Introduction

The petrochemical facility of Haldia Petrochemicals Ltd. (hereafter referred as HPL) is situated at Haldia in Purba Medinipur District of West Bengal. HPL was founded in 1985, a joint venture project promoted by the West Bengal Industrial Development Corporation, the Chatterjee Group and the TATA group. Majority of the shareholding of the company is currently held by The Chatterjee Group. HPL' petrochemical facility began it's commercial operation in 2001 with 420 KTA ethylene production. Presently, HPL's facility operates at a capacity of 700 KTA ethylene production.

Haldia is located 125 South West of Kolkata and is connected by National Highway (NH6 till Kolaghat and the NH 41). The HPL Plant has good accessibility through roads, railway and through an adjoining port. There is a link road approximately 4.22km in length that connects HPL Plant with NH-41. Silpaprabesh Railway Station is within 1km of the HPL Plant. The nearest airport is Netaji Subhash Chandra Bose Airport at Kolkata, 140km away from HPL Plant. Haldia Dock Complex is located approximately 2km South-West of HPL Plant.

Proposal

The Petrochemical Facility of HPL cracks Naphtha, to manufacture ethylene, propylene, C4 mix, Raw Pyrolysis Gasoline (RPG) as intermediates. These intermediates are subsequently used for manufacturing polymers and chemicals such as High Density Polyethylene (HDPE), Linear Low Density Polyethylene (LLDPE), Polypropylene (PP), Butadiene, Mixed Butane, Motor Spirit (MS) Euro IV, Pyrolysis Gasoline, CBFS and Benzene. Presently, HPL proposes to increase the naphtha cracker capacity from 700 KTA to 770KTA of ethylene. The additional ethylene produced would be processed into new products. The major projects under consideration are:

- Motor Spirit Capacity Expansion & Quality Up-gradation
- Butene-1 and MTBE
- Phenol & Acetone
- Polybutylene Terephthalate
- Vinyl Acetate Ethylene
- HDPE Train-3

Infrastructure Augmentation

To augment the existing and future power and steam requirements, HPL also proposes to establish a coal based captive power plant. Further, storage facilities and associated pipelines will be built as supporting infrastructure and utilities.

Following is the rationale for the expansion:

- Exploit the maximum potential of the existing design capacity and increase capacity by cost efficient debottlenecking
- Availability of requisite infrastructure for expansion
- To improve feed flexibility for better yield and economics
- To diversify the product basket and develop products to serve Indian market, which is otherwise dependent on imports
- The optimization and use of available infrastructure and associated utilities for the proposed project activity will reduce environmental impacts
- Value addition on available intermediates produced within HPL
- To build up capability to serve emerging demand of environmentally friendly fuel in the form of BS VI MS

Post expansion, the product and by-product slate of HPL will be as follows:

Sl No	Products	Existing (KTA)	Proposed (KTA)	Total (KTA)
Main Products				
1.	Ethylene	700	70	770
2.	Propylene	350	35	385
3.	Polypropylene	341	0	341
4.	High Density Poly Ethylene (HDPE)	334	160	494
5.	Linear Low Density Poly Ethylene (LLDPE)	386	0	386
6.	Butadiene	101	10	111
7.	Benzene	132	43	175[1]
8.	Butene-1	0	30.2	30.2
9.	MTBE	0	98.6	98.6
10.	Vinyl Acetate Ethylene (VAE)	0	60	60
11.	Mixed Butane	113	13	126[2]
12.	Cyclo Pentane	5.2	3	8.2
13.	Pyrolysis Gasoline	130.5	69.5	200[3]
14.	Motor Spirit (MS) Euro IV	250.6	49.4	300
15.	Phenol	0	200	200
16.	Acetone	0	123	123
17.	Carbon Black Feedstock (CBFS)	89	11	100
18.	Poly Butylene Terephthalate (PBT)	0	70	70
19.	Tetrahydrofuran (THF)	0	16	16
20.	C6 Raffinate	36.6	27.4	64[4]

Source:HPL

[1] If phenol is not operational
[2] When Butane-1 plant would be out of operations
[3] To be produced in maximum when MS is not under production
[4] To be produced in maximum when MS is not under production

Project Schedule and Cost

The proposed project will be completed within five years. The estimated cost of the project is INR 4310 crores.

Resource Requirements

Land: The proposed development will take place in the existing industrial complex of HPL Plant. Additional land will not be acquired for the proposed project.

Water: The existing water requirement is 7.73 MGD. Post expansion, the water requirement will increase by 2.57 MGD to 10.3MGD. HPL presently has anexisting agreement with Haldia Development Authority (HDA) provisions for the supply of8.4 MGD from the Water Treatment Plant at Geokhali. The existing water supply agreement with Haldia Development Authority would be suitably revised to receive assured supply of 10.3MGD raw water supply. HPL already has a dedicated water pipeline to handle 14MGD water from the Geokhali plant.

Raw Material: The major feedstock for the existing plant is Naphtha and it will remain the same post expansion. Additional Naphtha will be imported primarily from Middle East or from domestic coastal refineries as is currently done.
For new projects, HPL proposes to import Methanol, Butanediol, Vinyl Acetate, Propylene and Benzene from international market or source it from domestic market, if available.

Power:
At present HPL requires on an average 85 MW of power and 210 TPH of steam which met by Combined Cogeneration Captive Power Plant (CCCPP) The Power Plant is capable of producing 116 MW and 480 TPH of power and steam respectively. Due to the proposed expansion additional power of 19 MW and steam of 172 TPH would be required. HPL proposes to install a Captive Power Plant (3X120 TPH) and a 1X35 MW Condensing Steam Turbine Generator (CSTG) to meet the additional power and steam requirement.
The CPP is being proposed with the following objectives:

- Meeting additional power and steam requirements from proposed projects
- Create buffer capacity for future projects
- Improve efficiency and reliability of existing operations

Fuel: The existing average monthly fuel requirement is Fuel grade Naphtha (FGN) -9,000 T and CBFS -6768T. The peak fuel requirement can be equivalent to 21600T of FGN in a month. The estimated monthly fuel requirement after the proposed expansion has been estimated to be Naphtha- 9000T, CBFS-8730T and Coal 51840MT.

Manpower: At present, 829 permanent and approximately 3000 contractual employees work in HPL. Post expansion, additional 40-50 employees and another 100-150 contractual employees will be recruited.

Pollution Sources, Characterization and Control

The summary of pollution sources, their characteristics and existing controls are presented:

Emissions to Air : Air emissions from the HPL Plant occurs from several point and fugitive sources. Point source emissions primarily include emissions from boilers, crackers, process heaters and flares with the key pollutants being particulates, carbon monoxide, nitrogen oxides, sulphur dioxide. There are also several sources of fugitive emissions from the HPL plant including Volatile Organic Compounds (VOCs) comprising of alkanes, alkenes and aromatics compounds from pumps, valves, flanges, storage tanks, loading and unloading operations, and wastewater treatment facilities.

The Plant has adequate control equipment like scrubbers, low NOx burners, steam injected flare systems to reduce point source emissions and conforms to emission standards stipulated for the petrochemical industry. In addition, good design practices, equipment maintenance procedures and Leak Detection and Repair (LDR) programs are implemented in the plant to minimise leakages of VOCs from the process.

Discharge of Effluents : Several process units in Plant generate waste from process operations such as vapour condensation, from cooling tower blowdown, and from storm water runoff. Some of these waste water streams are characterised by high organic load in terms of Biochemical Oxygen demand (BOD) and Chemical Oxygen Demand (COD), oil and grease, suspended and dissolved solids and organic constituents like phenol and benzene.

The Plant operates an Effluent Treatment plant that has the capacity to treat 3600 KLD of process waste water and 490 KLD of sanitary waste through an activated sludge process treatment system involving primary and secondary treatment systems. The existing ETP has the capacity to treat the additional waste water that would be generated because of the expansion of the Plant and would not need to be augmented. The waste water discharged from the Plant meets effluent standards for petrochemical industry and after treatment flows through a drainage channel to the Green Belt Canal and finally into the Hooghly.

Hazardous Waste: The HPL Plant generates about 600 MTs of solid wastes including sludges, spent catalysts, resins, coke and caustic, distillation residues, etc. some of which are considered to be hazardous as per the Hazardous Waste Rules. The hazardous waste generated is either incinerated in existing incinerator or stored temporarily within the plant and then disposed off to the authorised TSDF (West Bengal Waste Management Ltd.) located at Haldia.

Baseline Environment

The study area for the EIA comprises of 10km radius from the boundary of HPL Plant. The primary environmental monitoring for air, noise, surface and

ground water, soil, noise and traffic was conducted through a NABL approved laboratory –Mitra S K Private Limited. The study period was October, 2016- January, 2017.

Landuse and Landcover: HPL Plant is located in the industrial area of Haldia Municipality. The major land cover in the study area are waterbody / rivers (34.91%), agricultural lands (23.62%), urban and semi-urban residential areas including homestead plantations (23.13%) and industries (5.66%).

Soil: The texture of the soil in the area is clayey and has low permeability. This reduces the potential of soil and groundwater contamination as water containing pollutants cannot penetrate through. No heavy metal or chemical contamination has been observed in soils samples collected from the study area.

Weather and Climate: The project site lies in Purba Medinipur district which experiences a tropical wet and dry climate characterized by a hot summer; high humidity nearly all year round and well distributed rainfall in the monsoon season. Tempratures vary from 9°C to 36°C, relative humidity between 24% to 99% and wind speed between 0.5 – 4.44 m/s. The mixing height for Haldia, as determined from Atlas of hourly mixing and assimilative capacity of atmosphere in India, IMD is 2200m.

Ambient Air Quality: Ambient air was monitored at 8 locations in the study area. The parameters determined in ambient air include Particulate Matters - PM_{10} and $PM_{2.5}$, Sulfur Dioxide (SO_2), Oxides of Nitrogen (NO_x), Ozone (O_3), Ammonia (NH_3), Carbon Monoxide (CO), Benzene (C_6H_6), Lead (Pb), Arsenic (As) and Nickel (Ni). Further, presence of parameters such as, 1,3 Butadiene, Hexane, Methane and Non-methane Hydrocarbon was studied in the ambient air. The results showed that except for (PM_{10}) at two locations, the concentration of other parameters was below the NAAQS. Monitored average PM_{10} concentrations in the study area ranged between 88 and 119 $\mu g/m^3$ with exceedance noted at 2 stations. At two locations i.eIt has been observed from the annual monitoring carried out WBPCB that the PM_{10} levels in Haldia during the winter season are usually reported to be on the higher side and at times exceed the standard of 24 hourly standards specified in NAAQS. The major contributors of particulate matter and other air pollutants in the study area are emissions from several other industries present in the area, fugitive emissions from loading and unloading operations at the Port, emissions from trucks and other motor vehicles, construction activities and other urban sources.

Ambient Noise Quality: Noise in dB(A) was recorded at 8 stations for 24 hours with the noise values computed as Leq (Daytime) and Leq (Night time) The equivalent noise level monitored in the commercial area of Durgachak for daytime is 63.6 dB(A) and night time is 58.8dB(A). The night time noise level in this area exceeded the standard. The equivalent noise level as measured at 5 residential areas adjoining the plant ranged between 32.7 -62.1 dB(A) at daytime and between 42-53 dB(A) at night time. The high noise level recorded

at residential areas was due to combination of industrial, traffic and other urban noise sources. The day time and night time noise level recorded at other locations were within the limits of the NAAQS.

Ground Water Quality: The concentration of majority of the parameters analysed were within the acceptable limit of Drinking Water Standard IS 10500, 2012 except for TDS, hardness, Chlorides. TDS level were found to vary between 711 – 1059 mg/l in the samples taken from tube wells in the areas adjoining to the plant. This can be attributed to saline water intrusion in the productive aquifers. The other parameters were within the acceptable limit ofthe standard. .

Surface Water Quality: Surface water has been monitored at 8 locations in streams, canals and waterbodies within the study area.

The water in the drainage channel to which the effluent discharged from the plant has high BOD levels and corresponds to Class E of Designated Best Use Category of CPCB. The waterbodies sampled in the residential areas are majorly used for the purpose of bathing and washing clothes. High BOD was reported in the sample collected from the water body at Durgachak New Colony, (10.6mg/l). Total Coliform was also reported to be more than 500MPN/100ml,

The water of the Hooghly estuary is used navigation, fishing, recreation and other purposes. The water quality as compared with standards for water quality of estuaries water systems suggests that the water could be used for these purposes.

Traffic: Traffic study was conducted at T-Junction of the link road from HPL and City Center-Manjushree More industrial road.

Traffic count was carried out on the City Center-Manjushree More Industrial link and the junction connecting HPL link road to HPL Gate No.2. It was observed that on both these roads Heavy Motor Vehicles forms majority of the traffic 904 (37.78%) and 474 (20%) respectively. The heavy traffic on the road connecting HPL Link road to HPL can be directly attributed to the HPL's plant for transporting raw materials and products while that on the HPL Link road is primarily contributed by the industrial activities linked to HPL and neighboring industries like Indian Oil-Petronas, Ruchi Soya, Gokul Refoils & Solvents, Marcus Oil, Reliance Industries, Adani Wilmar etc.

Biological Environment: The study area comprises majorly of modified ecosystems comprising of agricultural fields, mangroves, homestead plantations and green belts. Aquatic habitats present in the study area comprises of the Hooghly and Haldi Rivers and several creeks and drainage channels. However, there is no legally Protected Areas like Wildlife Sanctuary, National Park, Tiger Reserve, etc. in the study area (10 km around the project site).

Flora within the core zone (within the boundary of HPL Plant) comprises of 11 species of trees; 8 species of shrubs; 5 species of herbs and 4 species of grasses. None of the faunal species recorded or reported from the study area was endemic or threatened (Refer: IUCN: 2016-3). In the study area 3 species of amphibia, 9 species of reptiles, 68 species of birds, 10 species of mammals have been recorded. . Two Schedule I bird species viz. Black Kite (*Milvis migrans*) and Black Winged Kite (*Elanus caeraleus*) were recorded from the study area.

Socioeconomic Environment: The project footprint is spread across Haldia Municipality and the study area is spread across Haldia Municipality, Haldia and Sutahata Block, Nandigram 1Block of Purba Medinipur district and Kulpi Block in South 24 Pargana district in the State of West Bengal. The total population in the core zone (3km around the project site) is 4150 and in the buffer zone about 196677. The overall literacy and female literacy rates in the core zone were reported to be 89.31 % and 84.55 % respectively. The Worker Participation Ratio (WPR) in the core area was reported to be 32.69 % as compared to 30.84 % in the buffer area. The major occupations in the study area service in industries, cultivators and agriculture labourers.

Anticipated Environmental Impacts

The potential impacts of the project on different components of the environment are systematically identified for evaluation of significance.

Impact on Ambient Air Quality

Construction Phase

During construction phase, the sources of emission are fugitive emission from construction material handling, earth work, and emission from machinery and vehicles. The magnitude of the impact will be small as extent will be localized, limited to the construction area and access road; the scale of pollution is low.

The receptors affected due to the construction activity will be low since the footprint of the pollutants will be limited within the HPL plant. It is to be noted, the activities during construction stage will not impact upon the air quality. The receptor sensitivity is assessed to be medium. The impact significance of the proposed expansion on ambient air is assessed to be ***minor***.

Mitigation Measures

- Have specific areas earmarked for the access road
- Minimising stockpiling by coordinating excavations, spreading, re-grading, compaction and importation activities;
- Cease or phase down work if excess fugitive dust is observed, investigate source and take suppression measures;
- Proper maintenance of engines and use of vehicles with Pollution Under Control (PUC) Certificate; and
- Prevent idling of vehicles and equipment.
- Adherence to PPE's
- Water sprinkling at high dust areas

- As part of project planning, the transportation route will bypass the dense settlement of Durgachowk to reach the site.

Based on the implementation of these mitigation measures, the Significance of impact on air quality will be reduced *negligible*.

Operation Phase

During operational phase, the major sources of emissions are

- Point source or stack emission from boilers and furnaces of CPP and NCU, respectively.
- Fugitive VOC emissions from petrochemical storage tanks
- Emission from additional vehicular traffic

Point Source Emissions

The point sources of emission are the stacks at CPP and Furnace of Naphtha Cracker Unit. The stack of CPP will be connected with the three boilers (two operational and one stand-by). Embedded Control Measures at proposed CPP are the following:

- An ESP with 97-99% efficiency to reduce PM emission – helps achieve outlet concentration of 30mg/Nm^3
- Limestone dosing in boiler furnace to limit emission of SO_2- helps achieve 30-70% reduction, and will keep the emission level of SO_2 less than 100 mg/Nm^3
- Boiler Design is CBFC type with relatively low temperature (850 – 900^oC) to reduce NO_x emission less than 100 mg/Nm^3

The emissions from existing and proposed stacks have been modelled using ISCST3-AERMOD model for Particulate Matter (PM), Oxides of Nitrogen (NOx), Sulfur Dioxide (SO_2) and Carbon Monoxide (CO). The predicted maximum concentrations of PM, NO_x, SO_2 and CO due to proposed expansion is 0.21 µg/m^3 , 4.39 µg/m^3 , 1.02 µg/m^3 and 4.18 µg/m^3 at distance of 4.39 km, 6.62 km, 2.10km and 4.39km respectively. .

Fugitive VOC Emissions

The emissions from organic liquids in storage tanks were estimated using the United States (U.S.) Environmental Protection Agency (EPA) developed Tanks 4.0 model. The total VOC emissions estimated from storage tanks of HPL as derived through TANKS 4.0 was 77209.24lb/yr. Further AERMOD model was used to estimate the ground level concentrations (GLC) of VOC. The maximum 24 hourly GLC of VOCs estimated from the model is 56 µg/m^3, within the HPL plant boundary in the Southern side.

Emissions from Traffic

The 24 hour maximum incremental Ground level concentration of NO_x, PM, SO_2 and CO is predicted to be 2.41 µg/m^3, 0,03 µg/m^3, 0.75 µg/$m^3$and 4.16 µg/m_3 respectively. The GLC was reached within 20m from road centre line.

From the source apportionment point of view, prediction results show that the existing point emission sources from HPL plant have a very low contribution

to the baseline air pollutant concentrations in the study area. The incremental concentrations of pollutants due to the operation of the proposed project will also not change the existing baseline concentration significantly in the study area. As discussed above the predicted maximum concentrations of PM_{10}, NO_x, SO_2 and CO are located in the industrial area south of the HPL Plant. lie within 4.39 km,6.62 km,2.10 km and 4.39km respectively, South of HPL. The magnitude will be medium since the pollutants are expected to be dispersed beyond two kilometres but within 10km of study area. The duration will be of throughout the life of operation of the plant and hence can be considered to be long term. However, the scale of impact will be low since, very low incremental contribution from additional air pollutants emitted to the existing baseline concentration. The receptor sensitivity in these areas can be considered to be low because it already is an industrial area where the ambient levels for PM_{10} have been found to exceed NAAQS levels for two monitored locations. Hence, tThe impact significance due to the proposed project is assessed to be *Minor.*

Noise Environment

Construction Phase

Noise during the site preparatory phase will primarily be contributed by heavy construction machinery operating on site and vehicular sources. The intensity of the noise beyond the plant boundary will be low. Thus the impact is of negligible significance.

Operation Phase

The compressors, heaters, steam turbine generators, etc would be the major sources during the generation. The incremental noise level due to the proposed project was determined using SOUNDPLAN 7.2 modelling software. The result indicate that the predicted noise level will be attenuated to 40 dB(A) to 45 dB(A) outside the boundary of the plant . The incremental noise levels from the proposed project will not have any impact outside the plant boundary. Hence the impact will be of ***negligible*** significance.

Water Environment

Surface Water Resources

Construction phase

The additional water requirement for construction purpose will be met through the existing quantity of water supply. The impact nature is neutral since there is no additional demand on the water resources. The resource sensitivity is low and the impact significance is assessed to be ***negligible***.

Operation Phase

During operational stage, the water requirement will increase from 7.73MGD to 10.3 MGD. Geonkhali Water Supply Station has the capacity to supply additional 2.57MGD water, which is sourced from perennial rivers.

Surface Water Quality

Operation Phase

A peak volume of 2394m^3/day of process effluent is presently generated from existing units Post expansion, an additional 1000m^3/day of effluent will be generated. The design capacity of WWTP is 3600m^3/day and will be sufficient for handling the additional effluent generated. Effluents from HPL Plant is characterised by high organic load (BOD & COD), suspended and dissolved solids, oil and greases and some organic constituents like Phenol and Benzene. The effluent discharged would meet the standard for petrochemical industries (basic and intermediate) as stipulated by CPCB. The effluent from HPL Plant is discharged into Greenbelt Canal and routed through several interconnecting drainage channels which also receive treated effluents from other industries in the area and from urban sewage networks before draining into the Hooghly through the Green Belt Canal. The Hooghly is capable of providing sufficient dilution to the waste water streams originating from industrial sources and the receptor sensitivity is considered to be medium. Hence the impact significance is assessed to be *Minor*.

Groundwater

Operation Phase

Groundwater will be abstracted only for consumption of employees (contractual and permanent) in the three months of the summer season and would not be used for manufacturing processes. With the expansion, the increase in work force would be less than 1% compared to the existing workforce, hence the overall increase in water requirement is anticipated to be low. The significance of impact is assessed to be *negligible*.

Soil Quality

The topsoil removed from the area where the proposed units are planned will be used for landscaping. The construction debris will be used primarily as filling material in the project site HPL has a spill management plan that will be put into action to contain any accidental spills of chemical or fuel. Any accidental spillage will be contained, collected and disposed off as hazardous waste.

During operation stage, there is a risk of contamination of soil from leachate of the ash pond/ dykes, spillages from tanks. The texture of soil of the study area is clayey in nature. The permeability of these soils is low. Hence, the possibility of the leachate to permeate and contaminate underlying soil and groundwater is assessed to be low. Moreover, the ash pond will lined with HDPE liners. Also the ash pond is proposed to be used during emergency conditions only, since in normal conditions, the ash would be stored in silos and utilized as per the MoEFCC Notification S.O. 763 dated 14th September, 1999. For disposal of hazardous waste (spent catalyst, resins etc) HPL also has an arrangement with West Bengal Waste Management Limited.
Hence, the impact significance will be ***negligible***.

Land Environment

The proposed expansion project in HPL will be majorly constructed on the vacant land of existing industrial plant of HPL. No land will be acquired for the proposed project. Hence, there will be no change in the existing land use of the area.

Ecological Environment

Construction Phase

The major impacts envisaged from the proposed project in the construction phase are as follows:

- Vegetation loss/degradation due to site clearance/civil works
- Disturbance due to noise and vibration

Approximately, 1250 number of trees will be felled from western side of HPL Plant after obtaining permission under the West Bengal Trees (Protection and Conservation in non-Forest Areas) Act, 2006 and Rules, 2007. There will be minor loss of vegetation creating a short term and local level disturbance and the work will be primarily restricted to daytime only, the impact significance due to construction on flora and fauna is anticipated to be ***minor***.

Operation Phase

The impacts on ecology that are anticipated during operation phase are disturbances due to incremental pollution and noise. The overall disturbance to flora and fauna is expected to be insignificant due to minimal increase in incremental pollution load during the operation stage. Additionally, a green belt will be developed around the periphery of Coal Handling Unit. Additional trees will be planted (5 times the number of trees felled). The impact significance is assessed to be ***negligible***.

Occupational Health and Safety

Construction Phase

The impacts envisaged during construction phase on the occupational health and safety of workers is the following:

- Exposure to chemical hazards such as organic solvents, cement, adhesives, tar, asbestos, silica, etc
- Physical hazards such as heat, noise, vibration, working at heights, etc

HPL has a safety management system that will also be applicable on the construction workers. The exposure to hazards will be controlled by either of the following:

- Strict implementation of existing health and safety management system of HPL
- The duration of exposure is controlled by restricting the duty hours to 8 hours with breaks in between.
- Relevant PPE's such as anti-glare eye protective wear, gloves, steel toe shoes, harnesses, etc will be used during working

- The do's and dont's of activities such as – no smoking, no littering, etc in a Petrochemical Complex to be repeatedly reinforced through training of the contractual workers

Special controls such as vehicles plying within the facility will drive at a speed less than 30km/hr. Safety measures including usage of industrial plugs, installation of spark arrestors in internal combustion engines such as vehicles, restriction on usage of mobile is designated areas, etc. will be implemented. The duration and extent of the construction phase will be short but the any possibility of the occurrence of any hazard will lead to adverse impacts that could range from loss of productive time to loss of livelihood of workers. Hence the receptor sensitivity is high. The impact significance will be ***moderate***.

Socioeconomic Environment

Construction Phase

Project will create limited additional job opportunities during construction phase of expansion and debottlenecking of HPL. There would also be secondary employment opportunities consequent to increase in production of existing products and new products proposed to be manufactures. In addition to this, opportunities for contractual work for locals as being offered currently is expected to remain same in future. Impact on employment generation aspect is seen as positive.

Operation Phase

Project will create limited additional job opportunities during operation phase after the proposed expansion at HPL. In addition to this, opportunities for additional indirect employment for maintenance and service towards the new employees will increase. Impact on employment generation aspect is seen as positive.

Analysis of Alternatives

As the proposed project includes expansion within the existing plant area, alternative site analyses have not been considered.

Risk Assessment and Emergency Response Plan

The review of the RA results for storage tanks indicates that in most of the scenarios involving leakages leading to Pool/Jet Fire, the risk significance assessed to be **"*Low*" ;** however for failure of storage tanks and spheres bearing ethylene, propylene, butane-1, benzene, cyclopentane, pentane, hexane and motor spirit the risk is assessed to be as **"*Medium*"** . For scenarios with low risk significance, the effective distance for damage in terms of radiation intensity is found to be primarily in the range of 13m-91m, Hence, damaging effect is evaluated to be limited to neighbouring process equipment's and machineries, and may include occupation injuries/fatalities to site personnel and workers operating in the immediate vicinity. These risks can be mitigated through well-established controls viz. taking suitable measures during design, installing adequate fire and gas detection system,

firefighting system, creating training and awareness sessions and organizing periodic ONSEMP (Onsite Emergency Preparedness Plan) to check effectiveness of existing system.

For medium risk significance, catastrophic failures of highly flammable chemical and fuel storage tanks were found to result in VCEs and/or BLEVE. For VCEs, the maximum blast overpressure of 8.0 psi did not exceed the LOC in all cases except for hydrogen bullet (~17m). The blast overpressure of 3.5 psi (which may cause serious injury) was computed to be manifested within a radial distance of 112m to 1400m. With respect to BLEVEs modelled for spherical storages of ethylene, propylene etc. the maximum damaging effect from thermal radiation intensity (10 kW/m^2)was found to range within 530m to 1200m leading to potential lethal effects.

Environmental Management Plan

HPL Plant is an operational industry. An established environmental monitoring is in place, periodic reviews and audits are carried out for effective environmental management system and the same shall be strengthened and extended for the proposed project activity. Additional mitigation measures for the operational phase of the project have been provided below:

Air Quality Management Plan

- Stacks having sufficient heights (140m and 40m for boilers of CPP and furnace of NCU respectively) as per statutory norms to ensure dispersion of pollutants;
- The emissions from the point sources shall be as per norms stipulated by WBPCB/CPCB/MOEFCC.
- The proposed ESP should run as per recommended efficiency to maintain particulate emission at stack outlet limited to 30 mg/Nm^3 to ensure conformity to the "Charter of Corporate Responsibility for Environmental Protection (CREP)" recommendation of the MOEFCC, Govt. of India.
- Performance evaluation of the pollution control systems will be undertaken at planned regular intervals;
- Oxygen monitors will be installed in the furnaces for optimizing oxygen consumption and minimizing thermal NOx generation;
- Ultra Low NO_x burners will be used in boilers
- Gas LEL detectors and alarms will be installed for VOC measurements;
- The new units shall be connected with the existing closed loop flaring system;
- Vapour recovery system at the product loading area shall be maintained and shall be extended to the proposed project as well;
- Fugitive emissions to be monitored regularly and records to be maintained. The existing protocol of LDAR monitoring will be extended to the proposed project as well;
- HPL would install online PM analyser in the CPP stack to monitor and control particulate emission.
- Coal and fly ash/bottom ash should be transported in closed containers

- Adequate steps e.g. internal floating roof tank, provision of mechanical seal of pumps etc would be adopted for reducing fugitive emissions of VOCs:

Noise Quality Management Plan

- Selection of the new equipment's should be made with specification of low noise levels, wherever possible
- Acoustic laggings and silencers, sound proofing/ glass panelling etc. shall be provided at critical operating locations
- Regular maintenance of machinery should be undertaken to mitigate the noise generation. The existing maintenance schedule shall be extended to the proposed project activities also
- Employees should be provided with personal protective equipment's such as ear plugs or ear muffs
- Noise monitoring shall be carried out on a weekly basis all around the periphery of the HPL facility & records maintained
- Workplace noise levels for workers shall be as per statutory limits

Water and wastewater Management Plan

- The storm water drain network must be maintained in good conditions;
- The additional effluents generated from the proposed project activities shall be treated in the existing WWTP
- The effluent discharged from the WWTP would meet the standard for Petrochemicals (Basic and Intermediates) and the Consent conditions.
- Rain water percolating through the open coal stock pile would be collected and settled in a pit and finally be pumped to the Plant drainage channel.
- Additional cross drainage structures will be created at the construction material handling site.
- Periodic cleaning will be undertaken of cross drainage structures and road drainage system to maintain uninterrupted storm water flow.
- Ash disposal would be in solid form. High Concentration Slurry Disposal system is only for Emergency arrangement and emergency precautions would be taken

Hazardous Waste Management Plan

- As is the present practice , additional Used/waste oil/spent catalyst to be sold to registered recyclers/re-processors approved by MoEFCC/WBPCB
- Containers which can not be decontaminated by the unit and purge oil or fuel oil filters will be disposed to the authorised TSDF facility having valid consent to operate and authorization of WBPCB.
- Oil impregnated coke and resin are incinerated in the captive incinerator of HPL plant
- Annual details of hazardous waste generated, stored and disposed should be submitted in Form IV to WBPCB every year as practised.

Project Benefits

The following benefits are expected from the proposed project:

- Majority of the offsite and other infrastructure facilities required for the petrochemical manufacturing and production are already available

through the existing HPL facility. Therefore, the proposed expansion would result in enhanced production, with minimum investment on supporting facilities than that required for setting up a stand-alone manufacturing unit.

- The increase in production of intermediates and products and by-products such as ethylene, HDPE, VAE, Phenol and acetone, etc will cater to the increasing demands for petrochemical products within the country and will also help in reducing the import bills. This will enable meeting the gap in demand and supply of petrochemical products in the country.
- The proposed project at HPL is expected to generate additional direct and indirect employment opportunities. Local people will be preferred for employment based on their skill sets available.

Conclusions

HPL intends to undergo expansion of its existing units owing to the maximum exploitation of design capacity of it's Naphtha Cracker Unit. The expansion activity will lead to increased production of its intermediates i.e Ethylene and Propylene. The expansion process would also enable HPL to manufacture additional new products. To augment the existing power supply and to meet the future requirement, a coal based power plant has been proposed. These proposed project activities shall be carried out within the existing HPL premises in Haldia, West Bengal.

The present impact assessment study indicates that the overall impact from the proposed expansion project will be short term, reversible, localised and are not expected to contribute significantly to the surrounding environment. Also, with the implementation of the pollution control and strengthen the existing environment management measures, these anticipated impacts due to construction and operation of the proposed project will be mitigated.

HPL will also ensure that the environmental performances of all the activities are monitored throughout execution of the project during both construction and operation phase. Monitoring will include quantification of hazardous waste generated during construction phase, noise generated due to construction activities, etc. Similarly, during operation phase monitoring will be carried out for stack emission, quality of treated effluents, noise levels, hazardous waste generated and disposed etc. as presently being followed and verify that they meet the prescribed standards. HPL will continue to report environmental performance and submit monitoring reports regularly to statutory authorities.