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## **Reliability Goes Nonfat With Lean Maintenance**

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It drove Henry Ford crazy! The automobile-manufacturing pioneer focused on eliminating waste on his automotive assembly lines because he was well aware of the cost associated with waste. Wasted material, wasted motion, and wasted time drastically affected bottom line profitability.

Maintenance operations focus on avoiding equipment malfunction and fixing things that have failed to function as intended or required. Most maintenance departments do not consider their activities in terms of eliminating waste. In reality, the move from a reactive to a proactive maintenance strategy (RCM, TPM, etc.) is made easier when a preliminary focus is applied to eliminating waste in the maintenance delivery and management system. This is especially true for companies that already run under a lean manufacturing system.

### **Lean manufacturing**

Toyota engineers who studied Henry Ford's work in waste elimination developed lean manufacturing. This effective system defines the seven common forms of waste and includes a process for continuous improvement. You may already be working in a lean manufacturing company, even though maintenance operations are often overlooked in terms of training and other lean resources that are applied to operations or production.

### **Lean maintenance**

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Lean maintenance is a term used by many companies that are beginning to blend the techniques of lean manufacturing with maintenance experience. Unfortunately, many lean experts rarely combine the resident knowledge of the maintenance operation and their own. Without a maintenance background, an operations consultant finds it difficult to analyze waste in a maintenance operation, as a maintenance consultant would find operational waste difficult to spot.

Lean philosophy defines waste as "anything that does not add value to the product, process, or service." In a lean maintenance system, sources of waste usually consist of outdated procedures and overstocked and underused inventory of equipment, material, and parts, as well as wasted labor, time, and transportation. (See accompanying section "[Simple Steps to Lean](#).")

According to Greg Folts, director of operations for the Marshall Institute, Raleigh, NC, maintenance operations may be wasting up to 25 percent of available labor. Some plants find that up to 60 percent of wasted maintenance labor results from activities that add no value to the output factors or overall performance measurements of the plant.

One tool that Folts uses at the beginning of a lean maintenance implementation is value stream or process mapping. This procedure pinpoints sources of waste and is used to develop a more efficient and effective process or task. A group of stakeholders, people who are directly affected by the process being studied, are selected for that part of the mapping. A typical group may include members of the operations staff, maintenance staff, supervisors, engineers, and maybe purchasing or accounting. Each person who performs a function in the process explains his activity and it is noted on a large sheet of paper tacked to the wall. Wasteful areas like delay and waiting are identified. The entire process becomes visible as the sheet fills with each individual's tasks.

Processes or tasks are mapped in sequence, which can be enlightening for someone who performs only one part of the process and does not know what occurs prior or subsequent to his individual activity. A thorough and analytical understanding of a process makes waste easy to spot.

When all the players involved in process mapping map out a "what is" scenario, everyone usually agrees that the current methods are not the best way to get things done. Several obvious improvements can be mapped right away. This is especially true when the process crosses multiple disciplines such as purchasing, maintenance, production, and engineering. The team then can develop the "to be" map as well as create an implementation strategy to eliminate the waste. In order to become effective at identifying sources of waste, it is useful to fully understand the forms of waste as they exist in the maintenance operation (see accompanying section "[Seven Forms of Waste in Maintenance](#)").

### **Reasons for Waste**

The primary goal of any company should be to maximize the output that brings money in the door and minimize expenses that carry money out the door. Metrics that are department specific without regard to overall business goals will sub-optimize the entire system and allow waste to creep into the system. People who perform functions in a process or task are often isolated and only know or understand their activities without regard to how they fit into the system. It is possible that finance, production, and maintenance may all meet or exceed their measurement criteria while sub-optimizing the rest of the company. This eventually can cause the business to fail.

Process mapping allows people to see the larger picture and to work as a team to optimize the overall business result. What is the best way to run this process from a business perspective is the question that sets the tone in a process mapping session.

### **Record Keeping**

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Good records are key to maintaining a waste-free environment. A good computerized maintenance management system (CMMS) is essential, although many companies use Kanban, a Japanese system that uses visual triggers, as well.

### **Visual Workplace**

Laminated bar-coded work order cards can be generated from a CMMS and placed near each machine. If there was an unplanned shutdown on a machine, an operator could scan the proper failure bar code on the laminated card and it would start a work order request from maintenance for "machine down" or "machine will not cycle" or some other failure code. The card then could be placed in a rack that is visible to operations and maintenance supervisors.

The code would signal that an electrician is required on that machine because it will not start. The system automatically prints a work order in the maintenance department. This avoids the operators having to look for a supervisor only to find the supervisor is not available, and then searching for an engineer to approve the work order request.

The visual part of the system allows everyone to see the Kanban card in the rack. Supervisors could quickly scan the rack to see the status of any required maintenance work orders.

## Lean Maintenance as a Process

Lean maintenance is a journey, not a destination. It is about continuous improvement as an ongoing process. A lean system requires that priorities be set for delivering value and eliminating waste. When a lean process includes all functioning members of the process combined with open, honest, and blame-free communication, huge gains in productivity and profitability can be achieved.

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## Seven Forms of Waste in Maintenance

A core concept of lean manufacturing is eliminating the seven forms of waste. This concept can be helpful for maintenance as well as production. Knowing what to look for can be useful when pinpointing areas of waste, which often overlap in many tasks and processes.

### 1. Overproduction

A key waste in manufacturing facilities is the waste of overproduction. Activities often are performed that add no value or for which the customer is not willing to pay. In maintenance, this waste translates to performing preventive and predictive maintenance tasks at intervals more often than optimal and results in the overproduction of maintenance work. Unnecessary preventive maintenance (PM) is 100 percent wasteful.

### 2. Waiting

Maintenance-related waiting includes the production department waiting for maintenance personnel to perform a service. Waiting for tools, parts documentation, transportation, and other items also is wasteful. Waiting is not a value-added activity and must be eliminated or greatly reduced. Plan and schedule jobs in coordination with production, move the parts and documents closer to the job, and buy extra tools and store them near the job location where they will be used.

### 3. Transportation

Ask anyone in the plant what he sees maintenance people doing and the answer often will be "walking around." Tools that are stored a long way from the job, commonly used repetitive parts that have not been preassembled or kitted, documentation that must be hunted down, and work orders for machines that are not available all cause excess transportation. Maintenance people do spend a lot of time walking; most of it does not add value to the process. Transportation also can refer to running, driving, and flying.

### 4. Process waste

In reactive or breakdown maintenance, repairs are typically conducted to achieve operation as soon as possible, sometimes eliminating an opportunity to perform a longer term or higher quality repair. Planning and scheduling for maintenance is like setup for production. They are the keys to eliminating process waste.

### 5. Inventory

A typical maintenance inventory storeroom contains 65 percent needed material and 35 percent obsolete or rarely used material. In addition, secret inventories may be kept informally to ensure availability when needed. Organizing an effective lean spares strategy will eliminate the waste caused by obsolete and secret inventories. Inventory for a maintenance operation also includes the work order backlog. Like physical inventory, too much

maintenance work inventory means slow response, unexpected breakdowns, and a high reactive labor percentage. Too little backlog of maintenance work inventory means inefficient planning and scheduling.

## 6. Motion

Wasted motion/unnecessary process in the maintenance operation usually revolves around PM tasks that do not add value to the output. For example, a monthly PM inspection on a pump that has not changed status in three years should be extended to a longer frequency such as quarterly, semi-annually, or annually depending upon the criticality of that piece of equipment.

## 7. Defects

Job recurrence because of improperly performed repair work is a huge source of waste. How many times does the job need to be repeated before it is performed correctly? Using tools such as root cause analysis can ensure that the proper action is taken to eliminate the source of the defect. Proper training and detailed procedures can assist in ensuring defect elimination.

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## Simple Steps to Lean

Improve tool storage using strong visual cues such as painted outlines or foam cut outs to show where tools should be stored.

Improve documentation storage. Make sure it is neat, organized, and accessible by those who need it.

Have a system that clearly shows when a file is out or missing.

Use visual cues to show how things should be (normal state).

Use visual cues to indicate status, next inspection due date, etc.

Create a simple and uniform work request system that provides visual cues for operators, maintenance, and supervisors.

Use root cause analysis techniques to solve problems permanently.

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*Information supplied by Terrence O'Hanlon, publisher of [www.Reliabilityweb.com](http://www.Reliabilityweb.com), the solution-oriented asset reliability site for the plant maintenance community; P.O. Box 07070, Fort Myers, FL 33919; (941) 985-0317*