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Planning and Scheduling In A Lean Maintenance Environment

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With many companies facing global competition all areas of their organizations are being analyzed. In order to compete, companies are looking for ways to cut waste throughout their processes. Many have begun Lean Manufacturing initiatives to streamline their operations. Operators are being asked to perform equipment maintenance such as routine cleaning, equipment inspections, adjustments, and minor repairs. As part of these initiatives, the overall maintenance process is also being analyzed. How will the maintenance department, which is minimally sized, function in this new environment? What types of waste can be eliminated? Is the Preventive Maintenance program optimized? Is the proper Predictive Maintenance program in place? How will planning and scheduling be affected?
Proper planning and scheduling practices will help address many of these issues.

Operator PM's

Operators are now performing some of the work previously done by maintenance personnel. This work must now be shifted and scheduled to meet operations requirements and schedules. These operator PM tasks may need adjusted to address the skill level of the operators. The tasks may need to be more detailed showing lube points, types of lubricants, and amounts. Lock out/tag out procedures should also be included. Significant formal training will be required to teach operators the skills required to take on this role. Scheduling a maintenance person with an operator for a period of time to provide on the job training can get the operator started off in the right direction and help to ease what is often a difficult culture change. Operators must also have access to the CMMS, (Computerized Maintenance Management System) to enter PM completion information and create follow-up work orders as needed. Priority codes should be utilized on the work orders for scheduling purposes. These work requests can now be planned and scheduled for the appropriate personnel. Operator access should also allow them check the status of their requests. This online feedback will help to gain operator trust in the system. When operators see slow response or no response at all to their requests they become less likely to report machine It is important to plan and schedule these repairs as soon as possible. The planner's job is to coordinate with operations the scheduling of these tasks based on equipment down periods. If careful consideration is not given to this, PM completion rates may suffer due to the operator being too busy operating to perform the PM's. Preventive maintenance or often called TPM (Total Productive Maintenance) downtime must be built into the production schedule. Operator PM schedules should be created and posted on weekly basis so they are aware of the tasks that are due to be performed in case any unplanned downtime occurs during the week.

Maintenance PM's

Some preventive maintenance tasks can be too technical in nature for the operators. Qualified maintenance personnel should perform tasks such as time-based overhauls, replacements, component intrusive inspections, and sophisticated electronic calibrations Maintenance personnel must also have access to the CMMS to enter PM completion information and create follow-up work orders if needed. Maintenance PM's because of their more technical nature, should include detailed information such as BOM (Bill Of Material) requirements, work procedures, tools, documents, and lock out/tag out procedures. Parts and materials must be kitted and positioned near the job site. This effort helps eliminate the wasted time traveling looking for information, tools, parts, etc. Once again, coordination by the planner is needed to ensure time is allotted by operations to complete these tasks. Good estimates are required so that operations have realistic expectations for task duration. This can prevent the waste of future rework because of hurried repairs. Maintenance PM schedules must also be created on a weekly basis. Proper planning and scheduling of the preventive maintenance program is a key element to a successful lean maintenance program.

Predictive Maintenance Program

In order to be successful in a lean maintenance environment, unplanned repairs must become a thing of the past. There is no better way to do this than by having a
well-planned PdM, (Predictive Maintenance) program. First it must be determined what equipment will be included in the program. This is best done by determining the criticality of the equipment to the operation. Once criticality has been determined, the types of predictive technologies can be selected for each component. Typical technologies like vibration analysis, thermography, and oil analysis are used to predict impending failures. A Maintenance Engineer generally makes these decisions. Now it is time to consider how to plan and schedule these activities. Predictive maintenance work orders should be developed, planned, and scheduled, utilizing your CMMS. The tasks should be detailed PM work orders that describe the type of test or tests to be done, the frequency, duration, and by what type of craft and/or technology. These activities can then be scheduled just as you would any other PM work order. These work orders should contain a work class that designates them as predictive type PM work orders. Feedback from these work orders can then be entered into the CMMS. As needed, follow-up work orders can be generated, so appropriate actions can be scheduled as soon as possible.

Eliminating PM/PdM Waste

Periodic review of the PM/PdM tasks being performed by operations and maintenance is necessary to determine if the tasks are effective. If at least one corrective work order is not generated for each six times the task is performed, an audit should be done to verify the performance of the PM. If the PM is being performed, the frequency should be adjusted. This function typically is performed by a Maintenance Engineer, but must be communicated to the planner so task frequencies and schedules can be adjusted accordingly. Efficient inspection routes should be developed that take into consideration the economies of logical groupings and sequencing. (See Fig. 1) The planner should include a diagram that depicts the most efficient route as part of work order information. Most CMMS packages allow linking of such documents.

If done correctly, this will ensure that the amount of travel time will be minimized. In a lean maintenance environment, eliminating all waste is essential due to the limited resources at hand.

Parts and Tools Availability

Accurate inventories of both parts and tools are necessary to ensure that both operations and maintenance personnel have what is needed, when it is needed, to perform equipment maintenance. Controlled satellite storerooms, located near the equipment, are essential to ensure there is not time wasted looking for parts or tools or traveling from a distant stores location. When planning maintenance activities, parts and tool requisitions should be directed to the storeroom nearest the job site. Needed items must be kitted and ready based on the scheduled maintenance activities.

Planning and Scheduling Out Waste

In a lean maintenance environment, it is more important than ever to maximize the efficiency of both operations and maintenance personnel. The importance of the position and role of the maintenance planner/scheduler should not be underestimated. Very detailed planning is a must. The aim is to optimize the utilization of the available resources. This requires that all facets of the work at hand be analyzed. The number of, and type of, resources must be clearly identified. Duration of the work must be accurate. Detailed job steps, including safety requirements or permits, must be included. The planner can use historical data coupled with visits to the job site to review the most efficient methods and document requirements. Parts, materials and tools must be specified, requisitioned, kitted and placed near the job site before the work is to begin. Drawings, sketches, or any other related documents must be made available to the personnel performing the work. Transportation issues and equipment requirements must be coordinated and documented in the work plan. Coordinating with operations concerning the scheduling of these activities is key to having the equipment available when the work is to begin. Delays must be avoided at all cost. Weekly scheduling and coordination meetings must held to review and schedule the upcoming week's activities. This level of detail, coordination, and communication is required in order to plan and schedule out waste.

Root cause Analysis

Every equipment failure must be analyzed. Finding the root cause is key to being able to preventing this same failure in the future. Maintenance Engineer is generally responsible for coordinating this effort. It is the planner's responsibility to ensure that the proper failure codes are entered into history when reporting failure events on the equipment. These codes often provide the analysis tools needed to solve the equipment problem. When the problem has been solved the planner and engineer may need to make adjustments to work procedures, task frequencies, or part specifications, based on the conclusions.

Organization Structure

In typical Lean Manufacturing organizations, resources are divided into work teams centered on particular areas or work cells. It is important to identify the roles and responsibilities and

reporting structures of this type of organization. Typically a work team consists of required operation personnel and may include a maintenance person for that area. To support all of the work teams there is generally a centralized maintenance function. Planning and scheduling should also be centralized. The planning and scheduling function must coordinate the activities of the central maintenance resources as well as the work teams. An organization chart should be developed that portrays this inter-relationship. (See Fig 2) Centralizing the planning function will help to avoid any duplication of effort. This type of organizational structure will promote the Lean Manufacturing/TPM effort and will help shift the focus from reactive to proactive maintenance.

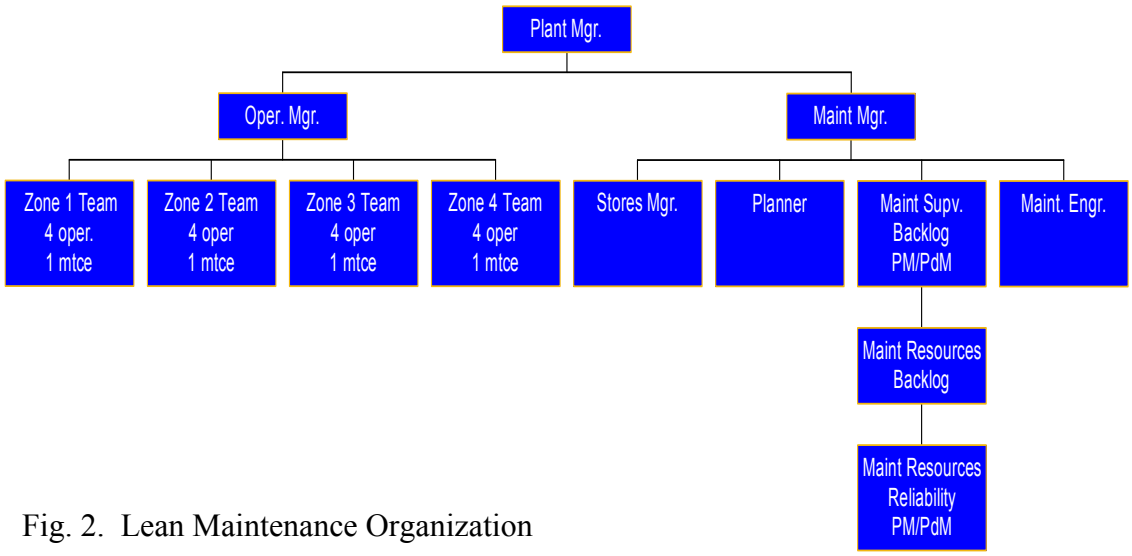

Fig. 2. Lean Maintenance Organization

Process Mapping

In order for lean maintenance planning and scheduling to be effective, it is important to map out the process in which the work teams and central maintenance must function. This no different than the mapping that was required, to lay out the most efficient work cells, from a production standpoint. This work process flow must be created through a team effort so that all have buy in to the process. This defined process will ensure that the planner is receiving the proper information to plan and schedule in a way that will reflect the most efficient utilization of available resources. It will also provide accurate information from which to manage the overall reliability effort.

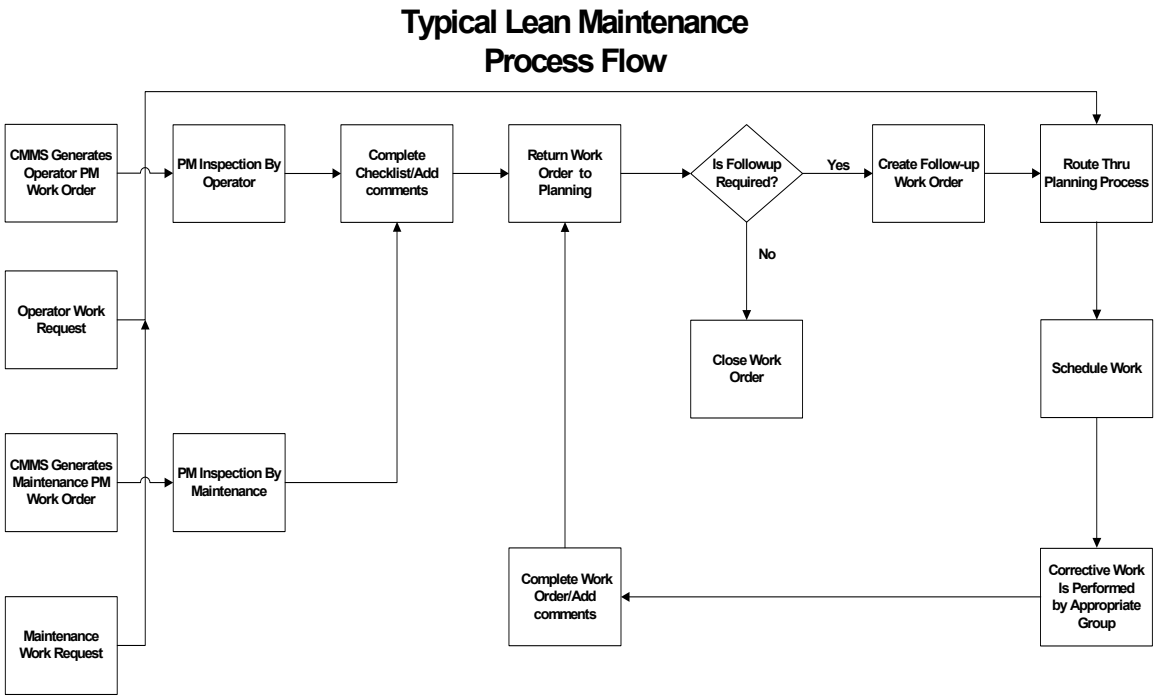

Fig. 3. Lean Maintenance Process Flow

Lean Maintenance Metrics

An important item to be addressed is making sure that the goals of the maintenance activities coincide with the overall business goals. Metrics should fall into three categories. Bottom Line Metrics, which are measurable in dollars, Maintenance Performance Metrics, which measure maintenance performance, and Planner Metrics, which measure planning effectiveness. (See Fig. 4) These metrics will address both the bottom line of the company as well as overall maintenance performance. Maintenance best practices should be used as the final targets, with interim targets that will show progress or the lack there of. The metrics chosen can be easily tracked when the maintenance process is followed. Remember; "What gets measured, gets done."

Bottom Line Metrics	Maintenance Performance Metrics	Planner Metrics
Maintenance Cost/Unit Produced	% Planned Maintenance	Planned vs. Actual Hrs
Overtime %	% PM Compliance	Ready Backlog Hrs
Energy Cost/Units Produced	Backlog Weeks	Schedule Effectiveness
Monthly Inventory Usage	PM Labor Hrs/Reactive Labor Hrs	Labor Utilization

Summary

Entering into the world of Lean Maintenance can be a challenge for any company. Often cultures must be transformed, and work practices re-engineered. In some cases survival in a competitive marketplace may be at stake. With the right tools in place along with a well-trained and disciplined workforce utilizing the proper process, your goals will be achieved. Above all be sure to put planning and scheduling at the core of your lean organization.
Be Lean, But Be Planned!

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