

Executive Summary

BACKGROUND

Numaligarh Refinery Limited (NRL) is a subsidiary of M/s Bharat Petroleum Corporation Limited, which is a Public Sector Undertaking (PSU) in Oil and Gas Sector. The refinery owes its existence to the commitment made by Government of India in the historic "Assam Accord", signed on 15 August 1985 and was conceived as a vehicle for speedy economic development of the region. Numaligarh Refinery Limited was incorporated on 22nd April 1993 and designed to process 3 MMTPA low sulphur indigenous crude oil produced from Upper Assam oil fields by adopting state-of-art technologies. The refinery comprises of Crude Distillation Unit (CDU), Vacuum Distillation Unit (VDU), Hydro Cracker Unit (HCU), Delayed Coke Unit (DCU), Hydrogen Unit (H₂U), Motor Spirit Unit (MSU), Sulphur Recovery Unit (SRU) and a Coke Calcination Unit (CCU). NRL produces three types of end products namely Light Distillates, Middle Distillates and Heavy Ends. NRL has also implemented its own Marketing Terminal. The products are supplied to various destinations like north-eastern states, eastern and northern regions of the country through pipeline, road and rail.

NRL is having excellent track record and progressive outlook in regularly upgrading its technology as well as undertaking expansion programmes. It has pursued a proactive environmental management policy and has established an environmental management system, in recognition of which, it has received a number of prestigious awards. Some of the prestigious awards may be mentioned as under:

- First prize of TERI Corporate Environmental Excellence Awards 2008 consecutively for second year in recognition of its leadership efforts towards Environment Management.
- BPCL Chairman's Appreciation Award 2008 in Green Category.
- Second prize of National Energy Conservation Awards 2008 from Bureau of Energy Efficiency under Ministry of Power.
- Second prize of Oil & Gas Conservation Awards 2008 in the category of Furnace & Boiler Efficiency.
- Second prize in the Refineries category of the prestigious Oil Industry Safety Awards for the year 2007-08.
- The "Shreshtha Suraksha Puraskar 2007 instituted by National Safety Council.
- Third prize of Jawahar Lal Nehru Centenary Awards for Energy Performance of Refineries having composite energy factor >5 for the year 2007-08.

EXISTING FACILITIES

The refinery produces different petroleum products, especially domestic and automobile fuels such as LPG, Naphtha, ATF, SKO, BS-II Grade HSD, Euro-III Grade HSD, RPC and elemental sulphur as by-product. The main existing units of NRL are as under:

Units		Capacity
Crude Distillation Unit (CDU)	:	3.00 MMTPA
Vacuum Distillation Unit (VDU)	:	1.32 MMTPA
Delayed Coke Unit (DCU)	:	0.306 MMTPA
Hydro Cracker Unit (HCU)	:	1.10 MMTPA
Hydrogen Generation Unit (H ₂ U)	:	38000 TPA
Motor Spirit Unit (MSP)	:	225 TPA
Coke Calcination Unit (CCU)	:	0.104 MMTPA
Sulphur Recovery Unit (SRU)	:	4000 TPA

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Besides these, the offsite facilities available with the refinery are Captive Power Plant (CPP), Raw Water Treatment Plant (RWTP), Effluent Treatment Plant (ETP), Flare System, Plant/Instrument Air, Cooling Water, DM Water, Fire Water System and Tank Farm for storage of crude and intermediate/ finished products.

PROJECT PROPOSAL

The project proposal relates to supply of 160 TMTPA of Petrochemical Grade Naphtha to M/s Brahmaputra Crackers and Polymers Limited (BCPL) as per agreement.

Justification of Project

Availability of Land

There would be no land acquisition as the proposed NS project shall be located within the battery limit of CDU/VDU in existing NRL complex.

Availability of Raw Material

The Naphtha Splitter Unit (NSU) was incorporated in the original design package with an objective to produce Reformer Feed Naphtha from full range Naphtha ex-VDU within the CDU/VDU Unit area. Adequate provision was also kept in the CDU/VDU area.

Power Supply

The additional power requirement of 0.2 MW for the proposed NS project would be met from the existing CPP comprising of two GT Sets of 30 MW capacity each, which are adequate to take care of the proposed project.

Water Availability

Additional water requirement for the proposed project is estimated to be less than 5 m³/hr. The consent to draw water from Dhansiri River is of 1200 m³/hr. The present withdrawal of water for running the existing units is about 700 m³/hr. The existing infrastructure for water supply is adequate to meet the additional meagre requirements.

PROCESS DESCRIPTION

NRL proposes to utilize Natural Gas (NG) to replace Naphtha as fuel in GTG, as feed and fuel in H2U Unit. After commissioning of NG Project, surplus Naphtha available will be used as feed to Naphtha Splitter Unit (NSU). Basic engineering design package (BEDP) of the proposed project is already submitted by M/s Engineers India Limited (EIL).

There will be two Splitters and one Stabilizer Column in the unit. The hot SRN from CDU/VDU will be fed to SRN Splitter and the hot HTN from Hydro Cracker will be fed to the HTN Splitter. The top cut of both the splitters will join and the combined stream will be fed to the Stabilizer Column to stabilize high RVP of the combined stream. The stabilizer bottom after RVP reduction will be sent to Gas Cracker Feed Pool where the HTN from MSU and Cold SRM Stream bypassing the SRN Splitter will also join. The bottom streams of both the splitters and the stabilizer top will join for the surplus Naphtha Pool. The splitters and the stabilizer column will be provided with reboiler, over-head air fin cooler and the overhead accumulator. Apart from these, feed effluent exchangers and product run down coolers will

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be provided for each column. The heating medium for the reboilers are MP/LP steam and condensate generated from the reboilers will be diverted to CPP.

Feed to NSU

Stream	Stream Description	Rate, TMTPA
1	Hot SRN ex CDU/VDU as SRN Splitter feed	51.135
2	Cold HCN ex-hydrocracker as HCN Splitter Feed	152

Feed Directly to Gas Cracker Feed Pool

Stream	Stream Description	Rate, TMTPA
3	HTN ex-MSU to Gas Cracker Feed Pool	46
4	Cold SRN ex-CDU/VDU to Gas Cracker Feed Pool	39.858

Product

Stream	Stream Description	Rate, TMTPA
5	SRN Splitter Top	15.336
6	HCN Splitter Top	72.215
7	Stabilizer Bottom	75.3

Final Product

Stream	Stream Description	Rate, TMTPA
8	Gas Cracker Feed	161.158

Power & Utility Requirement

- a) Power : 200 KW
- b) MP Steam : 9.3 MT/Hr (Surplus steam from refinery network will be used)
- c) Additional Cooling water make-up requirement will be 3-4 m³/hr (Circulate rate is 150 m³/hr)

BASELINE ENVIRONMENTAL STATUS

LAND ENVIRONMENT

Land Use Pattern

The proposed NS project would be established within the battery limit of CDU/VDU Unit area within the existing NRL complex. Thus, there would no change in land use pattern.

Topography

The topography of the project site as well as study area falls in the category of flat terrain and uneven slopes. Geologically the site area is covered by quaternary alluvial sediments comprising sand, silt and clay. The terrain of the study area within 10-kms radius is almost flat but it becomes hilly towards the southern side except fairly wide flat valley along the Dhansiri River.

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Geology

Geologically, the district is underlain by Quaternary formation followed by Archaean group of rocks. The hard crystalline of Archaean age covers extreme southern boundary of the district merging with Karbi-Anglong district. The rock types are granite gneiss and quartz.

Soils

The most important characteristic of the soil of Assam is its acidity. The soils of the northern bank of the Brahmaputra are less acidic than those of the southern bank. The pH value of the aqueous suspension of soil varies from 4.5 to 6. There are infertile tracts so far as tea is concerned within the tea zone, where the pH values may be as high as 7.6 to 8. This is a common trend of the soils of Assam.

Soil Characteristics

In order to evaluate the physico-chemical characteristics, 6 sampling locations were selected to represent various land use conditions in the study area. Out of six locations, two locations were selected within NRL complex and four locations were identified from the villages located around the NRL complex. The texture of soils from all the locations was Silty Clay to silty loam. Sand contents in the samples were observed in the range of 16.4 to 45.6%. Silt contents in the samples were observed in the range of 23.3 to 51.6%. Clay contents in the samples were observed in the range of 4.0 to 42.6%. Moisture content of soils was observed in the range 4.2 to 7.5%. Bulk densities were observed in the range 1.06 to 1.8 gm/cc. The pH of the samples ranged between 5.8 and 6.7. Electrical conductivities were observed in the range of 364 to 1576 $\mu\text{s}/\text{cm}$. Level of Organic Matters was observed in the range of 0.72% to 1.18%. Level of Nitrogen as N ranged between 4.2 Kg/ha and 5.9 Kg/ha, level of Phosphorus as P_2O_5 ranged between 2.0 Kg/ha and 2.5 Kg/ha, and level of Potassium as K_2O ranged between 0.12 Kg/ha and 0.28 Kg/ha.

CLIMATE & METEOROLOGY

Climate

The climate of Numaligarh and its surrounding areas is sub-tropical with hot and humid weather prevailing most of the summer and monsoon months. The winter months are cool and comparatively dry with cold nights and heavy mists. The winter season is usually the healthiest period of the year. The normal annual rainfall in the area is around 1898.8 mm. The atmosphere of the area remains humid even during the non-monsoon months and relative humidity also remains comparatively high during these months. About 85.7% of the rainfall is recorded from April to October. The rainfall is minimum (13.5 mm) during the month of December and is highest (330.7 mm) during the month of July. Out of 365 days in a year, number of rainy days is about 102. Annual Mean humidity is recorded 82% during evening hours and about 68% in morning hours. January is the coldest month, with the mean daily maximum temperature at 23.6°C and the mean daily minimum at 9.7°C. June is the hottest month and temperature decreases with the arrival of monsoon in the area in the middle of June. Predominant wind direction of the area during the year is north-west followed by south-east and north-east. Wind speeds are generally low during the post monsoon and winter months while they are comparatively high during summer and monsoon months. Baseline environmental data generation with respect to meteorological

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parameters was carried out from December 2007 to February 2008. Minimum temperature recorded during study period is 10°C while the maximum temperature was recorded as 34°C. The relative humidity during the study period has been recorded in the range of 37.1 to 95.1%.

AIR ENVIRONMENT

To evaluate the baseline status with respect to ambient air quality, an ambient air quality study was conducted at 6 locations for one season from December 2007 to February 2008. Six sampling locations were selected for ambient air quality survey. Out of six sampling locations, one was selected within NRL complex and remaining five locations were selected beyond the boundary of NRL complex within the study area. The survey was conducted with the frequency of two days per week per station to evaluate 24-hours average concentrations of SPM, RPM, SO₂, NO_x, HC and 8-hourly average concentration of CO. The summary of the observations made during the survey period is as follows:

Pollutants	Range		Average		98 th Percentile	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Industrial Area						
SPM, µg/m ³	98	143	-	114	-	140
RPM, µg/m ³	22	33	-	29	-	33
SO ₂ , µg/m ³	5.1	6.7	-	5.9	-	6.7
NO _x , µg/m ³	5.4	8.6	-	7.3	-	8.6
CO, mg/m ³	0.42	0.84	-	0.66	-	0.83
HC, ppm	0.50	0.62	-	0.56	-	0.61
Residential Area						
SPM, µg/m ³	52	177	79	142	117	171
RPM, µg/m ³	12	42	25	31	30	38
SO ₂ , µg/m ³	5.1	8.9	5.7	7.1	6.4	8.7
NO _x , µg/m ³	5.3	9.5	6.3	8.1	7.2	9.4
CO, mg/m ³	0.03	0.61	0.07	0.52	0.18	0.61
HC, ppm	BDL	BDL	BDL	BDL	BDL	BDL

Thus, it may be concluded that the concentration of all the pollutants are well within the permissible values prescribed under National Ambient Air Quality Standard (NAAQS).

WATER ENVIRONMENT

To evaluate the water environment around NRL refinery, a water quality survey was conducted for a period of three months from middle of December 2007 to February 2008. The characterization of surface water quality was obtained by conducting a survey during the study period at four locations. The observations of the survey revealed that there was great resemblance with respect to the characteristics like pH, temperature, turbidity, colour, odour, BOD, COD, TDS and heavy metals, etc. and all the parameters for all the surface water samples are well below the limits specified under IS:10500.

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The characterization of ground water quality was obtained by conducting a survey during the study period at six locations. The ground water characteristics observed during the study period has shown wide variations with respect to all the parameters like TDS, Total Alkalinity, Total Hardness, Calcium Hardness, Chloride, Sulphate and Iron etc. The concentration of iron in all ground water samples exceeds the desirable and permissible limits of Drinking Water Standard IS: 10500.

The analysis results of ground water samples collected from different locations reveals that ground water is suitable for domestic, irrigation and industrial purposes. Ground water from shallow aquifer has slightly higher pH whereas ground water from deeper aquifer is slightly acidic in nature. The high concentration of iron beyond permissible limit in ground water has been found in some areas, which can be lowered by aeration and filtration method. However, NRL doesn't use ground water for any purpose.

NOISE ENVIRONMENT

To evaluate the ambient noise level of major noise sources inside NRL complex as well as outside refinery complex, a study was carried out during the months of December 2007 to February 2008.

The 24 hour Leq values of noise level in main Units was recorded in the range of 59.5 dB(A) to 61.5 dB(A). The noise level recorded during day time was in the range of 54.1 to 70.0 dB(A) and the same was found in the range of 46.8 to 60.5 dB(A) during night time. It is concluded that the observed noise level values of the plants located within NRL complex are in compliance with and well below the noise level standards for industrial areas.

Monitoring of ambient noise level was also conducted in the areas located beyond refinery complex namely NRL town, Bishnupur, Rong Bong, Khumtai, Pura Bangla, and Lattakoojan villages. The observed noise level values of the above areas located outside the refinery complex are in compliance with and well below the noise level standards for residential and rural areas.

SOLID & HAZARDOUS WASTES

There would be no generation of solid and hazardous waste from the proposed NS project.

ECOLOGY

The Numaligarh Refinery is located in ecologically sensitive area. The refinery and its township as well as the surrounding areas are covered with natural vegetation, tea gardens, paddy fields representing a remote rural area look. Total geographical area of Golaghat district is about 3502 Square Kilometre, out of which about 1035 Square Kilometre which works out as 32% of total area, is covered by forest including Reserved Forest, Protected Forest and Unclassified Forest.

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.

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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 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 Eco System provides a natural habitat for butterflies to come, stay and breed in their natural way.

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.

Fauna

Dense forest in Golaghat district supports the wildlife habitat. Dhansiri and Kaliani 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. Also animals mainly are House rats, Bats, Jungle Cats, Leopard Cats, Squirrels, Monkey, Python and other variety of Snakes. The most common birds in this region are Hill mayna, green pigeon, Emarlad, 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.

Avi-fauna

The typical sub-tropical monsoon climate has resulted in abundant green field and the dense vegetation has provided the habitation of several bird species. The most common birds in this region are Hill Maina, green Pigeon, Doves, Parrots, etc.

Aquatic Fauna

The rivers Dhansiri and Kaliani, 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 (Hypphthalmichthys 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.

SOCIO-ECONOMIC ENVIRONMENT

The study area covers about 56 villages, out of which 52 villages falls under Golaghat PS and 4 villages 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 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.

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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 labourers 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.

SOCIAL WELFARE ACTIVITIES UNDERTAKEN NRL

With a strong commitment to improve the lives of the people in the neighbouring areas through innovative and people friendly initiatives, NRL continues its various schemes involving local bodies and government departments essentially aiming all the basic amenities.

As Corporate Social Responsibility (CSR) remains one of the principal objectives of the company, NRL is committed towards improving the quality of life in the society in general and that of the local community in particular. NRL has continued to shoulder responsibility in the sphere of community development through the process of implementing a number of Social Welfare Projects. A recent development is the setting up of gender budgeting cell which ensures the women are benefited from the schemes implemented by NRL in the area of community development.

IDENTIFICATION AND PREDICTION OF IMPACTS

Land Environment

The impacts of the proposed facilities during operation stage are as follows:

- No solid raw material shall be used in the proposed NS project. Hence, carry-over of raw material to land or water bodies does not arise at all. Thus, no impact on land environment is envisaged during handling of solid raw material.
- The quantity of wastewater due to proposed project shall be negligible which shall be treated in the existing Effluent Treatment Plant. As a measure of conservation of water, there would no discharge of treated wastewater outside NRL boundary and would be used within the NRL premises for various activities like horticulture, etc. Zero Discharge of treated effluent from NRL has been achieved since October, 2006 and would be continued. Thus, no impact due to disposal of treated wastewater is envisaged.

It is, therefore, concluded that the proposed facilities do not have any impact on land environment.

Air Environment

Practically there would be no direct emission from the process of the proposed NS project. However, there would be minor fugitive emissions which will be within prescribed limits.

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Water Environment

Water Requirement

Water requirement of the proposed NS project would be less than 5 m³/hr and the same shall be met from existing source Dhansiri river. Existing water requirement of the refinery is about 14,787 m³/day. Thus, after implementation of the proposed project, total water requirement shall be 14,907 m³/day. Consent for drawing from Intake well is 28,800 m³/day which is sufficient enough to meet the additional water requirement. Besides this, there is no other competing user of water from Dhansiri river in Golaghat district. As such no impact due to drawl of water is envisaged.

Waste water Generation

Wastewater generation from the proposed project shall be negligible. As such no extra load is envisaged in the existing ETP.

HAZARDOUS WASTE

There would be no generation of hazardous waste from the proposed NS project.

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 resultant noise level after implementation of the proposed facilities at boundary locations has been computed as under:

Name of Plants	Noise Levels, dB(A) at Boundary Walls			
	Day Time		Night Time	
	Min.	Max.	Min.	Max.
Crude Distillation unit (CDU)	44.6	42.4	36.9	37.7
Hydrogen unit (H ₂ U)	42.9	44.3	37.4	38.3
Hydrocraker unit (HCU)	43.4	43.4	35.5	38.6
Sulphur Recovery unit	39.9	48.4	39.5	36.4
Captive Power Plant	40.7	48.4	36.1	40.3
Cumulative Noise Level	47.2	51.0	42.5	43.3
Attenuation (Green Belt)	2.9	2.9	2.9	2.9
Net Cumulative Noise	44.3	48.1	39.6	40.4
Existing Noise Level	55.7	67.9	52.8	60.5
Resultant Noise Level	56.1	70.1	53.0	60.7

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.

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Impact on Flora

The area earmarked for proposed project is located within premises of existing refinery. The site bears a barren look and is devoid of any vegetation. After establishment of the proposed facilities of wad project, vacant spaces shall be brought under green belt area. Besides this existing green belt around factory premises shall be strengthened. Thus, Maintaining/ strengthening of existing green belt around NRL complex will have positive impact on flora.

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At present the floristic component of the area does not consist of any rare or endangered species. Thus impact on rare and endangered species of flora is not envisaged. The emission of gaseous pollutants from proposed facilities is expected to be well within buffering capacity of the micro-environment.

Impact on Fauna

As the proposed project does not envisage destruction or displacement of any fauna species, direct adverse impact on fauna is ruled out. The project proposal does not envisage cutting of trees. The existing green belt provides habitat, food and breeding area to birds, small animals and insects. Thus, a significant positive impact is envisaged.

Aquatic fauna

The liquid effluent from the proposed plants shall be suitably treated in existing ETP and shall be reused in the operational activities like CT filter backwash, greenbelt, fire fighting system, etc. No effluent is being discharged nor shall be discharged to any outside source. There is zero discharge of effluent from NRL complex since 2006. Thus, no impact on the aquatic ecology from the proposed facilities is foreseen.

SOCIO-ECONOMIC ENVIRONMENT

The proposed project would generate direct and indirect employment during construction phase. It is envisaged that about 200 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. As such it is envisaged that there would be no impact on existing demographic profile.

ENVIRONMENTAL MANAGEMENT PLAN

MANAGEMENT PLAN FOR CONSTRUCTION PHASE

Following factors shall require due consideration during construction phase:

Site Preparation

The proposed project site is already prepared to some extent and back filling is not required. However, during dry weather conditions (other than rainy season), it is necessary to control the dust nuisance caused by earth work, levelling and transportation activities by water sprinkling.

Sanitation

Facilities like water supply, sanitary toilets, rest room etc., are readily available within the NRL complex.

Construction Equipment & Waste

Care shall be taken to prevent accidental spillage of any oil from construction equipment. Combustible waste, if any, shall be burnt in Incinerator. Other wastes shall be disposed-off by adopting environmentally compatible methodology.

Storage of Hazardous Materials

The hazardous material such as, lubricating oils, compressed gases (for welding), paints, varnishes, etc. are required to be stored at the site during construction phase. Since, these materials are hazardous in nature, they shall be stored as per the prescribed / accepted safety norms.

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Solid / Hazardous Waste Disposal

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 MoEF.

MANAGEMENT PLAN FOR OPERATION PHASE

In order to mitigate the environmental impacts during operation of proposed process units at existing Numaligarh Refinery, the following measures are recommended:

Air Environment

Numaligarh Refinery is located in an environmentally sensitive area delineated by Ministry of Environment & Forests (MoEF) vide gazette notification dated 5th July 1996. As per this notification of MoEF, Govt. of India proposed to create a “No Development Zone” within a radial distance of 15 km along the Numaligarh Refinery site except towards north-west, where the “No Development Zone” extends right up to the eastern/south-eastern boundary of Kaziranga National Park.

The baseline ambient air quality monitoring carried out during study period around Numaligarh Refinery (within the study area), clearly reveals that the concentrations of SPM, RPM, SO₂, NO_x, CO and HC are well within the prescribed limits as per the National Ambient Air Quality Standards for residential as well as for sensitive areas.

Proposed Control Measures

Construction Phase

Generation of suspended particulate matter is a common phenomenon due to transportation of constructions materials. This would be mitigated by allowing the vehicles entering the NRL premises under cover. Emission of fugitive dust due to movement of heavy vehicles etc. shall be controlled by spraying water in the affected zone. Hosing down the wheels of the vehicles with water and providing washing troughs for them would further mitigate the amount of dust generated. In addition, emission of other pollutants from construction machinery using diesel driven prime movers, will be controlled by proper maintenance.

Operation 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.

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Fugitive Emissions

The proposed project does not have major equipments which may add further emission from the process. However, there would be three storage tanks and seven vessels which may add insignificant fugitive emissions of hydrocarbons. In order 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.

Water and Waste Water Management

Water Conservation Management

For conservation of water resources, following measures are taken at NRL to reduce water consumption:

- Using stripped sour water from SRU as coke cutting water and used in CCU for direct quenching of hot coke.
- Use of crude & vacuum column over-head sour water as desalter water.
- Use of hydrocracker column over-head water in high pressure water injection system.
- Recovery of steam condensate to reduce the DM water intake.
- 100% reuse of treated water (Zero Discharge) has been achieved since October 2006. Treated water is used as cooling water make-up, in fire water network and gardening of green belt.
- To recover oil from wastewater two numbers of high efficiency oil centrifuges are provided in ETP. All the treated effluent is being recycled by implanting suitable modification in ETP.

Measures to Control Water Pollution for Proposed Project

Since the proposed project is expected to generate insignificant effluent it is proposed to route the same to the existing Effluent Treatment Plant.

Construction Phase

The existing drinking and sanitation facilities available at the refinery shall be extended to the construction work force. This is necessary to reduce pollution of any receiving water body and also to prevent hazards due to water borne vectors.

Operation Phase

There would be insignificant wastewater generation from the proposed project.

Noise Environment

Noise Mitigation Measures for Proposed Project

In order to minimize adverse impact on the noise environment, due attention shall be given for implementing noise control measures:

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Design Stage

Comprehensive measures shall be taken at design stage for noise from proposed units. The measures are as under:

- The noise level at the plant boundary shall be restricted to 75 dB(A) during day time and 70 dB(A) during night time.
- Noise level shall be specified for various rotating equipment as per Occupational Safety and Health Association (OSHA) standards.
- Equipment lay-out shall be done considering segregation of high noise generating sources.
- Erection of suitable enclosure, if required, to minimize the impact of high noise generating sources.

During Construction Phase

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

- Noise emissions from construction equipment will be kept to a minimum by regular maintenance.
- Heavy and noisy construction jobs shall be avoided during night hours.

Following measures shall be adopted 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 panelling 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.

Solid Waste Management

No solid waste generation is envisaged from the proposed project.

Fire Fighting Measures

In case of fire, a self-contained breathing apparatus should be used. For small fires, dry chemical, carbon dioxide, water spray or alcohol-resistant foam should be used. Pouring water on the site of fire may be ineffective. For large fires, water spray fog or alcohol-resistant foam should be used. Straight streams of water should not be used. The containers with flooding quantities of water should be cooled until well after fire is out.

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Biological Environment

The existing 100 m wide greenbelts 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), *Mussaea ferrea* (Nahar), *Terminalia citrine* (Hilikha), *Dillenia indica* (Owtanga), *Salix tetrasperma* (Bhe), *dendrocalamus hamiltonii* (Kakobamboo), *Areca catechu* (Tamul), *Terminalia bellerica* (Bhomara), *Cassia fistula* (Sonaru), *Mangifera indica* (Aam), etc.

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 in organizing regular environmental awareness programme to bring forth the environmental management measures being undertaken and the beneficial aspects of the proposed project towards the improving the quality of life and environment.
- Social welfare activities should be improved with local bodies and the future plans of social welfare programme may be chalked out in consultation with local bodies and same shall be widely circulated to public.
- 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.

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

FIRE & SAFETY MANAGEMENT

A full-fledged fire fighting facilities is available in NRL refinery to tackle any fire contingency. Regular safety audits by internal and external auditors are carried out for improving safety performance. On-site and Off-site Disaster Management Plans have been developed and mock drills are conducted at regular intervals to keep the disaster management team in a state of full preparedness. Furthermore, refresher training programmes are conducted at regular intervals for NRL's own employees / contractor labourers as well as for tank lorry crews engaged in transportation of products to enhance their safety awareness and preparedness. The existing fire and safety management shall be extended to the proposed NS project.

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Details of First Aid and Hospital Services

Following facilities are available at NRL Hospital:

- A Medical Centre with one Doctor and para-medical staff runs in the plant round the clock to provide preliminary medical aid to accident victims. The doctor is a specialist in occupational disease, having the Associated Fellowship in Industrial Medicine from Central Labour Institute, Mumbai.
- One ambulance is available at the medical centre round the clock.
- Fully equipped 30 bedded Vivekananda Kendra Hospital at township with specialists of various disciplines and other medical staff is available round the clock. It is also a burn ward.

Quality Assurance

NRL is having a quality assurance plan which includes all reference methods for monitoring, relevant analytical technique, calibration of equipment, standard of reagents, collection and presentation of results, frequencies of monitoring, etc. This quality assurance plan will continue after establishment of proposed NS project.

Post Project Monitoring

NRL has an environmental and energy management cell headed by Sr. Technical Manager under the co-ordination of Chief of the Refinery. The post project monitoring system currently in practice at NR shall be extended to the proposed Naphtha Splitter project.

VARIOUS SOCIAL WELFARE SCHEMES UNDERTAKEN BY NRL

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 programme. 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. Every year, World Environment Day is celebrated over a week by involving people from nearby villages, students and teachers of nearby schools, college etc. Saplings are distributed to local population to develop plantation in nearby locality. Essay competition, debate, extempore speeches are organized in neighbouring schools, colleges to create environmental awareness amongst the mass.

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. The mobile hospital van of NRL Hospital is providing regular medical treatment and distributing essential medicines to rural areas of the locality through weekly medical camps conducted within 10-Kms radius. A Cervical and Breast Cancer Detection Camp is organized by NRL at regular intervals in which people from nearby villages are screened.

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

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COMPLIANCE OF TERMS OF REFERENCE:

The Expert Appraisal Committee (industry) for environmental appraisal of Industrial Projects considered the project during its meeting held on 23rd and 24th October, 2009. Based on the consideration of the documents submitted and the presentation made by the project proponent, the committee prescribed the following additional Terms of Reference for preparing Environment Impact Assessment report for the proposed Naphtha Splitter Project:

Sl. No.	TOR	Compliance Status of TORs
01.	Compliance to the environmental safeguard stipulated in the environmental clearance for the existing refinery.	All the environmental safeguards stipulated in various stages are complied with. (Details are enclosed as Annexure - I.)
02.	Method of calibration for SO ₂ analyzer.	SO ₂ analyzers are calibrated as per standard method by using standard gases. (Details are enclosed as Annexure - I.)
03.	Action plan to meet the new refinery standard issued by MoEF.	NRL has already taken necessary measures to meet the new refinery standard issued by MoEF. Most of them have been complied with and few of them would be complied soon as action has been initiated. (Details are enclosed as Annexure - I.)
04.	Execution plan for the proposed project in the existing refinery.	The proposed Naphtha Splitter Unit was conceived in the original design of the refinery and adequate provisions in CDU were kept. The execution of the NSU project has become urgent owing to an agreement with M/s BCPL to supply 160 TMTPA of petrochemical grade Naphtha. (Details are enclosed as Annexure - I.)
05.	Layout plan with marking of proposed & existing units.	Given in Annexure - I.
06.	Data on HC & VOCs in the existing refinery.	Details of data on HC & VOC are enclosed in Annexure - I.
07.	Details of safety system & procedures to be adopted during construction phase.	Details of safety system & procedures to be followed during construction phase are enclosed in Annexure - I.
08.	Risk assessment of the facilities to be installed.	Risk assessment is described in Chapter - 6 of the EIA report.