

EXECUTIVE SUMMARY

BACKGROUND

The Numaligarh Refinery Limited (NRL), a subsidiary of M/s Bharat Petroleum Corporation Limited, is a Government of India Enterprise in Oil and Gas sector. The Numaligarh Refinery has been set up to fulfill the commitment made as per the Assam accord signed in August 15, 1985 and incorporated on the 22nd of April, 1993 for the implementation, operation, maintenance and management of Numaligarh Refinery and finally commercial production started from Feb.,2000.

Presently, NRL is producing BS-II and Euro-III grade HSD by optimizing existing configuration of the refinery thereby limiting its capacity utilization up-to 90%. The capacity of refinery is 3.0 MMTPA and its requirement for crude oil is being fulfilled from the oil fields of ONGC and Oil India Limited (OIL), located in upper Assam. NRL is having excellent track record and progressive outlook in regularly upgrading its technology as well as undertaking expansion programmes.

1.1 PROJECT PROPOSAL

In order to save foreign exchange and judicious utilization of its intermediaries MVGO and HVGO obtained from VDU, M/s NRL proposes to set up a grass root Wax Plant within the existing Refinery premises for production of paraffin and semi-microcrystalline waxes.

1.2 JUSTIFICATION OF PROPOSED PROJECT

1. Assam crude mix processed at NRL is rich in high quality wax of type Paraffin and Semi Microcrystalline Wax. (SMCW)
2. The end products are having very good marketing potential in eastern and north-eastern regions.
3. Value addition for the product slate per unit of investment
4. Availability of Paraffin Wax & Semi Micro Crystalline Wax will provide an impetus for growth of various medium and small scale industries in the region.

1.3 SITE LOCATION

The Numaligarh Refinery is located at Numaligarh, at a distance of 25 km from Golaghat, District Headquarter and 264 km from Guwahati, the state capital in Assam. Geographically, NRL is located at latitude of 26°37'30" N and longitude of 93°43'30" E, at elevation of about 90-m above the mean sea level (MSL). The National highway (NH- 39) is passing adjacent to the refinery and NH-37 is also passing nearby. Jorhat and Tezpur are the nearest Air bases.

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1.4 SCOPE OF EIA STUDY

As per gazette notification of MoEF dated 14th September 2006, the proposed Wax project of the refinery requires prior environmental clearance from Ministry of Environment & Forests (MoEF), Govt. of India. In this process, Experts Appraisal Committee (EAC) meeting / presentation was held on 05.05.2009 at New Delhi. The EAC (Industry) considered the project based on the documents submitted and presentation made by the project proponent and advised to prepare Environment Impact Assessment Report in line with the presentation held.

1.5 EXISTING FACILITIES AT NRL

NRL Produces different petroleum products like domestic, automobiles and Aviation Fuels such as LPG, Naphtha, SKO, BS-II grade HSD, Euro-III grade HSD, RPC, ATF and Elemental Sulphur as by-product. The Main Existing units of NRL are described below-

Name of the Units	:	Capacity
Crude Distillation unit (CDU)	:	3.0 MMTPA
Vacuum Distillation unit (VDU)	:	1.32 MMTPA`
Hydrocraker unit (HCU)	:	1.10 MMTPA
Hydrogen unit (H ₂ U)	:	38,000 TPA
Delayed Coker unit (DCU)	:	0.306 MMTPA
Coke Calcination unit (CCU)	:	0.104 MMTPA
Sulphur Recovery unit	:	0.004 MMTPA
Naphtha Hydro treating unit (NHTU)	:	2,71,000 TPA
Semi Regenerative Catalytic Reforming (CRU)	:	1, 66,312 TPA
Isomerisation unit with De-Isohexaniser Section (ISMOU)	:	55,208TPA

Besides the above, the off-site facilities available with NRL are CPP, RWTP, ETP, unique Ground Flare system, plant/instrument air, cooling water system, DM water system, Fire water system and Tank farms for storage of Crude and intermediate / finished products.

1.6 PROJECT & PROCESS DESCRIPTION

(a) Introduction

Numaligarh Refinery processes Assam crude mix, which is highly paraffinic (8% on crude) and has high wax content. M/s NRL engaged M/s IIP, Dehradun, to carry out study for commercial production of paraffin and semi-microcrystalline wax. Accordingly, M/s IIP, Dehradun carried out probe runs on a number of sample feed stock provided by NRL on lab scale. This was followed by bench scale experiments at IIP to determine the filterability of various stocks, achievable quality of product wax as well as optimum operating parameters. Having received the results from M/s IIP, Dehradun, which

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were encouraging and promising both in the lab and bench scale study respectively, M/s NRL engaged the services of M/s EIL for preparing a Detailed Feasibility Report (DFR) for setting up a grass root De-waxing/ De-oiling Unit for the production of Paraffin and Semi-Microcrystalline Waxes (SMCW) at NRL, Numaligarh.

(b) Proposed Project

The proposal relates to set up a grass-root De-waxing / De-oiling Unit for production of paraffin and SMCW at existing refinery. Following new units have been envisaged for the proposed project:

- De-waxing & De-oiling Unit
- Hydro-finishing Unit
- Slabbing & Washing Unit and
- Warehouse

(c) Process Description

Paraffin and SMC Waxes are produced from dewaxing / deoiling of two different feed-stocks in blocked out operation employing MIBK as the deoiling solvent (> 98% purity, commercial grade).

The two designed feed stocks for the unit are:

- (1) MVGO obtained from Vacuum Unit
- (2) HVGO obtained from Vacuum Unit

Wax re-crystallization, such as wax sweating, separates wax into fractions and the process makes use of the different solubility of the wax fractions in a solvent such as Ketone.

The proposed wax plant has selected the process of solvent dewaxing by using Methyl Iso-butyl Ketone (MIBK) as solvent which would be recycled in the process.

1.7 RAW MATERIALS, UTILITIES AND PRODUCT DETAILS

(I) Raw Material

The feed stocks of the proposed project are-

1. Middle Vacuum Gas Oil (MVGO), Feed Rate: 28.20 TPH
2. Heavy Vacuum Gas Oil (HVGO), Feed Rate: 23.32 TPH

Both shall be obtained from Vacuum Distillation Unit.

(II) Utilities and Offsite Facilities

1. Land Requirement

Proposed Wax plant shall be established within existing NRL complex. The details of plot area requirement for various units/ facilities are mentioned below:

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Name of the Unit	:	Size of Plot area required
De-waxing & De-oiling Unit	:	76 M x 135 M
Hydro-finishing Unit	:	90 M x 60 M
Slabbing & Washing Unit and Warehouse	:	80 M x 40 M
Satellite Rack Room Building	:	32 M x 18 M
Sub-Station	:	48 M x 30 M

2. Power Requirement

Additional power requirement is envisaged as 2.4 MW and would be met from the existing CPP. A new sub-station shall be provided in the west side of De-waxing & De-oiling Unit.

3. Water Requirement

Additional water requirement for the proposed project is estimated about 60 m³/hr. The existing infrastructure for water supply is adequate to meet the additional requirements from Dhansiri River which is within the consent for drawl of water.

4. Cooling Water System

A new cooling water system of one has been envisaged for the proposed project. This system shall be located at the south side of Slabbing and Washing Unit & Ware-house.

5. Satellite Rack Room Building

A new Satellite Rack Room building shall be provided in the west side of De-waxing & De-oiling Unit

6. Effluent Treatment Plant

The waste water generation from the proposed project is envisaged about 8.1 m³/hr, which shall be added to the existing effluent treatment system provided with an ETP of capacity 220 m³/hr. Present waste water generation from various processes at refinery, is about 110m³/hr.

(III) Products

The products obtained from MVGO & HVGO feed shall have following characteristics:

Product	Type	M. Pt. (°C)	Oil Content(Wt. %)	Specification
Paraffin Wax	I	61.0	0.1	BIS:4654-1593
Semi Micro-crystalline Wax	A	67.0	0.3	BIS:13833-1993

The final products Paraffin Wax and Semi Micro-crystalline Wax would be produced in blocked out mode with quantities 43,300 and 4500 TPA respectively, destined to the storage in OSBL.

Storage Facilities

The following storage is envisaged within unit battery limit:

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Name of Tank	No. x Capacity (m ³)	MOC	Design Temp. (°C)
Slop Tanks	2 x 100	KCS+1.5 mm CA	150
Solvent Tank	2 x 100	KCS+1.5 mm CA	65
Finished Wax Product	4 x 500	KCS+1.5 mm CA	150
Semi MCW Wax Product	2 x 250	KCS+1.5 mm CA	150
De-oiled Paraffin Wax	2 x 1500	KCS+1.5 mm CA	150
De-oiled Semi MCW	2 x 1500	KCS+1.5 mm CA	150
HVGO	1 x 1500	KCS+1.5 mm CA	150
MVGO	1 x 1500	KCS+1.5 mm CA	150

1.8 STATUS OF ENVIRONMENT IN THE STUDY AREA

The baseline environmental studies help in assessing the existing environmental conditions of the study area and identifying the critical environmental attributes, which would be monitored after implementation of the project. This would facilitate the comparison of the resultant environmental conditions in the post project scenario with the present day conditions and would help in preserving the environment from any deterioration and safeguard the interest of the study. The existing environmental setting is considered to adjudge the baseline conditions which are described with respect to climate, hydro-geological aspects, atmospheric conditions, water quality, soil quality, ecology, socio-economic profile, land use etc.

The present study incorporates the data generated during 14th October 2009 to 14th January 2010 for a study area of 10 KM radius from the refinery and the secondary data collected from various Government, Semi-Government and Public Sector organizations. Secondary data has also been collected on various scientific studies done in the study area by different organizations.

The baseline data has been collected for various environmental components such as, Air, Water, Soil, Ecology, Socio-Economics, etc.

1.8.1 Land Environment

The refinery complex of M/s NRL is spread over an area of 750 acres of land and the NRL Township is spread over an area of 250 acres of land. The refinery is located in flat terrain, however there are uneven slopes in the surrounding areas where tea plantations are observed. The bottom of the slopes is almost even and paddy cultivation is being done in two seasons. Numaligarh Refinery is located in humid region and totally free from flood. Geologically the site area is covered by quaternary alluvial sediments comprising sand, silt and clay. The soil is silty clay to sandy silt and is usually poor in plant nutrients with sandier sub soil. In general, the soil is free from lime and it is acidic in nature. The terrain

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of the study area is almost flat but it becomes hilly towards the southern side except fairly wide flat valley along the Dhansiri River.

The data with respect to landuse / landcover of the study area has been presented in following Table:

Land Use / Land Cover Classification of the Study Area

Land-use/ Land-cover	Area, Ha	Area (%)
River	659.17	2.91
Dense Forest	1679.42	7.40
Open Scrub Jungle	531.61	2.34
Other Vegetation	1410.81	6.22
Tea Plantation	3468.46	15.28
Fallow (Tea Plant)	3267.53	14.40
Crop Land	5593.61	24.63
Fallow-1	1769.11	7.80
Fallow-2	2679.07	11.80
Built-up	138.94	0.61
Scrub Land	199.42	0.88
River Sand	1301.04	5.73
Total Area	22698	100.00

In order to evaluate the physico-chemical characteristics of soil, six sampling locations were selected in the area. Out of six locations, two locations were selected within NRL complex. The highlights of the observations are as follows:

- The texture of soils from all the locations was Silty Clay to silty loam.
- The pH of the samples ranged between 5.8 and 6.6.
- Electrical conductivities were observed in the range 374 to 1570 $\mu\text{S}/\text{cm}$.
- Level of Organic Matters was observed in the range 0.68 % to 1.32%.
- Level of Nitrogen as N ranged between 4.1 Kg/ha and 6.0 Kg/ha.
- Level of Phosphorus as P_2O_5 ranged between 1.6 Kg/ha and 2.7 Kg/ha.
- Level of Potassium as K_2O ranged between 0.12 Kg/ha and 0.28 Kg/ha.

1.8.2 Climate & Meteorology

The climate of Numaligarh and its surrounding areas is sub-tropical with a hot and humid weather prevailing most of the summer and monsoon months. The normal annual rainfall in the area is around 1898.8 mm. Annual Mean humidity is recorded 82% during evening hours and about 68% in morning hours. Predominant wind direction of the area during the year is north-west followed by south-east and north-east.

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During the study period (14th October 2009 to 14th January 2010), temperature ranges between 10°C-34°C while the relative humidity ranged between 37.1-95.1%. The total rainfall recorded during the study period was 14 mm. Predominant wind direction was observed in east-north-east direction with frequency of 14.04%, followed by east (10.52%) and south-west (10.43%) directions respectively.

1.8.3 Air Environment

Air quality monitoring was carried out at six locations during the study period. Major air pollutants under consideration were SPM, RPM, NO_x, SO₂, CO and HC to represent the existing status of the air environment. The monitoring was conducted with frequency of 2days/week/station to evaluate 24 hours average concentrations of SPM, RPM, SO₂ and NO_x while CO and HC on 8 hourly average concentration. The summary of observations made during the study period is as follows:

Pollutants	Range	Average	98 th Percentile
Industrial Area			
SPM, µg/m ³	60 - 101	88	100
RPM, µg/m ³	25 - 45	37	45
SO ₂ , µg/m ³	4.1 - 8.8	6.2	8.7
NO _x , µg/m ³	5.5 - 14.0	9.6	13.3
CO, mg/m ³	0.38 - 0.65	0.52	0.65
HC, ppm	0.50 - 0.62	0.56	0.61
Residential Area			
SPM, µg/m ³	62-110	73 - 94	79 to 108
RPM, µg/m ³	18 to 45	33 to 38	41 to 44
SO ₂ , µg/m ³	3.2 to 10.5	6.3 to 8.7	8.1 to 10.2
NO _x , µg/m ³	2.0 to 15.0	4.5 to 10.4	5.9 to 14.4
CO, mg/m ³	0.06 to 0.52	0.10 to 0.40	0.16 to 0.51
HC, ppm	BDL	BDL	BDL

NB: BDL= Below Detectable Limit

From the observations, it may be concluded that the concentrations of all the air pollutants were well below the limits prescribed under NAAQS.

1.8.4 Water Environment

The main source of surface water is Dhansiri River which is flowing in the vicinity of project site i.e. within 5 km from the refinery and is a tributary of the river Brahamputra while Kaliani River is a tributary of river Dhansiri. The Physico-chemical characteristics of the surface water samples collected from the four locations show a good resemblance with respect to almost all the characteristics like temperature, turbidity, pH, total suspended solids, total dissolved solids, chloride, sulphate, iron, and

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nitrate etc. In all the surface water samples the total dissolved solids were under permissible limit as per IS: 10500. Ground water collected from the 6 locations show a good resemblance with respect to almost all the characteristics like temperature, turbidity, pH, total suspended solids, total dissolved solids, chloride, sulphate, iron, and nitrate etc. Heavy metal values in all the water samples are below the detectable limit. From the above, it may be concluded that all the parameters except Iron, of the ground water are under the limits of Drinking Water Standard (IS: 10500) and as such is suitable for potable purpose.

1.8.5 Noise Environment

To evaluate the ambient noise level in the area, 12 locations were selected and monitored out of which 06 locations were selected in rural / residential and sensitive areas while 06 locations were selected within NRL premises including the proposed project location. The measurements were carried out continuously, at hourly intervals, for the 24-hour period to obtain hourly sound pressure level. The 24-hour L_{eq} value of noise level measured inside the refinery campus (at 06 locations) was in the range of 60.0 to 63.3 dB(A). The 24-hour L_{eq} value of noise level outside the refinery (six locations) ranged between 43.0 to 49.7 dB(A). Thus, it may be concluded from the observation that the existing noise level in the study area is within the specified NAAQS for Noise.

1.8.6 Solid & Hazardous Wastes

Major solid and hazardous wastes generated at NRL from various process activities are as follows:

QUANTITY OF SLUDGE/ SOLID WASTE GENERATED

Wastes	:	Quantity (MTPA)
Oily & Chemical Sludge	:	100-120
Tank Bottom Sludge	:	20-30
Spent Catalyst	:	50-60

The solid waste expected to be generated from the proposed wax project is spent catalyst with quantity of about 21 tonnes in every five years. The same shall be disposed of through approved recyclers.

1.8.7 Ecology

Total geographical area of Golaghat district is about 3502 Square Kilometer, out of which about 1035 Square Kilometer (32% of total area), is covered by forest including Reserved Forest, Protected Forest and Unclassified Forest.

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1.8.7.1 Flora

Assam State is very well known for its forest resource and biodiversity. The floristic study reveals that the species composition represents a highly diverse and rich gene pool uniformly spread in restricted patches around human settlements. The genera dominating the flora with large number of species are Calamus, Curcuma, Cyperus, Polygonum etc. Forest is fairly regular and depends considerably on climatic conditions such as temperature, humidity, rainfall and the soil type. A short term survey was conducted during the study period based on topography, land use and vegetation pattern. Data on Flora was collected based on field survey in the study area and from Forest Department. A Butterfly Park/ Butterfly Eco-system has been developed by NRL on the west side of its township which represents the floristic diversity of north-east India with overall plantation of about 60,000 endemic species. NRL has also established an herbal garden consisting of rare medicinal plants comprising 66 species.

1.8.7.2 Fauna

Dense forest in Golaghat district supports the wildlife habitat. Dhansiri and Kalyani rivers and many lakes (bills) are the perennial source of drinking water for wildlife. Deopahar reserve forest is nearest to the study area located in western direction at a distance of about 8-kms from NRL. The land in the study area is mostly with rural setting. Consequently fauna especially avifauna is rich and varied. Animals like House rats, Bats, Jungle Cats, Leopard Cats, Squirrels, Monkey, Python and other variety of Snakes are also seen in the area. The most common birds in this region are Hill maina, green pigeon, Emerald, Dove, Parrots etc. The domestic fauna in the area consists of Cow, Bullock, Buffalo, Sheep, Goat, Horse, Ponies and Pig among the live stock and Duck, Drake, Hen, Fowl.

Aquatic Fauna

The rivers Dhansiri and Kalyani, located within 5-kms radial distance from the proposed site support the habitat for fish fauna. These rivers are perennial and the common fishes found in the study area are Rehu (Labeo rohita), Mrigal (Cirrhinus mrigala), Silver Carp (Hypophthalmichthys melitrix), Common Carp (Cyprinus Carpio), Grass Carp (Ctenopharyngodon idella) and minor carps are Labeo genus, Lebeo bata, P. Sarana, P. Sepher, Clarias butrdehusive, H. Fessilis, W. Attu, Murrels etc.

1.8.8 Socio-Economic Environment

The study area covers about 56 villages, out of which 52 village falls under Golaghat PS and 4 village falls under Dergaon PS. Total population of human settlements falling under Golaghat PS is 61,877 and population of the human settlements falling under Dergaon PS is 2831. The family size of the

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villages under Golaghat PS is about 4.93 whereas the same for Dergaon PS is about 6.24. Sex ratio i.e. females per thousand males under Golaghat PS is 934 whereas the same for Dergaon PS is 910. The literacy rate in the study area is about 60% which clearly indicates that the education facilities in the study area are sufficient. In the field of literacy, males are more literate than female.

The economy of the area is dependent mainly on agriculture. The present employment pattern of the study area is agriculture based rural economy. The study area comprises a number of tea gardens and as such tea is the main crop grown in the study area. Besides tea, the other agricultural crops grown in the study area are rice, pulses etc. and rapeseed whereas mustard, potato are the main commercial crops. The vegetables grown in the study area are banana, papaya, potato, brinjal etc. Total main workers form about 30% of the total population. Out of the main workers, cultivators form about 35%, agricultural labours about 5%. It is also interesting to note that the percentage of marginal workers in the area is 52%, out of which 24% fall in male category.

1.9 ENVIRONMENTAL IMPACTS

The impacts of the project both positive and negative have been studied and wherever possible, have been quantified. The impacts on environmental components like Land, Water, Air, Noise, Ecology and Socio-economic environment have been assessed. The impacts on these environmental components have also been assessed during various phases of project cycle namely, project location, design, construction and operation. On the whole, the impact will be significantly improving the quality of life of surrounding area and present status of socio-economic structure.

1.9.1 Land Environment

It is envisaged that only minor leveling of land will be required for the proposed project within NRL complex. No solid raw material shall be used in the proposed wax project. Hence, carry-over of raw material to land does not arise at all. About 21.0 Tonnes of spent catalyst would be generated in every five years. These spent catalysts shall be stored in sealed drums and shall be disposed off through MoEF authorized recyclers.

Thus, no impact on land environment is envisaged during construction and operation of the project.

1.9.2 Air Environment

Emission from Stationary Source

Only one stack has been proposed for operation of the proposed wax project. This stack will be attached to fuel gas fired heater having designed capacity of 2.4 MM Kcal/hr. The mass emission rate of different pollutants such as SO₂ is computed to be about 0.25 Kg/hr, NO_x about 1.5 Kg/hr and CO

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about 2.5 Kg/hr. The quantity of the emissions discharged into the environment is insignificant and it is envisaged that the resultant effect on the concentration of pollutants in ambient air shall be insignificant.

Fugitive Emission

The main sources of fugitive emissions are HVGO, MVGO and MIBK solvent tanks. It is envisaged that the fugitive emission from above sources shall be very low and as such the same would not affect the ambient air quality.

1.9.3 Noise Environment

Major noise sources of the proposed project are moving/ rotating equipments like Air Compressors, Feed Pumps, ID Fans, Cooling Towers, FD Fans, etc. The anticipated noise level after implementation of the proposed facilities at boundary locations has been computed as under:

Sl. No.	Location	Noise level, dB(A)			
		Existing		Resultant	
		Day Time	Night Time	Day Time	Night Time
01.	Northern Boundary	50.0	45.0	52.1	49.9
02.	Southern Boundary	48.0	42.0	52.4	50.9
03.	Eastern Boundary	53.0	45.0	53.2	46.0
04.	Western Boundary	50.0	45.0	50.7	47.0

It is, therefore, concluded that the existing noise level near the boundary walls will slightly increase during day time whereas during night hours, there is negligible increase in existing noise level. Thus, insignificant impact on the noise level is foreseen.

1.9.4 Water Environment

There would be an enhancement of requirement of 1440 m³/day of water for the proposed project which would be met through existing facilities from Dhansiri River. NRL has consent for drawing 28,800 m³/day of water from Intake well at Dhansiri and presently drawing about 16,054 m³/day thus, there is sufficient margin to meet the additional requirement. The waste water generation would be about 8.1 m³/hr and would be sent to the existing ETP of capacity 220 m³/hr. The present wastewater generation at NRL is about 110 m³/hr. Considering the capacity and additional load of ETP after implementation of the Wax project, no significant impact on water environment is envisaged.

1.9.5 Solid / Hazardous Waste Management

The hazardous materials used during the construction may include petrol, diesel, welding gas and paints. These materials would be stored and handled according to the guidelines specified under Solid Waste (Management, Handling & Trans-boundary Movement) Rules dated 24th September 2008 by

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MoEF. Vehicles carrying construction materials and entering NRL premises should be allowed only when covered properly, to prevent fugitive emission.

The hazardous wastes produced from the proposed facilities have been identified as Methyl Isobutyl Ketone (MIBK) and spent catalyst. The MIBK solvent shall be recovered from process for which Solvent Recovery Unit has been proposed. About 21.0 Tonnes of spent catalyst would be generated in every five years. These spent catalysts shall be stored in sealed drums and shall be disposed of through MoEF authorized recyclers.

1.9.5 Biological Environment

No loss of any component comprising biological environment is anticipated. There will be no conflict regarding the encroachment on nature reserve, as the project and its surroundings are declared as no development zone.

1.9.6 Socio-Economic Environment

The proposed project would generate direct and indirect employment during construction phase. It is envisaged that about 200 to 300 manpower would be required in construction and transportation activities, supply of materials, auxiliary and ancillary works. Majority of the work force required during construction period shall be engaged from local population. Thus, it is envisaged there would be positive impact on existing local population.

This project will encourage small scale entrepreneurs to use the products as raw material in industries such as tyres and rubber, candles, adhesives, corrugated board, cosmetics, casting and a host of others.

1.10 MANAGEMENT PLAN

The affected environmental components in the study area include air quality, water quality, soil, land use, ecology, demographic. The management action plan aims at controlling pollution at source level to the possible extent with the best available technology followed by treatment measures before they are discharged to the environment. Necessary energy saving measures would be taken during design stage to save and conserve energy. An Effluent Treatment Plant is there for treatment of waste water up to tertiary level and would be utilized for greenbelt, fire fighting system, etc.

1.10.1 Site Preparation

The proposed project site is already prepared to some extent and back filling is not required. Stock piling of earthen material would be required temporarily due to construction of foundation for proposed facilities. It is necessary to control the dust nuisance caused by construction and transportation

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activities by water sprinkling. The construction area may be barricaded, if required, to prevent dispersion of particulate matter / dust. Care shall be taken to prevent accidental spillage of any oil from construction equipments. Combustible waste, if any, shall be burnt in incinerator.

1.10.2 Land Environment

The site of the proposed project is located within the NRL complex having insignificant vegetation cover like grass and scattered bushes. It is envisaged that minor leveling of land will be required for the proposed project. Every possible measures shall be taken by NRL authority to prevent contamination of soil from any kind of hazardous chemicals, wastes etc produced by the proposed project activities.

1.10.3 Air Environment

Emission of fugitive dust due to movement of heavy vehicles etc. shall be controlled by spraying water in the affected zone during construction phase.

In-plant Control Measures:

Some of the mitigation measures, which can reduce the impact on air environment, are as follows:

- Ensuring the operations of various process units as per specified operating guidelines/ operating manuals
- Strict adherence to maintenance schedule including lubrication for various machinery/ equipment
- Adoption of good house-keeping

Fugitive Emissions

To mitigate fugitive emissions of hydrocarbons, the following steps would be taken:

- ☞ Minimum number of flanges, joints and valves in pipelines
- ☞ Selection / use of state-of-the art leak proof valves
- ☞ Provision of mechanical seals in pumps
- ☞ Regular inspection of floating roof seals and proper preventive maintenance of roofs and seals for tanks
- ☞ Monitoring and preventive maintenance of valves, flanges, joints, etc.

1.10.4 Water Environment

The wastewater generation from proposed facilities would be about 8.1 m³/hr and would be treated in the existing ETP. The additional treated wastewater would also be utilized for various activities like horticulture, fire water make-up, etc. The following measures would be taken to minimize the water usage in the operational phase:

- Endeavor to reduce the actual process water consumption by way of improvement in operation of processing units.

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- Water saving shower head flow controls, spray taps and faucet aerators and photo-sensitive taps.
- Exploring other options of reusing the treated effluent besides fire water make up or for horticulture development.
- Ensuring proper monitoring and maintenance schedule for the effluent treatment plant.

1.10.5 Noise Environment

Following measures shall be taken for abatement of noise during operation phase:

- Acoustic laggings, enclosures and silencers shall be provided wherever necessary for high noise generating equipment.
- Sound proof glass paneling shall be provided for all operating stations / control rooms as well as for shift rooms at critical places.
- Strict implementation/ compliance of all statutory norms w.r.t. noise generation, occupational exposure shall be done.
- Use of personal protective devices such as ear-muffs and ear-plugs shall be strictly enforced.
- Acoustic barriers / shelter shall be developed in noisy workplaces.
- Noise generating sources in the plant areas shall be monitored regularly. Monitoring of ambient noise levels should also be carried out regularly both inside the Refinery premises as well as outside the greenbelt.

1.10.6 Solid Waste / Hazardous Management

The following measures shall be adopted for protection of the environment:

- Spent Catalysts shall be sold to MoEF authorized recyclers.
- MIBK solvent shall be recovered from process and shall be reused in the system.
- Waste having calorific value above 2500 Kcal/kg should be burnt in incinerator.
- Other hazardous wastes shall be considered for secured land fill.
- The additional bio-sludge generated during treatment of wastewater shall be used as compost and applied in the garden.

1.10.7 Biological Environment

The existing 100 m wide greenbelt around NRL as well as 25-metres wide green belt around marketing terminal are sufficient to mitigate impacts from proposed project. The selected species which will be useful, locally grown and found to be most suitable for strengthening the existing greenbelt are *Cedrela toona* (Poma), *Bischoffia javanica* (Urian), *Mussaesa ferrea* (Nahar), *Terminalia citrine* (Hilikha), *Dillenia indica* (Owtanga), *Salix tetrasperma* (Bhe), *dendrocalamus hamiltonii* (Kakobamboo), *Areca catechu*

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(Tamul), *Terminalia bellerica* (Bhomara), *Cassia fistula* (Sonaru), *Mangifera indica* (Aam), etc. Furthermore, NRL is committed for protection and development of environment and ventured for establishment of a Butter Fly Park and Herbal Garden as described below.

1. Butter Fly Park

A valley like area, spread over an area of about 20 acres, has been developed by NRL on the west side of its township as Butterfly Park/ Butterfly Eco-system comprising core zone and buffer zone. This park represents the floristic diversity of north-east India with overall plantation of about 60,000 endemic species. The butterfly park provides a natural habitat for butterflies to come, stay and breed in their natural way.

2. Herbal Garden

NRL has established an herbal garden consisting of rare medicinal plants comprising 66 species have been planted in this garden. This garden named as “Smirtibon” has been developed with the contribution from NRL employees under the guidance of Shri Gunaram Khanikar, a renowned herbal specialist of national repute.

1.10.8 Socio-economic Environment

Formulation of an effective EMP is important to mitigate the impacts likely to arise out of the proposed project and to maintain goodwill with local people. In view of this, the following measures are suggested:

- NRL shall continue to organize regular environmental awareness programme to bring forth the environmental management measures being undertaken and the beneficial aspects of the proposed project towards improving the quality of life and environment.
- Social welfare activities should be carried out with consultation of local bodies and the future plans of social welfare programme may be chalked out and circulated to public accordingly.
- In order to improve socio-economic status in nearby tribal area, the NRL authority shall consider extending welfare measures under the community development programme.
- Some basic amenities like education, safe drinking water supply, etc. to the nearby villages shall be taken up as a gesture of goodwill.
- Regular medical check-up camps for the villagers shall be organized on routine basis in the villages around the refinery with proper data record and also by providing mobile hospital services.

1.10.9 Environmental Management Cell

NRL is already having a Plant Safety & Environmental cell under the technical services department, consisting of well qualified and experienced technical personnel from relevant fields. It will continue to carry out various functions under the control of a Senior Executive who reports directly to the head of the organization. The cell will continue to ensure that all pollution control measures for the proposed

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project are effectively operating and are being maintained on regular basis.

1.10.10 Energy Conservation Measures

In continuation of its energy conservation efforts, NRL has identified various schemes for future implementation. Some of the schemes are as under:

- Phase-wise implementation of Advance Process Control (APC) in the remaining process plants are in progress (already implemented in CDU/ VDU). Activities for APC implementation in DCU and HCU have been taken-up.
- Implementation of innovative technology for use of oxygen rich waste air stream available from Nitrogen Plant as enrich air in Sulphur Recover Unit by replacing conventional use of process air.
- Replacement of conventional lighting fixture by more energy efficient fittings.
- Installation of improved insulation over the High Pressure (HP) steam line to reduce the heat loss.
- Installation of Flare Gas Recovery System for recovery and reuse of refinery waste gas going to flare.
- Steam trap survey and rectification covering all the units including utilities and off-sites.
- Utilization of surplus HP saturated steam from MS Unit.

1.10.11 Corporate Social Responsibilities

With a strong commitment towards socio-economic up-liftment of the region, NRL has always definitive measures for improving the quality of life of the people residing in neighbouring areas through innovative and people friendly program. Presently, NRL's special attention is focused on major thrust areas such as Agri-allied/ Income generation activities, Education, Infrastructure Development, Community Health, Promotion of art, Sports, Literature and Culture.

Training and awareness programs on environment protection for the local residents are organized regularly. In keeping with the commitment of a good corporate citizen, NRL has also initiated community development programs, extending medical assistance to the people of nearby villages through Vivekananda Kendra Hospital, instituting scholarships to the needy and deserving student, extending financial assistance to different educational institutions contributing positively for the development of sports and culture in the area.

In association with Vivekananda NRL Hospital, several free medical and health check-up programs are organized at regular intervals. A Cervical and Breast Cancer Detection Camp is organized by NRL at regular intervals in which people from nearby villages are screened.

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Awareness campaign on Eye Donation in collaboration with District Blindness Control Society is also organized at regular intervals by NRL.

CONCLUSION

No significant impacts due to the proposed Wax Project on environment are anticipated. Assam crude mix processed at NRL is rich in high quality wax of type Paraffin and Semi Microcrystalline Wax. Wax is an import substitution and production of wax at NRL would save significant amount of foreign exchange. Moreover, availability of wax would encourage small scale entrepreneurs in the area and region. Thus, the proposed wax project would be an impetus for socio-economic growth in the area as well as for the country.

Compliance With Terms Of Reference:

Sl.No.	Terms of Reference	Compliance With TOR
1.	Generic Structure of EIA	Complied with
2.	Handling & Safety arrangements for solvent MIBK.	Complied with Attached as Annex.-II
3.	One year existing data on Environmental compliance & HC, VOC (Methane & Non-Methane)	Complied with Attached as Annex.-III