International Journal of Mechanical and Industrial Technology ISSN 2348-7593 (Online)
Vol. 3, Issue 1, pp: (170-174), Month: April 2015 - September 2015, Available at: www.researchpublish.com

Evaluation of Machine Downtime and Failure Analysis of Components in Paint Manufacturing Unit: Review Paper

[1]Arjun Kotwal, [2]Dr.S.S Dhami, [3]Dr.Sarbjeet Singh

[1]ME manufacturing technology, [2]Professor, [3]Associate Professor
[1,2] Mechanical Engg. Department, National Institute of Technical Teachers Training and Research Chandigarh, India
[3]Mechanical Engg Department, Govt. College of Engg and Technology Jammu, India

1. INTRODUCTION

Modern Industries uses high level of automation with complex machines. The function of automation is to achieve higher production rate with better quality. Therefore machines must remain in operating condition in order to achieve the desired result or goal. This concept has changed the operating philosophy as well technology of the industry. A collective measures taken up by the industry in order to keep the equipment or machine in trouble free environment or in good environment is called maintenance engineering. Operational availability of the machines are taken care by the maintenance department. The concept of maintenance was very old and no proper care was given to the machines. When machines stopped, these machines were discarded or repaired. But in today's age, these high complex and invested machines need to be properly examined or maintained in order to increase or maximize their availability. [1] When unplanned breakdown or unexpected failure happen due to equipment failure, whole production line stops and production automatically stops. Therefore it would be expensive to bring the production system into running condition under emergency situation. Thus maintenance plays an important role in any industry. According to the study reported by Mobley [2] about 15% to 40% (average 28%) of the total production cost is due to maintenance activity in the factory

2. DEFINITION OF MAINTENANCE

Maintenance is an activity or routine or recurring process in order to keep the facilities and equipment in good working condition so that it can deliver better performance without causing any loss of time. In other words, maintenance is an activity in order to achieve better quality, reliability and efficient working [1] .According to Kumar and Parida [3] maintenance is defined as the combination of all technical and administrative actions necessary to bring the equipment or restore it into the state in which it can perform its intended function.

3. TYPES OF MAINTENANCE SYSTEM

Maintenance can be divided into two groups

(a) Breakdown maintenance

(b) Planned maintenance

Planned Maintenance can be divided into two following groups:

(a) Breakdown maintenance:- It is also called emergency based policy in which the plant or equipment is operated until it fails and brought back into running condition after repair. Breakdown maintenance is useful for small factories where there are few types of equipments. Machines and equipments are simple and does not require any experts.

(b)Planned maintenance:- It is also called an organized type of maintenance which focused on other aspects such as control and records. In this type of maintenance, work is planned in order to avoid the failures.

Another types of planned maintenances are:-

(1)Scheduled maintenance:- In this type of maintenance, program can be made with the help of production department in order to utilize the idle time of the equipment effectively. If the schedule of the maintenance is known, the specialists for this can be made available during the maintenance period.

(2)Preventive maintenance:- As the name suggests, it is planned type of maintenance in order to prevent or detect failure before breakdown. In this type, systematic and extensive inspection of each item of equipments is done in predetermined intervals.

(3)Corrective maintenance:- The preventive maintenance is useful to detect the nature of the fault. In order to avoid this fault or reoccurrence frequently, corrective maintenance can be carried out. Therefore, corrective maintenance is defined as that maintenance which is carried to restore equipment that has stopped working to acceptable standards.

(4) Condition based monitoring (CBM) :- This type of technique is used to detect potential failures that may not be evident even though a PM programmed. Condition based on maintenance uses actual condition of the equipment to decide what maintenance need to be done. It is used to detect the failure well in advance and therefore appropriate measures can be taken in planned manner. CBM improves equipment reliability ,minimize unscheduled downtime due to catastrophic failure, minimizes time spent on maintenance and improves worker safety.

Types of CBM:-

(a) Vibration analysis:- It is used to detect heavy vibration such as in rotating equipment like compressors ,pumps and motors etc.

(b) Infrared: - It is used to detect abnormal temperatures or hotspots.

(c) Oil analysis: - In this type of analysis sample of oil is analysed and can detect the deterioration or breaking down of an internal equipment part.

(d) Ultrasonic:-It is used to detect deep surface defect.

(e) Acoustic:- It is used to detect gas, liquid or vacuum leaks. [1]

(5) Reliability centered maintenance (RCM):- According to J .Moubray [4] RCM is a process used to determine what we can do for the equipment or assets so that it can perform its intended function what the user want in its present operating condition.

4. LITERATURE REVIEW

Some of the important literature reviewed by the researchers has been discussed as under.

Hasnida Ab samat et al. **[5]** conducted a case study by implementing preventive maintenance scheduling, in order to reduce the downtime of machines. This paper also investigate causes of downtime by performing root cause analysis and proposed a affinity diagram which highlighted several issues with implementation of PM. Analysis of Tree diagram done, in order to generate possible solutions. Due to this machines are separated into critical and non-critical each having a different priority and therefore reduction in downtime as well as workload on the technicians.

Kumar Parveen et al. **[6]** implemented a Root cause analysis and why- why analysis on one thousand ton hydraulic press. In the research the root causes of breakdown were identified and new preventive maintenance checklist for the machine was developed.

Chowdury M.L Rahman [7] conducted a case study of assessment of total productive maintenance implementation through downtime and mean downtime analysis. In the case study, " Pareto analysis" and T-Test" were prepared for determining downtime factors and mean-down time.

Panagiotis Tsarauchas [8] implemented total productive maintenance in food industry and revealed that there can be increase in productivity due to downtime reduction, decrease in cost production as well as reduction of delayed deliveries due to good knowledge of production capacity.

R Rakesh et al. **[9]** uses FMEA analysis in order to improve the reliability of the sub system. In the research, possible causes of failure and their effects were discussed, and also severity values, occurrence no, detection and risk no were determined.

Chauhan Arun et al. **[10]** conducted a case study in the casting industry. In the research possible causes of failure with their preventions were discussed. For this, severity values, occurrence number, detection and risk priority no are determined. Due to this, there is improvement in the efficiency of the manufacturing processes and productivity also increases.

C Danalakshmi Sowmya [11] proposed a case study on analysis of downtime and reliability estimation in a process industry. In the research, researcher aim to estimate the reliability of the components and also to perform FMEA in order to identify critical component so that preventive maintenance scheduling can be performed.

Godwin et al **[12]** conducted an assessment of maintenance performance in order to investigate the present state of management practices, identify the causes and potential sources of failures, breakdowns and defects in production facilities, improve function reliability of production facilities, improve environmental and manpower safety and establish key performance indicators for monitoring and evaluation of maintenance functions. Analysis of findings from the maintenance assessment throughout 2012 reveals a significant progressive increase in the cumulative equipment downtime hours which impacted on rising maintenance cost and drop in plant output across three paint industries (Sharon, Marshal and Flourish) in Enugu, Nigeria. Five strategic and sequential maintenance models were developed as the critical components of the optimum maintenance strategy for continuous improvement in maintenance architecture across planning, methods and scheduling, resource utilization, manpower capacity and safety, monitoring and evaluation.

Horner R.M.W et al **[13]** suggested that increasing pressure to prolong the useful life of a building without compromising the objectives of maintenance has led to an increasing interest in methods of integrated maintenance management. As an alternative to budget-driven maintenance strategies, developed a new approach to selecting an appropriate maintenance strategy which relies on determining the consequences of failure of every item in the building, and determining a suitable strategy for each one. The author analysed the relative advantages and disadvantages of corrective, preventive and condition-based strategies. Advocates a novel, systematic approach to the management of building Maintenance and suggested this method will help maintenance engineers and managers to reduce the cost of maintenance while preserving the safety, health and satisfaction of the user.

5. INFERENCES DRAWN OUT OF LITERATURE REVIEW

It has been observed from literature review that the major parameters for reducing machine downtime are mean time between failure (MTBF), mean time to repair (MTTR), Availability etc. Further, Failure mode effect analysis (FMEA) is a useful tool in finding the critical and non critical components in the process. It also helps in determining the failure mode and improves the process as well. Failure mode analysis improves the productivity or efficiency of industrial unit by ensuring maximum availability of machines or equipments.

6. PROPOSED WORK

In the company there are certain components which undergo frequent failures. Therefore in order to increase machine availability the following steps are proposed.

1. To go through work orders of last 2-3 years to evaluate total machine downtime due to maintenance.
2. To identify machines having very high downtime
3. To identify critical components in the machines having high downtime based on maintenance records.
4. To classify machines according to their downtime history.
5. To study the maintenance strategy used by the company
6. To evaluate Meantime between failure, meantime to repair, Availability of machines components.
7. The reliability analysis will be performed using the Weibull Distribution and various data plots and failure rate information will be extracted for utilizing in the near future by the management of Paint Industry for reducing the unexpected breakdowns and to enhance the reliability and availability of the machines.

8. To carry out FMEA of machines or components to identify failure mode.
9. To suggest new or optimum maintenance strategy this will increase the availability and decrease the machine downtime.

7. PROPOSED METHODOLOGY

In the proposed research work, various KPI's (keep performance indicators) will be used to evaluate machine downtime, different failure modes and causes. The reliability analysis will be carried out using the Weibull Distribution and various data plots and failure rate information be evaluated. The systematic Methodology proposed for solving this problem is shown in fig. 4.1

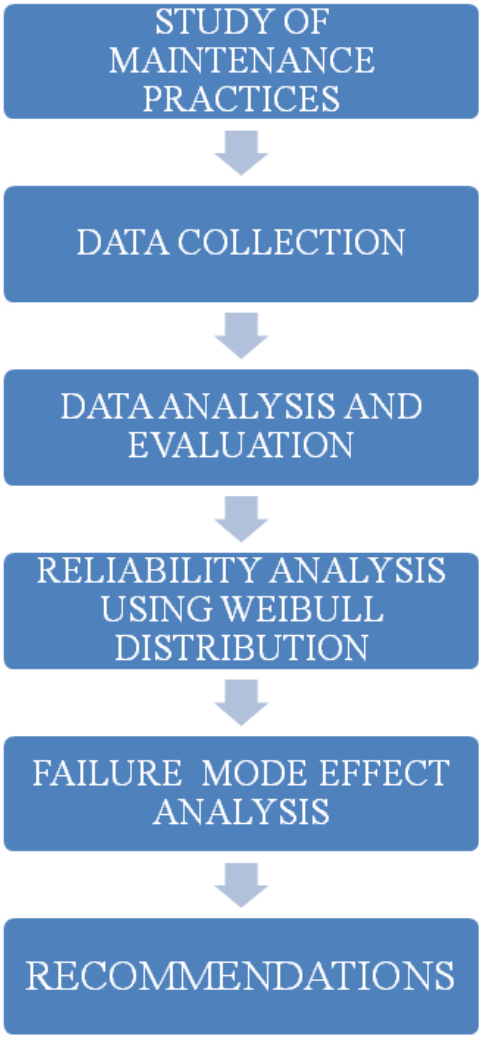

FIG 4.1 FLOW DIAGRAM OF PROPOSED METHODOLOGY

8. EXPECTED OUTCOME

Based on the Literature Review and proposed methodology, the following outcomes are expected from the present work.

1. There will be decrease in machine downtime and increase in machine or equipment availability.
2. There will be increase in Production due to increase in availability of machines.
3. On applying FMEA, MTTR, MTBF and Availability conclusion will be drawn which factors are responsible for failures, and how can an organization maintain their economic growth by maintaining their machine properly.

REFERENCES

[1] Mishra R.C. & Pathak K., "Maintenance engineering and management", PHI Learning Pvt. Ltd. 2012.

[2] Mobley R. K., "An introduction to predictive maintenance",Butterworth-Heinemann, 2002.

[3] Parida A. & Kumar U.,"Maintenance performance measurement (MPM): issues and challenges", Journal of Quality in Maintenance Engineering, Vol. 12(3), 2012 pp. 239-251.

[4] Moubray,"Reliability centered Maintenance", 2nd ed.Elsevier,1997.

[5] Ab-Samat H., Jeikumar L. N., Basri E. I., Harun N. A. & Kamaruddin S., "Effective Preventive Maintenance Scheduling: A Case Study", In Proceedings of the 2012 International Conference on Industrial Engineering and Operations Management, 2012 pp. 3-6,

[6] Kumar P. R., "Analysis of breakdown and improvement of preventive maintenance on one thousand ton hydraulic press", International Journal of Emerging technology and advanced engineering, Vol. 3 (8) , 2013, pp.636-645.

[7] Rahman C.M., Hoque M.A. & Uddin S.M., "Assessment of total productive maintenance implementation through downtime and mean downtime analysis (case study): a semi-automated manufacturing company of Bangladesh)", International organization of scientific research, Vol. 4(9), 2014, pp.38-47.

[8] Tsarouhas P., "Implementation of total productive maintenance in food industry: a case study", Journal of Quality in Maintenance Engineering, Vol. 13(1), 2007, pp.5-18.

[9] R Rakesh, Cherian Bobin, Mathew George ,"FMEA analysis for reducing breakdown of a sub-system in the life care product manufacturing industry", International Journal of Engineering Science and Innovative Technology," Vol. 2(2), 2013,pp 218-225.

[10] Chauhan A., Malik R.K., Sharma G. & Verma M., "Performance Evaluation of Casting Industry by FMEA 'A Case Study" International Journal of Mecahnical Engineering Applications Research, Vol. 2(2), 2011, pp.115-117.

[11] Godwin, Harold Chukwuemeka, and Okechukwu Michael Achara. "OPTIMUM MAINTENANCE STRATEGY FOR PAINT MANUFACTURING INDUSTRIES, A CASE STUDY." Int. J. Adv. Engg. Res. Studies, 2013 : pp. 18-24.

[12] Horner, R. M. W., El-Haram, M. A., & Munns, A. K. Building maintenance strategy: a new management approach. Journal of Quality in Maintenance Engineering, Vol. 3(4), 1997. Pp.273-280.