

## 5.0 ENVIRONMENTAL MANAGEMENT PLAN

### INTRODUCTION

Environmental Management Plan (EMP) is the key to ensure a safe and clean environment. A project may have taken proper pollution control measures but without a management plan to assure its proper function, the desired results may not be obtained. In view of ecological sensitivity of the project region, the stringent pollution limits prescribed by Assam State Pollution Control Board (ASPCCB) and Ministry of Environment and Forests (MoEF), M/s NRL initiated pollution prevention / control measures from the very beginning (i.e. right from the conceptual / design stage of Numaligarh Refinery).

It has been evaluated that the study area has not been affected adversely with present industrialization and urbanization. The proposed project is likely to provide new economical fillip, not only for the study area but also for the region as a whole. Mitigation measures at the source level and an overall Management Plan for the study area elicited so as to improve the supportive capacity of the study area and also to preserve the assimilative capacity of the receiving bodies.

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. Water requirement for the proposed NS project is less than 5.0 m<sup>3</sup>/hr. The amount of wastewater to be generated from the proposed project shall be minimal. However, an Effluent Treatment Plant is there for treatment of waste water up to tertiary level. The treated wastewater shall not be discharged and would be utilized for CT, filter backwash, greenbelt, fire fighting system, etc.

### 5.1 ENVIRONMENTAL MANAGEMENT DURING CONSTRUCTION PHASE

The proposed Naphtha Splitter Project (NSP) will be constructed within the existing refinery premises and there is no additional land requirement envisaged form outside for the project. M/s NRL shall take necessary steps to ensure strict implementation of occupational safety measures for the workers. Suitable safety clauses shall be included in

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individual construction contracts and the implementation of the same shall be monitored during job execution period. 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 CDU within the CDU/VDU unit area. Thus, adequate provision for NSU was kept in CDU/VDU area. The impacts of the construction phase on the environment would be basically of transient nature and are expected to wear out gradually on completion of the construction phase. During the operation stage, no significant impact on the environment is envisaged as there would be no direct emission or wastewater discharge from process.

**5.1.1 Various mitigation measures****(a) 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 foundation works for proposed facilities. During dry weather conditions (other than rainy season), it is necessary to control the dust nuisance caused by earth work, leveling and transportation activities by water sprinkling.

**(b) Sanitation**

The facilities like water supply, sanitary toilets, rest room, etc. are available in NRL complex.

**(c) 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 a controlled manner. Other wastes shall be disposed-off by adopting environmentally compatible methodology.

**(d) 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, shall be stored as per the prescribed / accepted safety norms.

**(e) Solid / Hazardous Waste Disposal**

The hazardous materials used during the construction may include petrol, diesel,

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welding gas and paints. These materials would be stored and handled according to the guidelines specified under hazardous material / wastes storage, Handling and Transportation Rules of EPA, 2000. Some of the precautions of storage and handling of hazardous materials and waste includes the following:

- Dyked enclosures would be provided where ever necessary for storage of hazardous materials.
- Diesel and other fuels would be stored in separate dyke enclosures,
- On-site recycling of all waste solvents / thinners and oils and off-site recycling of paint thinner solvent wastes and waste oil,
- Separate storage for waste paints and thinners, contaminated rags and brushes to facilitate recycling and reuse. Rags could be laundered for reuse,
- Vehicle maintenance area to be selected properly to prevent contamination of soil and ground water by accidental spillage of oil, and other wastes
- Maintaining appropriate inventory control.

## 5.2 ENVIRONMENTAL MANAGEMENT DURING OPERATION PHASE

The environmental management and safety management systems existing at NRL shall be extended to proposed NSP facilities which shall cover prevention of pollution, minimization of waste generation, conservation of resources like energy, water, feed, etc. as well as accountability of all efforts towards environmental protection. However, NRL management accords top priority to health, safety and environment issues. The safety and environmental issues are also reviewed by the Managing Director, NRL every month in functional co-ordination meeting.

### 5.2.1 Various mitigation measures

#### (a) Air Environment

Numaligarh Refinery is located in an environmentally sensitive area delineated by Ministry of Environment & Forests (MoEF) vide gazette notification dated 5<sup>th</sup> 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 sensitivity is with special reference to Kaziranga National Park, which is a home for  $\frac{3}{4}$  of total population of Rhinos in south-east Asia and contains

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largest single concentration of endangered species of wild animals like Swamp Deer, Wild Buffalo, Elephants, Tigers and Gangetic Dolphins. In view of this, some extraordinary mitigation measures for minimization of atmospheric emissions have been implemented at Numaligarh Refinery as per the directives of the statutory authorities.

The baseline ambient air quality monitoring around Numaligarh Refinery (within the study area), depicts concentrations of SPM, RPM, SO<sub>2</sub> & NO<sub>x</sub> well within the prescribed limits as per the National Ambient Air Quality Standards for residential as well as for sensitive areas. Proposed Naphtha Splitter project would not require any fuel directly. However, the following practices by NRL authorities would be continued for the protection and improvement of the environment.

- Record on sulphur balance shall be maintained at the Refinery as part of the environmental data on regular basis. The basic component of sulphur balance include sulphur input through feed (sulphur content in crude oil) , sulphur output from Refinery through products, by-product (elemental sulphur), atmospheric emissions, discharges (liquid as well as solid wastes), etc.
- Off gases from proposed units should also be treated in amine absorption and regeneration unit meant for H<sub>2</sub>S removal / sulphur recovery as currently in proactive for existing units.
- Performance evaluation of Sulphur Recovery Block (SRB) may be done on regular basis, at scheduled intervals, through monitoring of off gas flow rate, H<sub>2</sub>S concentration at inlet and outlet and efficiency of sulphur recovery process.
- Numaligarh Refinery should not be operated in case of any failure in sulphur recovery process.
- The SO<sub>2</sub> emission is expected to be low as per the details provided and usages of low sulphur fuels in combustion units. However, all the combustion units shall have to be operated and maintained at optimum conditions.
- Tangential / low NO<sub>x</sub> burners will be provided in all the proposed fuel combustion units. All fuel combustion units should be operated with minimum excess air so that fuel consumption is optimized and emission of NO<sub>x</sub> is minimized.
- Continuous online monitoring for SO<sub>2</sub> and SPM of all the stacks to be carried out as per routine practice.
- Routine stack sampling should be carried out for all the stacks barring NSP for

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monitoring flue gas velocity and flue gas temperature and also for checking concentration of different pollutants at regular intervals.

- Ambient air quality w.r.t. SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub>, H<sub>2</sub>S and CO monitoring shall be continued at the present six locations in the impact zone.
- NRL is having a digital weather monitoring station for monitoring wind speed, direction, temperature, relative humidity and rainfall with automatic data logging near Security Gate No-5. It is being operated continuously for recording micro meteorological data.
- To minimize occupational exposure / hazards, the present practice of using personal protective equipment like helmets, safety (gas) mask / safety dress, shoes etc. be ensured for all workers, engaged in operation of process units within the Refinery complex.
- The health checkups (diagnostic) for all regular employees at the Refinery complex at scheduled intervals to be maintained along with the corresponding health records. Work force deployment on rotation basis, if necessary at any particular unit.

### (b) Noise Environment

To mitigate noise pollution, the following measures are suggested for implementation in the proposed NSP:

- It should be ensured that low noise generating pumps are procured wherever feasible for proposed NS project.
- Strict implementation/ compliance of all statutory norms with respect to noise generation, occupational exposure, etc.
- Use of personal protective devices such as ear-muffs and ear-plugs should be strictly enforced.
- Noise generating sources in the plant areas should 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.

### (c) Water and Waste Water Management

#### Water Conservation

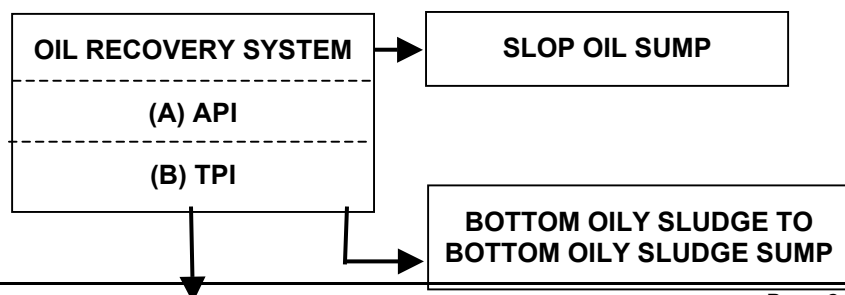
The additional raw water requirement for the proposed NS project, which is less than 5 m<sup>3</sup>/hr, would be met from the existing source (Dhansiri River). In order to conserve the water resources, the treated effluents would be reused in various activities of the refinery such as horticulture, make-up water of Cooling towers, fire water etc.

### **Water Consumption / Wastewater Generation**

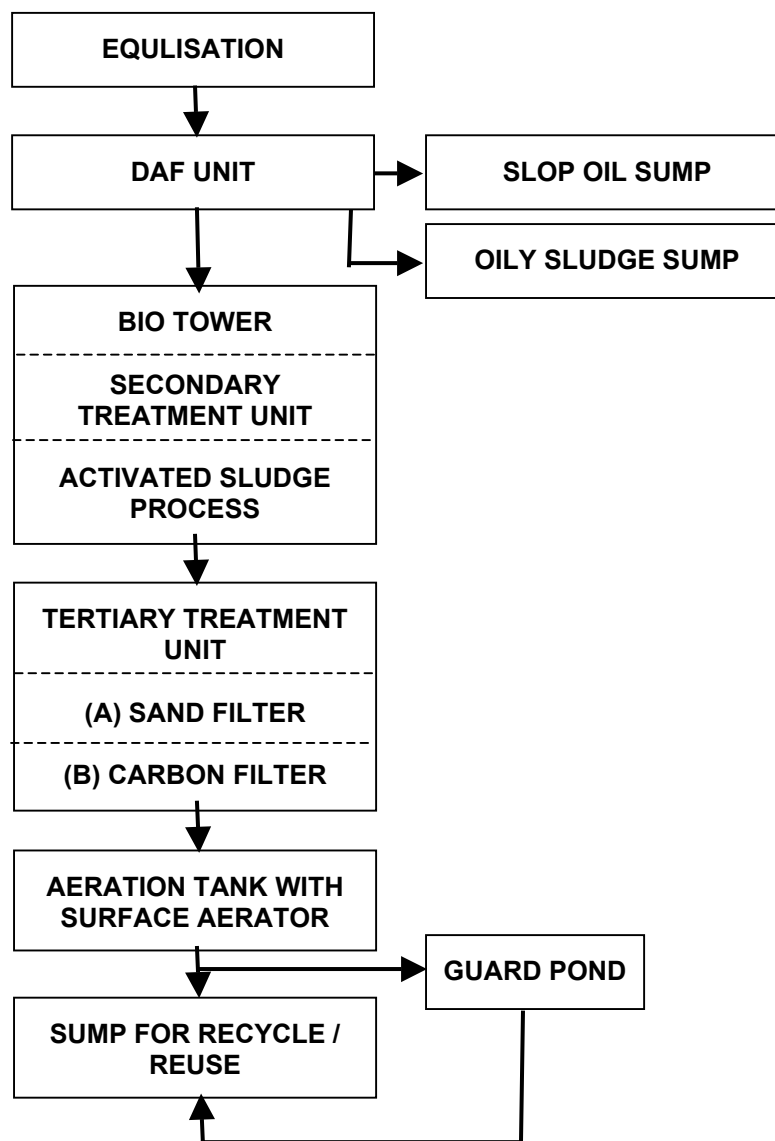
It is estimated about 14,787 m<sup>3</sup>/day water is required before implementation of NSP and 120 m<sup>3</sup>/day for proposed NS project thus, total water requirement will be about 14,907 m<sup>3</sup>/day. It would be met by existing source (Dhansiri River). Estimated waste water generation for proposed project is negligible.

The existing ETP shall be used for treatment of waste water generated from the process and it is having surplus capacity to accommodate the negligible amount of waste water generated from the proposed NS project. The treated effluent is proposed to be reused for different activities inside the Refinery. The detail record of raw water intake at Refinery (for processes, Cooling Tower makeup, fire water, greenbelt development, sanitary and drinking purposes) as well as township / CISF complex and waste water generation from different sources shall be maintained on daily basis w.r.t. flow rates and characteristics. These details would be useful in preparing comprehensive water balance at project site and also for identification and implementation of reuse / recycle practice of treated effluent at project site leading to mitigation of effluent discharge. The process block diagram of ETP is given hereunder:

### **PROCESS BLOCK DIAGRAM OF ETP (CAPACITY: 5280M<sup>3</sup> / DAY)**



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Regular monitoring of effluent and treated waste water including outlet of STP at township is recommended. Performance evaluation of Effluent Treatment Plant in Numaligarh Refinery as well as Sewage Treatment Plant at township should be undertaken at regular intervals for all relevant parameters. To evaluate the performance of the ETP, characteristics of effluent before and after treatment is given below:

**TABLE - 5.2**  
**Characteristics of effluent Streams Before & After Treatment**

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Parameters	Unit	Characteristics of wastewater	
		Before treatment	After treatment
pH		8.5-9.0	6.5 to 7.5
Colour & Odour		Blackish/ organic smell	Minimum
Oil & Grease, max.	mg/l	1000	<2.0
Temperature	°C	32	30
Suspended Solids, max	mg/l	250	15
COD, max	mg/l	1600	60
BOD (3 days at 27°C)	mg/l	750	8
Ammonia, as N	mg/l	16	4
TKN	mg/l	60	12
Sulphide (as S), max.	mg/l	4.8	<0.1
Phenol	mg/l	6.4	0.22

### (d) Solid Waste Management

There would be no generation of solid waste in any form from the proposed NS project. However, solid waste management at the existing refinery would be continued complying with statutory norms.

### (e) Biological Environment

Development of greenbelt with carefully selected plant species is one of prime importance due to their capacity to reduce noise and air pollution impacts by attenuation / assimilation and for providing food and habitat for local micro fauna. The existing 100 m wide greenbelt around NRL would be 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 recommended as follows:

- *Cedrela toona* (Poma)
- *Bischoffia javanica* (Urian)
- *Mussaea ferrea* (Nahar)
- *Terminalia citrine* (Hilikha)
- *Dillenia indica* (Owtanga)
- *Salix tetrasperma* (Bhe)
- *dendrocalamus hamiltonii* (Kakobambo)
- *Areca catechu* (Tamul)
- *Terminalia bellerica* (Bhomara)
- *Cassia fistula* (Sonaru)
- *Hibiscus microphylla* (Chamia)
- *Mangifera indica* (Aam)
- *Mallotus albus* (Morolia)
- *Melia azadirachta* (Gora neem)
- *Michelia champaca* (Titasopa)
- *Polyalthia simiarum* (Borkoliori)
- *Saraca indica* (Ashok), etc.

**Environmental Management Plan****(f) Socio-economic Environment**

Formulation of an effective EMP for smooth initiation and functioning is important to mitigate the impacts likely to arise out of the proposed NSP to maintain goodwill with local people. The support from local residents in the nearby villages around large scale industrial projects is always helpful in long term sustainability of the project. Necessary social welfare measures by NRL shall be useful in gaining public confidence depending on local needs. In view of this, the following measures are suggested:

- ☞ NRL shall continue regular environmental awareness programme to bring forth the environmental management measures being continued 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 may be widely circulated to public.
- ☞ In order to improve socio-economic status in nearby tribal area, the authority should consider extending welfare measures under the community development programme.
- ☞ Some basic amenities like education, safe drinking water supply, etc. to the nearby villages may be taken up as a gesture or goodwill.
- ☞ Regular medical checkup camps for the villager may be continued on routine basis in the villages around the Refinery with proper data record and also by providing mobile hospital services.

**5.3 ENVIRONMENTAL MANAGEMENT & MONITORING****5.3.1 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 are effectively operating and are being maintained on regular basis. The main functions of the cell are as follows:

- Co-ordination with the Production Department for proper operation of pollution control

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systems;

- Co-ordination with Central and State Pollution Control Boards;
- Routine monitoring of the efficiencies of pollution control systems;
- Routine monitoring of the quality of effluents, stack emissions, ambient air quality, noise level, etc.;
- Maintaining records and sending relevant portions of the results to State and Central Pollution Control Boards, as and when required;
- Implementation of pollution control measures.
- Implementation of safety rules and safe working procedures.
- Preparedness for tackling emergency situations arising from accidents, fire, explosion, toxic gas release, etc.

**5.3.2 Environmental Monitoring**

Environmental monitoring plays an important part in environmental management. In some instances it is beneficial to perform continuous monitoring. This can lead to rapid detection and recognition of irregular conditions and give the operating staff the possibility to correct and restore the optimum standard operating condition as quickly as possible. Environmental monitoring by regular spot checking (by manual methods), in other cases, will suffice to survey the status and performance of equipment and to record the emission levels. In general, the frequency of regular monitoring depends on process technology, type of process equipment, stability of the process, and reliability of the analytical method.

A monitoring schedule, prepared in consultation with Guwahati University, shall be maintained for the following environmental monitoring, and the test reports will be forwarded regularly to the State and Central Pollution Control Boards:

- Ambient air quality: Adequate number of sampling stations, as deemed fit by Assam State Pollution Control Board shall be established for monitoring of ambient SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub> & CO. The measurements will be performed regularly with the frequency of twice per week to evaluate 24 & 8 hourly concentrations
- Stack Emissions: For evaluation of flow, temperature, pressure, moisture, PM, SO<sub>2</sub>, NO<sub>x</sub> & CO in the stack gases, appropriate sampling ports with approach ladders and working platforms shall be made in all stacks during the construction phase. If

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directed by ASPCB, automatic continuous analyzers shall be installed in the stacks attached to the plants for monitoring of flow, temperature, moisture and particulate matter, and in the boiler stack for monitoring of flow, temperature, NO<sub>x</sub>, SO<sub>2</sub>, & CO.

- Wastewater Streams: Monitoring of wastewater streams shall cover all parameters specified by Assam State Pollution Control Board, with special emphasis on pH, Suspended solids, Dissolve Oxygen, COD, BOD, Oil and Grease, TKN, Total Ammonical Nitrogen, , and Nitrate Nitrogen.
- Regular analysis of influent and effluent of waste water treatment plant is recommended. Sampling and analysis of wastewater from individual treatment units may be carried out once in a week..
- Methods prescribed in “Standard Methods for Examination of Water and Wastewater” prepared and published jointly by American Public Health Association (APHA: 21<sup>st</sup> edition, 2005), American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF) and the manual on Water & Wastewater Analysis published by NEERI, Nagpur are recommended. A well equipped Central Plant Laboratory, ETP Laboratory and WTP Laboratory exist in NRL and all relevant physico-chemical parameters can be routinely analyzed in these laboratories.
- Ground water quality: Under this, ground water samples from 04 locations (near by secured land fill area) representing the site, collected and characterized for all parameters specified under IS:10500, with a frequency of once every month.
- Noise level: Noise generated by different noise sources and noise level within work zone & near boundary walls shall be measured with a frequency of once in three months.

### 5.3.3 INITIATIVES TAKEN TO CONTROL ENVIRONMENTAL POLLUTION

In its endeavour towards protecting and caring for the environment in every step of its sojourn, NRL has adopted a very advanced and comprehensive steps towards controlling pollution, essentially the stepping towards environment protection. These features were incorporated at the very nascent stage of project conceptualization and have been important corner stones, on which, the refinery stands today, modern efficient and yet econ-friendly in true sense.

#### Environment Friendly Process & Equipment

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Selection of process technologies and equipment was done with special care for environmental protection. Hydrocraker technology had been incorporated to produce the low sulfur products. Equipment like low NO<sub>x</sub> burners and low noise rotary equipment were considered during the time of equipment selection.

### **Minimum Generation of Waste**

In-built measures had been adopted to minimize and control pollution and generation of waste in all the units with proper collection and disposal system.

### **Adequate Segregation and Centralized treatment facilities**

Adequate segregation, collection and treatment facilities for wastewater for centralized treatment has been provided to meet the stringent standards laid down in MINAS.

### **Use of River Ways**

River ways was used for the movement of over weight consignments (OWS) and over dimensioned consignments (ODC) of project equipment.

### **Diversion of National Highway No-39**

To reduce congestion and ensure safety for traffic on NH-39, a portion of highway parallel to the refinery has been diverted by constructing a bypass road.

### **Unique Ground Flare System**

To avoid any adverse impact of the flare on animals in Kazaringa National Park, non-illuminating ground flare has been incorporated which is one of the firsts in the country.

### **Sulfur Recovery Plant**

In spite of processing low sulfur Assam crude (having only 0.26% sulfur) a Sulfur Recovery Plant has been incorporated and installed, which is the first amongst the refineries using sweet Assam crude.

### **Installation of Display Board**

Installation of display boards in the main gate for displaying environmental parameters of the refinery to the general public.

Magnetically operated electronic display board for displaying the on-line stack emission parameters from all the major stacks of the refinery has been installed at the main gate.

Manual display boards, both in Assamese as well as in English have been put at outside of the refinery gate for displaying various environmental parameters.

Installation of another display board for displaying parameters of online ambient air

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monitoring and quantity of hazardous waste generated as recommended by OISD.

**Fugitive Emission Monitoring**

To prevent loss of hydrocarbon, regular monitoring of passing valves and fugitive emissions are carried out throughout the year.

**5.4 Energy Conservations Measures Taken**

As a part of NRL's continual efforts towards energy conservation, the following new ENCON schemes have been taken up for implementation:

The salient features of ENCON's schemes are as follows:

- NG utilization project for replacement of naphtha as fuel in GTG and replacement of naphtha both as feed and fuel in H<sub>2</sub>U and replacement of fuel in refinery furnaces.
- 12 MW STG (Steam Turbine Generator) for utilizing surplus waste steam and recovering power from PRDS (Pressure Reducing Device Station) is in advance stage of implementation. This project is expected to recover around 14000 MWH of energy through PRDS as well as utilization of total surplus steam of the refinery.
- Substantial energy saving by cleaning of Fin Fan Coolers finned tubes in Hydrocracker Unit by application of Foam Cleaning Technique was achieved. Cleaning of Fin Coolers of other units also done by similar cleaning method in RTA 2008.
- Continual use of Energy Master in air compressors of CPP for better energy management.
- Continual benefit from the unique Step Less Control System implemented in the make-up gas compressor of the Hydrocracker Unit during the year 2006-07. This has saved around 600 MT of fuel per year. This has also improved the energy efficiency of the machine as well as the operational convenience. NRL has bagged the prestigious TERI award for best Energy Management with the above mentioned Stepless Control System as case study.
- Regular monitoring of all the valves connected with flare system for any passing by Acoustic Leak Detector was carried out throughout the year and timely detection and rectification of such passing valves had resulted in the saving of substantial amount of process/fuel gas from flaring.
- Fugitive emission survey for detecting and rectifying any minor leak from valve

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glands, flanges etc. was carried out on regular basis throughout the year by using Gas Measuring Instrument (GMI).

**5.4.1 Energy Conservation Measures Planned**

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.

**5.4.2 Ecological Commitments**

A valley like area (90 Bighas) on west side of NRL Township has been developed by NRL as butterfly park comprising core zone and buffer zone. This park represents the floristic diversity of north-east India with overall plantation of about 66,000 floristic plants.

**5.5 FIRE & SAFETY MANAGEMENT**

Full fledged fire fighting facilities are available in the 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

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preparedness. The existing fire and safety management shall be extended to the proposed NS project.

**Fire Preventive Measures**

- Alarm/ detection system have been installed in strategic locations of the refinery.
- Fire proofing of supports of LPG sphere and other structure is provided to prevent its collapse in case of fire.
- Predictive maintenance like thickness measurement of coke drum and pre-reformer tubes are done.
- Gas and hydrocarbon detector provided in plant area to detect leakage.
- Work permit system is being strictly adhered to in all operational areas.

**Fire Fighting Measures**

The following fire protection facilities are available to combat the emergencies and depending upon the type of emergencies, any one or combination of the facilities are applied:

- a. Fire Water System
- b. Carbon Dioxide System
- c. Foam System
- d. First Aid Fire Fighting Equipment
- e. Mobile Fire Fighting Equipment
- f. Fire / Gas Detection and Alarm System

**a) Fire Water System**

Following facilities are available in NRL:

- Two Fire Water Reservoirs of combined capacity 14,000 m<sup>3</sup> are provided to meet the water demand of two major fires at a time. These are further connected to Raw Water Reservoirs of capacity 24,000 m<sup>3</sup>.
- Four electric motor driven pumps, four diesel engine driven pumps and three jockey pumps are provide in Fire Water Pump House.
- Around 25-Kms fire water network with residual pressure of 7 Kg/cm<sup>2</sup> athe remotest point laid with 554 hydrant points and 104 monitors inside the refinery.
- Deluge sprinkler system and remote operated valves are provided in LPG storage facility.

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- Three nos. of foam cum water tenders and one DCP tender with crew is always ready at Fire Station.
- All hydrocarbon storage tanks have been provided with water spray cooling system and foam pourer system.
- High hazard area and hot oil pumps in the refinery have been provided with water spray system.
- Portable fire extinguishers as per OISD norms are placed at each unit and off-site areas.

**b) Carbon Dioxide System (In CPP)**

The fire extinguishing system for protection of Turbo set is housed in an enclosure by total CO<sub>2</sub> flooding system separately for turbine and generator of turbo set. The fire detection system is separately provided in CPP control room and other areas to actuate the system of fire protection/ fire fighting in turbo set. The system has two types of fire detectors:

- Ionization Smoke Detectors BJ-31
- Photo Electric Smoke Detectors BH-31

There is also manual call point for initiating manual fire alarm detection located in each protected area. In the event of fire out-break in any particular area, the detectors located on the ceiling of the particular area will sense the fire and annunciate the same in the annunciation panel. In case of human detection when a particular call point is actuated under fire, also annunciate the main fire alarm panel of BS-100.

**c) Foam System**

Two types of systems are in use:

- **Semi Fixed Foam System:** In this system foam solution is supplied through mobile foam tender to fixed piping system connected to foam makers of tanks (vapour seal box in case of cone roof tanks).
- **Mobile System:** Mobile system includes foam producing unit mounted on wheels to supply foam through monitors to the burning surface.

**d) Fire Aid Fire Fighting Equipment (Fire Extinguisher)**

First aid fire fighting equipment (extinguishers) provided in process units, Off-sites,

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Utilities and building etc., are of following types:

CO<sub>2</sub> Type : 6.5 Kg and 9.0 Kg capacities.

DCP Type : 75 Kg and 10 Kg capacities.

Halon Type : 5 Kg capacity.

### e) **Mobile Fire Fighting Equipment (Fire Tenders)**

- Foam cum water tenders (3 Nos.): Each foam tender has one water tank and one foam tank of 2600 KL and 3000 KL capacities. The tenders are equipped with public address system, siren and other accessories.
- DCP Tender – 1 No.
- Mobile Oil Spill Recovery Unit – 1 No.

### f) **Alarms**

- The process control and tripping logic including alarm and warning are provided in the control system (remote & local) through sophisticated PLC for all the plants.
- The Co Generation Plant has a dedicated Fire Detection and Suppression System for automatic control of fire. The refinery Fire Detection and Alarm System covers the refinery and marketing terminal, having data gathering fire alarm panel (DGFAP) in different sections. The rest of the refinery is networked with manual call points.
- Automatic/ Manual Sire System covers refinery, NRMT and township for communication in case of major emergencies.

### **Communication Facilities available during Emergency**

The following facilities are available in NRL refinery:

- a) P&T Telephones: Individual telephone connections, both in office as well as residence, to all key persons of the refinery.
- b) Intercom System for refinery with 800 lines, covering all offices, control rooms, process units and off-site areas etc., and other strategic locations like main gate, material gate, watch towers etc.
- c) Intercom system with another 500 lines connecting the quarters, offices, security

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main gate of township.

- d) Multi-channel mobile VHF station, seven nos. of base stations and VHF hand sets.
- e) Public address system to Central Control Room with all units and fire station
- f) E-mail facility
- g) V Sat facility

### Details of First Aid and Hospital Services

Following facilities at NRL:

- 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 special in occupational diseases, 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.
- The Onsite and Off-site Mock drills are regularly conducted at NRL as per the following schedules:

Minor fire mock drill	:	Monthly Once
Major fire mock drill	:	Quarterly
On-site Mock drill	:	Half-yearly
Off-site Diaster Mock drill	:	Yearly.

## 5.6 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.

## 5.7 Post Project Monitoring

NRL has an environmental and energy management cell headed by Sr. Technical Manager. The post project monitoring system currently in practice at NRL shall be extended to the proposed NS project, especially monitoring of atmospheric emissions, noise sources and waste water generation along with occupational health and safety

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aspects for the workers.

NRL has won many awards in the area of excellence for energy conservation performance, environment and safety management, Corporate Environment Award (TERI corporate award), etc. since 2003 to 2008. Thus, the environmental management has been the part of company's policy. The ambient air quality monitoring around existing Numaligarh Refinery is being done by Guwahati University. Stack monitoring is being done by online continuous analysers. Effluent quality is being monitored by in-house laboratory using sophisticated equipment. In near future, environmental monitoring laboratory may be strengthened & Numaligarh Refinery complex to undertake post project environmental monitoring w.r.t. air, noise, water, waste water, solid waste along with work environment quality and socio-economic aspect. Regular environmental audit studies are also conducted by NEERI with the objective of conservation of natural resources. This practice shall be continued.

## 5.8 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 neighboring 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 neighboring 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 checkup 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.