

Area-wide Environmental Quality Management Plan for Haldia

Haldia is one of the most rapidly growing industrial towns in West Bengal. It is located at a distance of 125 km South-West of Kolkata and 50 km upstream from Bay of Bengal at the confluence of three rivers, namely, Hooghly, Haldi and Roopnarayan. Haldia is also one of the biggest ports in the Eastern region and the focal point for industrial development in West Bengal. The Haldia planning area (HPA) is bounded by the rivers Hooghly, Haldi and Hajli canal and covers a total area of around 326.85 sq. km. The population of HPA has grown from 1.38 lakhs in 1951 to around 4.69 lakhs in 2001, and is further projected to increase to 6.26 lakhs in 2013. Likewise, the level of urbanisation in HPA has increased from less than 2% to around 36% in the last 50 years, and it is further projected to increase to more than 50% by 2013.

The HPA region has already seen many large industries setting up base here, especially in petrochemical and refining sector. IOC - Haldia refinery, Haldia Petrochemicals Ltd., Mitsubishi Chemical Corporation Pvt. Ltd, South Asian Petrochemicals Ltd. and some oil/gas terminals are the major industries. Apart from these units there is a detergent unit of HLL, Tata Chemicals Ltd, pesticide unit of Shaw Wallace, Exide Industries Ltd., vegetable oil units, etc. In future, the industrial base is likely to be diversified, and many new industries are proposed as per the perspective plan for HPA.

In view of the above, this study aims to prepare an Area-wide Environmental Quality Management (AEQM) plan for Haldia Planning Area. The AEQM plan assesses the extent of developmental activities (with focus on industries), that can be permitted in future without adverse effects on the natural resource environment.

In order to assess the future impacts, three scenarios for the future industrial development over a 10 year time frame (i.e., upto 2013) are considered in the Haldia region. These are as follows:

- Scenario I accounts for the expansion plans of Indian Oil Corporation- Haldia refinery, Haldia Petrochemicals Ltd., Mitsubishi Chemical Corporation Pvt. Ltd. and Exide Industries Ltd., as well as the setting up of two proposed industries, namely TCG refinery and the Hooghly Met Coke & Power Co. Ltd. In addition the emissions from all the existing industries are also considered.

- Scenario II accounts for all the emissions as in Scenario I and in addition, it assumes 50 % capacity enhancement of the existing industries in the following sectors: refinery, petrochemicals, coke oven, vanaspati and fertiliser. Further, taking into account the future development plan envisaged by

HDA (Perspective plan, HPA 2025), typical capacity additions in new sectors such as Steel, Thermal power plant (TPP) and Cement are assumed.

- Scenario III accounts for all the emissions as in Scenario I and in addition, it assumes 100 % capacity enhancement of the existing industries in the following sectors: refinery, petrochemicals, coke oven, vanaspati and fertiliser. In addition, it also assumes 50% capacity addition in the new sectors that were considered in scenario II, namely, steel, TPP and Cement.

It may be noted the above scenarios are assumed in order to get some idea of the likely environmental situation under different developmental prepositions. In a way, one could possibly consider Scenario I as business as usual scenario, while scenario II and III depict moderate and worst case scenarios. The choice of these scenarios is governed by the need to assess the extent of industrialisation that could be permitted in future in view of the existing industrialisation.

The impacts of the increasing industrialisation and urbanisation on the environmental status over a ten year period (upto 2013) are described below for the following parameters:

- air quality
- water, sewerage and drainage
- solid and hazardous wastes.

The environmental management plan for each of these issues is also described.

Air quality

Ambient air quality is currently being monitored by the WBPCB at three stations and by a number of other major industries in the area. Overall, in terms of criteria air pollutants, the existing ambient air quality is within the standards specified by CPCB for industrial areas. Also, broadly, the stack emissions from various industrial sources are reported to be within the limits specified in terms of emissions standards by regulatory authorities, most of the time.

A grid-wise emission inventory reveals that amongst the grossly polluting industries, Haldia refinery, South Asian Petrochemicals Ltd. (SAPL), and Tata Chemicals emit substantial SO₂ and PM pollutant loads. The total load produced by the units involved in manufacturing batteries, pesticides, detergents and edible oil products is small compared to the contribution by refinery and petrochemical units in Haldia. Cumulatively, in terms of the emission loads from all sectors (industrial, transport and domestic sectors), the top five grids are 8B, 8D, 9C, 8C, and 7B (see gridded map of study area).

Using information related to the gridded emissions along with meteorological data, an air quality modelling exercise is undertaken based on ISCST3 (Industrial Source Complex Short-Term model – 3), which is an operational USEPA model. The modelling exercise helps in evaluating the assimilative capacity of the study area. Assimilative

capacity of the atmosphere determines the maximum pollutant load that can be discharged into the atmosphere without violating the best-designated use of the air resources in the planning region. It is determined in terms of the pollution potential in terms of concentration of pollutants using air pollution dispersion model.

The air quality modelling exercise is undertaken for SO₂ since the main source for this pollutant is fossil fuel combustion which is significantly contributed by industries in the region and to a lesser extent by the transport sources. There have also been concerns raised about SO₂ pollution and the WBPCB is strictly monitoring the industrial emissions and has also placed cap (limits on the overall load) on the SO₂ emissions from certain industries.

The modelling exercise is undertaken for the summer and winter months so as to capture the seasonal variations in the meteorological conditions. Contours are plotted for SO₂ concentration for the existing scenario during the summer and winter months in 2003. The concentrations values are relatively low in both the seasons and are well within the ambient air quality standards. The maximum values in summer season are in the range 12-15 µg/m³ while that in the winter season are in the range 15-19 µg/m³. The calibrated model is then used subsequently to predict the impact of future expansion plans on air quality under different scenarios.

An emission inventory was prepared for the Sulphur dioxide (SO₂) and Particulate Matter (PM) emission loads under different future scenarios as described earlier. It is seen that the industrial emission loads of SO₂ increase from 2.8 to about 7.4 times of the existing load under different scenarios. Likewise, in the case of SPM, the emission loads increase by 1.7 to 8.2 times. Thus, there is tremendous increase in the emission load over the 10 year period, especially under scenario II and III.

Table 1 Air pollutant emission loads from industries under different scenarios

S.No	Scenario	Total SO ₂ load from industries (T/Yr)	Total SPM load from industries (T/Yr)	Ratio of new load to existing load for SO ₂	Ratio of new load to existing load for SPM
1	Existing	7449	1437	1	1
2	Scenario - I	20612	2487	2.8	1.7
3	Scenario - II	40320	8315	5.4	5.8
4	Scenario - III	55276	11817	7.4	8.2

The total number of vehicles shows a two fold increase during the period 2003 to 2013. However, the total pollutant load from the transport sector is only 1.25 times the load in 2003. This is basically due to improved fuel quality and lower emission norms in future years. Likewise, the increase in the emission load from the domestic sector is not significant.

Based on the emission estimates for the individual sectors (industry, transport and domestic), the cumulative gridded emission inventory was prepared for the various pollutants (PM, NO_x, HC, CO, SO₂) in the Haldia study area under different scenarios. Under scenario I, the total emission load of all the pollutants is roughly twice of the existing total load in 2003. The grids having higher concentration of existing industries such as 8B, 8C, 9C, and 8D obviously show high emission loads. In addition, the coming up of the proposed TCG refinery in grid 7D leads to the maximum pollution load in this grid. Cumulatively, in terms of the emission loads from all sectors, the top six grids in scenario I are 7D, 8B, 8C, 8D, 9C and 10D.

The total emission load of all the pollutants in scenarios II and III are roughly 3.7 and 5 times of the existing total load in 2003. The grids having higher concentration of existing industries such as 8B, 8C, 9C, and 8D obviously show high emission loads. In addition, the coming up of TCG refinery and steel plant in grid 7D, and the addition of TPP and cement plant in grid 9G leads to the high pollution loads in these grids. Cumulatively, in terms of the emission loads from all sectors, the top six grids in scenarios II and III are 7D, 8B, 9G, 8C, 8D and 9C.

As in the existing scenario, an air quality modelling exercise is undertaken for the three future scenarios namely, scenarios I, II and III. The model predicted calibrated concentrations are used to assess the impact of future expansion plans on air quality under the three different scenarios.

Concentration contours are plotted for SO₂ concentration in the study domain for the three scenarios in the year 2013. As expected, the concentration values increase from scenario I to III. The maximum values in summer season in scenarios I, II and III are broadly in the range 17-24, 25-34, 36-45 µg/m³. As compared to the existing scenario, scenario I shows a marginal increase in the SO₂ concentration values. However, scenarios II and III show a roughly 2 fold and 3 fold increases in the SO₂ concentrations. However, these

values are still within the ambient air quality standards for industrial and residential areas. It is seen that the grids of maximum impacts are 8D and 9D, followed by parts of 8C, 9C, 7E, 7D, 8E and 9E during the summer season.

Likewise, isopleths for future air quality of SO₂ concentration during the winter season in 2013 under scenarios I, II, III, respectively reveal that the maximum values in winter season in scenarios I, II and III are broadly in the range 31-40, 46-65, 61-85 µg/m³. As compared to the existing scenario, scenarios I, II and III show a roughly 2.5, 3.5 and 5 times increase in the SO₂ concentrations. The values in scenario I are still below the residential area standards. However, in scenarios II and III the maximum values are above the annual average standards for residential areas. In the case of scenario III, at certain places, the peak values even exceed the annual average standards for industrial areas. Due to the change in wind pattern in the winter season, it is seen that the grids of maximum impacts are now 7B and 8B.

Overall, due to the increased emission loadings in Scenario I, the air quality levels (in terms of SO₂ concentration) too show an increase but are still well within the air quality standards. However, scenarios II and III show a roughly 2-3.5 times and 3-5 times increases in the SO₂ concentrations. However, these values are still within the ambient air quality standards in summer but exceed the standards at a few places in winter. However, on an average during the whole year, though it would meet the annual standards but it would be quite close.

Thus, the different scenarios of industrial development till 2013 point to an increase in emission loadings and the associated impacts of air quality. The management plan for air quality takes into account these developments and in particular focuses on the industrial siting aspects.

In terms of industrial development, the perspective plan of HPA mentions highly polluting industries to be proposed in the North East portion of HPA. This would be appropriate as it would diversify the activities and lead to lesser stress on air quality. Thus, the grids such as 9G, 9F, 8H, 8G, and 8F would be ideal for locating polluting industries such as cement, TPP, fertiliser, smelting etc.

While further industrialisation in the existing grids and the grids in Zone II of HPA perspective plan, comprising of grids 7D, 7E, 6D, 6E could be considered as indicated by the results of scenario I. However, large scale industrialisation as considered in Scenario III could be a cause for concern and should be evaluated carefully in future. The impact of these developments is not only felt close to the industrial belt grids but also in residential areas towards south such as grids 6B, 6A and 7B.

In addition, only non polluting industries should be permitted in grids such as 5 C and 6C as these are close to the residential areas.

In terms of other contributing sectors, the transport sector is bound to benefit by the improvements in the fuel quality and the vehicular emission norms as outlined by the Government of India in the auto-fuel policy report. But better infrastructure in terms of good quality

roads is required in order to minimise fugitive dust emissions. In the domestic sector, though the emissions are not very significant compared to the industrial sector, still efforts should be made for the supply of better quality fuels for cooking purposes since improved indoor air quality has direct health benefits.

Water sewerage and drainage

Growing trends of the population and the industrial developments in the Haldia region has set in concerns related to water resources. The region being estuarine has salinity stress over the ground water resources. This alongwith overdraft of the groundwater, limits the future groundwater extraction from the confined aquifers. The total existing water demand of the region is 24.11 MGD.

HPA does not have sewerage collection and treatment system except at the industrial townships which treat about 80% of the wastewater generated. 90.33% of the rural and 65.6 % of the urban households have no sewerage and drainage system. This has contributed to the deteriorated biological quality of river water wherein the total coliforms exceeds far beyond the required limits. The physio-chemical water quality of the rivers Hooghly and Haldi across the city stretch by and large is within the standards. This was further verified for whole stretch of the rivers Hooghly and Haldi across city through sampling and analysis conducted for 39 points where it comes out clearly that barring the close proximity of the outfalls into the river Hooghly the organic pollution levels in the vast river is well within the prescribed general standard but the region being estuarine and experiencing regular tidal waves, the TDS & chloride levels are substantially high as one moves downstream.

At the green belt canal BOD and COD are higher along the stretch of IOCL while it decreases afterwards. The TSS however increases along the Patikhali end which is attributive to the additions by Manshatala Khal joining the canal. The canal does not have definite flow profile with blockades and weeds grown at places.

Groundwater shows elevated contamination in the industrial belt as compared to the non-industrial belt. TDS and chloride are frequently found higher than the drinking water standards. Bacteriologically groundwater has shown contamination at both the regions, which without treatment is unfit for drinking purpose.

Based on available datasets the existing pollution load has been assessed and further future scenarios have been predicted which in both cases depicts the industrial pollution loads spatially in different grids w.r.t different pollution indicators. In an overview of existing scenario it is observed that grids 10D & 7C have maximum pollution load in terms of BOD, COD, TSS & O&G. These grids along with grids 8D, 8B, 7B and 8C are having the major share of industrial pollution loads in the region. Grids 7D & 9C have comparatively lesser share of the load. The domestic BOD load generation in existing situation is concentrated in the municipal area. The population density as well as the per capita water consumption is higher in the municipal

areas and therefore BOD load is higher in these areas that range from 400-990 Kg/day as compared to approximately 200-500 Kg/day in the rural areas.

The future environmental conditions due to the industrial development has been evolved by considering three future scenarios taking into account the existing industries, proposed industries and new sectors that are anticipated. The total water demand of the region shall increase to 40.45 MGD, 190.03 MGD & 271.10 MGD in the envisaged Future Scenarios-I, II & III respectively. Water demand to this tune is proposed to be met by the existing WTP at Geonkhali along with existing 15 deep tubewells in combination of plans like capacity augmentation of existing WTP and upcoming 30 MGD water supply scheme by HDA. The 132 MGD water demand of the Thermal power plant is however to be met directly from the Hooghly river.

The future pollution load and impact assessment on the environment in each scenarios indicates that pollution load stress for most of the parameters like BOD, COD, TSS, O&G, Phenol & Sulphide are maximum in the grids 7C & 10D followed by 8B & 8D. Grid 9C has stress w.r.t lead. In context of the sewerage & drainage, grids 6B, 6C, 9C, 9D & 8E that represents densely populated area with residential, commercial and institutional activities, will have domestic BOD load generation more than 1000 kg/day by 2013 (maximum being 1693.77 kg/day in grid 9D).

Since the water quality of the river Hooghly has overall been well within the standards and taking into account the high flows & vastness of the river it can be safely envisaged that more industries can be set up in the region at new locations and with proper management. New industries are proposed to be set up by industrial zoning where three zones viz. Zone-I, II & III shall respectively accommodate industries with high pollution loads (smelting, textile, cement etc.); industries like refineries, iron & steel, petrochemical, food processing, downstream small scale industries; and industries which are small scale & not water intensive.

Green belt canal should be regularly cleaned often with dredging to ensure normal flow & water quality of the canal. Lining should be provided to ensure the flow gradient for continuous flow of wastewater and periodic opening & closing of both the gates at the outfall into river Hooghly should be maintained. The channel should be allowed to flow freely and blockade should be removed.

As a part of sewerage & drainage it is recommended to have piped network of collection system for the total urban area. The low cost sanitation system that can be adopted as on plot sanitation is the septic tank system. Amongst the high cost sanitation systems mechanised options like UASBR, activated sludge treatment & trickling filter has been considered. The suitable natural system is the waste stabilization pond (WSP). After various economical and technological evaluations WSP and UASBR are the most suited options for treating the 16.32 MGD of domestic waster water generated.

For the depleting groundwater resources rainwater harvesting is advantageous if implemented in proper scientific manner. The

rainwater harvesting potential of Industrial/Commercial areas are highest (67%) while that of residential and open space areas are 18.6 and 14.4%, respectively.

Solid and hazardous wastes

The daily generation of municipal solid waste in Haldia Municipal area is around 48 tonnes of which around 35 tonnes per day are handled by municipal authorities. In addition, it is estimated that presently rural areas in HPA generate another 30 tonnes of waste per day. Major generators of municipal wastes are located around commercial and industrial areas of the region. There is no house-to-house collection system and households dispose off their wastes to roadside small vats. The present disposal of solid waste is carried out on 7.0 acres plot of land identified by Haldia Municipality in CPT land near Patikhali.

Regarding industrial wastes, the region generates around 80,106 TPA of waste of which around 29099 TPA is hazardous and rest is non-hazardous. Overall, the state generates around 236514.7 TPA of hazardous waste of which 147834.6 TPA is recyclable, 3492.7 TPA is incinerable and 85187.3 TPA is disposable. Considering generation of disposable wastes from recyclable and incinerable wastes, the total hazardous waste required to be disposed in landfill would be around 100215 TPA.

The present generation of infectious biomedical waste in the HPA region is estimated at 50.5 TPA.

Future waste loads

The hazardous waste generation in the state under the three scenarios would be:

- Scenario I - 101298 TPA
- Scenario II - 151947 TPA
- Scenario III - 202596 TPA

Similarly based on population growth rate, growth in MSW is estimated for Haldia region and it is estimated that in 10 years time the region would generate around 241615 tonnes of MSW.

The total requirement of land for disposal of hazardous waste, MSW and biomedical waste for the next 10 years in Haldia would be:

- Scenario I: 46 acres
- Scenario II: 59.5 acres
- Scenario III: 73.1 acres

Thus, considering these scenarios, the present land acquired (70 acres) for the waste treatment and disposal seems adequate for scenario I and II. However, more land would be needed for waste disposal as envisaged in scenario III. The estimates however assume that the available depths of the landfill for waste disposal will be at least 10 metres. If the hydrology of the place does not allow this depth and the landfill is shallower than this depth, the corresponding requirement of

the land also will increase. The land estimate also does not include volume increase in waste if the waste is required to be stabilized (for instance ETP sludge) before disposal. Generally the waste volume increases by 10% when stabilization is practiced which would also require more land area depending on the quantity of waste stabilized.

Environmental management plan for solid waste

The overall area required for disposal of municipal, biomedical waste in Haldia region and hazardous waste for the state for the next ten years in the region seems adequate for scenarios I and II as per the estimates presented in above. Scenario III however would require extra land (around 3-4 acres) to be acquired by HDA. It will be responsibility of Haldia municipality to pick up waste from urban areas, segregate and either compost locally or compost at disposal site and dispose rest of the waste at the disposal site. Strategy also needs to be drawn for rural solid waste generated in the areas close to urban grids. The organic waste can be composted at the local level and inert waste can be transported to common disposal site. The transportation of MSW to the disposal site needs to be carried out in accordance with provision of MSW Rules.

The most impacted region in the area would be grid where M P Glychem is located where around 10,800 TPA and Exide where 2650 TPA respectively of hazardous waste is expected to be generated after expansion of all the industries in the region.

