

Enhancing Productivity through Maintenance Management

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Abstract

Over the last few years, many cement plants have upgraded the capacity of their plants through suitable modernization measures in packers.

The 1st Kiln of the Plant was lighted up in December'1974 and the 2nd Kiln in May'1975. The first bag of Ordinary Portland Cement rolled out of the Plant and dispatched on 3rd March 1975.

As the engineering equipment becomes sophisticated and expensive to produce and maintain, maintenance management has to face even more challenging situations to maintain effectively such equipment's in industrial environment. Maintenance management includes maintenance strategies, functions of maintenance department, maintenance organization and elements of maintenance management to enhancing of productivity of cement plant through up-gradation of packer.

1. Introduction

The term 'maintenance' means to keep the equipment in operational condition or repair it to its operational mode. Main objective of the maintenance is to have enhanced productivity of equipment and increased availability of production systems, with increased safety and optimized cost. Maintenance management involves managing the functions of maintenance. Maintaining equipment in the field has been a challenging task since the beginning of industrial revolution. Since then, a significant of progress has been made to maintain equipment effectively in the field.

2. Maintenance Strategies

A maintenance strategy means a scheme for maintenance, i.e. an elaborate and systematic plan of maintenance action. Following are the maintenance strategies [1] that are commonly applied in the plants.

- Breakdown Maintenance or Operate to Failure or Unplanned Maintenance
- Preventive or Scheduled Maintenance
- Predictive or Condition Based Maintenance
- Opportunity Maintenance
- Design out Maintenance

The equipment under breakdown maintenance is allowed to run until it breaks down and then repairing it and putting back to operation. This strategy is suitable for equipment's that are not critical and have spare capacity or redundancy available. In preventive or scheduled Maintenance, maintenance actions such as inspection, lubrication, cleaning, adjustment and replacement are undertaken at fixed intervals of numbers of hours or Kilometres. An effective PM program does help in avoidance of accidents. Condition monitoring (CM) detects and diagnoses faults and it helps in planned maintenance based on equipment condition. This condition based maintenance strategy or predictive maintenance is preferred for critical systems and for such systems breakdown maintenance is to be avoided. A number of CM techniques such as vibration, temperature, oil analysis, etc. have been developed, which guide the users in planned maintenance [2]. In opportunity maintenance, timing of maintenance is determined by the procedure adopted for some other item in the same unit or plant. In design out maintenance, the aim is to minimize the effect of failures and in fact eliminates the cause of maintenance. Although it is an engineering design problem, yet it is

often a responsibility of maintenance department. This is opted for items of high maintenance cost that are due to poor maintenance, poor design or poor design outside design specifications. It may be mentioned that a best maintenance strategy for each item should be selected by considering its maintenance characteristics, cost and safety.

In addition to the above, new strategies concepts such as Proactive Maintenance, Reliability Centred Maintenance (RCM), Total Productive Maintenance (TPM), etc. have recently been evolved to look it from different perspectives and this has helped in developing effective maintenance. In proactive maintenance, the aim is identify what can go wrong, i.e. by monitoring of parameters that can cause failures. In RCM, the type of maintenance is chosen with reliability of the system in consideration, i.e. system functions, failures relating to those functions and effects of the dominant functional system failures. This strategy in the beginning was applied to critical systems such as aircrafts, nuclear and space applications. At present, this is being extended to critical systems in the plant. TPM, a Japanese concept, involves total participation of all concerned. The aim is to have overall effectiveness of the equipment with participation of all concerned using productive maintenance system.

3. Functions of a Maintenance Department

Following are the major functions of a maintenance department [3-4]:

- Maintenance of installed equipment and facilities
- Installations of new equipment and facilities
- PM tasks – Inspection and lubrication of existing equipment
- CM tasks – monitoring of faults and failures using appropriate techniques
- Modifications of already installed equipment and facilities
- Management of inventory
- Supervision of manpower
- Keeping records

4. Maintenance Organization

It concerns in achieving an optimum balance between plant availability and maintenance resource utilization.

The two organization structures that are common are: Centralized and Decentralized. A decentralized structure would probably experience a lower utilization than centralized one but would be able to respond quickly to breakdowns and would achieve higher plant availability. In practice, one may have a mix of these two. A maintenance organization can be considered as being made up three necessary and interdependent components.

1. **Resources:** men, spares and tools
2. **Administration:** a hierarchy of authority and responsibility for deciding what, when and how work should be carried out.
3. **Work Planning and Control System:** a mechanism for planning and scheduling the work and feeding back the information that is needed for correctly directing the maintenance effort towards defined objective.

It may be mentioned that maintenance / production system is a continuously evolving organism in which the maintenance organization will need continuous modifications in response to changing requirements. Moreover, it is required to match the resources to workload. Maintenance activities – be it preventive or condition monitoring, involve use of resources- men and materials including documents. This requires coordination amongst the involved personnel so that these are timely undertaken. Work planning and control system under maintenance management in the plant ensures this and provides planning and control of activities associated with maintenance. This means application of general management principles of planning, organizing, directing and controlling to the maintenance functions, e.g. to the establishment of procedures for development of maintenance strategy and to models for describing the flow of work through maintenance work planning department. Control system controls the maintenance cost and plant condition.

5. Elements of effective Maintenance Management

An effective maintenance system includes the following elements [3-4]:

- Maintenance Policy
- Control of materials
- Preventive Maintenance
- Condition Monitoring
- Work Order
- Job planning
- Priority and backlog control
- Data recording system
- Performance measurement measures or indices

Maintenance performance for a plant or an organization can be assessed through analysis of Reliability, Availability and Maintainability (RAM) plant data. Relevant parameters, measures or indices for specific plants can be identified [5]. The performance over a period of time will show if it is improving, going down or being sustained. This will also help in knowing how well the objectives are being met. In addition, it will guide the areas which are strong and which need to be strengthened. Use of computers and dedicated software will certainly help in implementing this and the maintenance management system in general.

6. Modification of Packer

In the design out maintenance the equipment needs to upgrade the packing machine in cement industry and improve the productivity, through the following modification or up-gradation of Packer:-

Difference in Area (before and after modification)

S N	Parameters	Units	Packer Modification	
			Before	After
1	Spout diameter	mm	45	55
2	Aeration points	No	One	Five
3	Gate cylinder position		Horizontal	Vertical
4	Impeller housing diameter	mm	120	150
5	Gate cylinder bearing install.	No	02	Nil

Merits of Packer Modification: -

1. Spout chocking problem reduce due to increased aeration points.

2. Packer productivity enhanced & maintenance easy.
3. Load cell alignment easy, because it block are not welded with machine.

7. Conclusion

The modification enhanced the productivity of packer in the organization. The maintenance system has briefly focused on the various aspects of maintenance management. The down time cost for such systems is expected to be very high. To meet these challenges, maintenance has to use latest technology and management skills in all spheres of activities to perform its effective role in profitability of the company.

8. References

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