monitoring data
- Stack Emission Testing data
- Manufacturer's emission data
- Mass balance calculations
- Emission factors
- Engineering calculations

Table 4.5 shows the source information data determined for the proposed expansion project, which is the emission rate of the sources and used as the input to the model.

Table 4.5: Modelling Input

No.	Plant	Stack attached to	Stack Height (m)	Stack Diameter	Exit Velocity (m/s)	Exit Temp (C)	Emission Rate (g/sec)					
							NO_X	NH_3	SO_2	Acid Mist	F	PM
1	Ammonia Plant	Primary Reformer Stack	50	1	7.5	60	1.84	-	-	-	-	-
		Scrubbed gas stack	50	1	17.5	60	-	3.4	0.08	-	-	-
2	Sulphuric Acid	Absorption Tower Stack	50	0.8	16.58	55	-	-	6.3	0.200	-	-
3	Phosphoric acid	Rock grinding section	20	0.8	6.67	55	-	-	-	-	-	0.34
		Gas Scrubber	40	1.2	22.7	28	-	-	-	-	0.46	-
4	Nitric acid	Absorption Tower stack	50	0.8	7.5	45	1.29	-	-	-	-	-
5	DAP/NPK Complex fertilizer plant	Ammonia Scrubber	50	2.0	14.49	68	-	5.46	-	-	-	-
		HF gas scrubber	50	1.2	22.7	55	-	-	-	-	0.42	-
		Coal fire furnce	30	0.7	10.67	60	1.34	-	0.13	-	-	0.42
6	Zinc Sulphate	Process stack	30	0.6	6.67	45	-	-	-	-	-	0.20
7	Gypsum Granular plant	Coal fire furnace stack	30	0.7	10.67	60	1.34	-	0.13	-	-	0.42
8	Vinyl Sulphone	Sulphonation	15	0.5	7.78	55	-	-	0.05	-	-	-
		Reduction	15	0.5	7.78	55	-	-	-	0.02	-	-
9	Power	boiler house stack	30	0.7	10.67	60	1.0	-	2.01	-	-	2.01
1	DG Set	Capacity 1000kVA	30	0.3	18	280	0.36	-	0.83	-	-	0.01

4.3.3.3. Meteorological Data

The AERMOD model requires hourly surface data values for wind speed, wind direction, temperature, rainfall, relative humidity, pressure, cloud cover and ceiling height and solar radiation and at least once daily mixing height data. Surface data (temperature, rainfall, relative humidity, pressure, cloud cover and solar radiation as well as wind data (direction and speed) for year 2019 for the post monsoon season (October to December) was utilized

for the study which is collected from a local weather station located near proposed site location.

Both data files for the surface and mixing heights were then used to generate the meteorological file required by the AERMOD dispersion model using the AERMET meteorological preprocessor programme. This AERMET programme has three stages to process the data. The first stage extracts meteorological data and assesses data quality through a series of quality assessment checks. The second stage merges all data available for 24-hour periods and writes these data together in a single intermediate file. The third and final stage reads the merged meteorological data and estimates the necessary boundary layer parameters for dispersion calculations by AERMOD.

The 2019 post monsoon meteorological pre-processed data was used to determine its corresponding Wind Rose plot with the annual frequency of hourly-averaged wind speeds versus wind direction at the Project site.The Wind rose show that the most predominant wind direction blows from East and second predominant wind direction is from North East.

Model Domain, Receptor Network and Terrain Consideration

The selected domain was 10 Km in both East-West and North-South direction, with the centre of the domain being the centre of the proposed MBAPL plant site, with coordinates 290015.80 m UTME and 2657849.51 m UTMN (Latitude 24° 01.129'N and Longitude 78° 56.129'E). **Figure 4.1** shows the model domain that was utilized in the project, including the receptor grid and the plant boundary. The model domain is over laid on the Survey of India 1:20,000 topographic map. (SOI Toposheet Nos 54 L/16, 54 P/4, 55 I/13 and 55 M/1). The selection and location of the receptor network are important in determining the maximum impact from a source and the area where there is significant air quality impact. The receptor locations were selected as a multi-tier grid that is defined by uniform and non uniform Cartesian receptors. Certain special receptor locations as discrete Cartesian were also defined at the locations were ambient air quality was assessed as part of the baseline environmental monitoring. The plant boundary is marked as Cartesian plant boundary. A total of 475 were considered, and these are graphically depicted in **Figure 4.1.** The details of special receptors considered are presented along with the cumulative ground level concentrations in **Table 4.8.**

Terrain data were obtained from the Shuttle Radar Topography Mission (SRTM -3 Arc Second ~ 90 m) website. The classification of the land use in the vicinity of the MBAPL facility is needed because dispersion rates differ between urban and rural areas. For the proposed facility rural dispersion coefficient is selected for the modelling purpose, since majority of the area within the 3 km radius of the project is barren/cultivable land and has no building and structures which causes increased turbulent and buoyancy induced mixing.

Additionally, the topography in the region of the facility is defined as simple terrain (terrain lying below the stack top elevation). The topography from north east to south west directions has terrain elevation above 20 m only. A detailed discussion about the Land Use and Land Cover is provided in Section 3.4 of Chapter 3 of this EIA report. The terrain map along with the specific receptors is provided as **Figure 4.2.**

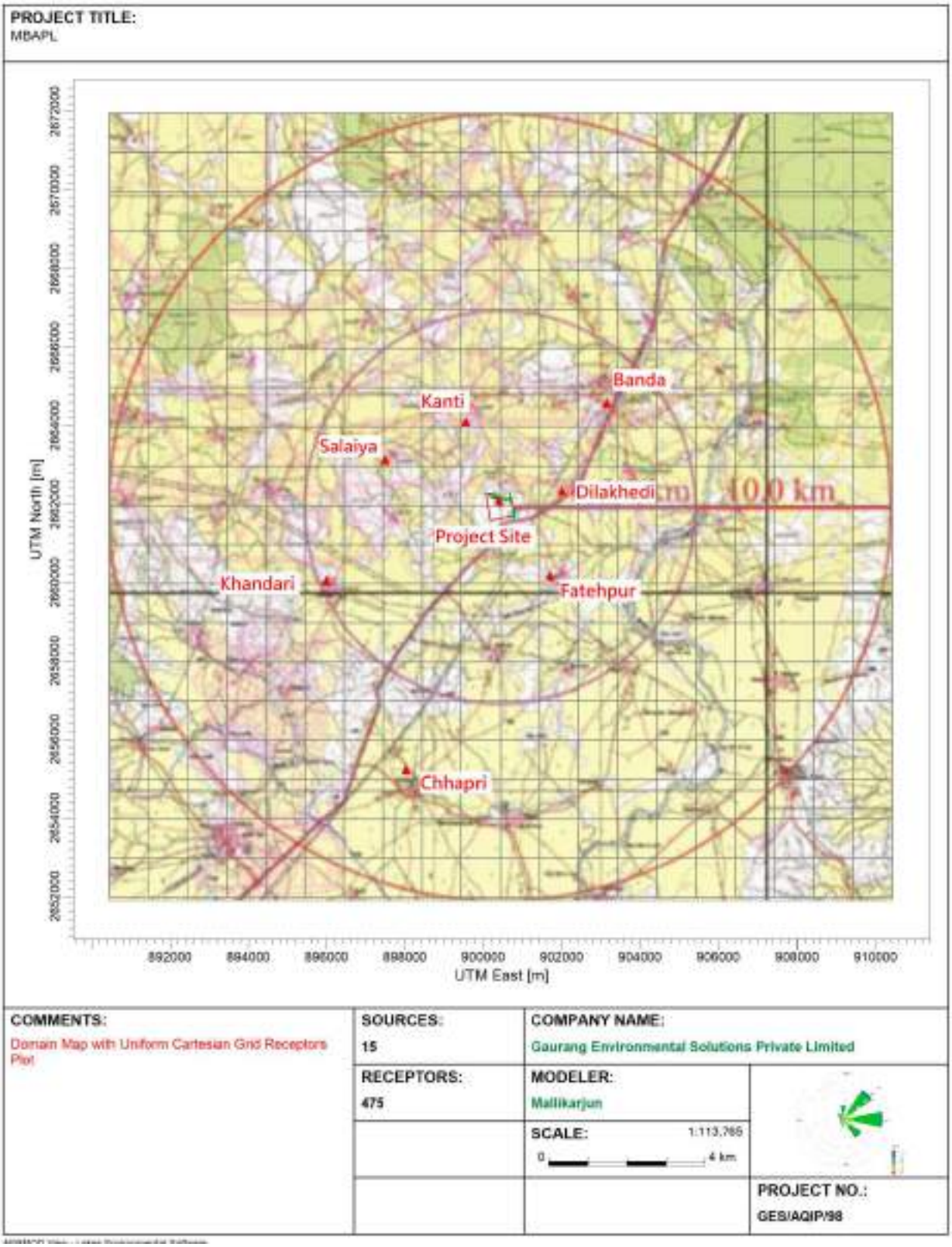


Figure 4.1 Domain and Receptor Grid

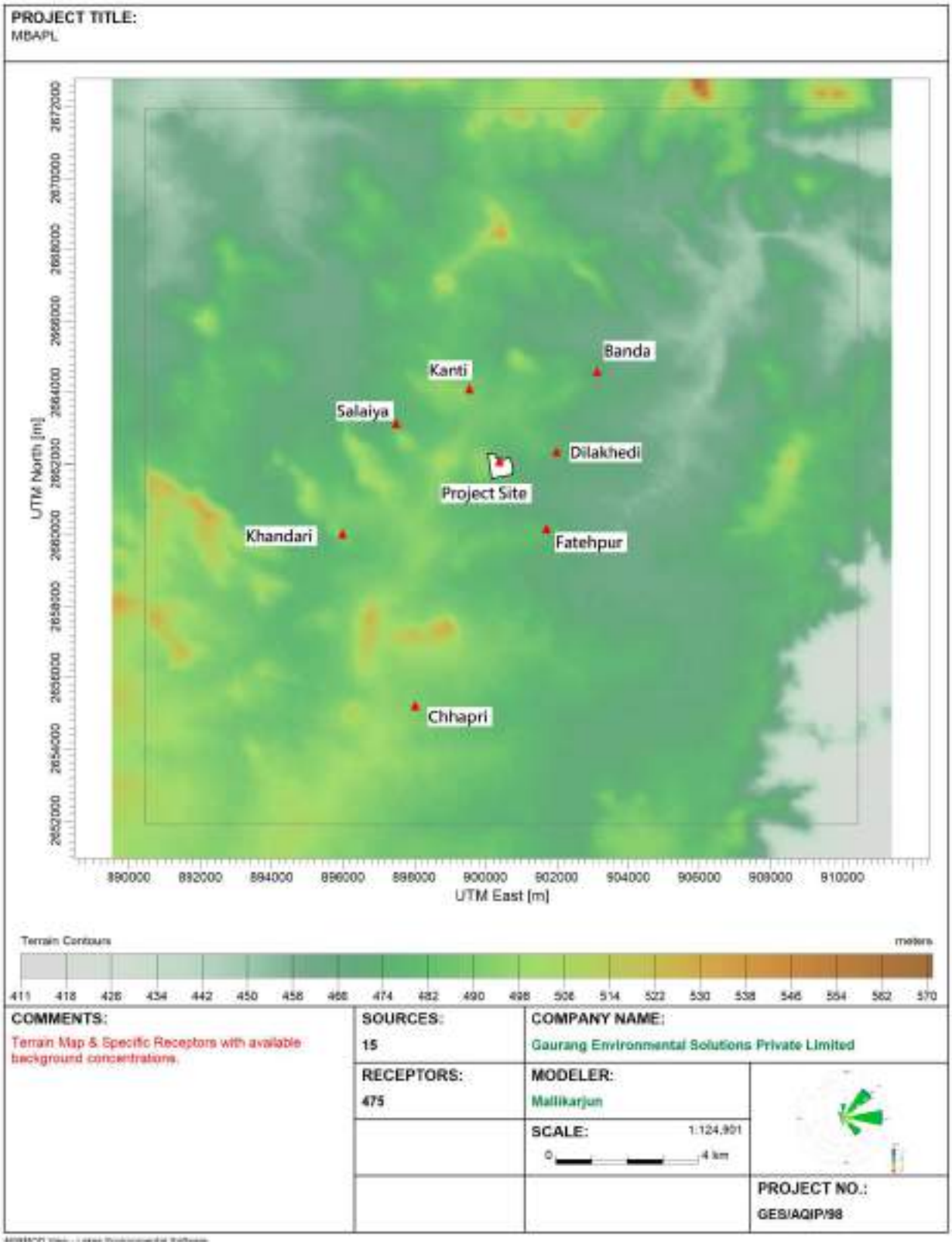


Figure 4. 2 Terrain and Specific Receptors Map

4.3.3.4. Presentation of Results

With the various sources identified, a model domain established of 10 km in the east-west direction and centered in the middle of the proposed project, and the necessary input files created, model predictions were made for the pollutants NOX, PM_{10}, NH_3, SO_2, Acid Mist and Flourine for averaging periods for which there are National Ambient Air Quality Standards. Model runs were conducted for the proposed expansion project's air pollutant sources, air quality impact in combination with the other defined sources in the vicinity of the project. The incremental concentrations are estimated for the study period representing pre monsoon season.

The results are presented in the form concentration contours and are given below in **Figure 4.3 to 4.8.**

The maximum ground level concentration is presented in **Table 4.6** and the final incremental ground level concentration is provided in **Table 4.7.**

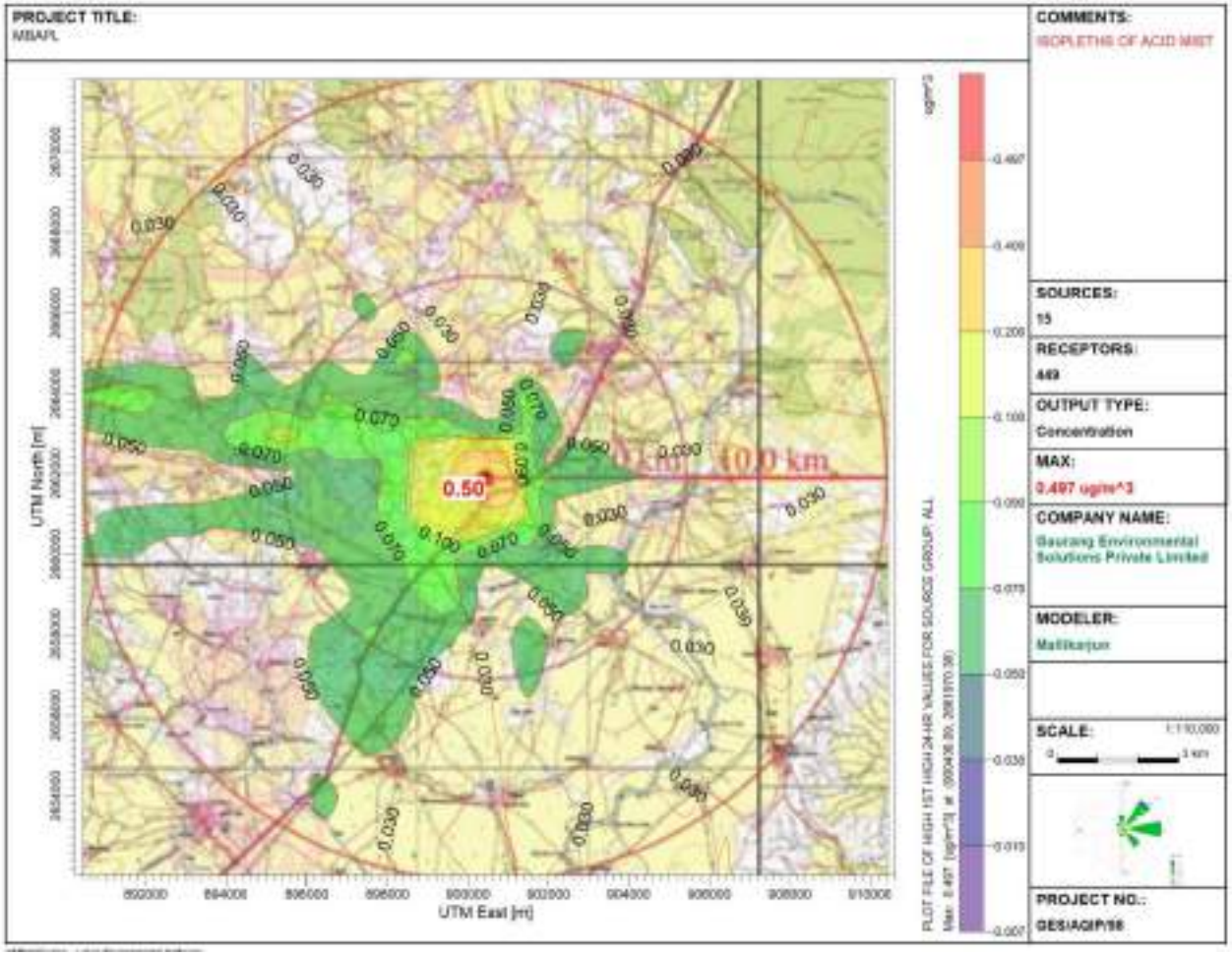


Figure 4.3; Isopleths of Acid Mist

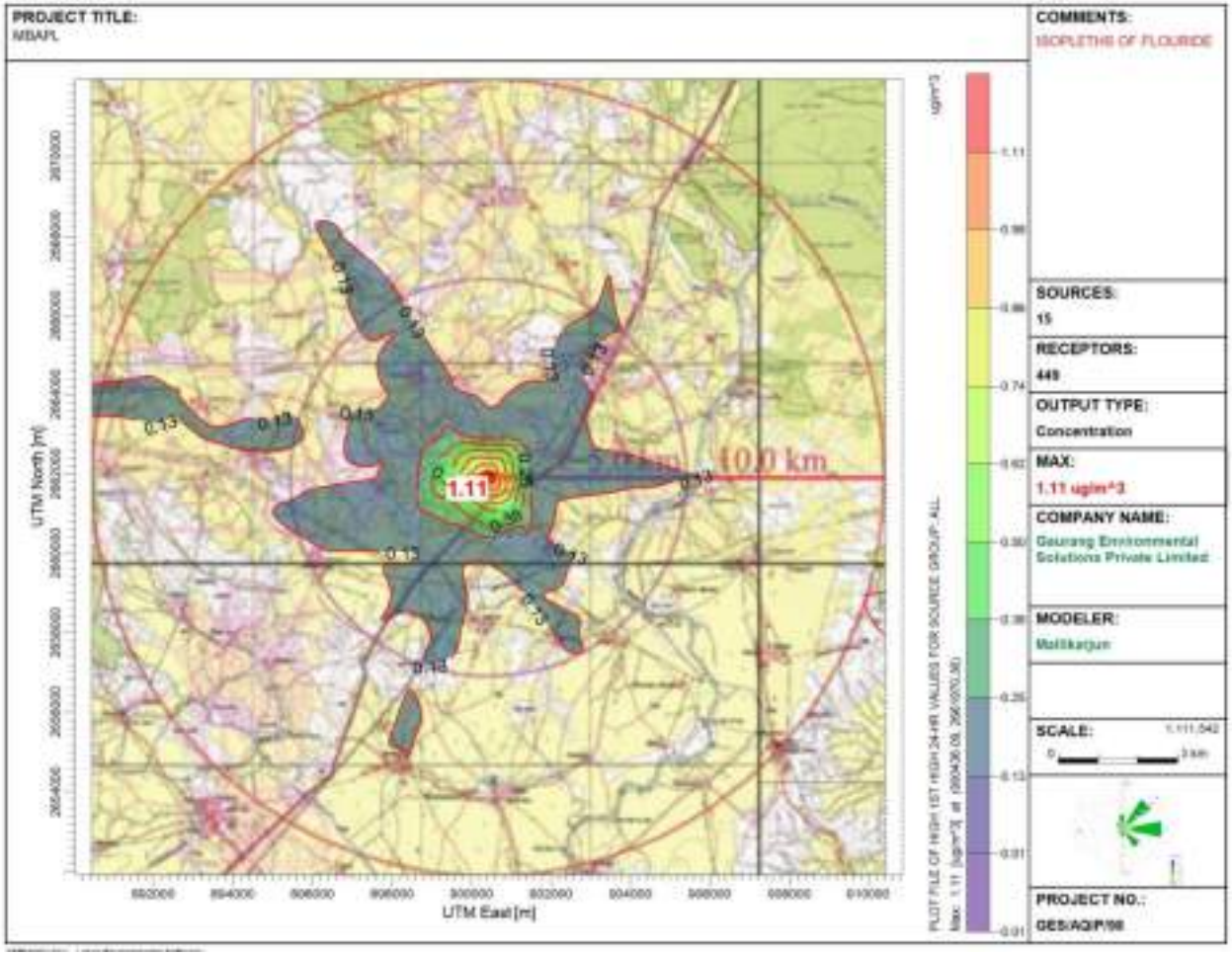


Figure 4.4: Isopleths of Fluoride

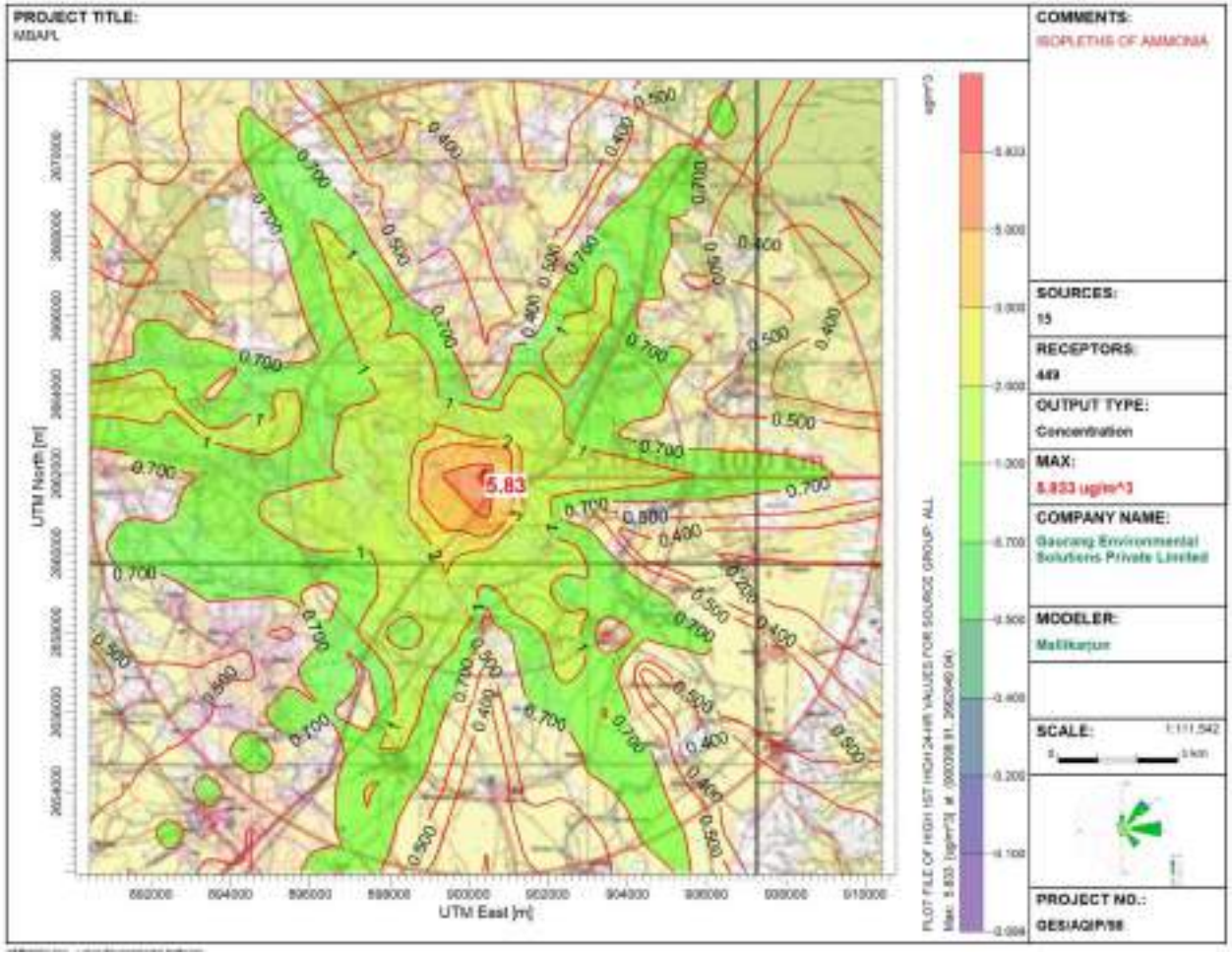


Figure 4.5 : Isopleths of Ammonia

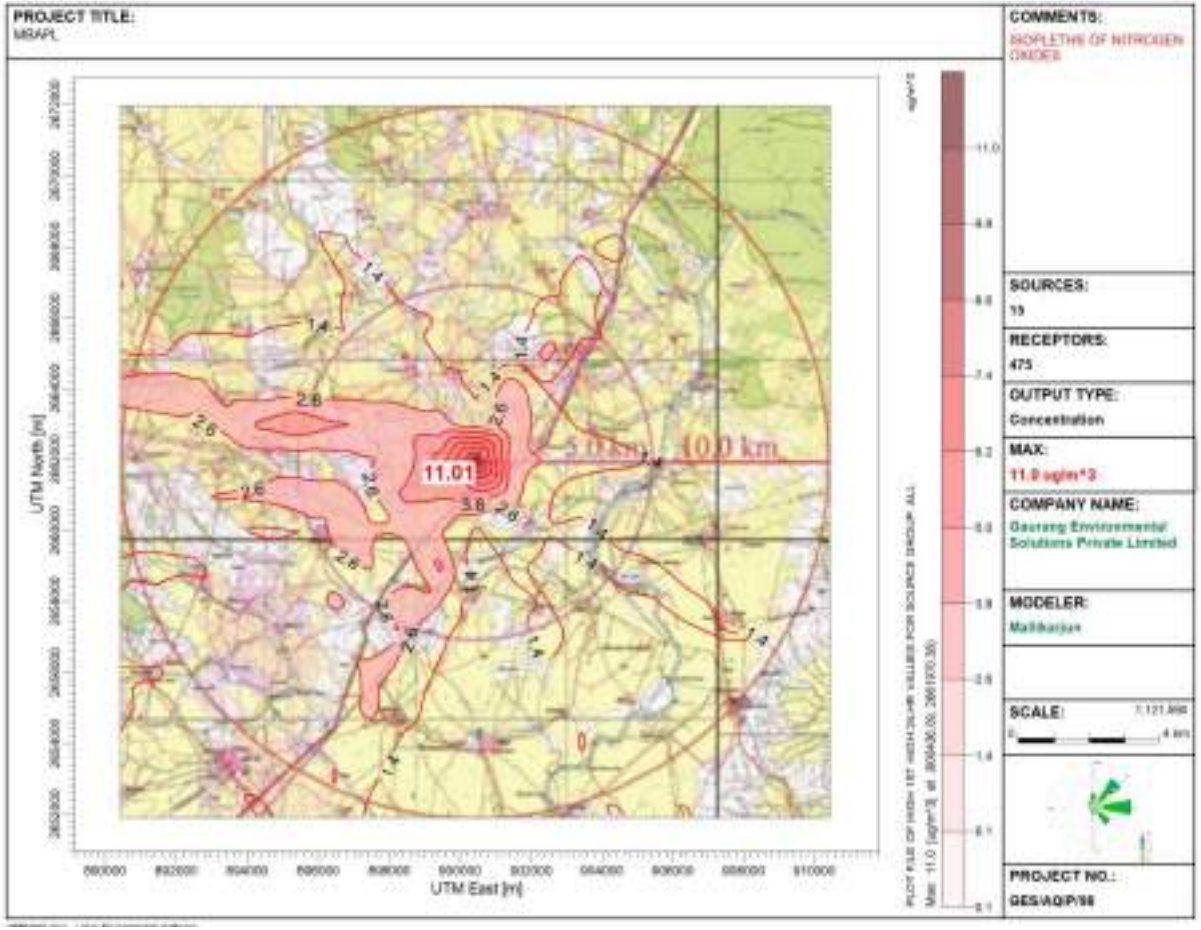


Figure 4.6: Isopleths of Nitrogen Oxides

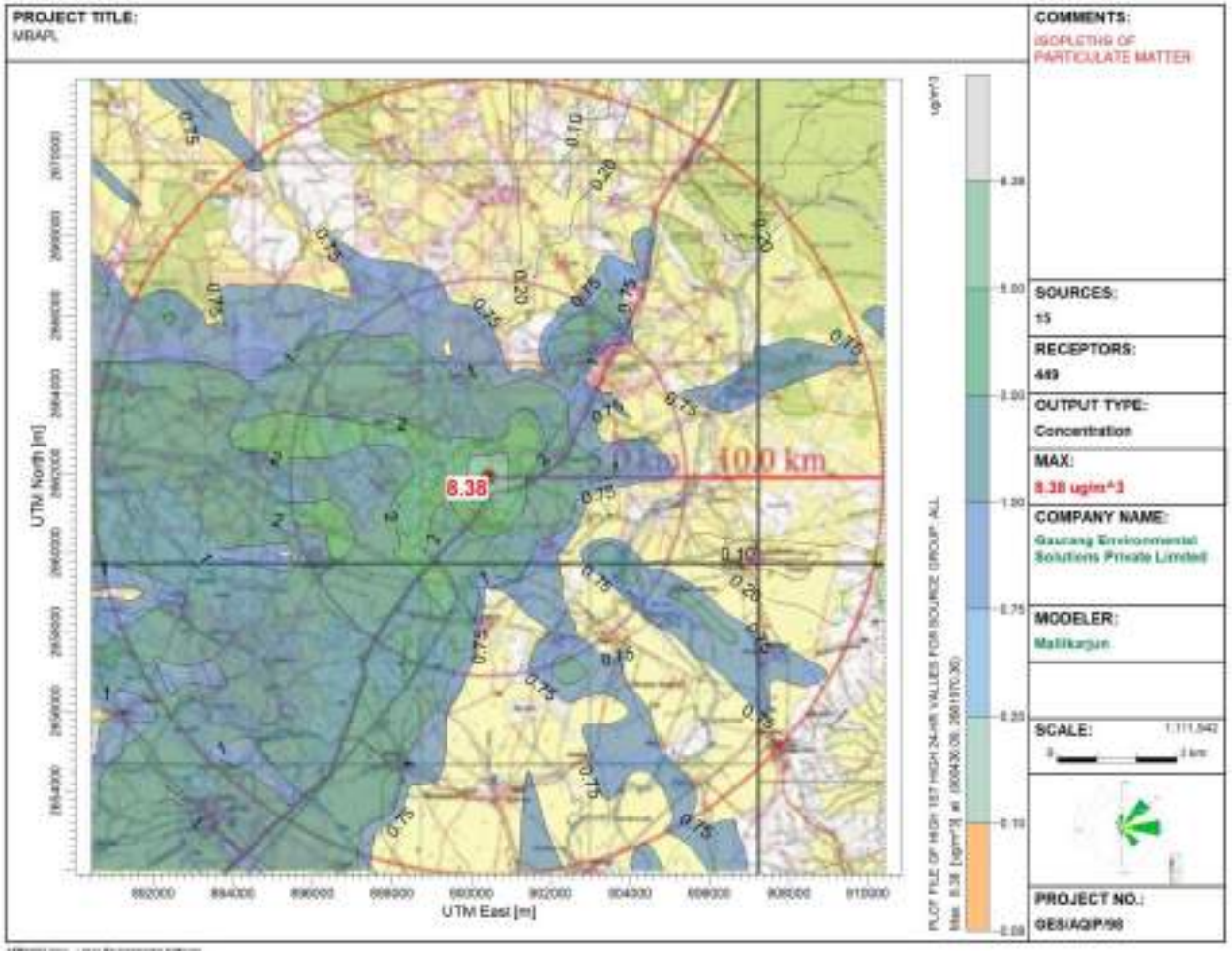


Figure 4.7 Isopleths of Particulate Matter

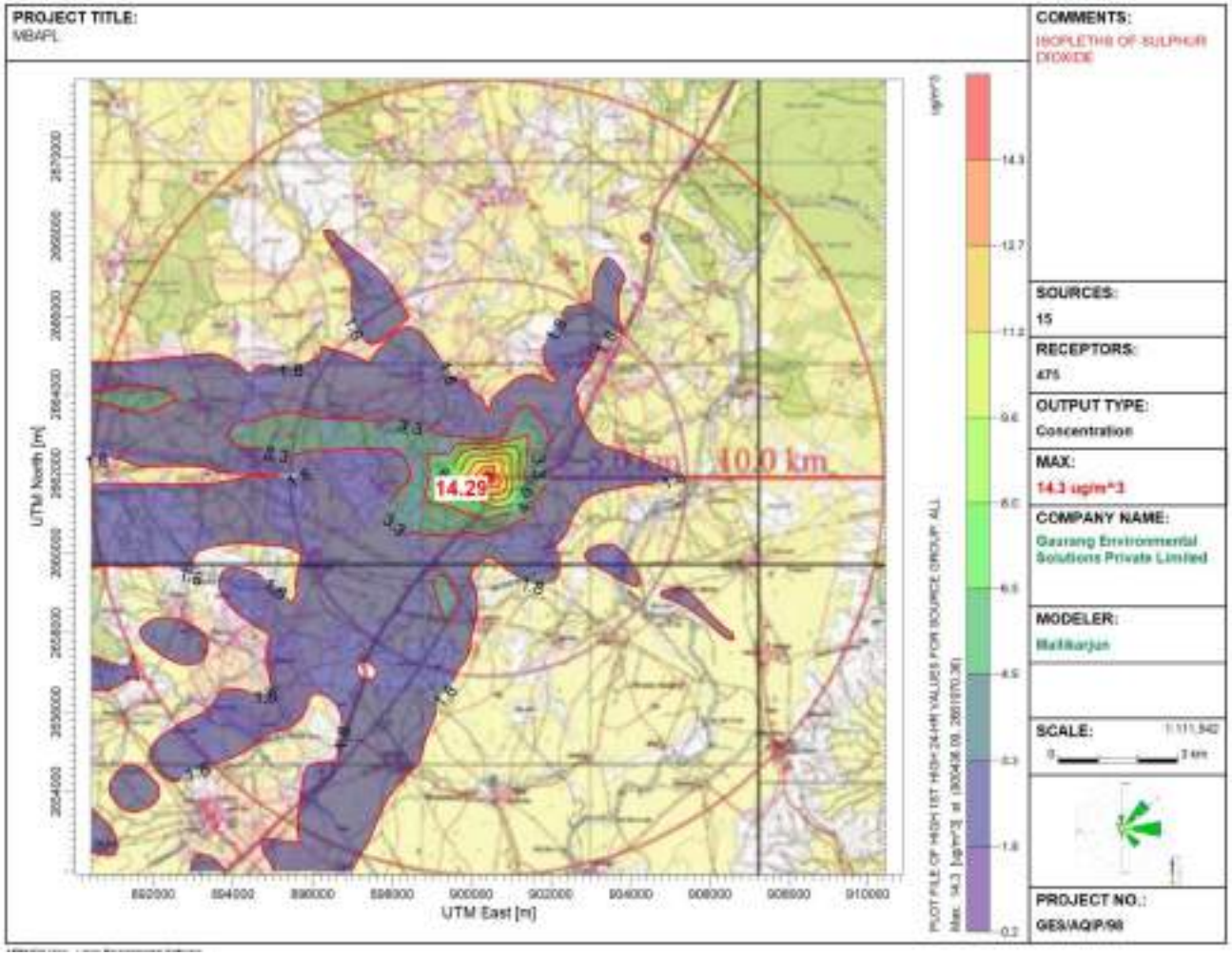


Figure 4.8: Isopleths of Sulphur Dioxide

Table 4.6: Maximum Ground Level Concentration

No.	Parameter	Maximum GLC (µg/ m^3)	Distance (m) wrt Project Site
1	Particulate Matter (considering all PM as PM_{10})	8.38	Within the project site
2	Sulphur Dioxide (SO_2)	14.29	
3	Oxides of Nitrogen (NO_x)	11.01	
5	Ammonia (NH3)	5.83	
6	Acid Mist	0.49	

Table 4.7: Final Incremental GLC's on Baseline AAQ

S. No	Criteria Pollutant	Locations	Baseline	Incremental	Maximum
1	PM_{10}	Project site	78.3	7.7	86
		Banda	63.9	0.54	64.44
		Dilakhedi	68.4	1.72	70.12
		Fatehpur Village	71.5	0.95	72.45
		Chhapri	56.7	1.62	58.32
		Salaiya	65.2	2.09	67.29
		Khandari	64.0	1.33	65.33
		Kanti	72.0	1.17	73.17
3	SO_2	Project site	7.6	12.6	20.2
		Banda	6.3	1.23	7.53
		Dilakhedi	7.1	2.64	9.74
		Fatehpur Village	7.9	1.93	9.83
		Chhapri	7.1	2.39	9.49
		Salaiya	6.7	3.86	10.56
		Khandari	6.5	2.04	8.54
		Kanti	7.1	2.01	9.11
4	NO_X	Project site	20.7	9.75	30.45
		Banda	18.1	0.89	18.99
		Dilakhedi	20.1	2.48	22.58
		Fatehpur Village	19.8	1.60	21.4
		Chhapri	19.8	2.08	21.88
		Salaiya	19.0	3.50	22.5
		Khandari	21.2	2.25	23.45
		Kanti	20.1	1.65	21.75

Table 4.8 Final Incremental Concentrations along with Background Concentrations

S.No	Location	UTM Coordinates		Incremental Ground Level Concentration (ug/m3)					
		East	North	NO_X	NH_3	SO_2	Acid Mist	F	PM
1	Project Si	900398.9	2662049	9.75172	5.83308	12.66516	0.37771	0.87465	7.76785
2	Dilakhedi	901992.1	2662329	2.48371	1.14244	2.64577	0.04616	0.15296	1.72093
3	Banda	903128.4	2664576	0.89496	0.79805	1.23934	0.02515	0.11031	0.54031
4	Kanti	899553.6	2664107	1.65967	0.84973	2.01766	0.03683	0.13831	1.17136
5	Salayia	897492.3	2663119	3.50974	1.36516	3.86445	0.08231	0.16918	2.09368
6	Khandari	896009.2	2660017	2.25595	0.97286	2.04107	0.04542	0.11947	1.33056
7	Fatehpur	901705.5	2660173	1.60459	1.20017	1.93152	0.064	0.15228	0.95977
8	Chhapri	897993.6	2655226	2.08856	1.12739	2.3964	0.05197	0.14067	1.62691

4.3.3.5. Mitigation Measure

The control measures employed for controlling air pollution are: -

In the proposed expansion plants exhaust gas from reactors is drawn by exhaust fan through series of Scrubbers in which the gas is washed with water to remove fluorine compound in exhaust gas before venting to atmosphere and there by fluorine is recovered from reaction stage itself and in turn reducing fluorine emission through acid and gypsum.

Venturi Gas scrubbers, cyclonic Mist Eliminators, Bag filters are being used to control the emissions to atmosphere. The emissions from stack will conform to the regulatory requirement

- Stack of adequate height for Phosphoric acid plant and D.G. Sets
- Elevated stack for venting of gases from the scrubbers to atmosphere

Fluorine gas generated from the Phosphoric Acid process will be transferred in rubber lined ducts to the multistage scrubbers and Fluorine from scrubber liquor will be recovered as Hydroflourosilcic acid which is used for the production of Aluminum Fluoride.

Fugitive Emission Control:

As Rock Phosphate has to be imported or to be acquired from captive mines /other domestic sources or imported, and most of it would be transported with the help of trucks and heavy vehicles, hence, a special plan for the handling & transportation of the raw material within the premises which are as mentioned below:

- All trucks will be transported after covering from the top.
- Raw material unloading will be done by mechanized truck unloading system.
- Dust collectors will be in line with unloading hoppers.
- Material handling in the plant will be done in closed conveyors.
- All the trucks being used for transportation of raw material and final product shall be checked for "Pollution under Control" certificate prior to their entry to the plant premises.
- Storage of raw material in dedicated sheds to avoid fugitive emissions.
- Speed of vehicles inside the factory premises will be controlled

Air Quality Index

Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. AQI is an initiative intended to enhance public awareness and involvement in efforts to improve air quality. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour. The AQI system is based on by selecting the maximum of sub indices of various pollutants as over all AQI. Ideally, eight parameters (PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, O_3, NH_3 and Pb) having short term standards should be considered for near real time dissemination of AQI.

Table 4.9: AQI at the Proposed Project Region

(Before and After Expansion of the Proposed Project)

Locations	Baseline AQI	Post Expansion AQI
Project site	78	84
Banda	64	64
Dilakhedi	68	71
Fatehpur Village	72	72
Chhapri	57	58
Salaiya	65	67
Khandari	64	65
Kanti	72	73

Based on the MS Excel sheet provided by CPCB, the AQI of the region is calculated and it is found to be between **71 - 84 (Satisfactory)** even after expansion of the project.

Good (0–50)	Minimal Impact	**Poor (201–300)**	Breathing discomfort to people on prolonged exposure
Satisfactory (51–100)	Minor breathing discomfort to sensitive people	**Very Poor (301–400)**	Respiratory illness to the people on prolonged exposure
Moderate (101–200)	Breathing discomfort to the people with lung, heart disease, children and older adults	**Severe (>401)**	Respiratory effects even on healthy people

4.3.4. NOISE ENVIRONMENT

The prediction of incremental noise levels due to the operation of the proposed expansion has been carried out using mathematical model.

Model Inputs

The noise model presented in this section is considered a screening approach to evaluate potential environmental noise impacts from the proposed expansion complex. Due to the early stage of the project, all the sources are considered to generate a noise of 90 db and whole facility as a source of 110 db with necessary acoustic measures.. Accordingly, should the as built information deviates from the current information used to run this model, it is highly recommended to rerun the model with the as built information before the plant start-up.

Topography and Terrain

The study area was assumed to be flat, which most closely approximates the actual topography. Obstacles to noise propagation, e.g., vegetation and infrastructure, located outside of the MBAPL were not considered. For the purpose of the model, the attenuation factor of 1.86 db/100m is provided to the model.

Facility Layout and Study Area

The facility layout showing the existing plants and the proposed project were used for layout to the model along with the study area map of 5 km.

4.3.4.1.Noise Emission Sources

Limited project-specific noise data are currently available due to the relatively early phase of project development. In the absence of accurate or complete information, the following assumptions were made:

- The main emission sources were assumed to be point or linear sources based on their nature. Sound waves from point sources travel in all directions (spherical propagation), and the sound energy decreases more rapidly under free field conditions than for linear or area sources.
- Small elements, such as structures, pipes and racks, were not included as noise sources or sound barriers.
- All sources were assumed to generate a mean frequency of 500 Hz. If spectral data are unknown or unavailable, industrial applications are most often calculated using a mean frequency of 500 Hz as an accepted practice.
- All noise sources were assumed to be operating continuously throughout the daytime and night-time periods, including discontinuous noise sources, which corresponds to a conservative approach (higher acoustic impact).

The various sources of machinery in the proposed expansion which are likely to generate noise more than 65 db are given in below: -

1. Ball Mill
2. Trommel Screen
3. Air Blower
4. Screw Conveyor
5. Filter Pump
6. Digestion Tank Slurry Pump
7. Hemi Circuit Wash Pump
8. Dehydration Tank Pump
9. Cake Wash Water Pump
10. Recycle Acid Pump
11. HH Weak Filtrate Pump
12. Weak Acid Product Pump
13. Weak Acid Sludge Pump
14. Weak Acid Sump Pump
15. Process Water Sump Pump
16. Nash Transfer Pump
17. Rock Storage Hopper
27. Filter Seal Tank Agitator
28. Vacuum Pump
29. Rehydrate Tank Agitator
30. Conversion Tank Agitator
31. Reslurry Tank Agitator
32. Gypsum conveyor belt system
33. Acid Settler Tank with rake
34. Flocculent Tank with Agitator
35. Flash Chamber
36. Condensate Pump
37. Phosphoric Acid Circulating Pump and Transfer Pump
38. First Flouring and Second absorber circulating Pump
39. Concentrated phosphoric acid discharge pump
40. Concentration Vacuum Pump
41. Fluorosilic Acid Transfer Pump
42. Underground channel pump
43. Cooling tower with water pump

18. Idler Rollers
19. Carrying Rollers
20. Ball Mill chutes
21. Transfer and Circulation Pump
22. Wash Tank Agitator
44. Dilute Phosphoric Acid Conveyor pump
45. Agitator
46. Hopper
47. Hot well tank Agitator

4.3.4.2. Methodology

Noise levels have been predicted using Custic Noise Pollution Modeling software, Version 3.2.

CUSTIC Noise Pollution Modeling Software

The CUSTIC 3.2 use numerical algorithms for noise dispersion modeling that give us the possibility to study the noise pollution that we find in our environment. Mathematical model that the software uses , provide options to model noise emissions from a wide range of sources that might be present at industrial areas and urban areas.

The modeling is based on estimates for dispersion of noise in free field by mean of numerical simulations which give as results approximate values for the noise levels, regardless of source type (point, line or area). It must be noted that only approximate values are obtained, since the noise dispersion is a complex physical phenomenon (that involves turbulences, non linear dynamics and thermodynamics of irreversible processes) that the simulations software must represent with simple equation. The basis of this mathematical model is linear sound propagation equation, which is used to model simple point source emissions from vehicles, industries, aircrafts...CUSTIC model calculates attenuation due to noise source enclosures and other noise control measures, the distance from the source to the receiver , the noise source size, type and directivity, barriers and natural topographical features and sound absorption in the air.

Excess attenuation from ground absorption effects such as those due to vegetation, bare ground hard surfaces are derived using the most recently available scientific theories. Weather conditions such as wind speed and direction, relative humidity and the vertical temperature gradient of the atmosphere are also accounted for.

The CUSTIC 3.2 Software accepts meteorological data records to define the conditions for sound propagation. The model estimates the noise level for each source/receptor combination and calculates user - selected averages. This software allows for creation of robust and useful numerical simulations that fully make use of the graphical user interface

The model setup is presented in Table below: -

Table 4.10: Noise Model Setup

Parameter	Details
Model used	Custic 3.2
Standard	ISO 9613-2
Solid angle for propagation	2
Topography for dispersion	Flat, propagates equally
Temperature	30^0c
Relative Humidity	70 %
Coefficient of attenuation	1.86 dB/100m
Barrier Height	3
Barrier sound attenuation	30 dB
Source type	Point source
Source group	All
Boundary limits	5000 m x 5000 m
Co-ordinate system	Cartesian
Grid	Uniform grid size of 20 m
Receptor height	1m from ground level

For the purposes of this assessment, ISO 9613-2:1996 method default values were selected for meteorological conditions, which correspond to soft wind blowing in all directions at the same speed and an average temperature of 30ºC. These conditions generate minimum attenuation over the modeling domain, which corresponds to a conservative approach.

The various noise levels assumed for different industrial equipment by the CUSTIC model are given below: -

S. No	Equipment	Noise in dB(A)
1	Pneumatic Equipment	115
2	Metal Equipment	105
3	Air Compressors	105
4	Fan Equipment	100
5	Compressors	100
6	Machine tools	95
7	Combustion	95
8	Turbo generator	92
9	Pipes	92
10	Power generators	90
11	Power Transformers	85

12	Electric engines	85

The noise level generating from a chemical industry (MBAPL) is considered to be 70 db as per the model. However, a worst case scenario of 110 db is considered for simulation.

For an approximate estimation of dispersion of noise in the ambient from the source point, a standard mathematical noise model will be used for sound wave propagation. The sound pressure levels generated by noise sources, decrease with the increase in distance from the sources due to wave divergence. An additional decrease in sound pressure level with distance from the source is expected due to atmospheric effect or its interaction with objects in the transmission path. For hemispherical sound wave propagation through homogenous loss free medium, one can estimate noise levels at various locations, due to different sources using model based on first principles, as per the following equation (1).

$Lp2 = Lp1 - 20 \log (r2/r1)$---------- (1)

Where Lp2 and Lp1 are Sound Pressure Levels (SPLs) at points located at distances r2 and r1 from the source. The combined effect of all the sources then can be determined at various locations by the following equation (2).

$Lp(total) = 10 \log (10 (Lp1/10) + 10 (Lp2/10) + 10 (Lp3/10))$ ---------- (2)

Where, Lp1, Lp2, Lp3 are noise pressure levels at a point due to different sources.

Based on the above equations, a user-friendly model has been developed. The details of the model are as follows:

- Noise levels can be predicted at any distance specified from the source;
- Co-ordinates of the sources are expressed in metres;
- Maximum and Minimum levels are calculated by the model;
- Output of the model is in the form of isopleths; and

Environmental attenuation factors and machine corrections have not been incorporated in the model but corrections are made for the measured Leq levels.

The maps are a graphical representation of the calculated sound pressure levels, considering reflections and diffractions of sound, and taking into account the geometry of buildings at the site and topography. The pressure level calculated or interpolated for each point within the modeling domain are shown as a grid of sound pressure, from which a contour map is generated showing isophones (lines of equal sound pressure). CUSTIC generates industrial noise maps using the calculation methods given by standards ISO 8913 for noise emissions and ISO 9613 for noise propagation.

4.3.4.3. Model Results and Discussion

The results of the model are presented on noise contour maps that are generated from a color-coded noise level distribution grid and are represented in Figure 4.9 and 4.10. The noise contour maps only representing the SPLs predicted in each area as a result of the operation of the MBAPL are given below in Table 3.

Table4.11: Predicted Maximum Noise Levels

S.No	Receptor/Location	Noise Range (dB)	Land Use
1	South West Corner	67.7	Industrial
2	West Side	76.2	Industrial
3	Rest of the plant boundary	< 60	Industrial
4	Project Site	55	Industrial
5	Fatehpur	20 -22	Habitation
6	Dilakhedi	28 -30	Habitation
7	Khanti	20 - 22	Habitation

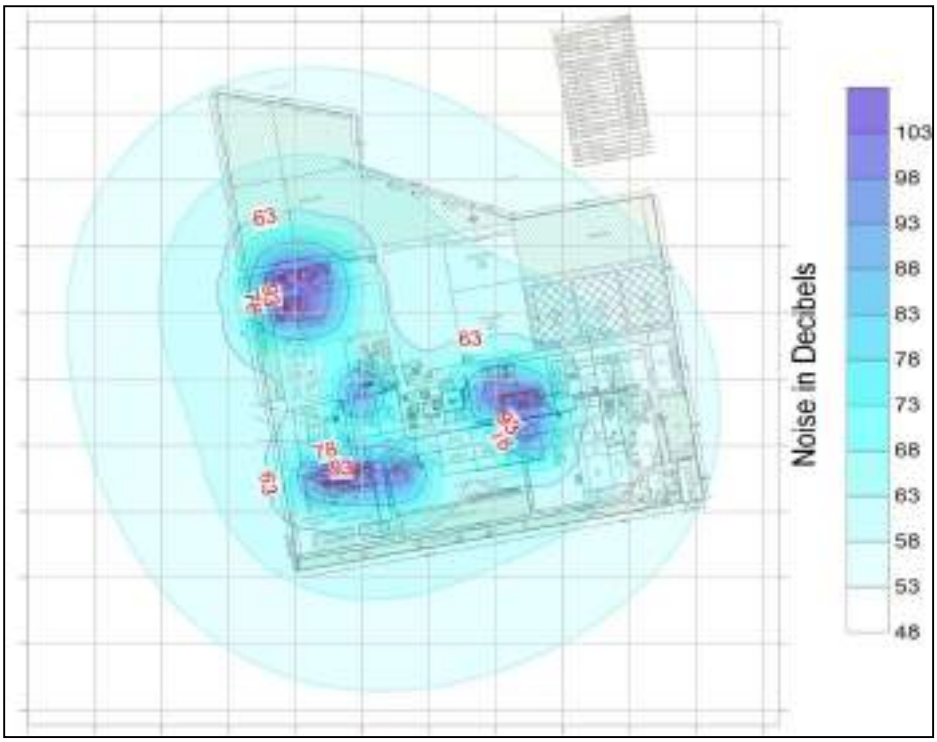


Figure4.9: Noise Contour Map

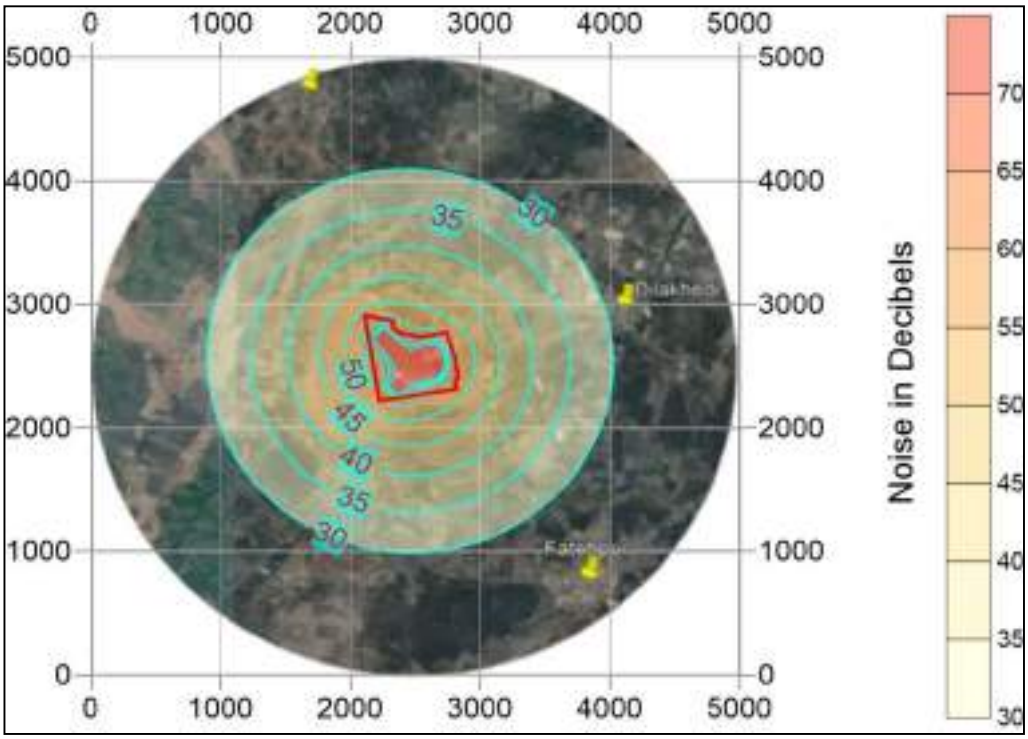


Figure4.10: Noise Modeling Contour

Project Activity	Impact	Mitigation Measure
The plant will have rock crushing area, granulation unit manufacturing of SSP, dryers and bucket elevators, screw conveyors, pumps, machineries, pumps, motor, The standards for occupational	Irritation, Headache, Hearing loss, Impact on output of Workers	• Anti-vibration pads and adequate walled room will be provided to compressors for noise absorption • The motors and compressors shall be provided with guards and shall be mounted adequately to ensure the reduction of noise and vibration. • Periodic maintenance of equipments/replacing whenever necessary/lubrication of rotating parts, etc • The DG set shall be kept in a separate enclosed room with acoustic enclosure. Closed bucket elevators and screw conveyors will be used to minimize noise levels.

		• The standards for occupational exposures - tolerable level is 90 dB(A) for 8 hour exposure is/will be achieved at work zone area through use of properly maintained machines, pumps, compressors and vehicles. • Conducting audiometry test for employees working in high noise area& employees shall be trained in the mitigation measures and personal protection measures to be taken to avoid noise related health impacts. • Implementation of greenbelt for noise absorbtion such as Alstonia scholaris Azadirachta indica, Melia monosperma, Grevillea peridifolia etc
DG set	Noise and vibration	Acoustic enclosure is/will be provided to DG set
Vehicular Movement	• Noise generation from vehicular movement • Work zone noise level increase inside the premises	• Vehicles having PUC certificates will only be allowed to transport materials at project site • Vehicle movement for transportation of materials and work force to the site will cause minor noise emission as the frequency of vehicular movement will be few times in a week. • Unnecessary horn honking will be avoided and strictly prevented

4.3.5. BIOLOGICAL ENVIRONMENT

Impacts due to the proposed expansion may be changes in ambient air quality and degradation of vegetation, due to gaseous emission and pollutants deposited on the leaflet of plant which affects the photosynthesis rate of flora and ultimately decrease the growth of vegetation of surrounding area of buffer zone. Impact of Noise due to machinery and transportation of raw materials and finish good increases the accidental mortality of fauna and also chances to decrease of habitation of local residential faunal groups of the study area, Keeping all this in mind the following mitigations have been suggested under environmental management plan. With the above understanding of the role of plant species as bio-filter to control air pollution, appropriate plant species (mainly tree species) have been suggested conceding the area/site requirements and needed performance of specific species.

Table: Impact Quantification

Significance Score	Perceived Impacts on Ecology & Biodiversity
Negligible -1	Impact confined to the core project area, habitat and species impacted therein of flora and fauna are common/ impact on life activities such as foraging etc are temporary , no fallout on the surrounding areas with minimum or no Zone of Influence
Minor - 2	Interim effects on proximate habitat, but not detrimental to floral and faunal species Impact can be negated over a period of time through resilience
Moderate - 3	Physical damage/impact to the habitat such as Tree uprooting, Nest destruction, Habitat loss and diminished functionality, extended damage to surrounding ecology yet impacts are mitigable through effective EMP
Major - 4	Temporarily targets Threatened species of flora and fauna , but does not displace or trigger loss extinction, population decimation and decline. Globally important species are impacted as designated as per IUCN, CITES, WCMC categories
Severe - 5	Impact on Indian Legally notified species of high conservation concern such as IWPA Sch I species, Keystone species, Flagship spcies, species within the PA, CCA, NP BR etc.

Table: Likelihood Assessment Score (LAS)

Frequency Rating	Description of frequency	Occurence frequency Score
Regular	Definite & Continuous event Each day	**5**

Frequent	Several times in a year	**4**
Periodic	Few times in a year	**3**
Rare	Few times during the Project Life Cycle	**2**
Unusual	Rare event of occurence	**1**

Table: Ecological Impact Scoring (EIS)

Perceived Impact description	BSS	LAS	Total Score (BSS X LAS)	Remarks
PRE-CONSTRUCTION				
Site Clearance , Floral Diversity Loss	**1**	**1**	**1**	**Less severe**
Loss of Habitat	**1**	**1**	**1**	**Less severe**
Disturbance to faunal Movements	**1**	**1**	**1**	**Less Severe**
CONSTRUCTION				
Disturbance to faunal Movement , foraging,habitat loss	**1**	**1**	**1**	**Less Severe**
POST CONSTRUCTION	**2**	**2**	**4**	**Less Severe**

Conclusion

]The proposed expansion project is not located in close vicinity of the any eco-sensitive area. So, it can be stated that the proposed expansion project and associated activities are unlikely to influence any floral and faunal components significantly provided that the suggestions / recommendations in this report are implemented. Strict implementations of EMP / mitigation measures are required to ensure that the biodiversity of the study area should not be impacted negatively.

4.3.6. SOCIO ECONOMIC ENVIRONMENT

Project Impacts:-

The project study area likely impacts were analyzed and is presented below:-

Activity	Impact Type & Degree	Remarks
No Land Acquisition No assets or property Acquisition	Indirect Impact & Minimal	Increase in asset & land value of the locals
Increase in Production	Direct Impact & Major	Increase in Pollution, mitigation measures will be provided Increase in sales help in increase profits New industries are likely to be established in the study area Ancillary industries will be increased Increase in Traffic due to influx of vehicles. Mitigation measures will be provided Increase in rural and regional economy
Increase in employment	Direct Impact & Major	More employment opportunities will be provided Indirect employment will be increased Skilled Labour will be increased Influx of labour
Women Status	Direct Impact & Major	With the help of programs women education standards will increase and financial dependency will be reduced Close eye on the improvement in women condition with the help of records in terms of sex ratio, school drop out Women security during commute Signage of emergency contacts at the public places such as bus stands etc
Education Status	Direct & Major	With the help of programs for enhancement towards education. The

		school facilities will be enhanced. School management will be encouraged for better education standards and perform well. Children and their parents will be encouraged to attend the school. Girls education will also improve.

******

INDEX

5.1. Analysis of Alternatives 271

5.1.1. Alternative Site 271

5.2. Alternatives of Technology 272

5.0 ANALYSIS OF ALTERNATIVES

5.1. Analysis of Alternatives

A comparison of alternatives helps to determine the best method of achieving the project objectives with minimum environmental impacts or indicates the most environment friendly and cost effective options. Alternative analysis depends on technical feasibility, economic viability and environmental acceptability of the identified alternatives.

5.1.1. Alternative Site

No alternative sites have been assessed as the proposed expansion project is coming up within the existing premises of Madhya Bharat Agro Products Limited (MBAPL) located at Plot No. A-1, A-2, Saurai Industrial Area, village–Saurai, Tehsil - Banda, District - Sagar (M.P.) and no additional land is required for the same. The unit is proposing to enhancing its production capacity of fertilizers by addition of DAP/NPK complex fertilizer, Phosphoric acid plant and new chemical production unit at its existing location. The total plot area is 80.65 acre (3, 26,404 sq. m.)

Since the objective is to manufacture fertilizers and chemical, a lush green & friendly environment is being selected for installing the plant. The salubrious pollution free climate of Saurai makes it an ideal location for fertilizer & chemical sector. The existing site is located in declared industrial estate where all common environmental infrastructure facilities are available and also site is well connected to rail, road and port.

The project is not likely to cause any significant impact to the ecology of the area since adequate preventive measures will be adopted to control various pollutants within permissible limits. Green belt development around the area has been and shall be taken up as an effective pollution mitigative technique. Also the existing site has following advantages:

- Site is located in a declared Industrial Area.
- No critically polluted area as notified by CPCB in 500 m radius of project site.
- No environmentally sensitive area in 500m radius of project site.
- Ease of administration
- Easy availability of infrastructure (administration & management) & raw material
- Well connected by Road & Rail.

Thus, the selected site is suitable from logistics and required infra-structural facilities point of view. Also, the availability of raw materials locally ideally suits the project site as Sagar/Chhatrapur region has rich deposits of Rock Phosphate& other minerals.

5.2. Alternatives of Technology

No alternative technology has been taken into consideration as this is existing project and proposed for expansion.

INDEX

0.1. INTRODUCTION.....274
0.2. ENVIRONMENTAL MONITORING.....274
6.2.1. Objective of Monitoring 275
6.2.2. Environmental Attributes to be monitored 275
6.2.3. Environmental monitoring and reporting procedure.....275
0.3. ENVIRONMENTAL MONITORING DURING CONSTRUCTION PHASE.....277
0.4. MONITORING SCHEDULE DURING OPERATIONAL PHASE.....278
0.5. RESPONSIBILITY MONITORING AND REPORTING SYSTEM.....279
0.6. SUBMISSION OF MONITORING REPORTS TO MoEF&CC.....280
0.7. COST PROVISION FOR ENVIRONMENTAL MEASURES.....280

6.0 ENVIRONMENTAL MONITORING PROGRAM

6.1. INTRODUCTION

Regular monitoring of ambient and site specific environmental parameters is of very much important to assess the status of the environment during operation of unit. The understanding of baseline conditions, the monitoring programme will provide as an indicator for good quality or deteriorate environmental conditions by the operation of the project. This gives a guidelines to build suitable mitigation and prevention steps or measure at source within a time to preserve the environment.

In short, Environmental monitoring is a tool to assess existing environmental conditions of any new or existing project and trends, support development of environmental management plan and its implementation, and develop environmental carrying capacity related information for the specific area in which project lies.

Usually, as in the case of the study, an impact assessment study is carried over short period of time and the data cannot bring out all variations induced by the natural or human activities. Therefore, regular monitoring programme of the environmental parameters is essential to take into account the changes in the environmental quality.

This chapter portray about the aspect of environmental attributes for monitoring, time schedule, organization arrangements for mitigate pollution control, cost for environmental protection measures and details of phase wise greenbelt development for the proposed expansion project.

6.2. ENVIRONMENTAL MONITORING

The important part of environmental monitoring is in terms of assessment of implementation of proper and suitable pollution control equipments set up in the industry at process and other areas. Regular monitoring is prescribed to mitigate and reduce the pollution level at site. The sampling and analysis of the environmental parameters will be as per the guidelines framed by Central Pollution Control Board (CPCB) / Madhya Pradesh State Pollution Control Board (MPSPCB). The frequency of sampling and location of sampling will be as per the directions of CPCB / MPSPCB.

Environmental monitoring (Sampling and analysis) is being/will be conducted on regular basis by third party or external agency for Madhya Bharat Agro Products Limited.

This is to assess the existing pollution level at the plant site as well as in the surrounding area. Any modification in pollution control technology or new technology equipment appropriate to plant may be assessed as per existing scenario of the environmental conditions and also achieve the standard prescribed by MOEF&CC CPCB. Environmental monitoring programme is being conducted for various environmental components as per conditions laid down in existing Environmental Clearance issued by SEAC, MP & existing Consent to Operate issued by MPSPCB.

6.2.1. Objective of Monitoring

The objectives of environmental post-project monitoring are:

- To validate effectiveness of planning decisions;
- Measure effectiveness of installed equipment at process;
- Confirm statutory and corporate compliance;
- To check or assess the efficacy of the controlling measures;
- Identify unforeseen changes and to mitigate risk associated with it;
- To establish a database for future Impact Assessment Studies for new projects to come up in the area

6.2.2. Environmental Attributes to be monitored

The attributes, which involve regular monitoring, are given below as per scope:

A. Air quality;
B. Water and wastewater quality;
C. Noise levels;
D. Soil quality;
E. Green Belt Development

6.2.3. Environmental monitoring and reporting procedure

Monitoring shall confirm that commitments are being met. This may take the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against corporate or

statutory standards, consent limits or targets. It may also require measurement of ambient environmental quality in the vicinity of a site using ecological/biological, physical and chemical indicators. Monitoring may include socio-economic interaction, through local liaison activities or even assessment of complaints.

Industry will have Group of Engineering to review the efficacy of environment management during construction and operational phase of proposed expansion project. The Environmental Monitoring Cell (EMC) is a part of Engineering Group who works for monitoring and meet regularly to review the effectiveness of the EMP implementation. The data collected on various EMP measures would be reviewed by EMC and if needed corrective action will be formulated for implementation.

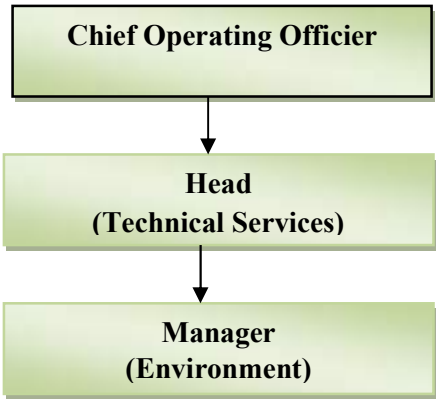


Figure:6.1 Organogram of Environment Monitoring cell

The following routine monitoring program will be implemented under the post project monitoring. The proposed monitoring program is given below:

Table 6.1: Proposed Monitoring Programme

Key Indicator for Monitoring	Monitoring for	Aspects
Air Quality	Effectiveness of Air Pollution control equipments installed at project site as well as Meteorological conditions	• Ambient air quality and stack emissions • The ambient air quality and stack will be monitored once in three months in the work zone covering the location of DG set and surroundings through a reputed environmental laboratory recognized by CPCB/ MoEF&CC. and results will be reported to state pollution control authorities.
Water & waste Water generated for E	Water and water treatment efficiency	• The domestic sewage waste water and Effluent Treatment Plant waste water will

and STP		be monitored once in a month for physico-chemical characteristics.
Noise	Efficiency of noise control equipment installed	Noise levels near the DG sets will be monitor once in three months.
Soil	Soil contamination due to spillage of oil Hazardous waste material	Soil quality will be monitored and around project site once in a year for heavy metal and phyiso- chemical parameters.
Green belt Development		Green belt development will be monitored as per guideline to maintain 33% of area at project site.

6.3. ENVIRONMENTAL MONITORING DURING CONSTRUCTION PHASE

The environmental monitoring cell of the construction team will manage all the monitoring programs during the construction phase of the proposed expansion project to evaluate the existing status and proposes monitoring schedule during the construction phase of the project is given below:

Table 6.2:Environmental Monitoring Schedule during Construction Phase

S. No.	Attributes	Action	Parameters for Monitoring	Frequency of Monitoring
1.	Drinking water Quality	--	Parameters as per IS:10500	Periodically/ Quarterly
2.	Air Emissions	All equipments are operated within specified design parameters and as per standards	PM_{10}, $PM_{2.5}$, SOx and NO_2, CO	Periodically
		Minimize the Vehicle trips	Vehicle logs	Periodically
		Dusty construction materials stored in sealed containers or prevented from blowing.	Absence of covered storage place or open containers of dusty materials.	Periodically
		Ambient air quality within the premises of the proposed unit	PM_{10}, $PM_{2.5}$, SOx and NO_2, CO	As per CPCB/ MPSPCB requirement or on monthly basis/ quarterly basis
3	Noise	List out high noise generating construction machinery onsite and their age of working and Checkout equipment condition and maintained in good working order	Equipment logs, noise reading	Regular during construction activities
		Night working shall be avoided.	Records of working hours	Daily update records
		Noise to be monitored in ambient environment within the plant premises.	At working zone	As per CPCB/RSPCB requirement or on quarterly basis whichever is earlier
		Acoustic mufflers / enclosures to be provided in	Mufflers / enclosures	Prior to use machinery

		large engines	shall be in place.	
4.	Wastewater Discharge	No waste water discharge in open in land or water body	Temporary Soak pit shall be there	Periodically
5.	Soil degradation	No spillage on soil	Precautionary measures to prevent the top soil contamination	Periodically
6.	Waste Management	Implement waste management plan to handling & disposal of each waste arising.	As per waste management plan	As per Construction and Demolition Waste Management rules,2016
7.	Occupational Health	Employee and workers checkup		Regular check up
8.	Flora and fauna	Plantation activity	Plant and species to be monitored	During site preparation and construction activity

6.4.MONITORING SCHEDULE DURING OPERATIONAL PHASE

The following monitoring programme schedule as detailed will be implemented at proposed expansion site. Besides to this monitoring, the EC and CTO compliances to all conditions laid down and regular permits from SPCB/MoEF&CC will be monitored and reported periodically.

Table 6.3: Environmental Monitoring plan for operation phase

S. No.	Environmental attributes	Parameters	Locations	Frequency of monitoring
1.	Ambient air	PM_{10}, $PM_{2.5}$, CO, SO_2, NO_x,	Three locations (one upwind + 2 downwind)	Once in a quarter
2.	DG Stack	CPCB notified standards	All DG sets within project	Once in a quarter
	>1000 kVA	PM, CO, NO_x, HC		
	<1000 kVA	PM, CO, NO_x, NMHC		
3.	Stack Emission	NOx&SO_2 in Reformer, stacks and NH_3 & PM in Prilling Tower	All continuous Stacks	Fortnightly
4.	Ground water	As per IS: 10500	All bore wells for water supply Peizo metric Wells	Monthly
5.	Treated water from STP & ETP	pH, Oil & Grease, TSS, BOD, COD, others as	Outlet of STP & ETP	Once in a month

S. No.	Environmental attributes	Parameters	Locations	Frequency of monitoring
		prescribed by CPCB/ MoEF/ SPCB		
6	Ambient noise levels	Day & Night time noise levels in dB (A)	Plant area	Monthly
7	Soil quality	Composite sample from the site for Physio-chemical parameters	Two locations within project site	Once in six months
8	Energy Audit	As per BEE standards	Project area	Once in three years
9	Water levels	Water level (mbgl)	Piezometric wells	Continuous through DWLR

Online Monitoring System for air emission: Industry has installed online monitor system for PM, SOx and NOx at plant site and continuous monitoring has been done and check the pollution level within the prescribed limit. The photographs of online monitoring system are enclosed as **Annexure-XLV.**

Online monitoring system for waste water: Online flow meter & web cam is installed at plant site. The photographs of online monitoring system and connected to CPCB server is enclosed as **Annexure- XLVI.**

6.5. RESPONSIBILITY MONITORING AND REPORTING SYSTEM

Responsibility of Monitoring:

The overall responsibility for environmental monitoring the above environmental parameter given in schedule shall be with the Management. The Environment Monitoring Cell shall be responsible for day to day monitoring activity of raw water and treated water quality.

The ambient air quality, stack emissions, soil, noise and water quality shall be monitored by either third party (approved MoEF/NABL laboratory) or by the EMC.

Records Keeping:

- Records shall be day to day maintained for the analysis of raw effluents and treated effluents

- Periodically ambient air quality results, stack emissions monitoring results, micro-meteorological data and noise levels.
- The industry shall maintain the records as per the Hazardous waste regulations and EPA regulations. Hazardous waste manifest will be maintained.
- Environment statement will be submitted annually.
- These records are utmost required for the perusal of the Pollution Control Board authorities but also to get efficiencies of the pollution control equipment
- The objective of the Industry is not only compliance with statutory regulations, but also a serious commitment towards clean environment.

.

6.6. SUBMISSION OF MONITORING REPORTS TO MoEF&CC

The status of environmental clearance stipulation implementation will be submitted to regional MoEF office in hard and soft copy on 1st December and 1st June of every calendar year. These reports will upload on MoEF&CC web site and will be updated every six months. The pollutants will be monitored and reports will be submitted to SPCB and CPCB respectively, as per the statutory requirement.

6.7. COST PROVISION FOR ENVIRONMENTAL MEASURES

For environment protection, management, pollution control, treatment and monitoring systems, appropriate budgetary provision would be made and provision for recurring expenditure for environment management of the project would be made. The details of budget allocation during functional phase are given in Table-6.3.

Table 6.4: Budgetary provisions for environmental monitoring (Recurring)

S. No.	Pollution control system	Existing		Proposed	
		Capital Cost (Rs. In Lacs)	Recurring Cost (Rs. In Lacs)	Capital Cost (Rs. In Lacs)	Recurring Cost (Rs. In Lacs)
1.	Air pollution control (Bag Filter, Stack, Scrubber, CEMS, WHRB)	130	50	320	32.0
2.	Water pollution control (Expansion of ETP, Installation of STP, Online effluent Monitoring System, MEE)	25.0	2.5	536	53.0

S. No.	Pollution control system	Existing		Proposed	
		Capital Cost (Rs. In Lacs)	Recurring Cost (Rs. In Lacs)	Capital Cost (Rs. In Lacs)	Recurring Cost (Rs. In Lacs)
3.	Noise pollution control (Acoustic Enclosure to Machinery)	10	5.0	20.0	2.00
4.	Waste Management (Solid and Hazardous Waste)	4.0	0.40	25.0	2.50
5.	Rainwater harvesting system and Storm water drainage system (Piezometer, RWH pit)	7.0	0.70	90.0	1.0
6.	Environment lab and Env. monitoring	30	10	60.0	15.0
7.	Occupational Health (PPE, Medical Examination)	20	5.0	30.0	6.0
8.	Firefighting system	5.0	1.0	200	2.0
9.	Green Belt/Landscaping	30	5.0	100	20.0
10.	Conservation Plan for Schedule I Species (for 3 Species)	-	-	55.0	5.0
Total		**261**	**79.6**	**1436**	**138.5**

******

INDEX

7.1 Additional Studies 284
7.1.1 Public Consultation 284
7.2 Risk Assessment Methodology 288
7.2.1 Software 289
7.3 Hazards Identification 289
7.3.1 Enumeration and Selection of Incidents 289
7.3.2 Hazards Classification 289
7.3.3 Characterising the Failures 291
7.3.4 Operating Parameters 291
7.3.5 Inventory 291
7.3.6 Loss of Containment 291
7.3.7 Isolatable Sections 292
7.4 Consequence Analysis 292
7.4.1 Weather Conditions 292
7.4.2 Hazards associated with Flammable Materials 293
7.4.3 Damage Criteria 293
7.4.4 Consequential Effects 294
7.4.5 Selection of Damage Criteria 294
7.4.6 Heat Radiation 294
7.4.7 Explosion 296
7.5 Frequency Assessment 296
7.6 Risk Assessment 296
7.6.1 Ignition Sources 297
7.6.2 Population Data 297
7.6.3 Location Specific Individual Risk (LSIR) 297
7.6.4 Individual Risk Criteria 298
7.6.5 Risk criteria for Societal Risk 299
7.7 Risk Results 300
7.7.1 Location Specific Individual Risk (LSIR) Results 300
7.9.1 Societal Risk 301
7.8 Conclusion 301
7.9 References 302
7.9.1 Codes and Standards 302

7.10 Disaster Management Plan 322
7.10.1 Introduction 322
7.10.2 Objective of Disaster Management Plan 322
7.10.3 Emergencies 323
7.10.4 Emergency Organization 323
7.10.5 Emergency Facilities 327
7.10.6 Emergency Actions 329
7.11 Off-Site Emergency Preparedness Plan 331
7.11.1 Introduction 331
7.11.2 Organizations involved and responsibilities and liaison arrangements between them City 332
7.12 Occupational Health And Safety 336
7.13 Safety Plan 338
7.13.1 Safety Organization 339
7.13.2 Safety Circle 339
7.13.3 Safety Training 339
7.13.4 Key Personnel 340
7.13.5 Emergency Planning For Disaster Due To Fire 340
7.13.6 Fire Fighting with Water 340
7.13.7 Water Line Arrangement 341
7.13.8 Fire Fighting with Fire Extinguishers 341
7.13.9 Inspection 341
7.13.10 Procedure for Extinguishing Fir 341
7.13.11 Health and Safety Monitoring Plan 342
7.14 Traffic Study 343
7.14.1 Traffic Management Plan. 345

****

7.0 ADDITIONAL STUDIES

7.1 ADDITIONAL STUDIES

In addition to the main EIA study, Rapid Risk Assessment and Disaster Management Plan (on-site & off-site emergency plan) have been carried out by MBAPL. All additional studies along with public hearing proceedings and compliance are given below:

7.1.1 PUBLIC CONSULTATION

The Public Hearing for the proposed expansion project was conducted as per EIA Notification 1533(E) dated 14.09.2006 and subsequent amendments dated 01.12.2009 at Plot No.A-1 & A-2, Saurai Industrial Area, Village–Saurai, Tehsil - Banda, District Sagar, Madhya Pradesh at plant premises of M/s Madhya Bharat Agro Products Limited (MBAPL) on dated 20.08.2020 at 11:00AM. The public hearing was presided under chairmanship of District Collector Shri Deepak Singh and in the presence of Regional Officer Shri S.P. Jha, Sagar. The details are given below:

Table 7.1: Brief details of Public hearing

S. No.	Particulars	Details
1.	Date of advertisement	18.07.2020
2.	Name of Newspaper	"Raj Express" & "Danik Bhaskar"
3.	Date & Time of Public Hearing	20.08.2020 at 11:00AM
4.	Public Hearing panel chaired by & members present	DM- Shri Deepak Singh; RO, Sagar- Shri S.P. Jha
5.	No. of people attended the public hearing meeting	146

At the inception of the public hearing, Shri Shri S.P. Jha,, Regional Officer, Sagar, Madhya Praesh Pollution Control Board, as a Representative of the Member Secretary, Madhya Pradesh Pollution Control Board outlined the various provisions of the Notification and briefed the procedural details for conducting this public hearing and also said that MBAPL has proposes for the expansion in Fertilizer unit with addition of Chemical unit for this the public hearing is being conducted and in reference to this to obtain the suggestions, obejections and vote are from local people, public hearing is being conducted. After that Public hearing was initiated. The issues raised alongwith reply/response is as given below:

Table7.2: Issue raised during public hearing and their reply

S. No.	Name & Address	Issue/Objection Raised	Response/Reply
1.	Shri Ranveer Singh Thakur, Village-Sorai, Banda, Sagar	The factory is running in the village and we welcomed it. The factory is running systematically. We are feeling good and no problem is due to factory. The management has distributed food, mask, plants in Coroa time to poor people. They also helped gram panchayat. The children are provided gifts. We donot have any objection. Problem of Driniking Water is here.Kindly arrange this. The relation between factory and people are good.We are happy. We are welcomed for coming project. Factroy will work for development in the area.	Suggestion is considered
2.	Shri Ram Bihari Singh Lodhi, Village - Bimhori Shahgarh, Banda, Sagar	Contamination of water due to seepage in and around the area. Water analysis shall be carried out. The agriculture crops are getting destroyed so verify from Agricultural Department.	No waste water is being discharged from the outside of the premises to maintain ZLD. Hence, no water seepage is envisaged. To verify it , Water report shows that there is no for agricultural crops and ground water due to seepage.
3.	Shri Kalyan Singh Village- Mangarh, Banda, Sagar	Road is damaged for Village Monpur. Kindly repair it. There is a request to construct computer room in Govt. School Sorai.	• Road will be maintained in consultation with PWD • Construction of Computer room in Govt. School

			Sorai
4.	Shri Bhagwan Singh Lodhi Village- Sorai, Banda , Sagar	He asked to provide the employment in the factory.	The capability of the person will be assessed on basis of his skill and qualification and after training as per assessment in required field the job will be given to the person.

Table 7.3: Action plan with Bugetary allocation

Action Plan	Time Schedule	Budgetary Fund (In Lacs)
Installation of RO in Govt. Middle School, Sorai	Within one year	0.50
Installation/ repair of handpums / tubewells at Sorai Panchayat	3 Years	0.5
Construct computer room	With in a year	5.0
Traning of computer (Company will provide the computer teacher)	One day in week	0.25
Plantataion along the both side of the roads	With in one year (Monsoon season)	0.11
Awarness for hygine and cleanliness		10.0

Figure 7.1: Photographs of Public Hearing

7.2 RISK ASSESSMENT METHODOLOGY

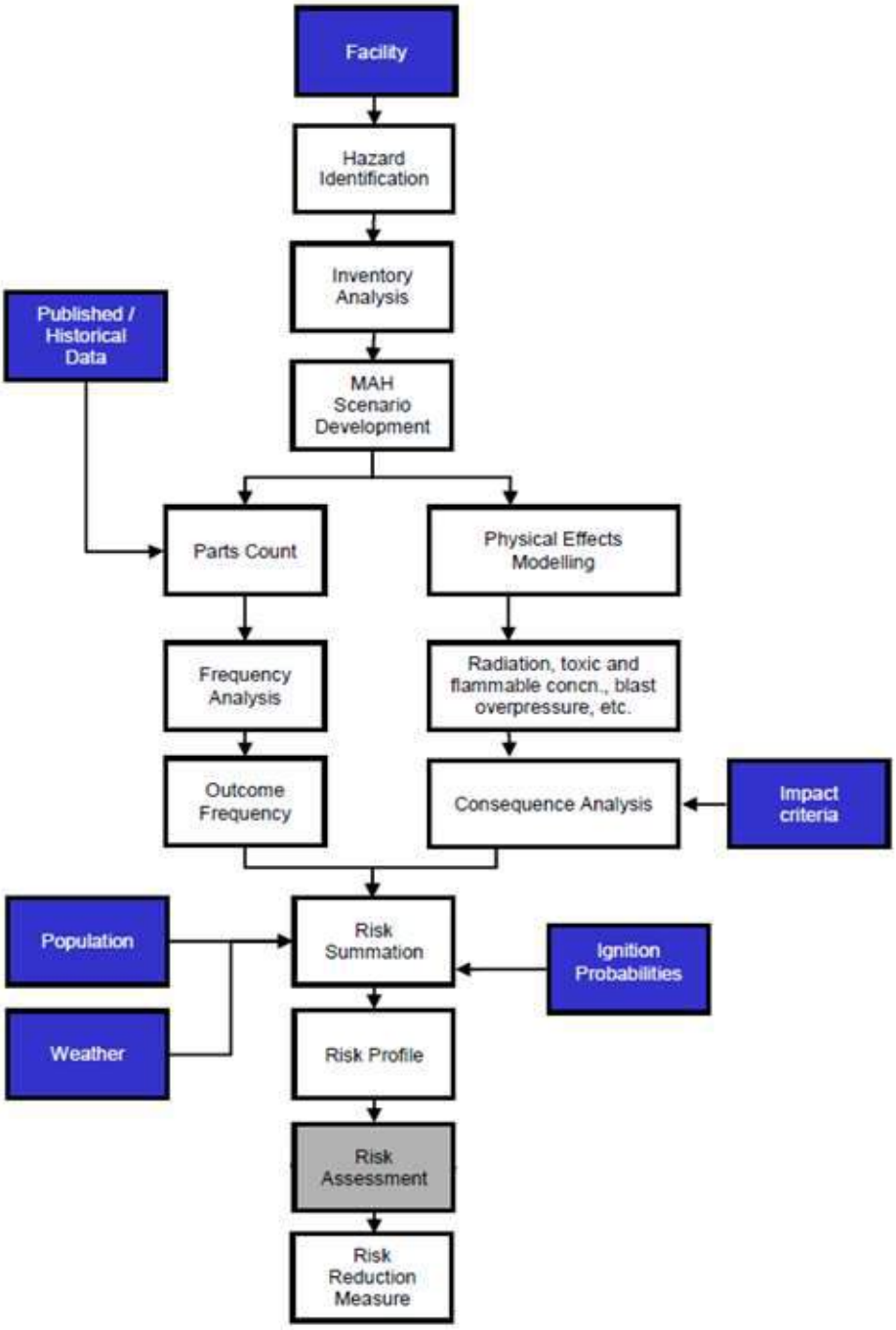


Figure 7.2: Risk Assessment Study Flow

7.2.1 SOFTWARE

DNV-PHAST and SAFETI 8.2 software have been used for carrying out the Risk Assessment study.

7.3 HAZARDS IDENTIFICATION

7.3.1 Enumeration and Selection of Incidents

Effective management of a Risk Assessment study requires enumeration and selection of incidents or scenarios. Enumeration attempts to ensure that no significant incidents are overlooked; selection tries to reduce the incident outcome cases studied to a manageable number. These incidents can be based on:

- **Loss of containment (LOC) of the materials**

  Unfortunately, there are infinite ways (incidents) by which loss of containment can occur. For example, leakages of process materials can be of any size, from a pinhole up to a severed pipeline or ruptured vessel. An explosion can occur in either a small container or a large container and, in each case, it can range from a small "puff" to a catastrophic detonation.

  A technique commonly used to generate an incident list is to consider potential leaks and major releases from fractures of all process pipelines and vessels. This compilation should include all pipe work and vessels in direct communication, as these may share a significant inventory that cannot be isolated in an emergency. The data generated is as shown below:
- Vessel number, description, and dimensions
- Materials present
- Vessel conditions (phase, temperature, pressure)
- Inventory and connecting piping and piping dimensions

  The goal of selection is to limit the total number of incident outcome cases, to be studied to a manageable size, without introducing bias or losing resolution through overlooking significant incidents or incident outcomes. The purpose of incident selection is to construct an appropriate set of incidents for the study from the Initial list that has been generated by the enumeration process. An appropriate set of incidents is the minimum number of incidents needed to satisfy the requirements of the study and adequately represent the spectrum of incidents enumerated.

7.3.2 HAZARDS CLASSIFICATION

The hazard classification has been carried out based on the data provided in MSDS data sheets and as per the classification MSHIC Rules, 1989 and its amendments thereof. The hazard classification is given in Table 7.4.

Table7.4(a): Potential Hazard Classification and Analysis of Chemicals Proposed in Unit

S. No.	Hazrdous Chemical	Potential Hazards	Hazard Classification as per Part I, Schedule I, MSHIC

			Rules, 1989 and its amendments thereof
1.	**Ammonia**	**Fire Hazard**: Forms flammable mixture with air. **Explosion Hazard**: Forms explosive mixture with air and highly reactive with other substances, especially metals to form violently explosive substances. **Health Hazard**: Strongly irritant to skin, eyes and respiratory system. Inhalation of high concentration causes suffocation, burning of the tract and may be fatal.	
2.	**Sulphuric Acid**	**Fire Hazard:** Contact with combustible materials may cause fire. Highly reactive. Contact with many organic and inorganic chemicals may cause fire or explosion. Contact with metals liberates flammable hydrogen gas. **Health Hazard:** Highly corrosive and toxic. Strong sulphuric acid mist is carcinogenic. **Reactivity:** Highly reactive with water, metals, excess heat, combustible materials, organic materials, oxidizers, amines, bases	Extremely Toxic (Inhalation Toxicity - 0.320 mg/l)
3.	**Phosphoric Acid**	**Fire hazard**: Reacts with most metals to produce flammable/explosive hydrogen gas. Reacts violently with strong caustics, sodium tetrahydroborate metals, fluorides, halogenated organics, cyanides, sulphides, mercaptans, nitrides, metal phosphides, acetylides, silicides, carbides. Potentially dangerous reactions with strong oxidizing agents, reducing agents, organic peroxides. Azo compounds, epoxides, aldehydes and other polymerizable compounds can polymerize violently with phosphoric acid. Forms detonable mixture with nitromethane. **Explosion Hazard:** Containers may explode when heated. **Health Hazard:** If heated, releases toxic vapours. Mists may cause	Extremely Toxic (Inhalation Toxicity - 0.026 mg/l)

		irritation of the eyes, nose and respiratory tract. May cause increased pulmonary resistance and transient cough. Severe overexposure can cause pulmonary edema which may be fatal. Symptoms (shortness of breath, cyanosis) may appear several hours after exposure. Concentrated solutions may cause pain and severe burns to the skin. Concentrated solutions cause immediate pain, severe burns and permanent corneal damage which may result in blindness	

7.3.3 Characterising the Failures

Accidental release of flammable materials can result in severe consequences. Delayed ignition of flammable vapours can result in blast overpressures covering large areas. This may lead to extensive loss of life and property. In contrast, fires have localized consequences. In most of the cases, fires can be put out or contained, but there are very few mitigating actions that one can take once a vapour cloud has been released.

7.3.4 Operating Parameters

Operating parameters (Temperature, Pressure & Phase) may vary subject to the processing, storage, handling, loading or unloading and transportation conditions. Potential vapour release of the materials handled depends significantly on these conditions. Temperature and pressure conditions provided by Client have been used for Consequence Analysis.

7.3.5 Inventory

Inventory Analysis is commonly used in understanding the relative hazards and short listing of release scenarios. Inventory plays an important role with regard to the potential hazard. A practice commonly used to generate an incident list is to consider potential leaks and major releases from fractures of pipelines and vessels containing sizable inventories. The potential vapour release (source strength) depends upon the quantity of liquid release, the properties of the materials and the operating conditions (pressure, temperature).

7.3.6 Loss of Containment

Inventory can be discharged into the environment due to Loss of Containment. Various causes and modes for such an eventuality have been described. Certain features of materials to be handled at the facility need to be clearly understood to firstly list out all significant release cases and then to short list release scenarios for a detailed examination.

Inventory release can be either instantaneous or continuous. Failure of a vessel leading to an instantaneous outflow assumes the sudden appearance of such a major crack that practically all of the contents above the crack shall be released in a very short time. The more likely event is the case of

inventory release from a hole in a pipe connected to the vessel. The flow rate will depend on the size of the hole as well as on the pressure in front of the hole, prior to the accident. Such pressure is dependent on the pressure in the system.

For a liquid release, the vaporization of released liquid depends on the vapour pressure and weather conditions. Such consideration and others have been kept in mind while performing calculations.

7.3.7 Isolatable Sections

An isolatable section is defined as the section between two ESD valves.

An inventory analysis will be undertaken within the process facilities are based on the following:

- Review of the Process Flow Diagrams (PFDs) & P&IDs to determine process streams;
- Review of the material balance sheets to gain an understanding of the properties of each stream (specifically physical conditions, composition, mass flow rate, fluid density, etc.);
- Identification of isolatable sections based on various units or individual vessels within the process units.
- Rationalisation of the streams in terms of duplicity or multiplicity of streams
- Following from the inventory analysis, isolatable sections will be defined. This will be further assessed for failure cases which are hazards specific within the isolatable section.

7.4 CONSEQUENCE ANALYSIS

7.4.1 Weather Conditions

The consequences arising out of the release of chemicals are dependent on certain things on the prevailing meteorological conditions. This section describes the influence of these conditions.

Stability Class

Dispersion of gases or vapours largely depends upon the Atmospheric Stability Class.

Table 7.4 : Pasquill's Atmospheric stability class

A	Very Unstable
B	Unstable
C	Slightly Unstable
D	Neutral
E	Stable
F	Very Stable

The stability class for a particular location is generally dependent upon:

- Time of the Day (Day or Night)
- Cloud Cover
- Season
- Wind Speed

Six stability classes from A to F are defined while wind speed can take any one of numerous values. It may thus appear that a large number of outcome cases can be formulated by considering each one of very many resulting stability class-wind speed combinations. However, in fact the number of stability class - wind speed combinations that needs to be considered for formulating outcome cases in any analysis is very limited. This is because, in nature, only certain combinations of stability class and wind speed occur. Thus, for instance combinations such as A-3 m/s or B-5 m/s or F-4 m/s do not occur in nature. As a result, only one or two stability class - wind speed combinations need to be considered to ensure reasonable completeness of Risk Assessment study. Furthermore, though wind speeds less than 1 m/s may occur in practice, none of the available dispersion models, including state-of-art ones, can handle wind speeds below 1 m/s. Fortunately, wind speed does not influence consequences as much as stability class and for a given stability class, the influence of wind speed is relatively less. On the other hand, consequences vary considerably with stability class for the same speed.

Except during the monsoon months little or no cloud cover along with the prevailing low wind velocities results in unstable conditions during the day (C or D) and **highly stable conditions (E or F)at night.** During the three months of monsoons, the wind velocities are generally higher and cloud cover generally present. This results in stability class of D during the day and E or F during the night.

The following wind velocity/ stability class combinations & frequencies are used for Risk Assessment.

- **D – 5 m/s**
- **F – 1.5 m/s**

7.4.2 Hazards associated with Flammable Materials

Fire and explosion hazards depend on the range of flammable concentrations of the material in air among all common gaseous fuels. Any spillage or loss of containment of heavier hydrocarbons may create a highly flammable pool of liquid around the source of release. High entrainment of gas phase in the liquid phase can lead to jet fires. If released at temperatures higher than the normal boiling point they can flash significantly.

7.4.3 Damage Criteria

In consequence analysis, use is made of a number of calculation models to estimate the physical effects of an accident (spill of hazardous material) and to predict the damage (lethality, injury, material destruction) of the effects. The calculations can roughly be divided in three major groups:

- Determination of the source strength parameters;
- Determination of the consequential effects;
- Determination of the damage or damage distances.

7.4.4 Consequential Effects

- Dispersion of gaseous material in the atmosphere as a function of source strength, relative density of the gas, weather conditions and topographical situation of the surrounding area.
- Intensity of heat radiation [in kW/m2] due to a fire, as a function of the distance to the source.
- Concentration of gaseous material in the atmosphere, due to the dispersion of evaporated chemical. The latter can be either explosive or toxic.
- It may be obvious, that the types of models that must be used in a specific risk study strongly depend upon the type of material involved:
- Gas, vapour, liquid, solid
- Inflammable, explosive,
- Stored at high/ low temperatures or pressure
- Controlled outflow (pump Inventory) or catastrophic failure

7.4.5 Selection of Damage Criteria

The damage criterion gives the relation between extent of the physical effects (exposure) and the percentage of the people that will be killed or injured due to those effects. The knowledge about these relations depends strongly on the nature of the exposure. In Consequence Analysis studies, in principle two types of exposure to hazardous effects are distinguished:

1. Heat radiation, from a jet, pool fire, fire ball or flash fire.
2. Vapour Cloud Explosion

7.4.6 Heat Radiation

The consequences caused by exposure to heat radiation are function of:

- The radiation energy onto the human body [kW/m2];
- The exposure duration [sec];
- The protection of the skin tissue (clothed or naked body).

The limits for 1% of the exposed people to be fatal due to heat radiation, and for second-degree burns are given in the table below:

Table 7.5: Damages to Human Life Due to Heat Radiation

Exposure Duration	Radiation energy (1% lethality, kW/m^2	Radiation energy for 2nd degree burns, kW/m^2	Radiation energy for first degree burns, kW/m^2
10 Sec	21.2	16	12.5
30 Sec	9.3	7.0	4.0

Reference: TNO purple book

Since in practical situations, only the people outside will be exposed to heat radiation. In case of a fire, it is reasonable to assume the protection by clothing. It can be assumed that people would be able to find a cover or a shield against thermal radiation in 10-sec. time. Furthermore, 100% lethality may be assumed for all people suffering from direct contact with flames, such as the pool fire, a flash fire or a jet flame. The effects due to relatively lesser incident radiation intensity are given below:

Table 7.6: Radiation intensity

Radiation Level (KW/m2)	Damage to Equipment	Damage to People
4.0	--	Causes pain if duration is longer than 20sec. But blistering is unlikely.
12.5	Minimum energy to ignite wood with a flame; melts plastic tubing.	1%lethality in one minute. First degree burns in 10sec.
37.5	Sufficient to cause damage to process equipment	100%lethalityin1min. 50%lethalityin20sec. 1%lethalityin10sec.

Reference: TNO purple book

The actual results would be less severe due to the various assumptions made in the models arising out of the flame geometry, emissivity, angle of incidence, view factor and others. Upon ignition, a spilled liquid would burn in the form of a large turbulent diffusion flame. The size of the flame would depend upon the spill surface and the thermo-chemical properties of the spilled liquid. In particular, the diameter of the fire (if not confined to a dyke), the visible height of the flame, the tilt and drag of the flame due to wind can be correlated to the burning velocity of the liquid. The radiative output of the flame would be dependent upon the fire size, extent of mixing with air and the flame temperature. Some fraction of the radiation is absorbed by carbon dioxide and water vapour in the intervening atmosphere. In addition, large pool fires produce thick smoke, which can significantly obscure flame radiation. Finally, the incident flux at an observer location would depend upon the radiation view factor, which is a function of the distance from the flame surface, the observer's orientation and the flame geometry.

Estimation of the thermal radiation hazards from pool / jet fires essentially involves 3 steps;

- characterization of flame geometry,
- approximation of the radiation properties of the fire and
- Calculation of safe separation distances to specified levels of thermal radiation

7.4.7 Explosion

In case of vapour cloud explosion, two physical effects may occur:

- flash fire over the whole length of the explosive gas cloud;
- A blast wave, with typical peak overpressures circular around ignition source.
- As explained above, 100% lethality is assumed for all people who are present within the cloud proper.
- For the blast wave, the lethality criterion is based on:
- Peak overpressure of 0.1 bars will cause serious damage to 10% of the housing/structures.
- Falling fragments will kill one of each eight persons in the destroyed buildings.
- The following damage criteria may be distinguished with respect to the peak overpressures resulting from a blast wave:
- As per approved design basis impact criteria for over pressure (Explosion, BLEVE, and VCE) is 0.2 bar for 30% fatality & 0.7 for 100% fatality is considered.

Table 7.7: Damage Due to Overpressures

Peak Overpressure, bar	Damage Type
0.7	Total destruction
0.2	Steel frame buildings distorted and pulled from foundations
0.05	Limited minor structural damage

Reference: DNV Help file

From this, it may be concluded that p = 0.17 E+5 pa corresponds approximately with 1% lethality. Furthermore, it is assumed that everyone inside an area in which the peak overpressure is greater than 0.17 E+5 pa will be wounded by mechanical damage. For the gas cloud explosion this will be inside a circle with the ignition source as its centre.

7.5 FREQUENCY ASSESSMENT

Applicable and considered frequencies for valves, flanges, pipes etc. to be included in report as per OGP Standards. Parts count and frequency calculations are used for risk modelling.

7.6 RISK ASSESSMENT

The output from the consequence analysis, and the frequency analysis, along with other supporting information are combined in a 'risk model'. The following data utilized for risk calculation are:

- Event frequencies
- Consequence data
- Ignition probabilities

- Population numbers and distribution in the plant.
- Local Weather data

7.6.1 IGNITION SOURCES

In order for a fire or explosion to start there must be an ignition source of sufficient heat intensity to cause an ignition. Ignition causes a release of flammable liquid or gas to become a fire (jet fire, flash fire, pool fire etc.) or explosion. There are many possible sources of ignition and those that are most likely will depend on the release scenario. Sources of ignition include electrical sparks, static electricity, naked flames, hot surfaces, impact, friction, etc. The following Ignition sources identified in a risk assessment under several categories including:

- **Current Electricity** – electrical equipment and cables can act as sources of ignition if sparks are generated at contact points or where wires overheat; e.g. Electrical equipment sparking
- **Static Electricity** – static electricity can build up on any unearthed equipment and generate sparks. Static is commonly found on vehicles, vessels handling particulate solids and manned areas with nonconductive floor or footwear unearthed floors; e.g. Electrostatic discharges.
- **Naked Flames** – all naked flames (including cigarettes) are potential sources of ignition; this category also includes welding, flame-cutting and other hot work, fired furnaces and flares; e.g. Open flame heaters (boilers and flame heaters)

7.6.2 Population Data

Population data of the Plant is mentioned in the following table. This data was utilized for two purposes, firstly to estimate the Individual Risk of fatality for a member of each onsite group, and also as the population input for calculating societal risk for site personnel.

Table 7.8: Occupancy Data

S. NO.	BUILDING	Manning Level
1	Proposed Guest House	10
2	Admin Block	2
3	Security Office	1
4	Proposed Store Area	2
5	Labour Room	-
6	Proposed Grain Godown	-

7.6.3 Location Specific Individual Risk (LSIR)

Location Specific Individual Risk (LSIR) is a commonly used risk assessment tool and is defined as the frequency per year at which an individual, who stays unprotected for 24 hours

per day and 365 days per year at specific location, is expected to sustain fatal harm due to exposure to hazards induced by the project facility. From the LSIR value, the Individual Risk Per Annum (IRPA) to the personnel based on their exposure within the project facility.

7.6.4 Individual Risk Criteria

Individual risk criteria are well established both within industry and by regulatory bodies. The criteria adopted by the UK HSE, which are widely used and considered most appropriate to this study are:

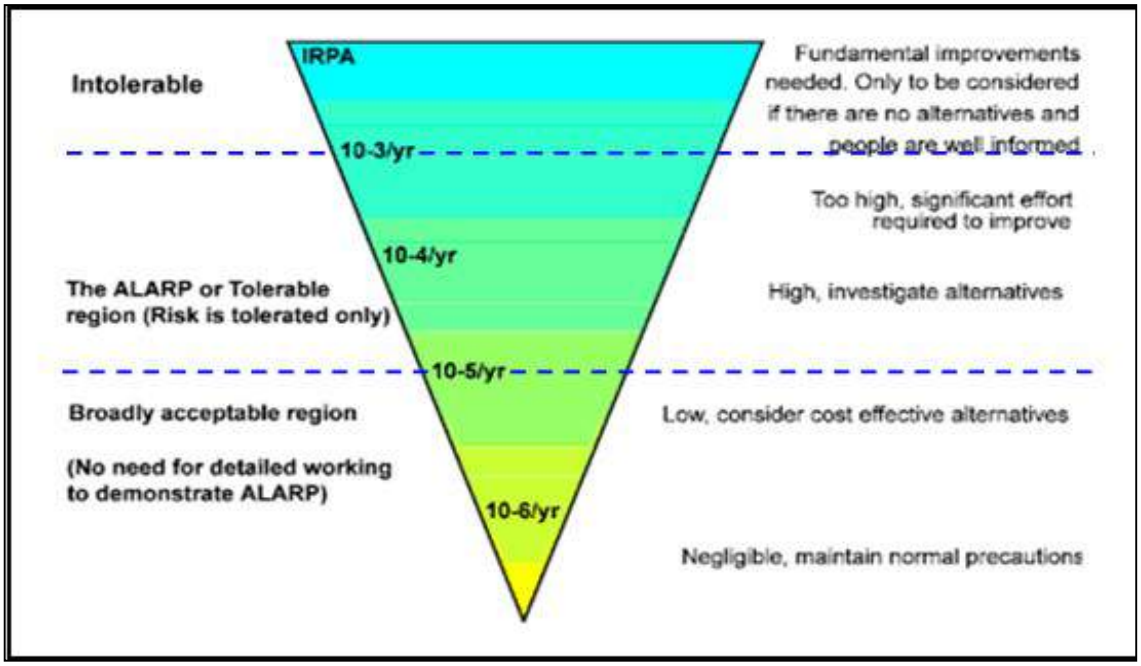


Figure 7.3: Individual Risk Acceptance Criteria

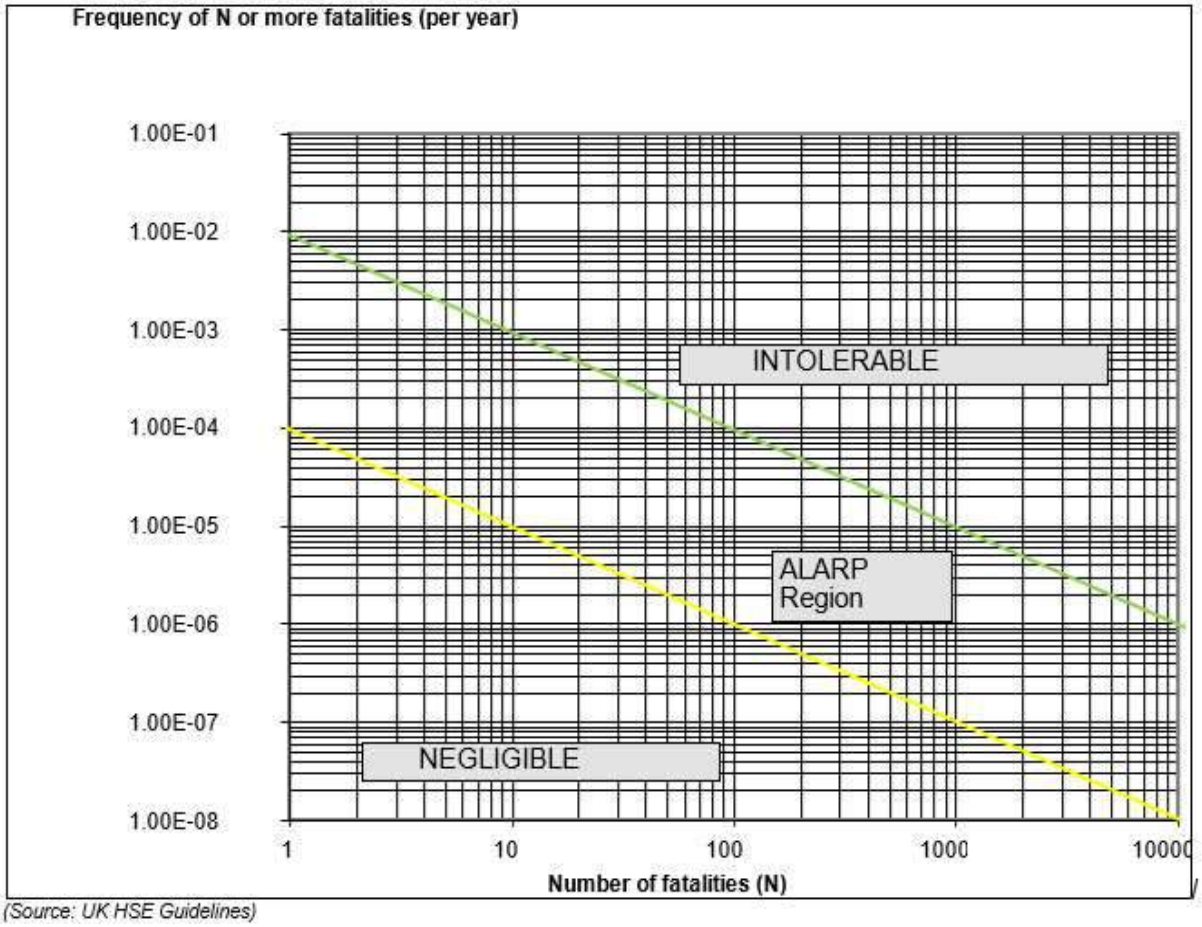
The "ALARP region" (1X10-3 to 1X10-5) lies between unacceptably high and negligible risk levels. Even if a level of risk for a "baseline case" has been judged to be in this ALARP region it is still necessary to consider introducing further risk reduction measures to drive the remaining, or "residual", risk downwards.

The individual risk contours will not be affected by the number of persons living or working in the area around the facility. Thus, a person located on the 1.0 x 10-6 individual risk contour for one year has one chance in a million of being fatally injured by the hazards associated with releases of hazardous fluids, regardless of how many other persons are located in the same area.

7.6.5 Risk criteria for Societal Risk

Societal risk is defined as the relationship between the frequency and the number of people suffering a given level of harm from the realization of specified hazards. It is usually taken to refer to the risk of death, and usually expressed as a risk per year. In the same way as for individual risk, maximum tolerable and broadly acceptable criteria are set a upper and lower limits, where between these levels (termed the ALARP region) risks should be reduced wherever possible.

Societal risk criteria are more judgmental, and therefore less well established, than those for individual risk. The general aim of such criteria is to balance the risk to population groups from a facility with the benefits that the group, or society as a whole, receive. The criteria, therefore, may vary according to the type and value of facility being assessed (where value is not necessarily defined in monetary terms) and the type of population that may be affected, as well as according to the country and regulatory authority.



(Source: UK HSE Guidelines)

Figure 7.4: Societal Risk Acceptance Criteria

7.7 RISK RESULTS

The risk modelling has been performed using DNV PHAST RISK software. Thereby, the input data used for the risk modelling are - vulnerability criteria, ignition probability and occupancy data. This chapter focuses on the outcome of the risk results and the comparison of the risk results with standard risk acceptance criteria.

7.7.1 Location Specific Individual Risk (LSIR) Results

The LSIR results for the project facility are presented in below figure;

Figure 7.5: Combined LSIR Contour for Project facility

The Following Table shows the Location Specific Individual Risk (LSIR) for different locations within plant premises based on outdoor vulnerability;

Table 1.9 : Location Specific Individual Risk

Locations	Location Specific Individual Risk (LSIR) (per average year)	Individual Risk Per Annum (IRPA) (per average year)	Risk Criteria
Proposed Guest House	3.04E-06	6.38E-07	**ACCEPTABLE**
Admin Block	2.2 E-06	4.62E-07	**ACCEPTABLE**
Security Office	1.9 E-06	3.99E-07	**ACCEPTABLE**
Proposed Store Area	2.6E-06	5.46E-07	**ACCEPTABLE**
Labour Room	7.9 E-05	1.6E-05	**ALARP**
Proposed Grain Godown	5.9 E-06	1.2E-06	**ALARP**

7.9.1 Societal Risk

The F-N curve is shown below presents the societal risk for all personnel from the fire and explosion hazards associated with the plant. The societal risk is presented in terms of cumulative frequency (F) of occurrence of events that lead to more than (N) number of fatalities.

Combined F-N Curve represents the risk for both day & night conditions. The Red and Yellow lines show the maximum and minimum risk levels as per UK HSE risk acceptance criteria. The Green line shows the combined risk for personnel.

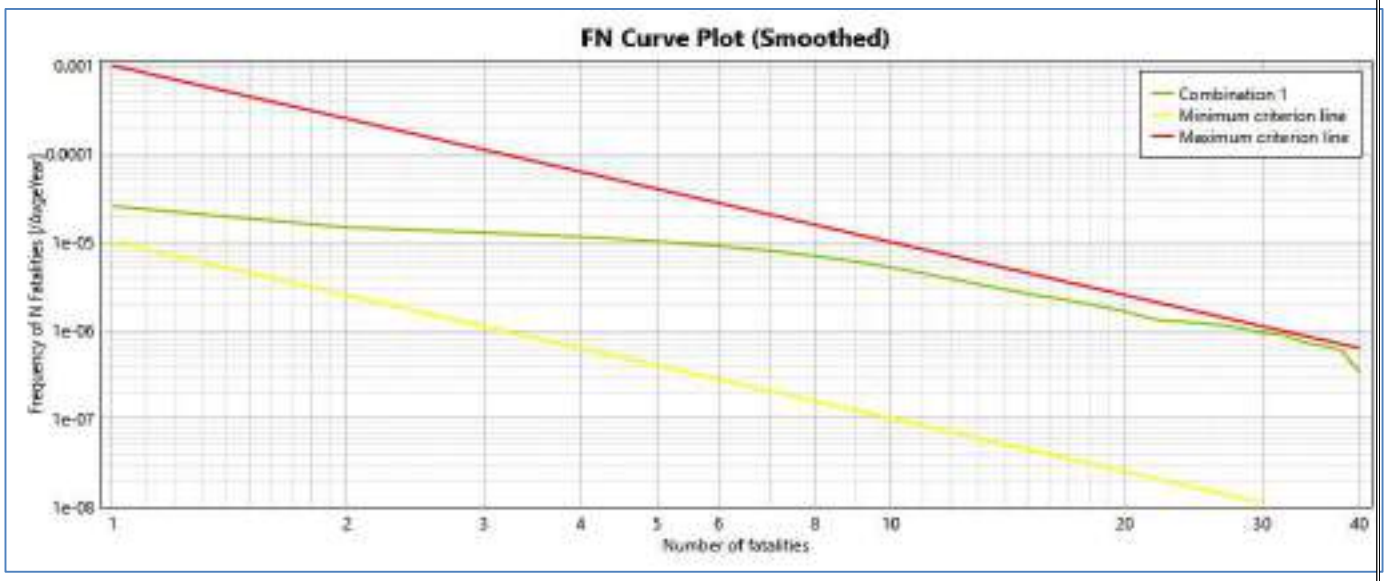


Figure 7.6: Societal Risk Acceptance Criteria

7.8 CONCLUSION

The study team identified 07 numbers of maximum credible LOC scenarios for this risk assessment study. Considering the risk contours and FN curve for combination of all scenarios, DNV- PHAST RISK (SAFETI) software has been used for estimating the risk.

The following interpretations are derived from the risk results of this study:

- Individual risk is in the well Acceptable region of the UK HSE Individual risk acceptance criteria.
- The societal risk is in the ALARP region of the UK HSE Societal risk acceptance criteria.

The conclusions based on the Risk Assessment study outcome are listed below:

Individual Risk Values at Proposed Guest House, Admin Block, Security Office and Proposed Store Area are found to be in well acceptable values of the standard risk acceptable criteria.

This Risk Assessment report represents the worst-case scenario for all the consequences. Maximum inventory has been considered as an initial cause for worst case scenario. It was observed that there are no foreseen unacceptable hazards even due to full bore rupture. Also, it has been observed that the consequence results are not having any adverse effects on the facilities.

Risk is combination of consequence and failure frequency of the scenario. Obtained Consequences are because of the availability of flammable gas/liquid and high pressure in the process. However, the probabilities of the failure are in the acceptable range (1E-4 to 1E-7). Hence the risk falls under Acceptable region.

IR Curve presents the combined risk hazards modelled for facility. The largest contour as shown in Red colors represents a risk level of 1E-6 per year while the smallest contour shown in Light Blue color represents an individual risk of 1E-4 year.

The F-N curves show that societal risk for the overall population considered falls under the ALARP region for the project which is due to the possibility of personnel exposure during Loss of containment scenarios of hazardous chemicals.

Overall Risk is in Acceptable region for the possible LOC scenarios. In general, it is recommended to follow SOP and equip necessary PPEs for the working personnel during handling and operation of the hazardous chemicals to eliminate the foreseen risks.

7.9 REFERENCES

7.9.1 Codes and Standards

- PGS 3 Guidelines for QRA by Ministerie van VROM (of Netherlands) – Purple Book
- OGP Database
- Hazard Identification & Risk Analysis – Code of Practice
- UK HSE Guidelines

IS Description

Table 7.10: IS Description

IS No	Description
IS 01	Ammonia Double walled Storage Tank (Typical – 1000MT)
IS 02	Ammonia Double walled Storage Tank (Typical – 100MT)
IS 03	Ammonia Compression Circuit
IS 04	Ethylene Dioxide Process circuit in Vinyl Sulphone Plant

IS 05	Natural Gas Storage and process circuit
IS 06	Methane MS tank dome type 1000 MT and process circuit
IS 07	Ammonia circuit in nitric acid plant

Consequence Table

Leak Sizes

a – Minor Leak

b – Small Leak

c – Medium Leak

d – Full Bore Rupture

Notation Example: IS 01a – Isolable Section 01 "Minor leak"

Table 7.11: Consequence Table

Isolable Section	Scenario	Weather	Jet Fire Downwind Hazard (m)			Flash Fire Downwind hazard (m)		Pool Fire Downwind Hazard (m)			Fire Ball Hazard (m)		
			4 kW/m2)	12.5 kW/m2	37.5 kW/m2	LFL	LFL Fraction	4 kW/m2)	12.5 kW/m2	37.5 kW/m2	4 kW/m2	12.5 kW/m 2	37.5 kW/m 2
IS 01	IS 01a	Category 1.5/F	25	NR	NR	5	8	23	18	n/a	NR	NR	NR
		Category 5/D	20	18	NR	4	6	22	19	n/a	NR	NR	NR
	IS 01b	Category 1.5/F	100	91	NR	19	44	93	67	n/a	NR	NR	NR
		Category 5/D	81	68	NR	19	29	86	67	n/a	NR	NR	NR
	IS 01c	Category 1.5/F	184	162	NR	32	118	178	128	100	NR	NR	NR
		Category 5/D	149	121	NR	30	78	166	127	93	NR	NR	NR
	IS 01d	Category 1.5/F	378	323	NR	105	400	492	360	287	NR	NR	NR
		Category 5/D	318	251	NR	60	266	460	353	266	NR	NR	NR
IS 02	IS 02a	Category 1.5/F	25	NR	NR	5	7	78	59	n/a	NR	NR	NR
		Category 5/D	20	18	NR	4	6	46	42	n/a	NR	NR	NR
	IS 02b	Category 1.5/F	101	91	NR	24	66	173	127	102	NR	NR	NR
		Category 5/D	81	68	NR	21	44	155	123	96	NR	NR	NR
	IS 02c	Category 1.5/F	185	163	NR	45	142	498	368	298	NR	NR	NR
		Category 5/D	150	121	NR	44	118	466	363	279	NR	NR	NR
	IS 02d	Category 1.5/F	419	356	NR	111	370	21	16	n/a	NR	NR	NR
		Category 5/D	369	291	NR	87	303	20	17	n/a	NR	NR	NR

Isolable Section	Scenario	Weather	Jet Fire Downwind Hazard (m)			Flash Fire Downwind hazard (m)		Pool Fire Downwind Hazard (m)			Fire Ball Hazard (m)		
			4 kW/m2)	12.5 kW/m2	37.5 kW/m2	LFL	LFL Fraction	4 kW/m2)	12.5 kW/m2	37.5 kW/m2	4 kW/m2	12.5 kW/m 2	37.5 kW/m 2
IS 03	IS 03a	Category 1.5/F	25	NR	NR	4	8	37	30	n/a	NR	NR	NR
		Category 5/D	20	18	NR	4	6	38	32	n/a	NR	NR	NR
	IS 03b	Category 1.5/F	100	91	NR	19	30	46	38	n/a	NR	NR	NR
		Category 5/D	81	68	NR	19	27	48	42	n/a	NR	NR	NR
	IS 03c	Category 1.5/F	184	162	NR	31	46	64	56	n/a	12	7	4
		Category 5/D	149	121	NR	30	50	69	62	n/a	12	7	4
	IS 03d	Category 1.5/F	379	323	NR	54	67	23	18	n/a	12	7	4
		Category 5/D	319	252	NR	57	87	22	19	n/a	12	7	4
IS 04	IS 04a	Category 1.5/F	1	NR	NR	1	1	NR	NR	NR	NR	NR	NR
		Category 5/D	2	NR	NR	1	1	NR	NR	NR	NR	NR	NR
	IS 04b	Category 1.5/F	8	6	3	3	6	NR	NR	NR	NR	NR	NR
		Category 5/D	8	7	NR	3	4	NR	NR	NR	NR	NR	NR
	IS 04c	Category 1.5/F	15	12	6	6	12	NR	NR	NR	NR	NR	NR
		Category 5/D	16	14	10	5	8	NR	NR	NR	NR	NR	NR
	IS 04d	Category 1.5/F	43	32	24	21	50	NR	NR	NR	NR	NR	NR
		Category 5/D	45	37	32	17	47	NR	NR	NR	NR	NR	NR
IS 05	IS 05a	Category 1.5/F	2	NR	NR	1	1	NR	NR	NR	NR	NR	NR

Isolable Section	Scenario	Weather	Jet Fire Downwind Hazard (m)			Flash Fire Downwind hazard (m)		Pool Fire Downwind Hazard (m)			Fire Ball Hazard (m)		
			4 kW/m2)	12.5 kW/m2	37.5 kW/m2	LFL	LFL Fraction	4 kW/m2)	12.5 kW/m2	37.5 kW/m2	4 kW/m2	12.5 kW/m 2	37.5 kW/m 2
		Category 5/D	2	NR	NR	1	1	NR	NR	NR	NR	NR	NR
	IS 05b	Category 1.5/F	7	6	5	3	6	NR	NR	NR	NR	NR	NR
		Category 5/D	7	6	4	3	5	NR	NR	NR	NR	NR	NR
	IS 05c	Category 1.5/F	15	13	11	7	14	NR	NR	NR	NR	NR	NR
		Category 5/D	15	13	12	6	11	NR	NR	NR	NR	NR	NR
	IS 05d	Category 1.5/F	48	38	30	25	57	NR	NR	NR	NR	NR	NR
		Category 5/D	48	39	33	23	60	NR	NR	NR	NR	NR	NR
IS 06	IS 06a	Category 1.5/F	2	NR	NR	1	1	NR	NR	NR	NR	NR	NR
		Category 5/D	2	NR	NR	1	1	NR	NR	NR	NR	NR	NR
	IS 06b	Category 1.5/F	6	5	3	3	6	NR	NR	NR	NR	NR	NR
		Category 5/D	6	5	3	3	5	NR	NR	NR	NR	NR	NR
	IS 06c	Category 1.5/F	12	10	9	6	12	NR	NR	NR	NR	NR	NR
		Category 5/D	12	11	7	5	9	NR	NR	NR	NR	NR	NR
	IS 06d	Category 1.5/F	39	31	25	22	45	NR	NR	NR	NR	NR	NR
		Category 5/D	39	33	27	20	49	NR	NR	NR	NR	NR	NR
IS 07	IS 07a	Category 1.5/F	25	NR	NR	5	8	23	18	NR	NR	NR	NR
		Category 5/D	20	18	NR	4	6	22	19	NR	NR	NR	NR
	IS 07b	Category	100	91	NR	19	38	64	48	NR	NR	NR	NR

Isolable Section	Scenario	Weather	Jet Fire Downwind Hazard (m)			Flash Fire Downwind hazard (m)		Pool Fire Downwind Hazard (m)			Fire Ball Hazard (m)		
			4 kW/m2)	12.5 kW/m2	37.5 kW/m2	LFL	LFL Fraction	4 kW/m2)	12.5 kW/m2	37.5 kW/m2	4 kW/m2	12.5 kW/m 2	37.5 kW/m 2
		1.5/F											
		Category 5/D	81	68	NR	18	29	62	50	NR	NR	NR	NR
	IS 07c	Category 1.5/F	184	162	NR	33	46	81	61	NR	NR	NR	NR
		Category 5/D	149	121	NR	30	66	81	66	NR	NR	NR	NR
	IS 07d	Category 1.5/F	378	323	NR	62	101	103	82	NR	28	16	8
		Category 5/D	319	251	NR	58	124	108	90	NR	28	16	8

Scenario	Weather	Overpressure level [bar]	Maximum distance [m]
IS 01b	Category 1.5/F	0.02068 0.1379 0.2068	104.436 60.58 57.9324
	Category 5/D	0.02068 0.1379 0.2068	81.5303 40.0153 37.5091
IS 01c	Category 1.5/F	0.02068 0.1379 0.2068	257.932 146.808 140.1
	Category 5/D	0.02068 0.1379 0.2068	153.928 94.3683 90.7728
IS 01d	Category 1.5/F	0.02068 0.1379 0.2068	1054.34 527.176 495.352
	Category 5/D	0.02068 0.1379 0.2068	476.376 310.111 300.073
IS 02b	Category 1.5/F	0.02068 0.1379 0.2068	142.915 84.1715 80.6252
	Category 5/D	0.02068 0.1379 0.2068	119.897 71.6414 68.7283
IS 02c	Category 1.5/F	0.02068 0.1379 0.2068	281.087 175.478 169.102
	Category 5/D	0.02068	237.205

Scenario	Weather	Overpressure level [bar]	Maximum distance [m]
		0.1379 0.2068	142.78 137.079
IS 02d	Category 1.5/F	0.02068 0.1379 0.2068	1000.59 492.559 461.89
	Category 5/D	0.02068 0.1379 0.2068	538.619 346.377 334.772
IS 03b	Category 1.5/F	0.02068 0.1379 0.2068	83.212 40.3421 37.7541
	Category 5/D	0.02068 0.1379 0.2068	82.7132 40.2452 37.6814
IS 03c	Category 1.5/F	0.02068 0.1379 0.2068	96.1672 50.9165 48.1848
	Category 5/D	0.02068 0.1379 0.2068	115.407 62.7123 59.5312
IS 03d	Category 1.5/F	0.02068 0.1379 0.2068	147.978 77.0992 72.8203
	Category 5/D	0.02068 0.1379	155.017 86.8142

Scenario	Weather	Overpressure level [bar]	Maximum distance [m]
		0.2068	85.1091
IS 04c	Category 1.5/F	0.02068 0.1379 0.2068	25.3024 12.9741 12.2299
IS 04d	Category 1.5/F	0.02068 0.1379 0.2068	89.3975 49.6007 47.1983
	Category 5/D	0.02068 0.1379 0.2068	83.2897 48.4136 46.3082
IS 05c	Category 1.5/F	0.02068 0.1379 0.2068	28.0496 13.5081 12.6302
	Category 5/D	0.02068 0.1379 0.2068	26.1588 13.1406 12.3547
IS 05d	Category 1.5/F	0.02068 0.1379 0.2068	111.121 61.8792 58.9066
	Category 5/D	0.02068 0.1379 0.2068	104.391 60.5712 57.9259
IS 06c	Category 1.5/F	0.02068 0.1379 0.2068	26.6376 13.2336 12.4245
IS 06d	Category 1.5/F	0.02068 0.1379 0.2068	95.4298 50.7732 48.0773

Scenario	Weather	Overpressure level [bar]	Maximum distance [m]
	Category 5/D	0.02068 0.1379 0.2068	88.1421 49.3567 47.0153
IS 07b	Category 1.5/F	0.02068 0.1379 0.2068	94.4901 50.5905 47.9404
	Category 5/D	0.02068 0.1379 0.2068	81.8981 40.0868 37.5627
IS 07c	Category 1.5/F	0.02068 0.1379 0.2068	121.066 71.8685 68.8986
	Category 5/D	0.02068 0.1379 0.2068	137.395 83.0986 79.8208
IS 07d	Category 1.5/F	0.02068 0.1379 0.2068	190.923 117.671 113.249
	Category 5/D	0.02068 0.1379 0.2068	210.927 137.672 133.25

Consequence Contours – Worst Case

IS 01d -Ammonia Double walled Storage Tank (Typical – 1000MT)

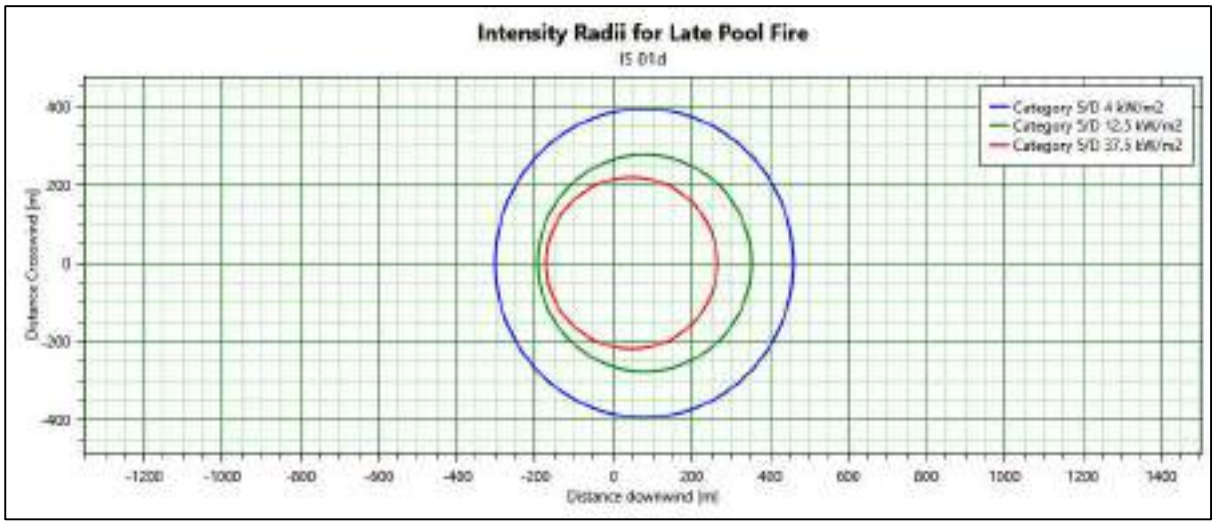


Figure 7.7: Intensity Radii for late Pool Fire

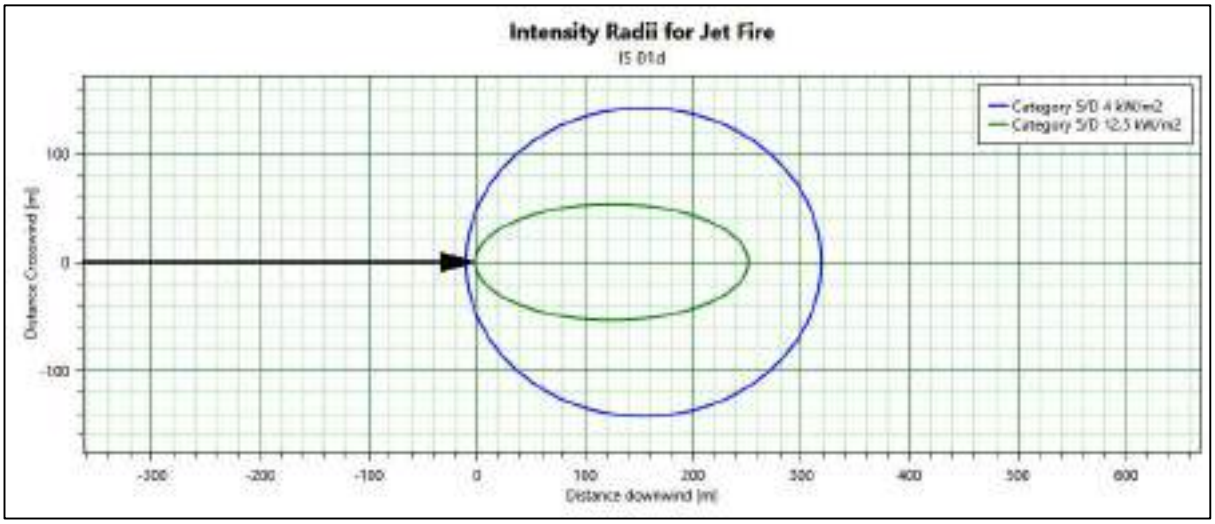


Figure 7.8: Intensity Radii for Jet Fire

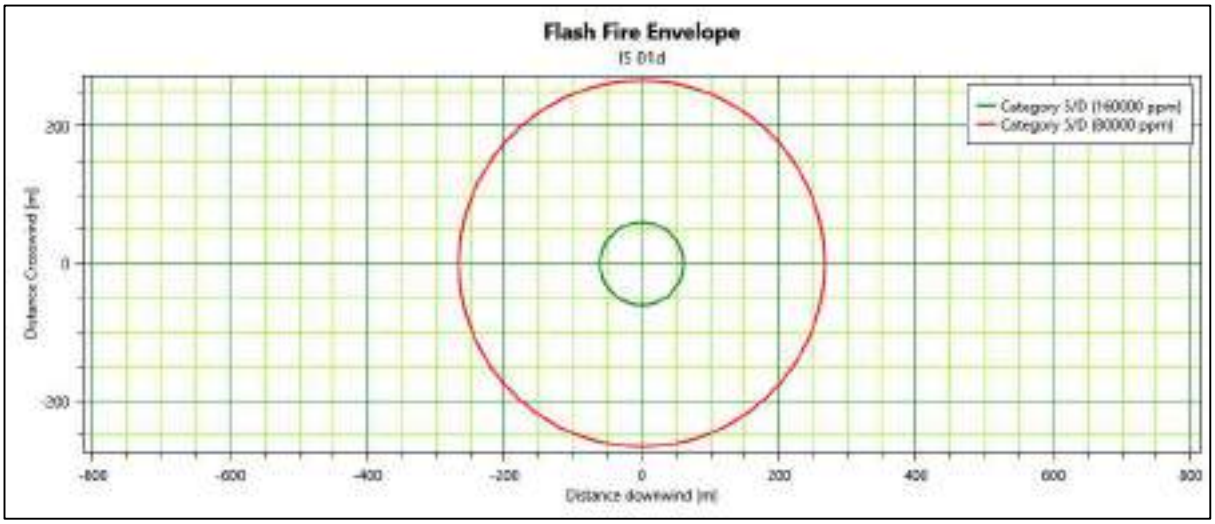


Figure 7.9: Flash Fire envelop

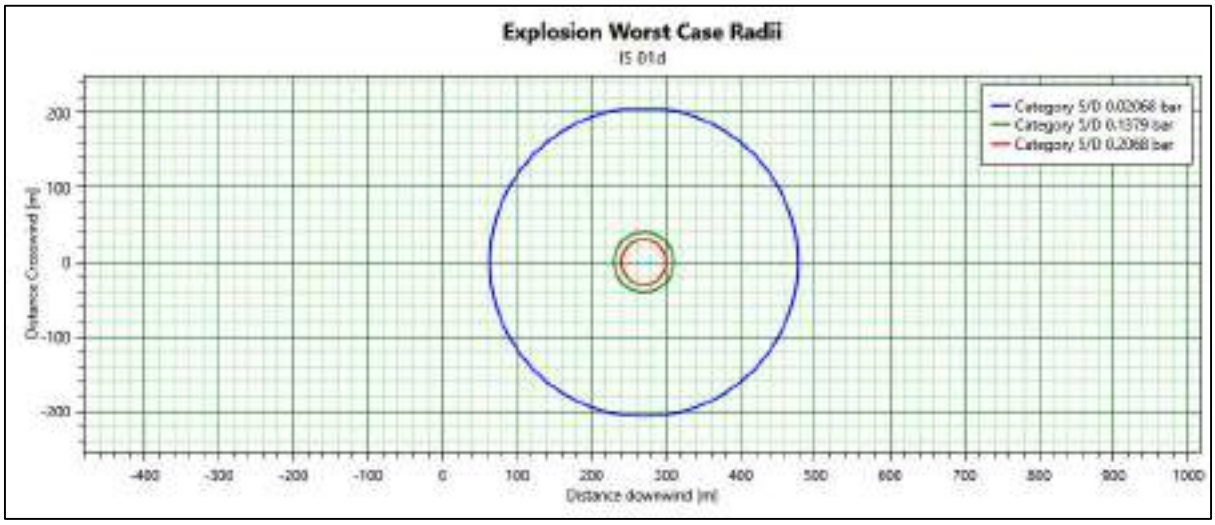


Figure 7.10: Explosion Worst Case Radii

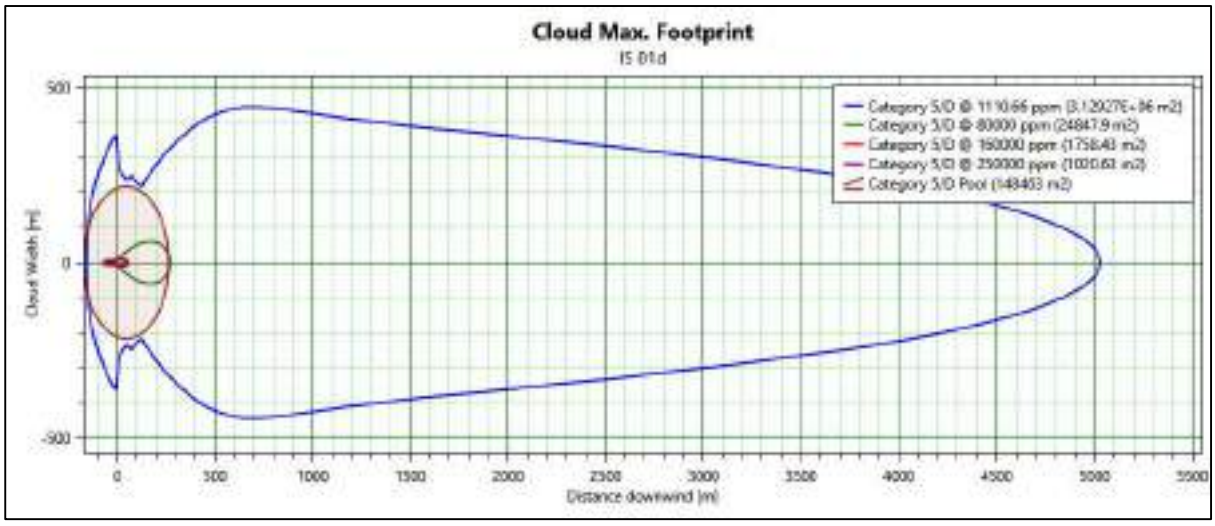


Figure 7.11: Cloud Max. Footprint

IS 02D- AMMONIA DOUBLE WALLED STORAGE TANK (TYPICAL – 100MT)

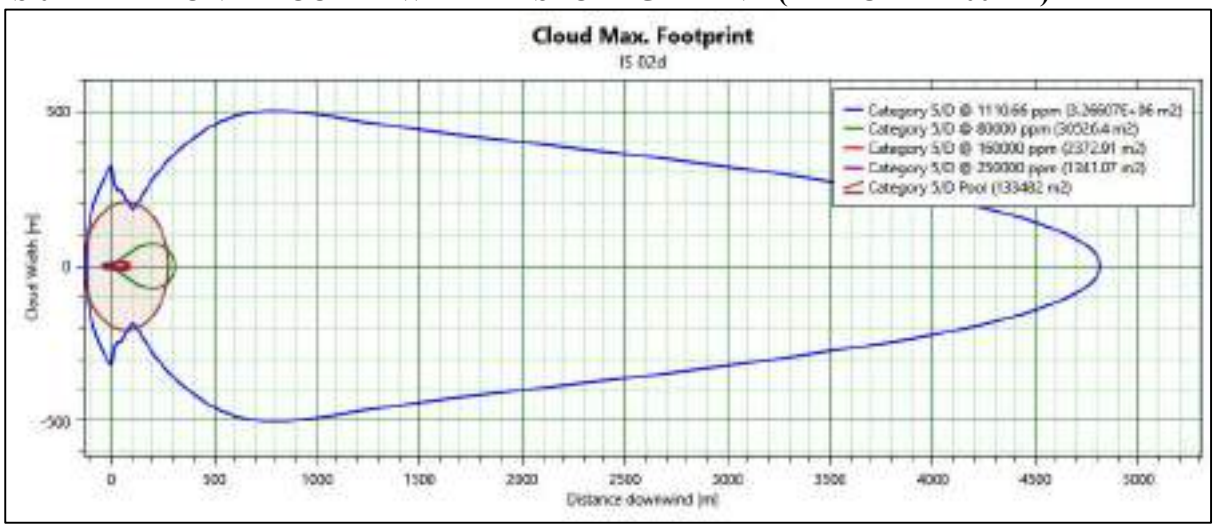


Figure 7.12: Cloud Max. Footprint

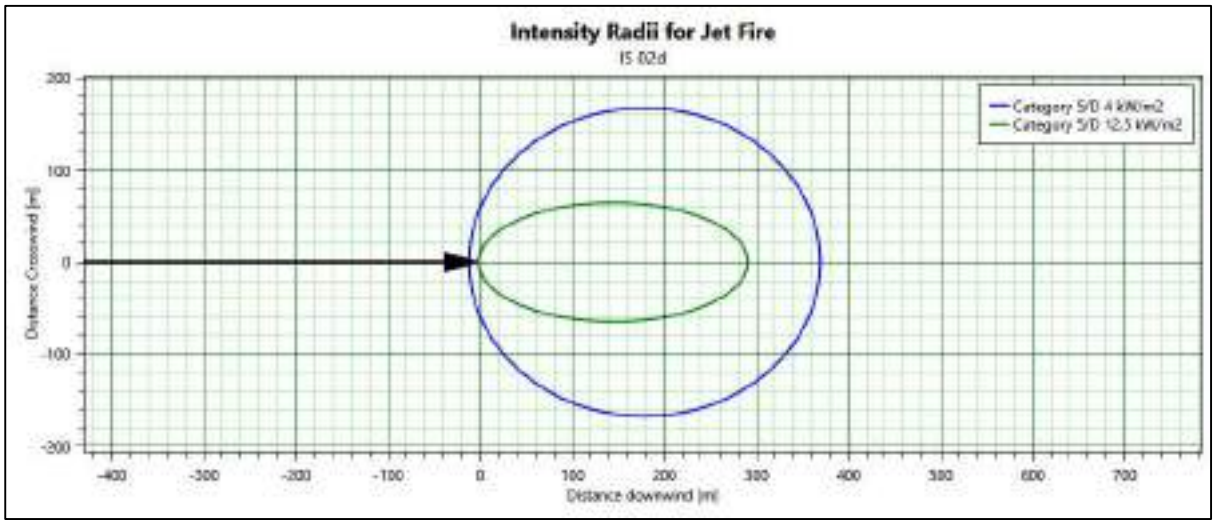


Figure 7.13: Intensity Radii for Jet Fire

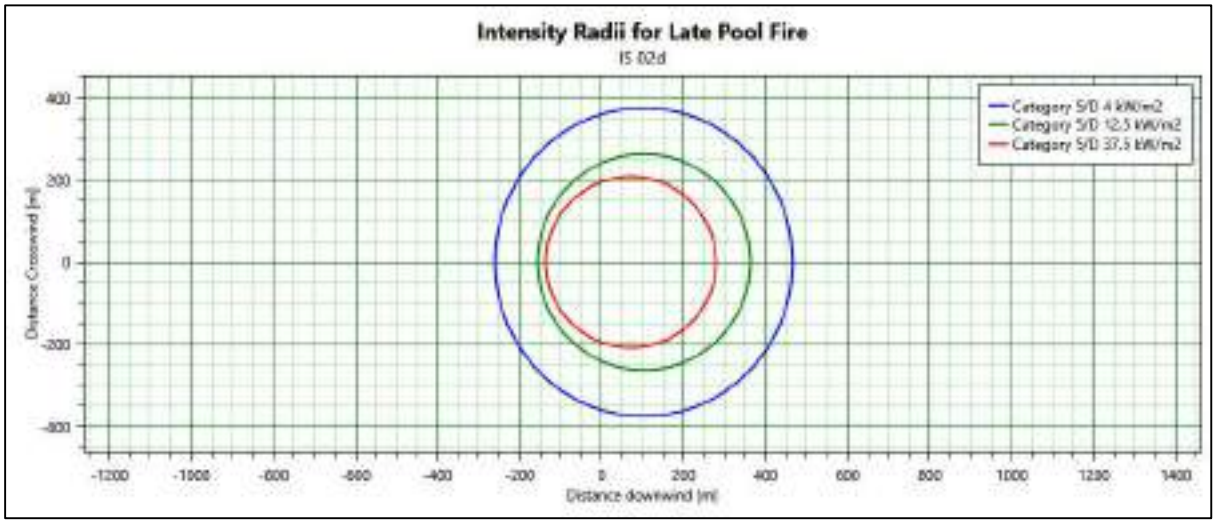


Figure 7.14: Intensity Radii for Late Pool Fire

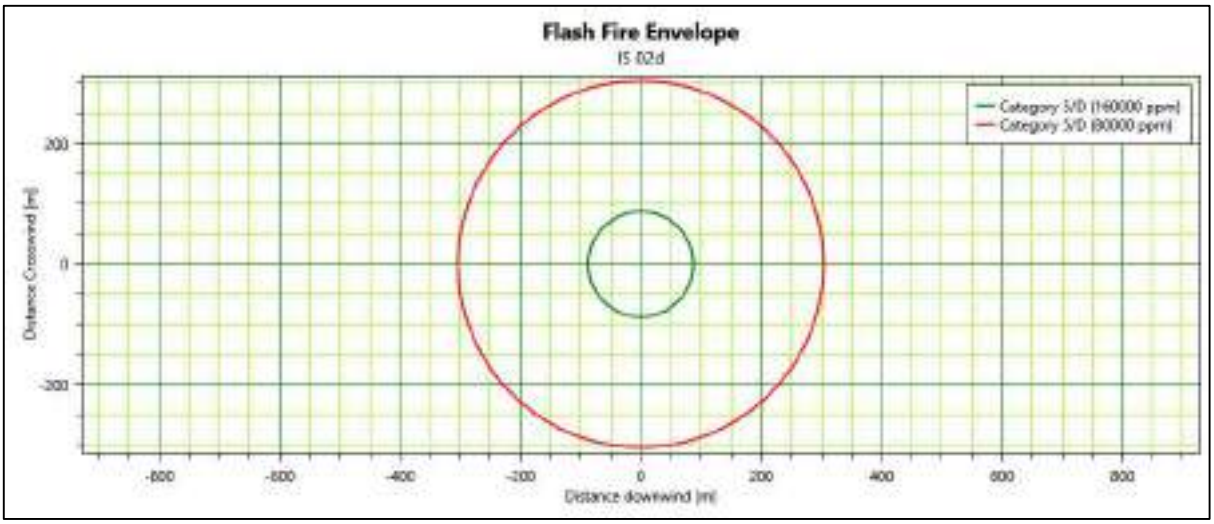


Figure 7.15: Flash Fire Envelop

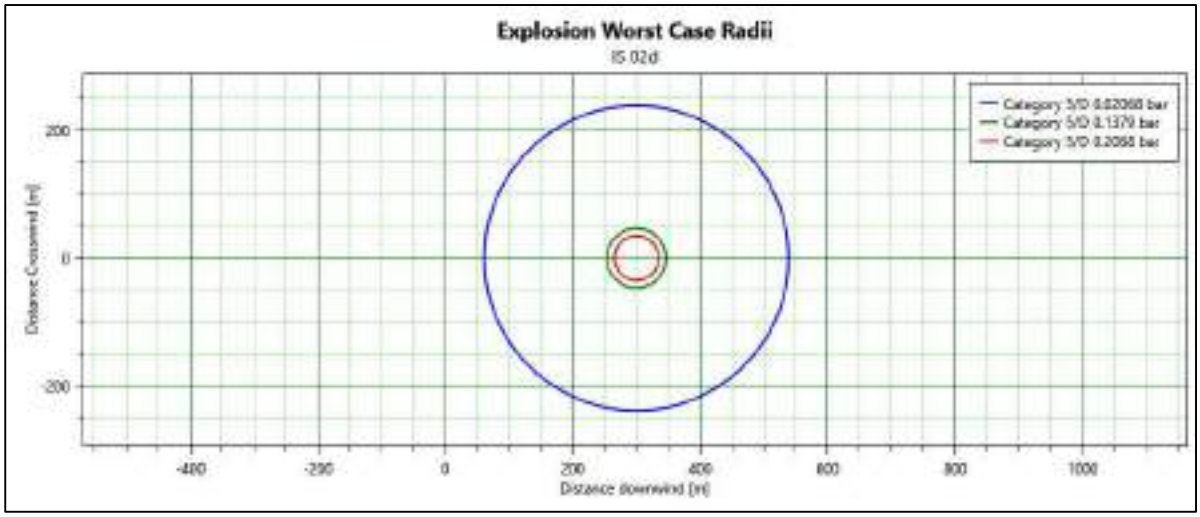


Figure 7.16: Flash Fire Envelop

IS 03D - AMMONIA COMPRESSION CIRCUIT

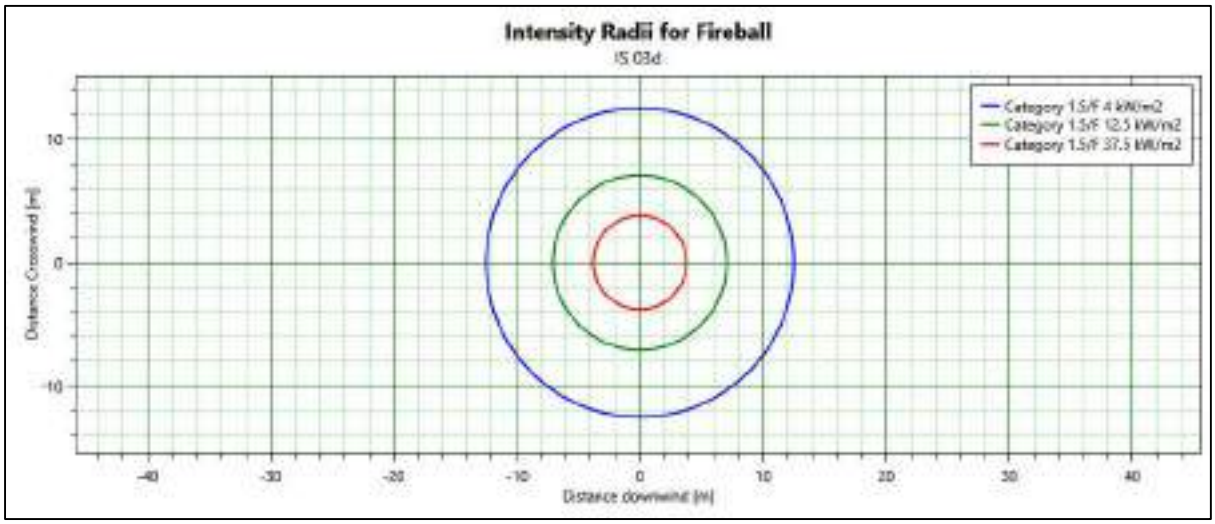


Figure 7.17: Intensity Radii for Fireball

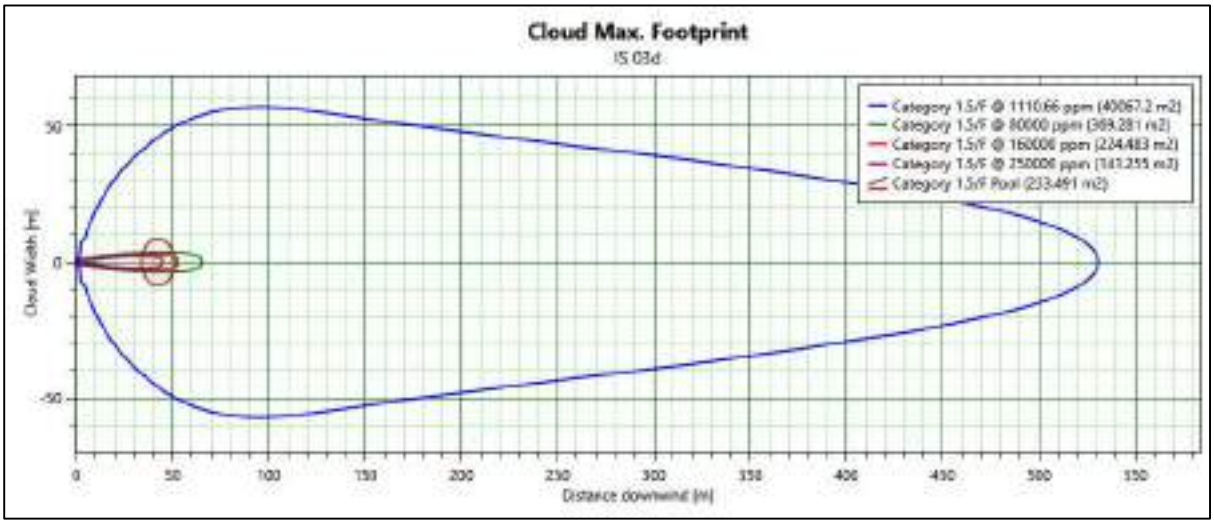


Figure 7.18: Cloud Max. Footprint

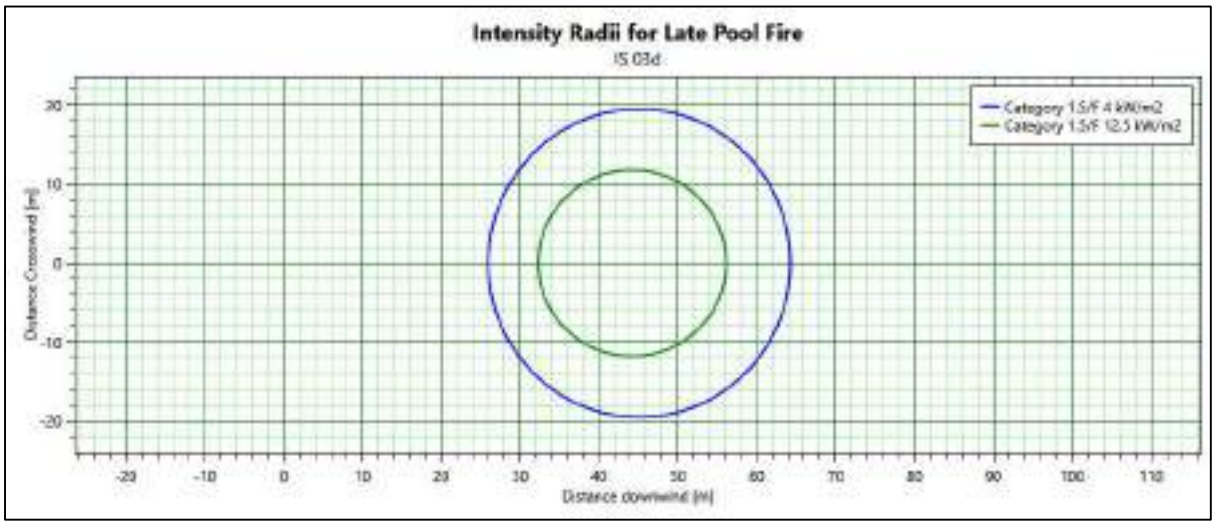


Figure 7.19: Intensity Radii for Late Pool Fire

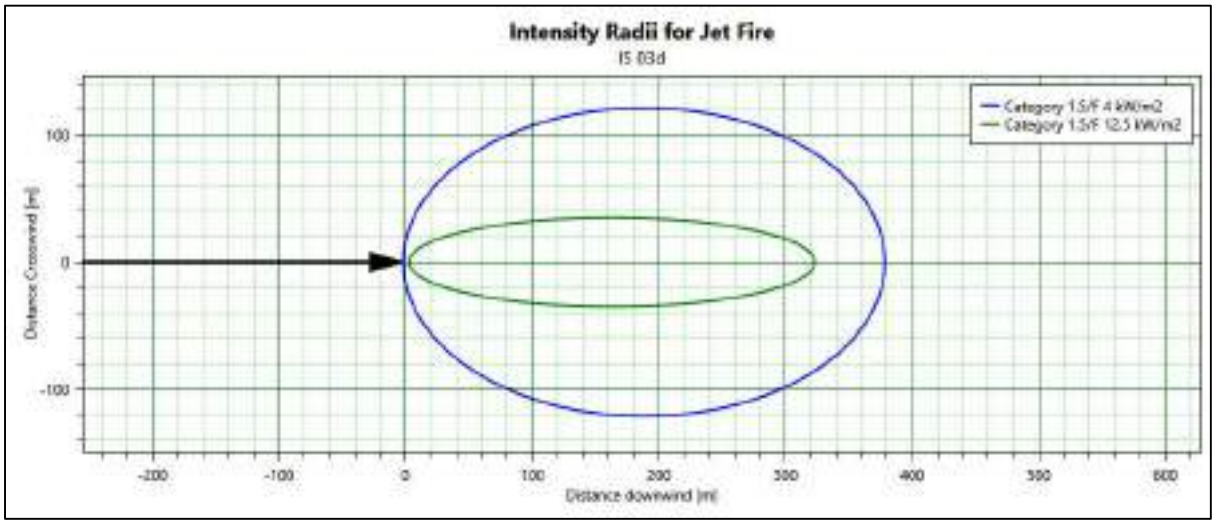


Figure 7.20: Intensity Radii for Jet Fire

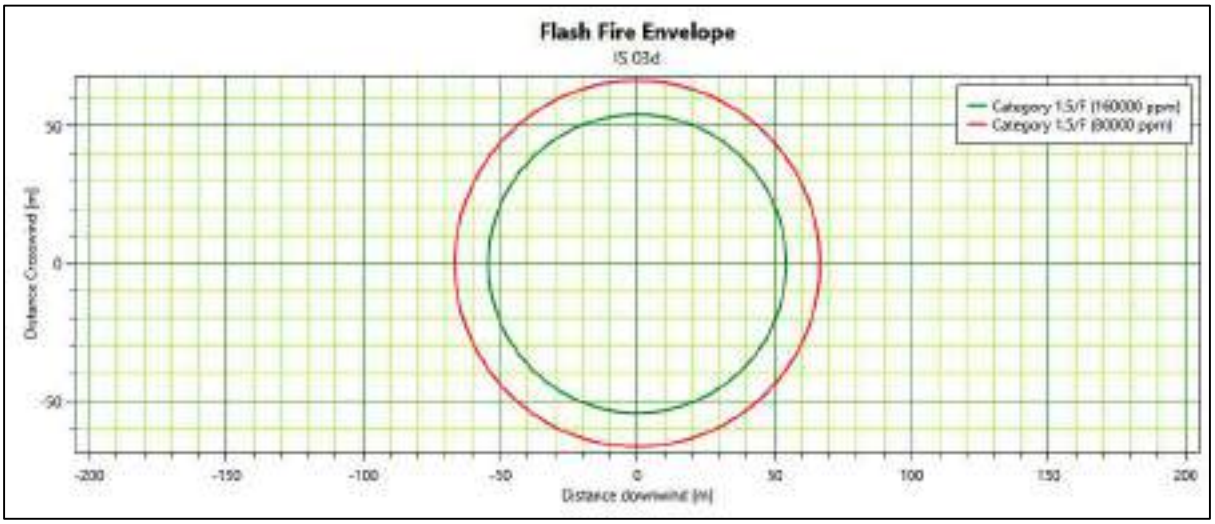


Figure 7.21: Flash Fire Envelop

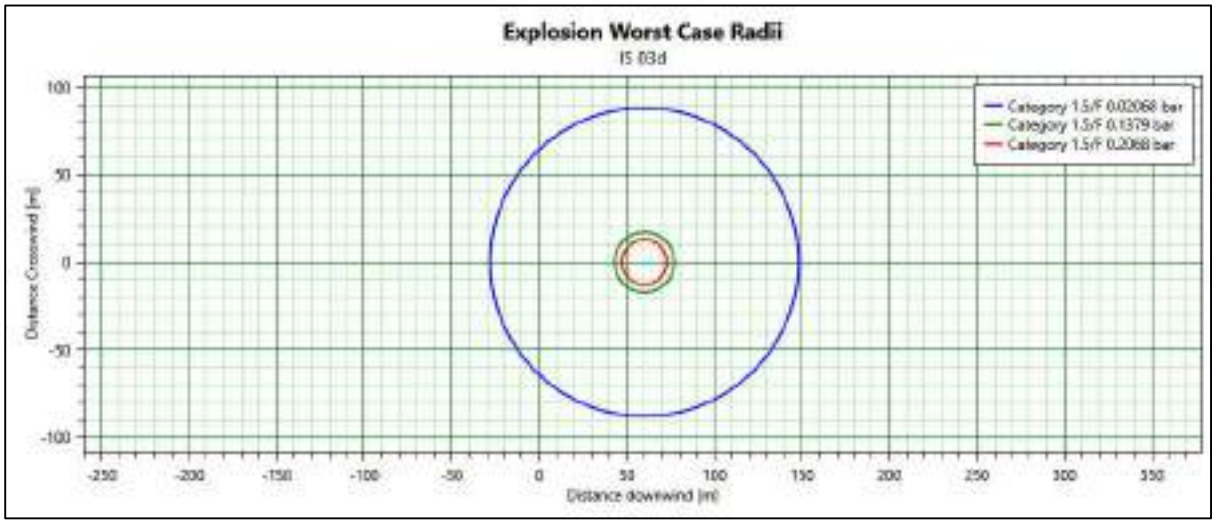


Figure 7.21: Explosion Worst Case Radii

IS 04D- ETHYLENE DIOXIDE PROCESS CIRCUIT IN VINYL SULPHONE PLANT

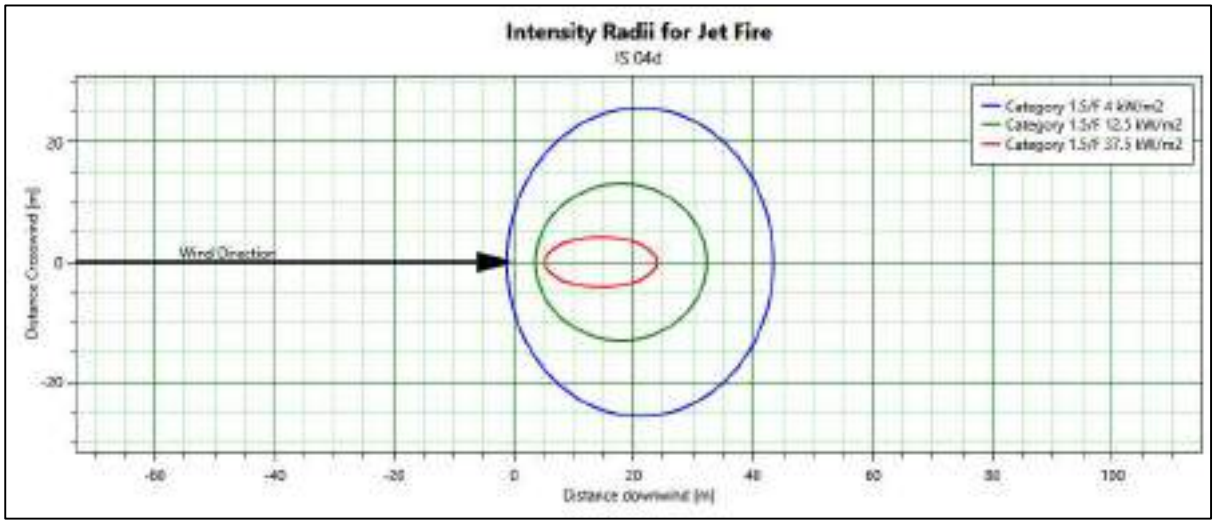


Figure 7.22: Intensity Radii for Jet Fire

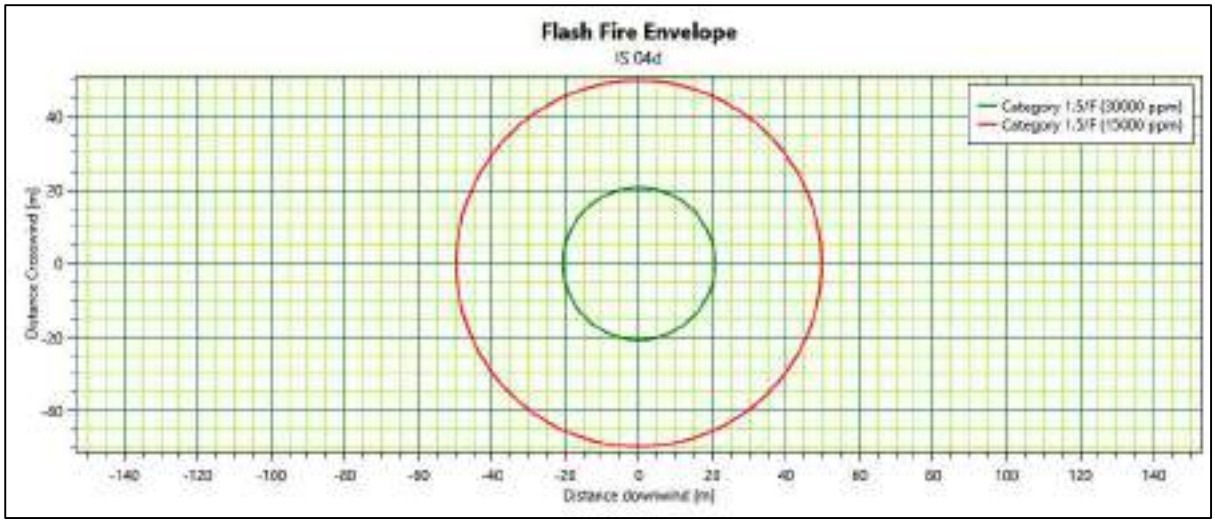


Figure 7.23: Flash Fire Envelop

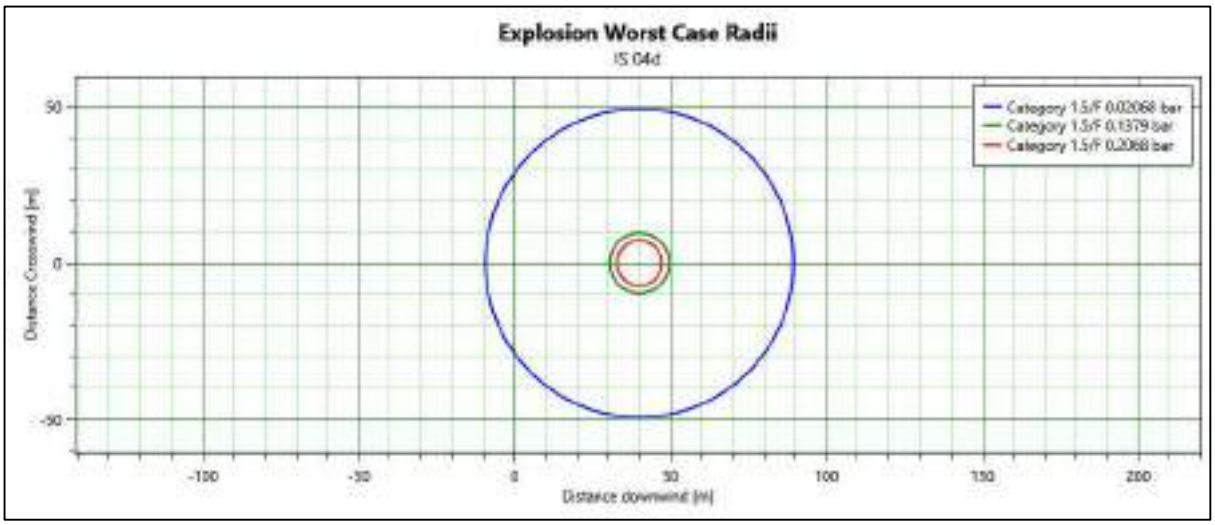


Figure 7.24: Explosion Worst Case Radii

IS 05D- NATURAL GAS STORAGE AND PROCESS CIRCUIT

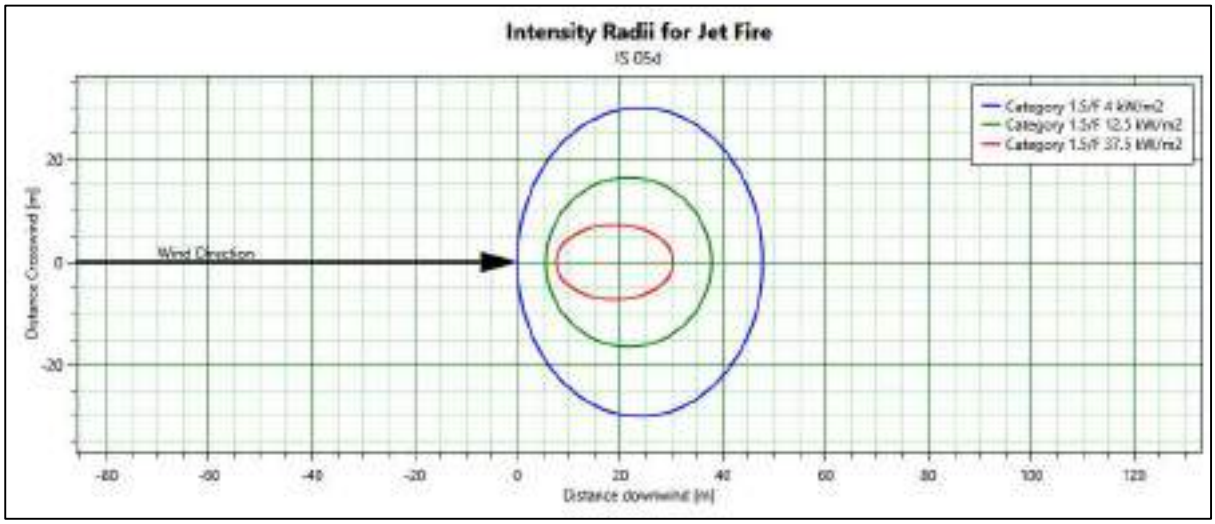


Figure 7.25: Intensity Radii for Jet Fire

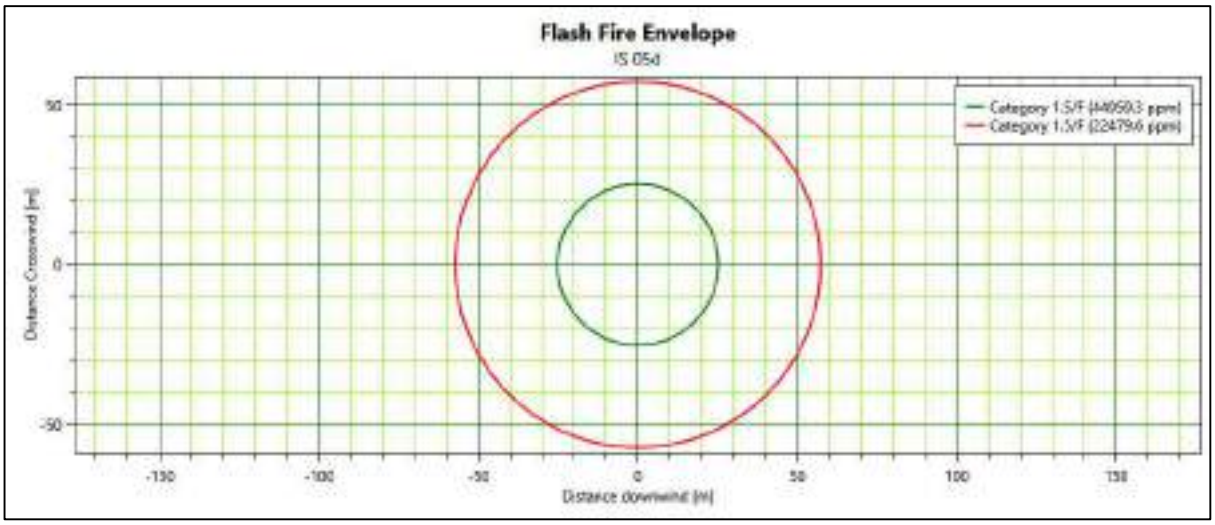


Figure 7.26: Flash Fire Envelop

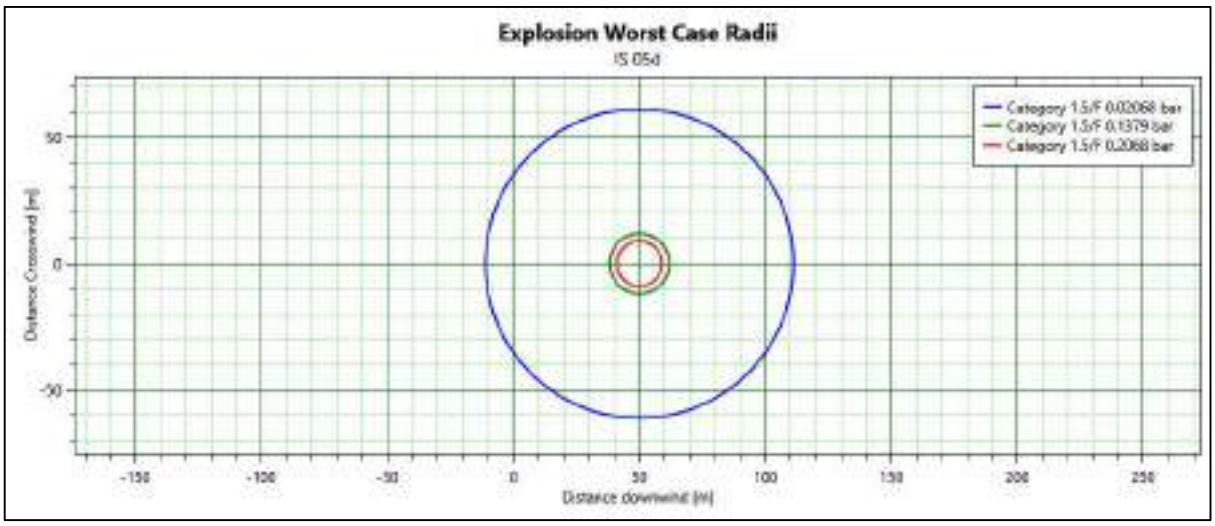


Figure 7.27: Explosion Worst Case Radii

IS 06D- METHANE MS TANK DOME TYPE 1000 MT AND PROCESS CIRCUIT

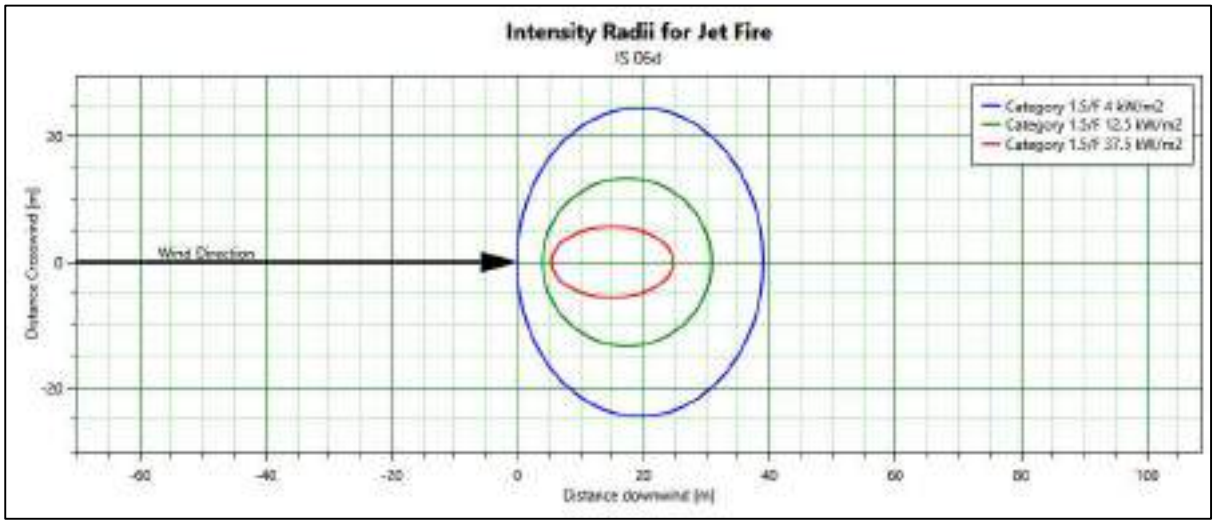


Figure 7.28: Intensity Radii fore Jet Fire

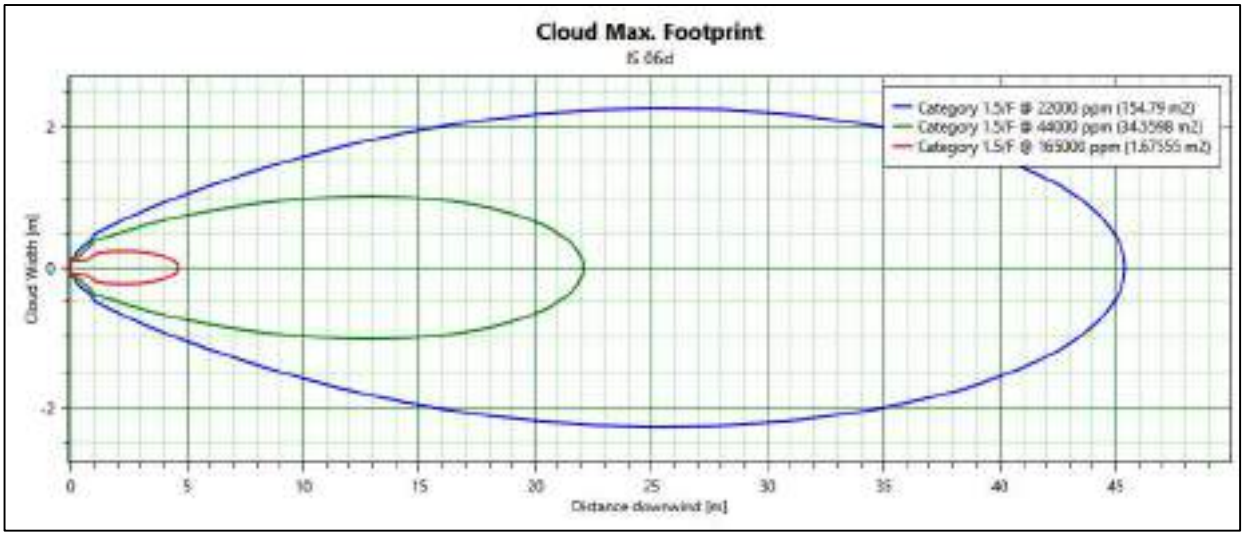


Figure 7.29: Cloud Max. Footprint

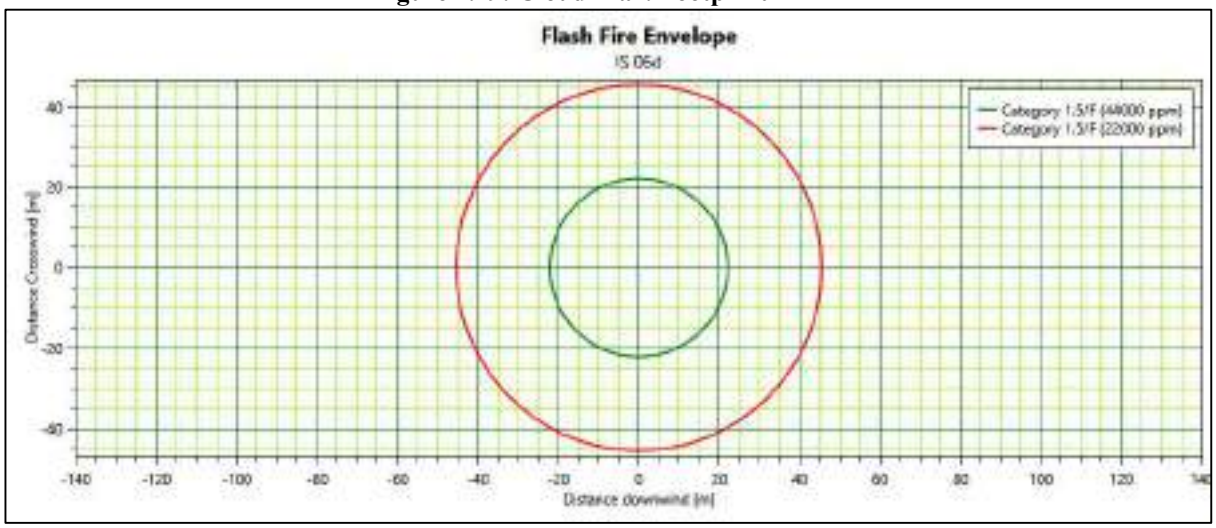


Figure 7.30: Flash Fire Envelop

IS 07D- AMMONIA CIRCUIT IN NITRIC ACID PLANT

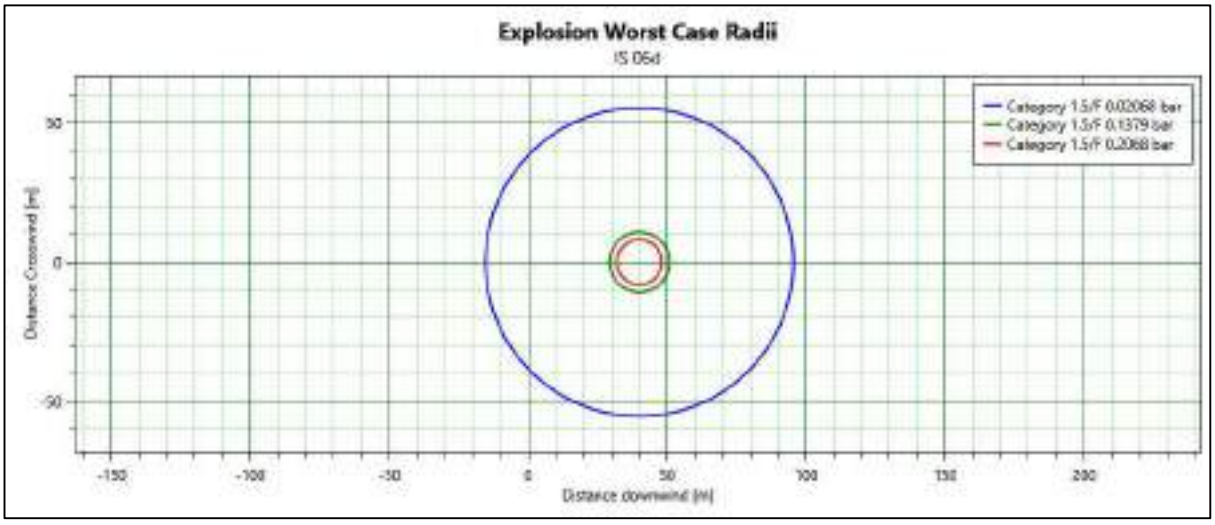


Figure 7.31: Explosion Worst Case Radii

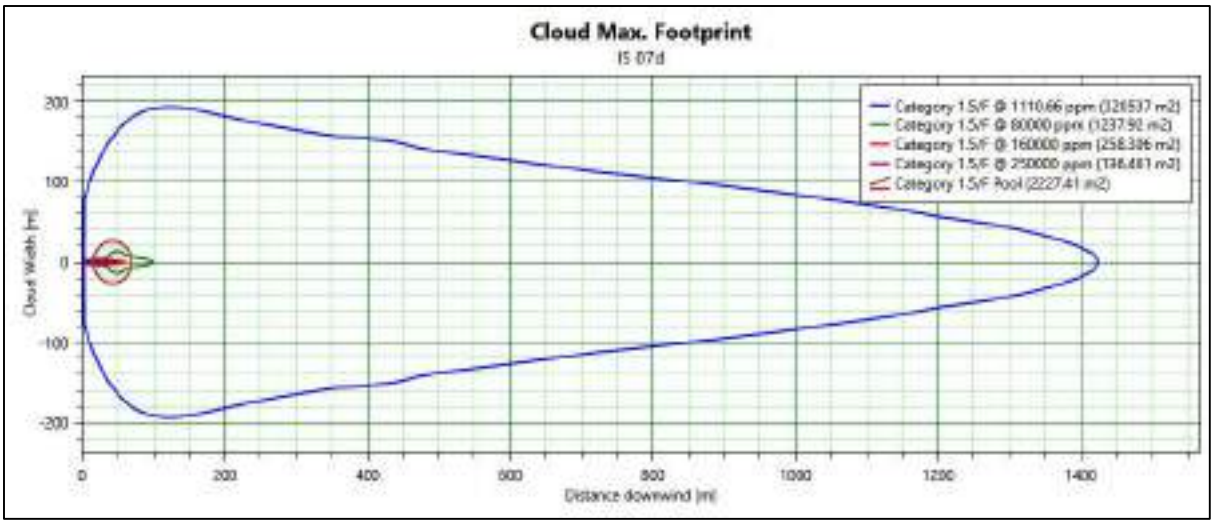


Figure 7.32: Cloud Max Footprint

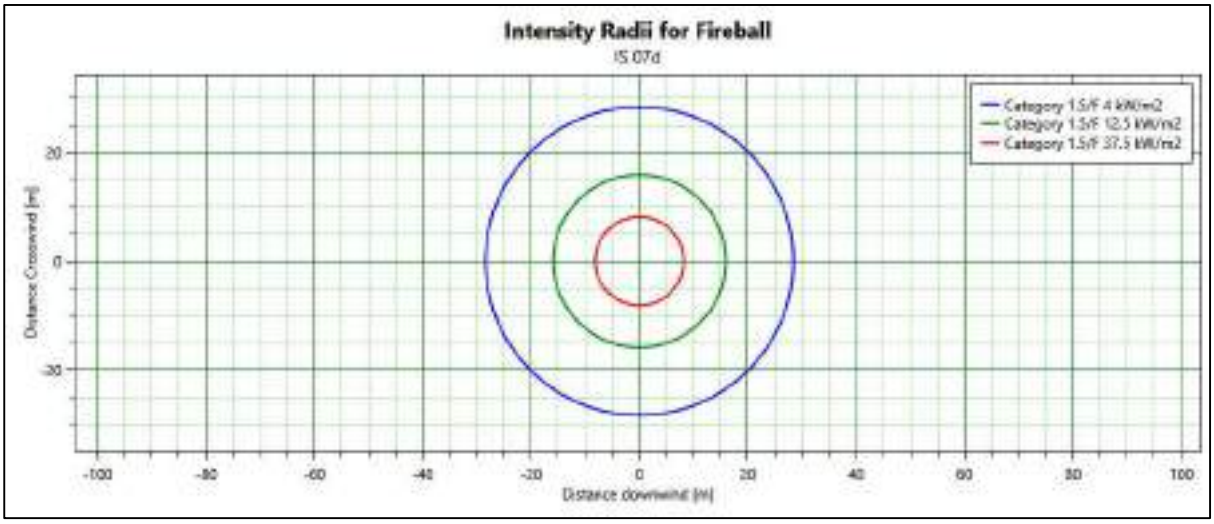


Figure 7.33: Intensity Radii For Fireball

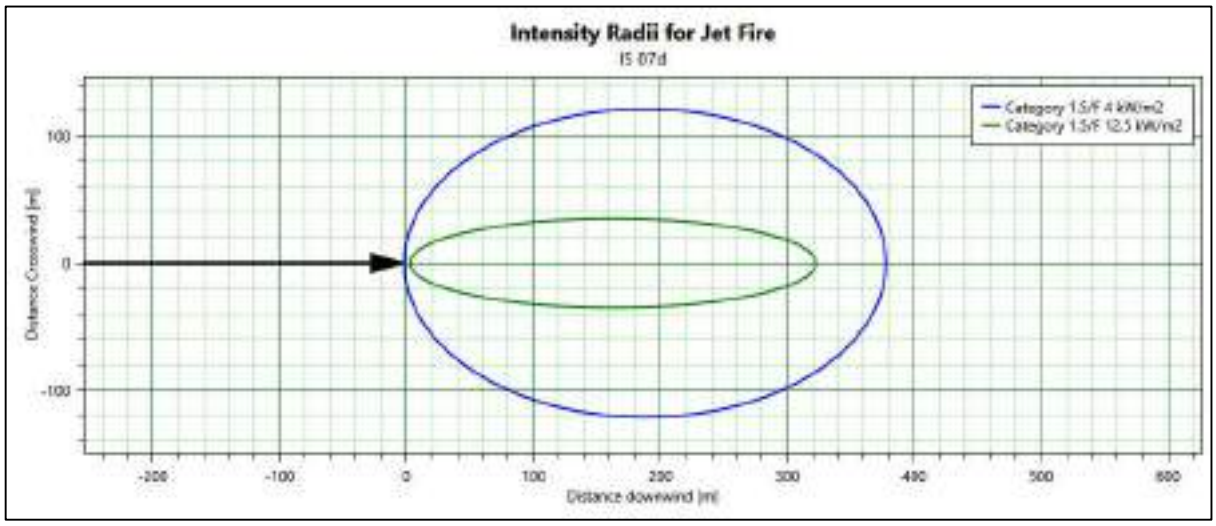


Figure 7.34: Intensity Radii for Jet Fire

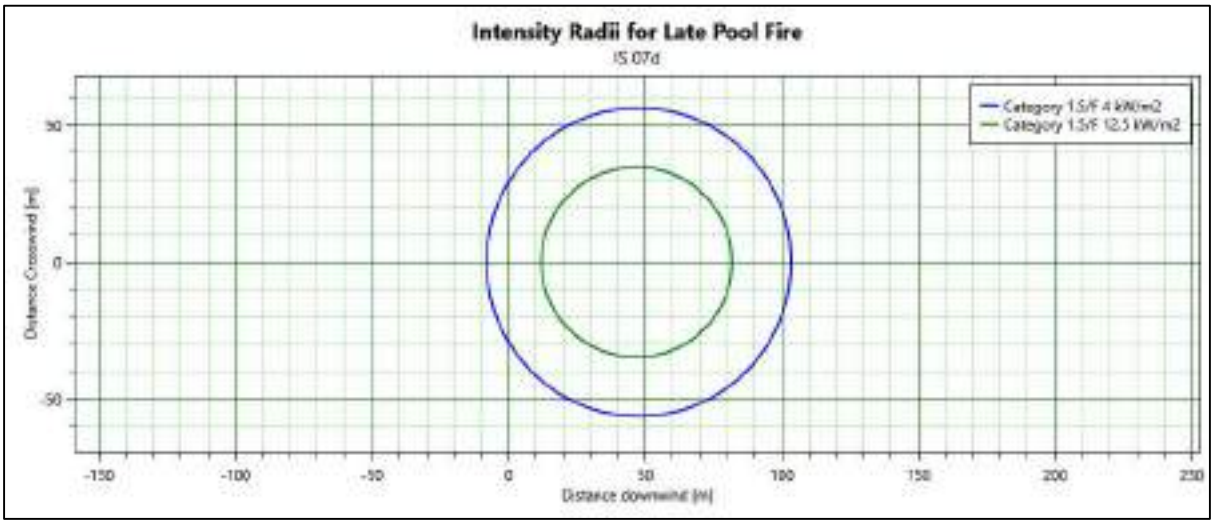


Figure 7.35: Intensity Radii for Late Pool Fire

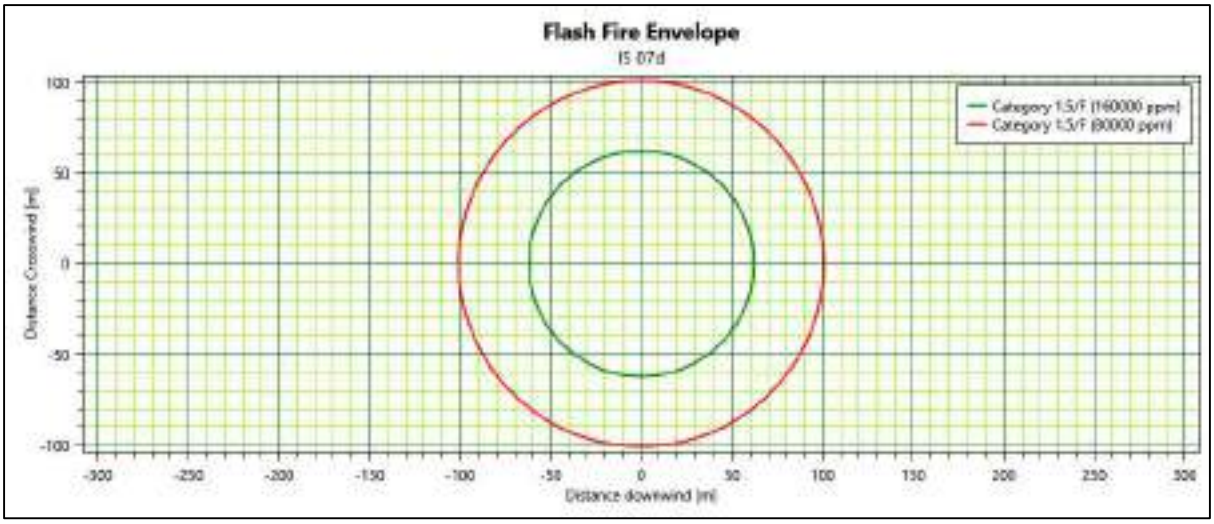


Figure 7.36: Flash Fire Envelop

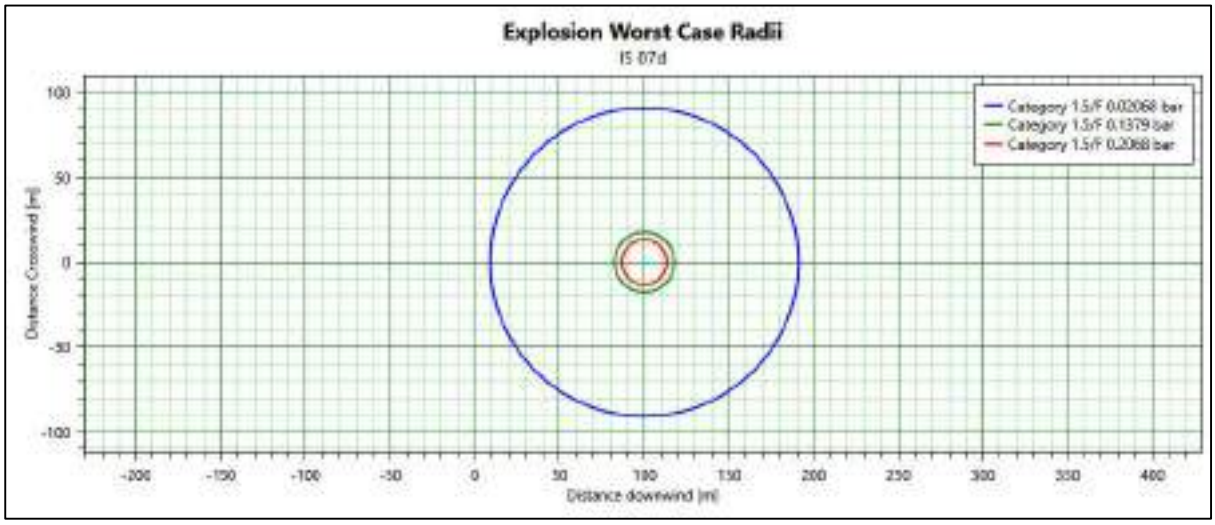


Figure 7.37: Explosive Worst Case Radii

7.10 DISASTER MANAGEMENT PLAN

7.10.1 Introduction

A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life. DMP is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of DMP, it should be widely circulated and a personnel training is to be provided through rehearsals/drills.

7.10.2 Objective of Disaster Management Plan

The objective of DMP is to make use of the combined resources of the plant and the outside services to achieve the following:

- Effective rescue and medical treatment of casualties
- Safeguard other people Minimize damage to property and the environment
- Initially contain and ultimately bring the incident under control
- Identify any dead Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area
- Preserve relevant records and equipments

7.10.3 Emergencies

I. General, Industrial, Emergencies

The emergencies that could be envisaged in the plant and fuel storage are as follows:

- A situation of fire at the tank farm of all storages;
- Slow isolated fires;
- Fast spreading fires;
- Structural failures;
- Contamination of food/water; and
- Sabotage/Social disorder.

II. Specific Emergencies Anticipated

Fire and Explosion Fire consequences can be disastrous, since they involve huge quantities of fuel either stored or in dynamic inventory in pipe lines or in nearby areas. Preliminary hazard analysis has provided a basis for consequence estimation. Estimation can be made by using various pool fire, tank fire consequence calculations. During the study of Risk Assessment, the nature of damages is worked out and probability of occurrence of such hazards is also drawn up.

7.10.4 Emergency Organization

The industry has setup an Emergency Organization. A senior executive who has control over the affairs of the plant should lead the Emergency Organization. He shall be designated as Site Controller. General Manager [O & M] shall be designated as the Incident Controller. In the case of stores, utilities, open areas, which are not under the control of the Production Heads, Senior Executive responsible for maintenance of utilities would be designated as Incident Controller. All the Incident Controllers would be reporting to the Site Controller. Each Incident Controller, for himself, organizes a team responsible for controlling the incidence with the personnel under his control. Shift In-charge would be the reporting officer, who would bring the incidence to the notice of the Incidence

Controller and Site Controller. Emergency Co-ordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and provide essential and support services. For this purposes, Security In-charge, Personnel Department, Essential services personnel would be engaged. All these personnel would be designated as Key personnel. In each shift, electrical supervisor, electrical fitters, pump house in-charge, and other maintenance staff would be drafted for emergency operations. In the event of power or communication system failure, some of staff members in the office/plant offices would be drafted and their services would be utilized as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

I. Emergency Communication

Whoever notices an emergency situation such as fire, growth of fire, leakage etc would inform his immediate superior and Emergency Control Center. A place nearer to the Gate House Complex shall be identified as Emergency Control Center. The person on duty in the Emergency Control Center would appraise the Site Controller. Site Controller verifies the Whoever notices an emergency situation such as fire, growth of fire, leakage etc would inform his immediate superior and Emergency Control Center. A place nearer to the Gate House Complex shall be identified as Emergency Control Center. The person on duty in the Emergency Control Center would appraise the Site Controller. Site Controller verifies the situation from the Incident Controller of that area or the Shift In-charge and takes a decision about an impending On Site Emergency. This would be communicated to all the Incident Controllers, Emergency coordinators. Simultaneously, the emergency warning system would be activated on the instructions of the Site Controller.

II. Emergency Responsibilities

Site Controller

On receiving information about emergency, he would rush to Emergency Control Center (ECC) and take charge of ECC and the situation. His responsibilities would be as indicated below:

- Ensures proper coordination between Operation & Service wings of the Emergency management team.
- Takes care of all communications with the higher management.
- Informs adjacent factories.
- Instructs the Emergency Operations Coordinator regarding the control of hazard situation.

- Informs the Off-Site Emergency Coordinator if the emergency is going to be Off-Site.
- Instructs the Emergency Services Coordinator regarding rescue operations.
- Instructs communication officer to obtain Mutual Aid, inform District Authorities.
- Ensures that the Police, Pollution Control Board and Director of Factories have been informed.

Incident Controller

- Assembles the incident control team.
- Directs the shutting down and evacuation of plant and areas likely to be adversely affected by the emergency;
- Ensures that key personnel help is sought;
- Provides advice and information to the Fire and Security Officer and the Local Fire Services as and when they arrive;
- Ensures that all non-essential workers/staff of the affected areas are evacuated to the appropriate assembly points, and the areas are searched for casualties;
- Has regard to the need for preservation of evidence so as to facilitate any inquiry into the causes and circumstances, which caused or escalated the emergency;
- Co-ordinates with emergency services at the site;
- Provides tools and safety equipment to the team members;
- Keeps in touch with the team and advices them regarding the method of control to be used; and
- Keeps the Site Controller of Emergency informed of the progress being made

III. Emergency Coordinator - Rescue, Fire Fighting

- On knowing about emergency, rushes to ECC;
- Helps the Incident Controller in containment of the emergency;
- Ensure fire pumps are in operating condition and instructs pump house operator to ready for any emergency with standby arrangement;
- Guides the fire fighting crew i.e. firemen, trained plant personnel and security staff;
- Organizes shifting the fire fighting facilities to the emergency site, if required;
- Takes guidance of the Incident Controller for firefighting as well as assesses the requirements of outside help;
- Arranges to control the traffic at the gate and the incident area;

- Directs the security staff to the incident site to take part in the emergency operations under his guidance and supervision;
- Evacuates the people in the plant or in the nearby areas as advised by Site Controller;
- Searches for casualties and arranges proper aid for them;
- Assembles search and evacuation team;
- Arranges for safety equipment for the members of this team;
- Decides which paths the evacuated workers should follow; and
- Maintains law and order in the area, and if necessary seeks the help of police

IV. Emergency Coordinator-Medical, Mutual Aid, Rehabilitation, Transport and Communication.

- In the event of failure of electric supply and thereby internal telephone, sets up communication point and establishes contact with the ECC;
- Organizes medical treatment to the injured and if necessary, will shift the injured to nearby hospitals; Mobilizes extra medical help from outside, if necessary;
- Keeps a list of qualified first aid providers for the plant and seeks their assistance;
- Maintains first aid and medical emergency requirements;
- Makes sure that all safety equipment is made available to the emergency team; ¬ Assists Site Controller with necessary data to coordinate the emergency activities;
- Assists Site Controller in updating emergency plan, organizing mock drills, verification of inventory of emergency facilities and furnishing report to Site Controller;
- Maintains liaison with Civil Administration;
- Ensures availability of canteen facilities and maintenance of rehabilitation center.
- Liaises with Site Controller/Incident Controller;
- Ensures transportation facility;
- Ensures availability of necessary cash for rescue/rehabilitation and emergency expenditure;

- Controls rehabilitation of affected areas on discontinuation of emergency; and
- Makes available diesel/petrol for transport vehicles engaged in emergency operation.

V. General Responsibilities of Employees during an Emergency

During an emergency, which becomes more enhanced and pronounced when an emergency warning is raised, the workers who are in-charge of process equipment should adopt safe and emergency shut down and attend to any prescribed duty as essential employee. Assessing the situation to determine whether an emergency exists requiring activation of your emergency procedures. If no such responsibility is assigned, he should adopt a safe course to assembly point and await instructions. He should not resort to spreading panic. On the other hand, he must assist emergency personnel towards meeting the objectives of DMP

7.10.5 EMERGENCY FACILITIES

I. Emergency control Centre

The following information and equipment are to be provided at the Emergency Control Center (ECC).

- Intercom, telephone;
- P and T telephone;
- Self contained breathing apparatus;
- Fire suit/gas tight goggles/gloves/helmets;
- Hand tools, wind direction/velocities indications;
- Public address megaphone, hand bell, telephone directories; (internal, P and T) Plant layout, site plan;
- Emergency lamp/torch light/batteries;
- Plan indicating locations of hazard inventories, plant control room, sources of safety equipment, work road plan, assembly points, rescue location vulnerable zones, escape routes;
- Hazard chart;
- Emergency shut-down procedures;
- Nominal roll of employees;
- List of key personnel, list of essential employees, list of Emergency Co-ordinators;

- Duties of key personnel;
- Address with telephone numbers and key personnel, emergency coordinator, essential employees; and
- Important address and telephone numbers including Government agencies, neighboring industries and sources of help, outside experts, fuel fact sheets and population details around the factory.

II. Assembly Point

Number of assembly points, depending upon the plant location, would be identified wherein employees who are not directly connected with the disaster management would be assembled for safety and rescue. Emergency breathing apparatus, minimum facilities like water etc. would be organized. In view of the size of plant, different locations would be ear marked as assembly points. Depending upon the location of hazard, the assembly points are to be used.

III. Fire Fighting Facilities

First Aid and Firefighting equipment suitable for emergency should be maintained in each section in the plant. This would be as per statutory requirements. However, fire hydrant line covering major areas would be laid. It would be maintained as 6 kg/cm2 pressure. Fire alarms would be located in the bulk storage areas. Do not block fire escape route .Keep all fire doors closed. Know the escape routes in your environment. Know the locations of break glass fire alarm buttons and firefighting equipment, and make sure they are easily accessible. Fire officer will be the commanding officer of fire fighting services.

IV. Location of Wind Sock

Wind socks shall be installed at appropriate places in the plant to indicate direction of wind for emergency escape.

V. Emergency Medical Facilities

Stretchers, gas masks and general first aid materials for dealing with chemical burns, fire burns etc would be maintained in the medical center as well as in the emergency control room. Medical superintendent of the medical center will be the head of the casualty services ward. Private medical practitioners help would be also be sought. Government hospital would be approached for emergency help. Apart from plant first aid facilities, external facilities would be augmented. Names of Medical Personnel, Medical facilities in the area would be prepared and updated. Necessary specific medicines for emergency treatment of Patient's Burns would be maintained. Breathing apparatus and other emergency medical equipment would be provided and maintained. Also, the help of nearby industries would be taken on mutual support basis.

VI. Ambulance

Availability of an ambulance with driver in all the shifts would be ensured to transport injured or affected persons. Number of persons would be trained in first aid so that, in every shift first aid personnel would be available.

7.10.6 EMERGENCY ACTIONS

I. Emergency Warning

The emergency would be communicated both to the personnel inside the plant as well as people outside. An emergency warning system shall be established for this purpose.

II. Emergency Shutdown

There are number of facilities, which can be provided to help deal with hazardous conditions, when a tank is on fire. The suggested arrangements are:

- Stop feed;
- Dilute contents;
- Remove heat;.
- Deluge with water; and
- Transfer contents.

III. Evacuation of Personnel

In the event of an emergency, unconnected personnel have to escape to assembly point. Operators have to take emergency shutdown procedure and escape. Time Office shall maintain a copy of deployment of employees in each shift, at ECC. If necessary, persons can be evacuated by rescue teams

IV. All Clear Signal

Also, at the end of an emergency, after discussing with Incident Controllers and Emergency Coordinators, the Site Controller orders an all-clear signal. When it becomes essential, the Site Controller communicates to the District Emergency Authority, Police, and Fire Service personnel regarding help required or development of the situation into an Off-Site Emergency.

V. Employee Information

During an emergency, employees would be warned by raising siren in specific pattern. Employees would be given training of escape routes and taking shelter. Employees would be provided with information related to fire hazards, antidotes and first aid measures. Those who would be designated as key personnel and essential employees should be given training for emergency response.

VI. Public Information and Warning

The industrial disaster effects related to this plant may mostly be confined to the plant area. The detailed risk analysis has indicated that the pool fire effects would not be felt outside. However, as an abundant precaution, the information related to Chemical in use would be furnished to District Emergency Authority for necessary dissemination to general public and for any use during an offsite emergency. Plants of this size and nature have been in existence in our country for a long time.

VII. Co-ordination with Local Authorities

Keeping in view of the nature of emergency, two levels of coordination are proposed. In the case of an on site emergency, resources within the organization would be mobilized and in the event extreme emergency local authorities help would be sought. In the event of an emergency developing into an offsite emergency, local authority and District Emergency Authority (normally the Collector) would be appraised and under his supervision, the Off Site Disaster Management Plan would be exercised. For this purpose, the facilities that are available locally, i.e. medical, transport, personnel, rescue accommodation, voluntary organizations etc. would be mustered. Necessary rehearsals and training in the form of mock drills would be organized.

VIII. Mutual Aid

Mutual aid in the form of technical personnel, runners, helpers, special protective equipment, transport vehicles, communication facility etc would be sought from the neighboring industries.

IX. Mock Drills

Emergency preparedness is an important part of planning in Industrial Disaster Management. Personnel would be trained suitably and prepared mentally and physically in emergency response through carefully planned, simulated procedures. Similarly, the key personnel and essential personnel would be trained in the operations.

1st Step: Test the effectiveness of communication system

2nd Step: Test the speed of mobilisation of the plant emergency teams

3rd Step: Test the effectiveness of search, rescue and treatment of casualties

4th Step: Test emergency isolation and shut down and remedial measures taken on the system **5th Step:** Conduct a full rehearsal of all the actions to be taken during an emergency The Disaster Management Plan would be periodically revised based on experiences gained from the mock drills.

Fire Fighting System

- Fire water is sourced from the raw water storage tanks of adequate capacity.

- An exclusive pipeline connecting water storage tank and plant area (vulnerable areas) with adequate pump is envisaged to fight any fires.
- Fire water pump containing combination of diesel and electrically driven pumps
- Portable and mobile extinguishers, such as pressurized water type, carbondioxide type, foam type, dry chemical powder (DCP) type located at strategic locations throughout the plant.

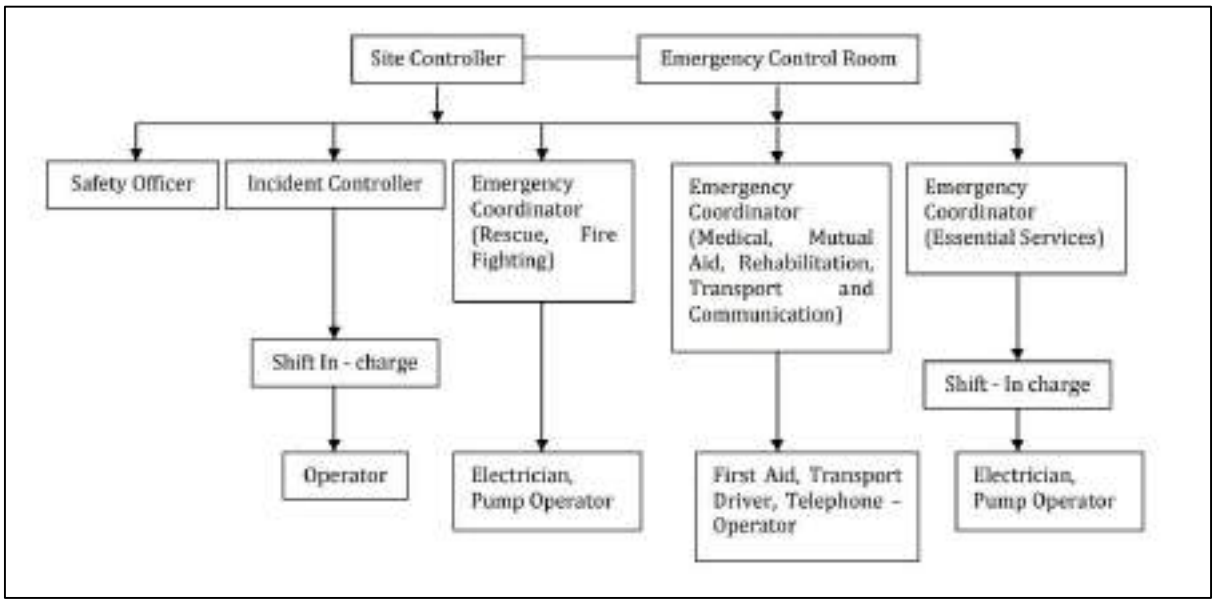


Figure7.38: On-Site Emergency Organization Chart

7.11 OFF-SITE EMERGENCY PREPAREDNESS PLAN

If an accident or mishappening takes place in industry /unit and it would affect outside the premises, the situation thus created is called an offsite emergency. The task of preparing the Off-Site Emergency Plan lies with the District Collector; however, the off-site plan will be prepared with the help of the local district authorities.

7.11.1 Introduction

Off-site emergency plan would follow the on-site emergency plan. When the consequences of an emergency situation go beyond the plant boundaries, it becomes an off-site emergency. Offsite emergency is essentially the responsibility of the public administration. However, the plant management will provide the public administration with the technical information

relating to the nature, quantum and probable consequences on the neighboring population. The off-site plan in detail will be based on those events, which are most likely to occur, but other less likely events, which have severe consequence, will also be considered. Incidents which have very severe consequences yet have a small probability of occurrence would also be considered during the preparation of the plan. However, the key feature of a good off-site emergency plan is flexibility in its application to emergencies other than those specifically included in the formation of the plan. The roles of the various parties who will be involved in the implementation of an off-site plan are described below. Depending on local arrangements, the responsibility for the off-site plan Site Controller Emergency Control Room Safety Officer Incident Controller Emergency Coordinator (Rescue, Fire Fighting) Emergency Coordinator (Medical, Mutual Aid, Rehabilitation, Transport and Communication) Emergency Coordinator (Essential Services) Shift In - charge Operator Electrician, Pump Operator First Aid, Transport Driver, Telephone – Operator Shift - In charge Electrician, Pump Operator would either rest with the plant management or with the local authority. Either way, the plan would identify an emergency co-ordinating officer, who would take the overall command of the off-site activities. As with the on-site plan, an emergency control center would be setup within which the emergency co-ordinating officer can operate. An early decision will be required in many cases on the advice to be given to people living "within range" of the accident - in particular whether they should be evacuated or told to go indoors. In the latter case, the decision can regularly be reviewed in the event of an escalation of the incident. Consideration of evacuation may include the following factors:

- In the case of a major fire but without explosion risk (e.g. an oil storage tank), only houses close to the fire are likely to need evacuation, although a severe smoke hazard may require this to be reviewed periodically; and
- If a fire is escalating and in turn threatening a store of hazardous material, it might be necessary to evacuate people nearby, but only if there is time; if insufficient time exists, people should be advised to stay indoors and shield themselves from the fire. This latter case particularly applies if the installation at risk could produce a fireball with very severe thermal radiation effects. Although the plan will have sufficient flexibility built in to cover the consequences of the range of accidents identified for the on-site plan, it will cover in some detail the handling of the emergency to a particular distance from each major hazard works.

7.11.2 Organizations involved and responsibilities and liaison arrangements between them City

A. Fire Services

To combat fire and carry out other emergency operations as per the need. In case of fire, the fire brigade is the best help from outside. Even in a disaster not involving fire, the fire brigade could be of good help, inside the plant and outside, in view of their specialized equipments and expertise in rescue and relief.

Responsibilities

- To reach the accident spot as soon as possible with all necessary equipments to extinguish the fire.
- To provide all other necessary help depending on nature of emergency

B. Police

To manage and control the mob, violence, sabotage or outbreak if any; Cordoning of the area and help in fire fighting and other emergency operations. In case of emergency the police department has a number of functions to perform;

Responsibilities

- Maintain law and order situation near the premises.
- To control the traffic to facilitate the victims to reach hospitals as early as possible.
- To restrict entry of any unauthorized persons.
- To set up communication to assist in disaster management operation.
- To take control of surrounding transport facilities and assist in disaster management operation by shifting injured persons and casualties to nearby hospitals.
- To assist in fire fighting and other emergency operations.

C. Hospital

Prompt and efficient medical aid is important in an emergency situation. The first center inside the Depot cannot cope up with all the treatment requirements; the right approach to this problem is to have arrangements with nearby hospitals so that in case of an emergency, services and facilities available with the nearby hospitals can be utilized.

Responsibilities

- Depute doctors and nurses to site with ambulance.
- To provide immediate medical relief to casualties.
- Augmentation of equipments, drugs and doctors.
- To provide first aid on the spot to casualties.
- To take all out efforts on war footing to save maximum lives.
- To continue treatment to casualties till all of them are attended and properly shifted to medical centers.

D. Medical Facilities

The nearest medical facilities are available in …… The other medical facilities available from outer agencies are as follows:

Antidotes and emergency medicines

General medicine such as antiseptic, analgesic, Anti-Snake Venom etc available in the first aid centre. The other local hospitals available in nearby cities are given below and specialist do

Table7.12: Details of hospital in nearby cities and specialist doctors in the townctors are available in these hospitals

S. No.	Name of Hospital	Address	Contact No
1.	Govt. Hospital, Banda	Kanpur - Sagar Hwy; Bandha; Madhya Pradesh-471311	--
2.	Arihant Hospital & Nursing Home	National Highway 86; Singrawan; Madhya Pradesh -470335	093013 09713
3.	Dr BabulalAnuj Hospital	Singrawan; Madhya Pradesh 470335;	098933 20446

E. District Collectorate/ Administration

- To supervise of all off-site emergency operations; order to evacuate off-site population.
- Local administration means those who are responsible for administration of the geographical area where the Depot is located

Responsibilities

- To protect the citizens.
- To assess the situation for overall control.
- To monitor the functioning and need of various agencies in rescue operation at site.
- To requisite and make available the services and facilities available in the area like hospitals, doctors, transport, police, fire brigade and so on.
- To coordinate the activities outside the Depot in view of their authority and experience in coordinating rescue and relief operation

F. RTO

To clear all approach roads to and from corporation area for free flow of vehicular traffic, which is engaged in combating the emergency and demarcate parking area for vehicles to evacuate population.

G. Controller of Explosives & Factory Inspectorate

- To provide expert advice and help in coordinating emergency operations with government agencies.
- The inspector of factories is expected to be a friend and a guide to industrial establishments. His involvement is a matter of course, since he would be officially connected with inquires after the disaster.

Responsibilities

- To coordinate with local govt. body e.g. collectorate, civil hospital, police department etc. as well as surrounding voluntary organizations.
- To act as Off-site emergency controlling authority.
- To inform public for precautionary measures.

H. Voluntary Organizations

- Voluntary organizations could help in relief and humanitarian services to victims in case of any emergency.

Responsibilities

- Assist in rescue operations and first aid to the victims.
- To arrange transport, refreshment and shelter.
- To take necessary assistance from social organizations like Red Cross Society, Scouts, NCC, Rotary, Lions clubs etc

I. Other Installations near to the site

Industrial installations or oil installations present near the site should help to combat the fire with the fire fighting equipments present in their locations

Responsibilities

- To provide the strongest possible support and resources to the plant managers so that the best accident prevention and emergency preparedness procedures are in place in the industrial facility.
- To encourage their facility managers to commit themselves fully to the awareness and preparedness for emergencies at local level process.
- To monitor the involvement of their facilities in the process.

Table 7.13: Contact numbers of district administration in case of emergency

S. No.	Authority /Agency	Contact No.
1.	District Collector & District Magistrate Office of The Collector, Sagar,Madhya Pradesh	07582-221900
2.	Superintendent of Police	07583-252229/07583-

		252253
3.	Chief Medical Officer	07582-264390
4.	Fire Brigade Service Centre	101
5.	Referral Hospital (Dr BabulalAnuj Hospital)	098933 20446
6.	Referral Hospital (Govt Hospital Banda)	--
7.	Plant Manager	800324445
8.	Safety Officer	94140827638

Safety training of personnel and mock drill / rehearsing emergency procedures

On appointment of every personnel, it is essential to provide training to cope with all types of perceived emergencies. Training is to be provided for:

- Properties and hazards of the steel industry as given in the report.
- Knowledge, location and use of fire fighting and protective equipments.
- Emergency actions for various emergency scenarios.
- Many organizations use table-top exercises to test their emergency plans.
- These are very cost-effective because they do not interrupt the day today running of the plant and because the organizer of the exercise can "arrange" for a variety of difficulties to be taken.
- Full-scale exercises, providing a realistic rehearsal setting, will still be needed to complement the tabletop exercises.

7.12 OCCUPATIONAL HEALTH AND SAFETY

For large industries, where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance, the men, materials and machines are the basic inputs. Along with the boons, industrialization generally brings several problems like occupational health and safety.

Occupational Health

Occupational health needs attention both during construction and erection and operation and maintenance phases. However, the problem varies both in magnitude and variety in the above phases.

- Construction and Erection

The occupational health problems envisaged at this stage can mainly be due to constructional accident and noise. To overcome these hazards, in addition to arrangements to reduce it within TLV's, necessary protective equipments shall also be supplied to workers.

- Operation and Maintenance

The problem of occupational health, in the operation and maintenance phase is primarily due to noise which could affect hearing. The necessary personal protective equipments will be given to all the workers. The working personnel shall be given the following appropriate personnel protective equipments:-

- Industrial Safety Helmet;
- Crash Helmets;
- Face shield with replacement acrylic vision;
- Zero power plain goggles with cut type filters on both ends;
- Zero power goggles with cut type filters on both sides and blue color glasses;
- Welders equipment for eye and face protection;
- Cylindrical type earplug;
- Ear muffs;
- Canister Gas mask;
- Self contained breathing apparatus;
- Leather apron;
- Aluminized fiber glass fix proximity suit with hood and gloves;
- Boiler suit;
- Safety belt/line man's safety belt;
- Leather hand gloves;
- Asbestos hand gloves
- Acid/Alkali proof rubberized hand gloves;
- Canvas cum leather hand gloves with leather palm;
- Lead hand glove;
- Electrically tested electrical resistance hand gloves; and

Industrial safety shoes with steel toe. Full-fledged hospital facilities will be available round the clock for attending emergency arising out of accidents, if any. All working personnel will be medically examined at least once in every year and at the end of his term of employment. This is in addition to the pre-employment medical examination.

Chemical Hazard

The main chemical use in the process is Sulphuric acid, which shall be kept in an isolated storage area on RCC platform in HDPE drums, and proper sign of danger shall be displayed there. Medical checkup shall be done regularly for the workers working in the plant.

7.13 SAFETY PLAN

Safety of both men and materials during construction and operation phases is a prime concern. The preparedness of an industry for the occurrence of possible disasters is known as emergency plan. The disaster in proposed plant is possible due to leakage of fuels, collapse of structures and fire/explosion etc. Keeping in view the safety requirements during construction, operation and maintenance phases, the plant shall formulate safety policy with the following regulations:

- To allocate sufficient resources to maintain safe and healthy conditions in working environment.
- To take steps to ensure that all known safety factors are taken into account in the design, construction, operation and maintenance of plants, machines and all other equipments.
- To ensure that adequate safety instructions are given to all employees.
- To provide wherever necessary protective equipment, safety appliances and clothing and to ensure their proper use.
- To inform employees about materials, equipments or processes used in their work which are known to be potentially hazardous to health or safety.
- To keep all operations and methods of work under regular review for making necessary changes from the point of view of safety in the light of experience and up to date knowledge.
- To provide appropriate facilities for first aid and prompt treatment of injuries and illness at work.
- To provide appropriate instruction, training, retraining and supervision to employees in health and safety, first aid and to ensure that adequate publicity is given to these matters.
- To ensure proper implementation of fire prevention methods and an appropriate fire fighting service together with training facilities for personnel involved in this service.
- To organize collection, analysis and presentation of data on accident, sickness and incident involving personal injury or injury to health with a view to taking corrective, remedial and preventive action.
- To promote through the established machinery, joint consultation in health and safety matters to ensure effective participation by all employees.
- To publish/notify regulations, instructions and notices in the common language of employees.

- To prepare separate safety rules for each type of occupation/process involved in a project.

7.13.1 Safety Organization

Construction and Erection Phase

A qualified and experienced safety officer shall be appointed. The responsibilities of the safety officer includes identification of the hazardous conditions and safe acts of workers and advice on corrective actions, conduct safety audit, organize training programs and provide professional expert advice on various issues related to occupational safety and health. He is also responsible to ensure compliance of safety rules/ statutory provisions.

Operation and Maintenance Phase

When the construction is completed the posting of safety officers shall be in accordance with the requirement of Factories Act and their duties and responsibilities shall be as defined thereof.

7.13.2 Safety Circle

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circles will be constituted in each area of work. The circle will consist of 5-6 employees from that area. The circle normally shall meet for about an hour every week.

7.13.3 Safety Training

A full fledged training center shall be set up at the plant. Safety training shall be provided by the Safety Officers with the assistance of faculty members called from Corporate Center, Professional Safety Institutions and Universities. In addition to regular employees, limited contractor labourers shall also be provided safety training. To create safety awareness safety films shall be shown to workers. Some precautions and remedial measures to be taken to prevent fires are

- Compartmentation of cable galleries, use of proper sealing techniques of cable passages and crevices in all directions which will help in localizing and identifying the area of occurrence of fire as well as ensure effective automatic and manual fire fighting operations;
- Spread of fire in horizontal direction will be checked by providing fire stops for cable shafts;
- Reliable and dependable type of fire detection system with proper zoning and interlocks for alarms are effective protection methods for conveyor galleries.
- Housekeeping of high standard helps in eliminating the causes of fire and regular fire watching system to strengthen fire prevention and fire fighting; and

- Proper fire watching by all concerned will be ensured.

7.13.4 Key Personnel

Apart from Works Incident Controller and Chief Incident Controller, other works personnel will have key role to play in providing advice and in implementing the decisions made by the Chief Incident Controller. The key personnel will include:

A. Sr. Supdts. /Engineer-in-charge responsible for

- Operation.
- Electrical Maintenance
- Mechanical maintenance.
- C&I.
- Chemical.

B. Head of Personnel and Officers connected with IR and Labour Welfare.

7.13.5 Emergency Planning For Disaster Due To Fire

Fuel storage, cable rooms, transformer unit, auxiliary transformers, and oil tanks are considered. Fuel bunkers including all conveyor lines etc., within the plant are the likely areas for which plan is outlined to deal with any eventuality of fire including stores, workshop, canteen and administration building

Classification of Fires

Table-7.14: Classes of Fire

S. No.	Explanation	Method of Fire	Fire Fighting
A	Solid-Carbonaceous Inflammable material	Fire involving wood, paper, cloth and other material.	Water
B	Liquid	Fire involving oil, kerosene etc	Foam or dry powder chemical extinguisher
C	Special	Electrical fir	DCP or CO2 extinguisher

7.13.6 Fire Fighting with Water

Adequate and reliable arrangement is required for fighting the fire with water such as:

- Identification of source of water and equipping with pumps;
- Arrangement of pipe lines along and around all vulnerable areas;
- Alternative water supply arrangements to divert the water from one set of pipe lines (connected to another source) or to connect to other source.
- Provisions of valves at appropriate points to enable supply of water at the required place/area or divert the same to another direction/pipe line.
- Each source of water shall be equipped with one standby diesel driver pump to serve in case of power failure

7.13.7 Water Line Arrangement

Water lines shall be provided at raw material handling area along with the conveyors and around the stockyards, transformers, oil tanks etc. Water lines shall also be provided around other infrastructures in the plant like administration building, canteen, stores and other plant equipments. Hydrant system feed pressurized water to hydrant valves shall be located throughout the plant and also at strategic locations. The water pressure shall be maintained at 6 to 8 kg/cm2 in these lines. By operating on few of the valves water pressure can be increased at one particular place. Non-return valves shall be provided to allow only unidirectional flow of water, gate valves shall be provided for closing or opening the water supply. An adequate number of gate valves shall be provided at appropriate points to tap water to deal with fire if it breaks out at any point of the plant.

7.13.8 Fire Fighting with Fire Extinguishers

To deal with fires - other than carbonaceous fires, which can be dealt with by water, suitable fire extinguishers are required to do the job effectively. Adequate numbers of fire stations are to be established with the following types of equipments and arrangements:

- Soda Acid Fire Extinguishers;
- CO_2 Extinguishers;
- Dry Powder Chemical Extinguishers;
- Foam Extinguishers;
- Fire Buckets; and
- 50-mm spray hoses up to 150-m length.

Appropriate types of fire extinguishers shall also be provided at several locations in the various manufacturing units, control rooms and other infrastructure facilities within the premises.

7.13.9 Inspection

Fire alarm panel (electrical) shall cover the entire plant. Fire Extinguishers in Fire Stations and machines and other places shall be periodically inspected by the inspection group; Emergency telephone numbers shall be displayed at vital points by the groups; General inspection for fire shall be regularly carried out by the group.

7.13.10 Procedure for Extinguishing Fire

The following steps shall be taken during a Fire Accident in the system

- As soon as the message is received about fire, one of the spray groups in the system shall be diverted to the place of the fire accident along with a staff member;
- Simultaneously plant Fire Station shall be informed by phone, walkie-talkie for fire brigades;

- Fire stations nearby also be informed by phone to be in readiness:
- In the meanwhile, the pipe system shall be operated to obtain maximum pressure and output;
- In case cables are within the reach of fire, power supply shall be tripped and the cables shifted;
- Further, other spray groups from the system shall be diverted to the spot.

7.13.11 Health and Safety Monitoring Plan

All the potential occupational hazardous work places such as fuel storage area, ore handling area shall be monitored regularly. The health of employees working in these areas shall be monitored twice a year for early detection of any ailment. Though effective measures are taken to combat pollution in ambient conditions, occupational health hazards are not overlooked. Project will provide well organized occupational health services to all its employees by taking responsibility for establishment and maintenance of safe and healthy working environment and assessment of the physical and mental capabilities to identify specific work loads.

The industrial medical centre will have following responsibilities:

- Surveillance of workers' health in relation to work. Surveillance of working environments.
- Identification and evaluation of environmental factors which may affect the workers' health.
- Assessment of conditions of occupational workers' health.
- Observance of safety norms and reduce/eliminate exposure to hazardous environs.
- Company will take up monitoring activities periodically to assess hazards due to gases, dusts, vibrations, radiations etc.

Plan and fund allocation to ensure the occupational health and safety of all contract and casual workers have been given below:-

S. No.	Parameter	Frequency
1.	Blood Pressure	Every Year
2.	Blood Group and RH	Every Year
3.	Blood Sugar (RBS)	Every Year
4.	Spirometry	Every Year
5.	Audiometry	Every Year
6.	Vision	Every Year
7.	Drug Allergy	Every Year

The fund allocation for Occupational Health and Safety of all contract and casual workers are as given below:-

Particular	Fund Allocation (In Rs.)
Workers	30.0

7.14 Traffic Study

Table 7.15: Real time traffic scenario along NH-934 Road towards (Sagar→ ← Shahgarh)

Timings	2Wh	PUC	4Wh	PUC	Buses /Trucks	PUC	Light Commercial Vehicles	PUC	Total
7 to 8 **AM**	20	10	35	35	10	22	20	28	95
8 to 9 **AM**	80	40	45	45	12	26.4	21	29.4	141
9 to 10 **AM**	50	25	52	52	8	17.6	25	35	130
10 to 11 **AM**	25	12.5	44	44	12	26.4	30	42	125
4 to 5 **PM**	30	15	32	32	10	22	22	30.8	99
5 to 6 **PM**	45	23	38	38	12	26.4	26	36.4	124
6 to 7 **PM**	90	45	65	65	20	44	24	33.6	188
7 to 8 PM	**62**	**31**	**80**	**80**	**38**	**83.6**	**40**	**56**	**250**

Table 7.16: No. of Vehicles per Hour

S. No	Vehicles Distribution	Number of vehicles distribution/hour	PCU Factor 5% (percentage composition of vehicle type in traffic stream)	Total Number of vehicles (PCU/hour)
		NH-934		NH-934
1	Two wheeler	62	0.5	31
2	Four wheeler	80	1.0	80
3	Bus/Trucks	38	2.2	83.6
4	Light Commercial Vehicles	40	1.4	56
Total		**220**		**250**

Table 7.17: Transport Distribution within Project Site.

Name of National Highway	Direction		Traffic Distribution
	UP	Down	%
NH-934	Shahgarh	Sagar	100

Table 7.18: Existing Traffic Scenario & LOS

Road	V	C (PCU/Hour)	Existing V/C Ratio	LOS
NH-934 road One way (Two lane)	250	2400	0.10	A

Table 7.16: Recommended design service volumes as per IRC: 106-1990, S.NO: 5, Page No: 11

V= Volume in PCUs/hr, C= Capacity in PCUs/ hr, LOS = Level of Service.

The existing Level of NH-934 road Service is "A" i.e. Excellent.

Table 7.18: Capacity as per IRC: 106-1990, Page No: 11, Table-2 for Arterial road/ Highways.

V/C	LOS	Performance
0.0 - 0.2	A	Excellent
0.2 - 0.4	B	Very Good
0.4 - 0.6	C	Good / Average / Fair
0.6 - 0.8	D	Poor
0.8 - 1.0	E	Very Poor

*According to IRC percentage composition of vehicle type in traffic stream is considered 5 % and above for the analysis of traffic load study due to the proposed project

Traffic Impact Analysis During Expansion of Operation Phase

Table 7.19: PCU Calculation during Operation Phase.

S.NO	Mode of transportation	No. of trucks per day	PCU Factor	PCU/day	PCU/Hr
1.	Trucks	60	2.2	132	5.5
2.	Staff vehicles				
	Car	20	1	20	20*
	Two wheeler	180	0.5	90	90*
Total PCU/hour					116

*Staff vehicles are considered as PCU /day equal to PCU/hour (morning & evening)

Table 7.20: Modified Traffic Scenario and LOS.

Road	Existing Traffic				Changed V/C and LOS after adding generated traffic from operational phase of proposed project.			
	V	C	V/C	LOS	V	C	V/C	LOS
NH-934 (2 lanes) (one way)	250	2400	**0.10**	**A**	250+116 =366	2400	**0.15**	**A**

Conclusion

The V/C ratio is found out to be 0.10 on NH-934, the proposed expansion project will result in a modified V/C ratio during the operation phase also to be same 0.15 on NH-934. Thus the additional load on the carrying capacity of the concern roads is not likely to have any significant adverse affect.

7.14.1 TRAFFIC MANAGEMENT PLAN.

- Guided traffic ways inside the project (two way traffic) with sufficient width of driveways to ensure smooth traffic movements during peak hours.
- Separate entry and exit provisions for the project.
- Provision of service road outside the project for smooth merging of traffic from the project.
- Designated parking lots for trucks/lorry. No vehicle will be allowed to park outside & inside the building.

INDEX

8.1 INTRODUCTION.....347

8.2 IMPROVEMENT IN INFRASTRUTURE 347

8.3 EMPLOYMENT GENERATION.....348

8.4 IMPROVEMENT IN SOCIO-ECONOMIC STATUS 348

8.5 CORPORATE ENVIRONMENTAL RESPONSIBILITY.....348

CHAPTER 8
PROJECT BENEFITS

8.1 INTRODUCTION

The project is an expansion of Chemical fertilizer manufacturing unit located at Plot No.A-1& A-2, Saurai Industrial Area, village–Saurai, Tehsil Banda, District Sagar, Madhya Pradesh by M/s Madhya Bharat Agro Products Limited (MBAPL).The unit is proposing to enhancing its production capacity of fertilizers by addition of DAP/NPK complex fertilizer, Phosphoric acid plant and new chemical production unit at its existing location.

The proposed expansion project will help in and around surrounding development and also generate job opportunities for skilled semi skilled and unskilled in construction phase and operation phase for the local people. The directly and indirectly people residing in the nearby areas will be benefit. It is likely that the proposed expansion project will provide benefits in all important aspects.

8.2 IMPROVEMENT IN INFRASTRUTURE

The proposed expansion will have numerous induced impacts on society. It will also attract other entrepreneurs to establish their venture in the region. The proposed expansion project will attract large number of population to the area in the form of equipment suppliers, material suppliers, maintenance technicians, etc. For their accommodation, the infrastructural facilities like lodging, eateries and transport facilities on the outskirts of nearby villages up to the plant area is expected to improve. These will also benefit the local population.

8.3 EMPLOYMENT GENERATION

The project promises to create job opportunities for about 100 individuals to be employed from the local community. Apart from that it will also create indirect employment including horticultural jobs, transportation, catering services and others.

8.4 IMPROVEMENT IN SOCIO-ECONOMIC STATUS

The proposed expansion project will have direct and indirect benefits to the overall socio-economic status of the region. During construction phase, there will be opportunities for local skilled and unskilled workers to be employed in the various construction related activities like material handling, operation of construction machinery, actual construction, painting, installation of plant machinery, etc. At the same time, local small contractors, vehicle owners, machinery owners will get substantial amount of business for providing their services. The construction activity and influx of visitors will also open up opportunities for setting up establishments like lodging, telephone, kiosks, small shopsetc. in the vicinity of the project. These may be considered indirect benefits due to the proposed expansion project in the area.

8.5 CORPORATE ENVIRONMENTAL RESPONSIBILITY

At the outset, CSR activities at Madhya Bharat Agro Products Limited is already in existence for the benefit of the society and employees It is recognized that integrating social, environmental and ethical responsibilities into the governance of businesses ensures the long term success, competitiveness and sustainability.

Further, Corporate Social Responsibility makes a business sense as companies with effective CSR, have image of socially responsible companies, achieve sustainable growth in their operations in the long run and their products and services are preferred by the customers.

Estimated Budget for CSR

S. No	Particulars	Nos.	Cost/Item	Total Amount (Rs.)
A. Education				

1	Provision of Library rack	3	Rs. 1200	3,6000/-
2	Provision of Sports Items	10	50,00/-	50,000/-
3	Provision of Science Lab. 15*22 sq feet. Hall	3300 sq. ft	@Rs. 1100 sq. ft.	36,30,000/-
4	Provision of Id cards for Students (No. 1200)	1200	RS. 30	3,6000/-
Total				**Rs. 37.52 lacs**
B. Environmental Management				**Rs.**
Plantation of Air Pollution Control Trees with tree guard (No. 1,000) –NH 86 Banda town				**11,00,000/-**
Provision of Dustbin (No. 1000) – Sorhi , Fathpur , banda area				**10,00,000/-**
Rain water Harvesting (No. 2) Sorhi Panchyat and School				**6,00,000/-**
Total				**Rs. 27 lacs**
C. Women & Farmer Welfare				**Rs.**
• Vocational education for women including providing sewing machines.(No.1000/-)				**30,00,000/-**
Other Workshop activities: • Workshop for Agricultural Workers to make them aware about recent developments in agricultural sector. • Health Awareness programmes • Water Conservation camp • Jobs & Business Development camp				**10,00,000/-**
Total				**Rs. 40 Lacs**
D. Development in the community area				**RS.**
Solar road light price with battery - sorhi village (No. 10)				**20,00,000/-**
Drinking water facility R.O. (50,000/- letter) in a Banda bus stand.				**1,50,000/-**
Traffic Awareness Programme near highway road – Banda Town NH 86				**2,00,000/-**
Health care camps programme with madison – Banda town Govt PHC				**5,00,000/-**
Swachh Bharat Abhiyan new toilet construction (No. 20)- Banda Town				**5,00,000/-**
Development of drainage system roads Sorhi village area				**50,00,000/-**
Development of Park Sorhi Village area				**20,00,000/-**
Installation/Repair of Hand Pumps/Tube Wells - sorhi panchyat all villages				**10,98,000/-**
Chief Minister Sahayata Kosh				**50,00,000/-**

Total :	**Rs.164.48 lacs**
Grand Total : A+B+C+D (37.52+27+40+164.48)= 269	

"EMP Budget allocation"

S. No.	Facilities to be provided	Activities to be done by PP	Total Expenditure (Rs in Lacs)					Activity area
			1st year	2nd year	3rd year	4rd year	5rd year	
A.	**Education**	• Provision of Library rakes • Provision of Sports Items • Provision of Science Lab. 15*22 sq feet. Hall • Provision of Id cards for Students (No. 1200)	12	10	8	5	2.52	**Govt girls Hs. Sec. school Banda (MP)**
B.	**Environmental Management**	• Plantation of Air Pollution Control Trees with tree guard (No. 1,000) –NH 86 Banda town • Provision of Dustbin (No. 1000) – Sorhi , Fathpur , banda area • Rain water Harvesting (No. 2) Sorhi Panchyat and School	8	6	5	5	3	
C.	**Women & Farmer Welfare**	• Vocational education for women including providing sewing machines (No.1000/-) **Other Workshop activities:** • Workshop for Agricultural Workers to make them aware about recent developments in agricultural sector. • Health Awareness programmes • Water Conservation camp • Jobs & Business Development camp	10	8	7	7	8	

D.	**Development in the community area**	• Solar road light price with battery - sorhi village (No. 10) • Drinking water facility- R.O. (50,000/- letter) in a Banda bus stand. • Traffic Awareness Programme near highway road. • Health care camps programme with Madison. • Swachh Bharat Abhiyan new toilet construction (No. 20) • Development of drainage system roads Sorhi village area • Development of Park Sorhi Village area • Installation/Repair of Hand Pumps/Tube Wells - sorhi panchyat all villages • Chief Minister Sahayata Kosh	50	40	30	25	19.48	
Total: Rs 269.00 lacs will be provided for EMP			**80**	**64**	**50**	**42**	**33**	

******

INDEX

9.0 ENVIRONMENT COST & BENEFIT ANALYSIS 353

CHAPTER 9

ENVIRONMENT COST & BENEFIT ANALYSIS

9.0 ENVIRONMENT COST & BENEFIT ANALYSIS

As per EIA Notification 2006, 'Environmental Cost Benefit Analysis' is applicable only if it is recommended at the Scoping stage. As per the standard ToR points issued by MoEF&CC on dated 12.12.2019 for the proposed project; the Environmental Cost Benefit Analysis is not applicable and hence has not been prepared.

****

INDEX

10. INTRODUCTION.....355

10.1. OBJECTIVE OF ENVIRONMENTAL MANAGEMENT PLAN.....355

10.2. COMPONENTS OF EMP.....355

10.3. CRITICAL ACTIVITES FOR EMP IMPLEMETATION.....356

10.4. ENVIRONMENTAL ACTION PROGRAMME.....356

CHAPTER 10
ENVIRONMENTAL MANAGEMENT PLAN

10. INTRODUCTION

The Environmental Management Plan (EMP) is amalgamation of all proposed mitigation and monitoring actions in set to a time frame with specific responsibility assigned to the organization to achieve these measures and follow-up actions defined. It is a site-specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment and comply with environmental legislation

Environmental management plan is requisite for formulation, implementation and monitoring of environmental protection measures during and after commissioning of proposed expansion project. The plans shall be detailed that how various measures have been or are proposed to be taken including cost components as may be required.

Apart from mitigation measures, EMP also includes institutional set-up for implementation of various measures, greenbelt development plan and environmental monitoring plan

10.1. OBJECTIVE OF ENVIRONMENTAL MANAGEMENT PLAN

The EMP consists of a set of mitigation, monitoring and institutional measures to be taken up during the design, construction and operation stages of the project. The EMP has been designed keeping in view of the regulatory and other requirements to ensure the following:

- **Prevention :** Least disturbance to the environment attributes and social aspects Compliance with the environmental acts, rules and guidelines prescribed by CPCB and MOEF&CC time to time
- **Preservation**: Keep the quality of air, water, soil and noise as per the prescribed norms by regulatory bodies.
- **Minimization:** Conservation of natural resources to the extent possible by Limiting or reducing the degree, extent, magnitude, or duration of adverse impacts to have a sustainable development.

10.2. COMPONENTS OF EMP

Following elements are the major components of Environment Management Plan:

Commitment and policy: The project strives to provide and implement the environment management plan that incorporates all issues related to air, land and water.

Planning: This head includes identification of environmental impacts, legal requirements and setting of environmental objectives.

Implementation: This comprises of resources available to the developers, accountability of contractors, training of operational staff associated with environmental control facilities and documentation of measures to be taken.

Measurement and evaluation: This includes monitoring, corrective actions and record keeping. It is suggested that as part of the EMP, a monitoring committee would be formed by MBAPL comprising of the site in-charge/coordinator, environmental group representative and project implementation team representative. The committee's role would be to ensure proper operation and management of the EMP including the regulatory compliances.

10.3. CRITICAL ACTIVITES FOR EMP IMPLEMETATION

- Training through Environmental Awareness;
- Documentation and record keeping;
- Reporting Procedures;
- Stakeholder/ Project Proponent commitment;
- Auditing;
- Act in response to Non-compliance

10.4. ENVIRONMENTAL ACTION PROGRAMME

The management of "Madhya Bharat Agro Products Limited." is quite aware about their responsibility for maintaining clean environment. Adequate funds for pollution control measures is being/ will be provided as a part of overall project financing to ensure the availability of proper treatment facilities before the commissioning of the unit. The overall fund kept for the project is approx. Rs. 590 Lacs for the environment protection program. This cost will be spent in phase wise along with the growth of project.

The proposed Environment Management plan for the unit is summarized in the below table:

TABLE 10.1: ENVIRONMENT MANAGEMENT PLAN AND RESPONSIBILITY

Environment Attributes	Mitigation Measures	Fund allocated	Effectiveness	Responsibility
Air Environment During Construction Phase	• All the loose material either stacked or transported will be provided with suitable covering such as tarpaulin. • For dust suppression due to vehicular movements, water sprinkling will be done from time to time. • To minimize the occupational health hazard, proper mask will be provided to the workers who are engaged in activities that may lead to dust generation. • The construction area will be secured with the help of construction cloth or net from all the four sides to contain the dust within the premises. • To minimize dust emission to the atmosphere when materials & waste will be removed from the premises and suitable covered skips and enclosed chats will be used. • Parking for vehicle and paved road will be constructed initially. • Foremost upwind portion of the project will be	For Air Pollution Monitoring in construction and operational phase the fund allocated is approx. 320 Lacs as capital cost and recurring cost is 32 Lacs	Ensuring work order has a safety compliance condition mentioning adhering to speed limits, having valid PUC.	Plant Manager /Safety Officer/Security

	constructed. • All transportation vehicles will be suitably covered with tarpaulin & overloading of the vehicles will be avoided. • The first and most important step towards emission control for the large in-use fleet of vehicles is the formulation of an inspection and maintenance system. • 30-40% pollution can be reduced by vehicles through proper periodical inspections and maintenance of vehicles. • PUC certified vehicles will be hire to avoid the exhaust emission.			
During Operation Phase	• To check the efficiency of Air Pollution Control			
	Equipments and emission within the limits • Ambient air quality and stack emissions is being/ will regularly monitored (as per CPCB/SPCB) to ensure that ambient air quality standards and suggested limits of the • Stack emission loads are met honestly all the time. • All the internal roads are/will be black topped to prevent fugitive emissions. • Raw materials will be stored under cover sheds.			

	• Adequate stack height as per CPCB emission regulations of 30 m. for dispersion of pollutants into the atmosphere. • Green belt development is being/ will be done to attenuate the pollution. Only local species will be planted. 33% area of the proposed plant will be under plantation. •			
Water Environment During Construction Phase	• Proper sanitation facilities to be ensured in the construction site. • Domestic sewage to be treated in modular STP. • Provisions is being/ will be made to ensure the construction vehicles stick to the access track to prevent mud & dirt being deposited on roads • Fence is being/ will be constructed around the site to trap sediments whilst allowing the water to flow through. • All mud & dirt deposited on the roads from the construction activities is being/ will be cleaned. • Adopting good construction and engineering practices is being/ will help in mitigating the water pollution. • Curing water is being/ will be sprayed and after liberal curing, all concrete structures will be covered with			• Plant Incharge • EC Incharge

	gunny bags this will conserves water • Ensure prompt cleaning up of accidental spillages to prevent water pollution during rainy season			
Water Environment Operational Phase	• Process effluent to be completely reused either after suitable extraction of supernatant from lagoon system or ETP treatment • Industrial waste water is will be treated in ETP • Domestic Waste water will be treated in STP • Regular ETP effluent monitoring is being/ will be done to track the working of ETP. • The unit will be shut in case of any problem in the ETP working. • Neutralization and sedimentation of wastewaters where applicable˙ Dewatering of sludge and appropriate disposal of solids. • Rainwater harvesting, ground water recharge and storm water management to be implemented • Flow meter installed at Raw water intake point. • Separate storm water drains and process drains are provided	For Water Pollution Monitoring in construction and operational phase the fund allocated is approx. 536 Lacs as capital cost and recurring cost is 53 Lacs	• Monitoring of wastewater quantity and Quality • Ensure characteristics of treated effluent within prescribed norms before disposal • Periodic inspection water quality in to storm water drain and non-mixing of water with process drain	

Noise Environment During Construction Phase	• Construction work especially heavy work will be done during day time. • Vehicular movement carrying raw materials is being/ will be avoided during night time. • The vehicles are will be regularly maintained and optimum use of the same will be made. • Adequate PPE's (ear plugs, ear muffs, helmet, mask etc) will be provided to the workers. • PUC certified vehicles will be used.	For Noise Pollution Monitoring in construction and operational phase the fund allocated is approx. 20Lacs as capital cost and recurring cost is 2 Lacs	• Ensuring work order has a safety compliance condition. • Ensuring workers should wear ear muff and ear plugs	• Project Manager/ Safety • Purchase • department Plant manager
Noise Environment During Operation Phase	• All equipments are being/ will be procured meeting the permissible noise standards. • The insulation provided for prevention and loss of heat and PPE is being/ will also act as noise reducer. • Foundations and structures is being/ will be designed to minimize vibrations and noise. • Regular equipment maintenance and better work habits is being/ will be adopted. • D.G. set is proposed to be housed in an inbuilt acoustic enclosure. The acoustic enclosure is being/ will be designed for minimum 25dB (A) insertion loss for meeting the ambient noise standards, whichever is on the			

	higher side. • Necessary safety and personal protective equipment such as ear plugs, ear muffs, helmet etc is being/ will be provided to the workers. • Noise levels generated is being/ will be maintained to comply with the Factories Act & Rules and will not exceed 75 dB (A) at 1 m distance. • Implementation of green belt within the premises of plant will absorb the noise. Thus is being/ will help to control the noise pollution. • Proper lubrication and housekeeping is being/ will be usually done to avoid excessive noise generation. • Supervisor is being/ will be responsible to control the noise by maintaining conditions of machineries and silencers. • 33% of the total plot area is under greenbelt			
Solid Waste During Construction Phase	• Careful design, planning and good site management would minimize waste of materials such as concrete, mortars and cement grouts. The contractor will make inventory of all types of solid waste that	For waste Pollution	To ensure scraps, used oil generated stored properly, maintain records and to disposed off within	

	are expected during the construction activity before starting the work. • Complete excavated material from the earthworks will be re-used on site as structural fill or for landscaping purposes by balancing with cut & fill operations. • Construction waste generated will be disposed off according to the nature of the waste. • Proper litter disposal and collection points will be established around the all construction work sites. • The transportation of construction spoil will be allowed only to designated dumpsites after obtaining permission of.	Monitoring in construction and operational phase the fund allocated is approx. 536 Lacs as capital cost and recurring cost is 53 Lacs	stipulated time	Plant in -charge
Solid Waste During operation Phase	• Municipal solid waste to the tune of 120 kg/day will be generated including the waste from existing operations and will be sent to Municipal Council,Banda, District- Sagar, M.P. • Hazardous waste like spent oil from DG set operations is being/will be generated from the			

operations which is being/will be sent to CPCB/SPCB approved recyclers.

- The solid waste generated is being/will be first segregated and then handled, stored &disposed off as per applicable Rules i.e. SWM Rules, HW Rules, C&D Rules etc.
- The hazardous waste generated during the operation phase is given below:-

Particular	Hazardous waste Quantity				Treatment Disposal
	Type of waste	Existing	Proposed	Total	
Hazardous waste	Used Oil Category 5.2	278 Litre	222 Litre	500 Litre	Stored in drums and reuse for lubricating the open chain/ gear /roller etc.
	Silica	None	119 MT	119 MT	Recycle in SSP manufacturing as filler.
	H_2SiF_6	None	6466 MT (liquor)	6466 MT (liquor)	Recycle in SSP manufacturing for acid dilution purpose.
	Vanadium Pentoxide Catalyst Waste	None	800 kg	800 kg	Stored and disposed through registered recycler only..
	Sulphur Sludge	None	9 MTPA	9 MTPA	Recycle in SSP manufacturing as a filler.
	Zinc Sludge	None	300MTPA	300MTPA	It will be reuse in SSP.
	ETP sludge	None	60 kg	60 kg	Stored and disposed through registered recycler only.
	Sludge (Schedule I	None	50MTPA	50MTPA	Stored and disposed through Govt.

		category 26.2)				authorized Agency only..	
		Sludge (Schedule I category 26.2) from DAP/NPK ,Ammonia and Nitric Acid Plant	None	50MTPA	50MTPA	It will reuse in SSP	
		Sludge (Schedule I category 34.3) from Sulphuric acid plant	None	100MTPA	100MTPA	It will reuse in SSP	
		Spent Acid Sludge (Schedule I category 34.3)	None	500 Liter /Annum	500 Liter /Annum	It will reuse in SSP	

.

****

Chapter 11

Summary and Conclusions

11.1 Introduction

M/s Madhya Bharat Agro Products Limited has proposed to enhance its production of Chemical fertilizer manufacturing unit located at Plot No.A-1& A-2, Saurai Industrial Area, village–Saurai, Tehsil Banda, District Sagar.The project involves expansion inproduction capacity of fertilizers by addition of DAP/NPK complex fertilizer, Phosphoric acid plant and new chemical production unit at its existing location. The total plot area is 80.65 acre (3,26,404 sq. m.).The proposed expansion of the project site is coming up in the existing unit at Plot NoA-1, A-2, Saurai Industrial Area, village – Saurai, Tehsil Banda, District Sagar (M.P.) and no additional land is required for the same.

The total investment for the project is estimated as Rs 436.75 Crores including Rs. 358.75 Crores/- for the proposed expansion project

The application for obtaining Terms of References (ToR) for carrying out EIA studies was submitted to MoEF&CC, New Delhi and the project has been accorded Standard ToR vide letter No. J-11011/314/2019-IA-II(I) dated 12.12.2019.

The Baseline studies were conducted during October, 2019 to December, 2019 covering post monsoon season. The site is well connected by road network, power supply and other necessary facilities required for the proposed project.

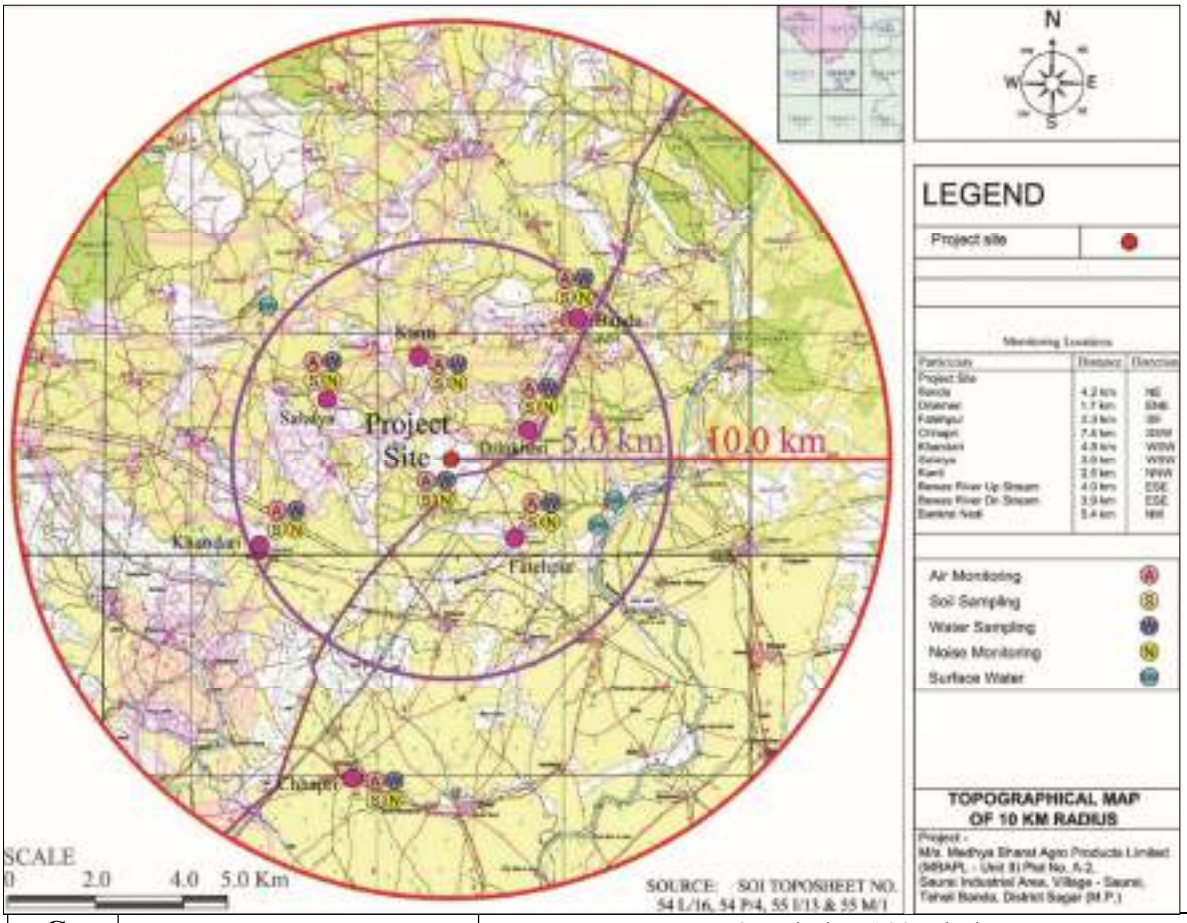
11.1 Description of the Project

11.1.1 Project Details

Table 11.1: Summary of project features

S. No.	Particular	Description
A.	Project Proponent	M/s Madhya Bharat Agro Products Limited
B.	Nature of Project	Expansion of fertilizer unit with addition of chemical unit(MBAPL – Unit II)
C.	Project Location	
1.	Plot No.	A-1& A-2, Saurai Industrial Area

2.	Village	Saurai
3.	Tehsil	Banda
4.	District	Sagar
5.	State	Madhya Pardesh
6.	Extent of geographical coordinates	
	Latitude	24^0 35’ 2.05” N to 24^0 35’ 3.09” N
	Longitude	73^0 45’ 5.24” E to 73^0 44’ 59.58” E
7.	SOI Toposheet No.	54L/16, 54P/4, 55I/13 & 55M/1
D.	Environmental Settings Details (with approx. aerial distance & direction from the project site boundary)	
1.	Nearest village	Sorai - 1.1 km towards S
2.	Nearest National Highway/ State Highway	• NH – 86- 0.5Km & SE
3.	Nearest Railway Station	**S. No.** / **Railway Station** / **Distance (Km) & Direction (From Project Boundary)** 1. / Makronia / Aprox.19.82 km, SE
4.	Nearest Airport	• Khajuraho – 132 Km, SE
5.	National Park, Wild Life Sanctuaries, Biosphere Reserves etc. within 10 Km radius study area	None within study area
6.	Reserved / Protected Forest within 10 km radius	• Semradant P.F.: 8.7 km towards W • P.F.(Hardauni): 10.0 km towards NNE • Mahuna P.F.: 8.3 km towards NNW • Sonpur R.F.: 7.4 km towards NE • Chauka R.F.: 6.9 km towards ENE • BheraKhas R.F.: 10.0 km towards ENE • Prahladpura R.F.: 9.7 km towards ESE
7.	Water Bodies within 10 km radius	• Bewas River : 3.9 km towards ESE • BankraiNadi : 5.4 km towards WNW
E.	Total project cost	Rs 436.75Crores including Rs. 358.75 Crores/- for the proposed expansion project
F.	Soil type	Clay& Clay Loam



G.	Depth of water table	• Pre-monsoon : 95 mbgl to 100 mbgl • Post-monsoon : 90 mbgl - 95 mbgl
H.	Socio-economic factors	No R&R issues involved
I.	Project site topography	Plain
J.	Seismicity	Seismic Zone-II, (Moderate Damage Risk Zone)

Figure- 11.1: Topographical Map showing Monitoring Location

11.1.2 Project Requirement

Table 11.2: Project Requirement

S. No.	Particular	Description
1.	Land requirement	Total: 3,26,404 sq. m *No additional land is required*
2.	Water requirement & its source	Daily total water requirement: 3395KLD • Fresh water requirement: 3376 KLD • Recycled Water requirement: 119KLD Source: Ground water (Bore well)
3.	Electricity requirement & its source	Connected load: 9250 kW (existing: 1200 kW; proposed: 8050 kW) Source : MPSEB
4.	Power Backup	DG Sets Cumulative Capacity: 1875 kVA (875 kVA: 1 no.&1000 kVA:1 No.)
5.	Manpower requirements	Total: 381 persons
6.	Fuel requirement & its source	HSD for DG Sets: 3000 lt/day/D.G set 10 TPH Boiler: 60000 kg/day/Boiler Fuel will be procured locally.

11.1.3 ENVIRONMENTAL MONITORING

For monitoring of the environmental parameters like meteorology, air, water, soil and noise quality, the monitoring stations have been established at different locations in and around the project area. The base line data has been collected in the pre monsoon season i.e. October'2019, November' 2019 & December' 2019.

Ambient Air Quality

The data was generated M/s Winmet Technology Private Limited, Noida U.P for the Post-Monsoon season i.e. October' 2019, November' 2019 & December'2019 for ambient air quality status within 10 km radius of the site. Eight monitoring stations (including project site) were installed at different locations during pre monsoon season i.e. October' 2019, November' 2019 & December'20179 to assess the ambient air quality the summary of all the above location are given below Table No.11.3

S. No.	Criteria Pollutant	Locations	Arithmetic Mean	Minimum	Maximum	98th Percentile
1	PM_{10}	Project site	72.8	67.2	78.3	77.9
		Banda	56.4	50.1	63.9	62.7
		Dilakhedi	64.4	60.9	68.4	68.0

S. No.	Criteria Pollutant	Locations	Arithmetic Mean	Minimum	Maximum	98th Percentile
		Fatehpur Village	64.5	59.0	71.5	70.9
		Chhapri	62.4	56.7	56.7	71.2
		Salaiya	57.4	51.4	65.2	64.0
		Khandari	58.3	50.7	64.0	64.2
		Kanti	65.3	58.2	72.0	71.3
2	$PM_{2.5}$	Project site	41.9	37.5	45.6	45.4
		Banda	28.4	23.1	32.3	32.1
		Dilakhedi	34.9	31.9	39.0	38.3
		Fatehpur Village	32.9	28.2	37.0	37.0
		Chhapri	34.1	29.1	37.9	37.9
		Salaiya	32.3	27.0	36.2	36.0
		Khandari	32.3	27.2	36.4	36.2
		Kanti	36.3	31.0	40.2	40.0
3	SO_2	Project site	7.0	6.4	7.6	7.6
		Banda	5.8	5.3	6.3	6.3
		Dilakhedi	6.0	5.3	7.1	6.9
		Fatehpur Village	7.1	6.2	7.9	7.8
		Chhapri	6.3	5.7	7.1	7.0
		Salaiya	6.1	5.4	6.7	6.7
		Khandari	5.8	5.2	6.5	6.5
		Kanti	6.5	5.7	7.1	7.1
4	NO_X	Project site	19.7	18.1	20.7	20.7
		Banda	16.4	14.9	18.1	17.9
		Dilakhedi	18.2	16.6	20.1	20.1
		Fatehpur Village	18.6	17.1	19.8	19.8
		Chhapri	18.3	16.8	19.8	19.8
		Salaiya	17.9	16.4	19.0	19.0
		Khandari	19.8	18.0	21.2	21.1
		Kanti	17.4	20.0	20.1	20.0
5	CO	Project site	700.4	600.0	780.0	775.4
		Banda	582.9	470.0	690.0	680.8
		Dilakhedi	556.7	480.0	620.0	620.0
		Fatehpur Village	670.4	570.0	750.0	745.4
		Chhapri	675.4	580.0	760.0	750.8
		Salaiya	650.4	550.0	730.0	725.4
		Khandari	675.4	580.0	750.0	745.4
		Kanti	730.4	630.0	810.0	805.4

The analysis results for the study period are presented in above monitoring tables. Various statistical parameters like 98th percentile, average, maximum and minimum values have been computed from the observed raw data for all the AAQ monitoring stations. These are compared

with the standards prescribed by Central Pollution Control Board (CPCB) for rural, residential Industrial and other area.

The observation based on the perusal of the results is summarized below:-

PM10:- The maximum value for PM10 observed at Project Site78.3µg/m3 and minimum value for PM10 at Banda50.1 µg/m3. The 24 hours applicable limit for industrial, residential rural and other areas is 100 µg/m3.

PM2.5:- The maximum value for PM2.5 observed at Project Site is 45.6µg/m3 and minimum value for PM2.5 at Banda is 23.1 µg/m3. The 24 hours applicable limit for industrial, residential rural and other areas is 60µg/m3.

SO2:- The maximum value for SO2 observed at Project Site is 7.6 µg/m3 and minimum value for SO2 at Khandariis 5.2 µg/m3. The 24 hours applicable limit for industrial, residential rural and other areas is 80µg/m3.

NOx: - The maximum value for NOx observed at Khandari is 21.2µg/m3 and minimum value for NOX at Banda14.9µg/m3. The 24 hours applicable limit for industrial, residential rural and other areas is 80µg/m3.

Surface water quality

To assess the present ground water condition seven sampling location were selected for ground water quality testing. The monitoring is done during the pre monsoon season i.e. October 2019, November 2019 & December 2019. It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under :acceptable" render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limit indicated under 'permissible limit in the absence of alternate source' in Colum permissible, above which the source will have to be rejected. If E.coli or Total Coliform are detected immediate treatment is require as per IS: 10500-1991 (Reaffirmed 2012).

The results obtained for the collected samples indicate that the surface water quality was found to be well within the prescribed standards limit (Class A) as per 'Primary water quality criteria for designated best-use classes' by CPCB. The analysis results indicate that:-

- pH of the surface water are in range of 7.22 – 7.51.
- The TDS were found to be in the range of 377 – 735 Mg/l.
- Total Hardness(as $CaCO_3$) was in the range of160-356 Mg/l,
- Total Alkalinity was in the range of 212 - 245 Mg/l.
- Calcium (as Ca) was in the range of 33.6 – 88 Mg/l,
- Magnesium (as Mg) was in the range of 18.47-33.05 Mg/l,

- Chloride (as Cl) was in the range of 69.98-123.97 Mg/l,
- Sulphate (as SO_4) was in the range of27.2-112.6 Mg/l;and
- Fluoride (as F)was in the range of 0.4-0.87 Mg/l

Dissolved oxygen (D.O.) content in surface water quality of monitored locations in study area except for monitoring station SW5 i.e. Nallah in Oda village, was found to be adequate for Class B i.e. *outdoor bathing (organized)*. D.O. at Nallah in Oda village was found suitable for Class A.

Ground Water

The analysis results indicate that pH of the groundwater were found to be in range of 6.82-7.51. The TDS were found to be in the range of 566 – 922 mg/l. Other parameters like Total Hardness as CaCO3 (236 Mg/l - 615Mg/ l), Total Alkalinity (161 – 205Mg/ l), Calcium as Ca (57 – 147 Mg/ l), Magnesium as Mg (22– 59.0 Mg/ l), Chloride as Cl (136-276 Mg/ l), Sulphate as SO4(45 -80 Mg/l) and Fluoride as F- (0.45-0.68 Mg/l) were found within the prescribed limits in absence of alternate source except Total Hardness as CaCO3 in Banda. The water quality is potable in nature

Noise Pollution

Day time Noise Levels Leq(day)

The day time Leq(day) noise levels at all the residential locations were observed to be in the range of 49.6-54.6 dB(A). The maximum noise level of 54.6 dB (A) was observed at Dilakhedi and the minimum noise level of 49.6dB (A) was observed at Kanti during the study period. It is observed that the day time noise levels are in accordance to the prescribed limit of 55dB (A).

Night time Noise Levels Leq(night)

The night time Leq(night) noise levels at all the residential locations was observed to be in the range of 38.5 – 40.1dB (A). The maximum noise level of 44.1dB (A) was observed at Banda the minimum noise level of 38.5 dB (A) at Kantiduring the study period. It is observed that the night time noise levels are in accordance to the prescribed limit of 45dB (A).

Noise levels within project site

The day time Leq(day) noise levels and night time Leq(night) noise levels at project site were observed to be 68.5 dB(A) and 53.6 dB(A) respectively. It is observed that the day and night time noise levels are in accordance to the prescribed limit of 75dB (A) and 70dB(A).

Soil Quality

Eight soil samples in around the project area was collected and analyzed. The result obtained is compared with the standard soil classification given Agriculture Soil Limits. It has been observed

that the soils are Sandy clay in texture and neutral in nature. The nutrient and organic matter contents are medium and the soil is normally fertile.

Ecology

The project site is already surrounded by the urban environment and does not hold any critical habitat/ecosystem as well as any threatened floral or faunal species. So project site will not have any adverse impact on the environment.

The study area is of 10.0 km from the project location.

i. 3 villages are falling are from 0.0 km to 2.0 km radius boundary
ii. 17 villages are falling are from 2.0 km to 5.0 km radius boundary
iii. 44 villages are falling from 5.0 km to 10.0 km radius boundary

Socio-Economic Aspects

The study area comprises of 44 villages, of Tehsil - Banda in the (10.0 k.m.) of the study area. The total population of the study area is 67543 accommodating in 15820 households with an average households size of approx. 5 members per family. The males in the study area constitute 53.28% and females constitute 46.71%. The gender ratio is 877 in the study area. It shall be noted that the district. In the study area, Schedule Caste population is 23.65% which is 15971of the total population. The males are 23.70% of the total male population and females account for 23.57% of the total female population. The sex ratio of the SC population is 872 females over thousand males.

In the study area the literate persons are 40358, which is 59.75% of the total population. The male literates are 69.38% of the total male population and female literates are 48.76% of the total female population. The work participation in the study area is 30119 which account to be 44.6% of the total population. The male work participation is 55.73% with respect to male population and female work participation accounts to be 31.88% with respect to female population in the study area.

11.1.4 ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The summary of anticipated adverse environmental impacts due to the expansion in product capacity with the existing project and mitigation measures are given below.

11.1.5 Air Environment

The impact on air quality is assessed based on emissions of the proposed DG set emissions. NOx and CO will be the important pollutants emitting from these sources. The air pollutants of concern

from the unit will be PM10, Acid Mist, NOX, SO2, HF and NH_3. The details of plant specific emissions are discussed below. Prediction of impacts on air environment has been carried out employing mathematical model based on a steady state Gaussian plume dispersion model designed for multiple point sources for short term. In the present case, AERMOD VIEW dispersion model designed for multiple point sources for short term and developed by United States Environmental Protection Agency [USEPA] has been used for simulations from point source. Model simulations have been carried out for the study period

The Ground level concentrations are computed for 24-hr average. Maximum Ground level concentrations of PM NOx , NH3 and Acid Mist, for study period were 8.38 µg/m3, 14.29 µg/m3, 11.01µg/m3, 5.83 µg/m3, 0.49µg/m3 respectively. The obtained GLC's are well within the stipulated CPCB standards.

11.1.6 Water Environment

Table: Existing and Proposed water demand

S. No	Particulars	Fresh Water	Waste water	Total
1.	Industrial	3258 KLD	107 KLD	3365 KLD
2.	Domestic	18 KLD	12 KLD	30 KLD
	Total	**3276 KLD**	**119 KLD**	**3395 KLD**
Source: Surface Water from Banda Irrigation Project, Sagar				

Approval: The approval for surface water supply to the tune of 1.018m.cum has obtained from office of Chief Engineer and Member of Secretary, Water Resources Department Bhopal (M.P.) vide letter no. 537 dated 23.10.2

11.1.7 Noise Environment

Noise levels have been predicted using Custic Noise Pollution Modeling software, Version 3.2.CUSTIC Noise Pollution Modeling Software

The CUSTIC 3.2 Software accepts meteorological data records to define the conditions for sound propagation. The model estimates the noise level for each source/receptor combination and calculates user - selected averages. This software allows for creation of robust and useful numerical simulations that fully make use of the graphical user interface

The model setup is presented in Table below: -

- Use of silencers for fans is being /will be used.
- Acoustic enclosure for DG set is being/ will be used. ¬

- Adopt Personal Protective Equipment's (Ear Plugs/ Muffs) in high noise zone. ¬ Foundations and structures has been/will be designed to minimize vibrations and noise.
- The insulation provided for prevention and loss of heat and personnel safety shall also act as noise reducer
- Anti-vibration pads and adequate walled room will be provided to compressors for noise absorption
- The motors and compressors shall be provided with guards and shall be mounted adequately to ensure the reduction of noise and vibration.
- Periodic maintenance of equipments/replacing whenever necessary/lubrication of rotating parts, etc
- The DG set shall be kept in a separate enclosed room with acoustic enclosure. Closed bucket elevators and screw conveyors will be used to minimize noise levels.
- The standards for occupational exposures - tolerable level is 90 dB(A) for 8 hour exposure is/will be achieved at work zone area through use of properly maintained machines, pumps, compressors and vehicles.
- Vehicles having PUC certificates will only be allowed to transport materials at project site
- Vehicle movement for transportation of materials and work force to the site will cause minor noise emission as the frequency of vehicular movement will be few times in a week.
- Unnecessary horn honking will be avoided and strictly prevented
- Conducting audiometry test for employees working in high noise area& employees shall be trained in the mitigation measures and personal protection measures to be taken to avoid noise related health impacts.
- Implementation of greenbelt for noise absorption such as Alstonia scholaris Azadirachta indica, Melia monosperma, Grevillea peridifolia etc

11.1.8 Socio-Economic Environment

The requirement of unskilled manpower is being met from nearby villages' operational phase through training and development. The project is also help in generation of the indirect employment apart from direct employment. This is a positive socio-economic development for the region. There is a general upliftment of standard of living in the region.

11.1.9 Solid & Hazardous Waste

Table: Details of Hazardous Waste

Particular	Hazardous waste Quantity				Treatment Disposal
	Type of waste	Existing	Proposed	Total	
Hazardous Waste	Used Oil Category 5.1 (Consent No. AWH -47347 & 45474)	278 Litre	500 Litre	778 Litre	Stored in drums and reuse for lubricating the open chain/ gear /roller etc.
	Silica (Annexure II in Form-4 (19-20)	119 MT	None	119 MT	Recycle in SSP manufacturing as filler.
	H_2SiF_6 (Annexure II in Form-4 (19-20)	6466 MT (liquor)	None	6466 MT (liquor)	Recycle in SSP manufacturing for acid dilution purpose.
	Zinc Sludge from Zinc Sulphate	None	300MTPA	300MTPA	It will be reuse in SSP.
	Sludge (Schedule I category 26.2) from DAP/NPK ,Ammonia and Nitric Acid Plant	None	50MTPA	50MTPA	It will reuse in SSP
	Sludge (Schedule I category 26.2) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	MEE Salt (Schedule I category 26.1) from VS	None	50MTPA	50MTPA	Stored and disposed through registered recycler only.
	Sludge (Schedule I category 34.3) from SAP	None	200MTPA	200MTPA	It will reuse in SSP

Generation of Municipal Solid Waste

Particulars	Population	Basis	Quantity of waste generated (in kg/day)
Workers	381	@0.3 kg/day	114
Landscaping	28.29	@0.2kg/acre/day	6
		Total	**120kg/day**

Management

Entire quantity of the hazardous waste is being /will be stored in the isolated hazardous waste storage area within premises having leachate collection system and roof cover Organic sludge generated in sewage treatment plant shall be collected and utilized for agriculture uses. The hazardous waste will be collected in HDPE bags and is being/will be sent to Common Treatment, Storage & Disposal Facilities, Used oil will be collected, stored and sold to registered recyclers. ETP sludge is being/will be collected, stored and disposed at secured landfill site.

11.2 ENVIRONMENTAL MONITORING PROGRAMME

Industry will have Group of Engineering to review the efficacy of environment management during construction and operational phase of proposed expansion project. The Environmental Monitoring Cell (EMC) is a part of Engineering Group who works for monitoring and meet regularly to review the effectiveness of the EMP implementation. The data collected on various EMP measures would be reviewed by EMC and if needed corrective action will be formulated for implementation.

S. No.	Environmental attributes	Parameters	Locations	Frequency of monitoring
1.	Ambient air	PM_{10}, $PM_{2.5}$, CO, SO_2, NO_x,	Three locations (one upwind + 2 downwind)	Once in a quarter
2.	DG Stack	CPCB notified standards	All DG sets within project	Once in a quarter
	>1000 kVA	PM, CO, NO_x, HC		
	<1000 kVA	PM, CO, NO_x, NMHC		
3.	Stack Emission	NOx&SO_2 in Reformer, stacks and NH_3 & PM in Prilling Tower	All continuous Stacks	Fortnightly
4.	Ground water	As per IS: 10500	All bore wells for water supply Peizo metric Wells	Monthly

S. No.	Environmental attributes	Parameters	Locations	Frequency of monitoring
5.	Treated water from STP & ETP	pH, Oil & Grease, TSS, BOD, COD, others as prescribed by CPCB/ MoEF/ SPCB	Outlet of STP & ETP	Once in a month
6	Ambient noise levels	Day & Night time noise levels in dB (A)	Plant area	Monthly
7	Soil quality	Composite sample from the site for Physio-chemical parameters	Two locations within project site	Once in six months
8	Energy Audit	As per BEE standards	Project area	Once in three years
9	Water levels	Water level (mbgl)	Piezometric wells	Continuous through DWLR

11.3 PROJECT BENEFITS

The proposed expansion project will help in and around surrounding development and also generate job opportunities for skilled semi skilled and unskilled in construction phase and operation phase for the local people. The directly and indirectly people residing in the nearby areas will be benefit. It is likely that the proposed expansion project will provide benefits in all important aspects.

11.4 ENVIRONMENT MANAGEMENT PLAN DURING CONSTRUCTION AND OPERATION PHASE

Environmental Management Plan (EMP) aims at the preservation of ecological system by considering in-built pollution abatement facilities at the proposed site. Some of the major criteria governing the environmental measures will be adopted, and the same is described in ensuring paragraphs.

Environment Attributes	Mitigation Measures
Air Environment During Construction Phase	• All the loose material either stacked or transported will be provided with suitable covering such as tarpaulin. • For dust suppression due to vehicular movements, water sprinkling will be done from time to time.

	• To minimize the occupational health hazard, proper mask will be provided to the workers who are engaged in activities that may lead to dust generation. • The construction area will be secured with the help of construction cloth or net from all the four sides to contain the dust within the premises. • To minimize dust emission to the atmosphere when materials & waste will be removed from the premises and suitable covered skips and enclosed chats will be used. • Parking for vehicle and paved road will be constructed initially. • Foremost upwind portion of the project will be constructed. • All transportation vehicles will be suitably covered with tarpaulin & overloading of the vehicles will be avoided. • The first and most important step towards emission control for the large in-use fleet of vehicles is the formulation of an inspection and maintenance system. • 30-40% pollution can be reduced by vehicles through proper periodical inspections and maintenance of vehicles. • PUC certified vehicles will be hire to avoid the exhaust emission.
During Operation Phase	• To check the efficiency of Air Pollution Control
	Equipments and emission within the limits • Ambient air quality and stack emissions is being/ will regularly monitored (as per CPCB/SPCB) to ensure that ambient air quality standards and suggested limits of the • Stack emission loads are met honestly all the time. • All the internal roads are/will be black topped to prevent fugitive emissions. • Raw materials will be stored under cover sheds. • Adequate stack height as per CPCB emission regulations of 30 m. for dispersion of pollutants into the atmosphere. • Green belt development is being/ will be done to attenuate the pollution. Only local species will be planted. 33% area of the proposed plant will be under plantation. •
Water Environment During Construction Phase	• Proper sanitation facilities to be ensured in the construction site. • Domestic sewage to be treated in modular STP. • Provisions is being/ will be made to ensure the construction vehicles stick to the access track to prevent mud & dirt being deposited on roads • Fence is being/ will be constructed around the site to trap sediments whilst allowing the water to flow through. • All mud & dirt deposited on the roads from the construction activities is being/ will be cleaned.

	• Adopting good construction and engineering practices is being/ will help in mitigating the water pollution. • Curing water is being/ will be sprayed and after liberal curing, all concrete structures will be covered with gunny bags this will conserves water • Ensure prompt cleaning up of accidental spillages to prevent water pollution during rainy season
Water Environment Operational Phase	• Process effluent to be completely reused either after suitable extraction of supernatant from lagoon system or ETP treatment • Industrial waste water is will be treated in ETP • Domestic Waste water will be treated in STP • Regular ETP effluent monitoring is being/ will be done to track the working of ETP. • The unit will be shut in case of any problem in the ETP working. • Neutralization and sedimentation of wastewaters where applicable˙ Dewatering of sludge and appropriate disposal of solids. • Rainwater harvesting, ground water recharge and storm water management to be implemented • Flow meter installed at Raw water intake point. • Separate storm water drains and process drains are provided
Noise Environment During Construction Phase	• Construction work especially heavy work will be done during day time. • Vehicular movement carrying raw materials is being/ will be avoided during night time. • The vehicles are will be regularly maintained and optimum use of the same will be made. • Adequate PPE's (ear plugs, ear muffs, helmet, mask etc) will be provided to the workers. • PUC certified vehicles will be used.
Noise Environment During Operation Phase	• All equipments are being/ will be procured meeting the permissible noise standards. • The insulation provided for prevention and loss of heat and PPE is being/ will also act as noise reducer. • Foundations and structures is being/ will be designed to minimize vibrations and noise. • Regular equipment maintenance and better work habits is being/ will be adopted. • D.G. set is proposed to be housed in an inbuilt acoustic enclosure. The acoustic enclosure is being/ will be designed for minimum 25dB (A) insertion loss for meeting the ambient noise standards, whichever is on the higher side. • Necessary safety and personal protective equipment such as ear plugs, ear muffs, helmet etc is being/ will be provided to the workers. • Noise levels generated is being/ will be maintained to comply with the Factories Act & Rules and will not exceed 75 dB (A) at 1 m distance.

	• Implementation of green belt within the premises of plant will absorb the noise. Thus is being/ will help to control the noise pollution. • Proper lubrication and housekeeping is being/ will be usually done to avoid excessive noise generation. • Supervisor is being/ will be responsible to control the noise by maintaining conditions of machineries and silencers. • 33% of the total plot area is under greenbelt
Solid Waste During Construction Phase	• Careful design, planning and good site management would minimize waste of materials such as concrete, mortars and cement grouts. The contractor will make inventory of all types of solid waste that are expected during the construction activity before starting the work. • Complete excavated material from the earthworks will be re-used on site as structural fill or for landscaping purposes by balancing with cut & fill operations. • Construction waste generated will be disposed off according to the nature of the waste. • Proper litter disposal and collection points will be established around the all construction work sites. • The transportation of construction spoil will be allowed only to designated dumpsites after obtaining permission of.
Solid Waste During operation Phase	• Municipal solid waste to the tune of 120 kg/day will be generated including the waste from existing operations and will be sent to Municipal Council,Banda, District- Sagar, M.P. • Hazardous waste like spent oil from DG set operations is being/will be generated from the operations which is being/will be sent to CPCB/SPCB approved recyclers. • The solid waste generated is being/will be first segregated and then handled, stored &disposed off as per applicable Rules i.e. SWM Rules, HW Rules, C&D Rules etc.

11.5 CONCLUSION

It is predicted that socio-economic impact due to this project will positively increase the employment opportunities for local inhabitants. There are no Resettlement and Rehabilitation issues involved in this project. The contribution to the revenue of the State Govt. will be put in public welfare and augment growth. The entire project area is devoid of any endangered flora and fauna. Thus the expansion of project is not likely to affect the environment or adjacent ecosystem adversely.

****