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An Optimal Preventive Maintenance Strategy for Efficient Operation of Boilers in Industry

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Abstract: This paper present optimal preventive maintenance strategy for efficient operation of boilers. Efficient operation of Boiler can be achieved from an optimal preventive maintenance strategy. It would be especially beneficial for those plants that rely on breakdown or run-to-failure maintenance. There are many advantages for having an optimal preventive maintenance strategy. The advantages apply to every kind and size of plant. The law of preventive maintenance strategy is that the higher the value of plant assets and equipment per square foot of plant, the greater will be the return on a preventive maintenance strategy.
Keywords: Preventive maintenance, Boiler, Scheduling, Downtime, Cost, Safety.

I. INTRODUCTION

Preventive Maintenance (PM): Preventive maintenance is planned maintenance of plant and equipment that is designed to improve equipment life and avoid any unplanned maintenance activity. PM includes painting, lubrication, cleaning, adjusting, and minor component replacement to extend the life of equipment and facilities. Its purpose is to minimize breakdowns and excessive depreciation. Neither equipment nor facilities should be allowed to go to the breaking point [1].

An optimal preventive maintenance strategy should include:

- Non-destructive testing [2].
- Periodic inspection [3].
- Pre planned maintenance activities.
- Maintenance to correct deficiencies found through testing or inspections.

The amount of preventive maintenance needed at a boiler facility varies greatly. It can range from a walk through inspection of boiler facilities and equipment noting deficiencies for later correction up to computers that actually shut down equipment after a certain number of hours or a certain number of units produced, etc [4].

Optimal Preventive Maintenance Strategy should be followed because of the following reasons: To Increased Automation in boilers, Reduce Business loss due to production delays, higher efficiency, Reduction in equipment redundancies, to develop a more organized & planned environment.

II. Implementation of Optimal Preventive Maintenance Strategy*:* The key to an Optimal Preventive Maintenance (PM) strategy is scheduling and execution.

Optimal Preventive Maintenance Schedule: Scheduling should be automated to the maximum extent possible. Priority should be given to preventive maintenance and a very aggressive program to monitor the schedule [5] and ensure that the work is completed according to schedule should be in place. For Most Boilers: The optimal preventive maintenance schedule should be as follows;

- *Daily*: Check water level, Check oil level and make note of level {if gas, read gas meter}, Determine daily consumption., Check oil level in compressor {oil burners}, Check water temperature and oil pressure gauges for correct readings, Make note of water addition {if any}, Take reading of stack thermometer, Check flame at high fire for length and colour.
- *Once a week*: Test low water safety cut off switch, Do a 15-second blow-down [6] on the: Column ,Low water automatic water feeder, Surface valve ,Oil preheater {for oil burners}, Bottom emptying valve, Clean strainers and filters {oil burners}.
- *Once a Month*: Clean spinning cup or nozzle, Clean fire eye, Clean smoke detection eye on chimney, Check pre-rotation veins for any oil residue, Check combustion chamber for any oil residue, Once every six months: Thoroughly clean burner and burner assembly, Clean tubes {once a year if oil or gas}, Test the safety relief valve on the boiler.

- *Once a year*: Have a complete burner overhaul, Conduct an efficiency test on the burner, Clean stack and breaching, Once every two years: Have a waterside boil out done, Once every five years: {oil burners}, Have the oil tank cleaned and inspected, Have the oil lines to and from the boiler steam-cleaned.

Optimal Preventive Maintenance Execution: Traditional preventive maintenance was based on the concept of the bathtub curve. That is, new parts went through three stages, an infant mortality stage, a fairly long run stage, and a wear-out stage. In order to have an Optimal Preventive Maintenance Strategy, the PM should focus on cleaning, lubrication, and correcting deficiencies found through testing and inspections. When there is a need to adjust or replace components, it should be done by highly trained [7] and motivated professionals. Cleaning should be carried out to remove dust, dirt, and grime because these things mask defects that can cause unplanned maintenance outages.

III. Benefits Optimal Preventive Maintenance Strategy: The most important benefit of an Optimal Preventive Maintenance Strategy is reduced costs as seen in these many ways:

- Reduced production downtime.
- Better conservation of assets and increased life expectancy of assets, thereby eliminating premature replacement of boiler machinery and equipment [8].
- Reduced overtime costs and more economical use of maintenance workers due to working on a scheduled basis instead of a crash basis to repair breakdowns.
- Reduced cost of repairs by reducing secondary failures. When parts fail in service, they usually damage other parts.
- Identification of boiler equipment with excessive maintenance costs, indicating the need for corrective maintenance, operator training, or replacement of obsolete equipment.
- Improved safety and quality conditions.

CONCLUSION

The importance of boiler maintenance goes beyond reliability. Conducting regular maintenance also reduces boiler operating and energy costs, improves safety, and extends the life of the boiler. It is possible to have an Optimal Preventive Maintenance Strategy which is highly beneficial to achieve efficient operation of boilers in industry.

In order to minimize risk, preventive maintenance has to be carefully planned and carried out by well-trained and motivated workers. If it cannot be shown that a preventive maintenance strategy will reduce costs, there is probably no good reason other than safety to have a PM strategy. Safety is always the first consideration in boiler operations. Efficiency is second.

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REFRENCES

[1] John M. Gross (Washington, MO), *Fundamentals of Preventive Maintenance* AMACOM (February 12, 2006) ISBN-13: 978-0814473894.

[2] Charles Hellier, *Handbook of Nondestructive Evaluation*. (2003) McGraw-Hill. pp. 1.1. ISBN 0-07-028121-1.

[3] J. W. Schoonahd, J. D. Gould, L. A. Miller (July 1973), "Studies of Visual Inspection", *Ergonomics* (Taylor & Francis) 16, issue 4 (4): 365–379, DOI:10.1080/00140137308924528.

[4] Worsham, W.C., 2000. "Is preventive maintenance necessary?" *Maintenance Resources On-Line Magazine*, Sep/Oct 2000.

[5] Chen, J.S., 2006b. "Optimization models for the machine scheduling problem with a single flexible maintenance activity", *Engineering Optimization*, Vol. 38, pp. 53-71.

[6] Amit Kumar Jain, "An Approach towards Efficient Operation of Boilers" International *Journal of Scientific & Engineering Research (IJSER)*, Volume 3, Issue 6, June-2012 ISSN 2229-5518.

[7] Aashish Khaira, Amit Kumar Jain, "Development of an Effective Maintenance Workman Skills Improvement Program" *International Journal of Engineering Research and Applications (IJERA)* Vol. 2, Issue 2, Mar-Apr 2012, pp.131-137, ISSN: 2248-9622.

[8] Newbrough, E. T., 1967. *Effective Maintenance Management*. McGraw-Hill.