# An Overview on Plant Maintenance Strategies in Paper Industry

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## INTRODUCTION

The pulp and paper Industry plays an important role in our country's economic growth. The Indian Pulp and Paper Industry is over one hundred and fifty years old. The installed capacity in our country has grown from 0.214 million tonnes to 4.4 million tonnes from First five year plan to Eighth five year plan respectively and during the end of Ninth five year plan the projected installed capacity will be of the order of 5.5 millien tonnes (1). This indicates an appreciable growth of about 26 times. The capacity utilization had been very poor during First Plan (51%) which however improved during the Third and Fourth Plan (83%), but again slumped down to 73% during Seventh and Eighth Plan period.

There are about 380 paper mills in India producing various types of paper products such as writing & printing papers, paper boards, news prints etc. The Indian paper industry is a mix of very small and large integrated plants having minimum capacity of 10 TPD which are basically categorized as forest based, agro based and waste paper based having a population of 37%, 31% and 32% respectively. Our existing paper mills have been practicing technologies falling in a wide spectrum; oldest to very modern, adopting technologies developed elsewhere generally in Europe and North America. Most of the machineries installed were imported from reputed companies, however, in the last 20-25 years a few of the machinery manufacturers have developed fabrication facilites for the equipment required for our paper mills. Still some equipments such as continous digesters, high-speed paper machine with sophisticated instrumentation & technology are supplied by reputed foreign manufacturers.

Presently, the Indian per capita consumption of paper is 4 kg. in comparison to Asian average of 18 kg. and US average of 320 kg. The planning commission forecasts a per captia consumption of 5 kg. by 2000 AD. So the Indian Pulp & Paper industry has got a tremendous growth potential estimated at 8% (2). Looking at the above facts and figures it is estimated that a capacity of 1 million tonne per annum has to be added within the 9th plan to meet our demand. Thus during the present five year plan we require an additional investment of about Rs. 16,666 crores assuming the cost of investment to be Rs. 5 crore/TPD.

In the present situation where money is hard to come, it may be a wise option to make efforts to keep existing mills alive and healthy, maximise the capacity utilization of the existing plants and increase the capability of producing quality products thorugh optimum plant maintenance strategies.

After the economic liberalization and drastic reduction in import tariff, the paper industries face international competition. Falling international prices and low domestic demand have compounded the problems of the Indian paper industry. In addition to the above factors, Indian pulp & paper industry suffers from scarcity of costly raw material, non-availability of power and disadvantage of having low economy of scale of production. The ways to overcome these difficulties in Indian pulp and paper industry are to produce best quality of the product, maximise capacity utilization of the mills and minimize paper

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manufacturing cost, by adopting the appropriate maintenance strategies.

By adopting the best strategy of maintenance management, the life cycle cost of the paper plant & machinery; operation and maintenance cost; consumption of lubricants, spare parts and consumables; generation of waste; safety hazards and chances of catastrophic failure/damage of capital assets can be minimized, making our mills more competitive in the world market.

Due to technological advancement in the process and machinery involving production of new generation high yield pulps, increase in volume of production, incorporation of sophisticated and costly capital equipment like continuos digesters, high speed double disk refiners and considerable increase in the speed of the paper machine (of the order of 1000 m/min), modern paper industry can not afford to have sudden equipment failures, excessive down times, product quality rejects, excessive operation and maintenance cost, safety hazards like leakages/accidents/emission of pollutants. Thus the importance of availability and maintainability and requirement of operational reliability of plant of machinery have become very high which can be again achieved by implementing the best strategies of maintenance management only.

A survey conducted at three leading paper mills in the private sector situated at different states, depicted that the average availability of plant & machinery is around 80% as against world class benchmark of 96% (3), and the total lost hour due to maintenance (Down-time) is 20%. After carrying out break down analysis it is revealed that 80% of the breakdowns are attributed to mechanical failures and the rest 20% is due to electrical and instrumentation faults. Some of the reasons of break downs are given below:

a) Incorrect assembly of the equipment after overhauling.

b) Misalignment while putting back on foundation.

c) Improper material of the spares and components.

d) Spurious and reconditioned bearing.

e) Spares and components dimensionally not correct.

f) Blow holes and fine hair cracks in the cast components.

g) Rotating parts dynamically unbalanced.

h) Lack of lubrication

i) Foreign material entering the equipment.

j) Wrong and faulty operation.

k) Motor burn-outs.

l) Failure of thyristerised controller of DC drives.

It can be observed from the above data that there is a considerable scope for improving the availability of paper mill machineries by minimising un-planned randon and sudden equipment failures by implementing planned predictive-preventive maintenance practices in a paper factory. It can be further emphasized that systematic predictive and preventive maintenance of paper mill machinery will ensure optimum performance efficiency, highest yield, best quality product, accident free operation, better house keeping and safety in the factory.

By planning maintenance activities with the help of modern techniques (application of PERT/CPM etc.), the overhauling and repair time can be greatly minimised, leading to availability of more number of dyas per annum for production.

The constant problem of wear and tear due to abrasion, impact, corrosion and friction have been reducing output of paper industry considerably and also decreasing the economic usage life of paper mill machinery. Therefore, application of predictive-preventive maintenance techniques has become very much necessary for reducing the abrupt premature failures of equipment.

In order to over come the chronic problems of sudden premature failure of different components of paper mill machineries, it is necessary that the failure histories are maintained and the same are analysed for applying modern techniques of Tribology, Corrosion Control & Diagnostic Techniques etc. It may be emphasized that the computerised system of maintenance information and documentation will help in a long way to undertake corrective actions leading to higher operational reliability and maintainability of pulp & paper mill machineries.

At present, in most of the paper factories only breakdown maintenance is followed. However, planned annual turn-arounds and some planned/scheduled maintenance activities are carried out based on

manufacturer's recommendation. The quality of turn-around maintenance/overhauling is not always assessed by modern Non-Destructive Examinations (NDE) & Condition Monitoring (CM) techniques leading to occurrence of forced outages. Most of the time, manufacturer's recommendation may not be practical and a better strategy of carrying out the planned/ routine maintenance should be based on failure reports and maintenance history of critical machines which is possible only if the preventive maintenance (PM) is done systematically, preferably using a computer. It is further emphasized here that, in order to carry out PM inspections properly, maintenance instructions should be made and the technicians should be trained to carry out these inspections according to the standards laid down.

It need not be over emphasized that application of tribological technology will help in reducing most of the mechanical failure of paper mill machineries due to wear and tear and also ensure conservation of energy. It will also help in increasing the reliability of these machineries which, of course, could be done by understanding the laws of friction, mechanism of wear and advanced lubrication system etc.

In our modern paper mills, sophisticated instrumentation systems like Automatic cooking analyser, On-line freeness tester, Brightness sensors and On-line flue gas analyser, etc. are being incorporated. But unfortunately, on-line CM sensors and diagnostic gadgets are not being incorporated in such critical mills. Implementation of these CM techniques like vibration analysis of rotating equipment, corrosion monitoring, thermography and wear debris analysis will ensure optimum operational reliability of the paper mill machineries and also help in extending the life of the same.

The latest philosophy of maintenance management is however Total Productive Maintenance (TPM). This concept has been implemented in large mass- production industries in Japan and advanced western countries. In our country also TPM is gradually being implemented in different progressive organisations. This philosophy encompasses the following two broad objectives:

## (i) MAXIMISING OVERALL EQUIPMENT EFFECTIVENESS (OEE)

The economic environment is becoming increasingly harsh. In order to survive, it is desirable that companies persue improvements in productivity and quality, to the limit. TPM aims to use equipment at its maximum effectiveness, in other words going all out to eliminate all kinds of wastages and losses caused by equipment. Specially, it aims at a complete elimination of the six major losses those caused by equipment failure, set-up and adjustments like wire and felt changes and wash-up of the system for quality changes, idling and minor stoppages due to washing of wire and felts, process defects and reduced yields. Failures are the "root of all evil" and TPM's first goal is to tackle the elimination of these failures. The basic concept in eliminating failure is to discard the idea that this is impossible to be convinced that failures can be eliminated. Failures occur because of the way equipment is manufactured, used and maintained. We could therefore say that man somewhat willingly causes failures. By changing man's views and behavior toward the methods by which equipment is manufactured, used and maintained, it is possible to eliminate all failures and the six major losses. This is a major and basic concept of TPM.

## (ii) AUTONOMOUS MAINTENANCE BY THE OPERATOR

Factory Automation (FA) is rapidly spreading in paper mills and major changes are occurring in the structure of production. TPM aims to create a maintenance management set-up that meets these changes. FA enables the automatic production of goods, so many people, particularly executives, fall victim to the illusion that they can leave everything to the machine. In reality, however, automatic continuous production at FA plants is interrupted by equipment failures and other troubles. The production operation has been automated. but since the maintenance of equipment has not been automated the process is frequently interrupted. Automated equipment has taken over the operations that were formerly performed by company employees, but employees are responsible for maintaining the new FA equipment if this maintenance is not carried out, the equipment will break down or become less effective. Just as man looks after his health, operators look after the well-being of their own equipment and carry out daily maintenance work such as cleaning, lubrication, tightening and external inspection so that the equipment does not fall sick or break down. Similarly, maintenance presonnel are equipment doctors, and they are responsible for carrying out periodical inspections and precision diagnosis and repairs.

Thus we may conclude that in order to minimise the manufacturing cost per tonne of paper and remain

globally competitive, we must implement TPM in our paper mill. This will ensure maximum OEE of paper mills machineries and hence enhance productivity and profitability of our paper mills by optimising availability of machines, maximising equipment performance efficiency and producing best quality product without any wastage. The implementation of TPM in our paper mills will help us in achieving world class maintenance norms which are given below.

- OEE for paper machine should be 90%.
- Planned and scheduled maintenance work should be 95%. (Planned maintenance activities 70%+ Continuous improvement 25%)
- Very high standard of cleanliness and house keeping.
- Closed stores yet delivering the spares and materials to job location.
- Flexible work force.
- High level of skills and motivation so that the supervisors' role is to plan and not to instruct.
- Fast access to technical documentation.
- Institutionalised and continuous training etc.

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