M/S. ARCELORMITTAL NIPPON STEEL INDIA LIMITED

EIA Report for Expansion of Integrated Steel Plant from 9.6 to 15.6 MTPA (Liquid Steel) Located at Hazira Village in Surat District, Gujarat

AUGUST 2022

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ACCREDITATION DETAILS

NABET Certificate No. NABET/EIA/1922/RA 0138, Issued on 05-08-2019, Valid up to 25-05-2022.

NABET Certificate No. NABET/EIA/2023/SA 0164, Issued on 19.04.2022 Valid up to 19.03.2023.

Monitoring Period: 12 weeks March to May 2021 and 1 month additional from 23rd Nov 2021 to 26th Dec 2021

Environmental Laboratary: Kadam Environmental Consultants

M/S. ARCELORMITTAL NIPPON STEEL INDIA LIMITED

EIA Report for Expansion of Integrated Steel Plant from 9.6 to 15.6 MTPA (Liquid Steel) Located at Hazira Village in Surat District, Gujarat

QUALITY CONTROL							
Name of Publication	EIA Report for expansion of Inegrated Steel Plant from 9.6 to 15.6 Milion Tons Per Annum Liquid Steel at Hazira in Surat District, Gujarat						
Project Number	2147133312	**Issue No.**	1	**Revision No.**	1	**Released**	August 2022
DISCLAIMER							
Kadam has taken all reasonable precautions in the preparation of this report as per its auditable quality plan. Kadam also believes that the facts presented in the report are accurate as on the date it was written. However, it is impossible to dismiss absolutely, the possibility of errors or omissions. Kadam therefore specifically disclaims any liability resulting from the use or application of the information contained in this report. The information is not intended to serve as legal advice related to the individual situation.							

AM/NS INDIA

TO WHOMSOEVER IT MAY CONCERN

M/s. ArcelorMittal Nippon Steel India Limited has proposed Expansion of its Integrated Steel Plant from 9.6 to 15.6 MTPA (Liquid Steel) at village Hazira, Tehsil Choryasi, District Surat, Gujarat state.

The proposed project is listed under activity 3(a) Metallurgical Industries (Ferrous & Non-ferrous), 4 (b) Coke Ovens and 1(d) Thermal Power Plant and falls under Category 'A', thus requiring prior Environmental Clearance (EC) from MoEF&CC.

We have appointed M/s. Kadam Environmental Consultants, an EIA Consultancy Organization, duly accredited for above mentioned sectors by NABET, for conducting the EIA study.

We hereby give an undertaking that the data and the information given in the EIA Report and its relevant Annexures / enclosures, prepared by M/s. Kadam Environmental Consultants, are factually correct to the best of our knowledge and belief.

Date: 03.08.2022

Place: Hazira, Surat, Gujarat

For, **M/s. ArcelorMittal Nippon Steel India Limited**

3/8/2022

Samar Suri
Head Projects - Upstream Expansion
Authorized Signatory

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A joint venture between ArcelorMittal and Nippon Steel Corporation

ArcelorMittal NIPPON STEEL

DECLARATION BY EXPERTS CONTRIBUTING TO THIS REPORT

"I, hereby, certify that I was a part of the EIA team in the following capacity that developed this Report".

EIA Sector Number as per NABET	8 11	**Name of Sector as per NABET**	Mettalurgical Industries (Ferrous & Non- Ferrous) 3(a) Coke Oven Plant 4 (b)

EIA COORDINATOR

Name	Mr. Krishna Mohan Khare	
Signature & Date		
Period of involvement	August 2021 to Ongoing	
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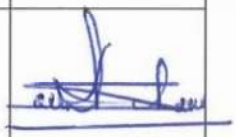
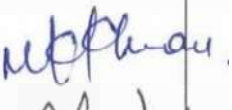
FUNCTIONAL AREA EXPERTS

S. No.	Functional Areas	Name of the Expert	Involvement		Signature & Date
			Period	Task	
1	Air Pollution Prevention, Monitoring & Control (AP)	Sangram Kadam (FAE)	August 2021 to Ongoing	Site visit, finalization of monitoring locations, checking air quality data, evaluation of results of Ambient Air Quality Monitoring (AAQM), supervision of air quality modelling and prediction, identification of impacts, suggestion and finalization of mitigation measures with client, and contribution to EIA documentation,	
2	Water Pollution Prevention, Control & Prediction of Impacts (WP)	Sameer Kadam (FAE)	August 2021 to Ongoing	Site Visit, Finalization of sampling locations for surface water sampling, water balance for the project, evaluation of water pollution control management, identification of impacts, suggestion and finalization of mitigation measures, contribution to EIA documentation	
3	Solid waste and Hazardous Waste Management (SHW)	Sameer Kadam (FAE)	August 2021 to Ongoing	Identification of waste generated from the proposed plant, studying adequacy of mitigation measures for management of hazardous waste, contribution to the EIA documentation	
4	Socio-Economics (SE)	Sangram Kadam (FAE)	August 2021 to Ongoing	Site Visit/ Field Survey, Assessment of the possible changes to socio-economic issues arising out of the proposed project activity	
5	Ecology and Biodiversity (EB)	Mitali Khuman (FAE)	August 2021 to Ongoing	Site visit, Field survey, Assessment of impacts of proposed project on biological environment, preparation of FAE report	
6	Hydrogeology, ground water and Water Conservation (HG)	N Kavlanekar (FAE)	August 2021 to Ongoing	Understanding and representing groundwater conditions, finalization of groundwater sampling locations, finalization of survey findings, identification of impacts, suggestion of	

S. No.	Functional Areas	Name of the Expert	Involvement		Signature & Date
			Period	Task	
				mitigation measures and contribution to the EIA documentation	
7	Geology (GEO)	N Kavalanekar (FAE)	August 2021 to Ongoing	Geology and geomorphologic analysis based on secondary data Finalization of soil sampling locations, analysis of the data collected, contribution to EIA documentation	
8	Soil Conservation (SC)	B K Patel (FAE)	August 2021 to ongoing	Site Visit, Finalization of Soil Sampling Location, Finalization of Survey findings, identification of impacts, suggestion of mitigation measures and contribution to the EIA documentation	
9	Meteorology Air Quality Modelling & Prediction (AQ)	Sangram kadam (FAE)	August 2021 to Ongoing	Site visit, finalization of monitoring locations, checking air quality data, evaluation of results of Ambient Air Quality Monitoring (AAQM), supervision of air quality modelling and prediction, identification of impacts, suggestion and finalization of mitigation measures with client, and contribution to EIA documentation,	
10	Noise and Vibration (NV)	Soham Joshi (FAE)	August 2021 to Ongoing	Site visit, Checking of Noise sampling results and analysis of data, identification of impact and mitigation measures and preparation of FAE report	
11	Land Use (LU)	Sangram Kadam (FAE)	August 2021 to Ongoing	Site visit, Development of land use maps of study area using GIS / related tools, site visit for ground truth survey, finalization of land use maps, contribution to EIA documentation	
12	Risk Assessment & Hazard Management (RH)	Amol Vadnere (FAE)	June 2020 to Ongoing	Coordinating safety studies Developing & interpreting consequence contours	

Declaration by the Head of the Accredited Consultant Organization / Authorised Person:

I, Sangram Kadam, hereby, confirm that the above-mentioned experts prepared the EIA Report for M/s. ArcelorMittal Nippon Steel India Limited and Draft EIA Report for expansion of Inegrated Steel Plant from 9.6 to 15.6 Milion Tons Per Annum Liquid Steel at Hazira in Surat District, Gujarat. I also confirm that Kadam Environmental Consultants shall be fully accountable for any misleading information mentioned in this statement.

Signature	: 
Name	: Sangram Kadam
Designation	: Director
Name of the EIA Consultant Organization	: Kadam Environmental Consultants
NABET Certificate No. & Issue Date	: NABET/EIA/1922/RA 0138, Issued on 05-08-2019, Valid up to 25-05-2022 NABET Certificate No. NABET/EIA/2023/SA 0164, Issued on 19.04.2022 Valid up to 19.03.2023

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ABBREVIATIONS AND ACRONYMS

AAQM	:	Ambient Air Quality Monitoring
AERMOD	:	AMS/EPA Regulatory Model
AFL	:	Aquatic Flora
AFA	:	Aquatic Fauna
BOD	:	Biochemical Oxygen Demand
BF	:	Blast Furnace
BOF	:	Basic Oxygen Furnace
BLEVE	:	Boiling Liquid Expanding Vapour Explosion
CPCB	:	Central Pollution Control Board
COD	:	Chemical Oxygen Demand
CO	:	Carbon Monoxide
CO	:	Coke Oven
CAGR	:	Compound Annual Growth Rate
CPP	:	Captive Power Plant
CRM	:	Cold Rolling Mill
CSP	:	Compact Strip Production
CHWTSDF	:	Common Hazardous waste Transportation Storage and Disposal Facility
DILR	:	District Inspector of Land Record
DRI	:	Direct Reduction of Iron
DMP	:	Disaster Management Plan
EC	:	Environmental Clearance
EB	:	Ecology and Biodiversity
EIA	:	Environmental Impact Assessment
EAF	:	Electric Arc Furnace
EHS	:	Environment, Health and Safety
EPRG	:	Emergency Response Planning Guidelines
ECC	:	Emergency Control Center
FAE	:	Functional Area Expert
FMECA	:	Failure Modes Effects and Criticality Analysis
FMO	:	Factory Medical officer
GIS	:	Geological Survey of India
GLC	:	Ground Level Concentration
GOI	:	Government of India
HBI	:	Hot Briquetted Iron
HRC	:	Hot Rolled Coil
IMD	:	Indian Meteorological Department
IDLH	:	Immediately Dangerous to Life or Health
IUCN	:	International Union for Conservation of Nature
IWPA 1972	:	Indian Wild Life Protection Act, 1972
KLD	:	Kilo Liters per Day
LEL	:	Lower Flammability Limits
LCLo	:	Lethal Concentration Low
MFL	:	Marine Flora
MFA	:	Marine Fauna
MTPA	:	Million Tons Per Annum

MSIHC Rules	:	Manufacture, Storage & Import of Hazardous Chemical Rules
MoEF&CC	:	Ministry of Environment, Forests and Climate Change
MCLs'	:	Maximum Credible Loss Scenarios
MSDS	:	Material Safety Data Sheet
NRSA	:	National Remote Sensing Agency
NIOSH	:	National Institute for Occupational Safety and Health
NOx	:	Oxides of Nitrogen
OSHA	:	Occupational Safety and Health Administration
PEL	:	Permissible Exposure Limits
PM	:	Particulate Matter
PPEs	:	Personnel Protective Equipment
SS	:	Suspended Solid
SO_2	:	Sulphur Dioxide
SPL	:	Sound Pressure Level
STEL	:	Short Time Exposure Limit
SMS	:	Steel Melting Shop
SS	:	Stainless Steel
ToR	:	Terms of References
TCLo	:	Toxic Concentration Low
TFA	:	Terrestrial Fauna
TFL	:	Terrestrial Flora
TLV	:	Threshold Limit Value
TDS	:	Total Dissolved Solid
TSDF	:	Treatment, Storage and Disposal Facility
USEPA	:	United States Environment Protection Agency
UFL	:	Upper Flammable Limits
VOC	:	Volatile Organic Compound
WHE	:	Waste Heat Evaporator
WHRB	:	Waste Heat Recovery Boiler

GLOSSARY OF TERMS USED FOR RISK ASSESSMENT AND DMP

Accident: An accident may be defined as 'an undesirable and unplanned event with or without or major or minor damage consequence to life and/or property.'

BLEVE: (Boiling Liquid Expanding Vapour Explosion): This is a type of explosion that can occur when a vessel containing a pressurized liquid is ruptured. Such explosions can be extremely hazardous.

Consequence: Magnitude or size of the damage or loss. In terms of health and safety, it is the degree of harm that could be caused to the people exposed to hazard, the potential severity of injuries or ill health, and/or the number of people who could be potentially affected. Consequence of hazard need not only be in terms of human safety criteria, but could also be in terms of a financial loss due to production and incurred costs due to repairs/replacement, environmental impacts as well as public outrage.

Disaster: Catastrophic consequence of a major emergency/accident that leads to, not only extensive damage to life and property but also disrupts all normal human activity for a long time and requires a major national and international effort for rescue and rehabilitation of those affected.

Emergency: Situation of process deviation that if uncontrolled may lead to a major accident/disaster with potential short term and/or long term risk damage consequence to life and property in and/or around the facility.

Explosion: An explosion is a sudden increase in volume and release of energy in an extreme manner, usually with the generation of high temperatures and the release of gases.

Flammable Limit: Flammable limits refer to the conditions under which a mixture of a flammable material and air may catch fire or explode. When vapours of a flammable or combustible liquid are mixed with air in the proper proportions in the presence of a source of ignition, rapid combustion or an explosion can occur. The proper proportion is called the flammable range and is also often referred to as the explosive range. The flammable range includes all concentrations of flammable vapour or gas in air, in which a flash will occur or a flame will travel if the mixture is ignited.

Flash Fire: A flammable gas release getting ignited at the farthest edge resulting in flash-back fire.

Fireball: The burning of a flammable gas cloud on being immediately ignited at the edge before forming a flammable/explosive mixture.

Hazard: Is the potential of an Accident.

Incident: Is an emergent situation of any critical deviation in the process control or otherwise that may lead to a major accident/potential emergency and disaster.

Injury Zone: Zone of injury in any hazardous event.

Lower Explosive Limit (LEL) / Lower Flammable Limit (LFL): Lower explosive limit (LEL) or the lower flammable limit (LFL) is the minimum concentration of flammable vapour or gas in air, below which propagation of flame does not occur on contact with a source of ignition. The mixture is said to be too lean.

Major Accident Hazard (MAH) Industry: If the quantity of any chemical as listed in MSIHC Rules' Schedule-2 or Schedule-3 is equal to or greater than the Threshold Quantity given therein.

Major Accident: Loss of life or 10 or more injuries on-site or 1 or more injuries off-site (as defined in MSIHC Rules).

Plumes: Plumes are continuous release of hazardous gases and vapours. Smoke from a chimney is an example. Plumes can cause FIRES AND EXPLOSIONS as secondary scenarios; in case the gases are flammable & ignition occurs.

Puffs: Puffs are instantaneous release of hazardous gases and vapours. Puffs can give rise to FIRE BALLS and vapour cloud explosions (VCE). A special case of vapour cloud explosion is the Boiling Liquid Expanding Vapour Explosion (BLEVE).

Risk Assessment: A process that involves estimation and measurement of risk to determine priorities and to enable identification of appropriate level of risk treatment (used also to describe the overall process of risk management).

Risk Control: Implementation of strategies to prevent or to control hazards

Risk Management: Overall description of the steps taken to manage risk, by identifying hazards and implementing controls in the workplace.

Risk Rating: The category, or level, or risk assigned following risk assessment (e.g. High, Medium or Low).

Risk: Combination of the likelihood of a specific unwanted event and the potential consequences, if it should occur.

Spills: Spills are liquid pools created by leaking liquid chemicals. Spills may cause evaporation and dispersal of toxic gases and if the spilled liquid is flammable, then it can catch fire creating a pool fire, or the vapour can cause explosion.

Upper (or HIGHER) Explosive Limit (UEL or HEL) / Upper (or Higher) Flammable Limit (UFL or HFL): Upper (or Higher) explosive limit (UEL/HEL) or the upper (or higher) flammable limit (UFL/HFL) is the maximum concentration of flammable vapour or gas in air, above which propagation of flame does not occur on contact with a source of ignition. The mixture is said to be too rich.

VCE (Vapour Cloud Explosion): Explosion resulting from vapour clouds formed from flashing liquids or non-flashing liquids and gases. Sometime also referred to as unconfined vapour cloud explosion. (UCVE)

Vulnerability Zone: Zone of Exposure leading to Fatality or recoverable injury in any hazardous event.

Stability Class

- A - Extremely unstable (sunny, light wind)
- B- Moderately unstable (less sunny or windier)
- C- Slightly unstable (very windy/sunny or overcast/light wind)
- D- Neutral (little sun and high wind or overcast/ windy night)
- E - Slightly stable (less overcast and less windy night than D)
- F - Moderately stable (night with moderate clouds and light/ moderate wind)

ERPG

- **Emergency Response Planning Guidelines1 (ERPG1):** The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour (without a respirator) without experiencing other than mild transient adverse health effects or without perceiving a clearly defined objectionable odor.
- **Emergency Response Planning Guidelines2 (ERPG2):** The maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

- **Emergency Response Planning Guidelines3 (ERPG3):** The maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effect

1 INTRODUCTION

1.1 Purpose of the Report

As per the EIA Notification, 2006, as amended till date, the proposed expansion of the existing integrated steel plant of ArcelorMittal Nippon Steel India Ltd. (AMNSI) is listed under activity 3(a) Metallurgical Industries (Ferrous & Non-ferrous) and 4 (b) Coke Ovens and 1(d) Thermal Power Plant and falls under Category 'A', thus requiring prior Environmental Clearance (EC) from MoEF&CC. Hence, as a part of the procedure, an application to MOEF&CC, for obtaining Terms of References (TOR), for conducting the EIA study, to obtain Environmental Clearance was submitted on 06.10.2021 along with pre-feasibility report & other supporting documents. Terms of Reference (ToR) for the project was granted by MoEF&CC, New Delhi vide letter no. J-11011/44/2004-IA. II (I) dated 3rd December 2021 for seeking prior Environment Clearance.

In the 53rd Reconstituted Expert Appraisal Committee (REAC) meeting held on 11.02.2022, during appraisal of AMNSI Modernization Project for grant of EC, the committee advised AMNSI to amend the Expansion project configuration, mentioned in the TOR issued on 03.12.2021, in line with the Modernisation proposal.

Also, during DILR Survey, jointly carried out by Revenue & Forest Dept., as approved by Surat District Collector on 17.03.2022, some area has been declared as Forest land, lying within the boundary of the plant.

Considering the above, M/s. ArcelorMittal Nippon Steel India Ltd has sought amendment in "Project configuration and land details" in the ToR issued by MoEF&CC on 03.12.2021 for the project. The amendment was sought for the followings:

a) Amendment in the land details and revised plant boundary based on recent DILR survey

b) Amendment in Project configuration in line with modernization Project EC dated.02.03.2022.

The amended Terms of Reference (ToR) for the project was granted by MoEF&CC on 30th May 2022

The purpose of the report is to take stock of the prevailing quality of environment, to assess the impacts of proposed industy expansion activity on the environment and to plan appropriate environmental control measures to minimize adverse impacts and to maximize beneficial impacts of expansion proposed. The following major objectives have been considered:

- Information for decision makers
- Internalizing the externalities

This report is prepared based on 'General Structure of EIA' given in Appendix III and III A of the EIA Notification 2006, amended till date.

1.2 Identification of Project and Project Proponent

1.2.1 Project Proponent

ArcelorMittal and Nippon Steel have established a joint venture (JV) company named ArcelorMittal Nippon Steel India Limited (AMNSI) in India. AMNSI has acquired a fully integrated steel plant at Hazira, Gujarat with a production capacity of 9.6 MTPA of liquid steel along with downstream units, namely, cold rolling mill, galvanising line, steel processing facilities, extra wide plate mill and pipe mill. Additionally, AMNSI also owns significant iron ore Beneficiation and Pelletisation capacities located in Eastern India, with direct access to the region's rich iron ore reserves.

The various facilities owned by AMNSI across India are listed below:

- 9.6 MTPA Integrated Steel Plant at Hazira, Gujarat.
- 8.0 MTPA Beneficiation Plant at Dabuna, Odisha.
- 2 x 6 MTPA Pellet Plants (PP#1 and PP#2) at Paradeep, Odisha, linked via a slurry pipeline to the Dabuna Beneficiation Plant.
- 8 MTPA Beneficiation Plant at Kirandul, Chhattisgarh.
- 7.2 MTPA Pellet Plant at Vizag, Andhra Pradesh linked via slurry pipeline with the Beneficiation Plant at Kirandul, Chhattisgarh.
- 0.7 MTPA Cold Rolling Complex including pickling, cold rolling, galvanizing and color coating facilities at Pune, Maharashtra.

The pellet plants at Vizag and Paradeep produce Direct Reduction (DR) grade and Blast Furnace (BF) grade pellets respectively. The entire production of DR grade pellets is consumed by the natural gas-based DR plant at Hazira, whilst a significant portion of the BF grade pellets is consumed by the BF and COREX units at Hazira. The balance BF grade pellets are sold in the market.

1.2.2 The Project

AMNSI proposes to undergo a brownfield expansion for production of liquid steel from 9.6 to 15.6 MTPA and corresponding 6.0 MTPA hot rolled coils within the existing steel plant of AMNSI.

1.3 Brief Description of Size, Nature, Location of The Project and Its Important to the Country and Region

1.3.1 Existing Project

Status of implementation of the projects under the exiting EC are as follows:

Table 1-1: Configuration and Production Capacity as per EC dated 02.03.2022 for the Modification Project of AMNS

Sl. No	Plant / Facility	As per EC dated: 09.03.2016 (A=A1+A2)							Final Configuration and Production as per EC dated 02.03.2022 for Modification Project of AMNS		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO			
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	Config.	Capacity in TPA	
1	HBI Plant (DRI Mod I to VI)	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83 (- 4.0* =3.83)	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	-	-	7.83	Mod I-IV: 4.0 Mod V - 1.98 Mod VI: 1.85	7.83	* Earlier planning was to remove HBI Modules (1 to 4) totalling 4 MTPA and replace it with Blast Furnace of 3.0 MTPA. This could not be implemented due to fund constraints and legal cases at the NCLT. *Original capacity prior to EC 2016 was 7.83 MTPA only. It is now proposed to maintain this original capacity. CTO has been sanctioned for 7.83 MTPA.
2	Blast Furnace (BF)	1 x 2.04 (2200 m3) 1 x 3.0	5.04	1 x 2.04	2.04*	1 x 3.0	3.0#	2.04	BF#1 (2200 m3)	2.04	# 1 x 3.0 MTPA couldn't be implemented due to fund constraints and legal cases at the NCLT, now dropped.
3	Sinter Plant	1x1.48 (1 x 120 m2) 2x3.5	8.48	1 x 1.48 (1 x 120 m2)	1.48	2 x 3.5 (~ 325 m2 each)	7.0*	1.48	1x1.48 (1 x 120 m2)	1.48	* 7.0 MTPA plant could not be implemented due to fund constraints and legal cases at the NCLT.

Sl. No	Plant / Facility	As per EC dated: 09.03.2016 (A=A1+A2)							Final Configuration and Production as per EC dated 02.03.2022 for Modification Project of AMNS		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO			
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	Config.	Capacity in TPA	
		(~ 325 m2 each)									Now, will establish the 7.0 MTPA Plant under the proposed expansion project.
4	Coke Oven (Recovery Type)	1 x 1.20 1 x 1.35	2.55	2 x 59 Ovens	1.35#	-	1.20*	-	CO Battery# 1 2 x 59 Ovens	1.35	# Under implementation *1.2 MTPA plant could not be implemented due to fund constraints and legal cases at the NCLT. *2016 EC approved for 2.55 MTPA, AMNSI is proceeding only with 1.35 MTPA since 1.2 MTPA originally secured in 2010 EC has now lapsed.
5	Air Separation Plant (Nm3/Hr)	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1 X 2200 TPD (Only oxygen)	424,744	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD (Only oxygen)	360,544	1 X 2200 TPD*	64,200*	360,544	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1 X 2200 TPD (Only oxygen)	424,744	* 3,60,544 Nm3/hr plants are in, operations, balance 64200 Nm3/hr plant will be established as per 2016 EC

Sl. No	Plant / Facility	As per EC dated: 09.03.2016 (A=A1+A2)							Final Configuration and Production as per EC dated 02.03.2022 for Modification Project of AMNS		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO			
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	Config.	Capacity in TPA	
6	SMS-1 (EAF 4 Nos.)	4 x 150 MT Heat size	4.6*	4 x 150 MT Heat size	4.6*		-	4.6	4 x 150 MT Heat size	4.6	*Earlier planning was to remove 4.6 MTPA EAF -4 nos. and replacing with BOF-3 nos. in its place but that could not be implemented due to fund constraints and legal cases at the NCLT. Original capacity prior to EC 2016 was 4.6 MTPA only and it is now submitted to retain this original capacity. CTO has been sanctioned for 4.6 MTPA.
7	SMS-2	4 x 200 MT Heat size	5.0	4 x 200 MT Heat size	5.0		-	5.0	4 x 200 MT Heat size	5.0	
Total SMS			9.6		9.6		-	9.6			
9	Corex Plant	2 x 0.85	1.7	2 x 0.85	1.7	-	-	1.7	2 x 0.85	1.7	Plant will be operated till the proposed expansion is completed. Thereafter it will be shutdown safely and will be started only in case of any unit going down but maintaining sanctioned production of hot metal.

Sl. No	Plant / Facility	As per EC dated: 09.03.2016 (A=A1+A2)							Final Configuration and Production as per EC dated 02.03.2022 for Modification Project of AMNS		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO			
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	Config.	Capacity in TPA	
10	Lime Plant (Lime/Dolomite	1 x 0.45 (4x300 TPD) 1x 0.48 (3x500 TPD)	0.93	1 x 0.45 (4x300 TPD) 1x 0.48 (3x500 TPD)	0.93	-	-	0.93	1 x 0.45 (4x300 TPD) 1x 0.48 (3x500 TPD) 1 x 0.27 (1x500 + 1x200 TPD)	1.2	*0.27 MTPA production through 1x500 + 1x200 TPD Kilns proposed under Modification project. 0.8 MTPA proposed under the 9.6 to 15.6 MTPA liquid steel expansion project.
11	Plate Mill	1 x 1.5	1.5	1 x 1.5	1.5	-	-	1.5	1 x 1.5	1.5	
12	CSP and HRC	1 x 3.5*CSP 1 x 4.5#HRC	8.0*	1 x 3.5*CSP 1 x 4.5#HRC	8.0*	-	-	8.0	1 x 3.5 CSP 1 x 4.5 HRC	8.0	* 3.5 MTPA approved vide 05.07.2010 EC # 4.5 MTPA Approved vide 29-05-2008 EC Total 8.0 implemented, but inadvertently mentioned 3.5 MTPA only in 2016 EC
13	CRM	1 x 1.5	1.5	1 x 1.5 1 x 0.54*	2.04*	-	-	2.04	1 x 1.5 1 x 0.54 1 x 2.2 1 x 1.0	5.24	* CTO taken for additional 0.54 MTPA from GPCB. #3.2 MTPA proposed in Modification Project, 2021 through 2 Units (1x2.2 + 1x1 MTPA)

Sl. No	Plant / Facility	As per EC dated: 09.03.2016 (A=A1+A2)							Final Configuration and Production as per EC dated 02.03.2022 for Modification Project of AMNS		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO			
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	Config.	Capacity in TPA	
14	Pipe mill:										
	H Saw Pipes (in MTPA)	1 x 0.15	0.15	1 x 0.15 1 x 0.15*	0.30*	-	-	0.3	1 x 0.15 1 x 0.15	0.30	0.15 MTPA as per 2016 EC *CTO taken for additional 0.15 MTPA from GPCB. (0.15+0.15=0.30).
	L Saw Pipes (in MTPA)	1 x 0.33	0.33	1 x 0.33	0.33	-	-	0.33	1 x 0.33	0.33	
15	CPP (in MW)	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW 1 X 48 MW	604	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW	556	1 x 48 MW	48*	556	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW	556	* 48MW has been dropped and will not be implemented
16	Waste Heat Recovery based Power Plant (in MW)	1 x 25 MW 1 x 20 MW*	45	1 X 25 MW	25	1 X 20 MW	20*	25	1 x 25 MW 1 x 20 MW	45	*20 MW to be implemented under EC 2016
17	Jetty (length in m)	456 m+ 734 m	1190 m	456 m + 734 m	1190 m	-	-	734 m*	-	1190	* 734 and 456-meters capacity was sanctioned in 2006 EC. This was implemented although inadvertently mentioned 734 m only in 2016 EC and

Sl. No	Plant / Facility	As per EC dated: 09.03.2016 (A=A1+A2)							Final Configuration and Production as per EC dated 02.03.2022 for Modification Project of AMNS		Remarks
		Total (A)		Implemented (A1)		Un-implemented (A2)		As per CTO			
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	Config.	Capacity in TPA	
											CTO also mentioned the same 734m length.

The Status of Existing Production Facilities as per the environmental clearance and Consent to Operate, are as follows:

Table 1-2: Existing Plant Configuration and Production

Particulars	Document No.	Date	Validity	Implementation Status
Details of Earlier EC	EC NO. J-11011/381/2014-IA.II (I) EC NO. 11-65/2005-IA.III	09.03.2016 18.09.2006	08.03.2023 17.09.2011	HBI Plant: 7.8 MTPA Blast Furnace: 2.04 MTPA Corex Plant: 1.7 MTPA Coke Oven: 1.35 MTPA* Sinter Plant: 1.48 MTPA SMS-1 (EAF#4 Nos.): 4.6 MTPA SMS-2 (ConArc#2 nos.): 5 MTPA Lime Plant: 0.93 MTPA CSP & HRC: 8 MTPA Plate Mill: 1.5 MTPA CRM:1.5 MTPA H Saw Pipe: 0.15 MTPA L Saw Pipe: 0.33 MTPA CPP: 556 MW WHRB: 25 MW Air Separation Plant: 360,544 Nm^3/hr. Jetty: 1190 meters
Details of CTO	GPCB/CCA-SURAT-340 (15)/ID 20680 (HRC Division)	07.04.2020	31.12.2024	HBI (Module I-V): 5.98 MTPA HRC Plant: 4.5 MTPA Lime Plant: 0.48 MTPA Oxygen Plant: 360,544 Nm^3 /hr CRM Plant: 2.04 MTPA CPP 31 MW Plant: 744 MWH (31 MW) Extension of Existing Captive jetty: 1190 Meters * (* 734m & 456m capacity was sanctioned in 2006. This was implemented although inadvertently mentioned 734m in 2016 EC) Waste Heat Recovery Based Power Plant : 25 MW
	GPCB/CCA-SRT-1162 (2) ID 22968 (Plate Mill Division)	07.04.2020	31.12.2024	Plate Mill : 1.5 MTPA
	GPCB/CCA-SRT-1082(5) ID 28839 (Pipe Mill Division)	07.04.2020	31.12.2024	Pipe Mill: H Saw Pipe: 0.3 MTPA L Saw Pipe: 0.33 MTPA

Particulars	Document No.	Date	Validity	Implementation Status
	GPCB/CCA-SURAT-1190(6)/ID 14186 (Conarc division)	20.05.2020	31.12.2024	HBI (Module VI): 1.85 MTPA Corex Plant: 1.7 MTPA Blast Furnace: 2.04 MTPA Sinter Plant: 1.48 MTPA SMS 2: 5 MTPA CSP, Hot Rolling & Long Product Mill: 3.5 MTPA Lime Plant: 0.45 MTPA
	AWH 103579 (Power Plant Division)	19.08.2019	31.03.2024	CPP : 525 MW

1.3.2 Proposed Project

AMNSI proposes to undergo a brownfield expansion for production of liquid steel from 9.6 to 15.6 MTPA and corresponding 6.0 MTPA hot rolled coils within the existing steel plant of AMNSI.

The major production facilities envisaged for the project will comprise of by product recovery-based coke ovens, blast furnace, steel melt shop (BOF), slab caster and hot rolling mills. The plant will have its captive power plant which will utilize surplus by-product fuel gas & steam from CDQ and TRT to produce power. The plant will also have its lime calcining plant. Sinter plant and air separation plant for producing oxygen, nitrogen and argon required by various units shall be available from existing facilities already installed or under implementation.

Table 1-3: Details of existing and proposed facilities vis-à-vis production capacities

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		Configuration	**Capacity in MTPA**	**Configuration**	**Capacity in MTPA**	**Configuration**	**Capacity in MTPA**	
1	HBI Plant (DRI Mod I to VI)	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	--	--	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	
2	Blast Furnace (BF)	BF#1: 2.04 MTPA (1x2200 m3)	2.04	BF#1: 0.96 MTPA BF#2 &3: 2 x 4.0 (~4500 m3 each)	8.96	BF#1: 3.0 MTPA (2200 m3) BF#2: 4.0 MTPA (4500 m3) BF#3: 4.0 MTPA (4500 m3)	11.0	Existing operational capacity of BF#1 is proposed to be upgraded from 2.04 MTPA to 3.0 MTPA. Further, additional 2 nos. of BFs of capacity 4.0 MTPA, each are proposed.
3	Sinter Plant	1x 1.48 MTPA (1 x 120 m2)	1.48	2 x 3.5 MTPA (~ 325 m2 each)	7.0	1x 1.48 MTPA (1 x 120 m2) + 2 x 3.5 MTPA (~ 325 m2 each)	8.48	
4	Coke Ovens (Recovery Type)	CO#1&2 (2x59 Ovens) *	1.35	CO Battery# 3,4,5 & 6 4 x 59 Ovens	3.05	CO Battery#1 to 6 6 x 59 Ovens	4.4	* CO Battery# 1&2 is being implemented under 2016 EC CO Battery# 3,4,5 & 6 shall be installed under the expansion

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	
5	Air Separation Plant (Nm3/Hr)	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD (Only oxygen) 1x2200 TPD	360,544 64,200*			1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1 X 2200 TPD (Only oxygen)	424,744	* 3,60,544 Nm3/hr plants are in operations, balance 64,200 Nm3/hr plant will be established as per 2016 EC
6	SMS-1 (EAF 4 Nos.)	4 x 150 MT Heat size	4.6	--	--	4 x 150 MT Heat size	4.6	
7	SMS-2 (ConArc 4 Nos.)	4 x 200 MT Heat size	5.0	--	--	4 x 200 MT Heat size	5.0	
8	SMS-3 (BOF–3 nos.)	--	--	3 x 350 MT Heat size *	6.0	3 x 350 MT Heat size *	6.0	New SMS-3 Shop for 6.0 MTPA is proposed. 3x350 Ton Converters shall be installed (* 2 Working + 1 stand-by)
Total SMS		9.6		--	6.0	15.6		
9	COREX Plant	2 x 0.85	1.7	-	-	2 x 0.85	1.7*	Plant will be shutdown safely and will be started only in case of any unit going down but maintaining sanctioned production quantity of hot metal.

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	
10	Lime Plant (Lime/ Dolomite	1 x 0.45 (4 x 300 TPD) 1 x 0.48 (3 x 500 TPD) 1 x 0.27* (1x200 + 1x500 TPD)	1.2	1 x 0.8 (4 x 600 TPD)	0.8	4x300 TPD 1x200 TPD 4x500 TPD 4x600 TPD	2.0	*0.27 MTPA plant shall be installed under Modernisation EC granted on 02.03.2022 0.8 MTPA proposed in this expansion.
11	Plate Mill	1 x 1.5	1.5	--	--	1 x 1.5	1.5	
12	CSP & HRC	CSP 1 x 3.5 MTPA HRC 1 x 4.5 MTPA	8.0	1 x 6.0 MTPA	6.0	1 x 3.5 MTPA 1 x 4.5 MTPA 1 x 6.0 MTPA	14.0	
13	CRM	CRM #1: 1 x 2.04 CRM #2: 1 x 3.2*	5.24	---	---	CRM #1: 1 x 2.04 CRM #2: 1 x 3.2*	5.24	CRM 3.2 MTPA is being implemented under Modification EC dated.02.03.2022
14	H Saw Pipes	1 x 0.15 1 x 0.15	0.30	--	--	1 x 0.15 1 x 0.15	0.30	
15	L Saw Pipes	1 x 0.33	0.33	--	--	1 x 0.33	0.33	
16	CPP	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW	556	2 x100 MW (By-product Gas based PP) 2 x 25 MW	250	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW 2 x100 MW 2 x 25 MW	806	1x48 MW dropped as per modification project EC dated.02.03.2022.

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	
				(TRT BF #3&4)				
17	Waste Heat Recovery based Power Plant	1 x 25 MW 1 x 20 MW#	45	1x 100 MW CDQ	100	1 x 25 MW WHRB 1 x 20 MW CDQ 1x 100 MW CDQ	145	#Will be implemented under the EC 2016
18	Jetty (length in m)	456 m + 734 m	1190 m	-	-	456 m + 734 m	1190 m	

Table 1-4: Proposed Unit Configuration With Capacity in TPA

Name of Facility	Configuration	Capacity (TPA)
Coke Ovens	4x59 Ovens By-product Recovery Type	3,050,000
Sinter Plant	~650 sqm (2 Units)	7,000,000
Blast Furnace	Up-gradation of existing BF#1 BF#2 & BF#3 (2x4500 Cum.)	960,000 8,000,000
Steel Melting Plant#3	3 x350 MT BOF (2/3 Operation)	6,000,000
Calcination Plant*	4x600 TPD + 1x500 TPD + 1x200 TPD Rotary Kiln	800,000 +2,70,000*
Hot Rolling Mill (HRC)	1 x 6 MTPA	6,000,000
CRM**	1 x 2.2 MTPA 1 x 1.0 MTPA	3,200,000
CPP	Gas Based Power Plant 2 x 100 MW Top Recovery Gas Turbine 2 x 25 MW	200 MW 50 MW
WHRB	Coke Dry Quenching	100 MW
* 1x 500 + 1 x 200 TPD Project is part of Modification Project, EC Received on 02.03.2021 ** Expansion of CRM Project is part of Modification Project, EC Received on 02.03.2021		

1.3.3 Nature of the Project

The proposed project activity is listed under activity 3(a) Metallurgical industries (Ferrous & Non- ferrous) and 4 (b) Coke Oven and 1 (d) Thermal Power Plant categorized as Category 'A'. under Schedule of EIA Notification, 2006, issued by MoEF&CC, Government of India.

1.3.4 Location of the Project

The pro posed project located at Hazira village, in Chorasi tehsil, district Surat in the state of Gujarat. The project site is located at latitude $21^0$6'43.72"N and longitude $72^0$38'40.29"E. The map showing location of the project and site boundary is given in ***Map 2-1 and Map 2-4***

1.3.5 Importance of Project to Country and Region

In 2018, India had replaced Japan as world's second largest steel producer with a production of 106.5 million tons (MT), up by 4.9 percent from 101.5 MT in 2017. In 2020, production of crude steel was about 108.5 MT against 111.2 MT in 2019. The reduction was as a result of industrial lockdown due to the pandemic scenario.

India's per capita steel consumption is about 66 kg, much lower than the global average of 214 kg. The Government of India has set pragmatic target of achieving per capita steel consumption of 158 kg by 2030-31 requiring a crude steel production of 255 MT and capacity of 300 MT

Private sector is playing an important role in supplementing the requirement of steel in the country. Their contribution in finished steel production has increased to 58.9% in 2017-18 as compared to 45% in 1992-93.

Indian economy is rapidly growing with key focus on infrastructure and construction sector. Several initiatives mainly, affordable housing, expansion of railway networks, development of domestic shipbuilding industry, opening up of defense sector for private participation, and the anticipated growth in the automobile sector, are expected to create significant demand for steel in the country. Considering the prospects for the development for Infrastructure, construction and Industrial activity in India in the years to come, large scope exists for increased consumption of steel products. The projections made by the Ministry of Steel in its Vision-2020 document, there is a significant domestic demand for steel in the Country.

Major factors which carry the potential of raising the per capita steel consumption in the country are listed below:

- Infrastructure improvement initiatives, such as 'Smart Cities project', 'Housing for All by 2022', 'Atal Mission for Rejuvenation and Urban Transformation (AMRUT)'.
- Manufacturing growth driven by Make-in-India initiative.
- Encouraging use of Made in India steel for various projects and levying of anti-dumping duties on certain steel products from Brazil, Russia, China, Korea, Japan and Indonesia.
- National Mineral Development Corporation expected to increase the iron ore production favoring steel production.
- Emergence of the rural market for steel buoyed by projects like MGNREGS, development of 'Rurban Clusters' under the Shyama Prasad Mukherjee Rurban Mission, Pradhan Mantri Gram Sadak Yojana, among others.

As per the National Steel Policy (NSP) 2017, in order to achieve expected capacity of 300 MT, finished steel production of 230 MT and per capita consumption of 158 kg of finished steel by 2030-31, steel demand would need to grow at a CAGR of around 7.16 percent during the period against a CAGR of 3.5 to 4 percent over the last 5 years. This would mean that capacity additions planned by most of the major steel players need to come on stream in next few years. In respect, the proposed project would contribute substantially towards the target steel production of NSP 2017.

The concept of the proposed project is in alignment with the current progress plan of the country.

Importance to the Region

The State can be benefited from the project as there will be direct employment of large people in the Steel plant. Preference will be given to the people of the state possessing requisite skill and qualification criteria and there will be lot of scope for indirect employment of the people of the state in and around the project site. Also, the CSR activity carried out by the company in the region will be benefitting the locals as well as whole of the surrounding area.

The concept of the proposed project is in alignment with the current progress plan of the country.

1.3.6 Employment Generation (Direct and Indirect) due To The Project

The proposed project would engage in recruitment of local skilled, semi-skilled and unskilled workers thereby contributing positively towards local employment and income.

- Total manpower required for the construction phase under direct and indirect employment is 500 and 15,000 respectively.
- Total manpower required for the operation phase under direct and indirect employment is about 1,750 and 5,250 respectively.

Growth of indirect employment opportunities due to development of ancillary industries is also envisaged.

1.4 Laws Applicable to this Project

Regulations, relevant procedures and requirements that may directly influence the project, the competence of the concerned institutions and their ability to successfully implement the environmental management measures have been addressed.

The applicable key laws and regulations applicable to the project, summarized below:

The Water (Prevention and Control of Pollution) Act, 1974

Water Act is the first environmental regulation that was introduced at the State level. State Pollution Control Boards to control / regulate environmental pollution in India. Amended twice in 1978 and 1988, the Act vests regulatory authority on the State Pollution Control Boards and empowers them to establish and enforce effluent standards for industries and local authorities discharging effluents.

The Act empowers the board to levy and collect cess on water consumed by the industry or local authority and to utilize and augment resources for the Pollution Control Boards. In line with this provision, The Water (Prevention & Control of Pollution) Rules, 1975 were formulated.

The Air (Prevention and Control of Pollution) Act, 1981:

The Air Act vests regulatory authority on the State Pollution Control Boards and empowers them to enforce air quality standards to prevent air pollution in the country. This Act provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise) in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

The SPCB is empowered to set air quality standards, monitor, and prosecute offenders under The Air (Prevention and Control of Pollution) Act, 1981. Section 21 of the Act requires an application to be made to the State board to establish or operate any industrial operation.

This Act has notified National Ambient Air Quality Standard Air quality during construction and operation phases will be guided by this specific Act.

Roles and Responsibilities of the plant under the Acts are;

- Not to discharge any effluent, not confirming to standards, prescribed by PCB into any stream, well, sewers or land
- Not to discharge air pollutant(s) in excess of standards, prescribed by the State PCB
- Obtain 'Consent to Establish' prior to establish any process, operation or treatment system
- Obtain 'Consent to Operate' prior to operation of system which is likely to discharge effluent
- Apply for renewal of the 'Consent to Operate' before the expiry
- Comply with conditions as prescribed under consents

Environment (Protection) Act, 1986

This is umbrella Act which was passed as an overall comprehensive act "for protection and improvement of environment". According to this Act, the Central Government has the power to take all such measures, as it deemed necessary or expedient for the purpose of protecting and improving the quality of environment and preventing, controlling and abating environmental pollution. Under this Act, rules have been specified for discharge/ emission of effluents and different standards for environmental quality. These include Environmental Impact Assessment (EIA) Notification, 2006, Hazardous and Other Wastes (Management and

Transboundary Movement) Rules, 2016, The Solid Waste Management Rules, 2016, Batteries (Management and Handling) Rules, 2001 etc.

- Prevent discharge or emission of environment pollutants in excess of the prescribed standards
- Submit 'Environmental Statement' every year
- Obtain prior "Environmental Clearance' from MoEF&CC in case of new project or for Modernization / Expansion

The Noise Pollution (Regulation and Control) Rules, 2016

The Union Government has laid down statutory norms to regulate to control noise levels to prevent their adverse effects on human health and psychological wellbeing of the people. Rule is to maintain the noise levels with respect to the place/equipment/ Industry. Under the regulation, different areas and zones are to be identified as industrial, commercial, residential and silence areas and anyone exceeding the specified noise level would be liable for action.

In industrial areas, the noise level limit during the day time (6 am to 10 pm) is 75 decibels and during night (10 pm to 6 am) 70 decibels. Similarly, for commercial areas day time limit is 65 decibel and night limit 55 decibels. In case of residential areas, the limits are respectively 55 and 45 decibels and for the silence zones, 50 and 40 decibels.

- Noise Quality Monitoring & submission of reports on weekly/monthly basis.
- Providing Ear plugs and Muffs to the workers working in noise prone areas.
- Dampening the source noise level or making the noise characteristics less annoying by providing suitable enclosures and barriers.

Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016

The rule has been formed under EP (Act), 1986 for management & handling of hazardous wastes in line with the Basel convention. Roles & Responsibilities of the plant under this rule are as follows:

- It is the responsibility of the occupier to identify the hazardous wastes in their units and ensure proper handling and disposal
- Company to take all steps to contain contamination, prevent accident and limit consequences on human being and environment
- Obtain authorization from Gujrat Pollution Control Board and comply with the conditions.
- Maintain records of Hazardous Waste generated in Form-3 and submit yearly return for generation, treatment, recycling, disposal etc., to SPCB in Form-4
- Waste Shall be transported in accordance with the applicable rules.
- On-Site storage is allowed for 90 days only

Solid Waste Management Rules, 2016

The rule under the EP (Act), 1986 has been formed to manage/ utilize the generated solid waste without damaging the environment and surroundings. The responsibilities of occupiers, under the rule are to Segregate waste in to three streams, Wet (Biodegradable), Dry (Plastic, Paper, metal, wood, etc.) and domestic hazardous wastes (diapers, napkins, empty containers of cleaning agents, mosquito repellents, etc.) and handover segregated wastes to authorized rag-pickers or waste collectors or local bodies.

Batteries (Management and Handling) Rules, 2016.

The rule has been formed under the EP (Act), 1986 to control the hazardous waste generation (lead waste) from used lead acid batteries. Under the rule;

- It is the responsibility of the generator to ensure that used batteries are not disposed of in any manner other than depositing with dealer, manufacturer, importer, re-conditioner registered recycler or at designated collection centre
- Submit half yearly return for disposal of used batteries to State PCB by 30th June & 31st December, every year
- In case of auction, ensure batteries are auctioned to the registered recycler only
- File half yearly return for the auction
- Maintain record for such auction

E-Waste (Management) Rules, 2016

This rule is formed to recycle/manage the electronic waste from the industry. Responsibility of the generator of the e-waste under the rule are;

- Shall make provisions for collection of e-waste generated from 'end of life' of their products and shall ensure that such e-wastes are channelized to registered dismantler or recycler, In line with the principle of 'Extended Producer Responsibility'.
- Create Awareness
- Maintain monthly waste generation records as per Form 2
- Prepare & submit annual returns of e-wastes as per Form 3

Factories Act, 1948 (as amended till date)

Responsible Ministry / Body

Ministry of Labour and Directorate of Industrial Safety and Health/Factories Inspectorate

Objective of the Legislation

Control of workplace environment, and providing for good health and safety of workers

Roles & Responsibilities

- Obtain and renew factory license and obtain permission for the site from State Government or the Chief Inspector of Factories in case of new or extension of any Factory.
- Ensure health, safety and welfare of all workers while they are at work in the Factory as far as reasonably practicable.
- Ensure effective and adequate ventilation of work place and adequate measures to be taken to protect workers particularly in the processes involving excessive temperature.
- Ensure effective and adequate ventilation of work place and adequate measures to be taken to protect workers particularly in the processes involving excessive temperature.

The Central Motor Vehicle Rules, 1989 (as amended till date)

Responsible Ministry / Body

Ministry of Shipping, Road Transport and Highways

Objective of the Legislation

To consolidate and amend the law relating to motor vehicles including to regulate the transportation of dangerous goods with a view to prevent loss of life or damage to the environment

Roles & responsibilities

- Ensure compliance to safety provisions in the transport vehicle carrying dangerous and hazardous substances inside works
- Display of emergency information panels at front, back and both side of vehicle
- Every transporter to ensure safe transportation of dangerous/ hazardous goods.
- Earthing chain for grounding, any prevalent static charge.
- All motor vehicle entering the works shall have properly maintained brakes, lights, signal system for brakes, blinkers and registration number displayed, and valid Pollution under Control Certificate.

The Boiler Acts 1923 & Rules 1950 (as amended till date)

Responsible Ministry / Body

State Government, District magistrate

Objective of the Legislation

To register the boilers used in industry

Roles & Responsibilities

- Ensure availability and effective functioning of steam vents, safety valve, drain valve, monitoring instruments of critical parameter through regular checks and maintain records for the same.
- Obtain authorization for boilers and their renewal prior to due date and / or when an accident occurs to the boiler / when any structural alteration / addition / renewal is made.
- Ensure mandatory registration of boilers.
- Ensure to obtain prior approval before taking any alteration and renewals to steam pipes after submitting plan and report.
- Ensure to obtain prior approval before taking structural alteration, addition and renewal to boilers from Chief Boiler Inspectors.
- Ensure prior examination of boiler by Inspector during & after any repair/shut down and maintain record for the same.
- Report accident / incident or any severe damage to property, human life within 24 hours giving details of occurrence.

1.5 Scope of Study – Details of Regulatory Scoping Carried Out as per Terms of Reference

The scope of the study is as per the ToRs issued by MoEF&CC, vide letter no. J-11011/44/2004-IA. II (I) dated 3rd December 2021 attached as ***Annexure 1*** and the ToR amendment letter issued by MoEF&CC, dated 30th May 2022 attached as ***Annexure 28.***

This EIA Report complies with the Terms of Reference (ToRs). Summarized details of the same are provided in ***Table 1-5***

Table 1-5: Compliance with the Terms of Reference

Sr. no.	Terms of Reference	Compliance
STANDARD TERMS OF REFERENCE (TOR)		
1	Executive Summary	Project executive summary containing project details, baseline monitoring details, details of impacts and EMP is given in EIA. Please refer ***Chapter 11 Page no. 572***
2	Introduction	
i	Details of the EIA Consultant including NABET accreditation	Kadam Environmental Consultant have accredition in aaplicable Sectors 3(a), 1(d) and 4(b). NABET Certificate No. NABET/EIA/1922/RA 0138, Issued on 05-08-2019, Valid up to 25-05-2022. NABET Certificate No. NABET/EIA/2023/SA 0164, Issued on 19.04.2022 Valid up to 19.03.2023 NABET accreditation is attached as ***Annexure 11, Page no. 679***
ii	Information about the project proponent	ArcelorMittal and Nippon Steel have established a joint venture (JV) company named ArcelorMittal Nippon Steel India Limited (AMNSI) in India. AMNSI has acquired a fully integrated steel plant at Hazira, Gujarat with a production capacity of 9.6 MTPA of liquid steel along with downstream units, namely, Cold Rolling Mill, Galvanising line, steel processing facilities, extra wide Plate Mill and Pipe Mill. Additionally, AMNSI also owns significant iron ore Beneficiation and Pelletisation capacities located in Eastern India, with direct access to the region's rich iron ore reserves. The various facilities owned by AMNSI across India are Hazira (Gujarat), Dabuna (Odisha), Paradeep (Odisha), Kirandul (Chhattisgarh) Pune (Maharashtra). The pellet plants at Vizag and Paradeep produce Direct Reduction (DR) grade and Blast Furnace (BF) grade pellets respectively. The entire production of DR grade pellets is consumed by the natural gas-based DR plant at Hazira, whilst a significant portion of the BF grade pellets is consumed by the BF and COREX units at Hazira. The balance BF grade pellets are sold in the market
iii	Importance and benefits of the project	As per the National Steel Policy (NSP) 2017, in order to achieve expected capacity of 300 MT, finished steel production of 230 MT and per capita consumption of 158 kg of finished steel by 2030-31, steel demand would need to grow at a CAGR of around 7.16 percent during the period against a CAGR of 3.5 to 4 percent over the last 5 years. This would mean that capacity additions planned by most of the major steel players need to come on stream in next few years. In respect, the proposed project would contribute substantially towards the target steel production of NSP 2017. The concept of the proposed project is in alignment with the current progress plan of the country.

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>Importance of the oroject is given in Chapter-1, Section 1.3.5, Page No. 49 and Benefits of the Project is given in Chapter 8, page no. 539</td></tr>
<tr><td>3</td><td colspan="2">Project Description</td></tr>
<tr><td>i</td><td>Cost of project and time of completion.</td><td>Total estimated cost for proposed project is INR 35,145 Crore
<table>
<tr><td>10.11.2020</td><td>:</td><td>Submission of Form-1/PFR</td></tr>
<tr><td>03.12.2021</td><td>:</td><td>TOR issued from MOEF</td></tr>
<tr><td>May, 2022</td><td>:</td><td>Draft EIA submission for Public Hearing</td></tr>
<tr><td>July 2022</td><td>:</td><td>Public Hearing</td></tr>
<tr><td>August 2022</td><td>:`</td><td>Submission of Final EIA to MoEF&CC for EC</td></tr>
<tr><td>September 2022</td><td>:</td><td>Consideration of Project by EAC (Industry-1)</td></tr>
</table>
After getting CTE from Gujarat Pollution Control Board and EC from MOEF&CC, tenders will be floated for purchase, installation and commissioning of equipment. Estimated completion schedule of project is 42 months. Please Refer Section 2.3, page No. 99 & Section 2.6, page no. 114</td></tr>
<tr><td>ii</td><td>Products with capacities for the proposed project.</td><td>
<table>
<tr><th rowspan="2">Sl. No.</th><th rowspan="2"></th><th>Existing as per Modification EC dated 02.03.2022</th><th>Proposed</th><th>Total after Expansion</th></tr>
<tr><th>Capacity in MTPA</th><th>Capacity in MTPA</th><th>Capacity in MTPA</th></tr>
<tr><td>1</td><td>HBI Plant (DRI Mod I to VI)</td><td>7.83</td><td>--</td><td>7.83</td></tr>
<tr><td>2</td><td>Blast Furnace (BF)</td><td>2.04</td><td>8.96</td><td>11.0</td></tr>
<tr><td>3</td><td>Sinter Plant</td><td>1.48</td><td>7.0</td><td>8.48</td></tr>
<tr><td>4</td><td>Coke Ovens (Recovery Type)</td><td>1.35</td><td>3.05</td><td>4.4</td></tr>
<tr><td>5</td><td>Air Separation Plant (Nm3/Hr)</td><td>424,744</td><td>-</td><td>424,744</td></tr>
<tr><td>6</td><td>SMS-1 (EAF 4 Nos.)</td><td>4.6</td><td>--</td><td>4.6</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>7</td><td>SMS-2 (ConArc 4 Nos.)</td><td>5.0</td><td>--</td><td>5.0</td></tr>
<tr><td>8</td><td>SMS-3 (BOF–3 nos.)</td><td>--</td><td>6.0</td><td>6.0</td></tr>
<tr><td colspan="2">Total SMS</td><td>9.6</td><td>6.0</td><td>15.6</td></tr>
<tr><td>9</td><td>COREX Plant</td><td>1.7</td><td>-</td><td>1.7*</td></tr>
<tr><td>10</td><td>Lime Plant (Lime/ Dolomite</td><td>1.2</td><td>0.8</td><td>2.0</td></tr>
<tr><td>11</td><td>Plate Mill</td><td>1.5</td><td>--</td><td>1.5</td></tr>
<tr><td>12</td><td>CSP & HRC</td><td>8.0</td><td>6.0</td><td>14.0</td></tr>
<tr><td>13</td><td>CRM</td><td>5.24</td><td>---</td><td>5.24</td></tr>
<tr><td>14</td><td>H Saw Pipes</td><td>0.30</td><td>--</td><td>0.30</td></tr>
<tr><td>15</td><td>L Saw Pipes</td><td>0.33</td><td>--</td><td>0.33</td></tr>
<tr><td>16</td><td>CPP</td><td>556</td><td>250</td><td>806</td></tr>
<tr><td>17</td><td>Waste Heat Recovery based Power Plant</td><td>45</td><td>100</td><td>145</td></tr>
<tr><td>18</td><td>Jetty (length in m)</td><td>1190 m</td><td>-</td><td>1190 m</td></tr>
<tr><td colspan="5">*The Corex Plant will be shutdown safely and will be started only in case of any unit going down but maintaining sanctioned production quantity of hot metal.</td></tr>
</table>
Please also refer Table 1-3, Page No. 45
</td></tr>
<tr><td>iii</td><td>If expansion project, details of existing products with capacities and whether adequate land is available for expansion, reference of earlier EC if any.</td><td>The project is for expansion of the existing plant for production of 15.6 million tons per annum (MTPA) liquid steel from the existing capacity of 9.6 MTPA, and additional 6 MTPA Hot Rolled Coil.
Details of existing products and capacities with reference to the earlier EC given in the Table, above
The existing plant area is 738.55 Ha and the total plant area after proposed expansion will be 824.82 Ha.
• The existing plant area is 738.55 Ha and 11.63 Ha having clear title included in the township (Total 750.18 Ha)
• Additional Area for proposed expansion: 74.64 Ha
• Total area after proposed expansion 824.82 Ha
Land required for proposed expansion: 147.17 Ha</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>It will comprise of the following:
• 65.73 Ha Forest land land possession is available and Copy of the same is attached as Annexure 2
• 8.91 Ha private land direct purchase from Land owners
• 72.53 Ha area will be used from existing plant area
Adequate land is available for installation of the project
Please refer Table 1-3, Page No. 45 for existing and proposed production details
Plant Layout is attached as Map 2-5, Page no. 109</td></tr>
<tr><td>iv</td><td>List of raw materials required and their source along with mode of transportation.</td><td>Following raw materials will be used in plant
<table>
<tr><th>Sl. No.</th><th>Raw Material</th><th>Source</th><th>Mode of Transportation</th></tr>
<tr><td>1.</td><td>DR Grade Pellets</td><td rowspan="2">AMNSI's Palletization plants located at Vizag and Paradeep</td><td rowspan="2">Sea Route</td></tr>
<tr><td>2.</td><td>BF Grade Pellets</td></tr>
<tr><td>3.</td><td>Calibrated Lump Ore</td><td>NMDC mines in Kirandul, Dist. Dantewada, CG</td><td>Rail + Sea Route</td></tr>
<tr><td>4.</td><td>Iron Ore Fines</td><td>Goa, Odisha NMDC mines</td><td>Sea Route</td></tr>
<tr><td>5.</td><td>Coal-PCI-BF</td><td rowspan="2">Australia (Mainly) and Canada, USA and Russia</td><td rowspan="2">Sea Route</td></tr>
<tr><td>6.</td><td>Metallurgical Coal</td></tr>
<tr><td>7.</td><td>BF and Sinter Grade Flux (Limestone+Dolomite +Pyroxenite +Quartzite)</td><td rowspan="2">Dubai and Oman</td><td rowspan="2">Sea Route</td></tr>
<tr><td>8.</td><td>SMS grade Limestone and Dolomite</td></tr>
</table>
Quantity of raw material requirement, raw material handling system and transportation details are attached as Section 2.8.1, Section 2.8.2 and Section 2.8.5 respectively from Page no. 117 to 122.</td></tr>
<tr><td>v</td><td>Other chemicals and materials required with quantities and storage capacities</td><td>Details of raw material requirement is attached as Section 2.8.1, Page no. 117</td></tr>
</table>

Sr. no.	Terms of Reference	Compliance
vi	Details of Emission, effluents, hazardous waste generation and their management.	There wil be total 54 nos. of proposed stack. Details of emission is attached ***Table 4-2, Page no. 316*** ***Effluent Generation and Management*** Waste water generation from the expansion units will be around 650 m^3/hr, i.e. 15,600 cum/day. Waste water generated from the proposed expansion units of the plant will be treated in 650 m3/hr. capacity propodsed CETP. The treated water shall be recycled back to the process to attain 'zero' discharge economizing on the make-up water requirement. The permeate from CETP will be sent to BF and SMS as make-up to cooling tower. Reject generated in the RO plant will be partly used after dilution for sprinkler type suppression at raw material storage yard and balance will be fed to the evaporator-crystallizer. Sludge and salts generated in the CETP will be disposed at approved TSDF Details of effluent is given in ***Section 2.8.22, Page no. 168*** ***Solid and Hazardous waste Generation and Management*** Details of hazardous waste generation and their management is given in ***Section 4.4.13, Page no. 396***
vii	Requirement of water and water balance diagram	***Water Requirement*** Water requirement for the existing plant is around 145,838 KLD (Approx. 32.08 million of gallons per day (MGD), which is being sourced from river Tapi. For the proposed expansion, additional raw water requirement will be around 81,600 KLD (approx. 17.95 MGD) which needs to be sourced from river Tapi. Hence total water requirement after expansion will be around 227,439 KLD (approx. 50.03 MGD). ***Water Permission*** The water permission from the Narmada Water Resources Water Supply and Kalpsar Department Division Surat for drawl of 87 MGD. is enclosed as ***Annexure 6*** Water withdrawal from river Tapi will be gradually reduced as tertiary treated water (TTW) from HAIA is made available
	Details of Power, with source of supply, status of approval,	The power requirement for exsting plant is 1163 MW and for proposed expansion 410 MW. The total power requirement will be 1573 MW. Details of Power with source of supply is given in ***Section 2.8.24, Page no. 170***

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td>Details of man-power requirement (regular and contract)</td><td>Details of Man power requirement is given below
<table>
<tr><th>Details</th><th>Direct</th><th>Indirect</th><th>Total</th></tr>
<tr><td>Existing Manpower</td><td>7,700</td><td>5,800</td><td>13,500</td></tr>
<tr><td>Manpower required for Modification Project</td><td>1,000</td><td>770</td><td>1,770</td></tr>
<tr><td>Manpower required for Expansion Project</td><td>1,750</td><td>5,250</td><td>7,000</td></tr>
<tr><td>Total Manpower requirement</td><td>10,450</td><td>11,820</td><td>22,270</td></tr>
</table>
Total manpower required for the proposed project during construction phase under direct and indirect employment is 500 and 15,000, respectively</td></tr>
<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>Details of process description is given in Section 2.8, Page No. 117 and Figure 2-1, Page No. 160</td></tr>
<tr><td>ix</td><td>Hazard identification and details of proposed safety systems.</td><td>Details of hazard identification and safety system is given in Section 7.1.2, Page no. 428</td></tr>
<tr><td>x</td><td>Expansion/modernization proposals:</td><td></td></tr>
<tr><td>a</td><td>Copy of all the Environmental Clearance(s) including Amendments thereto obtained for the project from MOEF&CC/SEIAA shall be attached as an Annexure.</td><td>Copy of existing environmental clearance is attached as Annexure 8, Page no. 642</td></tr>
<tr><td></td><td>A certified copy of the latest Monitoring Report of the Regional Office of the Ministry of Environment, Forests and Climate Change as per circular dated 30th May, 2012 on the</td><td>The certified compliance report of existing EC is obtained from RO MoEF Gandhinagar on dated 07/01/2022 based on the site visit of Regional officer Gandhinagar on 17th and 18th December 2022. Copy of certified compliance report for existing EC is attached as Annexure 20, Page no. 699</td></tr>
</table>

Sr. no.	Terms of Reference	Compliance
	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 existing operation of the project from SPCB shall be attached with the EIA-EMP report.	
b	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.	Copy of existing environmental clearance is attached as ***Annexure 8, Page no. 642*** The certified compliance report of existing EC is obtained from RO MoEF Gandhinagar on dated 07/01/2022 based on the site visit of Regional officer Gandhinagar on 17th and 18th December 2022. Copy of certified compliance report for existing EC is attached as ***Annexure 20, Page no. 699***
4	Site Details	

Sr. no.	Terms of Reference	Compliance
i	Location of the project site covering village, Taluka/Tehsil, District and State, Justification for selecting the site, whether other sites were considered.	The proposed project located at Hazira village, in Chorasi Tehsil, District Surat in the state of Gujarat. The project site is located at latitude $21^0$6'43.72"N and longitude $72^0$38'40.29"E. ***Justification for Selecting the site*** The proposal under consideration is a brownfield project, expansion of the existing steel plant, hence justification for selection of the Site is not required. However, the location would enable appropriate sharing of the existing infrastructure, other ancillary and auxiliary facilities and ensure uninterrupted movement of various raw materials without additional cost or involving minimal augmentation of material movement logistics. Moreover, it is planned to utilize the unutilized land area under the possession of AMNSI along with the partial land occupied by the township and offices. The proposed site also has the following advantages: 1. The area is under Notified Hazira Industrial Area. 2. Ensuring availability of adequate land for installation of units. 3. Suitability of sharing existing infrastructure in terms of connectivity, water resource and grid power. 4. Ease of raw materials acquisition and products transportation through the existing jetty. 5. Can handle additional cargo up to 20 MTPA (Bulk RM + Break bulk) through Adani Hazira Port Ltd. (AHPL) as per the assurance letter received from AHPL. 6. This project will help to boost the Western Region's infrastructure development of Gujarat under Atma Nirbhar Bharat scheme. 7. Availability of economical labour force
ii	A toposheet of the study area of radius of 10km and site location on 1:50,000/1:25,000 scale on an A3/A2 sheet. (including all eco-sensitive areas and environmentally sensitive places)	A toposheet of the study area of radius of 10 kms and site location on 1:50,000 is given as ***Map 2-3, Page No.102***
iii	Co-ordinates (lat-long) of all four corners of the site.	Please refer ***Map 2-4, Page No. 104***
iv	Google map-Earth downloaded of the project site.	Google map-Earth downloaded of the project site is given as ***Map 2-4, Page No. 104***

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td>v</td><td>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.</td><td>Layout maps indicating existing unit as well as proposed unit indicating storage area, plant area, greenbelt area, utilities etc is given as Map 2-5, Page No. 109</td></tr>
<tr><td>vi</td><td>Photographs of the proposed and existing (if applicable) plant site. If existing, show photographs of lantation/greenbelt, in particular.</td><td>Photographs of the proposed and existing (if applicable) plant site is given as Photographs 2-1 Page No.103</td></tr>
<tr><td>vii</td><td>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)</td><td>The existing plant area is 738.55 Ha and 11.63 Ha having clear title included in the township (Total area 750.18 Ha)
Additional Area for proposed expansion: 74.64 Ha
Total area after proposed expansion 824.82 Ha
Land required for proposed expansion: 147.17 Ha
It will comprise of the following:
65.73 Ha Forest land land possession is available
8.91 Ha private land direct purchase from Land owners
72.53 Ha area will be used from existing plant area</td></tr>
<tr><td>viii</td><td>A list of major industries with name and type within study area (10km radius) shall be incorporated. Land use details of the study area</td><td>The list of industry is given below
<table>
<tr><th>Sr. No.</th><th>Industry Name</th><th>Type</th><th>Approx. Distance and direction</th></tr>
<tr><td>1</td><td>Kribhco Ltd.</td><td>Chemical Fertilizers</td><td>6.5 km North - East</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>2</td><td>Shell India</td><td>Isolated storage & handling of hazardous chemicals</td><td>1 km South - West</td></tr>
<tr><td>3</td><td>Larsen & Toubro Ltd. (L&T)</td><td>Heavy engineering unit</td><td>1 km North – East</td></tr>
<tr><td>4</td><td>NTPC</td><td>Thermal power plant</td><td>4 km North – East</td></tr>
<tr><td>5</td><td>ONGC</td><td>Petro-chemical complexes</td><td>8 km North – East</td></tr>
<tr><td>6</td><td>GAIL</td><td>Isolated storage & handling of hazardous chemicals</td><td>10 km North – East</td></tr>
<tr><td>7</td><td>GSPC</td><td>Petro-chemical complexes</td><td>9.5 km North – East</td></tr>
<tr><td>8</td><td>UltraTech Cement</td><td>Cement plant</td><td>8 km West</td></tr>
<tr><td>9</td><td>Reliance Industries</td><td>Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)</td><td>4 km North – East</td></tr>
<tr><td>10</td><td>Adani Hazira Port</td><td>Port</td><td>3 km South -West</td></tr>
<tr><td>11</td><td>IBP Hazira Terminal</td><td>Isolated storage & handling of hazardous chemicals</td><td>10 km North-East</td></tr>
<tr><td>12</td><td>Gujarat State Energy Generation Ltd. (GSEG)</td><td>Thermal power plant</td><td>3.5 km North</td></tr>
<tr><td>13</td><td>Cairn energy</td><td>Isolated storage & handling of hazardous chemicals</td><td>5.8 km North</td></tr>
<tr><td colspan="4">The industry is inside the hazira notified industrial estate and hence surrounded by number of industries</td></tr>
</table>
</td></tr>
<tr><td>ix</td><td>Geological features and Geo-hydrological status of the study area shall be included.</td><td>Please Refer Section 3.9.2, Page No. 220</td></tr>
<tr><td>x</td><td>Details of Drainage of the project upto 5km radius of study area. If the site is within</td><td>The site is located at the distance of 500 m from Tapi river in east direction</td></tr>
</table>

Sr. no.	Terms of Reference	Compliance
	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)	As per Gujarat Disaster Management Plan'2021 , Hazira village is not coming under Flood affected area. HFL data is not being maintained for Hazira village and the same has been confirmed by Gujarat State Water data Center, Gandhinagar and the mail communication in this regard is submitted for reference. As per the Additional District Magistrate, no flood has occurred in Hazira village for the past 50 years. Certificate issued collector is attached as well as other relevant documents are attached as ***Annexure 30, Page No. 852 .***
xi	Status of acquisition of land. If acquisition is not complete, stage of the acquisition process and expected time of complete possession of the land.	The existing plant area is 738.55 Ha and the total plant area after proposed expansion will be 824.82 Ha. The existing plant area is 738.55 Ha and 11.63 Ha having clear title included in the township Additional Area for proposed expansion: 74.64 Ha. – 65.73 Ha Forest land land possession is available and The copy of forest clearance is attached as ***Annexure 2, Page no. 621*** – 8.91 Ha private land direct purchase from Land owners.
xii	R&R details in respect of land in line with state Government policy	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)	65.73 Ha Forest land land possession is available and The copy of forest clearance is attached as ***Annexure 2, Page no. 621*** 20.76 Ha. Township Forest Land Stage-1 Forestry Clearance obtained. Stage-2 Forestry Clearance is under process. Stage-1 Forestry Clearance is attached as ***Annexure 2, Page no. 621***
ii	Landuse map based on High resolution satellite imagery (GPS) of the proposed site delineating the forestland (in	• 65.73 Ha Forest land possession is available • 20.76 Ha. Township Forest Land Stage-1 Forestry Clearance obtained. Both these forest lands involved in this project and these forest lands have not been classified under Survey of India Map (Please refer ***Map 2-3***) and same is not captured in the satellite imagery (please refer ***Map 2-2***) because there is no forest or vegetation present in that land area.

Sr. no.	Terms of Reference	Compliance
	case of projects involving forest land more than 40 ha)	
iii	Status of Application submitted for obtaining the stage I forestry clearance along with latest status shall be submitted.	65.73 Ha Forest land land possession is available and The copy of forest clearance is attached as ***Annexure 2, Page no. 621*** 20.76 Ha. Township Forest Land Stage-1 Forestry Clearance obtained. Stage-2 Forestry Clearance is under process. Stage-1 Forestry Clearance is attached as ***Annexure 2, Page no. 621***
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	Not applicable as projects is not located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals
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	On the basis of direct and indirect evidences, it is evident that buffer zone of the project area supports three Schedule-I species i.e. Pea fowl (Pavo cristatus), White-rumped Vulture (Gyps bengalensis) and Leopard (Panthera pardus) as per Wild Life Protection Act (1972). Wildlife Conservation Plan is prepared and approved by PCCF Gujarat. Copy of the same is attached as ***Annexure 29, Page No. 830.***
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 as projects is not located within 10 km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td>6</td><td>Environmental Status</td><td></td></tr>
<tr><td>i</td><td>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.</td><td>Site specific meteorological data was collected for Summer 2021 and additional one month in Nov-Dec 2021
<table>
<tr><th rowspan="2">S. No.</th><th rowspan="2">Parameters</th><th colspan="2">7th March 2021 to 6th June 2021</th></tr>
<tr><th>IMD 1981 – 2010</th><th>Site Specific (24 hours)</th></tr>
<tr><td>1</td><td>Wind Speed</td><td>1.29</td><td>1.18</td></tr>
<tr><td>2</td><td>Wind Direction</td><td>SW</td><td>SW</td></tr>
<tr><td>3</td><td>Mean Temperature</td><td>35.9</td><td>31.4</td></tr>
<tr><td>4</td><td>Mean Relative Humidity</td><td>Morning- 66.6
Evening-34.3</td><td>72.2</td></tr>
</table>
<table>
<tr><th rowspan="2">S. No.</th><th rowspan="2">Parameters</th><th colspan="2">23rd November 2021 to 26th December 2021</th></tr>
<tr><th>IMD 1981 – 2010</th><th>Site Specific (24 hours)</th></tr>
<tr><td>1</td><td>Wind Speed</td><td>0.57</td><td>0.77</td></tr>
<tr><td>2</td><td>Wind Direction</td><td>NE</td><td>NE</td></tr>
<tr><td>3</td><td>Mean Temperature</td><td>18.05</td><td>25.3</td></tr>
<tr><td>4</td><td>Mean Relative Humidity</td><td>Morning-66
Evening – 43.5</td><td>69.3</td></tr>
</table>
Details of the same is given in Section 3.5, Page No. 190</td></tr>
<tr><td>ii</td><td>AAQ data (except monsoon) at 8 locations for PM_{10}, $PM_{2.5}$, SO2, NOX, CO and other parameters relevant to the project shall be collected. The monitoring stations shall be based CPCB guidelines and take into account the pre-dominant wind direction, population zone and sensitive</td><td>Raw AAQ data collected at 8 locations for Summer 2021 and additional one month in Nov-Dec 2021 AAQ Details of Summer season. The monitoring stations selected based on CPCB guidelines to take into account the pre-dominant wind direction, population zone and sensitive receptors etc.</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td>receptors including reserved forests.</td><td>
<table>
<tr><th>Code No.</th><th>AAQM Station</th><th>Dist. From nearest site boundary (km)</th><th>Dir.</th><th>Justification</th><th>Results</th></tr>
<tr><td>AA01</td><td>At Site (Nand Niketan)</td><td>Within site</td><td>-</td><td>Along 1st Downwind From proposed SMS with stack (height 100 m) and lying within max GLC area ,2.30 km in NE Direction</td><td rowspan="9">The average concentration of PM10 recorded ranged from 75 µg/m3 to 91 µg/m3. The average concentration of PM2.5 recorded ranged from 18 µg/m3 to 27 µg/m3. The average concentration of SO2 recorded ranged from 8.2 µg/m3 to 8.8 µg/m3. All these values are within the specified limit of CPCB (80 µg/m3). The average concentration of NOX recorded ranged from 11.8 µg/m3 to 12.5 µg/m3. All these values are within the specified limit of CPCB (80 µg/m3).</td></tr>
<tr><td>AA02</td><td>Hazira Police station (Beside Truck Parking area)</td><td>-</td><td>NE</td><td>Along 1st Downwind from proposed coke oven stack (height 140 m) and lying within max GLC area, 2.50 km in NE direction Line source emission will also be captured</td></tr>
<tr><td>AA03</td><td>Dumas</td><td>5.3</td><td>E</td><td>2nd Downwind</td></tr>
<tr><td>AA04</td><td>Hazira</td><td>2.8</td><td>SW</td><td>1st Upwind</td></tr>
<tr><td>AA05</td><td>Junagam</td><td>1.4</td><td>W</td><td>2nd Upwind</td></tr>
<tr><td>AA06</td><td>Mora</td><td>3.3</td><td>N</td><td>Crosswind</td></tr>
<tr><td>AA07</td><td>Kavas Limla Road</td><td>6.5</td><td>NE</td><td>1st Downwind</td></tr>
<tr><td>AA08</td><td>Gaviyer</td><td>8.3</td><td>E</td><td>3rd Downwind</td></tr>
<tr><td colspan="6">AAQ Details of Additional one month</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>Station Code No.</th><th>AAQM Station</th><th>Dist. (km)</th><th>Dir.</th><th>Justification</th><th>Results</th></tr>
<tr><td>AAQM 01</td><td>At Site (MRSS)</td><td>-</td><td>-</td><td>2nd downwind from coke oven</td><td rowspan="13">The value of PM_{10} ranges from 70 ug/m^3 to 97 ug/m^3
The value of $PM_{2.5}$ ranges from 23 ug/m^3 to 50 ug/m^3
The value of SO_2 ranges from 5.9 ug/m^3 to 8.7 ug/m^3
The value of NOx ranges from 13.7 ug/m^3 to 19.1 ug/m^3
The value of O_3 ranges from 6.7 ug/m^3 to 11.8 ug/m^3
The value of CO ranges from 0.6 mg/m^3 to 0.8 mg/m^3
The value of HC ranges from 837 ug/m^3 to 999 ug/m^3
The value of BaP ranges from 0.05 ng/m3 to 0.35 ng/m^3
The values for NH3, Pb, As, Ni, Hg and C_6H_6 are below detection limit</td></tr>
<tr><td>AAQM 02</td><td>At Site (Nand Niketan - STP)</td><td>-</td><td>-</td><td>2nd upwind</td></tr>
<tr><td>AAQM 03</td><td>Hazira village</td><td>1.70</td><td>SE</td><td>3rd downwind from SMS Stack</td></tr>
<tr><td>AAQM 04</td><td>Hazira (Angan Wadi)</td><td>1.4</td><td>SW</td><td>1st downwind from Sinter plant</td></tr>
<tr><td>AAQM 05</td><td>Suvali gam</td><td>3.4</td><td>NW</td><td>3rd upwind</td></tr>
<tr><td>AAQM 06</td><td>AMNSI - SW</td><td>-</td><td>-</td><td>1st downwind from the triangle formed with 3 major stacks(SMS, Sinter and coke oven)</td></tr>
<tr><td>AAQM 07</td><td>Mora</td><td>3.1</td><td>N</td><td>2nd Upwind</td></tr>
<tr><td>AAQM 08</td><td>Damka</td><td>5.58</td><td>N</td><td>2nd Upwind</td></tr>
<tr><td>AAQM 09</td><td>Kavas</td><td>6.78</td><td>NE</td><td>1st Upwind</td></tr>
<tr><td>AAQM 10</td><td>Gaviyer</td><td>8.41</td><td>E</td><td>crosswind</td></tr>
<tr><td>AAQM 11</td><td>Dumas</td><td>5.4</td><td>SE</td><td>3rd downwind</td></tr>
<tr><td>AAQM 12</td><td>Vanta</td><td>7</td><td>E</td><td>crosswind</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>iii</td><td>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.</td><td>The detailed results of AAQ is given in Annexure 10, Page No. 657</td></tr>
<tr><td>iv</td><td>Surface water quality of nearby River (60m upstream and downstream of discharge point) and other surface drains at eight locations as per CPCB/MoEF&CC guidelines.</td><td>Surface water samples were collected from 8 different locations in the study area and
<table>
<tr><th>Sam. Code</th><th>Location</th><th>Source</th><th>Distance w.r.t site (km)</th><th>Direction (from site)</th></tr>
<tr><td>SW01</td><td>At Site</td><td>Pond</td><td>-</td><td>-</td></tr>
<tr><td>SW02</td><td>Dumas</td><td>River</td><td>5.0</td><td>E</td></tr>
<tr><td>SW03</td><td>Hazira (Nr EBTL Gate)</td><td>Pond</td><td>2.2</td><td>S</td></tr>
<tr><td>SW04</td><td>Suvali</td><td>Pond</td><td>3.3</td><td>NNW</td></tr>
<tr><td>SW05</td><td>NR Hazira Police Station</td><td>Tapi River</td><td>0.1</td><td>E</td></tr>
<tr><td>SW06</td><td>Nr Nand Niketan</td><td>Tapi River</td><td>-</td><td>E</td></tr>
<tr><td>SW07</td><td>Mora</td><td>Pond</td><td>2.7</td><td>N</td></tr>
<tr><td>SW08</td><td>Junagam</td><td>Pond</td><td>1.4</td><td>W</td></tr>
</table>
Details of the same is given in Section 3.10, Page No. 231</td></tr>
<tr><td>v</td><td>Whether the site falls near to polluted stretch of river identified by the</td><td>Not applicable. The site is not falling near to polluted stretch of river identified by CPCB.</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td>CPCB/MoEF&CC, if yes give details.</td><td></td></tr>
<tr><td>vi</td><td>Ground water monitoring at minimum at 8 locations shall be included.</td><td>Ground water samples are collected from 8 different locations in the study area and results are compared with drinking water standards.
<table>
<tr><th>Sample Id</th><th>Sampling Locations</th><th>Distance w.r.t site (km)</th><th>Direction (from site)</th><th>Results</th></tr>
<tr><td>GW 1</td><td>Hazira Gam</td><td>2.40</td><td>SSW</td><td rowspan="8">Electrical Conductivity values appears high in all samples. EC values ranges from 718-9490 µmho/cm.
Sulphates present in GW-5 sample is within their acceptable and permissible limit, except GW-2, GW-3, GW-6 & GW-8 samples above Acceptable limit; while, GW-1, GW-4 & GW-7 is above Permissible limit.
Total Alkalinity found above the acceptable limit in GW-1, GW-2, GW-4 to 7 samples.
Nitrate is found in varying proportion in all samples and also found above the acceptable limit in GW 2 7 GW 3. Values ranges from 0.35 mg/l to 64.99 mg/l.
Total Nitrogen found above the acceptable limit in each ground water sample except GW-6 & 7. Values ranges from0.09 mg/l to 15.86 mg/l
Cadmium is detected in all groundwater samples and is within the acceptable limit. Value ranges from 0.19 mg/l to 0.26 mg/l
Copper is detected above the acceptable limit in all groundwater samples except in GW4 and GW 8.</td></tr>
<tr><td>GW 2</td><td>Junagam</td><td>1.50</td><td>NW</td></tr>
<tr><td>GW 3</td><td>Suvali Gam</td><td>3.25</td><td>NNW</td></tr>
<tr><td>GW 4</td><td>Ichchapore GIDC</td><td>9.40</td><td>NE</td></tr>
<tr><td>GW 5</td><td>Vanta Gam</td><td>9.00</td><td>East</td></tr>
<tr><td>GW 6</td><td>Dumas</td><td>7.30</td><td>SE</td></tr>
<tr><td>GW 7</td><td>Mora Tekra</td><td>3.45</td><td>North</td></tr>
<tr><td>GW 8</td><td>Kavas</td><td>7.00</td><td>NNE</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td></td><td></td><td></td><td>Total coliforms are detected in all samples except GW 4.
Faecal Coliforms is also detected in GW-1, GW-3, & GW-5 to GW 7.
The presence of Total coliforms & Faecal Coliforms is indicating leaky aquifer condition and Hydraulic connection between shallow and lower aquifer. Presence of Total coliforms and Faecal Coliforms in groundwater may be due to discharge & disposal of untreated sewage on land environment and infiltration of the same to underneath aquifer.</td></tr>
</table>
Details of the same are given in Section 3.9.3, Page No. 226
</td></tr>
<tr><td>vii</td><td>Noise levels monitoring at 8 locations within the study area.</td><td>
Noise level monitoring was carried out inside the plant premises and in the study area.
<table>
<tr><th rowspan="2">Loc. Code</th><th rowspan="2">Location</th><th rowspan="2">Date</th><th rowspan="2">Category</th><th rowspan="2">Distance w.r.t site (km)</th><th rowspan="2">Direction (from site)</th><th colspan="2">Permissible Limits in dB (A)</th><th colspan="2">Average Noise levels in dB (A)</th></tr>
<tr><th>Day Time</th><th>Night Time</th><th>Day Time</th><th>Night Time</th></tr>
<tr><td>NL01</td><td>At Site (Nr Hazira Police Station)</td><td>6/8/2021</td><td>Industrial</td><td>-</td><td>-</td><td>75.0</td><td>70.0</td><td>66.7</td><td>58.9</td></tr>
<tr><td>NL02</td><td>At Site (Truck Parking Area)</td><td>6/8/2021</td><td>Industrial</td><td>-</td><td>-</td><td>75.0</td><td>70.0</td><td>62.4</td><td>58.1</td></tr>
<tr><td>NL03</td><td>At Site</td><td>6/8/2021</td><td>Commercial</td><td>-</td><td>-</td><td>65.0</td><td>55.0</td><td>58.6</td><td>53.2</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td>(Nand Niketan)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>NL04</td><td>At Site (S boundary)</td><td>6/8/2021</td><td>Industrial</td><td>-</td><td>-</td><td>75.0</td><td>70.0</td><td>67.8</td><td>65.4</td></tr>
<tr><td>NL05</td><td>At Site (SW boundary)</td><td>6/9/2021</td><td>Industrial</td><td>-</td><td>-</td><td>75.0</td><td>70.0</td><td>60.4</td><td>58.9</td></tr>
<tr><td>NL06</td><td>Hazira Village*</td><td>6/10/2021</td><td>Residential</td><td>2.6</td><td>S</td><td>55.0</td><td>45.0</td><td>54.9</td><td>44.6</td></tr>
<tr><td>NL07</td><td>100 m in N direction from site boundary</td><td>6/10/2021</td><td>Industrial</td><td>0.1</td><td>N</td><td>75.0</td><td>70.0</td><td>62.1</td><td>57.5</td></tr>
<tr><td>NL08</td><td>Suvali</td><td>6/10/2021</td><td>Residential</td><td>1.6</td><td>WNW</td><td>75.0</td><td>70.0</td><td>53.9</td><td>42.4</td></tr>
</table>
Details of the same is given in Section 3.8.3, Page No. 217
</td></tr>
<tr><td>viii</td><td>Soil Characteristic as per CPCB guidelines.</td><td>
Soil samples were collected from 8 different locations in the study area
<table>
<tr><th>Sample Id</th><th>Sampling Locations</th><th>Type of land</th><th>Distance (km)</th><th>Direction</th><th>Results</th></tr>
<tr><td>ST01</td><td>Hazira Gam</td><td>Agricultural</td><td>2.40</td><td>SSW</td><td rowspan="6">The analysis of physicochemical properties of soil samples collected from surrounding area indicated that porosity ranged from 41 - 57 % and WHC varied from 30.90 – 44.59 %, while permeability ranged from 14.62 – 37.80 mm/hr.</td></tr>
<tr><td>ST02</td><td>Suvali</td><td>Agricultural</td><td>1.50</td><td>NW</td></tr>
<tr><td>ST03</td><td>Suvali Gam</td><td>Agricultural</td><td>3.25</td><td>NNW</td></tr>
<tr><td>ST04</td><td>Mora Tekra</td><td>Agricultural</td><td>3.45</td><td>North</td></tr>
<tr><td>ST05</td><td>Kavas</td><td>Agricultural</td><td>7.00</td><td>NNE</td></tr>
<tr><td>ST06</td><td>Ichchapore GIDC</td><td>Industrial</td><td>9.40</td><td>NE</td></tr>
</table>
</td></tr>
</table>

Sr. no.	Terms of Reference	Compliance					
		ST07	Vanta Gam	Agricultural	9.00	East	Moderate WHC and high porosity is on account of sandy to clay loam texture of soils and permeability was moderate due alkaline pH of soils. The CEC ranged from 15.81 – 23.84 meq/100 g soil, which is a moderate looking to the texture of soils. The EC (0.157 – 2.68 dS/m) was normal (<0.80 dS/m) to high (>1.6 dS/m) and ESP (1.99 to 2.28) was well within the safe limit of <15.0. The pH ranged from 7.96 – 8.71, indicating that soils are alkaline (pH 7.80 to <8.5) to sodic (pH >8.5). Among water soluble cations predominance of Mg (13.37 – 20.66 meq/100 g) was seen followed by K (0.25 to 2.35 meq/100 g), Ca (0.80 to 1.60 meq/100 g) and Na (0.18 to 1.33 meq/100 g). Fertility status of soil reveal that organic carbon was low (<0.50 % OC) to medium (0.50 – 0.75 % OC) and available potassium was high (>280 kg/ha). Soils in the area are alkaline to sodic, which require application of gypsum to bring down soil pH to near neutral condition
		ST08	Dumas	Agricultural	7.30	SE	

Sr. no.	Terms of Reference	Compliance
		Details of the same are given in ***Section 3.11, Page No. 238***
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.	The road considered for traffic survey is main approach road from Mora to Hazira which is National Highway no. NH-64. There is movement of heavy vehicles during day time for transport of goods from various industries in the area. Traffic survey was carried out for 24 hours on Mora-Hazira Road The existing traffic and additional traffic due to proposed project was calculated The total PCU per hour for Ichchapore-AMNS Road will be 1024 after expansion and carrying capacity two lane (One way) highway is 1900 PCU per hour as per Guidelines of Indian Road Congress 64-1990. The total PCU per hour for Ichchapore-Adani Road will be 1158 after expansion and carrying capacity two lane (Two way) highway is 1500 PCU per hour as per Guidelines of Indian Road Congress 64-1990.
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 are found within the study area, a Wildlife Conservation Plan shall be prepared and furnished.	Flora fauna study was carried out during post monsoon season in the study area. Primary observations as well as secondary data review reveals presence of 315 floral species which includes 131 tree species, 33 shrubs, 76 Herbs, 35 grasses, and 40 climber & twiner species. Among the birds in the study area, Pea fowl (Pavo cristatus), White Spoonbill and White-rumped Vulture (Gyps bengalensis), is included in schedule I of Wild life protection Act (1972), while many other birds are included in schedule IV. As per IUCN red list, bird species like Black-headed Ibis and Oriental Darter falls in the Near Threatened (NT) category while White-rumped Vulture is categorized as a Critically Endangered (CR) species database. Among the reptiles, Indian Cobra (Naja naja) and Common rat snake (Ptyas mucosus) were provided protection as per Schedule-II of Wild life protection act, (1972). Among mammals; Leopard is falls under Schedule I where as Jackal (Canis aureus) and Common Mongoose (Herpestes edwardsi) is schedule II; Common Langur (Semnopithecus entellus) and wild boar (Sus scrofa) is Schedule III animal of Wild Life Protection act 1972. Others noted animals are schedule IV of Wild Life Protection act 1972 Details of the same is given in ***Section 3.12, Page No. 242*** On the basis of direct and indirect evidences, it is evident that buffer zone of the project area supports three Schedule-I species i.e. Pea fowl (Pavo cristatus), White-rumped Vulture (Gyps bengalensis) and Leopard (Panthera pardus) as per Wild Life Protection Act (1972). Wildlife Conservation Plan is prepared and approved by PCCF Gujarat. Copy of the same is attached as ***Annexure 29, Page No. 830.***

Sr. no.	Terms of Reference	Compliance
xi	Socio-economic status of the study area.	Total 17 villages are present in the study area. Total population of male is 53,648 (64.23%) and female population is 29,883 (35.77%) and the sex ratio is 438 females per 1000 males in the study area. The national gender ratio in India is 940 as per latest reports of Census 2011 Socio economic status of the study area is given in ***Section3.13, Page No. 265***
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 Modelling 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.	Air quality Modeling has been done for determining cumulative impact of all sources of emission using AREMOD & CALPUFF dispersion modeling software. Please Refer ***Section 4.3.2 Page No. 305***
ii	Water Quality modelling - in case, if effluent is proposed to	Not applicable as there is no discharge in water body for proposed project

Sr. no.	Terms of Reference	Compliance
	be discharged in to the local drain, then water quality modelling study should be conducted for the drain water taking into consideration the upstream and downstream quality of water of the drain.	
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 conveyor-cum-rail transport shall be examined.	The road considered for traffic survey is main approach road from Mora to Hazira which is national highway no. NH-64. There is movement of heavy vehicles during day time for transport of goods from various industries in the area. Traffic survey was carried out for 24 hours on Mora-Hazira Road The existing traffic and additional traffic due to proposed project was calculated The total PCU per hour for Ichchapore-AMNS Road will be 1024 after expansion and carrying capacity two lane (One way) highway is 1900 PCU per hour as per Guidelines of Indian Road Congress 64-1990. The total PCU per hour for Ichchapore-Adani Road will be 1158 after expansion and carrying capacity two lane (Two way) highway is 1500 PCU per hour as per Guidelines of Indian Road Congress 64-1990.
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.	Waste water generated from the proposed expansion units of the plant will be treated in suitable treatment facilities and recycled back to the process to attain 'zero' discharge, facilitating adequate re-use of water in the respective recirculating systems, and economizing on the make-up water requirement. A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of 650 cu m/hr. and BOD Plants of capacities 137 cum/hr. and 275 cum/hr. The permeate from CETP will be sent to BF and SMS as make-up to cooling tower. Reject generated in the RO plant will be partly used after dilution for sprinkler type suppression at raw material storage yard and balance will be fed to the evaporator-crystallizer. Sludge and salts generated in the CETP will be disposed

Sr. no.	Terms of Reference	Compliance
		at approved TSDF. Treated water shall meet effluent discharge standard under E(P) Rules before reuse. Zero Effluent Discharge shall be followed Please Refer ***Section 2.8.22 Page No. 168***
v	Details of stack emission and action plan for control of emissions to meet standards.	Details of Stack Emission is given in Details of emission is attached ***Table 4-2, Page No. 316***
vi	Measures for fugitive emission control	Please Refer ***Section 4.3.2 Page No. 305***
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.	Details of solid and hazardous waste generation and their management is given in ***Section 4.4.13, Page no. 396*** The copy of agreement with TSDF is attached as is attached ***Annexure 7, Page No. 640***
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 as there is no generation of Fly ash
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	The greenbelt area needs to be strengthened to meet the requirement of ToR issued to AMNS, namely 33% coverage with density of 2500 trees/Ha. Existing area of the Plant is 738.55 Ha. Currently, 21.79% of this area (approx. 161 Ha.) is covered under plantation in which around 2,87,429 trees have been planted. For proposed expansion additional plantation will be carried out in 111.18 Ha of area in which 3,93,021 nos. of trees shall be planted

Sr. no.	Terms of Reference	Compliance
	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 details of the same is given in ***Section 10.11, Page No. 556***
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.	For Rain Water Harvesting, 100% plant area under the control of AMNSI India, including plant sheds, all sheds rundown and 100% township area have been considered with a belief that rain water can always be harvested from every shed, every house and every road. 10 nos. of Collecting Pond of approximately 19235 m^2 of area is used for harvesting. Each pond has a depth of at least 2m. To achieve optimal efficiency in rainwater harvesting, more than two kilo meter of pipes were laid with 12 pumps, being installed at various places. As a result, during the monsoon in CY20, harvested 81 crore litres (8,10,081 cubic meters) of rainwater Please refer ***Section 10.10.1, Page No. 554***
xi	Total capital cost and recurring cost/annum for environmental pollution control measures shall be included.	The capital cost for environmental pollution control measures is INR 1576 Crore and recurring cost is INR 151.02 Crore. Please Refer ***Table 10-14, Page No. 567*** for detail break up.
xii	Action plan for post-project environmental monitoring shall be submitted.	Action plan for post-project environmental monitoring is given ***Table 6-6, Page No. 418***
xiii	Onsite and Offsite Disaster (natural and Man-made) Preparedness and Emergency Management Plan including Risk Assessment and damage control. Disaster management	Disaster Management Plan is prepared with an aim of taking precautionary step to control the hazard or to avert disaster. Disaster Management Plan is linked with the Disaster Management Plan of the District. Please Refer ***Section 7.2, Page No. 479***

Sr. no.	Terms of Reference	Compliance
	plan should be linked with District Disaster Management Plan.	
8	Occupational health	
i	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,	Permissible Exposure Level (PEL) of different hazards and Suitable measures to bring PEL under permissible level is given in ***Chapter 7, Page No. 426*** of EIA Plese refer ***Section 6.4, page 423***
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-placement and periodical examinations give the details of the same. Details regarding last month analysed data of above mentioned parameters as per age, sex, duration of exposure and department wise.	Workers' health shall be evaluated by pre designed format, for chest X-rays, Audiometry, Spirometry, Vision testing (Far & Near vision, colour vision and any other Ocular defect) ECG, during pre-placement and periodical examinations. AMNSI has full fledged Care Nursing Home of 40 beds near to plant at Township and full fledged Occupational Health Centers at different plant areas inside the plant. The care nursing home has facilities of PFT, Audiometry, Vision Test, Blood Test, ECG etc. Plese refer ***Section 6.5, page 424***

Sr. no.	Terms of Reference	Compliance
iii	Annual report of health status of workers with special reference to Occupational Health and Safety.	Details are given in ***Annexure 32, Page No. 891***
iv	Plan and fund allocation to ensure the occupational health & safety of all contract and casual workers	Budget of approximately INR 6 crore per year has been kept for the worker's health and safety
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.	Yes, the M/s AMNSI have well laid down Environment Policy of the Company, approved by the Board of Directors. The copy of The copy of Environment Policy is given ***as Figure 10-1, Page No. 544*** of the EIA Report
ii	Does the Environment Policy prescribe for standard operating process / procedures to bring into focus any infringement / deviation / violation of the environmental or forest norms / conditions? If so, it may be detailed in the EIA.	Yes, the policy has provided the direction and SOP has been developed under environment management system regarding reporting of any deviation/violation of the environmental or forest norms/conditions to the Board of Directors of the Company. Details are incorporated in the EIA report. Please refer ***Section 10.3.1, Page No. 545***
iii	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 of the company is given in the EIA report, as approved by the Board of Directors of the Company, to deal with the environmental issues and for ensuring compliance with the environmental clearance. Please refer ***Section 10.3.2, Page no. 546***

Sr. no.	Terms of Reference	Compliance
iv	Does the company have system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large? This reporting mechanism shall be detailed in the EIA report	Details are given in the EIA report. Please refer ***Section 10.3.1, Page No 545***
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.	Infrastructure facilities such as rest room, first aid room, Cantreen & Welfare Center, Toilets, Change Room, Scooter & cycle park etc. will be provided to the Labour force during construction as well as to the casual workers. A separate area having facilities like truck parking, canteen/dining, rest room, wash room, first aid, communication facility, ATM, safety training center, studio etc. is allocated for truck drivers
11	To address the Public hearing issues, provisions contained under Ministry's Office Memorandum vide F. No. 22-65/2017-IA.III dated 30/09/2020 shall be complied.	Action plan to address issues raised during Public hearing as per MoEF&CC OM dated 30th September, 2020 and Social need assessment during EIA Study has been prepared. and given at ***Section 7.3*** of the EIA Report. The total budget of Rs. 46 Crores has been kept to address the concerns raised during public hearing. All the activities proposed will be implemented within 36 months after obtaining necessary clearances.
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	Three cases were filed against AMNSI after grant of ToR on 03.12.2021 and EC application (Form-2) initially submitted on 04.08.2022. Out of which, two cases were filed before the EC application and one case filed after the EC application. Details of the Court Cases are as follows: Writ petition no.14 of 2022 (PIL) filled by Roshni Patel on 01.02.2022 at Hon'ble High Court of Gujarat alleging "illegal and unauthorized discharge of industrial effluents into the estuary zone of river Tapi ("Tapi

Sr. no.	Terms of Reference	Compliance
	(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.	Estuary") in violation of the conditions prescribed in the environmental clearance ("EC") and Consolidated Consent and Authorization ("CCA"). AMNSI reply: The company has obtained requisite approvals for discharge of treated effluents into estuary zone of River Tapi from GPCB / MoEF&CC. Out of 5 divisions, 3 divisions of AMNS have been authorized as per GPCB Consent, to discharge treated effluents into Tapi estuary i.e. 1) HRC Division 2) Plate Mill Division 3) Power Division. As far as EC dated 09.03.2016 for implementation of zero effluent discharge condition is concerned, the entire projects approved in 2016 EC including Zero Liquid Discharge (ZLD) were not get implemented due to fund constraints and legal cases at the NCLT. Hence, ZLD was not applicable. Now, ZLD shall be implemented under our Modernization Proposal for which EC was granted on 02.03.2022. As committed in the Modernization proposal, ZLD will be implemented before 31.03.2023. Current Status: Last Hearing was on 04.07.2022 and court given order. As per the Hon'ble court order, IIT Gandhinagar is appointed as the court commissioner to look into the points of discharge of effluents and quality of effluents at discharge points. Matter will be next listed for hearing on 22.08.2022. Special civil Application 3931 of 2022 filled by M/s ESSAR Bulk Terminal Limited (EBTL) in the High Court of Gujarat at Ahmedabad on 17.02.2022 alleging that 35 Ha back up area allocated to EBTL by GMB is being used by AMNSI for existing raw material usage and sought cancellation of TOR issued on grounds of misrepresentation in the TOR application. AMNSI submitted the detailed reply to MoEF&CC and GPCB on 01.03.2022. However, this area is presently excluded from the proposed plant area.

Sr. no.	Terms of Reference	Compliance
		Current Status: Last listed on 02.08.2022. The case is next listed for hearing on 14.09.2022. A case filed by Thakorbhai Vallabhbhai Khalasi at Hon'ble National Green Tribunal vide Appeal No. 27/2022. Current Status: The case first admitted on 08.08.2022 and notices served to parties. Mr.Thakorbhai , Hazira filed the case in NGT, Pune against MoEF&CC for challenging our Modification Project EC dated: 02.03.2022. As per NGT rules, petitioner allow to file the case within 30 days from the date of EC granted and may allow to file up to 60 days with proper justification. In this case, the petitioner filed the case on 58th day with the justification stating that the company had not given the required paper ad for the EC within 7 days. This is not the correct fact and the PP have given paper ad within 6 days i.e on 08.03.2022, also they had uploaded the EC copy on their website (www.amns.in). The case is next listed for hearing on 07.09.2022.
13	A tabular chart with index for point wise compliance of above TOR.	A tabular chart with index for point wise compliance of above TOR is given in ***Table 1-5 Page No. 55***
14	The ToRs prescribed shall be valid for a period of three years for submission of the EIA-EMP reports along with Public Hearing Proceedings (wherever stipulated).	Noted
SPECIFIC TERMS OF REFERENCE (TOR)		
1	Cumulative impact assessment for the existing integrated steel	Please refer ***Chapter 4, Page no. 281 which has covered the cumulative impact for*** existing integrated steel & power plants and proposed modernization & expansion project

Sr. no.	Terms of Reference	Compliance
	& power plants and proposed modernization & expansion project shall be carried out including the impact on riverine ecology of the Tapi river.	Details of Riverine Ecology is given in ***Section 3.12.9, Page no. 263*** and impact on the ecology and biodiversity is covered in ***Section 4.3.6, Page no. 308***
2	No construction activity/infringement will take place in the flood plain of Tapi river situated in the vicinity of the project site.	Site layout is showing that there is no construction activity/infringement will take place in the flood plain of Tapi river. The copy of site lay out map is attached as ***Map 2-5, Page no. 109***
3	Status of Forest Clearance for the forest land and the land acquisition details as per MoEF&CC O.M. dated 7/10/2014 shall be submitted.	65.73 Ha Forest land land possession is available and The copy of forest clearance is attached as ***Annexure 2, Page no. 621*** Stage-I Forestry Clearance is available for 20.76 Ha of Forest land inside the township. Stage-II Forestry Clearance is under process ***Annexure 2, Page no. 621***
4	Action plan to develop green belt in 33% of the total project area all along the project boundary with density of 2500 saplings per hectare shall be submitted.	The greenbelt shall be developed in 33% area (in 272.18 Ha.) of the total plant area of 824.82 Ha. with tree density of 2500 trees/Ha. Existing area of the Plant is 738.55 Ha. Currently, 21.79% of this area (approx. 161 Ha.) is covered under plantation in which around 2,87,429 trees have been planted. For the proposed expansion additional plantation will be carried out in -111.8 Ha. area in which 3,93,021 nos. of trees shall be planted The details of the same is given in ***Section 10.11, Page No. 556***
5	During dismantling of existing facilities large number of trees are expected to be uprooted. PP shall be enumerate the trees to be cut, possible numbers that could be translocated and compensatory afforestation to be done (in consultation with DFO). Detail for the same shall	From the proposed project area, around 20,000 trees will be removed. These trees will be transplanted, maximum possible, inside the boundary in addition to greenbelt development proposed. For transplantation, AMNSI will consult local forest department for suitable technical equipment and exepertise. Balance trees which can not be transplanted will be removed with necessary statutary permission as per local guidelines. To compensate the balance removed trees, AMNSI will go for compensatory forestation as per the directives of the Forest Department Details of the trees, area and nos. of trees are given in ***Section 10.11.2, Page No. 557***

Sr. no.	Terms of Reference	Compliance
	be incorporated in the EIA report.	
6	Total water requirement for existing and expansion project shall be sourced from TAPI river. Raw water treatment facility shall be installed inside the plant premises. Sludge disposal plan shall be elaborated in EIA report.	Quantity of Raw water treatment sludge generation will be around 3000 MT/year and it will be reused for area levelling purpose in Horticulture.
7	PP has proposed the use of 75000 KLD treated sewage water from Surat Municipal Corporation to be pumped from Surat to Hazira. Scheme for treated sewage water pumping shall be furnished.	Hazira Industrial Authority (HAIA) has taken up a project for tertiary treatment of biologically treated Sewage water (Tertiary Treated Water or TTW) which will be supplied to various industries as make-up water. This project is under implementation and water from TTW source will be gradually available at a later stage. AMNSI, Hazira has given concurrence to Hazira Notified Area Authority to participate in the project for utilization of 75,000 KLD of treated Waste water on payment basis. The project will be implemented through Special Purpose Vehicle (SPV) mode for major Hazira Industrial consumers and the Hazira Notified Area Authority (GIDC) will be Nodal Agency for implementing this project. Water withdrawal from river Tapi will be gradually reduced as TTW is made available. AMNSI area falls under Bhesan cluster which is at a distance of 24 Km. from Bhesan to AMNSI, the treated wastewater is supplied through 1219 mm diameter pipe line. Please refer Section ***2.8.21, Page no. 166*** Sewage generated from various expansion plant units will be treated in the existing sewage treatment plants of capacity 480 KLD inside the plant premises and two numbers inside the township with capacities of 1000 KLD and 600 KLD and new STP of 1000 KLD. Sewage generated from the plant units located at the western side of the Hazira steel plant, i.e. BF-2, SMS, HSM, power plant, ASP and other miscellaneous areas, will be transferred to a new sewage treatment plant to be located in the north side of the plant through gravity type sewerage network. Sewage lift pumphouse will be provided wherever required. Treated effluent from the sewage treatment plant will be further treated in CETP.
8	Two new BF Gas cleaning process in the proposed expansion will be Dry type and	Complied. Dry type Gas cleaning type with TRT has been proposed under the expasion and details of the same is given in ***Section 2.8.10, Page no. 137***

Sr. no.	Terms of Reference	Compliance
	Stove waste gas heat recovery shall be proposed with TRT.	
9	Raw material from Adani port to plant will be transported through 1.3 km conveyor along the Surat-Hazira state highway and the same been marked in the layout. The required Right of Way for the conveyor shall be furnished in the EIA report.	The Layout showing conveyor route is attached as ***Annexure 4, Page no. 633.*** The request for Right of Way for the conveyor is submitted to State Highways Department, Gujarat and request is under process
10	Traffic study shall be carried out inter-alia including existing road details with traffic load, proposed quantum of material to be transported by sea/rail/road with anticipated vessels/rakes/vehicles details,	The road considered for traffic survey is main approach road from Mora to Hazira which is National Highway no. NH-64. There is movement of heavy vehicles during day time for transport of goods from various industries in the area. Traffic survey was carried out for 24 hours on Mora-Hazira Road The existing traffic and additional traffic due to proposed project was calculated The total PCU per hour for Ichchapore-AMNS Road will be 1024 after expansion and carrying capacity two lane (One way) highway is 1900 PCU per hour as per Guidelines of Indian Road Congress 64-1990. The total PCU per hour for Ichchapore-Adani Road will be 1158 after expansion and carrying capacity two lane (Two way) highway is 1500 PCU per hour as per Guidelines of Indian Road Congress 64-1990.
	Line sourcing modelling and infrastructure strengthening details etc. These details shall be included in the EIA report.	Please refer ***Section 4.4.1, Page No. 311***
11	Separate chapter on cyclone / disaster management shall be prepared and included in the EIA report.	Please refer ***Section 7.2.8, Page no. 499*** for Emergency Response plan during Natural Calamities and ***Section 7.2 , Page no. 479*** for Disaster Management plan
12	Mass balance as well as energy balance for the integrated steel plant shall be submitted.	Please refer ***Figure 2-1, Page no. 160***

Sr. no.	Terms of Reference	Compliance
13	The issues raised during public hearing and commitment of the project proponent on the same along with time bound action plan to implement it as per MoEF&CC O.M. dated 30/09/2020 shall be clearly provided.	Action plan to address issues raised during Public hearing as per MoEF&CC OM dated 30th September, 2020 and Social need assessment during EIA Study has been prepared. and given at ***Section 7.3*** of the EIA Report. The total budget of Rs. 46 Crores has been kept to address the concerns raised during public hearing. All the activities proposed will be implemented within 36 months after obtaining necessary clearances.
14	Performance evaluation of the existing pollution control systems shall be carried out and report shall be submitted.	Performance evaluation of existing pollution control equipment is carried out by DDIT is enclosed ***Annexure 33 Page no. 894***
15	Socio-economic survey in the project influence area that is 10 km radial coverage form the project site shall be carried out and included as a part of EIA report.	Total 17 villages are present in the study area. Total population of male is 53,648 (64.23%) and female population is 29,883 (35.77%) and the sex ratio is 438 females per 1000 males in the study area. The national gender ratio in India is 940 as per latest reports of Census 2011 Socio economic status of the study area is given in ***Section3.13, Page No. 265***
16	Characteristics of coal to be used in the steel and power plant shall be submitted along with the EIA report.	Charactestic of Coal presently being used is given in EIA. Please refer ***Table 2-14, Page no. 120.*** Charactestic of Metallurgical Coal to be used will be provided with Six monthly compliance Report.
17	Details regarding the existence of mangroves and coral reefs if any, within the study area of the project site along with the conservation plan shall be included in the EIA report.	A field survey has been carried out to see the status of mangrove forest in the study area. Areas of degraded as well as good mangroves occur in the Tapi estuarine system particularly as fringes around Kadia Bet and Mora Bet and just off the mouth at the northern periphery of the estuary. These sites sustain *Avicennia marina, Sonneratia apetala and Acanthus ilicifolius* as well as marsh vegetation consisting of mainly *Sesuvium portulacastrum* and occasionally Su*eada sp, Cyperus sp, Desmostachya bipinnata and Dichanthium aristatum* – grass. Among mangroves, *Avicennia marina* is dominant. ***Corals and associated Biota*** Coral were not reported in the proposed site and in the study area. As per our understanding, geochemical and physiochemical condition of the area is not conducive for the growth of the corals

Sr. no.	Terms of Reference	Compliance
		Conservation plan for Schedule I species present in the study area has been prepared and attached as ***Annexure 29, Page No. 830***
18	Action plan to limit the dust emission from all the stacks below 30 mg/Nm3 shall be furnished.	Action plan to limit the dust emission from all the stacks below 30 mg/Nm3 is provided in ***Chapter-4.*** Please refer ***Section 4.4.1, Page No. 311***
19	Action plan for fugitive emissions control in the plant premises shall be provided.	Various process operations would generate particulate dusts, oxides of sulphur and nitrogen and carbon dioxide to the environment. The emission would be from the stacks as well as there would be fugitive emission of dusts from open and closed areas. Fugitive dust emissions generating from the handling and stockpiling of raw material in open stockyards would be controlled by water sprinkling at regular intervals. All closed zone working areas such as raw materials handling zone, conveyor transfer points, dust generation points at screen would be provided with dust extraction (DE) systems/dry fogging (DF) at several emission points to control the fugitive dust emissions. DE system shall consist of suction hood followed by bag filter/ESP, ducts, extraction fans and stack of appropriate height. Please refer ***Section 4.4.1, Page No. 311***
20	Action plan for 100% solid waste utilization shall be submitted.	Action Plan for utilization of 100% Soild Wastes is given in ***Chapter 4 Section 4.4.13, Page 396*** of the EIA Report
21	Action plan for the stock piles with impervious floor, provision of garland drains and catch pits to traps run off material shall be submitted.	AMNS has presently 4 nos raw material storage stock yards and there will be addition of two new yard for oxide storage and BF slag Storage. AMNS has prepared a detail action plan to avoid leaching of materials to the ground water and land contamination. All the yards will have RCC flooring after hard surface rolling and compacting so there is no chance of water and slurry contamination in below ground level Plese refer ***Section 4.4.12, Page No.392***
22	AAQ modelling shall be done considering proximity to the coast and riverine ecology.	Please refer ***Section 4.4.1, Page no. 311***
23	AAQ monitoring shall be carried out for one-month period at four locations in conformity to	Raw AAQ data collected at 8 locations for Summer 2021 and additional one month in Nov-Dec 2021 was carried out for all 12 parameters AAQ Details of Additional one month

<table>
<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td>the wind rose diagram for all 12 parameters.</td><td>
<table>
<tr><th>Station Code No.</th><th>AAQM Station</th><th>Dist. (km)</th><th>Dir.</th><th>Justification</th><th>Results</th></tr>
<tr><td>AAQM 01</td><td>At Site (MRSS)</td><td>-</td><td>-</td><td>2nd downwind from coke oven</td><td rowspan="13">The value of PM10 ranges from 70 ug/m3 to 97 ug/m3
The value of PM2.5 ranges from 23 ug/m3 to 50 ug/m3
The value of SO2 ranges from 5.9 ug/m3 to 8.7 ug/m3
The value of NOx ranges from 13.7 ug/m3 to 19.1 ug/m3
The value of O3 ranges from 6.7 ug/m3 to 11.8 ug/m3
The value of CO ranges from 0.6 mg/m3 to 0.8 mg/m3
The value of HC ranges from 837 ug/m3 to 999 ug/m3
The value of BaP ranges from 0.05 ng/m3 to 0.35 ng/m3
The values for NH3, Pb, As, Ni, Hg and C6H6 are below detection limit</td></tr>
<tr><td>AAQM 02</td><td>At Site (Nand Niketan - STP)</td><td>-</td><td>-</td><td>2nd upwind</td></tr>
<tr><td>AAQM 03</td><td>Hazira village</td><td>1.70</td><td>SE</td><td>3rd downwind from SMS Stack</td></tr>
<tr><td>AAQM 04</td><td>Hazira (Angan Wadi)</td><td>1.4</td><td>SW</td><td>1st downwind from Sinter plant</td></tr>
<tr><td>AAQM 05</td><td>Suvali gam</td><td>3.4</td><td>NW</td><td>3rd upwind</td></tr>
<tr><td>AAQM 06</td><td>AMNSI - SW</td><td>-</td><td>-</td><td>1st downwind from the triangle formed with 3 major stacks(SMS, Sinter and coke oven)</td></tr>
<tr><td>AAQM 07</td><td>Mora</td><td>3.1</td><td>N</td><td>2nd Upwind</td></tr>
<tr><td>AAQM 08</td><td>Damka</td><td>5.58</td><td>N</td><td>2nd Upwind</td></tr>
<tr><td>AAQM 09</td><td>Kavas</td><td>6.78</td><td>NE</td><td>1st Upwind</td></tr>
<tr><td>AAQM 10</td><td>Gaviyer</td><td>8.41</td><td>E</td><td>crosswind</td></tr>
<tr><td>AAQM 11</td><td>Dumas</td><td>5.4</td><td>SE</td><td>3rd downwind</td></tr>
<tr><td>AAQM 12</td><td>Vanta</td><td>7</td><td>E</td><td>crosswind</td></tr>
</table>
</td></tr>
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<tr><th>Sr. no.</th><th>Terms of Reference</th><th>Compliance</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>24</td><td>Comprehensive risk assessment study for the entire steel complex shall be carried out and submitted.</td><td>Please refer Section 7.1, Page no. 426</td></tr>
<tr><td colspan="3">ADDITIONAL TERMS OF REFERENCE (TOR)</td></tr>
<tr><td>1</td><td>Iron ore/coal linkage documents along with the status of environmental clearance of iron ore and coal mines</td><td>Please refer Annexure 22, Page no. 783 and Annexure 23, Page no. 785</td></tr>
<tr><td>2</td><td>Quantum of production of coal and iron ore from coal & iron ore mines and the projects they cater to.
Mode of transportation to the plant and its impact</td><td>
Details of Quantum generation of Iron ore from Iron ore Mine
<table>
<tr><th>Sr. no.</th><th>Name of contract</th><th>Capacity</th><th>Supply to AMNS</th></tr>
<tr><td>1</td><td>Thakurani Iron Ore Mines of AMNS (Captive)</td><td>5.5 MTPA</td><td>5.5 MTPA</td></tr>
<tr><td>2</td><td>OMC limited</td><td>9.12 MTPA</td><td>9.12 MTPA</td></tr>
<tr><td>3</td><td>NMDC Limited</td><td>309 MTPA</td><td>1.30 MTPA</td></tr>
<tr><td>4</td><td>Serajuddin & Co., Odisha EX Mines only (Balda Iron Ore Block)</td><td>2,00,000 MT</td><td>Spot Purchasing</td></tr>
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Details of Quantum of generation of coal from mines
<table>
<tr><th>Suppliers</th><th>Origin</th><th>Cargo</th><th>Tonnage</th></tr>
<tr><td>Balta Gmbh</td><td>Poland</td><td>Low Ash Metallurgical coal 25-80 mm Low Ash Metallurgical
Coal 10-50 mm</td><td>740000 MT +/- 10%
40000 MT +/- 10%</td></tr>
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Sr. no.	Terms of Reference	Compliance
		Anglo American Marketing Limited Singapore | South African | Steam coal | 1360000 MT +/- 10% Anglo American Marketing Limited Singapore | South African | Steam coal | 920000 MT +/- 10% Avani Resources PTE Ltd | Russian | PCI Coal | 560000 MT +/- 10% Glencore International AG | Russian | PCI Coal | 80000 MT +/- 10% KRU Overseas Ltd | Russian | PCI Coal | 2780000 MT +/- 10% Adityaa Energy Resources PTE Ltd | Indonesia | Steam Non-Coking Coal | 300000 MT +/- 10% Pt. Bayan Resources TBK | Indonesia | Steam Non-Coking Coal | 660000 MT +/ 10%
3	For Large ISPs, a 3-D view i.e. DEM (Digital Elevation Model) for the area in 10 km radius from the proposal site. MRL details of project site and RL of nearby sources of water shall be indicated.	Please refer ***Map 3-2, Page no. 189***
4	Recent land-use map based on satellite imagery. High-resolution satellite image data having 1m-5m spatial resolution like quick bird, Ikonos, IRS P-6 pan sharpened etc. for the 10 Km radius area from proposed site. The same shall be used for land used/land-cover mapping of the area.	Land map is prepared based on the High-resolution satellite image and copy of the land use is attached as ***Map 3-1, Page no. 188***

Sr. no.	Terms of Reference	Compliance
5	PM (PM_{10} and $PM_{2.5}$) present in the ambient air must be analyzed for source analysis – natural dust/RSPM generated from plant operations (trace elements) of PM_{10} to be carried over.	The monitoring stations are selected based on CPCB guideline considering pre-dominant wind direction, nearest habitation, topography etc. Details of AAQ data collected for Summer 2021 and additional one month in Nov-Dec 2021 are given in ***Section 3.6 Page No. 200***
6	All stock piles will have to be on top of a stable liner to avoid leaching of materials to ground water	All the yards will have RCC flooring after hard surface rolling and compacting liner to avoid leaching of materials to ground water All the yards will have proper drainage system and retaining wall to evacuate ground water easily. Drain and retaining wall in Coal Yard, coke yard and flux yard is already available while in oxide yard the same is under construction. Please refer ***Section 4.4.12, Page No. 392***
7	Plan for the implementation of the recommendations made for the steel plants in the CREP guidelines.	Please refer ***Section 4.5, Page no. 405***
8	Plan for slag utilization	Along with Internal recycling AMNS is also developing various value added products to increase sale of by-products, especially steel slag. Products like Paver Blocks, Tiles, Garden Tiles, Concrete blocks, Fish reef, Tetrapods, Construction of road with Steel Slag etc. have been developed in in-house R&D Centre of AMNS. Please refer ***Section 4.4.13, Page no. 396***
9	Plan for utilization of energy in off gases (coke oven, blast furnace)	Plan for utilization of energy in off gases (Coke Oven, Blast Furnace, BOF and Tail Gas is given in ***Section 2.8.25, Page 172***
10	System of coke quenching adopted with justification.	Dry Coke Quenching (CDQ) facilities have been proposed with all Coke Oven Batteries with Stand-by Wet Quenching facility. CDQ has been proposed due to the following reasons: • **Energy saving** - Sensible heat of red hot coke is recovered as steam which can be utilized for electric power generation • **Effect of reduction of carbon dioxide emission**. Practically no carbon dioxide is emitted during power generation.

Sr. no.	Terms of Reference	Compliance
		• **Reduction of dust emission** compared with wet quenching, environment of steel works improved due to non-emission of quenching steam with toxic gases from coke ovens and non-emission of dust particles from coke whereas. • **Increase in coke strength compared to wet quenching**. The absence of moisture in the product coke. Along with its enhanced strength, contributes to the stable operation of the blast furnace
11	Trace metals Mercury, arsenic and fluoride emissions in the raw material.	Please refer ***Annexure 25, Page no. 802***
12	Trace metals in waste material especially slag	Please refer ***Annexure 24, Page no. 790***
13	Trace metals in water	Please refer ***Table 3-26, Page no. 235***
14	Details of proposed layout clearly demarcating various units within the plant.	please refer ***Map 2-5, Page no. 109***
15	Complete process flow diagram describing each unit, its processes and operations, along with material and energy inputs and outputs (material and energy balance).	Please refer ***Figure 2-1, Page no. 160***
16	Details on design and manufacturing process for all the units.	Please refer ***Section 2.8, Page no, 117***
17	Details on environmentally sound technologies for recycling of hazardous materials, as per CPCB Guidelines, may be mentioned	AMNS shall not handle any hazardous scrap in the process

Sr. no.	Terms of Reference	Compliance
	in case of handling scrap and other recycled materials.	
18	Details on requirement of energy.	Total power demand after proposgeneration wed expansion will be 1573 MW out of which 810 MW power will be generated in the plant premises and balance power of 763 MW will be obtained from third party and grid. Please refer ***Table 2-48, Page no. 175***
	Requirement of water along with its source and authorization from the concerned department	Water Requirement For the existing plant, raw water is sourced from river Tapi and the requirement is around 145,838 KLD (Approx. 32.08 million of gallons per day (MGD)). For the proposed expansion, additional requirement of raw water will be around 81,600 KLD (approx. 17.95 MGD) which needs to be sourced from river Tapi. Hence total water requirement after expansion will be around 227,439 KLD (approx. 50.03 MGD). Water Permission The water permission from the Narmada Water Resources Water Supply and Kalpsar Department Division Surat for drawl of 87 MGD. is enclosed as ***Annexure 6*** Total raw water requirement has to be sourced from Tapi river. Water withdrawal from river Tapi will be gradually reduced as ~ 75000 TTW is made available
	Location of water intake and outfall points (with coordinates)	Please refer ***Annexure 26, Page no. 822***
19	Details on toxic metal content in the waste material and its composition and end use (particularly of slag)	Please refer ***Annexure 24, Page no. 790***
20	Details on toxic content (TCPL), composition and end use of slag	Please refer ***Annexure 24, Page no. 790***
ToR amendment Points		
1	The rail track and road which are passing through the area should be shifted within the	Undertaking for the same is attached as ***Annexure 27, Page No. 823***

Sr. no.	Terms of Reference	Compliance
	plant premises in case the PP does not get the necessary clearance from the Forest Department.	
2	There is sparse mangrove vegetation now. As a CER activity, AMNS will put full efforts in conserving and improving the mangroves	Mangroves conservation programme shall be considered under CER activities after consultation with District Forest Department
3	As per discussion, the PP has to submit the revised layout of the project area during the final EIA report.	Site layout map is attached as ***Map 2-5, Page No. 109***
4	As a part of Corporate Environment Responsibility (CER) activity, the company shall undertake community development programmes either in terms of adoption of nearby villages or putting plastic recycling unit and plantation of mangroves/trees whichever is applicable to the surrounding area in consultation with local forest department & district administration.	AMNSI is proposing, • 50 Ha mangrove plantation in nearby suitable area in consultation with Gujarat Forest Department • Plan to develop plastic waste collection and segregation facilities in all nearby villages as well as to support a local to develop a plastic waste recycling facility in nearby area part of CER actitivities. Proposed CER budget details is given in ***Section 10.12, Page no. 563***
5	All earlier ToR conditions shall be prevailed.	Noted and shall be complied

Sr. no.	Terms of Reference	Compliance
6	A proper action plan must be implemented to dispose of the electronic waste generated in the industry.	As per the E waste management and handling rules 2016 amended till date, AMNSI is currently segregating and disposing all the E waste generated from the plant to the GPCB Registered authorized recycler and it will be continued for Upstream Expansion project also.
7	Project proponent shall submit a study report on De-carbonization program, which would essentially consist of company's carbon emissions, carbon budgeting/ balancing, carbon sequestration activities and carbon capture, use and storage after offsetting strategies. Further, the report shall also contain time bound action plan to reduce its carbon intensity of its operations and supply chains, energy transition pathway from fossil fuels to Renewable energy etc. All these activities/ assessments should be measurable and monitor able with defined time frames.	In line with the Country's Nationally Determined Contribution (NDC), AMNSIL has reduced its equivalent Carbon emission intensity by 33% in the year 2021 compared to 2015 levels (calculated as per Worls Steel Association methodology for eCO2 emission calculation). Under the expansion, 350 MW power will be generated from Top Recovery Gas Turbines (TRT) of new Blast Furnaces, WHRB utilising sensible heat at Coke Dry Quenching of Coke Oven Plants and Captive Power Plant utilising excess gases of the plant. These actions will replace fossil fuel for an equal amount of power generation. These measures will bring down eCO2 emission intensity by around 6% (2.1 ton eCO2 / ton of Crude Steel production AMNSIL recognizes the immediate threat of climate change and is committed to bring down the emission intensity after proposed expansion to **less than 1.95 tCO2/tCS** (calculated based on WSA philosophy) by **2030**. Details of the same is given in ***Section 10.16, Page no. 569***

2 PROJECT DESCRIPTION

2.1 Type of Project

The project is for expansion of Integrated Steel Plant of ArcelorMittal Nippon Steel India Ltd. for production of liquid steel from 9.6 to 15.6 MTPA of by addition of facilities to produce additional 6.0 MTPA liquid steel and 6.0 MTPA finished product (hot rolled coils) through Blast Furnace – BOF – Caster route followed by Hot Rolling.

Facilities envisaged for the expansion projects are as follows:

Table 2-1: Facilities Envisaged for the Expansion Project

Name of Facility	Configuration	Capacity (TPA)
Coke Ovens	4x59 Ovens By-product Recovery Type	3,050,000
Sinter Plant	~650 sqm (2 Units)	7,000,000
Blast Furnace	Up-gradation of existing BF#1 BF#2 & BF#3 (2x4500 Cum.)	960,000 8,000,000
Steel Melting Plant#3	3 x350 MT BOF (2/3 Operation)	6,000,000
Calcination Plant*	4x600 TPD + 1x500 TPD* + 1x200 TPD* Rotary Kiln	800,000 +2,70,000*
Hot Rolling Mill (HRC)	1 x 6 MTPA	6,000,000
CRM**	1 x 2.2 MTPA 1 x 1.0 MTPA	3,200,000
CPP	Gas Based Power Plant 2 x 100 MW Top Recovery Gas Turbine 2 x 25 MW	200 MW 50 MW
WHRB	Coke Dry Quenching	100 MW
* 1x 500 + 1 x 200 TPD Project is part of Modification Project, EC received in March 2022 ** Expansion of CRM Project is part of Modification Project, EC received in March 2022		

The project activity is listed under activity 3(a) Metallurgical Industries (Ferrous & Non-ferrous) and 4(b) Coke oven and 1(d) Thermal Power Plant of the Schedule of EIA Notification, 2006 and falls under Category 'A'.

The Project is a standalone project without dependence on or of other projects. There is no interlinked project or interdependent project. However, the existing utilities and other facilities from the 9.6 MTPA Integrated steel complex (ISC) wil be used.

2.2 Need for the Project

Steel is crucial to the development of any modern economy and is the backbone of the human civilization. The Iron & steel industry has tremendous forward and backward linkages in terms of material flow, income, and employment generation.

According to Ministry of Steel reports, the total production of Crude Steel in India has been 101.287 million tons during the year 2018-19 as compared to 57.8 million tonnes in 2007-08 indicating an increase of 83.34% in the last 10 years (i.e. annual growth rate of above 8.4%).

The Government's vision to achieve a $5 Trillion economy by the year 2024 entails investment in several sectors like infrastructure, housing for all, 100% electrification, piped water for all etc., growth potential for this sector is immense and the domestic steel consumption will increase significantly inline with these visions. It is therefore important to ensure that these demands are met through domestic steel industries.

In view of the above, ArcellorMittal Nippon Steel Limited proposes to undergo a brownfield expansion for production of liquid steel from 9.6 to 15.6 MTPA and corresponding 6.0 MTPA hot rolled coils production by installation of upstream facilities like Coke Ovens, Sinter Plant, Blast Furnaces, Steel Melting Shop (through BOF Route) and addition of downstream facilities like Slab Caster to make the product in most energy efficient and cost-effective manner.

2.3 Cost of the Project

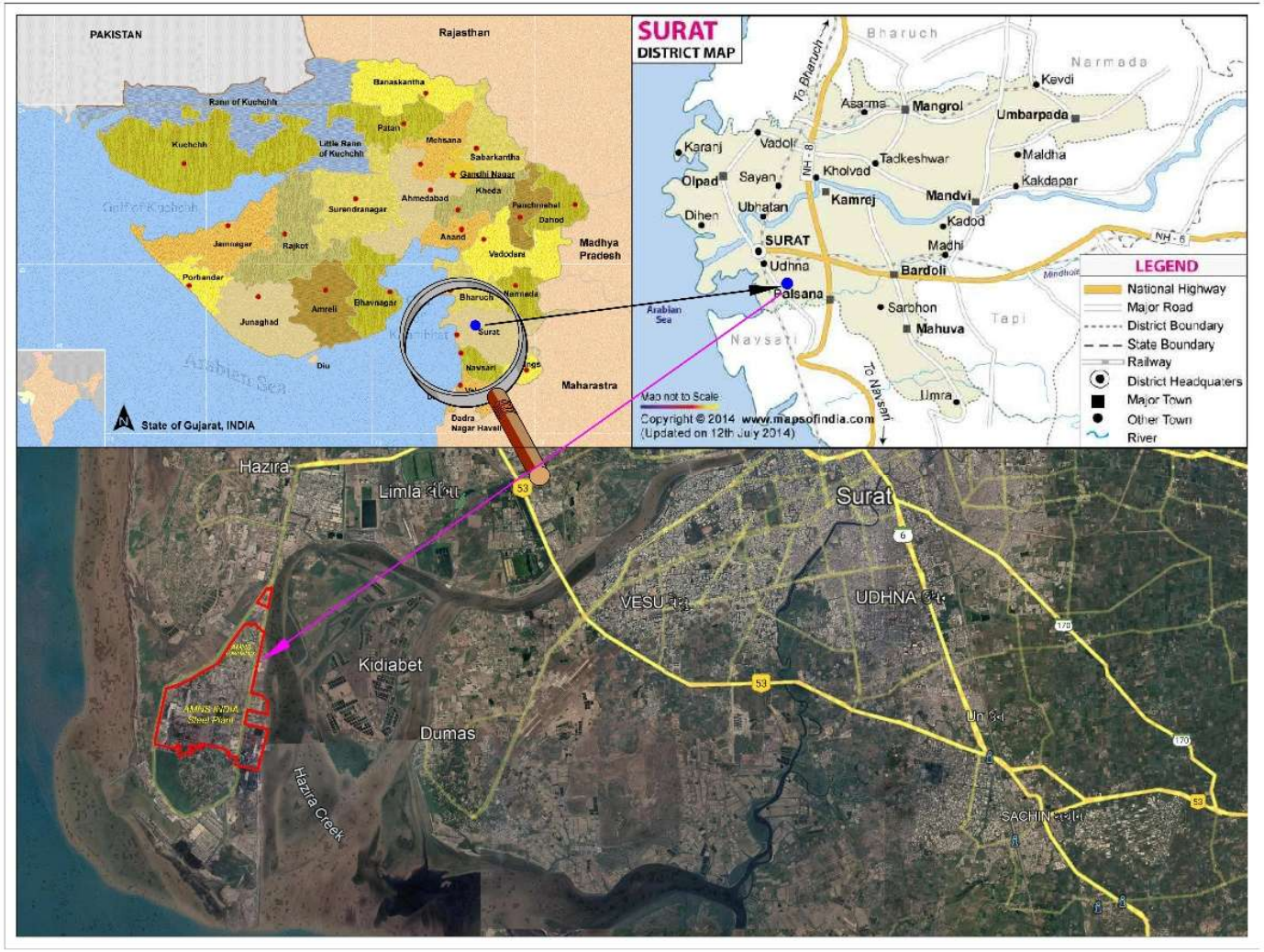
Total estimated cost for proposed project is INR 35,145 crore

2.4 Location

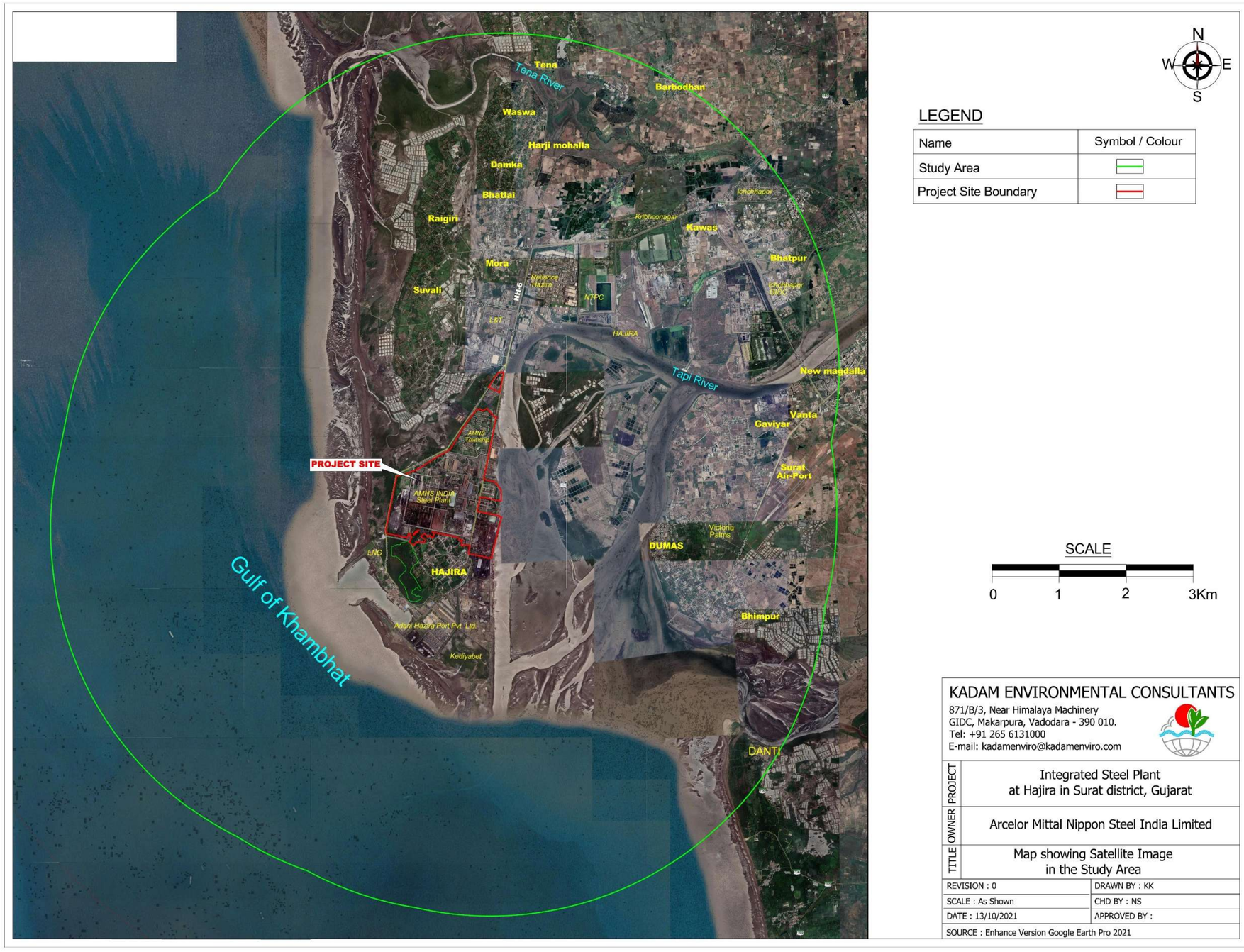
The proposed project located at Hazira village, in Chorasi Tehsil, District Surat in the state of Gujarat. The project site is located at latitude $21^0$6'43.72"N and longitude $72^0$38'40.29"E.

The Location map, Satellite Imaginary of the Study Area, Topographic map, Project Site Boundary with co-ordinates are shown in ***Map 2-1, Map 2-2, Map 2-3 and Map 2-4*** respectively. The plant layout is shown in ***Map 2-5 .*** The project site photographs are shown in ***Photographs 2-1.***

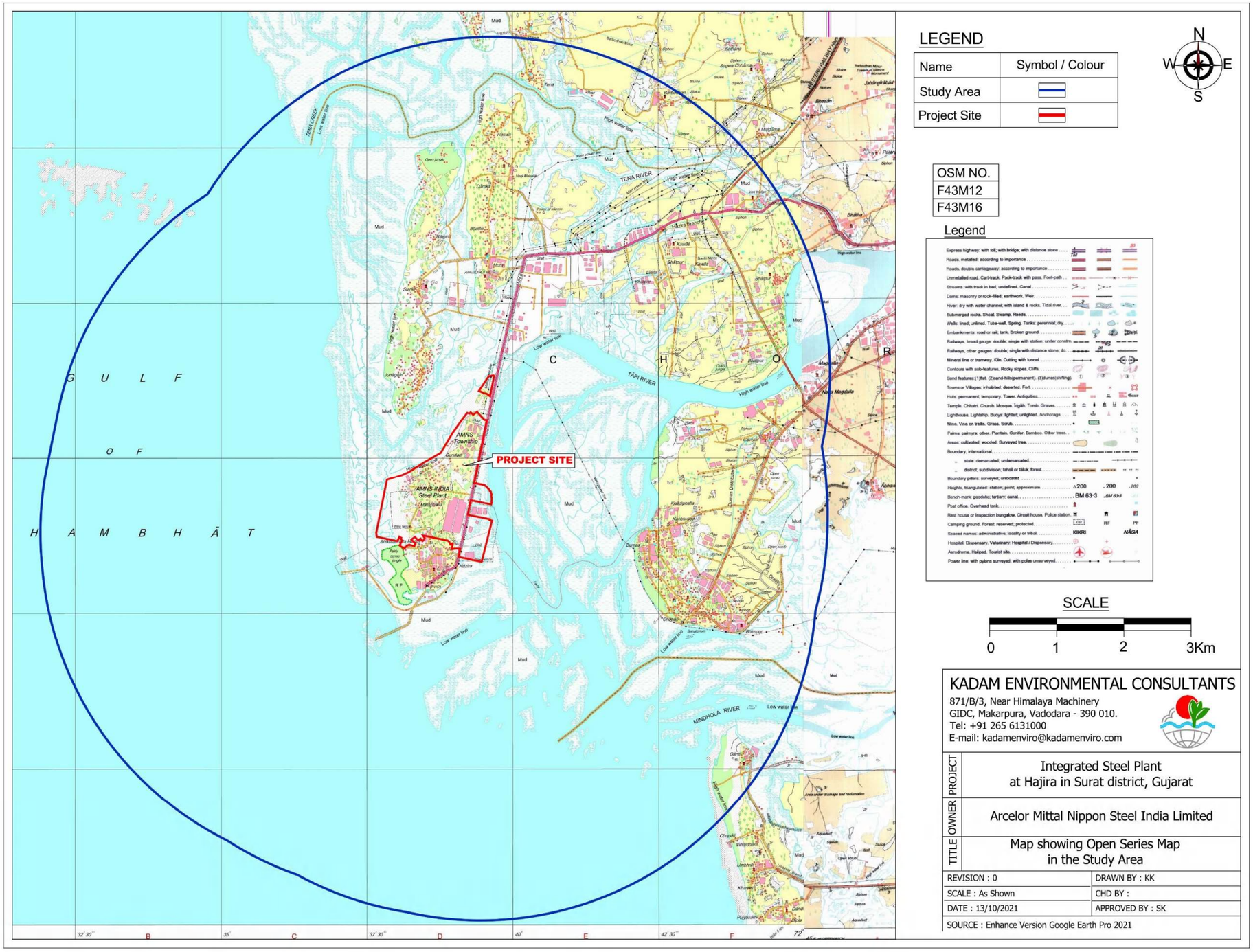
Map 2-1: Site Location Map



Map 2-2: Site location map on satellite image



Map 2-3: Survey of India OSM showing Project site



Photographs 2-1: Site Photographs

Cold Rolling Mill

Blast Furnace

Pipe Mill

Plate Mill

Greenbelt within plant premises

Site Visit by EIAC & FAEs

The map showing coordinates of the project site are given in ***Map 2-4***

Map 2-4: Project site Boundary with Coordinates

Legends

Project Boundary

N

W E

S

No	Latitude	Longitude
1	21° 8'9.68"N	72°39'11.19"E
2	21° 8'9.35"N	72°39'13.33"E
3	21° 8'10.48"N	72°39'14.41"E
4	21° 8'8.13"N	72°39'17.08"E
5	21° 8'10.69"N	72°39'20.84"E
6	21° 8'3.24"N	72°39'28.19"E
7	21° 8'2.72"N	72°39'30.79"E
8	21° 7'3.13"N	72°39'17.98"E
9	21° 7'1.20"N	72°39'28.66"E
10	21° 6'55.64"N	72°39'34.20"E
11	21° 6'42.96"N	72°39'35.28"E
12	21° 6'46.62"N	72°39'14.59"E
13	21° 6'33.14"N	72°39'11.74"E
14	21° 6'29.00"N	72°39'33.68"E
15	21° 6'28.09"N	72°39'33.76"E
16	21° 6'27.69"N	72°39'36.12"E
17	21° 5'48.56"N	72°39'25.32"E
18	21° 5'53.05"N	72°39'1.77"E
19	21° 6'1.03"N	72°39'3.44"E
20	21° 6'0.90"N	72°38'55.17"E
21	21° 6'6.02"N	72°38'55.95"E
22	21° 6'5.41"N	72°38'53.75"E
23	21° 6'8.85"N	72°38'51.56"E
24	21° 6'13.55"N	72°38'25.72"E
25	21° 6'10.85"N	72°38'27.55"E
26	21° 6'8.34"N	72°38'25.47"E
27	21° 6'10.68"N	72°38'23.68"E
28	21° 6'9.13"N	72°38'20.92"E
29	21° 6'12.14"N	72°38'17.95"E
30	21° 6'9.69"N	72°38'14.10"E
31	21° 6'6.45"N	72°38'18.51"E
32	21° 6'3.41"N	72°38'17.18"E
33	21° 6'4.54"N	72°38'12.51"E
34	21° 6'4.14"N	72°38'9.73"E
35	21° 6'1.70"N	72°38'7.69"E
36	21° 6'0.56"N	72°38'5.38"E
37	21° 6'4.22"N	72°38'2.17"E
38	21° 6'8.82"N	72°38'4.93"E
39	21° 6'10.73"N	72°38'3.25"E
40	21° 6'12.39"N	72°38'2.10"E
41	21° 6'8.41"N	72°38'0.40"E
42	21° 6'12.46"N	72°37'38.93"E
43	21° 6'15.98"N	72°37'38.41"E
44	21° 7'6.38"N	72°37'49.03"E
45	21° 7'11.04"N	72°38'4.94"E
46	21° 7'14.04"N	72°38'12.08"E
47	21° 7'32.01"N	72°38'43.92"E
48	21° 8'30.46"N	72°39'22.76"E
49	21° 8'43.89"N	72°39'32.65"E
50	21° 8'45.20"N	72°39'37.66"E
51	21° 8'44.39"N	72°39'38.17"E
52	21° 8'25.44"N	72°39'34.17"E

SCALE

0 0.5 1Km

KADAM ENVIRONMENTAL CONSULTANTS

PROJECT	Integrated Steel Plant at Hajira in Surat district, Gujarat
OWNER	Arcelor Mittal Nippon Steel India Limited
TITLE	Project Site Boundary Map
REVISION : 0	DRAWN BY : CP
SCALE : As Shown	CHD BY : MK
DATE : 19/05/2022	APPROVED BY: SK

2.4.1 List of Major Industries in the Study area

The list of industries which are located in the vicinity of the project site is given in ***Table 2-2.***

Table 2-2: List of Industries

Sr. No.	Industry Name	Type	Approx. Distance and direction
1	Kribhco Ltd.	Chemical Fertilizers	6.5 km North - East
2	Shell India	Isolated storage & handling of hazardous chemicals	1 km South - West
3	Larsen & Toubro Ltd. (L&T)	Heavy engineering unit	1 km North – East
4	NTPC	Thermal power plant	4 km North – East
5	ONGC	Petro-chemical complexes	8 km North – East
6	GAIL	Isolated storage & handling of hazardous chemicals	10 km North – East
7	GSPC	Petro-chemical complexes	9.5 km North – East
8	UltraTech Cement	Cement plant	8 km West
9	Reliance Industries	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	4 km North – East
10	Adani Hazira Port	Port	3 km South -West
11	IBP Hazira Terminal	Isolated storage & handling of hazardous chemicals	10 km North-East
12	Gujarat State Energy Generation Ltd. (GSEG)	Thermal power plant	3.5 km North
13	Cairn energy	Isolated storage & handling of hazardous chemicals	5.8 km North
The industry is inside the hazira notified industrial estate and hence surrounded by number of industries			

2.4.2 Approach and Connectivity to the Project Site

The proposed project area is situated in the West Coast of India at a distance of 27 km from the Surat City in the State of Gujarat. The existing plant site is connected to the Bypass NH6 road, along the northern and western sides of the plant site, through two plant gates, Gate A and Gate B. The Bypass NH6 road meets the four-lane National Highway NH6, which connects Hazira and Kolkata in West Bengal. NH6 is also linked to NH8, which connects Mumbai and Delhi. Surat-Hazira Road is passing within the existing works boundary, dividing it into two plots. Hot metal track for BF3 crosses the Surat-Hazira State Highway.

Presently, Hazira plant is not connected to the Indian Railway network. The Mumbai-Delhi broad gauge mainline via Surat, under the Western Railway, is located at a distance of about 30 km from the plant. There is a railway head, taking off from the mainline between the Kosad and Gothangam railway stations, available up to the plant of Kribhco Fertilizer Co., which is at a distance of about 7 km from the Hazira plant. However, G-RIDE yard will be available about 1.8 km away from plant site. Railway connectivity from `Zero Point' of G-RIDE yard to plant site will be made based on the land availability and location of 'Zero Point' of G-RIDE yard. There is an all-weather deep draft terminal under EBTL and is located on the western bank of the Tapi river, which is at the south of the present works' boundary.

There is also an all-weather deep draft port under AHPL (Adani Hazira Port Limited). and is located on the Arabian sea, which is at the south of the present works' boundary. The Tapi river is connected to the high seas of the Gulf of Khambatt by a navigation channel, under the Gujarat Maritime Board (GMB). Surat Airport is located at a distance of around 22 km.

With the expansion, the finished goods (FG) movement will increase. The FG movement will be by sea, road and rail.

By Road

Hazira is well connected with State and National highways. FG transportation to landlocked places is being done through road. ~5.5 MTPA of FG is to be dispatched by road and after expansion ~7.0 MTPA will be dispatched by this route. After commissioning of G-RIDE facility, the road dispatch will be reduced to ~4 MTPA.

By Rail

Western Railway's three (3) railway sidings (Kribhco, Ankleshwar and Udhana) are near to Hazira and are well connected to rest of the country. These sidings are being used to dispatch ~1.0 MTPA FG and dispatch will increase to ~2 MTPA after expansion. After G-RIDE implementation, ~5.0 MTPA FG will be dispatched by this route thereby reducing the load on road dispatch.

By Sea

Hazira is having well developed Ports in vicinity. Export to various countries including UAE/ Middle East and Europe, and domestic dispatch to Maharashtra and Southern states is through Port. Currently ~3.0 MTPA of FG is to be dispatched by sea route and after expansion ~6.0 MTPA will be dispatched by this route utilizing EBTL, existing Jetty and AHPL (Adani Hazira Port Limited). AHPL is connected to our plant by an existing National Highway (NH-6).

2.5 Size or magnitude of operations

2.5.1 Size and land distribution of the site

The project is for expansion of the existing plant for production of 15.6 million tons per annum (MTPA) liquid steel from the existing capacity of 9.6 MTPA, and additional 6 MTPA Hot Rolled Coil. The existing plant area is 738.55 Ha and the total plant area after proposed expansion will be 824.82 Ha.

The existing plant area is 738.55 Ha and 11.63 Ha having clear title included in the township (Total area 750.18 Ha)
Additional Area for proposed expansion: 74.64 Ha

Total area after proposed expansion 824.82 Ha

Land required for proposed expansion: 147.17 Ha
It will comprise of the following:

- 65.73 Ha Forest land land possession is available and Copy of the same is attached as ***Annexure 2***
- 8.91 Ha private land direct purchase from Land owners
- 72.53 Ha area will be used from existing plant area

The site layout along with land distribution of the proposed project site is given in ***Map 2-5***

The area break of the site is given in ***Table 2-3***

Table 2-3: Existing Area break up of site

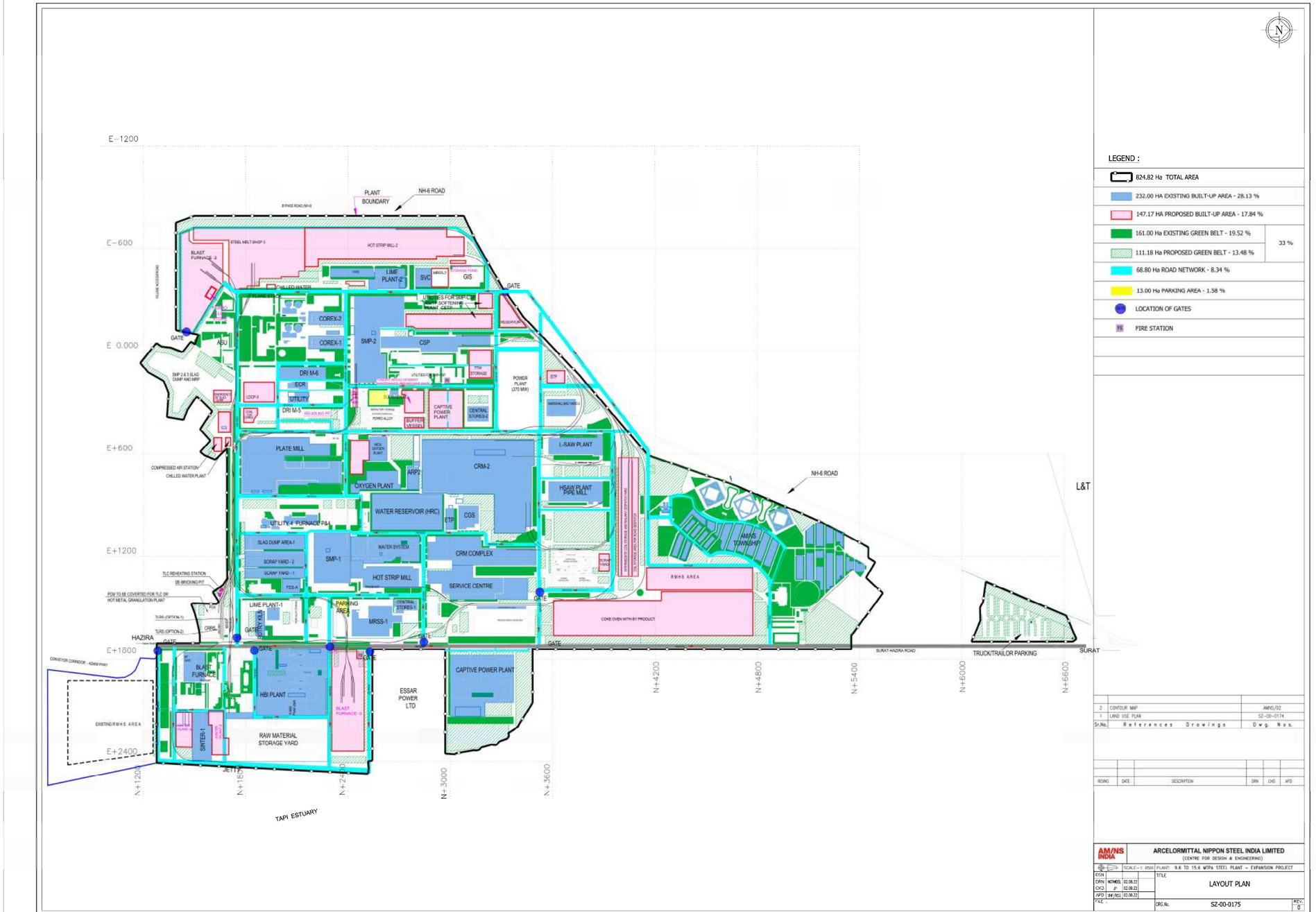
Sr. No.	Plant Name	Existing Area (in Ha.)	Proposed Area (in Ha)	Total area after expansion (in Ha)
1	Plant facilities	351.25	66.64	417.89
2	Proposed auxiliaries plant facilities	31.37	0	31.37
3	Existing greenbelt area	161	38	272.18
	Additional planned greenbelt area	73.18		
4	Admin area	15	-5	10
5	Parking area	13	0	13
6	Solid / hazardous waste storage area	10	0	10
7	Open area	25	-25	0
8	Coal storage area	10.38	0	10.38
9	Raw material storage area	19	0	19
10	Internal road area	8	0	8
11	Residential area	21	0	21
12	OHC area	4	0	4
13	Canteen area	8	0	8
Total		**750.18**	**74.64**	**824.82**

Table 2-4: Area break up of site for Proposed Expansion

Sr. No.	Plant Name	Area (in Ha.)
1	Blast Furnace-2	12.0526
2	Steel melt shop-3	17.5857
3	Hot strip Mill (HSM) – 2	22.4689
4	RWTP, Softening plant, CETP	5.393
5	MRSS-2	1.05
6	Sinter Plant-2	2.215
7	STP	0.728
8	TTW Storage	2.1067
9	Tundish, Mould segment maintenance and machine shop	1.6366
10	Captive Power plant	4.5831
11	Buffer vessel	0.6574
12	Reloading Pit	0.3114
13	LDCP-3	2.16
14	Hot metal pooling pit	0.84
15	Air separation plant	1.865
16	Intermediate coil storage and dispatch yard	5.3013

Sr. No.	Plant Name	Area (in Ha.)
17	Coil storage are for road dispatch	2.7105
18	TLC reheating station	0.02
19	De-bricking pit	0.02
21	Blast furnace-3	11.6877
22	Sinter plant-3	1.9506
23	Raw Material handling system	8.0784
24	Coke oven plant	31.2207
25	SMP-2 & 3 Slag dump and MRP	8.91
	Water Resorvoir	1.6171
TOTAL		**147.17***
* 72.53 Ha area will be used from existing plant area		

Map 2-5: Site layout Map



2.5.2 Size of the Project

The proposed project is for production of 6.0 MTPA liquid steel and 6.0 MTPA HRC. The additional crude steel (Slabs) required for production of 6.0 MTPA HRC will be sourced from outside. The existing and proposed production capacities and facilities are given in ***Table 2-5***

Table 2-5: Configuration and Production Capacities of Existing & Proposed Units

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		configuration	Capacity in MTPA	configuration	Capacity in MTPA	configuration	Capacity in MTPA	
1	HBI Plant (DRI Mod I to VI)	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	--	--	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	
2	Blast Furnace (BF)	BF#1: 2.04 MTPA (1x2200 m3)	2.04	BF#1: 0.96 MTPA BF#2 &3: 2 x 4.0 (~4500 m3 each)	8.96	BF#1: 3.0 MTPA (2200 m^3) BF#2: 4.0 MTPA (4500 m^3) BF#3: 4.0 MTPA (4500 m^3)	11.0	Existing operational capacity of BF#1 is proposed to be upgraded from 2.04 MTPA to 3.0 MTPA. Further, additional 2 nos. of BFs of capacity 4.0 MTPA, each are proposed.
3	Sinter Plant	1x 1.48 MTPA (1 x 120 m2)	1.48	2 x 3.5 MTPA (~ 325 m2 each)	7.0	1x 1.48 MTPA (1 x 120 m2) + 2 x 3.5 MTPA (~ 325 m2 each)	8.48	

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		configuration	Capacity in MTPA	configuration	Capacity in MTPA	configuration	Capacity in MTPA	
4	Coke Ovens (Recovery Type)	CO#1&2 (2x59 Ovens) *	1.35	CO Battery# 3,4,5 & 6 4 x 59 Ovens	3.05	CO Battery#1 to 6 6 x 59 Ovens	4.4	* CO Battery# 1&2 is being implemented under 2016 EC CO Battery# 3,4,5 & 6 shall be installed under the expansion
5	Air Separation Plant (Nm3/Hr)	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1x2200 TPD (Only oxygen)	424,744			1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1 X 2200 TPD (Only oxygen)	424,744	* 3,60,544 Nm3/hr plants are in operations, balance 64,200 Nm3/hr plant will be established as per 2016 EC
6	SMS-1 (EAF 4 Nos.)	4 x 150 MT Heat size	4.6	--	--	4 x 150 MT Heat size	4.6	
7	SMS-2 (Con Arc 4 Nos.)	4 x 200 MT Heat size	5.0	--	--	4 x 200 MT Heat size	5.0	
8	SMS-3 (BOF – 3 nos.)	--	--	3 x 350 MT Heat size *	6.0	3 x 350 MT Heat size *	6.0	New SMS-3 Shop for 6.0 MTPA is proposed. 3x350 Ton Converters shall be installed (* 2 Working + 1 stand-by)
Total SMS		**9.6**		**--**	**6.0**	**15.6**		
9	COREX Plant	2 x 0.85	1.7	-	-	2 x 0.85	1.7*	Plant will be shutdown safely and will be

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		configuration	Capacity in MTPA	configuration	Capacity in MTPA	configuration	Capacity in MTPA	
								started only in case of any unit going down but maintaining sanctioned production quantity of hot metal.
10	Lime Plant (Lime/ Dolomite	1 x 0.45 (4 x 300 TPD) 1 x 0.48 (3 x 500 TPD) 1 x 0.27* (1x200 + 1x500 TPD)	1.2	1 x 0.8 (4 x 600 TPD)	0.8	4x300 TPD 1x200 TPD 4x500 TPD 4x600 TPD	2.0	*0.27 MTPA plant shall be installed under Modernisation EC granted on 02.03.2022 0.8 MTPA proposed in this expansion.
11	Plate Mill	1 x 1.5	1.5	--	--	1 x 1.5	1.5	
12	CSP & HRC	CSP 1 x 3.5 MTPA HRC 1 x 4.5 MTPA	8.0	1 x 6.0 MTPA	6.0	1 x 3.5 MTPA 1 x 4.5 MTPA 1 x 6.0 MTPA	14.0	
13	CRM	CRM #1: 1 x 2.04 CRM #2: 1 x 3.2*	5.24	---	---	CRM #1: 1 x 2.04 CRM #2: 1 x 3.2*	5.24	* CRM 3.2 MTPA is being implemented under Modification EC dated.02.03.2022
14	H Saw Pipes	1 x 0.15 1 x 0.15	0.30	--	--	1 x 0.15 1 x 0.15	0.30	
15	L Saw Pipes	1 x 0.33	0.33	--	--	1 x 0.33	0.33	

Sl. No.		Existing as per Modification EC dated 02.03.2022		Proposed		Total after Expansion		Remark
		configuration	Capacity in MTPA	configuration	Capacity in MTPA	configuration	Capacity in MTPA	
16	CPP	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW	556	2 x100 MW (By-product Gas based PP) 2 x 25 MW (TRT BF #3&4)	250	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW 2 x100 MW 2 x 25 MW	806	1x48 MW dropped as per modification project EC dated.02.03.2022.
17	Waste Heat Recovery based Power Plant (in MW)	1 x 25 MW 1 x 20 MW#	45	1x 100 MW CDQ	100	1 x 25 MW 1 x 20 MW 1x 100 MW CDQ	145	#Will be implemented under the EC 2016
18	Jetty (length in m)	456 m + 734 m	1190 m	-	-	456 m + 734 m	1190 m	

2.6 Tentative Schedule for Project Approval & Implementation

2.6.1 Schedule for Project Approval

Table 2-6: Timeline of activities completed up to date

10.11.2020	:	Submission of Form-1/PFR
03.12.2021	:	TOR issued from MOEF&CC
30.05.2022		ToR amendment from MoEF&CC
May, 2022	:	Draft EIA submission for Public Hearing

Table 2-7: Tentative timeline/schedule of activities to be done in future

July 2022	:	Public Hearing
August 2022	:`	Submission of Final EIA to MoEF&CC for EC
September 2022	:	Consideration of Project by EAC (Industry-1)

After getting CTE from Gujarat Pollution Control Board and EC from MOEF&CC, tenders will be floated for purchase, installation and commissioning of equipment. Estimated completion schedule of project is 42 months.

2.6.2 Schedule for Project implementation

Implementation schedule of the project is 42 months. "Zero date" for the project is reckoned as the date when all statutory clearances shall be obtained. For implementation of the project "SPLIT PACKAGE BASIS" mode of procurement for project execution is proposed. The proposed solution shall help in optimizing project investment and minimizing entrepreneur risk due to unknown circumstances.

The major activities involved in the implementation and construction of the projects shown in the form of a Bar Chart in ***Table 2-9*** has been developed on the basis of the estimated quantum of Civil and Structural Works to be executed at site, expected delivery schedule of the various equipment proposed to be installed and expected time period for the erection, testing and commissioning of equipment.

Based on the consideration that pre-project activities are accomplished prior to the award of the main machinery order, implementation schedule is given below for various units to be installed. M/s ArcelorMittal Nippon Steel India Limied. has initiated the process to get clearance from the statutory bodies. The consent required under Air and Water Acts will be obtained from GPCB.

Table 2-8: Project Implementation Schedule

Sl. No.	Activity	Schedule in Months
1	Environmental clearance	Zero date
2.	Basic and detail engineering required to start construction (will continue in parallel)	6 months
3.	Procurement, Civil and structural work Installation & Commissioning	36 months
Total		42 months

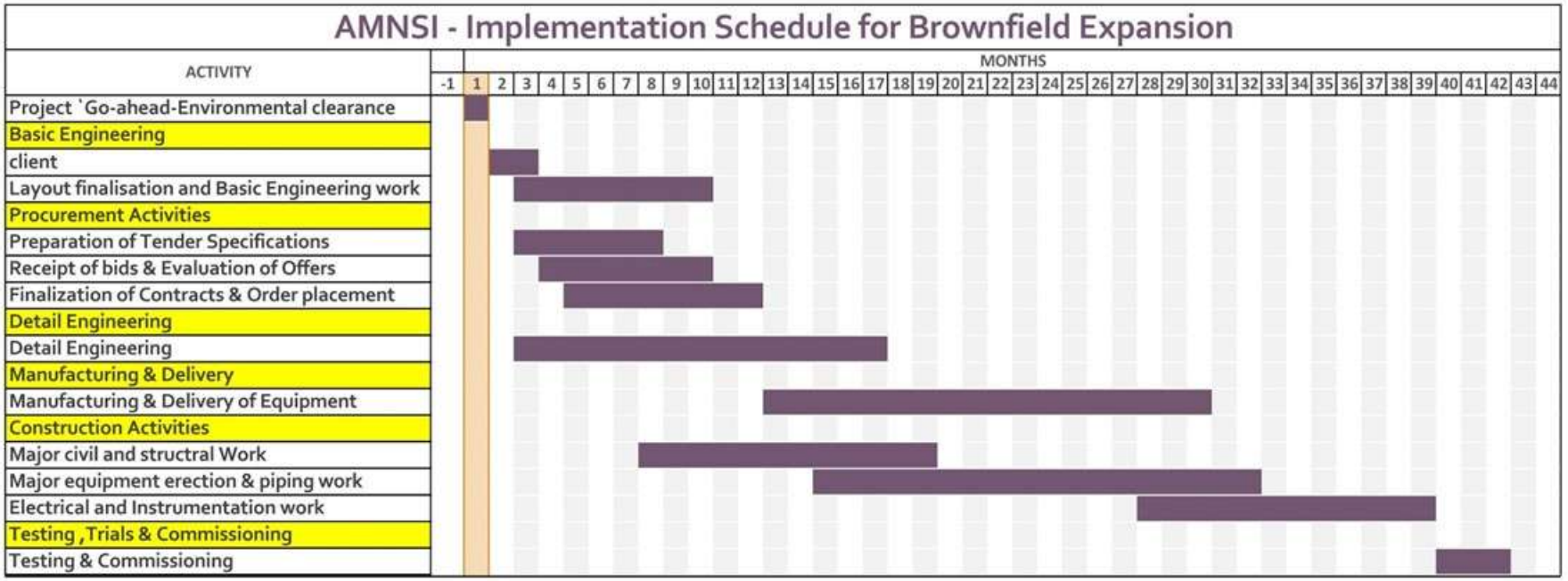
Implementation Strategy

Typically, the project has four core dimensions viz;

- Engineering directly impacts the smooth operations of the plant over its entire life.

- Procurement is critical on account of the impact that it has on investment and performance benchmarks and also in ensuring the choice of appropriate technology.
- Construction is critical in terms of its impact on completion quality and duration of the project phase.
- Project Management: other than its obvious impact on project time it also contributes to risk minimization for the project
- Effective monitoring and reporting procedure for review of progress and coordination among various agencies shall be used. At least a monthly coordination meeting, if not earlier, shall be held to closely monitor the project and take corrective action as required. The schedule may vary depending on the project status.

Table 2-9: Bar chart for Project Implementation Schedule



2.7 Technology and Process Description

Expansion of the ISP by addition of the facilities to produce additional 6.0 MTPA liquid steel and 6.0 MTPA finished product (hot rolled coils).

2.7.1 Proposed Technology

The proposed technology for steel making is through Blast Furnace (BF)-Basic Oxygen Furnace (BOF) route with Continuous Casting for converting liquid steel to Slabs (BF-BOF-CCM) and subsequent rolling in Hot Strip Mill for production of Hot Rolled Coil (HRC).

The principal process steps are;

- Coke making in recovery type Coke Ovens
- Sintering of iron ore fines with coke fines, flux and recycled dusts to make sinter burden for BF.
- Iron making in Blast Furnaces (BFs) from iron ore pellets produced in AMNSI Plants at Vizag and Paradeep and sintered ore, coke and fluxing materials to make hot metal.
- Conversion of hot metal to liquid steel by oxygen blowing in BOFs followed by refining of liquid steel in ladle furnaces and RH-Degasser with addition of alloying materials to achieve desired steel chemistry.
- Continuous casting of refined liquid steel to the Slab in Slab casters.
- Hot rolling operations to produce desired size and dimensions of Hot Rolled Coils

The plant will have its captive power plant (CPP) which will utilize surplus by-product fuel gas, steam from coke dry quenching (CDQ) and top recovery turbine (TRT) to produce power. The plant will also have its lime calcining plant. Air Separation Plant for producing oxygen, nitrogen and argon required by various units shall be available from existing facilities already installed or under implementation.

2.8 Process Description

2.8.1 Raw Materials Requirement

Estimated annual requirement of major raw materials are given in the ***Table 2-10***

Table 2-10: Estimated (Consolidated) Annual Requirement of Major Raw Materials

Sl. No.	Raw Material	Quantity required per annum			Source	Distance from site (Approx. Kms)	Mode of Transportation
		Existing	Proposed	Total			
1.	DR Grade Pellets	11,823,300	0	11,823,300	AMNSI's Palletization plants located at Vizag and Paradeep	5200/ 5750	Sea Route
2.	BF Grade Pellets	5,400,000*	6,759,536	12,159,536			
3.	Calibrated Lump Ore	0	127,660	127,660	NMDC mines in Kirandul, Dist.	450+5200	Rail + Sea Route

Sl. No.	Raw Material	Quantity required per annum			Source	Distance from site (Approx. Kms)	Mode of Transportation
		Existing	Proposed	Total			
					Dantewada, CG		
4.	Iron Ore Fines	185,000	3,942,444	4,127,444	Goa, Odisha NMDC mines	900/5750	Sea Route
5.	Coal-PCI-BF	408,000	2,036,444	2,444,444	Australia (Mainly) and Canada, USA and Russia	19650/ 16600/ 29850/ 17100	Sea Route
6.	Coal for Corex	2,770,000	-2,770,000	0			
7.	Metallurgical Coal	1,957,500	4,501,564	6,459,064			
8.	Coke	1,155,000	-1,155,000	0			
9.	BF and Sinter Grade Flux (Limestone +Dolomite + Pyroxenite + Quartzite)	690,000	493,715	1,183,715	Dubai and Oman	2640/ 2200	Sea Route
10.	SMS grade Limestone and Dolomite	1,863,000	2,562,564	4,425,564			
Note: All quantities are in gross and wet basis **Include 3,000,000 Tons for Corex Plant*							

2.8.2 Quantum Generation Iron Ore from Iron Ore Mines

The details of Quantum Generation Iron Ore from Iron Ore Mines are given in ***Table 2-11***. The characteristics (Trace Elements) of iron ore is given in ***Table 2-12***. The linkages of iron ore are enclosed as ***Annexure 22***

Table 2-11: Details of Quantum Generation of Iron Ore from Iron Ore Mine

Sr. no.	Name of contract	Capacity	Supply to AMNS
1	Thakurani Iron Ore Mines of AMNS (Captive)	5.5 MTPA	5.5 MTPA
2	OMC Limited	9.12 MTPA	9.12 MTPA
3	NMDC Limited	309 MTPA	1.30 MTPA
4	Serajuddin & Co., Odisha EX Mines only (Balda Iron Ore Block)	2,00,000 MT	Spot Purchasing

Table 2-12: Trace Element Analysis of Iron Ore

Sr. no.	Parameters	Unit	Result
1	Arsenic	mg/l	Not detected
2	Cadmium	mg/l	0.08
3	Lead	mg/l	0.12
4	Mercury	mg/l	Not detected
5	Antimony	mg/l	Not detected
6	Copper	mg/l	0.21
7	Nickel	mg/l	0.43
8	Zinc	mg/l	0.36
9	Fluoride	mg/l	0.13
10	Cyanide	mg/l	Not detected
11	Chromium	mg/l	Not detected
12	Moisture (H_2O)	%	7.98
13	Iron (Fe)	%	63.8
14	Silica (SiO_2)	%	2.67
15	Alumina (Al_2O_3)	%	2.49
16	LOI	%	2.99

2.8.3 Quantum Generation Coal from Mines

The details of Quantum Generation Coal from mines are given in ***Table 2-13***. The characteristics (Trace Elements) of Coal is given in

Sr. No	Suppliers	Origin	Cargo	Tonnage
1	Balta Gmbh	Poland	Low Ash Metallurgical coal 25-80 mm Low Ash Metallurgical Coal 10-50 mm	740000 40000
2	Teck Resources Ltd	Canada	PCI Coal	200000
3	Teck Resources Ltd	Canada	Metallurgical Coal	6500000
4	Peabody	Australia	PCI Coal	2440000
5	Peabody	Australia	Metallurgical Coal	6500000
6	KRU Overseas Ltd	Russian	PCI Coal	2440000
7	KRU Overseas Ltd	Russian	Metallurgical Coal	6500000
8	Mitsui &Co Ltd	Japan	PCI Coal	2440000
9	Mitsui &Co Ltd J	Japan	Metallurgical Coal	6500000

Table 2-14 ***and Table 2-15*** . The linkages of Coal and Coke enclosed as ***Annexure 23.*** The Coal and Iron ore are purchased from traders based on the COA submitted by them.

Table 2-13: Details of Quantum Generation of Coal from Mines

Sr. No	Suppliers	Origin	Cargo	Tonnage
1	Balta Gmbh	Poland	Low Ash Metallurgical coal 25-80 mm Low Ash Metallurgical Coal 10-50 mm	740000 40000
2	Teck Resources Ltd	Canada	PCI Coal	200000
3	Teck Resources Ltd	Canada	Metallurgical Coal	6500000
4	Peabody	Australia	PCI Coal	2440000
5	Peabody	Australia	Metallurgical Coal	6500000
6	KRU Overseas Ltd	Russian	PCI Coal	2440000
7	KRU Overseas Ltd	Russian	Metallurgical Coal	6500000
8	Mitsui &Co Ltd	Japan	PCI Coal	2440000
9	Mitsui &Co Ltd J	Japan	Metallurgical Coal	6500000

Table 2-14: Trace Element Analysis of Coal

Sr. no.	Parameters	Unit	Result
1	Mercury	mg/kg	2.6
2	Copper	mg/kg	12.4
3	Iron	mg/kg	2580
4	Nickel	mg/kg	19.6
5	Zinc	mg/kg	28.4
6	Cadmium	mg/kg	Not detected
7	Lead	mg/kg	1.2
8	Chromium	mg/kg	2.9
9	Manganese	mg/kg	79.8
10	Cobalt	mg/kg	5.8
11	Alumimun	mg/kg	12280
12	Barium	mg/kg	14.8
13	Molybdenum	mg/kg	Not detected
14	Vanadium	mg/kg	10.4
15	Arsenic	mg/kg	Not detected
16	Selenium	mg/kg	Not detected

Table 2-15: Trace Element Analysis of Coke

Sr. no.	Parameters	Unit	Result
1	Arsenic	mg/l	Not detected
2	Cadmium	mg/l	0.04
3	Lead	mg/l	0.86
4	Mercury	mg/l	Not detected
5	Antimony	mg/l	Not detected

Sr. no.	Parameters	Unit	Result
6	Copper	mg/l	0.65
7	Nickel	mg/l	0.32
8	Zinc	mg/l	1.86
9	Fluoride	mg/l	0.16
10	Cyanide	mg/l	Not detected
11	Chromium	mg/l	Not detected
12	Total Moisture	%	Above 6
13	Ash	%	Above 12.0
14	Volatile Matter	%	Above 1.3
15	Sulphur	%	Above 0.65
16	Phosphorus	%	Above 0.07
17	CSR	%	Below 60.0
18	CRI	%	Above 30.0

2.8.4 Raw Material Handling System

Cargo Handling and Storage Facilities for Raw Materials

The existing cargo handling requirement of the steel plant at Hazira is 25 MTPA. Presently this requirement is catered through its captive jetty of AMNSI, licensed by Gujarat Maritime Board (GMB) and Essar Bulk Terminal Limited (EBTL). AMNSI has cargo handling and storage contract for 25 MTPA with EBTL to handle raw materials such as iron ore, coal, coke, limestone, dolomite etc. and export of finished steel products such as coils, plates, pipes, slabs etc. through sea transportation.

The majority of the raw materials, i.e. coal, oxides and fluxes, will be received through EBTL. Grab bucket type ship unloaders work for unloading materials from vessels and subsequently onward transportation of unloaded materials to the yards are being carried through conveyor system for stockpiling with the help of stacker-cum-reclaimers. Conveyor connectivity has for diverting materials directly to different process plants. Reclaiming is being done through stacker-cum-reclaimers for onward dispatch of materials to process plants.

For the proposed expansion cargo handling and storage requirement, Adani Hazira Port Ltd (AHPL) has given in principle acceptance for 25 MTPA cargo handling and storage. The same is attached as ***Annexure 3*** . The layout for conveyor belt is shown as ***Annexure 4***

The majority of the raw materials, i.e. coal, oxides and fluxes, will be received through EBTL/AHPL. It is envisaged that grab bucket type ship unloaders will work for unloading materials from vessels. Raw materials received through the port, after unloading, will be conveyed to the yard and stored in the stockpile using stacker - cum-reclaimers.

Apart from existing Coal/Coke yard, additional storage for the Coke Ovens will be developed with facility for stacker- cum-reclaimers on the west of new COBP plant. Storage and handling of additional raw material required for proposed expansion will be handled through AHPL (Adani Hazira Port Limited).

AHPL will deliver the raw materials at take-over point (TOP) through belt conveyors as per plant requirement and subsequently onward transportation of unloaded materials to the yards shall be carried through conveyor system for stockpiling with the help of stacker-cum-reclaimers. Conveyor connectivity has also been envisaged for diverting materials directly to different process plants.

The proposed conveyor corridor (1.3 km with 10m corridor width) is coming under the state highway area. NOC for right of use (ROU) from state highway is under progress. Finished products will be dispatched from AMNSI jetty, EBTL, AHPL port & by Rail and Road.

Raw Material Storage Details

The details of the raw material and finished goods storage area are given in ***Table 2-16***

Table 2-16: Details of Raw Materials and Finished Goods Storage

Sl. No.	Raw Materials / Goods	Existing Storage		Proposed Storage		Total storage		Type of Storage
		Qty. in MMT	Area in Ha.	Qty. in MMT	Area in Ha.	Qty. in MMT	Area in Ha.	
1	Iron Ore / Ore Fines / Lime Stone	1.2	10	*	*	1.2	10	Open Storage
2	Coal /Coke	0.5**	35**	0.28	8	0.33	43	Open Storage
3	Finished Goods	0.04	0.5	0.35	8.1	0.39	8.6	Open Storage
Note: * Storage and handling of additional raw material required for proposed expansion will be through AHPL (Adani Hazira Port Limited). ** Present Coal yard is in 35 Ha existing RMHS area.								

AMNSI has prepared a detailed action plan to avoid leaching of materials to the ground water.

- All the yards will have RCC flooring after hard surface rolling and compacting so there is no chance of water and slurry contamination in below ground level.
- All the yards will have proper garland drainage system and retaining wall to evacuate ground water and run off water easily.
- Drain and retaining wall in Coal Yard, Coke yard and Flux yard is already available while in Oxide yard the same is under construction.

A tentative drawing showing typical details of RCC flooring, drains and retaining walls is given in ***Chapter-4, Section 4.4.5, Figure 4-27 and Figure 4-28***

2.8.5 Transportation details of Raw Materials and final product

The RM is transported from yard to different plants is by series of conveyors.

The by-products produced and chemicals required shall be transported by road vehicles/Sea route.

The internal transportation of materials like refractory, store materials shall be by plant vehicles. All the carriers of materials will be covered with tarpaulins during transportation through trucks to the site. The raw material Coal by road and rail transportation causes fugitive emission due to spillage strict adherence to closed mode of transportation is recommendation

Table 2-17: Raw Material Transportation Details

Sl. No.	Raw Material	Quantity required per annum			Source	Distance from site (Approx. Kms)	Mode of Transportation
		Existing	Proposed	Total			
1.	DR Grade Pellets	11,823,300	0	11,823,300	AMNSI's Palletization plants located at Vizag and Paradeep	5200/ 5750	Sea Route
2.	BF Grade Pellets	5,400,000	6,759,536	12,159,536			
3.	Calibrated Lump Ore	0	127,660	127,660	NMDC mines in Kirandul, Dist. Dantewada, CG	450+5200	Rail + Sea Route
4.	Iron Ore Fines	185,000	3,942,444	4,127,444	Goa, Odisha NMDC Mines	900/5750	Sea Route
5.	Coal-PCI-BF	408,000	2,036,444	2,444,444	Australia (Mainly) and Canada, USA and Russia	19650/ 16600/ 29850/ 17100	Sea Route
6.	Coal for Corex	2,770,000	-2,770,000	0			
7.	Metallurgical Coal	1,957,500	4,501,564	6,459,064			
8.	Coke	1,155,000	-1,155,000	0			
9.	BF and Sinter Grade Flux (Limestone +Dolomite + Pyroxenite + Quartzite)	690,000	493,715	1,183,715	Dubai and Oman	2640/ 2200	Sea Route
10.	SMS grade Limestone and Dolomite	1,863,000	2,562,564	4,425,564			

Dispatch of Raw Materials to Various Consuming Units

The dispatch of raw materials to various consuming units is given below:

Dispatch of Raw Materials to Blast Furnace

The various raw materials required for the Blast Furnaces, including pellets, fluxes etc. will be received from AHPL at Take-over-point (TOP) and despatched to the Blast Furnace stock house. Sinter will be fed to the BF stock house through the conveyor system. Feeding of Coke will be done similarly as indicated for the Sinter. Coal for pulverized coal injection (PCI) will be received from AHPL at TOP and it will be fed to the conveyor for its onward transmission to the bins at the Blast Furnace area.

The coke produced shall be routed through cutting unit of Coke Oven. Prime grade coke from this unit will be transported to Blast Furnace by conveyor and finer fractions shall be stored in bunker, from where it will be transported to other consumers.

Dispatch of Raw Materials to Coke Ovens

Hard coking coal, semi-soft coking coal and lean coal received from AHPL will be stored in proposed storage yard on west side of Coke Oven plant. Coal shall be reclaimed by stacker-cum-reclaimer and will be transferred at coal silo by conveyors.

Dispatch of Raw Material to the Sinter Plants

Iron ore fines will be received from AHPL at TOP and conveyed to the respective stock bins of the proportioning bin building of the Sinter Plant. Fluxes will be received from AHPL at TOP conveyed to the flux crushing and screening system. From there, the crushed material will be conveyed to the respective stock bins of the proportion bin building of the Sinter Plant. Coke breeze after reclaiming from the storage yard will be conveyed to the respective stock bins at the proportion bin building, after the close-loop crushing screening system.

Dispatch of Raw Material to the Calcining Plant

Limestone and dolomite will be received from AHPL at TOP and will be conveyed to limestone and dolomite storage building through a set of conveyor systems.

Dispatch of Raw Materials to the Steel Melt Shop

Lump iron ore will be conveyed to respective bins of steel melt shop from the stockyard. Ferroalloys shall be received through truck. Separate system is envisaged for handling and storing ferroalloys. DRI/HBI will be conveyed to respective bins of steel melt shop from the DRI/HBI plant.

2.8.6 HBI Plant (DRI Mod. I to VI) - Existing

Pellets from various sources are brought to the site by large ships. Lump ores and pellets are basically iron oxide with 65-69 % Fe content. Natural gas, which mainly consists of Methane, is reformed in presence of catalysts in Reformer. The cracked Natural gas consisting of Carbon Monoxide and Hydrogen at a temperature of 900°C is fed into shaft furnace from the bottom. The oxide coming from top and reducing gas coming from the bottom reacts with each other. Carbon Monoxide and Hydrogen having more affinity to Iron than oxygen, depletes oxygen from Iron oxide thereby producing Sponge Iron. There is no intermediate phase of liquefaction involved in this reduction. Therefore, the process is also called as Direct Reduction Iron (DRI).

DRI formed has a tendency of getting oxidized and is fire hazardous. To prevent this, they are compressed in Briquetting machine and produce a compact Hot Briquette Iron, which doesn't react with atmospheric air and is easy to handle. Iron ore fines generated during the process is being presently sent to Pelletisation Plant to convert the same into pellets which will again utilized as a raw material in HBI / BF plant.

HBI Plant total production capacity is 7.83 MTPA (Hot DRI, Cold DRI and HBI) and no expansion of HBI Plant envisaged under the proposed expansion.

Table 2-18:: Raw Material Requirement for HBI Plant

Raw Materials	Existing (TPA)	Proposed (TPA)	Total (TPA)

DR Grade Pellets	11,113,900	--	11,113,900
Note: All quantities are dry and net basis			

2.8.7 Coke Oven Complex

Raw material for the production of metallurgical coke is coking coal. The requirement of different types of coking coal will be met primarily through imports. Metallurgical coke is used as the reductant for reduction of iron ore to produce hot metal. Annual requirement of Coking coal after the proposed expansion will be approx. 58,13,100 tons.

Metallurgical coke is produced by carbonizing the coking coal at a temperature of around 1200^0C in absence of oxygen atmosphere in closed door multiple tall ovens. The volatile matter is liberated resulting in formation of coke due to carbonization in the ovens. The energy necessary for the carbonization process is provided by the Blast furnace or the Coke Oven gases. The coke thus produced in the oven after 20 to 25 hours of coking is quenched, cooled and screened for feeding to the Blast furnaces.

The crude coke oven gas having a potential heat value is cooled, separated from tars, naphthalene and ammonia to produce clean coke oven gas for use as plant fuel in various applications.

By-product recovery (BPR) type coke making process with stamp charge facility has been adopted for all the batteries.

Coke Oven Battery #1 &2, each of having 59 ovens for total production of 1.35 million tons per Annum is under installation. In order to meet the requirements of coke in the proposed new blast furnaces 2 and 3, four nos. of Coke Oven batteries of 59 ovens each with total coke production capacity of 3.05 MTPA have been considered. The plant design parameters and brief descriptions of the plant facilities for the proposed project are presented in ***Table 2-19.***

Table 2-19: Basic Design Parameters the Coke Oven Batteries

Parameters	Coke Oven Batteries # 1&2 (Under Installation)	Coke Oven Batteries # 3,4,5 &6 (Proposed)
No of Batteries	2	4
No. of Ovens / Battery	59	59
Length of Ovens (mm)	16,200	16,200
Height of Ovens (mm)	6,250	6,250
Width (mm)	500	500
Oven Pitch (mm)	1,500	1,500
Dry coal charge per Oven (tons)	43.7	43.7
Bulk Density, ton / cum	1.05 to 1.1	1.05 to 1.1
Normal Coking Time	24 hours	24 hours

For 15.6 MTPA liquid steel expansion, BF Coke requirement is 38,28,000 TPA for Hot Metal production of 11 MTPA and Coke Breeze requirement is 396,400 TPA for Gross Sinter production of 7.8 MTPA. The major plant design parameters considered for the proposed Coke Oven Plants are presented ***Table 2-20***

Table 2-20: Parameters considered for selecting Coke Oven capacity

Sl. No.	Items	CO Battery #1 &2 Quantity in TPA	CO Battery # 3,4,5,6 Quantity in TPA	Total Quantity in TPA
1	BF Coke Rate kg/ton of hot metal	348	348	348
2	**Gross Coke Production** Hard Coke (35 to 80 mm) Nut Coke (10 to 35 mm) Coke Breeze (<10 mm) CDQ Dust	**13,50,000** 10,80,000 1,89,000 67,500 13,500	**30,50,000** 24,40,000 427,000 152,500 30,500	**44,00,000** 35,20,000 6,16,000 2,20,000 44,000
3	By-product Production Crude Sulphur Crude Tar Crude Benzol	 1,954 62,171 18,244	 4,414 1,40,461 41,217	 6,368 2,02,632 59,461
4	Generation of Coke Oven Gas	586 million Ncum	1,324 million Ncum	1,910 million Ncum

Major facilities of the Coke Oven Plant will consist of following major facilities:

- Stamp-charged, by-product recovery type coke oven batteries
- Coke dry quenching with Stand-by wet quenching station.
- On-main charging with HPLA system
- Land based pushing and charging emission control system.
- Coal and coke handling facilities.
- By-product plant for the recovery of crude tar
- Desulphurization of coke oven gas, and recovery of elemental sulfur.

Coal Preparation & Coal Handling

The coal handling system will be designed for the receipt, storage, reclaiming, blending crushing and conveying of coking coal to the batteries. Each constituent of the coal blend envisaged for the plant will be drawn from the blending bins through belt weigh feeders. The blended coal will be crushed in the crusher to achieve the desired fineness [~90 percent of (-)3.15 mm]. The sequence of crushing and blending may be finalized during plant procurement stage. Dust extraction system will be provided for the crushing stations. After blending and crushing, tar sludge and water addition will be done to adjust the moisture content of the coal blend at 10 percent. The blended and crushed coal blend will then be fed to the coal towers. The coal will be transferred to the stamping-charging-pushing (SCP) machine from coal towers by belt conveyors.

Coke Oven Battery

The battery will be of twin flue, under-jet, regenerative type along with provision of recirculation of a part of waste gas. Oven width of 500 mm is envisaged for the proposed coke oven plant. For the annual production of gross coke of about 3,050,000 tonnes, coke oven plant with four batteries of 59 ovens each have been selected.

The batteries will be installed at separate but adjacent location as shown in the layout drawing. There will be separate by-product recovery plant to handle crude coke oven gases generated from batteries of respective two stages. Coal from the coal towers will be fed to the stamping charging-pushing (SCP) machines. The compacting of the coal charge (stamping) will be performed continuously with the feeding of coal into the stamping box until the desired height of the coal cake is achieved. Cake, the charging plate will be withdrawn.

The charging gas transfer car, operating at the oven top, will transfer the charging gases to the adjacent ovens.

When the oven is ready, after completion of carbonization, the SCP machine will push the hot coke into the hot coke car through coke guide cars (CGC). Door extractor device, provided both in the SCP and the CGC machines, will open the doors before pushing of coke. The door extractor device will be equipped with mechanical door and frame cleaners.

After completion of the coke pushing operation, the coke side door will be placed in place before charging the empty oven with stamped cake. After charging the stamped cake into the oven, the SCP machine will close the pusher side door. Red hot coke discharged into the hot coke car will be taken to the coke dry quenching (CDQ) station. Land based pushing emission control system integrated with the coke guide car will be provided to restrict coke side emission during pushing. Emission during charging will also be ensured with this system.

The ovens will be suitable for both under firing with mixed gas and coke oven gas (COG). The gas collecting main will be located at the coke side. The battery will be underlet/gas gun type with air stage/waste gas recirculation to achieve uniform temperature distribution and to restrict the formation of thermal Nox. Each oven will be provided with a separate gas transfer hole at the coke side to facilitate the transfer of charging gases to the adjacent/ alternate oven through a U-tube connection. The U-tube will be mounted on the charging gas transfer car. To minimize emission during charging, high pressure liquor aspiration system (HPLA) will be provided for effective on-main charging. The machine can move to the oven to be charged. After charging the coal, the coordination of the ovens and the oven machines, operation, and traveling of the machines to the ovens to be served in conformity with the pushing schedule will be accomplished via a control centre utilizing remote data transmission. For the exact spotting of machines, the machine will be provided with improved measuring and sensor systems. DCS based automatic heating control system will be provided for efficient and uniform oven heating. The Stamping Charging and Pushing (SCP) machine will push the incandescent coke after completion of carbonization out of the oven. The red-hot coke will be discharged into a coke bucket placed on the hot coke car through the coke guide car and will be taken to the CDQ station.

Table 2-21: Raw Materials Requirement for Coke Ovens

Raw Materials	CO Battery # 1 &2 (Prod. – 1350,000 TPA)	CO Battery # 3,4,5 & 6 (Prod. – 30,50,000	Total CO Battery # 1 to 6 (Prod. – 44,00,000 TPA)
Prime Coking Coal	540,000	1203,900	17,43,900
Semi Soft Coking Coal	10,80,000	2407,900	34,87,900
Lean Coal	180,000	401,300	581,300
Total	**1800,000**	**4013,100**	58,13,100

Note: All quantities are in net & dry basis

Coke Dry Quenching (CDQ) System

Single-chamber CDQ units with suitable capacity will be installed with stand-by wet quenching stations for scheduled maintenance in the CDQ chamber/boiler/ facilities and emergencies. Stand-by wet quenching stations will be provided with quenching towers of adequate height, settling basin for quenching water, quenching water pumps, overhead quenching water tanks, pipelines, and fittings. The quenching towers will be provided with baffles/grit arrestors. The coke quenched in quenching cars will be discharged into the coke wharf.

In the CDQ plant, the hot coke pushed from ovens will be received in a special type of coke car which has a detachable bucket with mechanism for bottom discharge. The coke car with hot coke will be brought to coke dry quenching installation. The coke bucket will be lifted to the top of cooling chamber with the help of coke bucket lifter. Each chamber will be provided with an independent coke bucket lifter. The bucket during lifting will be covered with a special type of screen. This will help in retaining the heat as well as protect the working area from emission of heat. Hot coke will be charged into the chamber through coke charging device. As the coke travels down the chamber, hot coke will be cooled with circulating inert gas in the cooling chamber. The hot coke will flow continuously from the top to the bottom of the chamber and the inert gas will flow in the opposite direction. The heat of the hot coke will be recovered by direct contact of circulating inert gas and the absorbed heat will be subsequently utilized for the generation of high-pressure steam in the waste heat boiler. The inert circulating gas will get heated during its contact with hot coke and enter waste heat boiler through a dust catching bunker, where coarse dust will be separated from the gas. The hot gas will be sent to the waste heat boiler, where high-pressure steam is generated utilising the sensible heat of hot gases. The cooled gas will be re-circulated to the cooling chamber after removing fine dust in cyclones.

Dust Extraction system is provided in the coke de-dusting unit (CDU). The system comprises of dust extraction air blasting unit, suction hoods on the coke de-dusting chute, ducting network, electrically operated dampers, bag filter unit, centrifugal fans, stack electrics & control. One spark arrestor & one multi-cyclone are provided in the ducting network at the inlet side of distribution chamber of bag filter unit. Spark arrestor prevents smoldering particle from entering into bag filter while cyclone separator collects coarser coke particles thereby preventing them from entering into bag filter. Bag filter unit consists of distribution chamber, filtering chamber with filter bags & fitting for the bags, outlet chamber, dust collection hopper with rotary air lock valves & dust storage cum disposal hopper with rack & pinion gate and disposal chute, structural stair case and platform, timers etc.

While running the CDU, air blasting unit fan sucks ambient air through air intake louver & transition piece and blast/supply the air into the CDU through the ducting network. The dust disposal from spark arrestor cum multi-cyclone and bag filter, is through discharge into a central pneumatic system (through dust storage hopper).

Advantages of CDQ

- Effect on energy saving. Sensible heat of red hot coke is recovered as steam which can be utilized for electric power generation and as other heat source.
- Effect of reduction of carbon dioxide emission. Practically no carbon dioxide is emitted during power generation.
- Reduction of dust emission compared with wet quenching, environment of steel works improved due to non-emission of quenching steam with toxic gases from coke ovens and non-emission of dust particles from coke whereas.
- Increase in coke strength compared to wet quenching. Environment of plant is improved due to non-emission of quenching steam with toxic gases from coke ovens and non-emission of dust particles from coke wharfs.
- The absence of moisture in the product coke. Along with its enhanced strength, contributes to the stable operation of the blast furnace.

Coke Handling Facilities

The hot coke pushed out from the ovens will be collected by a hot coke car and will be taken to CDQ stations for quenching or to the modified wet quenching stations. CDQ units will be used for normal operation for coke quenching for all the batteries, whereas modified wet quenching will be followed only during the annual

shutdown of the CDQ boilers and auxiliaries. The wet quenched coke will be dumped on to the coke wharf for drying. The dried coke from the wharf or the discharge of CDQ shall first be screened through 80 mm screens. (+)80 mm will be passed through a coke cutter. From the cutting station, coke will be sent to the blast furnace stock houses coke for sorting different coke sizes of hard coke [(-)80 mm (+)35 mm], nut coke [(+)15 mm (-)35 mm] and breeze [(-)15 mm]. The excess coke will be sent to storage yard.

Coke Oven By-product Plant

The by-product plant facilities will be planned for the production of clean Coke Oven Gas (COG) for use as plant fuel, as well as crude tar, naphthalene, and elemental sulphur. The following units will be provided in the by-product plant for the cleaning of COG to the required degree and recovery of crude tar and sulphur:

- Gas cooling and tar liquor condensation section
- Combined ammonia and hydrogen sulphide scrubbing
- De-acidifier and ammonia stripper unit
- Sulphur recovery unit
- Naphthalene recovery unit
- Gas holder

Gas Cooling and Tar-Liquor Condensation Section:

Crude COG evolved during carbonization of coal in the ovens will be collected in the gas collecting main, where it will be cooled with direct spray of ammonia liquor. Crude COG from the gas collecting main will be sucked by exhausters through primary gas coolers and electrostatic tar precipitators. Crude COG after the down-comers will be cooled to a temperature of about 21^{O}C in indirect, cross tube type primary gas coolers in two stages; in the upper stage with circulating cooling water and in the lower stage with circulating chilled water. The primary gas coolers will be provided with requisite extra capacity in the upper part (cooling water zone) to take care of probable fluctuations in temperature of crude gas. Coke oven gas after being cooled in the primary gas coolers will enter electrostatic tar precipitators (ETP) for separation of tar mist from the coke oven gas. The coke oven gas exhausters will be electric motor driven and will be provided with required lubrication, safety, idling, and suction condition control arrangement. Tar and liquor condensed in the crude gas pipelines, primary gas coolers, ETPs and exhausters will be processed in the tar-liquor condensation unit. This will consist of decanting tanks with thick tar/ammonia liquor separators, tar centrifuges, condensate pit tanks, flushing liquor pumps, condensate pumps etc. Separated tar will be transferred to the oil depot. Liquor will be transferred by flushing liquor pumps to the gas collecting main for cooling of gas. Excess liquor from tar ammonia liquor separating tank will be taken to a separating tank for separation of heavy oil from it and will be finally pumped out with excess liquor pump to the filtering system.

Combined Ammonia-Hydrogen Sulphide Removal Unit

Coke oven gas from exhauster will be first fed into final cooling stage at lower part of hydrogen sulphide scrubber. Coke oven gas after final cooling will be cleaned in respect of ammonia and hydrogen sulphide by scrubbing with soft water and circulating stripped liquor Coke oven gas leaving the exhauster will be admitted to H2S scrubbers. The lower section of H2S scrubbers will be designed for final cooling to remove the compression energy of the exhauster. Scrubbing of H2S will be carried out by enriched ammonia liquor and de-acidified water. Soda lime solution will be used at the final stage of the H2S scrubber. Carbon di-oxide, hydrogen cyanide and ammonia present in the gas will also be scrubbed during the same operation. After H2S scrubbing, the gas will be taken to ammonia scrubber. The ammonia will be removed from coke oven gas by scrubbing with cooled stripped liquor from ammonia still. Soft water and excess ammonia liquor will be admitted at the top and bottom stages of ammonia scrubbers respectively. A combined ammonia and H2S

scrubber will also be installed as stand-by, in order to achieve un-interrupted operation. The enriched liquor from H2S scrubber containing ammonia, H2S, carbon-dioxide and HCN will be stripped in the de-acidifier. A portion of ammonia vapor will also be admitted to the de-acidifier. A portion of de-acidifier liquor will be treated in ammonia still for stripping of ammonia. The vapor leaving the de-acidifier will contain ammonia, H2S, carbon-dioxide and HCN along with water vapor. For cooling of stripped liquor, inter stage circulation and suitable heat recovery tubular heat exchangers have been considered. The circulation of liquors will be achieved through pumps.

Sulphur Recovery Unit

The vapours from the top of the de-acidifier containing ammonia, hydrogen sulphide, water vapour, hydrogen cyanide and carbon dioxide etc. will be fed into the sulphur recovery plant for destruction of ammonia and production of sulphur. In the reactor, the acid gas will be brought into contact with the required quantity of air. Secondary air will also be added at the lower part of the reactor. Suitable temperature will be maintained in the reactor. The heat generated in the reactor will be utilized for generation of steam in the heat recovery boiler. Most of the heat required for the reaction will be generated by partial burning of hydrogen sulphide. The ammonia and hydrogen cyanide present in the acid gas is decomposed into hydrogen, nitrogen and carbon monoxide by catalytic cracking. The Claus conversion will be continued by the catalytic method in the Claus reactor. Claus reactor will be followed by a sulphur condenser and separator where sulphur will be removed from the process gas. Low pressure steam will be produced in the sulphur condenser. The molten sulphur will then be fed to the solidification plant for the production of sulphur pellets. The sulphur produced by this process will be of high purity (99.5 percent). The tail gas from the reactor will be introduced to the coke oven gas in the suction main. The sulphur pellets will be packed and finally transported out by truck.

Naphthalene Scrubbing and Naphthalene Distillation Section

Naphthalene scrubbing from coke oven gas will be carried out after removal of ammonia and hydrogen sulphide. Naphthalene scrubbing will be carried out by using petroleum-based wash oil. A small portion of the oil will be continuously withdrawn from the system in order to restrict the naphthalene build-up in the re-irculating oil. Rich oil withdrawn from circulation will be regenerated in naphthalene stripping columns. Heavy sludge / Spent wash oil removed from the unit will be taken to spent oil tank for either mixing with tar or for outside disposal. Naphthalene strippers will be provided. The regenerated oil along with make-up oil will be introduced to the oil circulating system. The naphthalene fraction recovered will be mixed with crude tar.

The clean coke oven gas, after naphthalene removal, will be fed to the coke oven gas holders.

Separate storage for crude tar, wash oil, caustic soda and spent wash oil will be provided. Suitable facilities for loading of crude tar and spent wash oil in to road tankers will be provided.

Biological Oxidation & De-phenolisation (BOD) Plant

The BOD Plant is a facility to be used for treatment of phenol cyanide containing waste water from Coke Ovens and By-product Plant, by using a process of A/A/O (Anaerobic, Anoxic, Oxic) and double membrane. During degradation of NH3-N in the coking waste water, other pollutants such as COD can also be degraded. The waste water goes through secondary sedimentation tank into biochemical treatment, which mainly includes mixing and reacting tank, and coagulation sedimentation tank. The effluent after coagulation sedimentation can be discharged out. The capacity of the BOD Plants shall be 275 m^3/hour and 137 m^3/hour.

Basic Principle of BOD Plant are;

- Physical Treatment
- Chemical Treatment

- Biological Treatment

(Three Stage Biological System – 1st Stage Activated Sludge Process, Followed by Nitrification and De-Nitrification Processes)

Effluents generated from Coke oven and By-Product Plant contains pollutants such as Ammonia, phenol, Tar & Oil, cyanide etc. Main function of BOD Plant is to remove tar and oils by physical and chemical systems and subsequent biological degradation of Phenols, Ammonia and cyanide.

Initially effluents are received in tar & oil separation tank. The capacity of the tank is suitable for one hour detention period. The effluent collected in this collection sump pumped to subsequent tar-oil separator. Tar-oil separator unit is provided with skimming facilities. From this unit effluents flow by gravity to equalization tank.

The equalization tank capacity with residence time of 24 hours for designed flow of 275 m^3/Hr. The equalization tank consists of three compartments, two compartments each having six hours holding while the third compartment having twelve hours holding capacity. The equalization tank is provided with necessary tar/oil skimming arrangement, and epoxy painting in the inside faces of each compartment. From the equalization tank effluents are pumped to dissolve air floatation unit for removal of emulsified oils. This unit consists of recirculation pump, air compressor and all other required accessories. A skimmed tar & oil sump is also provided for collection and storage of skimmed tar & oil.

Since the skimmed tar & oil contains major portion as water, this skimmed tar & oil is pumped to slop oil tank for separation of water & tar / oil. In the slop oil tank skimmed tar & oil allowed to remain for few days for separation of tar and oil. Tar/oil floating on the top surface is taken out through tapping connection provided for this and sent for secondary use. Water from the bottom of the tank taken out and sent back to the treatment plant.

From the dissolved air flotation unit effluents flow by gravity to pH adjustment tank. Alkali is added to raise the pH around 11. This tank is provided with agitator and pH indicating instrument. pH adjusted effluents are pumped to ammonia stripping tower. Stripping of ammonia is carried out in an ammonia stripping tower. The tower is of induced draft cross flow type and provided with suitable packing, effluent distribution piping, collection basin, adequate capacity aeration fan and all other accessories.

The ammonia stripped effluents from collecting basin sent to ammonia fixing cum pH adjustment tank. The residual free ammonia is fixed and pH is brought down to neutral pH by addition of sulphuric acid. The tank is provided with agitator and pH indicating instrument. Effluents form ammonia fixing tank are pumped to 1st stage aeration tank i.e. aeration tank-I. The aeration tank- I is aerated along with the return sludge by mechanical surface aerator. The tank is made of RCC and necessary arrangements are provided in the tank for receiving the return sludge and required nutrients.

The effluents from aeration tank-I flow to settling tank-I where solid particles are settled out. Overflow from settling tank-I flow to aeration tank-II whereas the underflow is taken to sludge sump-I. The settling tank is of RCC construction and provided with necessary scrapping arrangement, overflow weir, inlet and sludge outlet pipes, constant bleed arrangement and all other accessories required. From the sludge sump-I sludge is recirculated to aeration tank 1 and excess sludge is disposed to sludge thickener inlet.

The aeration tank-II is used as 2nd stage of the activated sludge process. The tank consists of aerators and other facilities for receiving the return sludge and required magnesium carbonate solution. Bacterial culture tanks provided at the platform of aeration tanks.

Effluents from aeration tank-II flow to settling tank-II. The settling tank-II is similar to settling tank-I. Facilities for collecting settled sludge from settling tank-II and pumping it to aeration tank-II & sludge

thickener inlet, sump is provided. The nitrified effluents from aeration tank-II flow to nitrification tank. The tank is operated under anaerobic condition. Requisite quantity of methanol is added as carbon source. Effluents from denitrification tank flow to settling tank-III. The settling tank-III is similar to settling tank-I. Similar facilities for collecting settled sludge from settling tank-III and pumping it to sludge thickener inlet, sump, and pumps provided.

From the de-nitrification tank, effluent flow to aeration tank-III, where surface aerators are provided in the aeration tank to supply required dissolved oxygen in the treated effluent before disposal. A sludge thickener is provided for thickening the excess sludge received from different sludge sumps. The thickener is provided with sludge collection arrangement and all other accessories. The overflow from sludge thickener is fed at the inlet of aeration tank-I. The underflow from sludge thickener is collected in a thickened sludge sump from where it is pumped to sludge drying bed unit for dewatering of the sludge.

Two (2) nos. of the BOD Plants have been proposed. BOD Plant #1 shall be provided with CO Battery #1,2,3 &4 for inlet flow of 275 m^3/hr. of untreated effluent and BOD Plant #2 shall be provided for CO Battery # 5&6 for inlet flow of 137 m^3/hr. of untreated effluent. The Equalization tank capacity with residence time of 24 hours for designed flow of 275 m^3/hr. and 137 m^3/hr., respectively for BOD Plant #1 &2 shall be provided.

Table 2-22: Design Specification of BOD Plant

Sl. No.	Parameters	Inlet Concentration	Outlet Concentration
1	pH	8~9	6.0 – 8.5
2	Temperature °C	50 - 60	Ambient
3	Phenol (mg/l)	500	≤1
4	Cyanide (mg/l)	25	≤0.2
5	Total Ammonia (mg/l)	500	Ammonical N_2 ≤50
6	COD (mg/l)	--	≤250
7	Tar & Oil (mg/l)	100 - 350	≤10
8	Suspended Solids (mg/l)	--	≤50

Flare stack

CO gas flare system is meant to control the pressure of CO gas network by flaring the excess gas to atmosphere. The excess gas released through the bleeder will be burnt in the burner located at the top of the stack. To ignite the CO gas at the main burner tip and to maintain the flame, a system of pilot burners and ignition device will be provided. The pilot burners will be ignited by CO gas. Pilot burners will be ignited through automatic ignition system from the local control panel as well as from CO battery control room. Remote operation of the ignition system for pilot burner shall be provided from CO battery control room.

Two flare stacks of approximately 145 meters height shall be installed to flare the Coke Oven gases.

Pollution Control Facilities

Emissions from coke ovens would mainly result from coal charging and coke pushing. Fugitive emissions may result from various leakages from oven doors, charging lids, ascension pipe (AP) covers etc.

Leak Proof Oven Doors and Hydro-jet door cleaners

Doors will be of leak proof oven doors with flexible sealing strips. The door design will provide flexible sealing strip and other modified features to ensure leak proof sealing. The door will be of heat resistant cast iron

provided with spring-loaded latches and spring-loaded sealing strips. Hydro-jet door cleaner system will be provided to reduce the pollution and improved working environment.

It is proposed to provide a water jet door and frame cleaner on the oven machines i.e. on pusher cars and door extractor cars. This will ensure proper cleaning of door frames and doors which in turn will ensure less or no leakage from the doors.

High Pressure Ammonia Liquor Aspiration (HPALA) System

To control charging emissions from Coke Oven Battery, high-pressure ammonia liquor aspiration (HPALA) system will be provided. It will consist of high-pressure booster pumps for ammonia liquor, spray nozzles and pipelines. The low pressure Ammonical liquor will be drawn from the liquor mains and injected into the gooseneck while charging. The charging gases evolved will be sucked in to the gas collecting mains, preventing emission of dust and smoke into the atmosphere.

Water Sealed Ascension Pipe (AP) Covers

The gas off-take system will comprise base castings, ascension pipes (AP), water sealed AP covers, goosenecks, isolation valves, gas collecting mains, necessary flushing liquor spraying and injection devices. The system will be complete with inlet and outlet water pipe network, water sealed AP covers, return trough, etc. Proper sealing of gas will be obtained with the help of water in the covers.

Pushing Emission Control (PEC) System

Land based pushing emission control system has been considered for the coke oven plant. Land based fume extraction system would be adopted for charging and pushing emission control. This system will consist of a duct running along the length of battery on coke side (away from the quenching car track), a traveling hood with one side connected to door extracting machine and other running on a 3rd rail supported on the trestle of the duct, spark arrester, bag filter house, fans and stack.

The hot coke would be quenched by coke dry quenching (CDQ) with recovery of sensible heat for steam generation.

The raw coke oven gas (COG) would be cleaned in by-product recovery plant with recovery of tar, ammonia and sulphur to make it suitable for use as plant fuel.

2.8.8 Sinter Plants

AMNSI has installed One Sinter M/c of grate area 120 m^2 for production of 1.48 million tons per annum. Under the proposed expansion, 2 (two) numbers of sintering machines of total 650m^2 grate area have been considered, based on use of about 40% sinter in the burden of Blast Furnaces. The sinter plant complex will consist sinter machine along with associated services facilities.

The sintered mass known as Sinter having higher strength is one of the main metallic bearing burden materials for BF. The hot sinter product after cooling is screened and desired size of sintered product is sent to the BF stock house for charging to the BF along with Iron ore pellets.

Advantages in use of agglomerated burden in the blast furnace are well established and almost all the high-capacity blast furnaces world-wide are using agglomerated burden for most efficient furnace operation. The major advantages for use of sinter in blast furnace are as follows:

- Control of physical, chemical and high temperature properties of burden materials
- Avoid use of raw flux charging directly in the Blast Furnace
- Increase in productivity of the furnace
- Decrease in Coke/fuel rate
- Longer life of furnace

- Production of desired grade of hot metal, etc.

Different units will be interconnected by conveyor galleries and junction houses for conveying raw material fines, finished sinter, and sinter return fines. All the iron bearing materials (Pellet fines / iron ore fines, BF flue dust, Cast House / Section House dust, Sludge Pond fines, BOF FES Dust, Mill Scale, CRM ETP Sludge etc.), flux and Coke breeze are blended in the base blending yard. Blended mix are received from the raw material blending yard to the sinter plant proportioning building. Burnt lime will be carried by lime tanker and fed to lime bin by pneumatic lime transportation system. A brief description of major facilities proposed for the sinter plant complex is given below.

Proportioning unit

Suitable capacity of storage and proportioning bins has been envisaged for the sinter plant. The bunkers for blended mix and return fines will have single outlet while bunkers for corrective additions of crushed limestone and crushed dolomite will have twin outlets. All the bins will be suitably lined except return fines bin, which will be self-lined. The blended mix, corrective additions and in-plant returns will be fed to the common collecting conveyor by electronic belt weigh feeders, whereas, lime will be fed to common collecting belt conveyor by loss in weigh feeder. Proportioned material from belt weigh feeders below respective proportioning bins shall be transported to a combined mixing and nodulizing drum by a common belt conveyor.

Combined Mixing and Nodulizing Unit

Material from belt weigh feeders below respective proportioning bins will be transported to a combined mixing and nodulizing drum by a belt conveyor where the various raw materials will be moistened and mixed in drum mixer. Lime from lime bins will be discharged onto common collecting conveyor through lime dosing equipment. A fixed quantity of water of about 60% of requirement will be added in the mixing part and the rest variable quantity will be added in the nodulizing part depending on requirement. The raw mix discharged from mixing and nodulizing drum will be transported to sinter plant main building by a belt conveyor.

Sinter Plant Main Building

The sinter plant main building will mainly consist of hearth layer and raw mix feeding units, ignition furnace, sinter machine, hot sinter breaker. The sintering machine will comprise charging and discharging sprockets, drive unit, sprin loaded pallet cars with high chrome cast steel grate bars, rails, curved guides at charging and discharge ends, grate bar cleaning device, automatic lubrication system, provision for thermal expansion, wind boxes, wind main with dust hoppers and double cone dust valves, machine Spillage hoppers, sinter machine support structures. The hearth layer (15 -25mm) will be spread onto the sintering machine first, followed by sinter mix. The height of the sinter mix bed onto the machine will be 650mm including 50mm protective hearth layer height.

The ignition furnace with post heat hood and pre-heating (before ignition furnace) will be installed just after the sinter mix drum feeder. The ignition furnace will have suitably located energy efficient type gas firing burner designed for 2000 kcal/Nm3 of mixed gas. Gas mixing station and gas boosting station will be located outside sinter plant battery limit.

Sintering is a high temperature (1200-13000C) process for agglomeration of Pellet / Iron ore fines with coke breeze and other fluxes like limestone, pyroxinite and recyclable solid wastes like Sludge Pond Fines, Cast House / Stock house dust fines, BOF Fume Extraction system dust, Mill scale, BF Flue dust and lime and Dolomite dust from Calcination Plant etc. which are blended in base mix. As per given burden, raw materials are collected on a common conveyor from the respective bunkers through weigh feeders and then mixed

homogeneously in mixing drums (primary & secondary mixing drums) by adding required water (7 to 8 %) and then feed on sinter machine.

Generally, raw mix bed height is 550 mm and is adjusted based on quality of the raw material. The bed in running (motion) condition is taken to ignition front. The raw mix undergoes through the ignition furnace and there is a negative suction from bottom. As the sinter bed moves, air is sucked from the top through the mixture, enabling combustion through the entire layer and complete sintering, where the temperatures may reach 1300 — 1480˚C. As soon as suction takes place, hot products of combustion are sucked through the bed and transfer its heat to the next layer of the bed keeping it ready for the combustion. These flue gases are let out from chimney through ESP. During the sintering process, iron ore fine particles agglomerate into a porous compact heterogeneous lumpy mass called SINTER by incipient fusion caused by the heat produced during the combustion of the solid fuel within the moving bed of loosely particles.

After completion of the sintering process, sinter cake will be crushed and screened after discharge from the machine. Sinter having size > 5 mm will go to the cooler and then it will go to BF. Sinter with size < 5 mm size fines will be re-cycled in the process.

Hot Sinter Breaker

Hot sinter breaker of suitable size will be provided at the discharge end of sinter machine along with trolley mounted grizzly assembly. Hot sinter passing through hot sinter breaker will be crushed to -150 mm size before feeding to sinter cooler.

Sinter Cooling Unit

Circular sinter cooler will be used to cool the sinter to less than 100˚C after it is discharged from hot sinter breaker at approximately 800˚C up to (-) 150 mm size, so that it can be transported through conventional conveyor system. Forced draught fans will be provided to cool the sinter in sinter cooler. Deep bed dip rail circular cooler of adequate capacity will be provided to match the sinter machine production with all the associated facilities like cooler fans, heat recovery system etc. Retention time for the coolers will be of approx. 60 minutes. Cooling of sinter is achieved by up-drafting ambient air through the bed of hot sinter to be cooled. The sinter after being cooled in the sinter cooler is transported to the screening house. In the screening house, sinter screening will be carried out in single deck screens arranged vertically in series. The screen house in sinter plant is a separate building in which all the vibrating screens will be located. These screens are arranged one above the other in order to facilitate successive screening of the gross sinter.

Waste Heat Recovery System

Effective cooler waste heat recovery units is provided near cooler which houses combustion air fans, hot air fans & multi cyclone, etc. Hot air at 350 – 400 deg. C coming out from first section of hot sinter receiving section of cooler is supplied to ignition furnace for use as combustion air. The hot air is cleaned in a multi cyclone and pressurized by combustion air fans before supplying to the ignition furnace. Hot air coming out from the second section of hot sinter receiving section of cooler is fed to post heat hood to avoid sudden chilling of raw mix after ignition by the hot air fan. Duct work from cooler to ignition furnace and post heat hood will be complete with fixed/ sliding supports & compensators, air intake valves and other instruments.

The main part is used to produce steam in a boiler and an alternative ducting enables the air to by-pass either completely or partially the boiler and cooling down through an evaporative cooler. By this way the temperature of the cold air at the outlet of the boiler is kept constant and within acceptable ranges for smooth operation of the filter and the cooling fan.

Boiler

The hot air recovered above the cooler is guided to the Waste Heat Recovery Boiler, where it produces steam. One common fan is used at the same time for the heat recovery draft and for the sinter cooler. In case the boiler is kept under maintenance, this equipment is by-passed and the cooling fan can continue in operation without disturbing sinter plant production.

The boiler is part of the waste heat recovery system. It produces hot steam for the steam network of the plant. The boiler is dimensioned to be at full capacity under nominal operating conditions. If the amount of sinter exceeds the nominal operating conditions, the additional hot gas will be led to an evaporative cooler

Evaporative cooler

An evaporative cooler is part of the waste heat recovery system. The evaporative cooler cools down the hot air by evaporating cold water. The amount of cold water is adjusted to the temperature of the hot gas and is injected by nozzles. If the sinter production exceeds nominal operating conditions (flow rate and temperature), the additional hot air from the sinter cooler will be led to the evaporative cooler. This ensures a constant steam production in the boiler and protects the boiler from erosion.

The cold air at the exit of the evaporative cooler will be reunited with the cold air coming from the boiler and led to the de-dusting system.

The evaporative cooler is dimensioned to cover the amount of hot air under nominal operating conditions to allow a continuous sinter production regardless of the condition of the boiler.

Waste Gas De-dusting Unit

Dry type electrostatic precipitators of suitable capacity will be envisaged for de-dusting of waste gases before entering the main exhausters. The unit will have high efficiency to ensure less than 30 mg/Nm^3 of dust in the outgoing gases. MEROS/Equivalent system will be installed to have the better control on emission.

Waste gas handling unit consists of Waste gas de-dusting ESPs, waste gas fan, duct work from wind main of sintering & cooling building to waste gas ESP & waste gas ESP to exhaust fan & exhaust fan to separate RCC stack for each sinter plant. Electrostatic precipitators for each strand for de-dusting of waste gases before the fans. Electrically driven dust valves and drag link chain conveyors are provided for discharge of dust from waste gas main and electrostatic precipitator. The collected dust is recycled in the process, if the alkali content is within limits.

Plant De-dusting

Horizontal type electrostatic precipitators (dry type) of suitable capacity will be provided for cleaning sinter strand waste gases and the dust content will be maintained within 30 mg/N cum. Electrostatic precipitators will be selected based on gas analysis, water vapor content in gas, and the dust content at ESP inlet normally encountered for such a plant. The selection will also consider the dust resistance, dust chemistry, volume of gas to be cleaned, and its temperature and suction in the network (nominal and maximum). The design temperature for ESP will be 250˚C, though the operating temperature will be about 160˚C.

Centralized plant de-dusting system will be installed to provide a dust- free working atmosphere in the sintering plant. All dust generating points, from the raw material takeover points to the product sinter take-over point will be covered under one system. The dust-laden air will be sucked through hoods and ductwork and then cleaned in an electrostatic precipitator (ESP) by a fan before being released to the atmosphere through a self-supported dedicated stack. Dust content of air at the outlet of ESP will be a maximum 30 mg per N cu m.

Table 2-23: Existing & Proposed Configuration and Production Details of Sinter Plant

Existing Installed Unit		Proposed Units		Final Configuration	
Unit	**Capacity (TPA)**	**Unit**	**Capacity (TPA)**	**Configuration**	**Capacity (TPA)**
1x120Sq. meters	14,80,000	1x 325 sqm 1x 325 sqm	35,00,000 35,00,000	1x120 sqm 1x 325 sqm 1x 325 sqm	84,80,000

Table 2-24: Exiting & Proposed Input Materials-Sinter Plants

Input Materials	For Existing Unit of 1.48 MTPA (TPA)	For Units to be installed 7.0 MTPA (TPA)	After Expansion for 1.48 + 7.0 MTPA Sinter Plant (TPA)
Pellet Fines	134,155	983,630	11,91,600
Iron Ore Fines (Pur.)	185,000	30,66,600	37,14,700
DRI Pellet Fines	660,715	660,715	709,400
Return Sinter	222,000	10,50,000	12,72,000
Sludge Pond Fines	93,050	145,455	254,700
HBI Dust / BF Flue dust / BOF FES Dust	--	229,900	278,500
CH SH DE Dust	11,200	42,680	51,700
CRM ETP Sludge			12,500
Mill Scale	32,800	155,100	187,900
Coke Breeze	69,185	327,215	396,400
Limestone (Pur.)	70,500	334,100	404,600
Limestone from CP	77,200	365,100	442,300
Calcined Lime from CP	26,650	126,050	152,700
Raw Dolomite (Pur.)	18,050	85,300	103,350
Raw Dolo from CP	41,610	196,790	238,400
Burnt Dolo from CP	15,970	75,530	91,500
Pyroxinite	19,900	93,800	113,700
Total	**16,77,985**	**79,37,965**	**96,15,950**

All quantities are in net and dry basis

2.8.9 Corex Plant

Existing plant is having 2 nos. of Corex Plant of capacity 0.85 MTPA for production of 1.7 million tons per annum of hot metal. The plant will be operated till the proposed expansion is completed. Thereafter, it will be shutdown safely and will be started only in case of any Blast Furnace is going down, however will be operated within the sanctioned production of hot metal.

2.8.10 Blast Furnace

Hot metal production using blast furnace process is most established and competitive iron making technology till date. A number of technological improvements have been taken place in Blast Furnace which resulted in higher production, less coke consumption, energy efficient, long campaign life, etc. State-of-the-art Blast Furnaces equipped with the following major facilities have been envisaged.

- Stock house with automatic conveyor charging facilities
- Bell less top charging equipment
- High top pressure operation and matching gas cleaning plant
- TRT installation for power generation
- Stoves for generation of high hot blast temperature
- Coal dust injection facilities
- Blast humidification and oxygen enrichment of blast
- Cast house with Slag Granulation Plant

Hot metal produced from the blast furnace will be transported to the steel melting plant using torpedo ladles. In case of poor off take of hot metal from SMS, the hot metal ladles can be diverted to pig casting machine / Gran shot machine for production of pig iron / Gran shots.

Sized iron ore, sinter and coke along with other fluxing materials are charged to the tall vertical BF for production of hot metal in presence of hot blast air. The temperature within the furnace is above 1600^0C. The gangue minerals present in the iron ore are converted to slag known as BF slag and 'Fe' content of the oxide ore gets converted to molten iron due to reduction of iron oxides of the ore with carbon present in the coke. In order to have adequate carbon for reduction purpose, as well as to reduce coke consumption, powdered coal is injected (Pulverised Coal Injection) into the furnace. The hot iron metal after desulphurization with carbide compound is ready for conversion to steel at steel making plants (EAF/Conarc /BOF). The BF slag is granulated by water jetting and granulated BF slag produced can be used for cement making. The BF gas containing Carbon monoxide is wet cleaned in by gas cleaning plant in Blast Furnace #1 to bring down the dust level below 5 mg/Nm3. Under the proposed expansion dry gas cleaning plant has been considered. The cleaned BF gas is used as plant fuel and for heating the BF stoves to produce hot blast.

AMNSI is having one (1) Blast Furnaces [BF#1] with production capacity 2.04 million tons per annum. Considering the daily requirement of hot metal in the steel melting shops for production of 15.6 million tons per annum of liquid steel, the capacity of the existing blast furnace (BF#1) is proposed to be upgraded to produce 3 MTPA from the present 2.04 MTPA by making suitable modifications and improving operating parameters. In addition, two new blast furnaces of 4 MTPA capacity each (BF-2 and 3) will be installed. The new blast furnaces will incorporate all the modern technological features.

The design basis of the blast furnaces is given below in ***Table 2-25***

Table 2-25: Technological Parameters for Blast Furnace

Parameters	BF#1	BF#2 & 3
Hot metal production, MTPA	3	2 x 4
Useful volume, cu m (138pprox..)	3200	2 x 4500
Operating days	350	350
Productivity, t/(useful volume)/day (138pprox..)	2.68	2.54
Burden (typical): a) Pellet, % b) Sinter, %	 60 40	 60 40
Oxygen enrichment (avg.), %	12	8
Coke rate (including nut coke), kg/thm	348	348
Pulverized coal injection rate, kg/thm	200	200
Top Recovery Gas Turbine	10 MW	2x25 MW
Slag rate, kg/thm	336	336

Parameters	BF#1	BF#2 & 3
Coke ash, %	12	12
Si in metal, %	0.5 to 0.7	0.5 to 0.7

Major Facilities

The production rate of the existing BF-1 will be increased from the current levels by increasing BF useful volume during the relining of BF-1. Upstream & downstream process and auxiliary facilities will be augmented adequately to support the increased production.

The new blast furnaces will be designed for;

High top pressure and Installation of TRT

Energy conservation would be carried out through installation of Top Pressure Recovery Turbine (TRT). High top pressure of ~2.5 kg/sq cm. and TRT shall be installed to generate 25 MW power from each new BF

Twin Cast House

The new blast furnaces will be provided with two cast houses, having two tap holes each.

Bell Less Top charging

The blast furnace will be provided with a bell less top charging system.

Provision of Fourth Stove

The new blast furnaces will be served by three stoves, along with a provision for a fourth stove. The stoves will be provided with ceramic burners to supply hot blast at a temperature of about 1250˚C. The stoves will be fired with blast furnace gas. Combustion air fans will be provided for the supply of combustion air to the stove burner. The combustion air and gas preheating facilities will be provided. One chimney will be provided for the stove system.

Heat Recovery from Stoves

Heat recovery from stove waste gas shall be installed for preheating of BF Gas and combustion air for stoves.

Pulverised Coal Injection

Pulverized coal injection (PCI) is a process which involves injecting fine coal particles into the blast furnace (BF). Pulverized coal is an important auxiliary fuel used in the BF ironmaking. PCI provides auxiliary fuel for partial replacement of Coke and has proven both economically and environmentally favourable. It can result in substantial improvement in the BF efficiency and thus contribute to the reductions of energy consumption and environmental emissions.

In BFs pulverised coal (non-coking coal) is injected as a partial replacement of the metallurgical coke. PCI rate of average 200 kg/thm has been envisaged for the existing and proposed Blast Furnaces

Gas Cleaning Plant

The gas cleaning system for the new blast furnace will consist of a dust catcher/cyclone and gas cleaning plant (Dry type GCP). The top gas of the furnace will be drawn through off-takes which extend upward to form vertical bleeder pipes provided with bleeder valves at the top. The offtake and uptake pipes would be connected to form a down comer, which terminates at the dust catcher. Dry dust disposal from the dust

catcher/cyclone will be by road transport. The gas leaving dust catcher/cyclone will flow into Dry type GCP for final cleaning. The disposal of dust will be done by road transport using trucks/tankers. The dust levels of the blast furnace gas will be less than or equal to 5 mg/N cu m. Following gas cleaning, there will be a top recovery turbine (TRT) to utilise the pressure of the top gas to generate power. A flare stack of adequate capacity will be provided.

Cast House & Stock House De-dusting System

The BF stock house would be provided with dust extraction systems complete with dust extraction hoods, bag filter, ID fan and stack of adequate height. Similarly, the cast house would have separate fume collection system during taping of hot metal and slag, equipped with bag filter for separation of particulates before venting through a stack of appropriate height. Dust collected in Bag Filter systems shall be reused in Sinter Plant and will be transported by truck.

Table 2-26: Raw Materials Requirement for Existing & Proposed Production

Raw Materials	Existing Production of 2.04 MTPA (TPA)	Additional for 8.96 MTPA (0.96 MTPA from BF#1 and 8 MTPA from BF# 2&3) (TPA)	Total after Expansion (TPA)
Charge Pellet	19,88,950	87,35,700	107,24,650
Charge Sinter	13,36,744	58,71,256	72,08,000
Charge Coke	709,920	311,8080	38,28,080
PCI Coal	408,000	17,92,000	22,00,000
Dolomite	14,280	62,720	77,000
Pyroxinite	50,400	221,300	271,700
Quartzite	23,664	103,936	127,600
Total	**45,32,038**	**199,04,992**	**244,37,030**
Note: All quantities are in net & dry basis			

Cast House Slag Granulation Plant

Hot metal granulation system of adequate capacity will be installed for the production of granulated iron which will be sold to the Cement Manufacturing companies. Slag granulation system and dry slag pit will be provided along with the granulated slag handling system. The slag runner arrangement will be made such that it can flow either to the slag pit or to the granulator of the slag granulation plant. Granulated slag bunkers will be provided for collecting and dewatering the granulated slag. The storage capacity for granulated slag will be about 6 to 8 hours. The granulated slag will be transported from the bunkers to the slag yard for onward dispatch to the outside plant area. A recirculating water system for water required for the granulation process including a hot well, cold well, cooling tower, etc.,

Hot metal Transportation

Hot metal will be transported to Steel Melting Plants by rail in torpedo ladles. There will be a torpedo repair shop which will have facilities for servicing, cooling, repairing and relining of torpedos. The shop will also have facilities for drying and heating of relined torpedo ladles.

BF Gas flares stack

BF gas flare system is provided to control the pressure of BF gas network by flaring the excess gas to atmosphere. The excess gas released through the bleeder will be burnt in the burner located at the top of the stack. To ignite the BF gas at the main burner tip and to maintain the flame, a system of pilot burners and ignition device will be provided. The pilot burners will be ignited by CO gas.

Pilot burners will be ignited through automatic ignition system from the local control panel as well as from BF control room.

Indication with alarms shall be provided at the main BF control room for the operating condition of the flare system. Remote operation of the ignition system for pilot burner shall be provided from BF control room.

Hot Metal Granulation

In case of any disruption in the hot metal off -take in the steel melt shops, one 350 tph hot metal granulation unit has been considered for pouring hot metal. In addition to the granulation unit, pooling pits of the adequate area will be provided with a suitable tilting station for quick emptying of torpedo ladle cars.

Four basic steps of Granshot process are (i) control of HM flow, (ii) granulation by forming of HM droplets and their rapid quenching, (iii) discharge of solidified and cooled iron granules by ejector, and (iv) dewatering of granules and transport to storage.

When Hot Metal (HM) arrives at granulation plant, it is poured into the tundish. Tundish weighing system automatically controls pouring rate in order to maintain a constant flow rate through the tundish nozzle outlet. As HM stream leaves the tundish and strikes refractory target positioned below the nozzle, it gets distributed evenly over the cooling water surface. HM forms droplets of which the outer part solidifies during the flight before their penetrating the surface of water. Remaining inner part of the semi liquid droplet, now a granule, is quenched as it strikes water surface and starts its movement downwards in the water volume. At the time of impact of granules into the water they get deformed slightly but are prevented from splitting up, thus avoiding fines generation.

As the granules go down by gravity through water in the granulating tank they transfer their heat to cooling water. Cooling water allows granules to reach a temperature below 100 deg C. After the granules reach the tank bottom they are discharged from the granulation tank and dewatered onto a vibrating dewatering screen. Finally, the product granulated pig iron (GPI) is transported to storage area or fed into a rotary drier by conveyor belt.

2.8.11 Calcination Plant

The calcining plants will produce lime and dolomite for consumption in the Steel Melting Shops. The size of calcined products will be 10 to 80 mm and the calcined products will be screened before they are conveyed to the Steel Melting Shops. The undersize product fines will be stored and used in the Sinter Plant or for other purposes. The production of liquid steel from the proposed Steel Melting Shop has been envisaged as 6.0 MTPA. The calcining plant will meet the flux requirement for proposed Steel Melting Shop as well as cater flux shortfall for existing plant.

The gross production figures include the product dust loss, handling loss, and undersize which will be screened out. Capacity of the Kiln has been determined considering 15 percent extra kiln capacity to handle fluctuations in the specific consumptions of flux and variation in raw materials quality and based on 330 days working in a year.

Based on the above peak requirement of calcined products, it is proposed to install total 4 x 600 tpd kilns for production of 0.8 MTPA Calcined Lime / Dolomite. Existing Lime (Calcination) Plant is having 4x300 TPD + 3x500 TPD Vertical Shaft Kilns for production of 0.93 MTPA Calcined Lime / Dolomite. 1 x 500 TPD kilns and 1 x 200 kilns for lime and dolomite production shall be installed for production of 0.27 MTPA under modification project of the plant. Total production capacity of the Calcination Plant, after the expansion will be 2.0 MTPA.

The calcining plant will comprise of facilities for raw materials storage bins, screening and handling, kiln with kiln feed building, calcined products storage and product handling & screening facilities.

Raw Material Handling

Sized limestone and raw dolomite will be delivered over a system of belt conveyors to the kiln feed building bunkers of calcining plant. The bunkers will have suitable storage capacity. To separate the fines generated during handling, the raw materials will be screened before being fed into the kiln. The kiln feed building will house raw material screening facilities. The screened limestone and raw dolomite will be fed into the kilns with the help of skip hoist and stone distribution system located at kiln top.

Calcination Process

The limestone will be calcined at a temperature 1050-1150^{0}C to achieve soft burnt lime (Specific fuel consumption 850 kcal/kg of burnt lime). Fuel used / Proposed in the Shaft Kilns are as follows:

- Lime Calcination Plant -1 (4x300 TPD) – Natural Gas / Mixed Gas
- Lime Calcination Plant -2 (3x500 TPD) – Mixed Gas
- Lime Calcination Plant -3 (1x200 + 1x500 TPD) – Mixed Gas
- Lime Calcination Plant -4 (4x600 TPD) – Mixed Gas

The discharge from the kiln will be routed through a closed loop screening system to separate out under size fraction and screened lime will be dispatched to Steel Melting Plants through a system of belt conveyors. The under sized fraction of lime will be dispatched in close container to sinter plant.

The vertical shaft kiln demands constants throughput. During each inversion, a measured amount of stone is charged into shaft, which, in the next cycle, will act as a regenerator. In this way, there is the lowest gas temperature and consequently, the maximum recovery of heat. The weight of the charge remains constant independent of the kiln output. The number of charges per hour and duration of the heating period are controlled. At nominal output, the kiln is charged every 12 minutes. At a lower output, the interval can be longer.

The charging system consists of a hopper placed above the kiln in the middle of two shafts. The hopper has two outlets; each equipped with a hydraulically operated valve. A belt conveyor feeds the hopper and charges a batch into the hopper. The stone from hopper will be fed to the appropriate valve.

The calcinated lime shall be continuously discharged from both shafts via discharged tables located below. The rate of discharge is present for constant discharge from below the cooling zone of both shafts.

The discharge tables extract the calcined lime from inside the kiln and the lime falls into the small discharge hoppers located underneath the discharge tables to collect the calcined lime during the 12 minutes (142 approx..) burning period.

Due to the high pressure inside the kiln, these hoppers are sealed off from the atmosphere by airtight hydraulically operated flaps. During each inversion action when shafts are without pressure, these hydraulically operated flaps are opened and the burnt lime drops into the pressure free reception hopper.

Cooling air is fed into the discharge hoppers from where it reaches the kiln passing through the lime situated on the discharge tables.

The periodical reversing of the heating from one shaft to another required reversing device for fuel, combustion air and waste gas. The fuel supply shall be reversed by means of special hydraulically operated valves. Combustion air and waste gas are also reversed by means of double acting hydraulic cylinder operated flaps. Cooling air however, flows continuously into both shafts. The inversion process is controlled automatically through automation program

Product Handling

For conveying the calcined products from below the kilns, belt conveyors will be provided. The calcined products will be stored in product storage bunkers. About one day's stock will be maintained for the calcined products. The undersize fraction of the calcined products will be stored in a separate bunker and will be dispatched in closed containers for other uses.

Waste Gas Cleaning System

The emissions arising due the fuel burning in lime calcining plant would be collected and taken through a bag filter to separate out the fines of lime/dolo. The lime/ dolo fines thus collected would be recycled to the sinter plant. The kilns in the calcining plant and other dust generation areas would be provided with separate DE systems, complete with bag filters and stack of adequate height to clean the particulates. The plant will be provided with a kiln waste gas cleaning system and a de-dusting system for raw materials and product handling facilities.

Table 2-27: Raw Materials Requirement for Calcination Plant

Raw Materials	**Raw Materials Requirement in TPA**			
	Existing		**Proposed**	**Total**
	LCP-1 4x300 TPD	LCP-2 3x500 TPD	LCP-3 1x200 + 1x500 TPD + 4x600 TPD proposed under Modification & Expansion	4x300 TPD + 4x500 TPD + 4x600 TPD +1x200 TPD Kilns
	Production Lime: 202,700 Dolomite: 202,700	Production Lime: 337,850 Dolomite: 168,950	Production Lime: 573,500 Dolomite: 295,800	Production Lime: 11,14,050 Dolomite: 667,450
Lime Stone	378,700	631,100	10,71,600	20,81,400
Dolomite	388,100	323,450	566,200	12,77,750
Note: All quantities are in net & dry basis				

2.8.12 Steel Melting Plant-1 (Existing)

Steel Melting Plant -1 is existing unit for production of 4.54 million tons of Slab. In order to achieve the 4.6 million tons per annum of liquid steel production from SMS-1, four (4) nos. Electric Arc Furnaces of capacity 150 Ton each along with 4 number of 150 Ton Ladle Refining Furnaces and 1 nos. of 150 Ton RH-Degasser, 1 nos. of 150 Ton VOD and 3 x 150 Ton Slab Casters have been installed. 1 additional 150 Ton Ladle refining furnace proposed under Modification project

Electric Arc Furnaces (4 Nos.)

Electric arc furnace is a DRI / Scrap melting furnace to make high quality steel as this furnace has facility of adding alloying items. Electric-arc method, which uses high-current electric arcs to melt DRI and steel scrap and convert it into liquid steel of a required chemical composition and temperature.

Ladle Refining Furnace (LRF)

Ladle Refining Furnace (LRFs) are used to addition of alloys, de-sulfurise steels, remove other impurities and hold the molten steel for casting operations. A Ladle Refining Furnace (LRF) is used to relieve the primary melter of many secondary refining operations, and its primary functions are:

Reheating of liquid steel is done through electric power conducted by graphite electrodes

Homogenization of steel temperature and chemistry through inert gas stirring

Formation of a slag layer that protects refractory from arc damage, concentrates and transfers heat to the liquid steel, trap inclusions and metal oxides, and provide the means for desulphurization.

Secondary functions that can be included with a ladle furnace are:

- Alloy additions to provide bulk or trim chemical control
- Provide a means for deep desulphurization
- Act as a buffer between the steel making furnace and continuous caster
- Allowing greater flexibility in steelmaking operations

Fumes and particulates generated during heating and alloying operations at the LRF will exit the water-cooled ladle roof through the various openings in the roof. These emissions will be captured into a lateral draft type fume collection hood mounted on supporting structures above the ladle roof. The ladle roof is typically a water-cooled designed to coordinate with existing ladles such that the roof will completely cover the top portion of the ladle when in the operating (i.e. fully lowered) position.

Five numbers of Ladle Furnaces (LF), each connected to 28 MVA transformer are installed in line with EAFs, for refining the steel.

RH-Degasser

RH-Degasser is a secondary refining unit which remove the dissolved gases present in molten steel such as Hydrogen, Nitrogen and Oxygen. The removal of these dissolved gases is necessary for the production of high-grade steel. RH degassers (RH) are suitable for quickly degassing from large quantities of molten steel. They feature a vacuum chamber equipped with two snorkels that is mounted to the ladle. Argon gas is blown from the sides of one of the snorkels, circulating the molten steel into the vacuum chamber using the buoyancy of the blown gas and removing dissolved gases such as hydrogen and Nitrogen from the molten steel. RH-degasser is also used for processing of ultra low carbon steel by removing Carbon from liquid steel under vaccum.

Vacuum Degassing (VD)

During the primary steelmaking process, gases like oxygen (O2), hydrogen (H2) and nitrogen (N2) dissolve in the liquid steel. These gases have a harmful effect on the mechanical and physical properties of steel. Dissolved O2 from liquid steel cannot be removed as molecular O2 and its removal is termed as deoxidation. The term degassing is used for the removal of H_2 and N2 gases from liquid steel. Since the degassing process of liquid steel is carried out under vacuum, it is also known as vacuum degassing of liquid steel. Vacuum degassing processes are carried out in steel teeming ladles.

Removal of H_2 and N_2 gases from liquid steel is necessary since both of these gases harm the properties of steel. Solubility of H2 in steel is low at ambient temperature. Excess H2 is rejected during solidification and results in pinhole formation and results into the porosity in solidified steel. Few ppm (parts per million) of H2 gas causes blistering and loss of tensile ductility. In case of N2 gas, maximum solubility of N2 in liquid iron is 450 ppm and less than 10 ppm at room temperature. During solidification excess N2 is rejected which can cause formation of either blow holes or nitrides. Excess N2 also causes embrittlement of heat affected zone during welding of steels and also impairs cold formability of steel.

VD consist of the main vacuum vessel into which there is the ladle of molten steel. The furnace will also be fitted with an electrical induction coil, which, when turned on, creates a stirring action within the liquid steel and, thus, agitates the steel within the ladle. This helps the homogeneity of the steel melt. The action will also help to release trapped gas particles within the molten-steel liquid and will ensure that the chemistry of the melt is homogenous.

One vacuum degassing/ Vacuum oxygen decarburisation (VD/ VOD) unit and one RH degasser is provided for degassing and refining of liquid steel in the ladle.

Table 2-28: Raw Materials Requirement for SMP-1

Raw Materials	Quantity in TPA
DRI from HBI Plant	55,03,900
Calcined Lime	271,400
Calcined Dolo	276,000
Ferro-alloys	46,600
Total	**60,97,900**
Note: All quantities are in net & dry basis	

Slab Caster

Three (3) number of single strand Slab Caster has been installed for total Slab production of 4537,900 TPA. Caster #1 & 3 are designed to cast slabs of thickness 220 and width range 800 – 2000mm whereas Caster #2 is designed for slabs of thickness 220 and width range 800 – 1550mm.

Products	Quantity in TPA
Liquid Steel	46,00,000
Slab	45,37,900

Primary & Secondary Emission Control System

Steel Making Plant -1 at AMNSI India Currently operates 4 DC Electrical Arc Furnace (EAF). Each EAF has dedicated Primary Fume Extraction system which captures the Fumes generated during the Steel melting process. To capture the secondary fumes and dust generated during the charging, Tapping and De-slagging operation, Secondary Fume extraction system is provided which is common for EAF1,2 and 3 however EAF4 has dedicated secondary fume extraction system. A project is proposed under modification project to increase the capacity of common Secondary Fume Extraction system (for EAF1,2 and 3) to achieve cleaner shop condition.

2.8.13 Steel Melting Plant -2 (Existing)

Steel Melting Plant -2 is existing unit for production of 5.0 million tons per annum of liquid steel through two (2) nos. Twin Con Arc Furnaces of capacity 200 Ton each along with 3 number of 200 Ton Twin Ladle

Refining Furnaces and 1 nos. of 200 Ton RH-OB. One (1) no. of additional 150 Ton Ladle refining furnace proposed under Modification project

Con Arc Furnaces (2 nos.)

The Twin Shell Con arc furnace is a combination of converter and electric arc furnace where in various charge mixes consisting of hot metal, DRI and scrap can be processed to produce good quality steel. Conarc furnace is designed to use large percentage of hot metal in the range of 30 to 80%. It is basically a twin shell operation comprising operating in converter mode by the oxygen lancing in one shell and arcing mode in the other shell at a time. Suitable arrangement is made to have a separate top lance similar to basic oxygen converter for each shell and a common electrode gantry to serve any of the shell like a conventional arc furnace. To enable oxygen lancing during arcing period, side wall mounted oxygen lance as well as door lance will be provided. The typical cycle time consists of set of activities - blowing phase and arcing phase. As soon as the blowing phase is completed in one shell, the arcing phase should be over in the other furnace.

Hot metal is poured into the furnace through slag door using a launder. Use of hot metal saves electric energy, reduces melting time, saves electrodes and improves overall economics of the plant. Oxygen is blown using roof mounted supersonic oxygen lances. Depending on the proportion of hot metal in the charge mix, the blowing period may vary from 30 to 55 min approximately. DRI is charged into the furnace through mechanized system of overhead bins, vibro feeders, conveyors, chutes. Lime is continuously fed during the blowing period and resulting slag is flushed out. When the bath carbon is about 0.06%, the blowing is stopped and then arcing period commences.

During this period, DRI along with lime is continuously charged to reduce high FeO in slag as well as to achieve foamy slag formation, coke injector is done at low bath carbon. The tap-to-tap time is about 74 min for each shell with the proposed charge mix. However, the actual tap to tap time will vary depending upon the casting time per ladle and heat delivery cycle from CONARC furnace. As soon as the charge is melted, bath sample is taken and the steel temperature is adjusted and the steel is tapped into a pre — heated ladle placed on the ladle transfer car below the furnace tap hole. The preheat temperature of the steel ladle should be in the range of 1000 — 1100˚C.

Predetermined quantity of Ferro-alloys and de-oxidizers are dosed into the ladle during tapping and the inert gas bubbling is started in ladle to properly mix the additives and to homogenize the temperature. After tapping of the furnace, EBT is closed, furnace walls and banks are inspected again and if necessary gunned/fettled. The furnace is then ready to commence the next melting operation. About 25 — 30 t of liquid steel is left in the furnace as hot steel for subsequent heat. CONRAC furnace slag is flushed into slag pot placed below the slag door from where it is disposed of using road transport. Entire operation of the CONARC furnace is controlled with level — II automation. Furnace and gases generated during furnace operation are continuously extracted and cleaned.

Ladle Refining Furnaces (LRFs)

3 nos. of 200 Ton twin Ladle Refining Furnaces (35 MVA) are installed (2 nos. operating + 1 no. standby) for refining of liquid steel produced in ConArc Furnaces. 1 additional 150 Ton Ladle refining furnace proposed under Modification project

RH-OB Process

The **Ruhrstahl Heraeus (RH)** Oxygen Blowing is a vacuum recirculation process which is carried out in a refractory-lined vessel equipped with two snorkels immersed in the steel bath. The process is focused on

decarburization and degassing and is the best suitable system for the production of Ultra Low Carbon Steel grades.

It is a further development of RH-Degassing where the use of gaseous oxygen blowing during RH degassing treatment. In the process, the RH degassing unit is equipped with a multi-function which enables oxygen to be blown from a single lance that is inserted into the vacuum chamber. It allows heat to be retained within the vacuum chamber both during vacuum processing and while on standby. This reduces the adhesion of metals within the chamber while making it possible to produce ultra-low carbon steel by means of oxygen blowing during processing. The aim of these processes was to accelerate the decarburization reaction, to reheat liquid steel by alumina-thermic reaction, to remelt skulls, to keep vessel at high temperature by converting generated carbon mono-oxide gas to carbon di-oxide gas during the decarburization period, and to heat the refractory lined vessel between the treatments.

1 nos. of RH-OB units of capacity 200 Tons (Nominal), each have been provided in SMP-2 for refining of Steel.

Table 2-29: Raw Materials Requirement for SMP-2

Raw Materials	Quantity in TPA
Hot Metal from Blast Furnaces	43,20,300
DRI from HBI Plant	14,40,100
Calcined Lime	300,000
Calcined Dolo	150,000
Ferro-alloys	50,000
Total	**62,60,400**

CSP Caster & Slab Caster

3 Nos. of Vertical CSP Casters (thin slab) and one number of single strand Thin Slab Caster (210 mm max.) has been installed to hadle 50,00,000 Liquid steel.

Products	Quantity in TPA
Liquid Steel	50,00,000
Thick Slab	14,12,100
Compact Strip Production (CSP)	35,00,000 HR Coil

2.8.14 Steel Melt Shop -3 (BOF – 3 Nos.): Proposed

Based on the hot metal production from the Blast Furnace and the requirement of Slabs in new Hot Strip Mill, the tentative production from SMS-3 will be around 6.0 MTPA liquid steel. BF-BOF process route has been proposed for the production from Steel Melting Plant-3 (SMP-3).

To maximise the utilisation of the hot metal produced in the blast furnace and to maximize the inherent advantages of largest heat size, higher size BOFs are envisaged for flat products. Accordingly, three (3) nos. of Basic Oxygen Furnaces (BOFs) of capacity 350 tph, each have been envisaged. Out of which, any two furnaces will operate at any point of time with required numbers of secondary metallurgy units and two twin strand slab casters.

The production facilities will be adequately supported by necessary auxiliary facilities such as raw materials unloading and storage, proportioning of raw materials, electric power receiving and distribution stations, various utility facilities and distribution systems, water treatment and distribution system etc.

The base Charge Mix of the BOF for production of 6.0 million tons of liquid steel is as follows:

Table 2-30: Charge-Mix of SMS-3

Description	Specific consumption, kg/tls	Annual requirement, TPY
Hot metal	938.2	5,629,100
DRI	66.2	397,400
Scrap	99.3	596,000

The total metallic requirement of SMS-3 will be met from hot metal from the Blast Furnaces, DRI from the existing plant, lump ore, purchased scrap and plant return scrap. Accordingly, the tentative requirements of crude steel and equivalent liquid steel in SMS-3 are given in the ***Table 2-31***

Table 2-31: Raw Materials Requirement for SMP-3

Raw Materials	Quantity in TPA
Hot Metal from Blast Furnaces	56,29,100
DRI from HBI Plant	397,400
Scrap (In-house + Purchased)	596,000
Iron Ore (as coolant)	120,000
Calcined Lime	390,000
Calcined Dolo	150,000
Ferro-alloys	84,000
Total	**73,66,500**

Steel making in SMP-3 envisaged with the following facilities:

- Desulphurization of hot metal in transfer ladle by impeller stirring method.
- Top oxygen blown BOF s with bottom inert gas blowing facilities for the production of low carbon steel, yield improvement and reduction of slag FeO, associated material handling facilities, lance handling facilities, slag, scrap, and liquid metal handling facilities.
- Slag splashing for improvement of Convertor life.

Gas Cleaning Plant

Dry type Gas Cleaning Plant (GCP) shall be installed for cleaning of BOF gas, which is basically a process requirement

Secondary Emission Control

Secondary emission would be generated mainly from charging and tapping operations. The secondary emissions of the steel melt shop would be controlled by Air Pollution Control comprising of Doghouse with collection hood, ID fan, bag filter and stack of appropriate height.

Ladle Refining Furnaces (LRFs)

2x350 Ton Twin Ladle Refining Furnaces have been proposed for refining of liquid steel produced in the proposed SMP-3. The emissions from the Ladle Refining Furnace would be collected by fume extraction (FE) system and routed to the overall secondary fume extraction system of the shop through ducts, to clean the dust laden fumes.

RH-OB Degasser

Secondary treatment of metal, 1 x twin vessel Ruhrstahl Heraeus Oxygen Blowing (RH-OB) (350 T) has been proposed for close control of composition, degassing, temperature, and matching of the production schedule. Fume extraction system with RH-OB will also be routed to the secondary fume extraction system of the Shop.

Slab Caster

The liquid steel produced from BOFs in SMS-3 is proposed to be cast through 2 x 2 strand slab casters Continuous casting facility will have slag detection system, continuous tundish temperature monitoring system, automatic mold level control system, quick SEN changing facility, breakout detection system, facility for width adjustment within sequence, electro-magnetic stirring equipment etc.

Production of Slab from 2x2 Strand Slab Caster will be 5.91 million tons per annum.

2.8.15 Rolling Mills

Hot Strip Mills -1 (Existing)

Existing Plant is having 1 no. of Hot Strip Mill (HSM) with for production of 4.5 million tons per annum Hot Rolled Coil (HRC).

Hot Rolling Mill is provided with Reversing Roughing Mill with Vertical Edger, Coil Box, Finishing Mill, Runout table and Down Coiler. The Roughing Mill and Finishing mills are composed of two work rolls (WRs), and two backup rolls (BURs) supporting them. The finishing Mill has a major influence on the dimensional accuracy of the strip thickness. The slab thickness is initially reduced in Roughing mill and final dimensions are achieved in Finishing Mill. The existing Hot Strip Mill is having Coil Box in between Roughing and Finishing Mills to retain heat and better rollability.

Reheating Furnaces

Slab from Continuous Caster enter into HSM after heating in the Reheating Furnaces. Two (2) nos. of Reheating Furnaces have been provided with HSM-1. Natural gas and Corex gas is being used as fuel in the Reheating Furnaces. After expansion Mixed Gas will be use.

Table 2-32: Raw Materials Requirement for HSM-1

Input	Output
Slab from SMP-1 – 45,37,900 TPA	HRC – 45,00,000 TPA
Purchased Slab – 30,600 TPA	
Total Slab – 45,68,500	

Compact Strip Production (CSP) Mill –(Existing)

The thin slab from Caster directly enters and heated in Three Tunnel Furnaces (each with a CSP Caster strand). At the Exit of Tunnel Furnace, slabs run over a roller table equipped with side guides through a Hydraulic Emergency Cutting Device and a High Pressure De-scaler. After descaling, the thin slab passes through 7 (seven) Mill stands where it is rolled down to specified final thickness.

At the exit of finishing mill, Online X-ray gauges for thickness & profile measurement and one width measurement gauge are housed in Measuring house.

The strips are cooled under laminar bank of water before coiling in down coiler. Prior to handling in the yard, the coils are strapped, weighed and marked online.

The tunnel furnaces are using Corex Gas + NG currently and will switch over to Mixed gas after expansion.

Table 2-33: Raw Materials Requirement for CSP

Input	Output
Liquid Steel from SMP-2 - 35,66,400 TPA	HRC – 35,00,000 TPA

Plate Mill (Existing)

Plate Mill for production of 1.5 million tons per annum has been installed. Slabs from SMP-2 is first heated in the Reheating Furnace before entering to the Plate Mill

Reheating of Slab

Slabs will be transported by overhead crane and placed onto the Reheating Furnace (RHF) approach table. From there the slabs will be transported via the roller table onto the RHF entry table. Once the slabs have been correctly aligned the slab charging device will lift the slabs and place them down on the RHF skids. A maximum of two slabs can be charged into the RHF in one cycle, side by side, to give a double row in the RHF.

The RHF is a walking beam type; the slabs are lifted and walked forwards on each cycle of the RHF. The RHF is split into two zones, initially the slabs are heated up to the required temperature in the heating zone, the slabs then pass through a second, soaking zone. The soaking zone allows the slabs to achieve a constant temperature through the volume prior to RHF dropout. Once the slabs reach the exit end of the RHF they will be at the correct temperature with a homogenous temperature profile. When the mill is ready to receive the next slab the RHF door will open and the exit discharge device will lift the slab out of the RHF and place it down on the RHF exit table. The discharge device is split into two to enable a single slab to be lifted out from the double row in the RHF. The slabs are dropped out of the RHF at an appropriate time to ensure the minimal gap time at the mill is maintained.

Descaling of Slabs

Once the slabs have been placed on the RHF exit table they will be transported via a roller table into a primary descaling unit (PDS). During the reheating process the slabs will develop an oxide layer (scale), which if not removed, will be rolled into the surface of the product causing surface defects and reduced product quality. In order to ensure optimum product quality, the slabs are descaled to remove the oxide layer.

The PDS unit consists of four headers (two top, two bottom) with nozzle jets delivering water at high pressure and suitable flows. Two of the headers are operational and two of the headers are standby headers, although both can be used simultaneously if required. The headers are enclosed in a descaler hood to contain the water and scale. Once the slabs are descaled, they are transported to the mill area via roller table.

Rolling

Mill stand area briefly the equipment comprises, a turnable either side of the mill stand, a modern four high mill stand with automatic gauge control cylinders (AGC), work roll bending and quick work roll change facilities. Slabs arriving at the entry turn table from the PDS are either rolled directly into the mill bite for the first pass of the rolling schedule or if required turned prior to entering the roll bite.

Slab turning serves three purposes: The main purpose is to develop product width from a slab, which cannot be cast at the full required width. Plates are turned and rolled out for width, before being turned back and rolled out to the final length. The second purpose for plate turning is to improve the homogeneity of the slab by rolling the microstructure in different directions this improves the micro structural texture of the plates and

consequently improves final plate properties. The final purpose is to give a benefit in product yield correct use of a plate turning strategy results in improved square ness of the rolled plate length, reducing the requirements for plate trimming and thereby improving the productivity of the plant. Generally known as plan view Rolling (PVR).

Although the PDS is effective at removing the primary scale built up during the reheating process, secondary scale will reform between the PDS and the mill and also between consecutive passes on the mill, until the piece temperature has dropped sufficiently. To avoid secondary scale being rolled into the plate surface the mill is equipped with secondary descaling headers on the mill stand. The secondary descaling system is used on the ingoing passes and in the same way as the PDS delivers sufficient volume of water at high pressure onto the product.

When the hot plate from the mill is passed through the laminar cooling system, stress can be set up in the plate, which lead to buckling of the plate. The hot leveller relieves these stresses by a sequence of reversals above the yield point of the material. The hot leveller processes the rolled plate length up to a maximum gauge of 100 mm under load.

In front of the cooling banks, a hot plate marker is located. This is intended for marking plates of gauges above 50 mm, which will be taken off onto cooling bed of the heavy plate cooling transfer device. Plates being processed on the shear lines will be marked on the shear lines. The walking beam type cooling beds are designed to allow the plates to cool as they are slowly transported from one end of the bed to the other. The cooling beds are designed such that either bed can be used for any of the product.

From the ultrasonic testing area, the plates are transferred via roller table to the static crop shear. The purpose of this shear is to divide rolled plate lengths into lengths approximately equal to the final plate length. This has advantage of improving yield from the side trim shear by reducing the effect of camber in the rolled product. The shear is also capable of taking head and tail crops if required.

Once the product has been processed on the static crop shear, as required it will be transported to the double side trim shear (DSTS) and slitting shear. The double side trim shear is capable of cutting material up to 50 mm thick.

Working in tandem with the DSTS, the slitting shear can be used to divide a rolled plate along its length to produce plate lengths with a minimum width of 900 mm.

Once plates have been side trimmed, they are transported by roller table to the divide shear. At this stage, if required, a sample piece can be cut. Once the reference cut is made the plate is moved forwards to cut the first final plate length. If multiple final plate lengths are produced then the last cut is a tail end cut on the last piece. A plate marker & stamper is provided after the divide shear to mark or stamp each final plate with a unique identification mark.

At the end of the shear line a plate pre-piler is provided for piling individual plates. The plate stacker can pile a maximum of 5 plates or to 50 mm high, whichever is the lower value.

The stacker consists of a lifting device to lift individual plates up to a set of electromagnets; each plate is lifted in turn until a complete pile is made. Once the pile is complete the lifting device rises to support the pile and then lowers the pile back down to the roller table. The pile is then transported to the dispatch area. For the anticipated product mix, the major part of quality plates can be produced without the use of a cold leveler, which is the case in numerous plate mills. However, as the requirements for tight flatness tolerances are constantly increasing. VAI recommend the installation of such equipment. This would be located on a parallel line after the plate marker in the shear line, with a plate transfer to move the plates to the cold leveller.

Heavy plate with gauges above 50 mm cannot be processed on the shear lines, which have a maximum cutting capability of 50 mm. Plates above this gauge will therefore be transferred onto the heavy plate cooling bed. Once the plates are at the exit of the transfer they will be lifted and placed on cooling grids to cool to ambient temperature. Once cooled, these plates can be stacked in the storage area and then processed through the flame cutting machine as required.

Heat Treatment

For enhancing the product quality and to cater high quality plate market, thin plates are further processed through thin plate heat treatment line. Heat treat line consists of normalizing line (normalizing furnace) and hardening line (Austentising furnace, quenching box and tempering furnace).

As per heat treatment requirement plates are transferred to heat treatment area, where all the plates are processed through in line shot blasting machine. The shot blasted plates are then lifted by hi speed piler defiler crane and placed on two heat treatment line as per requirement. Plates are centered with the help of lifting and centring device.

In the normalizing line the plate is heat treated for removal of internal stress by heating and then cooling it in normal atmosphere The Normalizing furnace is roller hearth type furnace of 70mtr in length. Natural gas is used as fuel for heating the plates up to 980 C through Self recuperative radiant tube burner (indirect heating). Here nitrogen act as protective atmosphere. The hot plate out from furnace is then cooled in the atmospheric temperature to get the desired mechanical properties.

In the Hardening line the plate is first heated to elevated temperature around 980 C in Austentising furnace then it is cooled in very quick time with the help of water sprayer in Quenching box the plate out from quenching box is the heated to 750 C in tempering furnace. Afterward the plate is cooled in atmospheric temperature.

The Austentising furnace is also roller hearth type furnace of 43.5 mtr in length. Natural gas is used as fuel for heating the plates up to 980 C through Self recuperative radiant tube burners (indirect heating). Here nitrogen act as protective atmosphere. The quenching furnace is roller type furnace of 26.22 mtr length, here water sprayer is used to cool the plates quickly. For this furnace is divided in three zones, high pressure, medium pressure and low-pressure zones, the plate is first pass-through high-pressure zone where the cooling rate is high after that the plate is taken to low pressure zone where plate is cooled slowly. The plate out from quenching furnace is taken to tempering furnace which is also roller hearth type furnace of 64 mtr in length. Natural gas is used as fuel for heating the plates up to 750˚C through direct heating

The pales out from both heat treatment lines are then sent to piler station where it is piled and stacked as per the requirement.

Table 2-34: Raw Materials Requirement for Plate Mill

Input	Output
Slab from SMP-2 – 14,12,100 TPA	HRC – 15,00,000 TPA
Purchased Slab – 103,100 TPA	
Total Slab – 15,15,200	

Out of total 15,00,000 TPA Plate production, 335,000 TPA will go to the LSaw Plant and remaining 11,65,000 TPA will be sold in the market

CRM Complex (Existing)

Pickling Line

Pickling is the one of the main essential activities of cold rolling & galvanizing process. CRM Complex has following Pickling Lines:

Pickling line -1 - 0.6 MTPA

Pickling line -2 - 0.8 MTPA

Pickling line -1 - 0.5 MTPA

The main objective of pickling is to remove the scales on the surface of the Hot Rolled Coil.

One (1) number semi continuous pickling line #1 of capacity about 0.6 MTPY equipped with shallow tanks is provided for pickling of HR coils before being rolled in the mill.

One (1) number continuous pickling line #2 of capacity about 0.8 MTPY equipped with in line electrostatic oiler and trimmer & chopper is provided for pickling of HR coils before being rolled in the mill. Both pickling line used Hydrochloric (HCL) acid as pickling agent.

One (1) number pickling line #3 of capacity 0.5 MTPA is provided for pickling of wider HR coils specially to cater the requirement of wider HRPO market of AMW & other vehicle manufacturing industry of the same kind.

In this process the strip, emerging from entry section enters Pickling section consisting of three tanks separated by squeeze roll stand. The Pickling tanks are shallow granite troughs specially designed to support and guide the strip during all phases of operation. Hot dilute Hydrochloric Acid (HCI) is circulated in each of the section from individual recirculation tanks through heat exchangers to make up the lost heat during the process.

When the strip passes through the pickling tanks in the presence of HCI, oxide layers on the strip will get dissolved in the acid and the strip emerging from the pickling tank passes through the rinse concentrate tank where hot water is circulated from a collection tank and sprayed on the strip.

The strip emerging from the rinse concentrate chamber passes through a five-stage hot rinse section where rinse water is cascaded from exit side chamber to entry side chamber through simple overflow system. Acid carried over along the strip will be cleaned in this rinse section and finally acid and oxide free strip will enter the drier. Waste pickle liquor from existing as well as proposed pickling line will be taken to Acid Regeneration Plant (ARP), where acid is regenerated and reuse in the system.

Due to heat contained in the strip, carry over water duly squeezed dries quickly. The dry strip is oiled and wound under the tension on the re-coiler and this coil is known as Hot Rolled Pickled Coil.

The hot acid evolves certain number of fumes. These fumes are sucked from the tanks with high-pressure suction blower and passed through to a water-scrubbing tower where they are washed to clean the HCI fumes. The pickling tanks, rinse tanks and acid recirculation tanks are connected to the system to ensure that no acid & acid fumes escape into the atmosphere. The final emission from the scrubbing tower will be less than the GPCB norms, 20 mg/Nm3 of HCI - stringent norms given by GPCB though EPA Norms would be 35 mg/Nm3 - and is released through a stack to the atmosphere.

Cold Rolling Mill

CRM Complex has two Cold Rolling Mills. A reversing mill 6-HI Combination Reversible UC Mills (supplied by Hitachi, Japan) of capacity of 0.2 MTPA MTPY is used for the cold reduction of low carbon hot rolled pickled material and the temper rolling of the cold rolled annealed material to thinner gauge coils. The mill housings are of single piece and closed top design. The mill is equipped with advance roll cooling and hydraulic side shifting quick roll changing facilities and

One (1) number five stands tandem mill (4-HI Tandem Mill supplied by VAI) with capacity of 1.0 MTPA is provided for reducing the pickled coils to thinner gauge coils. The main objective of cold rolling is to achieve lower thickness with better tolerance, better shape and surface on the material. An arrangement of accumulator with steering roll & roll coolant system with filtration unit is also provided.

Facilities proposed under Modification

The CTCM at existing CRM Complex is not capable of rolling grades more than 450 MPa Yield Strength steel due to 4- High design of the mill. Therefore, it is envisaged to install a Pickling cum Tandem Cold Mill for producing high strength steels of yield strength 450-1300 MPa.

One (1) number five stands 4-hi CTCM is provided for rolling of HR pickled coils into required thinner gauge CR coils. The mill had an initial four stands and had a capacity of about 0.85 MTPY with mill speed of 700 MPM. In recent past, the mill has been converted from four stands to continuous tandem configuration by adding fifth stand, flash butt welder and in line strip accumulator. This upgradation enables the mill to produce about 1 MTPY of CR coils with mill speed of about 1000 MPM

Proposed facilities for new CRM Complex will produce the following products:

- Cold Rolled Full Hard Coils
- HRPO Coils
- Galvanized (GI) Coils, ZnMg Coated Coils
- Galvannealed (GA) Coils
- Cold Rolled Continuous Annealed Coils (CRCA)

Continuous Galvanizing Line #4 is proposed to be installed to produce ZnMg Coated steel strip which finds application in high corrosive environment. Continuous Galvanizing line #3 (CGL-3) and Continuous Annealing Line (CAL) for GA product are proposed to be installed to produce the entire range of automotive steels which are required for car body manufacturing and for white goods applications.

Pickling Line coupled with Tandem Cold Mill (PLTCM)

One (1) number Pickling line coupled with tandem cold mill is provided for pickling and simultaneously rolling into required thinner gauge CR coils of high strength and automotive grade. PLTCM will have decoupling arrangement to produce HRPO coils. It has been briefed that the line will have a capacity of 2.2 MTPA for both pickling and rolling operation.

Continuous pickling line no. 4

One 1670 mm continuous pickling line with turbo flow concept along with HCL regeneration plant with modern technology has been envisaged for pickling of HR coils. The capacity of this line will be 1 MTPA.

2.8.16 Pipe Plant (Existing)

AMNSI Pipe Plant comprises one unit for Longitudinal Submerged Arc Welded (LSAW) Pipe with capacity of 3,30,000 TPA; conventional type Helical Submerged Arc Welded (HSAW) pipe unit of capacity 3,00000 TPA. Each of these units produces pipes in the length up to 12.2 meters. These facilities are augmented by external coating unit of capacity 2 million Sqm and an internal coating facility of capacity 1 million sqm. The USP of the plant lies in the integration with the raw material producing steel plant and plate mill at the operating level. This provides us with the ultimate control on the quality of the raw material and in turn very strong process control throughout the manufacturing process (Ore to Finished Pipe) from a customer point of view.

LSAW Pipe Mill

Hot Rolled plates, after inspection are subjected to Ultrasonic testing followed by edge milling operation to precise width and adequate double bevel. The plate is rolled in a 3roll bending machine, followed by post-Bending to impart the required edge profile to the bent plate and subsequently the plate is tack-welded at root using Gas Metal Arc Welding process. The welded pipe is washed and then transferred to the end facing machine to make the pipe ready for inspection and testing. Various tests as per applicable standards are carried out on the pipe viz. Real-Time Radiography (RTR), Hydro-static testing. Ultra-sonic testing, X-ray/RTR. Visual & dimensional inspection and mechanical and chemical testing.

Spiral Pipe Mill

Spiral Pipe Mill Hot Rolled Coil is first inspected for any lamination using the Ultrasonic Testing Equipment. It is then mounted on the de-coiler & is fed through a series of rollers to flatten and level it, followed by bevelling at both the edges. The bevelled coil is then fed by drive rollers to the formation table where the pipe is formed & followed immediately by inside welding. Then outside welding is performed and transferred to bevelling machine. The finished pipe is then tested by hydro tester as well as other non-destructive testing machine to ensure that all pipes attain desired quality levels Coating Line.

In the multi-layer coating process pipes are blast cleaned and covered with a composed coating of three or more individual layers viz. fusion bonded epoxy coating or anti-corrosion layer followed by an adhesive layer and the top layer which provides the mechanical protection to the pipe. Depending on the pipe diameter, grit blasting is either accomplished by the air blast method or by a blast turbine. The lining is done by means of airless liquid spray coats (cold- or hot applied) or by Fusion Bonded Epoxy (FBE).

Coal tar Enamel coating begins by the pipe being shot blasted to required standard. A synthetic primer is then applied on the steel surface a primer application station, depending upon the production planning control. The pipe is then flooded with hot melted coal tar. Instantly after the initial flooding, the pipe is wrapped with a fibre glass inner wrap. The pipe is then covered by a wrap of reinforced outer wrap. The pipe is then water quenched and is ready for final inspection. The details of which are as below:

- Coal Tar Enamel Coating of 1,500,000 Sq. M
- Layer PE Coating of 2,000,000 Sq. M
- Liquid Epoxy ID Coating of 1,000,000 Sq. M

Configuration of Pipe Mill Division Plants

Table 2-35: Raw Materials Requirement for Pipe Mill

Input	Output
HR Coil from HSM-1: 316,000 TPA	H saw Pipe – 300,000 TPA
Plates – 335,000 TPA	L saw Pipe – 330,000 TPA

Hot Strip Mill -2 (Proposed)

It is proposed to install a semi-continuous Hot Strip Mill for a production of about 6,000,000 tpa of Hot Rolled Coils (HRC). Considering the above yield figure, about 6.12 MTPA of slabs will be required for the

production of 6.0 MTPA of Hot Rolled Coils, of which 5.91 MTPA slab will be used from SMP-3 and 0.21 MTPA slabs shall be procured.

One of the objectives of AMNSI is the production of all grades of flat steel, including auto-body grades having high yield strength. Considering the same, conventional slab caster with downstream HSM has been considered for flat production instead of the compact strip production or thin slab casting and rolling, which

has some grade restrictions. Based on the product-mix and the production programme, the mill with following features has been envisaged:

Major equipment and facilities of the mill will include slab yard equipment, walking beam type slab reheating furnaces, high pressure water descaling system, slab sizing press, roughing mill with attached edger, seven finishing mill stands, run-out roller table with laminar cooling water system, hydraulic down coilers and coil conveyors.

Coil strapping, weighing and marking machines will be provided along with coil inspection, storage and handling systems.

Four (4) nos. of Walking beam type slab Reheating Furnaces have been proposed. Reheating Furnace will use mixed by-product gas as fuel. Burning of the gases would give rise to the emissions of particulates, CO2 and NOx. NOx emissions would be controlled by optimising the excess air supply and proper burner design. In addition, fume extraction (FE) system would be installed. The flue gas, which is fairly clean, would be vented through a stack of adequate height.

The HSM will be designed for rolling low, medium and high carbon steels, API grades, IF steel, dual-phase and multi-phase steels, high strength low alloy steel, AHSS and complex phase.

Additionally, the mill will also be provided with roll shop equipment, cranes, power distribution system and electrics, recirculating water system and utility services, i.e. fuel system, compressor, chiller plant etc.

Table 2-36: Raw Materials Requirement for HSM-2 (Proposed)

Input	Output
Slab from SMP-3 – 59,10,000 TPA	HRC – 60,00,000 TPA
Purchased Slab – 212,400 TPA	
Total Slab – 61,22,400	

2.8.17 Air Separation Unit

Oxygen will be required for oxygen enrichment in the Blast Furnaces, blowing in Basic Oxygen Furnace (BOF) or converting Hot metal, secondary refining, cutting of slabs in continuous casting plant, and for general purpose use in various units of the steel plant. Nitrogen will be mainly required as carrier gas in Pulverised Coal Injection, Bell less top equipment for Blast Furnace, DRI unit and also for occasional purging of fuel gas pipelines and equipment. Argon will be required for shrouding in the tundish and mould in the continuous casting plant, stirring in ladle.

Under the existing environmental clearance, AMNSI has permission to install Air Separation Plant of capacity 424,744 Nm^3/hr. of gaseous Oxygen (9,427 TPD), under which Units for 360,544 Nm^3/hr. has been installed and 1x2200 TPD Unit for 64,200 Nm^3/hr. of gaseous oxygen shall be installed under the proposed expansion.

Air separation: An air separation plant separates atmospheric air into its primary components, typically nitrogen and oxygen, and also argon and other rare inert gases. The most common method for air separation is fractional distillation. Cryogenic air separation units (ASUs) are built to provide nitrogen, oxygen and argon.

Cryogenic Oxygen Plant: A cryogenic oxygen plant is an industrial facility that creates molecular oxygen at relatively high purity. Oxygen is the most common element in the earth's crust and the second largest industrial gas. In steelmaking oxygen is required for the basic oxygen steelmaking. Today, modern basic oxygen steelmaking uses almost two tons of oxygen per ton of steel. The cryogenic air separation achieves high purity oxygen of more than 99.5%. The resulting high purity product can be stored as a liquid and/or filled into cylinders.

2.8.18 Captive Power Plant

Existing

Natural Gas Based Power Plant

Under the existing environment clearance of the plant, AMNSI has permission to install captive power generation facility for 604 MW, under which AMNSI has installed a 475 MW combined cycle Natural gas-based Power Plant and 31 MW power plant. Remaining 1x48 MW by-product based power plant, under the existing EC has been dropped and shall not be installed.

Natural gas being a very clean fuel does not cause any air pollution due to combustion. As can be seen from the analysis report of flue gas emission all the parameters like particulate matter, sulphur dioxide and oxides of nitrogen are well within the permissible limits specified by the MoEF&CC / GPCB.

Table 2-37: Existing Captive Power Generation

Plant / Unit	Captive Generation
Natural Gas Based Captive Power Plant	475 MW
Natural Gas Based Power Plant	31 MW
By-product Gas Based Power Plant	40 MW
TRT with BF#1	10 MW
Total Captive Power Generation	**556 MW**

Proposed

Utilisation of excess By-product gases for Power Generation:

In the process of manufacture of steel in the CO-BF-BOF routes, a large volume of fuel gases are generated from the Coke ovens, Blast furnaces and BOF shops. While these gases are used in various heating applications, there will be a surplus amount of gases that can be used to produce power. The maximum excess by-product gases available at the steel plant for power generation is given below:

Table 2-38: Excess Available By-product Gases for Power Generation

By-product Gases	Generation, N cu m/hr	Consumption in various plant units, N cu m/hr	Balance available for power generation, N cu m/hr
BF Gas	18,67,143	14,66,606	4,00,537
CO Gas	2,17,991	2,17,882	109
BOF Gas	70,455	70,287	168

In this, the surplus gases are burnt in a boiler to raise steam at high pressure which is used to generate power. It can be seen that mainly BF Gas is available for power generation.

The generation of power from the surplus gases is an environment friendly option as it eliminates the use of coal as the fuel for power generation along with its associated environmental problems like emissions of oxides of nitrogen & sulphur and disposal of fly ash.

Top Pressure Recovery Turbine:

The process involved in iron making through Blast Furnace generates considerable quantities of BF gas. The pressure energy in the BF gas will be recovered in top pressure recovery turbine (TRT). BF gas at a pressure

2.5 - 3.0 kg /cm^2 (g) will be generated. A portion of this BF gas will be utilized for generation of steam to fulfill the BF top recovery turbine

In-plant power generation potential from the by-product gases (BF gas, BOF gas and coke oven gas) and BF Top Recovery Turbine are tabulated below:

Table 2-39: Proposed Captive Power Generation

Plant / Unit	Captive Generation
By-product Gas Fired Power Plant	200 MW
Top Pressure Recovery Turbines of BF #2 & 3	50 MW
Total Proposed Captive Power Generation	**250 MW**

The technical profile of the boilers for by-product gas-based power plants is given below in ***Table 2-40***

Table 2-40 - Profile of Boilers

Unit Size	
Maximum continuous rating (MCR), tph	400
Nos. of boilers	2
Fuel to be used	BFG, COG, BOF
Start-up fuel	Natural Gas
Suspended particulate matter in flue gas at the outlet of chimney, mg/N cu m	30
SOx emission	100 mg/N cu m
NOx emission	100 mg/N cu m

The technical profile of the turbo generators for by-product gas-based power plants is given in ***Table 2-41***

Table 2-41 - Profile of Turbine and Generator

Unit Size	
Output under turbine maximum continuous rating (TMCR) at generator terminals, MW	100 MW (Approx.)
Nos. of turbines	2
Cooling medium for condenser	Water
Condenser pressure, ksca	0.10
Circulating water temperature at inlet/outlet of condenser, °C	34/42
Generator:	
Rated output, MW	100 MW (Approx.)
Quantity	2 Nos.
Rated voltage, kV	11
Power factor (Lagging)	0.85
Frequency, Hz	50
No. of phase	3
Stator winding	Direct water cooled
Rotor winding	Direct hydrogen cooled

2.8.19 Waste Heat Recovery based Power Plant

Existing

The existing 25 MW Waste Heat Recovery Power Plant is based on heat Recovery from the exhaust flue gases which are coming out from the HBI Plant. For this purpose, the power plant is provided with one common heat recovery steam generator (HRSG). The HRSG is provided with induced draft fan and stack. The ID fan creates the necessary draft required for the flue gas from tap off point up to fan inlet.

Additional 20 MW power shall be generated from Coke Dry Quenching (CDQ) facility with CO Battery# 1 &2 after the commissioning of Battery# 1 & 2.

Proposed

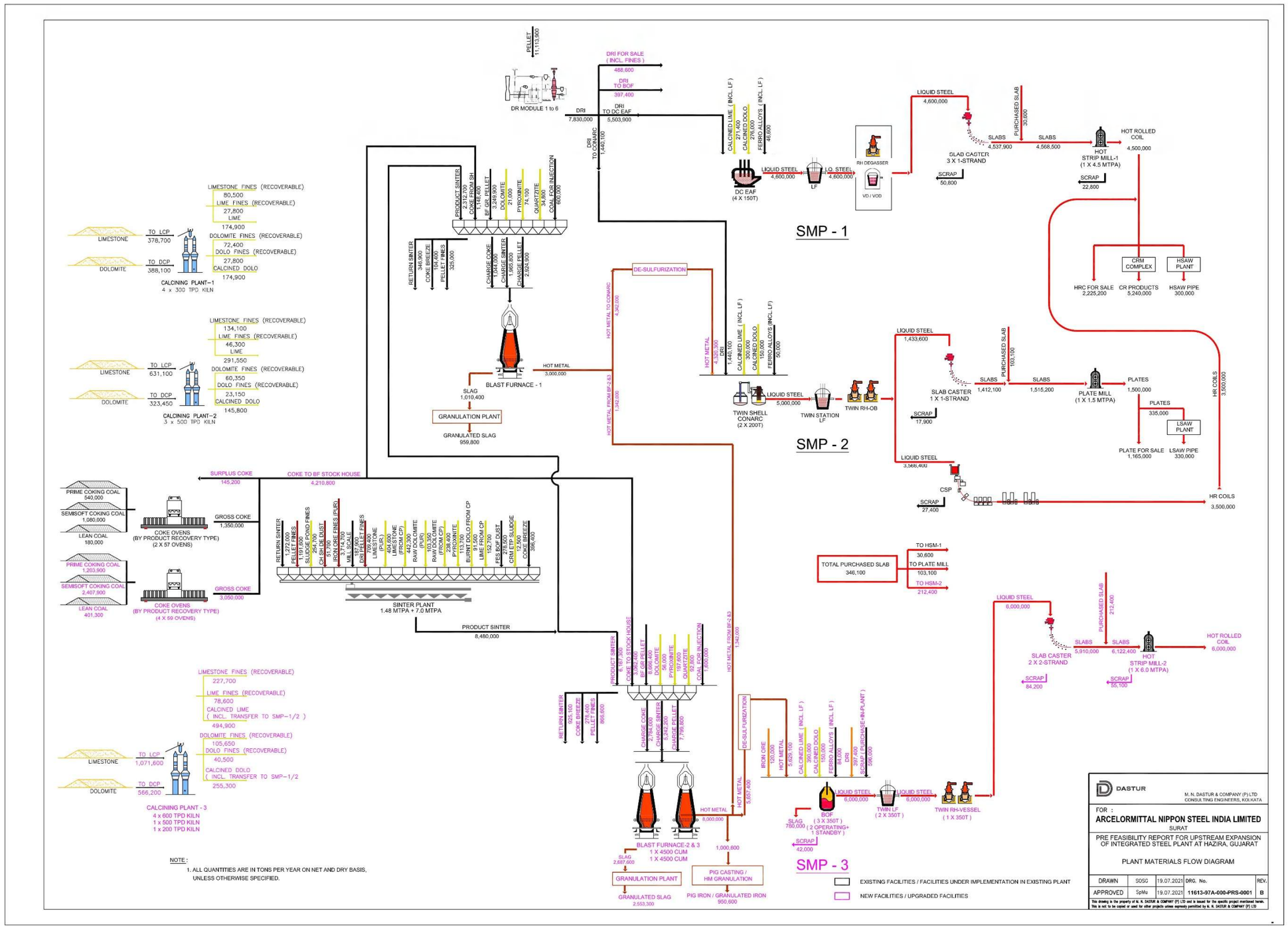
Under the proposed expansion 100 MW power shall be produced from the Coke Dry Quenching (CDQ) facility proposed with CO Batteries # 3,4,5 & 6

Table 2-42: Waste Heat Recovery Power Generation from Existing & Proposed Facilities:

Unit	Existing	Proposed
WHRB with HBI Unit 1 to 4	25 MW	--
CDQ with CO Battery # 1 & 2 (Under installation EC 2016)	20 MW	--
CDQ with CO Battery # 3,4,5 & 6	--	100 MW
Total	**45 MW**	**100 MW**
Total Power Generation from WHRB	**145 MW**	

The flow diagram showing the entire process description and mass balance is attached as ***Figure 2-1***

Figure 2-1: Proces flow diagram alongwith Mass Balance



2.8.20 Water Requirement

Cooling water is required for steelmaking and casting which are heat intensive processes. Process water losses will be compensated by adding make-up water of respective qualities.

For the existing plant, raw water is sourced from river Tapi and the requirement is around 145,838 KLD (Approx. 32.08 million of gallons per day (MGD)). For the proposed expansion, additional requirement of raw water will be around 81,600 KLD (approx. 17.95 MGD) which needs to be sourced from river Tapi. Hence total water requirement after expansion will be around 227,439 KLD (approx. 50.03 MGD).

The water permission from the Narmada Water Resources Water Supply and Kalpsar Department Division Surat for drawl of 87 MGD. is enclosed as ***Annexure 6***

Hazira Industrial Authority (HAIA) has taken up a project for tertiary treatment of biologically treated sewage water (Tertiary Treated Water or TTW) which will be supplied to various industries as make-up water. This project is under implementation and water from TTW source will be gradually available at a later stage. Hence to cater to the requirement of this expansion, the total raw water requirement has to be sourced from Tapi river. Water withdrawal from river Tapi will be gradually reduced as ~ 75000 KLD TTW is made available.

The raw water drawn from river Tapi will be treated in the raw water treatment plant (RWTP) to generate make-up grade water. This grade of water will be supplied as make-up water to the various consumers of the plant water system through the make-up water pump house. The sludge generated from raw water treatment plant will be used for area levelling in horticulture.

Unit wise water requirement for the existing plant, and for the modification project and for the proposed expansion is given below:

Table 2-43: Water Requirement for Existing Plant and at the end of Expansion

Unit	Water Requirement for Existing Units m^3/day	Water Requirement at the end of Expansion m^3/day	Remark
Industrial Water			
CPP	2649	0	31MW CPP will be relocated and water accounted in Power plant gas Based
WHRB 25 MW	2159	4318	Including WHRB#20 MW
Blast Furnace #1	7308	6408*	*900 m3/day recycled from HBI# 1-4
Sinter Plant	1096	0	1096 m3/day recycled from BF#1
Jetty	3044	3044	
HBI 1 to 4	6863	6863	
HBI 5&6	7921	7921	
Other Ancillaries	3500	3500	
Oxygen Plants	7619	7619	
Lime Plant	240	240	
SMP-1	13126	13126	
HSM	8063	8063	

Unit	Water Requirement for Existing Units m^3/day	Water Requirement at the end of Expansion m^3/day	Remark
CRM #1	2535	2535	
CRM#2	--	9696	
Plate Mill	3564	3564	
Pipe Mill	547	547	
Corex 1 &2	4675	0	
SMP-2	14986	14986	
CSP Mill	6246	6246	
Power Plant Bhander	37634	37634	
Coke Ovens #1&2	--	11760	
Expansion Projects			
Coke Ovens# 3,4,5 &6	--	20520	
Blast Furnace #3	--	7680	
Sinter Plant #3	--	768	1152 m3/day recycled from BF#3
Sinter Plant #2	--	1200	
Blast Furnace #2	--	7680	
Lime Plant #3	--	120	
BOF with Caster	--	13920	
HSM#2	--	13920	
RMHS & Others	--	3360	
Chillar Plant	--	3840	
ASU New (Under EC16)	--	3000	
Power Plant (Gas Based)	--	12480	including relocated CPP 31 MW
Miscellaneous		720	
Firefighting		720	
Total Industrial Water	**133775**	**237998**	
Domestic Water			
Drinking Water to Plant	200	200	
Drinking water to plant	880	880	
Drinking Water to Township	6027	6027	
Drinking water to Plant	1555	1555	
Drinking water to Plant & CSR	3402	3402	

Unit	Water Requirement for Existing Units m^3/day	Water Requirement at the end of Expansion m^3/day	Remark
Drinking water to plant	--	1680	
Total Domestic Water	**12064**	**13744**	
GRAND TOTAL	**145839**	**251742**	
Recycled Water	**0**	**27753**	
Total Make-up Water	**145839**	**223989**	
Additional Make-up Water		78150 (3256 m^3/hr.)	
Additional raw water requirement at plant boundary (considering losses in reservoir and RWTP)		81600 (3400 m^3/hr.)	
TOTAL WATER REQUIREMENT AFTER EXPANSION		**227,439 m^3/day**	

After the proposed expansion there will be two Reservoirs for storage of water:

- HRC Reservoir – 3,60,000 cubic meters
- New Reservoirs – 2,50,000 cubic meters

Figure 2-2: Water Balance Diagram for the Existing Plant

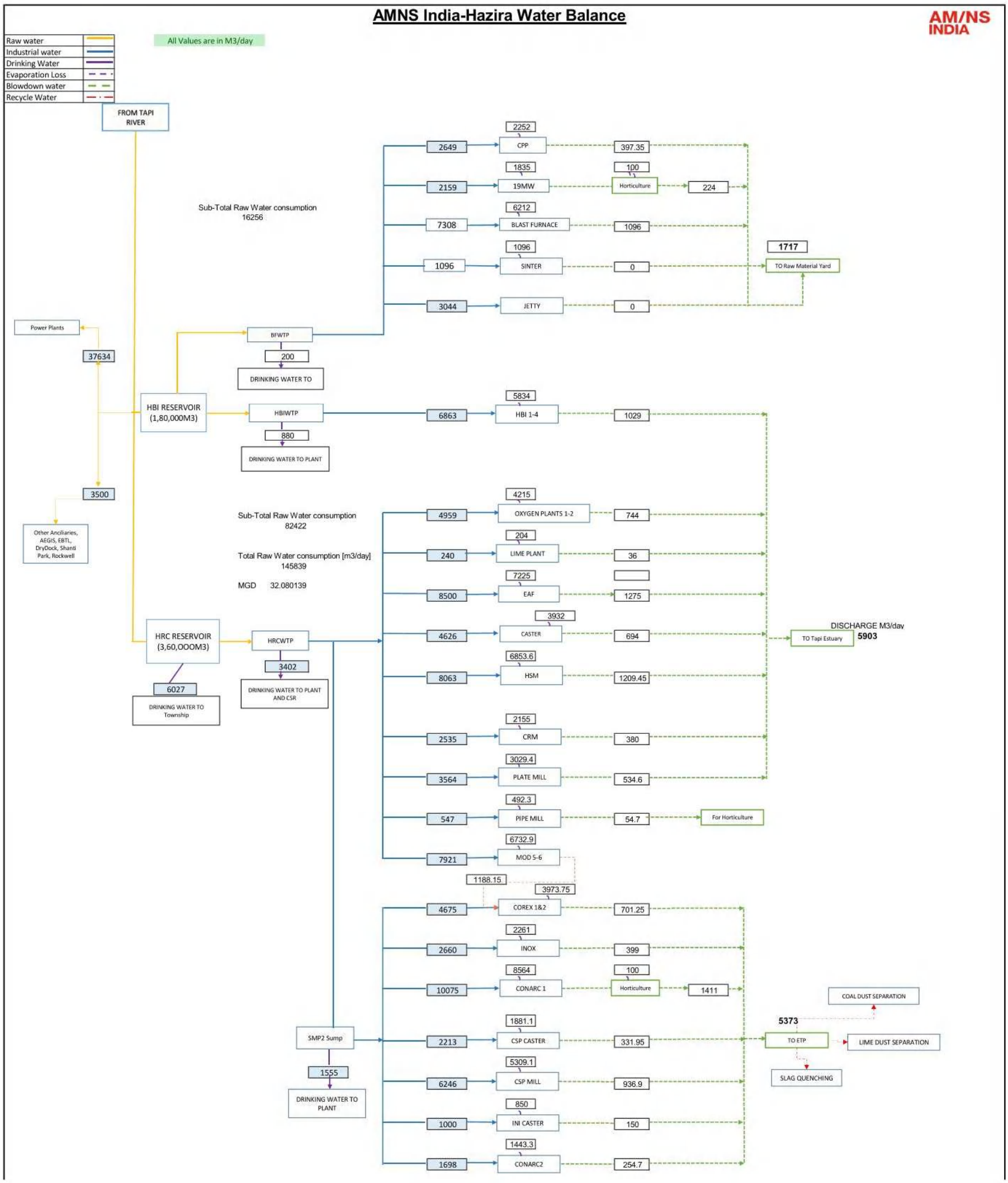
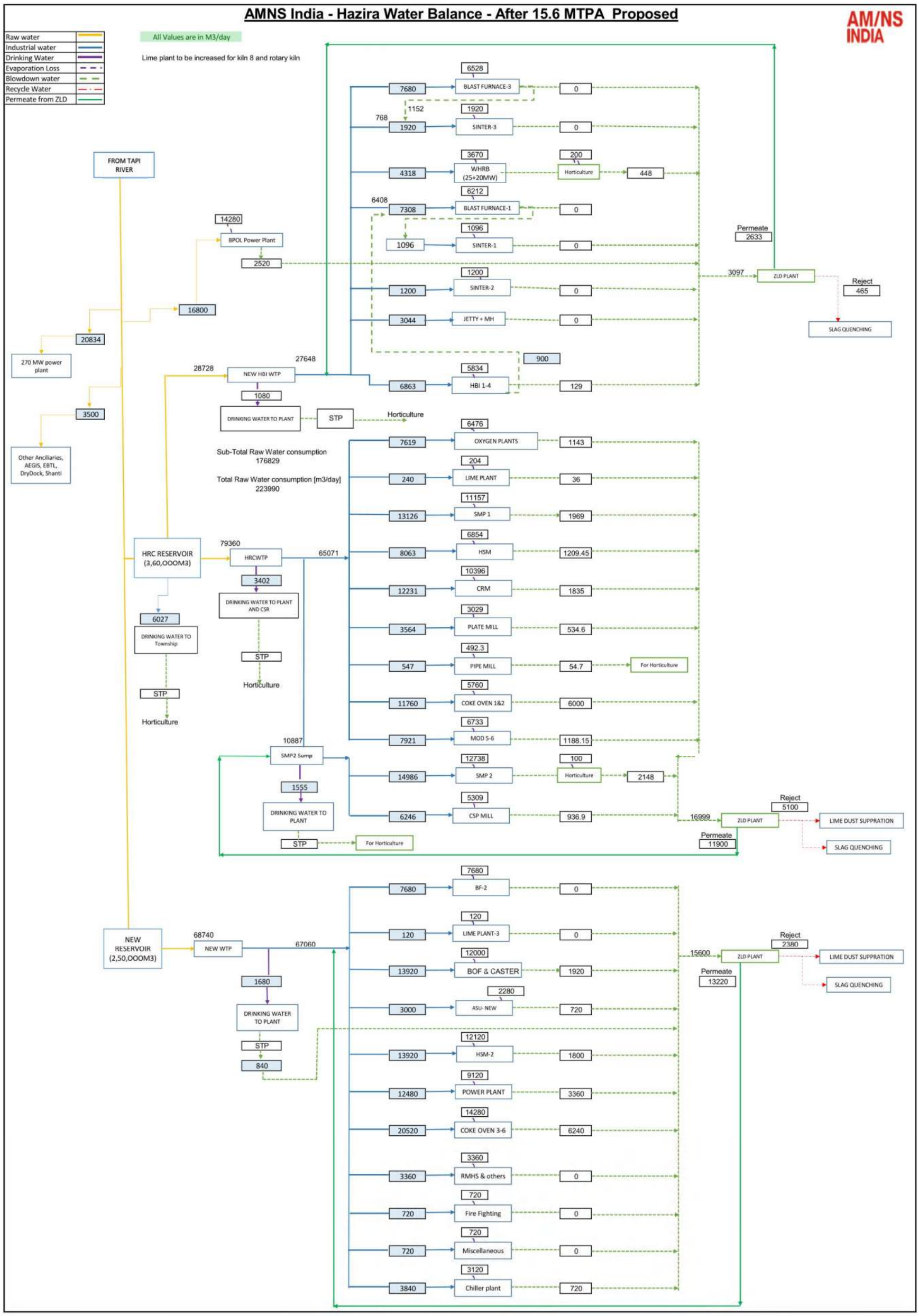


Figure 2-3: Water Balance Diagram after 15.6 MTPA Proposed Expansion



2.8.21 Reuse of Treated Waste Water (TWW) from Surat Municipal Corporation:

Based on Government of Gujarat Re-use of Treated Waste Water (TWW) policy '2018, the re-use of treated municipal waste water for Industrial use is planned by Surat Municipal Corporation with the objective of conserving fresh water intake from Tapi river and preserving water bodies from urban pollution.

Considering the magnitude of sewage generated in Surat city from 11 sewage Treatment plants, Surat Municipal Corporation conducted a survey to identify the water intensive industries in the vicinity of city area. Based on its proximity to STP locations, industrial areas were divided in to Zones / clusters.

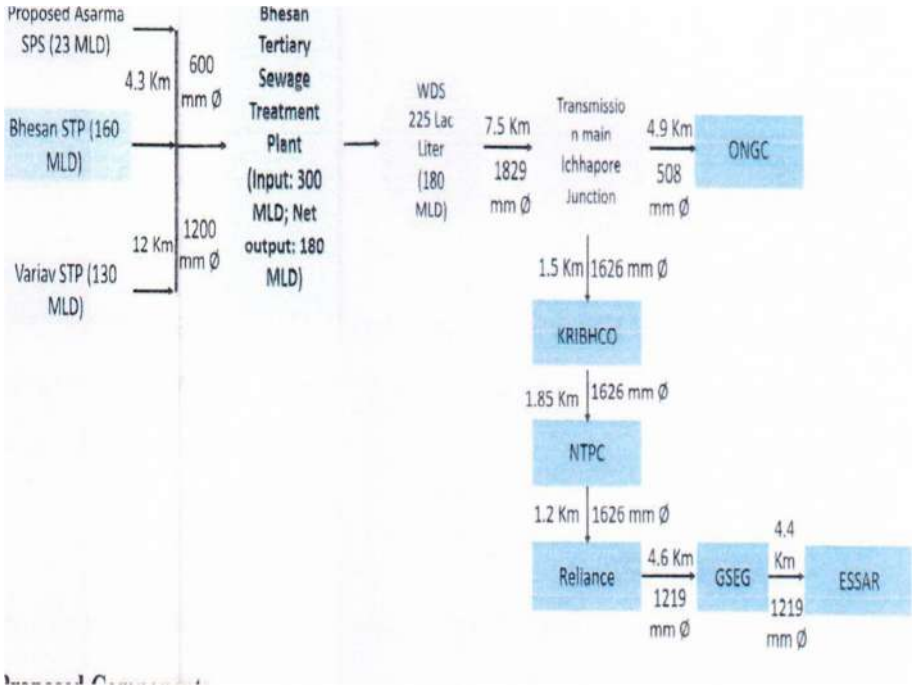
The project will be implemented through Special Purpose Vehicle (SPV) mode for major Hazira Industrial consumers. Hazira Notified Area Authority (GIDC) will be Nodal Agency for implementing this project. AMNSI, Hazira has given concurrence to Hazira Notified Area Authority to participate in the project for utilization of 75,000 KLD of treated Waste water on payment basis.

AMNSI area falls under Bhesan cluster which is at a distance of 24 Km. From Bhesan to AMNSI, the treated wastewater is supplied through 1219 mm diameter pipe line. The existing STP plant located at Bhesan was based on conventional Activated Sludge process which is upgrade to Integrated Fixed Film Activated Sludge Process (IFAS). Also new 100 MLD sewage treatment plant is under augmentation to Oxidation Ditch process to Biological Nutrient Removal(BNR).

Table 2-44: Quality of the treated sewage parameters for Bhesan Sewage Treatment plant

S. No.	Parameters	Unit	Treated Effluent
1	PH		6.9 – 7.5
2	BOD	mgl	< 10
3	COD	mgl	< 50
4	SS	mgl	< 20

Figure 2-4: Detailed pumping scheme



The entire project including tertiary treatment and treated wastewater supply pipeline network will be implemented by SPV and the total cost of the project around Rs. 955 Crores for 185 MLD total capacity. All the consumers will contribute the capital cost based on their registered demand. After commissioning of this scheme, the raw water requirement for AMNSI from the current Tapi river scheme will be reduced accordingly.

2.8.22 Waste Water Generation & Management

Total waste water generation from expansion units will be around 650 m^3/hr, i.e. 15,600 cum/day (waste water generation from the proposed Units are given in the ***Table 2-45***

Table 2-45: Waste Water Generation from the Facilities Under the Expansion

Sl. No.	Plant Unit	Effluent water in m^3/hr
1.	Coke oven by-product plant with CDQ PP	260
2.	SMS	80
3.	HSM	75
4.	Power plant (Gas based CPP)	90
5.	Air separation plant	30
6.	Chilled water plant	30
7.	Softening and DM plant regeneration waste	50
8.	Treated sewage from new STP	35
	Total	**650**

Waste water generated from the proposed expansion units of the plant will be treated in suitable treatment facilities and recycled back to the process to attain 'zero' discharge, facilitating adequate re-use of water in the respective recirculating systems, and economizing on the make-up water requirement.

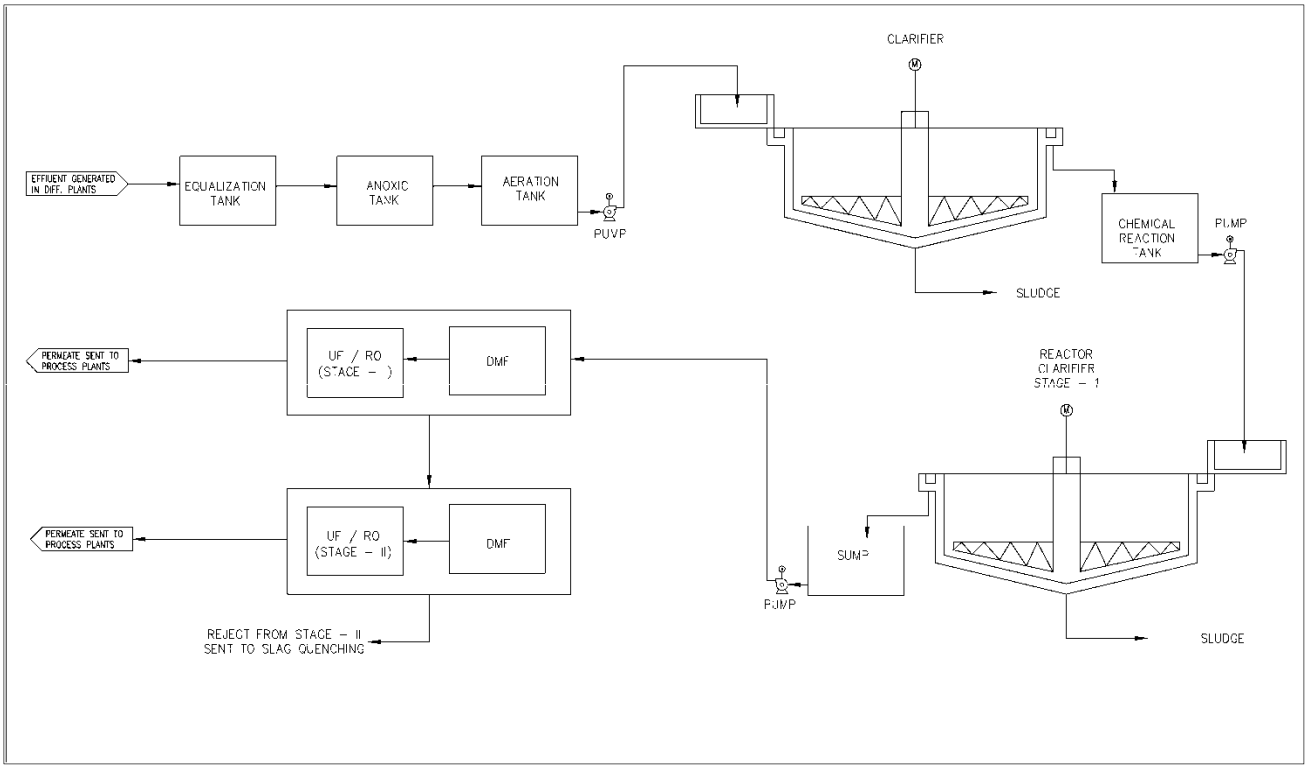
A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of 650 cu m/hr. and BOD Plants of capacities 137 cum/hr. and 275 cum/hr.

The permeate from CETP will be sent to BF and SMS as make-up to cooling tower. Reject generated in the RO plant will be partly used after dilution for sprinkler type suppression at raw material storage yard and balance will be fed to the evaporator-crystallizer. Sludge and salts generated in the CETP will be disposed at approved TSDF.

Storm Water Management

Open type drain has been envisaged for the plant storm water drainage. The drains will be laid generally by the side of the roads. Storm water run-off, collected through arterial and trunk drain as well as from the high-rise buildings, will be collected in a storm water pond and pumped back to the raw water reservoir/treatment plant.

Figure 2-5: Schematic Diagram of 650 m³/hr. Proposed ETP



2.8.23 Sewage Treatment

For existing plant, there are three STPs to treat domestic effluent generated from plant and residence, one with a capacity 480 KLD inside the plant premises and two numbers inside the township with capacities of 1000 KLD and 600 KLD. STP treated water will be used for gardening purpose.

Sewage generated from various expansion plant units will be treated in sewage treatment plants. Sewage generated from the plant units located at the western side of the Hazira steel plant, i.e. BF-2, SMS, HSM, power plant, ASP and other miscellaneous areas, will be transferred to a new sewage treatment plant of capacity 1000 KLD, to be located in the north side of the plant through gravity type sewerage network. Sewage lift pumphouse will be provided wherever required. Treated effluent from the sewage treatment plant will be further treated in CETP.

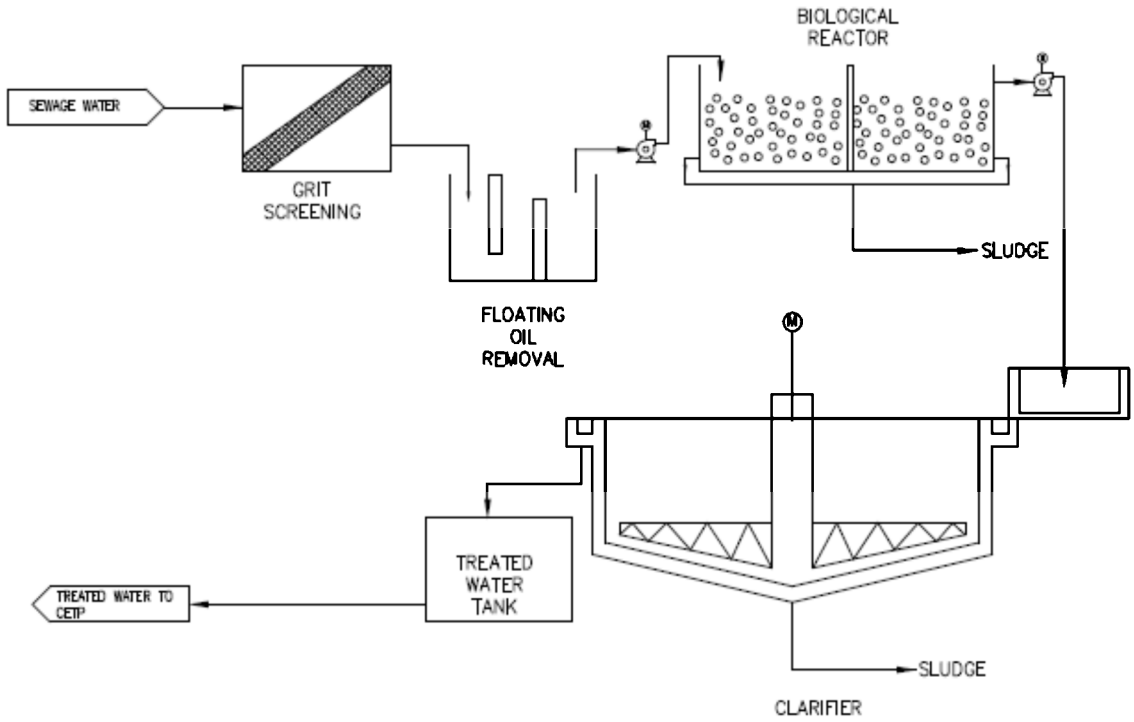
Sewage generated in COBP, BF-3 and RMHS area will be treated in existing STP in township after augmentation. Sewage from COBP plant will be transferred to the STP through sewerage network.

From balance areas, sewage will be transported through tankers.

Sewage generated from various expansion plant units will be treated in sewage treatment plants. Sewage generated from the plant units located at the western side of the Hazira steel plant, i.e. BF-2, SMS, HSM, power plant, ASP and other miscellaneous areas, will be transferred to a new sewage treatment plant with capacity of 1000 KLD to be located in the north side of the plant through gravity type sewerage network. Sewage lift pumphouse will be provided wherever required. Treated effluent from the sewage treatment plant will be further treated in CETP.

Sewage generated in COBP, BF-3 and RMHS area will be treated in existing STP in township after augmentation. Sewage from COBP plant will be transferred to the STP through sewerage network. From balance areas, sewage will be transported through tankers

Figure 2-6: Schematic Diagram for Proposed STP of 1000 m³/day (Generation 840 KLD)



2.8.24 Power Requirement and Source

The power requirements of the steel plant will be met from the following two sources, namely:

- The captive power generation
- Grid power: NTPC Jhanor-Gandhar Power Plant through WRLDC grid.

Table 2-46: Power Requirement for the Existing and Proposed Facilities

Sl. No.	Plant / Product	Average power in MW		
		Existing	Proposed expansion	Total
1	HBI Plant (DRI Mod I to VI)	120	0	120
2	Blast Furnace (BF)	15	131	146
3	Sinter plant	9	35	44
4	Coke Oven (Recovery Type)	0	30	30
5	Air Separation Plant	130	37	167
6	SMS-1 (EAF 4 Nos.)	400	0	400
7	SMS-3 (BOF- 3 nos.)	0	61	61
8	SMS-2	160	0	160
9	Corex Plant	15	-15	0
10	Lime Plant (Lime/Dolime)	4	6	10
11	Plate Mill	35	0	35
12	CSP and HRC	80	81	161
13	CRM	30	0	30

Sl. No.	Plant / Product	Average power in MW		
		Existing	Proposed expansion	Total
14	Pipe Mill	5	0	5
15	Auxiliary	35	44	79
16	Modification projects	125		125
Total		**1163**	**410**	**1573**

Captive Power Generation

The captive power generation units are given below in ***Table 2-47***

Table 2-47: Captive Power Generation Units

Plant Unit	Capacity
Existing	
Gas Based Power Plant	525 MW
Gas based Captive Power Plant	31 MW
By product gas power plant	40 MW
TRT BF #1	10 MW
By-product Gas based Power Plant (*Not implemented and it will be dropped)	48 MW*
Waste Heat Recovery Power Plant (25 MW implemented + *20 MW to be implemented)	45 MW#
Proposed	
By-product Gas Fired Power Plant (Proposed)	2 x 100 MW (Approx.)
BF Top Recovery Turbine (Proposed)	Proposed BF-2 x 25 MW (Approx.)
Coke Dry Quenching (CDQ) (Proposed)	100 MW (Approx.)
Total Captive Power Generation	**951 MW**
Available Power from inplant Generation	**810 MW**

Power Balance

The power balance is given in ***Table 2-48.*** The power balance depicts the firm sent-out capability of the in-plant power generating units. The TRT generator for BF-2 has been envisaged to be connected to BF-2 LBSS which in turn connected to MRSS-3 while the TRT for BF-3 has been envisaged to evacuate power to existing power distribution system through BF-3 LBSS.

The balance power demand that will have to be met from the respective grids is given below in ***Table 2-48***

Table 2-48: Power Balance

Plant Unit	MW
Power demand of steel plant for proposed facilities	410 (average)
Power demand of steel plant for existing facilities	1163
Total power demand	1573
In-plant generation available from generator installed	810

Balance power	**763**
Power drawn from adjacent Third Party	243
Balance to be imported from Grid	520

2.8.25 Fuel Requirement

Natural gas and the generated by-product gases, i.e. Blast Furnace (BF) gas, Coke Oven (CO) gas, Tail gas and BOF gas will be used as fuel for various heating applications (BF stove heating, Rolling Mill Reheatiing Furnaces, Sinter Plant, Calcination Plant etc.) of the steel plant. Balance available gases will be utilized for steam and power generation in the Power Plant.

The by-product fuel gas generation and consumption figures for the project is given in the ***Table 2-49***

Table 2-49: By-Product Gas balance

By-product Gases	**Generation, N cu m/hr**	**Consumption in various plant units, N cu m/hr**	**Balance available for power generation, N cu m/hr**
BF Gas	18,67,143	14,66,606	4,00,537
CO Gas	2,17,991	2,17,882	109
BOF Gas	70,455	70,287	168
Tailgas	30,000	29,950	50

Natural gas (NG) will also be required as sub-pilot/pilot fuel for flare stacks, for heating and cutting /slabs in casters, and as a start-up fuel for furnaces/boiler, as fuel in different plant facilities and in DRI 1-6 as reducing gas. For this purpose, approx. 3,60,000 Nm^3/hour of Natural Gas of CV 8967 Kcal/Nm3 will be required.

After expansion Gas balance is given in the ***Table 2-51***

To store the various by-product gases coming out from the SMS, Blast Furnace and Coke Oven plants, BOF, BF and CO gas holders of suitable capacities are required. These stored by-product gases will be utilized in various process facilities in the steel plant. The required capacities of gas holders are given below in ***Table 2-50***

Table 2-50: Gas Holders for Storage of By-product Gases

Holder Name	**Capacity (Cub. m)**	**Remarks**
BF Gas Holder	1,35,000	Existing
BOF Gas Holder	100,000	New
CO Gas Holder	50,000	New
Corex Gas Holder*	60,000	Existing
Tail Gas Holders	2 x 10,000	Existing
*Although the Corex Plant for steel production will be mothballed, its gas holder will continue to use as a resource conservation measure and will store gas from other plants. However, the gas holder related risks/consequences are covered in this report		

Table 2-51: Gas Balance after Expansion

AMNSI HAZIRA - FUEL BALANCE AFTER PH - 1

GENERATION	Yield	Production	Calorific Value	C. O. Gas			Blast Furnaces gas			Natural Gas			Tail Gas			LD Gas		
	Nm3 / T	000 tons	Kcal / Ncum	M Ncum	Nm3 / hr	Gcal	M Ncum	Nm3 / hr	Gcal	M Ncum	Nm3 / hr	Gcal	M Ncum	Nm3 / hr	Gcal	M Ncum	Nm3 / hr	Gcal
1a. Coke plant (Dry coke basis)	434	4400	4300	1910	217991	8211280												
2a. Existing Blast Furnace - 1 (relined)	1380	3000	970				4140	492857	4015800									
2b. New Blast Furnace - 3	1443	4000	900				5772	687143	5194800									
2c. New blast furnace - 2	1443	4000	900				5772	687143	5194800									
3. New SMS	93	6000	1750													558	70455	976500
4. Tail gas			1050											30000				
Avg CV CO Gas for coke oven plant			4300															
Avg CV of Natural Gas			8967															
Avg of CV BF Gas (for Blast furnace - 1, 2 & 3)			918															
Avg CV of tail gas			1050															
Avg CV of LD gas			1750															
Total Generation				1910	217991	8211280	15684	1867143	14405400					30000		558	70455	976500

CONSUMPTION	No. of opearing days	Production 000 tons	Specific Consumption Gcal / ton															
1. Coke plant(Dry coke basis)	365	4400	0.935	189	21597	813520	3595	410345	3235161	0	0	0	0	0	0	0	0	0
2a. Existing Sinter Plant	330	1480	0.023	2	198	6729	30	3754	27311	0	0	0				0	0	0
2b. Sinter plant under implementation in existing plant	330	7000	0.015	5	610	20758	92	11581	82548	0	0	0				0	0	0
3a. Existing Blast Furnace - 1 (Stove ,boiler & PCI)	350	3000	0.730	0	0	0	2384	283855	2190000	0	0	0				0	0	0
3b. New blast furnace - 2	350	4000	0.400	0	0	0	1742	207383	1567812	0	0	0				0	0	0
3b. New blast furnace - 3	350	4000	0.400	0	0	0	1742	207383	1567812	0	0	0				0	0	0
4. SMS Shop																	0	
4a. Existing SMP -1	310	4600	0.050	0	0	0	0	0	0	26	3448	230000				0	0	0
4b. Existing SMP -2	320	5000	0.050	12	1624	53616	0	0	0	0	0	0				112	14612	196384
4c. New SMS	330	6000	0.036	11	1360	46324	0	0	0	0	0	0	0	0	0	0	12242	0
5a. Existing Tunnel Furnace	330	3500	0.183	103	13028	443673	214	27058	196827	0	0	0				0	0	0
5b. New Hot strip mill	320	6000	0.290	244	31708	1047133	603	78559	542998	15	2014	0				0	0	0
5c1. Hot Strip Mill (EXISTING) (By NG)	330	3600	0.134	0	0	0	0	0	0	54	6801	482978				0	0	0
5c2. Hot Strip Mill (EXISTING) (By MG)	330	4500	0.223	162	20396	694622	336	42362	308155	0	0	0				0	0	0
6a. Existing LCP - 1	343	412	0.860	0	0	0	0	0	0	39	4795	353976				0	0	0
6b. Existing LCP - 2	343	515	0.860	71	8659	306498	148	17984	135972	0	0	0	0	0	0	0	0	0
6c. New LCP (4 * 600 TPD)	345	828	0.860	36	4289	152715	0	0	0							320	38603	559365
6c. New LCP (500 TPD + 200 TPD)	345	242	0.860	17	2008	71507	0	0	0	12	1442	107081				17	2008	29102
7a. Existing Plate mill (By NG)	330	1500	0.137	0	0	0	0	0	0	23	2889	205200				0	0	0
7b. Existing Plate mill (By MG)	330	1500	0.547	121	15260	519694	110	13882	100981	0	0	0	158	19950	165908	20	2469	34217
8. Existing CRM	330	2040		0	0	0	0	0	0	20	2470	175417				0	0	0
9. Existing DRI 1 (Process - Only COG for reduction)	330	935	0.310	67	8500	289476				0	0	0				0	0	0
9a. Existing DRI 1 (balance process & heating - Only NG)	330	935	2.147	0	0	0				224	28262	2007168				0	0	0
10. Existing DRI 2 (Process- Only COG for reduction)	330	935	0.310	67	8500	289476				0	0	0				0	0	0
10a. Existing DRI 2 (balance process & heating - Only NG)	330	935	2.147	0	0	0				224	28262	2007168				0	0	0
11. Existing DRI 3 (Process- Only COG for reduction)	330	935	0.310	67	8500	289476				0	0	0				0	0	0
11a. Existing DRI 3 (balance process & heating - Only NG)	330	935	2.147	0	0	0				224	28262	2007168				0	0	0
12. Existing DRI 4 (Process- Only COG for reduction)	330	1169	0.248	67	8500	289476				0	0	0				0	0	0
12a. Existing DRI 4 (balance process & heating - Only NG)	330	1169	2.209	0	0	0				288	36347	2581329				0	0	0
13. Existing DRI 5 (Process- Only COG for reduction)	330	1870	0.237	103	13000	442728	0	0	0	0	0	0	0	0	0	0	0	0
13a. Existing DRI 5 (Mixed gas for heating)	330	1870	0.467	141	17764	604988	292	36895	268390	0	0	0	0	0	0	0	0	0
13b. Existing DRI 5 (balance process & heating - Only NG)	330	1870	1.634	0	0	0				341	43012	3054670				0	0	0
14. Existing DRI 6 (Process- Only COG for reduction)	330	1987	0.223	103	13000	442728	0	0	0	0	0	0	0	0	0	0	0	0
14a. Existing DRI 6 (Mixed gas for heating)	330	1987	0.440	141	17764	604988	292	36895	268390	0	0	0	0	0	0	0	0	0
14b. Existing DRI 6 (balance process & heating - Only NG)	330	1987	1.675	0	0	0				371	46859	3327844				0	0	0
15. Existing Pipe mill	300	630	0.017							1	166	10710						
16. Existing BPOL	365									951	108593	8530081						
17. Existing Rotary lime klin	350		1.300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18. Existing 19 MW/CPP-1								70000										
19. New CRM#2	330	3020		0	0	0	0	0	0	81	10288	730642				0	0	0
20. New granulation unit	350	951	0.020	4	526	19011	0	0	0	0	0	0	0	0	0	0	0	0
20. Line loss/vent				10	1090	41056	157	18671	144054	0	44	3106	79	10000	83160	3	352	4883
Total Consumption				1742	217882	7490194	11737	1466606	10636410	2894	353955	25814539		29950		471	70287	823950
Remaining Gas				168	109	721086	3947	400537	3625352					50		87	168	152550
Gas Available for boilers				168	109	721086	3947	400537	3625352					50		87	168	152550

2.8.26 Energy

Specific Energy consumption of the plant is about 6.6 Gcal/ton of liquid steel. The plant has taken following energy conservations measures under the proposed expansion project:

- Top Recovery Gas Turbines with Blast Furnaces for power generation by utilising BF gas pressure. Approx. 50 MW Power will be generated from the proposed TRT installation
- Coke Dry Quernching with Waste Heat Recovery Boilers shall be installed. Approx. 100 MW power will be generated from the proposed CDQ Facilities
- By-product gases shall be used as fuel in various applications in the plant. Balance by-product gases will be used for power generation. Approx. 200 MW Power will be generated by utilising by-product gases.
- Pulverised Coal Injection proposed with the Blast Furnaces, which will reduce the frequirement of almost equal quantity of Coke in the Blast Furnace, thus reduce the energy requirement of the plant.
- Hot air from Siter Plant will be utilised for heating of combustion air to save fuel and steam generation, to be used in process.
- BF Stoves flue gases will be used for heating combustion air.

After the proposed expansion, specific energy consumption of the plant is expected to be around 6.1 Gcal/ton of liquid steel.

2.8.27 Manpower Requirement

Estimated direct and indirect manpower required during operation phase, after the proposed expansion is given in ***Table 2-52***

Table 2-52: Manpower Requirement during Operation Phase

Details	Direct	Indirect	Total
Existing Manpower	7,700	5,800	13,500
Manpower required for Modification Project	1,000	770	1,770
Manpower required for Expansion Project	1,750	5,250	7,000
Total Manpower requirement	10,450	11,820	22,270

The proposed project would engage in recruitment of local skilled, semi-skilled and unskilled workers thereby contributing positively towards local employment and income.

Total manpower required for the proposed project during construction phase under direct and indirect employment is 500 and 15,000 respectively.

Growth of indirect employment opportunities due to development of ancillary industries is also envisaged.

2.9 Land Requirement

The area requirement for the proposed plant has been minimized since the infrastructure and auxiliary facilities are already existing. The existing plant area is 750.18 Ha and the total land required after proposed expansion will be 824.82 Ha

Land required for proposed expansion: 147.17 Ha
It will comprise of the following:

- 65.73 Ha Forest land (Stage II clearance available & end use change under process)
- 8.91 Ha private land direct purchase from Land owners

- 72.53 Ha area will be used from existing plant area

2.10 Infrastructure Facility

Infrastructure facilities such as rest room, sanitation facility will be provided in all the plant for the workers. A separate area having facilities like truck parking, canteen/dining, rest room, wash room, first aid, communication facility, ATM, safety training center, studio etc. is allocated for truck drivers

2.11 Capital Cost of the Project

Capital cost of the project is estimated as Rs. 35,145 Crores.

2.12 Description of mitigation measures incorporated into the project to meet environmental standards, environmental operating conditions, or other EIA requirements

The following mitigation measures have been envisaged for the proposed plant which will meet the relevant environmental standards:

Sl. No.	Unit	Pollution Control Systems
Air Pollution Control System		
1.	Coke Ovens	HPLA System for charging emission control Land based pushing emission Control Hydrojet door and door frame cleaner Water seal AP Caps Bag Filter system with Coal Crusher Bag Filter system with Coke Crusher Multicyclone with Bag Filter with Coke Dry Quenching
2.	Sinter Plant	Dry type flue gas emission control (MEROS or Equivelent) Space dedusting Bag filters for Material handling Areas
3.	Blast Furnace	Dry type GCP with Dust Catcher Cast House dedusting system Stock house dedusting sysrem
4.	SMS (BOF)	Fume Extraction System with Dog House Dry type GCP Bag Filter with Desulphurisation Unit
5.	Calcination Plant	Bag filters with Kilns Bag Filters with Screens
Water Pollution Control Systems		
1	Coke Ovens	BOD Plant for Coke Oven effluent
2	For all Units	CETP of 650 m^3/hr.
3	For Western side of the Plant	STP (New)of 1000 m^3/Day.
Solid waste management		

Sl. No.	Unit	Pollution Control Systems
1.	Coal Fines	Coal Briquetting plant
2.	Pellet fines, BF Fines and process dust, lime fines and ETP sludge	Micro pellet plant
3.	Mill scale	Mill scale Brique plant
4.	Steel slag	Metal and flux recovery plant
5.	HBi & DRI fines, BF Dust	Magnetic separation + Ferrous briquetting plant
6.	Lime stone chips	Rotary kiln
Others		
1	Raw Material Yard	RCC flooring for all Stock Piles

2.13 Assessment of New & Untested Technology for The Risk of Technological Failure

Technology for production of steel through Blast Furnace, Basic Oxygen Furnace and Casting (BF-BOF-CCM) route is well established and working in India and elsewhere in the World. Hence, there is no risk of technology failiure due to the project.

2.14 Demolition and Relocation Plan

Details of Demoliion and Relocation due to proposed expansion is given in ***Table 2-53***.

Table 2-53: Details of Demolition and Relocation

Sl. No.	Facilities	Relocation / Demolition	Qty Civil Debris, m^3	Qty. Structural Scrap (Steel +Rebar) Ton	Land Filing, m^3	Qty. Elec-tircal waste, kg	Debris disposal plan	Relocation Plan
1	Water Reservoir Filling	Relocation	0	0	130000	0	Land will be levelled with demolition waste	Adequate Size of water reservoir is planned in expansion area
2	Demolition of Briquette house (Guest House)	Demolition	12000	600	0	1800	Debris will be used to fill the land, structural scrap and other scrap shall be recycled. Electrical waste (Lighting and Cables etc.)	Relocation is not required as alternate facility is available

Sl. No.	Facilities	Relocation / Demolition	Qty Civil Debris, m^3	Qty. Structural Scrap (Steel +Rebar) Ton	Land Filing, m^3	Qty. Elec-tircal waste, kg	Debris disposal plan	Relocation Plan
							shall be sold to authorised agencies for recycling/disposal.	
3	CPP 31 MW power Plant	Relocation	3000	1495	0	3400	Debris will be used to fill the land, structural scrap and other scrap shall be recycled. Equipment shall be reused. Electrical waste (Lighting and Cables etc.) shall be sold to authorised agencies for recycling/disposal.	Turbine and other equipment shall be relocated along with other waste heat recovery power plant
4	Santusthi Building	Demolition	4500	300	0	1200	Debris will be used to fill the land, structural scrap and other scrap shall be recycled.	Relocation is not required as it is an abandoned old office building
5	Slag quenching processing area	Relocation	500	1556	0	0	Civil debris shall be used for land filling	New area for Slag quenching and processing is Planed in expansion
6	MRSS-2	Relocation	600	50	0	0	Civil debris shall be used for land filling and structural scrap shall be recycled	MRSS#2 relocation is planned in Expansion
7	Marshalling Yard Shifting	Relocation	20000	1500	0	1600	Debris will be used to fill the land, structural	All FG dispatch shall be

Sl. No.	Facilities	Relocation / Demolition	Qty Civil Debris, m^3	Qty. Structural Scrap (Steel +Rebar) Ton	Land Filing, m^3	Qty. Elec-tircal waste, kg	Debris disposal plan	Relocation Plan
							scrap shall be recycled. Electrical waste (Lighting and Cables etc.) shall be sold to authorised agencies for recycling/disposal.	done directly from Plant.
8	Nand Vihar (Bachelor's accommodation) and Academy	Demolition	2500	1500	15000	1200	Debris will be used to fill the land, structural scrap and other scrap shall be recycled. (Lighting and Cables etc.) shall be sold to authorised agencies for recycling/disposal.	Unutilised facilities
9	Administrative building Dismantling	Demolition	5000	2000	0	1500	Debris will be used to fill the land, structural scrap and other scrap shall be recycled. Electrical waste (Lighting and Cables etc.) shall be sold to authorised agencies for recycling/disposal.	Office Staff will be shifted in Plant Offices
10	Guest House Complex	Demolition	3900	0	0	0	Debris will be used to fill the land, structural scrap and other scrap shall be recycled. (Lighting and	

Sl. No.	Facilities	Relocation / Demolition	Qty Civil Debris, m^3	Qty. Structural Scrap (Steel +Rebar) Ton	Land Filing, m^3	Qty. Elec-tircal waste, kg	Debris disposal plan	Relocation Plan
							Cables etc.) shall be sold to authorised agencies for recycling /disposal.	
Total			**52,000**	**9,001**	**145,000**	**10,700**		

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Study Area

The study area is considered within 10 km radius of the project site. Study area map of proposed project showing land use of the area is shown in ***Map 3-1***

3.2 Study Period

Baseline monitoring was carried out for 12 weeks from March to May 2021.

Additional one-month data for Ambient air quality was also collected at site and surrounding area from 23rd Nov 2021 to 26th Dec 2021 including Traffic survey.

3.3 Methodology

The guidelines given in the EIA Manual of the MoEF&CC and methodologies mentioned in Technical EIA Guidelines Manual for Mettalurgical Industry prepared by IL&FS Eco smart Ltd. and approved by MoEF&CC is followed for conducting the baseline environmental survey.

Field monitoring for meteorological conditions, ambient air quality, water quality, noise quality, Soil quality etc. has been carried out, which constitutes major portion of the baseline environmental studies. In addition to these important parameters, certain aspects like land use, socio-economic studies, Ecological and Biodiversity studies etc. are covered during the study period.

3.3.1 Primary Data Collection by Environmental Monitoring

Primary data collected include:

- Ambient air quality
- Noise
- Ground Water
- Surface water quality
- Soil quality
- Land use pattern
- Flora and Fauna
- Socio economic Environment

Secondary Data Collection

This includes review of secondary/published information on:

- Longterm Meteorological Data
- Socio-economic profile
- Sensitive areas such as biosphere reserve, forests, sanctuaries, places of historical, archaeological, tourist importance, etc.

3.4 Land use/Land Cover

3.4.1 Methodology Adopted for Landuse/Land Cover Study

The National Remote Sensing Agency (NRSA), Government of India, conducted a land use survey using Remote Sensing Techniques in the year 1988-89 at the behest of the Planning Commission for classifying land by visual interpretation techniques and digital techniques. NRSA's output resulted in a two-level system of classification, comprising seven primary land use / land cover categories. Some of these primary categories required further delineation, leading to a second level of classification that resulted in further sub-categories.

This system of classification has been the basis for land use / land cover studies. Whilst these categories are generally found relevant with respect to describing land use and land cover classes in the Indian context, sometimes modifications are required, and made, to include additional sub-categories, which are more relevant in describing the land use and land cover for a particular study. Such sub-categories are defined, and are described in ***Annexure 12.***

3.4.2 Secondary Data

Secondary data from Open series map by Survey of Indian and Satellite image from Google earth were used as base maps for preparation of land use land cover map of the study area. OSM and satellite image for study area is given as ***Map 2-3***

3.4.3 Primary Data

The aim of ground truth studies is to confirm whether the interpreted land uses are correct thus improving the quality of the output. It also allows interaction with local parties and stakeholders, thereby giving background information on the land use.

Ground truth was carried out to check the discrepancy of the interpreted data. The survey consisted of traversing the study area, cross-checking of identified features with those represented on the map.

Field notes were kept in the form of log sheets that recorded information pertaining to co-ordinates, photographs and identified land uses. Additional features identified or remarks made against existing interpretation were also recorded.

The field survey was carried out in the study area by Kadam's land use and land cover Functional Area Expert for quality check of the map.

GPS readings were taken during the surveys wherever it was felt that additional confirmation in interpretation of the data and also observations of land features were noted. Additionally, spot checks were also done to confirm the land use / land cover interpretation even where confidence of interpretation was high.

Table 3-1 enumerates the land features and its corresponding GPS readings of all the ground truthing locations selected.

Table 3-1: GPS reading within study area

S. No.	Location	Latitude (North)	Longitude (East)	Land use/ Land cover Classification
1	Hazira Village	21°05'13.61"	72°38'23.04"	Reserved Forest
2.	Hazira Village	21°05'55.60"	72°39'0.38"	Pond
3.	Hazira Village	21°06'4.34"	72°38'36.45"	Habitation
4	Hazira Village	21°06'9.75"	72°37'37.76"	Vegetation Cover

S. No.	Location	Latitude (North)	Longitude (East)	Land use/ Land cover Classification
5	Hazira -Suvali Road	21°07’26.02”	72°38’24.89”	Grasses
6	Hazira -Suvali Road	21°07’36.33”	72°38’39.50”	Muddy area
7	Suvali Village	21°09’50.29”	72°37’ 08.71”	Beach
8	Dumas Village	21°06’25.20”	72°42’22.81”	Mangroves
9	Dumas Village	21°06’20.00”	72°42’25.89”	Habitation (School)
10	Danti Village	21°02’42.72”	72°44’6.60”	Habitation
11	Hazira Village	21°06’9.05”	72°37’37.91”	Intertidal area
12	Hazira Village	21°05’23.28”	72°37’48.99”	Reserve Forest
13	Hazira Village	21°05’4.65”	72°38’0.79”	Industry (Adani Container yard)
14	Hazira Village	21°05’40.88”	72°37’37.89”	Industry (Shell LNG)
15	Hazira Mangroves	21°07’42.1”	72°41’51.8”	Forest
16	Gavier Lake	21°07’34.1”	72°44’02.0”	Lake
17	Surat Airport	21°07’23.6”	72°44’18.9”	Airport
18	Cairn India	21°09’55.6”	72°39’02.2”	Industry
19	L&T Howden Pvt. Ltd.	21°09’52.4”	72°39’02.3”	Industry
20	L&T Heavy Engineering	21°09’25.5”	72°39’49.3”	Industry

Land use and Land Cover Pattern of Study Area

The land use and land cover of the above mentioned study area covering various categories. The features identified have been presented, considering the discussion provided in ***Table 3-2.***

Table 3-2: Synopsis of Land use / Land cover Classification Used for the Project

S. No.	Level 1 Classification	Level 2 Classification
1.	Built-up Land or Habitation	Residential / Commercial
		Industrial
2.	Agricultural Land	Crop Land/Fallow Land
		Plantations
3.	Wastelands	Land without Scrub
4.	Water Bodies	Reservoir / Lakes / Ponds / Tanks
		River
5.	Vegetation Cover	Scrub
		Open vegetation
		Close Vegetation
6	Forest	Open Forest
		Dense forest
		Forest blank
		Scrub Forest
7	Others	Mining
		Grassland

The images classified into the above-mentioned classes for different regions of interest are given in ***Map 3-1***

3.4.4 Key Findings

Residential / Commercial

The Built up area is mostly in settlements. Mostly the settlements are limited to village areas and more precisely rural distributed habitants. Hazira is the main village with in study area along with Suvali, Dumas and Mora. The habitation class covered 2.21 per cent of total study area.

Industrial Area

This level of class covers 6.06 per cent of total study. The project is nearby Hazira INA. Major industries seen in study area near site are Cairn India, Adani Hazira Pvt. Port Ltd., Adani Wilmar Ltd. (Hazira), L&T group of companies, Reliance Industries Limited, NTPC Kawas Power Plant, HPPL, KRIBHCO, Etc.

Agricultural Land

Crop Land/Fallow Land

The Crop/Fallow land within study area was 5.046 per cent of the study area which is the 2nd most observed class after Industrial class on land.

Plantations

The Plantations land within study area was 0.26 per cent of the study area. Plantation of Nariyal, Neem, Badam, Papaya, Khajoor etc. were observed.

Wastelands

Land without Scrub

The class, Land without Scrub was 3.66 per cent of the study area.

Mudflat

The class, Mudflat observed within the study area covers 2.82 per cent.

Muddy Land

The class, Muddy Land covers 5.39 per cent of the study area.

Water Bodies

There were few ponds/reservoirs/lakes/tanks in the region having 1.24 per cent of the study area. Tapi River is present on East to the project site flowing from North-East to South-East and then into Gulf of Khambhat forming Estuary. River in the region covers 4.01 per cent of the study area.

Hazira Creek is observed in study area covering 0.531 per cent. A part of Arabian Sea (Gulf of Khambhat) is also observed in the study area covering 51.09 per cent present on West and South of project site.

Vegetation Cover

Scrub

The scrub region was observed in the region covering 4.15 per cent of the study area.

Open Vegetation

The open vegetation covers approx. 4.53 per cent of the study area..

Dense Vegetation

The dense vegetation covers approx. 1.62 per cent of the study area..

Mangroves

The mangroves covers approx. 2.53 per cent of the study area.

Forest

Open Forest

The open forest covers approx. 0.014 per cent of the study area.

Close Forest

The close forest covers approx. 0.147 per cent of the study area.

Scrub Forest

The scrub forest covers approx. 0.025 per cent of the study area.

Others

Saltpan

The saltpan covers approx. 2.034 per cent of the study area.

Airport

The airport covers approx. 0.713 per cent of the study area and is present to East of project site.

Aquatic Culture

The aquatic culture covers approx. 0.831 per cent of the study area.

Grassland

The grassland covers approx. 1.046 per cent of the study area.

Class Wise Area Statistics

The area statistics of these classes in the study area are presented in ***Table 3-3***.

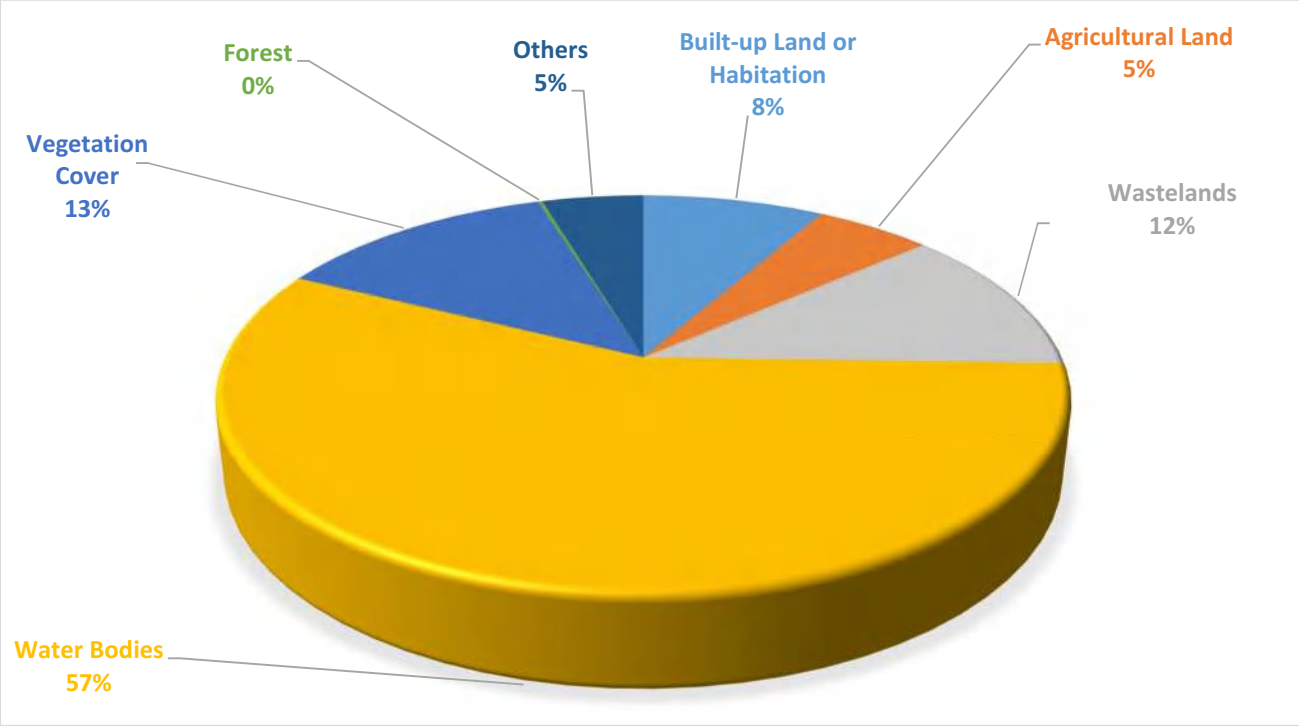
Table 3-3: Area Statistics for Land Use/ Land Cover Categories in the Study Area

S. No.	Level1 Classification	Level2 Classification	Area, Level 2 Class			Area, Level 1 Class		
			Ha.	~km 2	~%	Ha.	~km 2	~%
1	Built-up Land or Habitation	Residential / Commercial	1087	10.87	2.210	4068	40.68	8.27

S. No.	Level1 Classification	Level2 Classification	Area, Level 2 Class			Area, Level 1 Class		
			Ha.	~km 2	~%	Ha.	~km 2	~%
		Industrial	2981	29.81	6.060			
2	Agricultural Land	Plantation	131	1.31	0.266	2613	26.13	5.31
		Crop Land/Fallow Land	2482	24.82	5.046			
3	Wastelands	Land without Scrub	1803	18.03	3.665	5843	58.43	11.88
		Mudflat	1388	13.88	2.822			
		Muddy Area	2652	26.52	5.391			
4	Water Bodies	Reservoir / Lakes / Ponds / Tanks	611	6.11	1.243	27982	279.8	56.89
		River	1974	19.74	4.014			
		Creek	261	2.61	0.531			
		Sea	25135	251.35	51.099			
5	Others	Saltpan	1000	10.00	2.034	2274	22.7	4.62
		Airport	351	3.51	0.713			
		Aquatic culture	409	4.09	0.831			
		Grass Land	514	5.14	1.046			
6	Vegetation	Scrub	2041	20.41	4.150	6319	63.2	12.85
		Open Vegetation	2232	22.32	4.538			
		Dense Vegetation	800	8.00	1.626			
		Mangroves	1246	12.46	2.532			
7	Forest	Scrub Forest	12	0.12	0.025	91	0.9	0.19
		Open Forest	7	0.07	0.014			
		Close Forest	72	0.72	0.147			
Total			**49189.71**	**491.90**	**100**	**491 90**	**491.90**	**100.00**

Pie chart showing area statistics for land use / land cover categories in the study area is shown in ***Figure 3-1***

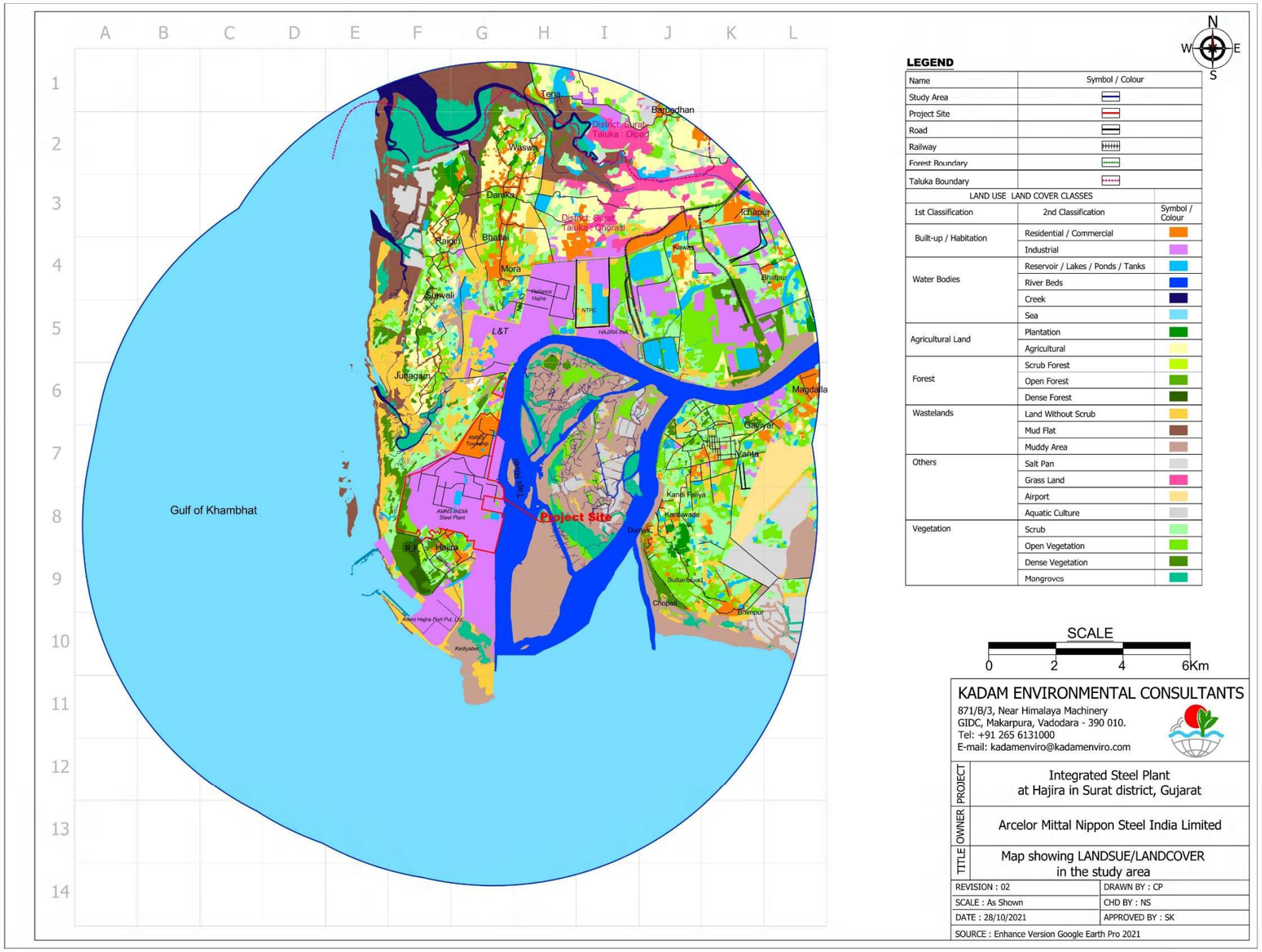
Figure 3-1: Pie – Chart showing Area Statistics for Land Use / Land Cover



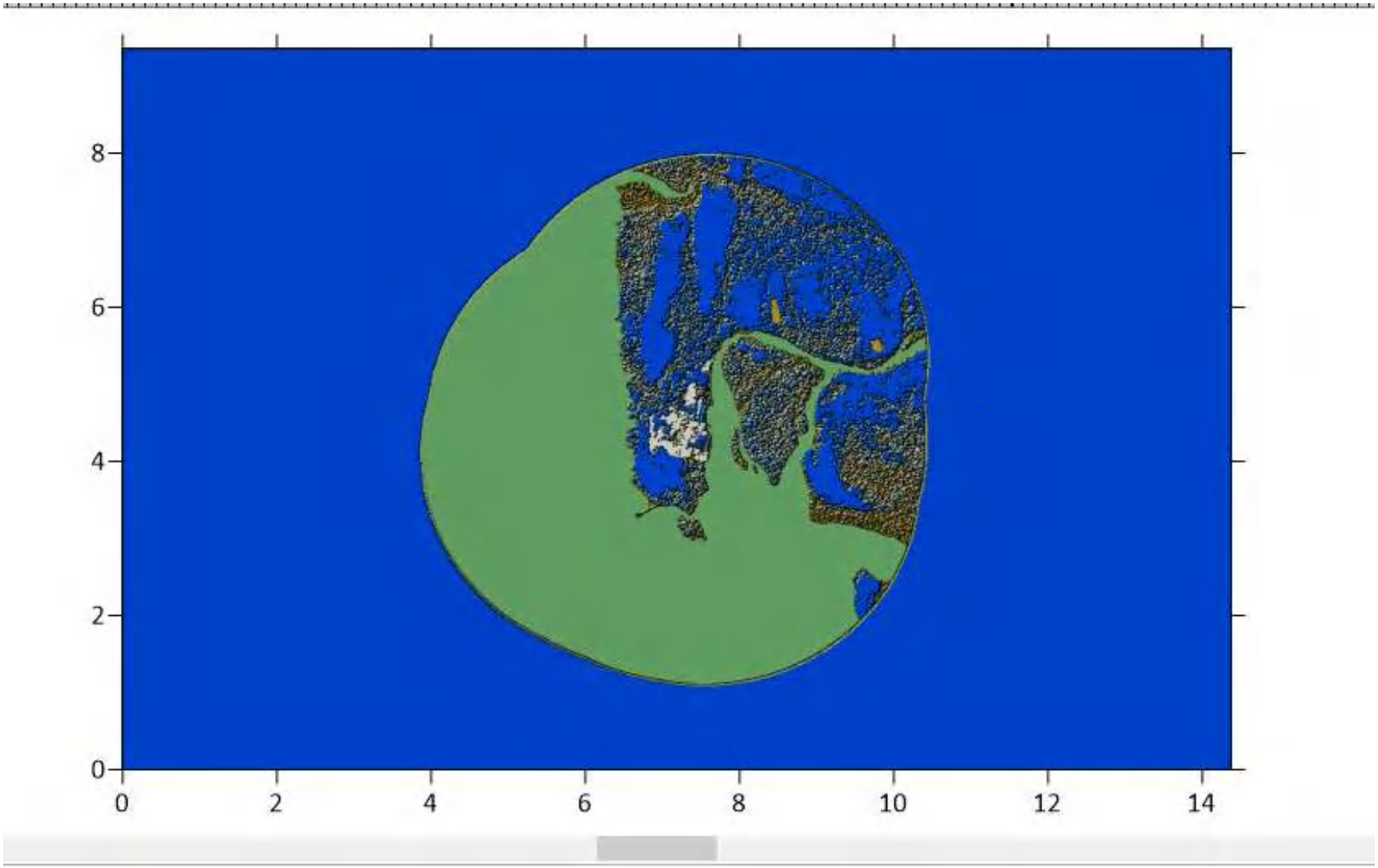
Final Map Preparation

The proportional presence of different land uses and land cover in terms of statistical percentages was derived for the study area. Appropriate legends were used to represent the various categories of land use and land cover, and were then written on the prepared land use and land cover map. The map is attached as ***Map 3-1.***

Map 3-1: Land use Map of 10 km radius of Study area



Map 3-2: Digital Elevation Model of the project site



3.5 Meteorology

3.5.1 Methodology

The methodology used for primary data collection of meteorology is described in ***Annexure 13.***

Information presented in subsequent paragraphs is from the most recently published long term meterological data of IMD Station No. 42840, Surat is by the Indian Meteorological Department (IMD).

The interpretation of climate is based on the secondary data sources. The long-term climatological tables published by Indian Meteorological Department covering data base for 30 years, from 1981 to 2010. Nearest IMD Station No. 42840, Surat is located at an aerial distance of about 11 km towards Ne direction from project site. The copy of the long-term climatological data is enclosed as ***Annexure 9.***

3.5.2 Secondary Data

Temperature

The mean daily maximum and minimum temperature recorded were 36.7^{0}C (in the month of April) & 15.2^{0}C (in the month of January) respectively.

During the post monsoon season i.e. for months of October, November, December, mean daily minimum and maximum temperature remain between 16.5^{0}C and 35.1^{0}C.

Wind

Long term wind direction data is prepared in ***Table 3-4***. Overall for the whole year, first predominant wind direction is from SW Direction, second predominant wind direction is from NE Direction and third predominant wind direction is from N Direction.

During the March to June month period, first predominant wind direction is from SW Direction, second predominant wind direction is from W Direction and third predominant wind direction is from S Direction.

Table 3-4: Predominant Wind Direction

Month	Predominant Wind					
	First		Second		Third	
	Morning	Evening	Morning	Evening	Morning	Evening
January	N	NW	NE	N	NW	NE
February	N	NW	NE	N	NW	W
March	N	NW	NE/NW	SW/W	NW	W
April	SW	SW	S	W	N	NW
May	SW	SW	W	W	S	S
June	SW	SW	W	S	S	W
July	SW	SW	W	W	S	S
August	SW	SW	W	W	NW/S	S
September	SW	SW	W	W	S/NW	NW
October	SE	SW/NW	NE	W	E	N/NE
November	NE	NW	E	NE	N/SE	N

Month	Predominant Wind					
	First		Second		Third	
	Morning	Evening	Morning	Evening	Morning	Evening
December	NE	NW	N	N	E	NE

Rainfall

Annual total rainfall in the region is 1202.9 mm. Number of rainy days are 43.7.

Distribution of rainfall by season is 1147.1 mm in monsoon (June, July, August, and September), 49.5 in October to December, 1.8 mm in January & February and 4.5 mm in March to May. About 95.36 % of the annual rainfall in the region is received during monsoon months i.e. June to September. July is the rainiest month.

Heaviest rainfall in 24 hours was 459.2 mm recorded on 5nd July, 1941. July is having maximum number of rainy days i.e. 14.6.

Cloud Cover

The area remains cloudy between July- Septembers, which is the active period of the monsoon season. Generally, cloud cover ranges from 0.8 – 6.3 OKTAS during monsoon season. In winter cloud amounts ranges minimum 0.8 Oktas to maximum 1.2 Oktas.

Humidity

Most humid conditions are found in the winter, followed by post-Monsoon, monsoons, and Summer in that order. Mornings are more humid than evenings, highest relative humidity is recorded as 86 % in August mornings followed by 83 % in September mornings.

During post-monsoon season, morning relative humidity remains between 65-73 % and in the evening it remains between 43-52%.

Average Long Term Meteorological Condition

Average meteorological condition is given in ***Table 3-5.***

Table 3-5: Average Meteorological Condition based on Long-term Data

Month	Mean Daily Temperature		Rainfall (mm) Monthly Total	No. of Rainy days	Relative Humidity (%), (Morning)	Relative Humidity (%), (Evening)
	Max	Min				
January	30.8	15.2	1.5	0.1	68	41
February	32.3	16.7	1.3	0.1	64	34
March	35.4	20.7	0.4	0	64	33
April	36.7	24	0.2	0	66	42
May	35.8	26.8	3.9	0.3	70	58
June	34	27	245.2	7	78	70
July	31.2	25.9	466.3	14.6	86	80
August	30.8	25.5	283.8	12.7	86	79
September	32.3	25.4	151.8	6.7	83	70
October	35.1	23.3	41.8	1.7	73	52
November	34.1	19.6	7.1	0.5	65	44
December	31.9	16.5	0.6	0	67	43
Total	400.4	266.6	1203.9	43.7	870	646
Average	**33.3**	**22.2**	**100.325**	**3.64**	**72.5**	**53.8**

3.5.3 Primary Data

An online weather logger was set up at site for 12 weeks in summer season (March to May) 2021 and also from 23rd November to 23rd December 2021.

3.5.4 Key Findings

Site Specific Meteorological Data (7th March 2021 to 6th June 2021)

Compiled mean meteorological data is represented in ***Table 3-6.***

Table 3-6: Mean Meteorological Data

Hour	Temperature (°C)	Relative Humidity (%)	Wind Speed (m/sec)	Wind Direction (from)	Cloud Cover, (tenths)	Rainfall (mm)
0	30.4	74.4	1.15	WSW	0	0
1	30.0	75.5	1.23	WSW	0	0
2	29.5	76.7	1.38	SW	0	0
3	29.7	77.0	1.06	SW	0	0
4	29.3	78.6	1.01	SW	0	0
5	29.2	79.6	1.03	SW	0	0
6	28.9	80.1	0.94	SW	0	0
7	28.9	80.7	0.83	SW	0	0
8	29.1	79.8	0.98	SW	0	0
9	30.4	74.4	1.22	SW	0	0
10	31.6	67.2	1.36	SW	0	0

Hour	Temperature (°C)	Relative Humidity (%)	Wind Speed (m/sec)	Wind Direction (from)	Cloud Cover, (tenths)	Rainfall (mm)
11	32.8	64.4	1.40	SW	0	0
12	33.7	63.6	1.50	SW	0	0
13	33.7	63.0	1.31	SW	0	0
14	34.2	63.0	1.38	WSW	0	0
15	34.7	65.3	1.62	WSW	0	0
16	34.4	66.6	1.44	SW	0	0
17	34.2	68.2	1.27	SW	0	0
18	33.5	69.8	1.28	WSW	0	0
19	32.3	68.8	1.04	WSW	0	0
20	31.3	71.1	0.98	WSW	0	0
21	30.8	74.1	1.29	WSW	0	0
22	30.7	75.5	1.43	WSW	0	0
23	30.7	75.1	1.38	WSW	0	0
Average	**31.4**	**72.2**	**1.2**	**SW**	**0**	**0**

Conclusion

Site-specific meteorological data shows that:

- Average wind speed is 1.2 m/sec.
- Wind blows predominantly from SW direction followed by WSW. Calm condition is ~ 24.69%. Wind rose diagram is shown as ***Figure 3-2***
- Average temperature recorded for Summer season was 31.4°C.
- The average relative humidity is 72.2%.
- The average Rainfall is 0.0 mm during the monitoring season.

Site Specific Meteorological Data (23rd November 2021 to 23rd December 2021)

Compiled mean meteorological data is represented in ***Table 3-6.***

Table 3-7: Mean Meteorological Data

Hour	Temperature (°C)	Relative Humidity (%)	Wind Speed (m/sec)	Wind Direction (from)	Cloud Cover, (tenths)	Rainfall (mm)
0	24.3	69.3	0.8	NE	0	0
1	23.9	71.0	0.7	NE	0	0
2	23.4	73.5	0.7	NE	0	0
3	23.0	75.1	0.6	NE	0	0
4	22.7	75.5	0.7	NE	0	0
5	22.3	76.9	0.7	NE	0	0
6	22.0	77.7	0.7	NE	0	0
7	21.8	78.6	0.6	NE	0	0
8	21.7	79.0	0.7	NE	0	0

Hour	Temperature (°C)	Relative Humidity (%)	Wind Speed (m/sec)	Wind Direction (from)	Cloud Cover, (tenths)	Rainfall (mm)
9	22.6	77.7	0.8	NE	0	0
10	24.2	71.8	1.2	ENE	0	0
11	26.2	64.2	1.5	ENE	0	0
12	27.7	62.3	1.5	ENE	0	0
13	29.0	59.0	1.2	ENE	0	0
14	29.7	58.7	1.1	ENE	0	0
15	29.8	60.9	1.0	ENE	0	0
16	29.4	61.5	0.8	NNW	0	0
17	28.6	63.1	0.7	N	0	0
18	27.4	65.5	0.6	N	0	0
19	26.4	67.9	0.6	NNE	0	0
20	25.9	68.5	0.8	NE	0	0
21	25.5	68.3	0.8	NE	0	0
22	25.0	68.9	0.8	NE	0	0
23	24.5	69.3	0.7	NE	0	0
Average	**25.3**	**69.3**	**0.8**	**NE**	**0**	**0**

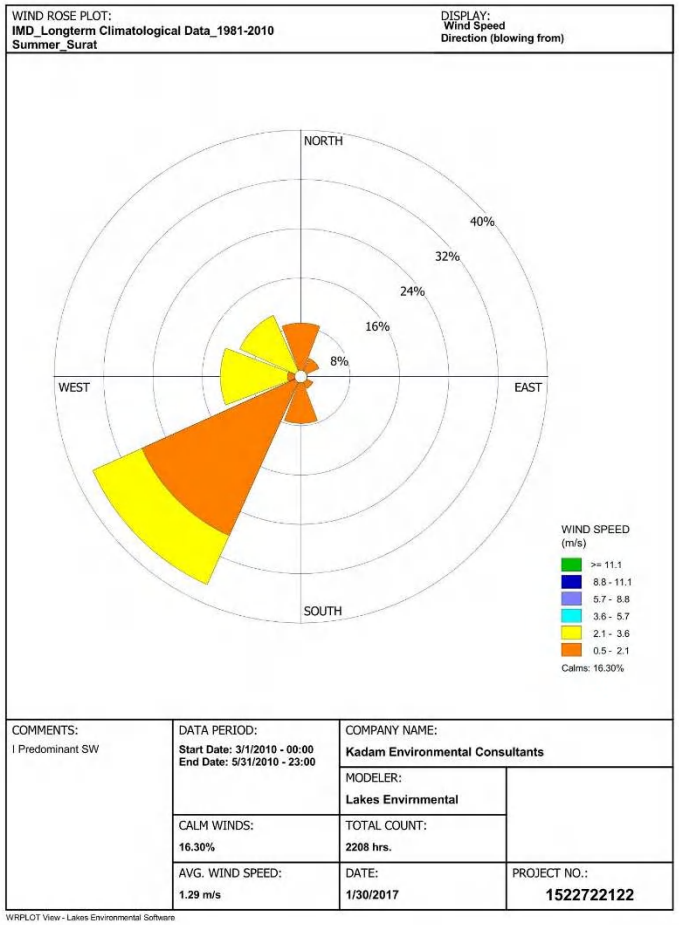
Conclusion

Site-specific meteorological data shows that:

- Average wind speed is 0.8 m/sec.
- Wind blows predominantly from NE direction followed by NNE. Calm condition is ~ 42.32%.
- Average temperature recorded for the season was 25.3°C.
- The average relative humidity is 69.3%.
- The average Rainfall is 0.0 mm during the monitoring season.

Figure 3-2: Windrose Diagram (7th March to 7th June May 2021)

IMD



KEC

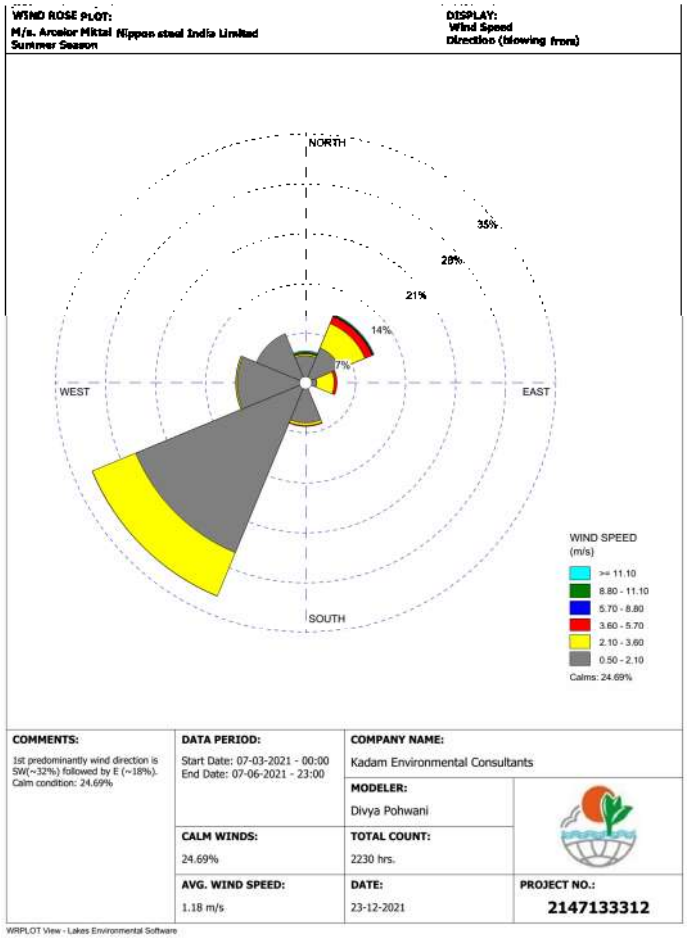
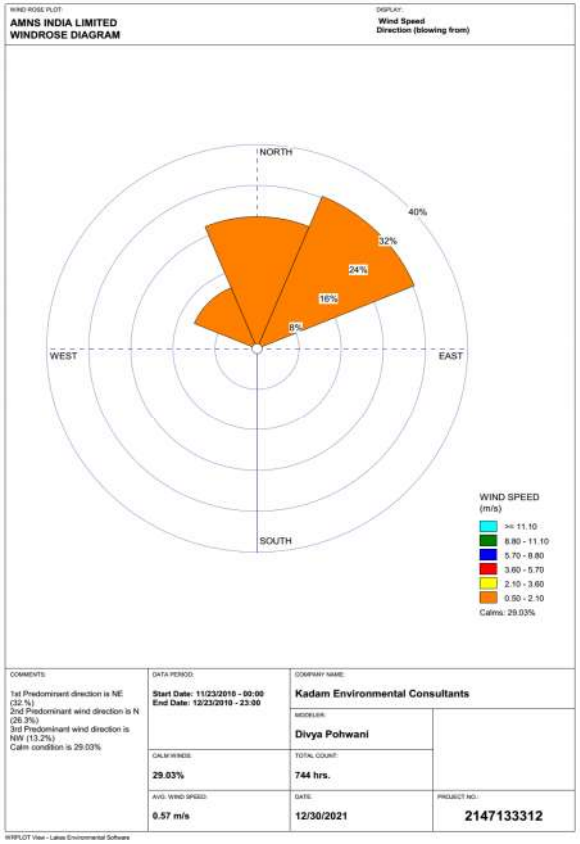
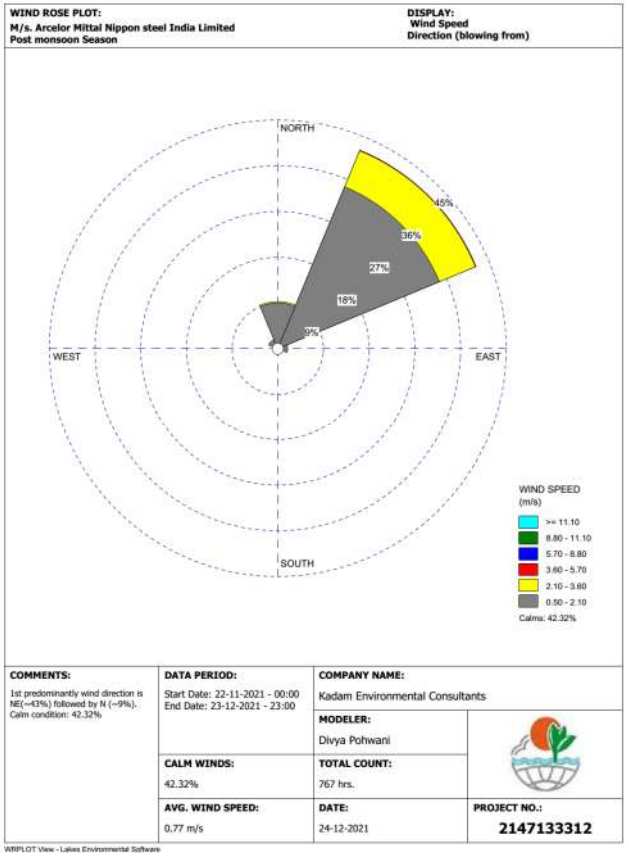


Figure 3-3: Windrose Diagram (23rd November 2021- 23rd December 2021)

IMD	KEC
	

Collation of Site Specific Data with Secondary Data of IMD

Site specific Meteorological data are compared with IMD's secondary data as shown in ***Table 3-8 & Table 3-9***.

Table 3-8: Collation of Meteorological data – 7th March 2021 to 6th June 2021

S. No.	Parameters	7th March 2021 to 6th June 2021	
		IMD 1981 – 2010	Site Specific (24 hours)
1	Wind Speed	1.29	1.18
2	Wind Direction	SW	SW
3	Mean Temperature	35.9	31.4
4	Mean Relative Humidity	Morning- 66.6 Evening-34.3	72.2

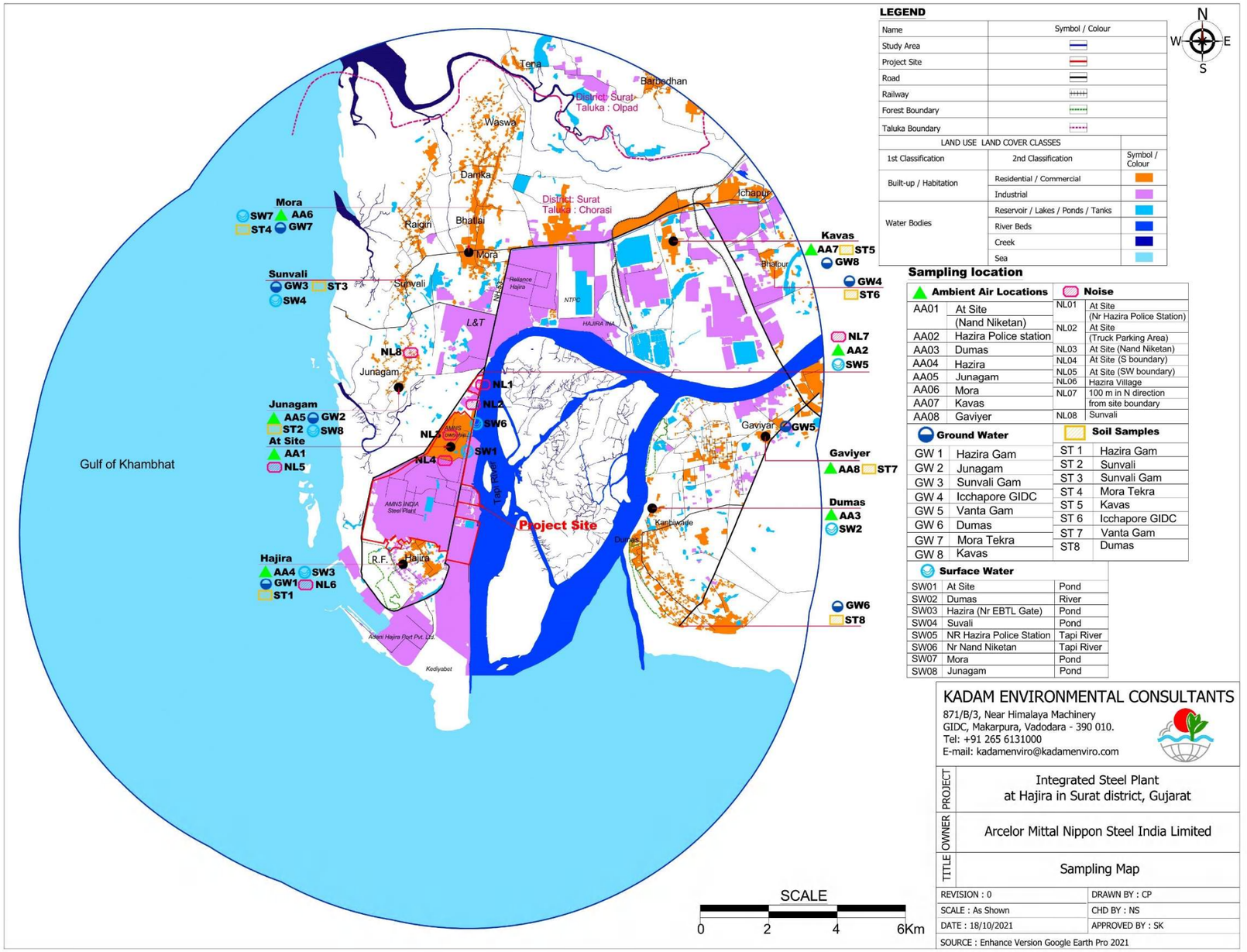
Table 3-9: Collation of Meteorological data – 23rd November 2021 to 26th December 2021

S. No.	Parameters	23rd November 2021 to 26th December 2021	
		IMD 1981 – 2010	Site Specific (24 hours)
1	Wind Speed	0.57	0.77
2	Wind Direction	NE	NE
3	Mean Temperature	18.05	25.3
4	Mean Relative Humidity	Morning-66 Evening – 43.5	69.3

Based on the above table, it is noted that there is no major difference in site specific & the long term meteorological data. Minor change is due to the following predicted reasons:

- Usage of different monitoring equipment, having wide range of sensitivity.
- Data collected of site specific are hourly, whereas the available IMD data is for morning (0830 hours IST) and evening (1730 hours IST) only.

Map 3-3: Sampling Location Map



LEGEND

Name	Symbol / Colour
Study Area	
Project Site	
Road	
Railway	
Forest Boundary	
Taluka Boundary	

LAND USE LAND COVER CLASSES		
1st Classification	2nd Classification	Symbol / Colour
Built-up / Habitation	Residential / Commercial	
	Industrial	
Water Bodies	Reservoir / Lakes / Ponds / Tanks	
	River Beds	
	Creek	
	Sea	

Sampling location

Ambient Air Locations	
AA01	At Site (Nand Niketan)
AA02	Hazira Police station
AA03	Dumas
AA04	Hazira
AA05	Junagam
AA06	Mora
AA07	Kavas
AA08	Gaviyer

Noise	
NL01	At Site (Nr Hazira Police Station)
NL02	At Site (Truck Parking Area)
NL03	At Site (Nand Niketan)
NL04	At Site (S boundary)
NL05	At Site (SW boundary)
NL06	Hazira Village
NL07	100 m in N direction from site boundary
NL08	Sunvali

Ground Water	
GW 1	Hazira Gam
GW 2	Junagam
GW 3	Sunvali Gam
GW 4	Icchapore GIDC
GW 5	Vanta Gam
GW 6	Dumas
GW 7	Mora Tekra
GW 8	Kavas

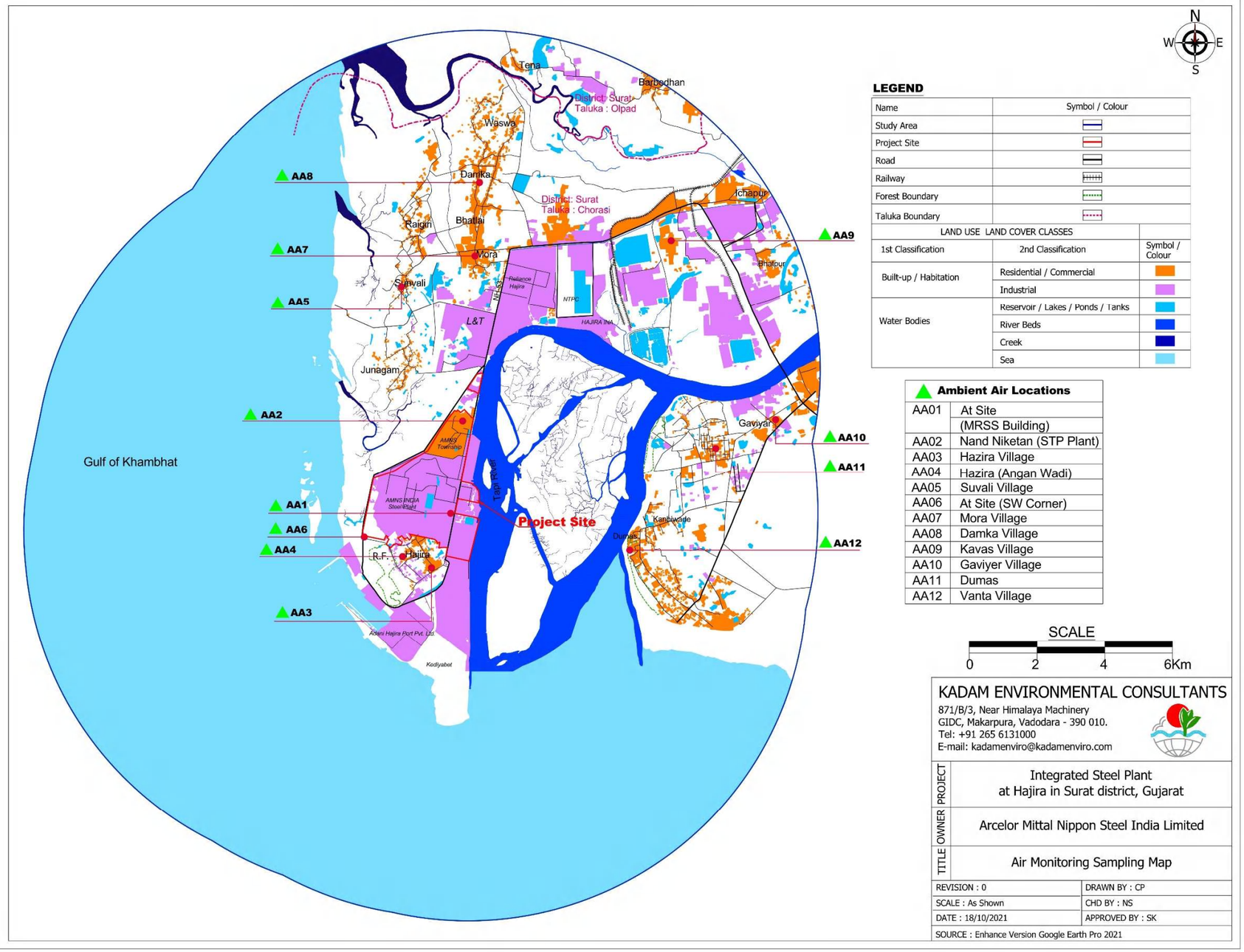
Soil Samples	
ST 1	Hazira Gam
ST 2	Sunvali
ST 3	Sunvali Gam
ST 4	Mora Tekra
ST 5	Kavas
ST 6	Icchapore GIDC
ST 7	Vanta Gam
ST8	Dumas

Surface Water		
SW01	At Site	Pond
SW02	Dumas	River
SW03	Hazira (Nr EBTL Gate)	Pond
SW04	Suvali	Pond
SW05	NR Hazira Police Station	Tapi River
SW06	Nr Nand Niketan	Tapi River
SW07	Mora	Pond
SW08	Junagam	Pond

KADAM ENVIRONMENTAL CONSULTANTS
871/B/3, Near Himalaya Machinery
GIDC, Makarpura, Vadodara - 390 010.
Tel: +91 265 6131000
E-mail: kadamenviro@kadamenviro.com

PROJECT	Integrated Steel Plant at Hajira in Surat district, Gujarat
OWNER	Arcelor Mittal Nippon Steel India Limited
TITLE	Sampling Map
REVISION : 0	DRAWN BY : CP
SCALE : As Shown	CHD BY : NS
DATE : 18/10/2021	APPROVED BY : SK
SOURCE : Enhance Version Google Earth Pro 2021	

Map 3-4: Sampling Location Map for additional one month AAQM



3.6 Ambient Air Quality

3.6.1 Methodology

The study methodology for ambient air quality monitoring involves the following steps:

- Based on the long term IMD data collection, identifying predominant wind direction subsequently selection of AAQM monitoring stations as per CPCB guidelines and preparing monitoring plan for 12 weeks
- One-month additional monitoring was also carried out as suggested in ToR issued by MoEF&CC.
- AAQM station installation as per the monitoring plan;
- Sample collection & its analysis in Lab (Kadam & SGS India Pvt. Ltd)
- Interpretation of collected AAQM data with ground condition for inferences

The methodology used for primary data collection for ambient air quality is described in ***Annexure 14***

3.6.2 Secondary Data

The secondary data was collected from different EIA report and details of the same is given ***Table 3-10***

Table 3-10: Ambient Air Secondary Data

Parameters	Reference Report 1 Title	Reference Report 2 Title	Reference Report 3 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**	**Environmental Impact Assessment study report for Development of Multi Cargo Port with Supporting Utilities & Infrastructure Facilities at Hazira, District - Surat, Gujarat for M/s. Adani Hazira Port Private Limited Prepared by Cholamandalam MS Risk Services Limited in the year February 2012**
Sampling Season / Period	**Post-monsoon 2017 (Oct to Dec 2017)**	**Summer 2014**	**April to June 2011**
Ambient Air Quality	(Maximum values)	(Maximum values)	(98% percentile values)
Sampling locations	Mora, Hazira, Junagam, Dumas, Nand niketan	Kavas, Dumas, Hazira	Hazira, Mora
PM10	97 – 118 µg/m3	52.1 – 90.4 µg/m3	120.72 – 132.16 µg/m3
PM2.5	41 – 57 µg/m3	29.5 – 47.7 µg/m3	71.12 – 78.55 µg/m3
SO2	10.3 – 12.7 µg/m3	10.7 – 13.8 µg/m3	34.06 – 35.13 µg/m3
NOx	19.9 - 21.4 µg/m3	13.8 – 20.3 µg/m3	45.43 – 48.41 µg/m3
Benzene	2.8 – 3.4 µg/m3	3.0 – 3.8 µg/m3	3.12 – 3.52 µg/m3
O_3	16.5 – 23.2 µg/m3	38.2 – 43.8 µg/m3	21.96 – 22.39 µg/m3
NH_3	BDL	24.9 – 7.9 µg/m3	18.35 µg/m3
Pb	BDL	BDL	0.75 – 0.77 µg/m3
VOC (BTX)	BDL	0.011 – 0.014 mg/m3	--

Parameters	Reference Report 1 Title	Reference Report 2 Title	Reference Report 3 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**	**Environmental Impact Assessment study report for Development of Multi Cargo Port with Supporting Utilities & Infrastructure Facilities at Hazira, District - Surat, Gujarat for M/s. Adani Hazira Port Private Limited Prepared by Cholamandalam MS Risk Services Limited in the year February 2012**
Sampling Season / Period	**Post-monsoon 2017 (Oct to Dec 2017)**	**Summer 2014**	**April to June 2011**
Benzopyrene	--	BDL	0.72 – 0.79 µg/m3
As (ng/m3)	BDL	BDL	BDL
Ni	BDL	BDL	16.36 – 18.43 ng/m3
HC as Methane	1.282 – 1.456 mg/m3	0.138 – 0.246 mg/m3	--
CO	1.323 – 1.371 mg/m3	1.1 – 1.5 mg/m3	BDL

3.6.3 Primary Data

Season and Period for Monitoring

The Ambient Air Quality Monitoring was carried out for post monsoon Season from 7th March 2021 to 6th June 2021 and additional one month monitoring was carried out from 23rd November 2021 to 23rd December 2021.

Ambient Air Quality Monitoring was conducted at 8 different locations.

Sampling Frequency

The frequency of monitoring was 24 hrs twice a week at each station spread over the entire season with gaseous samples being changed six times (at 8-hour intervals).

Selected Sampling Stations

The locations for Ambient Air Quality Monitoring were decided based on the guidelines given in the EIA manual approved by MoEF&CC. For this EIA, the purpose is to ascertain the baseline pollutant concentrations in ambient air. Accordingly, the criterion was selected to ascertain quality of air at important human settlements (residential areas). 8 locations were selected for carrying out ambient air quality monitoring within study area which are presented in ***Table 3-11.***

Table 3-11: Ambient Air Quality Monitoring Location Details (7th March 2021 to 6th June 2021)

Code No.	AAQM Station	Coordinates		Area Category	Dist. From nearest site boundary (km)	Dir.	Justification
		Latitude	Longitude				
AAQM at site							
AA01	At Site (Nand Niketan)	21° 7'41.26"N	72°39'8.98"E	Residential	Within site	-	Along 1st Downwind From proposed SMS with stack (height 100 m) and lying within max GLC area ,2.30 km in NE Direction
AAQM in Surrounding							
AA02	Hazira Police station (Beside Truck Parking area)	21° 8'48.62"N	72°39'38.24"E	Industry	-	NE	Along 1st Downwind from proposed coke oven stack (height 140 m) and lying within max GLC area, 2.50 km in NE direction Line source emission will also be captured
AA03	Dumas	21° 6'41.81"N	72°42'28.94"E	Rural	5.3	E	2nd Downwind
AA04	Hazira	21° 5'51.15"N	72°38'16.47"E	Rural	2.8	SW	1st Upwind
AA05	Junagam	21° 8'31.89"N	72°38'16.11"E	Rural	1.4	W	2nd Upwind
AA06	Mora	21°10'38.05"N	72°39'30.91"E	Rural	3.3	N	Crosswind
AA07	Kavas Limla Road	21°10'48.58"N	72°42'48.38"E	Rural	6.5	NE	1st Downwind
AA08	Gaviyer	21° 7'48.65"N	72°44'19.64"E	Rural	8.3	E	3rd Downwind

Table 3-12: Ambient Air Quality Monitoring Location Details (23rd November 2021 to 25th December 2021)

Station Code No.	AAQM Station	Latitude	Area Category	Dist. (km)	Dir.	Justification
AAQM 01	At Site (MRSS)	21° 6'29.93"N 72°39'5.60"E	Industrial	-	-	2nd downwind from coke oven
AAQM 02	At Site (Nand Niketan - STP)	21° 8'1.73"N 72°39'18.04"E	Residential	-	-	2nd upwind
AAQM 03	Hazira village	21° 5'40.34"N	Residential	1.70	SE	3rd downwind from SMS Stack

Station Code No.	AAQM Station	Latitude	Area Category	Dist. (km)	Dir.	Justification
		72°38'53.63"E				
AAQM 04	Hazira (Angan Wadi)	21° 5'41.00"N 72°38'15.95"E	Residential	1.4	SW	1st downwind from Sinter plant
AAQM 05	Suvali gam	21°10'18.11"N 72°38'19.19"E	Residential	3.4	NW	3rd upwind
AAQM 06	AMNSI - SW	21° 6'18.50"N 72°38'2.46"E	Industrial	-	-	1st downwind from the triangle formed with 3 major stacks(SMS, Sinter and coke oven)
AAQM 07	Mora	21°10'38.29"N 72°39'31.10"E	Residential	3.1	N	2nd Upwind
AAQM 08	Damka	21°12'0.94"N 72°39'51.12"E	Residential	5.58	N	2nd Upwind
AAQM 09	Kavas	21°10'52.17"N 72°42'42.71"E	Residential	6.78	NE	1st Upwind
AAQM 10	Gaviyer	21°7'47.97"N 72°44'17.33"E	Residential	8.41	E	crosswind
AAQM 11	Dumas	21° 6'2.82"N 72°42'9.57"E	Residential	5.4	SE	3rd downwind
AAQM 12	Vanta	21° 7'27.49"N 72°43'28.89"E	Residential	7	E	crosswind

Photographs 3-1: Photographs of Ambient Air Monitoring locations (March to May 2021)

AAQM 01- At Site

AAQM 02- Hazira Police station

AAQM 03 - Dumas

AAQM 04- Hazira

AAQM 05 - Junagam

AAQM 06 - Mora

AAQM 07 - Kavas

AAQM 08 - Gaviyer

Photographs 3-2: Photographs of Ambient Air Monitoring locations (23rd November 2021 to 23rd December 2021)

AA01 – At Site (MRSS Building)

AA02- Nand Niketan (STP Plant)

AA03- Hazira village

AA04- Hazira Anganwadi

AA05- Suvali

AA06- At Site (SW corner)

AA07- Mora

AA08 - Damka

AA09 - Kavas

AA10- Gaviyer

AA11 - Dumas

Observations

The monitoring results of ambient air is given in ***Table 3-13.*** Detailed Ambient Air monitoring results are given in ***Annexure 10***

Table 3-13: Ambient Air Monitoring Results (March to May 2021)

Average Pollutant Concentration (All units are in µg/m³ except CO in mg/m³ and As in ng/m³)										
Pollutants			**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**NH_3**	**HC**	**CO**	**As**
Sampling period / method			**24 hr**	**24 hr**	**24 hr**	**24 hr**	**24 hr**	**1 hr**	**1 hr**	**24 hr**
Detection Limit			**10**	**2**	**3.75**	**6**				
NAAQS 2009	**Industrial, Residential, Rural and Other Area**		**100**	**60**	**80**	**80**	**400**	**NS**	**4**	**6**
Permissible limits	**Ecologically Sensitive Area (Notified by Central Govt.)**		**100**	**60**	**30**	**30**	**400**	**NS**	**4**	**6**
AQ01	At Site (Nand Niketan)	Maximum	130	52	9.7	14.1	BDL	1084	1.13	BDL
		Minimum	45	10	7.2	10.4	BDL	974	0.89	BDL
		Average	88	23	8.6	11.9	BDL	1028	1.03	BDL
		98%tile	127	51	9.7	13.9	BDL	1081	1.13	BDL
AQ02	Hazira Police station	Maximum	135	48	9.8	13.9	BDL	1193	1.27	BDL
		Minimum	30	9	7.3	10.5	BDL	1002	0.96	BDL
		Average	91	18	8.5	12.2	BDL	1095	1.06	BDL
		98%tile	134	44	9.6	13.8	BDL	1187	1.26	BDL
AQ03	Dumas	Maximum	101	55	9.7	16.3	BDL	1133	1.15	BDL
		Minimum	37	8	4.3	10.2	BDL	1004	0.95	BDL
		Average	75	25	8.2	12.5	BDL	1078	1.06	BDL
		98%tile	98	49	9.7	16.2	BDL	1131	1.14	BDL
AQ04	Hazira	Maximum	117	55	14.0	15.2	BDL	1092	1.27	BDL
		Minimum	32	6	6.0	9.9	BDL	950	0.89	BDL
		Average	84	21	8.5	12.4	BDL	1025	1.11	BDL
		98%tile	115	47	12.6	15.1	BDL	1091	1.26	BDL
AQ05	Junagam	Maximum	138	53	14.0	13.7	BDL	1146	1.27	BDL
		Minimum	33	8	7.3	10.1	BDL	1036	0.89	BDL
		Average	87	27	8.8	11.9	BDL	1099	1.13	BDL

Average Pollutant Concentration (All units are in µg/m³ except CO in mg/m³ and As in ng/m³)										
Pollutants			**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**NH_3**	**HC**	**CO**	**As**
Sampling period / method			**24 hr**	**24 hr**	**24 hr**	**24 hr**	**24 hr**	**1 hr**	**1 hr**	**24 hr**
Detection Limit			**10**	**2**	**3.75**	**6**				
NAAQS 2009	**Industrial, Residential, Rural and Other Area**		**100**	**60**	**80**	**80**	**400**	**NS**	**4**	**6**
Permissible limits	**Ecologically Sensitive Area (Notified by Central Govt.)**		**100**	**60**	**30**	**30**	**400**	**NS**	**4**	**6**
		98%tile	136	53	12.4	13.7	BDL	1145	1.27	BDL
AQ06	Mora	Maximum	114	54	10.8	16.0	BDL	1135	1.35	BDL
		Minimum	32	8	7.2	10.1	BDL	1082	1.01	BDL
		Average	78	22	8.6	12.1	BDL	1104	1.19	BDL
		98%tile	114	51	10.4	15.2	BDL	1134	1.34	BDL
AQ07	Kavas	Maximum	128	47	16.1	16.6	BDL	1141	1.28	BDL
		Minimum	43	9	6.0	8.3	BDL	984	1.06	BDL
		Average	89	25	8.8	12.2	BDL	1091	1.20	BDL
		98%tile	128	46	14.3	16.1	BDL	1140	1.28	BDL
AQ08	Gaviyer	Maximum	127	57	11.0	13.9	BDL	1121	1.28	BDL
		Minimum	55	9	6.3	7.1	BDL	1027	0.96	BDL
		Average	89	23	8.5	11.8	BDL	1082	1.11	BDL
		98%tile	125	55	10.9	13.9	BDL	1119	1.28	BDL

Table 3-14: Ambient Air Monitoring Results (23rd November 2021 to 23rd December 2021)

Average Pollutant Concentration (All units are in µg/m³ except CO in mg/m³ and As, Ni in ng/m³)																
Pollutants			**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**NH3**	**O3**	**Pb**	**As**	**Ni**	**Hg**	**HC**	**CO**	**BaP**	**C_6H_6**
Sampling period / method			**24 hr**	**24 hr**	**24 hr**	**24 hr**	**24 hr**	**8 hr**	**24 hr**	**24 hr**	**24 hr**	**-**	**(GRAB)**	**1 hr**		
NAAQS 2009	**Industrial, Residential, Rural and Other Area**		**100**	**60**	**80**	**80**	**400**	**100**	**1**	**6**	**20**	**NS**	**NS**	**4**	**1**	**5**
Permissible limits	**Ecologically Sensitive Area (Notified by Central Govt.)**		**100**	**60**	**30**	**30**	**400**	**100**	**1**	**6**	**20**	**NS**	**NS**	**4**	**1**	**5**
AQ01	At Site	Maximum	136	54	8.6	16.5	BDL	18.8	BDL	BDL	BDL	ND	1012	1.2	0.46	BDL
		Minimum	73	22	5.2	13.1	BDL	6.1	BDL	BDL	BDL	ND	717	0.6	0.07	BDL
		Average	97	36	7.2	13.9	BDL	11.5	BDL	BDL	BDL	ND	867	0.9	0.19	BDL
		98th Percentile	135	54	8.6	16.1	BDL	18.3	BDL	BDL	BDL	ND	1005	1.2	0.44	BDL
AQ02	STP Area	Maximum	124	59	8.9	15.9	BDL	16.1	BDL	BDL	BDL	ND	928	1.0	0.76	BDL
		Minimum	34	23	5.0	12.0	BDL	6.1	BDL	BDL	BDL	ND	762	0.7	0.06	BDL
		Average	81	35	7.3	13.7	BDL	11.8	BDL	BDL	BDL	ND	840	0.9	0.31	BDL
		98th Percentile	122	55	8.8	15.8	BDL	16.0	BDL	BDL	BDL	ND	925	1.0	0.70	BDL
AQ03	Hazira Village	Maximum	125	57	7.8	19.8	BDL	17.8	BDL	BDL	BDL	ND	997	0.9	0.59	BDL
		Minimum	51	33	5.9	13.0	BDL	3.2	BDL	BDL	BDL	ND	788	0.6	0.15	BDL
		Average	92	44	6.7	17.5	BDL	9.8	BDL	BDL	BDL	ND	899	0.8	0.34	BDL
		98th Percentile	123	56	7.7	19.8	BDL	17.8	BDL	BDL	BDL	ND	992	0.9	0.58	BDL
AQ04	Hazira Aganwadi	Maximum	112	58	8.1	23.8	BDL	11.4	BDL	BDL	BDL	ND	974	0.8	0.30	BDL
		Minimum	72	29	6.6	13.4	BDL	3.2	BDL	BDL	BDL	ND	855	0.6	0.18	BDL
		Average	95	39	7.6	16.6	BDL	6.7	BDL	BDL	BDL	ND	913	0.6	0.23	BDL
		98th Percentile	112	56	8.1	23.3	BDL	11.0	BDL	BDL	BDL	ND	971	0.8	0.30	BDL

Average Pollutant Concentration (All units are in µg/m³ except CO in mg/m³ and As, Ni in ng/m³)																
Pollutants			**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**NH3**	**O3**	**Pb**	**As**	**Ni**	**Hg**	**HC**	**CO**	**BaP**	**C_6H_6**
Sampling period / method			**24 hr**	**24 hr**	**24 hr**	**24 hr**	**24 hr**	**8 hr**	**24 hr**	**24 hr**	**24 hr**	**-**	**(GRAB)**	**1 hr**		
NAAQS 2009	**Industrial, Residential, Rural and Other Area**		**100**	**60**	**80**	**80**	**400**	**100**	**1**	**6**	**20**	**NS**	**NS**	**4**	**1**	**5**
Permissible limits	**Ecologically Sensitive Area (Notified by Central Govt.)**		**100**	**60**	**30**	**30**	**400**	**100**	**1**	**6**	**20**	**NS**	**NS**	**4**	**1**	**5**
AQ05	Suvali	Maximum	121	36	9.4	21.8	BDL	12.1	BDL	BDL	BDL	ND	937	1.0	0.73	BDL
		Minimum	55	14	6.3	15.7	BDL	5.7	BDL	BDL	BDL	ND	728	0.6	0.17	BDL
		Average	84	30	7.2	19.1	BDL	8.4	BDL	BDL	BDL	ND	837	0.6	0.35	BDL
		98^{th} Percentile	119	36	9.1	21.8	BDL	11.9	BDL	BDL	BDL	ND	932	1.0	0.69	BDL
AQ06	At site (SW Corner)	Maximum	113	58	7.9	21.9	BDL	12.1	BDL	BDL	BDL	ND	1007	1.0	0.39	BDL
		Minimum	63	17	6.3	13.5	BDL	3.8	BDL	BDL	BDL	ND	880	0.6	0.02	BDL
		Average	89	50	7.0	15.6	BDL	7.0	BDL	BDL	BDL	ND	943	0.6	0.18	BDL
		98^{th} Percentile	113	58	7.8	21.4	BDL	11.8	BDL	BDL	BDL	ND	1004	1.0	0.38	BDL
AQ07	Mora	Maximum	119	58	11.3	20.1	BDL	13.9	BDL	BDL	BDL	ND	1013	0.9	0.91	BDL
		Minimum	42	15	6.6	11.4	BDL	5.7	BDL	BDL	BDL	ND	815	0.6	0.02	BDL
		Average	76	35	8.3	16.6	BDL	9.5	BDL	BDL	BDL	ND	918	0.6	0.26	BDL
		98^{th} Percentile	117	58	11.2	19.9	BDL	13.7	BDL	BDL	BDL	ND	1009	0.91	0.85	BDL
AQ08	Damka	Maximum	114	37	9.4	15.9	BDL	15.2	BDL	BDL	BDL	ND	1012	0.8	0.19	BDL
		Minimum	40	12	7.8	14.1	BDL	6.3	BDL	BDL	BDL	ND	871	0.6	0.02	BDL
		Average	73	23	8.7	15.2	BDL	10.2	BDL	BDL	BDL	ND	946	0.6	0.09	BDL
		98^{th} Percentile	111	35	9.4	15.9	BDL	14.9	BDL	BDL	BDL	ND	1009	0.89	0.18	BDL
AQ09	Kavas	Maximum	133	56	10.3	20.6	BDL	13.3	BDL	BDL	BDL	ND	946	0.9	0.07	BDL
		Minimum	24	11	6.6	13.7	BDL	5.7	BDL	BDL	BDL	ND	721	0.6	0.02	BDL

Average Pollutant Concentration (All units are in µg/m³ except CO in mg/m³ and As, Ni in ng/m³)																
Pollutants			**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NOx**	**NH3**	**O3**	**Pb**	**As**	**Ni**	**Hg**	**HC**	**CO**	**BaP**	**C_6H_6**
Sampling period / method			**24 hr**	**24 hr**	**24 hr**	**24 hr**	**24 hr**	**8 hr**	**24 hr**	**24 hr**	**24 hr**	**-**	**(GRAB)**	**1 hr**		
NAAQS 2009	**Industrial, Residential, Rural and Other Area**		**100**	**60**	**80**	**80**	**400**	**100**	**1**	**6**	**20**	**NS**	**NS**	**4**	**1**	**5**
Permissible limits	**Ecologically Sensitive Area (Notified by Central Govt.)**		**100**	**60**	**30**	**30**	**400**	**100**	**1**	**6**	**20**	**NS**	**NS**	**4**	**1**	**5**
		Average	78	34	8.2	17.7	BDL	8.5	BDL	BDL	BDL	ND	877	0.6	0.05	BDL
		98th Percentile	133	56	10.3	20.6	BDL	12.9	BDL	BDL	BDL	ND	944	0.9	0.07	BDL
AQ10	Gaviyar	Maximum	103	53	7.5	18.2	BDL	10.7	BDL	BDL	BDL	ND	1018	0.9	0.13	BDL
		Minimum	43	11	6.3	14.5	BDL	4.8	BDL	BDL	BDL	ND	898	0.6	0.02	BDL
		Average	70	34	7.0	16.4	BDL	8.0	BDL	BDL	BDL	ND	958	0.6	0.06	BDL
		98th Percentile	100	53	7.5	18.2	BDL	10.7	BDL	BDL	BDL	ND	1017	0.9	0.13	BDL
AQ11	Dumas	Maximum	100	39	8.4	21.7	BDL	12.7	BDL	BDL	BDL	ND	1066	0.9	0.15	BDL
		Minimum	48	18	7.2	13.6	BDL	5.7	BDL	BDL	BDL	ND	874	0.6	0.02	BDL
		Average	78	26	7.8	17.4	BDL	8.2	BDL	BDL	BDL	ND	948	0.6	0.06	BDL
		98th Percentile	99	39	8.4	21.6	BDL	12.4	BDL	BDL	BDL	ND	1059	0.9	0.14	BDL
AQ12	Vanta	Maximum	134	61	8.2	20.2	BDL	12.0	BDL	BDL	BDL	ND	1095	0.9	0.56	BDL
		Minimum	48	25	6.3	13.1	BDL	5.1	BDL	BDL	BDL	ND	893	0.7	0.03	BDL
		Average	89	38	7.2	17.2	BDL	9.2	BDL	BDL	BDL	ND	999	0.8	0.19	BDL
		98th Percentile	132	60	8.2	20.2	BDL	11.9	BDL	BDL	BDL	ND	1091	0.9	0.53	BDL

3.6.4 Key Findings

Interpretation of Data (7th March 2021 to 6th June 2021)

- The average concentration of PM_{10} recorded ranged from 75 µg/m^3 to 91 µg/m^3.
- The average concentration of $PM_{2.5}$ recorded ranged from 18 µg/m^3 to 27 µg/m^3.
- The average concentration of SO_2 recorded ranged from 8.2 µg/m^3 to 8.8 µg/m^3. All these values are within the specified limit of CPCB (80 µg/m^3).
- The average concentration of NO_X recorded ranged from 11.8 µg/m^3 to 12.5 µg/m^3. All these values are within the specified limit of CPCB (80 µg/m^3).

Interpretation of Data (23rd November 2021 to 26th December 2021)

- The value of PM10 ranges from 70 ug/m^3 to 97 ug/m^3
- The value of PM2.5 ranges from 23 ug/m^3 to 50 ug/m^3
- The value of SO2 ranges from 5.9 ug/m^3 to 8.7 ug/m^3
- The value of NOx ranges from 13.7 ug/m^3 to 19.1 ug/m^3
- The value of O3 ranges from 6.7 ug/m^3 to 11.8 ug/m^3
- The value of CO ranges from 0.6 mg/m3 to 0.8 mg/m^3
- The value of HC ranges from 837 ug/m3 to 999 ug/m^3
- The value of BaP ranges from 0.05 ng/m^3 to 0.35 ng/m^3
- The values for NH_3, Pb, As, Ni, Hg and C_6H_6 are below detection limit

3.7 Traffic Survey

Traffic survey is one of the important parameter to know the present traffic of the study area and help to determine the carrying capacity of existing road due to the additional traffic due to the proposed project. The vehicle movement has impact on ambient air. The pollution due to vehicular movement is known as line source. Vehicles are of two types, passenger and commercial/goods vehicles. Passenger vehicles including Buses, Taxies and Jeeps as well as commercial/goods vehicles including tankers, tankers and containers.

Traffic survey was carried out on important roads as well as site approach roads. Traffic survey is important study helps to find existing traffic density on the roads and with reference to existing traffic study we can easily estimate future increment in the vehicle numbers as well as pollution levels due to proposed project.

3.7.1 Road identification

The road considered for traffic survey is main approach road from Mora to Hazira which is national highway no. NH-6. There is movement of heavy vehicles during day time for transport of goods from various industries in the area.

3.7.2 Methodology

Traffic survey was carried out on both sides (up & down) on selected important road. Vehicles were classified into two types i.e. mechanized and non-mechanized vehicles.

The mechanized vehicles include two wheelers (bikes/mopeds/scooters), three wheelers (rickshaw/small 3 w tempos), four wheelers (cars/jeeps/tankers/buses/tractors etc.). The non-mechanized vehicles includes cycle/tricycle/carts.

Vehicle count was recorded at every 15 min interval for 14 hours, from early morning at 6:00hrs to late evening up to 20:00 hrs. The table below represents the total no. of vehicles over 14 hour duration.

3.7.3 Primary Data

Traffic survey was carried out for 24 hours on Mora-Hazira Road The existing traffic and additional traffic due to proposed project was calculated which is shown in below tables.

3.7.4 Key Findings

Table 3-15: Average per day - Existing & Proposed Traffic From Ichchapore to AMNSI

Type of Vehicle	From Ichchapore	% of Total Stream	Equivalent PCU Factor	Converted PCUs/ day	PCU/hr	Additional Vehicles per day	Additional PCUs / Day	Additional PCUs / hr	Total PCUs/day After Proposed Project	Total PCUs/hr After Proposed Project
Two wheeler	1671	36%	0.75	1253	52	200	150	6	1403	58
Three wheeler	92	2%	2	184	8	10	20	1	204	9
Car/Jeeps	868	19%	1	868	36	150	150	6	1018	42
Truck/Buses/Tractors	1874	40%	3.7	6934	289	750	2775	116	9709	405
Non Motorable vehicles	184	4%	0.5	92	4	30	15	1	107	4
Total	4689			9331	389	1140	3110	130	12441	518

Table 3-16: Average per day - Existing & Proposed Traffic To Ichchapore from AMNSI

Type of Vehicle	To Ichchapore	% of Total Stream	Equivalent PCU Factor	Converted PCUs/ day	PCU/hr	Additional Vehicles per day	Additional PCUs / Day	Additional PCUs / hr	Total PCUs/day After Proposed Project	Total PCUs/hr After Proposed Project
Two wheeler	1575	35%	0.75	1181	49	200	150	6	1331	55
Three wheeler	71	2%	2	142	6	10	20	1	162	7
Car/Jeeps	868	19%	1	868	36	150	150	6	1018	42

Type of Vehicle	To Ichchapore	% of Total Stream	Equivalent PCU Factor	Converted PCUs/ day	PCU/hr	Additional Vehicles per day	Additional PCUs / Day	Additional PCUs / hr	Total PCUs/day After Proposed Project	Total PCUs/hr After Proposed Project
Truck/Buses/Tractors	1824	40%	3.7	6749	281	750	2775	116	9524	397
Non Motorable vehicles	177	4%	0.5	89	4	30	15	1	104	4
Total	4515			9029	376	1140	3110	130	12139	506

Table 3-17: Average per day - Existing & Proposed Traffic From Adani port to Ichchapore

Type of Vehicle	From Adani	% of Total Stream	Equivalent PCU Factor	Converted PCUs	PCU/hr	Additional Vehicles per day	Additional PCUs / Day	Additional PCUs / hr	Total PCUs/day After Proposed Project	Total PCUs After Proposed Project
Two wheeler	1621	32%	0.75	1216	51	200	150	6	1366	57
Three wheeler	92	2%	2	184	8	10	20	1	204	9
Car/Jeeps	1046	21%	1	1046	44	150	150	6	1196	50
Truck/Buses/Tractors	2130	42%	3.7	7881	328	750	2775	116	10656	444
Non Motorable vehicles	151	3%	0.5	76	3	50	25	1	101	4
Total	5040			10402	433	1160	3120	130	13522	563

Table 3-18: Average per day - Existing & Proposed Traffic To Adani port from Ichchapore

Type of Vehicle	To Adani	% of Total Stream	Equivalent PCU Factor	Converted PCUs	PCU/hr	Additional Vehicles per day	Additional PCUs / Day	Additional PCUs / hr	Total PCUs/day After Proposed Project	Total PCUs After Proposed Project
Two wheeler	1649	30%	0.75	1237	52	200	150	6	1387	58
Three wheeler	92	2%	2	184	8	10	20	1	204	9
Car/Jeeps	1278	24%	1	1278	53	150	150	6	1428	60
Truck/Buses/Tractors	2265	42%	3.7	8381	349	750	2775	116	11156	465
Non Motorable vehicles	151	3%	0.5	76	3	50	25	1	101	4
Total	5435			11155	465	1160	3120	130	14275	595

The total PCU per hour for Ichchapore-AMNS Road will be 1024 and carrying capacity two lane (One way) highway is 1900 PCU per hour as per Guidelines of Indian Road Congress 64-1990.

The total PCU per hour for Ichchapore-Adani Road will be 1158 and carrying capacity two lane (Two way) highway is 1500 PCU per hour as per Guidelines of Indian Road Congress 64-1990.

3.8 Noise and Vibration

3.8.1 Methodology

The methodology used for primary data collection for ambient noise quality is described in ***Annexure 15.***

3.8.2 Secondary data

Secondary data for noise level are not available for this area

3.8.3 Primary data

Selection of Noise Monitoring Locations

Locations for noise monitoring were identified by desktop study and fixed the location during field survey at 2 km maximum from the source of noise generation and at sensitive locations ambient noise monitoring i. e. habitation area.

Photographs 3-3: Photographs of Noise Sampling locations

NL01 - At Site (Nr Hazira Police Station)

NL02 - At Site (Truck Parking Area)

NL03 - At Site (Nand Niketan)

NL04 - At Site (SE boundary)

NL05 - At Site (SW boundary)

NL06 - Hazira Village

NL07 - 100 m N from site boundary

NL08 - Suvali

Table 3-19: Noise Results, distance, direction, lat. / long

Loc. Code	Location	Date	Category	Distance w.r.t site (km)	Direction (from site)	Coordinates		Permissible Limits in dB (A)		Average Noise levels in dB (A)	
						Lat.	Long	Day Time	Night Time	Day Time	Night Time
NL01	At Site (Nr Hazira Police Station)	6/8/2021	Industrial	-	-	21° 8'38.43"N	72°39'35.70"E	75.0	70.0	66.7	58.9
NL02	At Site (Truck Parking Area)	6/8/2021	Industrial	-	-	21° 8'24.19"N	72°39'24.09"E	75.0	70.0	62.4	58.1
NL03	At Site (Nand Niketan)	6/8/2021	Commercial	-	-	21° 7'40.84"N	72°39'9.44"E	65.0	55.0	58.6	53.2
NL04	At Site (S boundary)	6/8/2021	Industrial	-	-	21° 7'26.07"N	72°39'3.45"E	75.0	70.0	67.8	65.4
NL05	At Site (SW boundary)	6/9/2021	Industrial	-	-	21° 7'31.68"N	72°38'40.85"E	75.0	70.0	60.4	58.9
NL06	Hazira Village*	6/10/2021	Residential	2.6	S	21° 5'42.64"N	72°38'57.23"E	55.0	45.0	54.9	44.6
NL07	100 m in N direction from site boundary	6/10/2021	Industrial	0.1	N	21° 8'56.78"N	72°39'43.83"E	75.0	70.0	62.1	57.5
NL08	Suvali	6/10/2021	Residential	1.6	WNW	21° 8'57.02"N	72°38'26.33"E	75.0	70.0	53.9	42.4

*Hazira village comes under Hazira notified industrial area

Observation

- Noise level during day and night time in Industrial area were observed within the permissible standard limits for industrial area (75 dBA (d)) & 70 dBA (n)).
- Noise level during day and night time in Residential area were observed within the permissible standard limit for residential area (55 dBA (d)) & 45 dBA (n)

3.9 Geology & Hydrogeology

3.9.1 General study methodology

Collection of existing maps and data

- District Resource Map, (Survey of India)
- CGWB reports
- State Groundwater report
- IMD data
- Land-use maps
- Google Earth and/or Topographic maps (drainage patterns, water bodies, topography, morphology and vegetation cover)

The integrated study of above maps leads to identification of specific issues related to geology and its effect on topography, morphology, drainage pattern and groundwater. It further gives an idea about water quality i.e. soluble salts. It further explains relation between surface and ground water.

Based on these inferences field visit, observation points and sampling locations are decided and acted upon. In some cases, non-invasive geophysical techniques are selected and data is correlated with surface features as well as with project requirement.

3.9.2 Secondary data Collection

Geological and hydrogeological conditions

The stratigraphic sequence as given by Geological Survey of India is given below:

Table 3-20: Geological succession

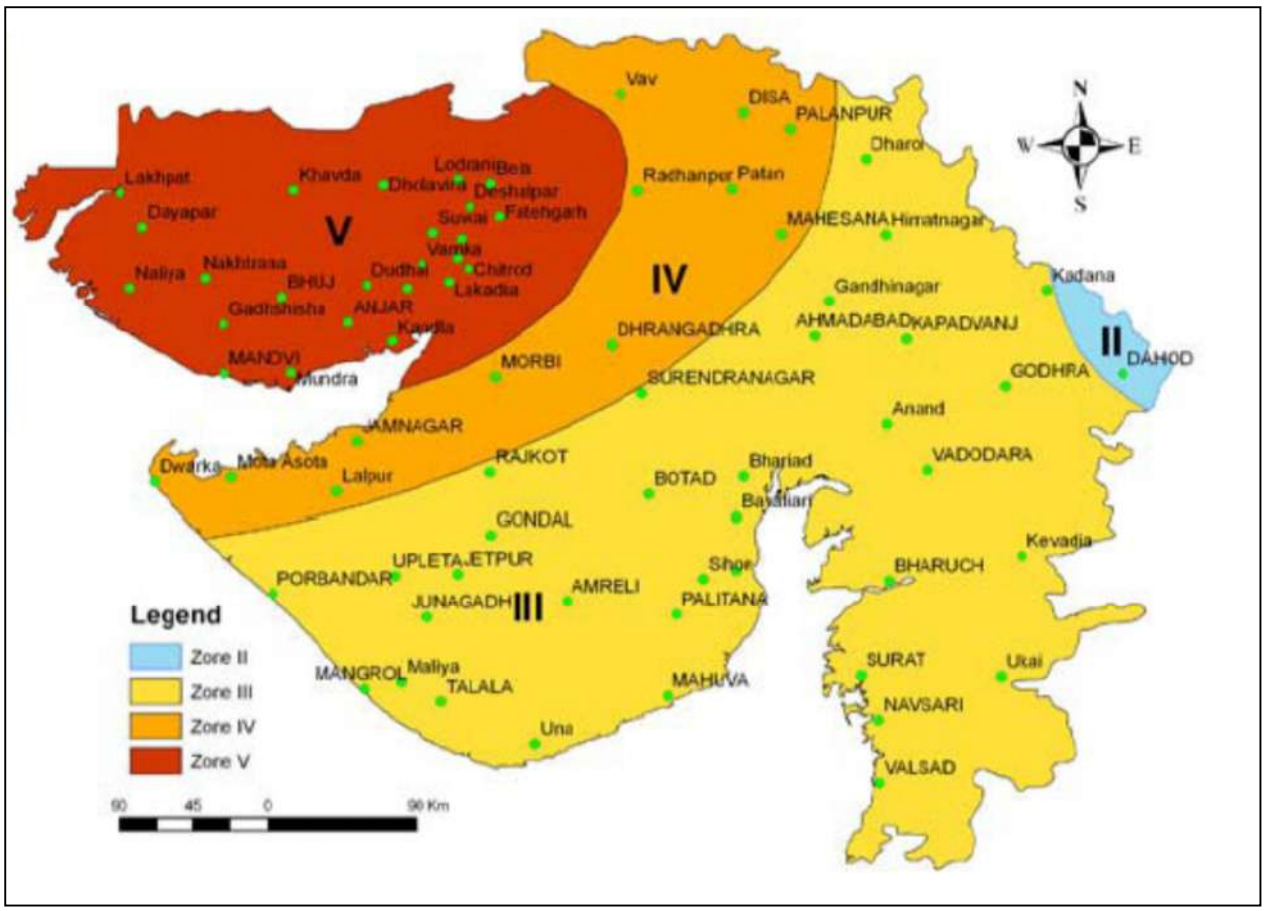
Lithology	Formation	Age
Spit/bar, tidal flat and shoal deposits	Mahuva Formation	Holocene
Coastal and Sand dunes	Akhaj Formation	
Flood plain deposits	Katpur Formation	
Older tidal flats and marsh deposits	Rann Clay Formation	
Calcareous sandstone with Conglomerate and clay	Jhagadia Formation	Middle MiocenetoPliocene
Clay, Fossiliferous Marl, Limestone, Sandstone, Siltstone and Conglomerate	Kand Formation	Lower Miocene
Ferruginous sandstone, Clay and conglomerate	Babaguru Formation	
Bentonite Clay, Claystone, Sandstone	Tarkeshwar Formation	Lower EocenetoOligocene
Argillaceous limestone, clay with Nummulites	Nummulite Formation	LowertoUpper Eocene
Clay, sandstone, conglomerate	Vagadkhol Formation	Lower Eocene
Basic dikes, plug, Rhyolite, Basalt, Alkali Basalt	Deccan Volcanics	Upper CretaceoustoEocene

Sandstone, limestone and clay	Bagh Formation	MiddleToUpper Cretaceous

Seismicity in the study area

The project area is located in the western India. The proposed site is situated in the Zone III (having moderate risk zone) of the Seismic Map of Gujarat shown in ***Figure 3-4.***

Figure 3-4: Seismic map of Gujarat

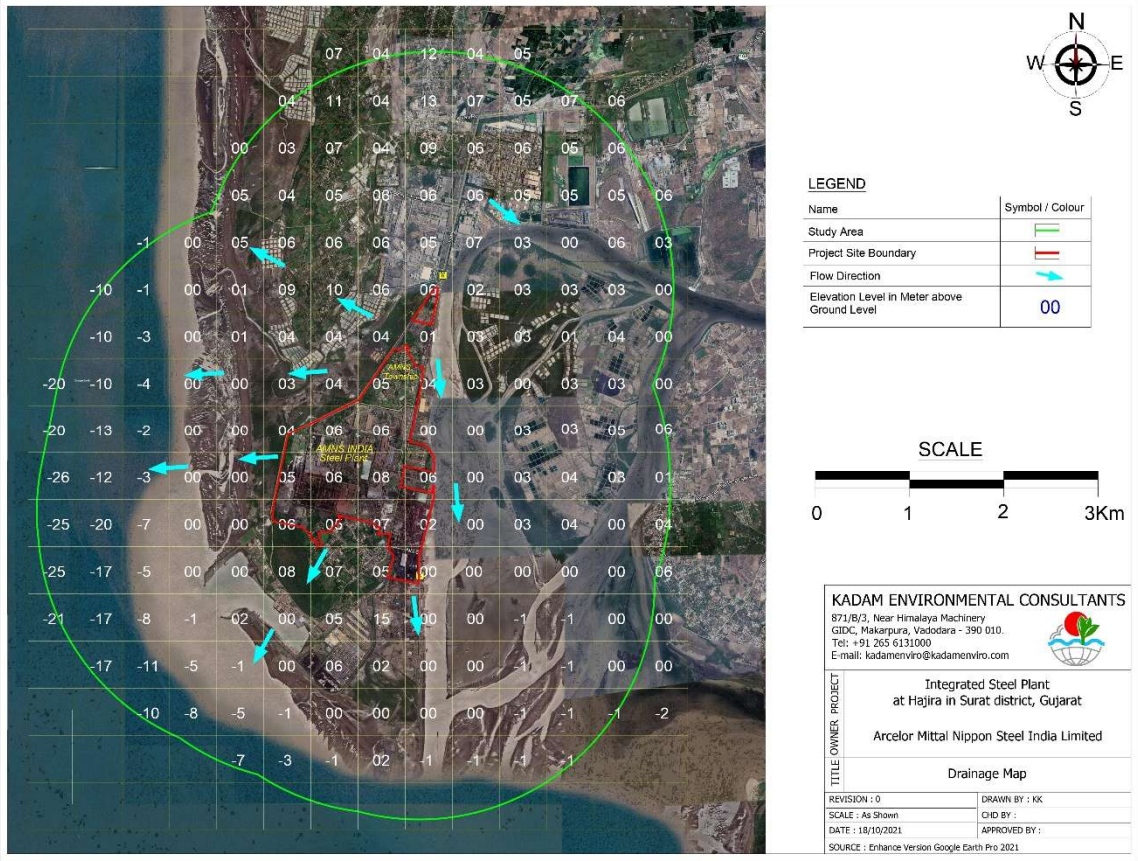


Source: Seismic Map of Gujarat (Institute of Seismological Research, Govt. of Gujarat)

Drainage Pattern in the study area

Map showing drainage pattern in the study area is given in ***Map 3-5***

Map 3-5: Drainage Map



The secondary data was collected from different EIA report and details of the same is given table below

Table 3-21: Ground water Secondary Data

Parameters	**Reference Report 1 Title**	**Reference Report 2 Title**
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**
Sampling Season / Period	Post-monsoon 2017 (Oct to Dec 2017)	Summer 2014
Sampling Locations	Hazira (Borewell), Suvali (Dugwell), Mora (Borewell), Vanta (Dugwell), Dumas (Dugwell)	Kawas, Suvali, Dumas, Hazira, Mora
pH	7.14 – 8.15	7.34 – 7.88
Temperature	29 – 29.5 °C	--
Turbidity	<0.1 NTU	<1 NTU
TDS	456 – 7620 mg/l	252 – 1110 mg/l

Parameters	Reference Report 1 Title	Reference Report 2 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**
Sampling Season / Period	Post-monsoon 2017 (Oct to Dec 2017)	Summer 2014
Electrical Conductivity	745 – 11800 µmho/cm	--
COD	<5 mg/l	--
BOD	<2 mg/l	--
Phenol	<0.001 mg/l	BDL
Chlorides	139 - 3297 mg/l	40 – 175 mg/l
Sulphates	21 – 1014 mg/l	24 – 89 mg/l
Total Hardness	130 – 1840 mg/l	125 – 260 mg/l
Ca++ Hardness	40 – 1700 mg/l	--
Mg++ Hardness	90 – 214 mg/l	--
Total Alkalinity	70 – 270 mg/l	100 – 510 mg/l
Nitrate	3.3 – 58.8 mg/l	1 – 9 mg/l
Fluoride	0.24 – 1.33 mg/l	0.7 – 0.8 mg/l
Sodium	87.6 – 1656 mg/l	33 – 278 mg/l
Potassium	6.8 – 20.1 mg/l	0.6 - 5 mg/l
Calcium	16.0 – 681.4 mg/l	42 – 78 mg/l
Magnesium	11.7 – 43.3 mg/l	3.6 – 13 mg/l
Salinity	251 – 5942 mg/l	--
Total Nitrogen	0.81 – 13.96 mg/l	--
Total Phosphorus	<0.02 mg/l	--
Dissolved Oxygen	2.4 – 3.3 mg/l	--
Ammonical Nitrogen	<0.05 – 1.83 mg/l	--
SAR (Sodium Absorption Ratio)	2.34 – 16.76	--
Arsenic (as As)	<0.002 mg/l	BDL
Cadmium (as Cd)	<0.003 mg/l	BDL
Chromium (as Cr)	<0.003 mg/l	BDL
Copper (as Cu)	<0.03 mg/l	BDL
Cyanide (as CN)	<0.003 mg/l	BDL
Iron (as Fe)	<0.05 – 0.09 mg/l	0.28 – 0.65 mg/l
Lead (as Pb)	<0.02 mg/l	BDL
Mercury (as Hg) (mg/lit)	<0.001	BDL
Manganese (as Mn) (mg/lit)	<0.02	BDL

Parameters	Reference Report 1 Title	Reference Report 2 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**
Sampling Season / Period	Post-monsoon 2017 (Oct to Dec 2017)	Summer 2014
Nickel (as Ni) (mg/lit)	<0.02	--
Zinc (as Zn) (mg/lit)	<0.03 – 0.10	BDL
Total Coliform (MPN/100ml)	Absent	BDL
Faecal Coliform (MPN/100ml)	Absent	BDL

3.9.3 Primary data collection

Topography

Hazira GIDC is located on west of Surat city on estuary of Tapi river Topographically the area is almost flat except few mounds on which villages Suvali, Rajgari and Mora are located. The area has a gentle slope toward west.

Drainage

The study area is drained by Tapi River flowing from North-East to South direction while Mindhola River flowing from East to West direction. Both of them are engulfing into Gulf of Khambhat. Overall, the general ground gradient is from North-East to South direction.

Ground Water

Methodology

The methodology used for primary data collection for ground water is described in ***Annexure 16***

Season and Period for Monitoring

The ground water samples were collected from Mid April to Mid June 2021.

Selection of Ground Water Sampling location

The ground water samples were collected from available 08 different locations during the monitoring period within the study area and the well-inventory data was collected and shown in table below.

Photographs 3-4: Photographs of Ground water sampling locations

GW01 – Hazira Gam

GW02 - Junagam

GW03 - Suvali Gam

GW04 - Ichchapore GIDC

GW05 - Vanta Gam

GW06 - Dumas

GW07 - Mora Tekra

GW08 - Kavas

Table 3-22: Ground Water Sampling Locations

Sample Id	Sampling Locations	Co-ordinates		Distance w.r.t site (km)	Direction (from site)
		Latitude	Longitude		
GW 1	Hazira Gam	21° 5'47.82"N	72°38'30.30"E	2.40	SSW
GW 2	Junagam	21° 8'50.88"N	72°38'20.64"E	1.50	NW
GW 3	Suvali Gam	21°10'12.87"N	72°38'24.99"E	3.25	NNW
GW 4	Ichchapore GIDC	21° 9'58.70"N	72°44'23.17"E	9.40	NE
GW 5	Vanta Gam	21° 7'49.06"N	72°44'41.29"E	9.00	East
GW 6	Dumas	21° 5'7.84"N	72°43'8.03"E	7.30	SE
GW 7	Mora Tekra	21°10'40.70"N	72°39'30.87"E	3.45	North
GW 8	Kavas	21°10'49.42"N	72°42'57.31"E	7.00	NNE

3.9.4 Key Findings

Analysis Results are given in ***Table 3-23.***

Table 3-23: Analysis Results of Ground water samples

Sample ID					GW 01	GW 02	GW 03	GW 04	GW 05	GW 06	GW 07	GW 08
Sampling Location					Hazira	Junagam	Suvali	Icchapur GIDC	Vanta	Dumas	Mora	Kavas
S. No.	Parameters	Unit	IS 10500 Standard Limits for drinking water									
			Acceptable limit	Permissible limit								
1	pH	pH scale	6.5-8.5	No Relaxation	8.30	8.31	7.54	7.96	8.15	7.84	7.85	8.01
2	Temperature	o C	NS	NS	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
3	Turbidity	NTU	1	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4	TDS	mg/lit	500	2000	1472	1180	1492	3992	404	1804	6852	912
5	Electrical conductivity	µmhos/cm	NS	NS	2340	1897	2498	6878	718	2940	9490	1612
6	COD	mg/lit	NS	NS	<5	<5	<5	<5	<5	<5	<5	<5
7	BOD	mg/lit	NS	NS	<2	<2	<2	<2	<2	<2	<2	<2
8	Phenol	mg/lit	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
9	Chlorides	mg/lit	250	1000	410	250	460	1340	150	680	2229	210
10	Sulphates	mg/lit	200	400	578	341	296	1111	21	227	586	281
11	Total Hardness	mg/lit	200	600	350	420	470	190	280	510	1210	350
12	Ca++ Hardness	mg/lit	NS	NS	240	316	330	112	214	356	56	240
13	Mg++ Hardness	mg/lit	NS	NS	110	104	140	78	66	154	1154	110
14	Total Alkalinity	mg/lit	200	600	300	300	150	230	270	210	210	240

Sample ID					GW 01	GW 02	GW 03	GW 04	GW 05	GW 06	GW 07	GW 08
Sampling Location					Hazira	Junagam	Suvali	Icchapur GIDC	Vanta	Dumas	Mora	Kavas
S. No.	Parameters	Unit	IS 10500 Standard Limits for drinking water									
			Acceptable limit	Permissible limit								
15	Nitrate	mg/lit	45	NR	24.92	66.34	64.99	5.66	1.70	0.85	0.35	5.10
16	Fluoride	mg/lit	1	1.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
17	Sodium	mg/lit	NS	NS	234.3	190.7	211.7	565.5	42.7	338.1	2819.0	94.6
18	Potassium	mg/lit	NS	NS	34.3	31.5	27.29	38	14.93	26.6	355	17.4
19	Calcium	mg/lit	75	200	96.2	126.7	132.3	44.9	85.8	142.7	22.4	96.2
20	Magnesium	mg/lit	30	100	26.7	25.3	34.0	19.0	16.0	37.4	280.4	26.7
21	Salinity	mg/lit	NS	NS	739	450	829	2414	270	1225	4017	378
22	Total Nitrogen	mg/lit	0.5	NR	5.88	15.86	15.02	1.40	0.65	0.37	0.09	1.21
23	Total Phosphorous	mg/lit	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
24	Dissolved Oxygen	mg/lit	NS	NS	2.5	2.2	2.5	2.9	2.7	2.3	2.8	2.2
25	Ammonical Nitrogen	mg/lit	NS	NS	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
26	SAR	-	NS	NS	5.43	4.04	4.23	17.78	1.11	6.49	35.03	2.19
27	TSS	mg/lit	NS	NS	13	12	16	11	14	12	13	15
28	Heavy Metals											
a	Arsenic (as As)	µg/lit	10	50	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
b	Cadmium (as Cd)	µg/lit	3	NR	0.26	0.19	0.19	0.19	0.20	0.20	0.24	0.22

Sample ID					GW 01	GW 02	GW 03	GW 04	GW 05	GW 06	GW 07	GW 08
Sampling Location					Hazira	Junagam	Suvali	Icchapur GIDC	Vanta	Dumas	Mora	Kavas
S. No.	Parameters	Unit	IS 10500 Standard Limits for drinking water									
			Acceptable limit	Permissible limit								
c	Cromium (as Cr)	µg/lit	50	NR	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
d	Copper (as Cu)	µg/lit	50	1500	0.12	0.11	0.12	<0.03	0.11	0.14	0.15	<0.03
e	Cyanide (as CN)	µg/lit	50	NR	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
f	Iron (as Fe)	µg/lit	300	NR	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
g	Lead (as Pb)	µg/lit	10	NR	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
h	Mercury (as Hg)	µg/lit	1	NR	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
i	Manganese (as Mn)	µg/lit	100	300	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
j	Nickel (as Ni)	µg/lit	20	NR	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
k	Zinc (as Zn)	µg/lit	5000	15000	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
28	Total Coliform	MPN	Shall not be detectable in any 100ml sample	Shall not be detectable in any 100ml sample	39	14	27	N.D(<1.8)	920	220	350	11
29	Faecal Coliforms	MPN	Shall not be detectable in any 100ml sample	Shall not be detectable in any 100ml sample	11	N.D(<1.8)	14	N.D(<1.8)	220	110	110	N.D(<1.8)

Interpretation of Ground water Data

From the observation of the distribution of Total Dissolved Solids Content (TDS) in ground water which is ranging from 404-6852 mg/l, shows that the TDS concentrations of samples GW 1-3, & GW 6-8 are above acceptable limit and GW-4, GW-7 are above permissible limit.

- Electrical Conductivity values appears high in all samples. EC values ranges from 718-9490 µmho/cm.
- Sulphates present in GW-5 sample is within their acceptable and permissible limit, except GW-2, GW-3, GW-6 & GW-8 samples above Acceptable limit; while, GW-1, GW-4 & GW-7 is above Permissible limit.
- Total Alkalinity found above the acceptable limit in GW-1, GW-2, GW-4 to 7 samples.
- Nitrate is found in varying proportion in all samples and also found above the acceptable limit in GW 2 7 GW 3. Values ranges from 0.35 mg/l to 64.99 mg/l.
- Total Nitrogen found above the acceptable limit in each ground water sample except GW-6 & 7. Values ranges from0.09 mg/l to 15.86 mg/l
- Cadmium is detected in all groundwater samples and is within the acceptable limit. Value ranges from 0.19 µg/lit l to 0.26 µg/lit
- Total coliforms are detected in all samples except GW 4.
- Faecal Coliforms is also detected in GW-1, GW-3, & GW-5 to GW 7.
- The presence of Total coliforms & Faecal Coliforms is indicating leaky aquifer condition and Hydraulic connection between shallow and lower aquifer. Presence of Total coliforms and Faecal Coliforms in groundwater may be due to discharge & disposal of untreated sewage on land environment and infiltration of the same to underneath aquifer.

The presence of Nitrogen found in ground water sample above the acceptable limit could be due to animal manure & use of chemical fertilizer for agriculture.

The area in the close proximity of sea. The aquifer comprises of saline water containing TDS above the acceptable limit. The wells located near the surface water bodies are only yielding relatively good quality water, it is observed and confirmed from chemical analysis of groundwater samples. However, Dug-wells water samples yield relatively good quality water.

3.10 Surface Water Environment

3.10.1 Methodology

The methodology used for primary data collection for surface water is described in ***Annexure 16.***

3.10.2 Secondary Data

The secondary data was collected from different EIA report and details of the same is given ***Table 3-24***

Table 3-24: Surface water Secondary Data

Parameters	Reference Report 1 Title	Reference Report 3 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**
Sampling Season / Period	**Post-monsoon 2017 (Oct to Dec 2017)**	**Summer 2014**
Sampling locations	Hazira Pond-1 (near EBTL gate), Suvali Pond	Hazira
pH	7.42 – 7.57	7.95
Total Dissolved Oxygen	4.2 – 4.6 mg/l	5.2 mg/l
Total Dissolved Solids	540 – 2812 mg/l	32400 mg/l
Electrical Conductivity	968 – 4800 µmohs/cm	--
BOD	12 – 14 mg/l	9 mg/l
Color	15 Pt.co	--
Total Hardness	290 – 460 mg/l	4500 mg/l
Ca++ Hardness	64 – 68 mg/l	960 mg/l
Mg++ Hardness	226 – 392 mg/l	--
Copper	<0.03 mg/l	0.02 mg/l
Iron	<0.05 mg/l	7.12 mg/l
Manganese	<0.02 mg/l	0.43 mg/l
Chlorides (as CL)	194 - 1370 mg/l	18725 mg/l
Sulphate	35 – 67 mg/l	2052 mg/l
Nitrate (as NO3)	<0.1 mg/l	7 mg/l
Fluoride	0.64 – 0.69 mg/l	--
Phenolic Compound	<0.001 mg/l	--
Free Ammonia	<0.1 mg/l	--
Mercury	<0.001 mg/l	--
Cadmium	<0.003 mg/l	<0.003 mg/l
Arsenic	<0.01 mg/l	--
Cyanide	<0.03 mg/l	--
Lead	<0.01 mg/l	<0.01 mg/l
Zinc	<0.03 mg/l	<0.012 mg/l
Chromium	<0.02 mg/l	<0.01 mg/l
Boron	<0.05 mg/l	--
Sodium Absorption Ratio	2.53 – 16.65 mg/gm	--
Total Coliform	1700 – 2100 MPN/100ml	--

3.10.3 Primary Data

Selection of monitoring locations with rationale

Surface water sampling locations are selected based on review of land use map, surface drainage pattern/ground water flow direction & nearby site habitation in study area.

Surface water samples were collected from locations mentioned in ***Table 3-25.***

Table 3-25: Sampling locations for Surface water

Sam. Code	Location	Source	Coordinate		Distance w.r.t site (km)	Direction (from site)
			Latitude	Longitude		
SW01	At Site	Pond	21° 8'42.58"N	72°39'33.86"E	-	-
SW02	Dumas	River	21° 6'23.02"N	72°42'18.05"E	5.0	E
SW03	Hazira (Nr EBTL Gate)	Pond	21° 5'55.34"N	72°38'59.35"E	2.2	S
SW04	Suvali	Pond	21°10'27.69"N	72°38'35.56"E	3.3	NNW
SW05	NR Hazira Police Station	Tapi River	21° 8'49.55"N	72°39'42.36"E	0.1	E
SW06	Nr Nand Niketan	Tapi River	21° 7'6.24"N	72°39'31.26"E	-	E
SW07	Mora	Pond	21°10'15.21"N	72°39'44.08"E	2.7	N
SW08	Junagam	Pond	21° 8'47.11"N	72°38'33.54"E	1.4	W

Photographs 3-5: Photographs of Surface Water sampling locations

SW01 - At Site

SW02 – Dumas

SW03 - Hazira (Nr EBTL Gate)

SW04 – Suvali

SW05 - NR Hazira Police Station

2 SW06-Nr Nand Niketan

SW07 - Mora

SW08 - Junagam

3.10.4 Key Findings

Analysis results of the surface water samples are presented in ***Table 3-26***

Table 3-26: Surface water Analysis Results

Sr. No.	Parameters	Unit	Classification for Inland Surface Water (CPCB)					Surface Water Quality							
								At site	Dumas (River)	Hazira (Pond)	Suvavli (Pond)	Nr. Hazira Police Station (River)	Nr. Nand Niketan	Mora	Junagam
			A	B	C	D	E	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21
1	pH	pH Scale	6.5 to 8.5	6.5 to 8.5	6.0 to 9.0	6.5 to 8.5	6.5 to 8.5	8.36	7.72	7.40	8.39	7.23	7.49	8.11	7.58
2	Dissolved Oxgen	mg/l	6.0	5.0	4.0	4.0	NS	4.5	6.6	3.5	4.2	4	5.6	4.5	5.5
3	Total Dissolved Solids	mg/l	500	NS	1500	NS	2100	344	39316	624	1208	31164	30476	2316	5288
4	Electrical Conductivity	µmohs/cm	NS	NS	NS	1000	2250	532	62500	1050	2050	51256	50565	3756	10150
5	BOD	mg/l	2.0	3.0	3.0	NS	NS	5	4	4	12	5	14	9	3
6	Colour	Pt.co	10	300	300	-	-	10	20	10	10	20	20	10	10
7	Total Hardness	mg/l	300	NS	NS	NS	NS	150	13500	460	260	8500	7100	700	750
8	Ca++ Hardness	mg/l	200	NS	NS	NS	NS	96	1500	380	190	162	154	346	380
9	Mg++ Hardness	mg/l	100	NS	NS	NS	NS	54	12000	80	70	8338	6946	354	370
10	Copper	mg/l	1.5	NS	1.5	NS	NS	0.11	0.10	0.12	0.15	0.13	0.13	0.11	0.15
11	Iron	mg/l	0.3	NS	50	NS	NS	0.13	0.13	<0.05	<0.05	0.69	<0.05	0.13	0.13

Sr. No.	Parameters	Unit	Classification for Inland Surface Water (CPCB)					Surface Water Quality							
								At site	Dumas (River)	Hazira (Pond)	Suvavli (Pond)	Nr. Hazira Police Station (River)	Nr. Nand Niketan	Mora	Junagam
			A	B	C	D	E	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21
12	Manganese	mg/l	0.5	NS	NS	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
13	Chlorides(as CL)	mg/l	250	NS	600	NS	600	100	19394	165	485	13896	13546	750	2249
14	Sulphate	mg/l	400	NS	400	NS	1000	71	1414	89	193	3562	3221	421	1128
15	Nitrate (as NO_3)	mg/l	20	NS	50	NS	NS	4.82	3.63	4.89	6.57	3.61	2.76	1.91	0.71
16	Fluoride	mg/l	1.5	1.5	1.5	-	-	0.08	0.05	0.28	<0.05	<0.05	<0.05	<0.05	<0.05
17	Phenolic Compound	mg/l	0.002	0.005	0.005	NS	NS	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
18	Free Ammonia	mg/l	NS	NS	NS	1.2	NS	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
19	Mercury	mg/l	0.001	NS	NS	NS	NS	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20	Cadmium	mg/l	0.01	NS	0.01	NS	NS	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
21	Arsenic	mg/l	0.05	NS	0.2	NS	NS	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
22	Cyanide	mg/l	0.05	0.05	0.05	NS	NS	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
23	Lead	mg/l	0.1	NS	0.1	NS	NS	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
24	Zinc	mg/l	15	NS	15	NS	NS	<0.03	<0.03	0.07	<0.03	<0.03	<0.03	<0.03	<0.03
25	Chromium	mg/l	0.05	1	0.05	NS	NS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
26	Boron	mg/l	NS	NS	NS	NS	2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Sr. No.	Parameters	Unit	Classification for Inland Surface Water (CPCB)					Surface Water Quality							
								At site	Dumas (River)	Hazira (Pond)	Suvavli (Pond)	Nr. Hazira Police Station (River)	Nr. Nand Niketan	Mora	Junagam
			A	B	C	D	E	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21	28.05.21
27	Sodium Absorption Ratio	mg/gm	NS	NS	NS	NS	26	1.82	30.51	1.94	5.53	32.99	28.86	5.17	17.06
28	Total Coliform	MPN/100 ml	50	500	5000	-	-	260	1800	1400	1110	1800	1800	1205	2000
29	COD	Mg/l	-	-	-	-	-	20	16	12	45	20	57	33	12
Class of Surfece Water body as per CBCB Guideline															
Note: NA - Not Applicable, NR - No Relaxation, NS - Not Specified															

Note: * - NS- Not Specified

S. No.	Class	Intended Use
1	A	Drinking water source without conventional treatment but after disinfection
2	B	Outdoor bathing (organized)
3	C	Drinking water source with conventional treatment followed by disinfection
4	D	Propagation of wild life, fisheries
5	E	Irrigation, industrial cooling etc.

Observation of surface water (Pond & River) quality:

Following inferences can be drawn based on the baseline water quality results.

River water: Quality of SW02 and SW05 can be compared with class E as per classification of Inland surface water and can be used for Irrigation, industrial cooling etc.

Pond water: Quality of SW1 can be compared with class B as per Inland surface water and can be used for outdoor bathing.

The Quality of SW3 can be compared with class D as per Inland surface water classification and can be used for Propagation of wild life, fisheries.

Quality of SW4, SW6, SW7 & SW8 can be compared with class E as per Inland surface water classification and can be used Irrigation, industrial cooling etc.

3.11 Soil

3.11.1 Methodology

The methodology used for primary data collection for soil is described in ***Annexure 17.***

3.11.2 Secondary Data

The secondary data was collected from different EIA report and details of the same is given ***Table 3-27***

Table 3-27: Soil Secondary Data

Parameters	Reference Report 1 Title	Reference Report 2 Title	Reference Report 3 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Environmental Impact Assessment report for Proposed Additional Facility of 51 MW Captive Combined Cycle Power Plant at Hazira ONGC Gas Processing Complex, Surat, Gujarat, Prepared by ONGC in the year 2015**	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**
Sampling Season / Period	Post-monsoon 2017 (Oct to Dec 2017)	March to May 2015	Summer 2014
Sampling Locations	Hazira village, Suvali village, Dumas village, Vanta village	Dumas, Kawas, Suvali, Hazira	Hazira, Dumas, Kawas
Porosity	37 – 58 %	36.8 – 48.8 %	47.2 – 47.84 %
Water Holding Capacity	31.87 – 60.34 %	37.53 – 62.13 %	47.44 – 54.82 %
Permeability	10.08 – 41.40 mm/hr	--	--
Sand	32.56 – 87.84 %	Core sand: 1.84 – 7.68 %	21 – 91 %

Parameters	Reference Report 1 Title	Reference Report 2 Title	Reference Report 3 Title
	EIA Study for Development of LNG Terminal at Hazira, District Surat, Gujarat, For Essar Bulk Terminal Limited, Prepared by Kadam Environmental Consultants in the year February 2019	**Environmental Impact Assessment report for Proposed Additional Facility of 51 MW Captive Combined Cycle Power Plant at Hazira ONGC Gas Processing Complex, Surat, Gujarat, Prepared by ONGC in the year 2015**	**Debottlenecking and Expansion of Existing Petrochemical Complex of M/s. Reliance Industries Limited , Hazira, Dist. Surat, Gujarat; Prepared by ERM India Private Limited in the year September 2016**
		Fine sand: 7.36 – 86.68 %	
Silt	1.28 – 32.72 %	8.04 – 41.76 %	5 – 34 %
Clay	7.16 – 34.72 %	1.6 – 48.8 %	4 – 45 %
Texture	Sand, Loamy Sand, Sandy Clay Loam, Clay Loam	Clay, Sand	Sandy Soil, Clay
Cation Exchange capacity	15.98 – 24.12 meq/100 gm	--	--
Electrical Conductivity	0.325 – 0.648 dS/m	0.24 – 0.45 dS/m	0.338 – 1.058 dS/m
Exchangeable Sodium	<0.1 – 0.61 %	--	--
pH	7.90 – 8.42	7.6 – 7.9	7.78 – 7.88
Calcium	0.11 – 0.22 g/kg	1.2 – 2.6 meq/l	26.6 – 52 mg/kg
Magnesium	0.21 – 0.35 g/kg	0.8 – 2.1 meq/l	13.44 – 22.44 mg/kg
Sodium	0.23 – 0.48 g/kg	0.17 – 1.5 meq/l	17.25 – 41.17 mg/kg
Potassium	0.16 – 0.44 g/kg	0.11 – 0.25 meq/l	4.29 – 53.04 mg/kg
Organic Carbon	--	0.36 – 0.48 %	0.23 – 1.04 %
Nitrogen	--	127.94 – 298.54 kg/Ha	Available Nitrogen: 110 – 410 kg/ha
K2O	--	50.57 - 96.43 kg/ha	91 – 168 kg/ha
SAR	--	--	--

3.11.3 Primary Data

Soil samples were collected from locations mentioned in ***Table 3-28***

Table 3-28: Sampling locations for Soil

Sample Id	Sampling Locations	Coordinate		Type of land	Distance (km)	Direction
		Latitude	Latitude			
ST01	Hazira Gam	21° 5'47.82"N	72°38'30.30"E	Agricultural	2.40	SSW
ST02	Suvali	21° 8'50.88"N	72°38'20.64"E	Agricultural	1.50	NW
ST03	Suvali Gam	21°10'12.87"N	72°38'24.99"E	Agricultural	3.25	NNW
ST04	Mora Tekra	21°10'40.70"N	72°39'30.87"E	Agricultural	3.45	North
ST05	Kavas	21°10'49.42"N	72°42'57.31"E	Agricultural	7.00	NNE
ST06	Ichchapore GIDC	21° 9'58.70"N	72°44'23.17"E	Industrial	9.40	NE
ST07	Vanta Gam	21° 7'49.06"N	72°44'41.29"E	Agricultural	9.00	East
ST08	Dumas	21° 5'7.84"N	72°43'8.03"E	Agricultural	7.30	SE

Photographs 3-6: Photographs of soil sampling locations

ST01 – Hazira Gam

ST02 - Suvali

ST03 – Suvali Gam

ST04 – Mora Tekra

ST05 – Kavas

ST06 – Ichchapore GIDC

ST07– Vanta Gam

ST08 - Dumas

3.11.4 Key Findings

Analysis results of the soil samples are presented in

Table 3-29

Table 3-29: Analysis Results of Soil sampling

Sampling Location			S1	S2	S3	S4	S5	S6	S7	S8
S. No.	Parameter	Unit								
1	Porosity	%	47	46	41	48	43	56	51	57
2	Water Holding Capacity	%	34.62	32.70	30.90	38.15	31.69	39.51	42.04	44.59
3	Permeability	mm/hr	31.68	33.88	37.80	25.85	36.36	14.62	24.52	15.66
4	Particle Size Distribution	-								
a	Sand	%	73	86	93	57	90	35	57	41
b	Silt	%	20	10	3	36	1	48	26	29
c	Clay	%	7	4	4	7	9	17	17	30
5	Texture	-	Loamy Sand	Loamy Sand	Sand	Sandy Loam	Sand	Loam	Sandy Loam	Clay Loam
6	Cation Exchange Capacity	meq/100g soil	18.47	16.61	15.81	18.58	18.96	21.26	21.75	23.84
7	SAR	µmohs/cm	0.23	0.21	0.12	0.32	0.09	0.04	0.18	0.10
8	Exchangeable Sodium	%	2.19	2.17	2.07	2.28	2.04	1.99	2.14	2.05
9	Electrical Conductivity	--	0.605	0.263	0.157	2.680	0.291	0.754	0.769	0.341
10	pH	g/kg	8.61	8.38	8.71	8.60	8.22	7.96	8.52	8.20
11	Calcium	g/kg	0.88	0.80	1.60	1.04	1.36	1.60	1.44	1.60
12	Magnesium	g/kg	16.12	14.18	13.37	15.96	16.85	18.63	17.17	20.66
13	Sodium	g/kg	0.95	0.83	0.47	1.33	0.39	0.18	0.79	0.48
14	Potassium	meq/100gm	0.52	0.80	0.37	0.25	0.36	0.84	2.35	1.10
15	Organic carbon	%	0.50	0.69	0.49	0.48	0.65	0.58	0.62	0.58
16	Total nitrogen	%	0.043	0.059	0.042	0.041	0.056	0.050	0.053	0.050
17	Available potassium	kg/ha	454.3	698.9	428.1	419.3	567.3	436.8	2052.9	436.8

Interpretation of Soil Data

The analysis of physicochemical properties of soil samples collected from surrounding area indicated that porosity ranged from 41 - 57 % and WHC varied from 30.90 – 44.59 %, while permeability ranged from 14.62 – 37.80 mm/hr.

Moderate WHC and high porosity is on account of sandy to clay loam texture of soils and permeability was moderate due alkaline pH of soils.

The CEC ranged from 15.81 – 23.84 meq/100 g soil, which is a moderate looking to the texture of soils. The EC (0.157 – 2.68 dS/m) was normal (<0.80 dS/m) to high (>1.6 dS/m) and ESP (1.99 to 2.28) was well within the safe limit of <15.0. The pH ranged from 7.96 – 8.71, indicating that soils are alkaline (pH 7.80 to <8.5) to sodic (pH >8.5).

Among water soluble cations predominance of Mg (13.37 – 20.66 meq/100 g) was seen followed by K (0.25 to 2.35 meq/100 g), Ca (0.80 to 1.60 meq/100 g) and Na (0.18 to 1.33 meq/100 g).

Fertility status of soil reveal that organic carbon was low (<0.50 % OC) to medium (0.50 – 0.75 % OC) and available potassium was high (>280 kg/ha).

Soils in the area are alkaline to sodic, which require application of gypsum to bring down soil pH to near neutral condition

3.12 Ecology & Biodiversity

3.12.1 Development and biodiversity

Biodiversity is an important component of the EIA study and it needs to be honestly addressed in the decision making process. Biodiversity conservation is important as all species are interlinked, even if this is not immediately visible or even known, and our survival depends on this fine balance that exists within nature. Impact assessment, simply defined, is the process of identifying the future consequences of a current or proposed action. It is an important tool for minimizing adverse effects from project-related activities on the environment in general and biodiversity in particular. Mitigation measures for biodiversity impacts include avoidance, reduction, moderation, and minimization, relocation and translocation, repair, reinstatement, and restoration, compensation, enhancement and mitigation banking. The biological environment is an important component of the environment of any area. It includes flora & fauna in the region and also different ecosystems/habitat types.

As a part of EIA, this report represents existing biodiversity status of the project site (core zone) and its surrounding environ of the project study area (buffer zone of 10 km. radius). Also, an effort have been made to predict likely impacts of project and its associated activities, and suggests mitigation measures to reduce impacts on various biological components of the project study area.

3.12.2 Study period

A field study for biodiversity inventory was carried out during summer 2021 and December 2021.

3.12.3 Scope, aim and objectives

- To inventories floral and faunal components of project area (project site /core zone and 10 km. radius / buffer zone).

- To locate / demarcate and understand ecological setting of the project area in terms of national parks / wildlife sanctuary / reserve forests / tiger reserve / Eco-sensitive Areas / wetlands etc. within 10 km. radius from project site (if any).
- To inventories floral and faunal components of the project site/core zone and 10 km. radius / buffer zone
- To identify Schedule-I, rare, endemic and endangered species within the project study area and prepare conservation plan for same.
- To identify impact zone and evaluate the likely impact of the proposed project on floral and faunal components of the project study area.
- To suggest / prepare action plan to mitigate likely impacts on the biodiversity of the project area through green belt development around project boundary, along roads to reduce.

3.12.4 Study area

Delineation of the study area

Project site / Core zone and Buffer zone

Project site as a core zone and surrounding 10 km. radius considered as a buffer zone for study.

Sensitivity / habitats of the study area

Table 3-30: Sensitivity of study area

S. No.	Sensitive Ecological Features	Name of feature / Location	Distance (km)	Direction	Reason of Significance
1	Ramsar wetland (Ramsar Convention)	No	--	--	--
2	Wetlands as per National Wetlands Atlas	No	--	--	--
3	National park	No	--	--	No such notified area
4	Wildlife sanctuary	No	--	--	No such notified area
5	Tiger reserve	No	--	--	No such notified area
6	Biosphere reserve	No	--	--	No such notified area
7	Elephant reserve	No	--	--	No such notified area
8	Important Bird Areas (IBAs)	No	--	--	No such notified area
9	Eco-sensitive zone (EP Act)	No	--	--	No such notified area
10	Forest (Forest Conservation Act) (including protected forests and reserved forests)	- Reserved Forest (RF) - Open Forest - Open Forest	- adjacent - 4.90Km. - 6.50 Km.	W E NNW	- Hazira RF adjacent to project site. - Open Forest near Dumas Village - Open Forest near Vasava Village
11	Wildlife corridor	No	--	--	No such corridors known in area
12	Coastal zones	Yes	Adjacent to Site	W	Arabian Sea

S. No.	Sensitive Ecological Features	Name of feature / Location	Distance (km)	Direction	Reason of Significance
13	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	No	--	--	No such corridors known in area
14	Endemic species, if any	No	--	--	No such species known in this area
15	Mangroves	Yes	0.56 Km 0.91 Km 1.80 Km	E NW S	Mangroves area present at various locations (refer map).

Rivers/Water Bodies

Table 3-31: Details of Water Bodies in the Buffer Zone

S. No.	River/Bandhara	Distance from Project Site (km.)	Direction
1	Tapi River	500 m.	E
2	Hazira pond	2.2 km.	S
3	Suvali pond	3.57 Km.	NNW
4	Mora pond	3.25 km.	NNE
5	Junagam Pond	1.81 km.	W

Forests Areas

Table 3-32: Details of Forest Areas in the Buffer Zone

S. No.	Type of Forest	Status	Distance from Project Site (km.)	Direction
1	Hazira	Reserve Forest	adjacent	W
2	Dumas	Forest (Unprotected)	4.90 Km.	E
3	Vanta	Forest (Unprotected)	6.50	NNW

Photographs 3-7: Habitats of the Buffer Zone Area

Sea shore with sparse mangroves the North-West Side of the project site

Adjacent Forest Area – Prosopis dominated towards Southern Side of the project site

Mudflat towards Eastern Site of the project site

Sea shore towards the Western Side of the project site

3.12.5 Methodology

The methodology used for primary data collection is described in ***Annexure 18.***

3.12.6 Terrestrial biodiversity status

Flora

Core Zone / Project site

Existing Greenbelt

Since this is an existing project, a plant area has been undergone extensive plantation / greenbelt development. Existing greenbelt area possesses 26 species of plants. Presently, plant premises and township area encompasses well grown greenbelt with 287429 trees planted in various locations. Green area includes plantation as well as landscaping. Detailed on numbers of each species is given in the following table.

Table 3-33: Details of Existing Greenbelt Species in the Core Zone

Sr. No.	Type of Tree	Plant Area Nos.	Township Area Nos.
1	Peltophorum sp.	67000	19000
2	Neem	3000	700
3	Kadamb	100	200
4	Siris	1500	500
5	Putranjiva	1700	450
6	Paras Pipal	45800	5500
7	Ashoka trees	300	500
8	Pipal	200	300
9	Indian banyan tree	100	50
10	Mango	500	7600
11	Amaltas	500	1500
12	Jambul / Black plum	900	1200
13	Date Palm	100	80
14	Bottle Palm	150	30
15	Casurina -Saru	45000	16000
16	Rain Tree	28000	750
17	Spathodia	800	500
18	Tabubia	2000	300
19	Alastonia - Saptaparni	700	500

Sr. No.	Type of Tree	Plant Area Nos.	Township Area Nos.
20	Coconut	50	80
21	Guava	150	450
22	Chikoo	395	750
23	Eucalyptus	22300	2043
24	Foxtail Palm	500	700
25	Adensonia	0	1
26	Badam	5000	1000
Total Trees		226745	60684
Total Trees in the Plant Area		287429	

Photographs 3-8: Existing Greenbelt within the AMNS Plant and Township Premises











Buffer Zone

Buffer zone encompasses diverse habitats like agriculture, costal habitats, mangroves, forest area, ponds, mudflats, river which supports many floral species. Primary observations as well as secondary data review reveals presence of 315 floral species which includes 131 tree species, 33 shrubs, 76 Herbs, 35 grasses, and 40 climber & twiner species. Taxonomic account of floral species given in the following various tables.

Trees

Taxonomic account of the tree species given in the following ***Table 3-34.***

Table 3-34: List of Trees Recorded / Reported from the Buffer Zone of the Study Area

Sr. No.	Family	Scientific Name	Common / Local Name
1	Mimosaceae	*Acacia auriculiformis*	Austrian / Bengali Baval
2	Mimosaceae	*Acacia catechu*	Khair
3	Mimosaceae	*Acacia leucophloea*	Hermobaval , Aniyar, Rijiado
4	Mimosaceae	*Acacia leucophloea*	Aniyar, Rijiado, Hermobaval
5	Mimosaceae	*Acacia nilotica*	Desi Baval
6	Mimosaceae	*Acacia senegal*	Gorad, Kumto
7	Mimosaceae	*Acacia tortilis*	Israeli Baval
8	Malvaceae	*Adansonia digitata*	Rukh, Rukhdo, Bukha
9	Rubiaceae	*Adina cordifolia*	Haldwan
10	Rutaceae	*Aegle marmelos*	Bili Or Bel
11	Simaroubiaceae	*Ailanthus excelsa*	Arduso
12	Alangiaceae	*Alangium salvifolium*	Ankol
13	Mimosaceae	*Albizia lebbeck*	Siris
14	Mimosaceae	*Albizia odoratissima*	Kalo Siras
15	Mimosaceae	*Albizia procera*	Kilai
16	Apocynaceae	*Alstonia scholaris*	Saptaparni, Chitvan
17	Annonaceae	*Annona squamosa*	Sitaphal

Sr. No.	Family	Scientific Name	Common / Local Name
18	Combretaceae	*Anogeissus latifolia*	Dhamoda, Dhavada
19	Moraceae	*Artocarpus heterophyllus*	Fanas
20	Avicenniaceae	*Avicennia alba*	Patcheradi
21	Avicenniaceae	*Avicennia officinalis*	Tavra
22	Meliaceae	*Azadirachta indica*	Limbado
23	Caesalpinaceae	*Bauhinia purpurea*	Kachnar, Chamel
24	Caesalpinaceae	*Bauhinia racemosa*	Asitro, Asitari
25	Bombacaceae	*Bombax Ceiba*	Sawar
26	Arecaceae	*Borassus flabellifer*	Tad
27	Burseraceae	*Boswellia serrata*	Salai/Salai Guggu
28	Euphorbiaceae	*Bridelia squamosa*	Asan
29	Anacardiaceae	*Buchanania lanzan*	Charoli
30	Fabaceae	*Butea monosperma*	Khakhro, Palas
31	Lecythidaceae	*Careya arborea*	Kumhbio
32	Caricaceae	*Carica papaya*	Papaya
33	Samydaceae	*Casearia graveolena*	Manjo
34	Caesalpiniaceae	*Cassia fistula*	Garmalo
35	Caesalpiniaceae	*Cassia siamea*	Kashid
36	Casuarinaceae	*Casuarina equisetifolia*	Sharu
37	Arecaceae	*Cocos nucifera*	Narial
38	Ehretiaceae	*Cordia dichotoma*	Gunda/Gundi
39	Fabaceae	*Dalbergia lanceolaria*	Dandosi, Patrali
40	Fabaceae	*Dalbergia latifolia*	Sisham
41	Fabaceae	*Dalbergia puniculata*	Patarali
42	Fabaceae	*Dalbergia sissoo*	Sissoo
43	Caesalpiniaceae	*Delonix elata*	Sandeshdo
44	Caesalpiniaceae	*Delonix regia*	Gulmohar
45	Dilleniaceae	*Dillenia pentagyna*	Karvat
46	Ebenaceae	*Diospyros melanoxylon*	Timru
47	Celastraceae	*Elaedendron roxburghii*	Alan
48	Euphorbiaceae	*Emblica officinalis*	Amla
49	Fabaceae	*Erythrina variegata*	Pangaro
50	Myrtaceae	*Eucalyptus sp.*	Nilgiri
51	Myrtaceae	*Eucalyptus sp.*	Nilgari
52	Moraceae	*Ficus amplissima*	Pipli
53	Moraceae	*Ficus bengalensis*	Vad
54	Moraceae	*Ficus hispida*	Dhedh Umardo
55	Moraceae	*Ficus racemosa*	Umro
56	Moraceae	*Ficus religiosa*	Pipalo
57	Moraceae	*Ficus rumphii*	Payar
58	Burseraceae	*Gariga pinnata*	Kakad
59	Verbenaceae	*Gmelina arborea*	Sivan

Sr. No.	Family	Scientific Name	Common / Local Name
60	Tiliaceae	*Grewia tiliaefolia*	Dhaman
61	Bignoniaceae	*Heterophragma quadriculare*	Varas
62	Apocynaceae	*Holarrhena antidysenterica*	Indrajav
63	Ulmaceae	*Holoptelea integrifolia*	Papdi
64	Rubiaceae	*Hymenodictyon excelsum*	Kadwai
65	Bignoniaceae	*Kigelia africana*	Sausage Tree
66	Malvaceae	*Kydia calycina*	Waring
67	Lythraceae	*Lagerstroemia lanceolata*	Nana
68	Lythraceae	*Lagerstroemia parviflora*	Bondaro
69	Rutaceae	*Lamonia acidissima*	Kothi
70	Anacardiaceae	*Lannea coromandelica*	Modad
71	Mimosaceae	*Leucaena leucocephala*	Pardesi Baval
72	Sapotaceae	*Madhuca indica*	Mahudo
73	Euphorbiaceae	*Mallotus philippensis*	Kamilo
74	Anacardiaceae	*Mangifera indica*	Ambo
75	Sapotaceae	*Manilka rahexandra*	Rayan
76	Sapotaceae	*Manilkara zapota*	Chikoo
77	Meliaceae	*Melia azadiracta*	Bakam, Bakamlimdo
78	Meliaceae	*Melia dubia*	Nimbora
79	Annonaceae	*Miliusa tomentosa*	Umbh
80	Bignoniaceae	*Millingtonia hortensis*	Akash Limdo
81	Sapotaceae	*Mimusops elengi*	Baku
82	Rubiaceae	*Mitrgyana paryifolia*	Kalam
83	Rubiaceae	*Morinda tomentosa*	Al
84	Moringaceae	*Moringa oleifera Lam*	Sargavo
85	Moraceae	*Morus alba*	Shetur
86	Bignoniaceae	*Oroxylum indicum*	Tet, Timru
87	Fabaceae	*Ougeinia oojainensis*	Tiwas, Tanach
88	Caesalpiniaceae	*Peltophorum pterocarpum*	Sonmukhi,
89	Arecaceae	*Phoenix sylvestris*	Khajuri
90	Arecaceae	*Phoenix sylvestris*	Khajuri
91	Caesalpiniaceae	*Piliostigma malabaricum*	Khatambo
92	Mimosaceae	*Pithecellobium ducle*	Goras Amli
93	Apocynaceae	*Plumeria rubra*	Champo
94	Annonaceae	*Polylathia longifolia*	Asopalav
95	Papilionaceae	*Prosopis cineraria*	Karanj, Khijado
96	Mimosaceae	*Prosopis cineraria*	Khyigdo
97	Mimosaceae	*Prosopis juliflora*	Gando Baval
98	Fabaceae	*Pterocarpus marsupium*	Biyo
99	Putranjivaceae	*Putranjiva roxburghii*	Jetun
100	Bignoniaceae	*Radermachera xylocarpa*	Nagvel
101	Arecaceae	*Roystonea regia*	Royal Palm

Sr. No.	Family	Scientific Name	Common / Local Name
102	Salvadoraceae	*Salvadora persica*	Piludi
103	Mimosaceae	*Samanea saman*	Raintree-Ratosiras
104	Sapindaceae	*Sapindus emarginatus*	Aritha
105	Sapindaceae	*Sapindus laurifolius*	Arithi
106	Sapindaceae	*Schleichera oleosa*	Kusum
107	Oleaceae	*Schrebera sweitenioides*	Mokha
108	Anacardiaceae	*Semecarpus anacardium*	Bhilamo
109	Meliaceae	*Soymida fabrifuga*	Rayan
110	Anacardiaceae	*Spondias pinnata*	Ambadi
111	Streculiaceae	*Sterculia urens*	Kadaya
112	Myrtaceae	*Sygygiumcumunii*	Jambudo
113	Myrtaceae	*Syzygium cumini*	Jambuda, Jambu
114	Caesalpiniaceae	*Tamarindus indica*	Amli
115	Verbenaceae	*Tectona grandis*	Sag
116	Ulmaceae	*Terma Oriintalis*	Gota
117	Combretaceae	*Terminalia arjuna*	Arjunsadad
118	Combretaceae	*Terminalia bellirica*	Bahedo
119	Combretaceae	*Terminalia catappa*	Badam
120	Combretaceae	*Terminalia crenulata*	Sadad
121	Malvaceae	*Thespesia populnea*	Paras Piplo
122	Malvaceae	*Thespesis populnea*	Bhindi
123	Cannabaceae	*Trema orientale*	Gora
124	Combretaceae	*Treminalia chebula*	Harda
125	Euphorbiaceae	*Trewia nudiflora*	Petari
126	Apocynaceae	*Wrightia tinctoria*	Dhudio
127	Apocynaceae	*Wrightia tomentosa*	Kudo
128	Rubiaceae	*Xeromphis uliginosa*	Gongad
129	Rhamnaceae	*Zizyphus glabrata*	Bor
130	Rhamnaceae	*Zizyphus mauritiana*	Bor
131	Rhamnaceae	*Zizyphus xylopyrus*	Ghatbor

Shrubs

Total 33 species of shrubs recorded from the in study area are listed in Table 3-35.

Table 3-35: List of Shrubs Recorded / Reported from the Buffer Zone of the Study Area

S. No.	Family	Scientific Name	Common / Local Name
1	Malvaceae	*Abelmoschus esculentus*	Bhindi
2	Malvaceae	*Abelomoschus manihot*	Jagali Bhindi
3	Zygophyllaceae	*Balanites aegyptiaca*	Ingorie
4	Acanthaceae	*Barleria prionitis*	Kapas
5	Nyctaginaceae	*Bougainvillea spectabilis*	Bougainvel
6	Apocynaceae	*Calotropis gigantea*	Akdo

S. No.	Family	Scientific Name	Common / Local Name
7	Asclepiadaceae	*Calotropis procera*	Akado
8	Caesalpiniaceae	*Cassia auriculata*	Aval
9	Rutaceae	*Citrus limon*	Limbu
10	Verbenaceae	*Clerodendrum inerme*	Madhi
11	Solanaceae	*Daturemetel*	Dhaturo
12	Euphorbiaceae	*Euphorbia neriifolia*	Thor
13	Euphorbiaceae	*Euphorbia tirucalli*	Kharsani
14	Zygophyllaceae	*Fagonia cretica*	Bhango
15	Tiliaceae	*Grewia tenax*	Nagbala
16	Malvaceae	*Hibiscus rosa –sinensis*	Jasund
17	Convolvulaceae	*Ipomoea carnea*	Nasarmo
18	Euphorbiaceae	*Jatropha curcas*	Ratanjot
19	Verbenaceae	*Lantana camara*	Ganthai
20	Lythraceae	*Lawsonia inermis L.*	Mendhi
21	Mimosaceae	*Mimosa hamata*	Kasi Baval
22	Celastraceae	*Maytenus emarginata*	Vico
23	Musaceae	*Musa paradisiaca*	Kela
24	Apocynaceae	*Neriumindicum*	Karen, Lalkaren
25	Oleaceae	*Nyctanthes arbor-tristi*	Parijat
26	Cactaceae	*Opuntia elatior*	Phafdothor
27	Mimosaceae	*Prosopis juliflora*	Gando Baval
28	Papilionaceae	*Sesbania sesban*	Shevari
29	Solanaceae	*Solanum incanum*	Ubhi Ringan
30	Malvaceae	*Thespesia populnea*	Paras Piplo
31	Apocynaceae	*Thevetia peruviana*	Pili Karan
32	Tiliaceae	*Triumfetta pentandra*	Zipti
33	Rhamnaceae	*Zizyphus nummularia*	Chanibor

Herbs

Taxonomic status of the herb species given in the ***Table 3-36.***

Table 3-36: List of Herbs Recorded / Reported from the Buffer Zone of the Study Area

Sr. No.	Family	Scientific Name	Common / Local Name
1	Malvaceae	*Abutilon indicum*	Khapat,Dabaliar
2	Euphorbiaceae	*Acalypha indica*	Dadarjo
3	Amaranthaceae	*Aerva Javanica*	Bur
4	Amaranthaceae	*Aerva lanata*	Gorakh Ganjo
5	Asparagaceae	*Agave Americana*	Ketki
6	Asteraceae	*Ageratum conyzoidesL.*	Mankad Mari, Dholi Saddi
7	Liliaceae	*Aloe barbadensis*	Kunvarpato
8	Papilionaceae	*Alysicarpus longifolius*	Motosamervo
9	Lythraceae	*Ammannia multiflora*	Zinoagio

Sr. No.	Family	Scientific Name	Common / Local Name
10	Lamiaceae	*Anisomeles indica*	Chodharo
11	Fabaceae	*Arachis hypogaea*	Mungfali
12	Scrophulariaceae	*Bacopa monnieri*	Brahmi, Kadavi Luni
13	Asteraceae	*Blumea mollis*	Bhutaco
14	Brassicaceae	*Brassica juncea*	Rai
15	Brassicaceae	*Brassica oleracea*	Cobbij
16	Papilionaceae	*Cacia tora*	Kuvandio
17	Papilionaceae	*Cajanus cajan*	Tuvar
18	Solanaceae	*Capsicum annum*	Marchi
19	Apocynaceae	*Catharanthus roseus*	Barmasi
20	Amaranthaceae	*Celosia argentea*	Lamdi
21	Amaranthaceae	*Chenopodium album*	Chilnibhaji
22	Araceae	*Colocasia esculenta*	Alavi
23	Commelinaceae	*Commelina benghalensis*	Motun Shishmuliyun
24	Convolvulaceae	*Convolvulus arvensis*	Hiranpug
25	Convolvulaceae	*Convolvulus microphyllus*	Shankhavli
26	Tiliaceae	*Corchorus aestunans*	Chunch
27	Tiliaceae	*Corchorus depressus*	Bhuphali
28	Apiaceae	*Coriandrum sativum*	Kothmir
29	Papilionaceae	*Cortalaria juncea*	Shun, Shaniyu
30	Convolvulaceae	*Cressa cretica*	Palio, Rudanti
31	Fabaceae	*Crotalaria Sp.*	--
32	Cyperaceae	*Cyperus sps.*	--
33	Asteraceae	*Echinops echinatus*	Shulio
34	Asteraceae	*Eclipta prostate*	Bhangro
35	Pontederiaceae	*Eichhornia crassipes*	Kanphutti
36	Euphorbiaceae	*Euphorbia hirta*	--
37	Convolvulaceae	*Evolvulus alsinoides*	--
38	Cyperaceae	*Fimbristylis dichotoma*	--
39	Cyperaceae	*Fimbristylis sps.*	--
40	Boraginaceae	*Heliotropium bacciferum*	--
41	Boraginaceae	*Heliotropium mariflolium*	Zinku Okharad
42	Malvaceae	*Hibiscus sabdariffa*	Khati Bhindi, Ambadi
43	Hydrocharitaceae	*Hydrilla verticillata*	
44	Acanthaceae	*Hygrophila auriculata*	Kanatashelio,Akaro
45	Papilionaceae	*Indigofera cardifoila*	--
46	Fabaceae	*Indigofera linnaei*	Fatakiya
47	Papilionaceae	*Indigofera oblongifolia*	--
48	Malvaceae	*Malachra capitata*	Pardesi Bhindo
49	Papilionaceae	*Medicago sativa*	Lachko
50	Solanaceae	*Nicotiana tobacum*	Tamaku
51	Nymphaeaceae	*Nymphaea pubescens*	Kamal

Sr. No.	Family	Scientific Name	Common / Local Name
52	Gentianaceae	*Nymphoides indicum*	Kumudini
53	Lamiaceae	*Ocimum basilicum*	--
54	Lamiaceae	*Ocimum sanctum*	Tulsi
55	Hydrocharitaceae	*Ottelia alismodies*	--
56	Asteraceae	*Parthenium hysterophorus*	Congress Grass
57	Malvaceae	*Pavonia sp.*	--
58	Poligonaceae	*Poligonum sp.*	--
59	Portulacaceae	*Portulaca quadrifida*	Ziniluni
60	Potamogetonaceae	*Potomogeton sp.*	--
61	Aizoaceae	*Sesuvium portulacastrum*	--
62	Malvaceae	*Sida sp.*	--
63	Solanaceae	*Solanum lycopersicum*	Tomato
64	Solanaceae	*Solanum nigrum*	Piludi
65	Solanaceae	*Solanum surattense*	Bhoringni
66	Chenopodiaceae	*Suaeda fruticosa*	Khari Luni
67	Chenopodiaceae	*Suaeda nudiflora*	Moras
68	Papilionaceae	*Tehrosia purpurea*	Sarpankho
69	Papilionaceae	*Tephrosia sps.*	--
70	Zygophyllaceae	*Tribulus terrestris*	Mithu Gokhru
71	Boraginaceae	*Trichodesma indicum*	Undha Fuli
72	Asteraceae	*Tridax procumbens*	Pardesi Bhangro
73	Typhaceae	*Typha angustata*	Ramban,Ghabajariu
74	Fabaceae	*Vigna radiata var. sublobata*	Jungli Mug
75	Asteraceae	*Xanthium strumarium L.*	Gokhru
76	Poaceae	*Zea mays*	Makai

Climbers

Taxonomic status of the climbers in study area are listed in Table 3-37.

Table 3-37: List of Climbers and Twinners Recorded / Reported from the Buffer Zone of the Study Area

Sr. No.	Family	Scientific Name	Common / Local Name
1	Papilionaceae	*Abrus precatorius*	Chanothi
2	Mimosaceae	*Acacia pinnata*	Chilari
3	Nyctaginaceae	*Bougainvillea spectabilis*	Boganvel
4	Fabaceae	*Butea superba*	Palasvel, Khakharavel
5	Caesalpiniaceae	*Caesalpinia crista L.*	Kachka
6	Fabaceae	*Canavalia gladiata*	Abvel
7	Celastraceae	*Celastrius paniculata*	Kangarvel
8	Celastraceae	*Celastrus paniculatus*	Malkagani
9	Vitaceae	*Cissus quadrangularis*	Kundvel
10	Vitaceae	*Cissus repanda*	Panivel
11	Papilionaceae	*Clitoria ternatea L.*	Gokaran

Sr. No.	Family	Scientific Name	Common / Local Name
12	Cucurbitaceae	*Coccinia grandis*	Ghiloda
13	Menispermaceae	*Cocculus hirsutus*	Vevdi, Tanvel
14	Cucurbitaceae	*Corallocarpus epigeus*	--
15	Periplocaceae	*Crytolepis buchanni*	Mendhvel
16	Cucurbitaceae	*Cucumis sativus*	Kakadi
17	Cuscutaceae	*Cuscuta reflexa*	Akaswel Or Amrvel
18	Leguminasae	*Dalbergia volubilis*	Alai
19	Euphorbiaceae	*Dalechampia scanens*	--
20	Dioscoriacea	*Dioscorea pentaphylla*	Kuvel
21	Asclepiadaceae	*Dregea volubilis*	Dodi
22	Convolvulaceae	*Ipomea aquatica Forsk.*	Nadinivel
23	Convolvulaceae	*Ipomea cairica*	--
24	Convolvulaceae	*Ipomea nili*	--
25	Convolvulaceae	*Ipomea pes-capre*	Arvel
26	Convolvulaceae	*Ipomea pulchella*	--
27	Convolvulaceae	*Ipomoea obscura*	--
28	Convolvulaceae	*Ipomoea pes-caprae var. pes-caprae*	Dariani Vel/Maryad Vel
29	Convolvulaceae	*Ipomoea pes-tigrides*	--
30	Convolvulaceae	*Ipomoea quamoclit*	Kamlata
31	Cucurbitaceae	*Luffa acutangula*	Jungli Turia
32	Cucurbitaceae	*Luffa cylindrica*	Galku
33	Fabaceae	*Millettia racemosa*	Morvel
34	Fabaceae	*Mucuna prurita*	Kavach
35	Asclepiadaceae	*Pentatropis spiralis (Forsk.) Decne*	Shingroti
36	Combretaceae	*Quisqualis indica*	Madhumalti
37	Fabaceae	*Rhynchosia minima*	Nani Kamal Vel
38	Fabaceae	*Teramnus labialis*	Valiovelo
39	Menispermaceae	*Tinospora cordifolia*	Charvel
40	Rhamnaceae	*Ventilago maderaspatana*	Achhvel

Grasses

Taxonomic status of the Grasses in study area are listed in ***Table 3-38.***

Table 3-38: List of Grasses Recorded / Reported from the Buffer Zone of the Study Area

Sr. No.	Family	Scientific Name	Common / Local Name
1	Poaceae	*Aleuropus lagopoides*	--
2	Poaceae	*Andropogon pumilus*	Zinzvo
3	Poaceae	*Apluda mutica*	Karkadiu
4	Poaceae	*Aristida adscensionis*	Uth-Lampdo
5	Poaceae	*Arundinella setosa*	Vad-Bajariu
6	Poaceae	*Bambusa arundinacea*	Katas
7	Poaceae	*Bothriochloa pertusa*	Zenzvo

Sr. No.	Family	Scientific Name	Common / Local Name
8	Poaceae	*Cenchrus setigerus*	Dhramnu
9	Poaceae	*Chrysopogon fulvus*	Kharhalu
10	Poaceae	*Coix lachryma-jobi*	Kansari, Kasi, Kasai
11	Poaceae	*Cymbopogon martinii*	Rosha
12	Poaceae	*Cyndon dactylon*	Darb, Daro, Durva
13	Poaceae	*Cynodon barberi*	--
14	Poaceae	*Dendrocalamus strictus*	Narvans,Manvel
15	Poaceae	*Dichanthium annulantum*	Rathedo
16	Poaceae	*Echinochloa colonum*	Samo
17	Poaceae	*Impcrttln cylindrical*	Chhaj
18	Poaceae	*Ischaemum rugosum*	Dholiu
19	Poaceae	*Ischticninin inlicnni*	Belkhaclu
20	Poaceae	*Oplimenus burmanii*	Bhimru
21	Poaceae	*Oryza sativa*	Chokha
22	Poaceae	*Paspalidium flavidum*	Gorju
23	Poaceae	*Phragmites kara*	--
24	Poaceae	*Pseudathisteria heleroclita*	Nanibhatadi
25	Poaceae	*Saccharum officinarum*	Sherdi
26	Poaceae	*Saccharum officinarum*	Sherdi
27	Poaceae	*Setaria tomentosa*	Ctiktu
28	Poaceae	*Sorghum bicolor*	Jowar
29	Poaceae	*Sorghum halepense*	Baru
30	Poaceae	*Themeda cymbaria*	Ful-Ghas
31	Poaceae	*Themeda quadrivalvis*	Bhatadi
32	Poaceae	*Themeda triandra*	Bhatadu
33	Poaceae	*Tragus biflorsu*	Vandarium Ghas
34	Poaceae	*Urochondra setulosa*	--
35	Poaceae	*Zea mays*	Makai

Status of flora in the Hazira reserve forest

Table 3-39: Phyto-sociology of tree species in the Hazira reserve forest area

S. No.	Species Name	Life Form	Total No of quadrate studied	Total no of quadrate in which species occurred	Total no of individual	F (%)	D	AB	RF	RD	RAB	IVI
1	*Cynodon dactylon*	Grass	8	3	75	37.50	9.38	25.00	6.11	23.05	49.29	78.46
2	*Calotropis procera*	Shrubs	8	3	32	37.50	4.00	10.67	6.11	9.84	21.03	36.98

S. No.	Species Name	Life Form	Total No of quadrate studied	Total no of quadrate in which species occurred	Total no of individual	F (%)	D	AB	RF	RD	RAB	IVI
3	*Calotropis gigantia*	Shrubs	8	5	21	62.50	2.63	4.20	10.19	6.45	8.28	24.93
4	*Prosopis juliflora*	Tree	8	8	350	100.00	43.75	43.75	16.31	107.58	86.26	210.14
5	*Datura stramonium*	Herb	8	4	14	50.00	1.75	3.50	8.15	4.30	6.90	19.36
6	*Xanthium strumarium*	Herb	8	4	45	50.00	5.63	11.25	8.15	13.83	22.18	44.17
7	*Zizyphus mauritiana*	Tree	8	5	90	62.50	11.25	18.00	10.19	27.66	35.49	73.34

Fauna

Avifauna

Core zone

Since the project site encompasses good greenery, it supports many common species of the birds. Total 24 Species of birds recorded from the project site. Taxonomic status of the species observed in the project site / core zone listed in the following table.

Table 3-40: Birds Recorded from Core Zone / Project Site

S. No.	Family	Common Name	Scientific Name	R-S
1	Cuculidae	Asian Koel	*Eudynamys scolopacea*	R
2	Dicruridae	Black Drongo	*Dicrurus adsimilis*	-
3	Charadriidae	Black-winged Stilt	*Himantopus himantopus*	R
4	Anatidae	Brahhminy Duck	*Tadorna ferruginea*	-
5	Ardeidae	Cattle Egret	*Bubulcus ibis*	R
6	Sylviidae	Common Babbler	*Turdoides caudatus*	R
7	Rallidae	Common Coot	*Fulica atra*	R
8	Sturnidae	Common Myna	*Acridotheres tristis*	R
9	Nectariniidae	Crimson-backed Sunbird	*Nectarinia minima*	R
10	Cuculidae	Drongo Cuckoo	*Surniculus lugubris*	R
11	Columbidae	Eurasian Collared-Dove	*Streptopelia decaocto*	R
12	Upupidae	Eurasian Hoopoe	*Upupa epops*	R
13	Centropodidae	Greater Coucal	*Centropus sinensis*	R
14	Corvidae	House Crow	*Corvus splendens*	R

15	Passeridae	House Sparrow	*Passer domesticus*	R
16	Ardeidae	Indian Pond-Heron	*Ardeola grayii*	R
17	Muscicapidae	Indian Robin	*Saxicoloides fulicata*	R
18	Coraciidae	Indian Roller	*Caracias benghalensis*	-
19	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	R
20	Ardeidae	Little Egret	*Egretta garzetta*	R
21	Meropidae	Little Green Bee-eater	*Merops orientalis*	R
22	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	R
23	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	R
24	Sturnidae	Rosy Starling	*Sturnus roseus*	-

Buffer zone

Total 79 bird species recorded / reported from the buffer zone covering various habitats of the study area. Aquatic habitat of the buffer zone also known for the habitat aquatic migratory birds. Taxonomic status, IUCN Status and Migratory Status of the species of the Buffer Zone area listed in table below.

Table 3-41: Birds reported from buffer zone

S. No.	Family	Common Name	Scientific Name	Schedule
1	Cuculidae	Asian Koel	*Eudynamys scolopaceus*	IV
2	Ciconiidae	Asian Open bill	*Anastomus oscitans*	IV
3	Sturnidae	Bank Myna	*Acridotheres ginginianus*	IV
4	Dicruridae	Black Drongo	*Dicrurus adsimilis*	IV
5	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	IV
6	Accipitridae	Black-winged Kite	*Elanus caeruleus*	IV
7	Charadriidae	Black-winged Stilt	*Himantopus himantopus*	IV
8	Anatidae	Brahhminy Duck	*Tadorna ferruginea*	IV
9	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	IV
10	Ardeidae	Cattle Egret	*Bubulcus ibis*	IV
11	Pteroclidae	Chestnut-bellied sandgrouse	*Pterocles exustus*	IV
12	Anatidae	Comb Duck	*Sarkidiornis melanotos*	IV
13	Sylviidae	Common Babbler	*Argya caudata*	IV
14	Rallidae	Common Coot	*Fulica atra*	IV
15	Accipitridae	Black Kite	*Milvus migrans*	IV
16	Rallidae	Common Moorhen	*Gallinula chloropus*	IV
17	Sturnidae	Common Myna	*Acridotheres tristis*	IV
18	Turnicidae	Common Quail	*Turnix suscitator*	IV
19	Corvidae	Common Raven	*Corvus corax*	IV
20	Pteroclididae	Chestnut-bellied Sandgrouse	*Petrocles exustus*	IV
21	Apodidae	Common Swift	*Apus apus*	IV

S. No.	Family	Common Name	Scientific Name	Schedule
22	Sylviidae	Common Tailorbird	*Orthotomus sutorius*	IV
23	Anatidae	Common Teal	*Anas crecca*	IV
24	Anatidae	Cotton Teal	*Nettapus coromandelianus*	IV
25	Nectariniidae	Crimson-backed Sunbird	*Leptocoma minima*	IV
26	Cuculidae	Crow pheasant / Greater Coucal	*Centropus sinensis*	IV
27	Cuculidae	Drongo Cuckoo	*Surniculus lugubris*	IV
28	Columbidae (Pigeon, Dove)	Eurasian Collared-Dove	*Streptopelia decaocto*	IV
29	Upupidae	Eurasian Hoopoe	*Upupa epops*	IV
30	Scolopacidae	Fantail Snipe	*Gallinago gallinago*	IV
31	Alaudidae	Finch-Lark	*Eremopterix griseus*	IV
32	Paridae	Great Tit	*Parus major*	IV
33	Centropodidae	Greater Coucal	*Centropus sinensis*	IV
34	Phasianidae	Grey jungle fowl	*Gallus sonneratii*	IV
35	Phasianidae	Grey Partrige	*Francolinus pondicerianus*	IV
36	Corvidae	House Crow	*Corvus splendens*	IV
37	Passeridae	House Sparrow	*Passer domesticus*	IV
38	Phalacrocoracidae	Indian Cormorant	*Phalacrocorax fuscicollis*	IV
39	Phasianidae	Indian Peafowl	*Pavo cristatus*	I
40	Ardeidae	Indian Pond-Heron	*Ardeola grayii*	IV
41	Muscicapidae	Indian Robin	*Saxicoloides fulicata*	IV
42	Coraciidae	Indian Roller	*Caracias benghalensis*	IV
43	Ardeidae	Intermediate Egret	*Mesophoyx intermedia*	IV
44	Scolopacidae	Jack Snipe	*Gallinago minima*	IV
45	Sylviidae	Jungle Babbler	*Turdoides striatus*	IV
46	Corvidae	Large Cuckoo-shrike	*Coracina macei*	IV
47	Phalacrocoracidae	Little Cormorant	*Phalacrocorax niger*	IV
48	Ardeidae	Little Egret	*Egretta garzetta*	IV
49	Meropidae	Little Green Bee-eater	*Merops orientalis*	IV
50	Laniidae	Long-tailed Shrike	*Lanius schach*	IV
51	Anatidae	Mallard	*Anas platyrhynchos*	IV
52	Anatidae	Northern Shoveller	*Spatula clypeata*	IV
53	Laniidae	Northern Shrike / Great Grey Shrike	*Lanius excubitor*	IV
54	Anhingidae	Oriental Darter	*Anhinga melanogaster*	IV
55	Scolopacidae	Paintail Snipe	*Gallinago stenura*	IV
56	Phasianidae	Painted Partrige	*Francolinus pictus*	IV
57	Pteroclididae	Painted sand grouse	*Pterocles indicus*	IV
58	Jacanidae	Phesant tailed jacana	*Hydrophasianus chirurgus*	IV

S. No.	Family	Common Name	Scientific Name	Schedule
59	Muscicapidae	Pied Bush chat	*Saxicola caprata*	IV
60	Nectariniidae	Purple Sunbird	*Nectarinia asiatica*	IV
61	Rallidae	Purple Swamphen	*Porphyrio porphyrio*	IV
62	Anatidae	Red crested Pochard	*Netta rufina*	IV
63	Threskiornithidae	Red-naped Ibis	*Pseudibis papillosa*	IV
64	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	IV
65	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	IV
66	Pycnonotidae	Redwhiskered Bulbul	*Pycnonotus jocosus*	IV
67	Phasianidae	Rock bus Quail	*Perdicula asiatica*	IV
68	Columbidae	Rock Pigeon	*Columba livia*	IV
69	Psittacidae	Rose-ringed Parakeet	*Psittacula krameri*	IV
70	Sturnidae	Rosy Starling	*Pastor roseus*	IV
71	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	IV
72	Accipitridae	Shikra	*Accipiter badius*	IV
73	Anatidae	Spot-billed Duck	*Anas poecilorhyncha*	IV
74	Anatidae	Tufted Pochard	*Aythya fuligula*	IV
75	Threskiornithidae	White Ibis	*Threskiornis aethiopica*	IV
76	Motacillidae	White Wagtail	*Motacilla alba*	IV
77	Rallidae	White-breasted Water hen	*Amaurornis phoenicurus*	IV
78	Accipitridae	White-rumped Vulture	*Gyps bengalensis*	I
79	Dacelonidae	White-throated Kingfisher	*Halcyon smyrnensis*	IV
80	Threskiornithidae	White Spoonbill	*Platalea leucorodia*	I

Herpetofauna

Core zone / Project site

No herpetofauna has been found at project site.

Buffer zone

Reptiles document in the region based on direct and indirect (use pictorial guide) evidences is given in the ***Table 3-42***.

Table 3-42: List of Herpetofauna in study area

S. No	Common Name	Scientific name	IWPA (1972) & IUCN
1	Common garden lizard	*Calotes versicolor (Daudin)*	Schedule-IV / LC
2	Common rat snake	*Ptyas mucosus (Linn.)*	Schedule-II / LC
3	Fan-Throated Lizard	*Sitana ponticeriana (Cuvier)*	LC
4	Indian Cobra*	*Naja naja (Linn.)*	Schedule-II/ LC
5	Red Sand Boa	*Eryx johnii**	Schedule-IV/ NT
6	Common Indian Krait*	*Bungarus caeruleus (Schneider)*	Schedule-IV/ LC
7	House Gecko	*Hemidactylus flaviviridis (Ruppell)*	Schedule-IV/ LC

** included in the list on the basis of secondary evidence / IUCN Category – LC: Least Concern, NT: Near Threatened*

Mammals

Core zone

One mammal species i.e. *Funambulus pennantii* (Five striped squirrel) was sighted from this zone.

Buffer zone

Total 9 species of mammals enlisted from the buffer zone on the basis of the primary and secondary information. Details on the mammal species and their Schedule Status (IWPA, 1972) and threatened status (IUCN) is given in the following table.

Table 3-43: Mammals reported from the buffer zone

S. No.	Family	Species Name	Common Name	Threatened Status IWPA-1972 & IUCN
1	Cercopithecidae	*Semnopithecus entellus*	Common Languor	Schedule-III / LC
2	Suidae	*Sus scrofa**	Wild Boar	Schedule-III / LC
3	Herpestidae	*Herpestes edwardsi*	Common Mongoose	Schedule-II / LC
4	Leporidae	*Lepus nigricollis**	Indian Hare	Schedule-IV / LC
5	Sciuridae	*Funambulus pennanti*	Five-striped Palm Squirrel	Schedule-IV / LC
6	Canidae	*Canis aureus**	Jackal	Schedule-II / LC
7	Muridae	*Rattus rattus*	House Rat	Schedule-IV / LC
8	Pteropodidae	*Pteropus giganteus**	Indian flying fox	LC
9	Mustelidae	*Lutra lutra**	Common Otter	NT
10	Felidae	*Panthera pardus*	Leopard	Schedule-I
** included in the list on the basis of secondary evidence / LC: Least Concern, NT: Near Threatened*				

3.12.7 Status of threatened and endemic biodiversity

Threat status of flora has been assessed by following Red Data Book (M.P. Nayar & A.R.K. Sastry, 1987) similarly faunal threat status has been assessed as per Indian Wild Life Protection Act (IWPA), 1972 and Red List of IUCN.

Among the plant species, no species falls under the threatened category as per the Red Data book of Indian Plants. However, locally known rare tree i.e. Adansonia digitata recorded from the township area of the plant. This tree earlier reported from the Gavier village (two trees) and Hazira village (one tree).

Among the birds in the study area, Pea fowl (Pavo cristatus) and White-rumped Vulture (Gyps bengalensis), is included in schedule I of Wild life protection Act (1972), while many other birds are included in schedule IV. As per IUCN red list, bird species like Black-headed Ibis and Oriental Darter falls in the Near Threatened (NT) category while White-rumped Vulture is categorized as a Critically Endangered (CR) species database.

Among the reptiles, Indian Cobra (Naja naja) and Common rat snake (Ptyas mucosus) were provided protection as per Schedule-II of Wild life protection act, (1972). As per IUCN red list, Red Sand Boa falls in the Near Threatened (NT) category.

Among mammals; Jackal (Canis aureus) and Common Mongoose (Herpestes edwardsi) is schedule II; Common Langur (Semnopithecus entellus) and wild boar (Sus scrofa) is Schedule III animal of Wild Life Protection act 1972. Others noted animals are schedule IV of Wild Life Protection act 1972

3.12.8 Aquatic Biodiversity Status

Code	Locations	Description of Site
AQ 01	Near Essar Bulk Terminal Limited Gate	This water body located inside Hazira village. Villagers are using this pond for washing purpose. Limited aquatic birds includes stilts, herons were observed.
AQ 02	Hazira Village	This is also in Hazira village. No avifauna has been observed here.
AQ 03	Hazira - Suvali road (Behind AMNS)	This is combination of saline & fresh water. Monthly twice during full moon and new moon sea water enters into this area due to tidal influx. Due to tidal influx salinity is dominating in this place. Aquatic birds i.e. coots, pelicans, stork, moorhen were observed.
AQ 04	Mora village	This is also water body in mora village.
AQ 05	Suvali village	This is fresh water channel enters into suvali village. Villagers are using water for agriculture field through pump. Several numbers of Coots were observed here.

The aquatic macrophytes (i.e. *Ipomoea carnea, Cyperus sp.*) including free floating algae, submerged hydrophytes, emergent hydrophytes and semi-aquatic plant like rooted herbs were observed during survey in the study area.

Photographs 3-9: Aquatic sampling during winter Season

Water sample collection at AQ3

Aquatic samples collection at suvali village

Aquatic sample preservation at Suvali

Aquatic sample preservation at AQ3

Fresh water Phytoplanktons

Phytoplankton cell count (no./ml.) in sampling locations attached as ***Table 3-44.***

Table 3-44: Freshwater phytoplankton quantification

Station	Seasons	Cell Count (no./ml.)	Total Genera	Major Genera
AQ 01	Post Monsoon Season	135	4	Oscillatoria sp., Anabaena sp., Nitzschia sp, Navicula sp.
AQ 02	Post Monsoon Season	115	6	Navicula sp., Biddulphia sp., Ceratium sp., Nitzschia sp.
AQ 03	Post Monsoon Season	95	5	Navicula sp., Nitzschia sp., Synerda sp., Cyclotella sp.
AQ 04	Post Monsoon Season	105	5	Navicula sp., Nitzschia sp, Amphora sp.,
AQ 05	Post Monsoon Season	88	6	Amphora sp., Cyclotella sp., Chaetoceros sp. Ceratium sp.

Fresh water Zooplanktons

Zooplankton reported from sampling locations are listed in ***Table 3-45.***

Table 3-45: Zooplankton Standing Stock (no. x 10^3/ml)

Station	Seasons	Population	Total Groups	Major Groups
AQ 01	Post Monsoon Season	1.4	4	Euglena sp., Arcella sp., Daphnia Sp.
AQ 02	Post Monsoon Season	2.4	6	Moina sp., Daphnia Sp., Moina sp., Calanus sp.
AQ 03	Post Monsoon Season	2.5	5	Diaptomus sp., Calanus sp., Favella sp., Tintinnopsis sp.
AQ 04	Post Monsoon Season	1.9	4	Diaptomus sp., Moina sp., Cyclops sp,
AQ 05	Post Monsoon Season	3.2	3	Cypris sp., Bosmina sp.,

Benthos

Benthos reported from AQ01 – AQ05 attached as ***Table 3-46.***

Table 3-46: Standing stock of Benthos

Station	Seasons	Biomass (gm/m2)	Population (no./m^2)	Total Group (No.)	Major Groups
AQ 01	Post Monsoon Season	1.1	120	3	Crustaceans, Tanaids
AQ 02	Post Monsoon Season	1.7	95	5	Fish larvae, Polychaetes, Crustaceans

AQ 03	Post Monsoon Season	5.2	375	4	Molluscs, Polychaetes, Crustaceans
AQ 04	Post Monsoon Season	2.1	155	4	Crustaceans, Molluscs
AQ 05	Post Monsoon Season	1.8	158	4	Bivalves, Crustaceans, Polychaetes

3.12.9 Estuarine and Marine Biodiversity Status

Phytoplankton, zooplankton and Benthos samples were collected from different sampling location.

Sampling procedure

Polyethylene bucket and Differential Water Sampler (DDWS) respectively were used for sampling surface and bottom waters for the estimation of phytoplankton pigments and population.

Sample for phytoplankton cell count was fixed in Lugol's iodine and a few drops of 3% buffered formaldehyde. For station 1 only hightide sampling was performed. Due to some technical problem and hard bottom low tide sampling was not done.

Zooplankton samples were collected by oblique haul using a Heron Tranter net with an attached calibrated flow meter. Samples were preserved in 5% buffered formaldehyde. Sediment samples for subtidal macrobenthos were collected using a van-Veen grab of 0.04 m^2 area. Intertidal collections between the High Tide Line (HTL) and the Low Tide Line (LTL) were done using quadrats of 0.04 m^2 area. The sediment was sieved through a 0.5 mm mesh sieve and animals retained were preserved in 5% buffered formaldehyde Rose Bengal.

Map 3-6: Sampling locations along the Tapi Estuary and Marine area

Table 3-47: Observed benthic fauna in Tapi estuarine area and marine sediments

Station	Tide	Generic diversity	Numerical diversity (No./m2)	Observation
1	HT	2	16.20	Bivalve, Gastropoda
	LT	NF	NF	NF
2	HT	3	24.52	Clam, Gastropoda
	LT	NF	NF	NF
3	HT	NF	NF	NF
	LT	NF	NF	NF
4	HT	NF	NF	NF
	LT	NF	NF	NF
5	HT	3	30.31	Clam, broken Gastropoda
	LT	2	35.72	Clam, Gastropoda
6	HT	NF	NF	NF
	LT	NF	NF	NF
7	HT	NF	NF	NF
	LT	3	57.8	Bivalve, Gastropoda
8	HT	NF	NF	NF
	LT	NF	NF	NF
NF: Not Found				

Phytoplankton

Phytoplankton load and diversity were low in all the station. Majority of the samples were dominated by Coscinodiscus sp.

Zooplankton

Zooplankton load and diversity were also low in all the stations studied. This may be due to more anthropogenic activities and ship movement the zooplankton diversity and abundance is less. There is no clear picture about the abundance of zooplankton change from different sampling sites starting from estuary mouth to open sea. Diversity was recorded to be less in all the sites. Nauplius was recorded from station MW03. Due to poor diversity and counts for both phytoplankton and zooplankton the final result was presented in one table (***Table 3-48)*** and no SWDI value was calculated.

Table 3-48: Both phytoplankton and zooplankton collected from different sampling stations

Station Code	High/Low tide	Generic diversity of Phytoplankton	Generic diversity of zooplankton	Observation
MW01	High tide	ND	ND	ND
	Low tide	-	-	-
MW02	High tide	ND	ND	ND
	Low tide	1	-	Coscinodiscus
MW03	High tide	1	-	Coscinodiscus
	Low tide	1	1	Coscinodiscus , Nauplius
MW04	High tide	1	-	Coscinodiscus
	Low tide	ND	ND	ND

Station Code	High/Low tide	Generic diversity of Phytoplankton	Generic diversity of zooplankton	Observation
MW05	High tide	ND	ND	ND
	Low tide	1	-	Coscinodiscus
MW06	High tide	ND	ND	ND
	Low tide	-	1	Diatom
MW07	High tide	1	-	Coscinodiscus
	Low tide	1	1	Coscinodiscus , Nauplius
MW08	High tide	ND	ND	ND
	Low tide	1	-	Coscinodiscus

3.12.10 Mangrove

A field survey has been carried out to see the status of mangrove forest in the study area.

Areas of degraded as well as good mangroves occur in the Tapi estuarine system particularly as fringes around Kadia Bet and Mora Bet and just off the mouth at the northern periphery of the estuary. These sites sustain *Avicennia marina, Sonneratia apetala and Acanthus ilicifolius* as well as marsh vegetation consisting of mainly *Sesuvium portulacastrum* and occasionally Su*eada sp, Cyperus sp, Desmostachya bipinnata and Dichanthium aristatum* – grass. Among mangroves, *Avicennia marina* is dominant.

3.12.11 Corals and associated Biota

Coral were not reported in the proposed site and in the study area. As per our understanding, geochemical and physiochemical condition of the area is not conducive for the growth of the corals.

3.13 Socio-Economics

3.13.1 Methodology

The aim / objectives of the study and how it was done (methodology) are given in ***Annexure 19.***

3.13.2 Secondary Data

Demographic Profile of Project District and Sub-Disrict

Demographic profile details are given in ***Table 3-49:***

Table 3-49: Demographic Profile of Project District and Sub-district

S. No.	Items	Surat (District)	Surat city (Sub-district)	Chorasi (Sub-district)	Olpad (Sub-district)
1	No. of Household	1,333,200	975,797	55,475	42,802
2	Total Population	6,081,322	4,467,797	229,277	196,846
3	Male Population	3,402,224	2,543,623	139,773	103,259
4	% of Male Population	55.95	56.93	60.96	52.46
5	Female Population	2,679,098	1,924,174	89,504	93,587
6	% of Female Population	44.05	43.07	39.04	47.54

S. No.	Items	Surat (District)	Surat city (Sub-district)	Chorasi (Sub-district)	Olpad (Sub-district)
7	Gender Ratio	4,561	4,579	4,133	4,599
8	Total Schedule Caste Population	158,115	105,572	5,361	8,957
9	% of Schedule Caste Population	2.60	2.36	2.34	4.55
10	Total Schedule Tribe Population	856,952	131,622	30,593	48,093
11	% of Schedule Tribe Population	14.09	2.95	13.34	24.43
12	Household Size	5	5	4	5

Source: Primary census abstract 2011

The project falls under Gujarat state, Surat district. The study area consists of Surat city, Chorasi and Olpad sub districts. The census details are however available for 2011.

Therefore, to create a baseline of the existing Study Area villages:

- From the land use map the villages lying in the Study Area were first identified.
- Then the list of sub-districts lying under Surat district were identified through the census details of 2011.
- The village data was then collected for the Study Area by referring the census data from the appropriate sub-districts.

The study area covers 17 habitations in Surat city, Chorasi and Olpad sub district of Surat district. The entire area consists of rural as well as urban population. For the same study area however, census data for year 2011 is available for 16 habitations. The number of dwelling units of villages in the study area indicates that there are 09 villages, 07 Municipal ward and 1 census town. The list of identified villages as mentioned, are provided in ***Table 3-50:***

Table 3-50: Villages in Study Area with Households and Population

Sr. No.	District	Sub-district	Distance (Km)	Habitation	Household	Population
1	Surat	Chorasi	0 - 3	Hajira	4,443	16,724
2	Surat	Chorasi	0 - 3	Junagam	-	-
Subtotal					4,443	16,724
3	Surat	Chorasi	3 - 5	Suvali	975	4,165
4	Surat	Chorasi	3 - 5	Rajgari	318	1,300
5	Surat	Chorasi	3 - 5	Bhatlai	1,144	4,066
6	Surat	Chorasi	3 - 5	Mora (CT)	3,802	13,924
7	Surat	Surat City	3 - 5	Surat (M Corp.) WARD NO.-0100 (Dumas+Kandifaliya+Sultanabad+Kandiwade)	789	3,661
Subtotal					7,028	27,116
8	Surat	Chorasi	5 - 7	Damka	1,331	5,604
Subtotal					1,331	5,604
9	Surat	Chorasi	7 - 10	Vansva	584	2,498
10	Surat	Olpad	7 - 10	Tena	470	1,976
11	Surat	Olpad	7 - 10	Barbodhan	785	3,358
12	Surat	Chorasi	7 - 10	Ichchhapor (CT) WARD NO.-0001	2,870	12,097

Sr. No.	District	Sub-district	Distance (Km)	Habitation	Household	Population
13	Surat	Chorasi	7 - 10	Bhatpor (OG) WARD NO.-0103 (Rural MDDS CODE:524210)	792	3,449
14	Surat	Chorasi	7 - 10	Magdalla (INA) WARD NO.-0001	5	18
15	Surat	Surat City	7 - 10	Surat (M Corp.) WARD NO.-0097	645	2,585
16	Surat	Surat City	7 - 10	Surat (M Corp.) WARD NO.-0098	52	244
17	Surat	Surat City	7 - 10	Surat (M Corp.) WARD NO.-0101	1,734	7,862
Subtotal					7,937	34,087
Grand Total					20,739	83,531

Source: Primary census abstract 2011

Social Profile

Population and Gender ratio details

The statistics regarding the sex ratio in the study area are given in ***Table 3-51.***

Table 3-51: Population and Gender ratio details

Distance (km)	2011		Gender Ratio
	Male	Female	
0 - 3	12,840	3,884	302
3 - 5	18,778	8,338	444
5 - 7	3,118	2,486	797
7 - 10	18,912	15,175	802
Total	53,648	29,883	557

Source: Primary census abstract 2011

The above table shows that the total population of male is 53,648 (64.23%) and female population is 29,883 (35.77%) and the sex ratio is 438 females per 1000 males in the study area. The national gender ratio in India is 940 as per latest reports of Census 2011, this indicates poor gender equality, then nationwide averages.

Social Characteristics

The study area is predominantly Hindu. Most of the people belong to the General, Schedule Cast, Schedule tribe and OBC. There is very small amount of population of Scheduled cast. The statistics regarding the Social Characteristics of villages in the study area are given in table below.

Table 3-52: Schedule Caste and Schedule Tribe Population Distribution in Study Area

Distance (km)	2011					
	% Schedule Caste			% Schedule tribe		
	Total	Male	Female	Total	Male	Female
0 - 3	0.48	78.75	21.25	2.15	57.66	42.34
3 - 5	2.32	56.76	43.24	6.80	50.79	49.21
5 - 7	1.14	54.69	45.31	3.77	53.55	46.45
7 - 10	2.56	52.98	47.02	10.78	52.52	47.48

Total	1.97	55.74	44.26	7.29	52.33	47.67

Source: Primary census abstract 2011

As per census 2011 average scheduled caste population in Study area is 7.29 % of the total population. Out of the total Schedule caste population, males are 55.74 % and female population is 44.26%. Tribal population is high as compared to scheduled castes in the study area, total scheduled tribe population is 7.29%, males are 52.33% and female population is 47.67%

Literacy rate

The statistics regarding the literacy rate in the study area are given in ***Table 3-53.***

Table 3-53 : Literacy Rate in Study Area

Distance (km)	2011		
	% Literacy		
	Total	Male	Female
0 - 3	80.69	85.79	63.80
3 - 5	85.33	89.81	75.26
5 - 7	80.19	83.52	76.03
7 - 10	80.60	84.09	76.24
Total	82.13	86.47	74.33

Source: Primary census abstract 2011

According to Census of India 2011, it is calculated that average literacy rate in the study area is 82.13%. Which is high as compared to the State literacy rate i.e. 79.31%. Out of total literate populate male literacy is 86.47% and female literacy is 74.33% of total population in the study area.

Basic Infrastructure facility

Education facility

The education facilities that are prevailing in the study area are shown in table below.

Table 3-54: Education Facility

Distance (km)	Government						Private					
	Pre- Primary School	Primary School	Middle School	Secondary School	Senior Secondary School	College	Pre- Primary School	Primary School	Middle School	Secondary School	Senior Secondary School	College
0 - 3	-	4	-	1	-	1	-	1	-	-	-	-
3 - 5	-	4	-	1	1	-	-	-	-	-	1	-
5 - 7	-	1	-	1	-	-	-	2	-	-	1	-
7 - 10	-	4	-	-	-	-	-	-	-	-	-	-
Total	-	13	-	3	1	1	-	3	-	-	2	-

Source: Primary census abstract 20

Medical and Health facility

The medical facilities available in the study area are shown in table below.

Table 3-55 : Medical Facility

Distance (km)	Community Health Centre	Primary Health Centre	Primary Health Sub Centre	Maternity And Child Welfare Centre	TB Clinic	Hospital Allopathic	Hospital Alternative Medicine	Dispensary	Veterinary Hospital	Mobile Health Clinic	Family Welfare Centre	Non-Government Medical facilities Out Patient
0 - 3	-	-	1	-	-	-	-	-	-	-	-	-
3 - 5	-	1	2	-	-	-	-	-	-	-	-	-
5 - 7	-	-	1	-	-	-	-	-	-	-	-	-
7 - 10	-	-	1	-	-	-	-	-	-	-	-	-
Total	-	1	5	-	-	-	-	-	-	-	-	-

Source: Primary census abstract 2011

Primary health sub- centre are available in the study area. As well Surat city is about 30 kms away from the study area. They go to the civil hospital as well the 108 ambulance is available for the transportation. Primary Health centre is located in Suvali village is also having ambulance. So, it is convenient for them to reach Surat for further diagnosis and treatment.

Source of water

Main source of drinking water is tap water. Borewell and canal water is used for irrigation also. Other water resources such as wells, lakes etc. are there as shown in table below.

Table 3-56 : Water Facilities

Distance (km)	Tap Water-Treated	Tap Water Untreated	Covered Well	Uncovered Well	Hand Pump	Tube Wells /Borehole	Spring	River/Canal	Tank/Pond /Lake	Others
0 - 3	A	NA	NA	A	A	A	NA	NA	A	NA
3 - 5	NA	A	A	A	NA	A	NA	NA	A	NA
5 - 7	NA	A	NA	A	A	NA	NA	A	A	NA
7 - 10	NA	A	NA	A	A	A	NA	A	A	NA

Source: Primary census abstract 2011

During the primary survey it has been noted that drinking water is provided by the nearby industries at Hazira Port and for irrigation village people have borewell and canals. As the study area is near the Tapi River and Gulf of Khambat water is saline. So, many of the industries nearby has provided RO system and treated drinking water through their pipelines.

Means of communication

The changing trends in technology have massively affected the people in the study area. The most important means of communication is mobile phones which are possessed by most of the individuals in the locality. All

other means of communication seem to have become extinct after the advent of mobile technology, details are given in ***Table 3-57:***

Table 3-57 : Communication Facilities

Distance (km)	Post Office	Sub-Post office	Telephone (landlines)	Public Call Office /Mobile (PCO)	Mobile Phone Coverage	Internet Cafes / Common Service Centre (CSC)	Private Courier Facility
0 - 3	A	NA	A	A	A	A	NA
3 - 5	NA	A	A	A	A	A	NA
5 - 7	NA	A	A	A	A	A	NA
7 - 10	NA	A	A	A	A	A	NA

Source: Primary Census Abstract 2011

Transportation facility

The various transportation facility available in the study area are shown in ***Table 3-58:***

Table 3-58: Transportation facility

Distance (km)	Bus Service		Railway Station	Autoricksaw	Taxi
	Government	Private			
0 - 3	A	NA	NA	A	NA
3 - 5	A	NA	NA	A	NA
5 - 7	A	NA	NA	A	NA
7 - 10	A	NA	NA	A	NA

Source: Primary Census Abstract 2011

The study area is well connected with road. The nearest railway station is Surat which is approximately 30 kms. All the means of transportation like bus, Autoricksaw etc. are available in the study area.

Economic profile

Agriculture in study area

The major crops being produced in of study area are Wheat and rice. Cash crop like groundnut and vegetables like lady finger, beans, bottle gourd etc. Agriculture is mostly carried out by the water from bore wells and canal.

Animal husbandry

Livestock rearing is common among the people of this region. Most of the animals reared by them are cows and buffaloes. Private veterinary doctors' visits on the basis of the requirement of the local people. Regular medical check-up of animals is carried out by the private doctors only. Milk produced is used for personal consumption and selling to dairies like Sumul and other cooperative dairies.

Occupational pattern

The statistics regarding the Occupational Pattern in the study area are given below.

Table 3-59 : Occupational Pattern

Distance (km)	% Occupational Status (2011)					
	Total Working Population	Cultivators	Agricultural Labor	Household Workers	Others	Marginal Workers
0 - 3	72.57	1.20	0.51	0.36	94.61	3.31
3 - 5	61.26	5.10	2.53	0.34	86.27	5.77
5 - 7	40.56	11.97	5.81	0.84	77.78	3.61
7 - 10	42.27	5.01	7.61	0.40	75.09	11.89
Total	54.39	4.37	3.77	0.39	84.53	6.94

Source: Primary Census Abstract 2011

As per the available Census Data 2011, there are total 54.39 % working population. Out of the total working population there are 4.37 % are cultivators, 3.77% Agricultural Labor, 0.39%household workers, others 84.53% and 6.94%marginal workers in the study area.

Historical and cultural profile

Places given protection under the ASI Ancient Monuments Act

There are no ASI protected monuments in the study area.

Places given protection under the Gujarat State protected monuments

There are no state protected monuments in the study area.

Places of tourist importance

There are no tourist importance places in the study area.

3.13.3 Primary Data

Identification of Focused Area

The main impact of Metallurgical plant is through air, soil and water. Considering the impact due to Land use/land cover, Noise and vibration and air the focus area for social studies was taken within 3 Kms from the proposed project site.

Detailed description of the focused area with reference to the socio economic study was carried out based on focus group discussions with the stakeholders. Community consultation results in identification of relevant issues identified by local residents, and a lack of it can result in missed data, in addition to missed opportunities to share experiences and identify solutions to resolve concerns / issues.

The nature of the villages in the focused area based on discussions with the Village Sarpanches / PRI representatives (duly recorded on village fact sheets) indicated the following.

The villages are predominantly consisting of General and OBC community. Being an industrial area also people from different region of India resides in the study area.

No significant diversity is observed within the villages. Most are single or double community villages.

Due to the above considerations, further field studies focused on undertaking primarily focus group discussions, since household level questionnaires would not probably yield any specific useful information requiring Redressal as part of the Social Management Plan.

Focused Group Discussion (FGD) Details and their Findings

The basic FGD was done in the Gram Panchayat, Anganwadi, School and Primary Health Centre. The people are aware about the project as proponent is having existing/new unit.

The following key points seems to emerge:

Hazira

FGD at Panchayat

The FGD was conducted with Clerk as Sarpanch had to attend a meeting. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax, professional tax and notified area grant from Government.
- Mostly people earn their livelihood by working on contract basis in the nearby industries and selling milk.
- M/s. Essar Ltd. pipeline supplies water to the entire village through overhead tank.
- Village is having Primary health sub- centre. For availing further treatment people go to Suvali Primary Health centre.
- Waste is collected from the village and segregated at the dumpsite outside the village. This waste management system is provided by M/S Shell company to the village Panchayat.
- During the conversation they have demanded community hall, Solar street light, cupboards and generator (125KVA) for panchayat.

FGD at Anganwadi

The FGD was conducted at the anganwadi. The following observations emerged during the discussion with the worker of the anganwadi.

- Anganwadi building is constructed as per the government norms. In anganwadi there is staff of two i.e. Worker and helper.
- The meal is cooked by helper at anganwadi. Regular stock of food material is provided by the ICDS.
- ANM regularly visits the anganwadi. Vaccination is conducted at primary sub- centre of the village where anganwadi students, pregnant and lactating women of the village are immunized on all Wednesdays of the month. The main disease found among the students is fever and common cold.
- Anganwadi is having toilet. Water for drinking and cooking food is provided through panchayat pipeline. For safe drinking water RO plant has been installed by ICDS in the anganwadi.
- Anganwadi worker has demanded for shed.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 266 students and 10 teachers. The student teacher ratio is 1:26. As observed by the attendance register girls students are more than boys in the school. All the teachers come from Surat and are having average 10 years of experience in teaching.

- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.
- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion are renovation of toilet blocks, repair and maintenance of RO plant, cupboards, renovation of school building and rainwater harvesting.

Junagam

FGD at Panchayat

The FGD was conducted with Clerk as Sarpanch had to attend a meeting. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax, professional tax and notified area grant from Government.
- Mostly people earn their livelihood by farming and animal husbandry.
- Water is supplied through Juth Pani Purvatha scheme.
- Village does not have Primary health sub- centre. For availing treatment people go to Suvali Primary Health centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded Employment, CCTV camera and sound system in whole village, Water pipeline from Mora to Junagam water tank.

FGD at Anganwadi

The FGD was conducted at the anganwadi. The following observations emerged during the discussion with the worker of the anganwadi.

- Anganwadi building is constructed as per the government norms. In anganwadi there is staff of two i.e. Worker and helper.
- The meal is cooked by helper at anganwadi. Regular stock of food material is provided by the ICDS.
- ANM regularly visits the anganwadi. Vaccination is conducted at the Anganwadi centre of the village where anganwadi students, pregnant and lactating women of the village are immunized on first Wednesday of every month. The main disease found among the students is fever and common cold.
- Anganwadi is having toilet. Water for drinking and cooking food is provided through panchayat pipeline. For safe drinking water RO plant has been installed by ICDS in the anganwadi.
- Anganwadi worker has demanded for Septic pit, replacement of doors and windows, celling fan and bags toys for students.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 115 students and 05 teachers. The student teacher ratio is 1:23. As observed by the attendance register boy's students are more than girls in the school. All the teachers come from Surat and are having average 15 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.

- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion are garden-tree plantation, RO repair and Maintenance, Compound wall and teachers for subjects – Computer, music and physical training.

Bhatlai

FGD at Panchayat

The FGD was conducted with Clerk as Sarpanch had to attend a meeting. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax and grant from Government.
- Mostly people earn their livelihood by farming and job in nearby industries.
- Water is supplied through Juth Pani Purvatha scheme and also panchayat is having RO plant.
- Village does not have Primary health sub- centre. For availing treatment people go to Suvali Primary Health centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded Employment and rain water harvesting.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 176 students and 05 teachers. The student teacher ratio is 1:35. As observed by the attendance register boy's students are more than girls in the school. All the teachers come from Surat and are having average 15 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.
- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion Ro with AMC, Renovation of school roof, benches, table and chair for office, projector with Led screen and locker cupboard for staff.

Damka

FGD at Panchayat

The FGD was conducted with Talati and Sarpanch. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax and grant from Government.
- Mostly people earn their livelihood by farming and job in nearby industries.
- Water is supplied through Juth Pani Purvatha scheme.
- Village is having Primary health sub- centre. For availing further treatment people go to Suvali Primary Health centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded Employment, deepening and beautification of ponds, solar street light, solar panel for gram panchayat, community hall, waste management system and road cleaning brush attachment for tractor.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 188 students and 07 teachers. The student teacher ratio is 1:26. As observed by the attendance register boy's students are more than girls in the school. All the teachers come from Surat and are having average 25 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.
- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion Ro with AMC, colour of entire school building and rain water harvesting.

Mora

FGD at Panchayat

The FGD was conducted with Talati and clerk. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax, professional tax and grant from Government.
- Mostly people earn their livelihood by job in nearby industries and house rent.
- Water is supplied through Juth Pani Purvatha scheme and Reliance industries water pipeline.
- Village is having Primary health sub- centre. For availing further treatment people go to Suvali Primary Health centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.

Kavas

FGD at Panchayat

The FGD was conducted with Talati and clerk. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax, professional tax and grant from Government.
- Mostly people earn their livelihood by job in nearby industries.
- Water is supplied through Juth Pani Purvatha scheme and KRIBHCO industries.
- Village is having Primary health sub- centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded -solar panel for gram panchayat.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 389 students and 10 teachers. The student teacher ratio is 1:40. As observed by the attendance register boy's students are more than girls in the school. All the teachers come from Surat and are having average 10 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.

- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion science lab with apparatus, library with books and furniture and activity room.

Rajgari

FGD at Panchayat

The FGD was conducted with Talati. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax and grant from Government.
- Mostly people earn their livelihood by farming and animal husbandry.
- Water is supplied through Juth Pani Purvatha scheme.
- Village does not have Primary health sub- centre. For availing treatment people go to Suvali Primary Health centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded CCTV camera, sound system in village and rain water system at Gram Panchayat and school building.

FGD at Anganwadi

The FGD was conducted at the anganwadi. The following observations emerged during the discussion with the worker of the anganwadi.

- Anganwadi building is constructed as per the government norms. In anganwadi there is staff of two i.e. Worker and helper.
- The meal is cooked by helper at anganwadi. Regular stock of food material is provided by the ICDS.
- ANM regularly visits the anganwadi. Vaccination is conducted at the Anganwadi centre of the village where anganwadi students, pregnant and lactating women of the village are immunized on second Wednesday of every month. The main disease found among the students is fever and common cold.
- Anganwadi is having toilet. Water for drinking and cooking food is provided through panchayat pipeline. For safe drinking water RO plant has been installed by ICDS in the anganwadi.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 81 students and 05 teachers. The student teacher ratio is 1:16. As observed by the attendance register girls' students are more than boys' in the school. All the teachers come from Surat and are having average 15 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.
- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion are RO with AMC, all in one printer, computer, cupboards, uniform and school bags and rain water harvesting.

Suvali

FGD at Panchayat

The FGD was conducted with Deputy Sarpanch. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax, professional tax and grant from Government.
- Mostly people earn their livelihood by farming, job in nearby industries and animal husbandry.
- Water is supplied through Juth Pani Purvatha scheme.
- Village is having a Primary health centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded for employment, sewing classes, projector and color printer.

FGD at Anganwadi

The FGD was conducted at the anganwadi. The following observations emerged during the discussion with the worker of the anganwadi.

- Anganwadi building is constructed as per the government norms. In anganwadi there is staff of two i.e. Worker and helper.
- The meal is cooked by helper at anganwadi. Regular stock of food material is provided by the ICDS.
- ANM regularly visits the anganwadi. Vaccination is conducted at the Primary health centre of the village where anganwadi students, pregnant and lactating women of the village are immunized on all the Monday of month. The main disease found among the students is fever and common cold.
- Anganwadi is having toilet. Water for drinking and cooking food is provided through panchayat pipeline. For safe drinking water RO plant has been installed by ICDS in the anganwadi.
- During the conversation they demanded for water filter, Septic pit and toilet renovation and drums for storage of food material.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 103 students and 06 teachers. The student teacher ratio is 1:17. As observed by the attendance register girls' students are more than boys' in the school. All the teachers come from Surat and are having average 15 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.
- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion are renovation of classroom, solar panel, tree plantation and teachers for subjects – Drawing, music and physical training

Vanasva

FGD at Panchayat

The FGD was conducted with Talati and clerk. Following points were highlighted during the discussion:

- The main source of income of gram panchayat is house tax and grant from Government.
- Mostly people earn their livelihood by farming and animal husbandry.

- Water is supplied through Juth Pani Purvatha scheme.
- Village do not have Primary health sub- centre. For availing treatment people go to Bhatlai Primary Health sub-centre.
- Waste is collected from village through tractor and thrown in the pit outside the village.
- During the conversation they have demanded -solar panel for gram panchayat and deepening and beautification of pond.

FGD at School

The FGD was conducted at the Government primary school of the village. The following observations emerged during the discussion with the Principal of the school.

- Primary school is a Gujarati medium government school in all there are 86 students and 10 teachers. The student teacher ratio is 1:21. As observed by the attendance register girls' students are more than boys in the school. All the teachers come from Surat and are having average 10 years of experience in teaching.
- Mid-day meal is provided to the students. They are having the provision of separate toilets for girls and boys, library, playground etc.
- Books, uniforms etc. are provided by government. There is a Parent Teacher Association in the school and monthly meetings are conducted.
- The requirements which emerged during the discussion are stage and shed for mid-day meal, renovation prayer place and tables and chairs for teachers.

3.13.4 Key Findings

Following community development activities are suggested based on the focus group discussion in different villages

Table 3-60: Suggested activities

Sr. No.	Name of Village	Suggested activities
01	Hajira	**Gram Panchayat** Community hall Street light Cupboards Generator – 125KVA **Anganwadi** Shed **Primary school** Repairing of toilet Repair and maintenance of RO Plant Glass door cupboards – 03 nos. Renovation of school building Rain water harvesting
02	Junagam	**Gram Panchayat** Employment CCTV camera and sound system in the whole village Water pipeline from Mora to Junagam water tank **Primary school** Garden333 – tree plantation Repair and maintenance of RO Plant

Sr. No.	Name of Village	Suggested activities
		Compound wall Teachers for subject – computer, music and physical education training (PT) **Anganwadi** Septic pit Repairing of windows Ceiling fan – 01 nos. Bags and toys for students
03	Bhatlai	**Gram Panchayat** Employment Rain water harvesting **Primary school** RO with AMC Renovation of school building roof Benches – 70 nos. Office table and chairs – 09 nos. Projector with Led Locker cupboard for staff
04	Damka	**Gram Panchayat** Deeping and beautification of ponds Solar street light Solar panel on Gram Panchayat building roof Community hall Employment Waste management system **Primary school** RO with AMC Painting of school building Rainwater harvesting
05	Mora	-
06	Kavas	**Gram Panchayat** Solar panel on panchayat building **Primary school** Science lab with apparatus Library with books and furniture Activity room
07	Rajgari	**Gram Panchayat** CCTV and sound system in whole village Rainwater harvesting system in panchayat and school **Primary School** RO with AMC All in one printer – 01 nos. Computer – 03 nos. Uniform and school bags Rainwater harvesting

Sr. No.	Name of Village	Suggested activities
08	Vansva	**Gram Panchayat** Solar Panel Deeping and beautification of ponds **Primary School** Stage and shed for mid-day meal Renovation of prayer place Tables and chairs for teachers – 08 nos.
09	Suvali	**Gram Panchayat** Employment Sewing classes Projector Color printer **Anganwadi** Water filter Septic pit Renovation of toilet Drums for storage of food material **Primary school** Renovation of classroom Solar panel Tree plantation Teachers for subject – Drawing, music and physical education training (PT)

4 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 Introduction

Environmental impact in the study area is any alteration of environmental conditions or creation of new set of environmental conditions, adverse or beneficial, caused or induced by the impact of project. Comparative study involving assessment and emulation of impacts of the project on surrounding environment is a significant component of this EIA report. As per the interpretations in Chapter–2 and Chapter–3, the plant and area are mainly susceptible to air, water and noise pollution and needs special emphasis on the impact and mitigation of the same. Solid waste management and impact on land environment needs to be addressed accordingly.

The projected impact may be broadly divided into two phases:

- During construction phase: These may be regarded as temporary or short term and ceases with implementation of the project.
- During operation phase: These impacts are continuous warranting built in permanent measures for mitigation and monitoring.

Construction and operation phase of the project comprises of various activities, each of which will have an impact on some or other environmental parameters. Impacts on environmental parameters during construction and operational phase have been studied to estimate the impacts on environment. The impacts have been predicted for the proposed project assuming that the pollution due to the existing activities has already been covered under baseline environmental monitoring.

The resultant (post-commissioning) quality of environmental parameters is reviewed with respect to the permissible limits. Based on the impacts thus observed, preventive and mitigation measures are incorporated in the environmental management plan to minimize adverse impacts on environmental quality during plant operation.

4.2 Identification of Impacting Activities and Impacts for the Proposed Project

Details of likely impact on environmrnt due to the project location, project design, decommissioning, during project construction and regular operations are discussed in this section.

Identified environmental impacts have been listed in the table below. Mitigation measures are formulated based on the significance of the impact.

Environmental impacts have been identified based on an assessment of environmental aspects associated with the project. The symbol '●' indicates an adverse (negative) impact and 'o' indicates a beneficial (positive) impact.

Identified environmental impacts have been listed in the ***Table 4-1***

Table 4-1: Impact Identification

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
1	**PROJECT DESIGN, LOCATION AND CLEARANCES**												
1.1	Preparation of conceptual and final designs & getting its approvals from various authorities	Employment generation	N, P								o		SE (+): Generation of work to service providers
1.2	Tendering and award of work to the selected bidders	Generation of business opportunities	N, T								o		SE (+): Injection of a substantial and large economic stimulus to the local economy
2	**PROJECT PRE-CONSTRUCTION PHASE**												
2.1	Site Preparation	Dust generation	N, O		•								AQ (-): Deterioration of indoor air quality
2.2	Replantation of trees	Land cover change	N, O	•									LU/LC (-): Change in certain land cover as applicable
		Fugitive Dust generation	N, O		•								AQ (-) : Air quality deterioration
		Loss of green cover, Loss of habitat to avi fauna	N, P							•			EB (-) : Shifting of trees, habitat fragmentation and loss of habitat, decrease in avifaunal movements
2.3	Establishment of Construction equipments	Dust generation	N, T		•								AQ (-) : Air quality deterioration
2.4		Fugitive Dust emission	N, O		•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
	Demolishing the buildings proposed for redevelopment	Noise generation	N, O			●							NV (-) : Noise pollution
		Generation of Debris	N, O						●				S (-) : Land quality degradation
		Scrap generation	N, O								o		SE (+): Offsets in salvaging old equipment and furniture for re-use or auction / sale
		Accidents during work activity	AN, O									●	OH (-) : Risk of occupational injuries
2.5	Movement of vehicles (earth excavation and moving equipment, trucks, tractors, etc.) for transportation of construction equipments, debris generated due to demolishing activities	Vehicular exhausts and dust emissions	N, T		●								AQ (-) : Air quality deterioration
		Noise generation	N, T			●							NV (-) : Noise pollution
		Works contracts for agencies involved in this activity	N, T								o		SE (+) : Employment for construction workers and vendors
		Operation of vehicles	AN, T								●		SE (-) : Wear and tear of roads
		Accidents during work activity	AN, T									●	OH (-) : Risk of occupational injuries
3	**CONSTRUCTION PHASE**												
3.1	Cut & fill, removal of top soil & excavation and leveling of site	Dust generation	N, T		●								AQ (-) : Air quality deterioration
		Noise generation and vibration	N, T			●							NV (-) : Noise pollution and vibration effects on workers

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
		Generation of top soil & excavated soil	N, O						•				S (-) : Depletion of top soil cover & loss of native soil
3.2	Storage of construction material in warehouse	Fugitive dust emissions	N, T		•								AQ (-) : Air quality deterioration
3.3	Construction of buildings as per approved plans (Excavation of earth, Raft and foundation, Carriage / reuse / disposal of excavated earth, Dressing and compaction, Reinforcement, Concrete structure, brick works & finishing activities)	Land utilized for establishing new / additional structures	N, P	•									LU/LC (-) : Change in certain land cover as applicable
		Dust generation	N, P		•								AQ (-) : Air quality deterioration
		Noise generation	N, P			•							NV (-) : Noise pollution
		Generation of C&D Wastes	N, O						•				S (-) : Land quality degradation
		Accidents during work activity	AN, T									•	OH (-) : Occupation Risk to the workers and labors working at height or other construction activities
3.4	Operation of batching plant & associated construction related activities (at laydown sites & project site)	Dust generation	N, T		•								AQ (-) : Air quality deterioration
		Noise generation				•							NV (-) : Noise pollution
3.5	Operation of DG sets	Emission of PM, SO2, NOx, CO & HC	N, T		•								AQ (-) : Air quality deterioration
		Noise generation				•							NV (-) : Noise pollution

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
3.6	Movement of Vehicles (Earth moving equipments, JCB, trucks, cranes, tractors, etc.) for carrying cut & fill material, C&D waste, excavated soil, construction material, employees etc.	Vehicular exhausts and dust emissions on road	N, T		•								AQ (-) : Air quality deterioration
		Noise generation and vibration	N, T			•							NV (-) : Noise pollution and vibration effects on workers
		Spillage of C&D waste from trucks on site or on nearby road	AN, O						•				S (-) : Risk of soil contamination
		Job opportunities	N, T								o		SE (+) : Employment for contractors, construction workers and Vendors
		Use of roads for transportation	AN, T								•		SE (-) : Wear and tear of roads
		Driving transport vehicles	AN, T									•	OH (-) : Risk involved in transportation activity such as accidents etc.
3.7	Water usage / leakage / spillage construction activities at project site	Leaching of contaminated water due to improper handling & storage of water	AN, O						•				S (-) : Risk of soil contamination

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
3.8	Storage and disposal of generated waste (C&D Wastes, Municipal Waste, Hazardous & E-waste) and Soil	Contamination of soil due to leaching of water due to improper handling & storage	AN, O						•				S (-) : Risk of soil contamination
3.9	External Development (Roads, Greenbelt, etc.)	Greenbelt / Space development	N, P							o			EB (+) : Habitat improvement will attract avian diversity, minimize noise and air pollution Green belts/Tree plantation not only absorb air and water pollutants but also will help in arresting noise and soil erosion, and creating favourable aesthetic conditions.
3.10	Construction works resulting in personnel hit by objects, electric shock, falling from heights and similar incidents	Accidents during work activity	E, T/P									•	OH (-) : Occupational risk / casualty
3.11	Fire, asphyxiation due to release of hazardous materials or lack of oxygen	Emission of PM, SO2 & NOx	E, T/P		•								AQ (-) : Air quality deterioration
		Accidents during work activity	E, T/P									•	OH (-) : Occupational risk / casualty
3.12		Noise generation	E, O			•							NV (-) : Noise pollution

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
	Damage to buildings / surrounding natural environment due to unforeseen activities / act of war / terrorist acts and natural calamities	Damage to trees near the project site	E, O							•			EB (-) : Affects tree growth & development
		Accidents during work activity	E, O								•		SE (-) : Loss of life or injuries
		Accidents during work activity	E, O									•	OH (-) : Occupational risk to workers
4	**OPERATION PHASE**												
4.1	Raw Material Handling												
(a)	Unloading of raw materials at ETBL/ AHPL	Air Pollution	N, P		•								AQ (-) : Air quality deterioration Dust suppression systems shall be provided
(b)	Transportation of Material through Conveyor	Dust emission	N, P		•								AQ (-) : Air quality deterioration DE system with Bag Filters at all Junction Points
		Noise generation	N, P			•							NV (-) : Noise pollution Insignificant
		Spillage of material	N, P						•				S (-) : Risk of soil contamination Closed conveyor shall be provided
(c)	Stacking & Reclaiming of material through Stacker cum Reclaimer	Dust is being airborn from Stockpile			•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
													Stationary Water Sprinklers shall be provided
		Noise generation from operation of Stacker cum Reclaimer				•							NV (-) : Noise pollution Regular maintenance of machineries
4.2	Coke Ovens												
(a)	Transportation of reclaimed coal (hard coking coal, semi-soft coking coal and lean coal to Coal Silo	Generation of dust	N, P		•								AQ (-) : Air quality deterioration DE system with Bag Filters at all Junction Points
(b)	Blending of Coal by drawing Coal from Blending Bins through Belt Weigh Feeder	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Insignificant
(c.)	Crushing of blended Coal	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Significant. Bag Filter will be provided
		Generation of Noise	N, P			•							NV (-) : Noise pollution Ear plug / Ear Muff to employees
(d)	Mixing of Tar sludge and BOD Plant sludge in blended coal	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Insignificant

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
(e)	Transportation of blended coal to Coal Tower	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Dust suppression system will be provided
(f)	The compacting of the coal charge (stamping) will be performed continuously with the feeding of coal into the stamping box until the desired height of the coal cake is achieved.	Generation of Noise	N, P			•							NV (-) : Noise pollution Ear Plug. Ear Muff will be provided to employees exposed to the noise source
(g)	Charging of Coal Cake into the Oven	Generation of Charging Gas	N, P		•								AQ (-) : Air quality deterioration U Tube will be mounted on Guide Car / Transfer Car
(h)	Underfiring of Oven by Coke Oven or Mixed Gas	Generation of flue gas	N, P		•								AQ (-) : Air quality deterioration Hot and Cold repair of Ovens will be carried out to avoid cross wall leakages Waste gas recirculation to achieve uniform temperature distribution and to restrict the formation of thermal NOx.
(i)	Carbonization of Coal in Oven	Emissions from Door	AN,P		•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
													High Pressure Liquor Aspiration (HPLA) System will be installed Door and Door frame cleaner will be provided with SCP M/c High Pressure Hydrojet Door cleaner will be installed at end benches of Coke Ovens
		Emissions from Ascention Pipe	AN,P		•								AQ (-) : Air quality deterioration Waterseal AP Caps will be provided
(j)	Pushing of hot coke into Coke Car	Emission of dust	N, P		•								AQ (-) : Air quality deterioration Landbased Pushing Emission Control system will be provided
(k)	Cooling of Coal by Nirogen Gas in Coke Dry Quenching (CDQ) Plant	Positive Impact.	N, P		o								AQ (+) : Air quality imrovement Recovery of heat of coke by Nitrogen Gas and generation of Power through WHRB
(l)	Cleaning of circulating Nitogen / Inert Gas	Process requirement for cleaning of circulating nitrogen. Stack emission will be kept below 30 mg/Nm3	N, P		•								AQ (-) : Air quality deterioration Process requirement. Dust Extraction system with Bag Filter will be provided to clean circulating Nitrogen Gas

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
(m)	Wet Quenching of Coke in Standby Wet Quenching Tower	Generation of Coal dust	N, P		●								AQ (-) : Air quality deterioration Modified Quenching Tower with Baffel /Grit Arrester will be installed
(n)	Recovery of Coke fines from Quench Pond	Recovery of Coke from Quenching Pond	N, P		o								AQ (+) Air Quality Improvement Recovered Coke fines will be used in Sinter Plant
(o)	Screening of Coke in Coke Screen	Generation of dust	N, P		●								AQ (-) : Air quality deterioration Bag Filter will be provided
(p)	Sizing of Coke in Coke Cutter	Generation of dust	N, P		●								AQ (-) : Air quality deterioration Bag Filter will be provided
	Coke Oven By-product Plant												
(a)	Cleaning of Coke Oven Gas in By-product Plant by recovery of Tar, Sulphur, Netptalene and Ammonia	Recovery of Tar, Sulphur, Nepthalene as by-products	N, P						o				Recovery of by-products (Saleable products) and improvement in CO Gas quality as fuel
		Generation of Tar Sludge	N, P						●				S (-) : Risk of soil contamination Mixed with Coal and charged in Coke oven battery
		Generation of spent Wash Oil	N, P						●				S (-) : Risk of soil contamination

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
		Generation of excess flushing liquor	N, P				•						SW (-): Risk of surface water contamination Will be treated in Biological Oxidation Dephenolisation (BOD) Plant
		Generation of Clean CO Gas (Fuel)	N, P		o								AQ (+): Air quality improvement Positive Impact
(b)	Operation of BOD Plant	Generation of sludge	N, P						•				S (-) : Risk of soil contamination Will be mixed with Coal and charged in Coke oven battery
		Generation of treated water	N, P				o						SW (+): Surface water quality improvement Positive impact. Water will be used in process
4.3	Sinter Plant												
(a)	Transportation of all iron bearing materials, flux and coke on top of Proportioning Bins	Dust emission	N, P		•								AQ (-) : Air quality deterioration DE System with Bag Filter Or Dust suppression system
		Spillage of material	N, P						•				S (-) : Risk of soil contamination Closed Conveyor
(c.)	Feeding of raw mix through Shuttle	Fugitive dust emission	N, P		•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
	Conveyor on hearth layer												
(d)	Sintering of Sinter Mix through heating by Ignition Furnace above the hearth	Generation of hot flue gas	N, P		•								AQ (-) : Air quality deterioration Waste heat recovery for steam generation, to be used in process ESP shall be provided to clean flue gas before letting out from stack
(e)	Braking of Sinter in Sinter Breaker	Dust emission	N, P		•								AQ (-) : Air quality deterioration Dust extraction system with Bag Filter will be provided
		Generation of Noise	N, P			•							NV (-) : Noise pollution
(f)	Screening of Sinter in Hot Sinter Screen	Dust emission	N, P		•								AQ (-) : Air quality deterioration Dust extraction system with Bag Filter will be provided
		Generation of Noise	N, P			•							NV (-) : Noise pollution Ear Plug / Ear Muff will be provided to employees working in noisy areas.
(g)	Transportation of Sinter to Blast Furnace by Conveyor	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Closed conveyor shall be provided

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
4.4	Calcination Plant												
(a)	Transportation of Limestone and raw dolomite from Stock Pile to the Kiln feed building bunkers of Calcination Plant	Dust emission	N, P		•								AQ (-) : Air quality deterioration DE system with Bag Filter
		Spillage of material							•				S (-) : Risk of soil contamination Closed Conveyor
(b)	Screening of Limestone and Dolomite	Dust emission	N, P		•								AQ (-) : Air quality deterioration DE system with Bag Filter
(c.)	Feeding of screened limestone or raw dolomite into Kiln with the help of Skip hoist	Fugitive dust emission	N, P		•								AQ (-) : Air quality deterioration Bag filter system will be provided
(d)	Calcination of lime / dolomite in Vertical Shaft Kiln	Flue gas emission	N, P		•								AQ (-) : Air quality deterioration Bag Filter system shall be provided for process exhaust
(e)	Conveying of calcined lime and calcined dolomite to Storage bunker	Dust emission	N, P		•								AQ (-) : Air quality deterioration DE system with Bag Filter
		Spillage of material	N, P						•				S (-) : Risk of soil contamination Closed Conveyor
4.5	Blast Furnace												

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
(a)	Transportation of Iron Pellets and Flux from Stock Piles to BF Stock House	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Dust extraction system with Bag house shall be provided
(b)	Transportation of Sinter from Sinter Plant to BF Stock House	Generation of dust	N, P		•								AQ (-) : Air quality deterioration Dust extraction system with Bag house shall be provided
(c.)	Screening of Iron Pellets, Sinter, Flux and Coke	Generation of dust	N, P		•								AQ (-) : Air quality deterioration
(d)	Return of Undersize raw materials to Sinter Plant	Dust emission	N, P		•								AQ (-) : Air quality deterioration
(e)	Charging of Sized raw materials into Blast Furnace		N, P		•								AQ (-) : Air quality deterioration Bell less Top Charging proposed
(f)	Production of Pig Iron in Blast Furnace by reduction of Iron Ore Pellets	Generation of liquid Slag	N, P		•								S (-) : Risk of soil contamination Slag will be granulated and sold to the Cement Companies
		Generation of BF Flue dust	N, P		•								AQ (-) : Air quality deterioration Recycled in Sinter Plant
		Generation of BF Gas	N, P		•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
													Will be used for Stove heating and used as fuel in the plant
(g)	Tapping of metal & slag	Generation of dust & gaseous	N, P		•								AQ (-) : Air quality deterioration
(h)	Pouring of metal and slag in respective ladles	Generation of fumes	N, P		•								Cast House Dust Extraction System with Bag Filter system will be installed to control emissions
(i)	Cleaning of BF Gas	Process requirement	N, P		•								AQ (-) : Air quality deterioration Dry type GCP will be provided for cleaning
(j)	Leakage of BF Gas	May be fatal	N, P									•	OH (-) : Occupational risk/ casualty Risk assessment & Disaster Management Plan will be developed
(k)	Heating of Stoves with BF Gas	Generation of flue gas	N, P		•								AQ (-) : Air quality deterioration Sensible heat of the flue gas shall be used for pre-heating of air
(l)	Transportation of PCI Coal to BF Bins	Generation of dust	N, P		•								AQ (-) : Air quality deterioration
(m)	Grinding of PCI Coal in Grinding Unit	Generation of dust	N, P		•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
(n)	Tansportation of PCI Coal to Coal Silo	Generation of dust	N, P		•								AQ (-) : Air quality deterioration
(o)	Injection of PCI Coal in Blast Furnace	Energy Conservation. Reduction in Coke Requirement.	N, P		o								AQ (+): Air quality improvement Positive impact
(p)	Granulation of Liquid Slag in Granulation Plant	Production of granulated BF slag	N, P						•				S (-) : Risk of soil contamination Will be sold to the Cement Companies for production of Portland Blast Furnace Cement
4.6	SMP-3												
(a)	Transportation of Iron Ore from Stock Pile to the Storage Bin at SMP-3	Dust emission	N, P		•								AQ (-) : Air quality deterioration
(b)	Unloading of Ferro-alloys from Truck on hopper	Dust emission	N, P		•								AQ (-) : Air quality deterioration
(c.)	Transportation of Ferro-alloys to Bins by Conveyor	Dust emission	N, P		•								AQ (-) : Air quality deterioration
(d)	Transportation of HBI to Storage Bin of SMP-3 by Conveyor	Dust emission	N, P		•								AQ (-) : Air quality deterioration

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
(e)	Desulphurization of hot metal	Generation of dust / fumes	N, P		•								AQ (-) : Air quality deterioration
(f)	Pouring of Hot Metal into Convertor	Generation of fumes	N, P		•								AQ (-) : Air quality deterioration Air Pollution Control system with Dog House and Bag Filter shall be installed
(g)	Addition of alloying materials and HBI. Iron Ore & Scrap are added (as coolant) into the BOF Convertors	Dust & Gaseous emissions	N, P		•								AQ (-) : Air quality deterioration
(h)	Lancing of Oxygen (Oxygen blowing) from top into Convertor	Generation of Fugitive emissions	N, P		•								AQ (-) : Air quality deterioration
(i)	Tapping of slag	Fugitive emissions	N, P		•								AQ (-) : Air quality deterioration
(j)	Tapping of liquid steel	Fugitive emissions	N, P		•								AQ (-) : Air quality deterioration Air Pollution Control system with Dog House and Bag Filter shall be installed
(k)	Refining of liquid steel in LRF & RH-OB Degasser	Fugitive emissions	N, P		•								
(l)	Cleaning of BOF Gas		N, P		•								AQ (-) : Air quality deterioration Moveable hood and Dry type BOF GCP shall be installed

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
(m)	Casting of liquid steel into 2x2 Slab Caster	Generation of Scale	N, P						•				S (-) : Risk of soil contamination Reused in Sinter Plant
		Generation of scrap	N, P						•				S (-) : Risk of soil contamination Reused in Steel Melting Plant
		Generation of Waste Water	N, P				•						SW (-): Risk of surface water contamination Waste water will have mainly scale.
4.7	Hot Strip Mill												
(a)	Heating of Slab in Reheating Furnace	Genreration of flue gas (mainly NOx, CO2 and SO2)	N, P		•								AQ (-) : Air quality deterioration NOx emissions would be controlled by optimising the excess air supply and proper burner design
(b)	Descaling by high pressure water descaling	Generation of effluent	N, P				•						SW (-): Risk of surface water contamination Shall be treated in ETP
		Generation of scale	N, P						•				S (-) : Risk of soil contamination
(c)	Rolling of Slab	Generation of Noise	N, P			•							NV (-) : Noise pollution
		Generation of Mill Scale	N, P						•				S (-) : Risk of soil contamination

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
													Will be reused in Sinter Plant
		Generation of Scrap	N, P						●				S (-) : Risk of soil contamination Will be reused in SMP
4.8	Captive Power Plant												
(a)	Generation of Steam in Boiler using By-product gases	Generation of noise due to steam leakage	N, P			●							NV (-) : Noise pollution Prevent leakasges and Provide Glass wool lagging
(b)	Generation of Power in TG Set	Generation of noise	N, P			●							NV (-) : Noise pollution Acoustic enclosure fot TG Set proposed
(c)	Utilization of Pressure of BF Gas in TRT for Power generation	Energy Conservation. Positive impact	N, P		o								AQ (+): Air quality improvement Back Pressure Turbine proposed for Power generation
(d)	Utilization of Sensible heat of nitrogen for steam generation in Waste Heat Recovery Boiler and power generation in Steam Turbine at CDQ	Energy Conservation. Positive impact	N, P		o								AQ (+): Air quality improvement
5	Final Decommissioning												
5.1	Dismantling of buildings and structures	Dust generation	N, P		●								AQ (-) : Air quality deterioration
		Noise generation	N, P			●							NV (-) : Noise pollution

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
		Material spillage & leaching to groundwater during dismantling activities in open area	N, T					●					GW (-) : Contamination of GW
		Leaching of contaminated water due to equipment wash or improper handling & storage of waste	N, O						●				S (-) : Risk of soil contamination
		Workers performing their tasks	AN, T	●								●	OH (-) : OH Risks & Injuries to workers
5.2	Final site clean-up	Land use change	N, P	●									LU/LC (-) : Change in land use pattern to new usage
		Dust generation	N, T		●								AQ (-) : Air quality deterioration
		Noise generation	N, T			●							NV (-) : Noise pollution
		Clearing of trees	N, P							●			EB (-) : Loss of existing ecology and biodiversity at site
		Natural growth of trees	N, P							o			EB (+): Increase in green cover

S. No.	Project Stages, Activities	Aspects	Impact	Potential Environmental Impacts on Environment									Impacts (+/-) with remarks
			(Type: N, AN, E; Duration: O, T, P)	LU / LC	AQ	NV	SW	GW	S	EB	SE	OH/ CH&S	
		Employment opportunities	N, P								•		SE (-) : Loss of jobs / employment

4.2.1 Identification & Characterization of Impacts

The major project activities and the anticipated environmental impacts of the expansion done are discussed below under the following categories:

- Impacts and mitigation measures due to project location
- Impacts and mitigation measures due to project design
- Impacts and mitigation measures during construction
- Impacts and mitigation measures during operation

4.2.2 Impacts and Mitigation measures due to Project Location

The existing plant area is 750.18 Ha and the total plant area after proposed expansion will be 824.82 Ha.

Land required for proposed expansion: 147.17 Ha
It will comprise of the following:

- 65.73 Ha Forest land (Land possession is obtained & end use change under process)
- 8.91 Ha private land direct purchase from Land owners
- 72.53 Ha area will be used from existing plant area
- AMNS has received Stage-II Forestry Clearance for use of 65.73 ha. of forest land for non-forest purpose and also taken possession of the forest land of 65.73 Ha.
- Approx. 20,000 nos. of trees to be cut from the area, within the plant, where proposed facilities will be installed.

Mitigation Measures

For 20.76 ha. of forest land, Compensatory afforestation shall be taken up in 41.52 ha. of degraded forest land at village – Kanji, Taluka – Songarh, Distt. – Tapi. AMNSI will also provide 110 ha. of forest land in "Lion Corridor Area", suitable as Lion habitat in village – Sanada, Disstt. – Bhavnagar.

For 65.73 ha. of forest land, Compensatory afforestation shall be undertaken by the Forest Deptt in 82.0 ha. of non-forest land at village Andhau, Taluka- Bhuj, District – Kutch Gujrat by planting not less than 136,612 trees.

The trees shall be cut in the area 79920 sqm. Total cost of for replantation has been considered under the EMP in ***Chapter-10***

4.2.3 Impacts and Mitigation measures due to Project Design

The project is for enhancement of production of AMNS, Hazira by installation of upstream and downstream facilities to make the product economically viable. The proposed project has envisaged state of art energy efficient technology, presently available and widely used in the country and worldwide. Following state-of-art pollution control and enrgy efficient technologies proposed in the project are:

- Dry type GCP for Blast Furnace and new Steel Melting Plant
- Dog house fume extraction system for secondary emission control from Basic Oxygen Furnace, Ladle Refining Furnaces, RH-OB.
- Recovery type Coke Oven Plant with HPLA system, Land Based Pushing emission control system and Water seal AP Caps
- Coke Dry Quernching with Waste Heat Recovery Boilers with power generation
- Top Recovery Gas Turbines with Blast Furnaces for power generation by utilising BF gas poressure.

- Use of by-product gases for as fuel in the plant and for power generation by using balance by-product gases.
- Pulverside Coal Injection with the Blast Furnaces, which will reduce the frequirement of almost equal quantity of Coke in the Blast Furnaces, thus reduce the energy requirement of the plant.
- Hot air from Siter Plant for heating of combustion air to save fuel and steam generation, for use in process.
- BF Stoves flue gases will be used for heating combustion air.

The expansion project is being envisaged based on techno-economic feasibility of the state of art technology as presently available in the country and thus no anticipated impacts are envisaged due to project design.

4.3 Impacts and Mitigation measures during Construction

The major activities carried out during construction phase are given below:

Project Activities

- Loading and unloading construction items and plant machineries
- Storage of construction items & plant machineries
- Civil works
- Fabrication
- Erection & Installation of structures and machineries
- Maintenance of construction machinery
- Vehicular movement
- Power supply installation
- Appropriate Disposal Mechanism of generated solid wastes

4.3.1 Land Environment

Identification of Impacting Activities for the Proposed Project

Environmental aspects and impacts have been identified based on an assessment of environmental aspects associated with the project.

Excavation

This activity will lead to generation of excavated soil and may lead to change in site topography.

Building of structures

This activity may lead to change in land cover from vacant / open land to paved / built up land.

Final site clean-up

Generation of debris.

Change in Landuse/Land cover

There will be change in Landuse pattern due to the expansion as current Landuse of the additional land for expansion project include foresrt land and agriculture land which will be converted into the industrial.

Mitigation Measures

Considering the forest land required for the proposed expansion, the compensatory afforestation shall be undertaken by the forest department in 82 ha. non-forest land transferred in favour of the State Forest department at Taluka-Bhuj, District – Kutch and 41.52 ha. of degraded forest land at village – Kanji, Taluka – Songarh, Distt. – Tapi. AMNSI will also provide 110 ha. of forest land in "Lion Corridor Area", suitable as Lion habitat in village – Sanada, Disstt. – Bhavnagar.

The development is planned in the shortest possible time and in phased manner. Land-clearing activity shall be kept to the absolute minimum by working at the specific sites one by one where construction is to take place so as to increase detention and infiltration.

Natural waterways/drainage pattern shall be maintained by providing culverts where needed. The land use is thus so planned that there will be minimum adverse impact.

4.3.2 Air Environment

Impact

During construction phase of the project, dust is expected to be the main pollutant, which is associated with general construction activity. The major activities will involve excavation, transportation of construction materials, fabrication, building of structures, erection & commissioning of machineries etc. These activities would cause a general increase in dust levels and gaseous emissions in the ambient air for short duration. The construction materials such as concrete, cement, wood, stone and silica, are prone for releasing dust and can be carried over wide areas. Additionally, diesel engines, and on-site equipment that uses diesel, releases dust-sized particulate matter in the form of soot, NOx, SO_2, CO and HC into the air.

Also, during construction phase, due to transportation of construction material, there will be marginal increase in the levels of particulate matter (PM), emissions of Sulphur dioxide (SO2), Nitrogen Oxide (NO2), carbon monoxide (CO) and hydrocarbons (HC). However, this increase in concentration levels of pollutants is distributed throughout the project site and shall fall under the category of area source and would be temporary in nature and localized.

Other major source of air pollution during construction / before construction are due to dismantling of the buildings and other processing areas as given under para 2.16 in Chapter-2 under Demolition & Relocation Plan. Demolition of buildings, and construction of buildings, can create dust, which can travel onto neighboring areas and may impact the ambient air quality.

Mitigation Measures

Mitigation measures for air quality impacts are:

- It shall be ensured that both gasoline and diesel-powered construction machines and vehicles are properly maintained to minimize smoke in the exhaust emissions
- Concentration of SO2, NOX, HC and CO may be increased due to increased vehicular traffic. The impact of such activities would be temporary and restricted to the constructed phase.
- The approach roads will be paved or tarred and vehicles will be kept in good order to minimize the dust pollution due to vehicular traffic.
- All vehicles delivering construction materials to the site shall be covered with tarpaulin to avoid spillage of materials and maintain cleanliness of the roads
- Regular water sprinkling will be done for dust suppression at the 'kaccha' transportation road and construction site.

- Ensuring the availability of valid Pollution Under Control Certificates (PUCC) for all vehicles used at site
- With the emission factor and the phased manner in which construction activity is to be carried out, it is likely that increase in PM levels due to construction would mainly be confined to the project site. Thus, it is inferred that minor negative impact within a few 100 meters from the source within the site would occur on the ambient air quality under the worst conditions, which are mitigated by implementing environmental management plan. However, no significant impacts are expected on the overall ambient air quality due to construction activities at the sensitive receptors outside the project premises.

4.3.3 Water Environment

Impact on Surface Water

Water pollution is another problem from construction sites, and is caused by the run-off of debris, dirt, diesel, oil, paints, and other harmful chemicals into the drains. General wastewater from construction sites can also cause issues with the local water systems.

The main water pollution issue is the deposition of construction materials into waterways where pollutants can also soak through the ground and leach into the groundwater. Many groundwater sites are also used for human consumption and contaminated groundwater is a lot harder to treat than surface water.

Another aspect to water pollution is during the land clearing process. When the land is cleared, the silt and soil can erode and travels as sediments which enter the local waterways — and this can destroy the local wildlife by making the waterway turbid and restricting the amount of sunlight entering the waterway. On the other hand, the presence of building materials in high-urban environments can lead to blockage of the underground sewers, which then poses further health risks.

Potential sources of impacts on the water environment during the construction phase are as follows:

- Soil runoff from the site leading to off-site contamination (particularly during rainy season).
- Improper disposal of construction debris leading to off-site contamination of water resources.
- Spillage of oil and grease from the vehicles and waste water generated on site activities such as vehicles washing, workshop etc.

Mitigation Measures

The main ways to prevent water pollution include; minimizing the land disturbance (whilst leaving as much vegetation as possible during the excavation process), covering up all drains on a construction site, using non-toxic chemicals where possible, covering building materials so the risk of them being washed away during rain (or other natural conditions) is minimized, and collecting and treating the wastewater before it is discharged as an effluent — where the clean water can be discharged and the sediment sludge can be collected and thrown away.

Following precautions and preventive measure will be taken at the site during construction to avoid any ground and surface water contamination.

- Not allowing water to leave the construction site.
- Disposal of construction debris in designated areas.
- Construction of storm water diversion channels to divert storm run-off from flowing over the construction areas.
- Use of metal tray during repair of construction vehicles in the workshop to avoid spillage of oil and grease on ground.

- Due to civil construction activities, during rainy season the surface runoff may contain more of eroded soil and other loose matter. As far as possible, construction activities will be avoided during rainy days to mitigate the small impacts on soil / water quality caused due to construction activity.
- With segregation of construction area with proper drainages, contamination of water due to soil erosion shall be prevented.
- The earth work includes cutting and filling will be avoided during rainy season and will be completed during the winter and summer seasons. Stone pitching on the slopes and construction of concrete drains for storm water to minimize soil erosion in the area will be undertaken. The overall impacts on water environment during construction phase due to proposed activity shall be temporary and marginal.

Impact on Ground water

Construction activities for the proposed development can have minor impact on hydrology and ground water quality of the area if the construction waste leaches into the ground water source. However, no ground water shall be used during the construction

Mitigation Measures

Following precautions and preventive measure will be taken at the site during construction to avoid any ground water contamination.

- Disposal of construction debris in designated areas.
- Storage of Paint Drums, Oil Drums and Used Oil drums on concrete flooring
- Use of metal tray during repair of construction vehicles in the workshop to avoid spillage of oil and grease on the ground.

4.3.4 Noise Environment

Impact

The major source of noise generation during the construction phase are civil works such as trenching, foundation casting, steel fabrication work, mechanical works, vehicle movements during site preparation, loading and unloading activities, construction equipment like dozers, scrapers, concrete mixer, cranes, generators, compressors, vibrators etc.

The noise produced during the construction will have significant impact on the surrounding ambient noise levels. However, this noise level will be near the source only and is not expected to create any noise pollution problem at far off distances and outside the plant premises. The potential impacts on noise level may arise out of the following:

- During construction phase, operation of earth movers like, dumper, roller, bulldozers etc. will be used for site preparation, excavation work, etc. The machinery will be used during daytime, intermittently. No significant adverse impact is envisaged on ambient noise levels in the nearby habitation due to proposed activity.
- Vehicle movement for transportation of materials and work force to the site will generate moderate noise as the frequency of vehicular movement will increase by more than ten times in a day.

Mitigation Measures

Major construction work will be carried out during the day time. Further, workers deployed in high noise areas will be provided with necessary protective devices like ear plug / ear-muffs etc. The exposure of construction

labor and supervisors to this high noise levels will be for a short time only and hence will not pose any health hazards.

- Overall, impact of generated noise on the environment will be insignificant, reversible and local in nature and mainly confined to the day hours.
- Moveable noise barriers will be considered
- Greenbelt development will be undertaken from the construction stage itself

4.3.5 Soil Environment

Impact on Soil

- During clearance of vegetation and excavation there may increase in soil erosion by cutting & filling
- Top soil loss due to excavation
- Spillage of liquid and solid / hazardous wastes may affect soil quality,

Mitigation Measures

Unauthorized dumping of waste oil should be prohibited. Wastes shall be disposed-off at an approved site.

- Store the top soil for landscaping.
- Discarded containers and paint drums etc. and other hazardous wastes to be stored at the earmarked secured place (for temporary storage, before final disposal).
- The vehicle maintenance area shall be located in such a manner to avoid sources by accidental spillage of oil.

4.3.6 Biological Environment

Project Pre-Construction Phase

Removal of vegetation cover, generation of noise & vibrations - Core Zone

Land clearing and removal of vegetation cover within the core zone likely to have the following direct/primary impacts.

Impact on the floral species diversity including trees and associated biodiversity of - core zone

Evaluation: Project site encompasses 26 species of the trees and other (shrubs, herbs, grasses) vegetation. Clearing of vegetation cover, especially larger tree species (canopy cover) and shrub species (above ground cover) will have significant impact on the flora and associated faunal diversity.

Mitigation Measures

Following measures will be implemented to mitigate the impact -

- Maximum trees will be retained and transplanted. Tree transplantation will be carried out in consultation of the Forest Department after approval from the competent authority.
- Greenbelt plan has been prepared in line with CPCB Greenbelt Development guidelines. As per the greenbelt plan, total 33% area with tree density of 2500 nos. per Ha will be developed as greenbelt. Proposed to plant additional 3,93,021 trees in consultation with Forest Department. The total no. of trees after expansion will be 6,80,450.

- Greenbelt plan includes 20m width tree plantation along the NH-6 between plant boundary & NH spanning 6.5 km. Also, Greenbelt along Hazira village side will also be intensified.

Impact-2. Impact on major faunal diversity due to removal of vegetation - core zone.

Evaluation: Core Zone area reported low and common species i.e. 24 species of birds and one species of mammal while no herpetofauna reported from this zone. Buffer zone consists of similar land use pattern / habitat types, the faunal species reported within the core zone may disperse to adjacent habitats. Therefore, the above discussed impact on faunal diversity may be at moderate level and short term.

Mitigation Measures

Mitigation measures given for the Impact 1 (i.e. greenbelt development and transplantation) will help to recolonize these species in future. Also, plantation programme in the Buffer Zone has been suggested as a part of the Conservation Plan, this will also help in habitat improvement to enhance biodiversity status of the project area in future.

Impact-3. Impact on major faunal groups in terms of displacement, change the normal behavior, movements, feeding and resting due to noise & vibration generated from earth movers - core zone.

Evaluation: Noise pollution will mainly due to operation of earth movers and other vehicles will affect the normal Behavioral patterns of the major faunal groups of the site as well as the vicinity.

Site reported 24 bird species and only one mammal species, these species include only common species. These are very common species found throughout the study area including agricultural habitats and none of them fall under threatened species category. Species reported from the site are generalist species and adapted to the routine urban activities. These species may use similar habitats of the core as well as buffer zone also. However, there will be short term and insignificant impact on the normal behavior and normal movements, feeding and resting activities of major faunal groups.

Mitigation Measures:

All the engineering controls will be implemented to reduce the disturbance level to the faunal species. Proper transport management system from the plant authorities like awareness and strict instruction to the transportation team will not give any chances of such impact.

Impact-4. Impact on surrounding vegetation / habitat (degradation) due to dust emissions due to site clearance – Core Zone.

Evaluation: site preparation activity will result in the increase the dust emission pollutants which will have impact on vegetation cover through the dust deposition on the leaf of the plant. This will lead to reduction in the photosynthesis rate and habitat degradation.

Mitigation Measures

Engineering controls will be required to reduce the dust dispersal.

Project Construction Phase

Aspects - generation of particulate matter, generation of noise & vibrations – Core Zone.

In this phase, similar impacts of the Project Pre-Construction Phase (i.e. Impact-3 & Impact-4) are expected in this phase also. So mitigation measures will remain same in addition to the engineering controls.

Construction activities at the site involving human and vehicular movement may disturb terrestrial micro flora and fauna of the area and aerial and wild animals in the area. The noise generated by construction machinery and movement of vehicles may also disturb the animal and birds in the region. The fugitive dust due to construction activity may affect the flora of the region.

Other Mitigation Measures

- The adverse effects are reduced by shortening the construction phase period and development of greenery along the plant boundary.
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement and the company staff will be strictly directed not to damage any vegetation such as trees, shrubs or bushes.
- Water sprinklers were installed within the plant premises to suppress any fugitive dust generated due to excavation or other constructional activity.
- Periodic water sprinkling was done on the vegetation along the plant boundary and approach road to the plant.
- Movement of vehicles and construction activity was not allowed between 11 P.M. to 5 A.M.
- Domestic waste generated was collected in the designated bins and was disposed-off properly.

4.3.7 Socio-economic Environment

The construction phase induces employment opportunities for the local people. In addition to the opportunity of getting employment in construction work, the local population would also have employment opportunities in related activities like small commercial establishments, small contracts and supply of construction materials etc. The dwelling of construction workers at the site may cause sanitation and other problems. As the villages are nearby and staying facilities are readily available in these villages, so the construction workers may not be required to stay at the project site. Safety and health care of workers is also an important factor to be considered during construction phase. Hazards expected are electrocution, vehicular accident, fall of personnel from overhead works, high level noise due to construction machinery, centering failure and exposure of eyes to dust and welding rays. Constructional and occupational safety measures will be adopted during construction phase of the industry.

4.4 Impact During Operational Phase

Impact on the environment during operation phase may be due to the handling of raw materials, by-products and finished products and due to operation of production unit & burining of fossil fuel.

These emissions, discharges and disposal may release different pollutants, which may affect air, water, land and ecological environment directly. However, all these are mainly primary impact. In addition to these primary impacts, any industrial project has some overall impact on its surrounding socio-economic environment through the existence of social and economic linkages between the project and society, which

are actually secondary impact. Under this clause, all the primary impacts due to this expansion plant are being discussed and wherever required, impacts have also been quantified.

Accordingly, in the subsequent paras, impacts on land, air environment, water environment, soil, noise, biological environment and Socio-economic due to the proposed expansion are discussed.

4.4.1 Air Environment

In integrated Steel Plant, dust is the major pollutants. Air pollutants which are generated at different stages of production may be particulate matter, sulphur dioxide, oxides of nitrogen etc. The pollutants may be released as Point source (stack emissions) or Area source (fugitive emission) and will have impacts on ambient air, during the operation phase.

Emission from Point Source (Stack)

Dust and gaseous emission shall be from the flue gases generated at Coke Ovens, Sinter Plant, Calcination Plant, Blast Furnaces, Basic Oxygen Furnaces, Reheating Furnaces & By-product gas Power Plant and also stacks provided with dust extraction systems at Coke Dry Quenching, Sinter Plant area dedusting, Blast Furnace Cast house and Stock house dedusting, Dog house system at SMP-2 etc. Stack details are provided in Table 4.2, below

Emission from Area Source (Fugitive Emission)

Fugitive emissions are expected from Material Handling areas of Coke Ovens, Calcination Plant, Sinter Plant, Blast Furnaces, SMP-2, fugitive emissions from Coal & Coke crushing & screening, fugitive emissions from Sinter breaker and Sinter screens, Calcination plant screens, Secndary emissions from BOFs, fugitive emissions from LRF and RH-OB etc. Fugitive emission is also generated due to vehicular movement in the plant premises.

Accordingly, it is most expected that there will be some variation in the emitted pollution load. It is therefore most justified to first assess the anticipated variation in the emitted pollution load. Once these variations vis-à-vis increase or decrease in emitted pollution load are estimated, its impact on air environment will be assessed and predicted.

The purpose of impact predictions on air environment, emission source can be classified as point source. Emissions from the above-mentioned point sources will be predicted for its impacts on the Ground Level Concentration (GLC) at various distances using the dispersion modelling guidelines of the Central Pollution Control Board, New Delhi.

4.4.2 Air Quality Model (AERMOD Software)

About the AERMOD Software

The American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) was formed to introduce state-of-the-art modelling concepts into the EPA's air quality models. Through AERMIC, a modelling system, AERMOD, was introduced that incorporated air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain.

AMS/EPA Regulatory Model (AERMOD) is a steady-state plume model. It is designed to apply to source releases and meteorological conditions that can be assumed to be steady over individual modeling periods (typically one hour or less). AERMOD has been designed to handle the computation of pollutant impacts in

both flat and complex terrain within the same modeling framework. In fact, with the AERMOD structure, there is no need for the specification of terrain type (flat, simple, or complex) relative to stack height since receptors at all elevations are handled with the same general methodology. To define the form of the AERMOD concentration equations, it is necessary to simultaneously discuss the handling of terrain.

AERMET is an input data processor that is one of the regulatory components of the AERMOD modelling system. It incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts.

AERMOD is a preferred/recommmeded model and is required to be used for air pollution dispersion modelling and permitting acticivities in the US. It is widely used world wide.

Meteorological Parameters

Surface meteorological data at project site was collected for post monsoon Season 2020-21 (Mid October 2020 to January 2021). The hourly meteorological data considered during this period were:

- Wind speed
- Wind Direction
- Ambient atmospheric temperature
- Cloud cover
- Solar insulation
- Relative Humidity

Following parameters were considered for dispersion modelling – Point source:

- Emission rate of pollutants as per GPCB/MoEF&CC standards
- Internal diameter at top of stack
- Height of stack
- Exit gas velocity
- Exit gas temperature

Assumptions

The dispersion modelling assumptions considered are as follows:

- The emission rate for PM was calculated based on statutory limit given in the existing consent for similar type of Furnaces.
- The terrain of the study area was considered as FLAT.
- Stability class was evaluated based on solar insulation and cloud cover.
- The mathematical equations used for the dispersion modeling assumes that the earth surface acts as a perfect reflector of plume and physic-chemical processes such as dry and wet deposition and chemical transformation of pollutants are negligible.

4.4.3 Air Quality Model (CALPUFF Software)

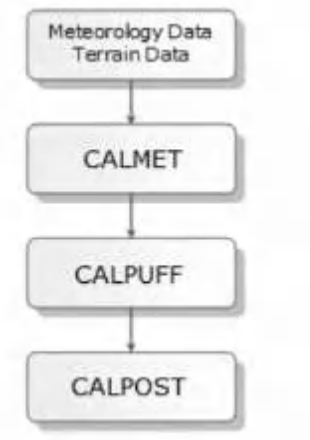
About CALPUFF

In addition to AERMOD, alternative regulatory model CALPUFF has also been used for the modelling exercise. The description of CALPUFF (as described by the USEPA on their website http://www.src.com & CALPUFF User Guide) is as follows:

CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model that simulates the effects of time- and space-varying meteorological conditions on pollution transport, transformation and removal.

CALPUFF is an alternative model specified by USEPA. *Owing to its structure which allows for non steady states inputs and varying topography across the study area it is very useful in determining breeze patterns in coastal areas and allows for dispersion modelling where thermally influenced boundary layers (TIBL) plays a role.*

Figure 4-1: Data Flow in CALPUFF modelling system



The CALPUFF modelling system includes:

CALMET – Diagnostic three-dimensional meteorological model

CALMET is a diagnostic meteorological model which includes a diagnostic wind field generator containing objective analysis and parameterized treatments of slope flows, kinematic terrain effects, terrain blocking effects, a divergence minimization procedure, and a micro-meteorological model for overland and overwater boundary layers. In the simplest terms, CALMET is a meteorological model that develops hourly wind and temperature fields on a three-dimensional gridded modeling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET.

CALPUFF – The puff dispersion model

CALPUFF is a transport and dispersion model that advects 'puffs' of material emitted from modelled sources, simulating dispersion and transformation processes along the way. It uses the fields generated by CALMET, or as an option, it may use simpler non-gridded meteorological data much like existing plume models. CALPUFF is a non-steady-state Lagrangian Gaussian puff air dispersion model. It computes the transport of the puff using the CALMET gridded wind field

CALPOST – Post-processor

CALPOST is a post-processing program with options for the computation of time-averaged concentrations and deposition fluxes predicted by the CALPUFF model. CALPOST computes visibility impacts in accordance with IWAQM and FLAG recommendations. CALPOST processes CALPUFF concentration and deposition flux output files

CALPUFF is a sophisticated model and is used in many modelling scenarios including:

- Near-field impacts in complex flow or dispersion situations

- Complex terrain
- Stagnation, inversion, recirculation, and fumigation conditions
- Overwater transport and coastal conditions
- Light wind speed and calm wind conditions
- Long-range transport
- Visibility assessments and Class I area impact studies
- Criteria pollutant modeling, including application to State Implementation Plan (SIP) development
- Secondary pollutant formation and particulate matter modeling
- Buoyant area and line sources (e.g., forest fires and aluminum reduction facilities)

Source of Modelling Inputs:

MET Data

CALMET-Ready WRF meteorological pre-processed data was purchased from Lakes Environmental. Lakes Environmental provides meteorological data, for any location in the world running the Weather Research and Forecasting mesoscale model (WRF).

3D.DAT format CALMET-ready data is generated by Lakes from WRF output employing CALWRF. The 3D.DAT file consists of three-dimensional data spanning many vertical layers and covering a horizontal grid and the domain specified.

Fumigation

The thermal internal boundary layer calculations are handled in CALPUFF.

CALPUFF | Coastlines input section to specify the coastline for consideration. By activating a coastline here, the model applies the appropriate TIBL calculations when necessary.

Terrain & Land-use Data

Integrated graphical interface including all geophysical and meteorological data pre-processing necessary to run CALMET, intuitive data input for CALPUFF emission sources and full featured post-processing for visualizing CALPOST output

- Automatically downloads terrain and land use data from webGIS.com
- Supports base maps in a variety of formats for easy visualization and source identification

Key Assumptions

Point Sources

Following parameters were considered for dispersion modelling:

- Quantity of Fuel (for flue gas stacks)
- Emission rate of pollutants
- Stack Details
- Stack Diameter
- Stack Height
- Exit Gas Velocity
- Gas Exit Temperature

Line Sources

- Length of road
- Width of road

- Truck trip/day
- Initial Sigma Y & Initial Sigma Z were calculated using 'Haul Calculator'

The stack details along with emission rate of pollutants are given ***Table 4-2***

Table 4-2: Details of Stacks : Proposed Stack details and emission rate of pollutants from proposed project

Sr. No.	Unit name	Stack	No. of stack	Stack Ht., m	Stack Dia. (Top), m	Stack Exit Velocity, m/s	Stack Exit Temp, oK	Proposed APCM	PM (g/s)	SOx (g/s)	NOx (g/s)
S1	Coke Oven	COB#3&4	1	140	4.5	13.67	573	NA	3.390	59.22	28.25
S2	Coke Oven	COB#5&6	1	140	4.5	13.67	573	NA	3.390	59.22	28.25
S3	Sinter Plant-2	Process Flue Gas	1	120	5	15.06	433	ESP	6.102	20.34	30.51
S4	Sinter Plant-3	Process Flue Gas	1	120	5	15.06	433	ESP	6.102	20.34	30.51
S5	Blast Furnace-1 after upgrade (3 mtpa)	BF#1 Stoves	1	80	5	13.54	623	NA	3.814	6.36	19.07
S6	Blast Furnace-2 (4 mtpa)	BF#2 Stoves	1	80	5	15.65	623	NA	4.407	7.35	22.04
S7	Blast Furnace-3 (4 mtpa)	BF#3 Stoves	1	80	6.3	9.86	623	NA	4.407	7.35	22.04
S8	Lime Calcining Plant	LimeKiln#1 (600 tpd)	1	55	1.6	16.72	443	Bag filter	0.678		
S9	Lime Calcining Plant	LimeKiln#2 (600 tpd)	1	55	1.6	16.72	443	Bag filter	0.678		
S10	Lime Calcining Plant	LimeKiln#3 (600 tpd)	1	55	1.6	16.72	443	Bag filter	0.678		
S11	Lime Calcining Plant	LimeKiln#4 (600 tpd)	1	55	1.6	16.72	443	Bag filter	0.678		
S14	Mills	HSM-RHF#1 (420 tph)	1	85	3.1	17.00	748	NA	1.533	2.55	24.01

Sr. No.	Unit name	Stack	No. of stack	Stack Ht., m	Stack Dia. (Top), m	Stack Exit Velocity, m/s	Stack Exit Temp, oK	Proposed APCM	PM (g/s)	SOx (g/s)	NOx (g/s)
S15	Mills	HSM-RHF#2 (420 tph)	1	85	3.1	17.00	748	NA	1.533	2.55	24.01
S16	Mills	HSM-RHF#3 (420 tph)	1	85	3.1	17.00	748	NA	1.533	2.55	24.01
S17	Mills	HSM-RHF#4 (420 tph) (Future)	1	85	3.1	17.00	748	NA	1.533	2.55	24.01
S18	Byproduct gas based captive power plant	CPP	1	100	3.5	17.00	673	NA	2.172	3.62	34.02
S19	Coke Oven	CDQ#1	1	30	2.4	17.32	413	Bag filter	1.695		
S20	Coke Oven	CDQ#2	1	30	2.4	17.32	413	Bag filter	1.695		
S21	Sinter Plant-2	Dedusting	1	40	3.5	16.00	373	Bag filter	3.688		
S22	Sinter Plant-3	Dedusting	1	40	3.5	16.00	373	Bag filter	3.688		
S23	Blast Furnace-1 after upgrade (3 mtpa)	BF#1CH1	1	50	3.5	18.00	353	Bag filter	4.384		
S24	Blast Furnace-2 (4 mtpa)	BF#2CH1	1	50	3.5	18.00	353	Bag filter	4.384		
S25		BF#2CH2	1	50	3.5	18.00	353	Bag filter	4.384		
S26	Blast Furnace-3 (4 mtpa)	BF#3CH1	1	50	5.4	11.70	353	Bag filter	6.780		
S27		BF#3CH2	1	50	5.4	11.70	353	Bag filter	6.780		
S28	SMS -3	Secondary Emission Stack 1	1	100	6.5	16.50	393	Bag filter	12.449		
S29	SMS -3	Secondary Emission Stack 2	1	100	6.5	16.50	393	Bag filter	12.449		
S30	Coke Ovens	COB#3&4DE	1	30	2.5	18.00	413	Bag filter	1.912		
S31	Coke Ovens	COB#5&6DE	1	30	2.5	18.00	413	Bag filter	1.912		

Sr. No.	Unit name	Stack	No. of stack	Stack Ht., m	Stack Dia. (Top), m	Stack Exit Velocity, m/s	Stack Exit Temp, oK	Proposed APCM	PM (g/s)	SOx (g/s)	NOx (g/s)
S32	Sinter plant	Fuel & flux building	1	30	0.5	18.00	313	Bag filter	0.101		
S33	Blast Furnace-1 after upgrade (3 mtpa)	BF#1SH (Iron Fine-1)	1	50	5	16.85	323	Bag filter	9.154		
S34	Blast Furnace-2 (4 mtpa)	BF#2SH (Iron Fine-1)	1	50	5	17.00	323	Bag filter	9.234		
S35	Blast Furnace-3 (4 mtpa)	BF#3SH (Iron Fine-1)	1	50	3.8	17.00	323	Bag filter	5.334		
S45 to 50	Junction Houses at vaious	Various JH for Coal, Coke, Oxide, Flux	6	50	1	16.00	323	Bag filter	0.348		
S37	Coke Ovens	COB#1,2,3& 4 Common	1	80	2	17.00	343	NA			
S39	Blast Furnace-1 after upgrade (3 mtpa)	BF#1(Flare Stack)	1	80	3	18.00	343	NA			
S40	Blast Furnace-2 (4 mtpa)	BF#2(Flare Stack)	1	80	3.5	18.00	343	NA			
S41	Blast Furnace-3 (4 mtpa)	BF#3(Flare Stack)	1	80	3.5	18.00	343	NA			
S42	SMS -3	BOF 1 (Flare Stack)*	1	80	2	18.00	343	NA			
S43	SMS -3	BOF 2 (Flare Stack)*	1	80	2	18.00	343	NA			
S44	SMS -3	BOF 3 (Flare Stack)*	1	80	2	18.00	343	NA			

Sr. No.	Unit name	Stack	No. of stack	Stack Ht., m	Stack Dia. (Top), m	Stack Exit Velocity, m/s	Stack Exit Temp, oK	Proposed APCM	PM (g/s)	SOx (g/s)	NOx (g/s)
S51	Coke oven	COB#3&4DE	1	30	2.5	18	413	Bag filter	1.912		
S52	Coke oven	COB#5&6DE	1	30	2.5	18	413	Bag filter	1.912		
S53	Sinter palnt 3	Cooler stack	1	30	3.7	16.7	473	Bag filter	3.390		
S54	Lime Calcining Plant	Lime screening and dedusting	1	30	3	17	473	Bag filter	2.270		

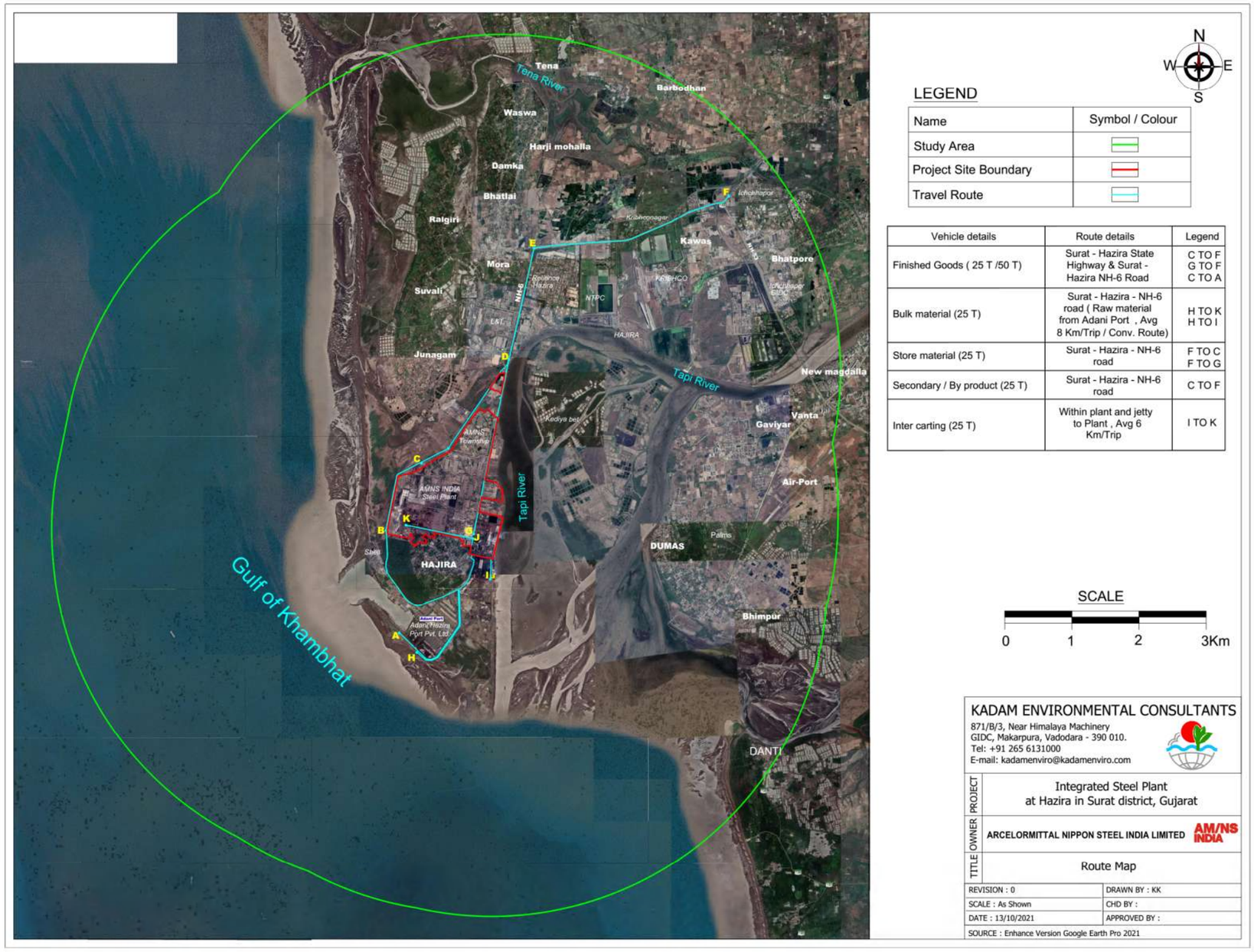
Table 4-3: Details of Line source emission rate due to the proposed project

S. No.	Model Run Type, Location & Activity	Modelling Considerations	Emission rates (Point Source in gm/sec & Line Source in gm/sec/m2)				
			PM10	PM2.5	CO	HC	NOx
L.	Line						
L.1	Route D to F						
L.1.1	Vehicular Traffic - Exhaust	(i) Vehicular exhaust emission as per ARAI (The Automotive Research Association of India), heavy Duty Commercial Vehicle Engines : BS VI	2.0E-08	-	2.9E-06	2.5E-07	7.8E-07
L.1.2	Vehicular Traffic - Non-Exhaust	(ii) Road Abrasion, Tyre wear & Brake Wear - EMEP / EEA emission inventory guidebook 2013 (Ref. Pg. 14) & Road Dust Resuspension - Page 55 & 71 of OECD document, Non-exhaust emissions from road transport (25.06.2020)	4.5E-07	1.9E-07	-	-	-
L.2	Route C to D						

S. No.	Model Run Type, Location & Activity	Modelling Considerations	Emission rates (Point Source in gm/sec & Line Source in gm/sec/m2)				
			PM10	PM2.5	CO	HC	NOx
L.2.1	Vehicular Traffic - Exhaust	(i) Vehicular exhaust emission as per ARAI (The Automotive Research Association of India), heavy Duty Commercial Vehicle Engines : BS VI	2.9E-08	-	4.3E-06	3.7E-07	1.1E-06
L.2.2	Vehicular Traffic - Non-Exhaust	(ii) Road Abrasion, Tyre wear & Brake Wear - EMEP / EEA emission inventory guidebook 2013 (Ref. Pg. 14) & Road Dust Resuspension - Page 55 & 71 of OECD document, Non-exhaust emissions from road transport (25.06.2020)	2.9E-07	1.2E-07	-	-	-
L.3	Route G to D						
L.3.1	Vehicular Traffic - Exhaust	(i) Vehicular exhaust emission as per ARAI (The Automotive Research Association of India), heavy Duty Commercial Vehicle Engines : BS VI Bharat Stage VI	1.5E-08	-	2.2E-06	1.9E-07	6.0E-07
L.3.2	Vehicular Traffic - Non-Exhaust	(ii) Road Abrasion, Tyre wear & Brake Wear - EMEP / EEA emission inventory guidebook 2013 (Ref. Pg. 14) & Road Dust Resuspension - Page 55 & 71 of OECD document, Non-exhaust emissions from road transport (25.06.2020)	8.9E-08	7.1E-08	-	-	-
L.4	Route C to A						
L.4.1	Vehicular Traffic - Exhaust	(i) Vehicular exhaust emission as per ARAI (The Automotive Research Association of India), heavy Duty Commercial Vehicle Engines : BS VI	3.4E-09		5.2E-07	4.5E-08	1.4E-07
L.4.2	Vehicular Traffic - Non-Exhaust	(ii) Road Abrasion, Tyre wear & Brake Wear - EMEP / EEA emission inventory guidebook 2013 (Ref. Pg. 14) & Road Dust Resuspension - Page 55 & 71 of OECD document, Non-exhaust emissions from road transport (25.06.2020)	7.3E-08	3.1E-08			
L.5	Route H to K						

S. No.	Model Run Type, Location & Activity	Modelling Considerations	Emission rates (Point Source in gm/sec & Line Source in gm/sec/m2)				
			PM10	PM2.5	CO	HC	NOx
L.5.1	Vehicular Traffic - Exhaust	(i) Vehicular exhaust emission as per ARAI (The Automotive Research Association of India), heavy Duty Commercial Vehicle Engines : BS VI	5.0E-09	-	7.5E-07	6.5E-08	2.0E-07
L.5.2	Vehicular Traffic - Non-Exhaust	(ii) Road Abrasion, Tyre wear & Brake Wear - EMEP / EEA emission inventory guidebook 2013 (Ref. Pg. 14) & Road Dust Resuspension - Page 55 & 71 of OECD document, Non-exhaust emissions from road transport (25.06.2020)	8.1E-08	3.5E-08	-	-	-
L.6	Route I to K						
L.6.1	Vehicular Traffic - Exhaust	(i) Vehicular exhaust emission as per ARAI (The Automotive Research Association of India), heavy Duty Commercial Vehicle Engines : BS VI	7.9E-08	-	1.2E-05	1.0E-06	3.1E-06
L.6.2	Vehicular Traffic - Non-Exhaust	(ii) Road Abrasion, Tyre wear & Brake Wear - EMEP / EEA emission inventory guidebook 2013 (Ref. Pg. 14) & Road Dust Resuspension - Page 55 & 71 of OECD document, Non-exhaust emissions from road transport (25.06.2020)	4.9E-07	2.1E-07	-	-	-

Map 4-1: Map showing routes considered for line source modelling



4.4.4 AERMOD-Air Dispersion Modelling Result – GLC isopleths for air emission sources from the proposed project- Summer Season

Table 4-4: Incremental GLC (µg/m3) of Particulate Matter (PM) for Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	16.62	16.21	15.84	14.97	14.11	13.34	12.65	12.02	11.46	10.46	9.59	8.84	8.17	7.58	7.07
20	16.89	16.67	16.41	15.71	14.94	14.20	13.50	12.86	12.26	11.19	10.24	9.40	8.74	8.23	7.78
30	17.04	16.82	16.51	15.80	14.93	14.05	13.22	12.63	12.12	11.35	10.33	9.46	8.67	7.92	7.29
40	17.07	16.98	16.70	15.71	14.63	13.81	13.87	13.84	13.72	13.92	12.76	12.04	11.32	10.62	9.95
50	17.24	17.06	16.60	15.25	15.60	15.76	15.54	15.00	14.21	12.37	10.53	8.97	8.92	8.72	8.58
60	17.36	17.00	16.34	16.41	16.40	15.53	14.14	12.58	11.23	11.07	10.53	9.75	8.90	8.10	7.38
70	17.43	16.89	16.56	16.89	15.54	13.47	12.46	12.24	11.78	10.41	9.23	9.34	9.23	8.94	8.53
80	17.47	16.78	17.29	16.46	13.89	12.87	12.30	11.45	11.56	11.90	11.41	10.41	9.16	7.89	6.71
90	17.51	17.14	17.69	15.58	13.15	12.49	12.98	13.50	13.43	12.16	10.07	7.87	6.00	4.58	3.52
100	17.57	17.62	17.82	14.71	12.99	14.07	14.61	14.21	13.23	10.25	7.14	4.83	5.66	6.14	6.34
110	17.67	17.96	17.85	14.10	14.15	15.35	14.94	13.69	11.89	7.70	6.98	7.29	8.16	9.13	9.94
120	17.82	18.21	17.92	13.81	15.49	15.75	14.62	12.72	10.21	7.45	8.92	10.16	11.20	9.98	7.38
130	18.00	18.36	18.13	13.88	16.22	15.75	14.16	11.79	8.75	8.76	11.34	10.46	6.31	3.90	2.46
140	18.19	18.39	18.49	14.32	16.54	15.63	13.86	11.19	8.10	11.27	9.83	4.80	2.76	2.46	2.22
150	18.35	18.20	18.91	15.10	16.66	15.53	13.83	11.09	8.53	12.27	5.25	3.53	3.12	2.78	2.51
160	18.43	18.66	19.07	16.26	16.71	15.52	14.00	11.58	10.94	8.94	4.91	4.35	3.94	3.63	3.36
170	18.36	18.95	19.04	17.95	16.71	15.63	14.61	12.66	13.81	7.46	6.76	6.20	5.87	5.68	5.31
180	18.52	18.84	19.44	19.46	16.90	16.53	16.19	14.54	17.39	11.45	9.69	8.43	7.61	7.18	6.45
190	18.44	18.98	19.45	19.96	22.75	22.02	20.35	16.87	22.63	15.08	11.80	9.77	8.51	7.73	7.20
200	17.96	18.16	18.17	17.32	16.98	17.79	19.53	14.32	15.19	13.54	10.38	8.78	7.87	7.31	6.85
210	17.25	16.77	15.90	15.23	13.83	13.05	12.44	12.05	12.59	19.28	10.70	8.20	6.97	6.44	5.91

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
220	16.40	15.39	15.12	13.56	11.98	11.82	11.75	12.39	12.59	12.51	13.56	10.80	9.18	8.73	7.82
230	15.55	14.89	14.40	12.03	10.40	11.24	11.25	8.85	8.96	8.69	7.33	8.24	8.31	9.00	9.35
240	15.36	14.45	13.15	10.12	10.30	10.02	7.80	7.03	6.67	6.43	6.22	6.93	5.73	6.35	6.36
250	14.80	13.70	12.04	9.75	9.60	8.03	5.81	5.75	5.83	5.03	4.89	4.96	5.52	5.88	4.80
260	14.46	13.06	11.10	9.48	8.67	6.55	5.10	4.93	4.87	4.69	4.07	3.62	4.26	4.34	4.26
270	14.18	12.57	10.43	9.15	7.90	5.73	4.69	4.73	4.69	4.30	3.72	3.23	3.06	2.80	2.74
280	13.98	12.28	10.09	8.89	7.43	5.38	4.44	4.51	4.47	4.16	3.66	3.12	2.65	2.30	2.08
290	13.86	12.19	10.13	8.76	7.26	5.37	4.17	4.13	4.12	3.93	3.63	3.30	2.97	2.65	2.35
300	13.84	12.30	10.30	8.77	7.34	5.62	4.20	3.80	3.65	3.55	3.41	3.24	3.06	2.86	2.63
310	13.88	12.56	10.75	8.96	7.60	6.09	4.64	3.85	3.50	3.06	2.97	2.89	2.79	2.68	2.54
320	14.12	12.90	11.41	9.35	8.04	6.74	5.43	4.26	3.64	3.16	2.77	2.44	2.29	2.20	2.11
330	14.58	13.24	12.13	10.00	8.68	7.53	6.41	5.34	4.38	3.32	3.03	2.75	2.47	2.21	1.99
340	15.08	13.88	12.78	10.97	9.61	8.52	7.54	6.62	5.76	4.27	3.14	2.87	2.66	2.46	2.28
350	15.62	14.71	13.83	12.24	10.94	9.87	8.95	8.14	7.40	6.07	4.95	4.03	3.28	2.70	2.38
360	16.12	15.52	14.90	13.67	12.57	11.61	10.79	10.06	9.40	8.25	7.27	6.42	5.68	5.05	4.50

Figure 4-2: Isopleth of Incremental GLC of Particulate Matter (PM) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

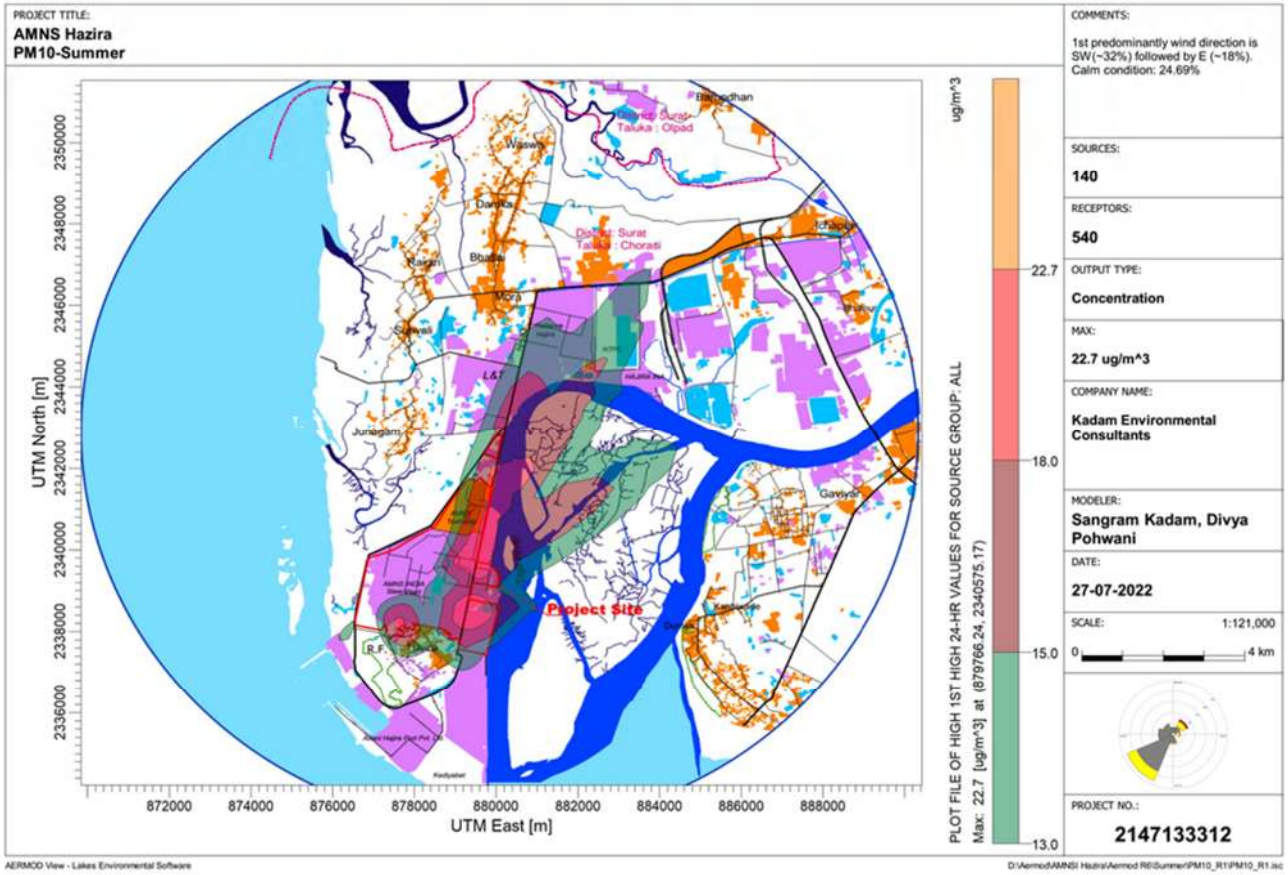


Table 4-5: Incremental GLC (µg/m³) of Particulate Matter ($PM_{2.5}$) for Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	11.22	10.95	10.68	10.09	9.52	9.00	8.54	8.12	7.74	7.08	6.50	5.99	5.54	5.14	4.79
20	11.42	11.26	11.07	10.58	10.05	9.56	9.09	8.66	8.26	7.54	6.90	6.33	5.91	5.57	5.26
30	11.53	11.37	11.21	10.70	10.10	9.51	8.95	8.48	8.13	7.56	6.90	6.33	5.80	5.32	4.91
40	11.60	11.54	11.33	10.64	9.85	9.31	9.34	9.31	9.22	9.19	8.57	8.10	7.63	7.17	6.72
50	11.74	11.59	11.25	10.32	10.51	10.63	10.50	10.15	9.63	8.40	7.15	6.04	5.85	5.73	5.61
60	11.81	11.54	11.07	11.07	11.10	10.54	9.63	8.58	7.57	7.51	7.16	6.63	6.05	5.50	5.00
70	11.85	11.46	11.15	11.43	10.59	9.21	8.42	8.32	8.03	7.10	6.23	6.33	6.27	6.08	5.81
80	11.87	11.38	11.65	11.20	9.52	8.73	8.40	7.84	7.82	8.11	7.80	7.13	6.28	5.40	4.59
90	11.89	11.53	11.94	10.65	8.90	8.51	8.79	9.19	9.18	8.35	6.92	5.40	4.11	3.13	2.41
100	11.93	11.85	12.06	10.10	8.86	9.54	9.98	9.76	9.11	7.05	4.89	3.30	3.78	4.14	4.31
110	11.99	12.09	12.11	9.70	9.56	10.48	10.29	9.45	8.20	5.28	4.74	5.00	5.56	6.27	6.85
120	12.09	12.25	12.17	9.53	10.52	10.84	10.12	8.78	7.02	5.03	6.16	7.05	7.73	6.87	5.05
130	12.21	12.35	12.31	9.59	11.07	10.90	9.81	8.12	5.99	6.10	7.86	7.21	4.31	2.64	1.66
140	12.34	12.36	12.55	9.91	11.33	10.86	9.60	7.69	5.64	7.84	6.77	3.25	1.87	1.67	1.51
150	12.46	12.33	12.80	10.46	11.45	10.82	9.58	7.62	5.96	8.46	3.53	2.39	2.11	1.88	1.70
160	12.52	12.65	12.85	11.25	11.49	10.82	9.73	7.96	7.64	6.10	3.30	2.93	2.65	2.45	2.27
170	12.49	12.86	12.90	12.34	11.47	10.88	10.19	8.74	9.66	5.04	4.55	4.19	3.98	3.87	3.62
180	12.54	12.81	13.19	13.24	11.54	11.40	11.36	10.15	12.17	7.81	6.60	5.76	5.21	4.92	4.43
190	12.51	12.84	13.19	13.59	15.31	15.11	14.45	11.84	15.55	10.22	7.93	6.61	5.75	5.24	4.90
200	12.14	12.29	12.32	11.84	11.46	12.10	13.34	9.90	10.35	9.20	7.03	5.95	5.33	4.97	4.67
210	11.67	11.38	10.90	10.43	9.49	8.92	8.51	8.28	8.70	13.13	7.30	5.66	4.76	4.41	4.06
220	11.12	10.57	10.38	9.30	8.22	8.10	8.10	8.54	8.72	8.56	9.35	7.46	6.32	6.02	5.39
230	10.56	10.21	9.78	8.19	7.15	7.73	7.73	6.07	5.99	5.93	5.06	5.69	5.75	6.20	6.46
240	10.30	9.84	8.97	6.93	7.08	6.88	5.34	4.77	4.54	4.37	4.30	4.81	3.93	4.36	4.37

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	10.08	9.35	8.22	6.71	6.59	5.50	3.94	3.89	3.96	3.42	3.35	3.43	3.84	4.10	3.27
260	9.86	8.92	7.59	6.52	5.95	4.48	3.45	3.33	3.34	3.21	2.76	2.46	2.95	3.02	2.97
270	9.68	8.59	7.15	6.30	5.42	3.92	3.19	3.23	3.21	2.94	2.54	2.19	2.12	1.90	1.86
280	9.55	8.39	6.94	6.12	5.10	3.68	3.01	3.06	3.04	2.84	2.50	2.12	1.80	1.57	1.42
290	9.47	8.33	6.97	6.02	4.98	3.67	2.81	2.79	2.79	2.68	2.47	2.24	2.02	1.81	1.60
300	9.46	8.41	7.08	6.03	5.04	3.85	2.83	2.57	2.47	2.41	2.32	2.20	2.08	1.95	1.79
310	9.48	8.59	7.37	6.16	5.22	4.18	3.18	2.61	2.39	2.06	2.01	1.96	1.90	1.82	1.73
320	9.60	8.81	7.80	6.43	5.53	4.63	3.73	2.92	2.47	2.15	1.89	1.66	1.55	1.49	1.43
330	9.89	9.04	8.28	6.86	5.96	5.17	4.40	3.66	3.00	2.27	2.07	1.88	1.69	1.51	1.36
340	10.22	9.43	8.70	7.50	6.59	5.84	5.17	4.54	3.95	2.93	2.15	1.96	1.82	1.68	1.56
350	10.57	9.96	9.38	8.32	7.46	6.74	6.13	5.57	5.07	4.16	3.40	2.76	2.25	1.85	1.62
360	10.90	10.49	10.08	9.25	8.52	7.88	7.33	6.84	6.40	5.63	4.96	4.38	3.88	3.45	3.07

Note: $PM_{2.5}$ emission rate has been considered 70% of PM pollutants

Figure 4-3: Isopleth of Incremental GLC of Particulate Matter (PM2.5) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

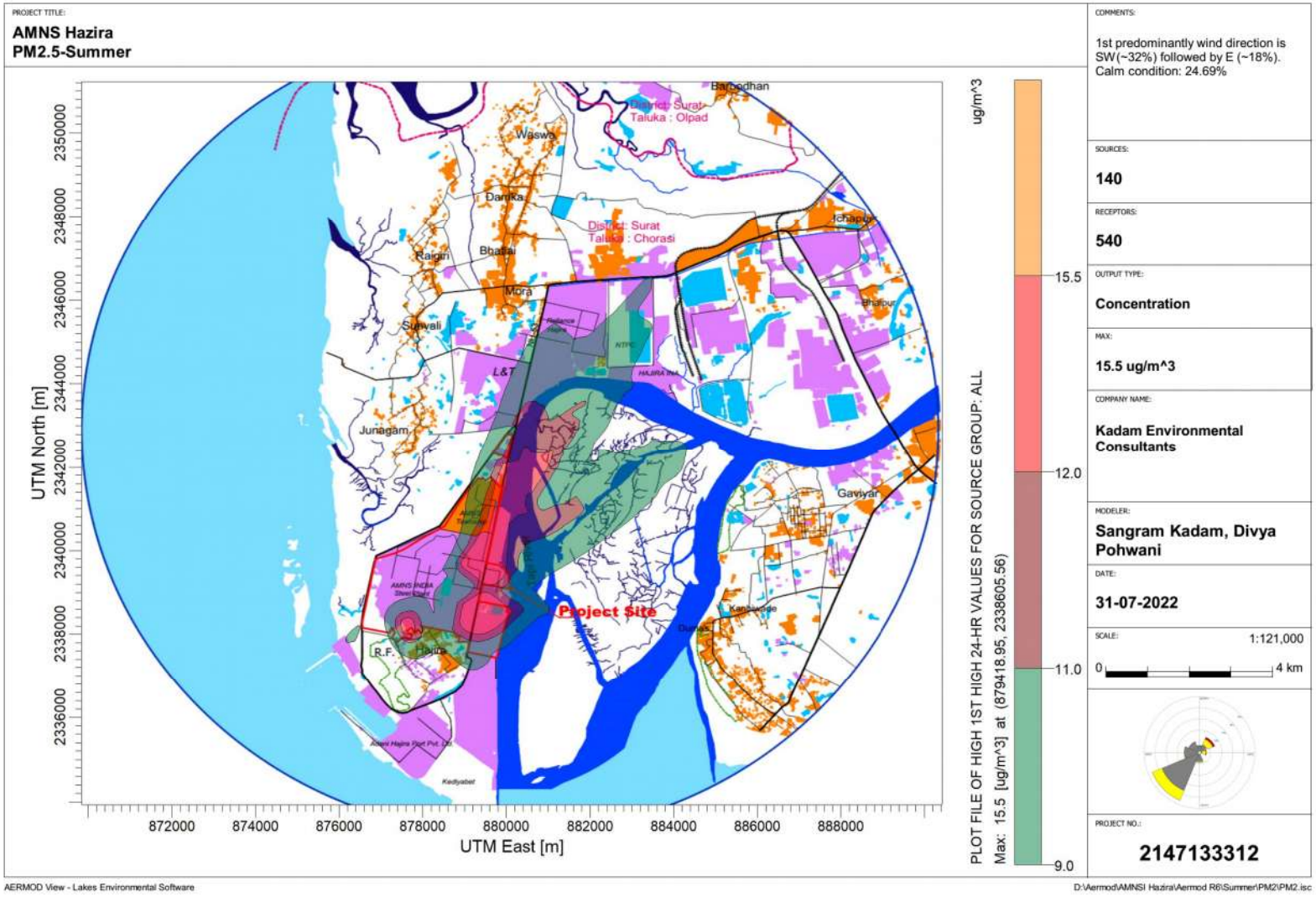


Table 4-6: Incremental GLC (µg/m3) of Oxides of Nitrogen (NOx) for point sources and Line Source

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	19.08	18.44	17.86	17.09	15.91	14.63	13.71	13.47	13.20	12.27	11.37	10.58	10.03	9.48	8.96
20	17.29	17.90	18.12	17.37	16.73	16.10	15.57	14.74	14.56	13.32	12.66	12.11	11.54	10.98	10.44
30	16.58	16.51	16.40	16.40	16.49	16.36	16.01	15.74	15.32	13.98	12.99	12.29	11.61	10.97	10.38
40	16.09	15.88	15.71	15.40	15.06	14.68	14.37	14.08	13.82	13.84	13.12	12.43	11.74	11.13	10.56
50	15.61	15.31	15.02	14.45	14.34	14.25	13.94	13.47	12.92	11.84	10.97	10.10	10.85	10.60	10.53
60	15.24	14.79	14.35	14.10	14.03	13.58	12.88	12.58	12.60	12.26	12.08	11.84	11.55	11.17	10.68
70	15.37	14.54	13.86	14.17	13.46	13.25	13.14	12.70	12.42	12.20	11.98	11.26	10.17	9.06	8.57
80	15.48	14.39	14.04	14.60	13.48	12.97	12.85	12.82	12.65	12.07	11.28	10.36	9.39	8.41	7.48
90	15.49	14.39	14.28	14.31	13.63	14.01	13.92	13.59	13.13	11.92	10.44	8.85	7.33	5.94	4.77
100	15.50	14.51	14.38	13.96	14.63	14.60	14.08	13.39	12.62	10.79	8.66	6.55	7.09	7.69	8.10
110	15.59	14.62	14.35	14.62	15.08	14.48	13.54	12.58	11.62	9.30	8.81	9.68	10.13	10.00	10.62
120	15.76	14.71	14.23	15.20	15.05	13.86	12.68	11.70	10.60	9.65	10.77	11.28	11.62	10.12	8.22
130	15.98	14.84	14.09	15.52	14.72	13.07	11.90	11.00	9.82	10.86	11.40	10.02	8.37	6.11	4.38
140	16.20	15.13	14.15	15.62	14.22	12.33	11.45	10.75	9.73	11.13	10.66	7.92	4.74	4.23	3.80
150	16.32	15.71	14.34	15.55	13.72	11.70	11.10	10.76	10.68	12.42	9.08	6.06	5.27	4.63	4.12
160	16.36	16.44	14.91	15.32	13.42	12.18	11.55	11.14	10.77	12.04	8.26	6.95	5.91	5.11	4.49
170	16.49	16.72	16.28	14.96	13.66	13.62	14.01	13.95	13.32	12.23	10.10	8.16	6.85	5.96	5.27
180	16.78	16.91	16.80	15.07	14.93	15.65	15.68	16.34	17.52	17.35	12.93	10.30	8.37	7.00	6.10
190	15.10	14.75	15.89	17.44	14.37	17.14	18.22	19.77	22.32	21.11	17.32	12.72	10.24	8.50	7.29
200	15.51	14.96	14.32	14.50	15.77	16.31	17.53	18.97	20.02	19.69	15.74	12.66	10.93	9.48	8.34
210	15.76	15.40	14.98	14.31	14.69	15.83	16.97	18.63	20.51	23.66	17.24	13.83	10.89	8.81	7.36
220	16.22	16.24	16.13	16.25	16.98	17.61	17.88	18.31	24.73	24.73	14.50	10.75	9.35	8.17	7.14
230	16.79	17.18	19.63	18.98	19.20	18.87	17.16	15.37	17.07	14.93	11.30	9.19	8.42	8.04	7.73
240	18.83	18.98	18.42	17.80	16.48	15.71	13.79	12.33	12.37	11.21	9.25	8.63	8.15	7.33	6.49

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	19.40	18.55	18.13	15.92	15.46	13.83	10.37	10.26	9.98	8.96	7.68	6.53	6.85	7.43	7.54
260	18.67	18.40	17.35	15.39	14.14	11.73	9.07	8.78	8.41	7.51	6.57	5.71	5.00	4.48	4.95
270	18.53	18.11	16.52	15.24	13.48	10.49	8.08	7.71	7.32	6.52	5.76	5.08	4.51	4.04	3.65
280	18.47	17.79	15.87	14.95	13.04	10.03	7.31	6.92	6.53	5.81	5.16	4.60	4.12	3.73	3.39
290	18.40	17.53	15.44	14.69	12.85	10.14	6.97	6.32	5.94	5.27	4.70	4.25	4.21	3.95	3.57
300	18.33	17.38	15.27	14.54	12.83	10.61	7.71	5.86	5.50	4.87	4.35	4.11	4.08	3.88	3.63
310	18.27	17.36	15.35	14.46	12.85	11.26	8.81	6.45	5.17	4.57	4.08	3.69	3.61	3.47	3.31
320	18.23	17.43	15.67	14.37	12.88	11.88	10.08	8.01	6.13	4.35	3.89	3.57	3.20	2.94	2.80
330	18.20	17.57	16.17	14.22	13.41	12.27	11.20	9.70	8.07	5.29	3.84	3.61	3.33	3.05	2.80
340	18.16	17.71	16.68	13.97	13.69	12.55	11.87	11.03	9.96	7.63	5.62	4.14	3.33	3.02	2.83
350	18.13	17.79	17.12	14.84	13.76	13.26	12.32	11.71	11.18	9.80	8.30	6.88	5.66	4.66	3.86
360	18.65	17.81	17.42	16.01	14.06	13.57	13.17	12.58	11.85	11.09	10.32	9.44	8.57	7.76	7.01

Figure 4-4: Isopleth of Incremental GLC of Oxides of Nitrogen (NOx) from point source and Line Source

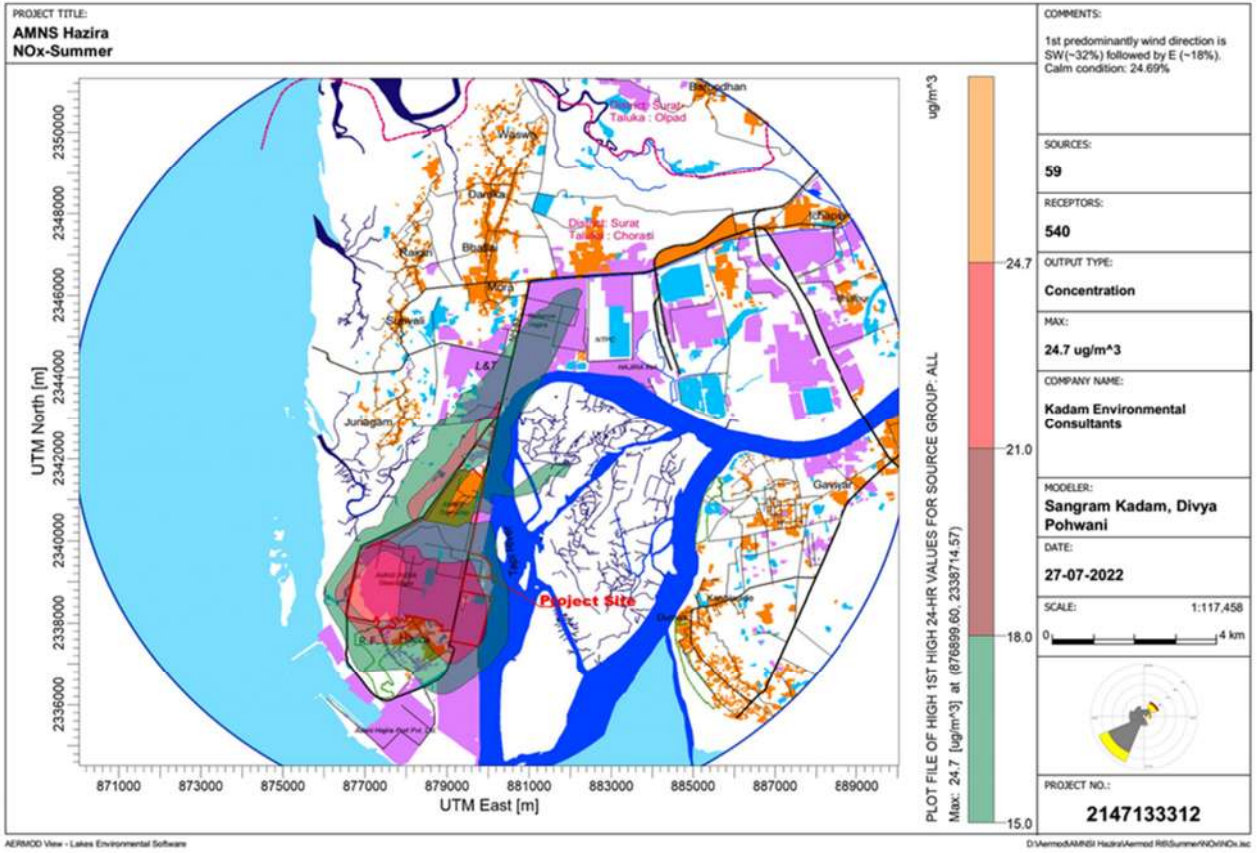


Table 4-7: Incremental GLC (µg/m3) of Sulphur dioxide (SO_2) for point sources

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	12.50	12.16	11.74	10.75	10.13	9.76	9.39	9.05	8.96	8.97	8.70	8.26	7.76	7.26	6.79
20	12.61	12.40	12.17	11.61	10.99	10.77	10.59	10.47	10.40	10.22	9.84	9.36	8.84	8.33	7.86
30	12.65	12.52	12.37	12.05	11.69	11.29	10.88	10.58	10.50	10.26	9.76	9.12	8.45	7.80	7.20
40	12.64	12.50	12.35	12.01	11.63	11.21	10.88	10.84	10.85	10.72	10.37	9.90	9.38	8.84	8.31
50	12.58	12.37	12.15	11.64	11.44	11.59	11.47	11.15	10.71	9.62	8.66	7.67	7.14	7.04	6.89
60	12.49	12.18	11.84	11.74	11.98	11.62	10.88	9.98	9.56	10.01	9.88	9.46	8.94	8.38	7.83
70	12.38	11.95	11.66	12.06	11.61	10.46	10.55	10.84	10.69	9.82	9.01	8.04	7.10	6.25	5.69
80	12.26	11.71	11.66	11.80	10.44	10.85	10.66	10.10	9.38	8.64	7.71	6.76	5.91	5.15	4.48
90	12.15	11.59	11.74	11.06	10.71	10.53	10.62	10.19	9.51	7.93	6.47	5.23	4.22	3.60	3.26
100	12.07	11.44	11.60	10.23	11.01	11.35	10.71	9.63	8.49	6.49	4.91	5.77	6.34	6.67	6.78
110	12.02	11.26	11.31	10.42	11.78	11.31	9.89	8.39	7.13	7.19	8.18	8.26	7.68	6.86	6.66
120	12.02	11.16	10.95	11.23	12.04	10.61	8.65	7.13	8.04	8.95	8.03	7.11	6.87	6.21	5.20
130	12.06	11.21	10.56	11.81	11.98	9.64	7.48	8.46	8.88	7.51	7.15	6.27	5.04	3.68	2.62
140	12.14	11.36	10.47	12.19	11.82	8.74	8.66	8.48	7.63	7.19	6.23	4.41	3.51	3.11	2.78
150	12.27	11.59	10.64	12.32	11.72	8.71	8.67	7.74	7.28	6.56	5.21	4.45	3.84	3.36	2.98
160	12.41	11.89	11.13	12.05	11.73	10.06	9.65	9.05	8.43	7.18	6.00	5.01	4.24	3.71	3.30
170	12.56	12.19	11.68	11.22	11.78	11.75	11.35	10.68	10.03	8.76	7.17	5.84	4.99	4.36	3.88
180	12.70	12.46	12.13	11.05	12.77	13.62	13.21	12.45	12.13	11.66	9.05	7.23	5.90	5.08	4.50
190	12.82	12.65	12.40	11.45	13.64	14.62	14.63	14.43	14.26	13.26	10.57	8.43	6.86	5.79	5.02
200	12.91	12.79	12.53	11.43	13.54	15.22	14.59	14.37	14.19	12.59	10.08	8.63	7.74	6.88	6.10
210	12.95	12.86	12.64	11.73	12.61	13.48	13.43	13.28	13.96	19.06	11.29	9.14	7.26	5.91	4.95
220	12.94	12.83	12.64	12.16	12.18	12.15	11.98	12.46	14.60	14.90	9.94	7.29	6.41	5.67	5.03
230	12.85	12.65	12.34	11.59	10.90	11.54	11.14	10.48	10.70	9.71	7.49	6.94	6.25	5.89	5.54
240	12.69	12.29	11.72	10.25	10.74	10.53	8.95	8.75	8.46	7.48	6.21	5.99	5.48	4.80	4.52

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	12.48	11.82	10.92	9.56	10.13	8.50	7.76	7.44	7.07	6.19	5.28	4.74	5.15	5.33	5.27
260	12.24	11.31	10.14	9.47	9.10	7.15	6.83	6.48	6.10	5.33	4.62	4.01	3.52	3.73	3.94
270	12.01	10.86	9.49	9.16	8.24	6.45	6.11	5.75	5.39	4.72	4.13	3.63	3.22	2.88	2.60
280	11.81	10.50	9.04	8.83	7.68	5.90	5.55	5.20	4.87	4.26	3.75	3.33	2.97	2.68	2.43
290	11.67	10.27	8.76	8.57	7.38	5.61	5.10	4.77	4.46	3.92	3.46	3.09	2.77	2.51	2.29
300	11.60	10.18	8.67	8.41	7.31	5.72	4.76	4.44	4.15	3.64	3.23	2.89	2.61	2.38	2.18
310	11.61	10.21	8.74	8.37	7.42	6.03	4.69	4.17	3.90	3.43	3.05	2.74	2.48	2.27	2.08
320	11.68	10.38	8.98	8.41	7.66	6.50	5.28	4.22	3.70	3.26	2.91	2.62	2.38	2.17	2.00
330	11.81	10.65	9.36	8.53	7.99	7.10	6.07	5.08	4.22	3.32	2.79	2.52	2.29	2.10	1.94
340	11.98	11.01	9.88	8.70	8.36	7.75	6.98	6.17	5.38	4.05	3.41	2.88	2.42	2.05	1.89
350	12.17	11.41	10.50	8.88	8.70	8.36	7.89	7.35	6.79	5.69	4.69	3.86	3.19	2.90	2.64
360	12.35	11.81	11.15	9.68	9.08	8.81	8.60	8.38	8.15	7.63	6.95	6.22	5.55	4.94	4.42

Figure 4-5: Isopleth of Incremental GLC of Sulphur dioxide (SO2) from point source

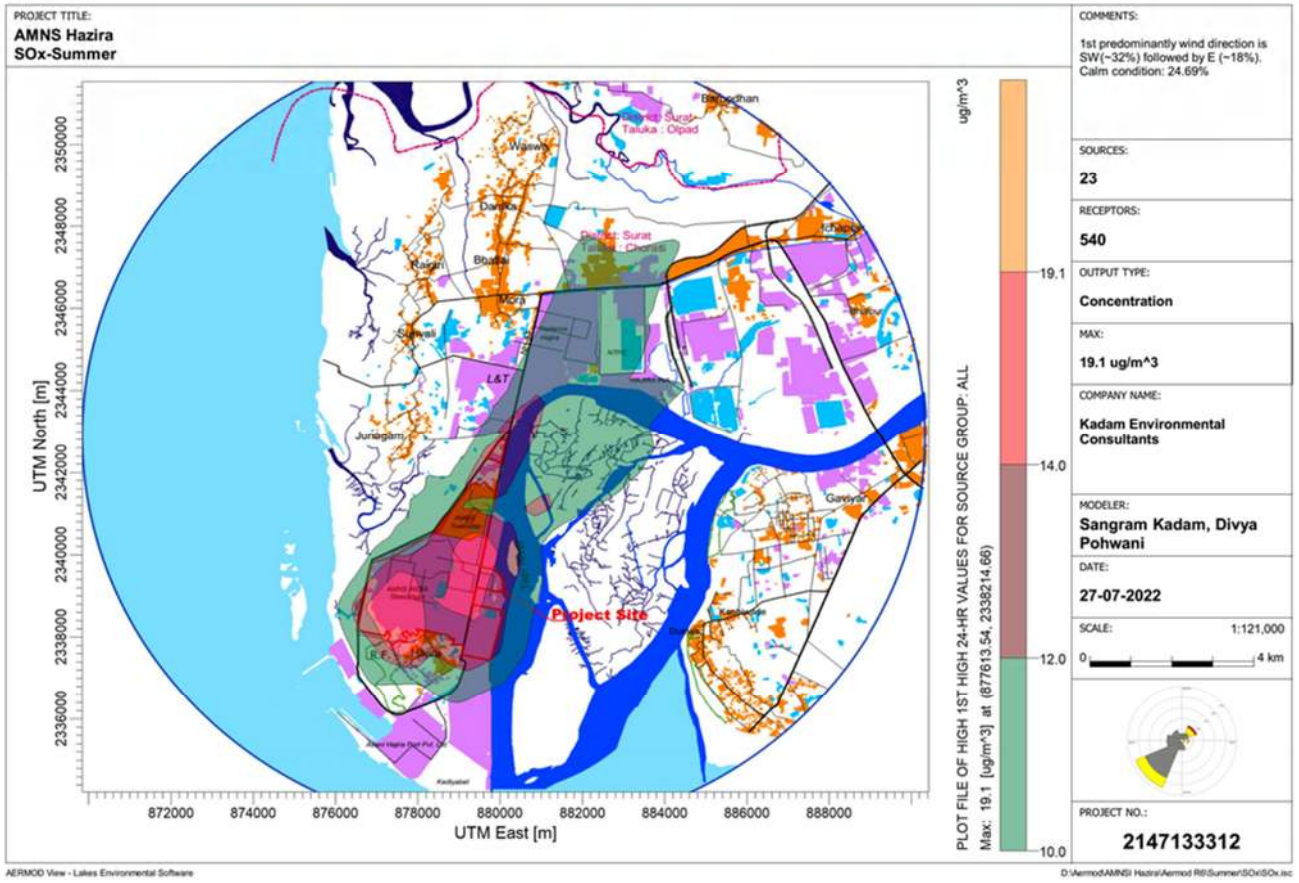


Table 4-8: Incremental GLC (µg/m3) of Hydro carbon (HC) for line sources

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	1.643	1.485	1.391	1.222	0.992	0.710	0.536	0.315	0.283	0.175	0.147	0.123	0.104	0.087	0.074
20	1.508	1.435	1.094	0.730	0.597	0.511	0.449	0.399	0.547	0.366	0.245	0.192	0.159	0.133	0.112
30	0.955	0.676	0.710	0.559	0.445	0.363	0.341	0.332	0.340	0.325	0.213	0.169	0.145	0.128	0.115
40	0.760	0.632	0.475	0.332	0.254	0.218	0.191	0.204	0.226	0.436	0.232	0.164	0.129	0.113	0.099
50	0.658	0.597	0.459	0.331	0.239	0.195	0.196	0.215	0.243	0.302	0.379	0.454	0.376	0.202	0.271
60	0.585	0.498	0.430	0.259	0.194	0.193	0.210	0.220	0.213	0.258	0.207	0.192	0.242	0.114	0.124
70	0.531	0.418	0.325	0.253	0.188	0.175	0.201	0.154	0.153	0.128	0.150	0.126	0.080	0.069	0.060
80	0.477	0.351	0.287	0.233	0.203	0.175	0.161	0.142	0.124	0.109	0.125	0.079	0.069	0.066	0.069
90	0.432	0.312	0.285	0.236	0.192	0.158	0.151	0.113	0.105	0.110	0.100	0.095	0.087	0.071	0.079
100	0.401	0.306	0.286	0.246	0.190	0.157	0.130	0.120	0.130	0.130	0.105	0.111	0.092	0.075	0.058
110	0.385	0.307	0.287	0.232	0.200	0.170	0.142	0.156	0.166	0.120	0.118	0.088	0.085	0.070	0.065
120	0.391	0.314	0.292	0.226	0.181	0.182	0.167	0.192	0.162	0.141	0.119	0.113	0.137	0.118	0.101
130	0.407	0.326	0.300	0.230	0.203	0.199	0.202	0.208	0.175	0.153	0.149	0.153	0.125	0.049	0.032
140	0.432	0.345	0.313	0.258	0.223	0.228	0.225	0.230	0.198	0.225	0.202	0.137	0.049	0.058	0.043
150	0.467	0.375	0.340	0.297	0.235	0.234	0.247	0.260	0.247	0.345	0.215	0.083	0.062	0.043	0.042
160	0.517	0.425	0.384	0.329	0.299	0.242	0.278	0.298	0.353	0.235	0.160	0.088	0.083	0.051	0.043
170	0.594	0.503	0.436	0.370	0.335	0.297	0.341	0.393	0.457	0.397	0.178	0.098	0.117	0.072	0.055
180	0.743	0.644	0.575	0.490	0.434	0.378	0.376	0.473	0.688	0.944	0.407	0.136	0.083	0.072	0.062
190	1.656	1.468	1.407	0.919	0.971	0.885	0.892	0.948	1.279	1.471	0.937	0.718	0.613	0.635	0.442
200	1.536	1.402	1.296	1.163	1.028	0.920	0.838	0.767	0.743	1.538	1.253	1.108	0.940	0.930	0.835
210	1.592	1.445	1.315	1.099	0.927	0.796	0.710	0.656	0.627	1.165	1.156	0.945	0.777	0.622	0.518
220	1.602	1.442	1.288	1.158	1.245	1.354	1.303	1.007	0.766	0.510	0.470	0.375	0.307	0.271	0.256
230	1.508	1.308	1.416	0.853	0.590	0.435	0.428	0.439	0.409	0.226	0.174	0.437	0.265	0.140	0.136
240	1.987	0.994	0.710	0.440	0.326	0.307	0.273	0.204	0.236	0.145	0.079	0.070	0.115	0.308	0.135

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	1.105	0.675	0.538	0.308	0.282	0.262	0.222	0.159	0.151	0.081	0.082	0.092	0.057	0.059	0.057
260	0.821	0.563	0.434	0.248	0.251	0.233	0.197	0.137	0.103	0.093	0.079	0.057	0.053	0.050	0.047
270	0.697	0.498	0.375	0.227	0.228	0.212	0.187	0.133	0.092	0.062	0.074	0.066	0.043	0.038	0.043
280	0.633	0.454	0.344	0.209	0.208	0.196	0.179	0.142	0.099	0.073	0.043	0.045	0.028	0.035	0.044
290	0.598	0.426	0.329	0.194	0.191	0.184	0.168	0.152	0.119	0.058	0.040	0.069	0.039	0.037	0.069
300	0.583	0.412	0.321	0.184	0.176	0.171	0.160	0.146	0.133	0.088	0.056	0.096	0.047	0.037	0.023
310	0.582	0.413	0.318	0.196	0.163	0.156	0.151	0.142	0.130	0.108	0.092	0.053	0.034	0.022	0.014
320	0.596	0.427	0.323	0.221	0.155	0.145	0.138	0.131	0.142	0.136	0.093	0.077	0.066	0.054	0.041
330	0.625	0.453	0.346	0.243	0.176	0.133	0.123	0.139	0.108	0.097	0.091	0.084	0.075	0.066	0.057
340	0.679	0.529	0.410	0.264	0.201	0.164	0.133	0.219	0.288	0.093	0.083	0.074	0.067	0.062	0.058
350	0.860	0.643	0.526	0.343	0.236	0.192	0.156	0.291	0.162	0.095	0.079	0.067	0.059	0.054	0.049
360	1.159	0.919	0.695	0.534	0.382	0.302	0.184	0.362	0.160	0.107	0.089	0.074	0.064	0.056	0.052

Figure 4-6: Isopleth of Incremental GLC of Hydrocarbon (HC) from line source

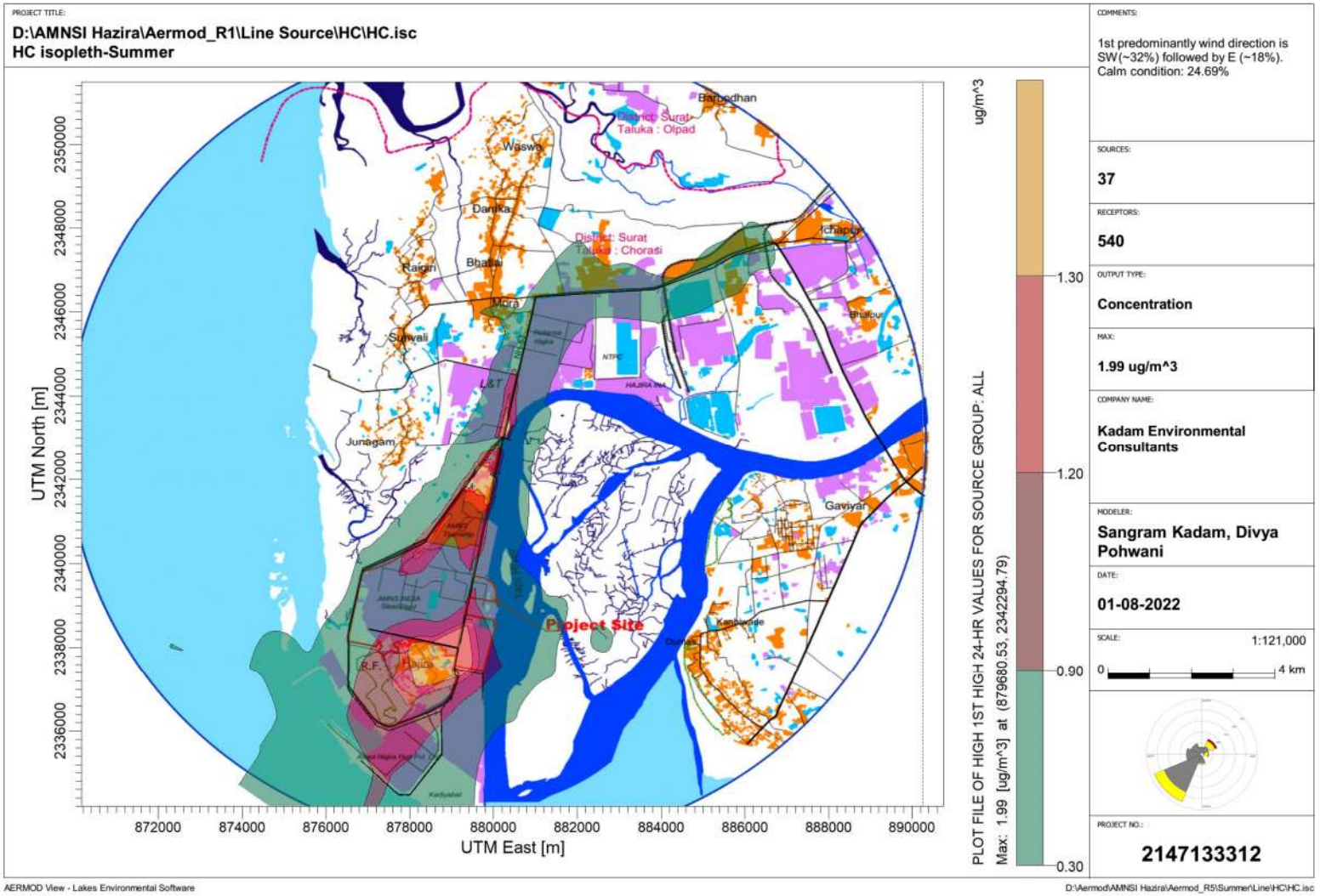
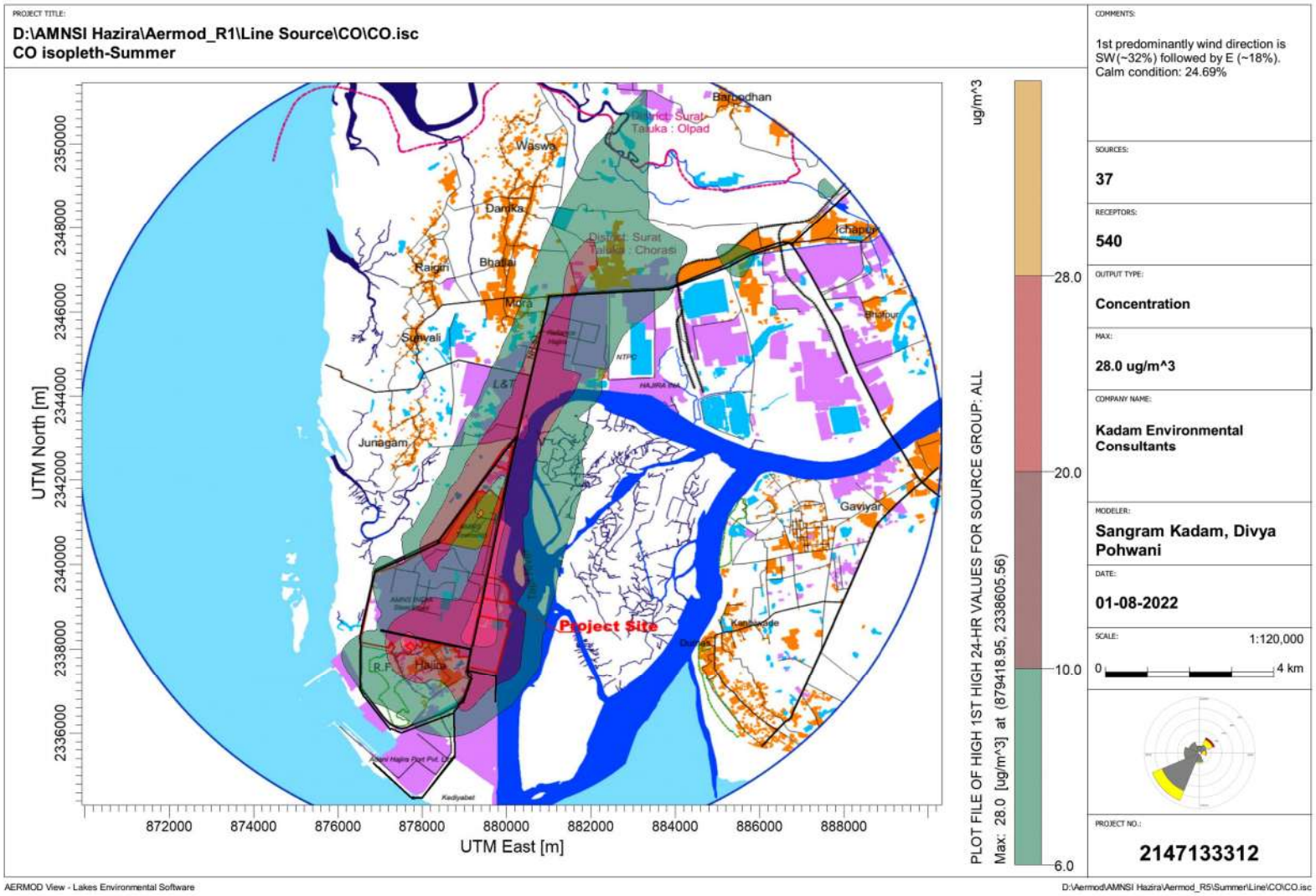


Table 4-9: Incremental GLC (µg/m3) of Carbon monoxide (CO) for line sources

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	20.276	19.031	16.879	13.916	11.919	10.493	9.408	8.534	7.852	6.709	5.745	4.886	4.251	3.684	3.131
20	26.696	24.797	20.627	17.030	14.906	13.385	12.192	11.326	10.590	11.664	9.269	8.047	7.008	6.221	5.653
30	21.144	21.025	17.171	13.584	11.223	9.781	8.405	7.210	6.299	7.813	6.432	5.409	4.621	3.619	3.034
40	18.813	17.497	16.508	13.543	11.621	10.236	8.713	7.578	6.750	8.025	6.580	5.611	4.750	4.011	3.479
50	17.144	15.457	12.984	8.979	7.898	6.815	5.310	4.265	3.777	3.532	3.326	7.114	5.524	5.405	6.539
60	15.643	12.565	9.181	6.377	5.682	5.285	4.646	4.147	3.566	3.010	2.630	2.068	2.148	1.634	1.799
70	14.130	9.758	7.328	6.444	6.241	4.830	3.963	3.377	2.978	2.602	1.876	1.687	1.502	1.057	0.736
80	12.717	9.164	7.235	6.591	5.471	4.397	3.539	3.234	2.971	1.914	1.678	1.016	0.872	0.932	0.907
90	11.466	8.601	7.435	6.506	4.963	3.976	3.398	3.012	2.078	1.815	1.102	1.031	0.868	0.857	0.715
100	10.620	8.314	7.385	6.724	5.162	4.102	3.630	2.288	2.046	1.214	1.102	0.902	0.645	0.606	0.720
110	10.711	8.358	7.501	6.958	5.413	4.053	3.196	2.219	2.080	1.266	0.969	0.984	1.477	1.046	0.823
120	10.877	8.612	7.703	7.208	5.568	4.129	3.067	2.396	1.720	1.144	1.701	1.252	2.327	1.381	1.287
130	11.161	9.164	7.971	7.430	5.996	4.514	3.343	2.619	1.776	2.038	2.267	1.683	1.467	0.505	0.192
140	11.569	10.053	8.372	8.593	6.789	5.148	3.834	2.835	1.657	2.207	2.037	1.485	0.340	0.239	0.217
150	12.283	11.028	9.061	8.084	7.986	6.131	4.669	3.145	2.783	4.157	2.103	0.414	0.297	0.773	0.489
160	13.378	11.895	10.721	8.813	9.348	8.351	6.387	5.004	3.486	3.363	1.671	1.160	0.480	0.487	0.870
170	15.242	13.278	12.806	10.044	9.491	9.111	9.696	7.838	6.465	4.506	2.034	1.519	1.400	0.860	0.765
180	18.852	16.526	15.063	15.186	12.448	11.395	11.184	10.469	13.094	11.833	5.317	5.263	3.315	2.440	1.908
190	12.685	15.776	20.114	24.143	22.350	22.011	22.607	26.303	28.007	13.957	10.740	4.934	3.731	2.514	1.744
200	7.853	6.731	6.399	6.237	6.550	7.481	8.428	9.590	11.229	13.938	7.357	5.450	4.182	3.583	2.690
210	10.055	8.697	6.867	5.835	6.315	6.896	7.772	9.026	10.516	23.696	7.628	5.284	2.991	2.283	1.966
220	12.064	12.522	12.978	13.718	13.566	13.665	12.106	7.385	7.635	5.552	6.953	3.798	2.971	2.028	1.696
230	14.012	19.721	16.055	15.986	12.137	10.052	9.085	4.939	7.637	3.213	2.095	4.083	2.122	2.371	1.803
240	24.886	15.942	14.989	11.728	7.876	5.767	2.356	1.977	1.789	1.961	1.639	1.432	1.502	2.865	1.525

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	15.983	14.620	12.758	7.873	5.961	2.130	1.611	1.365	1.222	1.065	1.188	0.925	1.051	0.744	0.606
260	15.389	13.267	11.085	6.676	3.531	1.916	1.239	1.126	1.030	0.958	0.817	0.869	0.793	0.801	0.701
270	14.604	12.107	9.904	5.974	2.252	1.780	1.158	1.007	1.013	1.033	0.764	0.654	0.803	0.745	0.528
280	13.984	11.311	8.994	5.435	1.917	1.684	1.182	1.292	1.065	0.865	0.990	0.716	0.427	0.402	0.306
290	13.547	10.844	8.543	5.128	1.856	1.606	1.360	0.974	1.100	0.997	0.615	0.548	0.422	0.397	0.614
300	13.308	10.627	8.499	5.117	1.956	1.516	1.311	1.367	1.292	0.756	0.588	0.697	0.628	0.410	0.384
310	13.249	10.613	8.720	5.369	2.310	1.531	1.452	1.468	0.891	0.676	1.029	0.492	0.367	0.278	0.226
320	13.381	10.795	8.995	5.725	3.172	1.652	1.743	1.341	1.088	1.442	0.580	0.429	0.408	0.383	0.335
330	13.725	11.225	9.376	6.329	4.454	2.174	1.834	1.310	1.172	1.039	0.542	0.294	0.259	0.224	0.200
340	14.362	11.844	9.973	7.627	5.408	3.881	2.136	1.675	2.469	1.287	1.092	0.935	0.631	0.311	0.189
350	15.436	12.737	10.931	8.532	6.917	5.284	4.277	2.979	3.139	2.095	1.612	1.289	1.095	0.952	0.833
360	17.300	14.486	12.454	9.798	8.203	7.144	6.105	5.098	4.424	3.076	1.954	1.586	1.491	1.391	1.309

Figure 4-7: Isopleth of Incremental GLC of carbon monoxide (CO) from line source



4.4.5 CALPUFF-Air Dispersion Modelling Result – GLC isopleths for air emission sources from the proposed project-Summer Season

Figure 4-8: Isopleth of Incremental GLC of Particulate Matter (PM) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

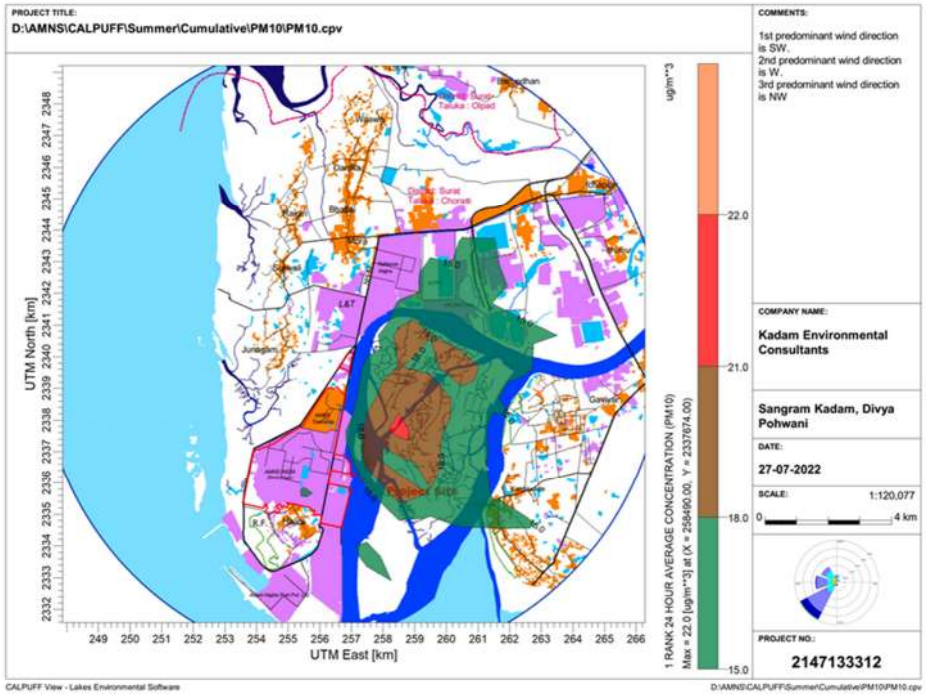


Figure 4-9: Isopleth of Incremental GLC of Particulate Matter (PM2.5) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

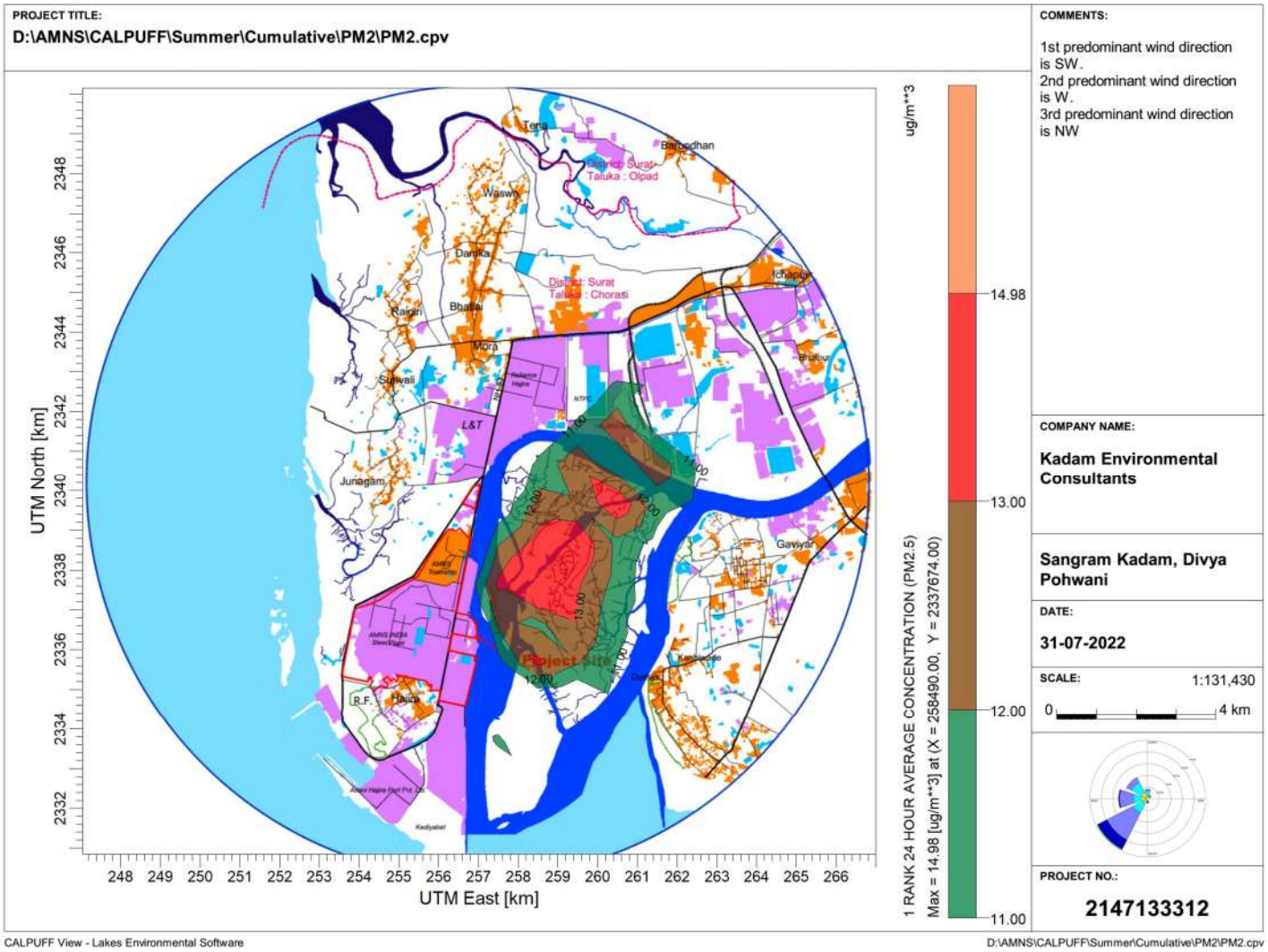


Figure 4-10: Isopleth of Incremental GLC of Oxides of Nitrogen (NOx) from Point & Line Source emission from flue gas stack and Process gas stack

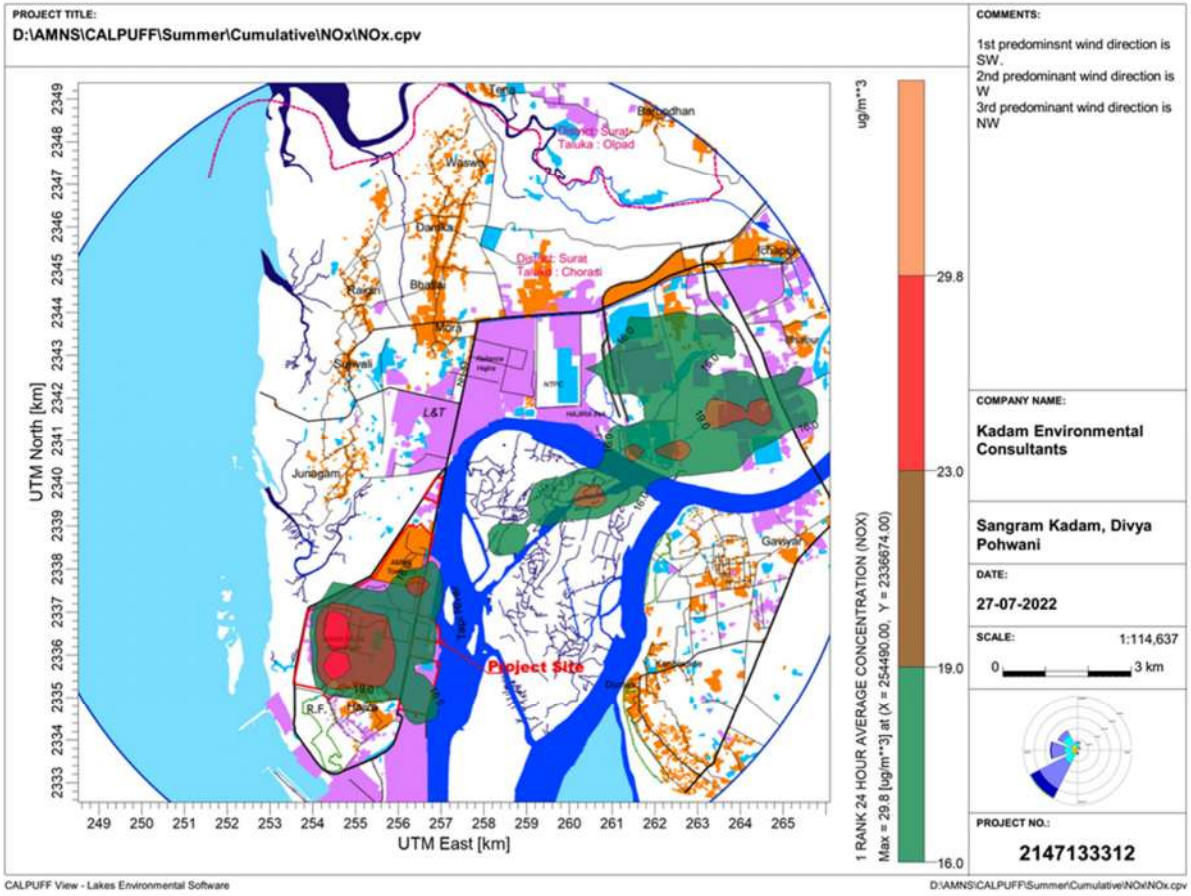


Figure 4-11: Isopleth of Incremental GLC of Sulfur Dioxide (SO2) from Point Source emission from flue gas stack and Process gas stack

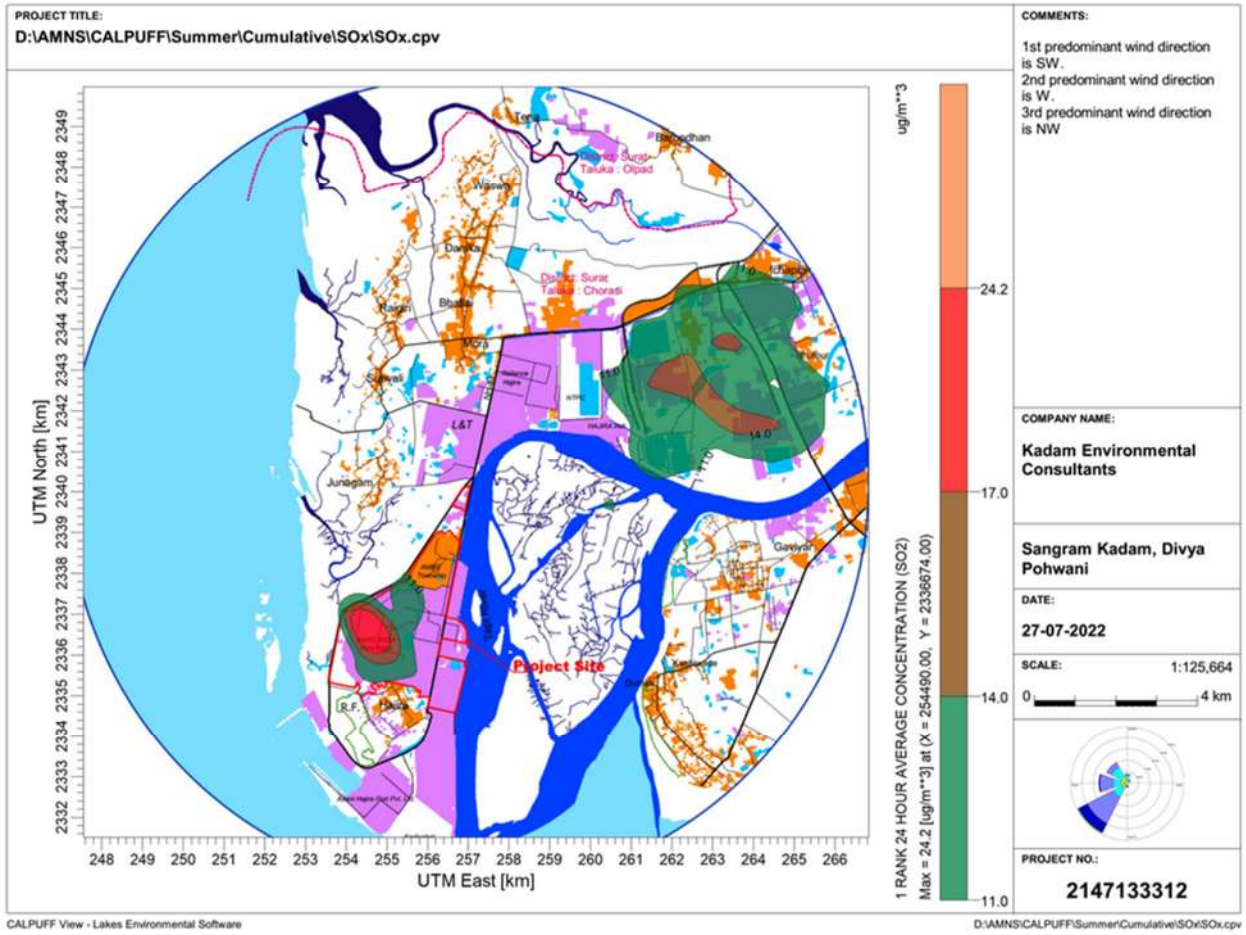


Figure 4-12: Isopleth of Incremental GLC of Carbon monoxide (CO) from vehicular emissions

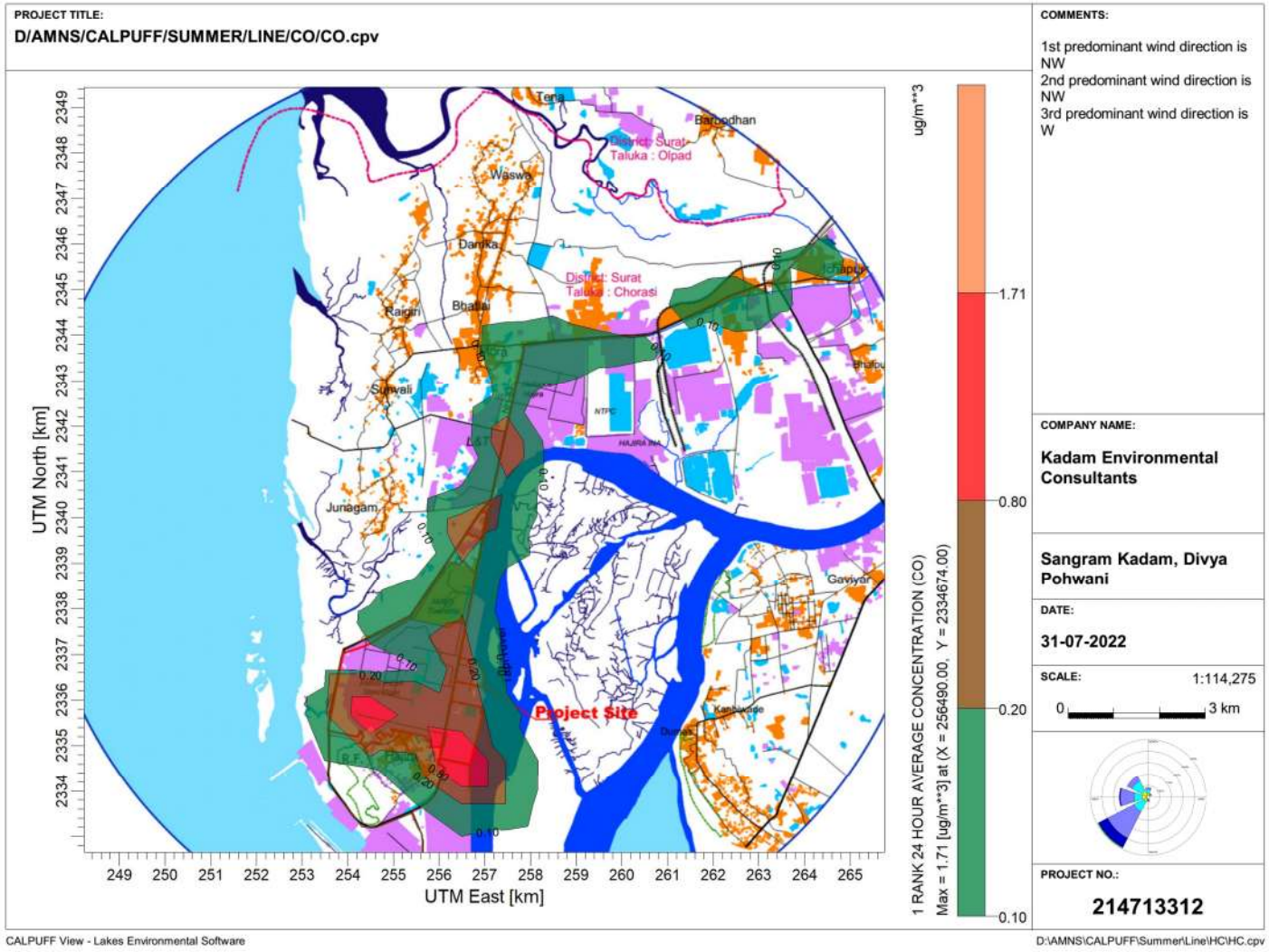


Table 4-10: Average GLC during study period and Predicted GLC on date of highest baseline reading- Summer Season

Station-ID	Pollutants	Unit	CPCB Limit Concentration (24 Hrs)	Baseline (Time Weighted Average)	Aermod	Aermod	Calpuff	calpuff	Baseline (Single Day Maximum)	Aermod	Aermod	calpuff	calpuff
					Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)	Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)		Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)	Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)
C1	C2	C3	C4	C5	C6	C7 (C5+C6)	C8	C9 (C5 +C8)	C10	C11	C12 (C10+C11)	C13	C14 (C10+C13)
AAQ1 At site (~0.0 km / -)	PM10	µg/m3	100	88	3.11	91.110	3.23	91.231	130.0	16.62	146.619	11.551	141.551
	PM2.5	µg/m4	60	23	1.93	24.933	2.302	25.302	52.0	11.22	60.196	8.2	60.196
	SO2	µg/m3	80	8.6	2.50	11.096	2.2923	10.892	9.7	12.50	22.200	7.6334	17.333
	NOx	µg/m3	80	11.9	4.83	16.727	3.5265	15.427	14.1	19.08	33.2	14.372	28.5
	HC	µg/m3	NS	1028	0.38103	1028.381		1028	1084.0	1.64264	1085.6		1084.0
	CO	mg/m³	2	1.03	0.0057	1.036	0.000038	1.030	1.1	0.02028	1.150	0.00013	1.130
AAQ2 Hazira Police Station (~0 km / -)	PM10	µg/m3	100	91	3.11	94.110	1.96	92.960	135.0	16.62	151.619	11.141	146.141
	PM2.5	µg/m4	60	18	1.93	19.933	1.382	19.382	48.0	11.22	55.149	7.1	55.149
	SO2	µg/m3	80	8.5	2.50	10.996	1.3884	9.888	9.8	12.50	22.300	5.9708	15.771
	NOx	µg/m3	80	12.2	4.83	17.027	2.8894	15.089	13.9	19.08	33.0	12.916	26.8
	HC	µg/m3	NS	1095	0.38103	1095.381		1095	1193.0	1.64264	1194.6		1193.0
	CO	mg/m³	2	1.06	0.0057	1.066	0.000116	1.060	1.3	0.02028	1.290	0.00027	1.270
AAQ3 Dumas Village (~5.3 km / E)	PM10	µg/m3	100	75	1.62	76.625	2.40	77.402	101.0	12.16	113.159	9.7079	110.708
	PM2.5	µg/m4	60	25	1.10	26.100	1.7039	26.704	55.0	8.35	61.985	7.0	61.985
	SO2	µg/m3	80	8.2	1.63	9.827	1.3726	9.573	9.7	7.93	17.628	5.2815	14.982
	NOx	µg/m3	80	12.5	2.45	14.954	2.0835	15	16.3	11.84	28.1	9.1089	25.4
	HC	µg/m3	NS	1078	0.04587	1078.046		1078	1133.0	0.30204	1133.3		1133.0
	CO	mg/m³	2	1.06	0.00022871	1.060	0.000029	1.060	1.2	0.00353	1.154	0.00014	1.150
AAQ4 Hazira Village (~2.8 km /SW)	PM10	µg/m3	100	84	3.44	87.441	2.59	86.590	117.0	11.25	128.250	9.3127	126.313
	PM2.5	µg/m4	60	21	2.29	23.294	1.8273	22.827	55.0	7.73	61.533	6.5	61.533
	SO2	µg/m3	80	8.5	3.68	12.184	1.623	10.123	14.0	11.14	25.138	7.1731	21.173
	NOx	µg/m3	80	12.4	5.69	18.086	2.9501	15	15.2	17.16	32.4	14.303	29.5
	HC	µg/m3	NS	1025	0.10275	1025.103		1025	1092.0	0.42847	1092.4		1092.0
	CO	mg/m³	2	1.10	0.00220	1.102	0.000015	1.100	1.3	0.00908	1.279	0.00010	1.270
AAQ5 Junagam (~1.4 km / W)	PM10	µg/m3	100	87	2.12	89.120	0.26	87.263	138.0	9.15	147.155	6.9315	144.932
	PM2.5	µg/m4	60	27	1.41	28.414	0.1788	27.179	53.0	6.30	57.834	4.8	57.834
	SO2	µg/m3	80	8.8	2.55	11.353	0.11979	8.920	14.0	9.16	23.162	3.2388	17.239
	NOx	µg/m3	80	11.9	3.51	15.406	0.20236	12	13.7	15.24	28.942	8.1084	21.808
	HC	µg/m3	NS	1099	0.04755	1099.048		1099	1146.0	0.22651	1146.2		1146.0
	CO	mg/m³	2	1.13	0.0010	1.131	0.000004	1.130	1.3	0.0057	1.276	0.000041	1.270
AAQ6 Mora (~3.3 km / N)	PM10	µg/m3	100	78	1.52	79.519	0.76	78.757	114.0	10.06	124.056	6.0918	120.092
	PM2.5	µg/m4	60	22	0.99532	22.995	0.5123	22.512	54.0	6.84	58.127	4.1	58.127
	SO2	µg/m3	80	8.6	1.43	10.032	0.5926	9.193	10.8	8.60	19.401	5.12	15.920
	NOx	µg/m3	80	12.1	2.52	14.624	1.2912	13	16.0	13.17	29.174	11.274	27.274
	HC	µg/m3	NS	1104	0.02581	1104.026		1104	1135.0	0.36214	1135.4		1135.0

Station-ID	Pollutants	Unit	CPCB Limit Concentration (24 Hrs)	Baseline (Time Weighted Average)	Aermod	Aermod	Calpuff	calpuff	Baseline (Single Day Maximum)	Aermod	Aermod	calpuff	calpuff
					Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)	Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)		Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)	Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)
C1	C2	C3	C4	C5	C6	C7 (C5+C6)	C8	C9 (C5 +C8)	C10	C11	C12 (C10+C11)	C13	C14 (C10+C13)
	CO	mg/m³	2	1.19	0.00098	1.191	0.000047	1.190	1.4	0.00510	1.355	0.00014	1.350
AAQ7 Kavas (~6.5 km /NE)	PM10	µg/m3	100	89	1.68	90.677	3.55	92.547	128.0	8.97	136.975	14.635	142.635
	PM2.5	µg/m4	60	25	1.05	26.052	2.4128	27.413	47.0	7.15	57.247	10.2	57.247
	SO2	µg/m3	80	8.8	1.42	10.225	2.5764	11.376	16.1	7.67	23.766	14.442	30.542
	NOx	µg/m3	80	12.2	2.48	14.683	3.9156	16	16.6	10.10	26.700	17.285	33.885
	HC	µg/m3	NS	1091	0.18353	1091.184		1091	1091.0	0.4541	1091.5		1091.0
	CO	mg/m³	2	1.20	0.0020	1.202	0.000013	1.200	1.3	0.00711	1.287	0.00003	1.280
AAQ8 Gaviyer (~8.3 km / E)	PM10	µg/m3	100	89	0.95	89.948	3.22	92.216	127.0	6.00	133.004	13.015	140.015
	PM2.5	µg/m4	60	23	0.64	23.641	2.1631	25.163	57.0	5.85	66.122	9.1	66.122
	SO2	µg/m3	80	8.5	1.31	9.812	1.7432	10.243	11.0	7.14	18.141	6.8696	17.870
	NOx	µg/m3	80	11.8	1.50	13.300	2.7444	15	13.9	7.33	21.228	14.186	28.086
	HC	µg/m3	NS	1082	0.03093	1082.031		1082	1082.0	0.08651	1082.1		1082.0
	CO	mg/m³	2	1.11	0.00156	1.112	0.00001	1.110	0.3	0.0055	0.286	0.00002	0.280

HC is not available in the species directory of CALPUFF

Cumulative species(Point+Line): PM10,PM2.5, NOx; Cumulative species(Point only): SOx; Cumulative species(Line only): HC,CO

Table 4-11: Maximum GLC due to Cumulative impact on Ambient Air Quality (AERMOD)

S. No.	Parameters	Maximum GLC Concentration, µg/m3	Direction	Distance (m)	Features of Area where Max GLC is buidling
1	PM	22.7	SSW	2000	Towards the sea
2	PM2.5	15.31	SSW	2000	Towards the sea
2	NOx	24.7	SW	4000	Towards the sea
3	SO2	19.1	SSW	5000	Towards the sea

Table 4-12: Maximum GLC due to Cumulative impact on Ambient Air Quality (CALPUFF)

S. No.	Parameters	Maximum GLC Concentration, µg/m³	Direction	Distance (m)	Features of Area where Max GLC is buidling
1	PM	22	E	1600	Towards the saltpans
2	PM2.5	14.98	E	1600	Towards the saltpans
2	NOx	29.8	-	At site	-
3	SO2	24.2	-	At site	-

4.4.6 AERMOD-Air Dispersion Modelling Result – GLC isopleths for air emission sources from the proposed project-Post monsoon season

Table 4-13: Incremental GLC (µg/m3) of Particulate Matter (PM) for Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	5.15	4.93	4.73	4.38	4.12	3.92	3.63	3.00	2.82	2.50	2.25	2.05	1.88	1.73	1.60
20	5.37	4.76	4.37	3.97	3.64	3.35	3.11	2.90	2.71	2.41	2.16	1.96	1.79	1.65	1.53
30	4.81	4.56	4.33	3.93	3.59	3.30	3.06	2.84	2.72	2.36	2.12	1.92	1.75	1.62	1.50
40	4.81	4.55	4.32	3.92	3.57	3.29	3.04	2.83	2.74	2.40	2.11	1.91	1.75	1.61	1.50
50	4.81	4.56	4.34	3.93	3.59	3.31	3.06	2.90	2.84	2.71	2.64	2.53	1.77	1.63	1.51
60	4.84	4.60	4.37	3.98	3.65	3.36	3.12	2.91	2.72	2.44	2.17	2.03	1.80	1.66	1.54
70	4.88	4.65	4.44	4.06	3.74	3.46	3.21	3.00	2.81	2.50	2.24	2.03	1.86	1.71	1.58
80	4.93	4.72	4.53	4.17	3.86	3.59	3.34	3.12	2.93	2.60	2.33	2.11	1.93	1.77	1.63
90	5.00	4.82	4.64	4.32	4.03	3.76	3.51	3.29	3.09	2.74	2.45	2.21	2.02	1.85	1.70
100	5.09	4.93	4.78	4.50	4.23	3.97	3.73	3.50	3.29	2.91	2.60	2.34	2.13	1.94	1.78
110	5.18	5.07	4.95	4.71	4.48	4.24	4.00	3.77	3.54	3.14	2.79	2.50	2.26	2.06	1.88
120	5.29	5.22	5.15	4.98	4.78	4.57	4.34	4.11	3.87	3.42	3.03	2.70	2.43	2.20	2.00
130	5.41	5.40	5.38	5.29	5.16	4.97	4.76	4.53	4.28	3.78	3.33	2.95	2.63	2.36	2.14
140	5.54	5.59	5.63	5.67	5.63	5.49	5.30	5.06	4.81	4.25	3.72	3.26	2.88	2.56	2.31
150	5.67	5.79	5.91	6.11	6.21	6.18	6.03	5.79	5.51	4.87	4.22	3.65	3.18	2.80	2.49
160	5.79	6.00	6.21	6.62	6.95	7.07	7.02	6.82	6.52	5.71	4.86	4.12	3.53	3.06	2.70
170	5.91	6.20	6.51	7.19	7.86	8.30	8.41	8.30	8.00	6.92	5.68	4.67	3.92	3.35	2.91
180	6.02	6.38	6.79	7.79	8.99	10.04	10.58	10.60	10.44	8.53	6.63	5.26	4.31	3.62	3.11
190	6.13	6.60	7.08	8.40	10.88	15.50	15.59	14.39	16.22	13.03	9.73	7.62	6.27	5.30	4.69
200	6.16	6.63	7.20	8.85	11.76	15.24	18.28	15.01	14.81	15.13	11.44	9.03	7.21	6.17	5.64
210	6.19	6.69	7.30	9.15	11.74	12.51	12.97	12.85	12.55	18.39	12.81	10.75	9.46	8.53	7.71

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
220	6.20	6.70	7.33	9.24	10.84	10.99	11.21	11.01	12.35	11.42	15.25	13.05	11.24	9.88	8.72
230	6.32	6.69	7.35	9.11	10.15	10.03	9.84	9.75	10.13	8.34	7.48	6.55	6.92	6.90	6.75
240	6.35	6.61	7.23	8.82	9.55	9.28	8.81	8.57	8.22	6.52	5.74	5.12	4.49	3.95	3.52
250	6.07	6.49	7.06	8.43	9.00	8.66	8.08	7.66	7.13	5.59	4.63	4.05	3.63	3.26	2.94
260	5.97	6.34	6.83	7.99	8.51	8.24	7.66	7.10	6.51	5.04	4.12	3.50	3.04	2.77	2.54
270	5.86	6.16	6.56	7.57	8.24	8.13	7.52	6.82	6.16	4.78	3.81	3.23	2.81	2.49	2.23
280	5.74	5.97	6.28	7.21	7.99	8.02	7.48	6.76	6.06	4.78	3.75	3.10	2.67	2.36	2.12
290	5.62	5.77	6.01	6.81	7.53	7.71	7.37	6.80	6.17	5.00	3.98	3.21	2.69	2.34	2.08
300	5.50	5.57	5.73	6.32	6.88	7.11	7.00	6.69	6.27	5.34	4.45	3.67	3.04	2.57	2.22
310	5.38	5.39	5.46	5.79	6.13	6.30	6.32	6.22	6.02	5.48	4.86	4.25	3.69	3.19	2.77
320	5.27	5.21	5.21	5.30	5.40	5.44	5.43	5.38	5.30	5.05	4.72	4.37	4.02	3.69	3.37
330	5.16	5.06	4.98	4.89	4.80	4.70	4.60	4.49	4.39	4.17	3.95	3.74	3.53	3.34	3.15
340	5.07	4.92	4.79	4.57	4.36	4.16	3.98	3.81	3.66	3.38	3.14	2.92	2.73	2.57	2.41
350	5.03	4.81	4.64	4.34	4.06	3.81	3.59	3.39	3.21	2.90	2.64	2.42	2.24	2.08	1.94
360	5.09	4.82	4.59	4.17	3.86	3.59	3.35	3.15	2.96	2.65	2.39	2.18	2.01	1.85	1.72

Figure 4-13: Isopleth of Incremental GLC of Particulate Matter (PM) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

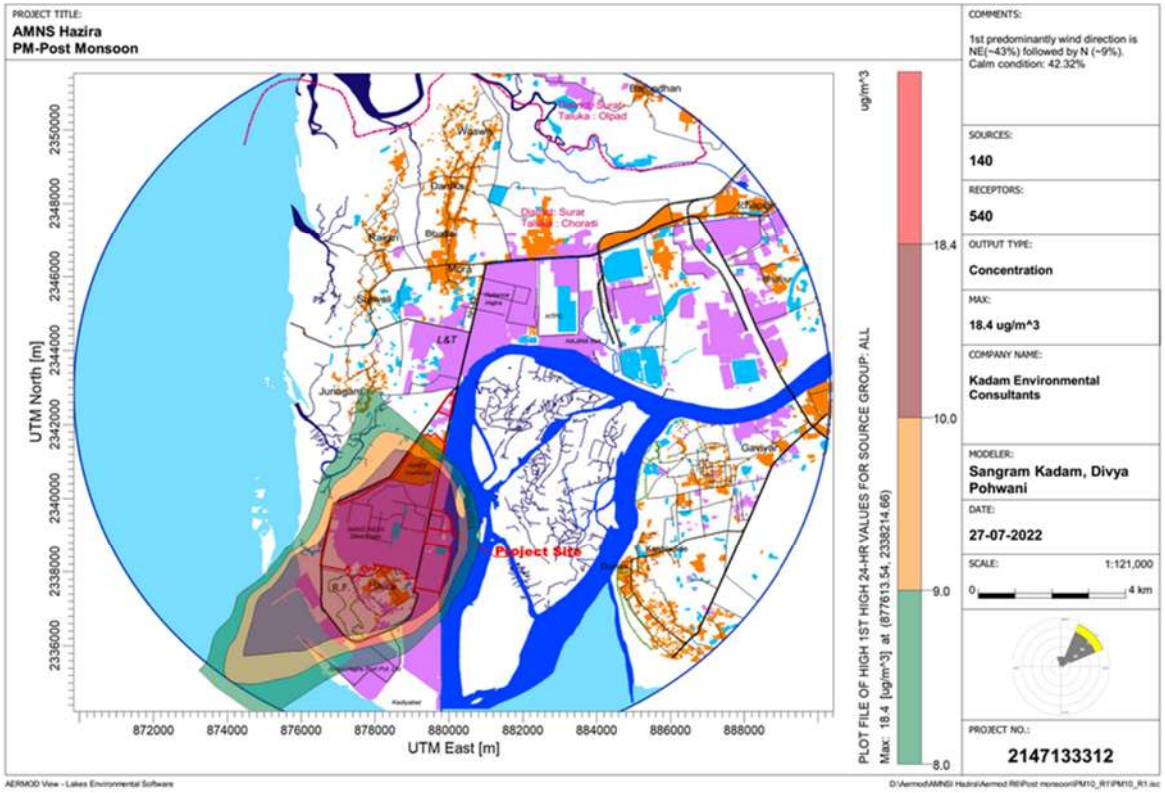


Table 4-14: Incremental GLC (µg/m3) of Particulate Matter (PM2.5) for Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	3.31	3.13	2.99	2.73	2.51	2.33	2.16	2.02	1.90	1.69	1.52	1.38	1.27	1.17	1.08
20	3.26	3.09	2.94	2.68	2.45	2.26	2.10	1.96	1.83	1.63	1.46	1.32	1.21	1.12	1.03
30	3.24	3.07	2.92	2.65	2.42	2.23	2.06	1.92	1.80	1.59	1.43	1.30	1.18	1.09	1.01
40	3.24	3.07	2.91	2.64	2.41	2.22	2.05	1.91	1.79	1.58	1.42	1.29	1.18	1.09	1.01
50	3.24	3.08	2.92	2.65	2.42	2.23	2.07	1.93	1.80	1.61	1.53	1.45	1.20	1.10	1.02
60	3.26	3.10	2.95	2.69	2.46	2.27	2.11	1.96	1.84	1.63	1.47	1.33	1.22	1.12	1.04
70	3.29	3.13	2.99	2.74	2.52	2.33	2.17	2.02	1.90	1.69	1.51	1.37	1.25	1.15	1.07
80	3.32	3.18	3.05	2.81	2.61	2.42	2.26	2.11	1.98	1.76	1.58	1.43	1.30	1.20	1.11
90	3.37	3.24	3.13	2.91	2.72	2.54	2.37	2.22	2.09	1.85	1.66	1.50	1.36	1.25	1.15
100	3.42	3.32	3.22	3.03	2.85	2.68	2.52	2.36	2.22	1.97	1.76	1.58	1.44	1.31	1.21
110	3.49	3.41	3.33	3.18	3.02	2.86	2.70	2.54	2.39	2.12	1.89	1.69	1.53	1.39	1.27
120	3.56	3.51	3.46	3.35	3.22	3.08	2.93	2.77	2.61	2.31	2.05	1.83	1.64	1.49	1.35
130	3.64	3.63	3.62	3.56	3.47	3.35	3.21	3.06	2.89	2.56	2.25	1.99	1.78	1.60	1.45
140	3.72	3.76	3.79	3.82	3.79	3.70	3.58	3.42	3.25	2.87	2.52	2.20	1.95	1.74	1.56
150	3.81	3.89	3.97	4.11	4.18	4.16	4.07	3.92	3.73	3.29	2.85	2.47	2.15	1.89	1.69
160	3.89	4.03	4.16	4.44	4.66	4.77	4.74	4.62	4.42	3.87	3.29	2.79	2.39	2.07	1.83
170	3.97	4.16	4.36	4.81	5.26	5.59	5.70	5.64	5.45	4.70	3.85	3.16	2.65	2.27	1.97
180	4.04	4.28	4.55	5.19	5.99	6.76	7.20	7.25	7.14	5.85	4.50	3.57	2.92	2.45	2.11
190	4.11	4.42	4.73	5.58	6.90	10.25	10.55	9.85	11.14	8.87	6.41	4.99	4.11	3.50	3.09
200	4.14	4.45	4.82	5.88	7.83	10.40	12.46	10.37	10.17	10.23	7.69	6.00	4.78	3.91	3.57
210	4.16	4.49	4.89	6.12	7.93	8.52	8.88	8.82	8.61	12.41	8.48	7.09	6.25	5.64	5.10
220	4.16	4.50	4.92	6.23	7.37	7.49	7.67	7.53	8.50	7.70	10.32	8.82	7.59	6.67	5.89
230	4.15	4.49	4.93	6.17	6.92	6.85	6.72	6.67	6.96	5.66	5.09	4.30	4.56	4.56	4.47

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
240	4.18	4.44	4.87	5.99	6.52	6.34	6.02	5.87	5.63	4.45	3.89	3.46	3.04	2.67	2.38
250	4.08	4.37	4.76	5.73	6.15	5.92	5.52	5.24	4.88	3.81	3.15	2.74	2.46	2.21	1.99
260	4.01	4.27	4.61	5.43	5.82	5.64	5.24	4.86	4.45	3.43	2.80	2.38	2.07	1.88	1.72
270	3.94	4.15	4.43	5.14	5.63	5.56	5.14	4.67	4.21	3.26	2.59	2.19	1.91	1.69	1.52
280	3.86	4.02	4.24	4.89	5.42	5.46	5.11	4.62	4.14	3.27	2.55	2.10	1.81	1.60	1.44
290	3.78	3.89	4.05	4.59	5.08	5.22	5.01	4.63	4.21	3.42	2.72	2.19	1.83	1.59	1.41
300	3.70	3.75	3.86	4.24	4.62	4.78	4.73	4.54	4.26	3.64	3.04	2.51	2.08	1.75	1.51
310	3.62	3.63	3.68	3.88	4.10	4.22	4.24	4.19	4.07	3.71	3.30	2.89	2.51	2.17	1.89
320	3.54	3.51	3.51	3.55	3.61	3.63	3.63	3.61	3.56	3.40	3.19	2.96	2.72	2.50	2.29
330	3.47	3.41	3.35	3.28	3.21	3.14	3.07	3.00	2.94	2.79	2.65	2.51	2.37	2.25	2.12
340	3.41	3.31	3.23	3.07	2.93	2.79	2.67	2.55	2.45	2.27	2.10	1.96	1.83	1.72	1.62
350	3.36	3.24	3.12	2.92	2.73	2.56	2.41	2.28	2.16	1.95	1.78	1.63	1.51	1.40	1.30
360	3.32	3.18	3.04	2.81	2.60	2.42	2.26	2.12	2.00	1.79	1.62	1.47	1.35	1.25	1.16

Note: PM2.5 emission rate has been considered 70% of PM pollutants

Figure 4-14: Isopleth of Incremental GLC of Particulate Matter (PM2.5) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

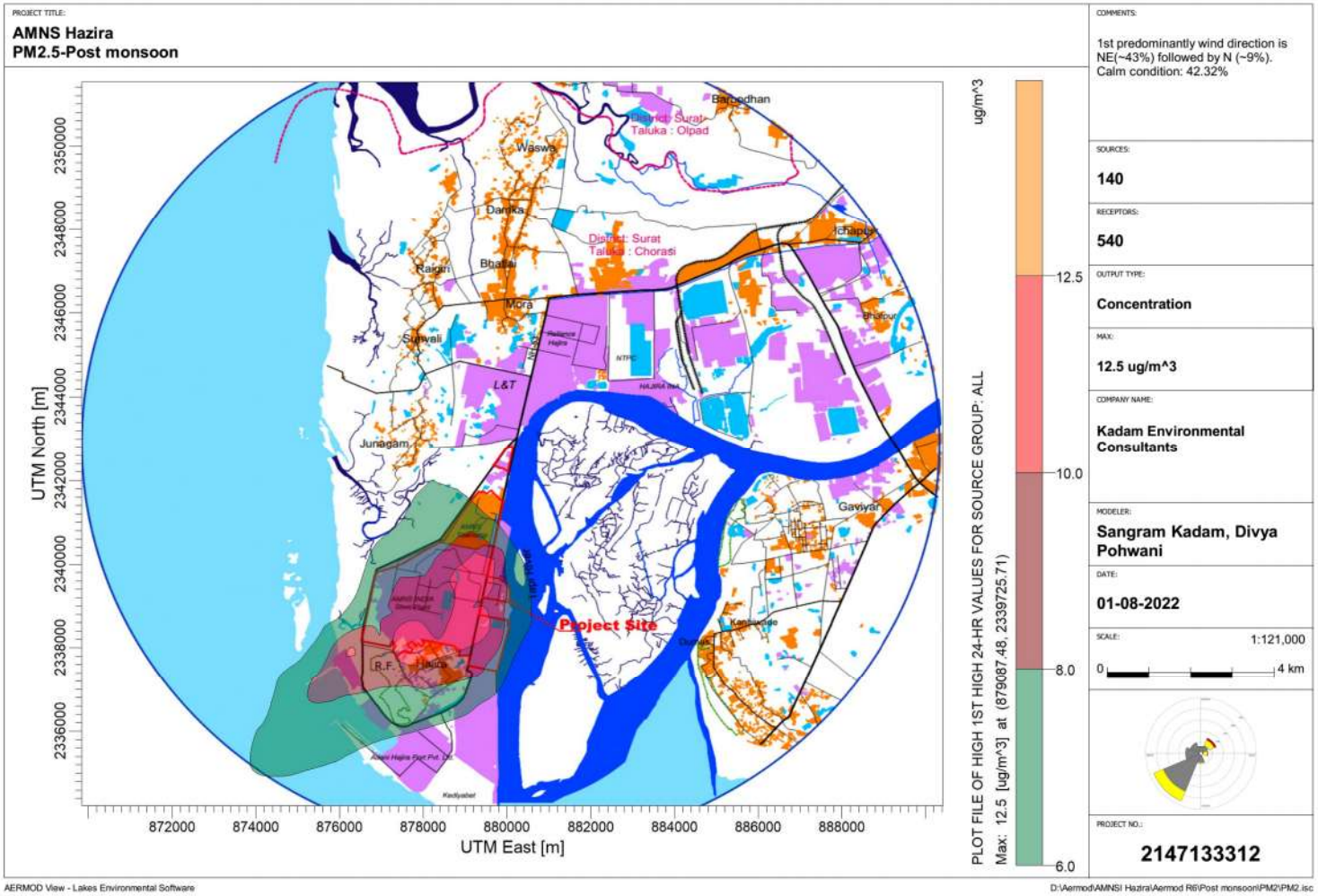


Table 4-15: Incremental GLC (µg/m3) of Oxides of Nitrogen (NOx) for point sources and Line Source

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	8.44	8.10	7.79	7.22	6.81	6.50	6.02	4.93	4.50	4.00	3.61	3.28	3.01	2.78	2.57
20	8.81	7.81	7.07	6.24	5.75	5.32	4.94	4.67	4.33	3.84	3.45	3.13	2.86	2.63	2.44
30	7.56	7.07	6.75	6.17	5.66	5.22	4.84	4.56	4.51	3.74	3.36	3.04	2.78	2.56	2.37
40	7.40	7.05	6.72	6.13	5.62	5.18	4.82	4.64	4.54	3.97	3.32	3.01	2.75	2.54	2.35
50	7.40	7.05	6.72	6.14	5.63	5.19	4.96	4.79	4.69	4.49	4.38	4.18	2.78	2.56	2.37
60	7.43	7.08	6.76	6.18	5.68	5.25	4.87	4.54	4.25	4.04	3.45	3.36	2.84	2.60	2.41
70	7.47	7.14	6.83	6.28	5.79	5.37	4.99	4.66	4.37	3.89	3.49	3.17	2.90	2.67	2.47
80	7.53	7.23	6.94	6.42	5.95	5.54	5.17	4.84	4.55	4.04	3.63	3.29	3.01	2.76	2.56
90	7.61	7.34	7.08	6.60	6.17	5.77	5.41	5.08	4.78	4.25	3.81	3.45	3.14	2.88	2.66
100	7.71	7.47	7.25	6.83	6.44	6.07	5.71	5.38	5.07	4.51	4.04	3.65	3.32	3.03	2.79
110	7.82	7.63	7.45	7.11	6.77	6.43	6.09	5.76	5.44	4.85	4.33	3.89	3.53	3.21	2.95
120	7.95	7.81	7.68	7.43	7.16	6.86	6.55	6.23	5.90	5.27	4.70	4.20	3.79	3.43	3.13
130	8.09	8.01	7.94	7.80	7.61	7.38	7.12	6.82	6.49	5.81	5.16	4.59	4.10	3.70	3.36
140	8.23	8.23	8.22	8.21	8.13	7.99	7.79	7.54	7.23	6.51	5.75	5.08	4.50	4.02	3.62
150	8.38	8.45	8.51	8.66	8.72	8.68	8.58	8.41	8.15	7.40	6.52	5.69	4.98	4.39	3.92
160	8.53	8.68	8.82	9.11	9.36	9.48	9.47	9.40	9.22	8.51	7.49	6.45	5.55	4.82	4.25
170	8.68	8.91	9.12	9.47	9.87	10.32	10.47	10.63	10.67	9.87	8.60	7.31	6.54	5.27	4.58
180	9.32	9.20	9.41	9.77	10.33	11.04	11.66	12.26	12.54	12.04	12.52	10.38	7.48	6.04	5.16
190	10.27	11.05	11.80	12.10	10.59	13.16	14.22	14.86	14.89	16.44	17.30	14.05	12.35	9.64	7.92
200	9.76	10.05	10.41	11.23	11.66	13.35	14.54	15.48	16.14	21.15	16.89	13.72	11.28	9.93	8.94
210	9.98	10.42	10.88	11.82	12.78	13.86	15.22	16.69	18.22	21.06	18.20	15.11	12.48	10.53	9.43
220	10.95	11.73	12.30	13.15	13.88	14.57	17.05	17.71	20.81	23.46	18.07	14.79	13.16	11.61	10.40
230	11.77	13.09	13.14	11.63	11.47	12.07	13.11	14.35	15.74	13.86	12.21	12.58	11.82	11.02	10.29
240	12.88	10.79	10.19	10.33	10.85	11.50	12.23	13.03	13.26	10.75	9.30	7.96	6.77	5.80	5.04

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	10.56	9.71	9.52	9.99	10.37	10.78	11.22	11.75	11.70	9.32	7.52	6.68	5.90	5.23	4.66
260	9.67	9.06	9.28	9.60	9.83	10.02	10.24	10.48	10.35	8.37	6.72	5.65	5.07	4.60	4.19
270	9.19	8.87	9.02	9.21	9.28	9.30	9.36	9.41	9.27	7.82	6.25	5.22	4.52	3.98	3.63
280	8.56	8.67	8.75	8.81	8.76	8.64	8.55	8.48	8.32	7.43	6.09	5.04	4.32	3.80	3.39
290	8.42	8.47	8.48	8.43	8.28	8.07	7.85	7.68	7.51	6.94	6.05	5.10	4.34	3.77	3.34
300	8.28	8.26	8.22	8.07	7.84	7.57	7.29	7.03	6.80	6.38	5.82	5.19	4.54	3.96	3.49
310	8.17	8.07	7.97	7.73	7.45	7.15	6.83	6.53	6.25	5.78	5.39	4.99	4.57	4.15	3.76
320	8.12	7.88	7.74	7.43	7.10	6.77	6.45	6.14	5.85	5.33	4.91	4.55	4.25	3.98	3.73
330	8.11	7.71	7.53	7.16	6.79	6.44	6.11	5.80	5.52	5.01	4.58	4.22	3.91	3.64	3.41
340	8.14	7.68	7.34	6.91	6.51	6.14	5.80	5.50	5.21	4.72	4.31	3.97	3.67	3.41	3.18
350	8.22	7.77	7.35	6.70	6.27	5.88	5.53	5.22	4.94	4.45	4.06	3.72	3.44	3.19	2.98
360	8.33	7.90	7.55	6.84	6.06	5.66	5.30	4.98	4.70	4.21	3.82	3.49	3.21	2.97	2.76

Figure 4-15: Isopleth of Incremental GLC of Oxides of Nitrogen (NOx) from point source and Line Source

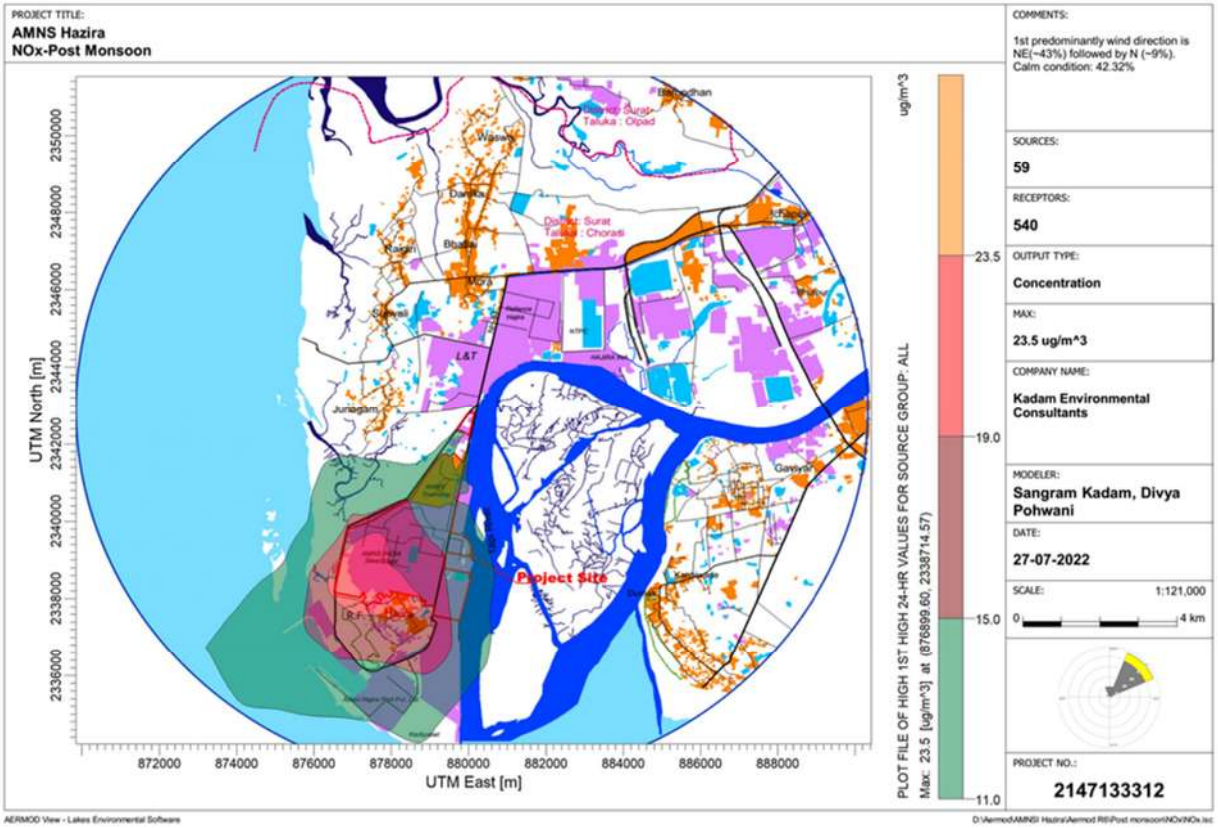


Table 4-16: Incremental GLC (µg/m3) of Sulphur dioxide (SO2) for point sources

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	6.20	5.93	5.67	5.19	4.77	4.40	4.08	3.79	3.55	3.14	2.81	2.54	2.32	2.13	1.97
20	6.16	5.87	5.59	5.09	4.66	4.28	3.95	3.66	3.42	3.01	2.68	2.42	2.20	2.02	1.86
30	6.12	5.82	5.54	5.02	4.58	4.19	3.86	3.58	3.33	2.92	2.60	2.34	2.13	1.95	1.80
40	6.11	5.80	5.51	4.99	4.54	4.15	3.82	3.53	3.29	2.88	2.57	2.32	2.11	1.93	1.79
50	6.11	5.80	5.51	4.99	4.54	4.15	3.82	3.54	3.30	2.90	2.58	2.33	2.13	1.95	1.80
60	6.12	5.82	5.53	5.02	4.58	4.21	3.88	3.60	3.36	2.95	2.64	2.38	2.17	1.99	1.84
70	6.16	5.86	5.59	5.10	4.68	4.31	3.99	3.71	3.46	3.05	2.72	2.45	2.23	2.05	1.89
80	6.21	5.93	5.67	5.21	4.81	4.46	4.14	3.86	3.60	3.17	2.83	2.55	2.32	2.12	1.95
90	6.27	6.02	5.78	5.37	5.00	4.66	4.35	4.06	3.79	3.34	2.97	2.67	2.42	2.21	2.03
100	6.35	6.13	5.92	5.56	5.23	4.91	4.60	4.31	4.03	3.54	3.14	2.81	2.54	2.31	2.12
110	6.44	6.26	6.08	5.79	5.51	5.22	4.91	4.61	4.33	3.80	3.36	2.99	2.69	2.44	2.23
120	6.55	6.40	6.27	6.05	5.83	5.57	5.29	4.99	4.69	4.12	3.63	3.22	2.88	2.60	2.36
130	6.66	6.56	6.47	6.33	6.19	5.98	5.73	5.44	5.14	4.52	3.96	3.49	3.10	2.78	2.51
140	6.78	6.73	6.68	6.63	6.57	6.44	6.24	5.98	5.68	5.02	4.37	3.82	3.36	2.99	2.68
150	6.91	6.92	6.91	7.03	7.14	7.01	6.80	6.59	6.31	5.62	4.89	4.22	3.67	3.23	2.88
160	7.04	7.11	7.15	7.58	7.94	7.96	7.70	7.30	7.02	6.33	5.50	4.70	4.03	3.50	3.08
170	7.16	7.31	7.42	8.12	8.82	9.08	8.87	8.46	8.01	7.05	6.17	5.23	4.41	3.78	3.29
180	7.28	7.50	7.70	8.59	9.46	9.71	10.02	9.63	9.21	8.13	6.74	5.71	4.76	4.02	3.46
190	7.37	7.67	7.97	8.85	9.18	6.60	10.33	10.43	10.11	9.16	7.88	6.06	5.00	4.19	3.59
200	7.45	7.80	8.17	8.85	9.46	8.66	10.76	11.38	11.14	9.82	8.30	6.97	5.77	4.84	4.13
210	7.50	7.88	8.27	9.00	9.61	10.67	11.05	10.80	11.82	14.49	8.91	7.62	6.54	5.80	5.23
220	7.52	7.90	8.28	8.92	9.12	9.93	10.32	10.42	12.16	14.80	13.93	11.11	9.00	7.66	6.96
230	7.50	7.86	8.20	8.70	8.84	8.85	9.17	9.42	10.02	8.99	7.69	8.01	7.90	7.56	7.16
240	7.46	7.78	8.06	8.43	8.49	8.42	8.54	9.16	9.30	7.12	6.28	5.40	4.65	4.04	3.55

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	7.40	7.66	7.88	8.12	8.12	8.02	8.10	8.56	8.52	6.40	5.28	4.66	4.11	3.64	3.25
260	7.31	7.52	7.67	7.80	7.73	7.57	7.55	7.76	7.67	5.97	4.68	4.03	3.63	3.28	2.98
270	7.21	7.36	7.45	7.47	7.33	7.11	6.99	7.00	6.90	5.74	4.45	3.69	3.20	2.88	2.64
280	7.10	7.18	7.22	7.15	6.95	6.69	6.46	6.34	6.23	5.55	4.47	3.63	3.09	2.71	2.43
290	6.98	7.01	6.99	6.85	6.60	6.30	6.02	5.80	5.64	5.24	4.55	3.79	3.18	2.73	2.41
300	6.86	6.84	6.77	6.56	6.28	5.96	5.65	5.38	5.15	4.80	4.41	3.92	3.42	2.97	2.59
310	6.74	6.67	6.57	6.30	5.99	5.66	5.34	5.05	4.79	4.38	4.06	3.76	3.46	3.15	2.85
320	6.63	6.51	6.37	6.06	5.72	5.39	5.08	4.78	4.52	4.08	3.73	3.45	3.21	3.00	2.80
330	6.53	6.37	6.20	5.84	5.48	5.15	4.84	4.55	4.30	3.86	3.50	3.20	2.96	2.75	2.57
340	6.43	6.23	6.03	5.64	5.27	4.93	4.62	4.34	4.09	3.67	3.32	3.03	2.79	2.58	2.40
350	6.34	6.12	5.89	5.47	5.08	4.73	4.41	4.14	3.89	3.48	3.15	2.87	2.63	2.44	2.26
360	6.27	6.01	5.77	5.32	4.91	4.55	4.23	3.95	3.71	3.30	2.97	2.70	2.47	2.28	2.11

Figure 4-16: Isopleth of Incremental GLC of Sulphur dioxide (SO2) from point source

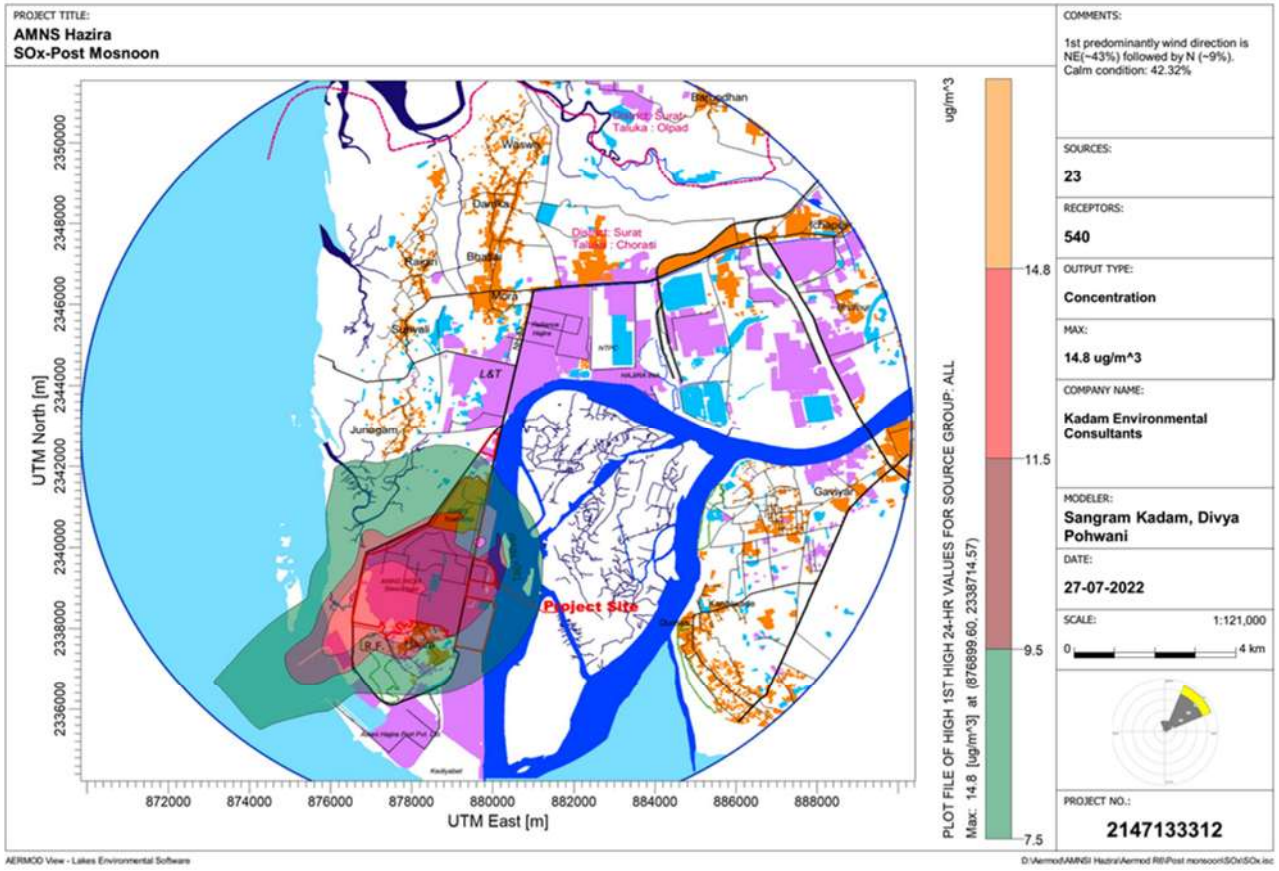


Table 4-17: Emission of HC due to proposed Project

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	1.722	1.652	1.583	1.438	1.259	1.002	0.718	0.572	0.219	0.070	0.054	0.045	0.039	0.034	0.029
20	1.469	1.118	0.998	0.694	0.471	0.419	0.347	0.366	0.822	0.089	0.050	0.041	0.035	0.030	0.026
30	0.928	0.689	0.498	0.384	0.312	0.289	0.291	0.334	0.374	0.192	0.081	0.021	0.017	0.015	0.013
40	0.676	0.430	0.360	0.307	0.284	0.264	0.276	0.302	0.340	0.763	0.281	0.108	0.023	0.013	0.011
50	0.602	0.350	0.305	0.267	0.258	0.274	0.300	0.329	0.370	0.431	0.623	0.569	0.184	0.126	0.051
60	0.631	0.506	0.284	0.258	0.262	0.261	0.265	0.277	0.310	0.364	0.336	0.371	0.374	0.241	0.188
70	0.610	0.498	0.398	0.233	0.229	0.251	0.276	0.272	0.220	0.249	0.267	0.178	0.177	0.186	0.183
80	0.586	0.492	0.428	0.292	0.259	0.239	0.215	0.203	0.207	0.220	0.162	0.090	0.079	0.078	0.090
90	0.574	0.526	0.420	0.337	0.284	0.226	0.186	0.185	0.180	0.199	0.106	0.091	0.086	0.081	0.072
100	0.566	0.507	0.457	0.335	0.282	0.253	0.216	0.196	0.182	0.164	0.150	0.136	0.123	0.114	0.107
110	0.562	0.501	0.448	0.371	0.301	0.249	0.214	0.198	0.188	0.171	0.152	0.138	0.131	0.128	0.118
120	0.562	0.502	0.449	0.370	0.311	0.271	0.245	0.231	0.217	0.194	0.179	0.150	0.133	0.151	0.171
130	0.565	0.508	0.456	0.375	0.315	0.277	0.253	0.239	0.238	0.203	0.165	0.190	0.296	0.388	0.421
140	0.571	0.519	0.471	0.387	0.327	0.289	0.271	0.272	0.241	0.173	0.238	0.482	0.567	0.239	0.094
150	0.579	0.534	0.491	0.409	0.348	0.315	0.313	0.272	0.206	0.352	0.754	0.562	0.126	0.082	0.253
160	0.712	0.553	0.517	0.443	0.382	0.370	0.341	0.240	0.189	0.747	0.840	0.154	0.512	0.233	0.237
170	0.932	0.699	0.545	0.485	0.436	0.446	0.367	0.243	0.229	1.738	0.753	0.412	0.339	0.134	0.251
180	1.170	1.017	0.875	0.665	0.519	0.534	0.407	0.341	0.379	1.005	0.706	0.721	0.468	0.416	0.403
190	1.677	1.673	1.776	1.526	1.333	1.202	1.121	1.048	1.000	1.581	2.042	1.744	1.612	1.270	1.024
200	1.722	1.623	1.530	1.352	1.227	1.134	1.053	0.988	0.929	2.137	1.790	1.540	1.392	1.319	1.141
210	1.988	1.951	1.894	1.719	1.519	1.357	1.247	1.173	1.067	1.517	1.677	1.403	1.094	0.879	0.746
220	2.223	2.078	1.996	2.278	2.562	2.776	2.914	2.272	1.651	0.944	0.868	0.704	0.661	0.594	0.532
230	2.425	2.732	2.240	1.583	1.148	0.905	0.759	0.662	0.591	0.500	0.421	0.814	0.485	0.357	0.285
240	2.591	1.625	1.091	0.619	0.430	0.379	0.341	0.326	0.304	0.359	0.146	0.266	0.130	0.138	0.409
250	1.638	0.844	0.610	0.391	0.344	0.282	0.257	0.238	0.224	0.216	0.171	0.146	0.254	0.229	0.114

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
260	1.021	0.576	0.449	0.372	0.298	0.264	0.249	0.234	0.214	0.161	0.138	0.120	0.088	0.075	0.072
270	0.771	0.486	0.440	0.357	0.285	0.264	0.225	0.181	0.136	0.083	0.057	0.049	0.045	0.043	0.043
280	0.604	0.485	0.431	0.340	0.248	0.172	0.138	0.103	0.079	0.058	0.052	0.047	0.044	0.042	0.060
290	0.601	0.488	0.426	0.326	0.226	0.163	0.114	0.083	0.063	0.051	0.043	0.095	0.145	0.075	0.044
300	0.614	0.496	0.433	0.322	0.200	0.129	0.076	0.053	0.050	0.050	0.200	0.064	0.034	0.019	0.007
310	0.646	0.509	0.451	0.333	0.206	0.119	0.068	0.055	0.052	0.267	0.065	0.028	0.019	0.018	0.021
320	0.703	0.527	0.482	0.364	0.217	0.120	0.064	0.058	0.175	0.079	0.035	0.029	0.020	0.021	0.022
330	0.793	0.551	0.514	0.415	0.256	0.132	0.078	0.089	0.397	0.055	0.041	0.015	0.011	0.011	0.011
340	0.926	0.657	0.550	0.464	0.336	0.171	0.092	0.236	0.124	0.078	0.017	0.012	0.011	0.008	0.007
350	1.105	0.851	0.651	0.551	0.459	0.262	0.123	0.387	0.122	0.072	0.015	0.015	0.009	0.006	0.005
360	1.350	1.160	0.980	0.665	0.608	0.520	0.247	0.365	0.150	0.063	0.021	0.017	0.013	0.011	0.008

Figure 4-17: Isopleth for HC emission from proposed project

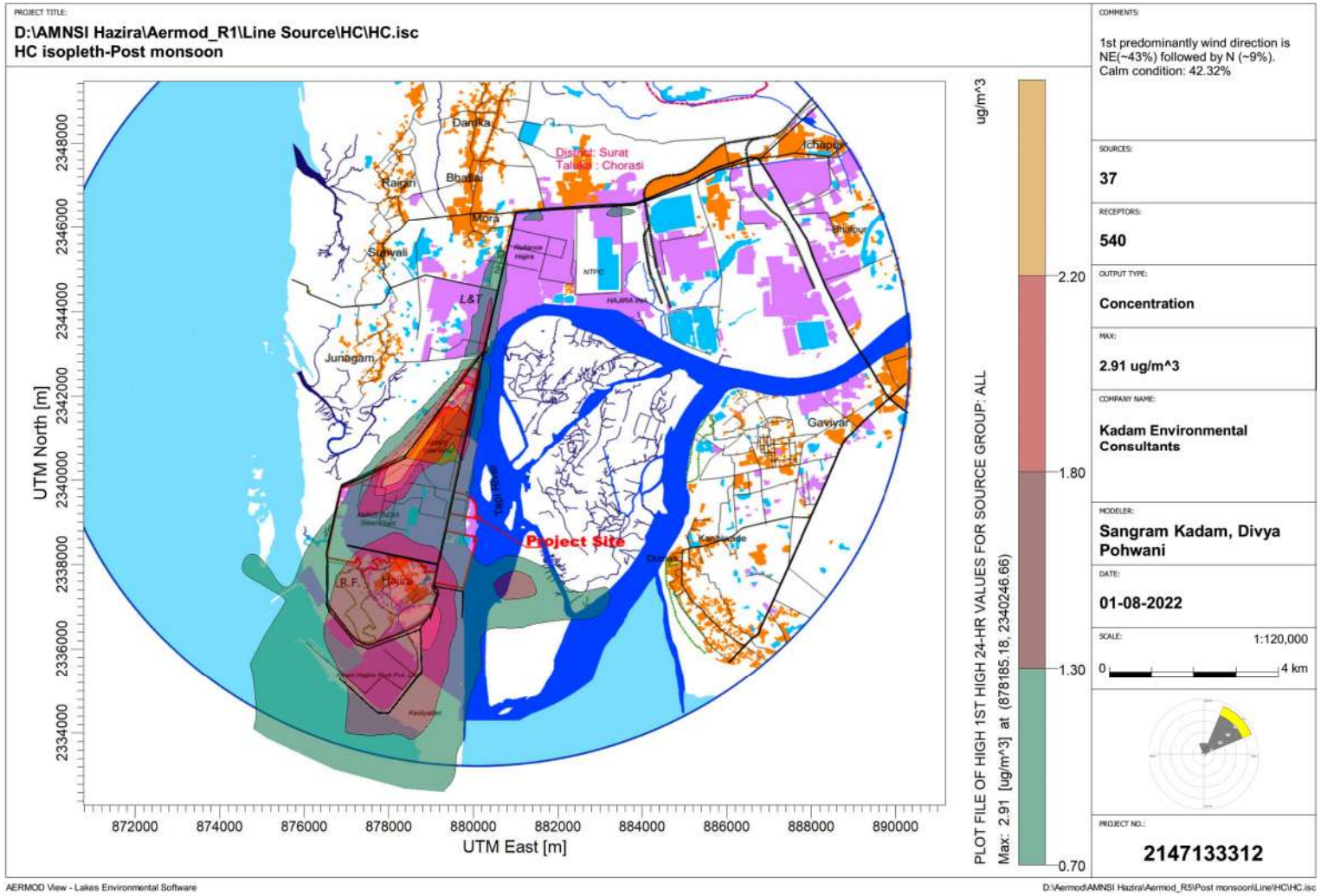
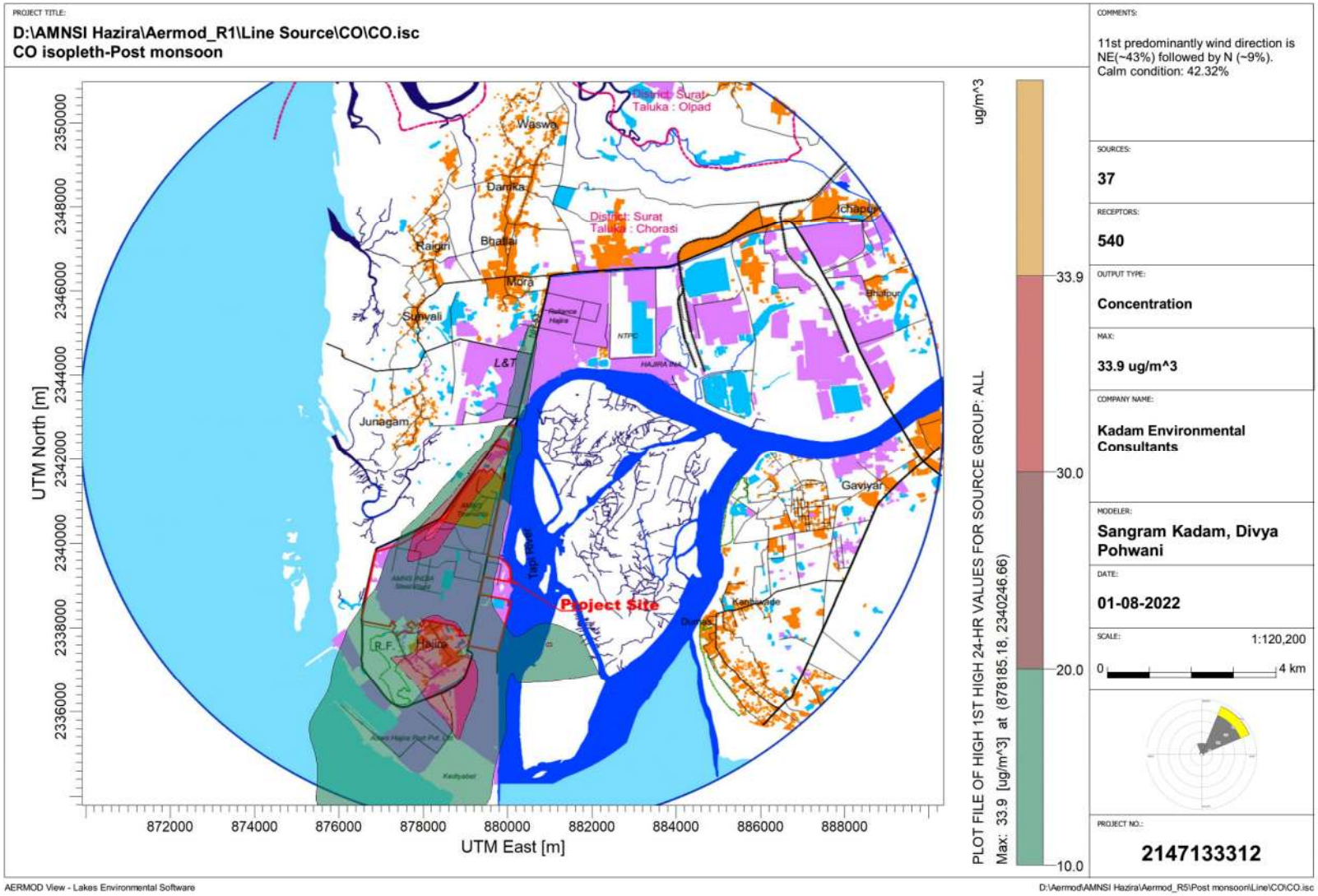


Table 4-18: Emission of CO due to proposed Project

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
10	19.970	19.160	18.368	16.678	14.600	11.618	8.330	6.641	2.537	0.812	0.634	0.531	0.451	0.393	0.346
20	17.038	12.969	11.575	8.048	5.467	4.862	4.025	4.250	9.537	1.028	0.581	0.479	0.404	0.348	0.303
30	10.766	7.994	5.782	4.451	3.622	3.365	3.378	3.876	4.338	2.224	0.936	0.245	0.201	0.174	0.153
40	7.838	4.991	4.177	3.565	3.304	3.067	3.197	3.500	3.947	8.852	3.256	1.258	0.266	0.151	0.127
50	6.998	4.068	3.540	3.095	2.990	3.183	3.484	3.816	4.295	5.000	7.231	6.604	2.132	1.462	0.591
60	7.336	5.886	3.304	2.990	3.037	3.027	3.079	3.214	3.595	4.223	3.895	4.305	4.335	2.794	2.177
70	7.097	5.787	4.631	2.708	2.651	2.907	3.198	3.158	2.557	2.887	3.094	2.063	2.049	2.162	2.117
80	6.816	5.716	4.981	3.393	3.003	2.776	2.494	2.349	2.405	2.551	1.881	1.040	0.922	0.910	1.048
90	6.676	6.121	4.882	3.913	3.301	2.621	2.163	2.147	2.092	2.313	1.226	1.054	1.000	0.945	0.835
100	6.583	5.897	5.319	3.890	3.279	2.936	2.512	2.280	2.116	1.905	1.747	1.582	1.430	1.330	1.243
110	6.537	5.832	5.204	4.307	3.496	2.896	2.483	2.305	2.187	1.986	1.762	1.603	1.520	1.484	1.367
120	6.535	5.836	5.217	4.297	3.616	3.149	2.844	2.681	2.522	2.259	2.078	1.751	1.542	1.807	2.014
130	6.573	5.905	5.308	4.354	3.661	3.210	2.936	2.784	2.764	2.361	1.926	2.266	3.518	4.624	5.017
140	6.645	6.032	5.476	4.495	3.800	3.360	3.154	3.168	2.808	2.020	2.816	5.740	6.770	2.835	1.103
150	6.735	6.212	5.715	4.754	4.046	3.661	3.638	3.157	2.397	4.197	8.991	6.711	1.476	0.959	3.007
160	8.259	6.429	6.012	5.154	4.448	4.302	3.960	2.794	2.210	8.897	10.042	1.813	6.113	2.791	2.835
170	10.809	8.103	6.334	5.647	5.079	5.193	4.278	2.832	2.675	20.778	8.999	4.937	4.062	1.568	2.981
180	13.564	11.797	10.151	7.714	6.017	6.217	4.747	3.997	4.461	12.018	8.454	8.616	5.531	4.914	4.759
190	19.434	19.390	20.583	17.690	15.453	13.929	12.995	12.142	11.587	18.906	24.186	20.612	19.157	15.032	12.103
200	19.974	18.825	17.751	15.681	14.233	13.152	12.214	11.465	10.776	25.296	21.188	18.206	16.454	15.571	13.427
210	23.074	22.652	21.991	19.959	17.647	15.767	14.490	13.629	12.399	17.863	19.875	16.604	12.920	10.361	8.796
220	25.815	24.138	23.175	26.464	29.759	32.257	33.864	26.401	19.184	10.965	10.358	8.197	7.709	6.927	6.209
230	28.159	31.728	26.020	18.389	13.335	10.511	8.813	7.691	6.858	5.806	4.929	9.652	5.737	4.219	3.304
240	30.090	18.865	12.668	7.184	4.996	4.403	3.963	3.779	3.526	4.163	1.699	3.144	1.520	1.619	4.865

DIRECTION	DISTANCE (METERS)														
(DEGREES)	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	5,000	6,000	7,000	8,000	9,000	10,000
250	19.025	9.792	7.080	4.532	3.995	3.276	2.984	2.761	2.595	2.508	1.988	1.694	2.987	2.686	1.331
260	11.853	6.677	5.205	4.315	3.462	3.063	2.886	2.713	2.488	1.863	1.602	1.392	1.021	0.875	0.837
270	8.942	5.640	5.103	4.137	3.308	3.063	2.614	2.101	1.580	0.967	0.659	0.574	0.525	0.500	0.501
280	7.012	5.621	4.995	3.949	2.882	1.998	1.599	1.194	0.917	0.668	0.601	0.549	0.508	0.484	0.696
290	6.971	5.664	4.944	3.779	2.620	1.896	1.328	0.960	0.733	0.592	0.495	1.100	1.686	0.866	0.513
300	7.123	5.757	5.017	3.733	2.321	1.493	0.887	0.620	0.576	0.585	2.314	0.737	0.397	0.217	0.086
310	7.495	5.901	5.237	3.867	2.392	1.375	0.787	0.641	0.603	3.099	0.749	0.329	0.231	0.209	0.248
320	8.153	6.115	5.589	4.225	2.522	1.386	0.737	0.678	2.029	0.914	0.405	0.335	0.230	0.253	0.266
330	9.197	6.396	5.968	4.810	2.975	1.528	0.910	1.029	4.607	0.635	0.473	0.169	0.126	0.128	0.126
340	10.741	7.618	6.382	5.386	3.895	1.981	1.066	2.738	1.440	0.902	0.201	0.138	0.125	0.089	0.087
350	12.823	9.876	7.552	6.389	5.326	3.040	1.427	4.489	1.414	0.831	0.177	0.173	0.100	0.065	0.060
360	15.664	13.454	11.368	7.715	7.052	6.032	2.861	4.237	1.735	0.735	0.244	0.196	0.157	0.126	0.100

Figure 4-18: Isopleth for CO emission from proposed project



4.4.7 CALPUFF-Air Dispersion Modelling Result – GLC isopleths for air emission sources from the proposed project-Post monsoon season

Figure 4-19: Isopleth of Incremental GLC of Particulate Matter (PM) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

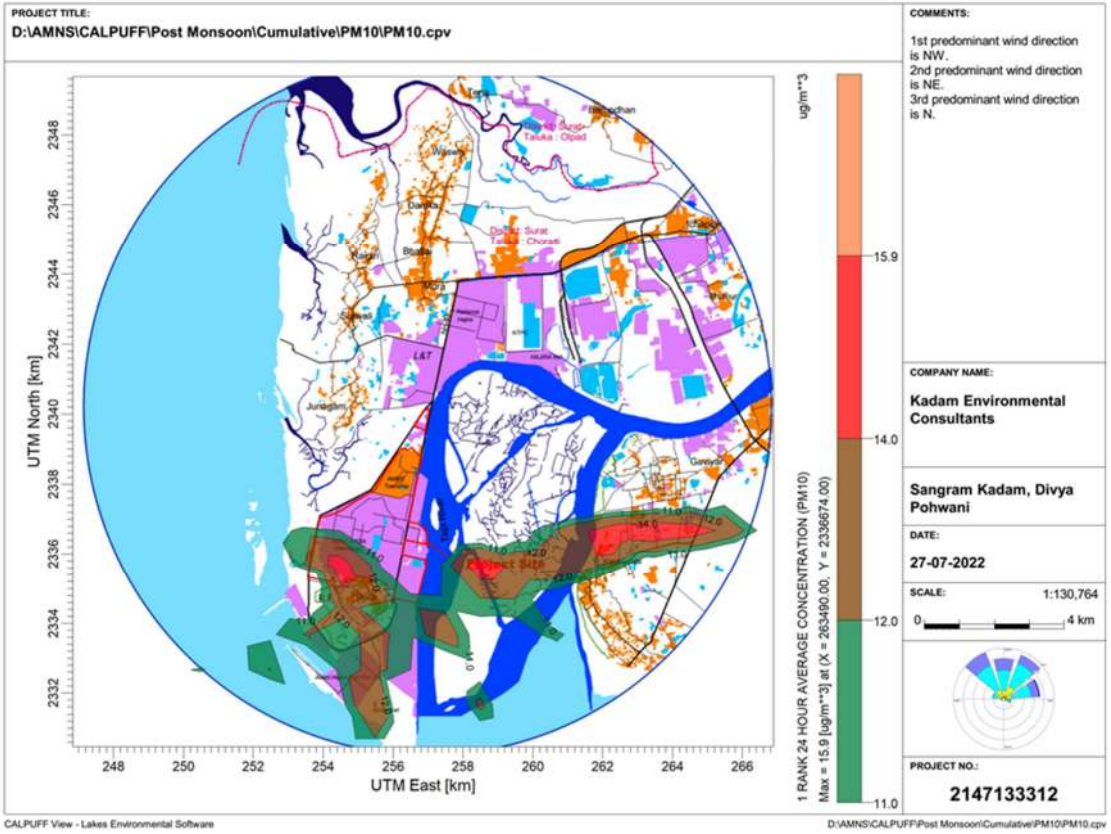


Figure 4-20: Isopleth of Incremental GLC of Particulate Matter (PM2.5) from Point Source emission from flue gas stack and Process gas stack and Line source emission from Vehicular exhausts

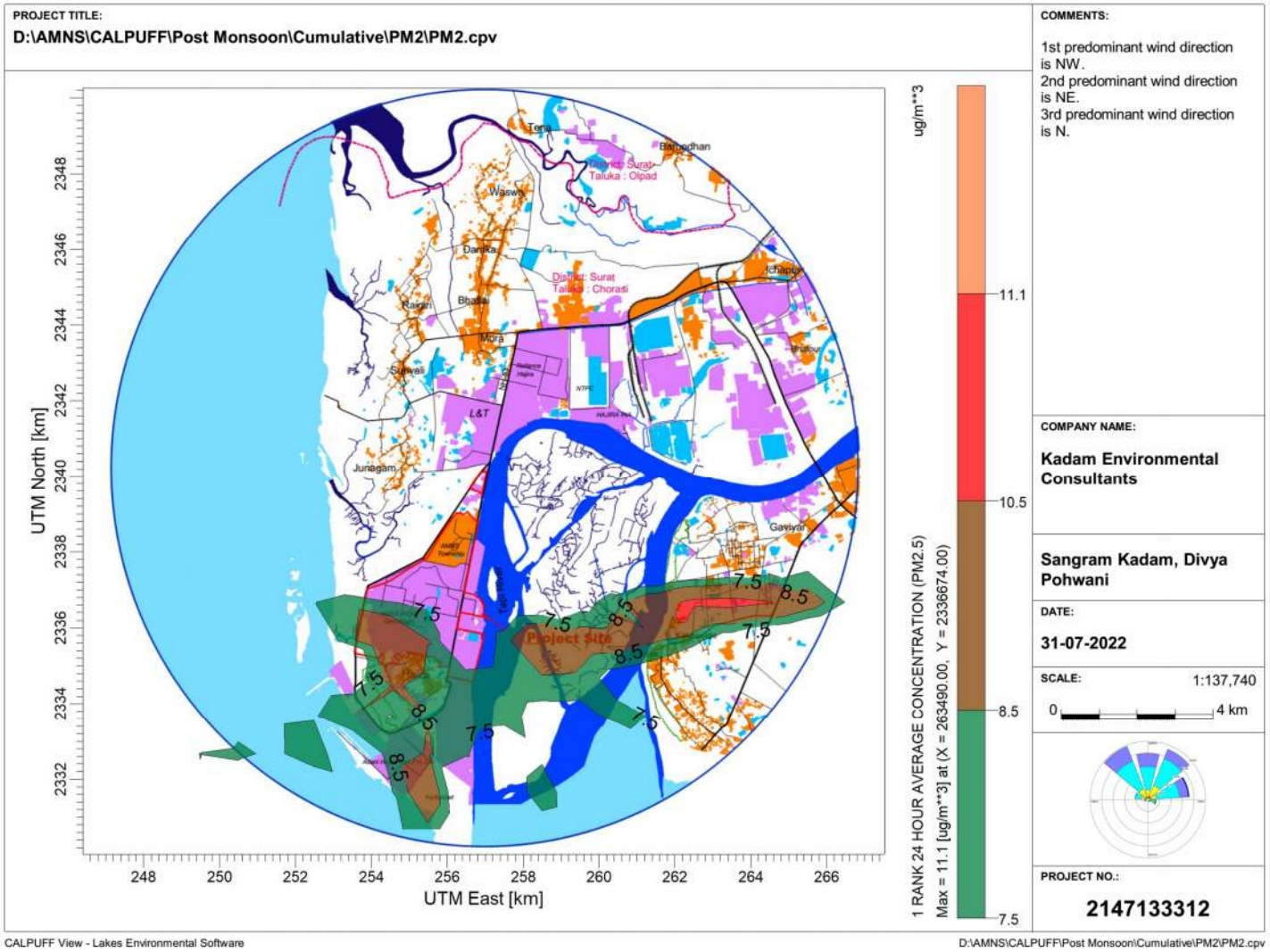


Figure 4-21: Isopleth of Incremental GLC of Oxides of Nitrogen (NOx) from Point & Line Source emission from flue gas stack and Process gas stack

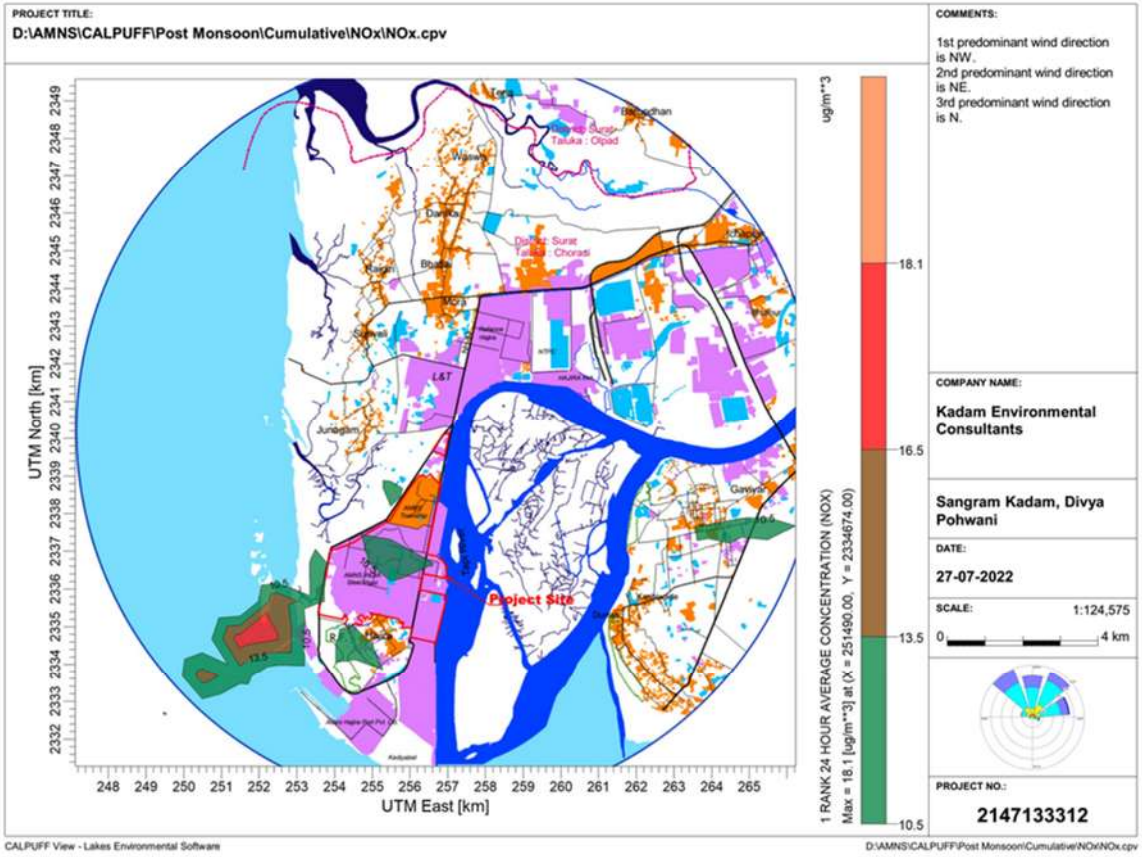


Figure 4-22: Isopleth of Incremental GLC of Sulfur Dioxide (SO2) from Point Source emission from flue gas stack and Process gas stack

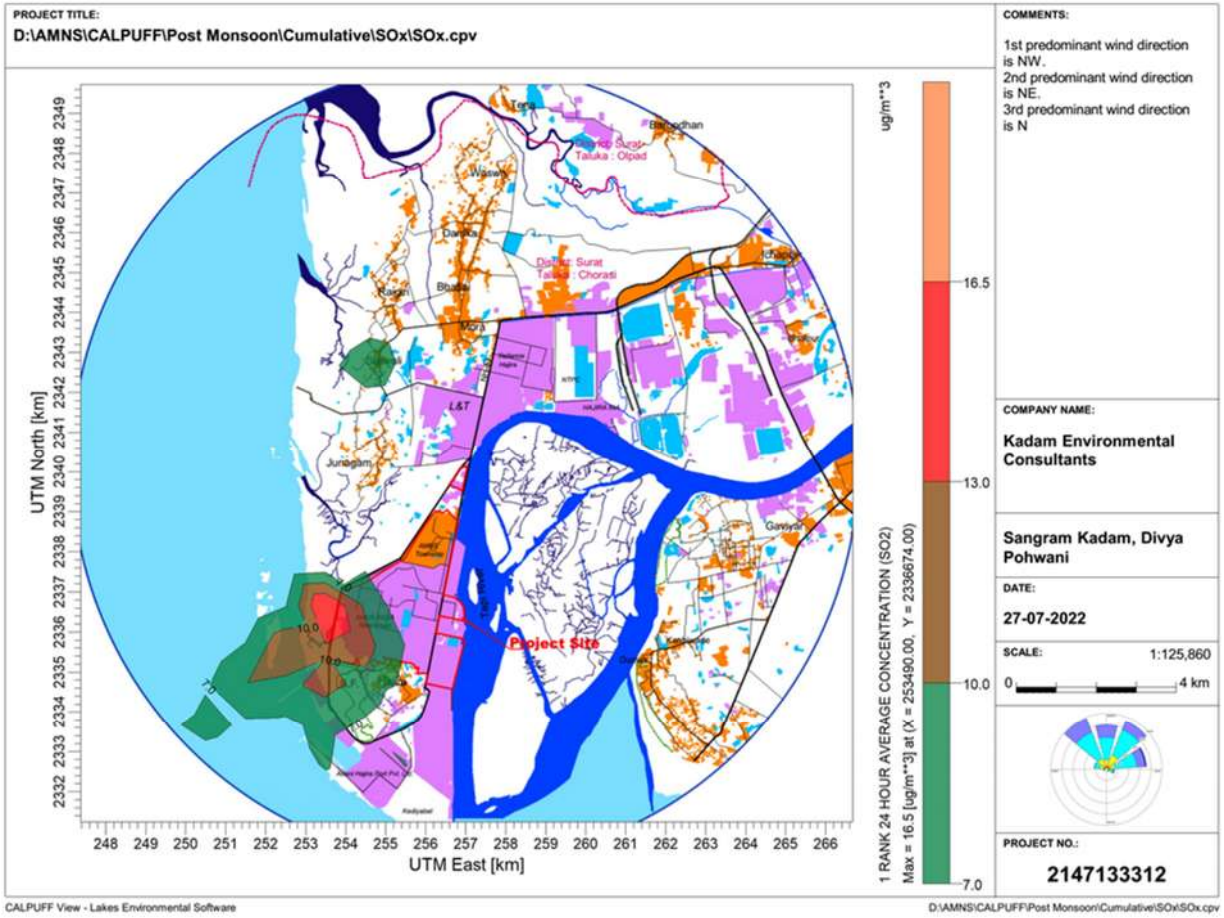


Figure 4-23: Isopleth of Incremental GLC of Carbon Monoxide (CO) from Line source emissions

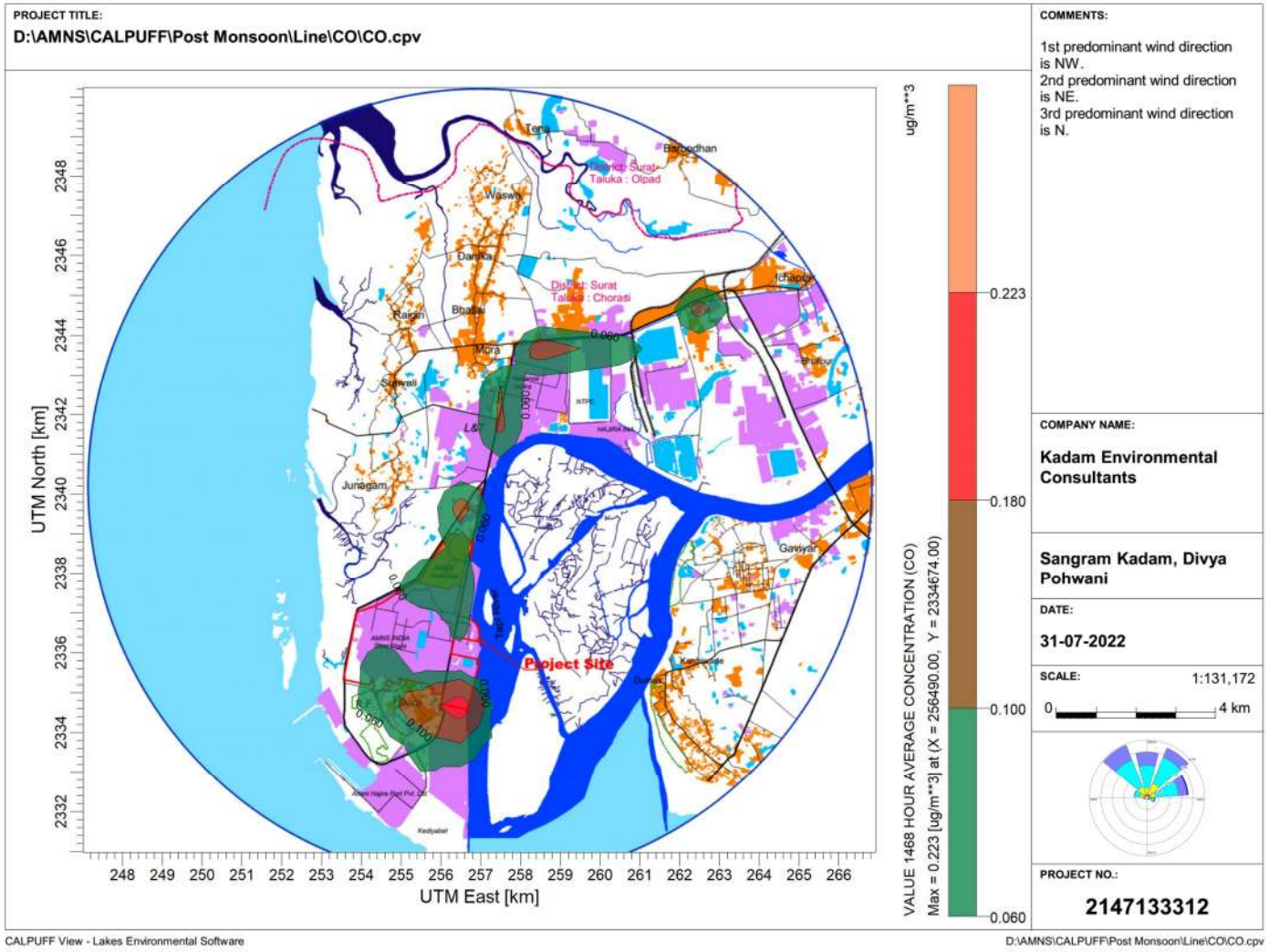


Table 4-19: Average GLC during study period and Predicted GLC on date of highest baseline reading- Post monsoon Season

Station-ID	Pollutants	Unit	CPCB Limit Concentration (24 Hrs)	Baseline (Time Weighted Average)	Aermod	Aermod	Calpuff	calpuff	Baseline (Single Day Maximum)	Aermod	Aermod	calpuff	calpuff
					Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)	Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)		Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)	Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)
C1	C2	C3	C4	C5	C6	C7 (C5+C6)	C8	C9 (C5+C8)	C10	C11	C12 (C10+C11)	C13	C14 (C12+C13)
AAQ1 At Site (MRSS Building) (~0.0 km / -)	PM10	µg/m3	100	97	3.371	100.371	3.730	100.730	136.0	5.154	141.154	9.240	145.240
	PM2.5	µg/m4	60	36	1.93	37.932	2.657	38.657	54.0	3.31	57.308	6.651	60.651
	SO2	µg/m3	80	7.2	2.795	9.995	0.562	7.762	8.6	6.205	14.805	6.500	15.100
	NOx	µg/m3	80	13.9	5.520	19.420	0.727	14.627	16.5	8.437	24.94	8.085	24.585
	HC	µg/m3	NS	867	0.6785	867.68		867	1012.0	1.7216	1013.72		1012.000
	CO	mg/m³	2	0.9	0.0078	0.91	0.000054	0.900	1.256	0.0199	1.27590	0.00021	1.256
AAQ2 Nand Niketan (STP Plant) (~0.0 km / -)	PM10	µg/m3	100	81	3.37	84.371	0.384	81.384	124.0	5.15	129.154	5.4727	129.473
	PM2.5	µg/m4	60	35	1.93	36.932	0.269	35.269	59.0	3.31	62.308	3.8766	62.877
	SO2	µg/m3	80	4	2.80	6.795	0.197	4.197	8.9	6.20	15.105	2.473	11.373
	NOx	µg/m3	80	13.7	5.52	19.220	0.389	14.089	15.9	8.44	24.337	6.5457	22.446
	HC	µg/m3	NS	840	0.6785	840.68		840	928	1.7216	929.722		928.000
	CO	mg/m³	2	0.9	0.0078	0.91	0.000078	0.900	1.041	0.0199	928.020	0.00026	928.000
AAQ3 Hazira village (~1.7 km / SE)	PM10	µg/m3	100	92	2.84	94.841	7.231	99.231	125.0	5.63	130.627	11.247	136.247
	PM2.5	µg/m4	60	44	1.86	45.861	4.999	48.999	57.0	3.79	60.789	7.9977	64.998
	SO2	µg/m3	80	6.7	4.35	11.049	2.086	8.786	7.8	6.57	14.374	5.5042	13.304
	NOx	µg/m3	80	17.5	4.48	21.98	2.623	20.123	19.8	8.13	27.9	6.7518	26.6
	HC	µg/m3	NS	788	0.1179	788.12		788	997.0	0.3271	997.3		997.0
	CO	mg/m³	2	0.839	0.0013	0.840	0.00015	0.839	0.962	0.0036	0.966	0.00027	0.962
AAQ4 Hazira aanganwadi (~1.4 km /SW)	PM10	µg/m3	100	95	4.14	99.138	7.366	102.366	112.0	9.11	121.112	12.503	124.503
	PM2.5	µg/m4	60	39	1.84	40.838	5.123	44.123	58.0	6.17	64.170	8.6482	66.648
	SO2	µg/m3	80	7.6	4.12	11.719	3.823	11.423	8.1	8.70	16.803	7.7673	15.867
	NOx	µg/m3	80	16.6	7.02	23.62	4.096	20.696	23.8	11.63	35.4	13.057	36.9
	HC	µg/m3	NS	913	0.6963	913.70		913	974.0	1.58337	975.6		974.0
	CO	mg/m³	2	0.6	0.008	0.608	0.000064	0.600	0.827	0.0183	0.845	0.00015	0.827
AAQ5 Suvali (~3.4 km /NW)	PM10	µg/m3	100	84	1.57	85.574	0.197	84.197	113.0	5.38	118.384	2.5885	115.589
	PM2.5	µg/m4	60	30	1.06	31.061	0.138	30.138	58.0	3.61	61.607	1.8092	59.809
	SO2	µg/m3	80	7.2	1.90	9.102	0.431	7.631	7.9	4.78	12.684	8.42	16.323
	NOx	µg/m3	80	19.1	2.47	21.57	0.371	19.471	21.9	6.14	28.0	5.9993	27.9
	HC	µg/m3	NS	837	0.00584	837.01		837	1007.0	0.05843	1007.1		1007.0
	CO	mg/m³	2	0.6	0.00007	0.600	0.000004	0.600	1.034	0.001	1.035	0.00003	1.034
AAQ6 At Site (SW corner)	PM10	µg/m3	100	89	3.37	92.371	4.217	93.217	121.0	5.15	126.154	9.5023	130.502
	PM2.5	µg/m4	60	50	1.93	51.932	2.962	52.962	36.0	3.31	39.308	6.6182	42.618
	SO2	µg/m3	80	7	2.80	9.795	3.554	10.554	9.4	6.20	15.605	10.053	19.453
	NOx	µg/m3	80	15.6	5.52	21.12	2.401	18.001	21.8	8.44	30.2	7.6479	29.4

Station-ID	Pollutants	Unit	CPCB Limit Concentration (24 Hrs)	Baseline (Time Weighted Average)	Aermod	Aermod	Calpuff	calpuff	Baseline (Single Day Maximum)	Aermod	Aermod	calpuff	calpuff
					Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)	Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)		Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)	Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)
C1	C2	C3	C4	C5	C6	C7 (C5+C6)	C8	C9 (C5+C8)	C10	C11	C12 (C10+C11)	C13	C14 (C12+C13)
	HC	µg/m3	NS	943	0.6785	943.68		943	937.0	1.7216	938.7		937.0
	CO	mg/m³	2	0.684	0.0078	0.692	0.00007	0.684	1.052	0.0199	1.072	0.00014	1.052
AAQ7 Mora (~3.1 km /N)	PM10	µg/m3	100	76	1.55	77.550	0.147	76.147	119.0	5.43	124.430	2.4705	121.471
	PM2.5	µg/m4	60	35	1.01	36.011	0.102	35.102	58.0	2.26	60.260	1.6983	59.698
	SO2	µg/m3	80	8.3	1.81	10.110	0.198	8.498	11.3	4.23	15.533	3.5442	14.844
	NOx	µg/m3	80	16.6	2.52	19.12	0.212	16.812	20.1	5.30	25.4	2.7667	22.9
	HC	µg/m3	NS	918	0.07217	918.07		918	1013.0	0.24666	1013.2		1013.0
	CO	mg/m³	2	0.6	0.00008	0.600	0.000009	0.600	0.918	0.00286126	0.921	0.00005	0.918
AAQ8 Damka (~5.58 km / N)	PM10	µg/m3	100	73	1.01	74.010	0.100	73.100	114.0	2.65	116.649	2.7564	116.756
	PM2.5	µg/m4	60	23	0.68	23.683	0.070	23.070	37.0	1.79	38.786	1.8907	38.891
	SO2	µg/m3	80	8.7	1.26	9.961	0.091	8.791	9.4	3.30	12.699	1.3032	10.703
	NOx	µg/m3	80	15.2	1.82	17.02	0.108	15.308	15.9	3.82	19.7	1.2967	17.2
	HC	µg/m3	NS	946	0.00181	946.00		946	1012.0	0.02073	1012.0		1012.0
	CO	mg/m³	2	0.6	0.000002	0.60	0.000002	0.600	0.896	0.0024	0.9	0.000057	0.9
AAQ9 Kavas (~6.78 km / NE)	PM10	µg/m3	100	78	1.63	79.627	0.097	78.097	133.0	2.53	135.525	1.4966	134.497
	PM2.5	µg/m4	60	34	0.91	34.909	0.066	34.066	56.0	1.45	57.445	1.0485	57.049
	SO2	µg/m3	80	8.2	1.15	9.352	0.101	8.301	10.3	2.33	12.633	1.8115	12.112
	NOx	µg/m3	80	17.7	2.66	20.36	0.138	17.838	20.6	4.18	24.8	2.0963	22.7
	HC	µg/m3	NS	877	0.37617	877.38		877	946.0	0.56934	946.569		946.000
	CO	mg/m³	2	0.612	0.00436	0.616	0.000031	0.612	0.922	0.0066	0.929	0.000065	0.922
AAQ10 Gaviyer (~8.41 km / E)	PM10	µg/m3	100	70	0.99	70.994	0.375	70.375	103.0	1.77	104.772	7.1686	110.169
	PM2.5	µg/m4	60	34	0.59	34.588	0.266	34.266	53.0	1.36	54.363	5.1049	58.105
	SO2	µg/m3	80	7	1.05	8.054	0.242	7.242	7.5	2.42	9.918	3.7879	11.288
	NOx	µg/m3	80	16.4	1.60	18.00	0.429	16.829	18.2	3.14	21.3	8.6746	26.9
	HC	µg/m3	NS	958	0.01581	958.02		958.000	1018.0	0.18375	1018.2		1018.0
	CO	mg/m³	2	0.6	0.00018	0.600	0.000002	0.600	0.929	0.0021	0.931	0.0000096	0.929
AAQ11 Dumas (~5.4 km / SE)	PM10	µg/m3	100	78	2.08	80.081	0.934	78.934	100.0	4.25	104.252	15.823	115.823
	PM2.5	µg/m4	60	26	1.39	27.386	0.654	26.654	39.0	2.87	41.875	10.932	49.932
	SO2	µg/m3	80	7.8	2.47	10.274	0.308	8.108	8.4	5.02	13.415	4.7587	13.159
	NOx	µg/m3	80	17.4	3.35	20.75	0.488	17.888	21.7	6.51	28.2	7.315	29.0
	HC	µg/m3	NS	948	0.04828	948.05		948	1066.0	0.17314	1066.2		1066.0
	CO	mg/m³	2	0.6	0.00056	0.601	0.000003	0.600	0.918	0.002	0.920	0.000024	0.918
AAQ12 Vanta (~7 km / E)	PM10	µg/m3	100	89	1.09	90.095	0.519	89.519	134.0	2.21	136.215	8.7221	142.722
	PM2.5	µg/m4	60	38	0.91	38.909	0.366	38.366	48.0	1.45	49.445	6.1702	54.170
	SO2	µg/m3	80	7.2	1.32	8.520	0.307	7.507	8.2	2.67	10.868	4.1916	12.392

Station-ID	Pollutants	Unit	CPCB Limit Concentration (24 Hrs)	Baseline (Time Weighted Average)	Aermod	Aermod	Calpuff	calpuff	Baseline (Single Day Maximum)	Aermod	Aermod	calpuff	calpuff
					Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)	Predicted Incremental GLC (Time Weighted Average)	Predicted Post Project GLC (Time Weighted Average)		Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)	Predicted Incremental GLC (Single Day Maximum)	Total Predicted Post Project GLC (Single Day Maximum)
C1	C2	C3	C4	C5	C6	C7 (C5+C6)	C8	C9 (C5+C8)	C10	C11	C12 (C10+C11)	C13	C14 (C12+C13)
	NOx	µg/m3	80	17.2	1.77	18.97	0.573	17.773	20.2	3.45	23.7	11.024	31.2
	HC	µg/m3	NS	999	0.37617	999.38		999	1095.0	0.56934	1095.6		1095.0
	CO	mg/m³	2	0.8	0.00023	0.800	0.000003	0.800	0.912	0.001	0.913	0.0000151	0.912

HC is not available in the species directory of CALPUFF

Cumulative species(Point+Line): PM10,PM2.5, NOx; Cumulative species(Point only): SOx; Cumulative species(Line only): HC,CO

Table 4-20: Maximum GLC due to Cumulative impact on Ambient Air Quality (AERMOD)

S. No.	Parameters	Maximum GLC Concentration, µg/m³	Direction	Distance (m)	Features of Area where Max GLC is buidling
1	PM	18.4	SSW	5000	Towards the sea
	PM2.5	12.46	SSW	3000	Towards the sea
2	NOx	23.5	SSW	5000	Towards the sea
3	SO2	14.8	SSW	5000	Towards the sea

Table 4-21: Maximum GLC due to Cumulative impact on Ambient Air Quality (CALPUFF)

S. No.	Parameters	Maximum GLC Concentration, µg/m³	Direction	Distance (m)	Features of Area where Max GLC is buidling
1	PM	15.9	E	6700	Nr. Dumas village
	PM2.5	121.1	E	6700	Nr. Dumas village
2	NOx	18.1	SW	2100	Towards the sea
3	SO2	16.5	SW	2100	Towards the sea

4.4.8 Mitigation Measures for Air Environment during Operation

Various process operations would generate particulate dusts, oxides of sulphur and nitrogen and carbon dioxide to the environment. The emission would be from the stacks as well as there would be fugitive emission of dusts from open and closed areas.

Fugitive dust emissions generating from the handling and stockpiling of raw material in open stockyards would be controlled by water sprinkling at regular intervals. All closed zone working areas such as raw materials handling zone, conveyor transfer points, dust generation points at screen would be provided with dust extraction (DE) systems/dry fogging (DF) at several emission points to control the fugitive dust emissions. DE system shall consist of suction hood followed by bag filter/ESP, ducts, extraction fans and stack of appropriate height.

In the existing plant, Air Pollution control devices are provided to control the dust and gaseous emissions during production of HBI, Hot metal in Corex, Steel making in EAF and ConArc Furnaces, Refining of steel, Desulhurisation of hot metal, Reheating processs etc. Various measures are also undertaken to ensure control on fugitive emissions arising during raw material handling, production processes, vehicular movement, etc. For adequate dispersion of dust & gases, stacks of adequate height have been provided. For heat dissipation in the work zones arising from furnaces adequate ventilation systems has been provided.

Details of Air Pollution Control Devices (APCDs) and other steps taken to control air pollution form the proposed project are mentioned below:

Coke Oven & By-Product Deptt.

Emissions from coke ovens would mainly result from coal charging and coke pushing. Fugitive emissions may result from various leakages from oven doors, charging lids, ascension pipe (AP) covers etc. Charging emissions would be controlled by High Pressure Liquor Aspiration (HPLA) injection in goose neck during charging. Coking emissions would be controlled by efficient sealing of oven doors, water sealing arrangement of AP cap etc. Land based fume extraction system would be adopted for charging and pushing emission control. The hot coke would be quenched by coke dry quenching (CDQ) with recovery of sensible heat for steam generation.

The raw coke oven gas (COG) would be cleaned in by-product recovery plant with recovery of tar, ammonia and sulphur to make it suitable for use as plant fuel.

While collection of baseline data, Coke Oven batteries #1 &2 for production of 1.35 millon tons per annum were under installation and Coke Oven batteries #3,4,5 &6 for production of 3.05 million tons per annum are proposed under the expansion project.

Measures to control Fugitive Emissions

Coal Handling Plant

Fugitive emission is generated during Coal crushing and during transportation of Coal to the Coal Silos and at Silos during loading

Following facilities have been provided to control fugitive emissions:

- DE system with Bag Filter / Dry Fog Dust Suppression (DFDS) system will be provided at Crusher
- DE System with Bag Filter / Dry Fog Dust Suppression (DFDS) systems will be provided at Junction Houses
- Dry Fog Dust Suppression (DFDS) systems will be provided at Silos

Coke Ovens

The fugitive emissions are generated during charging, coking, coke pushing, and quenching activities.

The Coke Oven Battery will have following state of art facilities to reduce pollution:

- On-main charging with HPLA System
- Coke Dry Quenching (CDQ) with Multi-cyclones and Bag Filter
- Land Based Pushing Emission Control System with Bag Filter
- Zero leak doors and Water seal AP Caps
- Pusher and Guide Car with door and door frame cleaning mechanism
- High pressure Hydro-jet door cleaner at end benches.
- Because of this the fugitive emissions in the area will be less.

Coke Dry Quenching

In the CDQ plant, the hot coke will be charged from the coke bucket into the cooling chamber with the help of an overhead crane. Hot coke will be cooled with circulating inert gas in the cooling chamber. The hot coke will flow continuously from the top to the bottom of the chamber and the inert gas will flow in the opposite direction. The heat of the hot coke will be recovered by direct contact of circulating inert gas and the absorbed heat will be subsequently utilized for the generation of high-pressure steam in the waste heat boiler. From the waste heat boiler, the cooled circulating gas will then be admitted into cyclones with spark arrester followed by Bag Filters system, where the fine fraction of coke dust will be removed.

Spark arrestor & multi-cyclone are provided in the ducting network at the inlet side of distribution chamber of bag filter unit. Spark arrestor prevents smouldering particle from entering into bag filter while cyclone separator collects coarser coke particles thereby preventing them from entering into bag filter. Bag filter unit consists of distribution chamber, filtering chamber with filter bags & fitting for the bags, outlet chamber, dust collection hopper with rotary air lock valves & dust storage cum disposal hopper with rack & pinion gate and disposal chute, structural stair case and platform, timers etc. The dust disposal from bag filter, multi-cyclone& spark arrestor is through discharge into a central pneumatic system (through dust storage hopper)

Coke Sorting Plant

Fugitive emissions will be generated from Coke Cutting and Screening areas. Dust extraction system with Bag Filter shall be provided

Measures to control Stack Emissions

Flue gas Stack

Stack emissions, PM, SO2, NOx and CO are due to the cross-wall leakages in the batteries. Hot repair / Cold Repair of the Coke Oven walls and dry gunneting will be done to reduce cross wall leakage vis-à-vis stack emission

Dedusting Stacks

Stack emission, mostly dust from the Dedusting Stacks provided with Dust extraction systems proposed at Coal Handling Plant, Coke Dry Quenching and Coke Sorting Plant.

PM Emissions from stack shall be kept within 30 mg/Nm3.

Quenching Emissions

Dry Coke Quenching of suitable capacities have been proposed with the Coke Ovens. Stand-by wet quenching stations has been proposd to be operated during schedule maintenance of CDQ chamber / Boiler and during emergencies.

For meeting quenching emission norms during wet quenching 'Modified Quench Tower with Baffels and Grit Arresters will be installed.

Sinter Plant

Sintering is basically an agglomeration of iron ore fines, coke breeze and flux at high temperature (1050°C to 1150°C). Use of Sinter in the iron bearing burden of Blast Furnace increase the yield of the furnace. Most of the waste material like iron ore fines, coke breeze, lime fines etc. can be recycled through Sinter Plant hence Sinter plant may be considered as Waste Management Plant.

One Sinter plant of grate afrea 120 m^2 for rated production capacity of 1.48 million tons per annum is in operation. Another 2nos. of Sinter plants for production of 7 million tons per annum have been proposed under the proposed expansion.

Measures to control fugitive emissions

Dust extraction system with Bag Filter shall be provided for space dedusting (to control fugitive emissions from Sinter Breaker and Sinter Screen areas).

Flue gas Stack

During the process of agglomeration by sintering, flue gases are generated from the Sinter M/c. which carries along with-it particulate matter, oxides of sulphur and nitrogen as major pollutant. Electrostatic Precipetator (ESP) shall be provided with, one with each Sinter M/c to clean the flue gases before letting out to atmosphere. MEROS or equivalent technology shall be adopted for reduce dioxine and other harmful emissions during sintering.

Dedusting Stacks

Stack emission, mostly PM, from the dust extraction systems with Bag Filter, provided for control of fugitive emissions at Sinter Breaker and Sinter Screens.

Material handling

PM Emissions from stack shall be kept within 30 mg/Nm3.

Calcination Plant

The emissions arising due the fuel burning in lime or raw dolo in calcining plant would be collected and taken through a bag filter to separate out the lime/dolo fines. The lime/dolo fines thus collected would be recycled to the Sinter Plants. The kilns in the calcining plant and other dust generation areas would be provided with separate DE systems, complete with bag filters and stack of adequate height to clean the particulates.

Calcination Plant -1 is having 4x300 TPD Kilns and Calcination Plant-2 is having 3x500 TPD Kilns, under operation for production of 0.93 MTPA calcined lime/dolomite. Under modification of the plant 1x500 TPD and 1x200 TPD Kilns shall be installed for production of 0.27 MTPA calcined lime/dolomite.

Under the proposed expansion, 4x600 TPD Vertical Shaft Kilns for production of 0.8 MTPA calcined lime/dolomite shall be installed.

The waste gases from the Kilns contain large amount of dust. Bag Filters have been provided to arrest the particulates and emit the clean flues to the atmosphere.

Under the proposed expansion 4 nos. of Bag Filters, one with each Kiln has been proposed for control of process exhaust emissions below 30 mg/Nm^3. However, in order to meet the statutory ground level concentration limits for SO_2, NOx and other gaseous pollutants, suitable stack height for proper dispersion of pollutants has been considered. All stacks have been provided with port hole and working platform so that stack monitoring can be done as per norms of statutory authority.

All bag filters have bags with non-adhesive coating to avoid blinding of bags and no air infiltration into bag house including ducting shall be ensured. Pug mills shave been provided below dust silos to prevent secondary pollution / fugitive emission during unloading of dust. The collected dust from bag filters is being transported to consumer points such as sinter plant.

Measures to control Fugitive Emission

Dust extraction systems with Bag Filters have been provided at Screen House, Lime Size Unit, Lime delivery building, Material Storage building.

Measures to control Stack Emission

Bag Filter systems have been provided for cleaning of flue gases

Blast Furnace

In addition to cleaning of BF gas in gas cleaning plant (dry type GCP), the main sources of air pollution would be stock house and cast house. The BF stock house would be provided with DE systems complete with dust extraction hoods, bag filter, ID fan and stack of adequate height. Similarly, the cast house would have separate fume collection system during taping of hot metal and slag, equipped with bag filter for separation of particulates before venting through a stack of appropriate height.

Flue gas from hot stoves is also source of pollution from the operation of blast furnace. Hot stoves are fired with blast furnace gas for heating of combustion air fed to Blast Furnace. This flue gas contains particulate matter (in very small quantity) and oxides of Sulphur and Nitrogen. Oxides of nitrogen are formed due to the high temperature of the stoves. Heat recovery from stove waste gas shall be installed for preheating of BF Gas and combustion air for stoves. In addition, energy conservation would be carried out through installation of TRT and pulverized coal injection.

AMNS is having one (1) operating Blast Furnaces 3200 cum capacity of production of 2.04 million tons per annum. Production capacity of this Blast Furnace shall be enhanced to 3.0 million tons per annum under the proposed expansion. Additional two (2) Blast Furnaces of 2x4500 cubic meters, each with total production capacity of 8.0 million tons are proposed under the expansion.

The casting of pig iron generates emission. These emissions mainly arise from contact between hot metal and slag and ambient oxygen. The main pollutant in these fugitive emissions is particulate matter with some amount of sulphur dioxide.

Measures to control Fugitive Emission

Following pollution control equipment installed with the Blast Furnace#5 to control fugitive emissions;

- Bag filter for Stock house dedusting (for control of fugitive emissions during handling of raw materials.
- Bag Filters for Cast House dedusting system for control of fugitive emissions during tapping and pouring of metal / slag in ladle.

Measures to control Stack Emission

BF Gas is used for heating of Stoves. Flue gases after stove heating is passed through the heat exchanger to pre-heat the combustion air. Flue gas, after heat exchanger, let out from the stack. No pollution control equipment envisaged as clean BF gas is used as fuel.

Basic Oxygen Furnace (BOF) Shop

The objective of Basic Oxygen Furnace (BOF), in steel making is to burn (oxidise) the undesirable impurities contained in the metallic feedstock. The main elements are thus converted into oxides are carbon, silicon, manganese, phosphorus, and sulphur. The purpose of this oxidation process is:

- To reduce the carbon content to a specified level
- To adjust the contents of desirable foreign elements
- To remove undesirable impurities to the greatest possible extent

Under the expansion of AMNS, thrre (3) numbers of Basic Oxygen Furnaces (BOF), each of capacity 350 Tons with 2x350 Ton LRF, 1xtwin vessel RH-OB Degasser and 2x2 strand Slab for production of 6.0 MTPA liquid steel and 5.91 MTPA of Slabs, has been proposed, out of which, at a time two (2) BOFs will be in operation and one (1) will be stand-by.

Besides BOF gas cleaning in dry type GCP, which is basically a process necessity, secondary emission would be generated mainly from charging and tapping operations. The secondary emissions of the steel melt shop would be controlled by Air Pollution Control system comprising of doghouse with collection hood, ID fan, bag filter and stack of appropriate height.

The emissions of LF would be collected by fume extraction (FE) devices and routed to the overall secondary fume extraction system of the shop through ducts to clean the dust laden fumes.

Measures to control Fugitive Emission

To control secondary emissions from BOF Convertor, Ladle Refining Furnace and RH-OB Degasser, Dog House systems with Bag Filter has been proposed.

Measures to control Stack Emission

Dry type Gas Cleaning Plant (GCP) with ESP has been proposed

Slab Caster

2x2 Strand Slab Caster with Continuous casting facility including slag detection system, continuous tundish temperature monitoring system, automatic mold level control system, quick SEN changing facility, breakout detection system, facility for width adjustment within sequence, electro-magnetic stirring equipment etc.

The water required for cooling the hot cast slabs would generate hot fumes comprising mainly water vapour, hot waste water and suspended particulates. The slab casting area would be provided with adequate ventilation in order to have the water vapour properly dispersed.

De-sulphurisation

A de-sulphurisation unit for hot metal pre-treatment to ensure consistent supply of homogenous and low sulphur hot metal to the BOF has been envisaged. The process of de-sulphurization generates fugitive emissions. The exhaust air generated in the process is contaminated with particulate matter.

2 x twin station hot metal desulphurization unit by desulphurisation in transfer ladle by impeller stirring method has been proposed under the expansion.

Dust extraction system with Bag Filter has been proposed to control fugitive emissions.

Hot Strip Mill

Semi-continuous type Hot Strip Mill for a production of about 6,000,000 tpa of Hot Rolled Coils (HRC) has been proposed. For heating of Slabs, before rolling, four (4) nos. of Walking Beam type Reheating Furnaces have been proposed. Clean by-product gases would be used in the reheating furnaces as fuel. Burning of the gases would give rise to the emissions of particulates, CO_2 and NOx. NOx emissions would be controlled by optimising the excess air supply and proper burner design. The flue gas, which is fairly clean, would be vented through a stack of adequate height.

Captive Power Plant

200 MW by-product gas-based power plant proposed under the expansion. The excess by-product gases, which is mainly the Blast Furnace gas will be used for power generation.

Table 4-22: Details of Proposed Air pollution Control Facilities

Unit	Location / Source	Type of Pollution Control Equipment	Connected with Stack (No.)	Stack Height (m)	Stack Emissions (mg/Nm3)
Coke Ovens #3&4	Flue gases	Nil (clean fuel- Coke Oven Gas is burnt)	1	140	30
Coke Oven # 5&6	Flue gases	Nil (clean fuel- Coke Oven Gas is burnt)	1	140	30
Coke Ovens #3&4	Coal Handling Crusher & Screen	Bag Filter	1	30	30
Coke Oven # 5&6	Coal Handling Crusher & Screen	Bag Filter	1	30	30
Coke Ovens#3&4 – Coke Handling	Coke Cutter	Bag Filter	1	30	30
Coke Ovens#5&6 – Coke Handling	Coke Cutter	Bag Filter	1	30	30
Coke Ovens#3&4 CDQ	Cleaning of Inert Gas	Multicyclone with Bag Filter	1	30	30
Coke Ovens#5&6 CDQ	Cleaning of Inert Gas	Multicyclone with Bag Filter	1	30	30
CO# 1,2,3,4	Unutilised Gas	Flaring	1	80	Flaring in Emergency
CO# 5 & 6	Unutilised Gas	Flaring	1	80	Flaring in Emergency
BF#3	Stove Flue Gas	Nil	1	80	30
	Stock House DE	Bag Filter	1	50	30

Unit	Location / Source	Type of Pollution Control Equipment	Connected with Stack (No.)	Stack Height (m)	Stack Emissions (mg/Nm3)
	Cast House#1 DE	Bag Filter	1	50	30
	Cast House#2 DE	Bag filter	1	50	30
	Gas Cleaning Plant	Bag filter	1 Flaring Stack	80	Flaring in Emergency
BF#4	Stove Flue Gas	Nil (clean fuel BF Gas is burnt)	1	80	30
	Stock Housed DE	Bag Filter	1	50	30
	Cast House#1 DE	Bag Filter	1	50	30
	Cast House#2 DE	Bag filter	1	50	30
	Gas Cleaning Plant	Bag filter	1 Flaring Stack	80	Flaring in Emergency
LCP#3	Kiln#1 600 TPD	Bag Filter	1	55	30
	Kiln#2 600 TPD	Bag filter	1	55	30
	Kiln#3 600 TPD	Bag Filter	1	55	30
	Kiln#4 600 TPD	Bag filter	1	55	30
	Lime screening dedusting system	Bag filter	1	30	30
Sinter Plant# 2	Process Waste Gas	ESP	1	120	30
	Area Dedusting+ Sinter cooler	Bag filter	1	30	30
	Fuel & Flux Building	Bag Filter	1	30	30
Sinter Plant #3	Process Waste Gas	ESP	1	120	30
	Area Dedusting + Sinter cooler	Bag filter	1	30	30
	Fuel & Flux Building	Bag Filter	1	30	30
Streel Melting Plant -3	Secondary Emission Control from BOF, LF, RH-OB & Desulpharization (2 nos.)	Dog House with Bag Filters (2 nos.)	2	100	30
	Gas Clearning Plant	Bag filter	Flaring in Emergency	80	
Junction Houses (6 nos.)	Transfer Points	Bag Filters	6	50	30
Hot Strip Mill	Reheating Furnace#1	Nil	1	85	30
	Reheating Furnace#2	Nil	1	85	30
	Reheating Furnace#3	Nil	1	85	30
	Reheating Furnace#4	Nil	1	85	30
CPP – By-product Based Power Plant	Boiler	Nil	1	100	30

Action Plan to control PM_{10} and $PM_{2.5}$ Emission

- High PM_{10} emission at these two locations may be due to the dust emissions from AMNSI
- It has been proposed to install 45 nos. of Air Pollution Control devices which includes Bag filters, Venturi scrubbers, ESP etc. at different units of the plant at a cost of Rs. 173 Crores under the modernization of AMNSI and also been submitted to the GPCB.
- Implementation of these control measures delayed due to NCLT process. However, after the new management has taken over, implementation has started in October 2020. Till date approx. 80% facilities have been installed. Remaining modifications including installation of Fume Extraction System with Steel Melting Plant-1 will be completed by December 2022.
- After implementation of these facilities by December 2022, it is expected that PM_{10} values will be reduced drastically.

4.4.9 Noise Environment

Impact During Operation Phase

During operation, the major noise generating sources from the steel plant from various sources are Sinter Fan, Blast Furnace Tuyeres, Steam leakages, TG Sets, Rotary equipment like Fans, Blowers and Compressors, Combustion Chamber Steam traps etc. However, this will be confined only within plant boundary and that too will be confined within shops. The level will be further minimised when the noise reaches the plant boundary and the nearest residential areas beyond the plant boundary.

Various noise sources from the proposed plant will be as follows:

Coke Ovens

- Coal and Coke Crushers and Screens
- CO Gas Exhauster
- Steam leakages from CDQ Unit

Sinter Plant

- Sinter Fan
- Sinter Crusher & Screen

Blast Furnace

- Blast Furnace Tuyeres
- Cold Blast and Hot Blast
- Cast House Dedusting Fan

Steel Melting Shop

- BOF Operation Platform
- Dog House system ID Fan

Hot Strip Mill

- Rotating machinery like mill motors, mill stands, water pumps, compressors.
- Cutting shears.
- Laminar Cooler

Power Plant

The major source of noise pollution in the Power Plant is from the following:

- Rotating equipment like Fans, Feed Water Pumps, TG Set, Compressors.
- Boiler & Super heater safety valves.
- Start-up Vent etc.

Prediction of anticipated noise levels resulting from operation of the proposed plant has been computed using software "Sound Plan".

Assessment of Noise using SoundPlan

Noise modeling study was done using the Software tool called "Sound Plan" which predicts the Noise Map generated due to the sources present at the project site, and predicts the Noise Levels at various receiver points due to the sources present at the project site.

To analyze the Noise Map of the project site, first, the geometrically coordinated Google Earth images of the Project site were imported into the software. Various Sources of noise were added with their approximate Sound Pressure Levels, and the "Receiver points" were added at various locations where Noise Monitoring was conducted.

"SoundPlan" generates the Noise Map with coloured pattern isopleths, which indicate whether or not the SPL in that particular region is above the limits mentioned by CPCB or not. If the Limit for Sound Pressure Level indicated by CPCB for that particular area is 75 dB during the day, and if the predicted SPL is below that, the Noise Map will show 'Green' colour for that area. But if the SPL is above the "user set" allowable limit, the same will be shown in 'Red' colour depending upon the Difference between then Predicted SPL and the Allowable SPL, and the "Conflict" in SPL is mentioned in the table if any conflict is predicted.

Consideration during the analysis

The sources considered at the project site for the analysis with their approximate Sound Pressure Levels are considered slightly on the higher side for more critical analysis. The sources of noise considered are as ***Table 4-23.***

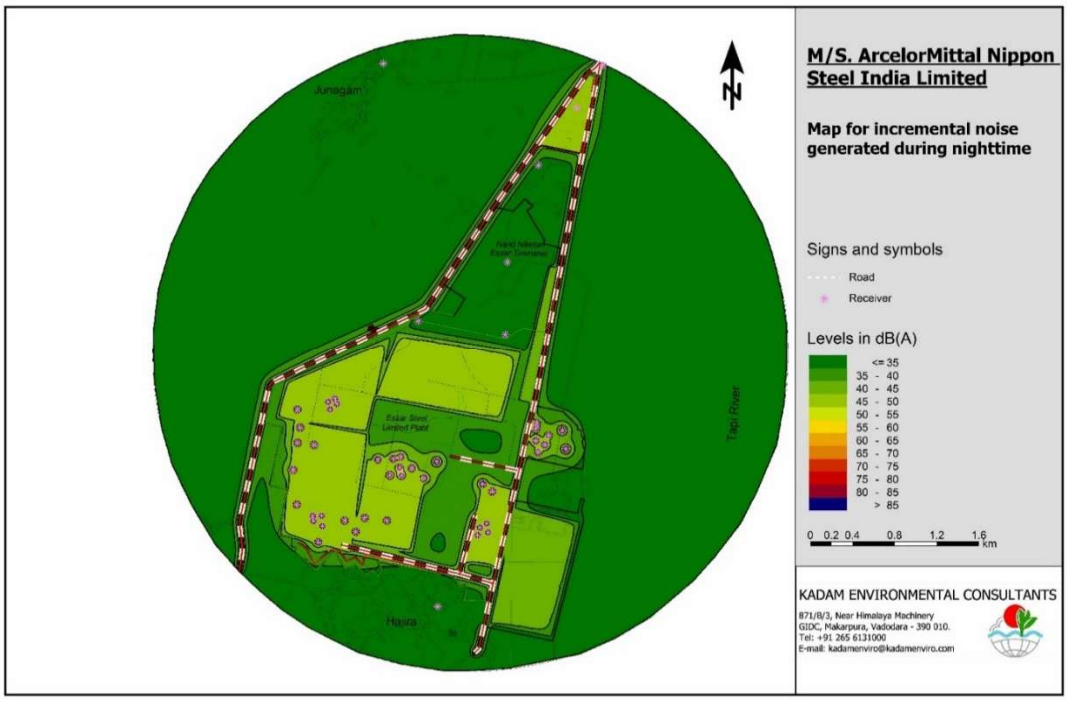
Table 4-23: Sources of noise with their sound pressure levels

S.No.	Sources	Levels dB(A)
1.	Exhauster Coke Oven	105
2.	Coal Crusher	82
3.	Coke Cutter	80
4.	Sinter Fan	110
5.	Sinter Breaker	95
6.	Sinter Screen	92
7.	Blast Furnace Cast House (Near Tuyeres)	105
8.	BOF Platform	85
9.	Hot Strip Mill (near Rolling Operation)	95
10.	Laminar Cooler	80
11.	DG Set	100

Using above consideration, the isopleths generated during daytime and nighttime are as given in ***Figure 4-24 and Figure 4-25.***

Figure 4-24: Isopleths for incremental noise generated during daytime

Figure 4-25: Isopleths for incremental noise generated during nighttime



Observations

The sound pressure levels were predicted at different sources as mentioned above. The observations are:

The project site considered as Industrial area, where the permissible limits defined for Noise Levels are 75 dB(A) during the day and 70 dB(A) during the night. Sound pressure levels of the sound sources are considered on higher side for more critical analysis.

SoundPlan analysis predicts an increase of 0.1 to 0.3 dB(A) during the daytime and 0.1 to 0.4 dB(A) increase during the nighttime.

Baseline data for Noise has been monitored at 08 locations around the plant site. However, for prediction of increase in ambient noise levels, villages within 2 km radius only are considered as noise generated from the proposed expansion project will not cause any impact over distance more than 2.0 km.

From ***Figure 4-24 and Figure 4-25,*** it can be observed at project site, noise is predicted in the range of 59.0 dB(A) – 67.2 dB(A) which is within the permissible limit for industrial area and there is no increase observed in the Residential area.

Table 4-24: Noise level at receptor locations

S. No.	Receiver Name	Category	Baseline Average Noise levels in dB (A)		Predicted Cumulative incremental increase in Noise level dB (A)		Incremental increase in Noise level dB (A)	
			Day	Night	Day	Night	Day	Night
			A		B		C	
					Algorithmic Calculation		C=B-A	
1	At Site (Nr Hazira Police Station)	Industrial	66.7	58.9	66.9	59.3	0.2	0.4
2	At Site (Truck Parking Area)	Industrial	62.4	58.1	62.4	58.1	0.0	0.0
3	At Site (Nand Niketan)	Commercial	58.6	53.2	58.6	53.2	0.0	0.0
4	At Site (Nand Niketan S boundary)	Industrial	67.8	65.4	67.8	65.4	0.0	0.0
5	At Site (Nand Niketan SW boundary)	Industrial	60.4	58.9	60.4	58.9	0.0	0.0
6	Hazira Village	Residential	54.9	44.6	54.9	44.7	0.0	0.1
7	100 m N from site boundary	Industrial	62.1	57.5	62.4	57.7	0.3	0.2
8	Suvali Village	Residential	53.9	42.4	53.9	42.4	0.0	0.0

Conclusion

SoundPlan analysis is carried out assuming that there are no obstructions (such as trees, buildings, walls etc.) in between the receiver locations and the sources of sound, which is not true in real conditions. Therefore, the actual ambient noise levels will be much lower than that predicted by SoundPlan as presented in above table. Thus, it is predicted that there will not be any significant impact on the ambient noise levels due to proposed project activities.

Mitigation Measures

Although there was no significant increase predicted at any of the noise monitoring locations outside the project site, the noise environment also includes the people who are working within the project site, and who may face permanent hearing damage in case they face the Noise Dosage beyond the permissible limits. Therefore, it is important to implement adequate noise control measures in order to avoid any permanent hearing damage to the people working inside the project site.

AMNS is already adopting necessary noise control measures in its existing industries as given below and the same will be implemented and further strengthened in the proposed project. Additional noise control measures will be adopted, wherever required.

Power Plant

The start-up vent, safety valve outlets will be provided with silencers to reduce the noise level to acceptable limits.

- The Hogging Ejector will be provided with silencer.
- The turbine will be covered with acoustic enclosure.

Rolling Mill

- Rubber mounting shall be used for Water pump and Compressor
- Regular maintenance of rotating equipment to keep the sound level at 1.0 m away at a level of 85 to 90 dB(A).

Other Mitigation Measures

Various measures proposed to reduce noise pollution include reduction of noise at source, provision of acoustic enclosure or separate housing for TG Set, Compressor, Snort Valve with Cold Blast Line of Blast Furnace, stoppage of leakages of steam and air, accoutic lagging for the equipment and suction side of silencers, vibration isolators. Care will be taken during selection of the equipment like compressors, blowers, pumps, fans etc. In some areas, personnel working will be provided with noise reduction aid such as ear muffs/ ear plugs and also the duration of exposure of the personnel will be limited as per the norms.

The following measures will be undertaken:

<u>Technological Measures</u>

- Use of better accoustic systems to minimize noise generated by the equipment
- Regular maintenance of equipment to minimize noise pollution
- Noise will be reduced by preventing leakages from steam lines, compressed air lines and other high-pressure equipment.
- The air compressor, TG sets, DG sets, process air blower, pneumatic valves etc, will be provided with acoustic enclosure;

- Noise proof cabins will be provided for operators wherever remote control for operating noise generating equipment is feasible.
- Suitable padding will be provided at required locations to avoid rattling due to vibration
- Other than the regular maintenance of various equipment, ear plugs/muffs will be provided to personnel working close to the noise generating units.
- All rotating equipment / parts will be well lubricated and provided with enclosures as far as possible to reduce noise transmission.
- Suitable personal protective equipment (PPE) such as earplugs shall be provided to the workers working in high noise area. Job Rotation of the workers working in the high noise area shall be considered. High noise generating areas shall and marking with display board for warning.
- Plugging leakages in high-pressure gas/air pipelines.
- Reducing vibration of high-speed rotating machines by regular monitoring of vibration and taking necessary steps.
- Design of absorber system for the shift office and pulpit operator's cabin.
- Noise absorber systems in pump houses.
- Noise level at 1m from equipment will be limited to 85 dB (A).
- The fans and ductwork will be designed for minimum vibration.
- All the equipment in different new units and in units where capacity expansion is taking place will be designed/operated in such a way that the noise level shall not exceed 85 dB (A).
- Periodical monitoring of work zone noise and outside plant premises.

Management Measures

In a steel plant, with a variety of noise producing equipment, it may not be practicable to take technological control measures at all the places. In such cases the following administrative measures shall also be taken:

- Un-manned high noise zone will be marked as "High Noise Zone".
- Workers exposed to noise level will be provided with protection devices like earmuffs as per present practice and will be advised to use them regularly, while at work.
- Workers exposed to noisy work place shall be provided with rotational duties.
- All workers will be regularly checked medically for any noise related health problem and if detected, they will be provided with alternative duty.
- Monitor the ambient noise level and work zone noise level to conform the stipulated norms.
- Creation of awareness for noise attenuation and mitigation program.
- Design/installation precautions will be taken as specified by the manufacturers with respect to noise control and will be strictly adhered.
- Noise control will form an integral part of the plant design.
- Development of 3 tier green belt within the plant premises and along project boundary to screen noise.

4.4.10 Surface Water Environment

Potential impacts of withdrawal of water and wastewater discharges from the proposed industry on land or water body is an important factor in EIA Studies. Water environment may be affected by the industry due to drawal of water, discharge of polluted water / waste water, and by contaminated leachate from land disposal / dumping of solid waste. The present activities are scrutinized in light of the above factors and its impact is predicted accordingly.

The quantitative and qualitative information on water utilization and waste water generation in the proposed industry is presented in ***Chapter-2***. The information also includes the built-in facilities and measures for treatment and disposal waste water proposed in the project.

Impact due to Water Usage

For the existing plant, raw water is sourced from river Tapi and the requirement is around 145,838 KLD (Approx. 32.08 million of gallons per day (MGD)) For the proposed expansion, additional requirement of raw water will be around 81,600 KLD (approx. 17.95 MGD) which needs to be sourced from river Tapi. Hence total water requirement after expansion will be around 227,438 KLD (approx. 50.03 MGD).

No impact on ground water is also envisaged since no ground water will be drawn by the expansion plant.

Mitigation Measures

The plant has been designed based on maximum recycling and zero liquid effluent discharge and will have less impact on ground water as well as surface water hydrology in this region. Rain water harvesting will be taken up as a measure to conserve water.

Hazira Industrial Authority (HAIA) has taken up a project for tertiary treatment of biologically treated sewage water (Tertiary Treated Water or TTW) which will be supplied to various industries as make-up water. This project is under implementation and water from TTW source will be gradually available at a later stage. Hence to cater to the requirement of this expansion, the total raw water requirement has to be sourced from Tapi river. Water withdrawal from river Tapi will be gradually reduced as TTW is made available.

The project will be implemented through Special Purpose Vehicle (SPV) mode for major Hazira Industrial consumers and the Hazira Notified Area Authority (GIDC) will be Nodal Agency for implementing this project. AMNSI, Hazira has given concurrence to Hazira Notified Area Authority to participate in the project for utilization of 75,000 KLD of treated Waste water on payment basis.

Impact due to Effluent Discharge

In an integrated Steel plant wastewater may be generated from different units / shops. Some are being discharged after treatment; some are reused in the plant itself after treatment and only bleed off quantity are being discharged. After the proposed expansion Zero effluent discharge will be from the plant.

Total effluent discharge from the proposed Unit will be 650 cu m/hr, as per the follwing details:

Table 4-25: Waste Water Generation from the Facilities Under the Expansion

Sl. No.	Plant Unit	Effluent water in m3/hr
1.	Coke oven by-product plant with CDQ PP	260
2.	SMS	80
3.	HSM	75
4.	Power plant (Gas based CPP)	90
5.	Air separation plant	30
6.	Chilled water plant	30
7.	Softening and DM plant regeneration waste	50
8.	Treated sewage from new STP	35
Total		**650**

Mitigation Measures

After implementation of the proposed modification project, the tretaed waste water generation will be 20,096 m^3/day (~ 837 m^3/hr).

All major exiting Units have been provided with Effluent Treatment Plants, as per the details given in the ***Table 4-26*** and part of the treated water is either being recycled within the plant or being used for slag cooling. Remaining treated water is being discharged in the Tapi River. The plant has permission to discharge 27,572 m3/day of treated water in the river.

Under the modification proposal of the plant, RO Plant of 250 m^3/hr. is planned to be installed in Phase-1. It will be upgraded to 750 / 850 m3/hr. by March 2023 in phases.

Under expansion, total waste water generation from expansion units will be around 650 cu m/hr i.e. 15,600 cum m/day. A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of approx. 650 cum/hr.

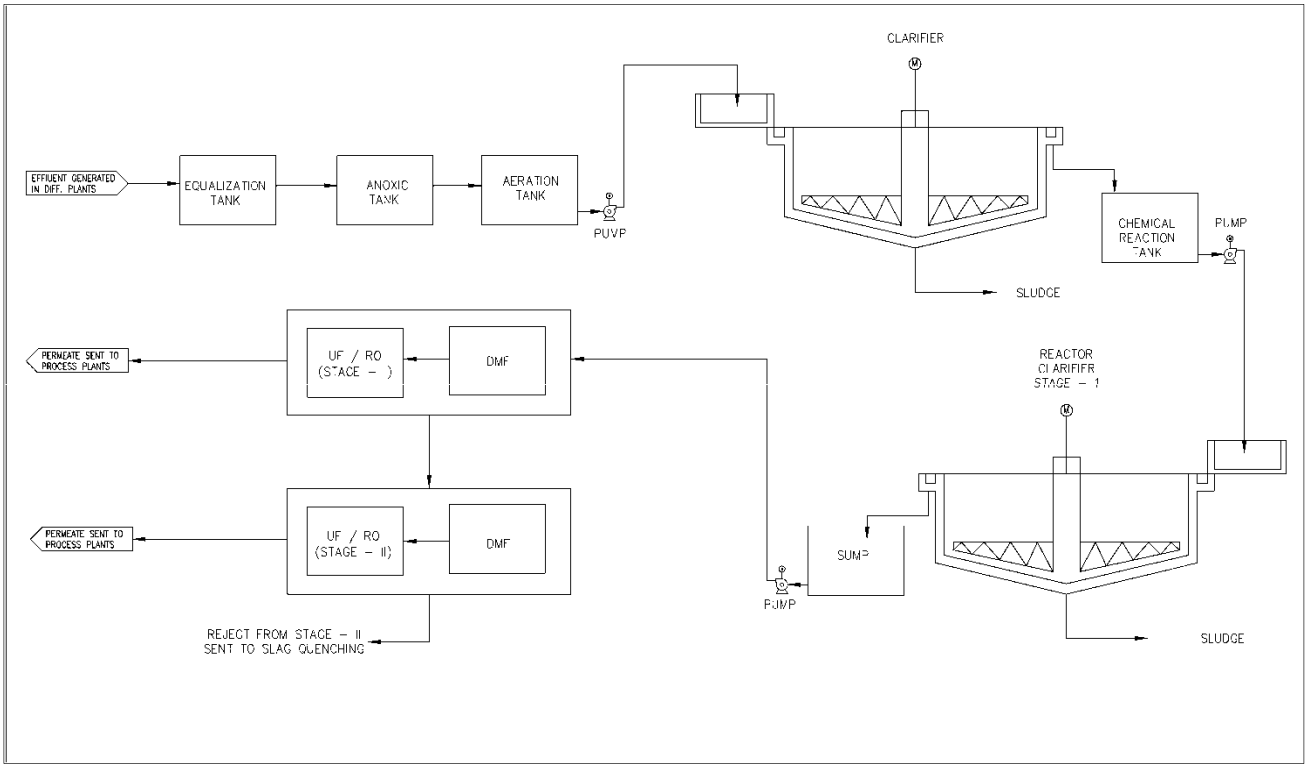
Table 4-26: Existing effluent generation and Management

Details	Plant Scheme		Inlet Flow (m^3/hr)	Outlet Flow (m^3/hr)	Recycled Qty (m^3/Hr)	Discharge Qty (m^3/Hr)	Tretaed water recycled for	Discharge Management
Corex ETP	Collection tank→ Flocculant treatment→Treated water sump→Final Outlet		125	125	95	30	Slag cooling	After implementation of proposed modification project, the treated waste water generation will be 20096 m^3/Day (~ 837.3 m^3/Hr) Part of Modification project, we propose to reuse the balance treated water through RO units. RO Plant of 250 m3/Hr planned in Phase-1 and stage wise it will be
HSM ETP	Collection thickner→ Flocculant treatment→Makeup to direct system		100	100	50	50	System makeup	
CSP MILL ETP	Collection thickner→ Flocculant treatment→DMF→Makeup to Different stream		150	150	110	40	System makeup,Slag cooling,PSF Backwash	
CONARC ETP	Collection thickner→ Flocculant treatment→Drain		40	40	40	0		
CRM ETP	Acidic Stream	Acidic Stream:- Collection tank→pH Correction with Lime addition→ Flocculant treatment→HRSCC→pH Correction→Drain Oily Alkali Stream:- pH Correction→Flocculant treatment→DAF→Aeration1→Clarifier1→Aeration2→Clarifier2→Drain	120	120	44	76		
	Oily Stream							
	Alkali Stream							
Plate Mill ETP	collection → HRF Treatment clarifier → Treated Water Tank		10	10	7.7	2.3	System makeup	
HBI Module 1-6 ETP	Feed Tank→Clarifloculator →Sludge Ponds Oil Skimmer Outlet		3200	3200	3145	55	Treated Water from Mod 5&6 used as make up in corex Plant. Treated Water from Mod 1&4 used as	

Details	Plant Scheme	Inlet Flow (m^3/hr)	Outlet Flow (m^3/hr)	Recycled Qty (m^3/Hr)	Discharge Qty (m^3/Hr)	Tretaed water recycled for	Discharge Management
						make up in Blast Furnace.	upgraded to 750 to 850 m3/Hr by Dec'2023. RO reject will be used for Slag quenching purpose or to the evaporator-crystallizer.
Bhander Power (525 MW)	Cooling Tower Blow down				104		
HRC, HBI, CRM & Plate mill	Cooling Tower Blow down				230		
Coke oven 1&2	BOD Plant	250	250	0	250		
Total				**3491.7**	**837.3**		

Total waste water generation from expansion units will be around 650 cu m/hr i.e. 15,600 cu m/day. A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of approx. 650 cu m/hr.

Figure 4-26: Schematic Diagram of 650 m3/hr. Proposed ETP



CETP will have RO unit for treating the treated waste water. The permeate from RO will be sent to BF and SMS as make-up to cooling tower. Reject generated in the RO plant will be partly used after dilution for sprinkler type suppression at raw material storage yard and balance will be fed to the evaporator-crystallizer. Sludge and salts generated in the CETP will be disposed at approved TSDF. Waste water after recycling shall be reused in the process and zero effluent discharge shall be maintained.

Sewage Treatment

For existing plant, there are three STPs to treat domestic effluent generated from plant and residence, one with a capacity of 480 KLD inside the plant premises and two numbers inside the township with capacities of 1000 KLD and 600 KLD. STP treated water will be used for gardening purpose.

Sewage generated from various expansion plant units will be treated in sewage treatment plants. Sewage generated from the plant units located at the western side of the Hazira steel plant, i.e. BF-2, SMS, HSM, power plant, ASP and other miscellaneous areas, will be transferred to a new sewage treatment plant of capacity 1000 KLD, to be located in the north side of the plant through gravity type sewerage network. Sewage lift pumphouse will be provided wherever required. Treated effluent from the sewage treatment plant will be further treated in CETP.

Sewage generated in COBP, BF-3 and RMHS area will be treated in existing STP in township after augmentation. Sewage from COBP plant will be transferred to the STP through sewerage network.

From balance areas, sewage will be transported through tankers.

4.4.11 Ground water Environment

Impacts

The expansion plant does not envisage any ground water drawl and hence no impact on ground water around the plant is anticipated.

The waste disposal area around any industry is one of the major factors deteriorating ground water quality, if the water leached from the waste dumps contains toxic substances. At the expansion plant, some wastes are dumped in secured land fill sites and some inert wastes are dumped in low lying area. All other solid wastes are either reused / recycled or sold out.

Mitigation Measures

Periodical monitoring of ground water quality at up-gradient and down gradient of slag dump area.

Disposal of waste generated from the proposed project will be done in a systematic /scientific manner as per guidelines to prevent any ground water pollution.

4.4.12 Soil Environment

Major impact on the soil will be due to Storage of raw materials, storage, handling and transportation of solid wastes and hazardous wastes and also on the soil of nearby agricultural land due to air pollution. Impact due to air pollution has been discussed in the previous section. In this section impact due to storage of raw materials and generation of solid and hazardous wastes and their management has been discussed.

Details of Storage Yard

AMNS has presently 4 nos raw material storage stock yards and there will be addition of two new yard for oxide storage and BF slag Storage. The storage capacity of stockyards is given in the Table, below:

Sl. No.	Raw Material Storage Yard	Storage Capacity (Million Tons)	Remarks
1.	Coal Yard	0.30	Existing
2.	Coke Yard	0.12	Existing
3.	Flux Yard	0.20	Existing
4.	Oxide Yard	1.20	Existing
5.	Oxide Yard	0.35	New
6.	BF Slag Storage Yard	0.13	New

AMNS has prepared a detail action plan to avoid leaching of materials to the ground water and land contamination.

Action Plan to avoid Leaching

- All the yards will have RCC flooring after hard surface rolling and compacting so there is no chance of water and slurry contamination in below ground level.

- Along with that all the yards will have proper drainage system and retaining wall to evacuate ground water easily.
- Drain and retaining wall in Coal Yard, coke yard and flux yard is already available while in oxide yard the same is under construction.

A tentative drawing is attached below showing typical details of RCC flooring, drains and retaining walls.

Figure 4-27: RCC Flooring

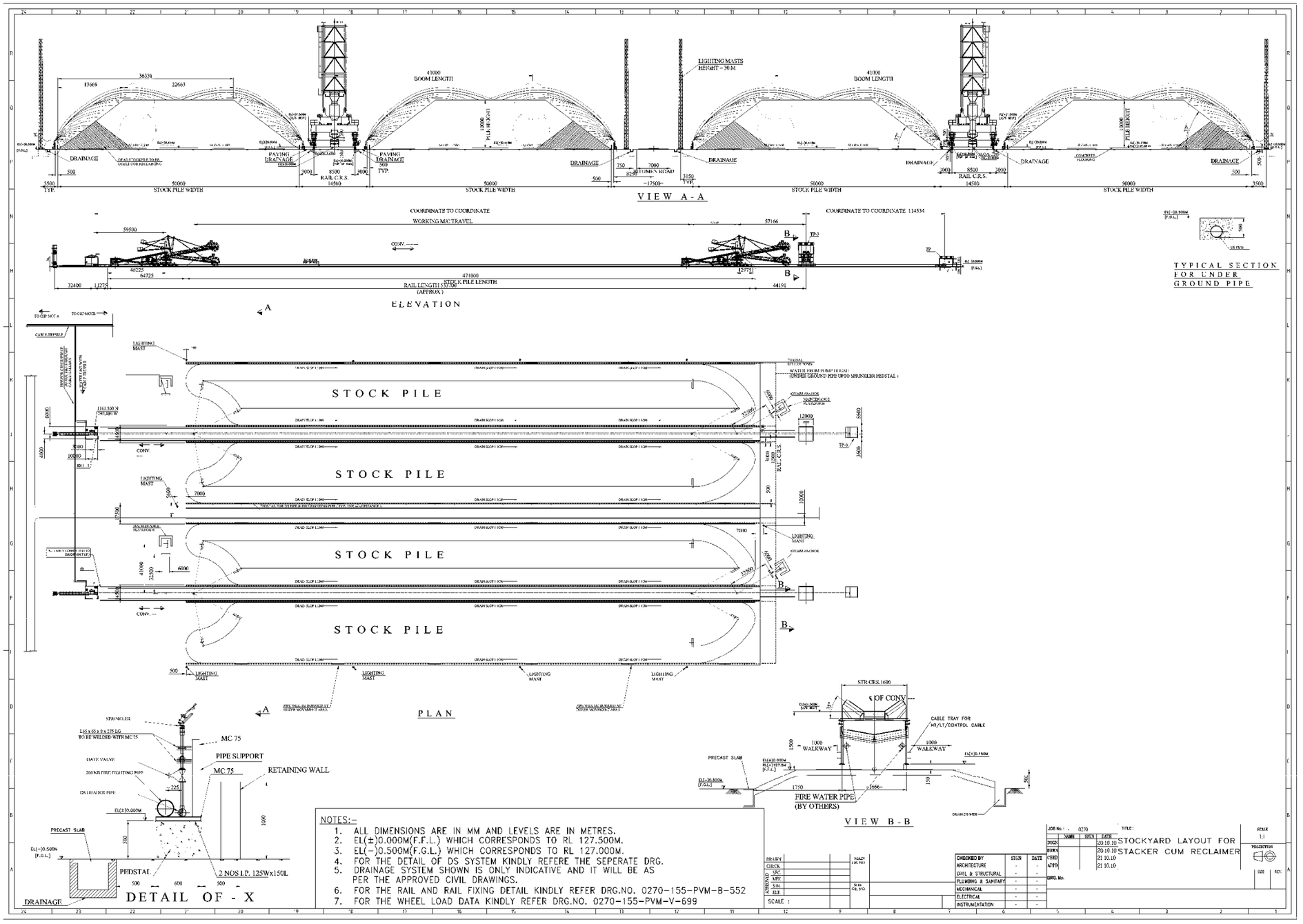
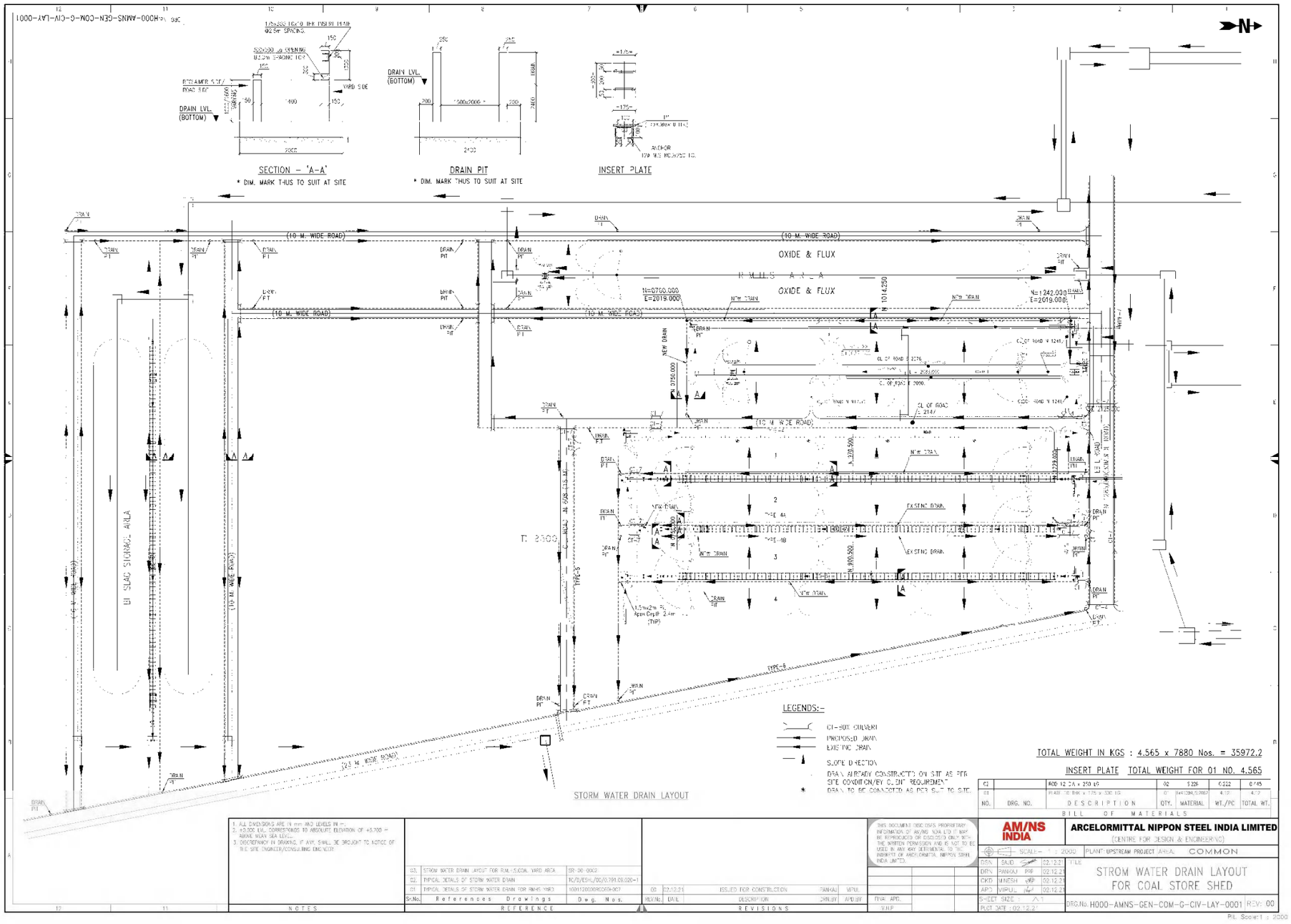


Figure 4-28: Drain and retaining wall drawing for coal and Coke Yard



4.4.13 Solid Waste Generation & Management

Integrated Iron & steel plant generates solid wastes, some of which are hazardous while others are non-hazardous. Some of these wastes are reused / re-utilised and some are not. AMNS is also not exception to that.

The expected solid wastes and Hazardous wastes generation and their management will be given a priority consideration from the initial stage of the operation. The solid waste generation and disposal from the existing and proposed plant is given below:

Table 4-27: Solid Wastes Generation & Management

Sl. No.	Solid Wastes	Quantity of Generation in TPA			Management
		Existing + Modification	Proposed	Total	
Dust Generation					
a.	HBI (DRI) Fines	228,690	0	228,690	Sales to outside agencies / units for Iron recovery.
b.	Corex Plant Dust	9,000	0	0	Corex plant will be kept in standby mode
c.	Coke Oven CDQ Dust	13,500	30,500	44,000	Will be used in Sinter Plant
d.	BF Flue Dust (Dust Catcher)	102,000	448,000	550,000	Will be used in Sinter Plant
e.	BF GCP Dust (BF#2&3)	--	268,800	268,800	Will be used in Sinter Plant.
f.	EAF, LRF & RH-OB Dust	57,500	0	57,500	Will be used in Sinter Plant
g.	ConArc Fce., LRF & RH-OB Dust	140,000	0	140,000	Will be used in Sinter Plant
h.	BOF GCP Dust	--	90,000	90,000	Will be used in Sinter Plant
i	BOF FES Dust	--	135,000	135,000	Will be used in Sinter Plant
j	Lime Plant Bag Filter Dust	74,100	78,600	152,700	Will be used in Sinter Plant
k	Dolo Plant Bag Filter Dust	50,950	40,500	91,450	Will be used in Sinter Plant
Sludge Generation					
a.	HBI Plant	254,700	0	254,700	Will be used in Sinter plant
b.	Corex Plant	1,20,000	0	0	Corex plant will be kept in standby mode
c	Blast Furnace#1 GCP Sludge	61,200	0	61,200	Will be used in Sinter plant after drying
Slag Generation					
a.	Corex Plant	6,40,000	0	0	
b.	BF Air Cooled Slag	68,545	150,550	219,095	Will be used as construction aggregates and internal road making
c.	BF Granulated Slag	616,895	28,60,450	34,77,345	Will be sold to the Cement companies
d.	EAF Slag (incl. LRF & RH-Degasser)	11,04,000	0	1104,000	Will be crushed and after metal recovery, will be used as aggregates in construction work, for internal roads and approach roads as a sub base material

Sl. No.	Solid Wastes	Quantity of Generation in TPA			Management
		Existing + Modification	Proposed	Total	
e.	ConArc Slag (incl. LRF, RH-Degasser & Desulphurisation)	990,000	0	990,000	Will be crushed and after metal recovery, will be used as aggregates in construction work, for internal roads and approach roads as a sub base material
g.	BOF Slag	--	780,000	780,000	Shall be used for soil conditioning. Weathered slag shall be used for internal road and village road construction under CSR and as rail ballast for internal rail network.
Generation of Scale					
a.	SMP-1 Slab Caster	11,300	--	11,300	Will be used in Sinter Plant
b.	SMP-2 Slab Caster	3,600	--	3,600	Will be used in Sinter Plant
c.	CSP	39,000	--	39,000	Will be used in Sinter Plant
d.	SMP-3 Slab Caster	--	5,800	5,800	Will be used in Sinter Plant
Generation of Mill Scale					
a.	HSM-1	45,700	--	45,700	Will be used in Sinter Plant
b.	Plate Mill	10,100	--	10,100	Will be used in Sinter Plant
c.	Lsaw Plant	2,000	--	2,000	Will be used in Sinter Plant
d.	Hsaw Plant	5,350	--	3,100	Will be used in Sinter Plant
e.	HSM-2	--	67,300	67,300	Will be used in Sinter Plant

Table 4-28: Details of Hazardous Waste generation and its management

Sl. No.	Name of Hazardous Waste	Total Quantity after Proposed Modification (TPA)	proposed Expansion (TPA)	Total After proposed Expansion (TPA)	Action plan for Disposal / Management.
1	ETP Sludge	38,000	23,000	61,000	Disposal to GPCB authorized TSDF site
2	Used Oil (KL/Year)	3,000	2,100	5,100	Selling to MoEF&CC / GPCB Authorised Vendors.
3	Oily Waste	2,500	1,600	4,100	Collection, Storage, Transportation and Disposal by selling to Registered Vendors/TSDF/Recycle in process (Sinter plant/Blast Furnace), Briquetting, Co processing in cement units.

Sl. No.	Name of Hazardous Waste	Total Quantity after Proposed Modification (TPA)	proposed Expansion (TPA)	Total After proposed Expansion (TPA)	Action plan for Disposal / Management.
4	Discarded Container / Barrels / Liners / Paint Drums (Nos/Year)	30,000	21,600	51,600	Selling to MoEF&CC / GPCB Authorised Vendors.
5	Discarded Resin	200	120	320	Co-processing in DRI / HBI units as per CPCB guidelines / Disposal at TSDF/CHWF
6	Zinc Dross & Zinc Ash	6,000	0	6,000	Selling to authorized recycler.
7	Contaminated cotton rags (Oily socked cotton waste)	500	500	1,000	Collection, Storage, Transportation and Disposal by selling to authorized Vendor or disposal at GPCB approved TSDF site.
9	Spent Acid	8,57,750	0	8,57,750	Maximum acid will be recovered from this Spent acid in Acid Regeneration Plant (ARP) and balance spent Acid disposal to Authorized Recyclers. Recovered acid will be Reuse as a Raw Material
10	Tar Sludge (Coke Oven)	120	280	400	Tar sludge will be mixed with coal blend before feeding it to coke oven batteries
11	ETP (BOD Plant) Sludge (Coke Oven)	160	320	480	ETP (BOD Plant) sludge will be mixed with coal blend for charging in the coke oven batteries.
12	Chromic Sludge	8	0	8	Selling to outside Agency

4.4.13.1 AMNSI Plan for 100% Solid Waste Utilisation

AMNS India, Hazira complex is on a journey for 100% waste utilization. Various Solid waste utilization projects through value addition have been under taken and implemented successfully in last few years. The unit has also planned for various new projects to achieve zero waste to landfill following 3 R principles of Reduce, Reuse & Recycle.

Presently the unit have implemented Coal briquetting plant, Micro Pelletization, sludge agglomeration plant, ferrous briquetting plant, Mill scale brick making plant, Steel slag metal recovery & screening plant, Oily sludge injection in BF, Corex coal fines injection in BF, Chamber lumps crushing and screening plant, magnetic separation plant for dusts like Blast furnace dust catcher, LF Slag, etc. This has enabled the solid waste utilization to reach 70% in 2021. Capacity expansion of our existing units and installation of new facilities like Steam Box aging (new BOF units), LF Slag Briquetting Plant, Lime/Dolime briquetting Plant, Upgradation of Micro-pellet plant, Upgradation of slag metal recovery plant, etc will facilitate AMNS in increasing its solid waste utilization capacity to 100%. Along with this branding, sales and marketing efforts for slag sand, slag aggregate and eco-pavers/eco tetrapods are in line.

Along with Internal recycling AMNS is also developing various value added products to increase sale of by-products, especially steel slag. Products like Paver Blocks, Tiles, Garden Tiles, Concrete blocks, Fish reef, Tetrapods, etc have been developed in our in-house R&D Centre. Road has been constructed using Steel Melting processed slag.

Following technologies have been already implemented by AMNS India to gainfully utilize various solid waste generated within the steel plant

Coal Briquetting plant

AMNS uses non-coking coal for running its Corex units. Around 2000 TPD coal fines is generated during screening of raw coal which is imported. Initially coal fines were sold or given to our captive power plant, but we found a more economical solution for internal utilization. In 2013 R&D applied for a patent for developing an organic binder for briquetting of Corex coal that retains all the high temperature properties of coal required for use in Corex process. The unit also developed systems for injection of Corex coal fines as PCI in our BFs. Later to this development a 500 TPD Coal briquetting plant was setup in 2018 and a second unit of 1000 TPD is under Project stage. Consumption of coal briquettes in Corex reduces the gross purchase of coal and in-directly also reduces the generation of coal fines. The briquettes have good CSR, CRI, Thermal and Thermo-mechanical properties. Its uniform shape and size helps to improve process efficiency in Corex and helps to reduce fuel rate.

In future explore the possibility of using these briquettes in Coke Ovens for Coke making.

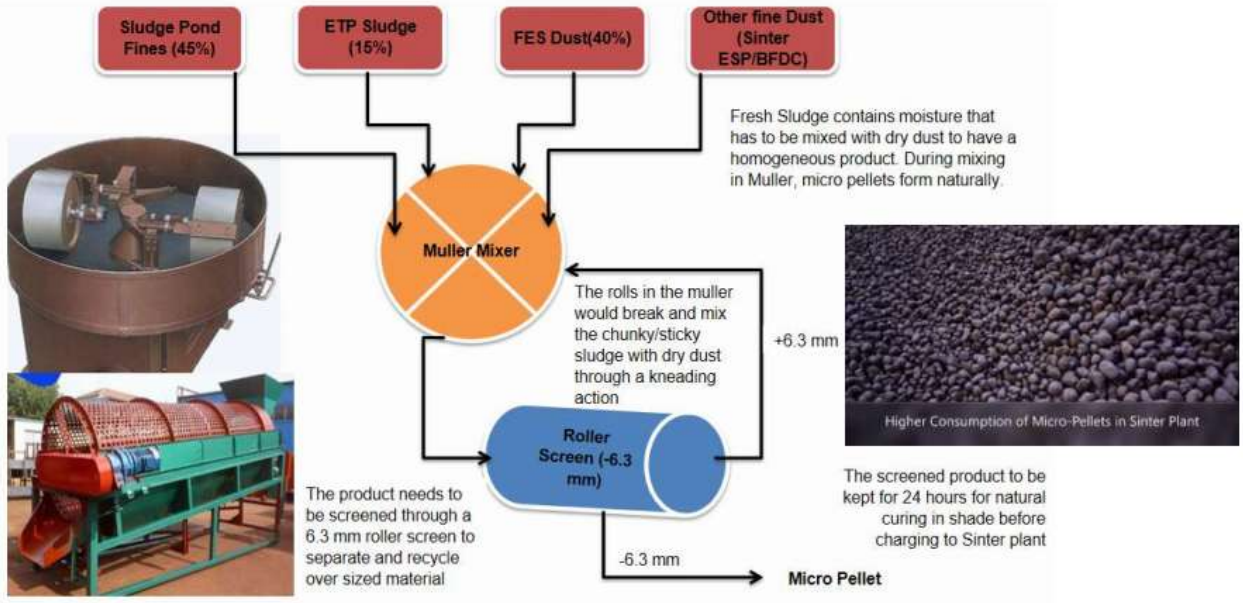
Photograph 4-1: Images of coal briquetting plant for corex coal recycling

Micro Pellet Plant.

Sinter plant at AMNS is one of its kind. This is only sinter plant that runs on 100% on by-Products. The sintering capacity is about 4500 TPD only as our blast furnace runs on 35% sinter and remaining pellets. Being a small sinter plant it has many other solid wastes to consume like pellet fines, BF return fines, Dusts from Steel making, Blast furnace, lime/dolime plants, and Sludges from Corex, Blast furnace, Midrex, Rolling mills effluent treatment plants, etc. Owing to high load of micro-fines dust and sludge it is difficult to maintain the productivity and quality of sinter. These wastes also led to problems during handling and transportation. The silos get jammed or sudden flushes were creating safety issues. The manual handling of dust led to air pollution and high dust load on the de-dusting systems affected its performance.

The unit developed an in-house technique of micro pelletization where wet sludge were coated with fine dust along with binder in a continuous mixing and kneading machine which produced uniform shaped micro-pellets strong enough for transportation without generating more fines on the way. The plant of about 900 TPD was installed and with increasing production after our expansion the unit are planning to upgrade it upto 3500 TPD capacity. Currently the existing sinter plant is running at a load of 25% micro-pellets which is highest amongst all other Indian plants.

Figure 4-29: Schematic flowchart showing micro-Pelletization of dust and sludge



Mill Scale Briquetting Plant

Mill scale is normally recycled through sinter route but owing to its flaky shape and oil content there is a limit to its utilization. Sinter plant uses about 6% mill scale and still the unit has about 150 TPD excess mill scale. The unit is also utilizing it in pellet making as mill scale undergoes exothermic reaction and generates heat, thereby reduces the fuel consumption in sinter or pellet making. Since the pellet plant is situated at another end of the country it is not economical to ship the mill scale that far. The development of mill scale brick plant solved this problem. The 60x60x60 mm cubical bricks using Mill scale and cement are charged in blast furnace. This product has sufficient strength to sustain blast furnace conditions and being a high Iron source increases the productivity of blast furnace. Today the blast furnace is running at a bench mark production of over 2.4 T/m^3/day. A 200 TPD mill scale brick plant is installed in 2020 and will help in achieving 100% recycling of mill scale.

Figure 4-30: Mill scale briquettes for recycling in blast furnace.

Metal Recovery plant for Steel Slag.

A Government of India undertaking company "Ferro Slag Nigam Limited" has been hired for treatment of Steel slag generated from Electric Arc furnace and Conarc furnace. Daily about 4000 Tonnes slag is processed under this facility. The plant has various processing units like Balling, magnetic separation and

screening. Non-Magnetic slag of various sizes are produced from 0-6.3 mm, 6.3 to 20 mm, 20-40 mm, 40-60 mm 60 to 150 mm and above. Finer fraction of magnetic and non magnetic slag are recycled back through sinter plant. The other fraction is sold for various application of road making, civil construction, irrigation projects, nation express highway, bullet train, internal road and rail projects and expansion projects.

Joint project with CRRI is going on for utilization of steel slag in construction of National highway. A patch of 1.25 km is under construction near our plant on NH53 to practically understand the performance of all slag road.

Steel Slag Road – A Sustainable Green Utilisation of Steel Slag in Road Construction

CSIR-Central Road Research Institute and Arcellormittal Nippon Steel Limited has constructed 1 km. long, six lane bituminuous steel slag road connecting NH6 to Hazira Port Road at Surat, Gujrat were constructed with 1 lakh tons of 100% processed electric arc furnace steel slag aggregates.

4.4.14 Biological Environment

The proposed activity may result in degradation of surrounding habitat, introduction of weeds, increased road traffic, habitat fragmentation. These activities may act at the larger level and reduce ecosystem resilience. Ecosystem resilience is the overall diversity of the habitat, which helps to resist the adverse conditions and or calamities that may seriously damage that particular habitat.

In general, impact prediction methods argue that the foremost step in impact appraisal must consider and identify project actions that are likely to bring significant changes in the project environment. Likely impacts on the biological components have been assessed considering that, all operational / engineering control suggested in EMP will be properly implemented.

Identification of Impacting Activities for the Proposed Project

Likely impacts on the biological components have been identified on the basis of activities and associated aspects involved in the different phases of project cycle and various ecosystems or habitats falling in the identified Likely impact zone area.

Impact on Riverine Ecology

Evaluation

Tapi river is located at the distance of 500 meter from the plant boundary in East direction as well as nearest mangroves is located at the distance of 0.56 km in East direction.

These diverse habitats support many bird species and release of waste water in tho the Tapi esturine area will reduce the population of zooplankton and Benthos and will have negative impact on avifaunal habitat.

Mitigation Measures

Total waste water generation from expansion units will be around 650 cu m/hr i.e. 15,600 cu m/day. A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of approx. 650 cu m/hr.

The permeate from CETP will be sent to BF and SMS as make-up to cooling tower. Reject generated in the RO plant will be partly used after dilution for sprinkler type suppression at raw material storage yard and balance will be fed to the evaporator-crystallizer. Sludge and salts generated in the CETP will be disposed at approved TSDF. Waste water after recycling shall be reused in the process and zero effluent discharge shall be maintained.

Impacts on surrounding habitats and associated biodiversity due to release of pollutants

Evaluation:

Surrounding habitats includes Reserve Forest, agriculture, sparse mangroves, mud flats and creeks. These diverse habitats support many bird species. Release of pollutants during operation phase will have impacts on these habitats if not properly managed.

Mitigation

Following measures will be implemented to mitigate this impact -

Greenbelt plan has been prepared in line with CPCB Greenbelt Development guidelines. Facts considered during selection of plant species for greenbelt development are:

- Type of pollutant (mainly air) likely to disperse from project activities.
- Agro-climatic zone and sub-zone of the project area
- Adaptability of plant species to the local environment
- Biological-filter Efficiency: Absorption of gases, Dust capturing and Noise control
- Plantation of threatened species to improve its population status in the study area

As per the greenbelt plan, total 33% area with tree density of 2500 nos. per Ha will be developed as greenbelt. Proposed to plant additional 3,93,021 trees in consultation with Forest Department. The total no. of trees after expansion will be 6,80,450.

Greenbelt plan includes 20m width tree plantation along the NH-6 between plant boundary & NH spanning 6.5 km. Also, GB along Hazira village side will also be intensified.

Impacts on Schedule and Threatened species.

Evaluation

It is revealed that buffer zone supports Schedule-I and other threatened species including one rare tree i.e. Adansonia Digitata (locally known as Rukh, Rukhdo). Release of pollutants in various modes during operation phase will have impacts on these habitats / species if not properly managed.

Mitigation

Conservation plant has been prepared for conservation of these species which includes awareness programme (village and school level) as well as habitat improvement programme through plantation of 12 suggested species in LIZ area. Out of these 12 species suggested to absorb various gas emissions, control dust emissions and to suppress noise levels. One tall tree species i.e. Borassus flabellifer suggested for plantation to improve vulture population in the study area since this tall tree provides nesting habitat for Vulture. Similarly, plantation of rare tree i.e. Adansonia Digitata at suitable places suggested to improve population of this rare tree species as a part of conservation plan.

In addition to it, certain project related activities can improve the surrounding environmental status in terms of improvement in infrastructural facility, natural resource, social and cultural development of the local community. These, changes can be identified as positive impacts of the proposed project.

Other Mitigation Measures

- State of art pollution control technologies have been selected to keep the emission low, hence insignificant impact on the nearby vegetation.
- The fugitive dust generated during operation phases shall be controlled by sprinkling of water.
- Tall trees with thick canopy will be planted along the boundary area to reduce fugitive dust emission and gaseous emission.
- To minimize the impact due to noise generated during the operational phase clear instruction will be given to the vehicles entering in the project site not to use pressure horns during night time as it may distract the fauna or animals near the site.
- Hunting, poaching and harassing of wild animals will be strictly prohibited. Boundary wall is erected at plant site to check the entry of animals in search of eatables.
- Wastes of the canteen will be properly disposed-off to prevent the chances of eating by wild animals, which may become hazardous to them.
- Special measures will be adopted to minimize impacts on the wild animals, birds such as avoiding noise generating activities during the critical periods of breeding.

Since the proposed project is expansion and most of facilities will be within the existing plant area, the overall impacts are predicted will be insignificant.

4.4.15 Socio economic

Impacts

Critically analyzing the existing environmental status of the socio-economic profile and visualizing the scenario with the project, the impacts of the project would be varied and may generate both positive and negative impacts of the proposed project in the region that are stated below.

Positive Impacts

Increase in Job Opportunities

As per the survey it has been observed that the population in general do not have opportunities of earning from employment and the non-worker population is higher in the region so the project in general will help to provide direct and indirect job opportunities for auxiliary and ancillary works etc. In the absence of any high employment potential activities, the people are economically weak.

Improvement in Infrastructure

The activity will benefit the local people due to provision of more infrastructural facilities and development activities under CSR

Adverse Impacts:

Impacts on Human Health

The project may have impact on the buffer zone villages due to air pollution. The impact from air emissions will be minimal due to state of art pollution control facilities proposed and adequate stack heights for efficient disposal of pollutants. Air emissions will remain well within the prescribed ambient air quality standards set forth by CPCB. The proponents of this facility will adopt effective control systems at all the identified sources of emission.

Impacts on Agriculture

Productivity of crops may be deteriorated affecting the agriculture-based livelihood due to the pollution arising out of the project activity, if proper mitigation measures are not implemented.

Impacts on Public Health and Safety

The discharge of waste materials (stack emission, wastewater and solid wastes) from process operations can have potential impact on public safety and health. It is predicted that the impacts on public safety will be very low, due to the effective safety system and safety management available in the plant.

Mitigation Measures

- Adequate measures have been envisaged in the project design to control air & noise pollution.
- Awareness programs shall be arranged on health, hygiene, sanitation and environmental protection
- At the work place, first aid facilities shall be maintained at a readily accessible place with necessary appliances including sterilized cotton wool etc. Ambulance facility shall also be provided during emergency
- Sufficient supply of potable drinking water shall be provided at suitable places.
- Sanitary facilities shall be provided at accessible place within the work place and shall be maintained in a good condition.
- Periodic health checkup camps, blood donation camps shall be organized by project authority for villagers, contract laborers, employees and their family
- Apart from the normal health checkup, emphasis on continual monitoring of health shall be organized to prevent occupational alignment/diseases such as respiratory ailments, skin problems, water borne diseases, hearing loss etc.
- Job oriented training courses shall be organized through industrial / technical training institutions for educated youth like on skill development trades like electrical, tailoring, plumbing, type writing, shorthand and machine repairing, welding, fabrication and social enterpreneurship development programs etc.
- Whenever necessary, collaboration between project authority and local bodies will be organised on regular basis with an objective to build and maintain a good relationship with the stakeholders, which is necessary for smooth functioning of the project as well as progress and welfare of the people in the study area.

No burden in the existing Infrastructure Facilities

Local work force will be given preference in the activity due to which influx of the outsiders is not envisaged or it will be very minimal. Thus, there will not be the necessity of provision of additional housing facility for the local workers and not stressing on the existing civic amenities of the area.

4.4.16 Occupational Health and Risk to surrounding community

No major occupational health hazards are envisaged in plant after adequate safety and environmental protection measures. Persons will be trained to take sufficient precautionary measures for safety and hygiene.

Project activities are not likely to cause changes in occurrence of disease or affect disease vector, though medical check-up of workers will be regularly done as per statute.

Also, the operating and maintenance personnel will be provided with all necessary safety appliances such as hand gloves, gum boots, aprons, helmets, dust mask, protective glasses, ear muffs etc.

Worker's training will focus on reduction of wastes, utilization of wastes and generally maintaining a clean and healthy environment.

4.5 Plan for implementation of the Recommendation made for Steel Plants in the Charter on Corporate Responsibility for Environment Protection (CREP) Guidelines

Plan for implementation of the Recommendation made for Steel Plants in the Charter on Corporate Responsibility for Environment Protection (CREP) Guidelines is given in table Below

Table 4-29: Action plan for CREP guideline

S. No.	Unit	CREP Requirement	Compliance Status / Action Plan
1	Coke Ovens	To meet the parameters PLD, PLL, PLO of notified standard under EP (Act)	Shall be complied. CO Battery#1&2 will be installed after getting the modification EC and CO Battery # 3,4,5 shall be installed under the proposed Upstream expansion. Following facilities proposed to meet the parameters PLD, PLL, PLO of the notified standard: Zero-leak self-sealing doors with door and door frames cleaner. High Pressure Hydro-jet door cleaner at end benches Water seal AP Caps on pusher side and coke side
2	Steel Melting Shop	Fugitive emissions – to reduce 100% (including installation of Secondary de-dusting facility)	SMS-1: Required fugitive emission control measures with Bag filters is in place. Secondary De-dusting system upgradation under implementation and will be established by Jun'2022 part of the Modification project. SMS-2: Required fugitive emission control measures with Bag filters and Secondary De-dusting facilities with Bag filters have already installed. SMS-3: Proposed and to be complied. To control fugitive emissions from the proposed BOFs, secondary emissions control system with doghouse & Bag Filter shall be installed.
3	Blast Furnace	Direct injection of reducing agent	Complied. Pulverized Coal Injection system has been installed with the existing Blast Furnace#1 and proposed with the new Blast Furnaces #2 &3. Present CDI Rate is approx. 200 kg /thm.
4.	Solid Waste /Hazardous Waste Management	100% utilization of Steel/Melting shop (SMS)/ Blast Furnace (BF) Slag	Partially complied. Approx. 90% of BF Slag is being granulated and sold to the Cement units. EAF slag is being used for road making, area levelling etc. and explored for using in National Highway projects, Bullet Train Project.
		Charge of tar sludge/ETP sludge to Coke Oven	Shall be complied. Decanter Tar sludge and BOD Plant sludge will be charged in Coke Ovens once commissioned.

S. No.	Unit	CREP Requirement	Compliance Status / Action Plan
5.	Water Conservation/ Water Pollution	To reduce specific water consumption to 5 m3/t for long products and 8 m3/t for flat products notified effluent discharge standard	Complied. Present Sp. Water consumption of the plant is 3.8 m3/ton of Crude Steel. After the proposed expansion Sp. Water Consumption is envisaged as 3.5 m3/ton. of Crude steel.
		To operate the Co-BP effluent treatment plant efficiently to achieve the norm	Shall be complied. A BOD Plant using a process of Anaerobic, Anoxic, Aerobic, and double membrane has been proposed for treatment Co-BP effluent. Coke Oven Effluent Standards notified under the GSR 277(E) dated 31st March 2012 shall be achieved.
6.	All major stacks	Installation of online stack monitoring & online ambient air quality monitoring stations	Complied. Online stack monitoring with all major stacks have been installed and shall be installed with all major stacks under the expansion. 4 nos. of Online ambient air quality monitoring stations have been installed.
7.	To operate the existing pollution control equipment efficiently and to keep proper record of run hours, failure time and efficiency		Being complied. Existing pollution control equipment are being operated efficiently, and proper record are kept for run hours, failure time and efficiency
8.	Implement the recommendations of Life Cycle Assessment (LCA)		Shall be complied
9.	Industry will initiate the steps to adopt the following clean technologies measures to improve the performance of industry towards production, energy, land environment:		
		Energy recovery of top Blast Furnace (BF) gas	Complied. TRT has been installed with the existing BF#1 and shall be installed with proposed BF# 2& 3
		Use of Tar- free runner linings.	Complied. We are using Tar-free runner linings.
		De- dusting of Cast house at tap holes, runners, skimmers ladle and charging points.	Complied. Cast House de-dusting systems have been installed with exiting BF#1 and shall be installed with the proposed BF# 2 &3
		Suppression of fugitive emissions using nitrogen gas or other inert gas	Will explore the possibilities.
		To study the possibility of slag and fly ash transportation back to the abandoned mines, to the abandoned mines, to fill up the cavities through empty railway wagons while they return to the mines and its implementation.	Not feasible as our Steel complex is located far away from Mines and Raw material is being transported by Ships
		Processing of the waste containing flux & ferrous wastes through waste recycling plant.	Complied. Flux and ferrous wastes shall be recycled through Sinter Plant

S. No.	Unit	CREP Requirement	Compliance Status / Action Plan
		To implement rainwater harvesting	Complied. We have implemented rainwater harvesting. Total 6,51,364 m3 rainwater harvested during the current year.
		Reduction Green House Gases by: Reduction in power consumption Use of by –products gases for power generation Promotion of Energy Optimization technology including energy/ audit	Being Complied. Current Energy conservation measures: Installation of VVFD in CWPS Cooling Tower 2 in Blast Furnace Tail gas recovery from HBI Plant. Installation of transparent sheet and utilization of day light in Plate mill Conventional illumination replacement with LED Reduction in pumping power by relocation of cooling tower overflow line from warm to cold sump Optimizing compressed air consumption Replacing existing screw and reciprocating compressors with high efficiency centrifugal compressor in HSM Under the proposed expansion 200 MW By-Product gas-based power plant shall be installed Energy optimization technologies such as; Coke Dry Quenching with 100 MW Power generation Top Recovery Gas Turbines with power generation of 50 MW shall be installed. Sinter plant Waste heat recovery and Heat recovery from Blast Furnace flue gases will be installed
		To set targets for Resource Conservation such as Raw material, energy and water consumption to match International Standards.	Being complied. We have already set targets for Resource conservations (Raw Material, Energy & Water) to match international standards. Specific Energy – 6.1 Gcal/tcs - Target 2030 Specific GHG Emissions – 2.01 tco2/tcs - Target 2030 Specific Water conservation – 2.95 m3/tcs - Target 2030
		Up- gradation in the monitoring and analysis facilities for air and water pollution. Also, to impart elaborate training to the manpower so that realistic data is obtained in the environmental monitoring laboratories	Complied. Online stack monitoring with all major stacks have been installed and shall be installed with all major stacks under the expansion. 4 nos. of Online ambient air quality monitoring stations have been installed.
		To Improve overall housekeeping	Being complied. Dust collection and extraction system is strengthened. Bag house capacity is increased & filter bags have been replaced. Manual water sprinkling is going on, in & around plant as well as on roads Road sweeping machines have been increased form 2 nos. to 7 nos. for effective road cleaning.

S. No.	Unit	CREP Requirement	Compliance Status / Action Plan
			Manual cleaning of the roads and the surrounding areas is enhanced by increasing additional manpower to 270 nos. per day. Regular cleaning is being done of Factory shed to remove dust deposition. Deployment of New battery operated sweeping machine used inside plants for cleaning purpose

5 ANALYSIS OF ALTERNATIVES (TECHNOLOGY AND SITE)

AMNSI proposes to undergo a brownfield expansion of the existing steel plant of AMNSI for production of liquid steel from 9.6 to 15.6 MTPA and corresponding 6.0 MTPA Hot Rolled Coils.

5.1 Analysis of Alternative Technology

AMNSI has selected the Blast Furnace (BF) – Basic Oxygen Furnace (BOF) – Caster - Hot Strip Mill (HSM) route for the the proposed expansion. The technology selected for expansion of existing integrated steel plant for production of liquid steel and various Sections along with Captive Power Plant is well proven, latest and technically & economically viable. AMNSI is already operating Blast Furnace, Slab Casters, CSP and Hot Strip Mill. For Steel making instead of Electic Arc Furnace (EAF) or Con – Arc Furnace, Basic Oxygen Furnace (BOF) is selected for the proposed expansion. Many operating steel plants in India and in the World are using similar technologies. Hence there will not be any risk of technological failure from this expansion project. A brief of the technology including Method of Work and Design parameters is given in ***Chapter 2.***

AMNS is further committed to use the best technology available for controlling, treating and disposing of all type of waste to be generated during the operation of proposed plant.

AMNS will use the existing technology for proposed expansion project due to following reasons.

- Existing technology is already well established and in operation
- Ease of training for new manpower as they can be trained in house
- Compatibility of available quality of raw material
- Fit in the available space

5.1.1 Proposed Technological Interventions

- Top Pressure Recovery Turbine (TRT) power Generation from both Blast Furnaces (New) and increasing Power generation from existing Blast furnace as we increase the existing BF production capacity.
- Power generation from Coke dry Quenching plants. Also space provision for future Carbon capture facility.
- Waste heat recovery from BOF to generate process steam
- Latest technology for environment management will be adopted in the sinter plant. Hot air from sinter cooler will be utilized as follows:

  a) Pre-heat the combustion air to save fuel.

  b) For steam generation (power generation/utilized as process steam)
- MEROS/Equivalent system will be installed with a gas conditioning tower and high temperature filter bags, has paved a possibility of drastically reducing outlet emissions.to have the better control on emission.
- Dry type gas cleaning plant in blast furnaces and SMS
- Process Gas grid to utilize most of the by product gas into the process through innovativetechnology to use lower Calorific values gas in re-heating process. Balance of gas will be used for power generation which would reduce the fossil based power demand.
- The Technical Specification for the expansion plants, the suppliers were asked to provide the State of the Art equipment for energy efficiency and lower carbon footprint. Also keeping provision for Hydrogen usage in future wherever feasible.
- Provision for Power requirement through Renewable energy sources.

- The overall expansion is to reduce the specific Carbon footprint of the AMNS Hazira plant. The Corex plants (Corex - Conarc Furnace route) has higher Carbon footprint compared to BF – Conarc route and BF – BOF route. The Corex Plant is proposed to be shutdown after expansion.

The details of air emission, waste water and solid wastes proposed to be generated and their disposal during operation phase are given in ***Chapter 2.*** Environment sensitivities present in the study area of 10 km around the proposed project site are given in ***Chapter 3.*** The anticipated adverse impacts shall be less due to the following:

- All statutory requirements, guidelines and recommendations of GPCB/CPCB/MOEF&CC shall be complied.
- Waste water to be generated shall be treated and used within the plant premises. No waste water shall be discharged outside the premises.
- 100% Solid waste to be generated shall either be utilized or disposed-off in environment friendly manner.
- Air emission shall be controlled by providing adequate pollution control equipment.
- Continuous efforts shall be made for improvement of the socio-economic status of the surrounding area.

5.2 Analysis of Alternative Site

The proposal under consideration is a brownfield project which would be located within the existing ISP works boundary operated by the group. This would enable appropriate sharing of the existing infrastructure, other ancillary and auxiliary facilities and ensure uninterrupted movement of various raw materials without additional cost or involving minimal augmentation of material movement logistics. Moreover, it is planned to utilize the unutilized land area under the possession of AMNSI along with the partial land occupied by the township and offices.

The proposed site also has the following advantages:

- The area is under Notified Hazira Industrial Area.
- Ensuring availability of adequate land for installation of units.
- Suitability of sharing existing infrastructure in terms of connectivity, water resource and grid power.
- Ease of raw materials acquisition and products transportation through the existing jetty.
- Can handle additional cargo up to 20 MTPA (Bulk RM + Break bulk) through Adani Hazira Port Ltd. (AHPL) as per the assurance letter received from AHPL.
- This project will help to boost the Western Region's infrastructure development of Gujarat under Atma Nirbhar Bharat scheme.
- Availability of economical labour force.

Environment Sensitivity of the Location

- There is no Wildlife Sanctuary / National Park / Bio-sphere Reserve / Habitat of Migratory birds within 10 km radius from the project site.
- There is no Tiger Reserves / Elephant Reserve / Turtle Nesting Ground within 10 km radius from the project site.
- There is no Archeological Monument / Defense installation within 10 km radius from the project site.

6 ENVIRONMENTAL MONITORING PROGRAM

6.1 Introduction

The monitoring and evaluation of the management measures envisaged are critical activities in implementation of the Project. The post project monitoring is an equally important aspect in Environmental Management Plan. In order to verify the outcome on the implemented mitigation measures discussed in ***Chapter 4*** and also to alter the proposed mitigation, the post project monitoring becomes inevitable. Monitoring involves periodic checking to ascertain whether activities are going according to the plan. It provides the necessary feedback for project management to keep the program on schedule. The purpose of the environmental monitoring plan is to ensure that the envisaged purpose of the project is achieved and results in desired benefits.

installation of Continuous Emission Monitoring Systems (CEMS) as per CPCB requirement and also periodic checking to ascertain whether activities are going according to the plans. CEMS shall provide necessary feedback to control room for process management to keep the emissions under norm. The purpose of the environmental monitoring plan is to ensure that the envisaged purpose of the project is achieved and results in desired benefits.

Various measures have been proposed in the environmental mitigation measures for mitigation of adverse environmental impacts. These shall be regularly monitored to ensure compliance to environmental statutory regulation and also to maintain a healthy environment around the complex.

For the effective implementation of EMP, AMNSI, Hazira has a dedicated Environmental Department. The department undertakes all the monitoring work to ensure the effectivenrss of environmental mitigation measures.

Incase the monitored results are found variance from norms in Ambient Air, Stack Emission, Work Zone Air Quality and Noise monitoring results, performance of ETPs, waste water discharge from outfalls is reported to the concerned department as well as to the higher management for necessary corrective action.

Apart from above monitoring programme, the following activities are being carried out to ensure the effectiveness of the mitigation measures:

- Third party Environmental Audits by GPCB approved auditors from various Technical academics are being carried out once in every year.
- Hazardous Wastes are being handled and disposed in accordance with Haazardous and Other Wastes (Management and Transboundary Movement) Rules,2016.
- All major Existing stacks have been provided with Online Continuous Emission Monitoring systems (CEMS) & its real time data is being transferred to process control rooms and CPCB server.
- Four Continuous Ambient Air Quality Monitoring Stations (CAAQMS) established and its real time data is being transferred to CPCB server.
- Similarly, at 03 nos. of waste water discharge out falls, Online Continuous Effluent Quality Monitoting Systems (CEQMS) are installed and its real time data is being transferred to CPCB server.
- Entire environment monitoring has been carried out by NABL Accredited /MoEF&CC Empaneled laboratory for compliance requirement of MoEF&CC standards/GPCB consent conditions/CPCB Guidelines.

6.2 Objective of Monitoring

To ensure the effective implementation of the proposed mitigation measures, the broad objectives of monitoring plan are:

- Evaluate effectiveness of implementation of mitigation measures identified.
- Measure effectiveness of operational procedures
- Confirm statutory and mandatory compliance
- To evaluate the adequacy of Environmental Management Plan and to suggest improvements in management plan, if required

A detailed monitoring of emissions and effluent sources for different environmental parameters will be carried out as per the present norms and any further notification/direction from Gujarat Pollution Control Board (GPCB), Central Pollution Control Board (CPCB) and MoEF&CC. Monitoring methodologies will follow standard methods prescribed by CPCB, Bureau of Indian Standards (BIS), USEPA, AWWA etc.

6.3 Monitoring shall be carried out for the following:

- Ambient Air Quality,
- Stack Emission,
- Work zone Air quality,
- Surface water and Ground Water Quality,
- Noise Level
- Parameter to be monitored shall be in accordance to the statutory norms (CPCB and Factory Act)

6.3.1 Ambient Air Quality

Ambient Air Quality is being monitored regularly at 07 locations manually in accordance with CPCB/GPCB guidelines. Presently Four continuous online Ambient Air Quality monitoring stations were established and its real time data is being transferred to CPCB server.

The parameters monitored include the parameters and frequency as per National Ambient Air Quality Standard, 2009. After the implementation of the expansion plan the ambient air shall be regularly monitored* as given in ***Table 6-1***

Table 6-1: Ambient Air Monitoring Stations

S.NO.	Monitoring Area	Sampling Locations	Parameters	Frequency
1	Ambient Air Quality	**Manual Monitoring:** 1. Briquette House, 2. SVC – MRSS, 3. Near Suprabhat, 4. CRM Office, 5. AMNSI Township 6. Hazira – Village 7. AMNSI Power	PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, Ammonia, Ozone, Benzene, Benzo(a) Pyrine, Lead, Nickel, Arsenic.	Twice in a Week.
		CAAQMS 1. East Station 2. West Station 3. South Station	PM_{10}, $PM_{2.5}$, SO_2, NOx, CO, Ammonia, Ozone, Benzene.	Online (Continuous)

S.NO.	Monitoring Area	Sampling Locations	Parameters	Frequency
		4. North Station		
AMNSI is going to add two more CAAQMS in consultation with GPCB				

6.3.2 Stack Emissions

Periodical monitoring of stack for PM, SO2, NOx and CO in case of process stacks shall be done to assess the performance of pollution control facilities installed at the unit. In case emissions are found to exceed the norms the concerned departmental personnel shall check the relevant process parameters and take appropriate corrective action. Emissions from all the stacks shall be monitored once in a month using the manually operated stack emissions monitoring equipment. However, the frequency of monitoring may be increased if required in accordance with the stipulations of GPCB / CPCB or other statutory authorities.

All major stacks of the existing plant have been provided Continuous Online stack monitoring systems and its real time data is being transferred to CPCB server. Apart from this, manual monitoring for PM, SO2, NOX is also being carried out at existing stacks to cross check the online data and same practice will be continued in future also for modicfication as well as expansion project.

Table 6-2: Stacks monitoring details

Existing stacks (Nos.)	Modification Project stacks (Nos.)	Proposed expansion stacks (Nos.)
85	64	35

Details of proposed stack is given ***Table 6-3.***

Table 6-3: Details of Proposed stacks

Stack. No	Plant/process	Stack Attached to
Propsoed Stack		
S1	Coke Oven	COB#3&4
S2		COB#5&6
S3	Sinter Plant-2	Process Waste Gas
S4	Sinter Plant-3	Process Waste Gas
S5	Blast Furnace-1 after upgrade (3 mtpa)	BF#1STOVE
S6	Blast Furnace-2 (4 mtpa)	BF#2STOVE
S7	Blast Furnace-3 (4 mtpa)	BF#3STOVE
S8	Lime Calcining Plant	LimeKiln#1 (600 tpd)
S9		LimeKiln#2 (600 tpd)
S10		LimeKiln#3 (600 tpd)
S11		LimeKiln#4 (600 tpd)
S14	Mills	HSM-RHF#1 (420 tph)
S15		HSM-RHF#2 (420 tph)
S16		HSM-RHF#3 (420 tph)
S17		HSM-RHF#4 (420 tph) (Future)
S18	Byproduct gas based captive power plant	CPP
S19	Coke Oven	CDQ#1
S20		CDQ#2

S21	Sinter Plant-2	Dedusting
S22	Sinter Plant-3	Dedusting
S23	Blast Furnace-1 after upgrade (3 mtpa)	BF#1CH1
S24	Blast Furnace-2 (4 mtpa)	BF#2CH1
S25		BF#2CH2
S26	Blast Furnace-3 (4 mtpa)	BF#3CH1
S27		BF#3CH2
S28	SMS -3	Secondary Emission Stack 1
S29		Secondary Emission Stack 2
Material handling Stacks		
S30	Coke Ovens	COB#3&4DE
S31		COB#5&6DE
S32	Sinter plant	Fuel & flux building
S33	Blast Furnace-1 after upgrade (3 mtpa)	BF#1SH (Iron Fine-1)
S34	Blast Furnace-2 (4 mtpa)	BF#2SH (Iron Fine-1)
S35	Blast Furnace-3 (4 mtpa)	BF#3SH (Iron Fine-1)

6.3.3 Periodic Efficiency Monitoring of Pollution Control Equipment

A detailed maintenance schedule shall be drawn for all pollution control systems. The maintenance shall be done strictly as per schedule and guidelines furnished by plant manufacturer. All pollution control, monitoring and safety equipment shall be periodically checked and calibrated. Efficiency of the air pollution control equipment shall be checked once in a year as per guidelines furnished by and maintenance work shall be taken-up, if required.

6.3.4 Fugitive Emissions

Fugitive emissions shall be measured at eight (8) locations at a distance of about 5-10 meters from the source of fugitive emissions, monitoring is carried out monthly and values shall be compared with the standard notified under G.S.R. 277 (E) dated 31st March,2012.

6.3.5 Meteorology

The plant has a designated automatic weather monitoring station inside the plant at R&D area from which meteorological data is being recorded and archived. The continuous monitoring will help in emergency planning and disaster management.

6.3.6 Noise Monitoring

Noise monitoring shall be carried out at near to the high noise generating areas once in six months and shall be compared with as per the requirement of Occupational Safety and Health Administration (OSHA) Standards.

Monitoring of Ambient noise levels will be monitored once every month during day time (6 AM to 10 PM) and night time (10 PM to 6 AM) as per Schedule of the Noise Pollution (Regulation & Control) Rules, 2016 at Industrial, Commercial, Residential and Silence Zone for Ambient Noise Quality.

6.3.7 Effluent Quality

Effluent quality at inlet and outlet of ETP from different plants is being monitored on daily basis by individual plant ETP operation team to assess the performance of Effluent Treatment facilities. Water quality is also being monitored at the intake reservoir.

There will be no effluent discharge after the proposed expansion as the plant will adopt zero liquid discharge (ZLD) concept. Domestic water generated will be treated in Sewage Treatment Plant and blow-down water from Cooling Tower, DM Plant regeneration water and Boiler blow down water will be treated in Effluent Treatment Plant. Treated water will be used for horticulture, slag cooling, dust suppression etc.

6.3.8 Ground Water Quality

Ground water shall be sampled from up gradient and down gradient of the proposed slag bank to check for possible contamination and to ascertain the trend of variation in the water quality, if any. In case any adverse trend is noticed, immediate remedial measures shall be taken.

A total of four samples shall be collected from nearby slag dump yard and will be compared with IS: 10500:2012 drinking water standards.

Surface water samples are collected from River near to industry location once in a month and analysed for relevant parameters.

6.3.9 Solid / Hazardous Waste Generation & Utilization

Re-cycling and utilization of generated solid waste monitoring, characterisation analysis and TCLP as per the requirement of applicable guidelines / once in 3 years will be done. Hazardous waste shall be disposed off as per statutory guidelines.

6.3.10 Green Belt Development

The plant has a dedicated Horticulture department which is responsible for appointing agencies for carrying out plantation works. The Horticulture Department will prepare Annual plans for tree plantation with specific number of trees to be planted and also responsible for ensuring the plantations are carried out as per the CPCB guidelines.

The Horticulture department shall be regularly monitored the growth of plantation, its maintenance and survival rate. Photographs (before & after plantation, before & after monsoon) will be collected as records to aid in monitoring growth & survival.

6.3.11 Occupational Health and Safety

AMNSI has full fledged Care Nursing Home of 40 beds near to plant at Township and full fledged Occupational Health Centers at different plant areas inside the plant. The care nursing home has facilities of PFT, Audiometry, Vision Test, Blood Test, ECG etc.

A systematic programme for medical check-up at regular intervals is followed for all workers and employees to ascertain any changes in Health condition due to the working conditions.

The plant has a dedicated Safety Department whose responsibilities is to look out safety of their respective plant. With help of all Plant HSE Engineer all the safety practices before executing any work used to take such as starting with quantitative & qualitative risk assessment of work- HIRAC & HAZOP, PSSR/ PCSR, JSA. Alongwith it their procedure of reviewing all SOPs through Job Cycle Check (JCC). To maintain 5S in organisation we used to conduct Cross Functional Good Housekeeping Audit. Moreover, for horizontal

deployment of all safety practices we used to review investigation of the incident. For the stoppage of any incident to re-occur.

Annual Amount of INR 6 crore will be spent on worker's health and safety

Table 6-4: Pre-employment: Periodical Examination- In the first six months of the year

EXAMINATION	PURPOSE
Complete Blood Count	Identifies cases of Anaemia (low Haemoglobin), high WBC counts and bleeding disorders (low platelet counts)
Blood Sugar	Identifies early cases of Diabetes and informs on blood sugar control of known Diabetics
Lipid Profile (Cholesterol, HDL,VLDL, Triglycerides, ratios)	High Blood Lipids makes a person more susceptible to Heart disease
Routine Urine	Identifies Kidney function and Urinary tract infections
Abdominal Ultrasound	Identifies abnormality in Liver, Kidneys, Gall Bladder, Urinary bladder, Prostate and Spleen
Audiometry Test - Air Conduction	Determines Hearing status of employees
Lung Function	Quantifies lung capacity
Vision Test - Far, near & Colour	Determines Visual acuity, which may require correction with glasses
Electrocardiography	Determines the electrical function of the heart
Physical Examination	Medical history, Blood Pressure (BP) and general examination

Table 6-5: Periodical Examination- In the second six months of the year

EXAMINATION	PURPOSE
Complete Blood Count	Identifies cases of Anaemia (low Haemoglobin), Blood cancers (high WBC counts) and bleeding disorders (low platelet counts)
Routine Urine	Identifies Kidney function and Urinary tract infections
Vision Test - Far, near & Colour	Determines Visual acuity, which may require correction with glasses

6.3.12 Accidents Monitoring

AMNSI has established procedures and systems for reporting and recording of Occupational accidents and dangerous occurrences and incidents.

These systems shall enable workers to report immediately to their immediate supervisor any situation they believe presents a serious danger to life or health. The systems and the employer shall further enable and encourage workers to report to management all:

- Occupational injuries and near misses;
- Suspected cases of occupational disease; and
- Dangerous occurrences and incidents.
- Environmental accidents & spillages

All reported occupational accidents, occupational diseases, dangerous occurrences, Environmental spillages and incidents together with near misses shall be investigated with the assistance of a person knowledgeable/competent in occupational safety & Environment. The investigation shall:

- Establish what happened;

- Determine the cause of what happened; and
- Identify measures necessary to prevent a recurrence.

Table 6-6: Environmental Monitoring Plan

Sl. No.	Parameters	Measurement Methodology	Frequency	Location	Data Analysis	Reporting Schedule	Capital Cost in INR	Recurring Budget in INR / year
A	Air							
1	Ambient air monitoring of parameters specified by GPCB consents from time to time (PM10, PM2.5, SO2, NOx, CO)	IS 5182 NAAQS,2009 & CPCB Guidelines Vol. 1 (Gravimetric Method)	Twice in a Week.	7 locations – manual 6 locations – (CAAQMS)	Comparison with National Ambient Air Quality Standard, 2009 and previous baseline data of the area, if available	Compliance report of EC to MOEF&CC on 6 monthly basis and Compliance report of consent to GPCB as per requirement. Reports to be sent to top management and the process manager as well.	--	2000 per sample x 742 samplers = INR 14,84,000
2	Installation of CAAQMS	Online	Contiinuous	Locations in consultation with GPCB	-do-	Real time data transfer to GPCB & CPCB	500,00,000	50,00,000
3	Stack monitoring of parameters specified by GPCB consents from time to time	Stack monitoring by Isokinetic sampling IS: 11255.	once in a month	All process stacks of plant in rotation	Comparison with G.S.R. 277 (E) and/or limits specified by GPCB in consents	Compliance report of EC to MOEF&CC on 6 monthly basis and Compliance report of consent to GPCB as per requirement Reports to be sent to top management and the process manager as well.	--	2250 per stacks x 229 stacks x 12 = INR 61,83,000
4	Installation of Online CEMS	Online	Continuous	At all major process stacks under expansion	-do-	Real time data transfer to GPCB & CPCB	50,00,00,000	500,00,000

Sl. No.	Parameters	Measurement Methodology	Frequency	Location	Data Analysis	Reporting Schedule	Capital Cost in INR	Recurring Budget in INR / year
5	Fugitive emission monitoring for parameter PM10	IS 5182 & CPCB Guidelines Vol. 1 (Gravimetric Method)	Once in a month CEMS - Continuouly	At Site	Comparison with G.S.R. 277 (E)	Compliance report of EC to MOEF&CC on 6 monthly basis and Compliance report of consent to GPCB as per requirement Reports to be sent to top management and the process manager as well.	--	3000 per location x 5 locations x 12 = INR 1,80,000
6	Work-zone Air Quality	IS 5182 & CPCB Guidelines Vol. 1 (Gravimetric Method)	Once in a year	16 locations	Comparison with TLV under Factories Act	Compliance report of EC to MOEF&CC and Compliance report of consent to GPCB in case on new/expansion/renewal application or as per requirement	--	500 x 16 locations x 12 months = INR 96,000/-
B	Water							
7	Maintaining record of water consumption and wastewater generation	SOP of maintaining record of flow meter for water consumption and wastewater generation	Daily	Near fresh water consumption tank and treated effluent collection tank	Comparison with allowed water consumption and effluent generation as per Consents and EC	Compliance report of EC to MOEF&CC on 6 monthly basis and Compliance report of consent to GPCB as per requirement Reports to be sent to top management and the process manager as well.	--	Plant staff will maintain the record
8	Monitoring of industrial and Domestic	IS: 2490 and IS:3025 APHA: 23rd Edition, 2017	Internal: daily basis by individual	Inlet and out let of ETPs and STPs	Comparison with Schedule – VI of Environmental	Compliance report of EC to MOEF&CC on 6 monthly basis and Compliance report	--	2000 per sample x 28 samples (10 ETP + 4 STP inlet

Sl. No.	Parameters	Measurement Methodology	Frequency	Location	Data Analysis	Reporting Schedule	Capital Cost in INR	Recurring Budget in INR / year
	effluent of parameters		plant ETP operation team External once in a month		(Protection) Rules, 1986	of consent to GPCB as per requirement Reports to be sent to top management and the process manager as well.		and outlet) x12 = INR 672,000
9	Monitoring of groundwater	APHA : 23rd Edition, 2017	4 locations Once in a month	Inside & out side nearby slag dump yard	IS: 10500:2012 drinking water standards.	Compliance report of EC to MOEF&CC on 6 monthly and Compliance report of consent to GPCB in case on new/expansion/renewal application, if it mentioned	--	2500 per sample x 4 location x 12 months = INR 1,20,000/-
C	Noise							
10	Ambient Noise level	IS 9989 : 1981	Once in month	27 locations	Comparison with the Noise Pollution (Regulation & Control) Rules, 2000	Compliance report of EC to MOEF&CC on 6 monthly and Compliance report of consent to GPCB in case on new/expansion/renewal application or as per requirement	--	1000 x 27 locations x 12 months = INR 3,24,000/-
11	Work Zone Noise monitoring	SLM	Once in a year	30 locations	Comparison with OSHA Standard for Work-zone noise	Compliance report of EC to MOEF&CC and Compliance report of consent to GPCB in case on new/expansion/renewal application or as per requirement	--	1000 x 30 locations = INR 30,000/-
D	Solid /Hazardous Wastes							

Sl. No.	Parameters	Measurement Methodology	Frequency	Location	Data Analysis	Reporting Schedule	Capital Cost in INR	Recurring Budget in INR / year
12	Maintaining record of Hazardous Waste Generation, Storage and Disposal	SOP of Hazardous waste management. HW shall be identified as per Schedule-I & II of Hazardous and Other Wastes (Management & Transboundary) Rules, 2016 and shall be treated, store and disposed as per the Rule	Regular. Maintain hazardous waste generation, disposal and stock data as and when generated and disposed.	Hazardous waste storage facility	Comparison of concentration of hazardous constituents with the HW Rule in TCLP test of the waste for categorisation and quantity as permitted under for quantity with permitted limit as per under Consent / Authorisation	Maintain Form 3 monthly Form-4 & Form-5 annually to GPCB. Compliance of Consent to GPCB, reporting to higher authority as per company procedure Reports to be sent to top management and the process manager as well.	--	Will be done by inhouse staff only
13	Characterisation analysis & TCLP	USEPA 1311	Once in a 03 years	At Site	-	--	--	2500 per samples x 12 = INR 30,000
E	Miscellaneous							
14	Monitoring of Greenbelt	As per CPCB Guideline	Regular	At site	Survival rate, water consumption as well as photographs (before and after every 6 months)	---	--	Will be done by inhouse staff only

Sl. No.	Parameters	Measurement Methodology	Frequency	Location	Data Analysis	Reporting Schedule	Capital Cost in INR	Recurring Budget in INR / year
15	Occupational Health & Safety (OHS)	As per validity of the certificates	Regular	At site	Inspection / Certification of Safety Appliances and Pressure Vessels / Boilers	AS per Factory's Inspector's requirement	--	INR 6,00,00,000
		Periodical Medical Examination	Once in year	At OHC	Medical examination on joining and regular	As per Factory's Act and others		
16	Readiness for Emergency Response	Conduct mock drill in presence of observer	Once in a six months	Various locations.	Mock drill report for identifying deficiency and opportunities for improvement	Mock drill report sent to Management as and when mock drills are conducted	--	INR 1,00,000
17	Efficiency Monitoring of Pollution Control Equipments	Will be provided by the agency, engaged	Once in year	At Site	Efficiency of the pollution control equipment shall be checked and compared with the designed efficiency	Report to be sent to top management and the process manager as well.	--	INR 10,00,000
TOTAL							**55,00,00,000**	**12,52,19,000**

6.4 Permissible Exposure level (PEL) and Mitigation Measure

AMNSI will adopt suitable measures for the proper occupational health safety of workers complying with OSHA standards. Permissible Exposure Level (PEL) of various Chemical Handled onsite are listed below in ***Table 6-7.***

Table 6-7: PEL level Summary as per OSHA

S. No.	Chemical Name	OSHA PEL	Cal/OSHA PEL	NIOSH REL	ACGIH
		mg/m3	8-hour TWA (ST) STEL (C) Ceiling mg/m³	Up to 10-hour TWA(ST) STEL (C) Ceiling mg/m³	TLV
1.	Coal Dust			1	0.9 (resp.) bituminous or lignite; 0.4 (resp.) anthracite (coal dust to be monitored for crystalline silica
2.	a) Respirable fraction less than 5% SiO2	2.4 mg/m³	0.9 (bituminous)		
	b) Respirable fraction greater than 5% SiO2	10 (%SiO2)	0.1 (bituminous)		
3.	Iron oxide	10 (fume)	5 (fume)	5 (dust and fume)	5 mg/ m³
4.	Limestone				
	Total Dust	15 mg/m³	10 mg/m³	10 mg/m³	
	Respirable dust fraction	10 mg/m³	5 mg/ m³	5 mg/m³	
5.	Gypsum				
	Total Dust	15 mg/ m³	10 mg/ m³	10 mg/m³	
	Respirable dust fraction	10 mg/ m³	5 mg/ m³	5 mg/m³	
6.	Quartzite	5 mg/ m³	2 mg/ m³	2 mg/m³	2 mg/ m³
7.	Carbon Monooxide	55 mg/ m³	25 ppm	35 ppm	25 ppm

Reference- OSHA/PEL exposure limit Guide

Mitigation Measures

- Dust Exposure level of shop floor workers shall be appropriately monitored.
- Check of the effectiveness of preventive and control measures on regular basis.
- Adequate supplies of potable drinking water is to be provided. Water supplied to areas of Plant food preparation or for the purpose of personal hygiene (washing or bathing) are according to drinking water quality standards
- Where there is potential for exposure to harmful dusts by ingestion arrangements are to be made for clean eating areas, where workers are not exposed to the hazardous or noxious substances
- Periodic medical hearing checks are to be performed on workers exposed to high noise levels

- Provisions are to be made to provide OHS orientation training to all new employees to ensure they are apprised of the basic site rules of work at / on the site and of personal protection and preventing injury to fellow employees
- Contractors that have the technical capability to manage the occupational health and safety issues of their employees are to be hired, extending the application of the hazard management activities through formal procurement agreements
- Ambulances and first aid treatment facilities are made available for any emergency situation
- PP is carrying out the Annual Medical Check-up /Pre-employment check up for their employees regularly and records are being maintained at Medical facility as per Factories Rules. These records have been verified by statutory officials during their inspections.

6.5 Evaluation for Specific Health Status of Workers

As this is an expansion project, company is already in practice to conduct the evaluation of workers health in pre designed format. All the workers working in the company are evaluated pre-placement and periodically for chest X-rays, Audiometry, Spirometry, Vision testing (Far & Near vision. color vision and any other ocular defect) ECG. The format of evaluation sheet is provided below:

Spirometry Tests						
Year	Total Manpower	FVC (litres)	FEV 1	FEV 1/ FVC %	PEFR	Conclusion

Physical Examination Tests								
YEAR	Total Manpower	Pulse	ECG	BP	Right Eye	Left Eye	Color Blindness	Squint

Investigations Tests					
YEAR	Total Manpower	Blood (CBC)	Blood Sugar (F& PP)	Lipid profile	URINE (R&M)

Audiometry Tests					
YEAR	Total Manpower	Audiometry done	Normal	Abnormal	Conclusion

AMNSI has full fledged Care Nursing Home of 40 beds near to plant at Township and full fledged occupational Health Centers at different plant areas inside the plant. The care nursing home has facilities of PFT, Audiometry, Vision Test, Blood Test, ECG etc.

6.5.1 Annual report of health status of workers with special reference to Occupational Health and Safety

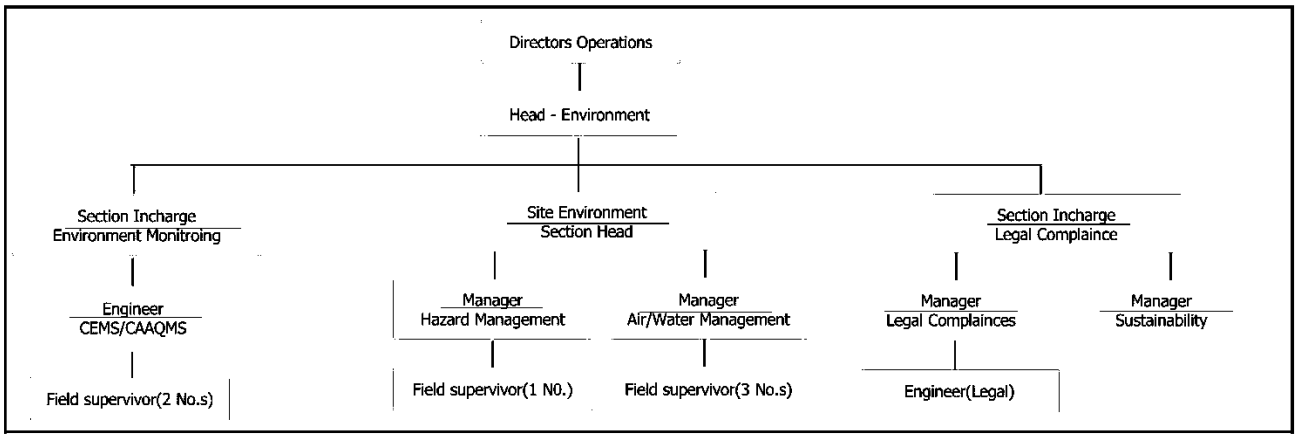
Report of the latest conducted evaluation for health status of workers on the above-mentioned parameters as per age, sex, duration of exposure and department wise is provided a ***Annexure 32***. Annual report of health is always reviewed for the facility and necessary actions are taken in the facility for maintaining the OHS.

6.6 Environment Health & Safety (EHS) Department

AMNSI is responsible for implementation Environmental Monitoring Program. A separate department for Environment Management (EMD) headed by General Manager (ENV) exists in the company to look after all

environmental related matters of the plant. The EMD supervise the activities time to time for smooth implementation of Environmental Monitoring Program, ensuring the 100% legal compliance, project approvals and and will take necessary actions if required for any environmental deviation. The EMD will act to ensure the suitability, adequacy and effectiveness of the Environment Monitoring Program and will also ensure to meet all the Statutory Requirements. The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental standards is presented below:

Figure 6-1: Organization chart of EHS



6.7 Progress Monitoring and Reporting

The environment monitoring plan enables environmental management system with early sign of need for additional action and modification of ongoing actions for environment management, improvement and conservation. The environmental monitoring points will be decided considering the environmental impacts likely to occur due to the operation of proposed project as the main scope of monitoring program is to track, timely and regularly, the change in environmental conditions and to take timely action for protection of environment Monitoring of environmental samples will be done as per the guidelines provided by MoEFCC/CPCB/GPCB. Separate records for water, wastewater, solid wastes, air emission, soil and manure/ compost will be prepared and preserved regularly. Along with other budgets, Budget for environmental management will be prepared and revised regularly as per requirement.

6.8 Updating of EMP

Time to time updation of EMP will be taken keeping in view of directives from MoEF & CC and regulations in force at any time shall govern the periodicity of monitoring and implementation of suggested / recommended in the Environmental Monitoring Programme be taken as EMPs to effectively implement the measures for continual improvement in Environmental performance.

7 ADDITIONAL STUDIES

7.1 Comprehensive Risk Assessment

Risk Assessment is proven valuable management tool in assessing the overall safety performance of the industry. Although management systems such as engineering codes, checklists, and reviews by experienced engineers have provided substantial safety assurances to the industry, major incidents involving numerous casualties, injuries and significant damage can occur as illustrated by recent world-scale catastrophes. Risk Analysis techniques provide advanced quantitative means to supplement other hazard identification, analysis, assessment, control and management methods to identify the potential for such incidents and to evaluate control strategies.

In Risk assessment studies the first step would be the Hazard Identification & quantification. This involves Hazard analysis which essentially is identification and quantification of the various hazards that are likely to occur in the industry as well as quantification of the consequences due to a particular hazard. The risk analysis estimates the probability as well as severity of a particular hazard over an exposed group of people, plant equipment or both.

Hazard identification and Risk assessment (HIRA) assists in identifying the most likely hazards which can have significant impact on workplace safety in an industry. It helps in devising effective management measures as well as engineering measures for both preventive as well as post-disaster management.

The underlying basis of Risk Analysis is simple in concept. It offers methods to answer the following four questions:

- What can go wrong?
- What are the causes?
- What are the consequences?
- How likely is it?

This study tries to quantify the risks to rank them accordingly based on their severity and probability. The report should be used to understand the significance of existing control measures and to follow the measures continuously. Wherever possible, additional risk control measures should be introduced to bring down the risk levels.

The assessment has been made in a systematic manner covering the requirements of the "Manufacture, Storage and Import of Hazardous Chemicals Rules (MSIHC) Rules. 1989". Accordingly subsequent sections have been divided as follows:

i. Process description
ii. Applicability of the rule
iii. Description of hazardous chemicals
iv. Hazard identification & risk analysis (HIRA)
v. Hazard assessment
vi. Consequence analysis including MCACA
vii. Brief description of the measures taken and
viii. On site emergency plan

Accordingly next sections are elaborated.

7.1.1 Process Description

AMNSI proposes to undergo a brownfield expansion for production of liquid steel from 9.6 to 15.6 MTPA and corresponding production of 6.0 MTPA hot rolled coils.

The major production facilities envisaged for the project will comprise of by product recovery-based Coke Ovens, Blast Furnace, ~~and~~ Steel Melting Shop (BOF), Slab Caster and Hot Rolling Mill~~s~~. The plant will have its captive power plant which will utilize surplus by-product fuel gas & steam from CDQ and TRT to produce power. The plant will also have its Lime Calcining Plant. Sinter Plant and Air Separation Plant for producing oxygen, nitrogen and argon required by various units shall be available from existing facilities already installed or under implementation.

Table 7-1: Proposed Unit Configuration with Capacity in TPA

Name of Facility	Configuration	Capacity (TPA)
Coke Ovens	4x59 Ovens By-product Recovery Type	3,050,000
Sinter Plant	~650 sqm (2 Units)	7,000,000
Blast Furnace	Up-gradation of existing BF#1 BF#2 & BF#3 (2x4500 Cum.)	960,000 8,000,000
Steel Melting Plant#3	3 x350 MT BOF (2/3 Operation)	6,000,000
Calcination Plant*	4x600 TPD + 1x500 TPD + 1x200 TPD Rotary Kiln	800,000 +2,70,000*
Hot Rolling Mill (HRC)	1 x 6 MTPA	6,000,000
CRM**	1 x 2.2 MTPA 1 x 1.0 MTPA	3,200,000
CPP	Gas Based Power Plant 2 x 100 MW Top Recovery Gas Turbine 2 x 25 MW	200 MW 50 MW
WHRB	Coke Dry Quenching	100 MW
* 1x 500 + 1 x 200 TPD Project is part of Modification Project, EC received in March 2022 ** Expansion of CRM Project is part of Modification Project, EC received in March 2022		

The proposed process for steel making is through Blast Furnace (BF)-Basic Oxygen Furnace (BOF) route with Continuous Casting for converting liquid steel to Slabs (BF-BOF-CCM) and subsequent rolling in Hot Strip Mill for production of Hot Rolled Coil (HRC).

The principal process steps are;

- Coke making in recovery type Coke Ovens
- Sintering of iron ore fines with coke fines, flux and recycled dusts to make sinter burden for BF.
- Iron making in Blast Furnaces (BFs) from iron ore pellets produced in AMNS Plants at Vizag and Paradeep and sintered ore, coke and fluxing materials to make hot metal.
- Conversion of hot metal to liquid steel by oxygen blowing in BOFs followed by refining of liquid steel in ladle furnaces and RH-Degasser with addition of alloying materials to achieve desired steel chemistry.
- Continuous casting of refined liquid steel to the Slab in Slab casters.
- Hot rolling operations to produce desired size and dimensions of Hot Rolled Coils

The plant will have its captive power plant (CPP) which will utilize surplus by-product fuel gas, steam from coke dry quenching (CDQ) and top recovery turbine (TRT) to produce power. The plant will also have its lime

calcining plant. Air Separation Plant for producing oxygen, nitrogen and argon required by various units shall be available from existing facilities already installed or under implementation.

From the process description it can be noticed that the process of manufacture requires considerable thermal energy. This thermal energy is supplied through fuel gasses generated in the plant e.g. Coke oven gas, Blast Furnace gas, BOF gas and Tail Gas. If there is any shortfall of these generated gasses then fuel gas is also supplied from outside source also. In plant generation of fuel gasses will not meet the requirement of proposed capacity. Therefore use of Natural Gas has been considered. Further Oxygen is also required. Therefore to run the plant, it is required to store all these chemicals along with their distribution arrangement. In addition to this also some other hazardous chemicals, which are required in the manufacture of steel or produced as a by-product also, being stored and handled by the plant.

7.1.2 Hazard Identification

The steel manufacturing industry is labour intensive and uses large scale and potentially hazardous manufacturing processes. Hazard analysis involves the identification and quantification of the various hazards (unsafe conditions) that exist in the project site. In this chapter, an attempt has been made towards hazard identification and risk assessment.

Hazard is the characteristics of a system/plant/storage that presents potential for an accident and risk is the probability of occurrence of hazard. Hence hazard identification is of prime significance for the quantification of risk and for cost-effective control of accidents in any industrial installation. Various techniques of predictive hazard evaluation and quantitative risk analysis suggest that identification of hazard has very important role in estimation of probability of an undesired event and its property and environment.

Hazards are mostly manifested in the form of toxic release. Each anticipated hazard scenario associated in the unit is described along with its assessment of impact on plant and locality in the following table:

Table 7-2: Anticipated Hazards at AMNSI

Sl. No.	Area / Activity	Hazard	Hazard Potential	Impact
1	Storage and Handling of High-Speed Diesel (HSD) / Low Speed Diesel (LSD)	Pool Fire/ Fireball may occur in case of direct contact with flame	Medium	Fire may propagate and spread over to other areas
2	Storage and handling of Coke Oven gas/ Blast Furnace Gas/ BOF gas/ Natural Gas (CO Gas)	Leakage of gas from the Gas line / Gas holder /Boosting Station.	Major	Toxic CO gas may spread affecting the people in the nearby areas. This also highly and flammable to cause explosion & Fire and fatal
3	Electrical Power supply and distribution in Transformer yard and motor control centre	Fire & electrocution may occur	Medium	Fire may propagate to other areas
4.	Spill & spread of hot metal	Fire & Metal burn. Explosion, if fell on accumulated water	Medium	Fire may propagate to other areas

Sl. No.	Area / Activity	Hazard	Hazard Potential	Impact
5.	Storage and handling of Hazardous Waste: Tar Sludge, Used Oil.	Fire Hazard and acid burn due to contact of skin.	Medium	Fire may propagate to other areas.

*Actions against sudden exposure to specific toxic chemicals are detailed in MSDS.

Table 7-3: List of Chemicals used in the Steel Plant and their Characteristics

Sl. No.	Chemical Name	Type of Hazard	Melting Point/ Freezing point	BP	FP	Auto ignition temperature	LEL	UEL	V.D	S.G @ 20 Deg C	NFPA HFR	Toxic Properties					
												IDLH ppm	TLV/ TWA ppm	LD 50	ERGP1	ERGP2	ERGP3
1	Hydrochloric Acid	Corrosive	-74°C	53°C	NA	NA	NA	NA	NA	NA	3; 0; 0	NA	NA	900 mg/kg	NA	NA	NA
2	Sulphuric Acid	Corrosive	- 75.5^0 C	10^0C	NA	NA	NA	NA	2.25	NA	NA	NA	1 mg/m^3	NA	NA	NA	NA
3	Liquid Oxygen	Oxidising substance reacts with reducing agents. Explosive material under certain condition	- 218.4^0 C	83^0C	NA	NA	NA	NA	1.43	NA	NA	NA	NA	NA	NA	NA	NA
4	Carbon Mono Oxide Gas	Extremely flammable /Toxic	-205^0C	191^0C	NA	605^0C	12.5	74.2	0.9	NA	2; 4; 0	NA	25 ppm	NA	NA	NA	NA
5	Carbon Di Oxide Gas	Relatively non-flammable/ non toxic	NA	NA	NA	NA	NA	NA	1.5	NA	NA	NA	5000 ppm	NA	NA	NA	NA
6	Ammonia Solution	NA	69°C	27°C	NA	NA	NA	NA	NA	0.89	NA	NA	50 ppm	NA	NA	NA	NA
7	Caustic Lye	Causes eye and skin burns	318°C	1390 deg C	NA	NA	NA	NA	NA	2.13 g/cm^3	3; 0; 1	10 mg/m3	2 mg/m3	NA	NA	NA	NA
8	Benzene	Flammable Liquid	42°F	176°F	12°F	NA	0.012	0.078	NA	0.88	2; 3; 0	NA	0.1 ppm	NA	NA	NA	NA
9	Toluene	Flammable Liquid	139°F	NA	40°F	NA	0.011	0.071	NA	0.87	2; 3; 0	NA	NA	NA	NA	NA	NA
10	Chlorine	Poison Gas Oxidizer Corrosive	-101°C	-34°C	NA	NA	NA	NA	2.49	1.424	4; 0; 0	10 ppm	0.1 ppm	NA	1 ppm	3 ppm	20 ppm
11	Liquid Nitrogen	Non-Flammable Gas	-210°C	-196°C	NA	NA	NA	NA	NA	NA	3; 0; 0	NA	NA	NA	NA	NA	NA
12	High Speed Diesel/ Light Diesel Oil	Flammable liquid	NA	215 - 376 Deg C	32	225 deg. C	0.006	0.06	NA	0.86 - 0.90	NA	NA	NA	NA	NA	NA	NA
13	Transformer Oil	Flammable liquid	-75 ° F	Very high	295°F	NA	NA	NA	NA	0.891	0; 1; 0	NA	NA	5 to 15 g/kg	NA	NA	NA

Sl. No.	Chemical Name	Type of Hazard	Melting Point/ Freezing point	BP	FP	Auto ignition temperature	LEL	UEL	V.D	S.G @ 20 Deg C	NFPA HFR	Toxic Properties					
												IDLH ppm	TLV/ TWA ppm	LD 50	ERGP1	ERGP2	ERGP3
14	Coal Tar	Combustible	30-180°C	>250°C	>200°C	>500°C	NA	NA	NA	NA	0; 1; 0	NA	0.2 mg/m³	NA	NA	NA	NA
15	Coke Oven Gas (60 % Methane and 40 % Hydrogen)	NA	~2600 °F	NA	>56oC	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	NA
16	Blast Furnace Gas (Carbon Monoxide)	Same as CO															
17	BOF Gas (Carbon Monoxide)	Same as CO															
18	Natural Gas (Methane)	Extremely flammable	-183°C	-161°C	-306 ° F	537°C	0.05	0.15	0.55	0.422	2; 4; 0	NA	NA	NA	NA	NA	NA
19	Petrol	Flammable Liquid	NA	20-200°C	-36 ° F	853 ° F	0.013	0.071	NA	0.7321	1; 3; 0	NA	300 ppm	NA	200 ppm	1000 ppm	4000 ppm
20	Hydrogen	Extremely flammable	-259°C	-253°C	NA	560°C	0.04	0.75	NA	0.071	0; 4; 0	NA	NA	NA	NA	NA	NA
22	Elemental Sulphur (Solid)	Health/explosion hazard	251 deg F	832.3 ° F at 760 mm Hg	405 ° F	450 ° F	NA	NA	NA	1.8 at 248 ° F	NA	NA	NA	NA	NA	NA	NA

Table 7-4: List of Hazardous Substance to be Stotred / Handled

Hazardous Substance	Capacity (Cub. m)	Type of vessel used for handling / storage	Nature of hazard associated
BF Gas Holder	1,35,000	Stored in steel Cylindrical shaped gas holder with dry seal and handled via in-plant Steel pipelines	Flammable gas
BOF Gas Holder	100,000	Stored in steel Cylindrical shaped gas holder with dry seal and handled via in-plant Steel pipelines	Flammable gas
CO Gas Holder	50,000	Stored in steel Cylindrical shaped gas holder with dry seal and handled via in-plant Steel pipelines	Flammable gas
Corex Gas Holder*	60,000	Stored in steel Cylindrical shaped gas holder with dry seal and handled via in-plant Steel pipelines	Flammable gas
Tail Gas Holders	2 x 10,000	Stored in steel Cylindrical shaped gas holder with dry seal and handled via in-plant Steel pipelines	Flammable gas
*Although the Corex Plant for steel production will be mothballed, its gas holder will continue to use as a resource conservation measure and will store gas from other plants. However, the gas holder related risks/consequences are covered in this report			
Note: 1. Blast Furnace Gas density 1.25 kg/m3 at 0°C, 1 atm pressure conditions considering tentative gas mixture composition. 2. BOF Gas quantity computed considering density as 1.37 kg/Nm3 #Total Quantity of gas handled includes amount of gas stored in holders along with gas in associated new pipelines			

The scope of this study includes the assessment of proposed operations, storage and handling of hazardous materials with respect to associated hazards, the risks involved and updation of existing Disaster Management plan (DMP). Based on the Hazard Identification and analysis, the major disaster scenarios would be worked out to estimate the consequence of failure. AMNS, Hazira is an existing plant and already has a comprehensive Disaster Management plan (DMP) which would be updated to meet the emergency situations due to the envisaged facilities of the proposed expansion project.

The present study includes hazard identification and consequence analysis for the new projects included in the proposed expansion of AMNSI, Hazira.

Applicability of the MSIHC Rules, 1989

As per MSIHC Rules, 1989 with subsequent amendments, the steel production process is classified as an "industrial activity" handling hazardous substances. To decide whether the above mentioned industrial activities/substances are likely to come within the scope of the above mentioned "Manufacture Storage and Import of Hazardous Chemicals Rules, 1989 & subsequent amendments", the threshold quantities mentioned in the rules are used for comparison, as given below:

Table 7-5: Threshold Quantity & Identified Hazardous Substances to be handled as per MSIHC Rules, 1989 & subsequent amendments

Sl. No.	Hazardous substance stored / handled	Max. Qty Stored	Whether included in the List of Hazardous & Toxic Chemicals	Type of vessel used for storage	Lower Threshold Qty. (In Tonne) [For rules 5,7 to 9 & 13 to 15]	Upper Threshold Qty. (In Tonne) [For rules 10 to 12]	Remarks
1	BF Gas Holder	135000 m^3	Yes As per Sch. 3(i)	Steel Cylindrical shaped gas holder – 135,000 m^3	15	200	Exceeds lower but within upper threshold limit. Consequence analysis required to be carried out.
2	BOF Gas Holder	100000 m^3	Yes As per Sch. 3(i)	Steel Cylindrical shaped gas holder – 135,000 m^3	15	200	Exceeds lower but within upper threshold limit. Consequence analysis required to be carried out.
3	CO Gas Holder	50000 m^3	Yes As per Sch. 3(i)	Steel Cylindrical shaped gas holder – 135,000 m^3	15	200	Exceeds lower but within upper threshold limit. Consequence analysis required to be carried out.
4	Tail Gas	10000 m^3	Yes As per Sch. 3(i)	Steel Cylindrical shaped gas holder – 135,000 m^3	15	200	Exceeds lower but within upper threshold limit. Consequence analysis required to be carried out.

After comparison of the stored / handled and threshold quantities, it can be noticed that majority of the chemicals are crossing the lower threshold quantities but are below the upper threshold quantities. Accordingly, rule nos. 7,8,9,13,14, and 15 will be applicable, whereas for the other chemical, the stored / handled quantities are less than the lower threshold quantity. Accordingly only rule 17 i.e. preparation and maintenance of material safety data sheets for these chemicals are required. Rule -7 i.e. notification of site requires submission of a written report containing containing consequence analysis among other information.

Further, rule 17 i.e. preparation and maintenance of material safety data sheets are also required for both the substances.

Owing to the hazardous nature of Coke Oven Gas, BF Gas, Tail Gas and BOF gas, consequence analysis of the facility has been done, taking in consideration all hazardous substances identified at Table 7.4 above. MCAA

(maximum credible accident analysis) approach has been used to identify plausible worst case scenarios for hazard identification and risk assessment.

Damage due to Fire & Heat Load

Flammable and explosive substances released from sources of storage as a result of failures or catastrophes, can cause losses in the surrounding area in the form of:

Fires, fireballs, and flash back fires, resulting in a heat wave (radiation), or

Explosions (Vapor Cloud Explosions) resulting in blast waves (overpressure).

Table 7-6: Unit Wise Fire Risk

Unit	Risk of Fire
Co & Cc Coal Handling Plant	• Auto Ignition of Coal at Coal Storage Yard • Coal Conveyor Belt Due to Coal, Bush Fire • Reclaimer Machine, Elect. Cable May Catches Fire Due to Coal And Bush Fire
Coke Oven Battery	• Unquenched/Partially Quenched Coke Causes Coke Conveyor Belt Fire • Autoignition of Deposited Coal Dust in Charging Car • Spillage/Leakage of Oil & Deposition of Coal/Coke Dust • Gas Leakage in Gas Main in Battery Cellar • Hot Job in Charging & Pushing Car
Coal Chemical	• Gas fire in Decanter due to ingress of CO gas in the insulator upper chamber • Leakage of gas from inlet / outlet valve gland in Exhauster Cellar • Leakage / Spillage of inflammable liquids from Pipeline, Tanks, Pump gland (Specially where Mechanical gland sealing is not used) • Electrical failure / Faults • Gas cutting / Welding without proper precautions • Fire hazard due to Tar sludge
Power Plant	• BF / CO gas leakage in Boiler / Turbine area • Explosion in Boiler • Cable Basement of Sub-Station
Blast Furnace	• Hot Metal / Slag spillage – Burn / Fire • Explosion Due to Fall of Hot metal on Accumulated Water • Gas Leakage
Sinter Plant	• Fire in Cable Basement • Fire in Sinter Cable belt • Fire in Hydraulic Room / Cellar • Fire in Gas Line
RMHP	• Fire in Conveyor Belt from Dry Vegetation •
BOF & CCP	• Burn & Fire Due to Spillage/Leakage Of Liquid Metal Including explosion • Fire in Elect. Cable Rooms, Hydraulic Rooms • Fire in Gas Booster and Gas Line

Unit	Risk of Fire
Rolling Mill (Slab Rolling)	• Fire near Cooling Table Gear Box due to accumulation of oil • Motor room basement cable gallery • Oil Cellar • Gas leakage from gas line (Furnace) • Cooling Bed • Basement Room
Oxygen Plant	• Basement Cable gallery • Oxygen spill
Water Treatment Plant	• Leakage of Chlorine Gas

Table 7-7: List of Damages Envisaged at Various Heat Loads

Sl. No.	Heat Loads (kW/m²)	Type of Damage Intensity	
		Damage to Equipment	Damage to People
1	37.5	Damage to process equipment	100% lethality in 1 min. 1%Lethality in 10 s-
2	25.0	Minimum energy required to ignite wood	50% Lethality in 1 min. Significant injury in 10 sec
3	19.0	Maximum thermal radiation intensity allowed on thermally unprotected Equipment	--
4	12.5	Minimum energy required to melt plastic tubing	1% lethality in 1 min
5	4.0	--	First degree burns, causes pain for exposure longer than 10 sec
6	1.6	--	Causes no discomfort on long exposures
Source: World Bank (1988). Technical Report No. 55: Techniques for Assessing Industrial Hazards. , Washington, D.C: The World Bank.			

Damage Criteria for Thermal radiation and Overpressure Impacts

The storage of BF Gas, CO Gas, BOF Gas, Tail Gas, HSD, LDO, Coal Tar, Benzol etc. lead to fire and explosion hazards. Following section describes damage criteria due to accidental release of any hydrocarbon arise from fire and explosion. The vapours of these fuels are not toxic and hence no effects of toxicity are expected.

Tank fire will occur if the radiation intensity is high on the peripheral surface of the tank leading to increase in internal tank pressure. Pool fire will occur when fuel collected in the dyke due to leakage gets ignited.

A flammable hydrocarbon (High Speed Diesel HSD/Propane) can undergo combustion. This releases heat based on the heat of combustion and the burning rate of the fluid. A part of the heat is radiated while the rest is convicted away by rising hot air and combustion products. The radiations can heat the contents of a nearby storage or process unit to above its ignition temperature and thus result in a spread of fire. The radiations can also cause severe burns or fatalities of workers or fire fighters located within a certain distance. Hence, it will be important to know beforehand the damage potential of a flammable fluid likely to be created

due to leakage or catastrophic failure of storage or process equipment. The damage effects on people and equipment due to thermal radiation intensity and explosion are presented in following tables.

Fire load is expressed in terms of thermal radiation and explosion is expressed in terms of overpressure waves.

The effect of thermal radiation on people is mainly a function of intensity of radiation and exposure time. The effect is expressed in term of the probability of death and different degree of burn. The consequence effects studied to assess the impact of the events on the receptors are:

Table 7-8: Damage due to Radiation Intensity

Radiation (kW/m^2)	Damage to Equipment	Damage to People
4.0	-	Causes pain if duration is longer than 20 sec. 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 10 sec.
37.5	Severe damage to plant	100% lethality in 1 min. 50% lethality in 20 sec. 1% lethality in 10 sec.

Damage due to Overpressure

The effects of the shock wave vary depending on the characteristics of the material, the quantity involved and the degree of confinement of the vapor cloud. The peak pressures in an explosion therefore vary between a slight over-pressure and a few hundred kilopascals (kPa). Whereas dwelling are demolished and windows and doors broken at overpressures as low as 0.03- 0.1 bar. Direct injury to people occurs at greater pressures. The pressure of the shock wave decreases rapidly with the increase in distance from the source of the explosion.

Table 7-9: Overpressure Damage

Overpressure (bar)	Damage
0.02068	Limited minor structural damage, Glass damage
0.21	Corrugated asbestos shattered; corrugated steel or aluminium panels, fastenings fail, followed by buckling, wood panels (standard housing) fastenings fail, panels blown in, structural damage to Buildings
1	Fatality

Source: CCPS Consequence analysis of chemical release

Stability Classes

Atmospheric stability plays an important role in the dispersion of chemicals. "Stability means, its ability to suppress existing turbulence or to resist vertical motion".

Weather parameters play a significant role in dispersion analysis. The notable parameters for assessing the atmosphere are wind speed, atmospheric stability, ambient temperature, humidity and topographic parameters.

Atmospheric stability represents the vertical turbulence in the air due to temperature differentials caused by heating of the earth by solar radiation. Atmospheric stability effects are represented through Pasqual parameters as follows shown in ***Table 7-10***

Table 7-10: Pasqual parameters

Stability Class	Atmospheric Condition
A	Very Unstable
B	Unstable
C	Slightly Unstable
D	Neutral
E	Stable
F	Very Stable

The relationship between wind speed and atmospheric stability is shown in ***Table 7-11***

Table 7-11: Relationship between Wind Speed and Atmospheric Stability

Wind speed	Day-time solar radiation			Night-timecloud cover		
(m/s)	Strong	Medium	Slight	Thin<3/8	Medium>3/8	Overcast>4/5
<2	A	A-B	B	-	-	D
2-3	A-B	B	C	E	F	D
3-5	B	B-C	C	D	E	D
5-6	C	C-D	D	D	D	D
>6	C	D	D	D	D	D

Category D (neutral) is the most probable at sites in moderate climates and may occur for up to 80% of the time at relevant sites. Stability E (stable) represents the most adverse condition in which dispersion extends over longer distances horizontally. Normally, stability E occurs for short periods in the year, mainly during winter nights.

Weather Conditions

The representative combinations of weather parameters for the site considered in this study are shown in table below.

Table 7-12: Weather parameters for risk analysis

Time	Remarks	Weather Condition			Met data
		Temperature (°C)	Wind speed (m/s)	Stability Class	
Day Time	Prevalent during the day, most times of the year	32.28	1.50	C	1.5/C
Night Time	Prevalent during the night, most times of the year	30.51	1.45	E	1.5/E
Monsoon Period	Prevalent during the monsoon months	31.39	4.00	D	4/D

We have analysed the risk qualitatively and quantitatively both, associated with the hazards.

7.1.3 Quantitative Risk Assessment

The main objective of the risk assessment study is to determine damage due to major hazards having damage potential to life and property and provide a scientific basis to assess safety level of the facility. The secondary objective is to identify major risk in manufacturing process, operation, occupation and provide control through assessment and also to prepare on-site, off site plans to control hazards. Risk assessment requires an assessment of failure probability, credible accident scenario, vulnerability of population etc. Much of this information is difficult to get or generate consequently, the risk analysis in present case is confined to maximum credible accident studies and safety and risk aspect related to Steel Industry.

Risk assessment is the determination of quantitative and qualitative value of risk related to a concrete situation and a recognized threat. Activities requiring assessment of risk due to occurrence of most probable instances of hazard and accident are both onsite and off-site

In Qualitative Risk Assessment, risk has been analysed using methodology called HIRA-Hazards Identification & Risk Assessment. In HIRA, major manual activities carried out by plant personnel as well as contract labours have been considered. Rating Pattern is shown in ***Table 7-13.*** Hazard Identification and Risk Assessment (HIRA) register is provided in ***Table 7-15***

The risk management measures for the proposed project activities will be adopted as required for best safety practice within the works boundary.

Figure 7-1: Risk Assessment Methodology

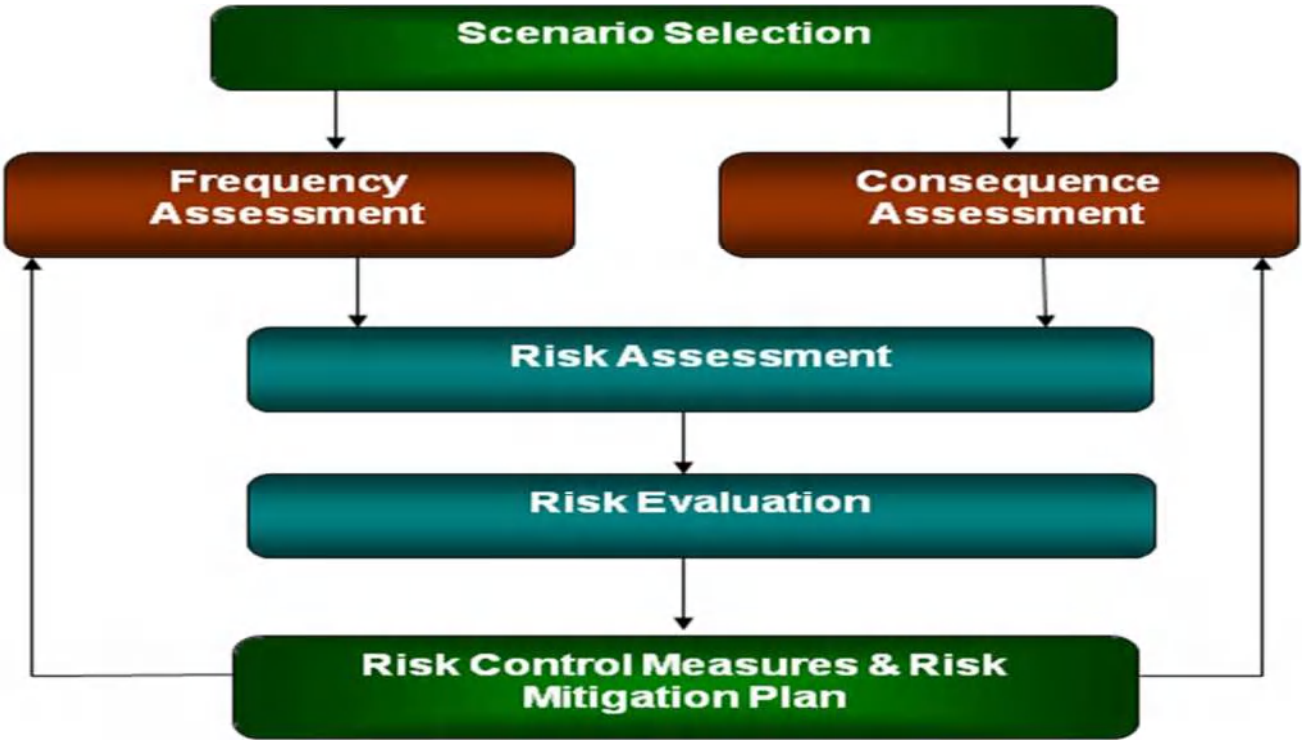


Table 7-13: Rating Pattern

Likelihood (L)		Severity (S)	
Score	**Description**	**Score**	**Description**
1	Can happen theoretically but never happened so far	1	Insignificant Harm

Likelihood (L)		Severity (S)	
Score	**Description**	**Score**	**Description**
2	Happens Rarely	2	First Aid
3	Happens Several Times	3	Minor Injury/ Hospitalization
4	Always Happens	4	Severe Bodily Injury, Fatality

Quantitative Risk Assessment (QRA) is a structured approach to identifying and understanding the hazards and risks associated with Storage and Handling of flammable/explosive/toxic chemicals. The assessment starts by taking into account an inventory of hazardous chemicals stored, likelihood of leakage/spillage associated with it and selecting the worst case scenario for consequence estimation. Finally, suggesting the measures to minimize or mitigate risks to meet appropriate acceptability criteria. The planning for emergency evacuation shall be borne in mind whilst interpreting the results.

Table 7-14: Associated Risk and Risk Levels for AMNSI

Plant Area	Hazard	Risk Level
Coal Handling Plant	Auto ignition of coal at coal storage yard	Low
	Coal conveyor belt due to coal, bush fire	Medium
	Reclaimer machine, elect. Cable may catch fire due to coal and bush fire	Medium
	Coal dust explosion	High
Coke Oven Battery/ Plant	Unquenched/partially quenched coke causes coke conveyor belt fire	Medium
	Autoignition of deposited coal dust in charging car	Medium
	Spillage/Leakage of Oil & Deposition Of Coal/Coke Dust may cause dust/explosion	High
	Gas Leakage in Gas Main in Battery Cellar can cause fire/explosion	High
	Hot Job in Charging & Pushing Car coal	Medium
	Fire hazard due to tar sludge, benzol acid sludge.	Low
	Gas cutting/welding without proper precaution	High
	Gas fire in deterrer due to ingress of co gas in the insulator upper chamber	Medium
	Leakage of Gas from Inlet/ Outlet Valve Gland In Exhauster Cellar leading to Fire/explosion	Medium
	Leakage of Benzol lead to toxic/fire/explosion	High
	Elemental Sulphur causing dust explosion	Medium
Power Plant	BF / CO gas leakage in Boiler / Turbine area may lead to fire/explosion	High
	Explosion in boiler	High
Blast furnace	Hot metal / slag spillage- burn, fire	Medium

Plant Area	Hazard	Risk Level
	Explosion due to fall of hotmetal on accumlated water	High
	Gas leakage leading to Fire/explosion/Toxic exposure due to CO	High
Sinter Plant	Fire in cable basement	Medium
	Fire in sinter conveyor belt	Medium
	Fire in hydraulic room/cellar	Medium
	Fire/explosion in gmbs & gas line	High
BOF	Gas leakage leading to Fire/explosion/Toxic exposure due to CO	High
CPP	Fire in gas booster and CBM / LPG line	High
	Boiler explosion	High
Rolling Mill	Fire near rolling table gear box due to accumulation of oil.	Medium
	Gas Leakage from Gas Line (Furnace) leading to fire/explosion/toxic exposure	High
Oxygen Plant	Oxygen Spill - Physical Injury	Medium
	Nitrogen Spill - Physical Injury	Medium
Water Treatment Plant	Leakage of chlorine gas/toxic exposure	High

Table 7-15: Hazard Identification and Risk Assessment register

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
CONSTRUCTION PHASE									
1.	Vehicular movement for transportation of materials and equipment	R	Dust emission due to vehicular movement	Eye Irritation, Breathing problem	3	1	3	NS	Use of PPE Water sprinkling on the roads
			Accident due to collision Accident due to damage of approach roads due to spillage of construction material from trucks Accident due to adverse weather Accident due to overloading	Physical Injury	1	3	3	NS	Operation by trained worker/ Driver Skilled and well trained drivers will only be considered for this work Maintain the site safety speed limits of 10 KMPH and traffic rules All operators/drivers checked at the gate incase of doubt by security staff using breath alcohol meter Training for drivers Since most accidents occur due to human error and improper work practice, safety awareness workshop for the plant personnel will be organized on regular basis.
2.	Movement of heavy machinaries like JCB, Crane, Concrete Mixer etc.	R	Dust emission	Eye Irritation, Breathing problem	3	1	3	NS	Use of PPE Water sprinkling on the roads
			Accident Accident due to adverse weather Accident due to overloading	Physical Injury	1	3	3	NS	Operation by trained worker/ Driver Skilled and well trained drivers will only be considered for this work Maintain the site safety speed limits of 10 KMPH and traffic rules All operators/drivers checked at the gate incase of doubt by security staff using breath alcohol meter Training for drivers Since most accidents occur due to human error and improper work practice, safety awareness workshop for the plant personnel will be organized on regular basis
3.	Excavation	R	Dust emission	Eye Irritation Respiratory problem - Occupational health issues like asthma, lung problem	3	1	3	NS	Use of PPE – nose mask & ear plug Water sprinkling to ensure dust control Restricted speed limit Excavated soil will be properly covered
			Electrocution due to underground cable	May be fatal	1	4	4	S	Inspect for underground utilities before start of excavation using trial pits Excavation work permit system will be implemented De-energised all the electrical cable/other utility services lines & remove the same from the vicinity of excavation operation prior to start activity. SOP will be developed
			Equipment sliding off while unloading	Loss of property Injury. May be fatal	2	3	6	S	Parking will be carried out on a firm & levelling surface while unloading Back stoppers will be placed at the back wheels & parking brakes will be put on while unloading
4	Heavy fabrication work including metal cutting, Gas cutting,	R	Exposure of heat Accidents	Health Hazard Physical Injury	1	3	3	NS	Operation by trained worker, Use of PPE Proper use of PPE during welding, during hot work, work on height

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
	welding and other steel structure								
5	Working on Scaffolding	R	Fall of person/ scaffolding materials during work	Physical Injury May be fatal	1	4	4	S	Safety belt to be used while working Guardrails shall be erected with working platform Scaffold will be erected by trained & authorised workman only Awareness session will be conducted for the workmen engaged in erection work Tag lines will be used for lifting & lowering the scaffolding materials Height work permit system will be implemented.
			Collapse of scaffold (Construction workmen & staff)	Physical Injury May be fatal	1	4	4	S	Scaffolding will be erected on the firm & rigid ground A scaffolding certified person will be supervising the erection of scaffold. No entry Zone around the Scaffolding to be earmarked Safe to use- tag is being attached on all scaffold which will be inspected & okay for usage
6			Collapse due to overload (construction workmen)	Physical Injury May be fatal	1	4	4	S	Scaffold selection will be done after mapping the activity and the no. of persons who will be using the scaffolding. For heavy work "Heavy duty scaffolding" & for light work "Light duty scaffolding" will be used Work will be planned in such a way that uniform distribution of load will be maintained
7	DG Set operation	R	Leakage/ spillage of Diesel	Fire due to spillage of Diesel	2	2	4	S	Use of Fire extinguisher
OPERATION PHASE									
1.0	Material Handling (Raw Materials & Finished Products)								
1.1	Raw Material Handling Section	R	Transportation of BF Pellet and HBI Pellets through Conveyor	Fatal / Major Injuries Fire & Structural / Building Collapse	1	3	3	NS	Permit to work system is in place before carrying out any maintenance activity (HOT Jobs) Inspection of structural / Building once in 5 years. Monitoring of material temp before charging into Conveyor Belt Maintaining good house keeping Safety Operating & Maintenance Procedures in place Fire Fighting System is in place for all the conveyors Emergency quenching in place for all routes conveyors Training of operators on Emergency preparedness
1.2	RMHS-Track hopper	R	Water entry into low lying areas	Water flooding Fatal/ Major Injury Property damage	2	1	2	NS	Flood Management Plan exist Well maintained Drainage system Availability of de-watering pumps both diesel and Electrical. Availability of trained personnel for water rescue.
1.3	Transportation Coal / Coke	R	Inflammable, fire/ explosion hazard Structural / Building Collapse	Fire and Explosion hazard in the facility can lead to fatality.	1	4	4	S	Permit to work system is in place before carrying out any maintenance activity (HOT Jobs) Inspection of structural / Building once in 5 years. Monitoring of material temp before charging into Conveyor Belt Maintaining good house keeping Safety Operating & Maintenance procedures in place

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
									Fire Fighting System is in place for all the conveyors Emergency quenching in place for all coke route conveyors Training of operators on Emergency preparedness
1.4	Transportation of material by conveyors	R	Dust arising during conveying of materials / Spillage	Respiratory problem Injury to personnel	3	1	3	NS	Ensure operation of dust suppression systems
1.5	Finished Product Handling and Transportation	R	Occupational and Physical Hazard	Cuts, Falling of material	1	2	2	NS	Operation by trained operator Safe distance to be maintained Training to drivers Use of Red Flag
2.0	**Storage and Distribution of CO Gas, BF Gas and BOF Gas**								
2.1	Storage of BF Gas, CO Gas, BOF Gas and Tail Gas in respective Storage Tank	R	Failed tank or associated fittings, pump or pipework or operator error or mechanical damage	Fire and explosion Toxic cloud dispersion	1	4	4	S	Design of storage structures / tanks to relevant standards and legislations. Regular inspections and maintenance. Operator induction and ongoing training. Operational procedures. Material safety data sheet (MSDS) register and MSDSs kept on-site at different locations in form of signage etc. Hazard Signage. Design of storage structures / tanks to relevant standards and legislations. Appropriate storage of all chemicals, fuel and dangerous substances in accordance with relevant Hazardous Chemical Rules, 2000 with subsequent amendments and associated legislations. Housekeeping activities – site would be kept clean and tidy and fire hazards removed where practicable. Availability of firefighting equipment, such as overhead water spray system, mounted on top of gas holders. Regular inspections and maintenance of firefighting equipment and storage areas, where required. Site policies, management plans and procedures. Protection of storage facilities (e.g. bollards). Location of explosive storage should be such that it has minimum interaction with people and property.
2.2	Transport of BF & BOF Gas via associated pipelines	R	Failure of pipeline, bursting of pipeline due to Corrosion, Vibration, external loading, Operation error, Over pressure, Maintenance failure, or Sabotage	Fire and explosion Toxic cloud dispersion	1	4	4	S	Design of pipelines (i.e. wall thickness and stress relief), well sites, Central Processing Facility and related infrastructure to relevant standards and legislation. Installation of pressure monitoring systems. Conduct regular inspections, maintenance and testing of equipment. Site policies, management plans and procedures. Operator induction and ongoing training. Maintenance of fire breaks to slow the progress of bushfires. Routine hazard reduction burns.

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
									Fire-fighting equipment and spill kits located in on-site vehicles and infrastructure (where appropriate). Restriction of access to storage areas, including securing storage facilities. Provision of adequate lighting around storage facilities. Signage (i.e. unauthorized entry warning and information signs). Police would be notified as soon as possible in case of a suspected breach. Material safety data sheet (MSDS) register and MSDSs kept on-site at different locations in form of signage etc.
3.0	**Coke Ovens**								
3.1	Operation of Coke Ovens	R	Release of Carbon Monoxide, Fire / Explosion	Fatal / Major Injuries, Property Damage	1	4	4	S	Installation of fixed CO-Detectors. Use of personal CO-Detectors. Calibration of CO-Detectors once in six months. Inspection of CO-Detectors once in a month. Fixed Fire detection & Fighting System. Both the nitrogen & steam arrangements are provided in gas line in order to dilute the toxicity in case of emergency. Provision of double disc gate valve & U Seals in case of emergency Explosion proof /intrinsic safe instruments in hazardous area to avoid fire. Safe Operating & Maintenance procedures in place Provision of Block & Bleed System to ensure complete isolation Flare system for pressure safeguarding
4.0	**Sinter Plant**								
4.1	Sinter Plant Furnace	NR	Mixed gas leakage in the expansion joints , Vents, furnace area	Fatal / Major injuries Fire & Explosion Property Damage	1	4	4	S	Installation of fixed CO-Detectors Use of personal CO-Detectors. Calibration of CO-Detectors once in six months. Inspection of CO-Detectors once in a month. Regular inspection of gas pipe lines, expansion joints & maintenance Provision of Goggle valve & U-seals for isolation SOPs developed for Gas lines operational controls and all personnel trained Emergency Response Plan developed to tackle the situation & regular mock drills are being conducted to test the preparedness
5.0	**Blast Furnace Operation**								
5.1	Tapping of hot metal & slag in ladle Tapping of hot metal	R	Tapping in ladle	Explosion	1	4	4	S	Continuous monitoring of Furnace to maintain and observe proper temperature. Movement of staff and labour is not permitted near the furnace. Heat zone is displayed near the furnace. Safety shoes, safety goggles, hand gloves, apron and safety helmet provided to the workers
		R	Spillage	Burn injury	1	4	4	S	

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
									No smoking zone is declared.
5.2	Operation of Blast Furnace	R	Leakage of CO gas	May be fatal	1	4	4	S	Installation of fixed CO-Detectors. Use of personal CO-Detectors. Calibration of CO-Detectors once in six months. Inspection of CO-Detectors once in a month. Risk Assessment of Blast furnace operation and ensuring all control measures implementation Safe Operating Procedures are developed for all types of emergencies and mock drills are being conducted accordingly Inspection of structural / Building once in 5 years. Interlocks are provided for all control parameters of Blast furnace Fire Hydrants installed Ensuring no water accumulation around the blast furnace and surroundings Availability of Breathing Apparatus sets, Oxypac and waterjel blankets
5.3	Opening of Tap Hole	R	Tap hole puncture. Sudden release of molten metal	Burn Injury	1	4	4	S	Regular inspection of Tap hole SOP to be followed
5.4	Tapping and pouring of hot metal	R	Generation of dust	Respiratory problem	1	2	2	NS	Ensure operation of Cast house dedusting system
5.5	Transportation of Hot Metal and Slag	R	Torpedo puncture	Spillage of hot metal on road Derailment of loco	1	4	4	S	Regular inspection Torpedo and ensuring its healthiness Ensuring no water accumulation along the movement of torpedo
5.6	Pulverised Coal Injection	R	Coal blast	Fire Explosion	1	4	4	S	Nitrogen purging system is provided inside the bag filters and silos to cool the coal in case of Fire or rise in temperature. Interlocks are provided for all control parameters of Coal injection system Fire Hydrants are installed
	Coal drying Platform	R							
6.0	**Steel Melting Shop Operation**								
6.1	Operation of Convertor	R	Spurting of Hot metal	Fatal / Major Injuries	1	4	4	S	Risk Assessment system in place Safe Operating Procedures are developed Inspection of structural / Building once in 5 years. Interlocks are provided for all control parameters of converters Converter Refractory bricks are replaced as per the time schedule Scanners are installed for inspection of refractory linings Pits are made at zero meter of converter to collect any spilled hot metal Stacks are kept in healthy condition in which there is no water leakage Forced de-dusting system is provided Aluminum suits are being used by the personnel working near to convertor.
			Major Fire	Property Damage	1	4	4	S	
		R	Convertor Puncture	Fatal / Major Injuries Property Damage	1	4	4	S	
6.2	Melting operation in furnace	R	Electric shock	Body injury	1	3	3	NS	
6.3	Tapping of liquid steel	R	Spillage of liquid steel	Burn injury	1	3	3	NS	

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
			Explosion in ladle due to trapped water	Body injury. May be fatal	1	4	4	S	
6.4	Material Handling System - Cranes	R	Failure of cranes while transporting hot metal from ladle to Converter	Collapse of structure Personnel injury, may be fatal	1	4	4	S	Cranes are periodically inspected
6.5	Torpedo / Ladle Puncture	NR	Spurting of Hot metal	Spillage of hot metal on the road during transportation Hot Metal Explosion Derailment of loco	1	4	4	S	Regular inspection Torpedo/Ladle and ensuring its healthiness Ensuring no water accumulation along the movement of torpedo
7.0	**Rolling Mill**								
7.1	Mill operation	R	Hot object	Burn injury	1	3	3	NS	SOPs and SMPs and Training manuals shall be prepared and awareness shall be created Provide adequate training to operators Conduct regular safety audits and rectify safety issue and monitor safety compliance reports Ensure use of PPE
7.2	Cutting of Rebars /Plates/Channels/ Angles in shear machine	R	Flying off sharp metals	Body injury	1	3	3	NS	
7.3	Water treatment plant operation and cleaning	R	Chemical attack	Body injury	1	3	3	NS	
8.0	**Captive Power Plant**								
8.1	Operation of Captive Power Plant	R	Exposure to High temperatures & Blast overpressure	Burn injury, Body injury	1	4	4	S	Insulating clothing, body suits, aprons etc. of appropriate materials Preparation of SOP and SMP and Training manuals Fire fighting system in operation For high dust levels, wear: a Full-face Class P3 (Particulate) or an Air-line respirator. For inhalation risk, wear: a Class P1 (Particulate) respirator. Provide Onsite rescue equipment
8.2	BF/CO gas leakage in Boiler /Turbine area	NR	Fire & Explosion	Burn, Injury & Death	1	4	4	S	
9.0	**Electrical System**								
9.1	Electrical Shock / Fire	NR	Exposure to Electrical Shocks Scope of Fire due to Electrical Short circuits Exposure to Burns due to Electrical Systems	Burns due to electrical accidents Shocks due to electrical accidents Damages to skin due to electrical fire accidents Neurological problems due to electrical shocks	1	3	3	NS	Adequately rated and quick response circuit breakers, aided by reliable and selective digital or microprocessor based electromagnetic protective relays would be incorporated in the electrical system design for the proposed activities. Proper firefighting scheme for electrical failures eliminate these Hazards Proper design of electrical equipment as per standards/HAC and proper isolation to eliminate these Hazards. All motors should be flame proof in case of usage near Hydrocarbon handling area.

Sr. No.	Activity / Unit	Routine activities (R) / Non-Routine activity (NR)	Hazard	Risk	Rating Score				Control Measures
					L	S	Risk Number RN (L X S)	Significant (S)/ Non-significant (NS)	
									The metering and instruments would be of proper accuracy class and scale dimensions.
10.0	**Fire/Explosion hazard (General)**								
10.1	Hot Area	R	All Hot Metal Areas Furnace Transformers Furnace Operating Floor	Scope of fire accidents and burns Scope of damage to skin	1	3	3	NS	Proper SOPs for O & M and good firefighting scheme eliminate these Hazards Proper safety and protective equipment eliminate impact of these Hazards Safety distance of 4 mtr. from the delivery spout are suggest to work near molten metal
10.2	Diesel Generator	R	Mechanical hazards, fire hazards in Lube oil system and Cable galleries, Short circuits	Fire / electrical accident	1	3	3	NS	Inspection and Maintenance Fire protection system. Provision in electrical system described above
10.3	Hydrocarbon handling (Coal/HSD)	R	Highly inflammable nature of fuels may cause fire/explosion in the facility leading to fatality.	Fire and Explosion	1	4	4	S	1.Inspection and Maintenance 2. Fire protection/suppression system. 3.Fire/smoke detectors 4.Fire Hydrant system
10.4	Used Oil Storage in the Plant	R	Fire hazard / Slippage	Burn injury, May be fatal if magnitude of fire is high and uncontrollable Body injury due to slippage	1	4	4	4	Oil storage on Concrete floor with catchment Firefighting system Fireproof bulb in Oil storage area Proper house keeping No smoking/any other ignition source while handling Used oil

7.1.4 Event Classification and Modes of Failure

Hazards that can lead to accidents in operations are discussed in this section. Important hazardous events are classified in ***Table 7-16***

Table 7-16: Event Classification

Type of Event	Explanation
BLEVE	Boiling Liquid Evaporating Vapor Explosion; may happen due to catastrophic failure of refrigerated or pressurized gases or liquids stored above their boiling points, followed by early ignition of the same, typically leading to a fire ball
Deflagration	Is the same as detonation but with reaction occurring at less than sonic velocity and initiation of the reaction at lower energy levels
Detonation	A propagating chemical reaction of a substance in which the reaction front advances in the unreacted substance at or greater than sonic velocity in the unreacted material
Explosion	A release of large amount of energy that form a blast wave
Fire	Fire
Fireball	The burning of a flammable gas cloud on being immediately ignited at the edge before forming a flammable/explosive mixture.
Flash Fire	A flammable gas release gets ignited at the farthest edge resulting in flash-back fire
Jet Fire	A jet fire occurs when flammable gas releases from the pipeline (or hole) and the released gas ignites immediately. Damage distance depends on the operating pressure and the diameter of the hole or opening flow rate.
Pool Fire	Pool fire is a turbulent diffusion fire burning above a horizontal pool of vaporizing hydrocarbon fuel where the fuel has zero or low initial momentum
Spill Release	'Loss of containment'. Release of fluid or gas to the surroundings from unit's own equipment / tanks causing (potential) pollution and / or risk of explosion and / or fire
Structural Damage	Breakage or fatigue failures (mostly failures caused by weather but not necessarily) of structural support and direct structural failures
Vapor Cloud Explosion	Explosion resulting from vapor clouds formed from flashing liquids or non-flashing liquids and gases

7.1.5 Consequences Analysis

The consequences of the release of Hazardous substances by failures or catastrophes and the damage to the surrounding area can be determined by means of models. Models help to calculate the physical effects resulting from the release of hazardous substances and to translate the physical effects in terms of injuries and damage to exposed population and environment. To assess the damage level caused by the various accidental events, it is essential to firm up the damage criteria with respect to different types of accidents e.g. thermal radiation, explosion overpressure etc.

Consequence analysis involves the application of mathematical, analytical and computer models for calculation of effects and damages subsequent to a hydrocarbon release accident. Consequence models are used to predict the physical behaviour of the hazardous incidents. The techniques used to model the consequences of hydrocarbon and other hazardous material releases.

The information normally required for consequence analysis includes meteorological conditions, failure data of equipment and components, ignition sources, population characteristics within and outside the plant, acceptable levels of risk etc.

About the software – PHAST, Version 7.1

The consequence analysis for the modelled scenarios has been done using DNV's software PHAST (Process Hazard Analysis Software Tool) which allows assessment of situations which present potential hazards to life, property and the environment, and to quantify their severity. PHAST examines the progress of a potential incident from the initial release to far-field dispersion including modelling of pool spreading and evaporation, and flammable and toxic effects. It is considered to be one of the most powerful software as available today which predicts very accurate and reliable results and thus also recommended for use by the Ministry of Environment & Forests per its EIA Guidelines, dated January 2001.

PHAST Professionals sophisticated modelling calculates distances effect produced by hazardous events. With this information, you can evaluate the need for mitigating measures such as changes in design, operation or response. PHAST software can be used to model a proposed facility or operational change to ease the selection of the most effective solutions. With PHAST Professional, you can define special events, model the change in a leak over time, and investigate the details of behaviour with special stand-alone models and much, much more.

PHAST is integrated into safety and meets regulatory requirements. It uses unified dispersion modelling to calculate the results of the release of material into atmosphere

The salient features of this package:

1. It gives the consequence results in terms of – Flammable, Toxic and Explosion effects.
2. Flammable parameters covered under this package is-
    - Defines the LEL and UEL zone
    - Jet fire and pool fire scenario along with their respective effect zones (risk contour).
    - Flash fire and fire ball envelope
3. Toxic parameters-
    - Cloud concentration at user defined time as well as location
    - Categorize the toxic results in terms of ERPG, IDLH and STEL values.
    - Summarize results in terms of equivalent toxic dose along with effect zones.
4. Explosion parameters-
    - Categorize the explosion effects in terms of overpressures levels along with distance covered.
    - BLEVE (Boiling Liquid Expanding Vapor Explosion)

Assumption

For consequence analysis, assumptions regarding Meteorological, Pasquil Stability Classes, Wind velocity, Ambient Temperature, Relative Humidity, Inventory, Ground Roughness, Model used etc. are very important. In this report, the following assumptions have been considered.

1. Meteorological factors
    - Atmospheric Conditions: No Inversion
    - Ambient Temperature: 30°C has been considered as MCA approach.
    - Relative Humidity: 50% has been considered.

2. Pasquil Stability Classes
    - Pasquil Stability category C/D is considered as conservative approach.
3. Other assumptions:
    - Ground Roughness: Ground Roughness has been considered as 0.3 M.
    - Dispersion model of both Heavy Model and also Gaussian distribution have been used as applicable/ appropriate.
    - Inventory: Release of 100% of the inventory has been considered.

Input data for software (modelling)

For consequence analysis, input data considered are as below:

4. Volume inventory (Quantity of material)
5. Scenario
    - Jet fire
    - Flash fire
    - Fireball
    - Toxic dose
6. Storage conditions
    - Pressure
    - Temperature
7. Weather condition:
    - Wind speed
    - Pasquil stability
    - Atmospheric temperature
    - Relative humidity

7.1.6 Selection of Maximum Credible Loss Scenarios (MCLs')

As a first step towards risk assessment is to identify the possible release scenarios based on available information about scenario development for Maximum Credible Accident Scenarios (MCAS).

Following important points should be considered for the selection of release scenarios.

- Flammability and the flash point of the material
- Phase of material i.e. liquid or gas
- Threshold quantity of the chemicals as prescribed in MSHIC Rule
- Operating temperature and pressure of the material
- Total inventory of the material

On the basis of study of chemical properties (MSDS) of the chemicals those are selected for simulation are presented in ***Table 7-17.***

Table 7-17: Chemicals selected for Simulation

S. No	Product/Chemical	Means of storage	Storage capacity	Number of Storage Means	Total storage capacity	Pressure (Bar)	Temperature (°C)
1	BF Gas (CO- 22%, CO_2- 21%, N_2 - 56%, H_2- 1.2%, CH_4- 0.04%, H_2O- 2%)	Gas holder	135000 m^3	1	135000 m^3	1.08	35
2	BOF Gas (CO- 60%, CO_2- 18%, N_2 - 21%, H_2- 1%)	Gas holder	100000 m^3	1	100000 m^3	1.08	35
3	Corex Gas (CO-44%, CO_2-29%, H_2- 21% H_2O-2% CH_4- 1%, N_2- 3 %)	Gas holder	50000 m^3	1	50000 m^3	0.05	35
4	Tail Gas (CO- 19%, CO_2- 47%, N_2 -6%, H_2- 23%, CH_4-5%, NCV- 1500)	Gas holder	10000 m^3	2	20000 m^3	0.07	50
5	Coke Oven Gas (CO- 9%, CO_2- 4%, H_2-56%, CH_4-26%, N2 balance)	Gas Holder	50000 m^3	1	50000m^3	1.06	35
6	Ammonia	Tank	10 MT (19.02 KL)	2	20 MT	8	30
7	Hydrogen	Tank	9.9 KL	4	39.6 KL	10.125	50

On the basis of the information provided in ***Table 7-17*** and as discussed over failures sceneries given in publications like UKHSE, World Bank Technical Paper 55 and TNO Purple Book and the experience of the consultant, MCLs' which may take place are presented in ***Table 7-18***

Table 7-18: Scenarios Selected for Simulation

S. No.	Product/ Chemical	Hazard	Types of Failure Possible		Consequences Studied
			Maximum Credible Scenario	Worst Case Scenario	
1	BF Gas	Flammable and Toxic	13mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE, Toxic effect
			25mm leak		
			50mm leak		
2	BOF Gas	Flammable and Toxic	13mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE, Toxic effect
			25mm leak		
			50mm leak		
3	Corex Gas		13mm leak		

S. No.	Product/ Chemical	Hazard	Types of Failure Possible		Consequences Studied
			Maximum Credible Scenario	Worst Case Scenario	
		Flammable and Toxic	25mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE, Toxic effect
			50mm leak		
4	Tail Gas	Flammable and Toxic	13mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE, Toxic effect
			25mm leak		
			50mm leak		
5	Coke Oven Gas	Flammable and Toxic	13mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE, Toxic effect
			25mm leak		
			50mm leak		
6	Ammonia	Flammable and Toxic	13mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE, Toxic effect
			25mm leak		
			50mm leak		
7	Hydrogen	Flammable	13mm leak	Catastrophic Rupture	Jet Fire, Flash Fire, Fireball, VCE
			25mm leak		
			50mm leak		

7.1.7 Simulation of Release and Development of Contours

As the MCLS' were developed for the selected set of chemicals, the next step is to carry out the consequence analysis. The consequence analysis results along with their contours are presented in the following sections. Contours are presented on plant layout map.

7.1.8 Consequence analysis results

BF Gas

The results obtained for BF Gas in terms of the radiation levels and effect distances are presented below;

Table 7-19: Radiation level and effect distance due to release of material – BF Gas

Material/ Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
BF Gas	13 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
			1.5/C	NR	NR	NR

Material/ Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
		Fire ball Hazard	1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	10	NR	NR
			1.5/E	10	NR	NR
			4/D	11	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	Catastrophic Rupture	Fire ball Hazard	1.5/C	284	NR	NR
			1.5/E	289	NR	NR
			4/D	286	NR	NR

NR: Not Reached

Table 7-20: Flash fire level and effect distance due to release of material– BF Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (62500 ppm)	UFL (125000 ppm)
BF Gas	13 mm leak	Flash fire	1.5/C	1	0
			1.5/E	1	0
			4/D	1	0
	25 mm leak	Flash fire	1.5/C	2	1
			1.5/E	2	1
			4/D	2	1
	50 mm leak	Flash fire	1.5/C	4	2
			1.5/E	4	2
			4/D	3	2
	Catastrophic Rupture	Flash fire	1.5/C	102	71
			1.5/E	116	75
			4/D	188	98

Table 7-21: Toxic effect distance due to release of material– BF Gas

Chemical	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (1200 ppm)
BF Gas	13 mm leak	1.5/C	88
		1.5/E	96
		4/D	37
	25 mm leak	1.5/C	178
		1.5/E	183
		4/D	105
	50 mm leak	1.5/C	332

Chemical	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (1200 ppm)
		1.5/E	348
		4/D	226
	Catastrophic Rupture	1.5/C	1238
		1.5/E	1750
		4/D	603

The contours for effect distance generated are presented below;

Figure 7-2: Fireball effect distance contour due to catastrophic rupture of BF Gas holder at weather condition 1.5/E

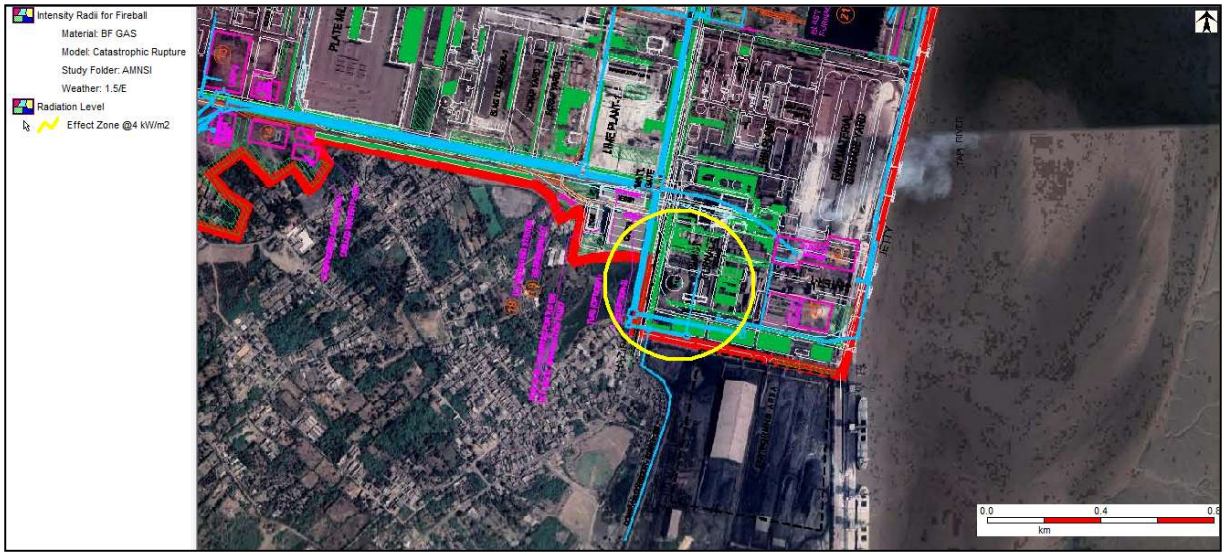


Figure 7-3: Flash fire effect distance contour due to catastrophic rupture of BF Gas holder at weather condition 4/D

Figure 7-4: Max concentration effect distance contour due to catastrophic rupture of BF Gas holder at weather condition 1.5/E

BOF Gas

The results obtained for BOF Gas in terms of the radiation levels and effect distances are presented below;

Table 7-22: Radiation level and effect distance due to release of material– BOF Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
BOF Gas	13 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	10	NR	NR
			1.5/E	10	NR	NR
			4/D	11	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
			1.5/C	255	NR	NR

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
	Catastrophic Rupture	Fire ball Hazard	1.5/E	259	NR	NR
			4/D	257	NR	NR

NR: Not Reached

Table 7-23: Flash fire level and effect distance due to release of material– BOF Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (62500 ppm)	UFL (125000 ppm)
BOF Gas	13 mm leak	Flash fire	1.5/C	1	0
			1.5/E	1	0
			4/D	1	0
	25 mm leak	Flash fire	1.5/C	2	1
			1.5/E	2	1
			4/D	2	1
	50 mm leak	Flash fire	1.5/C	4	2
			1.5/E	4	2
			4/D	3	2
	Catastrophic Rupture	Flash fire	1.5/C	92	64
			1.5/E	103	67
			4/D	167	88

Table 7-24: Toxic effect distance due to release of material– BOF Gas

Chemical	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (1200 ppm)
BOF Gas	13 mm leak	1.5/C	88
		1.5/E	96
		4/D	37
	25 mm leak	1.5/C	178
		1.5/E	183
		4/D	105
	50 mm leak	1.5/C	332
		1.5/E	348
		4/D	225
	Catastrophic Rupture	1.5/C	1048
		1.5/E	1467
		4/D	468

The contours for effect distance generated are presented in below;

Figure 7-5: Fireball effect distance contour due to catastrophic rupture of BOF Gas holder at weather condition 1.5/E

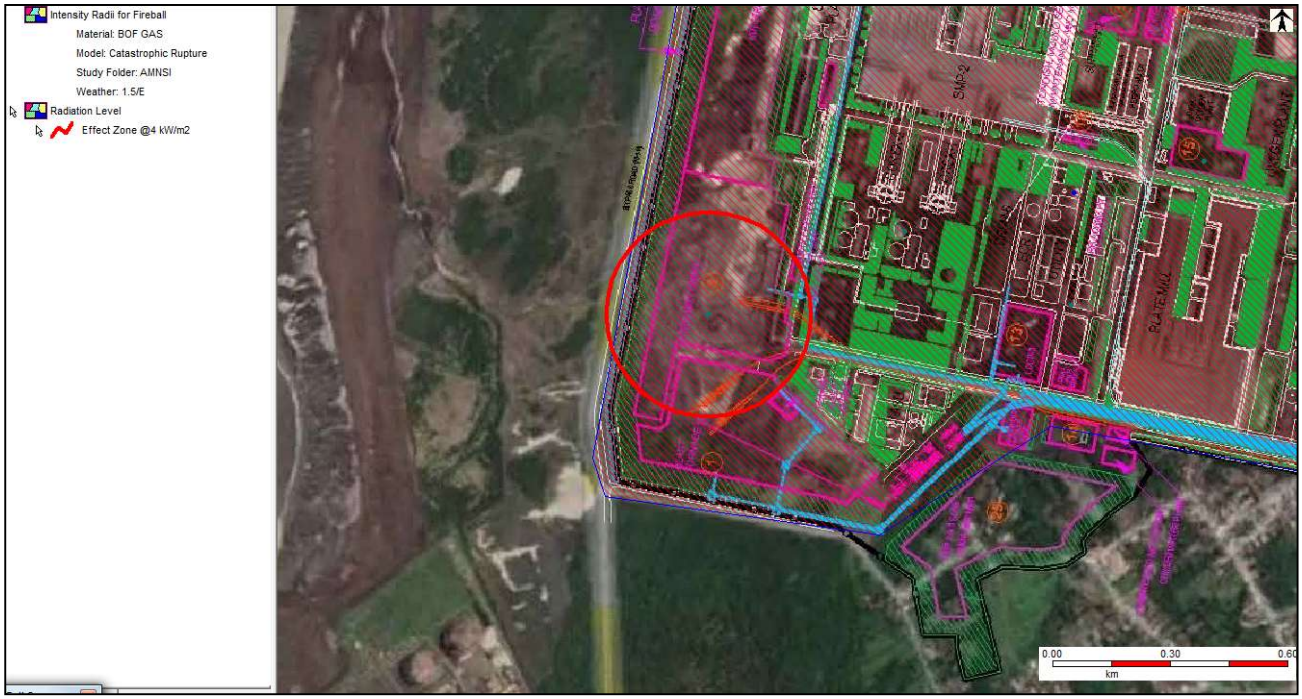


Figure 7-6: Flash fire effect distance contour due to catastrophic rupture of BOF Gas holder at weather condition 4/D

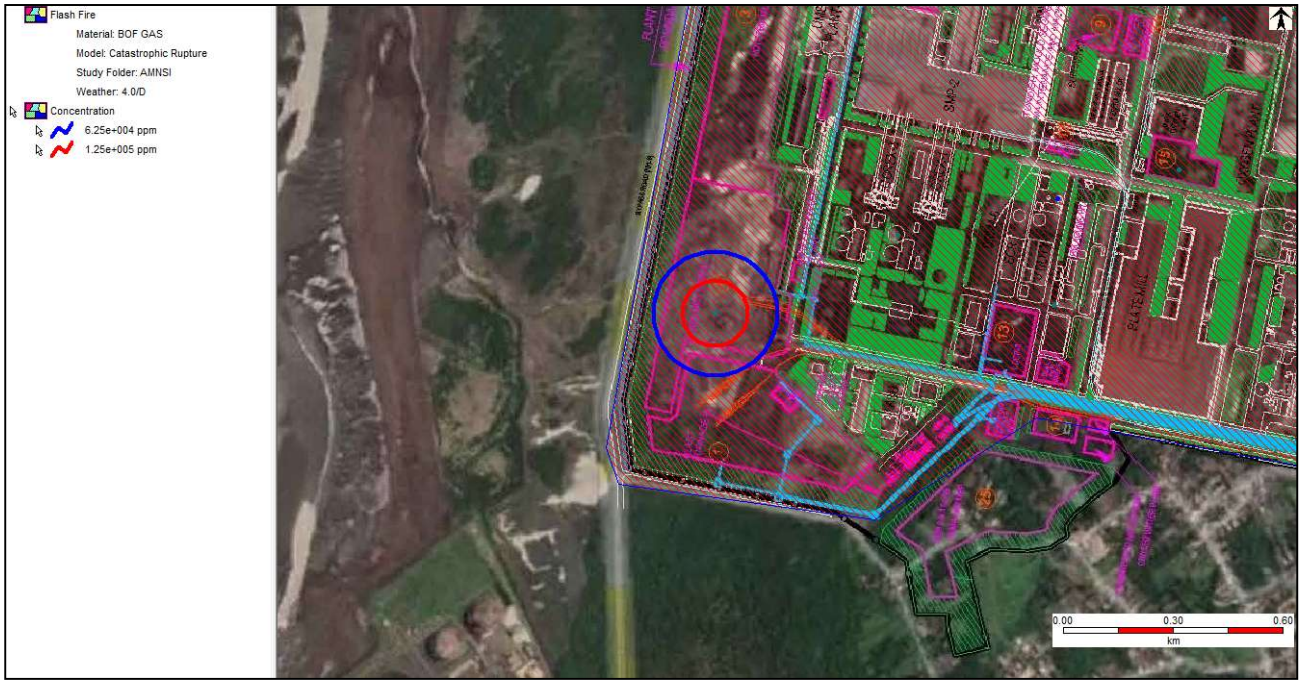


Figure 7-7: Max concentration effect distance contour due to catastrophic rupture of BOF Gas holder at weather condition 1.5/E

Corex Gas

The results obtained for Corex Gas in terms of the radiation levels and effect distances are presented below;

Table 7-25: Radiation level and effect distance due to release of material – Corex Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
Corex Gas	13 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
			4/D	NR	NR	NR
	Catastrophic Rupture	Fire ball Hazard	1.5/C	101	NR	NR
			1.5/E	107	NR	NR
			4/D	105	NR	NR

NR: Not Reached

Table 7-26: Flash fire level and effect distance due to release of material– Corex Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (20000 ppm)	UFL (40000 ppm)
Corex Gas	13 mm leak	Flash fire	1.5/C	1	0
			1.5/E	1	0
			4/D	1	0
	25 mm leak	Flash fire	1.5/C	1	1
			1.5/E	1	1
			4/D	1	1
	50 mm leak	Flash fire	1.5/C	3	1
			1.5/E	3	1
			4/D	2	1
	Catastrophic Rupture	Flash fire	1.5/C	110	67
			1.5/E	769	441
			4/D	272	172

Table 7-27: Toxic effect distance due to release of material– Corex Gas

Chemical	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (1200 ppm)
Corex Gas	13 mm leak	1.5/C	15
		1.5/E	23
		4/D	NR
	25 mm leak	1.5/C	52
		1.5/E	68
		4/D	17
	50 mm leak	1.5/C	128
		1.5/E	148
		4/D	58
	Catastrophic Rupture	1.5/C	51
		1.5/E	45
		4/D	89

The contours for effect distance generated are presented below;

Figure 7-8: Fireball effect distance contour due to catastrophic rupture of Corex Gas holder at weather condition 1.5/E

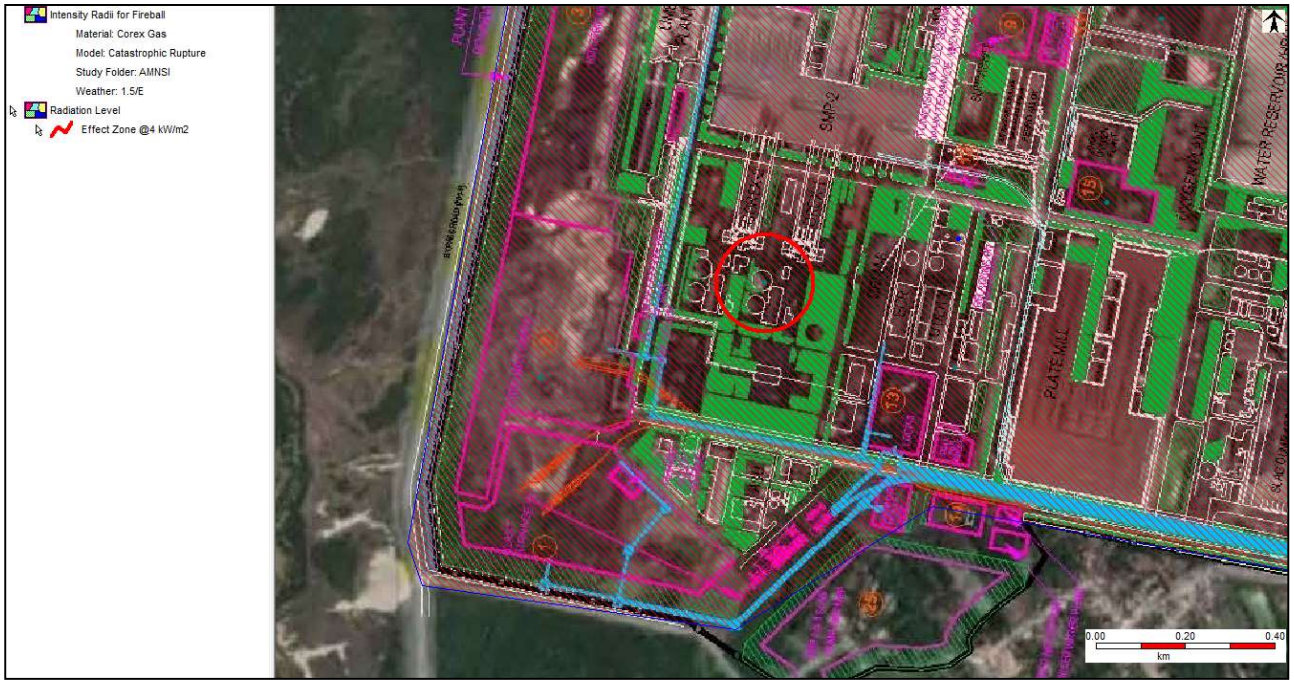


Figure 7-9: Flash fire effect distance contour due to catastrophic rupture of Corex Gas holder at weather condition 1.5/E

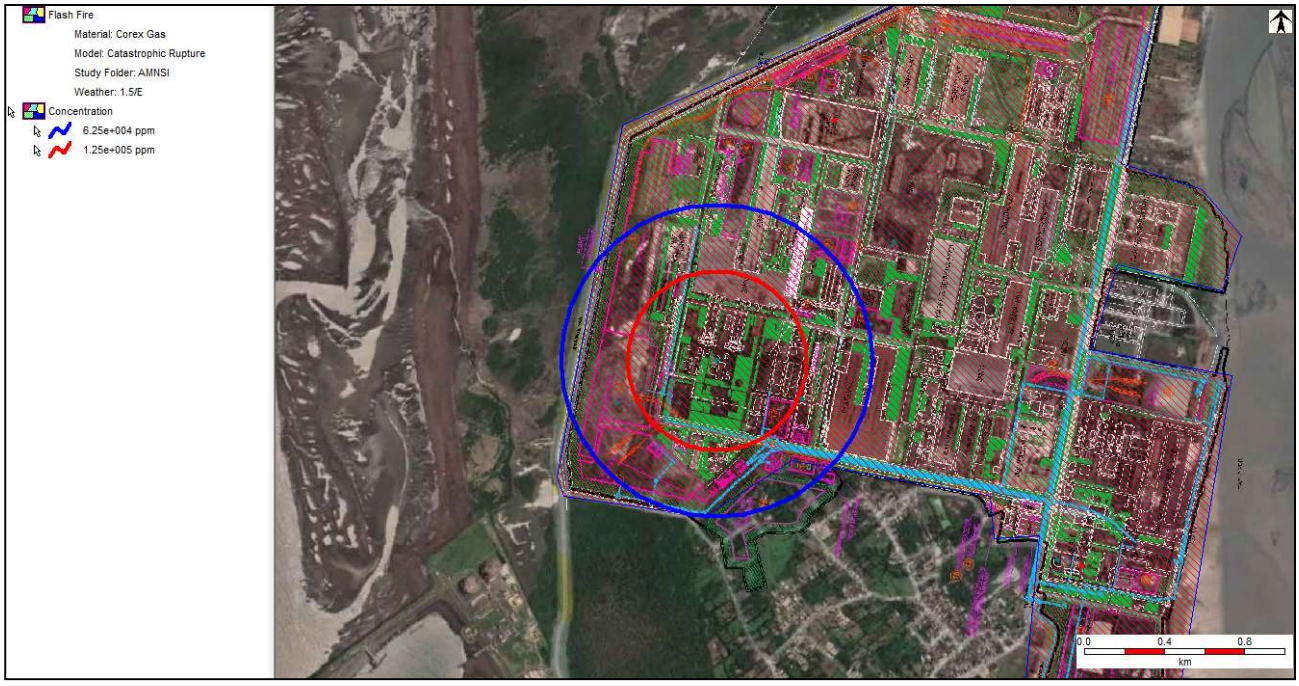


Figure 7-10: Max concentration effect distance contour due to catastrophic rupture of Corex Gas holder at weather condition 1.5/E

Tail Gas

The results obtained for Tail Gas in terms of the radiation levels and effect distances are presented below;

Table 7-28: Radiation level and effect distance due to release of material – Tail Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
Tail Gas	13 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
			4/D	NR	NR	NR
	Catastrophic Rupture	Fire ball Hazard	1.5/C	45	NR	NR
			1.5/E	47	NR	NR
			4/D	46	NR	NR

NR: Not Reached

Table 7-29: Flash fire level and effect distance due to release of material– Tail Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (20000 ppm)	UFL (40000 ppm)
Tail Gas	13 mm leak	Flash fire	1.5/C	1	0
			1.5/E	1	0
			4/D	1	0
	25 mm leak	Flash fire	1.5/C	1	1
			1.5/E	1	1
			4/D	1	1
	50 mm leak	Flash fire	1.5/C	3	1
			1.5/E	3	1
			4/D	2	1
	Catastrophic Rupture	Flash fire	1.5/C	53	33
			1.5/E	70	42
			4/D	105	61

Table 7-30: Toxic effect distance due to release of material– Tail Gas

Chemical	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (1200 ppm)
Tail Gas	13 mm leak	1.5/C	12
		1.5/E	18
		4/D	NR
	25 mm leak	1.5/C	40
		1.5/E	48
		4/D	14
	50 mm leak	1.5/C	89
		1.5/E	89
		4/D	48
	Catastrophic Rupture	1.5/C	18
		1.5/E	19
		4/D	24

The contours for effect distance generated are presented below;

Figure 7-11: Fireball effect distance contour due to catastrophic rupture of Tail Gas holder at weather condition 1.5/E

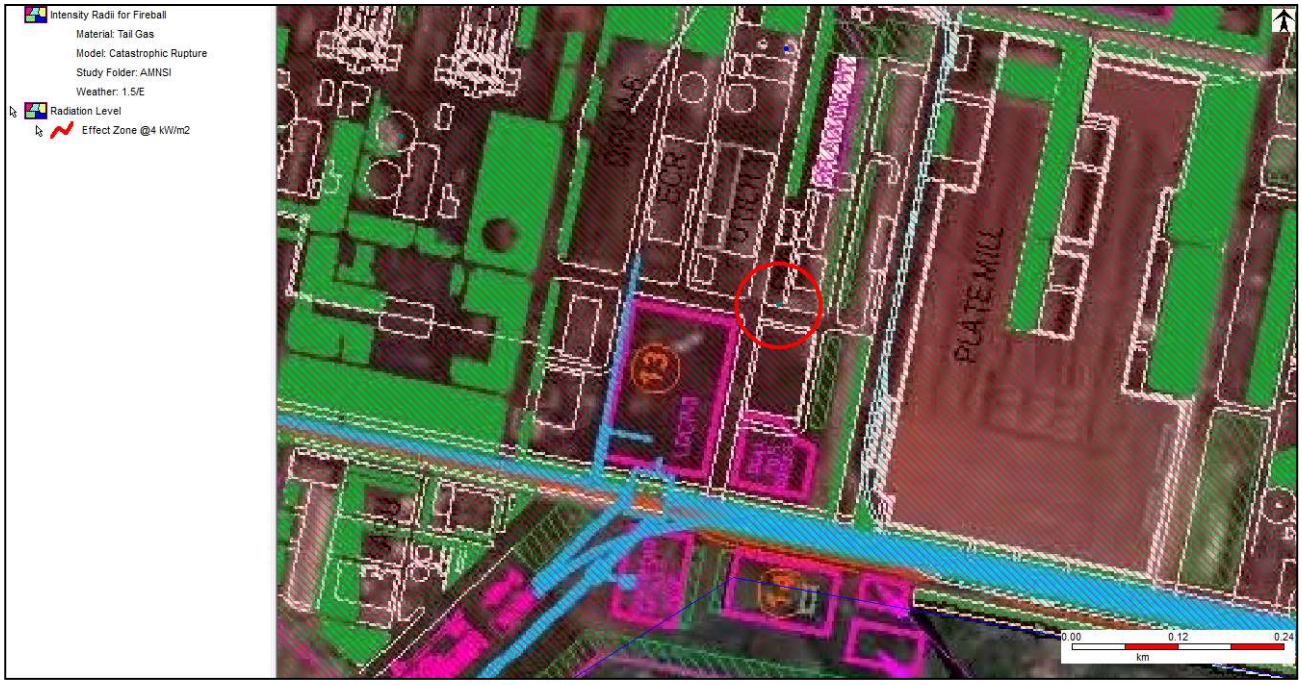


Figure 7-12: Flash fire effect distance contour due to catastrophic rupture of Tail Gas holder at weather condition 4/D

Figure 7-13: Max concentration effect distance contour due to catastrophic rupture of Tail Gas holder at weather condition 1.5/E

Coke Oven Gas

The results obtained for Coke Oven Gas in terms of the radiation levels and effect distances are presented below;

Table 7-31: Radiation Level and effect distance due to release of material – Coke Oven Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
Coke Oven Gas	13 mm leak	Jet Fire	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	5	NR	NR
			1.5/E	5	NR	NR
			4/D	5	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	12	9	NR
			1.5/E	12	9	NR
			4/D	12	10	NR
			1.5/C	NR	NR	NR

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
		Fire ball Hazard	1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	Catastrophic Rupture	Fire ball Hazard	1.5/C	411	225	97
			1.5/E	414	227	98
			4/D	413	226	98

NR: Not Reached

Table 7-32: Flash fire level and effect distance due to release of material– Coke Oven Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (20000 ppm)	UFL (40000 ppm)
Coke Oven Gas	13 mm leak	Flash fire	1.5/C	7	5
			1.5/E	7	5
			4/D	5	4
	25 mm leak	Flash fire	1.5/C	12	8
			1.5/E	12	9
			4/D	9	6
	50 mm leak	Flash fire	1.5/C	21	15
			1.5/E	21	15
			4/D	19	12
	Catastrophic Rupture	Flash fire	1.5/C	148	104
			1.5/E	178	116
			4/D	310	218

The contours for effect distance generated are presented below;

Figure 7-14: Fireball effect distance contour due to catastrophic rupture of Coke Oven Gas Holder at weather condition 4/D

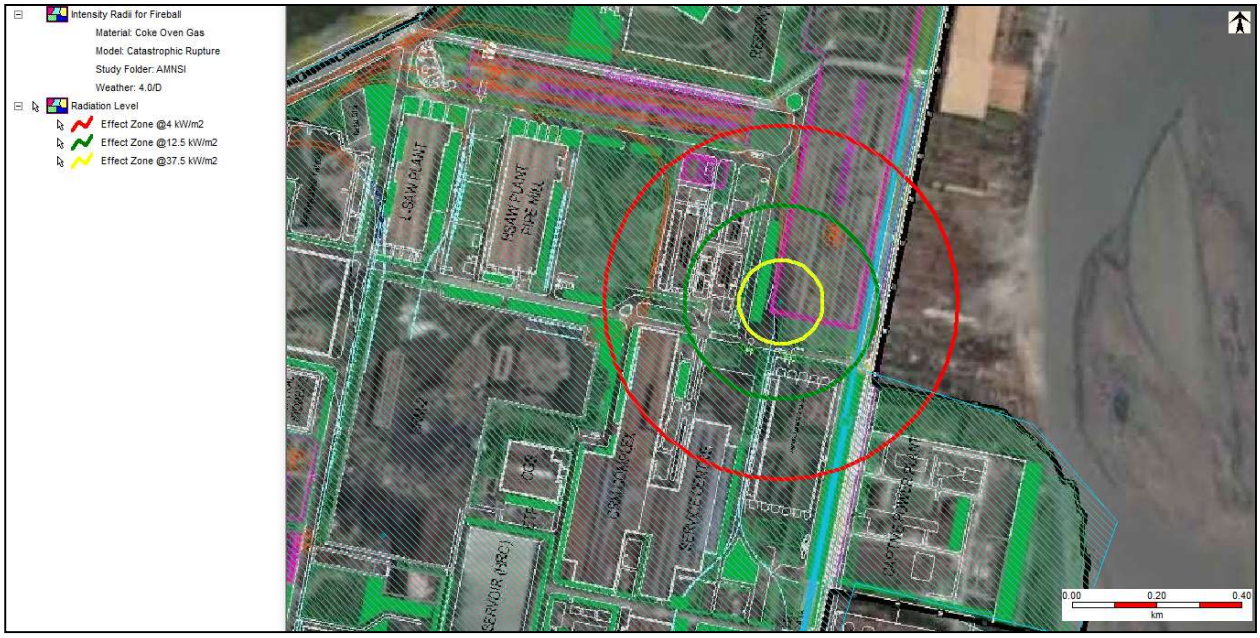
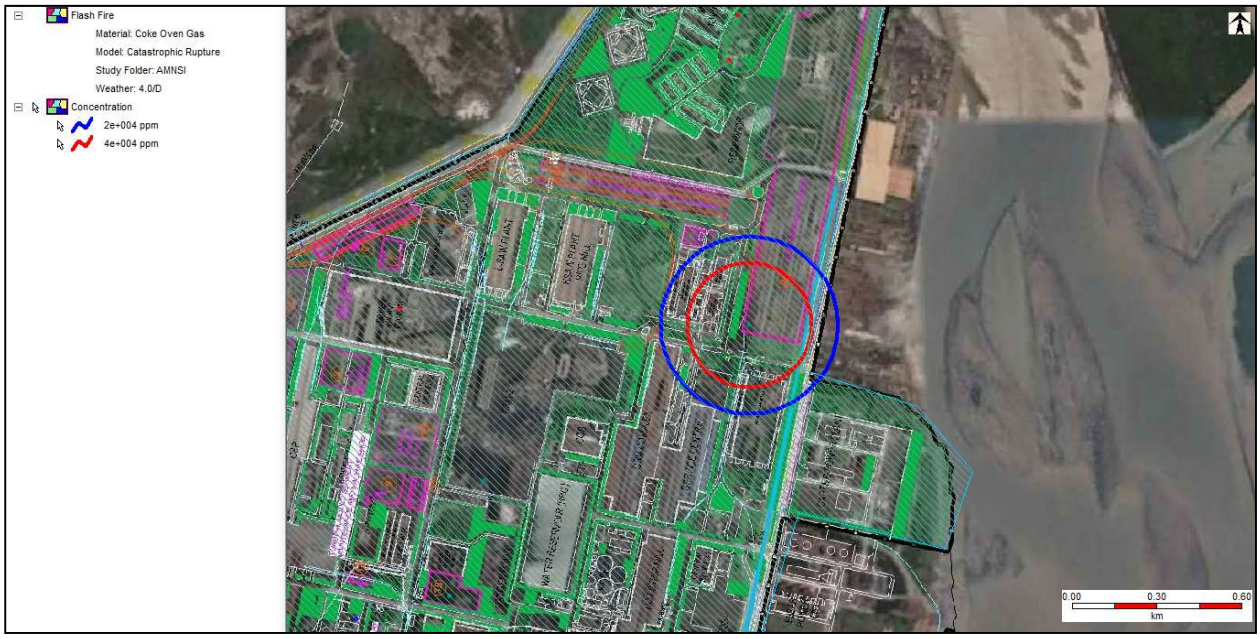


Figure 7-15: Flash fire effect distance contour due to catastrophic rupture of Coke Oven Gas Holder at weather condition 4/D



Ammonia Gas

The results obtained for Ammonia Gas in terms of the radiation levels and effect distances are presented below;

Table 7-33: Radiation level and effect distance due to release of material– AmmoniaGas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
Ammonia Gas	13 mm leak	Jet Fire	1.5/C	11	NR	NR
			1.5/E	11	NR	NR
			4/D	9	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	20	NR	NR
			1.5/E	20	NR	NR
			4/D	17	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	38	33	NR
			1.5/E	38	33	NR
			4/D	32	27	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	Catastrophic Rupture	Fire ball Hazard	1.5/C	44	5	NR
			1.5/E	44	6	NR
			4/D	44	5	NR

NR: Not Reached

Table 7-34: Flash fire level and effect distance due to release of material– Ammonia Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (8000 ppm)	UFL (160000 ppm)
Ammonia Gas	13 mm leak	Flash fire	1.5/C	2	1
			1.5/E	2	1
			4/D	2	1
	25 mm leak	Flash fire	1.5/C	4	2
			1.5/E	4	2
			4/D	3	2
	50 mm leak	Flash fire	1.5/C	7	3
			1.5/E	7	3
			4/D	7	3
	Catastrophic Rupture	Flash fire	1.5/C	7	5
			1.5/E	7	5
			4/D	7	5

Table 7-35: Toxic effect distance due to release of material– Ammonia Gas

Chemical	Failure Scenario	Met Data	Effective Distance in meter to Toxic Level
			IDLH (300 ppm)
Ammonia Gas	13 mm leak	1.5/C	0
		1.5/E	0
		4/D	0
	25 mm leak	1.5/C	171
		1.5/E	165
		4/D	214
	50 mm leak	1.5/C	198
		1.5/E	192
		4/D	261
	Catastrophic Rupture	1.5/C	29
		1.5/E	31
		4/D	39

The contours for effect distance generated are presented below;

Figure 7-16: Fireball effect distance contour due to catastrophic rupture of Ammonia tank at weather condition 4/D

Figure 7-17: Flash fire effect distance contour due to catastrophic rupture of Ammonia tank at weather condition 4/D

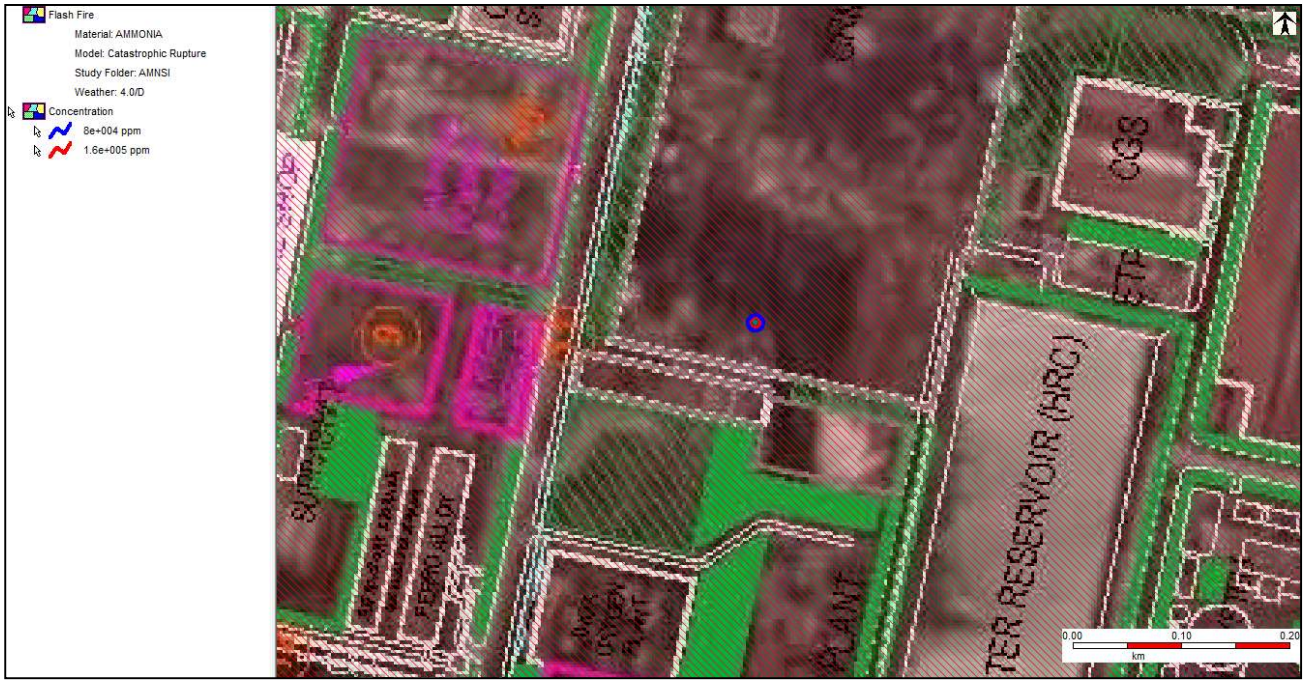
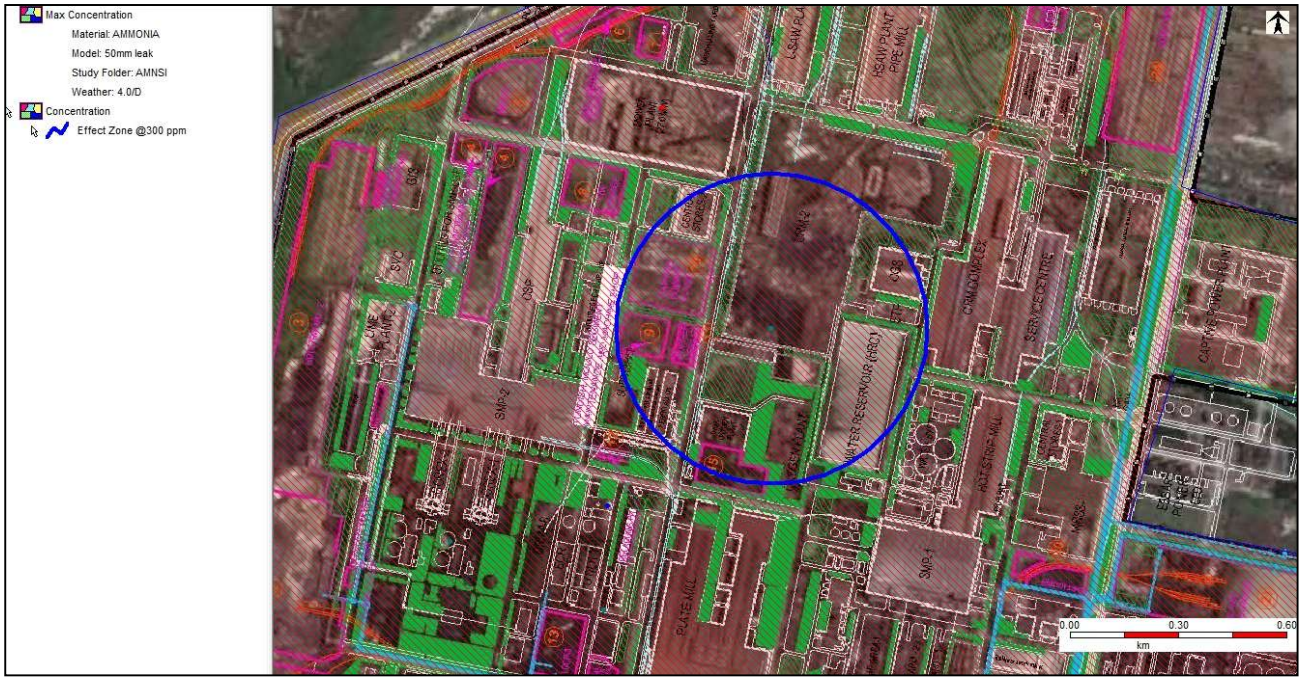


Figure 7-18: Max concentration effect distance contour due to catastrophic rupture of Ammonia at weather condition 4/D



Hydrogen Gas

The results obtained for Hydrogen in terms of the radiation levels and effect distances are presented below;

Table 7-36: Radiation level and effect distance due to release of material– Hydrogen gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter to Radiation Level		
				4 kW/m²	12.5 kW/m²	37.5 kW/m²
Hydrogen Gas	13 mm leak	Jet Fire	1.5/C	7	NR	NR
			1.5/E	7	NR	NR
			4/D	7	NR	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	25 mm leak	Jet Fire	1.5/C	14	11	NR
			1.5/E	14	11	NR
			4/D	15	12	NR
		Fire ball Hazard	1.5/C	NR	NR	NR
			1.5/E	NR	NR	NR
			4/D	NR	NR	NR
	50 mm leak	Jet Fire	1.5/C	27	21	NR
			1.5/E	27	21	NR
			4/D	29	24	NR
		Fire ball Hazard	1.5/C	49	27	12
			1.5/E	49	27	12
			4/D	49	27	12
	Catastrophic Rupture	Fire ball Hazard	1.5/C	49	27	12
			1.5/E	49	27	12
			4/D	49	27	12

NR: Not Reached

Table 7-37: Flash fire level and effect distance due to release of material– Hydrogen Gas

Chemical	Failure Scenario	Consequence	Met Data	Effective Distance in meter	
				LFL (20000 ppm)	UFL (40000 ppm)
Hydrogen Gas	13 mm leak	Flash fire	1.5/C	14	10
			1.5/E	14	10
			4/D	12	8
	25 mm leak	Flash fire	1.5/C	24	17
			1.5/E	24	18
			4/D	22	15
	50 mm leak	Flash fire	1.5/C	40	30
			1.5/E	41	31
			4/D	36	26
	Catastrophic Rupture	Flash fire	1.5/C	10	7
			1.5/E	10	7
			4/D	15	9

The contours for effect distance generated are presented below;

Figure 7-19: Fireball effect distance contour due to catastrophic rupture of Hydrogen tank at weather condition 4/D

Figure 7-20: Flash fire effect distance contour due to catastrophic rupture of Hydrogen tank at weather condition 1.5/E

7.1.9 Conclusion

Based on the above study, the maximum distance affected due to effect is given in *Error! Reference source not found.*.

Table 7-38: Maximum Effective Distances

Chemical	Scenario	Effect Distance in Meters		Consequence Zone	Consequence Acceptability
		At Radiation level 37.5 Kw/m²	At Toxic Level (IDLH)		
BF Gas	50 mm leak	NR	348 @ 1.5/E	R - Within Site T- Out of site	Unacceptable; Need to perform RA
	Catastrophic Rupture	NR	1750 @ 1.5/E	R - Within Site T- Out of Site	Unacceptable; Need to perform RA
BOF Gas	50 mm leak	NR	348 @ 1.5/E	R - Within Site T-Within Site	Acceptable
	Catastrophic Rupture	NR	1467 @ 1.5/E	R - Within Site T- Out of site	Unacceptable; Need to perform RA
Corex Gas	50 mm leak	NR	148 @ 1.5/E	T- Within Site	Acceptable
	Catastrophic Rupture	107 @ 1.5/E	89 @ 4/D	R - Within Site T- Within Site	Acceptable
Tail Gas	50 mm leak	NR	89 @ 1.5/E	T- Within Site	Acceptable
	Catastrophic Rupture	47 @ 1.5/E	24 @ 4/D	R - Within Site T- Within Site	Acceptable
Coke Oven Gas	50 mm leak	NR	0	R - Within Site	Acceptable
	Catastrophic Rupture	98 @ 4/D	0	R - Within Site	Acceptable
Ammonia Gas	50 mm leak	NR	261 @ 4/D	T - Within Site	Acceptable
	Catastrophic Rupture	NR	39 @ 4/D	T - Within Site	Acceptable
Hydrogen Gas	50 mm leak	12 @ 4/D	0	R - Within Site	Acceptable
	Catastrophic Rupture	12 @ 4/D	0	R - Within Site	Acceptable
R: For Radiation Level; O: At Overpressure; T: At Toxic Level; NR: Not Reached					

From above conclusion, risk levels are not expected to result into any offsite consequences. However, these may result into injuries to employees inside the plant. To ensure minimum potential frequency of release, it is recommended at preventive and mitigative measure discussed in section below.

7.1.10 Risk Assessment (RA) Result for AMNSI Plant

Estimate Risk

Risk can be defined as a measure of economic loss, human injury or environmental damage both in terms of likelihood and magnitude of loss, injury or damage. Risk is expressed as the product of frequency of an event

and the magnitude of the consequences that results each time the event occurs. The mathematical expression for risk is:

R = FC

Where, R = risk (loss or injury per year); F = frequency (event per year); C = consequence (loss or injury per event)

The input details are discussed below:

Ignition Sources

In case of hazardous chemical release, the risk depends on location of ignition sources. In this case, the ignition sources are considered as for risk analysis are as below;

- AMNSI Township
- Canteen
- Furnace
- Boiler
- Truck parking area

Risk Criteria

Risk criteria are the acceptable levels of risk that can be tolerated under a particular situation, 'In many countries the acceptable risk criteria has been defined for industrial installations and are shown in below photograph. These criteria are yet to be defined in the Indian context, but values employed in other countries can be used for comparison. The Risk Criteria in Some countries are given in table below.

Table 7-39: Risk Criteria in some countries

Authority and Application	Maximum Tolerable Risk (Per Year)	Negligible Risk (Per Year)
VROM, The Netherlands (New)	1.0E-6	1.0E-8
VROM, The Netherlands (Existing)	1.0E-5	1.0E-8
HSE, UK (Existing hazardous industry)	1.0E-4	1.0E-6
HSE, UK (New nuclear power station)	1.0E-5	1.0E-6
HSE, UK (Substance transport)	1.0E-4	1.0E-6
HSE, UK (New housing near plant)	3 x 1.0E-6	3 x 1.0E-7
Hong Kong Government (New plants)	1.0E-5	Not used

Source: BIS Standard No. 15656:2000, Annex E, PP 21.

Individual Risk

Individual risk is the annual risk of death or serious injury to which specific individuals are exposed. Whether the risk is tolerable can be judged relatively easily as individuals knowingly take and accept risks all the time by, for example, travelling in a car. By reference to known statistics about such risks, it is generally accepted that risk of death or serious injury to third parties should not exceed 1 in 10,000 in any year and that risk below 1 in 100,000 is negligible in relation to other accepted risks. Between these limits, the risk arising from a hazard must be made "as low as reasonably practicable" (ALARP).

The iso–risk contours representing Location specific individual risk (LSIR) in Hazardous chemical storages are shown in the ***Figure 7-21***

Figure 7-21: Risk Contours for Individual Risk

Risk contour of 1.0E-06 per year is within the Plant boundary. Therefore, the maximum individual risk to members of the public outside the plant boundary is less than 1.0E-06 per year which is on acceptable level.

Societal Risk

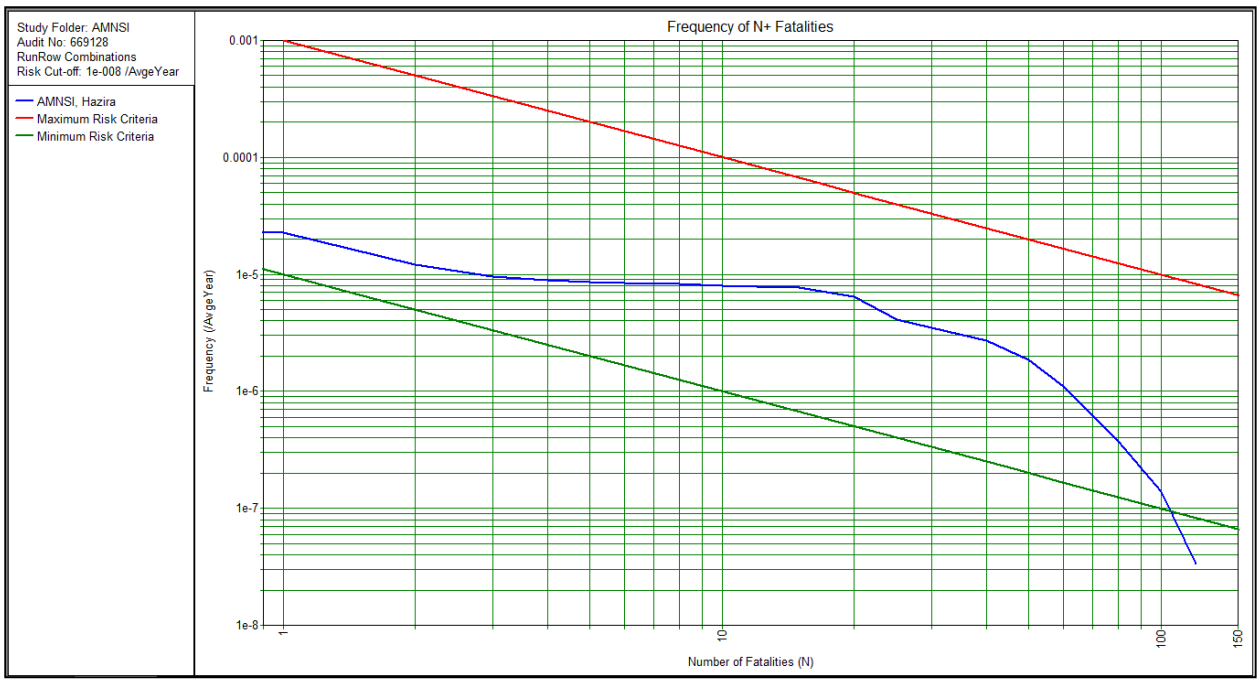
Individual risk does not, however, completely describe situations where a single accident could kill or injure large numbers of people. Decision makers are aware that there is a big public reaction when, for example, a train crash kills a number of people while the fact that a greater number die on the road everyday goes largely unnoticed. The cost effectiveness of risk reduction measures must be assessed in relation to the likely number of casualties.

These situations are addressed by estimating societal risk which is expressed as the relationship between the probability of a catastrophic incident, expressed as the average frequency with which it can be expected to occur, and its consequences. It is usually represented as an F-N curve.

This graph plots the expected annual frequency (F) of the number (N or more) of casualties in the whole surrounding area arising from all possible dangerous incidents at a hypothetical hazardous site. Note that the number of casualties (N) is cumulative so the curve can only increase towards the left of the graph.

The FN Curve representing Location specific societal risk for Hazardous chemical storages are shown in ***Figure 7-22***

Figure 7-22: FN Curve for Societal Risk – Hazardous chemical storages



Conclusions

The risk to the member of the public from the material storage System at AMNSI is within 1.0E-06 per year which is in 'Acceptable' region.

This is an 'Acceptable' risk level as per BIS Standard No. 15656:2000, which permits consideration of HSE, UK (Existing hazardous industry) Risk Level for existing plants of 1.0E-06 per year.

7.1.11 Mitigation Measures

All necessary fire Fighting Arrangement and Measures to control and limit Flammable/ Toxic releases will be taken by the Work Main Controller. Indoor Air Quality Monitoring will be conducted so as keep eye on any alarming levels of Hazardous Chemical Exposure. Detectors will be installed in the hazardous chemical storage area. Statutory obligations will be complied for implementation of Occupational Health and Safety at site.

Following preventive/mitigation measures to be followed to ensure the safety of Plant:

- Gas safety man would accompany the team and would test the atmosphere for the presence of CO, before starting the work. If CO, concentration is found exceeding the sage limit, the job would be undertaken using necessary safety appliances viz., Oxygen Breathing Apparatus/Blower type Gas mask.
- Any gas cutting /welding job would be undertaken with the clearance from Gas safety man.
- Regular inspection of 'WATER SEALS' and 'GAS VALVES'
- Regular inspection of fire fighting facilities and conduct 'Mock Drill'
- Firefighting measures should be provided to avoid any fire and ensure that there is no explosive or chemical reaction in storage yard.
- Coal unit should take measures to control the air pollution while loading/handling coal. Specific measures should be under-taken to avoid fugitive emission at the time of loading/unloading of coal by individual coal yard unit.
- All electric fittings as per HAC, as inappropriate selection of electrical fittings can cause dust explosion.

- Preventive Measures for Electricity Hazard
  a) Adequately rated and quick response circuit breakers, aided by reliable and selective digital or microprocessor based electromagnetic protective relays would be incorporated in the electrical system design for the proposed activities.
  b) The metering and instruments would be of proper accuracy class and scale dimensions.
  c) Installation of electrical equipment as per HAC.
  d) Periodic electric audits to be done.
- Precautionary Measures for Falling material
  e) Regular inspection of Cranes, Crane hooks, Crane ropes etc.
  f) Safety helmets to be used to protect workers below against falling Material
  g) Barriers like a toe boards or mesh guards is to be provided to prevent items from slipping or being knocked off the edge of a structure
  h) An exclusion zone is to be created beneath areas where work is taking place.
  i) Danger areas are to be clearly marked with suitable safety signs indicating that access is
  j) Restricted to essential personnel wearing hard hats while the work is in progress.
- In order to avoid malfunction of Boiler/BF/COB/BOF, it is ensured that the equipment design is as per norms and all the critical instruments on such equipment to be periodically tested to ensure their operation when need during emergency. The preventive maintenance of all these would help in preventing the loss of containment of hazardous chemical thus preventing fire/explosion/toxic exposure.
- In order to ensure the safety of the installation, the facility should be constructed as per relevant codes and standards.
- Wind indicator should be provided at the highest level of the plant to know the wind direction.
- Automatic sprinkler system for the flammable material tanks (over ground tanks only) may be provided as knock on effect in case of fire is possible.
- Provision of flameproof electrical fittings / equipment's.
- Proper maintenance of earth pits.
- Strict compliance of security procedures like issue of identity badges for outsiders, gate passes system for vehicles, checking of spark arrestors fitted to the tank lorries etc.
- Strict enforcement of no smoking.
- Periodic training and refresher courses to train the staff in safety firefighting.
- Employee training and education will be carried out.
- Regular safety audits shall be undertaken to ensure that hazards are clearly identified and risk-control measures are maintained within tolerable limits.
- Yearly EHS Audit will be conducted to address any issues pertaining to Environment Health and Safety
- Structural fireproofing in the process area could be considered as a safety measure in the light of probable spill and fires in the area.
- Emergency drills should be carried out periodically to ensure preparedness must continue.
- Many operations involve use of highly toxic/flammable materials and these needs to be documented as SOPs. These must be made and kept updated on priority.

- Extensive training on use of Self-Contained Breathing apparatus (SCBAs) and other PPEs must be ensured for emergency control.
- Ventilation should be provided for any enclosed are where hydrocarbon or toxic vapours may accumulate. Several such areas were noticed- these may be surveyed and tackled accordingly.
- Hydrocarbon Detectors / CO detectors shall be used for the detection of any Leak scenario to take the preventive action.
- Flame arrestor should be provided.
- Adequate number of caution boards highlighting the hazards of chemicals should be provided at critical locations.
- The health & physical hazards caused due to toxic, irritant, corrosive, flammable materials. All chemicals are within Threshold Limit Value as per ACGIH.
- Monitoring of occupational hazards like noise, ventilation, chemical exposure etc. will be carried out regularly and its record will be maintained.
- Good housekeeping, use of PPE, Engineering controls, Enclosure processes, scrubber system, display of safety boards, SOP of loading / unloading, local exhaust ventilation, safety shower etc. are important safety measures have taken to keep these chemicals within TLV.
- Appropriate personal protective equipment will be provided & ensure the usage of them.
- Workers will be trained on safe material handling of hazardous chemicals.
- Prepare & display the safe operating procedure for hazardous chemicals storage, handling & transporting or using.
- Local Exhaust ventilation and scrubber should be installed where it is required to reduce fumes, vapours, temperature and heat stress.
- Pre-employment medical check-up and periodically medical examination will be done.
- Proper inspection and maintenance of all instruments like PSVs, temperature indicator etc to avoid boiler/furnace box explosion
- Use alcohol foam, water spray or fog in case of large fire.
- Use dry chemical powder for small fire.
- Following Fire safety devices/Provision will be provided to protect from Fire
- Water storage of adequate capacity to meet the requirements of water for firefighting purposes.
- Fire hydrants and automatic sprinkler system.
- Adequate Portable fire extinguishers, sand bucket, wheeled fire & safety equipment should be provided at the required places.
- Equipment required for personal safety like blankets, gloves, apron, gum boots, face mask helmets, safety belts, first aid boxes etc. are provided. Proximity suits and self- contained breathing apparatus to be provided.
- Designated firefighting team should be present to handle the emergency.

Personal Protective Equipment (PPE)

Personal Protective equipment kept onsite is made readily available to plant personnel. Following table shows the lists of recommended Personal Protective Equipment (PPE) onsite.

Table 7-40: Summary of Recommended Personal Protective Equipment According to Hazard

	Workplace Hazards	Suggested PPE
Eye and face protection	Flying particles, molten metal, gases or vapors, light radiation	Safety glasses with side-shields, protective shades, etc.
Head protection	Falling objects, inadequate height clearance, and overhead power cords	Plastic helmets for top and side impact protection
Hearing protection	Noisy Areas	Hearing protectors (ear plugs or ear muffs)
Foot protection	Failing or rolling objects, points objects. Corrosive or hot liquids	Safety shoes and boots for protection against moving and failing objects, liquids and chemicals
Hand protection	Hazardous materials, cuts or lacerations, vibrations, extreme temperatures	Gloves made of rubberor synthetic material (Neoprene), leather, steel, insulation materials, etc.
Respiratory protection	Dust, fogs, fumes, mists, gases, smokes, vapors	• Facemasks with appropriate filters for dust removal and air purification (chemical, mists, vapors and gases). • Single or multi-gas personal monitors, if available
	Oxygen deficiency	Portable or supplied air (fixed lines). Onsite rescue equipment
Body / leg protection	Extreme temperatures, hazardous materials, biological agents, cutting and laceration	Insulating clothing, body suits, aprons etc. of appropriate materials
BF / CO Gas – Mainly CO	Maintenance of BF / CO Gas Line	• Online gas detector systems to be installed in addition to portable CO monitors. O_2 masks & kits with other appropriate PPEs will be provided

7.2 Disaster Management Plan

Disaster control planning is an essential part of the loss prevention strategy. This is a pre-plan to handle any emergency situation effectively. Its objective is to reduce the probability of serious loss/ damage to public, plant, machinery, equipment, important document etc.

The natural or man-made emergency/disaster like Flood, Earthquake, Thunder Storm / Lightning Strike, Cyclone/Hurricane, Heavy Rain, Tsunami, Bomb Threat (Terrorism) are identified. Some of the industrial hazards like Electrical Shock, Fire Hazard, Falling Hazard and Trapping in rotating parts are also identified for the said project.

7.2.1 Objectives of the Disaster Management Plan

The overall objectives of the Disaster Management Plan (DMP) are summarized as follows:

- To contain and control emergency incidents;
- To prevent loss of life and minimize the risk of bodily injury to workers;

- To minimize damage to property;
- To provide maximum possible safety equipment for the emergency response personnel.

Emergencies can be anticipated based on audit or other procedures prior to commencement of operations

7.2.2 Response Action on Disaster & Hazard

Emergency situations which may lead to Disaster: The following are the situations where we can face an emergency and disaster may take place.

a. Fire
b. Explosion
c. Oil Spillage
d. Toxic release (gases & chemicals)
e. Electrocution
f. Structure/building collapse
g. Flood/cyclone/earth quake/aggression/sabotage etc.

Area/Plant where different types of emergency situation can occur:

a. Furnace Area Turbine Hall Boiler	Explosion
b. Oil Storage Conveyors	Pool Fire & fire in general
c. Electrical Room Transformer area Cable Tunnel	Electrical Shock & Flash enjury
d. Water Treatment Plant	
e. Coke Oven / Blast Furnace/ Sinter Plant / BOF / CCP / Rolling Mills / Gas Pipes / Gas Mixing Station	Release of highly toxic Carbon Mono-oxide gas Fire & Explosion
f. CCP	Fire / Explosion due to BF/CO/BOF Gas – LOT system failure Spillage of liquid metal from ladle
g. Oxygen Plant Cryogenic liquid spill	Fog cloud from a cryogenic release
h. NG/ BF/CO/BOF Gas Boosting station	Fire / Explosion
i. Coke Ovens	Fire hazard (Tar sludge, Benzol Acid Sludge)

Explosion

- Explosion in supply pipeline of O_2, NG, Coke Ovens, BOF, BF, N_2 gas due to excess pressure and Storage tank of Coke Oven Gas, BF Gas, BOF Gas, Tail Gas, Ammonia Storage Tank and Hydrogen Storage Tank

Fire

- Fire in and around the pipe lines transferring Flammable gas.

- Fire due to failure of pipeline.
- Fire due to leakage, spillage of flammable liquid /gas from the pipe line.
- Fire due to electricity or static charge accumulation.

Flammable Gas Dispersion

- Sudden Gas Dispersion due to failure of pipeline. Further, if dispersed gas get any source of ignition, then it may result into explosion and subsequent fire.

Toxic gases / Vapour Dispersion

- CO gas, BF Gas, BOF Gas may leak from pipeline due to failure of pipe lines, valves etc and will disperse along with Wind direction, will create toxic effect to the persons, if inhaled.
- Nitrogen gas may leak from pipeline due to failure and Nitrogen gas will disperse along with Wind direction, will create suffocation effect to the persons, if inhaled.

Hazards due to Vehicle transportation

Various heavy vehicles like, cranes, loaders etc. are used in the plant. The serious events of emergency may be created due to collision, strikes, collapse of the vehicles with the pipelines.

Collapse of Building / Structure

Collapse of pipe line structures would result in the damage of pipe lines leading to fire, explosion, burn injury, and dispersion of poisonous gases.

Electrical Fires

Electrical fire due to electric power supplied to motorized operated valves, in close proximity to the pipelines transferring flammable gases may result in fire and further cause explosion.

Other Hazards

- Machinery & Equipments Failure.
- Hazards during maintenance jobs
- Failure of automation, instruments etc.
- Natural Calamities.

The cause of major accidents

Minor or serious accidents cannot be overruled; failure of containment may be caused by various reasons resulting into leakage of hazardous chemicals, in form of gas, liquid.The common causes & failure as explained below, which may be reason of possible emergency.

Unsafe Acts & Unsafe conditions

- Inadequate design against internal pressure, external forces, corrosion and temperature etc.
- Mechanical failure of Pipes, Vessels, Elbows due to corrosion, erosion, impact, liquid expansion etc.
- Failure of manual or automatic control system and machine guarding.
- Failure of safety systems.
- Weld failure, Gasket failure.
- Unsafe operation / maintenance.
- Fire / Emergency in neighboring units.

- Heating of electrical coils may result into fire.
- Spillage, leakage of flammable material, if get any sources of ignition will result into fire.
- Uncontrolled vehicle movement result into fire, explosion or accident.
- Wrong operating valve, mixing or overflowing of liquid chemicals from the tanks, result into fire or mishaps.

Deliberate

- Sabotage
- Terrorism
- Commotion / Army conflicts
- Plane crash / Air raid
- Bomb Threat

Natural Calamity

- Storm
- Cyclone
- Flood
- Frost
- Earthquake
- Lightening
- Heavy Rainfall

Initial operation (starting) phase & design

- Improper design
- Improper selection of equipment
- Improper selection and design of pipe lines
- Improper fabrication / welding work
- Improper erection or commissioning
- Improper pre-commissioning and commissioning
- Untrained operatives

Failures could be in the form of small gasket leaks in a flange joint, failure of pipeline or even rupture / Catastrophic failure of Tank. Major failure modes associated with different operation areas in the facility are listed below;

- Flange gasket leaks
- Valve gland leakage
- Failure of weld joint (Sample point, instrument connection etc.)
- Hose rupture or hose getting snapped off
- Pipeline rupture

During Working / Process / Operation

- Opening of relief Valves
- Wrong line up because of human error
- Failure of weld joints, gaskets, and other material failure due to wear & tear
- Failure due to fatigue or corrosion
- Improper preventive maintenance

Hazards of Interplant Pipe Rack

Gas leakage in pipe rack during operation

Detection mechanism

The leakage of Corex gas in large amounts can be detected by the decrease of network pressure in the pipe rack. Minor leakages can be identified with the help of CO gas monitors.

Response Procedure:

Evacuate the area. The source of the gas is isolated so that no further leakage takes place.

Follow up Activities:

The area is cleaned and damaged parts are replaced/repaired and system is made ready for start. The plant is stopped if the leakage is severe due to fire hazard.

Fire in Pipes containing flammable gases like Corex Gas, Natural Gas, BF Gas Oxygen Gas due to bursting of pipes

Detection mechanism

The bursting of pipe lines either occur due to increase in the pressure of the gas above the design pressure or due to fall or collision of structures, vehicles on the pipelines or due to physical wear and tear of the pipes.

Response Procedure:

Evacuate the area. The explosion immediately detected by the field operator / control room operator with the help of malfunctioning of the system. The plant is stopped to arrest the gas leakages and to take care of fire hazard if required. Suitable actions are taken depending on the extent of explosion and gas leakage. Fire is put off by Local fire extinguishers / fire fighting water hoses. Incase of gas leakage, the leakage point / location is identified and actions are taken to arrest the gas leakage. Suitable oxygen masks are used during the leakage arresting.

Follow up Activities:

Shift manager will inform the higher authorities and necessary actions are taken. The area is cleaned and damaged parts are replaced / repaired and system is made ready for start in case of explosion.

Explosion of pipes containing flammable gases like Corex gas, Natural gas, BF gas & Oxygen gas due to bursting of pipes

Detection mechanism

Explosion is detected by the field operator.

Response Procedure:

Evacuate the area. The fire is immediately detected by the field operator and is intimated to the control room. Suitable actions are taken depending on the extent of fire / flame. Fire is put off by fire-fighting water line.

Follow up Activities:

The area is cleaned and damaged parts are replaced / repaired and system is made ready for start in case of explosion.

Bursting of puncture of pipelines containing steam

Detection mechanism

The steam leakage is detected by field operator.

Response Procedure:

Evacuate the area. The bursting is detected by the field operator and is intimated to the responsible authority and stopped immediately if possible and hand valves nearest to the burst area are closed.

Follow up Activities:

The area is cleaned and damaged parts are replaced / repaired and system is made ready for start in case of explosion / bursting.

Safety in Plant Design

A safe and sound design, based on international standard and National design are the foundation to the safe conditions in the installation. Safe operations and safe maintenance are other links for the Safety system. The Safety Systems as provided at various places are describes as below in respect of hazardous process / substance.

Civil and Structural Works: The civil and structural work has been done as per the relevant Indian Standards and codes for industrial plant and building construction. Additional safety factor for static and dynamic, maximum wind speed conditions and other weather condition that have bearing on the safety of structure are also considered while designing.

The care has been taken to provide the suitable internal, external and surrounding roads for easy approach to plant equipments machinery etc. the necessary termite and anticorrosive treatments are also done wherever required.

Considering the type of hazard / risk planning has been made during the planning and construction phase that the process units, storage installation, utility facilities and office premises are located away from each other's, so that in case of any accident in one area it will not affect another area.

Controls & Alarms

Auto control Systems with D.C.S Computer Operation are provided on valves. Further, qualified & experienced person is posted in the control room. If abnormality in process is observed, then, the supply of materials can be stopped or other parameter can be controlled by computer system. If it is uncontrollable condition, then, after accessing the situation HOD/IC authority will decide the emergency situation & on site emergency plan will be activated and the process can be stopped immediately.

An electrically operated siren with range of 5 Kilometers is installed and emergency siren code is described for various type of emergency i.e. fire, Toxic leak, all clear, testing etc.

Fire Alarms & detection systems are installed with Manual call. The control room, at fire station is equipped with microprocessor based computerized addressable fire alarm system and the wireless (VHF).

Further, Calibration & Testing of all equipments are carried out periodically.

Fire Protection System

The different hazardous chemicals are stored in the different tanks. The following fire protection and prevention measures are adopted right from the design point of view.

Fire Precaution

- Flame proof electrical fittings.
- Smoking is strictly prohibited
- Earthing to pipe line and all equipment
- Flange to flange earthing for pipeline
- Continuity of earthing and earth resistivity tests are carried out
- Periodical checking of pipelines
- Trained and Experienced staff are employed

Fire Protection

- Fire Hydrant Network
- Water Monitor Points
- Various types of Fire Extinguishers provided at different locations
- Fire Buckets are provided at various places
- Trained person in Fire Fighting
- Fire water storage with fire pumps (Electrical, Diesel and Jockey Pumps)
- Fire suits, Self breathing apparatus are available.
- Explosive meter, Oxygen meter etc instruments are available.
- Provision of DG set.
- Fire men, Fire tender, etc.

7.2.3 Emergency Communication System & Roles and Responsibility of Key Personnel

Emergency

An emergency is an abnormal event, which could result in danger to personnel, property and environment. It could be due to fire, Explosion, Heavy spillage of hazardous liquid, toxic gas release etc.

Classification of Emergencies

Emergencies can be categorized into three broad levels on the basis of seriousness and response requirements, namely:

Level-1:

- Can be effectively and safely managed and contained within the site, location or installation by the available resources.
- Has no impact outside the site, location or installation.

Level-2:

- Cannot be effectively and safely managed or contained at the location or installation by available resource and additional support is alerted or required.
- Is having or has the potential to have an effect beyond the site, location or installation and where external support of mutual aid partner may be involved.
- Is likely to be danger to life, the environment or to industrial assets or reputation.

Level-3:

This is an emergency or an incident with off-site impact which could be catastrophic and is likely to affect the population, property and environment inside and outside the installation, and management and control is

done by district administration. Although the Level-III emergency falls under the preview of District Authority but till they step in, it should be responsibility of the unit manage the emergency.

Emergency Organization Functions and Action Sequence at AMNS:

For effective management of emergency, coordinated group efforts on the part of all concerned personnel are essential. On-Site Emergency Control Centre (OSECC), located in Emergency Control Room & Security Office of Main Gate is the nodal point from where On-Site Emergency controller will co-ordinate the emergency operations and co-opt executives from Emergency Teams as deemed fit. Emergency teams shall consist of key executives of various departments.

Both internal as well as external telephone facilities are provided at selected locations in the plant for communication during an emergency. A communication team has been identified with allocation of the duties and responsibilities of the team members.

Besides arranging one communication station close to the site using Portable loud speakers, Walkie-Talkies sets, messengers with vehicles are also proposed for communicating emergencies to external agencies and rushing casualties to hospitals. Telephone numbers of external agencies like police, fire brigade, hospitals, etc. are available in the emergency plan as well as at selected locations in the plant.

Intercom system, Mobile Phones are also provided as internal communication facilities in the plant. Two sirens, one each at the main gate with 5km range and at the Coal Handling Plant with 2km range are available in the plant for communication during emergency situations.

7.2.4 Roles and Responsibility of Key Persons

Plantwise list of Incident controller & Dy. Incident controller

The list of incident controller are given in ***Table 7-41*** & Dy. Incident Controller in ***Table 7-42***

Table 7-41: Plantwise details of Incident Controller

Designation	Department / Plant	Office No.
Incident Controller	Sinter Plant	2309
	Blast Furnace	8898
	Hot Briquette Iron 1 & 4	2309
	Material Handling	8981
	Captive Power plant – 31 MW	2257
	Waste Heat recovery plant -25 MW	2257
	Central Store – HBI	2400
	Coal Shed	8981
	Corex 1 & 2	8206
	Hot Briquette Iron 5 & 6	2309
	EAF 1 to 4	3200
	Steel making plant (Conarc 1.1 to 2.2)	8303
	Cold Rolling Mill (CRM) & Downstream	3480
	Hot Strip Mill (HSM)	3125
	Compact Strip Mill (CSP mill)	3421
	Plate Mill	6705
	MRSS 1 & 2	3511

Designation	Department / Plant	Office No.
	Utilities A & B	3550
	Lime Plant A	3200
	Lime Plant B	8303
	Oxygen Plant 1 & 2	3200
	Pickling Line – 3	3480
	Coal Briquette Plant	8549
	Logistic	3866
	Heavy Equipment Division	3004
	Metal Recovery Unit (FSNL Site)	8549
	L-saw pipeline	8669
	H-saw pipeline	8669
	Coating Plant	8669

Table 7-42: Plantwise details of Dy. Incident Controller

Designation	Department / Plant	Office No.
Dy. Incident Controller	Sinter Plant	2308
	Blast Furnace	3600
	Hot Briquette Iron 1 & 4	6685
	Material Handling	2159
	Captive Power plant – 31 MW	2457
	Waste Heat recovery plant -25 MW	2457
	Central Store – HBI	2372
	Coal Shed	2159
	Corex 1 & 2	8857
	Hot Briquette Iron 5 & 6	2261
	EAF 1 to 4	3407
	Steel making plant (Conarc 1.1 to 2.2)	3438
	Cold Rolling Mill (CRM) & Downstream	3003
	Hot Strip Mill (HSM)	3114
	Compact Strip Mill (CSP mill)	8873
	Plate Mill	6709
	MRSS 1 & 2	3345
	Utilities A & B	3401
	Lime Plant A	3396
	Lime Plant B	8232
	Oxygen Plant 1 & 2	3426
	Pickling Line – 3	8581
	Coal Briquette Plant	8630
	Logistic	6341
	Heavy Equipment Division	6366
	Metal Recovery Unit (FSNL Site)	8630
	L-saw pipeline	8679

Designation	Department / Plant	Office No.
	H-saw pipeline	8679
	Coating Plant	8777

Alarm Raiser / First Responder

Any person who notices the abnormal incident of hazardous nature i.e. Fire, Explosion, Toxic gas Release, Heavy Spillage of hazardous & Toxic Chemicals-

- He will first shout "FIRE", "FIRE" or "Gas Leak", "Gas Leak" or "HELP", "HELP".
- He will inform to his co-worker/Supervisor/Shift In-charge/HOD of the department/Fire Control Room.
- Simultaneously, he will try to attack on the emergency if it is safe to do so.

Site Main Controller

He is the head authority of the Emergency Organization. Occupier/Executive Director holds the responsibility of the Site Main Controller. He is having overall responsibility for directing operation and calling for outside help from Emergency Control Center (ECC). On being informed about the emergency he will:

- He will rush to the ECC.
- He will relieve the incident controller from responsibilities for overall main control. Inconsultation with I.C. and Key Personnel decide about the type of emergency and activateon-site/off-siteEmergencyPlanifnotactivated.
- He will ensure that key personnel are called in.
- After declaring the major emergency,
    i. He will activate the off-siteplan (if required).
    ii. He will ensure about the outside emergency services and mutual aid helps are called.
    iii. He will inform neighbors' organization by telephone or by sending runner and surrounding population through loudspeakers, if required.
- He will continuously review and assess possible developments to determine the most probable course of events.
- He will direct the safe close down and evacuate the plant in consultation with the incident controller, other ICs and key person. If necessary, arrange to evacuate the neighboring population:
    i. He will ensure that the casualities are receiving adequate attention.
    ii. To arrange for hospitalization of victims.
    iii. To inform / ensure that the relatives are informed.
- He will inform and liaison with Local Crisis Group (SDM-LCC), District Crisis Group (collector-DCR),Joint Director (Industrialsafety & Health) and experts of health and safety.
- He will ensure that assembly point managing team reached on the company assembly point to take charge.
- He will ensure the accounting of personnel and rescue of missing persons.
- He will arrange to control traffic movement inside factory.
- He will ensure canteen facilities, if the emergency is prolonged.
- He will issue authorized statement to the news media.
- He will ensure preservation of evidence make arrangement for photographs etc.
- He will control rehabilitation of affected areas and victims on cessation of emergency.
- He will instruct the Security officetoraise "AllClearSiren" after ensures that the emergency is controlled and over.
- He will ensure that the plant is not start unless inspected/investigated by Joint Director (Industrial safety & Health) or Police or Other Government Authorities/insurance surveyor.

Incident Controller

Head of Department of each manufacturing division / stores / Plant hold the responsibility of the Incident Controller, if the incident is in their plant/area.On being informed of the emergency and its location he will rush to the site and he will.

- Assess the scale of emergency, if the emergency is minor, try to prevent by using internal resources like fire extinguishers in case of fire, and cover the spillage by sand in case of liquid spillage.
- Assess the scale of emergency, if the emergency is major / unable to prevent by usinginternal resources, he will start to activate on-site plan by raising the siren throughtelephoneoffice/security office or by attenuation points.
- If fire emergency is there and fire is major /unable to prevent by using internal resources, the Incident Controller (IC) will inform to local fire brigade through (ECC) office. In case of urgency, he may call fire brigade directly.
- Incident Controller and in his absence, Deputy Incident Controller shall also have to take responsibilities of Site Main Controller (SMC), at emergency control center (ECC).
- To Call in Auxiliary fire team and company fire department.
- OtherIncidentController

    i. They should remain at the plant assembly point with their personnel if safe to do so unless instructed by IC/SMC.
    ii. To carry out head count at plant/area assembly point.
    iii. As per the emergency, to send the essential person team member will fully equip at incident place.

- Incident Controller shall depute one or two other's area Incident Controller of other plant/area for his help in communication to SMC.
- To send telephonic message to SMC and key personnel or send messenger/runner to inform them about incident.
- As per the incident, direct the respective team of essential personnel to prevent it by using extinguishers in case of fire, by covering the liquid spillage by sand or soil in case of liquid spillage or by adequate equipment, etc.
- To ensure about key personnel arrived and distribute their duties.
- Establish a "site control point" at a safe distance to better manage the situation by set up a communication point and establish contact with the emergency control center.
- To ensure availability of the outside services like mutual aid, fire brigade through emergency control center.
- Direct the safe shut down of the plant or part of the plant and evacuate the plant or area to the safe company assembly point.
- Direct all operations within the affected areas with the following priorities
- To search for causalities.
- To give advice and as asked by the head of fire brigade and emergency services.
- To brief Site Main Controller (SMC) and keep informed of development of situation.
- To Inform the SMC after controlling the emergency to raise all clear siren.
- To preserve evidences that will be necessary for subsequent inquiry into the cause of the emergency and concluding preventive measures.

Deputy Incident Controller

In the absence of Head of Department (IncidentController), ShiftIn-charge of respective Plant will hold the responsibility of the Deputy Incident Controller.

Head-Health & Safety

- On getting information on emergency, he will rush to site.
- On reaching site, he will evaluate the situation with IC (HOD) and SMC at ECC.
- He will ensure that rescue operation is in action.
- He will ensure that all trapped persons are safely rescued and if necessary given proper medical treatment.
- He will continuously monitor the situation and give guidance in response action to his team members.
- He will do co-ordinate with IC & other response team members.
- He will ensure adequacy of resources to tackle the emergency. If required more resources, than after consulting with HOD (IC) & SMC, he will call other out-side resources from mutual aiders and Surat Municipal Corporation Fire Brigade.
- He will ensure experienced and trained persons are properly and adequately posted at various locations to handle the emergency effectively.
- He will advise for shutdown of processor plant due to emergency situation.
- He will give his expert opinion to IC/SMC on Fire / Gas Leak, evacuation of persons, hazards of chemicals and on emergency situation.
- He will ensure that injured or casualties are receiving adequate attention for medical.
- He will help and co-ordinate to the internal investigation committee.
- He will ensure that environment will be properly monitored before environment clearance for re-starting of plant.
- In absence of HEAD–Health & Safety., GM-Safety will hold the responsibility of the Head-Health & Safety.
- He will coordinate with factory inspector with Head HR.

Head-Fire

- On getting information on emergency, he will rush to site.
- On reaching site, he will evaluate the situation with IC (HOD) and SMC.
- He will ensure that fire fighting and rescue operation are in action.
- He will ensure that all trapped persons are safely rescued and if necessary given proper medical treatment.
- He will continuously monitor the situation and give guidance in response action to his teammembers.
- He will do co-ordinate with IC & other response team members.
- He will ensure adequacy of resources to tackle the emergency. If required more resources, than after consulting with HOD (IC) & SMC, he will call other out-side resources from mutual aiders and SMC Fire Brigade.
- He will ensure experienced and trained persons are properly and adequately posted at various locations to handle the emergency effectively.
- He will give his expert opinion to IC/SMC on Fire / Gas Leak, evacuation of persons, hazards of chemicals and on emergency situation.
- He will help and co-ordinate to the internal investigation committee.
- In absence of HEAD in Fire dept., In-charge (Fire) will perform the duty of response action.

Fire Crew

- Fire crew will rush to the site/incident place immediately on getting information and survey out the area, accordingly give feedback to control room/IC/GM (Health &Safety, F) and start responding action by selecting and using proper firefighting equipments and ask fireman to use gas masks or respirator if required.
- Then, crew will communicate firefighting progress and details on additional resource needed to control room (Fire) time to time.

- Theywillco-ordinate between various departments like Operation, Mechanical, electrical, etc. during fire fighting operation.
- They will ensure to carry out rescueoperation for injured/trapped person and more vehicles called to shift them for hospitalization.
- They will ensure during the search no person is left inside.
- They will ensure route of fire tender will be free from obstacles and if required, he will ask help from transportation or heavy vehicles department.
- The crew will confirm the extinguishment of fire and accordingly he will inform HEAD (Fire), and IC.
- The crew will arrange to collect all fire fighting equipments, instruments, articles, used or non-used from the site.
- The crew will co-ordinate for removal of water logging due to fire fighting at site.
- The crew getting clearance from IC, SMC or HEADs (Fire) he and his staff can leave the incidence place.

Fire Control Room

- Ascertain information on type of incident, involvement of chemicals, exact location, involve department, person presents etc. FCR will confirm such details from HOD of respective department; then, pass on the information to other designated person.
- FCR will deploy fire crew at incident place.
- FCR will communicate security to report at site immediately.
- Simultaneously, FCR will passon information to Head (Fire) and SMC.
- FCR will co-ordinate with HOD at incident place, constantly.
- On getting message to declare the emergency accordingly, ensure to sound the siren immediately and intimate to IC, Head (Fire), SMC.
- FCR will communicate to the control room of local crisis group, disaster management area and fire control room, as instructed.
- FCR will convey the message for rescue of trap person, requirement of ambulance etc. as instructed by IC/SMC
- FCR will communicate the requirement of equipments, manpower, vehicles etc. to mutual aiders as instructed by IC/SMC.
- On arrival of mutual aiders, FCR will co-ordinate constantly with own fire crew and other related matters.
- FCR will maintain communication system in working and efficient condition.
- On arrival of mutual aiders, FCR will co-ordinate constantly with own fire crew and other related matters.
- FCR will maintain communication system in working and efficient condition.

Head – Security

- He will arrange to cord on the incident place by deputing more security guard & mobilize additional search force for help.
- He will control the traffic by deputing additional security guard & prevent unauthorized entry to the factory and theft.
- He will arrange proper parking to the incoming vehicles without obstructing movement of emergency vehicles and ensure that escaping route shall not be disturbed by any vehicle.
- He will arrange additional man power for evacuating and shifting person from assembly point to safe shelter, after consultation with SMC, Head (Safety) & Head (Fire), local authorities.
- He will arrange to operate PA system for warning and alerting surrounding people, villagers for evacuation and shifting to safe shelter as directed by SMC.
- He will ensure that the evidence of the incident shall not get dismantled.

- He will ensure that the Police Dept., Collector's Office, Office of HADA and other local Authorities are informed.

Factory Medical Officer

- To take charge of Occupational Health Centre.
- To provide treatment/first aid to the affected persons and if necessary, send them to hospitals for further treatment.
- To keep liaison with hospitals and inform them about the type of emergency help required as per discussion with Site Main Controller.
- Arrangement for adequate stock of antidotes, life saving drugs and special medicines.
- To keep the record of persons given first aid/treatment and send them to hospitals with their name.
- To keep ready, the list of blood groupings.
- To inform Site Main Controller about the developing situation.
- Toguide/instruct first aider, first aid & Rescue team in case of any emergency.
- To keep ready, the list of first aider.
- To identify of all the hospitals for facilities to render medical aid to victims of exposure todangerous chemical substances, burns and other specific injuries. (State authorities, local authorities, ESICS, Private, Railways/Voluntary institutions, trusts etc.) & report to SMC.
- To keep provisions of buffer stock of essential medicines like intravenous fluids, dressingmaterials, splints, oxygen cylinders, suction apparatus etc. Keeping in view the large number of third degree burns, heat radiation.

Essential Personnel Team

As soon as the essential personnel hear the emergency siren or any emergency brought to the knowledge, they first report to incident controller (After hand over their charge to other plant supervisor/next person) with fully equipped themselves. (For proper information all team Member has to contact immediately on telephone Number)

The team of the essential personnel trained in Fire Fighting & Rescue, Firstaid, Gas & pill Control and Technical.They are available in factory in all shifts. Their responsibilities are as under:

- To rush at the site for help with fully equipped .I.e. fire fighting equipment, SCBA sets, etc. and to report to Incident Controller.
- To decide line of action in consultation with incident controller & Key personnel and take appropriate measures to extinguish the fire & to control spillage.
- To fight fire tilla Central Fire Fighting Team takes the charge.
- To help to the Central Fire Fighting Team and mutual aid teams.
- To control leakage with emergency kit or spillage control with sand or neutralizing material.
- To Rescue the injured person.
- To provide first aid to the affected persons and if necessary, send them to hospitals for treatment.
- To take charge of ambulance room and first aid room.
- To help & assist Factory Medical officer.
- To assist at casualties reception area store cord details of casualties.
- To send wiremen at Fire pump immediately.
- To provide emergency power supply if required.
- To take emergency Electrical black out if required.
- To provide emergency search light if required.
- To remain near control point and await further instruction from IC.

- On hearing the siren or any emergency brought to the knowledge, reach at incident with fitters and tool box for any mechanical assistance.
- To do emergency engineering work like isolation of equipments, material, process, providing temporary by pass lines safe transfer of materials, urgent repairs and replacement etc.

Personel Works under Site Main Controller

Manager (Transportation of Evacuated Personnel) (Head Admin)

- On getting information from SMC and ECC, he will arrange adequate vehicle withdrivers to evacuate person/casualties from Assembly Point to the safe shelter, hospital etc.
- To cope up the situation, in addition to own vehicles, he will arrange additional vehicles from outside with drivers, after consultation with SMC.
- He will arrange a Jeep/ vehicle with public address system to inform the public invicinity.
- He will arrange for the vehicles to mobilize emergency responding resources atincidentsite.

Assembly Point Managing and Control Personnel (HR Manager)

- Nodal officer will prepare and maintain the records of persons present at assembly point, evacuated persons, person not tracked out.
- Nodal officer will collect the attendance sheets from the contractors and ensure that all personnel reported duties are evaluated safety at the assembly point.
- All nodal officer posted at assembly point shall coordinate among themselves for re-confirmation/re-verification of total manpower evacuated from the area.
- In affected and vulnerable plants, all affected workers shall be evacuated to a specified assembly point by Nodal Officer.
- In case of person who are missing or not tracingat incident site and not reported to the assembly point, the nodal officer will immediately inform to SMC, IC, Head HR, Fire & Safety department and Head (Contract)
- Nodal officer will ensure that the list of relatives or care taker of such person, with contact details will be collected and communicated to the concern.
- Nodal officer will prepare and maintain the records of injured/ affected/hospitalized/under treatment/personon leave, in addition to attendance sheet.

7.2.5 Fire safety Management System

Fire Safety Organization

- AMNS owns an experienced & well trained professional Fire Staff & the Chief Security Officer, who is a retired Colonel from Indian Army, leads the fire fighting team.
- A fire officer, a fire supervisor and firemen, who are distributed inshifts, support him.
- Fire Department is well equipped with all necessary Fire ProtectionTools.
- It has a robust Preventive Inspection System.
- Frequent & regular Fire Mock Drills are conducted.
- Employees at shop floor are being trained in Fire Prevention & fire fighting techniques.
- Regular Fire Safety Audits & Thrust Drives & Topography Drills are conducted.
- Inspection of Critical Fire Prone areas is being regularly conducted.
- Exhaustive SOP's are available to cater for various eventualities.
- Check Systems & Counter Measures to ensure functionalities & sustainability of all equipment including Pump Houses.

Fire Detection Systems

- Most of the areas in the plant premises remain occupied round the clock for all sevendays in a week.Therefore fires in most of the areas are likely to be detected early.
- Smoke/Flamed ejectors are installed in the control rooms and offices for quick fire detection.
- Linear heat sensing cables are installed along the coal conveyor belts.

Manual Call points are provided at all critical locations

- Smoke Detectors–ISD (633 Nos.) & PSD (432 Nos.)
- Heat Detector–(105 Nos.)
- Manual Call Point–(54 Nos.)

Fire Communication System

- The first person noticing fire shall start shouting FIRE! FIRE! FIRE! and communication shall start with the next person arriving at the site of incidence. The Fire / Emergency Control room and Shift In-charge shall be intimated over phone / intercom and walkie-talkie set, whatever is first available. The fire fighting crew shall immediately rush to the site and start fire-fighting work as quickly as possible.
- Both internal as well as external telephone facilities and VHF/UHF Radio Sets are provided in the plant for communication.
- The exit routes are designated to facilitate exiting according to wind direction. Manual fire alarms (break glass type) are provided at various locations and be connected to a main fire annunciator panel located at the Fire Control Room. In the event of a fire, the person noticing it can break the glass for actuation of the alarm, which would alert all the employees and enable them in initiating the necessary action.
- Siren Arrangements. There are 02 Sirens available, One at HBI Fire Station with range of 6 KM and another one at Plant B Fire Station with range of 8 KM.

Fire Fighting facilities, equipments & supplies

The plant is protected against potential fires by mean so several protection arrangements (Passive & Active Fire Protection Systems).

The plant has its own Fire Station. The details of the Fire Fighting facilities available are furnished here under:

Fire Station:

AMNS has a full-fledged Fire Station operated by qualified and trained Fire Fighting Personnel. The Fire Station is equipped with the following facilities for controlling various fire emergencies effectively.

Fire tenders

The fire station is equipped with four tenders for fire fighting as given in ***Table 7-43***.

Table 7-43: Fire Tender Details

Sr. No.	Make/Year	Pump discharge in LPM	Dry chemical powder vessel capacity in KG	Foam tank capacity	Water tank capacity	Condition
1	TATA/1994	2250	NA	500Ltr	4000 Ltr	All are fit and road worthy
2	TATA/1995	3200	1000	4000Ltr	4000 Ltr	
3	TATA-2516/2005	3800	NA	2000Ltr	5000 Ltr	

4	MANFORCE/2012	6000	NA	1000	9000 Ltr	

Nearest Fire Brigade

Table 7-44: Nearest Fire Brigade details

Sr. No.	Location	Distance From Plant	No. of Tenders	Nos & Types Of Tenders
1	Reliance	6 km	08	06 Foam Tender, 01 DCP tender, 01Rescue Tender
2	NTPC Kawas	8 km	03	02 Foam Tender, 01 DCP Tender
3	Kribhco	10 km	06	05 Foam Tender,01 DCP Tender
4	Adani	3 km	05	02 Foam Tender and 03 Water Tender
5	L&T	3 km	01	Foam tender

Fire Emergency Equipment

The Fire Station is also equipped with the following emergency equipment as well:

- Self Contained breathing Apparatus Sets- 54 Nos
- Asbestos Suit
- Aluminised Suit
- Inaddition, gas masks with cartridges are available for use while attending any leak of toxic gas in the Plant.

Hydrant System:

A well-designed fire hydrant system is provided in the plant premises to control major fireemergency scenarios. The plant is provided with exclusive static firewater storage for thehydrant system. The hydrant mains are laid in loop form to ensure water supply to hydrants even during the maintenance operation involving a part of the hydrant main.

- Total Fire Hydrants. 1668 & all are Single Head,
- Total Fixed Monitors. 37 Nos.

High Velocity Water Spray System:

Oil cooled transformers are protected by means of automatic high velocity water spray arrangement from potential fires involving oil. The system is equipped with quartzoid bulbs, which fuse at a fixed temperature (79^{o}C) and release the air pressure thereby actuating the water spray arrangement.

Medium Velocity Water Spray System:

The following equipment are protected against possible fires by means of manually operated medium velocity water spray systems:

- Conveyor Belts for Coal,
- Ammonia Bullets.

In case of ammonia bullets, this spray system primarily aids in absorbing ammonia vapours in the event of a major release:

- Fire Water Sprinkler System (MVWSS): It is available at all Cable Tunnels and CriticalConveyors
- Fire Water Sprinkler System (MVWSS) for Ammonia & Hydrogen Storage is placed at CRM, Hydrogen Storage at Oxygen Plant and NGL Day Tank at Utilities.
- Fire Water Sprinkler System (MVWSS) is provided at top for Gas Holder
- All Critical Hydraulic Rooms do have Semi Fixed Foam Spray System

- Aerosol Based Detection-cum-Suppression System has been placed at one Critical Cable Cellar of Sinter Plant.
- Nitrogen Injection System are provided for all Critical Transformers at SMP 2 & MRSS
- Integrin Fire Suppression System is available at IT Data Center.
- CO2 Flooding System is available for Gas Turbine at CPP, EDT Machine at CRM, Application area of Coating Plant, Caster Turret Well & Critical Transformer Room of SMP-1.
- Foam Pourer System for NGL Day Tank is at Utilities.

List of PPE

Table 7-45: List of PPE

PPE Descriptions	Nos.
Fire Entry Suit	02
Proximity Suit	04
PVC Suit	06
Rubber Hand Gloves	06 Pair
Full Body Harness	08
Life Jackets	08
Life buoyring	08

Fire Equipments:

Table 7-46: List of Fire Fighting Equipments

Sr. No.	Fire Fighting Equipment Details	Number
1.	DCP type fire extinguishers	3362
2.	CO_2 type fire extinguishers	2232
3.	Fire Hydrant	1668
4.	Water Monitors	37
5.	Mobile Foam Units	42
6.	Hose Reel House	42
7.	Fire House Box	290
	Total	**7673**

Spill Control Equipment and Supplies:

Containment of a spill canbe achieved by dykes, curbs, and entrenchments. Plastic linings and floating booms can also be used to limit the leaching of the spilled material into the ground and to nearby sensitive areas such as water streams. Spill containment equipment's and supplies are stored at the facility insufficient quantities to cope with any possible spill.

7.2.6 Medical Facilities

Care Nursing Home (CNH) – AMNS Hospital is available inside the township with full time doctorsand supporting paramedical staff. The Hospital operates round the clock and is equipped with 40 indoor beds facility including 1 executive room.

Other Facilities at the Care Nursing Home – AMNSI Hospital include:

- Consultation to MD & MBBS doctors
- 24 hours medical officer availability to handle all kinds of emergency
- Well skilled nursing staff (24 hours)
- Laboratory to perform reports (General duty hours-9 am to 5 pm)
- X-ray department (7 am to 11 pm hours X-ray facility)
- Emergency ward with 5 bedded ICU (having 5 multi-paramonitors, 1De-fibrillate, 2suction machines & 2 ECG machines with emergency medications)
- Mobilization facility
- Round the clock (24x7days) well–equipped ambulance services available for patient movement.
- Vision (Near & Distant) checkup
- Observation room to monitor the patients
- Apollo Pharmacy (24 hours) facility
- Gynecologist doctor for one days (Friday 3 pm to 5 pm) per week
- Visiting Orthopedic Specialty at CNH (2nd and 4th Saturday 11.30 am to 1.00 pm)
- Dentist Vesting Doctor for daily working days (9.00 am to 12.00 pm) and (one Dentist Monday, Wednesday, Friday, Timing 3.00 pm to 5.00 pm)
- Physiotherapy Services (daily working days (10.00 am to 2.00 pm and 2.00 pm to 6.00 pm)
- Various camps arrangement like–Blood Donation camp, Pediatric checkup, Gynecological checkup etc.

Occupational Health activities includes

- Pre Employment Medical Check up
- Yearly Periodical Medical Checkup (Examination)
- Food Handlers Medical Checkup (Six Monthly)
- Crane Operators medical checkup
- Heavy vehicle drivers/operator medical check up
- Noise –Audiometry
- Dust-Spirometer
- Ultrasound (USG) Test done in Our Annual Medical check–up (Age+)
- ECO-Test done in Our Annual Medical check–up (Age+)
- Health Promotion Activities.
- First Aid Boxes various sites in the plant

Plant-A Medical Centre

- Round the clock (24 x 7 days) One Paramedical Staff available to attend to emergencies
- Oxygen Cylinder available.
- One General patient bed.
- Refilling of first Aid. Boxes various sites in the plant.
- Round the clock (24 x 7days) One Paramedical Staff available to attend to emergencies
- Round the clock (24 x 7days) well–equipped ambulance services available for patient movement.
- Oxygen Cylinder available.
- One General patient bed.
- Life saving drugs and General medicines, Injection available in ambulance /centre and Refilling of first Aid. Boxes various sites in the plant.

Medical Officers at CNH

Table 7-47: List of Medical Officers at CNH

Name	Doctors Name	Telephone Number
Doctors	Duty Doctors	5101/5103/5105
Ambulance Driver	CNH Ambulance	5100/5108
	Plant Ambulance	6000/2888
Apollo Pharmacy	Town Ship	4156
	CNH	5109

Referral Hospital in Surat

Cases, depending of requirement & severity are referred to hospitals in Surat city as listed below.

Table 7-48: Details of Nearby Hospitals

Hospital	Address	Phone No
Mahavir Hospital	Ring Rd, Opposite Jivan Bharti School, Nanpura, Surat, Gujarat 395001.	02612290000
Mahavir Cardiac Hospital	Nanpura, Surat, Gujarat 395001.	---
Asutosh Hospital	RajashriHall Road Beside Kshetrapal Temple, Majura Gate, Surat, Gujarat 395002.	09327070000
Sunshine Globa lHospital	Dumas Rd, Beside Big Bazar, Piplod, Surat, Gujarat 395007.	18002706666
DWTI-PGH & Bankers Heart Institute-Surat	Opp. Lakeview Garden, Behind Shardayatan School, Kargil Chowk, Piplod, Surat, Gujarat 395007.	02612293000
BAPS Pramukh SwamiHospital	Shri Pramukh Swami Maharaj Marg, Adajan Char Rasta, Adajan, Surat, Gujarat 395009.	02612781000

7.2.7 Emergency Control Centre (ECC)

Fire Station Building and Suprabhat / AMNS House Conference Room No-2 are declared as Emergency Control Center (ECC). The emergency control centre (or room) is the place from which the operations to handle the emergency are directed and coordinated. The site main controller, key personnel and senior officers of the fire, police, factory inspectorate, district authorities and emergency services will attend it. The centre is equipped to receive and transmit information and directions from and to the incident controller and areas of the works as well as outside. It also has equipment for logging the development of the incident to assist the controllers to determine any necessary action.

In addition to the means of communication, the centre is to be equipped with relevant data and equipment which will assist those manning the centre to be conversant with the developing situation and enable them to plan accordingly.

It is to be sited in an area of minimum risk and close to a road to allow for ready access by a radio-equipped vehicle for use if other systems fail or extra communication facilities are needed. It contains the following:

- List of internal & external telephone numbers
- Plant Layouts
- Site map and Drawings of emergency escape route
- Personel protective equipments
- Fire Extinguishers
- Details of Hazardous Chemical Storage

- Material Safety Data Sheet
- Emergency Operation manuals

7.2.8 Emergency Response Plan during Natural Calamities

Cyclone

- Over the last year, unusual activity in the Arabian Sea is being observed. The oceanic basin to the west of the Indian sub-continent which usually sees low-intensity cyclonic activity has suddenly turned into a hotspot of sorts, churning out severe cyclonic storms one after the other.
- Not only there is growing formation of cyclones in the Arabian Sea, these storms have also been increasingly severe in intensity.
- The cyclone pattern from the last few years suggest that the Arabian Sea also started receiving tropical cyclones of high intensity in a small time interval. For instance, in 15 years (1998 to 2013), five extremely severe cyclones originated in the Sea.
- It is believed that among other factors, the ongoing climate emergency could be the reason for this abnormal activity in the Arabian Sea which is presumed to certainly aggravate the intensity as well as frequency of occurrence of cyclonic storms in the region.
- Cyclonic disturbances strike North- Gujarat, particularly the Kutch and Saurashtra regions, periodically. These disturbances generally originate over the Arabian Sea and sometimes the Bay of Bengal. Generally during June, the storms are confined to the area north of 15°N and east of 65°E. In August, in the initial stages, they move along the northwest course and show a latitude scatter. West of 80°E, the track tends to curve towards north. During October the direction of movement of a storm is to the west in the Arabian Sea. However, east of some of the storm move north – northwest and later recurve northeast to strike Gujarat – North Makran Coast.

As per the study conducted in 2015 cyclone prone districts as given in ***Table 7-49***

Table 7-49: Coastal Districts of Gujarat with degree of proneness to Cyclone Hazard

District Name	Proneness
Junagadh	P2
Ahmedabad	
Kutch	
Bhavnagar	
Jamnagar	
Anand	
Navsari	
Surat	
Bharuch	
Valsad	
Rajkot	
Porbandar	
Morbi	
Gir Somnth	
Vadodara	P3
Amreli	

District Name	Proneness
Surendranagar	P4
Kheda	
Devbhoomi Dwarka	Between P2-P3
P1-Very High; P2-High; P3-Moderate; P4-Low	

Source: A report on frequency of Cyclones affecting Gujarat Statte & Role of Mangroves and shelterbelt in cyclone risk mitigation, Gujarat Institue of Disaster Mnagment, PP. 5.

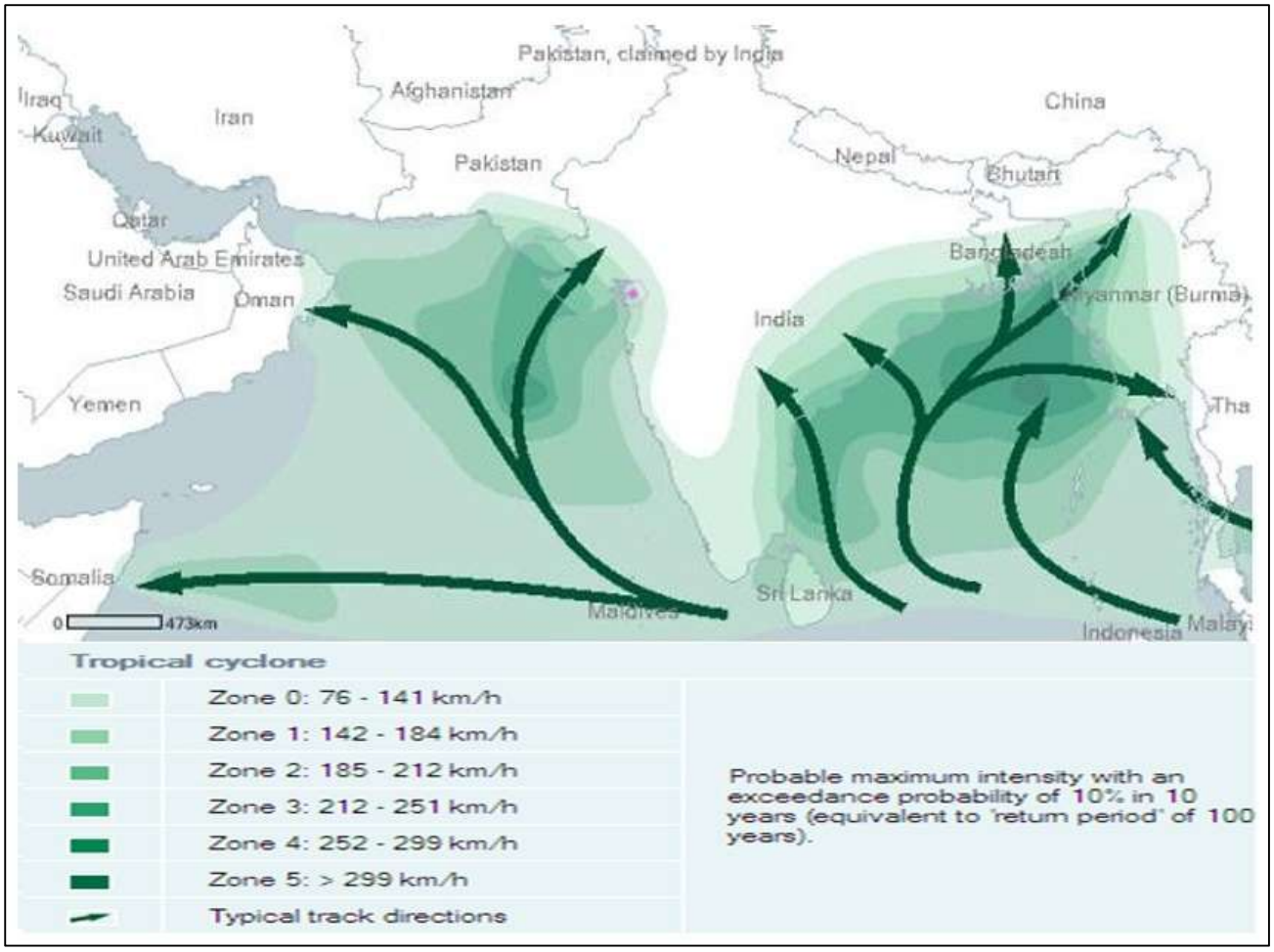
Yearwise record of all Cyclonic activity with which Gujarat state effected is given in table below;

Table 7-50: Year-wise record of all Cyclonic Activity Effecting Gujarat State Between 2001-2009

Year	Activity Duration	Classification	Affected Region (s)
2001	21-29 May	Extremely Severe Cyclonic Storm 2001 India Cyclone	Kandla, Kosamba, Jamnagar, Valsad
	7-13October	Cyclonic Storm	Southern Gujarat
2004	30 September – 10 October	Severe Cyclonic Storm Onil	Porbandar
2005	21-22 June	Depression	Western Gujarat
	14-16 September	Depression	Western Gujarat
2006	21-24 September	Severe Cyclonic Storm Mudka	Porbandar, Rajkot
2008	23-24 June	Depression	Diu
2010	30 May – 7 June	Very Severe Cyclonic Storm Phet	Rajkot, Kutch, Surendranagar, Jamnagar, Mehsana
2011	11 – 12 June	Depression	Gir Somnath, Veraval, Kodinar, Talala, Upleta
2014	10-14 June	Cyclonic Storm	South Coast of Gujarat
	25-31 October	Extremely Severe Cyclonic Storm Nilofar	Kutch, Saurashtra
2015	22-24 June	Deep Depression	Gir-Somnath, Amreli, Rajkot
2016	27-29 June	Depression	Western Gujarat
2017	29 November – 6 December	Very Severe Cyclonic Storm Ockhi	Surat, Dahanu
2019	10-17 June	Very Severe Cyclonic Storm Vayu	Saurashtra, Kutch, Diu
	30 September – 01 October	Depression	Kandla (Kutch)
	22-25 December	Very Severe Cyclonic Storm Hikaa	South Coast of Gujarat
	30 October – 7 November	Extremely Severe Cyclonic Storm Maha	Diu

Source: A report on frequency of Cyclones affecting Gujarat Statte & Role of Mangroves and shelterbelt in cyclone risk mitigation, Gujarat Institue of Disaster Mnagment, PP. 10

Figure 7-23: Cyclone Map



Emergency Response for Cyclone

Once a cyclone watch has been issued:

- Stay calm and await instructions from the Emergency Co-ordinator or the designated official.
- Move early out of low-lying areas or from the coast, at the request of officials.
- If you are onhigh ground, away from the coast and plan to stay, secure the building, moving all loose items indoors and close windows and openings.
- Collect drinking water in appropriate containers.
- Plant and structures to be designed considering the above Cyclone statistics.
- Structure stability need to be verified at regular intervals.

During Hurricane

- Once a hurricane warning has been issued be ready to evacuate as directed by the Emergency Coordinator and / the designated official.
- Small interior rooms on the lowest floor and without windows.
- Remain on the lowest floor away from doors and windows, and Rooms constructed with reinforced concrete, brick, or block with no windows.
- Stay away from outside walls and windows.
- Use arms to protect head and neck.
- Remain sheltered until the tornado threat is announced to be over.

Earthquake

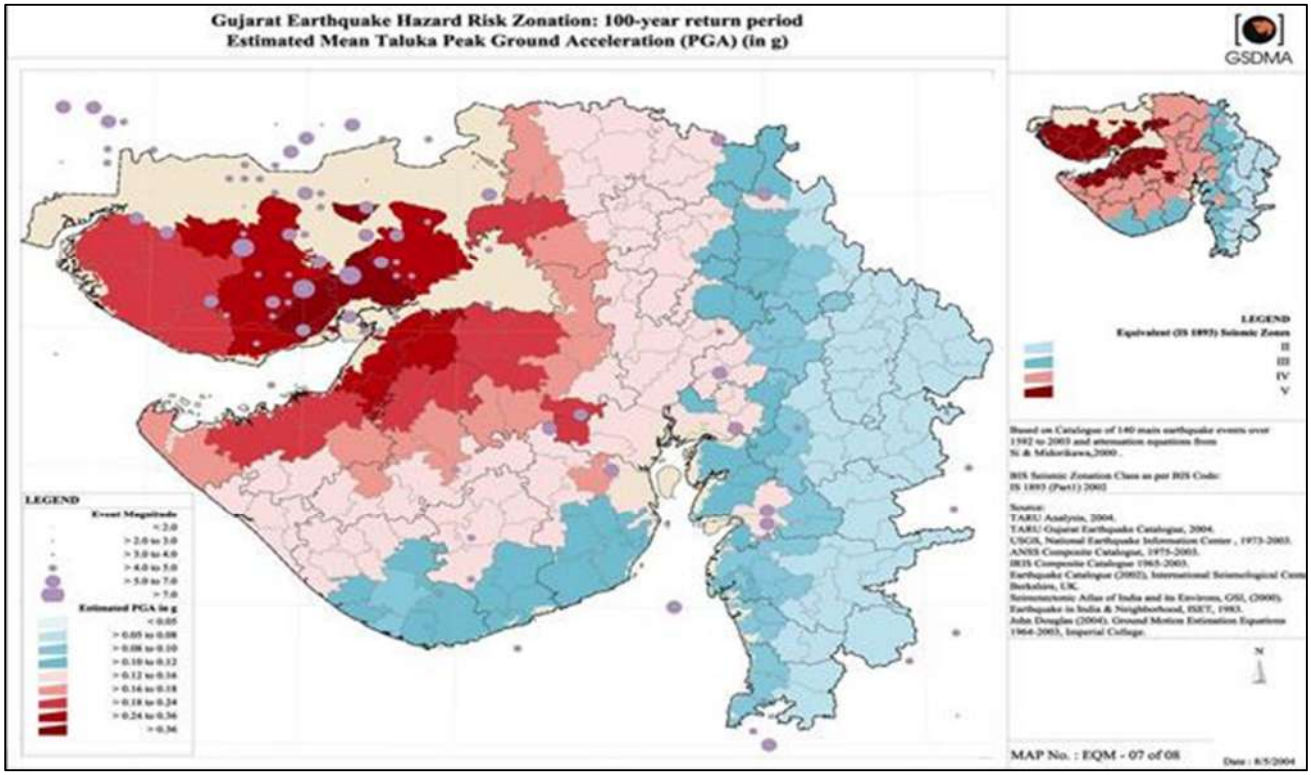
As per Natural hazards map in the M/s AMNS-Hazira is falling under Mercalli scale Zone 3 MM IX and high exposure to earthquake risk.

As per TAC the M/s AMNS-Hazira is coming under Zone I which is having high exposure to earthquake risk.

Whereas, seismic experts have opined that the Indian land mass is being constantly compressed between the sea and Himalayas and thus the developed stresses are being released in the form of earthquakes in the least expected areas.

Thus taking the above in to consideration risk exposure can be considered as High. Plant structure has been made considering this risk.

Figure 7-24: Guajarat Earthquake map



Emergency Response during Earthquake, if indoors

- Take cover under a piece of heavy furniture or against an inside wall and hold on.
- Stayi nside.
- The most dangerous thing to do during the shaking of an earthquake is to try to leave the building because objects can fall on you.

During Earthquake, if Outdoors:

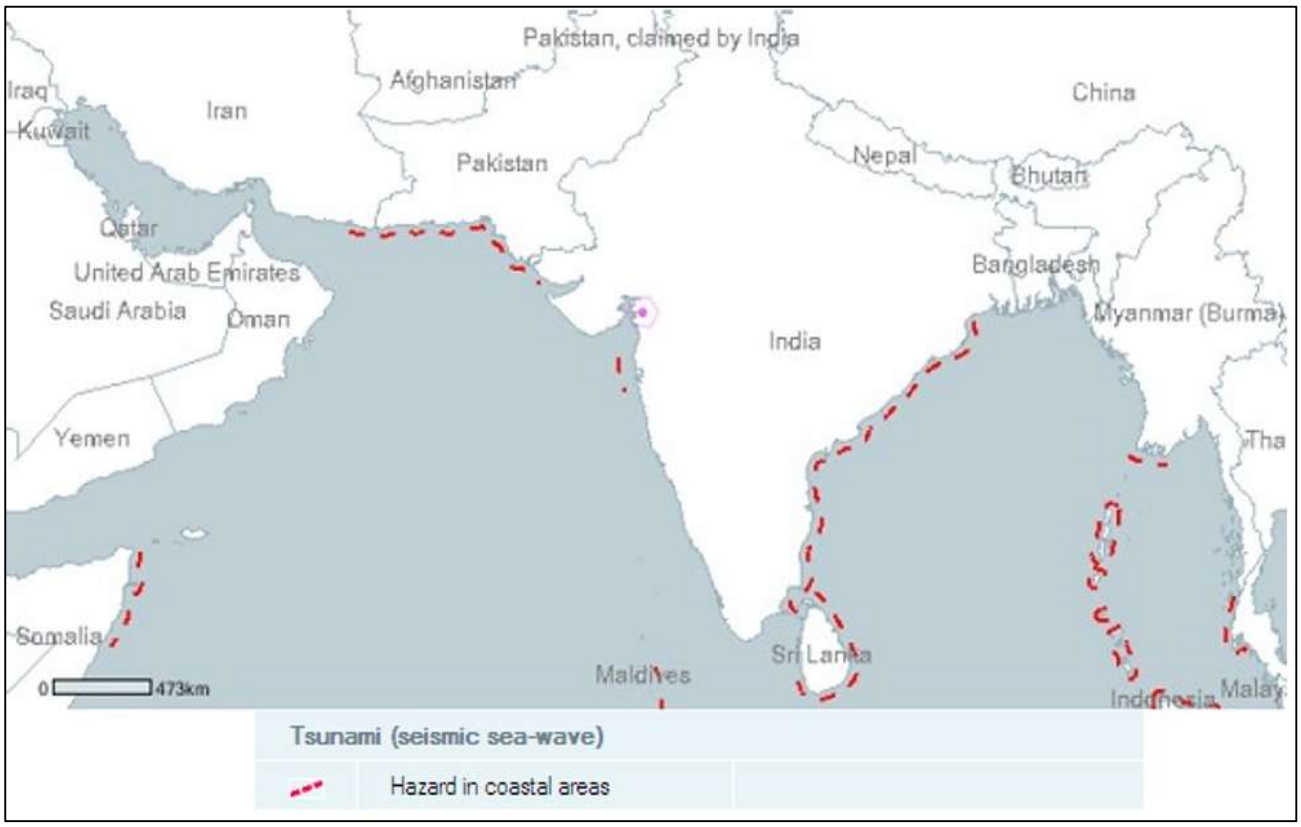
- Move into the open, away from buildings, street lights, and Utilities wires.
- Once in the open, stay there until the shaking stops.
- Stop quickly and stay in the vehicle.
- Move to a clear area away from buildings, trees, overpasses, or Utilities wires.
- Once the shaking has stopped, proceed with caution. Avoid bridges or ramps that might have been damaged by the quake.

After Earthquake

- Be prepared for aftershocks. Although smaller than the main shock, aftershocks cause additional damage and may bring weaken structures down. Aftershocks can occur in the first hours, days, weeks, or even months after the quake.
- Help injured or trapped persons.
- Give first aid where appropriate.
- Do not move seriously injured persons unless they are in immediate danger of further injury.
- Call for help.
- Listen to a battery-operated radio or television for the latest emergency information.
- Remember to help your neighbours who may require special assistance--infants, the elderly, and people with disabilities.
- Stay out of damaged buildings.
- Return home only when authorities say it is safe.
- Use the telephone only for emergency calls.
- Cleanup spilled chemicals or other flammable liquids immediately. Leave the area if you smell gas or fumes.

Tsunami

Figure 7-25: India Tsunami map



Emergency Response for Tsunami

The phenomenon Tsunami is a series of travelling ocean waves of extremely long lengthgenerated primarily by earthquakes occurring below or near the ocean floor; occurrence oftsunami:

Before

Be familiar with the tsunami signals. People living along the coast should consider an earthquake or a sizable ground rumbling as a warning signal. A noticeable rapid rise or fall in coastal waters is also a sign that a tsunami is approaching.

During

- Listen to a radio or television to get the latest emergency information, and be ready to evacuate if asked to do so.
- If you hear a tsunami warning, move at one to higher ground and stay there until local authorities say it is safe to return home.
- Move in an orderly, clam and safe manner to the evacuation.
- Stay away from the beach. Never go down to the beach to watch a tsunami come in.
- Return home/plant only after authorities advise it is safe to do so.

After

- Stay tuned to a battery-operated radio for the latest emergency information.
- Help injured or trapped persons.
- Stay out of damaged buildings. Return plant/home only when authorities say it is safe.
- Enter your home with caution. Use a flashlight/ torch when entering damaged buildings. Check for electrical shorts and live wires. Do not use appliances or lights until an electrician has checked the electrical system.
- Open windows and doors to help dry the building.
- Shovel mud while it is still moist to give wall sand floors an opportunity to dry.

Flood

Emergency Response for Flood:

Surat city and surrounding villages from time immemorial have been known to be getting affected due to excessive rainfall not only in the region but also due to rains in the catchments areas of states of MP and Maharashtra. Ukai dam was actually built to regulate the water flow as well as to use the stored water for generation of electricity, irrigation and drinking purpose. The most important factor in controlling the flood / release of water lies in understanding correct inflow of water and finally decision to release the water. Even small delay in release of water can later create a situation beyond control, which is what holds key to flood situation. In the year 2006, unprecedented rains and uncontrollable release of water from Ukai caused devastating flood in Surat city and many a village.

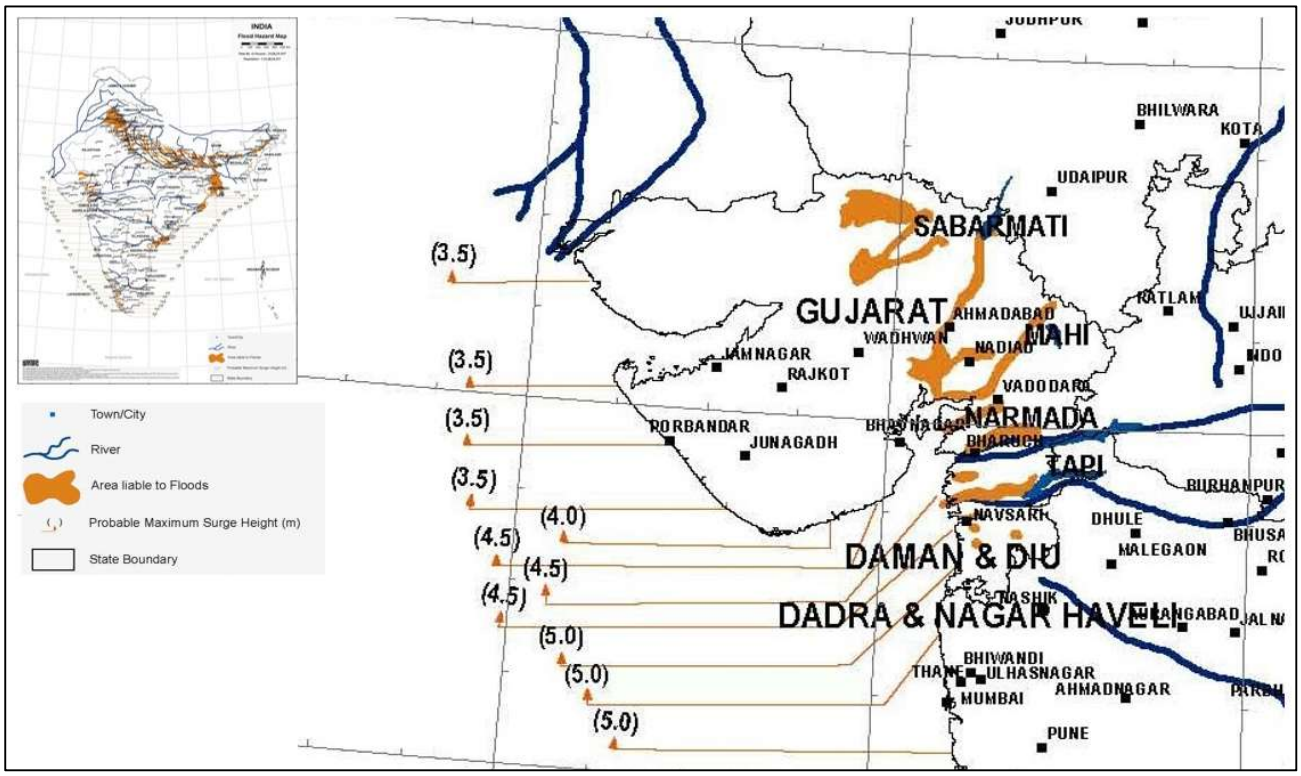
As per Gujarat Disaster Management Plan - 2021, Project site ie. Hazira village is not coming under Flood affected area. HFL data is not being maintained for Hazira village and the same has been confirmed by Gujarat State Water data Center, Gandhinagar.

AMNSI Captive jetty is located 8.75m above the Chart datum and maximum tide level in Tapi estuary is 7.4m as per Hydrographic Chart 2018. Based on these, AMNSI jetty is located 1.35m above the maximum tide level of Tapi estuary and remaining plant areas are located above the Jetty level. Hence flooding in plant area is ruled out.

Floods (or excess water) whether due to nature or manmade reasons is a reality and cannot be ruled out. We therefore need to prepare ourselves to cater for all possible Situations. The counter measures to mitigate the effects can be divided in three stages as under:

- Stage-I Pre Flood Preparation
- Stage-II During Flood Actions
- Stage-III Post Flood-Relief Operations

Figure 7-26: India flood map



Pre Flood Preparations

One month prior to the onset of monsoon (similar to plant / Utilities / administration monsoon preparations), there is need to carry out pre-flood preparations to cater for eventualities arising out of flood like situations both at Surat as well as Nand Niketan Residential. These preparations should include the following:

- Setting of control room and nominating managing staff.
- Control room staff should consist of Executives from Plant operations, HR, Administration, Safety and Security & Fire personnel. Mumbai and Vadinar control Rooms should also be contacted and activated for mutual support.
- Prime function of the Control rooms initially will be collection, collation and dissemination of information (taken from various sources).
- List of all employees and details of family department/areawise. If possible giving nearby Landmark/identifiable objects.
- Pre Identifying area in city or in Nand Niketan where during the emergency people could be shifted or kept for safety and ease of better logistics support.
- Possibly shifting all youngsters and family (ies) needing medical aid to Nand Niketan much prior to flood like or emergency situations
- Form and nominate Quick Reaction Teams (QRTs) from Security for rescue, relief etc.
- Vehicles, other heavy equipment should to be earmarked and checked for operational worthiness. The Silencer length to be extended of the Vehicles so the vehicles will be operational in high level water in flooding condition.

- Dos and Don'ts to be circulated to the employees and their family Members through e-mails, cable network, literature in advance.
- Cater for communication systems like spare cell phones with alternate network, Satellite phones, spare wireless sets, landlines at important locations to be put into place /checked and kept ready to be used in case of floods (warning of flood)
- Reserve stock of grocery and vegetables to be stocked by caterers and stores.
- Sufficient stock of empty bottles/containers for drinking water to be stocked.
- Fuel (including aviation fuel Qty. to be specified), cooking gas, candle set to be stocked for use during emergency.
- Shift buses, light vehicles or other equipment to be parked at safer place and should be kept ready to move incase of emergency.
- Medicines to be stocked both at medical shops as well as medical centre/hospital.

During Flood Actions

- At the start of theflood situation(on receipt of warning of floods/release of water) the head of DMP shall take a call to start operations after declaring the situation is a disaster in consultation with CEO/COO and other key authorities. Strategic decisions should be taken by the Steering committee consisting of key executives.
- A control room shall be setup at Prabhat.
- The respective node in-charges shall go out into their areas and should be detailed as per the Topography and level of water and alert and advice all personnel to go to their safety and assembly areas. The node officers shall help all people of their areas to reach the assembly point safely. After the same the support team shall go into the area and look for trapped personnel and report the same to control room for help.
- Chopper QRT should start sorties to assess the situation (& not for rescue) and feedback to be given to the controlroom.
- All the teams to record their departure and arrival back from operation with the controlroom.On departure of one rescue team, the next team to be standby.
- All the rescue operations to be executed as per the instructions from control room and feed back to be given to control room continuously.
- After getting necessary feedback from the zone officers (Area personnel) regarding evacuation, the control room shall advise MRSS to cut off power for the entire plant zone wise.
- Email, SMS and telephone calls shall be activated to reach and inform all areas about the disaster call and assembly points.
- The control room shall call for walkie-talkies for all the node officers from the Security department.
- Traffic survey shall be done by the respective node officers and all unsafe routes shall be banned from entry and diversion routes shall be notified to Control room & Security Controlroom.
- Arrangements for Terex vehicles shall be made by the control room and the same shall be directed to each of the nodes in the plant area.
- All the disaster management emergency cabins (refpoint5) shall be opened and manned by the respective node assistants.
- The various nodes in charges shall check drains and report to the control room.
- The control room shall take help from utilities and install pumps wherever required based on priority and emergency.
- The control room shall mobilize two boats available in house and send it to areas required to help personnel to reach to their assembly points.
- Food provisions and stocks shall be simultaneously moved to the first floor of the shopping center.

- Requirements for food shall be ascertained by the concerned node officer and arrangements for the same shall be made for preparation and dispatch.
- Medical aid and medical center shall be established at all nodes and centrally at Nand Niketan (NN). Personnel needing serious attention shall be sent to NN by Terex or by Boat by the node officers with an accompanying volunteer.
- The control room shall inform AMNS Mumbai and Vadinar control rooms on the situation and keep aviation and shipping divisions informed on requirement if needed.
- The control room shall coordinate with local govt. bodies, the Surat Collector's office and keep them informed of the status of AMNSI Hazira.
- The control room shall also coordinate with the national disaster team and get updates on weather and other information.
- The control room shall call for help if required from the Surat Collector's office.
- The control room shall check on the status of the nearby villages by telephone and provide transport and help in bringing them to safe areas and providing them support.
- The control room shall keep all big (company) buses available with drivers and ready for movement on improvement in water level for safe transportation of personnel to their place of residence or staying.
- The Dos and don'ts for flood shall have been circulated to all employees a copy of which could be re-circulated through mail, SMS and handouts during the flood time.
- During flood it is obvious that friends, neighbours affected by flood may call the employee for help. The same should be informed to the control room for possible help. No staff/employee should act on his own.

Post Flood Relief Operations

- After the flood over, the main task ahead is to provide the relief to the affected people. For that the control room should identify the areas and people through feedback received from rescue teams and other sources.
- After the floods, the entire campus shall be checked for any kind of trapped persons, loss of life, loss and damage to property.
- The area shall be checked for proper drainage, waste accumulation and disposal, any kind of common or spreading sickness, contamination of water, damage of Gas lines & Elect. Power supply lines etc.
- The relief work should be done by the various teams under the control of one key authority who should organize the relief work in consultation with Control room.
- Relief activities should consist:
  i. Providing pure drinking water.
  ii. Providing medicines to ill people.
  iii. Providing ration like Milk for children, bread, biscuits, snacks.
- All the teams doing relief work should be provided with facemask, hand gloves etc.
- All node In-charges shall ensure that they should be accompanied by mobile medical team to conduct medical checkups in their areas and to give medical aid.
- Boricpowder, Insecticide, lime etc. Should be sprayed to the people affected by the flood for prevention of spread of any infection and epidemic.
- Do's and Don'ts to be informed to the people for taking precautions after floods.

Control Room

- A control Room will be activated at AMNS House.
- Landline extension number shall be activated as control room no. with 2 overflow extensions.
- The Chief of Admin along with GM–Safety shall be incharge of the Control room.
- The room shall be equipped with a fax, computer with access to internet, intranet and otherconnections, printers, STD, ISD lines, mobile phones with chargers, Walkie talkies, and telephonedirectory–internal and

external, General layout of the plant, Surat city Map and Standard Operating Procedure for Floods- AMNS Steel India-Hazira.

- Senior members from the management including the CEO, COO, Health & Safety and Security & Fire services members may bepart of the control room operations.

7.2.9 Off-Site Emergency Plan

After the Risk and their possible environmental impact and after making an organization for the preparedness to control the emergency, the next step is to make ready the communication system. It is crucial factor in handling an emergency. Under section 41-b of Factories Act 1948, the disclosure of information to the workers, general public, local authority and the chief inspector should be made compulsory. Such advance communication is for the purpose of their emergency preparedness. For the purpose of on-site and off-site emergency plan, Company is having quick and effective communication system to make the emergency known

- Inside the factory
- To key personnel outside normal working hours
- To the outside emergency services and authorities and
- To neighboring factories and public in vicinity

Alarm Raiser

Any person who notices any incident of hazardous nature i.e. fire, Explosion, Spillage of Toxic & Hazardous Chemicals, Toxic Gas leakage etc. He will first inform to his superior and co-worker.

The Incident Controller / Respective Incident Controller will order to raise the siren/Rings the manual bell.

Alarm Systems

When the area of the site and the number of installations are more, Siren has to be installed for general communication to the people. It can be used for declaring the On-site as well as Off-site Emergency and making the emergency known to the people

We at M/s AMNS India Ltd., Hazira are having separate identity of plants running of independent manufacturing. Hence we have separate alarm raising arrangement for complexes by making provision of localized Sirens with operating point at their control rooms.

Final All Clear Siren will be activated gate security after instruction from Emergency Control Centre (ECC) and/or SMC. IC/Dy. IC will give All Clear Siren after consultation with SMC.

Emergency Siren Code: Wailing Sound (Four times in 2 minute)

Table 7-51: Types of Alarm Siren

Sr. No.	Types of Emergency	Types of Alarm or Siren	Duration of Sounding	Type of Sound of Alarm or Siren
1	On-site	Wailing Sound	2 minutes	Wailing Sound (Four times in 2 minute)
2	Off-site	Wailing Sound	2 minutes	Wailing Sound (Six times in 2 minute)
3	All Clearing/Testing	Continuous Sound	2 minutes	Continuous (2 minutes)

Disclosure of Information to the Public

The arrangement to disclose the following instruction is to be made by the management toeducate the surrounding public about the hazards existed at site and explain the precautionary measures and responding

actions during emergency, if arise. The management has taken ample steps to run the installation safely. However, the emergency may strike at any time due to unavoidable circumstances and beyond control of the management. Fire and toxic gas spillage would be major emergency, which may affect people and property outside the installation/unit. The declaration of emergency will indicate by siren. The public in vicinity shall take prompt action to protect them as instructed. The following suggestions / actions have to be implemented immediately, in case of major fire or any emergency arise in the installation.

Follow the Do's and Don'ts instruction as given below:

- Shut down open flame, gas, electrical instruments etc.
- Do not smoke. Do not light Bidi/Cigarette/Lighter etc.
- Do not move any vehicle in the area.
- Do not go near the incident and don't allow others.
- Becalm, don't get panic.
- Shutdown the windows, doors etc. and seat openground or terrace.
- Rush to the Safe Shelter as instructed by authority.
- Ascertain the emergency and hear the correct instruction.
- Do not approach unnecessarily to the incident for information or more enquiries.
- Do not allow unnecessarily crowd nearby incidence place.
- Do not believe in rumours unnecessarily.
- Listen, Radio, TV or Public Addressing System.
- Follow the instructions and convey to others accordingly during the emergency.
- On announcement of withdrawal of emergency or clearance siren, you can start your routine work.
- Inenquiry, deposit your statement on emergency as experienced by you to the authority as called on you.
- Co-operate, help and assist the person(s)/authority handling the emergency and rescue operation.

Information on Major Emergency Hazard (MEH) unit Installations

Table 7-52: Information on MAH unit Installation

Sr. No.	MAH Unit name with Address	Contact Person name#(OCC,FM.SI) with Phone:-Number (O,R,M)	Source/Equipments and Material (SCBA, PPE, Fire Extinguishers etc)
1.	M/S. Krishak Bharati Cooperative Ltd. (Kribhco) P.O. Kribhco Nagar, Hazira Road, Surat.394515, Gujarat	Occupier (0) 0261-2802303 FACTORYMANAGER (0)0261-2802170 Site Incident Controller (0)0261-2802085 (R)0261-2802671	CO_2-316 DCP-565 OTHER-50 SCBA-90 FOAM-29
2.	NTPC-Kawas Gas Power Project P.O. Aditya Nagar Surat-394516 Gujarat	Occupier (0) 0261-2860290 Factory Manager (0) 0261-2861434 Site Incident Controller (0) 0261-2860375 (R) 0261-2860287	CO_2-186 DCP-225 SCBA-8 FOAM-32

Sr. No.	MAH Unit name with Address	Contact Person name#(OCC,FM.SI) with Phone:-Number (O,R,M)	Source/Equipments and Material (SCBA, PPE, Fire Extinguishers etc)
3.	Reliance Industries Ltd. (Hazira MFG. DIV.) Mora, Post Bhatha Hazira Road Surat-394510, Gujarat	Occupier (0)0261-4135999 Factory Manager (0) 0261-4135999 Site Incident Controller (0) 0261-4135055 (R) 0261-2802671	CO_2-1274 DCP-4476 SCBA-308 Rescue Tools Like Cutter & Spreader Hazmat Fully Encapsulated Chemical Suits.
4.	ONGC-Hazira Gas Processing Complex ONGC Nagar Surat-394518, Gujarat	Occupier (0) 0261-2223657 (R) 0261-2875600 (M) 9426613900 Factory Manager (0) 0261-2875700 (R) 0261-2875408 (M) 9427504764 Site Incident Controller (0) 0261-2875700 (R) 0261-2875408 (M) 9427504764	CO_2-680 DCP-1135 SCBA-12 FOAM-14373 LTR

7.2.10 Plant Emergency Scenarios & Control Measures

Table 7-53: Plant Emergency Scenarios & Control Measures

Sr. No.	Probable Emergency	Affected Plants	Control Measures
1	Explosionin Blast Furnace /Corex Gas Holder/Tail gas holder/BOF Gas holder	Blast Furnace & Corex/DRI 5,6/SMP 3	Operation Discipline to be maintained for Gasholders operation. Upstream and downstream safety devices to be in functional to safeguard the gas holders. Periodic HAZOP & LOPA Study.
2	Explosion due to Water Ingress into Hot Metal	SMP1, SMP2, SMP 3 (BOF), BF, HBI & Corex	Adherence to the approved SOP and refractory lining monitoring after each heat.
3	Falling / puncture of hot metal filled ladle while shifting through EOT Crane	SMP1, SMP2, SMP 3 (BOF), BF, HBI & Corex	All the emergency provisions like Calliper brakes of EOT cranes to be maintained in perfect working condition. Refractory lining of the ladle to be monitored as per the SOP and in case any non-compliance, ladle to be taken out of circulation. Structural integrity to be checked and confirmed by third party expert.
4	Hearth breakout near Tap hole due to refractory erosion, hotspot	Blast Furnace & Corex	Adherence to the approved SOP, refractory lining and hotspot monitoring after each heat.

Sr. No.	Probable Emergency	Affected Plants	Control Measures
5	Zinc Pot explosion	CRM	Process Safety Controls –Trips/alarms All the persons working near Zinc Pot bath must betrained / certified and authorized to do the job with adequate PPEs. Work Permit System, Safety Mandate, and deployment of skilled persons and provision of PPEs.
6	Explosion at Batch Annealing Furnace	CRM	Process Safety Controls–Trips/alarms All the persons working near BAF must be trained /certified and authorized to do the job with adequate PPEs, Flammable Sensor in working condition. Work Permit System, Safety Mandate, deployment of skilled persons and provision of PPEs, availability of LEL Sensors.
7	Explosion in Boiler	Utility	Process Safety Controls–Trips /alarms All the parameters as per Explosive licence to be checked & maintained frequently as per schedule. Maintenance of Boilers to be done through Internal/External competent personnel's as per norms. Renewal process to be done as per schedule. Access Control.
8	Spillage of Hot Metal Slag	BF, Corex, SMP1, SMP2, SMP3 (BOF)	Use leakage proof vessels Avoid Overfilling of Hot Metal. Competent Crane Operator to be deployed for handling purpose. Proper Tools & Tackles to be used for Hot metal handling activities. Working to be done as per guidance of competent
9	Ingress of Hot metal into cable tunnel	SMP1, SMP2, SMP3 (BOF) HBI, BF, Corex	MVWSS is in place. Periodic inspection shop floor in section and plugging of openings.
10	CO Gas, BF Gas Leakage	CRM, HSM, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill Plate Mill, Corex, Power Infra, Coke Oven	All the persons working in CO prone areas must be trained/ certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system. Access Control. Working to be done as per guidance of competent supervision.
11	Ammonia Gas Leakage	CRM	Process Safety Controls–Trips/alarms All the persons working in Ammonia prone areas must be trained/certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system.

Sr. No.	Probable Emergency	Affected Plants	Control Measures
			AccessControl. Working to be done as per guidance of competent supervision.
12	Hydrogen Gas Leakage	CRM	Process Safety Controls – Trips/alarms All the persons working in Hydrogen prone areas must be trained/certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system. Access Control. Working to be done as per guidance of competent supervision.
13	Nitrogen Gas Leakage	Utility	Process Safety Controls–Trips/alarms All the persons working in Nitrogen prone areas must be trained/ certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gasmonitoring system. Access Control. Working to be done as per guidance of competent supervision.
14	Oxygen Gas Leakage	SMP1, SMP2, SMP3 (BOF)	Process Safety Controls – Trips/alarms The persons working in Oxygen prone areas must be trained/ certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system. Access Control. Working to be done as per guidance of competent supervision.
15	H_2S gas leakage	Pipe Mill	Process Safety Controls–Trips/alarms All the persons working in H_2S prone areas must be trained/ certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system. Access Control. Working to be done as per guidance of competent supervision.
16	Leakage in NG Station/NG Gas	BF, Utility, HBI, Refractory	Process Safety Controls–Trips/alarms All the persons working in NG prone areas must be trained/certified and authorized to do the job.

Sr. No.	Probable Emergency	Affected Plants	Control Measures
			Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system. Access Control. Working to be done as per guidance of competent supervision.
17	Gas Inhalation/Asphyxiation while working in Confined space.	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex	All the persons working in Confined Space Entry must be trained/certified and authorized to do the job. Work Permit System, Safety Mandate, Provision of Gas test and availability of Gas monitoring system.
18	Radio Active Source/Nucleonic Gases Leakage	SMP1, SMP2, SMP3 (BOF), Plate Mill, Pipe Mill, CSP Mill, Corex	All the persons working in Radio Active prone areas must be trained/certified and authorized to do the job. Work Permit System, Safety Mandates, Access Control. Working to be done as per guidance of RSO/Competent supervision.
19	Failure of Pressure Vessels.	Utility, Pipe Mill, CRM, SMP1 SMP2, SMP3 (BOF)	All the parameters as per Explosive licence to be checked & maintained frequently as per schedule. Maintenance of Boilers to be done through Internal/External competent personnel's as per norms. Renewal process to be done as per schedule. Access Control.
20	Spillage of Acid /Chemicals	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, CEID, Admin, Refractory, CMD, CMS, Pipe Mill, Utility, Power Infra, Pipe Mill, MH, Projects, Coke Oven	All the persons working in Chemicals must be trained/certified and authorized to do the job. Work Permit System, Safety Mandate, Positive Isolation, deployment of skilled persons and provision of PPEs.
21	Fire In Cable Cellar	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, Coke Oven	Provision of Fire Barrier Provision of Fire Door Application of Fire Retardant Painting/Coating Installation of Fire Alarm & Detection System
22	Fire In Hydraulic Cellar	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, Coke Oven	Provision of Fire Barrier Provision of Fire Door Application of Fire Retardant Painting/Coating Installation of Fire Alarm & Detection System
23	Fire In Oxygen Gas Storage	SMP1, SMP2, SMP3 (BOF)	All the persons working in Oxygen prone areas must be trained/ certified and authorized to do the job. Work Permit System, Safety Mandates, Provision of Gas test and availability of Gas monitoring system. Access Control.

Sr. No.	Probable Emergency	Affected Plants	Control Measures
			Working to be done as per guidance of competent supervision.
24	Fire In Building	Power Infra, MRSS, 19 MW, MH	Provision of Fire Barrier Provision of Fire Door Application of Fire Retardant Painting/Coating Installation of Fire Alarm & Detection System
25	Fire In Conveyor Belts	Sinter, Bf, Corex, MH, Coke Oven	Provision of Fire Barrier Provision of Fire Door Application of Fire Retardant Painting/Coating Installation of Fire Alarm & Detection System
26	Fire in Coal/Coke Storage	Material Handling (MH)	Enclosed Storage to be provided Avoid Exposure to Sunrays. Proper Water Sprinkling System to be available. Monitoring with Competent personnel.
27	Electrical Shock/Short Circuit/Flash over	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, CEID, Admin, Refractory, CMD, CMS, Pipe Mill, Utility, Power Infra, Pipe Mill, MH, Projects, Coke Oven	All the persons working in electrical job must be trained/certified and authorized to do the job. Work Permit System, Safety Mandate, LOTO system, deployment of skilled persons.
28	Failure of Cranes, Lifting Tools & Tackles	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, CEID, Admin, Refractory, CMD, CMS, Pipe Mill, Utility, Power Infra, Pipe Mill, MH, Projects, Coke Oven	Regular Testing to be done & Report is maintained forLifting Tools & Tackles. Periodic Testing Report by DISH Approved Competentperson under Form No.9, 10 & 11 (Lifts, Lifting Tools &Tackles and Pressure Vessels) shall cover load testdetail.
29	Fall from Height/Fall of Material	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, CEID, Admin, Refractory, CMD, CMS, Pipe Mill, Utility, Power Infra, Pipe Mill, MH, Projects, Coke Oven	All the persons working at height must be trained /certified and competent to do the work at height job. Work Permit System, Safety Mandate, Provision of Safety Belt, Safety Net, Fall arrester and Skilled personnel.
30	Collapse of Structure	CRM, HSM, DSC, SMP1, SMP2, SMP3 (BOF), HBI, Sinter, BF, CSP Mill, Plate Mill, Corex, CEID, Admin, Refractory, CMD, CMS, Pipe Mill, Utility, Power Infra, Pipe Mill, MH, Projects, Coke Oven	Corrosion Mapping & Test to be done for the Old MS structures. Structural stability to be conformed from third party expert.

7.3 Public Consultation

7.3.1 Application for Conducting Public Hearing

An application for conducting the Public Hearing was made to Gujarat Pollution Control Board (GPCB), Gandhinagar. The following documents were submitted to GPCB:

- Draft EIA/EMP & RA/DMP report
- Executive summary in English and in local language (Gujarati)
- In addition to above, soft copies containing EIA report and Executive Summaries were also submitted to GPCB.

7.3.2 Notice of Public Hearing

After processing the application for Public Hearing, GPCB in consultation with district administration fixed 18th July 2022 at 11:00 am to conduct the Public Hearing at ArcelorMittal Nippon Steel India Limited, Truck Parking area, Behind Hazira Police Station, Surat- Hazira Road, Hazira 394270, Dist Surat (Gujarat). An advertisement for conducting the Public Hearing was published in Gujarati Newspapers "Gujarat Mitra" on dated 15th June 2022 and in English newspaper "Times Indian Express" on dated 15th June 2022.

Draft Environmental Impact Assessment report and the Executive Summary of Environmental Impact Assessment report of the project in both English and Gujarati (local language) were sent to the following authorities for inspection by the public till the date when Public Hearing was conducted:

- The District Collector Office, Surat
- District Development Office, Surat
- District Industry Centre, Surat
- Taluka Development Office – Taluka Chorasi, Dist: Surat
- Regional Officer, Integrated Regional Office, Ministry of Environment, Forests & Climate Change, Room No. 407, Aranya Bhawan, Near CH-3 Circle, Sector 10-A, Gandhinagar, Gujarat-382010
- Regional Office (Surat), GPCB, Belgium Square, Silver Plaza complex, Opp. Linear Bus stand, Ring Road, Surat

In addition to above, the draft EIA & RA/DMP reports and the executive summary in English and Gujarati (Local language) were made available electronically at the website of GPCB. (www.gpcb.gov.in).

7.3.3 Publicity of Public Hearing

Wide publicity was given to ensure maximum participation from the local people during the Public Hearing. Executive Summary of the project, in local language (Gujarati), was made available in all the villages falling in study area and to the Sarpanch of the villages.

Announcements were made in all the villages falling in the study area through a loudspeaker on the Auto-rickshaw to inform the people about the project, date, time and venue of the Public Hearing, so that maximum number of local people can participate in the Public Hearing, the photographs of the same are given in ***Photographs 7-1***

Photographs 7-1: Photographs of Public Hearing Publicity

7.3.4 Public Hearing Proceedings

The Public Hearing for the proposed project was conducted on 18th July 2022 at ArcelorMittal Nippon Steel India Limited, Truck Parking area, Behind Hazira Police Station, Surat- Hazira Road, Hazira 394270, Dist Surat (Gujarat).

Shri Aayush Oak (I.A.S.), District Collector & District Magistrate, Surat supervised and presided over the entire Public Hearing proceedings and Dr. J D Oza, Regional Officer, GPCB Surat as a representative of Member Secretary, Gujarat Pollution Control Board, supported the conduct of entire public hearing proceedings.

A detailed presentation of proposed Expansion of Integrated Steel Plant from 9.6 to 15.6 MTPA (Liquid Steel) Located at Hazira Village in Surat District, Gujarat, Company introduction, Project location, products and their capacity, land area and green belt information, fuel and electricity requirements, expected environmental impacts and its mitigation measures, information of baseline monitoring for air, water, soil, noise, surface water and groundwater, safety measures, socio-economic environment and project benefits etc. were presented by company representative in Gujarati language.

The proceedings of the Public Hearing with the list of attendees are available electronically at the website of GPCB (www.gpcb.gov.in). However Public Hearing Proceeding will be attached separately as Annexure with Form-2.

The issues/suggestions/objections/opinions raised by the participants were responded by the project proponent AMNSI. The queries as well as the written representations submitted by local villagers, various gram panchayats and concerned persons in the Environment aspects were also duly responded by AMNSI. The issues raised during the Public Hearing and the response by AMNSI are summarized in table below.

Table 7-54: Issues Raised in Public Hearing

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	(A) Concerns of Local Affected Peoples: Verbal																	
1	Shri Hiteshbhai Patel (On Behalf of Sarpanch) Vill. : Hazira, Ta : Choryasi, Dist. : Surat	√											√	√	√			
2	Harsha Dhirajbhai Village: Gundardi, Tal.: Choryasi, Dist.: Surat.		√				√											
3	Shri Umeshbhai Patel, Secretary-Akhil Bharatiya Koli Samaj, New Delhi, Pradesh Minister-Gujarat Akhil Bhartiya Koli Samaj, Yuva Karobari	√							√					√		√		

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Sabhya-B.J.P. Dist.: Surat.																	
4	Patel Jagrutiben Village: Damka, Ta.: Choryasi ,Dist.: Surat.	√												√		√		
5	Jinalben Prashantbhai Patel, Village: Damka,Ta.: Choryasi, Dist.: Surat.	√												√		√		
6	Shri Dipakbhai Dhansukhbhai Patel, Village: Damka, Ta.: Choryasi, Dist.: Surat.		√				√							√				
7	Nishaben Patel, Vill. : Damka, Ta. : Choryasi, Dist. : Surat		√											√				

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
8	Naynaben Patel, Vill. : Hazira, Ta : Choryasi, Dist. : Surat		√											√	√			
9	Naynaben Patel Vill. : Damka, Ta : Choryasi, Dist. : Surat	√													√			
10	Shri Hashmukhbhai Patel, Principal – Navchetan International, Vill. : Vasva, Ta. : Choryasi, Dist.: Surat.	√													√	√		
11	Shri Satishbhai Patel, Principal – Navchetan Vidhyalaya, Secondary and Senior Secondary	√													√	√		

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	granted department, Village: Vasva, Ta.: Choryasi, Dist.: Surat.																	
12	Shri Bhalubhai Dahyabhai Patel Village: Hazira,Ta.: Choryasi, Dist.: Surat.		√		√									√				
13	Shri Chetanbhai Patel, Village: Gundardi, Ta.: Choryasi, Dist.: Surat.		√				√							√				
14	Shri Rohitbhai Jentibhai Patel Uup Sarpanch, Village: Hazira, Ta.: Choryasi, Dist.: Surat.	√												√	√	√		

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
15	Prarthanaben Shaileshbhai Patel Village: Hazira, Ta.: Choryasi, Dist.: Surat.	√												√				
16	Shri Mayurbhai Patel Village: Damka, Ta.: Choryasi, Dist.: Surat.		√		√		√											
17	Shri Yaksheshbhai Rajeshbhai Patel Youth for Hazria Area Trust Village: Bhatlai, Ta.: Choryasi, Dist.: Surat.		√							√		√						
18	Shri Miteshbhai Kanubhai Patel Youth for Hazria Area Trust	√							√									

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues													
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Ta.: Choryasi, Dist.: Surat.																	
19	Shri Hemantbhai Patel, Youth for Hazria Area Trust, Ta.: Choryasi, Dist.: Surat.		√								√		√					
20	Shri Kuntal Kishorbhai Patel Youth for Hazria Area Trust, Village: Kawas, Ta.: Choryasi, Dist.: Surat.		√					√										
21	Shri Shashibhai Ahir Village: Mora, Ta.: Choryasi, Dist.: Surat.		√										√					
22	Shri Jenishbhai Patel, Youth for Hazria Area Trust, Ta.:		√						√								√	

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues													
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Choryasi, Dist.: Surat.																	
23	Shri Hemanshu Patel, Vill. : Junagam, Ta : Choryasi, Dist. : Surat		√				√		√				√	√	√	√		
24	Shri Jaimin Chandrakantbhai Patel, Vill. : Hajira,Ta : Choryasi, Dist. : Surat	√												√	√			
25	Shri Chetan Patel , Vill. : Rajgari Ta : Choryasi, Dist. : Surat	√												√				
26	Shri Alpeshbhai Patel, Vill. : Junagam, Ta : Choryasi, Dist. : Surat		√										√	√	√			

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
27	Dr. Mitesh Parekh Principal, Navjagriti Vidyavihar School managed by Kelavani Mandal Hazira,Vill. : Hazira,Ta : Choryasi, Dist. : Surat	√													√	√		
28	Shri Chhotubhai Ramubhai, Vill. : Bhatlai, Ta : Choryasi, Dist. : Surat		√		√													
29	Shri Bhagubhai Manilal Patel, Former Sarpanch, Vill. : Junagam, Ta : Choryasi, Dist. : Surat		√									√		√	√			

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
30	Shri Rameshbhai Patel, Vill.:Shivrampur, Junagam, Ta : Choryasi, Dist. : Surat	√													√	√		
31	Shri Astikbhai Babubhai Patel, Vill. : Kavas,Ta : Choryasi, Dist. : Surat		√												√	√		
32	Shri Bharatbhai Patel, Vill. : Bhatlai, Ta : Choryasi, Dist. : Surat		√		√													
33	Shri Manojkumar Karsanbhai Patel, Dy. Sarpanch, Vill. : Kawas, Ta : Choryasi, Dist. : Surat	√												√				

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
34	Shri Dhansukhbhai Kantibhai Patel, Former President, Hazira Kantha Vistar, Vill. : Kawas, Ta : Choryasi, Dist. : Surat	√				√						√						
(B) Concern of Other Persons: Written																		
1	Thakorbhai Vallabhbhai Khalasi, Asha Street, Vachlo Mohallo, Hazira 394270		√		√													√
2	Deepak D Patel, Convener, Hazira shore Area Industrial Pollution Prevention Committee.		√					√			√		√					

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues													
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Posted at Nagar Street Damka Ta Choryasi, Dist. Surat 394510																	
3	Jalpesh Paladiya, Advocate		√		√			√	√		√						√	
4	Patel Jitendrakumar Babalbhai, A-4, Gajanan Park, Behind R B L School, GIDC, Ankleshwar		√		√			√			√						√	
5	Nareshbhai Ahir		√															
6	Chotubhai R Patel Hazira Vikas Sahkari Mandli, Pintubhai M Patel Vice President,		√		√									√	√			

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues													
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Rameshchandra J Patel Maha Mantrishri																	
7	Mahesh Pandya Paryavaran Mitra 502, Raj Avenue, Bhaikakanagar Road Thaltej, Ahmedabad - 380059		√			√		√			√						√	√
8	Patel Jitendrakumar Babalbhai, A-4, Gajanan Park, Behind R B L School GIDC, Ankleshwar, Dist. Bharuch		√			√		√			√						√	√
9	Vijaybhai Jivanbhai Patel : A-41, Gurukrupa Raw House,		√		√	√		√			√							

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues													
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Opp. to Shell Petrol, Pump, Adajan village, Surat																	
10	Prakashbhai V Contractor, Kantha Vibhag, Yuga KoliSamaj, Community Post, At Post Khajod, Ta & Dist. Surat		√	√		√		√	√		√			√				√
11	Thakor V Khalasi, Mahendrabhai M patel, Dhansukhbhai V Khalasi		√	√		√		√	√		√			√				√
12	Roshni Patel, Environmental Scientist A-402 Vandan Apartment,		√	√	√	√		√	√		√			√				√

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
	Althan Bhatar Road, Surat																	
13	Vijay Keshavbhai Ahir, Motavada Mora Ta. Chorasi, Dist. Surat		√								√	√	√		√			
14	Deepakbhai Dhansukhbhai Patel & Others		√		√	√		√			√							√
15	Darshan A Nayak Advocate		√		√	√		√			√							√
16	Disable Charitable Trust, Hazira Kantha Vistar, Ta. Chorasi, Dist. Surat		√											√				

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues														
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
17	Darshan A Nayak Advocate		√		√	√		√			√							√
18	Dharmesh Mistry, Shop No. 10, Om Complex, Opposite District Court, Bharuch.		√	√														√
19	Hirenkumar Kanubhai Var and others. Village: Damka		√													√		
20	Sarpanch, Shivrampur Gram Panchayat, Ta. Choryasi, Dist. Surat		√		√				√	√			√	√				
21	Vikibhai Dahyabhai Patel, Bhatlai Village		√					√	√		√							

S. No.	Name of Speaker	Overall supporting project	No explicit support	Issues													
				Base line analysis issues	Land related issue	Source of Water	Water logged in issues	Wastewater treatment and disposal	Air Pollution of the Project	Traffic Related issues	TSDF membership/ disposal of waste	Safety Related Issue/ Accident	Health related issue	Employment	CSR Activities	Education	Greenbelt	CRZ and other Legal issue
22	Youth for Hazira Area		√							√				√				
153 NOS. written representation received by the local villages to welcome the project and in favour of AMNSI																		

Photographs 7-2: Photographs of Public Hearing

Outcome of all issues raised in Public Hearing are summarized in ***Table 7-55.***

Table 7-55: Outcome of Public hearing, Reply Fund and Timeline

S. No.	Issue related to	Concerns in Public hearing	Reply
1	Employment	• What has been done for the employment of women? • Employment to local people • Employment to physically disabled people	• Given opportunities for Woman and will give more opportunities based on the qualification and skill. • More than 8% of our employees from local and will provide maximum opportunities to the local people according to their education qualification, experience, and skills. • Provided employment to physically disabled people and will continue.
2	CSR	• To continue allotment of CSR fund for fishing community and the development of the village. • CSR fund for school infrastructure • CSR fund for hospital development • CSR fund for uniform utensil for student & to provide computer • CSR fund for sports complex • CSR fund to develop community hall • CSR fund in road repairing	• Will carry out CSR activities for fishing community for example providing the fishing net or fishing tools. • School infrastructure development activities will be continued in study area and will start one English medium school in study area. • Will strengthen the existing PHC / medical sub-centres by providing Infrastructure support and medical equipment support etc. • Will continue the activity regarding providing the school uniform and computer to schools located in study area under their CSR activity. • Will establish the sports complex in 2 schools located in the study area. • Will develop the community hall in Hazira & other nearby villages based on their requirements

		• Free education to local people	• Strengthened Surat – Hazira road and will construct the additional road to Hazira . • Will give funding to the needy student for higher education under CSR activity
3	Base line Analysis issues	• Noise levels are high in plant • Ambient air results are high • Increase of traffic due to proposed project	• Acoustic enclosures are provided at all noise generating equipments. • Online Ambient Air Quality Monitoring Stations – 4 Nos. are available in plant and 2 more going to be installed. • The increase in traffic due to proposed project will be within limit of IRC.
4	Air Pollution of the Project	• Air pollution from COREX plant & different plant utilities.	• The required Air Pollution Control devices are already installed and working efficiently.
5	Land related issue	• Land Encroachment of Hazira village, Forest land and Gram Panchayat & Land compensation	• Acquired 100% land for proposed project and is no illegal encroachment by AMNSI
6	Greenbelt	• Greenbelt within plant premises • Greenbelt outside plant premises	• Will improve the greenbelt to 33% within plant premises with the rate of 2500 nos. of trees per hector • Part of CSR , will plant 20000 nos. of tree in the nearby villages immediately and further support will be extended based on land availability.
7	Source of Water	• Reduce the water consumption from Tapi river • Proposal for desalination plant • Fresh water provision to Hazira village	• Planning to reduce the intake of fresh water by implementing Tertiary Treated Waste Water (TWW) from Surat Municipal Corporation through Hazira Notified Area authority • May consider the proposal for desalination plant in future if required. • Daily supplying required drinking water (950 KLD) Hazira village
9	Safety Related Issue/ Accident	• If an accident happens in a village, have you constructed any hospital? Is there a provision for free treatment for poor? • How will you help poor people in case of hospitalization? Dedicated hospital in Hazira village	• AMNSI has dedicated hospital in the Township area where local people are allowed for treatment. • Will strengthen the existing PHC or medical sub-centres by providing Infrastructure support and medical equipment support etc
10	Health related issue	• Health issues to local peoples due to heavy noise and health impacts due to handling of corex plant and other furnaces on workers or	• After takeover by AMNSI , implementing the major Air pollution control project at a cost of Rs.173 Cr and will be completed by Dec'22 • The emission from different units are well within the permissible limits. All the required

		villagers working in plant.	mitigation measures are in place to combat the pollution.
11	Wastewater treatment and disposal	• Arrangement for disposal of generated waste water from Plant.	• Permission for disposal of waste water is available from GPCB • The parameters for the outlet is also within the permissible limit of GPCB.
12	TSDF membership/ disposal of waste	• What arrangements have been made for the disposal of waste generated from this project? & Provision for disposal of slag	• AMNSI is on a journey to become a "zero waste" steel plant by implementing various Solid waste utilization projects through value addition have been under taken and implemented successfully in last few years. • Recently completed the steel slag road jointly with CRRI and with this , we will maximise our slag dsiposal in Road construction.
13	Traffic issue	• Traffic on Hazira road & Accident due to Traffic on Hazira road	• The company will take all necessary steps to prevent accidents & care will be taken not to cause any harm to the workers, employees working inside the company and people living in the surrounding area. • All the major industries are proposing to implement the dedicated railway line (G-RIDE) with the participation of Guj.Govt.
14	Water Logging	• Water logging in Damka village during rainy season	• Will provide necessary support for dewatering during rainy season and with village approval , required drainage system will be delevloped part of CSR.
15	CRZ and other Legal issues	• CRZ clearance not obtained for Jetty • Disposal of slag in CRZ area • Disposal of waste in Mangroves area • Pendency of legal case on private land acquired by company • Pendency of legal case on disposal of waste water in tapi river and not implementing ZLD system	• CRZ clearance is obtained for existing jetty in 2006. • AMNSI does not dispose any slag in CRZ area • AMNSI does not dispose any slag in mangroves area • Legal cases details were submitted to MoEF&CC and mentioned in the EIA report • Company is going to implement ZLD Scheme by March'2023 after that there will be discharge of treated waste water to Tapi river except storm water.

7.3.5 Public Hearing Action Plan with Budget

Action plan to address the issues raised during the public hearing with target as per MoEF&CC O.M. dated 30/09/2020.

Table 7-56: Action Plan with Budget to address issued raised during Public Hearing

Activities and budget proposed to address issues raised during Public Consultation - Yearly (1-3 yrs.)		**2023**	**2024**	**2025**	**Rs. In Lakhs**
S. No.	**Major activities**	**1st Year**	**2nd Year**	**3rd Year**	**Total Amount**
A	**Education**				
1	STEM Learning Centre in 10 Middle and 5 High Schools	20	20	20	60
2	Padhega Bharat- Digital Pathasala - (Smart class +Learning apps etc.) - 40 Middle school (Class 6-8)	80	60	60	200
3	Model Anganwadi - Improvement in basic amenities & teaching learning materials in Anganwadi centre	30	30	30	90
4	Construction of English medium School Building/hall, Computer Lab, Biology Lab, Chemistry Lab	200	50	50	250
5	Improvement in basic amenities, community teachers & teaching learning materials in Primary and Middle School for quality education.	25	25	25	75
6	Provision of necessary equipment and infrastructure for sports activities	25	25	25	75
7	Construction of sport complex in nearby villages	50	50	50	150
8	Model School Project in terms of Green School and Smart School Development project for Hazira, Mora, Suwali, Damka, Vansva & Bhatlai Village	30	30	30	90
9	Solar Panel Installation in Govt. Schools of Hazira Village	50	50	50	150
10	Water Harvesting Project for Govt School. At Hazira, Damka & Junagam Villages	50	50	50	150
	Sub Total	**560**	**390**	**390**	**1290**
B	**Health & Sanitation**				
1	Strengthening/Renovation of the Government Health Centres. PHC, CHC & Medical Sub-centres	60	60	80	200
2	Medical Equipment Support to the Govt. Hospitals	50	50	50	150
3	Hospital Facility for Local People with Partnership of Notified Authorities	80	60	60	200
4	Mobile Medical Unit for free treatment and medicine support to community	50	50	50	150
5	Artificial limb camp for People with physical disability	50	50	50	150
6	Dispensary Setup at Hazira Village	30	30	30	90
	Sub Total	**360**	**360**	**360**	**1080**
C	**Infrastructure Development**				
1	Community RO project in Hazira, Vansva, Bhatlai & villages.	30	30	40	100
2	Construction of Community Centre in Hazira, Vansva, Rajgari & Damka villages	50	50	50	150
3	Construction and repair of drainage system in Hazira with Panchayat-Hazira to avoid water logging	30	30	30	90

Activities and budget proposed to address issues raised during Public Consultation - Yearly (1-3 yrs.)		2023	2024	2025	Rs. In Lakhs
S. No.	**Major activities**	**1st Year**	**2nd Year**	**3rd Year**	**Total Amount**
4	Repair and Renovation of the Internal Road in Hazira Village and other need-based community support	30	30	30	90
5	Infrastructure development (Deepening/creation of pond, Pond Beautification, community park, recreation centre etc)	60	60	60	180
6	Drinking Water pipeline installation work at Hazira Village	100	50	50	200
	Sub Total	**300**	**250**	**260**	**810**
D	**Sustainable Livelihood**				
1	Vocational Skill Training centre for unemployed 1000 youths- in partnership with NSDC.	50	50	50	150
2	Partnership with NABARD/BAIF for NRM/Livelihood project (Artificial Insemination, Agriculture Equipment Support, Kitchen-Garden, Farm-based, livestock & watershed work) Hazira, Junagam, Mora, Damka, Vansva, Rajgari, Suwali & Bhatlai Villages	65	65	65	195
3		10	10	10	30
4	Fishing net and fishing tool to fishing community of Hazira Village	25	25	25	75
5	Machine Support to SHGs for Livelihood Activity Hazira, Junagam, Mora, Damka, Vansva, Rajgari, Suwali & Bhatlai Villages	25	25	25	75
6	Plastic waste recycling unit for Womens of Hazira Village	20	20	20	60
	Sub Total	**195**	**195**	**195**	**585**
E	**Sports and Youth Development**				
1	Development of Playground for nurturing local talents for sports at Hazira, Mora, Damka, Junagam,Suwali, Bhatlai, Rajgari & Vansva Panchayat	50	50	50	150
2	Cricket Ground & running track construction work at Damka & Hazira Village	60	40	40	140
3	Sport Material support to the schools at Hazira, Damka & Junagam	10	10	10	30
	Sub Total	**120**	**100**	**100**	**320**
F	**Environment**				
1	Tree Plantation and Greening Drive-in villages and School premise (10K saplings)	15	15	15	45
2	Installation and promotions of solar energy in partnership with GEDA (Gujrat Energy development Agencies) solar streetlight, solar roof top energy, solar water pump	60	60	80	200
3	Cleaning and deepening of Existing Ponds	30	30	30	90
4	Mangrove conservation Project for Hazira, Suwali & Damka villages	20	20	20	60

Activities and budget proposed to address issues raised during Public Consultation - Yearly (1-3 yrs.)		2023	2024	2025	Rs. In Lakhs
S. No.	**Major activities**	**1st Year**	**2nd Year**	**3rd Year**	**Total Amount**
	Sub Total	**125**	**125**	**145**	**395**
G	**Others**				
1	Relief measure during natural calamity, pandemic etc.	30	30	30	90
2	Impact Assessment and hiring of vehicle for monitoring and implementation of activities	10	10	10	30
	Sub Total	**40**	**40**	**40**	**120**
	Grand Total				**4600**

8 PROJECT BENEFITS

The development of industrial projects plays a key role in the economic growth of any country. Steel making is traditionally considered as the back bone of any manufacturing industry. It is a major input for industrial sectors which support economic growth of the nation, such as, Defence, Agriculture, Automobile, Industrial, Power, Construction & Mining Equipment, Railways and General Engineering. Demand and production have been growing at a healthy rate and forecast for the next ten years is very bright. The global report also states that the industry has been increasingly focusing on enhancing flat product production efficiency. Peripheral development takes place and due to more influx of money through the area, overall importance of the area increases and overall infrastructure improves

8.1 Employment Potential

The growth of the steel industry significantly contributes to economic growth as it generates employment both directly and also indirectly due to development of downstream industries. The proposed project would engage in recruitment of local skilled, semi-skilled and unskilled workers thereby contributing positively towards local employment and income.

8.1.1 Direct Employment

At present AMNSI has around 7,700 direct employees are working in the plant. After the proposed expansion additionally approx. 2,750 persons are expected to be employed, including 1000 direct demployees for the modification poroject. Hence, total 10,450 persons will work during operation phase at full capacity after expansion, which includes permanent and contract workers. Both skilled & un-skilled workers will be employed by the company.

During construction phase around 500 people will be directly employed for construction, installation and Commissioning activities.

As manpower required for the proposed expansion shall be sourced from local population, there will not be increase in population in the area due to direct employment for the proposed expansion

8.1.2 Indirect Employment

Indirect employment and income effects of any steel plant are non-marginal and usually remain widespread across a long region. Over the years, the owners of the plant have caused generation of income and employment opportunities for the ancillaries and service unit which came in the vicinity of the plant, specially, transport and manufacturing sectors. It is expected that substantial portion of the investment in this project will trickle down to the local people in the form of employment. Indirect employment due to this proposed plant is expected to be around 14,500 during operation phase in the plant operation and many more in supply of raw material, disposal or sale of finished goods, handling of raw material etc.

Employment potential of the area may be attributed to the existing plant and other industries in the vicinity. As the expansion will take place, indirect employment is likely to grow further. The project is expected to generate substantial indirect employment in other sectors such as service units etc. The proposed plant by nature serves as the nuclei for development of small-scale industries in the areas around them. These small-scale units usually have input-output linkages with the other industries.

The demand for spares, assemblies and sub-assemblies by steel plants are generally met through the supply (of these items) from small-scale units located nearby. The present project is likely to accelerate such industrialization through "Bubble Effects" in the study area. It is important to note that the small-scale units are usually labour-intensive and high-priority industries from social point of view. This is expected to play a major role in the future economic and social development of this area.

Total manpower required for the operation phase under indirect employment will be about 5,250

8.2 Improvement in Infrastructure

AMNSI intends to provide infrastructure development in the study area and market for the product grobally:

- **Market for product:** 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 the requirement of all the products, it is essential to have the proposed manufacturing unit. Need of steel products are in Industrial Machinery, Power, Construction & Mining Equipment, Railways and General Engineering.
- **Market for Consumer Goods:** With the implementation of the project and development of the locality, existing demand pattern is likely to continue which indicates more importance on consumer goods and quality products. This will affect the local consumer goods market will grow, thus creating more income opportunities to the local people. The proposed project is going to have positive income effect and consequently, the multiplier effect is expected to lead to an overall increase in average consumption of the people of the study area.
- **Infrastructure:** AMNSI will undertake peripheral development as part of company's CSR programme, which will benefit local villagers. Creation of community assets (infrastructure) like Community RO project in 4 villages, Construction of Community Centre in 4 villages, Construction and repair of drainage system in Hazira with Panchayat-Hazira, Other need-based community support Infrastructure development (repair of village road, pond, community park, recreation centre etc. as a part of Corporate Social Responsibility
- **Increasing other business opportunities for local people-** There will be scope of hiring vehicle like tractors & trolleys, JCB, excavators during construction phase of the project and trucks / trailers during operation phase.

8.3 Revenue to Govt. and State of Gujrat

The expanded project will generate substantial revenue for the state and central exchequers both directly as well as from downstream industries which will be utilized for various social developments.

8.4 Incresed Economic Growth

Direct and indirect employment will give a boost to the local economy. It is expected that a significant proportion of the money earned by the additionally employed people will be spent locally which will boost the local economy.

8.5 Action Plan with Time Frame and Budget for meeting Commitments to Address the Issues Raised During Public Hearing

AMNSI is responsible for carrying out social activities and encourages a positive impact on the stakeholders. Plant authorities have provided support for local schools and local groups, for health care, sports, water supply, job opportunity, etc. in the recent past and will continue to do so in future.

Activities will be carried AMNSI to meet commitments made to address issues raised during public hearing of the project as well as need-base assessment. Detailed action plan with budget shall be prepared to implement the activities proposed to meet commitments during Public Hearing.

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9 ENVIRONMENTAL COST BENEFIT ANALYSIS

As per EIA Notification dated 14th September, 2006 as amended from time to time; the chapter on "Environmental Cost Benefit Analysis" is applicable only, if the same is recommended at the Scoping Stage.

As per the ToR issued by MoEF&CC for the project, vide F.No. J J-11011/44/2004-IA. II (I) dated 3rd December 2021 and ToR amendment dated 13th May 2022 the Environmental Cost Benefit Analysis is not required

10 ENVIRONMENTAL MANAGEMENT PLAN

10.1 Introduction

The environment management plan is prepared with a view to facilitate effective environment management of the project, in general and implementation of the mitigation measures in particular.

The EIA study for the proposed project has identified impacts that are likely to arise during different phases of the project. The study has also exam of mitigation measures. A ined the extent to which the adverse impacts identified can be controlled through the adoption of Environment Management Plan shall be formulated for mitigation of the adverse impacts and is based on the present environmental conditions and the environmental impact appraisal. The Environmental Management Plan describes in brief, the management plan for proper and adequate implementation of treatment and control system for Air, water and noise pollution for maintaining the environment. It also includes the development of greenbelts in and around the plant, proper safety of the workers, noise control, fire protection systems and measures.

10.2 Purpose of Environmental Management Plan

The environment management plan is prepared with a view to facilitate effective environment management of the project, in general and implementation of the mitigation measures in particular. The EMP provides a delivery mechanism to address potential adverse impacts and to introduce standards of good practices to be adopted for all project works. For each stage of the program, the EMP list out all the requirements to ensure effective mitigation of every potential biological, environmental and socio-economic impact identified in the EIA. For each operation, which could otherwise give rise to impact, the following information is presented:

- To treat and dispose-off all the pollutants viz. liquid, gaseous and solid waste so as to meet statutory requirements (Relevant Pollution Control Acts) with appropriate technology.
- To support and implement work to achieve environmental standards and to improve the methods of environmental management.
- To promote green-belt development.
- To encourage good working conditions for employees.
- To reduce fire and accident hazards.
- Budgeting and allocation of funds for environment management system.
- To adopt cleaner production technology and waste minimization program.

10.3 Environment Management Policy & Environment Committee

As a corporate, the Company is serious about its responsibility in protecting the Environment. Thus, various mitigation measures as given in the report shall be taken-up and effort will be made to minimize the impact of the Project, on the Environment, if any.

The Company has a well-defined policy for management of Environment. The management has decided that all effective steps shall be taken to continual improvement in the environment.

Figure 10-1: Environment Policy

AM/NS INDIA

HEALTH, SAFETY & ENVIRONMENT POLICY

ArcelorMittal Nippon Steel India Limited is committed to achieve excellence in Health, Safety & Environment (HSE) and our Goal is to have an **"Injury Free, Safe & Healthy Work Environment".**

In fulfillment of this commitment, we shall make continuing efforts to:

- Identify health & safety hazards, environmental aspects and assess health & safety risk, environmental impact in our operations and mitigate them.
- Utilize natural resources efficiently and promote waste reduction & recycling measures for minimizing environmental impact.
- Reduce & prevent pollution for continual improvement in environmental performance by involving eco-friendly techniques.
- Reduce carbon footprint & promote usage of low carbon technologies thereby contributing to climate change for sustainable development.
- Protect & preserve the biodiversity in the areas of our operations.
- Incorporate safety as a condition of employment & part of an employee's career advancement.
- Report all unsafe conditions, acts and near-miss cases so that corrective actions can be taken proactively.
- Increase HSE awareness and competence through job training in order to facilitate safe and healthy working environment.
- Ensure compliance with all the applicable statutory and other requirements & strive to go beyond it.
- Demonstrate a safe behavior at the workplace.
- Display visible commitment at every level by engaging all company & contractor employees in HSE initiatives and activities.

It will be our endeavor to have HSE at center of any business planning, designing and decision making process.

In fulfillment of our vision of **"Zero Incidents"**, co-operation from all stake-holders is solicited through prompt and concerted discharge of responsibilities.

Dilip Oommen
CEO
ArcelorMittal Nippon Steel India Ltd.

Place: Hazira
Date: March 11, 2020

A joint venture between ArcelorMittal and Nippon Steel Corporation

ArcelorMittal NIPPON STEEL

The main aims under the said Environment, Health & Safety Policy are to:

- Effectively manage, monitor, improve and communicate the environmental performance.
- Take all reasonable steps to prevent pollution.
- Set realistic and measurable objectives and targets for continual improvement of the environmental performance.
- Ensure that all employees and contractors are trained to understand their environmental responsibilities and create an environment that adheres to the Company's Policies, procedures and applicable regulations.
- Minimize waste and increase recycling within the framework of waste management procedures.
- Comply fully with all relevant legal requirements, codes of practice and regulations.
- Identify and manage environmental risks and hazards.
- Hold leadership accountable for good environment performance of our operations and projects. Inherent in that accountability will be the commitment of management to provide resources and successfully create an appropriate environment.
- Reduce, recycle and reuse natural resources.
- The project proponent shall regularly review this policy and ensure that corrective and preventative actions are taken in order to ensure continual improvement.
- To treat all the pollutants viz. liquid and gaseous, which contribute to the degradation of the environment, with appropriate technologies.
- To comply with all regulations stipulated by the Central / State Pollution Control Boards related to air emissions and liquid effluent discharge as per air and water pollution control laws, to handle hazardous wastes as per the Hazardous & Other Wastes (Management and Transboundary Movement) Rules, 2016 of the Environment (Protection) Act, 1986.
- To encourage support and conduct developmental work for the purpose of achieving environmental standards and to improve the methods of environmental management.
- To make continuous efforts to improve environment.

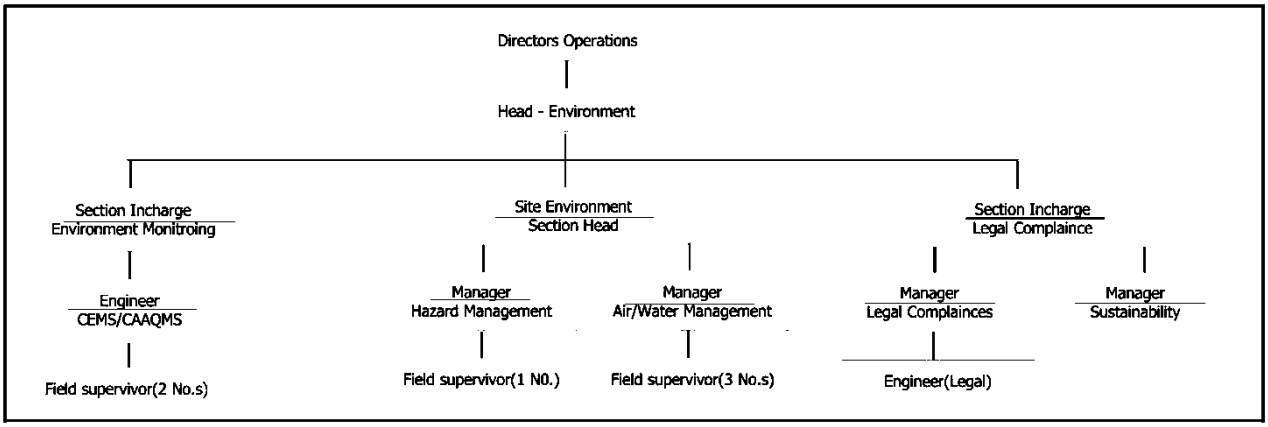
The system of reporting of Non-conformances/ violation of any Environmental Law/Policy will be as per the management system

10.3.1 Hierarchical system for reporting of Non-conformance / Violation / Deviations from the Environment Policy

The system of reporting of Non-conformances /violation of any Environmental Law/Policy will be as per the SOP defined under the Environment Management System. As per the SOP, any non-conformances/violation of Environmental Law/Policy, either identified during Internal Audits or reported by any authority or received through any source, will be discussed during the Review Meetings with Board of Directors. Under the system designated persons at all hierarchy level have been identified for ensuring adherence to the policy and compliance with the environmental laws and regulations. Also, system has been developed to take adequate measures.

AMNSI has formed reporting system of any non-conformance / violation to the Board of directors of the Company, as follows.

Figure 10-2: Organization structure for reporting violation/Deviation/Non-conformance



10.3.2 Hierarchical system or administrative order of the company to deal with the environmental issues

AMNS is responsible for implementation of all the mitigation and management measures. A separate department "Environment Management Department" (EMD) exists to look after all environmental related matters of the plant. The EMD will supervise the reported activity from time to time for smooth implementation of Environmental Mitigation and Management measures and will take necessary actions if required. The EMD will act to ensure the suitability, adequacy and effectiveness of the Environment Management Program. It will also ensure to meet all the Statutory Requirements. Roles & responsibilities of Environment Management Department (EMD) has been discussed in details in ***Chapter-6.***

Head-Environment will conduct reviews of our operations to monitor environmental performance to comply with all relevant environmental laws and regulations to minimize risks to health, safety and the environment. Work with local government, regulatory authorities and communities to ensure safe handling, use and disposal of all materials, resources and products, if required.

All the Environmental issues pertaining to the organization are immediately highlighted by the respective Sectional Incharges or any employee who observed, to the Head- Environment who in turn shall take all necessary actions to deal with the environmental issues.

10.4 Land use/Land cover

The environmental management plan for land use/land cover is given as ***Table 10-1.***

Table 10-1: Environment Management Plan for Land use and Land cover

EMP	Objective	To ensure that negative impacts on Land use and land cover are minimized during construction of the project and mitigation measures lead to enhanced land cover quality						
	Concern	Construction of manufacturing plant will change the land use at site from scrub land to built up land						
	Benefit of EMP	Impacts on land use and land cover due to project will be minimized						
	Impacting Activities	Mitigation Measures and Actions	Implementation and Management					Remarks
			Location	Timing	Responsibility	Monitoring	Records	
1	Site preparation- Clearance of vegetation/crop	Clearance of vegetation shall only be done on which construction is to take place. Top soil will be stored separately and will be used for greenbelt within the site. Compensatory green cover development within site	At site	For the construction period	Site engineer	Random checks by Site supervisor	Periodic records in form of photographs	
2	Construction activity- Excavation and filling of foundation	Excavated earth will be used for backfilling and care will be taken that natural drainage pattern remains unchanged	At site	For the construction period	Site engineer	Random checks by Site supervisor	Periodic records in form of photographs	

10.5 Air Quality

The environmental management plan for air quality is given as ***Table 10-2.***

Table 10-2: Environmental Management Plan for Air Quality

Objective	**To ensure that air emissions due to the site preparation, installation of proposed project and operation phase will be minimum**						
Concern	**Site preparation, installation of manufacturing facility and operation phase can deteriorate air quality**						
Benefit of EMP	**Mitigation of impact and protection of health of workers and local community**						
Impacting Activities	**Mitigation Measures and Rationale**	**Implementation and Management**					**Remarks**
		Location	**Timing**	**Responsibility**	**Monitoring**	**Records**	
Transportation of raw materials and products	Ensure that vehicles have a Pollution Under Control (PUC) Certificate	Along the vehicle movement track	At all times during operational phase	Site engineer	Checks by security staff at the entry gate	PUC Certificate	-
Operation of the various plant	Cyclone separator, Bag filters, ESP, scrubbers are installed at various locations which relase the emission in air and emission level will be kept within prescribed limits	At processing areas of the plant premises	At all times during operational phase	Site engineer	Ambient air quality monitoring, Work place monitoring	Ambient air quality monitoring reports, Work place monitoring report	PPEs to be provided to workers and will be used by workers in process area; regular health checkups of the employees/workers

10.6 Noise environment

The environmental monitoring plan for noise generated due to the proposed project is as presented in ***Table 10-3.***

Table 10-3: Environmental Monitoring Plan for Noise Environment

Objective	**To reduce noise level due to the proposed project**								
Benefit of EMP	**Noise environment of the area will not be impacted by the proposed activity**								
Impacting Activity	**Mitigation Measures**	**Implementation and Management**							**Remark**
		Data Analysis	**Measurement Methodology**	**Timing**	**Location**	**Reporting Schedule/Responsibility**	**Emergency Procedure**	**Procurement Schedule**	
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
Startup and shutdown activities like operation of equipment for all the proposed plants	SOP's will be followed. PPEs, Ear plugs and Ear muffs will be provided to workers wherever applicable.	Noise Levels	SLM	Once during week (Hourly reading for 24 hours at each location)	All plants	Site engineer	Regular Maintenance of equipment to be done.	During commissioning phase	-
Operation of Exhausters in Coke Ovens, Tuyers in BF, Sinter Fan, Sinter Breaker, Sinter Screen, Mills,	SOP's will be followed. PPEs, Ear plugs and Ear muffs will be provided to workers wherever applicable.	Noise Levels	SLM	Once during week (Hourly reading for 24 hours at each location)	1 meter away from the Noise source Noise generation maachineNear Blower & in CRM Plant	Site engineer	Periodic Maintenance of Blower and other noise gerating equipment will be scheduled	During Operation phase	Proper personal protective equipment to be worn by workers.

Objective	**To reduce noise level due to the proposed project**								
Benefit of EMP	**Noise environment of the area will not be impacted by the proposed activity**								
Impacting Activity	**Mitigation Measures**	**Implementation and Management**							**Remark**
		Data Analysis	**Measurement Methodology**	**Timing**	**Location**	**Reporting Schedule/Responsibility**	**Emergency Procedure**	**Procurement Schedule**	
C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
Blowers, TG Set, DG Sets etc.									

10.7 Water Quality

The environmental management plan is given in ***Table 10-4.***

Table 10-4: Environmental Management Plan for Water Quality

Impacting Activities	**Mitigation Measures and Rationale**	**Implementation and Management**				
		Location	**Timing**	**Responsibility**	**Monitoring/Data Analysis**	**Records**
Usage of Water	Water conservation plans shall be ensured such as recycling of the effluent through recycle and reuse system Flow meters shall be installed at each of raw water intake point. Care shall be taken to avoid leakage of water sources and it will be maintained by	At site	All times	Site engineer	Monitoring of raw water consumption. Parameters as per IS 10500, 2012 and Methodology will be followed as per as IS method.	Records of Water consumption at each unit to be carried out. Water Auditing at regular intervals to be carried out in order to conserve fresh water resources

Impacting Activities	Mitigation Measures and Rationale	Implementation and Management				
		Location	Timing	Responsibility	Monitoring/Data Analysis	Records
	continuous monitoring by flow measurements.					
Wastewater generation and disposal	The effluent generation from the proposed unit shall be treated in proposed ETP and treated water shall be sued for gardening, firefighting and dust suppression. Flow meters shall be installed at inlet and outlet of the ETPs. Use of spill control measures, mechanical handling, PPE's shall be mandatory while handling the chemicals in ETP	At Site	All times	Site engineer	Inlet and outlet characteristics as per consent condition and Methodology will be followed as per IS method	Records of wastewater generation and reuse quantity to be maintained.

10.8 Solid and Hazardous waste

The environmental management plan is given in ***Table 10-5.***

Table 10-5: Environmental Management Plan for Solid and hazardous waste Material

Objective	**To reduce soil and land contamination due to hazardous waste storage and disposal**						
Concern	**Pollution to soil, land, groundwater and surface water**						
Benefit of EMP	**Surrounding environment will not be impacted by the proposed activity**						
Impacting Activities	**Mitigation Measures and Rationale**	**Implementation and Management**					**Remarks**
		Location	**Timing**	**Responsibility**	**Monitoring**	**Records**	
Storage , handing, transportation and disposal of hazardous waste	Hazardous waste shall be segregated at source and stored in hazardous waste storage area for maximum period of 90 days. Storage area will be with impervious lining to avoid leaching and shall be properly demarcated. Spill control mechanism shall be in place. PPE's shall be mandatory wile handling the hazardous waste during loading & unloading. Possibility of reuse shall be explored to the extent possible. Membership of approved TSDF shall be taken for safe disposal of hazardous waste.	At site	At all time	Site engineer	Quantities of wastes generated shall be monitored; Spill incidents will be documented & recorded. Photographs will be taken.	Records of hazardous waste generation and disposal quantity to be maintained as per Form 3. Annual returns to be submitted to GPCB as per Form 4. Manifest system will be followed for waste disposed off-site.	

10.9 Land and Soil

EMP for soil environment for the proposed project is presented in ***Table 10-6***

Table 10-6: Environment Management Plan for Soil Environment

Objective	**To ensure that soil contamination due to the site preparation, installation of proposed project and operation phase will be minimum**						
Concern	**Site preparation, installation of manufacturing facility and operation phase can deteriorate soil quality**						
Benefit of EMP	**Reduction / minimization of soil quality pollution**						
Impacting Activities	**Mitigation Measures and Rationale**	**Implementation and Management**					**Remarks**
		Location	**Timing**	**Responsibility**	**Monitoring**	**Records**	
Soil contamination due to storage, handling of Hazardous waste	The places where hazardous materials will be stored and handled will have RCC floor to avoid such contaminations.	Dedicated storage area	During operation/ maintenance phase	Site engineer	Regular checks and quantity of hazardous waste generation and disposal		-

10.10 Hydrogeology

10.10.1 Rain water Harvesting

Rainwater harvesting is one of the most efficient and cost-effective ways of conserving and storing water for later use. It is a simple process that primarily involves three steps: collecting accumulated rainwater from roofs, ground and roads; storing it safely to avoid any contamination; and, finally, pumping it for usage

To revive this practice of water management at the Hazira plant, the Utilities team at Hazira has devised an effective strategy to revamp the existing rainwater harvesting systems at the plant. For CY19, a CAPEX was cleared to harvest at least 60% of the targeted water on a sustainable basis.

Design Data:

As per long term IMD data Average rainfall of 30 years in Surat District is 1172 mm/annum.

Runoff coefficient for plant and AMNSI Township considered is 0.5

Note:

We have considered 100% plant area under the control of AMNSI India, including plant sheds, all sheds rundown and 100% township area with a belief that rain water can always be harvested from every shed, every house and every road.

It is also to be noted that AMNSI India is perhaps one of the most compact plant vis-avis the land and its production capacity.

The following catchment areas had been created for harvesting:

Table 10-7: Rain water Harvesting Collection Tank

Location Area	[M^2]
AMNSI Township Entrance Pond 1	8,753
AMNSI Township Entrance Pond 2	1,765
AMNSI Township Entrance Pond 3	717
AMNSI Township Entrance Pond 4	777
Near Plate Mill Pond 1	1,838
Near Plate Mill Pond 2 [Hed]	1,680
Near Nursing Home	1,942
Pond 1 In Front Of R & D Building	603
Pond 2 In Front Of R & D Building	707
Pond Before HSE Office	2,103
Total	**19,235**

Thus, approximately 19235 m^2 of area is used for harvesting. Each pond has a depth of at least 2m.

From strategy to execution

A detailed roadmap was prepared to harvest a million cubic meters of water over a period of two years. This includes drafting of comprehensive guidelines for the design, installation, commissioning and operations of the harvesting system.

To achieve optimal efficiency in rainwater harvesting, more than two kilo meter of pipes were laid with 12 pumps, being installed at various places.

An enduring commitment to sustainability

The utilities team is responsible for managing the operations and maintenance of the entire rainwater harvesting system.

As a result, during the monsoon in CY20, harvested 81 crore litres (8, 10,081 cubic meters) of rainwater.

Photograph 10-1: Rain water Harvesting within plant premises

10.11 Ecology and Biodiversity

The greenbelt area needs to be strengthened to meet the requirement of ToR issued to AMNS, namely 33% coverage with density of 2500 trees/Ha. To do this, AMNS proposes to develop dense greenbelt around plant boundary in the space available inside the plant area. The greenbelt development is therefore explained in three parts namely:

- Existing greenbelt with details and map
- Greenbelt required to removed or transplanted for project purposes and compensatory plantation
- Greenbelt Development plan for achieving 33% target

10.11.1 Status of Greenbelt in Plant premises

Existing area of the Plant is 750.18 Ha. Currently, 21.46% of this area (approx. 161 Ha.) is covered under plantation in which around 2,87,429 trees have been planted. ***Table 10-8*** shows the existing greenbelt details. Office premises of the units is undergone landscaping with lawn and provision of other floral species of decorative plants, palm trees and other flowering species (trees, herbs, scrubs and creepers).

Table 10-8: Existing Greenbelt area Details

Existing Greenbelt Details					
Location	**Existing Land (Ha)**	**Existing green belt, Ha**	**No of Trees**	**Density (No of trees / Ha)**	**Total greenbelt, %**
Plant	638.55	136.05	2,26,745	1667	21.30%
Township	111.63	24.95	60,684	2432	22.35%
Combined	**750.18**	**161**	**2,87,429**	**1785**	**21.46%**

This area does not consider substantial lawns and shrubs already available in the campus. Further, it is required to cover 33% of the total area under plantation with increased density of 2500 trees per Ha. Owing to the fact that the expansion project will allow for reorganizing several structures and units, and will also provide an opportunity to convert lawn and shrub to dense greenbelt, AMNS now proposes a revised greenbelt plan to achieve the 33% requirement. The existing greenbelt plan is provided in ***Map 10-1*** and the proposed greenbelt plan is provided in ***Map 10-2***.

Table 10-9: List of plant species present in the greenbelt area

Plant				Township			
Sr. No.	**Type of Tree**	**Nos. (rounded off to zero)**	**% Land Area Cover**	**Sr. No.**	**Type of Tree**	**Nos. (rounded off to zero)**	**% Land Area Cover**
1	Peltophorum sp.	67000	30%	1	Peltophorum sp.	19000	31%
2	Neem	3000	1.32%	2	Neem	700	1%
3	Kadamb	100	0.04%	3	Kadamb	200	0.30%
4	Siris	1500	0.66%	4	Siris	500	0.80%
5	Putranjiva	1700	0.74%	5	Putranjiva	450	0.70%
6	Paras Pipal	45800	20%	6	Paras Pipal	5500	9%
7	Ashoka trees	300	0.13%	7	Ashoka trees	500	0.80%
8	Pipal	200	0.08%	8	Pipal	300	0.40%
9	Indian banyan tree	100	0.04%	9	Indian banyan tree	50	0.08%
10	Mango	500	0.22%	10	Mango	7600	12.52%
11	Amaltas	500	0.22%	11	Amaltas	1500	2.47%
12	Jambul / Black plum	900	0.39%	12	Jambul / Black plum	1200	2%
13	Date Palm	100	0.04%	13	Date Palm	80	0.13%
14	Bottle Palm	150	0.06%	14	Bottle Palm	30	0.04%
15	Casurina -Saru	45000	19.84%	15	Casurina -Saru	16000	26.36%
16	Rain Tree	28000	12.34%	16	Rain Tree	750	1.23%
17	Spathodia	800	0.35%	17	Spathodia	500	0.80%
18	Tabubia	2000	0.88%	18	Tabubia	300	0.40%
19	Alastonia Saptaparni -	700	0.30%	19	Alastonia - Saptapami	500	0.80%
20	Coconut	50	0.02%	20	Coconut	80	0.13%
21	Guava	150	0.06%	21	Guava	450	0.74%
22	Chikoo	400	0.17%	22	Chikoo	750	1.23%
23	Eucalyptus	22000	9.70%	23	Eucalyptus	2050	5%
24	Foxtail Palm	500	0.22%	24	Foxtail Palm	700	1.15%
25	Adensonia	0	0%	25	Adensonia	1	0.00%
26	Badam	5000	2.20%	26	Badam	1000	1.64%
	Total	**226450**			**Total**	**60691**	

10.11.2 Greenbelt required to removed or transplanted for project purposes and compensatory plantation

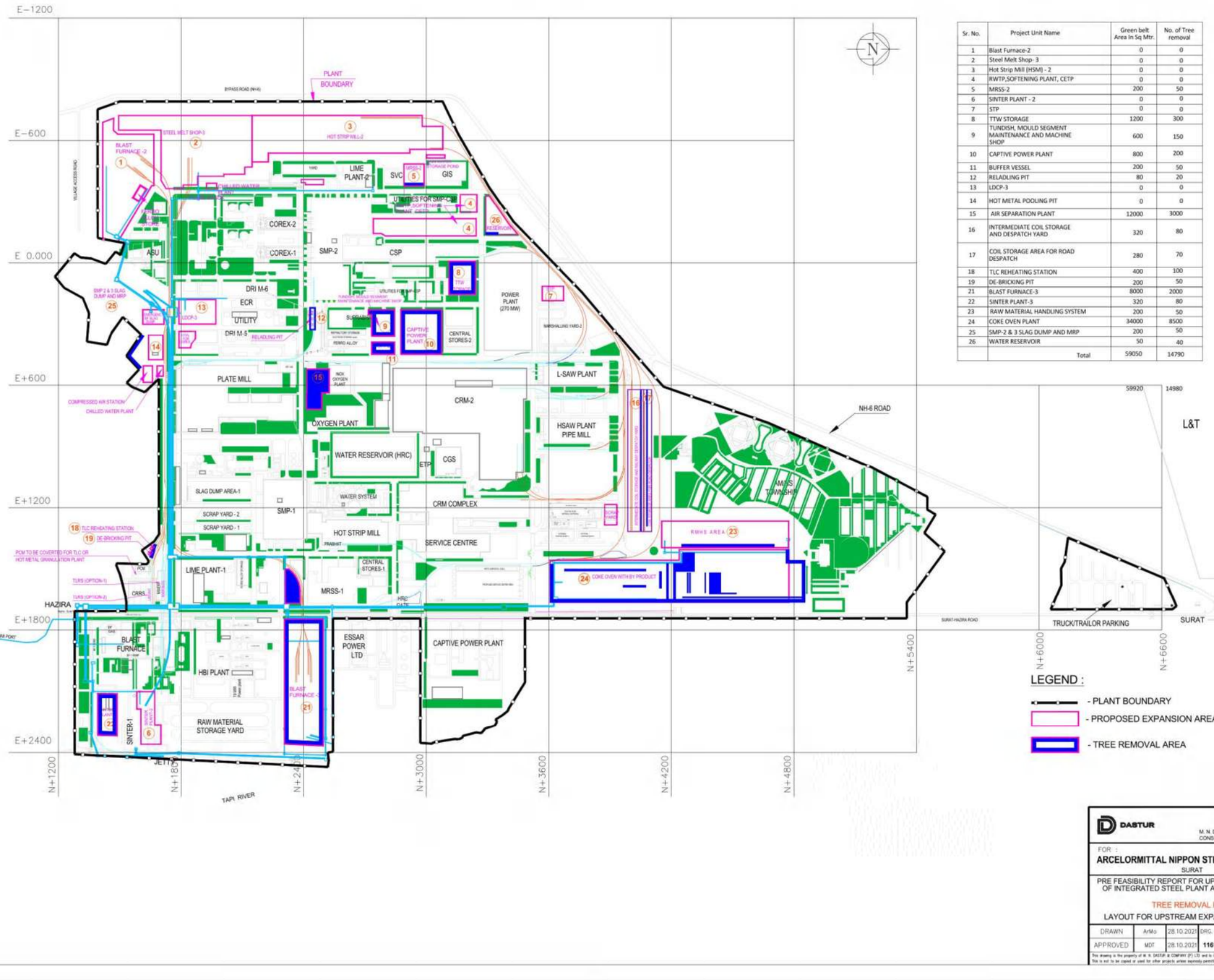
From the proposed project area, around 20,000 nos. of trees to be removed. These trees will be transplanted maximum possible inside the boundary in addition to greenbelt development proposed. For transplantation, AMNSI will consult local forest department for suitable technical equipment and exepertise. Balance trees which can not be transplanted will be removed with necessary statutary permission as per local guidelines. To

compensate the balance removed trees, AMNSI will go for compensatory forestation as per the directives of the Forest Department.

Table 10-10: Location of Trees Removal

Sr	Location	Green belt Area in sqm	No. of Trees removal	Tentative height of the trees & Name
1	Blast Furnace - 2	0	0	NA
2	Steel Melt Shop - 3	0	0	NA
3	Hot Strip Mill - 3	0	0	NA
4	EWTP, Softening Plant, CETP	0	0	NA
5	MRSS - 2	1120	280	Peltoforum sp. 10ft.
6	Coil Service Centre	0	0	NA
7	STP	0	0	NA
8	TTW Storage	1200	300	Peltoforum sp. 10ft.
9	Tundish, Mould Segment Maintenance and Machine shop	600	150	Peltoforum sp. 10ft.
10	Captive Power Plant	800	200	Peltoforum sp. 10ft.
11	Buffer Vessel	200	50	Peltoforum sp. 10ft.
12	Reladling Pit	80	20	Peltoforum sp. 10ft.
13	LDCP - 3	0	0	NA
14	Hot Metal Pooling Pit	0	0	NA
15	Air Separation Plant	12000	3000	Peltoforum sp. 15ft.
16	Intermediate Coil Storage & Railway Despatch Yard	320	80	Casurina sp. 20 ft
17	Coil Storage area for Road Despath	280	70	Casurina sp. 20 ft
18	TLC Reheating Station	400	100	Kashid 12 ft.
19	De-Bricking Pit	200	50	Kashid 12 ft.
20	CMS Facilities	20000	5000	Neelgiri 20ft, Peltophorum 15 ft.
21	Blast Furnace - 3	8000	2000	Neelgiri 20ft, Peltophorum 15 ft.
22	Sinter Plant - 3	320	80	Peltoforum sp. 10ft.
23	Raw Material Handling System	200	50	Casurina sp. 20 ft
24	Coke Oven Plant	34000	8500	Neelgiri - 20 ft. , Casurina 20ft, Peltophorum 15 ft.
25	SMP - 2 & 3 Slag Dump and MRP	200	50	Neem 15 ft., Rain Tree 15 ft.
Total		**79920**	**19980**	

Map 10-1: Map showing existing greenbelt area and location for removal of trees



Sr. No.	Project Unit Name	Green belt Area In Sq Mtr.	No. of Tree removal
1	Blast Furnace-2	0	0
2	Steel Melt Shop- 3	0	0
3	Hot Strip Mill (HSM) - 2	0	0
4	RWTP,SOFTENING PLANT, CETP	0	0
5	MRSS-2	200	50
6	SINTER PLANT - 2	0	0
7	STP	0	0
8	TTW STORAGE	1200	300
9	TUNDISH, MOULD SEGMENT MAINTENANCE AND MACHINE SHOP	600	150
10	CAPTIVE POWER PLANT	800	200
11	BUFFER VESSEL	200	50
12	RELADLING PIT	80	20
13	LDCP-3	0	0
14	HOT METAL POOLING PIT	0	0
15	AIR SEPARATION PLANT	12000	3000
16	INTERMEDIATE COIL STORAGE AND DESPATCH YARD	320	80
17	COIL STORAGE AREA FOR ROAD DESPATCH	280	70
18	TLC REHEATING STATION	400	100
19	DE-BRICKING PIT	200	50
21	BLAST FURNACE-3	8000	2000
22	SINTER PLANT-3	320	80
23	RAW MATERIAL HANDLING SYSTEM	200	50
24	COKE OVEN PLANT	34000	8500
25	SMP-2 & 3 SLAG DUMP AND MRP	200	50
26	WATER RESERVOIR	50	40
	Total	59050	14790

LEGEND :
- PLANT BOUNDARY
- PROPOSED EXPANSION AREA
- TREE REMOVAL AREA

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SURAT

PRE FEASIBILITY REPORT FOR UPSTREAM EXPANSION OF INTEGRATED STEEL PLANT AT HAZIRA, GUJARAT

TREE REMOVAL PLAN

LAYOUT FOR UPSTREAM EXPANSION PROJECT

DRAWN	ArMo	28.10.2021	DRG. No.	REV.
APPROVED	MDT	28.10.2021	11613-97A-000-LTL-0003	02

10.11.3 Proposed Greenbelt Plan

Greenbelt Designing

Following parameters have been considered to design green belt;

Selection of Plant Species

Considering the environmental status of project area, four main parameters like salinity, draught, fire resistance, pollution tolerant species with faster growth rate and ever green nature have been considered while selecting the species. Facts considered during selection of plant species for greenbelt development are:

- Agro climatic zone (Semi-arid to dry sub humid – as per CPCB) of the project area
- Evergreen species to mitigate cumulative impacts due to other industries also.
- Type of pollutant (mainly air) likely to disperse from project activities.
- Biological–filter Efficiency: Absorption of gases, Dust capturing and Noise control.

Proposed Greenbelt area to be developed

Table 10-11: Greenbelt Details after proposed expansion

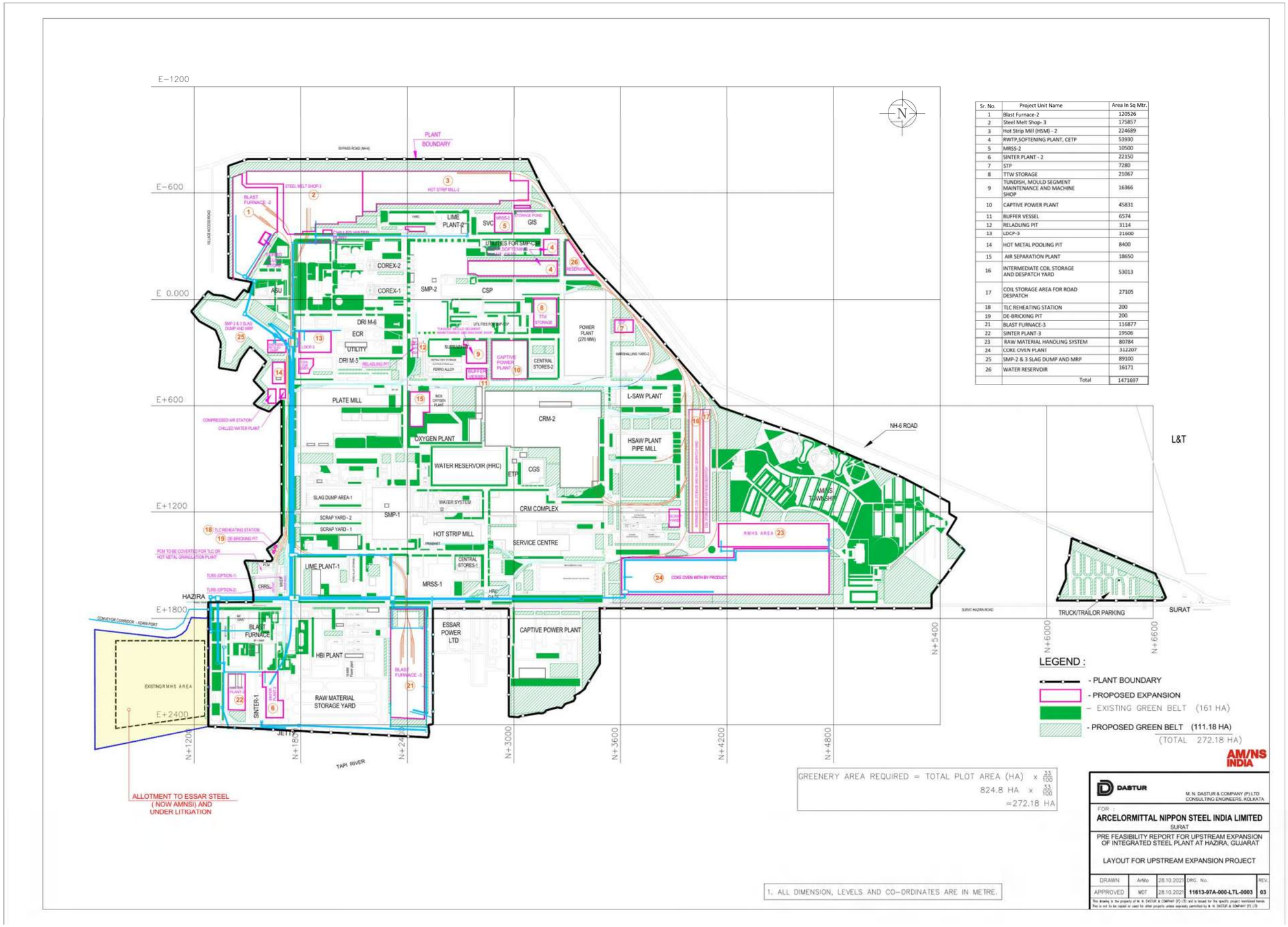
After expansion Greenbelt Details									
Location	**Land after expansion (Ha)**	**Existing green belt, Ha**	**Proposed green belt, Ha**	**Total green belt area, Ha**	**No of Trees Existing**	**No of Trees Proposed to be planted**	**Total No. of Trees after expansion**	**Density (No of trees / ha)**	**Total greenbelt, %**
Plant	750.18	136.05	101.18	237.23	2,26,745	3,66,330	5,93,075	2,500	31.62%
Township	74.26	24.95	10	34.95	60,684	26,691	87,375	2,500	47.06%
Total	824.8	161	111.18	272.18	2,87,429	3,93,021	6,80,450	2,500	33%

Table 10-12: List of plant species selected for proposed the greenbelt area

Plant				Township			
Sr. No.	**Type of Tree**	**Ht. in ft.**	**Age of Tree**	**Sr. No.**	**Type of Tree**	**Ht. in ft.**	**Age of Tree**
1.	Peltophorum sp.	15 - 20	40 - 50	1.	Peltophorum sp.	15 - 20	40 - 50
2.	Neem	20 - 30	70 - 90		Neem	20 - 30	70 - 90
	Kadamb	15 - 20	50 - 60	3.	Kadamb	15 - 20	50 - 60
4.	Skis	15 - 20	30 - 50	4.	Skis	15 - 20	30 - 50
5.	Putranjiva	15 - 20	30 - 50	5.	Putranjiva	15 - 20	30 - 50
6	Paras Pipal	15 - 20	40 - 50	6	Paras Pipal	15 - 20	40 - 50
7	Ashoka trees	15 - 20	30 - 50	7	Ashoka trees	15 - 20	30 - 50
8	Pipal	25 - 30	100 Plus	8	Pipal	25 - 30	100 Plus
9	Indian banyan tree	25 - 30	30 - 50	9	Indian banyan tree	25 - 30	30 - 50
10	Mango	15 - 25	30 - 50	10	Mango	15 - 25	30 - 50
11	Amaltas	15 - 20	30 - 50	11	Amaltas	15 - 20	30 - 50

Plant				Township			
Sr. No.	**Type of Tree**	**Ht. in ft.**	**Age of Tree**	**Sr. No.**	**Type of Tree**	**Ht. in ft.**	**Age of Tree**
12	Jambul / Black plum	15 - 25	40 - 50	12	Jambul / Black plum	15 - 25	40 - 50
13	Date Palm	10 - 15	30 - 50	13	Date Palm	10 - 15	30 - 50
14	Bottle Palm	15 - 20	30 - 50	14	Bottle Palm	15 - 20	30 - 50
15	Casurina -Sam	25 - 35	30 - 50	15	Casurina - Sam	25 - 35	30 - 50
16	Rain Tree	25 - 30	30 - 50	16	Rain Tree	25 - 30	30 - 50
17	Spathodia	15 - 20	30 - 50	17	Spathodia	15 - 20	30 - 50
18	Tabubia	15 - 20	30 - 50	18	Tabubia	15 - 20	30 - 50
19	Alastonia - Saptaparni	15 - 20	30 - 50	19	Alastonia - Saptaparni	15 - 20	30 - 50
20	Coconut	10 - 20	30 - 50	20	Coconut	10 - 20	30 - 50
21	Guava	10 - 20	30 - 50	21	Guava	10 - 20	30 - 50
22	Chikoo	10 - 20	30 - 50	22	Chikoo	10 - 20	30 - 50
23	Eucalyptus	25 - 35	30 - 50	23	Eucalyptus	25 - 35	30 - 50
24	Foxtail Palm	15 - 20	30 - 50	24	Foxtail Palm	15 - 20	30 - 50
25	Adensonia	15 - 20	100 Plus	25	Adensonia	15 - 20	100 Plus
26	Badam	15 - 20	30 - 50	26	Badam	15 - 20	30 - 50

Map 10-2: Map showing Greenbelt area after proposed expansion



Sr. No.	Project Unit Name	Area In Sq Mtr.
1	Blast Furnace-2	120526
2	Steel Melt Shop- 3	175857
3	Hot Strip Mill (HSM) - 2	224689
4	RWTP,SOFTENING PLANT, CETP	53930
5	MRSS-2	10500
6	SINTER PLANT - 2	22150
7	STP	7280
8	TTW STORAGE	21067
9	TUNDISH, MOULD SEGMENT MAINTENANCE AND MACHINE SHOP	16366
10	CAPTIVE POWER PLANT	45831
11	BUFFER VESSEL	6574
12	RELADING PIT	3114
13	LDCP-3	21600
14	HOT METAL POOLING PIT	8400
15	AIR SEPARATION PLANT	18650
16	INTERMEDIATE COIL STORAGE AND DESPATCH YARD	53013
17	COIL STORAGE AREA FOR ROAD DESPATCH	27105
18	TLC REHEATING STATION	200
19	DE-BRICKING PIT	200
21	BLAST FURNACE-3	116877
22	SINTER PLANT-3	19506
23	RAW MATERIAL HANDLING SYSTEM	80784
24	COKE OVEN PLANT	312207
25	SMP-2 & 3 SLAG DUMP AND MRP	89100
26	WATER RESERVOIR	16171
	Total	1471697

LEGEND :
- PLANT BOUNDARY
- PROPOSED EXPANSION
- EXISTING GREEN BELT (161 HA)
- PROPOSED GREEN BELT (111.18 HA)

(TOTAL 272.18 HA)

GREENERY AREA REQUIRED = TOTAL PLOT AREA (HA) x 33/100
824.8 HA x 33/100
=272.18 HA

1. ALL DIMENSION, LEVELS AND CO-ORDINATES ARE IN METRE.

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PRE FEASIBILITY REPORT FOR UPSTREAM EXPANSION OF INTEGRATED STEEL PLANT AT HAZIRA, GUJARAT

LAYOUT FOR UPSTREAM EXPANSION PROJECT

DRAWN	ArMo	28.10.2021	DRG. No.	REV.
APPROVED	MDT	28.10.2021	11613-97A-000-LTL-0003	03

10.11.4 Budget Allocation for Existing and Proposed Greenbelt Development

Total capital budget of INR 10,00,00,000 alloted for the development of greenbelt and INR 50,00,000 for the maintenance of the greenbelt. Total 3,93,021 nos. of sapling will be planted by December 2023 to meet the requirement of 33% greenbelt area within plant premises with the tree density of 2500 nos/Ha

10.12 Social Management Plan

The social management plan proposes to improve the quality of life of inhabitants of potentially affected villages directly.

The goal is "a pollution free area with improved quality of life and empowered community" and the three key pillars on which this would be developed are – Social, Health, Infrastructure improvements with efforts on minimal disruptions present life style.

10.12.1 Corporate Environment/Social Responsibility

The total cost estimation has been split into different thematic area of work. The total costs of all proposed program implementation during 1- 3 years will be around Rs. 46,00,00,000 (Rupees Forty-Six Crores only). The estimated budget for the planned CER/CSR activities is given below. In future the responsibilities for all these facilities will be handed over to the Government. A CER/CSR cost estimation is finalized after public consultation. It covers major two activities as suggested in ToR.

AMNSI is proposing,

- 50 Ha mangrove plantation in nearby suitable area in consultation with Gujarat Forest Department
- Plan to develop plastic waste collection and segregation facilities in all nearby villages as well as to support a local to develop a plastic waste recycling facility in nearby area part of CER actitivities

Table 10-13: CER Budget

Activities and budget proposed to address issues raised during Public Consultation - Yearly (1-3 yrs.)		**2023**	**2024**	**2025**	**Rs. In Lakhs**
S. No.	**Major activities**	**1st Year**	**2nd Year**	**3rd Year**	**Total Amount**
A	Education				
1	STEM Learning Centre in 10 Middle and 5 High Schools	20	20	20	60
2	Padhega Bharat- Digital Pathasala - (Smart class +Learning apps etc.) - 40 Middle school (Class 6-8)	80	60	60	200
3	Model Anganwadi - Improvement in basic amenities & teaching learning materials in Anganwadi centre	30	30	30	90
4	Construction of English medium School Building/hall, Computer Lab, Biology Lab, Chemistry Lab	200	50	50	250
5	Improvement in basic amenities, community teachers & teaching learning materials in Primary and Middle School for quality education.	25	25	25	75
6	Provision of necessary equipment and infrastructure for sports activities	25	25	25	75
7	Construction of sport complex in nearby villages	50	50	50	150

Activities and budget proposed to address issues raised during Public Consultation - Yearly (1-3 yrs.)		2023	2024	2025	Rs. In Lakhs
S. No.	**Major activities**	**1st Year**	**2nd Year**	**3rd Year**	**Total Amount**
8	Model School Project in terms of Green School and Smart School Development project for Hazira, Mora, Suwali, Damka, Vansva & Bhatlai Village	30	30	30	90
9	Solar Panel Installation in Govt. Schools of Hazira Village	50	50	50	150
10	Water Harvesting Project for Govt School. At Hazira, Damka & Junagam Villages	50	50	50	150
	Sub Total	560	390	390	1290
B	Health & Sanitation				
1	Strengthening/Renovation of the Government Health Centres. PHC, CHC & Medical Sub-centres	60	60	80	200
2	Medical Equipment Support to the Govt. Hospitals	50	50	50	150
3	Hospital Facility for Local People with Partnership of Notified Authorities	80	60	60	200
4	Mobile Medical Unit for free treatment and medicine support to community	50	50	50	150
5	Artificial limb camp for People with physical disability	50	50	50	150
6	Dispensary Setup at Hazira Village	30	30	30	90
	Sub Total	360	360	360	1080
C	Infrastructure Development				
1	Community RO project in Hazira, Vansva, Bhatlai & villages.	30	30	40	100
2	Construction of Community Centre in Hazira, Vansva, Rajgari & Damka villages	50	50	50	150
3	Construction and repair of drainage system in Hazira with Panchayat-Hazira to avoid water logging	30	30	30	90
4	Repair and Renovation of the Internal Road in Hazira Village and other need-based community support	30	30	30	90
5	Infrastructure development (Deepening/creation of pond, Pond Beautification, community park, recreation centre etc)	60	60	60	180
6	Drinking Water pipeline installation work at Hazira Village	100	50	50	200
	Sub Total	300	250	260	810
D	Sustainable Livelihood				
1	Vocational Skill Training centre for unemployed 1000 youths- in partnership with NSDC.	50	50	50	150
2	Partnership with NABARD/BAIF for NRM/Livelihood project (Artificial Insemination, Agriculture Equipment Support, Kitchen-Garden, Farm-based, livestock & watershed work) Hazira, Junagam, Mora, Damka, Vansva, Rajgari, Suwali & Bhatlai Villages	65	65	65	195
3		10	10	10	30

Activities and budget proposed to address issues raised during Public Consultation - Yearly (1-3 yrs.)		2023	2024	2025	Rs. In Lakhs
S. No.	**Major activities**	**1st Year**	**2nd Year**	**3rd Year**	**Total Amount**
4	Fishing net and fishing tool to fishing community of Hazira Village	25	25	25	75
5	Machine Support to SHGs for Livelihood Activity Hazira, Junagam, Mora, Damka, Vansva, Rajgari, Suwali & Bhatlai Villages	25	25	25	75
6	Plastic waste recycling unit for Womens of Hazira Village	20	20	20	60
	Sub Total	195	195	195	585
E	Sports and Youth Development				
1	Development of Playground for nurturing local talents for sports at Hazira, Mora, Damka, Junagam,Suwali, Bhatlai, Rajgari & Vansva Panchayat	50	50	50	150
2	Cricket Ground & running track construction work at Damka & Hazira Village	60	40	40	140
3	Sport Material support to the schools at Hazira, Damka & Junagam	10	10	10	30
	Sub Total	120	100	100	320
F	Environment				
1	Tree Plantation and Greening Drive-in villages and School premise (10K saplings)	15	15	15	45
2	Installation and promotions of solar energy in partnership with GEDA (Gujrat Energy development Agencies) solar streetlight, solar roof top energy, solar water pump	60	60	80	200
3	Cleaning and deepening of Existing Ponds	30	30	30	90
4	Mangrove conservation Project for Hazira, Suwali & Damka villages	20	20	20	60
	Sub Total	125	125	145	395
G	Others				
1	Relief measure during natural calamity, pandemic etc.	30	30	30	90
2	Impact Assessment and hiring of vehicle for monitoring and implementation of activities	10	10	10	30
	Sub Total	40	40	40	120
	Grand Total				4600

10.13 Implementation of EMP

AMNSI. is committed for implementation of all the mitigation measures and Environment Management Plan measures suggested in ***Chapter-4*** and ***Chapter-10***. A separate department "Environment Management Department" (EMD) exists to look after all environmental related matters of the plant. The EMD will supervise the reported activity from time to time for smooth implementation of Environmental Management Plan and Mitigation measures and will take necessary actions, if required. The Department will act to ensure the suitability, adequacy and effectiveness of the Environment Management Program. It will also ensure to meet all the Statutory Requirements. EMD will serve the following purpose:

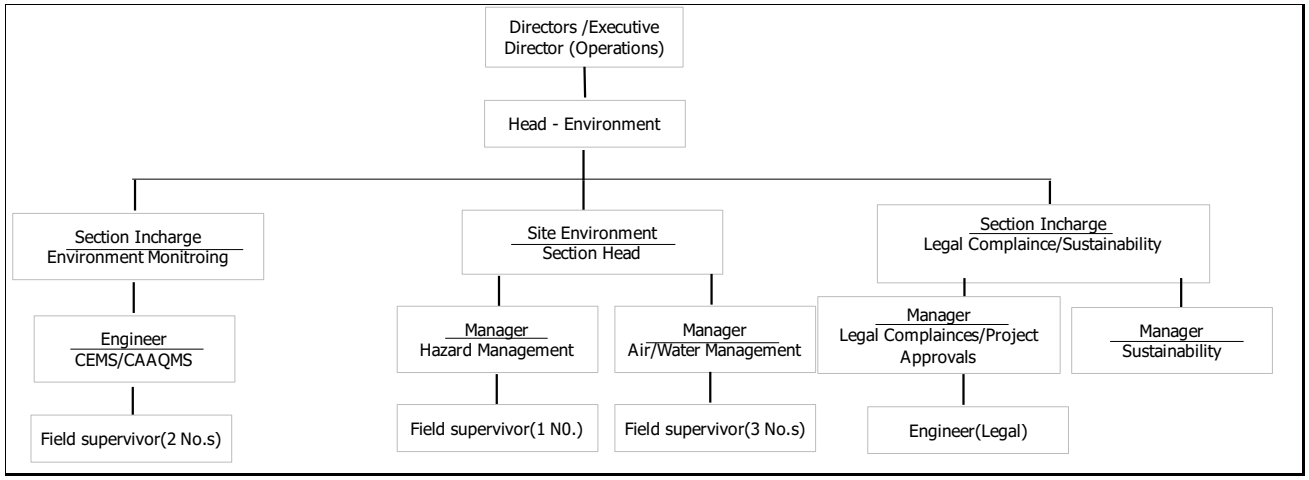
- Identification of any problem in implementation of EMP and mitigation measures.
- Initiating or providing solutions to those problems through designated channels and verification of the implementation status
- Control of activities inside the plant, until the environmental problem has been corrected
- Suitably respond to emergency situations. Provide details of the emergency and the actions taken to the top management
- Suitably make modifications or alterations in the plan to meet regulatory standards as amended from time to time.
- Keeping the management updated on regular basis about the findings / results of implementation status of EMPs and mitigation measures.
- Submit compliance to the conditions of environmental clearance, to the statutory authorities and to the top management.
- Conducting regular safety drills and training programs to educate employees on safety practices. A qualified and experienced safety officer will be responsible for the identification of the hazardous conditions and unsafe acts of workers and advise on corrective actions, organize training programs and provide professional expert advice on various issues related to occupational safety and health.
- Conducting safety and health audits to ensure that recommended safety and health measures are followed.

10.14 Environmental Management Department

It is necessary to have a permanent organizational set up to ensure its effective implementation. Hence, company has a well experienced team consisting of officers from various departments to co-ordinate the activities concerned with management and implementation of the environmental control measures. This team undertakes the activities of monitoring the stack emissions, ambient air quality, noise level etc. either departmentally or by appointing external agencies wherever necessary. Regular monitoring of environmental parameters is being carried out to find any deterioration in environmental quality and also to take corrective steps, if required, through the involvement of the respective internal departments. The existing Environmental Management Department also collects data about health of workers, green belt development etc.

An organogram of the Environmental Management Department (EMD) is presented in following ***Figure 10-3***

Figure 10-3: Organization structure for implementation of EMP and Mitigation Measures



10.15 Expenditure on Environmental matters

The expenditure to be incurred by AMNSI on environmental matter is given in ***Table 10-14.***

Table 10-14: Expenditure on environmental matters

S. No	Head	Approximate capital cost (in Rs. Crores)	Approximate recurring cost per annum (in Rs, Crores)	Basis for cost estimate
1	Air pollution control	800	80	**Capital cost (part of process plant)** Cost of providing Pollution Control Equipment and for providing adequate stack height
				Recurring cost Maintenance of Pollution Control Equipment
2	Water pollution	550	55	**Capital cost** Installtion and commissioning of ETP including ZLD
				Recurring cost Cost of operating ETP including manpower cost, cost of chemicals etc.
3	Noise Pollution	1.0	0.5	**Capital cost** Cost of acoustic enclosures
				Recurring cost Maintenance cost
4	Solid and hazardous waste management	150	2.5	**Capital cost** RCC flooring / Sheds for storage of Solid Wastes and temporary storage of hazardous wastes
				Recurring cost Membership fees of TSDF for disposal of hazardous waste, Cost of transportation

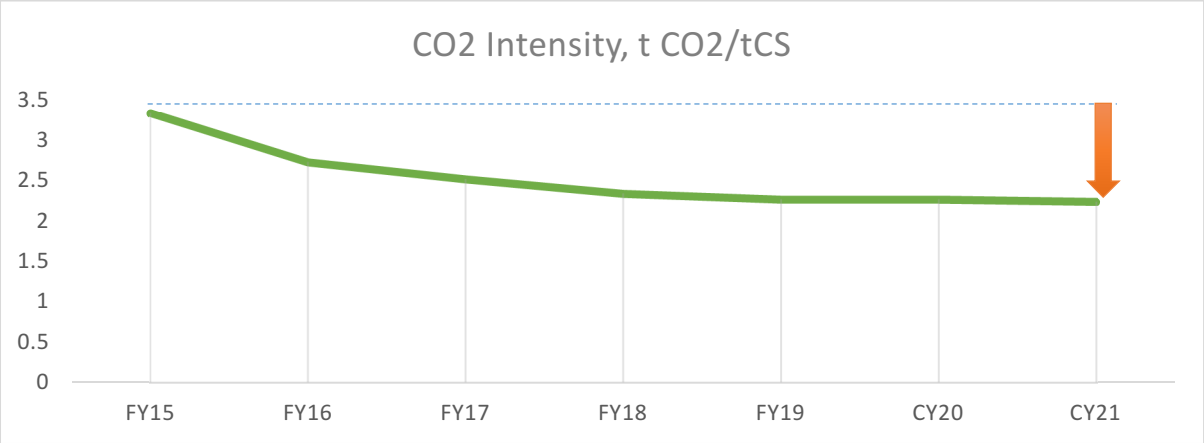
S. No	Head	Approximate capital cost (in Rs. Crores)	Approximate recurring cost per annum (in Rs, Crores)	Basis for cost estimate
				and storage of Solid and hazardous waste
5	CEMS (Continuous Emission Monitoring Systems)	50	5	Implentation of onlineline monitoring systems as per CPCB guidelines
6	CAAQMS & Lab upgradation	5	0.5	**Capital Cost** installation of CAAQMS as per CPCB guidelines
				Recurring cost Maintenance cost of CAAQMS and Lab
7	Environment Monitoring Cost of Air, Water, Noise, TCLP etc. including efficiency monitoring of Pollution Control Equipment	--	1.0219	**Recurring cost** For Environment Monitoring
8	Occupational Health & Safety	--	6.0	**Recurring cost** Occupational health monitoring per annum cost
9	Greenbelt Development	10	0.5	**Capital cost** Greenbelt development cost
				Recurring cost Greenbelt maintenance cost
10	Greenbelt-Transplantation and compensatory aforestation	10		Compensatory afforestation cost and transplantation cost
Total		**1,576**	**151.02**	
11	Budget for implementation of commitments made to address the issues raised during the public hearing	**46.00**		
Grand Total		**1,622**	**151.02**	

10.16 Company's carbon emissions, De-carbonization program, offsetting strategies, energy transition pathway from fossil fuels to Renewable energy etc. and carbon sequestration activities

GHG performance and future emissions for 15.6 MTPA expansion at ArcelorMittal Nippon Steel India Ltd., Hazira facility

In line with the Country's Nationally Determined Contribution (NDC), AMNSIL has reduced its equivalent Carbon emission intensity by 33% in the year 2021 compared to 2015 levels (calculated as per World Steel Association methodology for CO2 emission calculation). Please find below figure for reference.

Figure 10-4: Historical emission intensity of AMNSIL



The organization is following best practices across the supply chain to demonstrate its commitment towards environment and sustainability in a larger perspective.

By the year 2025, the company plans to increase its production capacity to 15.6 MTPA by implementing latest state of the art and energy efficient steel making facilities through BF-BOF route integrat ɜɜ advanced digitization.

The proposed expansion to 15.6 MTPA will be comprising of:

- Waste heat recovery from Coke Dry Quenching (CDQ) off gases
- Hot air from Sinter plant for heating of combustion air to save fuel & steam generation, for use in process.
- BF stoves flue gases will be used for heating of combustion air & fuel gas.
- Top Recovery Gas Turbines with the Blast Furnaces have been proposed
- Captive power generation from the excess by-product gases

Under the expansion, 350 MW power will be generated from Top Recovery Gas Turbines (TRT) of new Blast Furnaces, WHRB utilising sensible heat at Coke Dry Quenching of Coke Oven Plants and Captive Power Plant utilising excess by-product gases of the plant. These actions will replace fossil fuel for an equal amount of power generation.

These measures will bring down CO2 emission intensity by roughly 6% (around 2.1 ton CO_2/ton of Crude Steel production) compared to 2021 level.

AMNSIL recognizes the immediate threat of climate change and is committed to bring down the emission intensity after proposed expansion to less than 1.95 tCO2/tCS (calculated based on WSA philosophy) by 2030. The organization is going to leverage the following instruments to achieve said target:

- Using Renewable Energy: The company has already signed a 25 years PPA for 250 MW of round-the-clock renewable energy (RE RTC) which will come online by the end of 2024 and will cater to at least 20% of grid power requirements at Hazira. This is just the beginning. AMNSIL plans to increase the share of renewable energy at Hazira every year and reach at least 45% by 2030.
- Scrap: AMNS India already has EAFs at its Hazira facility and even the proposed BOFs can consume scrap upto a certain extent. Currently, scrap supply is scattered and not available in the required quantity and quality. With the introduction of voluntary vehicle recycling policy and many other initiatives taken by Govt. of India, a healthy ecosystem is brewing and expected to take a mature shape eventually. AMNS India is preparing to use the opportunity and increase scrap contribution in its steel melt shops to bring down the emission intensity.
- Natural Gas injection in Blast Furnace: The company has already conducted successful trials of injecting natural gas along with PCI in Blast Furnace to reduce the coke rate and determined the optimum injection levels. Substantial emission reductions are expected when this operating philosophy will be applied to all the upcoming Blast Furnaces.
- Coke Oven Gas injection: Coke Oven Gases have higher hydrogen content compared to all the other by-product gases used in steel plants. AMNS India is deliberating Coke Oven gas injection as well in the upcoming Blast Furnaces to bring down the coke rate even further.

Table below shows the historical and expected emissions with expansion along with impact of the decarbonization levers AMNSIL is pursuing at Hazira (by 2030) calculated as per WSA methodology:

Table 10-15: Existing And Target CO_2 Emissions

Particular	UoM	CY 2020	CY 2021	15.6 MTPA Expansion	2030 Target (for 15.6 MTPA)
CS Production	MTPA	6.6	7.4	15.6	15.6
Scope 1 intensity	tons CO2/tCS	1.88	2.00	1.99	1.93
Scope 2 intensity	tons CO2/tCS	0.35	0.20	0.16	0.06
Scope 3 intensity	tons CO2/tCS	0.03	0.03	-0.05	-0.05
Total emissions	tons CO2/tCS	2.26	2.23	2.10	1.94

Carbon Sequestation Program

AMNS India already has full grown greenbelt with 3,00,000 trees and will plant 4,00,000 (4 Lakh) additional trees at its Hazira facility by 2023 which will act as a natural carbon sink and will absorb roughly 14,000 tons of CO2 per year from nearby emissions. The total reduction in emissions over lifetime of these trees will be roughly 3.5 lakh tons of CO2.

Carbon Capture and Use/Storage is being deliberated and shall be taken up after commissioning of the expansion project subject to identification and viability of suitable use case or storage area nearby. This might take at least 36 months after successful commissioning of the expansion project.

AMNS India remains committed to the nation's pledge of achieving carbon neutrality by 2070. Even after 2030, we will continue our efforts to bring down the emission intensity at the same or much faster pace.

Detailed Report on Carbon emissions, De-carbonization program, Cabon Capture, Offsetting strategies, Energy transition pathway from fossil fuels to Renewable energy etc. is enclosed as ***Annexure 31.***

11 SUMMARY AND CONCLUSION

11.1 Introduction

11.1.1 Project Proponent

ArcelorMittal and Nippon Steel have established a joint venture (JV) company named ArcelorMittal Nippon Steel India Limited (AMNSI) in India. AMNSI has acquired a fully integrated steel plant at Hazira, Gujarat with a production capacity of 9.6 MTPA of liquid steel along with downstream units, namely, Slab Casters, Compact Strip Production (CSP), Hot Rolling Mills, Cold Rolling Mill, Galvanising Line extra wide Plate Mill and Pipe Mill..

The various facilities owned by AMNSI across India are listed below.

- 9.6 MTPA Integrated Steel Plant at Hazira, Gujarat.
- 8.0 MTPA Beneficiation Plant at Dabuna, Odisha.
- 2 x 6 MTPA Pellet Plants (PP#1 and PP#2) at Paradeep, Odisha, linked via a slurry pipeline to the Dabuna Beneficiation Plant.
- 8 MTPA Beneficiation Plant at Kirandul, Chhattisgarh.
- 7.2 MTPA Pellet Plant at Vizag, Andhra Pradesh linked via slurry pipeline with the Beneficiation Plant at Kirandul, Chhattisgarh.
- 0.7 MTPA Cold Rolling Complex including pickling, cold rolling, galvanising and colour coating facilities at Pune, Maharashtra.

The pellet plants at Vizag and Paradeep produce Direct Reduction (DR) grade and Blast Furnace (BF) grade pellets respectively. The entire production of DR grade pellets is consumed by the natural gas-based DR plant at Hazira, whilst a significant portion of the BF grade pellets is consumed by the BF and COREX units at Hazira. The balance BF grade pellets are sold in the market.

11.2 Existing Project

Configuration and production capacities of the existing plant as per the environmental clearance (EC) granted on 09.03.2016 and status of implementation and planned to be implemented under the EC is given below:

Existing Plant Configuration and Production

Sl. No	Plant / Facility	As per EC dated :09.03.2016 (A=A1+A2)							Remarks
		Total Capacity Under EC (A)		Implemented (A1)		Un-implemented (A2)		As per CTO	
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	
1	HBI Plant (DRI Mod I to VI)	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	-	-	7.83	

Sl. No	Plant / Facility	As per EC dated :09.03.2016 (A=A1+A2)							Remarks
		Total Capacity Under EC (A)		Implemented (A1)		Un-implemented (A2)		As per CTO	
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	
2	Blast Furnace (BF)	1 x 2.04 (2200 m^3) 1 x 3.0	5.04	1 x 2.04	2.04*	1 x 3.0	3.0#	2.04	# 1 x 3.0 MTPA couldn't be implemented due to fund constraints and legal cases at the NCLT, now dropped.
3	Sinter Plant	1x1.48 (1 x 120 m^2) 2x3.5 (~ 325 m^2 each)	8.48	1 x 1.48 (1 x 120 m^2)	1.48	2 x 3.5 (~ 325 m^2 each)	7.0*	1.48	7.0 MTPA of sinter plant will be implemented in proposed expansion
4	Coke Oven (Recovery Type)	1 x 1.20 1 x 1.35	2.55	2 x 59 Ovens	1.35#	-	1.20*	-	# Under implementation *1.2 MTPA plant could not be implemented due to fund constraints and legal cases at the NCLT, is now lapsed.
5	Air Separation Plant (Nm3/Hr)	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1 X 2200 TPD (Only oxygen)	424,744	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD (Only oxygen)	360,544	1 X 2200 TPD*	64,200*	360,544	64200 Nm3/hr plant will be established as per 2016 EC
6	SMS-1 (EAF 4 Nos.)	4 x 150 MT Heat size	4.6*	4 x 150 MT Heat size	4.6*		-	4.6	

Sl. No	Plant / Facility	As per EC dated :09.03.2016 (A=A1+A2)							Remarks
		Total Capacity Under EC (A)		Implemented (A1)		Un-implemented (A2)		As per CTO	
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	
7	SMS-2	4 x 200 MT Heat size	5.0	4 x 200 MT Heat size	5.0		-	5.0	
Total SMS			**9.6**		**9.6**		**-**	**9.6**	
9	Corex Plant	2 x 0.85	1.7	2 x 0.85	1.7	-	-	1.7	Plant will be operated till the proposed expansion is completed. Thereafter it will be shutdown safely and will be started only in case of any unit going down but maintaining sanctioned production of hot metal.
10	Lime Plant (Lime/Dolime	1 x 0.45 (4x300 TPD) 1x 0.48 (3x500 TPD)	0.93	1 x 0.45 (4x300 TPD) 1x 0.48 (3x500 TPD)	0.93	-	-	0.93	*0.27 MTPA production through 1x500 + 1x200 TPD Kilns proposed under Modification project.
11	Plate Mill	1 x 1.5	1.5	1 x 1.5	1.5	-	-	1.5	
12	CSP and HRC	1 x 3.5*CSP 1 x 4.5#HRC	8.0*	1 x 3.5*CSP 1 x 4.5#HRC	8.0*	-	-	8.0	
13	CRM	1 x 1.5	1.5	1 x 1.5 1 x 0.54*	2.04	-	-	2.04	* CTO taken for additional 0.54 MTPA from GPCB. #3.2 MTPA proposed in Modification Project, 2021 through 2 Units (1x2.2 + 1x1 MTPA)
14	H Saw Pipes (in MTPA)	1 x 0.15	0.15	1 x 0.15 1 x 0.15*	0.30*	-	-	0.3	0.15 MTPA as per 2016 EC

Sl. No	Plant / Facility	As per EC dated :09.03.2016 (A=A1+A2)							Remarks
		Total Capacity Under EC (A)		Implemented (A1)		Un-implemented (A2)		As per CTO	
		Config.	Capacity in TPA	Config.	Capacity in TPA	Config.	Capacity in TPA	Capacity in TPA	
									*CTO taken for additional 0.15 MTPA from GPCB. (0.15+0.15=0.30).
15	L Saw Pipes (in MTPA)	1 x 0.33	0.33	1 x 0.33	0.33	-	-	0.33	
15	CPP (in MW)	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW 1 X 48 MW	604	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW	556	1 x 48 MW	48*	556	* 48MW has been dropped and will not be implemented
16	Waste Heat Recovery based Power Plant (in MW)	1 x 25 MW 1 x 20 MW	45	1 X 25 MW	25	1 X 20 MW	20*	25	*20 MW to be implemented under EC 2016
17	Jetty (length in m)	456 m+ 734 m	1190 m	456 m + 734 m	1190 m	-	-	734 m*	

11.3 Proposed Project

AMNSI proposes to undergo a brownfield expansion of the existing plant for production of liquid steel from 9.6 to 15.6 MTPA and corresponding 6.0 MTPA Hot Rolled Coils production.

The major production facilities envisaged for the project will comprise of by product recovery-based Coke Ovens, Blast Furnaces, Steel Melting Shop (BOF), Slab Caster and Hot Rolling Mills along with Captive Power Plant which will utilize surplus by-product & steam from CDQ and TRT to produce power. The plant will also have its Lime Calcining Plant, Sinter Plant and Air Separation Plant for producing oxygen, nitrogen and argon required by various units, shall be available from existing facilities already installed or under implementation.

Proposed Unit Configuration with Capacity in TPA

Name of Facility	Configuration	Capacity (TPA)
Coke Ovens	4x59 Ovens By-product Recovery Type	3,050,000
Sinter Plant	~650 sqm (2 Units)	7,000,000
Blast Furnace	Up-gradation of existing BF#1 BF#2 & BF#3 (2x4500 Cum.)	960,000 8,000,000
Steel Melting Plant	3 x350 MT BOF (2/3 Operation)	6,000,000
Calcination Plant*	4x600 TPD + 1x500 TPD + 1x200 TPD Rotary Kiln	800,000 +2,70,000*
Hot Rolling Mill (HRC)	1 x 6 MTPA	6,000,000
CRM**	1 x 2.2 MTPA 1 x 1.0 MTPA	3,200,000
CPP	Gas Based Power Plant 2 x 100 MW Top Recovery Gas Turbine 2 x 25 MW	200 MW 50 MW
WHRB	Coke Dry Quenching	100 MW
* 1x 500 + 1 x 200 TPD Project is part of Modification Project, EC received in March 2022 ** Expansion of CRM Project is part of Modification Project, EC received in March 2022		

11.4 Nature of the Project

The proposed project activity is listed under activity 3(a) Metallurgical industries (Ferrous & Non- ferrous) and 4 (b) Coke Oven and 1 (d) Thermal Power Plant categorised as Category 'A'. under Schedule of EIA Notification, 2006, issued by MoEF&CC, Government of India.

11.5 Location of the Project

The proposed project located at Hazira village, in Chorasi tehsil, district Surat in the state of Gujarat. The project site is located at latitude $21^0$6'43.72"N and longitude $72^0$38'40.29"E.

11.6 Cost of the Project

Total estimated cost for proposed project is INR 35,145 crore

11.7 Size or magnitude of operations

The project is for expansion of the existing plant for production of 15.6 million tons per annum (MTPA) liquid steel from the existing capacity of 9.6 MTPA, and additional 6 MTPA Hot Rolled Coil Production. The area requirement for the proposed plant has been minimized since the infrastructure and auxiliary facilities are already existing. The existing plant area is 750.18 Ha and the total land required after proposed expansion will be 824.82 Ha

Land required for proposed expansion: 147.17 Ha
It will comprise of the following:

- 65.73 Ha Forest land Land possession is available & end use change under process)
- 8.91 Ha private land direct purchase from Land owners
- 72.53 Ha area will be used from existing plant area

Details of existing and proposed facilities vis-à-vis production capacities

Sl. No.		Existing		Proposed		Total after Expansion		Remark
		Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	
1	HBI Plant (DRI Mod I to VI)	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	--	--	Mod I-IV: 4.0 Mod V: 1.98 Mod VI: 1.85	7.83	
2	Blast Furnace (BF)	BF#1: 2.04 MTPA (1x2200 m3)	2.04	BF#1: 0.96 MTPA BF#2 &3: 2 x 4.0 (~4500 m3 each)	8.96	BF#1: 3.0 MTPA (2200 m^3) BF#2: 4.0 MTPA (4500 m^3) BF#3: 4.0 MTPA (4500 m^3)	11.0	Existing operational capacity of BF#1 is proposed to be upgraded from 2.04 MTPA to 3.0 MTPA. Further, additional 2 nos. of BFs of capacity 4.0 MTPA, each are proposed.
3	Sinter Plant	1x 1.48 MTPA (1 x 120 m2)	1.48	2 x 3.5 MTPA (~ 325 m^2 each)	7.0	1x 1.48 MTPA (1 x 120 m2) + 2 x 3.5 MTPA (~ 325 m2 each)	8.48	
4	Coke Ovens (Recovery Type)	CO#1&2 (2x59 Ovens) *	1.35	CO Battery# 3,4,5 & 6 4 x 59 Ovens	3.05	CO Battery#1 to 6 6 x 59 Ovens	4.4	* CO Battery# 1&2 is being implemented under 2016 EC CO Battery# 3,4,5 & 6 shall be installed under the expansion

Sl. No.		Existing		Proposed		Total after Expansion		Remark
		Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	
5	Air Separation Plant (Nm3/Hr)	1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1x2200 TPD (Only oxygen)	424,744			1 X 343 TPD 1 X 257 TPD 1 X 785 TPD 3 X 1714 TPD 1 X 700 TPD 1 X 2200 TPD (Only oxygen)	424,744	* 3,60,544 Nm3/hr plants are in operations, balance 64,200 Nm3/hr plant will be established as per 2016 EC
6	SMS-1 (EAF 4 Nos.)	4 x 150 MT Heat size	4.6	--	--	4 x 150 MT Heat size	4.6	
7	SMS-2 (ConArc 4 Nos.)	4 x 200 MT Heat size	5.0	--	--	4 x 200 MT Heat size	5.0	
8	SMS-3 (BOF–3 nos.)	--	--	3 x 350 MT Heat size *	6.0	3 x 350 MT Heat size *	6.0	
Total SMS		**9.6**		**--**	**6.0**	**15.6**		
9	COREX Plant	2 x 0.85	1.7	-	-	2 x 0.85	1.7*	Plant will be shutdown safely and will be started only in case of any unit going down but maintaining sanctioned production quantity of hot metal.
10	Lime Plant (Lime/ Dolomite	1 x 0.45 (4 x 300 TPD) 1 x 0.48 (3 x 500 TPD) 1 x 0.27* (1x200 +	1.2	1 x 0.8 (4 x 600 TPD)	0.8	4x300 TPD 1x200 TPD 4x500 TPD 4x600 TPD	2.0	*0.27 MTPA plant shall be installed under Modernisation EC granted on 02.03.2022

Sl. No.		Existing		Proposed		Total after Expansion		Remark
		Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	Configuration	Capacity in MTPA	
		1x500 TPD)						0.8 MTPA proposed in this expansion.
11	Plate Mill	1 x 1.5	1.5	--	--	1 x 1.5	1.5	
12	CSP & HRC	CSP 1 x 3.5 MTPA HRC 1 x 4.5 MTPA	8.0	1 x 6.0 MTPA	6.0	1 x 3.5 MTPA 1 x 4.5 MTPA 1 x 6.0 MTPA	14.0	
13	CRM	CRM #1: 1 x 2.04 CRM #2: 1 x 3.2*	5.24	---	---	CRM #1: 1 x 2.04 CRM #2: 1 x 3.2*	5.24	*CRM 3.2 MTPA is being implemented under Modification EC dated.02.03.2022
14	H Saw Pipes	1 x 0.15 1 x 0.15	0.30	--	--	1 x 0.15 1 x 0.15	0.30	
15	L Saw Pipes	1 x 0.33	0.33	--	--	1 x 0.33	0.33	
16	CPP	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW	556	2 x100 MW (By-product Gas based PP) 2 x 25 MW (TRT BF #3&4)	250	1 X 475 MW 1 X 31 MW 1 X 40 MW 1 X 10 MW 2 x100 MW 2 x 25 MW	806	
17	Waste Heat Recovery based Power Plant	1 x 25 MW 1 x 20 MW#	45	1x 100 MW CDQ	100	1 x 25 MW 1 x 20 MW 1x 100 MW CDQ	145	#Will be implemented under the EC 2016
18	Jetty (length in m)	456 m + 734 m	1190 m	-	-	456 m + 734 m	1190 m	

11.8 Raw Materials Requirement and handling system

Estimated (Consolidated) Annual Requirement of Major Raw Materials

Sl. No.	Raw Material	Quantity required per annum			Source	Distance from site (Approx. Kms)	Mode of Transportation
		Existing	Proposed	Total			
1.	DR Grade Pellets	11,823,300	0	11,823,300	AMNSI's Palletization plants located at Vizag and Paradeep	5200/ 5750	Sea Route
2.	BF Grade Pellets	5,400,000	6,759,536	12,159,536			
3.	Calibrated Lump Ore	0	127,660	127,660	NMDC mines in Kirandul, Dist. Dantewada, CG	450+5200	Rail + Sea Route
4.	Iron Ore Fines	185,000	3,942,444	4,127,444	Goa, Odisha NMDC mines	900/5750	Sea Route
5.	Coal-PCI-BF	408,000	2,036,444	2,444,444	Australia (Mainly) and Canada, USA and Russia	19650/ 16600/ 29850/ 17100	Sea Route
6.	Coal for Corex	2,770,000	-2,770,000	0			
7.	Metallurgical Coal	1,957,500	4,501,564	6,459,064			
8.	Coke	1,155,000	-1,155,000	0			
9.	BF and Sinter Grade Flux (Limestone +Dolomite + Pyroxenite + Quartzite)	690,000	493,715	1,183,715	Dubai and Oman	2640/ 2200	Sea Route
10.	SMS grade Limestone and Dolomite	1,863,000	2,562,564	4,425,564			
Note: All quantities are in gross and wet basis **include 3,000,000 Tons for Corex Plant*							

Cargo Handling and Storage Facilities for Raw Materials

The cargo handling requirement of the steel plant at Hazira is approximately 30 MTPA. Presently this requirement is catered through its captive jetty (~5 MTPA) of AMNSI licensed by Gujarat Maritime Board (GMB) and Essar Bulk Terminal Limited (EBTL). AMNSI has cargo handling and storage contract for 25 MTPA

with EBTL to handle raw materials such as iron ore, coal, coke, limestone, dolomite etc. and export of finished steel products such as coils, plates, pipes, slabs etc. through sea transportation.

The majority of the raw materials, i.e. coal, oxides and fluxes, will be received through EBTL. Grab bucket type ship unloaders work for unloading materials from vessels and subsequently onward transportation of unloaded materials to the yards are being carried through conveyor system for stockpiling with the help of stacker-cum-reclaimers. Conveyor connectivity has for diverting materials directly to different process plants. Reclaiming is being done through stacker-cum-reclaimers for onward dispatch of materials to process plants.

For the proposed expansion cargo handling and storage requirement, Adani Hazira Port Ltd (AHPL) has given in principle acceptance for 25 MTPA cargo handling and storage.

AHPL will deliver the raw materials at take-over point (TOP) through belt conveyors as per plant requirement and subsequently onward transportation of unloaded materials to the yards shall be carried through conveyor system for stockpiling with the help of stacker-cum-reclaimers to the existing AMNSI area. Conveyor connectivity has also been envisaged for diverting materials directly to different process plants. It is envisaged to consider 28 to 30 days of storage for coal and approx.15 days of storage for oxide and flux materials.

From AHPL, raw materials such as coal, limestone and pellets will be conveyed through proposed conveyor to existing AMNSI stock yards. The proposed conveyor corridor (1.3 km with 10m corridor width) is coming under the GMB area. NOC for right of use (ROU) from GMB is under progress. Fininshed products will be dispatched from AMNSI jetty, EBTL, AHPL port & by Rail and Road.

Apart from existing Coal/Coke yard, additional storage for the Coke Ovens will be developed with facility for stacker- cum-reclaimers on the west of new COBP plant. Storage and handling of additional raw material required for proposed expansion will be handled through AHPL (Adani Hazira Port Limited).

11.9 Water Requirement

For the existing plant, raw water is sourced from river Tapi and the requirement is around 145,838 KLD (Approx. 32.08 million of gallons per day (MGD)). For the proposed expansion, additional requirement of raw water will be around 81,600 KLD (approx. 17.95 MGD) which needs to be sourced from river Tapi. Hence total water requirement after expansion will be around 227,438 KLD (approx. 50.03 MGD).

The water permission from the Narmada Water Resources Water Supply and Kalpsar Department Division Surat for drawl of 87 MGD.

11.10 Waste Water Generation & Management

Total waste water generation from expansion units will be around 650 m^3/hr, i.e. 15,600 cum/day

Waste water generated from the proposed expansion units of the plant will be treated in suitable treatment facilities and recycled back to the process to attain 'zero' discharge, facilitating adequate re-use of water in the respective recirculating systems, and economizing on the make-up water requirement.

A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of 650 cu m/hr. and BOD Plants of capacities 137 cum/hr. and 275 cum/hr.

The permeate from CETP will be sent to BF and SMS as make-up to cooling tower. Reject generated in the RO plant will be partly used after dilution for sprinkler type suppression at raw material storage yard and balance will be fed to the evaporator-crystallizer. Sludge generated in the CETP will be disposed at approved TSDF/Recycling sinter plant.

11.10.1 Storm Water Management

Open type drain has been envisaged for the plant storm water drainage. The drains will be laid generally by the side of the roads. Storm water run-off, collected through arterial and trunk drain as well as from the high-rise buildings, will be collected in a storm water pond and pumped back to the raw water reservoir/treatment plant.

11.10.2 Sewage Treatment

For existing plant, there are three STPs to treat domestic effluent generated from plant and residence, one with a capacity 480 KLD inside the plant premises and two numbers inside the township with capacities of 1000 KLD and 600 KLD. STP treated water will be used for gardening purpose. New sewage treatment plant of capacity 1000 KLD for the proposed expnansion, to be located in the north side of the plant through gravity type sewerage network.

11.11 Power Requirement and Source

Existing power requirement is 1163 MW. Total power requirement after proposed expansion will be **1573 MW.** The power requirements of the steel plant will be met from the following two sources, namely:

- The captive power generation (Existing + Proposed)
- Grid power: NTPC Jhanor-Gandhar Power Plant through WRLDC grid and third party.

Captive Power generation after the expansion will be 951 MW (CPP-806 MW + WHRB- 145 MW) and average power available from captive power generation will be approx. 810 MW. Balance 763 MW shall be from third party and grid.

11.12 Fuel Requirement

Natural gas and the generated by-product gases, i.e. Blast Furnace (BF) gas, Coke Oven (CO) gas, Tail gas and BOF gas will be used as fuel for various heating applications (BF stove heating, Rolling Mill Reheatiing Furnaces, Sinter Plant, Calcination Plant etc.) of the steel plant. Balance available gases will be utilized for steam and power generation in the Power Plant.

The by-product fuel gas generation and consumption figures for the project is given in the ***Table 2-49***

Table 11-19: By-Product Gas balance

By-product Gases	Generation, N cu m/hr	Consumption in various plant units, N cu m/hr	Balance available for power generation, N cu m/hr
BF Gas	18,67,143	14,66,606	4,00,537
CO Gas	2,17,991	2,17,882	109
BOF Gas	70,455	70,287	168
Tailgas	30,000	29,950	50

11.13 Manpower Requirement

Manpower Requirement during Operation Phase

Details	Direct	Indirect	Total
Existing Manpower	7,700	5,800	13,500
Manpower required for Modification Project	1,000	770	1,770
Manpower required for Expansion Project	1,750	5,250	7,000
Total Manpower requirement	10,450	11,820	22,270

The proposed project would engage in recruitment of maximum possible local skilled, semi-skilled and unskilled workers thereby contributing positively towards local employment and income.

Total manpower required for the proposed project during construction phase under direct and indirect employment is 500 and 15,000 respectively.

11.14 Baseline Monitoring

11.14.1 Study Area

The study area is considered within 10 km radius of the project site.

11.14.2 Study Period

Baseline monitoring was carried out for 12 weeks from March to May 2021.

Additional one-month data for Ambient air quality was also collected at site and surrounding area from 23rd Nov 2021 to 26th Dec 2021 including Traffic survey

11.14.3 Ambient Air Quality

The study methodology for ambient air quality monitoring involves the following steps:

- Based on the long term IMD data collection, identifying predominant wind direction subsequently selection of AAQM monitoring stations as per CPCB guidelines and preparing monitoring plan for 12 weeks
- One month additional monitoring was also carried out as suggested in ToR issued by MoEF&CC.
- AAQM station installation as per the monitoring plan;
- Sample collection & its analysis in Lab (Kadam & SGS India Pvt. Ltd);
- Interpretation of collected AAQM data with ground condition for inferences.

Ambient Air Quality Monitoring Location Details (7th March 2021 to 6th June 2021)

Code No.	AAQM Station	Area Category	Dist. From nearest site boundary (km)	Dir.
AA01	At Site (Nand Niketan)	Residential	Within site	-
AA02	Hazira Police station (Beside Truck Parking area)	Industry	-	NE
AA03	Dumas	Rural	5.3	E
AA04	Hazira	Rural	2.8	SW
AA05	Junagam	Rural	1.4	W

Code No.	AAQM Station	Area Category	Dist. From nearest site boundary (km)	Dir.
AA06	Mora	Rural	3.3	N
AA07	Kavas Limla Road	Rural	6.5	NE
AA08	Gaviyer	Rural	8.3	E

- The average concentration of PM_{10} recorded ranged from 75 µg/m^3 to 91 µg/m^3.
- The average concentration of $PM_{2.5}$ recorded ranged from 18 µg/m^3 to 27 µg/m^3.
- The average concentration of SO_2 recorded ranged from 8.2 µg/m^3 to 8.8 µg/m^3. All these values are within the specified limit of CPCB (80 µg/m^3).
- The average concentration of NO_X recorded ranged from 11.8 µg/m^3 to 12.5 µg/m^3. All these values are within the specified limit of CPCB (80 µg/m^3).

11.14.4 Noise and Vibration

Noise samples were collected from following locations.

Loc. Code	Location	Category	Distance w.r.t site (km)	Direction (from site)	Permissible Limits in dB (A)		Average Noise levels in dB (A)	
					Day Time	Night Time	Day Time	Night Time
NL01	At Site (Nr Hazira Police Station)	Industrial	-	-	75.0	70.0	66.7	58.9
NL02	At Site (Truck Parking Area)	Industrial	-	-	75.0	70.0	62.4	58.1
NL03	At Site (Nand Niketan)	Commercial	-	-	65.0	55.0	58.6	53.2
NL04	At Site (S boundary)	Industrial	-	-	75.0	70.0	67.8	65.4
NL05	At Site (SW boundary)	Industrial	-	-	75.0	70.0	60.4	58.9
NL06	Hazira Village*	Residential	2.6	S	55.0	45.0	54.9	44.6
NL07	100 m in N direction from site boundary	Industrial	0.1	N	75.0	70.0	62.1	57.5
NL08	Suvali	Residential	1.6	WNW	75.0	70.0	53.9	42.4

- Noise level during day and night time in Industrial area were observed within the permissible standard limits for industrial area (75 dBA (d)) & 70 dBA (n)).
- Noise level during day and night time in Residential area were observed within the permissible standard limit for residential area (55 dBA (d)) & 45 dBA (n)

11.14.5 Ground water

The ground water samples were collected from available 08 different locations during the monitoring period within the study area

Sample Id	Sampling Locations	Distance w.r.t site (km)	Direction (from site)
GW 1	Hazira Gam	2.40	SSW
GW 2	Junagam	1.50	NW
GW 3	Suvali Gam	3.25	NNW
GW 4	Ichchapore GIDC	9.40	NE
GW 5	Vanta Gam	9.00	East
GW 6	Dumas	7.30	SE
GW 7	Mora Tekra	3.45	North
GW 8	Kavas	7.00	NNE

- Electrical Conductivity values appears high in all samples. EC values ranges from 718-9490 µmho/cm.
- Sulphates present in GW-5 sample is within their acceptable and permissible limit, except GW-2, GW-3, GW-6 & GW-8 samples above Acceptable limit; while, GW-1, GW-4 & GW-7 is above Permissible limit.
- Total Alkalinity found above the acceptable limit in GW-1, GW-2, GW-4 to 7 samples.
- Nitrate is found in varying proportion in all samples and also found above the acceptable limit in GW 2 7 GW 3. Values ranges from 0.35 mg/l to 64.99 mg/l.
- Total Nitrogen found above the acceptable limit in each ground water sample except GW-6 & 7. Values ranges from0.09 mg/l to 15.86 mg/l
- Cadmium is detected in all groundwater samples and is within the acceptable limit. Value ranges from 0.19 mg/l to 0.26 mg/l
- Copper is detected above the acceptable limit in all groundwater samples except in GW4 and GW 8.
- Total coliforms are detected in all samples except GW 4.
- Faecal Coliforms is also detected in GW-1, GW-3, & GW-5 to GW 7.
- The presence of Total coliforms & Faecal Coliforms is indicating leaky aquifer condition and Hydraulic connection between shallow and lower aquifer. Presence of Total coliforms and Faecal Coliforms in groundwater may be due to discharge & disposal of untreated sewage on land environment and infiltration of the same to underneath aquifer.

The presence of Nitrogen found in ground water sample above the acceptable limit could be due to animal manure & use of chemical fertilizer for agriculture

The area in the close proximity of sea. The aquifer comprises of saline water containing TDS above the acceptable limit. The wells located near the surface water bodies are only yielding relatively good quality water, it is observed and confirmed from chemical analysis of groundwater samples. However, Dug-wells water samples yield relatively good quality water.

11.14.6 Surface Water Environment

Surface water sampling locations are selected based on review of land use map, surface drainage pattern/ground water flow direction & nearby site habitation in study area.

Surface water samples were collected from below mentioned locations

Sam. Code	Location	Source	Distance w.r.t site (km)	Direction (from site)
SW01	At Site	Pond	-	-
SW02	Dumas	River	5.0	E

Sam. Code	Location	Source	Distance w.r.t site (km)	Direction (from site)
SW03	Hazira (Nr EBTL Gate)	Pond	2.2	S
SW04	Suvali	Pond	3.3	NNW
SW05	NR Hazira Police Station	Tapi River	0.1	E
SW06	Nr Nand Niketan	Tapi River	-	E
SW07	Mora	Pond	2.7	N
SW08	Junagam	Pond	1.4	W

Following inferences can be drawn based on the baseline water quality results.

River water: Quality of SW02 and SW05 can be compared with class E as per classification of Inland surface water and can be used for Irrigation, industrial cooling etc.

Pond water: Quality of SW1 can be compared with class B as per Inland surface water and can be used for outdoor bathing.

The Quality of SW3 can be compared with class D as per Inland surface water classification and can be used for Propagation of wild life, fisheries.

Quality of SW4, SW6, SW7 & SW8 can be compared with class E as per Inland surface water classification and can be used Irrigation, industrial cooling etc.

11.14.7 Soil Environment

Soil samples were collected from locations mentioned in table below:

Sample Id	Sampling Locations	Distance (km)	Direction
ST01	Hazira Gam	2.40	SSW
ST02	Suvali	1.50	NW
ST03	Suvali Gam	3.25	NNW
ST04	Mora Tekra	3.45	North
ST05	Kavas	7.00	NNE
ST06	Ichchapore GIDC	9.40	NE
ST07	Vanta Gam	9.00	East
ST08	Dumas	7.30	SE

- The analysis of physicochemical properties of soil samples collected from surrounding area indicated that porosity ranged from 41 - 57 % and WHC varied from 30.90 – 44.59 %, while permeability ranged from 14.62 – 37.80 mm/hr.
- Moderate WHC and high porosity is on account of sandy to clay loam texture of soils and permeability was moderate due alkaline pH of soils.
- The CEC ranged from 15.81 – 23.84 meq/100 g soil, which is a moderate looking to the texture of soils. The EC (0.157 – 2.68 dS/m) was normal (<0.80 dS/m) to high (>1.6 dS/m) and ESP (1.99 to 2.28) was well within the safe limit of <15.0. The pH ranged from 7.96 – 8.71, indicating that soils are alkaline (pH 7.80 to <8.5) to sodic (pH >8.5).
- Among water soluble cations predominance of Mg (13.37 – 20.66 meq/100 g) was seen followed by K (0.25 to 2.35 meq/100 g), Ca (0.80 to 1.60 meq/100 g) and Na (0.18 to 1.33 meq/100 g).
- Fertility status of soil reveal that organic carbon was low (<0.50 % OC) to medium (0.50 – 0.75 % OC) and available potassium was high (>280 kg/ha).

11.14.8 Ecology & Biodiversity

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

Among the reptiles, Indian Cobra (*Naja naja*) and Common rat snake (*Ptyas mucosus*) were provided protection as per Schedule-II of Wild life protection act, (1972).

Among mammals; Jackal (*Canis aureus*) and Common Mongoose (*Herpestes edwardsi*) is schedule II; Common Langur (*Semnopithecus entellus*) and wild boar (*Sus scrofa*) is Schedule III animal of Wild Life Protection act 1972. Others noted animals are schedule IV of Wild Life Protection act 1972.

11.14.9 Socio Economic

The project falls under Gujarat state, Surat district. The study area consists of Surat city, Chorasi and Olpad sub districts. The census details are however available for 2011.

The study area covers 17 habitations in Surat city, Chorasi and Olpad sub district of Surat district. The entire area consists of rural as well as urban population. For the same study area however, census data for year 2011 is available for 16 habitations. The number of dwelling units of villages in the study area indicates that there are 09 villages, 07 Municipal ward and 1 census town.

11.15 Anticipated Environmental Impact and Mitigation Measures

11.15.1 Impacts and Mitigation measures during Construction

Land Environment

Excavation

This activity will lead to generation of excavated soil and may lead to change in site topography.

Building of structures

This activity may lead to change in land cover from vacant / open land to paved / built up land. Land has been already demarcated for industrial use.

Final site clean-up

Generation of debris.

Change in Landuse/Land cover

There will be change in Landuse pattern due expansion of the existing facility as current Landuse of the additional land for expansion include foresrt land and agriculture land which will be converted into industrial.

There may be temporary change in land use due to influx of construction labour, however this will persist during construction period only.

Mitigation Measures

The development is planned in the shortest possible time and in phased manner. Land-clearing activity shall be kept to the absolute minimum by working at the specific sites one by one where construction is to take place so as to increase detention and infiltration.

Natural waterways/drainage pattern shall be maintained by providing culverts where needed. The land use is thus so planned that there will be minimum adverse impact.

Air Environment

Impact

During construction phase of the project, dust is expected to be the main pollutant, which is associated with general construction activity. The major activities will involve excavation, transportation of construction materials, fabrication, building of structures, erection & commissioning of machineries etc.

During construction phase, due to transportation of construction material, there will be marginal increase in the levels of particulate matter (PM), emissions of Sulphur dioxide (SO2), Nitrogen Oxide (NO2), carbon monoxide (CO) and hydrocarbons (HC). However, this increase in concentration levels of pollutants are distributed throughout the project site and shall fall under the category of area source and would be temporary in nature and localized.

Mitigation Measures

Mitigation measures for air quality impacts are:

- It shall be ensured that both gasoline and diesel-powered construction machines and vehicles are properly maintained to minimize smoke in the exhaust emissions
- Concentration of SO2, NOX, HC and CO may be increased due to increased vehicular traffic. The impact of such activities would be temporary and restricted to the constructed phase.
- The approach roads will be paved or tarred and vehicles will be kept in good order to minimize the dust pollution due to vehicular traffic.
- All vehicles delivering construction materials to the site shall be covered with tarpaulin to avoid spillage of materials and maintain cleanliness of the roads
- Regular water sprinkling will be done for dust suppression at the 'kaccha' transportation road and construction site.
- Ensuring the availability of valid Pollution Under Control Certificates (PUCC) for all vehicles used at site

Water Environment

Impact on Surface Water

Potential sources of impacts on the water environment during the construction phase are as follows:

- Soil runoff from the site leading to off-site contamination (particularly during rainy season).
- Improper disposal of construction debris leading to off-site contamination of water resources.
- Spillage of oil and grease from the vehicles and waste water generated on site activities such as vehicles washing, workshop etc.

Mitigation Measures

Following precautions and preventive measure will be taken at the site during construction to avoid any ground and surface water contamination.

- Not allowing water to leave the construction site.
- Disposal of construction debris in designated areas.
- Construction of storm water diversion channels to divert storm run-off from flowing over the construction areas.
- Use of metal tray during repair of construction vehicles in the workshop to avoid spillage of oil and grease on ground.
- Due to civil construction activities, during rainy season the surface runoff may contain more of eroded soil and other loose matter. As far as possible, construction activities will be avoided during rainy days to mitigate the small impacts on soil / water quality caused due to construction activity.
- With segregation of construction area with proper drainages, contamination of water due to soil erosion shall be prevented.
- The earth work includes cutting and filling will be avoided during rainy season and will be completed during the winter and summer seasons. Stone pitching on the slopes and construction of concrete drains for storm water to minimize soil erosion in the area will be undertaken.

Impact on Ground water

Construction activities for the proposed development can have minor impact on hydrology and ground water quality of the area if the construction waste leaches into the ground water source. However, no ground water shall be used during the construction

Mitigation Measures

Following precautions and preventive measure will be taken at the site during construction to avoid any ground water contamination.

- Disposal of construction debris in designated areas.
- Use of metal tray during repair of construction vehicles in the workshop to avoid spillage of oil and grease on the ground.

Noise Environment

Impact

The major source of noise generation during the construction phase are civil works such as trenching, foundation casting, steel fabrication work, mechanical works, vehicle movements during site preparation, loading and unloading activities, construction equipment like dozers, scrapers, concrete mixer, cranes, generators, compressors, vibrators etc.

Mitigation Measures

- Overall, impact of generated noise on the environment will be insignificant, reversible and local in nature and mainly confined to the day hours.
- Moveable noise barriers will be considered
- Greenbelt development will be undertaken from the construction stage itself

Soil Environment

Impact on Soil

- During clearance of vegetation and excavation there may increase in soil erosion by cutting & filling
- Top soil loss due to excavation
- Spillage of liquid and solid / hazardous wastes may affect soil quality,

Mitigation Measures

Unauthorized dumping of waste oil should be prohibited. Wastes shall be disposed-off at an approved site.

- Store the top soil for landscaping.
- Discarded containers and paint drums etc. and other hazardous wastes to be stored at the earmarked secured place on RCC flooring (for temporary storage, before final disposal).
- The vehicle maintenance area shall be located in such a manner to avoid sources by accidental spillage of oil.

Biological Environment

Project Pre-Construction Phase

Evaluation: Project site encompasses 26 species of the trees and other (shrubs, herbs, grasses) vegetation. Clearing of vegetation cover, especially larger tree species (canopy cover) and shrub species (above ground cover) will have significant impact on the flora and associated faunal diversity.

Mitigation Measures

Following measures will be implemented to mitigate the impact -

- Maximum trees will be retained and transplanted. Tree transplantation will be carried out in consultation of the Forest Department after approval from the competent authority.
- Greenbelt plan has been prepared in line with CPCB Greenbelt Development guidelines. As per the greenbelt plan, total 33% area with tree density of 2500 nos. per Ha will be developed as greenbelt. Proposed to plant additional 393,021 trees in consultation with Forest Department. The total no. of trees after expansion will be 680,450.
- Greenbelt plan includes 20m width tree plantation along the NH-6 between plant boundary & NH spanning 6.5 km. Also, GB along Hazira village side will also be intensified.

Project Construction Phase

Construction activities at the site involving human and vehicular movement may disturb terrestrial micro flora and fauna of the area and aerial and wild animals in the area. The noise generated by construction machinery and movement of vehicles may also disturb the animal and birds in the region. The fugitive dust due to construction activity may affect the flora of the region.

Other Mitigation Measures

- The adverse effects are reduced by shortening the construction phase period and development of greenery along the plant boundary.

- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement and the company staff will be strictly directed not to damage any vegetation such as trees, shrubs or bushes.
- Water sprinklers were installed within the plant premises to suppress any fugitive dust generated due to excavation or other constructional activity.
- Periodic water sprinkling was done on the vegetation along the plant boundary and approach road to the plant.
- Movement of vehicles and construction activity was not allowed between 11 P.M. to 5 A.M.
- Domestic waste generated was collected in the designated bins and was disposed-off properly.

Socio-economic Environment

The construction phase induces employment opportunities for the local people. In addition to the opportunity of getting employment in construction work, the local population would also have employment opportunities in related activities like small commercial establishments, small contracts and supply of construction materials etc.

11.15.2 Impact During Operational Phase

Air Environment

In integrated Steel Plant, dust is the major pollutants. Air pollutants which are generated at different stages of production may be particulate matter, sulphur dioxide, oxides of nitrogen etc. The pollutants may be released as Point source (stack emissions) or Area source (fugitive emission) and will have impacts on ambient air, during the operation phase.

Emission from Point Source (Stack)

Dust and gaseous emission shall be from the flue gases generated at Coke Ovens, Sinter Plant, Calcination Plant, Blast Furnaces, Basic Oxygen Furnaces, Reheating Furnaces & By-product gas Power Plant and also stacks provided with dust extraction systems at Coke Dry Quenching, Sinter Plant area dedusting, Blast Furnace Cast house and Stock house dedusting, Dog house system at SMS-2 etc.

Emission from Area Source (Fugitive Emission)

Fugitive emissions are expected from Material Handling areas of Coke Ovens, Calcination Plant, Sinter Plant, Blast Furnaces, SMS-2, fugitive emissions from Coal & Coke crushing & screening, fugitive emissions from Sinter breaker and Sinter screens, Calcination plant screens, Secndary emissions from BOFs, fugitive emissions from LRF and RH-OB etc. Fugitive emission is also generated due to vehicular movement in the plant premises.

Mitigation Measures for Air Environment during Operation

Under the propodsed expansion dry tye of GCPs have been proposed with Blast Furnaces and. MEROS or equivalent technology shall be adopted for reduce Furan and dioxine and other harmful emissions during sintering.

Details of Air Pollution Control Devices (APCDs) to control air pollution form the proposed project are mentioned below:

Details of Proposed Air pollution Control Facilities

Unit	Location / Source	Type of Pollution Control Equipment	Connected with Stack (No.)	Stack Height (m)	Stack Emissions (mg/Nm3)
Coke Ovens #3&4	Flue gases	Nil (clean fuel- Coke Oven Gas is burnt)	1	140	30
Coke Oven # 5&6	Flue gases	Nil (clean fuel- Coke Oven Gas is burnt)	1	140	30
Coke Ovens #3&4	Coal Handling Crusher & Screen	Bag Filter	1	30	30
Coke Oven # 5&6	Coal Handling Crusher & Screen	Bag Filter	1	30	30
Coke Ovens#3&4 – Coke Handling	Coke Cutter	Bag Filter	1	30	30
Coke Ovens#5 & 6 – Coke Handling	Coke Cutter	Bag Filter	1	30	30
Coke Ovens#3&4 CDQ	Cleaning of Inert Gas	Multicyclone with Bag Filter	1	30	30
Coke Ovens#5&6 CDQ	Cleaning of Inert Gas	Multicyclone with Bag Filter	1	30	30
CO# 1,2,3,4	Unutilised Gas	Flaring	1	80	Flaring in Emergency
CO# 5 & 6	Unutilised Gas	Flaring	1	80	Flaring in Emergency
BF#3	Stove Flue Gas	Nil	1	80	30
	Stock House DE	Bag Filter	1	50	30
	Cast House#1 DE	Bag Filter	1	50	30
	Cast House#2 DE	Bag filter	1	50	30
	Gas Cleaning Plant	Bag filter	1 Flaring Stack	80	Flaring in Emergency
BF#4	Stove Flue Gas	Nil (clean fuel BF Gas is burnt)	1	80	30
	Stock Housed DE	Bag Filter	1	50	30
	Cast House#1 DE	Bag Filter	1	50	30
	Cast House#2 DE	Bag filter	1	50	30
	Gas Cleaning Plant	Bag filter	1 Flaring Stack	80	Flaring in Emergency
LCP#3	Kiln#1 600 TPD	Bag Filter	1	55	30
	Kiln#2 600 TPD	Bag filter	1	55	30
	Kiln#3 600 TPD	Bag Filter	1	55	30
	Kiln#4 600 TPD	Bag filter	1	55	30
	Lime screening dedusting system	Bag filter	1	30	30
Sinter Plant# 2	Process Waste Gas	ESP	1	120	30

Unit	Location / Source	Type of Pollution Control Equipment	Connected with Stack (No.)	Stack Height (m)	Stack Emissions (mg/Nm3)
	Area Dedusting+ Sinter cooler	Bag filter	1	30	30
	Fuel & Flux Building	Bag Filter	1	30	30
Sinter Plant #3	Process Waste Gas	ESP	1	120	30
	Area Dedusting + Sinter cooler	Bag filter	1	30	30
	Fuel & Flux Building	Bag Filter	1	30	30
Streel Melting Plant -3	Secondary Emission Control from BOF, LF, RH-OB & Desulpharization (2 nos.)	Dog House with Bag Filters (2 nos.)	2	100	30
	Gas Clearning Plant	Bag filter	Flaring in Emergency	80	
Junction Houses (6 nos.)	Transfer Points	Bag Filters	6	50	30
Hot Strip Mill	Reheating Furnace#1	Nil	1	85	30
	Reheating Furnace#2	Nil	1	85	30
	Reheating Furnace#3	Nil	1	85	30
	Reheating Furnace#4	Nil	1	85	30
CPP – By-product Based Power Plant	Boiler	Nil	1	100	30

In addition to the above to control fugitive emissions from Coke Ovens following facilities have been proposed:

- On-main charging with HPLA System
- Coke Dry Quenching (CDQ) with Multi-cyclones and Bag Filter
- Land Based Pushing Emission Control System with Bag Filter
- Zero leak doors and Water seal AP Caps
- Pusher and Guide Car with door and door frame cleaning mechanism
- High pressure Hydro-jet door cleaner at end benches.
- Dry Coke Quenching with Stand-by wet quenching stations with 'Modified Quench Tower with Baffels and Grit Arresters has been proposd
- PM Emissions from stack shall be kept within 30 mg/Nm3
- Provision for Power requirement through Renewable energy sources.

Noise Environment

Impact During Operation Phase

Various noise sources from the proposed plant will be as follows:

Coke Ovens

- Coal and Coke Crushers and Screens
- CO Gas Exhauster
- Steam leakages from CDQ Unit

Sinter Plant

- Sinter Fan
- Sinter Crusher & Screen

Blast Furnace

- Blast Furnace Tuyeres
- Cold Blast and Hot Blast
- Cast House Dedusting Fan

Steel Melting Shop

- BOF Operation Platform
- Dog House system ID Fan

Hot Strip Mill

- Rotating machinery like Mill motors, Mill stands, Water pumps, Compressors.
- Cutting shears.
- Laminar Cooler

Power Plant

The major source of noise pollution in the Power Plant is from the following:

- Rotating equipment like Fans, Feed Water Pumps, TG Set, Compressors.
- Boiler & Super heater safety valves.
- Start-up Vent etc.

Mitigation Measures

No significant increase predicted at any of the noise monitoring locations outside the project site. AMNS has proposed following noise control measures in the expansion project:

Power Plant

The start-up vent, safety valve outlets will be provided with silencers to reduce the noise level to acceptable limits.

- The Hogging Ejector will be provided with silencer.
- The turbine will be covered with acoustic enclosure.

Rolling Mill

- Rubber mounting shall be used for Water pump and Compressor
- Regular maintenance of rotating equipment to keep the sound level at 1.0 m away at a level of 85 to 90 dB(A).

Other Mitigation Measures

Various measures proposed to reduce noise pollution includes provision of acoustic enclosure or separate housing for TG Set, Compressor, Snort Valve with Cold Blast Line of Blast Furnace, stoppage of leakages of steam and air, accoutic lagging for the equipment and suction side of silencers, vibration isolators.

Care will be taken during selection of the equipment like compressors, blowers, pumps, fans etc.

Employees working in high noise areas will be provided with ear muffs/ ear plugs and also limit the duration of exposure of the personnel

Water Environment

Water environment may be affected by the industry due to drawal of water, discharge of polluted water / waste water, and by contaminated leachate from land disposal / dumping of solid waste. No impact on ground water is also envisaged since no ground water will be drawn by the expansion plant

Mitigation Measures

Under expansion, total waste water generation from expansion units will be around 650 cu m/hr. i.e. 15,600 cum m/day. A portion cooling tower blowdown generated from some facilities, viz. BF and SMS, will be directly used in respective plant areas for applications viz. make-up to SGP, slag quenching, make-up to fire reservoir etc. The cooling tower blowdown from some facilities, viz. COBP, ASP etc., will be directly used for dust suppression sprinkler system at raw material storage yard. For various other plant units, different qualities of effluent generated will be collected in a common tank and then transported to CETP, with designed treatment capacity of approx. 650 cum/hr.

Sewage generated from various expansion plant units will be treated in sewage treatment plants. Sewage generated from the plant units located at the western side of the Hazira steel plant, i.e. BF-2, SMS, HSM, Power Plant, ASP and other miscellaneous areas, will be transferred to a new sewage treatment plant of capacity 1000 KLD, to be located in the north side of the plant. Treated effluent from the sewage treatment plant will be further treated in CETP.

Soil Environment

Major impact on the soil will be due to Storage of raw materials, storage, handling and transportation of solid wastes and hazardous wastes and also on the soil of nearby agricultural land due to air pollution

Action Plan to avoid Leaching

- All the yards will have RCC flooring after hard surface rolling and compacting so there is no chance of water and slurry contamination in below ground level.
- Along with that all the yards will have proper drainage system and retaining wall to evacuate ground water easily.
- Drain and retaining wall in Coal Yard, coke yard and flux yard is already available while in oxide yard the same is under construction.

Biological Environment

The proposed activity may result in degradation of surrounding habitat, introduction of weeds, increased road traffic, habitat fragmentation. Surrounding habitats of the identified LIZ area includes habitats like Reserve Forest, agriculture, sparse mangroves, mud flats and creeks. These diverse habitats support many bird species. Release of pollutants during operation phase will have impacts on these habitats if not properly managed.

Mitigation

As per the greenbelt plan, total 33% area with tree density of 2500 nos. per Ha will be developed as greenbelt. Proposed to plant additional 393,021 trees in consultation with Forest Department. The total no. of trees after expansion will be 680,450

Conservation plant has been prepared for conservation of these species which includes awareness programme (village and school level) as well as habitat improvement programme through plantation of 12 suggested species in LIZ area. Out of these 12 species suggested to absorb various gas emissions, control dust emissions and to suppress noise levels. One tall tree species i.e. Borassus flabellifer suggested for plantation to improve vulture population in the study area since this tall tree provides nesting habitat for Vulture. Similarly, plantation of rare tree i.e. Adansonia Digitata at suitable places suggested to improve population of this rare tree species as a part of conservation plan.

Socio economic

Impacts

Total 17 villages are present in the study area. Total population of male is 53,648 (64.23%) and female population is 29,883 (35.77%) and the sex ratio is 438 females per 1000 males in the study area. The national gender ratio in India is 940 as per latest reports of Census 2011/ As per the survey it has been observed that the population in general do not have opportunities of earning from employment and the non-worker population is higher in the region so the project in general will help to provide direct and indirect job opportunities for auxiliary and ancillary works etc.

Mitigation Measures

- Adequate measures have been envisaged in the project design to control air & noise pollution.
- Awareness programs shall be arranged on health, hygiene, sanitation and environmental protection
- At the work place, first aid facilities shall be maintained at a readily accessible place with necessary appliances including sterilized cotton wool etc. Ambulance facility shall also be provided during emergency
- Sufficient supply of potable drinking water shall be provided at suitable places.
- Sanitary facilities shall be provided at accessible place within the work place and shall be maintained in a good condition.
- Periodic health checkup camps, blood donation camps shall be organized by project authority for villagers, contract laborers, employees and their family
- Apart from the normal health checkup, emphasis on continual monitoring of health shall be organized to prevent occupational alignment/diseases such as respiratory ailments, skin problems, water borne diseases, hearing loss etc.
- Job oriented training courses shall be organized through industrial / technical training institutions for educated youth like on skill development trades like electrical, tailoring, plumbing, type writing, shorthand and machine repairing, welding, fabrication etc.

11.16 Environmental Monitoring Program

The regular monitoring of environmental parameters is of immense importance to assess the status of environment during project operation. Monitoring is as important as that of control of pollution since the efficiency of control measures can only be determined by monitoring. The main objectives of monitoring are,

it measures effectiveness of operational procedures, confirm statutory and mandatory compliance & identify unexpected changes. Environment monitoring plan for Ambient Air Quality, Stack emission, Fugitive Emission, Noise level, Surface & Ground water quality, Soil Quality and Solid & Hazardous waste management for the project after proposed expansion during operation phase with estimated budget of Rs. 1.02 Crores per year has been prepared for regular/periodic monitoring to enable taking up suitable mitigation measures in time to safeguard the environment. An Environment Management Cell (EMC) has been formed to perform & implement the post project-monitoring plan for this project

11.17 Occupational Health Monitoring

Potential occupational hazardous work places are being monitored regularly. The health of employees are being monitored at regular intervals for early detection of any ailment due to exposure to noise, heat, respirable dust and hazardous chemicals. The audiometry and lung function tests will also be included in this surveillance program. Company has a detailed occupational health management plan to address the occupational diseases. A budget of INR 6 Crores per year has been kept for Occupational Health & Safety.

11.18 Comprehensive Risk Assessment

A Comprehensive risk assessment and consequence analysis has been carried for all the plant operations of existing units as well as for the proposed project. A disaster management plan for entire complex is available. The responsibilities of the officers include identification of the hazardous conditions and unsafe acts of employees and advice on corrective actions, conduct safety audit, organize training programs and provide professional expert advice on various issues related to occupational health and safety. Safety training is being provided by the safety officer with the assistance of experts. In addition to regular employees, all contractor labors are/will attend safety training.

11.19 Project Benefits

Steel making is traditionally considered as the back bone of any manufacturing industry. It is a major input for industrial sectors which support economic growth of the nation, such as, Defence, Agriculture, Automobile, Industrial, Power, Construction & Mining Equipment, Railways and General Engineering.

The project is expected to employment about 15,500 direct and indirect employees during construction phase and 7,000 during operation phase of the project. AMNSI has a commendable record in corporate social responsibility and made significant contributions to improve quality of people's life in Gujarat, APSEZL and APL have started key initiatives in support of sustainable development.

Direct and indirect employment will give a boost to the local economy. It is expected that a significant proportion of the money earned by the additionally employed people will be spent locally which will boost the local economy.

The project will boost the infrastructure development in the area. Corporate Social Responsibility (CSR) is an integral part of Arcelor Mittal Nippon Steel India Limited business operations to make positive impact in communities where it operates. Arcelor Mittal Nippon Steel CSR team is actively engaged with the local community in discharging its CSR in the nearby villages of Hajira. CSR policy of the company drives the social efforts. A dedicated CSR team is in place to plan and implement the projects.

The Company under CSR has already undertaken for their existing plant a wide range of initiatives in the sphere of (i) education (ii) community health (iii) livelihood (iv) sports and culture and (v) infrastructure and (vi) Environment.

To undertake CSR activities in future, in and around nearby villages of proposed expansion project, a total ***amount of Rs. 46 crores would be utilized in next five years.***

The project would create substantial amount of tax revenue for India which will be utilized for various social evelopments.

AMNSI will spend INR 46 Crores to address issues raised during the Public hearing held on 18.07.2021

11.20 Greenbelt Development Plan

Existing area of the Plant is 750.18 HA. of which 21.8% of the area (approx. 161 Ha.) is covered under plantation in which around 287,429 trees have been planted. It is proposed to cover 33% of the total area under plantation by planting approx. 2500 trees per Ha. Total 272.18 Ha of area will be converted into the greenbelt after proposed expansion by planting additional 3,93,021 trees. A capital budget of INR 10 Crores and annual budget of INR 50 lakhs has been kept for maintenance of plantation.

11.21 Rain Water Harvesting

To revive this practice of water management at the Hazira plant, the Utilities team at Hazira has devised an effective strategy to revamp the existing rainwater harvesting systems at the plant. During 2019, a CAPEX was cleared to harvest at least 60% of the targeted water on a sustainable basis.

For Rain Water Harvesting, 100% plant area under the control of AMNSI India, including all plant sheds and 100% township area have been considered with a belief that rain water can always be harvested from every shed, every house and every road.

10 nos. of Collecting Pond of approximately 19235 m^2 of area is used for harvesting. Each pond has a depth of at least 2m. To achieve optimal efficiency in rainwater harvesting, more than two kilo meter of pipes were laid with 12 pumps, being installed at various places. As a result, during the monsoon in CY20, harvested 81 crore litres (8,10,081 cubic meters) of rainwater

A detailed roadmap was prepared to harvest a million cubic meters of water over a period of two years. This includes drafting of comprehensive guidelines for the design, installation, commissioning and operations of the harvesting system.

11.22 Environmental Management Plan

The Environment Management Plan (EMP) is prepared with a view to facilitate effective environmental management of the project, in general and implementation of the mitigation measures in particular. The EMP provides a delivery mechanism to address potential adverse impacts and to introduce standards of good practice to be adopted for all project works. Specifically project related management plans prepared for air, water, noise, soil, ecology and biodiversity, occupational health and socio-economic conditions. For each stage of the programme, the EMP lists all the requirements to ensure effective implementation of EMP identified in the EIA.

Total capital budget of INR 1576 Crores and recurring budget of INR 151.02 Crores/year has been kept for EMP implementation

11.23 Conclusion

ArcellorMittal Nipppon Steel India Limited (AMNSI) is one of the largest steel-making company in India.

The present study provides an insight to the development in terms of technology, environment protection and production of AMNSI, Hazira. The analysis of the environment parameters along with production techniques have enabled to determine the development that has occurred in the past. Expansion of the plant shall provide new and cleaner technologies, sustainable development and proper environment management plan.

The organization also takes note of the public view through informal interactions with cross-sections of the residents of the nearby villages and /or as reflected in the local media and takes effective steps to ensure that these are given due cognizance while formulating and implementing scheme/ programmes that affect the common populace.

The steel plant has been a source of pride, strength and happiness for local residents and resident of surrounding areas since decades. Spreading its wings far beyond the scope of industrial manufacturing, the plant has engaged itself in a number of cultural, social and community services. People, the real driving force behind every step, have always been the centre of such activities.

One of the foundational principles of AMNSI lies in giving back to the society what it takes from it. AMNSI's initiatives in education, healthcare, sanitation and energy have brought vast changes at the grassroots level in surrounding areas and the improvements will continue in future also.

In view of the above, the project, if implemented will provide employment to more than 22,500 skilled, semi-skilled and unskilled personnel during construction and operational phases of the project. This will undoubtedly provide huge socio-economic benefits and improve the local, regional and state economies through ancillary job creation and revenues to the State and Central Governments.

Accordingly, proposed project may be considered for Environmental Clearance by the Competent Authority

12 DISCLOSURE OF CONSULTANT

12.1 Brief Resume and Nature of Consultancy Rendered by Kadam Environmental Consultants

Kadam Environmental Consultants (KEC) was established in 1981 and has four decades of varied experience in the field of environment. The mission of the company is to provide sustainable solutions in the field of Environmental Consultancy and allied fields with the firm belief on "Environment for Development".

Headquartered at Vadodara, India, Kadam group of companies (including Kadam Pollution Control Pvt. Ltd. and Kadam Enviro Projects LLP in addition to Kadam Environmental Consultants), have a total office and site staff strength of ~350 persons covering the entire gamut of specializations in the Environment, Health and Safety spheres.

KEC has been servicing its clients, including several multinationals, government institutions, public and private sector Indian enterprises across several sectors for four decades, now.

KEC is certified to ISO 9001:2015 and OHSAS 18001:2007 by BSI. KEC has been recognized as Environmental Auditors with Gujarat Pollution Control Board (GPCB) since inception of the Environmental Audit Scheme. KEC is also empanelled with Gujarat Industrial Development Corporation (GIDC), Ministry of Housing and Urban Affairs (MHUF) and Gujarat Infrastructure Development Board (GIDB) as Consultants.

Customer services provided by KEC are mainly categorized into:

Consultancy Services: Environmental Impact assessment, Environmental Site Assessment and Due Diligence, Enviro-Legal Services, Statutory Environmental Audits/ Environmental Statements/Compliance, Risk assessments and HAZOP, Energy Audit, Environmental, Health and Safety Management Systems, Deep Sea Pipeline Projects and Waste Management Systems.

Engineering Services: Collection and Conveyance of liquid and solid wastes, designing and executing effluent and sewage treatment plants, municipal solid waste studies and solid waste management systems, bio gas plants, rain water harvesting systems and deep sea marine disposal systems.

Laboratory Services: Chemical and waste testing, microbiology, soil testing and field sampling. The company has a well-equipped laboratory with modern instruments and experienced staff catering to the need of statutory and advisory environmental testing of water, wastewater and hazardous solid waste. KEC's widely-acclaimed laboratory is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL), a Constituent Board of Quality Council of India. The laboratory is capable of monitoring of ambient air and air emissions, water, including surface waters (marine as well as sweet water including ecological parameters), groundwater, soil, solid and hazardous wastes. The laboratory is staffed by more than 25 full time scientists supported by an equal number of field staff engaged in sampling and collection of environmental samples.

KEC has a team comprising of environmental planners and engineers, chemical, civil, structural and electrical engineers, geologists and hydrogeologists, enviro-legal experts, socio-economic experts, microbiologists, zoologists, botanists, industrial hygienists and industrial / analytical chemists.

For Environmental Impact Assessment Studies, the company's strength lies in project management, performing risk assessment, HAZOP/HAZID studies, formulating environmental disaster plans, use of satellite imagery in impact assessment, use of mathematical models for air / surface water / ground water / marine studies / solid waste / hazardous waste and soil assessment, and expertise in public consultation.

KEC is an accredited EIA Consultant Organization (ACO) by NABET, Quality Council of India under EIA accreditation scheme as per mandatory requirement of the MOEF&CC, Govt. of India for carrying out Environmental Impact Assessment studies. It has accredited EIA coordinators and Functional Area Experts for undertaking Environmental Impact Assessment and related studies in all approved functional areas.

12.2 EIA Team Members

Work presented in this report was carried out by KEC with active co-operation from AMNSI. The names of the EIA co-coordinator and FAEs deployed for the project are mentioned at the start of the report (in Quality Control section). KEC team members (along with their role in the project) are given in ***Table 12-1.***

Table 12-1: EIA Team Member

Functional Areas	Name of the Team Member	Involvement /Task
Project Co-ordinator	Mitali Khuman	Site Visit, assist in identification of impact of the project & suggesting mitigation measures, preparation of EMP & environment budget, key issue identification in the project
Air Pollution Monitoring & Control (AP)	Divya Pohwani	Finalization of monitoring locations, checking air quality data, evaluation of results of Ambient Air Quality Monitoring (AAQM) and contribution to EIA documentation
Air Quality Modeling and Prediction (AQ)		Finalization of monitoring locations, checking air quality data, evaluation of results of Ambient Air Quality Monitoring (AAQM)
Risk Assessment & Hazard Management (RH)	Dhruv Joshi	Assistance in preparation of RH report and Developing & interpreting consequence contours
Socio Economic	Aarti Sharma & Hitendra Sinh Parmar	Site Visit, assist in identification of impact of the project & suggesting mitigation measures, preparation of EMP & environment budget, key issue identification in the project
Laboratory	Vaishali Patel	Sample analysis of water, soil and air collected from the study area as per MoEF requirements.
Drafts Man	Viraj Vyas	Preparation of landuse maps of study area using GIS / related tools
Independent Review	K.K.Antani	Independent Review of EIA report against pre-set criteria