

Towards Cleaner Production : Nagaon Paper Mill

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Pulp and Paper industry is one of the major polluting industries in the world. Rigid environmental compulsions in the industry has forced 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 process. Nagaon Paper Mill (NPM) has already initiated many steps since inception of the mill for pollution abatement in and around the mill. As a part of commitment, towards continual improvement of environmental performances as per EMS many schemes have been implemented and more schemes are under implementation. We have already achieved targets in some of the areas like reduction in water consumption, reduction in wastewater discharge, reduction in pollution load, reduction in bamboo and coal consumption. The 'Modernization and Technological Upgradation Plan' (MTUP) is aimed at value addition of product, conservation of energy as well as further reduction in emission. Towards raw material availability initiatives, NPM has already launched Farm Forestry scheme based on Rhizome and Seedling plantation. On completion of MTUP, NPM would be in a position to ensure cleaner production, which in turn would contribute to improvement of Mill's environmental performances.

Key words : Eco-friendly practices, Action plans, Bleaching sequence

INTRODUCTION

Hindustan Paper Corporation Ltd (HPC) is one of 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, achieving the best ever operational performance during financial year 2003 -04 and 2004- 05.

To conserve environment in nature, Environmental Management System (EMS) has been adopted in many industrial units. Towards care for nature, EMS was implemented in NPM in 2001.

The issue of organized activity for conservation of environment was first discussed in 1972 when the United

Nation held a conference on Human Environment in Stockholm to reassess the impact of industrial development on the environment. Following this, global initiatives on climate change were adopted in Rio-Earth Summit in 1992 by United Nation Framework convention on Climate Change (UNFCCC). The above initiative was further strengthen at Kyoto Protocol in 1997, wherein the nations of the world agreed that the industrialized countries would reduce their aggregate emission by 5.2% below 1990 levels by 2008 – 2012.

Environmental conservation or preservation is a major task before all worldwide. We have been doing many things for the preservation of the environment as well as for improvement of environmental performances and still many things are yet to be done. In this paper, the activities completed and are yet to be completed for the protection of environment is discussed.

Schemes Towards Cleaner Production

NPM has under taken many measures and many are under implementation,

to improve its environmental performances. As a part of our Environmental Policy of continual up-gradation of the mill adopting environment friendly technologies, we have taken up different schemes to improve upon the environmental aspects in and around our mill. Some of them are discussed below in brief:

- Free Flow Falling Film Evaporator was installed in 2001 as an energy cum environment improvement scheme. Renovation of LHS & RHS ESP was undertaken to take care of mainly Suspended Particulate Matters (SPM). The overall recovery efficiency is also in increasing trend, Fig.1.
- Installation of Disc Save All for fiber recovery and to permit reuse of clear filtrate.
- Installation of 4 Nos of Floating Aerators in lagoon in addition to existing 20 numbers of oxy-aerators, for further enhancement of aeration.
- In order to easy exit of flue gas to a greater height, Recovery Boiler Chimney height is being increased from existing 50 m to 60 m to improve the ambient air quality.
- Upgradation of screening system of

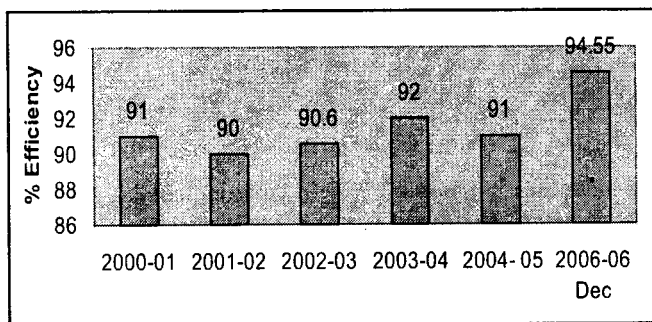


Fig. 1 Chemical Recovery Efficiency

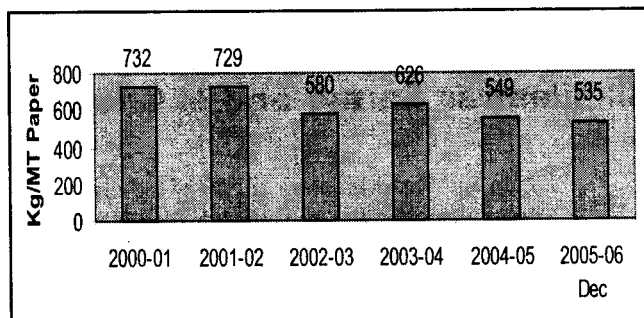


Fig. 2 Reduction in Lime Mud Generation

Pulp Mill to facilitate pulp quality improvement vis-a-vis conservation of natural resources.

- One additional Primary Clarifier is being installed in our ETP to improve the performance of clarification of raw effluent as well as the efficiency of forwarding treatment stages.

Mercury is a non-degradable potent environmental pollutant that has been engaging our vigil attention and we have been looking for developing several methods with latest technology for total containment in the plant itself within permissible limit.

Towards Mercury abatement, schemes that have implemented are as under :

- Mercury bearing effluent is collected in a common pit and it is circulated through the Mercury Removal plant, based on Activated Carbon adsorption.
- Vacuum Mercury Distillation Plant.
- Hydrogen Gas Demercuration Unit.

Schemes under Implementation

- Mercury Removal Filters for Caustic stream.

Scheme on the Anvil

- Conversion of existing Mercury cell to Membrane cell by 2009.

CREP (Corporate Responsibility on Environmental Protection) conditions of both Pulp & Paper and Chlor-alkali plant are being implemented in full spirit.

Modernization and Technological Upgradation Plans (MTUP)

The purpose of MTUP is to strengthen and reinforce competitiveness of NPM in keeping with the strategic and structural changes taking place in the Pulp and Paper Industry including meeting environmental regulatory requirements.

Proposed ECF (D E_p DED) bleaching will ensure meeting AOX (Absorbable Organic Halides) target of 1.0 kg/MT of paper by 2008 apart from enhancing pulp brightness of 88% ISO. It has got a positive impact in reduction of AOX (1). This apart the proposed changes in the mill will facilitate to improve air emissions, liquid effluent discharges and solid waste discharges.

Solid Waste Management

The principal sources of solid wastes are domestic, commercial, industrial and agricultural activities. Industrial activities alone generate about 85 % of the total solid wastes. Larger industries are generally located outside the cities and the disposal of their wastes is primarily the responsibility of the industries themselves. The disposal problem is getting many fold day by day, mainly due to stringent laws formulated by the legal authorities. It is encouraging that, to-day some of the industrial wastes are utilized and recycled while others can be used as energy sources. Energy can be recovered from solid wastes by number of thermal routes as well as by biochemical conversion. An effective Solid Waste Management Plan has

been prepared at NPM as per Environmental Management System (EMS) and as per the directives from Ministry of Environment and Forest (MoEF), to deal with the problems arising out of huge generation of solid wastes like Lime mud, Bamboo dust, Coal ash etc.

Lime Mud Management

Solid waste is often called third pollution after air and water pollution. Chemical process industries generate a variety of wastes, both organic and inorganic. Organic wastes are easily used for producing energy, however it is seen that the inorganic part is creating disposal problem to a large extent. Lime mud, which is an inorganic waste, is being generated by all large paper plants with no exception to NPM. It is about 350 MT as such with an average consumption of 180 MT of lime per day. Actions have already been initiated to install a Lime mud re-burning plant, so that lime mud disposal problem is reduced to minimum along with a minimum utilization of natural resources. It is also proposed that once the plant is commissioned, provisions will be there for burning non-combustible odour creating gases in the Kiln. Moreover, once it is installed the total disposal quantity will be around 20 -30 % of the total volume. Expected installation by September 2006.

In the mean time, there is a drastic reduction in generation of mud, which can be seen in the Fig. 2.

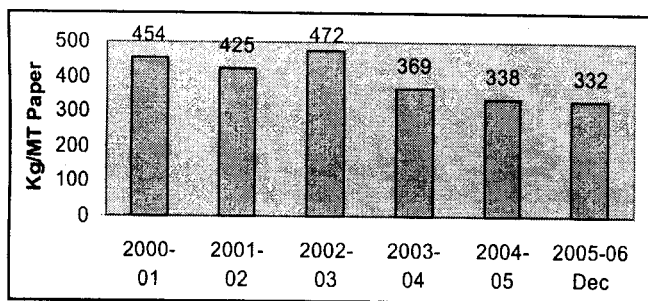


Fig. 3 Reduction in Coal Ash Generation

Coal Ash Management

Coal based thermal power stations are the principal source of power generation in the country. They also produce a large amount of ash to the tune of about 50 million tonnes per annum. It is unfortunate that only 4 % of it is utilized for generating energy and other purposes against world average of 33 %.

About 110 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. NPM has placed order to install a AFBC Boiler with ESP by June 2007, to burn mill's wastes including fly ash along with coal fines. In this case the entire dry fly ash, having high un-burnt, will be burnt in AFBC Boiler. The ash generated from the FBC Boiler will have low un-burnt and is expected to have excellent pozzolanic properties for use in Cement industry.

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 333 Kg in 2005- 06 Dec.

Bamboo Dust Management

Bamboo dust is having a very high

energy potential, which can be recovered by converting to other form or by controlled combustion. If combustion is to become an economical method for solid waste disposal, the process must also recover useful material and energy. The heat or energy so recovered can be utilized for generating other energy in other form or for reduction of fossil fuels.

Keeping this in view, we approached Indian Institute of Science, Bangalore, for consultancy service to install a Bamboo Dust Gasification plant. Accordingly order placed and expected commissioning by September 2006. The producer gas produced will be used in Lime mud re-burning kiln.

Brine Sludge Management

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 Peizometric 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.

Conservation of Natural Resources and Energy

Industry has to necessarily understand that improvement in environment can be brought with improvement in production and process aiming at conservation of resources, energy, recovery of pollutants etc. Top management is committed with strong energy managers by creating availability of database towards energy conservation in the mill. VFD (Variable Frequency Drives) have been installed in many areas wherever possible with replacement of high rating motors by low rating motors. Economizers of both Recovery and CF boilers have been modified to save energy. Reduction of TG frequency to 49.0 Hz from 50.0 Hz along with installation of load monitoring software was an added advantage towards energy conservation.

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 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' 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 achieved its goal to some extent, in reduction in use of some of the natural resources like Water, Coal, Lime, Bamboo etc. However, efforts are still on for further reduction. Few proven steps already implemented are noted below in brief:

- Conversion of wet fly ash handling

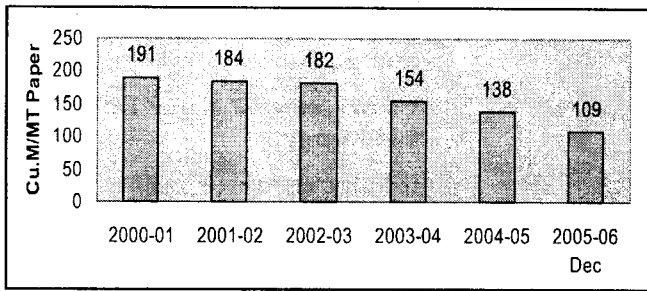


Fig. 4 Water Conservation

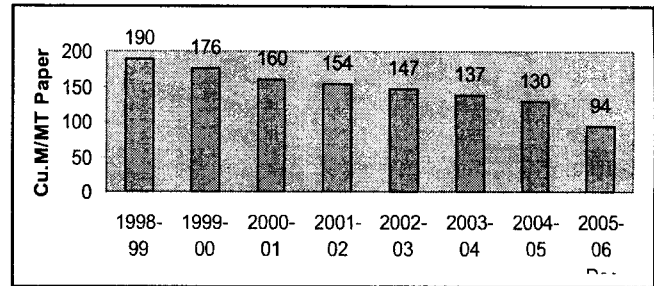


Fig. 5 Reduction in Wastewater Discharge

system to dry ash handling system, which saves about 90 m³ fresh water per hour.

- Re-circulation of bleach filtrates in bleaching plant.
- Re-circulation of sealing cooling water of Utility and Soda Recovery plants.
- Reuse of excess foul condensate of evaporators in Causticizing plant.
- Use of wastewater in Chipper house bamboo handling as well as in chips washing plant.
- Use of evaporator condenser water in Pulp Mill unbleached pulp dilution.
- Installation of Cooling tower & Separators for facilitating reuse of Paper machine vacuum flume water, that saves water to the tune of 20-25 m³ per tonne of paper.
- Recovery and reuse of water through settling of Water Treatment Plant Clarifier underflow, about 60 M³ water per hour is saved.
- Replacement of reciprocating compressor by centrifugal compressor saves 30 m³ water per hour.

These promising steps have resulted a decreasing trend in Mill water consumption per MT of paper. Fig. 4 revealed that in 1998 – 99, the water consumption was as high as 221 M³/MT of paper produced and to –day it is 109 m³ in 2005- 06 Dec. As a result the wastewater-discharged quantity is also getting reduced, which is shown in Fig.5. The presented data revealed that the NPM has already achieved the laid

down wastewater discharge norm in CREP.

The water consumption and the wastewater discharge shall be reduced further once the following time targeted action plans as noted below are completed.

- After implementation of new bleaching sequence with re-circulation of filtrates for spray etc., another 400 m³ per hour of water is expected to be reduced.

Coal consumption rate is also gradually reduced. This is possible because of the following reasons :

- Energy conservation from power side and steam side,
- Steam generation in Recovery boiler improved because of some capital schemes implemented, like Falling Film Evaporator etc.
- Reduction of process steam consumption.
- Increase in capacity utilization of the mill.
- The specific coal consumption got reduced from 2.21 MT coal per MT paper produced in 1999-00 to 1.1 MT in 2005- 06 Dec.

Treated Effluent Quality

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. NPM has a modern ETP with about 2200 m³/Hr. flow capacity, attached to an Aerated Lagoon. 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 these pollutants is reflected in Fig.6, 7 and 8 respectively.

In order to ascertain the best alternative disposal of treated effluent, as per directive of the Govt. of India, an expert committee was constituted drawing scientists from Assam Agricultural University, Ministry of Environment and Forest, National Environmental Engineering Research Institute (NEERI), Central Pulp and Paper Research Institute (CPPRI), Indian Council of Agricultural Research in 1986. The committee after site visit and due analysis of soil and treated wastewater have concluded their recommendations in a report

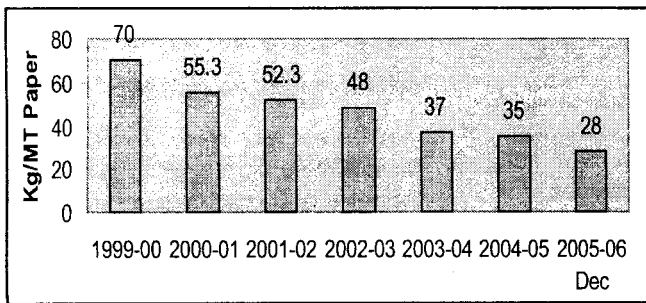


Fig. 6 Treated Effluent Quality, Reduction in Cod Discharge

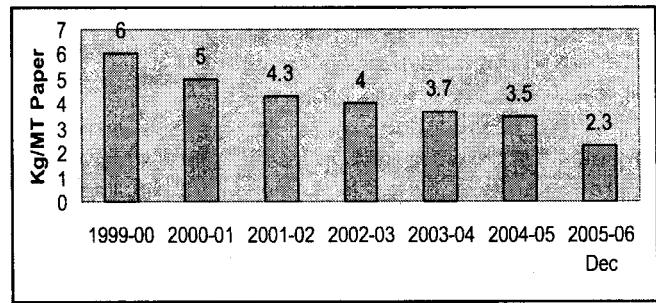


Fig. 7 Treated Effluent Quality, Reduction in BOD Discharge

which was circulated to all concerned including Govt. of Assam and State Pollution Control Board.

And as per their recommendation, the treated effluent 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 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 February every year. Wastewater use for agricultural purposes is widely used all over the world. There were 153 installations in USA by 1997 where crops irrigated were a major reuse activity (2).

Environmental Surveillance

Sampling of wastewater streams is

being done round the clock. The entire stretch of 25 km to river Kolong is regularly being monitored. The reports are communicated to the statutory authorities that include every day analysis data on treated effluent quality, Ambient air quality, Noise monitoring data, Ground water quality, Beel water quality to river Kolong.

Ambient air monitoring is also being carried out in four stations installed in different directions of the mill. Both ambient and stack emission in all the boilers is also regularly being done by a recognized Institution. Ground water quality near Brine Sludge pit and lagoon is being monitored as per the directives from the statutory bodies. Samples are collected every month, as per the lay out submitted, 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, Peizometric tubes also installed all around the lagoon in five different places for ground water sampling and analysis. No contamination observed so far.

It may not be out of place to mention here that; the NPM is a certified ISO 14001 Company under EMS. The

certifying body is also regularly carrying surveillance Audits on these environmental aspects.

Study by External Agencies and Their Revelation

In order to ascertain any adverse impact in the surrounding areas of the treated effluent disposal route, renowned Institutions were awarded work orders to carry out many impact studies. These are :

- Study by the expert committee in 1986.
- Rapid EIA study by the NEERI in 1989.
- Short-term study by the Gauhati University in 1986.
- Comprehensive EIA study by M/ S.Ghose Bose & Associates, Kolkata in 1998.
- Short-term study by the Gauhati University in 1998.
- Short-term study by the IIT, Guwahati in 2003.
- Short-term study by the CPPRI, Saharanpur, in March 2005 and
- Long term study by ex-soil scientists of AAU, Jorhat, in 2004-05, 2005-06 Nov.

Most of the above mentioned studies are directly or indirectly related to the impact on the surrounding areas of the disposal route. The reports revealed that the water or soil collected from the disposal route does not show any major abnormality as far as environmental parameters are concerned. "A Study of

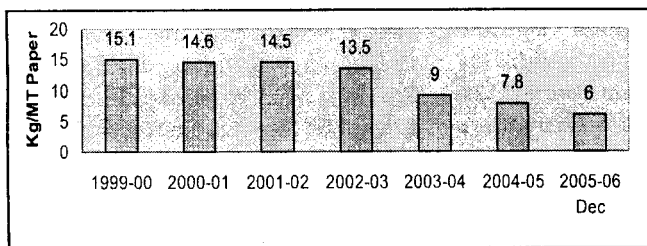


Fig. 8 Treated Effluent Quality, Reduction in Suspended Solids Discharge

the Elenga Beel Ecosystem”, by the Gauhati University in 1998, revealed that- ‘as a whole, the soil analysis does not reveal any adverse impact from the use of the Elenga Beel water for irrigation. On the other hand, as learnt from the cultivators, the soil has shown increased fertility during the last few years. Moreover, after about six years of the previous study, a scientists group, comprising of renowned soil scientists of the state, who has recently submitted the final report, expressed their satisfaction as the entire stretch shows good yield of crops with less requirement of fertilizers. The Satellite imagery picture submitted by the experts also revealed healthy crop growth in the area.

Aforestation : A Step Towards Sustainable Development

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 (3). Aforestation activities adopted by the Mill are not only to meet the requirement but also to maintain the ecological balance in its surrounding regions since a huge quantity of bamboo is being consumed in the process. Govt. of India has established the Mill, in order to ensure rapid development of this region to keep pace with the developments take place in other parts of the country. The mill is rendering its services towards eradication of unemployment problem by way of utilizing the abundant raw material in a most scientific manner on sustainable basis. For its capacity production, the mill requires about 4.5 lakh tones of Bamboo in a year. Though at this moment the mill is not facing any crisis for the raw material, but in near future, there may be deficiency of raw material due to the traditional practice of shifting cultivation and reservation of vast forest areas for environmental control.

Keeping this in mind, the mill has adopted a Farm Forestry Scheme for raising bamboo along with other fast growing pulpable timber species. The

objective of the scheme is as under :

- To establish an agro-silvicultural system.
- To increase the productivity from land which are not otherwise utilized for usual agricultural practice.
- To provide job to the local labourer and tribal community in plantation related work.
- To increase the availability of raw material to Nagaon Paper Mill.

Since introduction of this scheme in 2001–02, a total 24 NGOs participated in the first year, 51 in the second year 2002-03, 54 in 2003–04 and 54 Nos NGOs in 2004- 05. Target 15 lakhs seedlings in 2001-02, 25 lakhs in 2002–03, 20 lakhs in 2003-04 and again 20 lakhs in 2004-05 year. So far we have distributed about 41 lakhs of seedlings through NGOs. Seeds of plants along with poly bags are being distributed by the Mill authority to all the NGOs under the Scheme.

Development of Tissue Culture Bamboo Plant for Mass Production of Bamboo

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. 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 proving 50% of the total cost, and remaining 50% will be provided by NPM. The task has been awarded to a renowned farm M/S.Growmore Biotech, Hosur, Tamilnadu. In the mean time, the farm has established a shed net house in NPM premises and the work is in progress. The TC plantlets shall be distributed to the interested

parties/ organizations/ tea estate and Forest Dept. of 7 NE States.

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CONCLUSION

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 many 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. NPM realizes that prevention of pollution and protection of environment is an ongoing process and NPM is committed for continual improvement as per Environmental Management System, which is in force, by application of modern eco-friendly practices. Investment made for this noble cause can be realized in terms of fulfillment of social obligation, which is more important for survival of any industry.

REFERENCES

- 1| N.V.S.R Murthy et.al., Modification of bleaching Tech. For Env. Mgt at APPM, IPPTA AGM issue, 1994, p 13- 16.
2. K.Mbaya and M.Jawed, Wastewater reuse for irrigation- Preliminary criteria/guidelines for South African countries, Institute of Engg, 16th National Convention, 2000, p 20–27.
3. Prof.S.Sampth, Inagural address, J. of Indian Association of Env. Mgt., 1989, p 83- 90.