

A Strategy to Improve Plant Performance

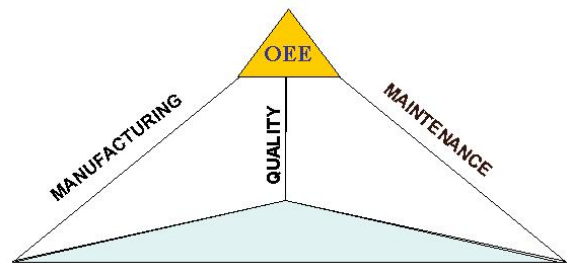
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MaintainIT, Ltd.

Most manufacturers in the United States have experienced the pressures of foreign competition and free trade with which you are likely familiar. We face higher prices for raw materials along with market demands for improved quality, lower production costs and reduced delivery times. The response has been the development and implementation of integrated plant improvement programs using the most current lean manufacturing, six sigma and maintenance technologies. The results have been impressive for those companies with the leadership and discipline to carefully define their objectives, plans and follow through with the changes required to succeed. This paper describes a program that has been successfully implemented to improve plant performance by effectively changing maintenance management practices and equipment reliability.

Our maintenance improvement program is based on our successful experience in industry, implementing maintenance improvement programs in many manufacturing and process plants. We base our programs on individual plant operational requirements and values. Our emphasis is to document and establish a rational basis for designing plant maintenance and reliability programs specific to an individual plant's needs.

Overall Equipment Effectiveness
OEE = Rate x Quality x Availability



Maintenance Diagnostic

Maintenance assessments are designed to baseline current maintenance practices and to identify the most significant plant costs or losses related to maintenance performance. This approach allows us to identify maintenance tasks that are aimed at the prevention, early detection, and mitigation of expensive or repeating equipment failures. These tasks will also address detection and prevention of unanticipated first time component failures. By measuring and frequently reviewing equipment failure data the maintenance program is audited and adjusted to become more effective and efficient.

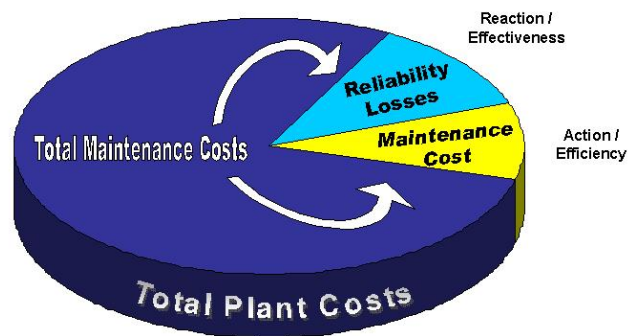
This process allows the plant maintenance organization to focus its limited resources on performing the most important activities that will produce the most value in support of plant production. Focusing on these activities provides the greatest positive impact on the plant's maintenance costs, productivity and quality.

We use an assessment process that is designed to objectively analyze the practices of a maintenance organization in twenty-one specific areas. Since maintenance performance is a result of the practices employed, it is important to clearly understand how maintenance is currently managed and to define a vision of how it should be managed in the future in order to achieve optimum performance from the improvement investment.

Maintenance performance can be accurately measured only after a clear understanding of the plant operational requirements and values have been established. Maintenance performance has two major components:

Effectiveness

Maintenance is effective when it accomplishes its mission of providing functional equipment capable of producing quality product at its designed rate when required by operations, without unscheduled repairs, while preserving the value of the assets. The cause and cost of failures to accomplish the specified mission should be carefully measured.



Efficiency

The efficiency of a plant's maintenance organization should be measured and improved continuously. This involves the economic use of manpower and materials to accomplish the maintenance mission, measured in a number of ways including: wrench time, backlog, overtime, schedule compliance, rework, PM inspections vs. corrective work orders, stores performance, etc.

Master Plan

A master plan is required for improving plant reliability, organizational effectiveness, efficiency and program management. It is the guiding document for the maintenance department that protects it from mismanagement and reverting back to a culture of reactive maintenance. The master plan evolves as the maintenance improvement program progresses.

Preliminary Master Plan

This is the first cut at a master plan that is created during the initial maintenance assessment. It defines the initial activities for implementing the findings and recommendations from the assessment. It is used to estimate resources required for the maintenance improvement process. This information is combined with the estimated benefits from improved performance to create a cash flow for project justification.

Maintenance Master Plan

Immediately following the initiation of the maintenance improvement project, the preliminary plan is expanded upon by the project team to plan and schedule in detail the activities, resources, critical path, etc. required to manage the development of all maintenance programs and initiatives outside the normal day-to-day maintenance activities. This will include special training, equipment strategies, computerized maintenance management system (CMMS) implementation, master equipment listing, spare parts/stores improvement, reorganizations, etc. The master plan is a continuing document that becomes the maintenance department's perpetual plan with a one or two year outlook that is updated at least monthly. It provides long-term justification, continuity and guidance for maintenance performance improvement programs.

Equipment Reliability

Before equipment can be maintained properly, it needs to be in a known serviceable condition and maintainable. The importance of the equipment to the plant mission must be identified. During the equipment reliability phase of the maintenance improvement project the following activities take place.

Plant processes, systems, value streams and equipment are identified and assigned a criticality through a defined procedure. Maintenance history is examined to determine past equipment failures, causes and costs.

Process or system failure modes and effects analyses (FMEA) are performed to determine how the equipment fails, the effects and costs of those failures, and how they can be prevented or mitigated. This information is used for prioritizing the maintenance improvement activities to focus efforts where the best returns can be achieved.

Individual equipment improvement events are then performed, prioritized by the above process. These activities include

- Event planning
- Equipment FMEA

- Condition assessment and restoration
- Bill of materials
- Spare parts requirements
- Maintenance requirements definition
- Drawings and documents

Program Development

During the master planning and equipment reliability processes, a number of decisions are made regarding to how maintenance will be performed and what techniques and programs will be required to meet the expectations. As each of these components is defined and information is accumulated, the programs need to be fully developed, often requiring special skills. Included in this development phase will be:

- CMMS implementation
- Work process control
- Preventive maintenance inspections
- Periodic maintenance requirements
- Predictive maintenance routes
- Lubrication program
- Stores / spares management
- Maintenance quality
- Failure elimination
- Document control
- Change management

Organization

Once a vision has been clearly defined for the effective and efficient management of plant maintenance, responsibilities will likely change and reorganization may be required. Also, during the maintenance improvement process additional, temporary manpower requirements can disrupt the daily flow of work if it is not well planned. Training needs must be addressed to prepare people for new roles and certain programs must be developed before the new roles can be assumed. During the maintenance improvement process - moving from current steady state to future steady state - transitional events must be carefully planned and scheduled.

Metrics

A system of metrics must be incorporated to clearly track maintenance effectiveness and efficiency performance improvements in order to justify the maintenance improvement program. These metrics should be layered with reports meaningful to everybody. This system is critical for the new culture to survive, and to ensure improvements gained during this process continue to be realized and increase. For instance, general performance roll-ups should be

presented periodically to upper management. More detailed metrics at the department level will enable mid or lower management to focus their energies in the right places. Measurements directly affected by individuals should be made available to them so they can understand where and how they contribute to the overall success of the maintenance department and plant performance.

There are three key elements in developing an excellent maintenance program:

- Evaluate the condition of the plant equipment and bring all critical equipment to a known serviceable condition. Define equipment failure modes and causes and develop required maintenance, parts and documentation strategies.
- Evaluate the current maintenance practices, procedures and organization. Implement the maintenance management practices and tasks that will keep the equipment in a predetermined serviceable condition.
- Measure maintenance performance, analyze results and continuously improve maintenance efficiency and effectiveness. Focus on failure elimination.

In conclusion, a successful maintenance improvement program is realized by applying the maintenance organization to the activities that will have the greatest positive impact on a plant's maintenance costs and plant reliability.