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Development and implementation of preventive-maintenance practices in Nigerian industries

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Abstract

A methodology for the development of PM using the modern approaches of FMEA, root-cause analysis, and fault-tree analysis is presented. Applying PM leads to a cost reduction in maintenance and less overall energy expenditure. Implementation of PM is preferable to the present reactive maintenance procedures (still prevalent in Nigeria).

Keywords: PM; Changes; Challenges; Nigerian industries

Abbreviations: CBM, condition-based maintenance; CM, corrective maintenance; FMEA, failure modes and effect analysis; JIT, just-in-time; MMP, maintenance-management process; MTBFs, mean-time between failures; OR, operational research; PM, preventive (or proactive) maintenance; RCA, root-cause analysis; RCFA, root-cause failure analysis; RCM, reliability-centred maintenance; REP, reliability-engineering principles; RM, reactive maintenance; RTF, run-to-failure; TPM, total productive-maintenance; TQM, total quality-maintenance.

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1. Glossary

1.1. Reliability

Higher plant-reliability leads to reductions in the (i) frequency of equipment failure and (ii) wastages of energy. Failures decrease production as well as erode profits. Hence it is desirable to:

- deal effectively with each type of failure;
- move towards a more proactive-maintenance approach;
- address how to extend the run length between shut-downs, i.e. the mean-time between failures (MTBFs); and
- harness the cooperation of all those involved in, or affected by, the maintenance functions.

So consideration is focused on equipment condition, operation standards, reasons for deteriorations, the quality-management approach to improve the output, while simultaneously significantly reducing the overall operational cost. Hence ways are sought to implement maintenance methodologies that will significantly reduce operational and maintenance costs by focusing on the root cause of failure through creating a sense of ownership in each of the plant-equipment operators, maintainers and support staff, so as to encourage 'a prevention of problems at source' attitude. Two compatible processes, namely, reliability-centred maintenance (RCM) and total productive maintenance (TPM) are likely to help confront and overcome these challenges. A strategic framework methodology can be developed for developing a cost-effective maintenance plan by identifying:

- What is wanted of the plant/equipment?
- What the plant/equipment can do?
- In which way may it fail to meet the requirement?
- What can be done to ensure that the equipment meets expectations in a safe and cost effective manner?

1.2. Preventive maintenance (PM)

In PM, the system which is highly likely to exhibit a demobilising fault is replaced before that failure is allowed to occur. The most common forms of this policy are scheduled PM and condition-based maintenance (CBM). In the former approach, the PM action is performed on the item at a scheduled time regardless of its actual condition. Because the schedule is often drawn up on the supplier's recommendation, but made with either only limited local knowledge of the actual use conditions or from past experience, it is seldom an optimal procedure. PM schedules that minimize resource consumption or maximize availability can be determined through the use of quantitative decision-models, based on factual information such as time-to-failure distributions, cost of intervention (e.g. for inspection, repair or replacement) and consequences of failure. Models for the optimization of PM decisions have been published [1–3].