Effective Maintenance in Pulp & Paper Plant

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The main purpose of a maintenance set-up in a plant is to ensure that the machineries are available in a planned way for the production programmes of the mill at its best efficiency keeping in mind that the life factor of the machinery is not impaired

Pulp mill like any other chemical plant will have various types of machineries for various process duties. The chipper house, for example, is a purely mechnical plant designed to handle wood or bamboo, and the intensity of wear and tear would be high.

The digester is basically a pressure vessel, and connected heat exchangers, pumps, etc., are subjected to high thermal stresses and corrosion.

The Washing and Bleaching Section has its own special equipments with its own special features. Normally the installed standby capacities in these sections will be nil.

The Finishing department consists of paper machine, or flash dryers, packing section etc. It would be right to assume that from Washing to Finishing, the line equipments are called upon for the maximum availability.

The Recovery Plant handles costly chemicals and is the nerve centre of the Plant economy.

The process duty requirements of the equipments are to be clearly understood before an effective maintenance programme can be organised.

For proper maintenance, a correct managerial approach and a competent maintenance organisation are very essential. Maintenance cannot be considered as an independent function, and its effectiveness is always interrelated with the operation of the plant. Between two planned maintenance attentions, on an equipment, the equipment is being run and handled by the operating crew. Improper attention during the above period can land up in an earlier failure causing loss of production.

Proper understanding and care, both from the maintenance and operating departments, would be necessary to ensure best performance of the machinery.

The Maintenance department will be called upon for the following duties:-

1. Routine maintenance,
2. Breakdown maintenance,
3. Preventive maintenance and
4. Minor modifications and alterations in the Plant.

There is special mention of minor modifications because it is not always correct to burden the maintenance department with the major development activities in the mill. An independent organisation should be available in the mill for large development work.

Routine maintenance is the type of minor care required for the daily running of the machinery which more or less merges with the duties of the operations of the Plant. Or, it is the minor but important maintenance required for keeping a fit equipment in its fit running condition for a period of time. Tightening of a leaky valve or loose gland, or dripping fiange, replacing coupling bushes, make up of lubricants, keeping the equipment in clean condition, ensuring the cooling arrangement and ventilation, come in this category.

Apparently this routine attention

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may appear simple and unimportant due to the fact that the consequences of neglect may not be immediate. But, until this care is ensured the machinery cannot be brought under a planned preventive maintenance programme. This function is usually attended by the shift maintena nce crew and the lubrication department. However, a very close liaison with the operating department is necessary and vigilance all around is called for.

When an equipment has stopped by itself and immediate repairs are called for, it is called a 'breakdown'. It could happen at any time and no prior arrangements can be made. The main objective of the maintenance department is to prevent such breakdowns by organising affective maintenance programmes. The adverse effects of a breakdown on production, overtime, and economy, are known to everyone, and I am not elaborating on this.

Preventive maintenance is attention given to the machinery in a planned way well ahead of its reaching the breakdown point. In a proper set up at least 75 per cent of the maintenance load should be in this category. The terminology 'Preventive Maintenance' is not understood by many, though everyone is anxious to avoid a breakdown.

There are categories of equipments on which preventive maintenance can deliver adverse results instead of improving the performance. For example, a ceiling fan; if some one decides to open it up and overhaul, the chances are that the small components would get damaged and replacements would become necessary which may not have been called for if the fan was left alone. At the same time, there is definite advantage of checking periodically the regulator of the fan, or the capacitor, for loose connections.

A machine consists of various components, moving and stationary. Every machine is designed in such a way that certain components are meant to wear, and certain others have indefinite long life. Let us examine centrifugal pump, one of the most common machinery in a pulp mill. The bearings, the coupling bushes, the sleeve and the casing rings are items meant for wear. Depending on corrosion and erosion, the impeller and the volute may also wear out at a much slower rate. The bearing housing, shaft and couplings are not meant for any wear and the built-in life is unlimited.

For the convenience of discussing preventive maintenance, let me limit the wearing part to one, say the pump sleeve alone. Normally, the sleeve is expected to work satisfactorily for a period of eight months to one year. If this is the case, the pump should have given excellent performance during the first month, and gradually deteriorated in a period of eight months, and become unworkable or broken down by the tenth month. Left alone it might carry on with leakages for a period of another two months also. Preventive maintenance programme is so sheduled that the pump is taken out for maintenance, say at the seventh month, and a new sleeve i. e. the wearing components are renovated to the original level. If some other unexpected deterioration is seen those are also repaired and the equipment is supposed to have become fit for the original performance level again. To predict this programme, the first condition is that once renovated the pump should have a satisfactory working span for seven months.

Though unusual, it is also possible that life of the sleeve may get reduced to two or three months due to some abnormalities in the working conditions, lack of routine attention, running the pump with leakages etc. This is where the routine maintenance and operation assume importance, so that the built-in life of the component is ensured in between the duration of planned maintenance.

Further, it is quite possible that during the first preventive maintenance attention, the sleeve was not replaced of a correct material and of correct fit. In either case, part of the life of the component is already finished before the start-up itself and the equip-

ment has to fail ahead of the programme. Hence, the right type of workmanship and right quality of spares introduced assume extra importance in a planned maintenance programme. It is necessary to have proper agencies for inspection of spares for its quality fitness and tolerance.

When frequent breakdowns are noticed on a particular equipment, renovating the same to original level will not solve the problem. This is where expertise and intelligence are called for. When breakdowns repeat at a particular spot, sevreal other factors have to be looked into—whether the equipment is suitably designed for the duty; whether the installation condions have in any way adversely affected the design performance of the equipment; whether there are fluctuations possible in the operating conditions, so that occasionally the equipment is performing outside its design limits; whether the material of construction of the equipment is suitable for the duty, etc. When compromises are struck on the above details, the equipment would not behave in a predictable pattern, and when predicitions are not possible the programme will not work. The fault will have to be identified and corrected first and machinery to be brought to a predictable pattern of working, and thereafter preventive maintenance can be carried out on the equipment satisfactorily.

This is where modifications, change of equipment, and change of layout, become necessary and it forms part of the corrective maintenance. It is always better to correct the deficiencies in the equipment rather than trying to maintain the same in impossible working conditions. What I am trying to explain is that first the equipment should be corrected to work in a predictable pattern and then only organize the preventive maintenance on the basis of the predictions. Thereafter, continuous corrective maintenance can be done to improve upon the established predictable norms.

But corrective maintenance is more easily said than done. Sometimes it calls for very intimate knowledge about the design details of the equipment, working conditions, and the possible financial involvement. However, in majority of the cases the solutions are simple, and can be easily implemented by an intelligent maintenance head. Indigenous improvisations on sophistlcated imported machinery is better done after careful consideration of all details, instead of hastening with a temporary remedy. It has been already stressed that the long term performance of the equipment is most important. In handicapped situations the top management should be brought to the picture and posted upto date.

Once a predictable pattern of working is established and the necessary periodical checks are ensured on all wearing components, and attention is paid on its day to day routine care, a large percentage of the breakdowns will disappear.

Majority of preventive maintenance is directed towards the wearing components of the machinery as mentioned above. Incidentally a mill may stop due to various other equipments also, like pressure vessel failure, pipeline corrosion, failure of tank linings, etc. A separate inspection programme is to be maintained for such equipments, the frequency of inspection derived on the basis of local experience. The digester in a pulp mill might have several years of life. It can also explode in one day if the design ratings of the pressure and temperature conditions are exceeded. Hence. adequate check must be given on all protective fittings almost once in six months to ensure that all the safety fittings and the pressure components are fit for operation. Usual procedure is a hydraulic test which by no means is the final guarantee. Particularly in case of lined tanks and vessels failures have been observed even after satisfactory hydraulic test. It is not always possible to inspect the linings and protective layers with a machine or an instrument every time, and ensure its satisfactory condition. However, a proper

visual inspection by a competent person followed by a hydraulic test should go a long way in certifying these equipments.

The piping also should be brought under the inspection programme under various categories–pressure pipes, corrosive duties, non–ferreus pipes, etc. The available instruments like thickness gauge, spark testers, etc., should be made use of to evaluate the reduction in thickness and a programme can be made for the replacements. Changing these pipes at a constant frequency is likely to be either too early or a little too late, and in either case it may prove uneconomical. Chlorine pipes, chlorine valves, etc., seem to fail occasionally too early, and sometimes giving out much longer life. Such changes are liable to occur as the process materials handled by the pipes do vary within limits.

In a process plant, the equipments will be in two categories: in-line equipments and batch equipments. The chippers and digesters are batch equipments and the chip handling may be 'in-line'. For carrying out preventive maintenance, the stoppages on a line will call for a higher man-power requirement as several jobs are to be simultaneously attended. The maintenance of the batch machineries will require only lesser strength as the work load is uniformly distributed during the year. This would mean that a constant maintenance strength working in the department cannot handle everything. The department should have a constant strength required for the uniform work load and the additional force required for the organised shut–downs should be available from a maintenance pool. This central pool can also do the functions of minor modifications in the plant during off peak load and the balance of their time should be utilised for renovation of spare parts and preparatory work for the future preventive maintenance jobs. It is of utmost importance that this pool should have extreme skill as they would be handling a variaty of jobs and the consequences of a bad workmanship could be a breakdown immediately on start-up.

Since preventive maintenance is to be done on an equipment which for its external look is still working satisfactorily an element of negligene can always creep in. After all, when the equipment is working satisfactorily there is no immediate pressure for its attention. This is the major factor working in the way of effective preventive maintenance. The possibility of the engineer, who is immersed in his routine, slackening a little cannot be ruled out. It is better to have an independent agency for preventive maintenance–programming at least, so that the long term interests are always kept in sight. Once the programming is done and stoppages are planned, the section engineer concerned can look after the execution part of preventive maintenance, and can be responsible for the quality of the work done.

Some amount of clerical work is necessary for preventive maintenance programming. The records of maintenance jobs done are to be compiled and equipment history is to be built up, so that the benefit of past experience is not lost. Adjustments in the frequency of maintenance schedules are to be continuously reviewed on the basis of past performance. Breakdown reports are to be generated and corrective actions programmed and implemented. The availability of spare parts and the costing is to be continuously reviewed. The preventive maintenance control cell should have the organisation for all the above functions.

Lubrication of the mill is also a very important item which comes in the category of routine maintenance. Replacement of the lubricant will go with preventive maintenance programme and the daily make-up would be a routine. Vigilance is called for as the possibility of neglect does exist. It is better to have a centralised lubrication system, so that pooling of old lubricants can be arranged for inferior duties and wastage of lubricants controlled. Under-lubrication is as harmful as over-lubrication,

as all lubricants work as a heat insulation. The right grade of the lubricant and the right quantity is to be ensured at all spots. At times it is noticed that correcting the grade of lubricant improves the performance of the machinery, especially in extreme duty conditions of temperature, and speeds. It would be worthwhile to get the advice of specilist if one is in doubt, instead of taking a chance on the grade of the lubricant. Standardisation and limiting the variety of grades can considerably reduce the costs.

The major part of a mill consists of mechanical equipments and the preventive maintenance programmes have been more or less discussed in a way best suited for the mechanical equipments. Similar programmes should be made for the electrical and instrument service also, so that the down time for the former is utilised by these agencies. The programming section will have to make out schedules for these services departments also, so that all jobs are completed in the minimum possible down time of the Plant. Normally accommodating the electrical and instrument jobs would be easy enough.

Cleanliness goes a long way in speaking for the effectiveness of maintenance. Leakages and unclean appearance are the first indications of troubles ahead. Attended in time. the plant will look neat and machinery would perform better. Almost every failure would give a prior indication by way of change in the working noise, change in the temperature, slight leakage, etc. The maintenance personnel should be vigilant enough to observe and act in time.

I have note touched the subject of specific maintenarce on any particular equipment specially due to the fact that the design of the equipment and installed conditions are never common and any generalised procedure may not be the best suited for a particular situation. The benefit of previous experience on a specified equipment also would be a major factor for deciding the maintenance programme. Hence, it would be for the individual maintenance engineer to evolve a programme that is best suited for the situation in his mill.