"Need for Organised and Effective Preventive Maintenance in A Pulp and Paper Mill"

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The purpose of any maintenance programme is to keep the equipment running properly. A well trained, equipped and organised maintenance team can certainly reduce the amount of downtime. Moreover product quality is improved because equipment is kept finely turned. Mostly these objectives are achieved through breakdown maintenance. There is lot of talk about preventive maintenance, but hardly anybody cares to introduce this programme in a real and effecctive manner, because it takes time and requires consistent follow up to introduce such a programme.

It is frequently argued that preventive maintenance costs quite a bit. but we should not forget "a stitch in time saves nine." It can be proved beyond doubt, that cost incurred in preventive maintenance is paid many times over by increased productivity. The elements of good maintenance are organisation, Engg. records, inspection, lubrication, Engg. analysis, planning and sheduling inventory control of maintenance store and spares, workshop, tools and maintenance facilities, standards and budgeting and cost control. Anybody who feels it can be done in a short period is disappointed. It has to be taken up patiently in stages.

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Firstly a detailed list is prepared comprising of all the equipment in each plant, alongwith detailed specifications. For instance, on paper machine, under a broad head, a master record of different itmes such as pumps, head box, wire part, press part, driers, calenders, reelers, alongwith rewinders and sheet cutters, machine clothings, machine drives, instrumentation, steam and condensate removal system and lubrication should be prepared. These items should be sub-divided into units. It will be better if an easily approachable code system is also evolved. These items are coded as L-Lubrication, I-Inspection, R-Minor Repair, M-Major Repair, O-Overhaul.

Second stage will involve planning and scheduling i. e. what should be the periodicity of lubrication, inspection, minor repairs, major repairs and overhauls and when to perform a particular job. Supplier's manuals are very helpful in this regard, but hardly these are properly filed and for old machines these are rarely available. The maintenance engnieer has to apply his own knowledge and discretion, blended with his experience.

The third and the final stage is to organise and distribute the work among the persons who have to perform individual duties. The preventive maintenance team is sometimes termed as "Maintenance Gang". This gang works in parallel with others and draws comparatively more salary and incentives. The productivity of a PM gang is certainly immea-

surable. An effective communication system is also necessary and there should be clear authority and responsibility.

The next question is whether the organisation should be centralized or decentralized. This depends largely on the size of the organisation. In an integrated pulp and paper mill it should be centralized, but with sufficient degree of autonomy at the middle level. All these activitics should be well co-ordinated i. e. between the engineers themselves as well as the process people.

Apart from this material management is a very important function. In case of failure, one cannot afford to wait. T. I. Meehan., Sr.,[1] emphasises the following key points:

1. Prepare adequate material and equipment list.
2. Assign single responsibility for storage, receiving and material handling.
3. Be sure the people responsible have a good understanding of how equipment is to be received and erected (in case of new installation).
4. Prepare some sort of graphic presentation of job planning, such as PERT charts, procedure planning or critical path.

A maintenance engineer has to be cost minded. He should be particular about accepting such designs which prove to be less costly in the longer run. E.G. Wilson[2] advises against "less maintenance prove designs" and says the design criteria which can reduce maintenance cost without greatly affecting capital expenditure, such as case of clean up, balanced design, observability and accessibility, minimum surface, exposure, proper surface protection and standardization, should only be accepted.

Another aspect of cost has been discussed by D.S. Adams[3] with special reference to maintenance versus replacement of a fleet of fork trucks. It has been pointed out that the trucks should be replaced when 'total annual average cost' is at a minimum i. e. if you are spending more than the desired on maintenance expenses, you should go for replacement in a reasonable time. Mechanical maintenance groups face day to day problems with rotating machinery, valves, packings (leakage), corrosion and pipeline bursts etc. Donald E. Bently[4] has divided the rotating machinery in the pulp and paper industry into two groups.

1. Turbines, electric motors and generators, Air compressors, forced and induced draft fans, pulp pumps and boiler feed pumps.
2. The main paper making machinery.

For the group 1 shaft motion transducers are employed. The result of gap shift, as in axial thrust protection in shaft eccentricity protection can well be distinguished and corrective action is taken. For the machines in group-2 special scanning type monitors are employed. The maintenance personnel, can make special observations for their malfunction diagnosis work and maintenance scheduling. The use of vibroscopes, ultrasonocopes, industrial stethoscopes etc. should be encouraged as these do not require stoppage of the equipment.

About roll cover maintenance, Pulp and Paper[5] writes that a minimum removal of rubber during grinding is 0.8 mm. Grinding schedule depends on types of cover and the job the roll is doing. Some new covers e.g. on size press roll have three to four times the previous usable time between grindings, but periodic planned maintenance is necessary for each item.

Recently, vibration measurement and its analysis has proved to be very helpful. E. T. Shilling and MD Wood[6] state that machinery units vibrations are related to its conditition. Frequency, magnitude and phase are the properties which help in diagnosing the trouble. For example the magnitude of vibration is an indicater of the condition of machinery, while the frequency of the maximum vibration and direction of the vibration are indicators of the fault, which is causing the excessive vibrations.

The application of vibration analysis to preventive maintenance is based on these commonsense propositions. This application reduces lot of inspection time and schedule required by the operators in day to day checking.

E. W. Fisher[7] states that corrosive materials such as sulphite liquor, chlorine, bleach solutions, and green white and black liquors must be stored and transferred efficiently and with a minimum of leakage-while paper stock, water, steam, dyes, sizing materials and other additives also must be transferred at throttled leakage rates. Correct use and knowledge of proper packing materials is of utmost importance. TFE which offers the advantage of complete corrosion resistance, whiteness, lack of contaminants, and high lubricity resulting in long life has come to play a major role. However, great care is to be taken while adjusting or installing TFE packings as its thermal co-efficient is high (six times greater than metal) and only experinced hands should tighten the belts (please see table-1).

Table 1 : Guide to Packing for Pulp & Paper Application

Application	Preferred	Recommendation Acceptable
Sulphite, acid and Waste liquors.	TFE fiber yarn LATTICE BRAID	Blue asbestos impregnated with TFE, LATTICE BRAID or treated graphitic regular square braid. (Garfite 100).
Kraft Green Liquor White Liquor Black Liquor	TFE fibre yarn LATTICE BRAID	Blue asbestos impregnated with TFE, LATTICE BRAID or treated graphitic regular square braid (Garfite 100).
Chlorine, SO_2 valves.	TFE Washers	Blue asbestos impregnated with TFE, LATTICE BRAID as end rings with plastalic centres rings of TFE powder, synthetic binder, imgraphited.
Fresh water	White asbestos yarn, white lubrication, impregnated with TFE, LATTICE BRAID	White asbestos yarn, lubricated but ungraphited, LATTICE BRAID or long fiber flax, lubricated but ungraphited regular square braid.
Condensate & Steam	White asbestos yarn, lubricated and ungraphited LATTICE BRAID.	White asbestos yarn, lubricated but ungraphited, regular square braid.
Wet strength solution, dyes and Alum.	White asbestos yarn, White lubrication, impregnated with TFE, LATTICE BRAID.	White asbestos yarn, lubricated but ungraphited, LATTICE BRAID or long fiber flax, lubricated but ungraphited regular square braid.
Clay Pumps	White asbestos yarn White lubrication, impregnated with TFE, LATTICE BRAID.	White asbestos yarn, lubricated but ungraphited, LATTICE BRAID, or long fiber, flax lubricated but ungraphited, regular square braid.

E.J. Bonner[8] says, corrosion prevention is an essential form of preventive maintenance and when the capital cost of constructional materials are considered, two important facts should be remembered.

a) It is more economical in the long run to take into account the most corrosive conditions that are likely to be encountered and to specify materials accordingly.

b) The layout and the design of the plant should be based on standard principles of corrosion prevention (Please see table 2).

According to Albert Walz 9 FRP (Fiberglass reinforced plastic) is in the increased use in the piping for unbleached brown stock chlorination towers (FRP lined), tanks for sodium bisulphite solutions, condensing tower, headboxes, exhaust ducts for SO_2 digester blow off gases.

New trends in the maintenance, according to Michael D. Sullivan[10] include 'selective maintenance' which is a means of determining maintenance and inspection schedules for paper machinery, on the basis of reliability and productivity. Two indices, one representing productivity or the importance of the machine to the entire operation and the reliability are compared to determine the inspection schedule. Machinery with a high productivity and low reliability are checked most often. With the use of the schedule, potential

Table—2 : Materials Application-Ferrous/Nonferrous Alloys

Stainless steels	Austenitic	Composition
Type 304	EN58E	18CR 10Ni
Type 316	EN58J	18CR 10 Ni 3Mo
Applications		Type
Alum Handlin		316
Head boxes) Refiners) Stock Pumps) Suction Rolls)		304/316
Condensate handling equipment		316
Heat exchanger tubing		316
Dilute acid proportioning equipment		316
Turbine blading		316
Hydrapulper table cladding		304
Refiner bars		316
Ni Resistant Austenitic Cast Irons		Composition
Type 1) & 2)		1.75–4.5% Cr. 5.0 –22.0% Ni
Less corrosive conditions pH 4.5 Applications of normal grey cast iron		
Effluent treatment plant.		Type 2
Filter bodies (River)		Type 1
Pump Impellers (River)		Type 1
Condenser boxes		Tpye 1
Condensate mains		Type 1
Fourdriner machine Frames		Type 1/2
Fourdrinier & Yankee (MG) Cylinders		Type 1/2
Non Ferrous Alloys Bronze		
Copper 89%, Tin 10%, Phos. 0.5%, pH 5.5—7.5		
USE : Pump Internals (mild brine condition) River Water Screens, Fourdrinier machine wires, Fourdrinier.		
Cupro Nickel		Composition
Copper		60—70%
Nickel		40—30%
USE : Heat Exchanger tube, LP Units, Turbine condensers Turbing (High Water Velocity).		

problems can be isolated with a minimum of inspection.

Another trend is contract maintenance–less common in India i. e. getting jobs done by contracting outside firms. For instance, the repair of internally corroded digester surface by welding (stainless steel rods) can better be performed by contractors specialised in the field and may involve less cost.

Above all, over maintenance should be avoided. A maintenance programme is aimed at running the equipment in an efficient manner. It is the high time to introduce an effective PM programme which can be done in three stages. A centrally controlled PM programme with sufficient autonomy at the middle level will be more suitable.

Materials management, cost mindedness, and selecting maintenance prone designs are the keys to success. Modern devices should be used to detect faults. The packings and special materials help fighting corrosion. Modern trends are selective & contract mintenance. Donot overmaintain.

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