

Environmental Management at Nagaon Paper Mill : Enhancing Competitiveness

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ABSTRACT

Even after facing many constraints, quite a few paper plants in India are doing very good and have shown their ability which is globally comparable. Pulp and Paper industry has been considered as one of the major polluting industries in the world. At the same time, stringent environmental legislations has forced the industry to look for drastic measures to recycle natural resources by adopting eco-friendly practices, so that they can be used as raw material to other processes inside the plant or outside. Nagaon Paper Mill (NPM) has already initiated and implemented many schemes since inception of the mill to fight with the pollution potentials in and around mill premises for betterment of the local inhabitants not only for its survival but also as a social obligation, which is considered to be a major step in to-day's competitive scenario. NPM is marching towards continual improvement of environmental performances as per EMS because of which many time targeted action plans of eco-friendly nature have been implemented and many are under implementation. Total recycle concept has already been implemented in processes to reduce consumption and wastage. We have already achieved target in some of the areas like reduction in wastewater discharge, reduction in total pollution load and reduction in consumption of some natural resources like water, coal, bamboo, etc. The use of treated effluent, all along the disposal route to a stretch of 25 km is remarkable. Regular monitoring of effluent, ground water & air quality have shown very encouraging results since last couple of decades. The Mill is going for modernization and technological upgradation of its processes including Pulp Mill, which will further improve the quality of product as well as quality of out going emissions. To conserve Forest, NPM has adopted a Farm Forestry scheme, which was introduced in 2001 and is progressing well. The tissue culture laboratory of NPM, for mass production of bamboo plantlets is considered to be a noble step towards conservation of forests in NE states that may also be considered as a break through in this field for global competition.

INTRODUCTION

There is a new economic scene in India and the international competition is increasing. The GATT Declaration has opened a new era forcing us to follow a new path in world trade, so as to integrate ourselves with the world economy. Paper industry in India is over hundred years old and it was about this time when the industrial revolution was shaping in Europe. Over the long period of colonial rule and exploitation, many of these units had become sick, technologically obsolete and non-competitive. Paper industry was no exception to it. This might be the reason; the performance of paper mills in India in comparison to the units in developed countries is rather poor in terms of size, quality, material and energy consumption and environmental management. This industry is capital intensive, raw material intensive, energy intensive, manpower intensive and also pollution intensive as well. This is because pulping, bleaching and paper making technology in most of the mills is not comparable with their counter part in developed countries. However, it is very encouraging that

quite some time from now, 'competitiveness' thought in terms of quality, technology, and environmental management has already entered in mind set of technocrats in India and as a result, positive impact has become visible while analyzing the out put data of many paper plants. The environmental condition in surrounding areas of many paper industries is quite comparable to their counter parts abroad. Most of them are marching towards cleaner production by conserving environment in all fronts. Waste paper recovery and reuse has been given more important in abroad compared to Indian paper plants.

Environmental Management System (EMS) adopted in many industrial units to cope up with the situation arising out of stringent norms formulated by the statutory bodies.

Environmental issues remain a major topic in the Pulp & Paper industry. Environmental compliance has become more important all over the world and cost of non-compliance has increased. As a result of increasing environmental concern, especially market forces have been strong enough to prompt the start

of a new era in Pulp Mill technology, considered to be one of the most polluting part of an integrated Pulp & Paper mill. To-day many customers are putting more and more emphasis on environment friendly products (1). This has definitely geared up the mind set of Indian technocrats to find ways & means to reduce generation of pollutants and discharge of emissions for the betterment of industry in particular & society as a whole. Many paper plants in India have shown their ability in reducing consumption of natural resources to minimum and has emerged as efficient to join the race.

This paper analyses a case study of NPM, which is marching towards cleaner production by adopting all possible measures with the resources available and utilizing them efficiently, to conserve and protect the environment. The steps implemented and initiated are quite comparable and it is expected that it will be an example towards preservation of environment and control of pollution in India. NPM is a unit of Hindustan Paper Corporation Ltd (HPCL), the paper-manufacturing giants in India. HPCL set up the Nagaon Paper Mill (NPM) for

production/ manufacture of writing and printing paper. The full capacity of the plant is 1,00,000 MT per annum. The plant was commissioned in October 1985 against all infrastructural constraints compounded by the then socio-political disturbances. After overcoming all odds, NPM has exceeded 100% capacity utilization since financial year 2000-01.

SCHEMES TOWARDS ENVIRONMENTAL COMPLIANCES

Since inception of the mill, it has under taken many measures to fight with the pollution potential substances to improve its environmental performances. As a part of our Environmental Policy of continual upgradation of the mill, adopting environment friendly technologies. Some of them are discussed below in brief:

CREP Compliances

The conditions stipulated in Corporate Responsibility on Environmental Protection (CREP) are near full implementation except two major capital items, which are also being dealt and in different stages of implementation.

AOX in treated effluent

The AOX norm in treated effluent is fixed by CPCB at 1.5 kg/MT of paper produced up to February 2008 and thereafter it will be 1.0 kg/MT from March 2008. The present value is well below the norm. The NPM has taken few steps to keep the value below the norm by recirculating the chlorine back water in unbleached dilution tower, recirculation of hypo back water, neutralization of chlorine back water by alkali extraction back water, etc. Proposed ECF (D E_p D E D) bleaching will further reduce the AOX value apart from enhancing pulp brightness.

Installation of Lime Kiln

Lime mud, which is an inorganic waste, is generated by all large paper plants. About 350 MT of mud is generated per day with an average consumption of 150 MT lime. The construction of lime mud reurning plant is in full swing and expected to be commissioned within a month or two. Once the plant is commissioned, provision will be kept for burning of NCG in kiln.

Wastewater discharge

Discharge of wastewater is directly related to consumption of water in processes. It is very much encouraging that, today most of the mills have been able to reduce their water consumption as well as waste water discharge due their tremendous effort on this aspect. Reuse and recirculation of wastewater has become important to reduce consumption of water. The target of wastewater discharge of 120 M³/MT of paper is already achieved by NPM way back in April 2004. The present discharge is 91 M³. Recycling was the major factor in achieving this target. However, this figure will be further reduced once the proposed modification in pulp mill is completed. About 400 m³/hr of water is expected to be reduced in bleach section itself. Some of the major steps taken to reduce water consumption are : conversion of wet fly ash system to dry system, recirculation of bleach filtrate, recirculation of sealing cooling water, use of wastewater in bamboo handling, use of evaporator condensate in pulp mill, use of paper machine back water in pulp mill for ring dilution, reuse of clarified water from water treatment plant underflow, etc. Because of this, the water consumption and wastewater

discharge have drastically reduced. (Fig.1 and Fig. 2). It is interesting to note that the Cheng loong Paper mill in the Republic of China uses only 10 M³ of water per MT paper produced (2). All paper mills in China have been recognized by the Water Resource Bureau for excellent achievements in water consumption

Use of treated effluent

Use of treated effluent for irrigation purposes is not new. This has been in use since the last several decades. However, its scientific use is important to see whether there is any adverse impact on soil and crop quality due to their prolong use. Since the treated NPM's wastewater is extensively used by the local farmers throughout the entire stretch of 25 km of treated effluent disposal route to river Kolong, especially during lean period, number of studies have been conducted by number of reputed Institutions to ascertain whether there is any adverse impact on soil and crop quality. The most recent study in 2005-06 by a team of ex-soil scientists of Assam Agricultural University revealed that water, soil and crop samples collected from the disposal route did not show any abnormality as far as required

Fig. 1 : Specific Water Consumption

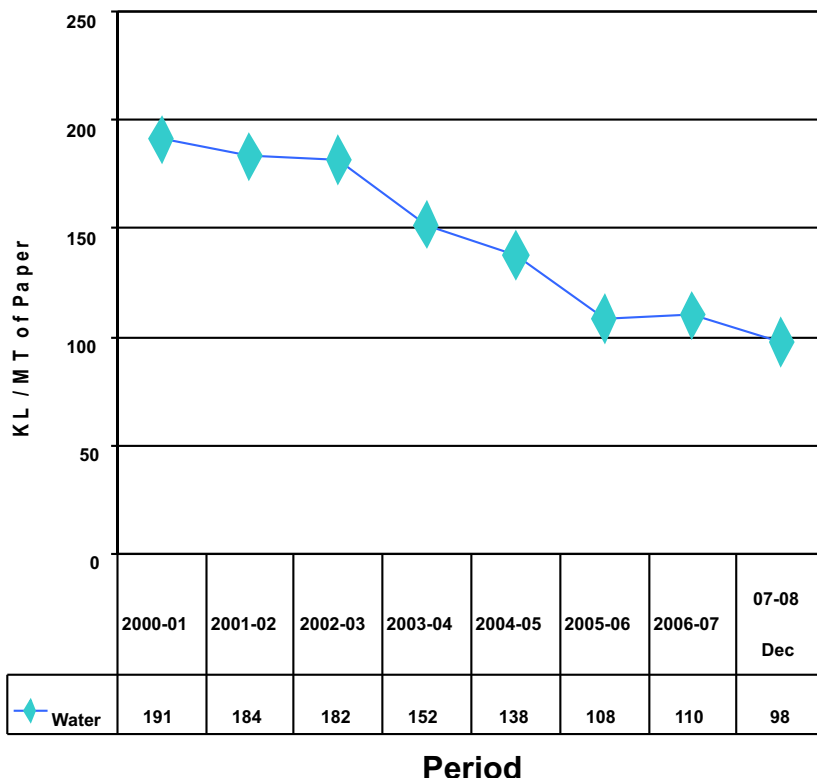


Fig.2 : Reduction in Wastewater Discharge

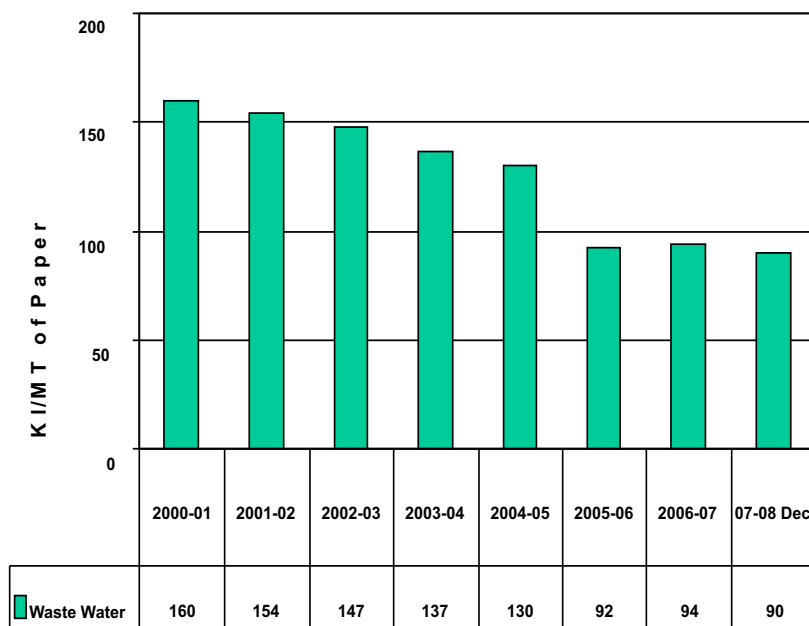
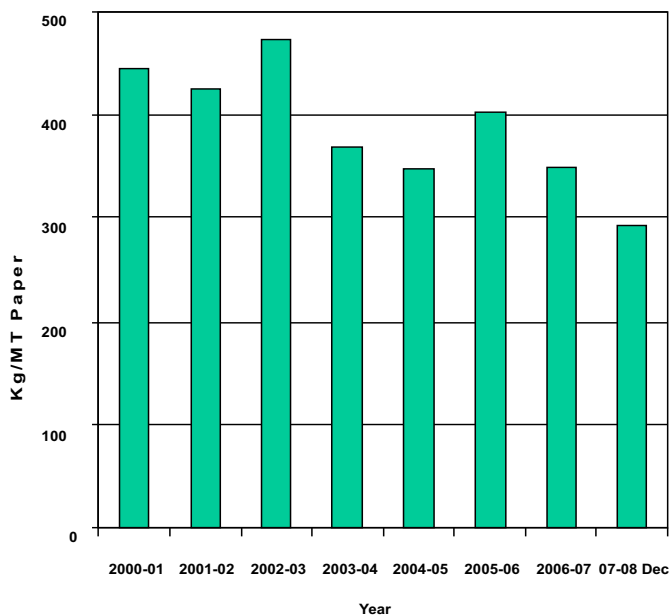


Fig. 3 : Reduction in Coal Ash Generation



parameters are concerned. The report revealed that the discharged water is further diluted in beel area to the extent of 75-80% due to which the parameters like COD, BOD, etc. are drastically reduced before it meets river confluence. They reported that the average crop production, when used treated effluent for irrigation, showed yield 5-6 MT per Ha against a state average of 3.5MT.

Colour removal

Lignin has no reported toxic and health related problems but is main responsible for giving brown colour to

the effluent. Since it is difficult to remove colour by simple biological processes, many methods have been developed such as coagulation with various coagulating agents and sorption with adsorbents. But due to high cost intensive of these processes, very few units adopt these methods for colour removal. NPM is utilizing hypo sludge successfully as coagulating agent to remove colour from pulp mill effluent. Little positive affect is also noticed after treating extraction back water by chlorine back water. However, a detail study on colour removal is being carried out by IPMA/ CPPRI and on successful completion of this project, we shall be able to initiate accordingly.

Pollution control measures in Caustic & Chlorine plant

Before introduction of CREP, NPM had, number of pollution control measures implemented, in Caustic Chlorine plant, such as collection of mercury bearing effluent in a common pit to circulate through mercury removal plant and then reuse in process, segregation of all surface inside drains and connected to common pit to avoid contamination, reuse of hypo sludge wash water, etc. All conditions laid down in CREP completed except conversion to Membrane Cell technology. Action has already initiated to complete conversion by 2009.

Few major steps, as per CREP implemented are :

- Installation of Mercury Distillation plant
- Installation of hydrogen gas demercurization unit
- Treatment of cell room gas ventilation
- Mercury removal filters for Caustic stream
- Reduction of mercury content in caustic to below norm, etc.

Change in bleaching sequence

Elemental chlorine though widely accepted as the conventional oxidizing agent for bleaching of pulp, but due to mounting pressure from environmentalist as well as from statutory bodies to reduce its use, many plants are opting for its replacement by chlorine compound or for total elimination. As such, in NPM, change in bleach sequence is proposed and under implementation as indicated in the Mill Development Report (MDR) submitted by renowned Canadian consultant M/s. Sand Well. For diversification of product, strength properties and brightness of pulp being the prime requirement along with environmental considerations, after laboratory study, they suggested DE_pD $E D$ for final brightness of 89% ISO with minimum generation of AOX (3), which shall be an added advantage in dealing with the product in to-days competitive market.

Solid Waste Management and Disposal

The solid waste management in paper industry has become a threat to all plant managements for their safe disposal

Fig.4 : Specific Coal Consumption

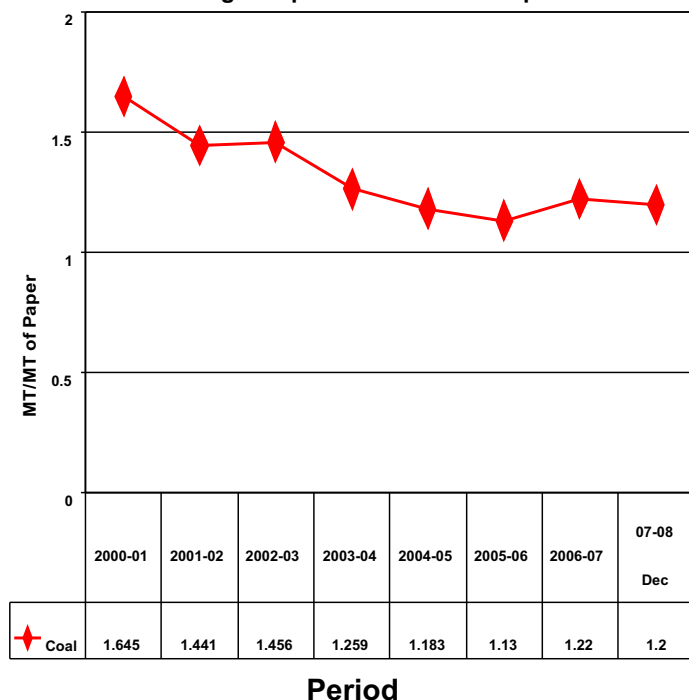
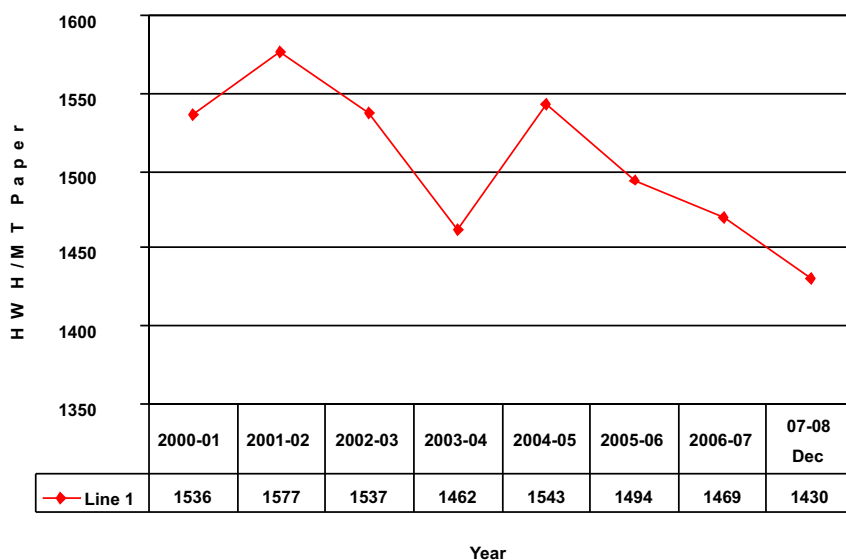


Fig : 5 : Specific Power Consumption



mainly due to huge generation. Industrial activities in India alone generate about 85 % of the total solid wastes. The disposal problem is getting many folded day by day, mainly due to stringent laws formulated by the legal authorities. However, it is encouraging that, to day some of the industrial wastes are utilized and recycled while others can be used as energy sources. About 350 MT of lime mud as such is generated in NPM and disposed in an earmarked area. To ascertain whether there is any percolation or contamination of water from mud disposal area, regular monitoring of ground water from nearby areas is being done along with conductivity and

pH checking of nearby soil. As already mentioned, the Lime kiln construction is in progress and expected commissioning within a month or two.

About 110- 120 MT/day coal ash is being generated at NPM with almost entire amount is being utilized for road building in nearby areas, filling low lying areas, supplying to railways on request etc. and a small portion of the fly ash is being lifted by local Cement and brick manufacturers free of cost as per the directives of MoEF notification, dated 14th Sept., 1999. Total fly ashing system has been converted to dry ashing system for easy lifting of material by the manufacturers of

Cement and Brick thereby reducing water consumption too. The AFBC boiler construction is near completion. Most of the organic wastes of the mill will be burnt in this boiler. It is observed that, the total ash generation per MT of paper produced is also gradually decreasing as shown in Fig. 3. The total ash generation in 1998-99 was 542 Kg/MT Paper as against 292 Kg in 2007- 08 Dec.

20-25 MT of bamboo dust is generated every day. Since it has tremendous potential towards generation of energy, NPM has already commissioned a 'Bamboo Dust Gasification' plant. The producer gas thus generated shall be used in lime mud reburning plant. In today's competitive scenario, installation of such energy producing plant by using waste product is remarkable.

Approximately 200 MT Brine sludge is generated in Chlor- alkali plant annually. It is disposed in secured landfill lined with LDPE with both side brick soling. All statutory guidelines are being maintained while handling the hazardous waste. The general public is cautioned regarding the hazardous nature of the sludge through TREM card, signboards near the pit as well as near the main entrance of the Mill as directed by the Hon'ble Supreme Court of India. Press notification also issued in this regard. The area is well protected and the entry is restricted as projected in the signboard by writing both in English and Assamese language. The ground water around the landfill is being monitored regularly through tube wells as well as through Piezometric tubes. New Brine sludge secured landfill is being constructed as per new guidelines from CPCB. Once the construction is over, we shall start capping the old fills. Hypo sludge generated is used in pulp mill drain to reduce colour, COD and BOD.

Conservation of resources

Though the paper making process is water consuming process, but effort has been initiated by all plants to bring down their consumption as well as discharge. Environmental compulsions in the industry has forced to look for drastic measures to recycle natural resources, like water, coal and its byproducts, waste materials etc. Recycling of water can easily be done by improvements in process and reuse of water from one system to other or by

Fig.6 : Treated Effluent Quality, Reduction in COD

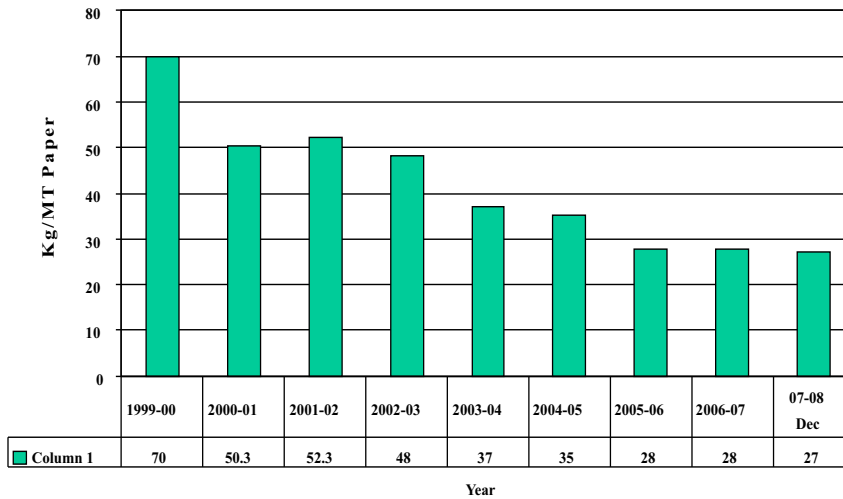
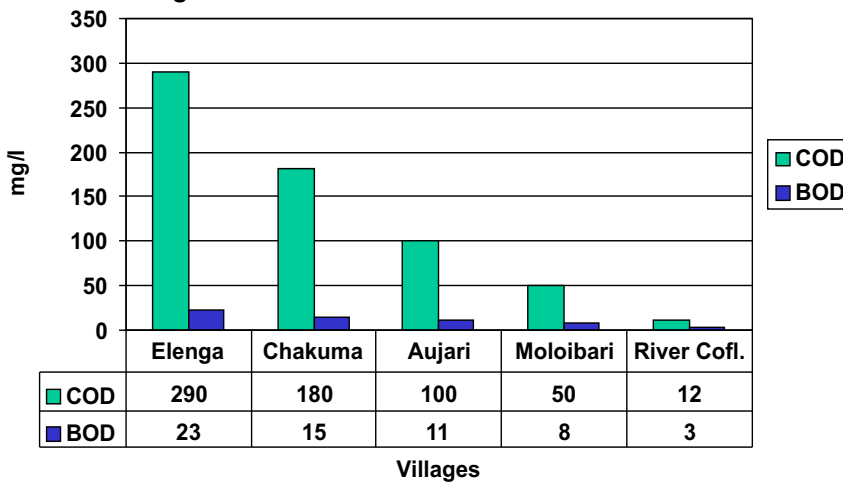


Fig.8 : Reduction in COD & BOD in Beel water



clarifying it by viable water treatment and purification technologies. In the global scenario, water and other resources scarcity faced by the Pulp and Paper industry has compelled to find solutions and its management. The requirement for pollution abatement, such as 'Zero Discharge' has increased the interest in this subject. Rising cost of energy fuels is also one of the reasons for wide spread implementation of water reuse on economic grounds. NPM has already implemented many schemes (few of them mentioned earlier) of reuse and recirculation of water, wastewater, etc.

NPM has achieved its goal to some extent, in reduction in use of some of the natural resources like Water, Coal, Lime, and Bamboo etc. However, efforts are still on for further reduction, to compete in to-day's global scenario. The continual improvement in consumption of coal and power are shown in Fig. 4 and Fig.5.

Biological treatment and monitoring of disposal route

Several treatment and control technologies have been developed. Some of these are in use to reduce wastewater or pollutant discharge to natural watercourse. The two major technology approaches are:

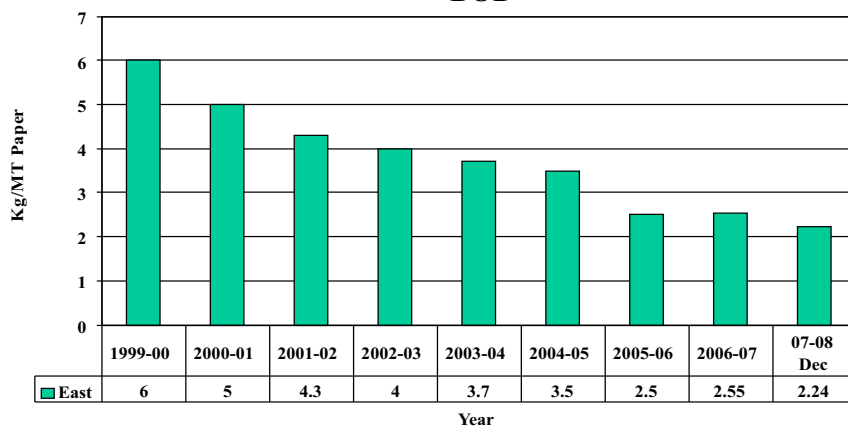
- Production process controls aimed at reducing wastewater volume and pollutant load discharge from the mill.
- Wastewater treatment technology or end-of-pipe treatment systems aimed at reducing discharge of pollutants contained in the wastewater.

Both these approaches are adopted all over the world, however, the process control system is widely accepted so that, the pollutants generated can be reduced at the point of generation itself. All possible control systems are adopted in NPM to keep the discharge

within both internal and statutory norms. NPM has a modern ETP with about 2200 m³/Hr. flow capacity, attached to two Aerated Lagoons and two Polishing ponds. The treated effluent after meeting the laid down permissible limits is discharged to a natural watercourse. The reduction of COD, BOD and Suspended Solids values over years revealed that the facilities available are utilized properly and working effectively, which is in agreement with the recent study carried out by the CPPRI, Saharanpur. The continual improvement towards reduction of COD and BOD in treated effluent is reflected in Fig. 6 and Fig. 7 respectively.

And as per recommendation of expert committee formed by the Govt. of India way back in 1886, the treated effluent after attaining permissible limits, is discharged in a natural watercourse known as Elenga Beel which finally meets the river Kolong after traveling about 25 km. Treated effluent while passing through disposal route is being extensively used by the local farmers for irrigating their crops since the last more than a decade. The report submitted by the expert committee also recommended the use of treated water saying, "Such effluent for irrigation has been safely recommended in India and abroad for various crops without any adverse effect on course textured soil". It is estimated that about 150-200 DG pump sets are generally pressed into service by the farmers during lean period from November to March every year. Such use of treated effluent for irrigating nearly 2500 Ha of land without any adverse impact is reported to be rare. Since this water is used by the local farmers for years together, NPM thought of to have some scientific reasoning and data based support on quality of soil and crops and as such awarded number of studies by renowned Institutions like NEERI, Ghose Bose & Associates, Kolkata, Gauhati University, IIT, Guwahati, etc. The reports revealed very encouraging data on nearby soil and crops, especially paddy, where the water is extensively used for irrigation. Moreover, as a measure to ascertain the quality of water in beel area up to river confluence, NPM is monitoring quality parameters of water in beel and ground water in nearby areas of disposal route after every 15 days and one month respectively. The data so generated over the years show the decreasing trend of parameters towards river confluence,

Fig.7 : Treated Effluent Quality, Reduction in BOD



due to natural dilution and aeration is shown in Fig. 8 for reduction of COD and BOD. Ground water samples are also collected every month, from selected tube wells and dug wells at a distance of 20 m, 70 m, 100 m and 500 m from the secured landfill as well as from lagoon. Apart from this, Piezometric tubes at different levels also installed all around the lagoon in five different places for ground water sampling and analysis. No contamination observed so far. The installation of this type tubes are reported to be first of this kind in North Eastern region.

Air pollution control measures

Like any other industry, Nagaon Paper Mill is also having its own Coal fired Boilers as well as liquor fired Boiler. The chimneys provided with each boiler emit gases like Sulphur dioxide, Carbon dioxide etc. including Suspended Particulate Matters (SPM). To minimize the effect of these substances in atmosphere, each coal-fired boiler is provided with Multicyclone separators, which removes the SPM. The liquor-fired boiler is also provided with equipment called Electrostatic precipitator (ESP), which prevents escape of SPM through chimney. It is proposed that all other coal fired boilers shall also be provided with ESP. In the mean time, all the boilers are provided with online Particulate Matter monitoring kit (PM) for monitoring of PM values. To release the Recovery boiler flue gas at greater height, the chimney height was increased to 60 m from 50 m.

The mill has four numbers of High Volume Samplers (HVS), used for ambient air monitoring in 4 stations in and around the mill premises. Round

the clock monitoring is done with the help of a recognized institution of the area. The gases parameters are far below the standards and after renovation of Recovery chimney, the parameters have further come down.

Clean development mechanism (CDM)

Nagaon Paper Mill has undertaken a green house gas abatement project involving Falling Film Finisher Evaporator and retrofit to Recovery boiler initially under CDM of Koyoto Protocol, later some other areas like bamboo dust gasification plant, massive plantation under farm forestry scheme and tissue cultured plantlets will be included. NPM has already appointed an advisor and validation of project completed. Preparation of project design document (PDD), base line study, emission reduction calculation, etc. are in progress. Recently, a large integrated pulp and paper mill in India, in a bid to achieve greening of wastelands through its ongoing social forestry programme, reportedly promoted 74,427 Ha of plantation by distributing 313 million saplings in Andhra Pradesh (4). It has succeeded in registering these projects accounting nearly one million CERs (Certified Emission Returns). This type of activities initiated by Indian Paper Industry has the potential of competitiveness under global scenario. A recent report in Canada said- Pulp and Paper sector reduces Green House emission by 62% since 1990 in British Columbia (Price Water house Cooper reports). In China, the total waste paper consumption has reached more than 3 million tons which has positive implications in terms of conservation of forest resources. The country's use of waste paper instead of virgin product

has indirectly conserved as estimated 67 million grown trees and prevented additional release of 6 million tons CO₂ that would have resulted from incineration of waste paper.

Aforestation : Conservation of forests

Deforestation has been estimated to release about 1000 million tones of carbon into the air annually a sixth of the total release caused by human activities (4). Aforestation activities adopted by the Mill are not only to meet the requirement but also to maintain the ecological balances in its surrounding regions since a huge quantity of bamboo and othe fibrous materials are being consumed in the process.

As a step towards sustainable development, NPM has introduced a Farm Forestry scheme in 2001 by involving local NGOs. Since introduction of this scheme in 2001 02, NPM has distributed about 50 lakhs of seedlings for plantation. Seeds of plants along with poly bags are being distributed by the Mill authority to all the NGOs.

On the other hand, the Department of Biotechnology, Govt. of India has approved and sanctioned a project on 'Tissue Culture (TC) Bamboo Plant', titled "Validation, testing and locational trials for micro/macro propagated planting stock of selected bamboo species in North East India", for raising of block plantation in 20 hectares of land with bamboo TC culture materials initially. The Govt. of Assam has allotted 20 hectares of land to NPM at Amsoi and Nellie in Morigaon District. The total project cost is estimated at Rs.150 lakhs of which the National Mission on Bamboo Application (NMBA), Govt. of India is providing 50% of the total cost, and remaining 50% is provided by NPM. The tissue culture laboratory is already commissioned in March 2007 and bamboo plantlets are already being produced. About 7000 TC plantlets already planted in nearby areas. It is expected that about 20 lakhs TC plantlets will be produced in the laboratory annually and accordingly the TC plantlets shall be distributed to the interested parties/ organizations/ tea estate and Forest Dept. of 7 NE States.

HEALTH AND SAFETY ASPECTS

The mill has its own full fledged

hospital in township and an Occupational Health Centre inside the plant. All employees working in hazardous area need to go a schedule of Periodic Medical Examination (PME). As per OHSAS 18001 certification all related aspects of health and safety are maintained. Awareness training on safety, environment and energy of employees including casual workers and contracted labourers is held regular. This facility has been further extended to nearby villages by holding free medical camps for local inhabitants.

CONCLUSION

A constructive approach to pollution control and waste conversion pays dividends. Environment is one of the basic resources for development and therefore, sustainable development must occupy a high place in the overall planning process. The natural resources of our country are in danger of exhaustion if we permit the old wasteful methods of exploiting them longer to continue. The time has come now to enquire seriously what will happen when our forests are gone, when the coal, the iron, the oil, and the gases are exhausted, when the soils shall have been still further impoverished and washed into the streams, polluting the rivers, fields. It is the time for us now, as a nation to exercise the same reasonable foresight in dealing with our great natural resource that would be shown by any prudent man in conserving and

wisely using the property which contains the assurance of well being for himself and his children, which is known as sustainable development. However, it is also true that because of constant positive efforts by many paper industries in India towards implementation of eco-friendly practices and conservation of environment techniques, the overall status of the industry has come up which is more or less equivalent to be able for 'competitiveness', under the present global scenario. This may further be accentuated by recycling more waste paper which may also be a tool to conserve environment.

NPM is marching towards implementation of many time targeted action plans for up gradation of processes in the line of adoption of eco-friendly practices for improvement of environmental aspects. Many of them have already been implemented and few are under implementation stage. We have achieved our target in some of the areas in reduction of natural resources as well as in abatement of pollution. NPM is certified with Quality Management System, ISO 9001: 2000, Environmental Management System, ISO 14001:2004 and OHSAS 18001:1999. These management systems are also subjected to regular surveillance audit by the certifying agency. Little more efforts on these aspects may further bring about a total change that may push forward to

enter into competitive atmosphere, prevailing in global scenario.

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REFERENCES

1. Radka Mark. P, Cleaner Production in Pulp and Paper Industry, UNEP, IPPTA Convention issue, 1994, p XIX XXVI
2. Cheng Loong Corpn., The 40th Anniversary of Cheng Loong, Special Edn, 1999
3. Murthy N.V.S.R., et al, Modification of bleaching technology for env mgt. at APPM, Convention issue, 1994, p 13-16
4. Corporate env. Inc., Pulp and Paper industry, vol.10, No.2, Sept. 2007, p 39-40

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