From the Reliability Professionals at GP*Allied*

Are You Doing Too Much PM?

16 Ways to Save Time and Money On Preventive Maintenance

Inside:

The No. 1 Law You Should Know

The Real Truth About PM

The First Question You Should Ask

And much more...

A Must-Read Guide
for Maintenance and Reliability Leaders

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GP*Allied*, LLC
4200 Faber Place Drive
Charleston, SC 29405

Phone 888.335.8276
Fax 843.414.5779

info@gpallied.com
www.gpallied.com

6th Edition
April 2011

GP*Allied*, LLC is a division of
Allied Reliability Group

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Are You Doing Too Much PM?

16 Ways to Save Time and Money on Preventive Maintenance

Unless you have been living on another planet for the last fifty years, you already know that the case for doing Preventive Maintenance (PM) is watertight if focused on the correct failure modes.

Done right, PM will preserve, protect, and extend the life of your equipment – and reduce overall maintenance cost.

So here's the question: Why are most maintenance and reliability professionals so unhappy with their PM programs?

Surprisingly enough, according to our research, we have found that just 22% of maintenance managers are satisfied with their current programs. Their two biggest complaints are listed below

PM Consumes Too Many Resources

Many maintenance managers believe their PM program is simply bigger than it should be. They find it difficult to execute their PM program and their other work at the same time. Also, they feel like they do not have enough manpower to manage all of their PMs along with other important maintenance tasks.

Lack of Results

Despite all of the time and money being spent on PM, there are still way too many unexpected equipment failures.

Case in point: During a chemical plant tour, the frustrated maintenance manager said, "We just PM'd that machine, and it failed a short time later anyway. So why didn't we catch the problem with the PM?"

Why indeed.

In a nutshell, the problem with PM is that it takes too much time and produces too little results.

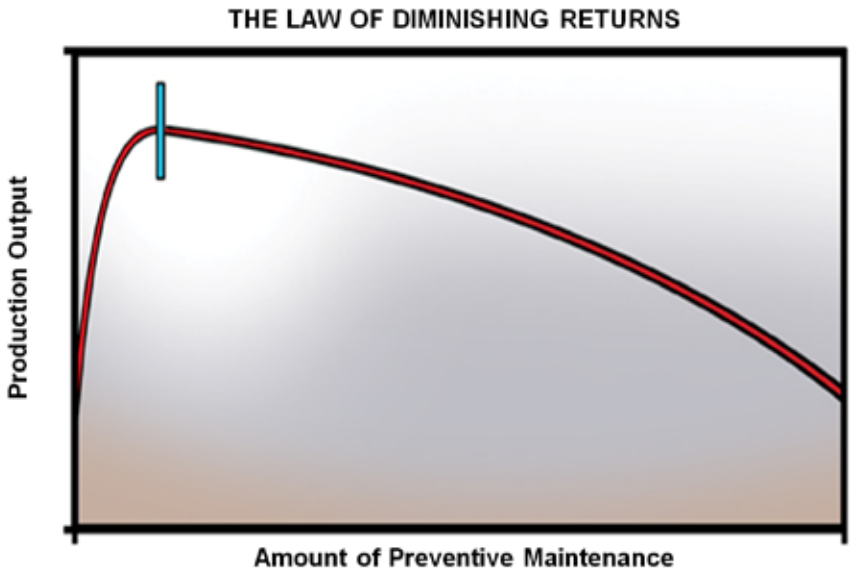
This guide will address these concerns, as well as other common factors that lead to isues with PM programs. Out goal is to give you the tools you need to implement and maintan an effective PM program.

1. The No. 1 Law You Should Know

The number one law of economics you need to know is based on a principle discovered over 200 years ago. You have probably heard of it – it is called the **Law of Diminishing Returns.**

As any good MBA student can tell you, this law states that as one production factor increases and the others remain constant, overall production decreases after a certain point.

In plain English, this means that as you increase PM, production output eventually decreases. The following chart illustrates this idea:



You see, there is a fine line between doing too much, too little, and just the right amount of PM. Clearly, there is a point at which increasing PM hurts the bottom line.

The reason? It is very simple. Most PM procedures require that the equipment be shut down. That means uptime goes down, so production output eventually goes down as well. Meanwhile, maintenance costs go up.

So, how much PM is too much?

According to a private study, best practice programs generate 15% of their maintenance work from PM inspections. Another 15% is corrective work identified by those inspections. Therefore, PM should account for about 30% of your total maintenance work flow.

2. The Real Truth About PM

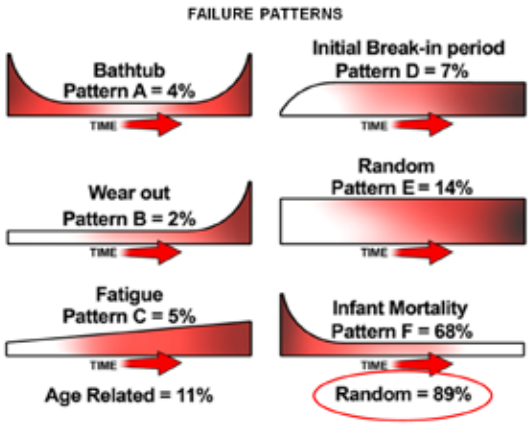
By definition, all PMs are time-based, meaning either calendar time or operating time dictates when an asset should be inspected, cleaned, adjusted, replaced or reconditioned.

But, is there really a direct relationship between the time equipment spends in service and the likelihood that it will fail?

In short, the answer is no.

The truth is, most equipment failures are not age-related. In fact, for complex systems, **the majority of failures will occur at random**.

Consider the facts. The Failure Patterns graphic demonstrates failure probabilities relative to the age of the equipment itself. This gives us a true picture of how equipment fails when it is maintained and operated correctly.



Note: It is important to understand that this data comes from the airline industry, where maintenance and operations standards are exceptionally high. That gives us a true picture of how equipment fails when it is maintained and operated correctly.

The reality is that 89% of equipment failures are not age-related. Therefore, there is no amount of time-based rebuild/replace/refurbish that can manage these failures effectively.

This is why using time as the primary basis for your maintenance strategy is inherently flawed. It will have very little impact on overall reliability.

From a risk standpoint, it is much safer to assume that equipment failures can happen at any time. In other words, move from a time-based repair/replace/rebuild to a time-based inspection.

3. If It Isn't Broken, Don't Fix It

Many PMs are highly invasive procedures that can disrupt and disturb stable systems.

Take a pump, for example. Here are the five most common mistakes that can happen whenever a pump is taken apart and put back together again for the purpose of PM:

- Bearings are damaged
- Shaft is not properly aligned
- Pump is not bolted down properly
- Seals are not properly installed and adjusted
- Lubricants are contaminated

As a result, when the pump is turned back on, bad things can happen.

The dirty little secret in maintenance is that a significant number of equipment problems are caused by maintenance itself.

Stated a little differently, PM can trigger the very same failures it is intended to prevent.

That is why it is important to avoid excessive and unnecessary tinkering.

The preferred order is:

1. Running (full load)
2. Running (no load)
3. Idle
4. Idle (minimally invasive)
5. Idle (invasive)
6. Disassembled

4. Beware of PM Creep

The vast majority of PM programs were not properly planned, designed, or engineered up front. Quite simply, they have evolved over time.

Consider what happens whenever a critical piece of equipment fails. Frequently, the boss says, "Make sure this never happens again!" In order to do that, maintenance adds more PMs: more cleaning, more lubrication, more inspections. Another failure? Another PM. Before long, the PM program is bigger than it needs to be.

Unchecked, PM creep is a major source of waste and excess costs.

The solution? Have a team that regularly reviews and removes unnecessary PMs from the system.

5. The First Question to Ask About PM

All PMs are not created equal. In fact, you might be surprised to learn how much PM is done every day that does not add any real value. According to Forbes magazine:

"One out of every three dollars spent on preventive maintenance is wasted."
You see, you can become really good at doing PMs that do not add value. Here is the question to ask yourself:

"Does this PM help us preserve, protect, or increase our manufacturing output?"

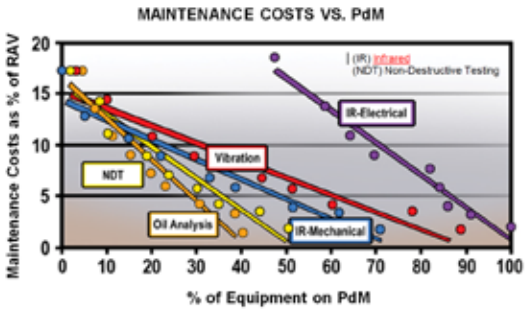
If the answer is no, and it is not required for safety or administrative purposes, stop doing it.

By simply recognizing and eliminating waste, you can free up the time and money you need for the maintenance activities that really do add value.

6. Consider PdM First

No matter what kind of industry you are in, predictive maintenance (PdM) is almost always more cost-effective than sensory inspections (look, touch, listen) as your first line of defense against equipment failures.

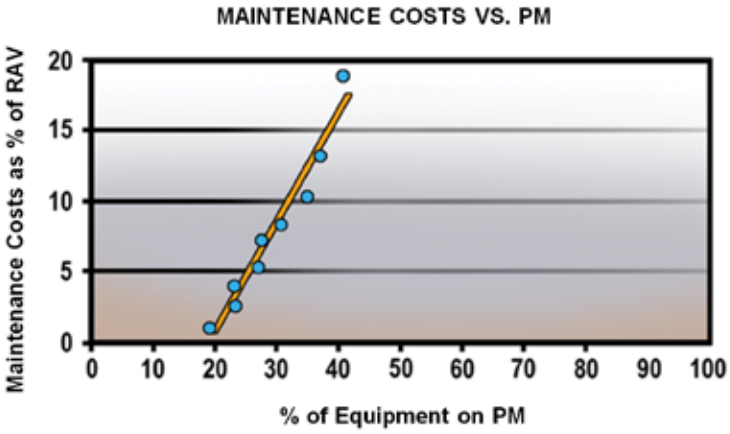
Based on studies done in major industries including chemicals, paper, metals, automotive and power generation, something interesting happens as more equipment is added to the PdM program:



Overall maintenance costs go **down**. Consider the graphic above. As you can see, there is a direct correlation between high levels of PdM and low overall maintenance costs – measured as a percent of the Replacement Asset Value (RAV).

On the other hand, the data also shows that increasing the size of a replacement PM program directly results in higher maintenance costs. The graph on the next page illustrates this idea. Why is this the case?

PdM inspections can identify problems much earlier on the failure curve than PM. So, PdM gives you more time to plan, schedule and make the repairs – and avoid unscheduled downtime.

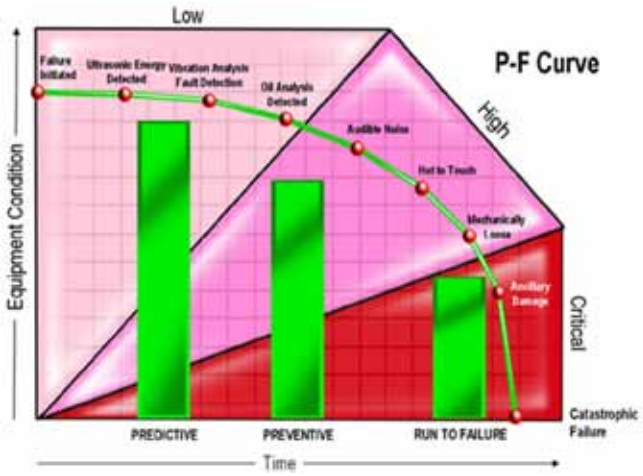


For all of these reasons and more, be sure to consider PdM technologies first before adding more PM.

And that is really the secret – PdM drives more planned work. What that means is:

- Jobs are done faster, safer, and at a lower cost.
- As shown in studies, a well-planned job takes only half as much time to execute as an unplanned job.
- Each dollar invested in planning saves three to five dollars during execution.

Remember, most PdM inspections require equipment to be up and running. This means downtime for maintenance is minimized – a key issue at plants where the value of downtime is $5,000, $10,000, $20,000 or more an hour.



7. Get Data You Can Trend

In the past, maintenance was viewed simply as a repair function. Not any more.

Today, maintenance is a highly sophisticated process driven by one key factor: information.

One of the primary goals of modern maintenance is to collect and analyze equipment information, and then decide when to intervene.

This is why PM should provide you with real data that you can trend and analyze over time. You want PMs that give you quantitative measurements you can do something with, not just somebody's opinion.

Start with the equipment itself and ask yourself: "This can fail, so can I measure it?"

If so, do it. Write it on the PM. Maybe you just need to record the voltage or the pressure. Or maybe you want physical measurements so you can see how equipment wears over time.

What you do not want are the PMs that say "Go inspect pump." That is where someone will walk out in the plant, look at the equipment, and not tell you anything.

Get rid of this type of PM and make them lean, mean, value-added PMs.

One suggestion is to measure Mean Time Between Failures (MTBF) to see if the labor expended on PM is effective or not remember that you cannot perform PM on equipment that continues to break down. You must restore the equipment to a maintable level first, then apply PM.

8. Check the History

Many machine rebuilds are performed on a rigid schedule, regardless of the asset's condition.

Case in point: One maintenance manager admitted his crews had just spent a full day replacing parts on a machine as scheduled – despite the fact that it had just been refurbished two weeks before.

9. Approach Vendor Recommendations with Caution

There are plenty of reasons to be skeptical about maintenance recommendations from Original Equipment Manufacturers (OEMs). For example:

- Vendors usually are not experts about your plant and production processes.
- Vendors do not know all the details of your plant's operating conditions.
- Vendors do not always consider the skill sets of your workforce.

So what do vendors know? Their equipment! As a result, they tend to over-prescribe maintenance to ensure their equipment makes it through the warranty period. Very few PMs from vendor recommendations are focused on specific failure modes and their early detection or prevention.
After all, they are not the ones paying for your labor, and it is easy to spend someone else's time and money on PM overkill.

Do not forget that selling spare parts is nearly always more profitable than selling the original equipment. There is built-in motivation for vendors to steer you towards buying excessive spare parts.

10. Find Out the Reason Why

When PMs identify equipment problems, instead of asking, "how fast can we fix this?", the question should be "why did this break?"

It is important to discover root causes, not just symptoms.

11. Do the Math

If the annualized cost of a PM activity – including the total value of labor, materials and downtime – exceeds the cost of a potential failure, it is the wrong PM activity.

Remember that the value of downtime can be huge.

12. Eliminate Pencil-Whipping

The practice of pencil-whipping, or signing off on work that has not been done, is commonplace at some plants. However, this is serious business and should not be allowed.

Here's the deal: Falsifying records and making false statements is illegal.

It is not just the person making the false entry who can be held liable; managers, supervisors, co-workers, and the company itself can be punished, as well.

Be sure everyone clearly understands the legal requirements for completing maintenance records. Lay out a clear disciplinary policy for violators, and investigate any suspicious incidents.

13. Apply the 6:1 Rule

If your PM inspections are not generating much corrective work, that is a warning sign. You see, corrective work is your return on investment in PM – that is where you get your money back.

Specifically, low corrective work means low return on investment.

Remember, the main goal of PM is not to prevent equipment failures. It is to prevent the consequences of failures.

How? PM should detect problems while they are still small and easy to fix. This allows you time to plan and schedule the repair work and avoid extended downtimes.

A good metric to track is PM inspection time versus correction time using the 6:1 rule. This rule states if you do not find something wrong every 6 times you perform the inspection, you should question a couple of different aspects of the PM inspection.

#1 – Question whether or not the inspection method being applied is appropriate for the specific problem. Perhaps the reason you were not finding anything is because you were not looking for the right thing.

#2 – Question the methods by which the inspection is being conducted. Perhaps the reason you were not finding anything is because you were not performing the inspection correctly.

#3 – Question the frequency of the inspection. The inspection interval should be a little less than half of the time required for the problem to enter the system and fail catastrophically. This gives you a high chance of seeing the problem at least twice before the failure occurs.

In the end, inspection intervals are not a function of how many times you have or have not found a problem. They are a function of how quickly the defect propagates to failure.

Keep in mind, if your PM program, RCA program and craft skills are all excellent, the number of defects identified in your inspection program will decrease over time. In essence, when you are identifying and eliminating root causes of problems and you are not generating more defects as a result of insufficient craft skills, there will be fewer problems to find.

Does this mean you decrease the frequency

of the inspections? Absolutely not! Those improvements you made have no bearing on the speed of propagation of defects.

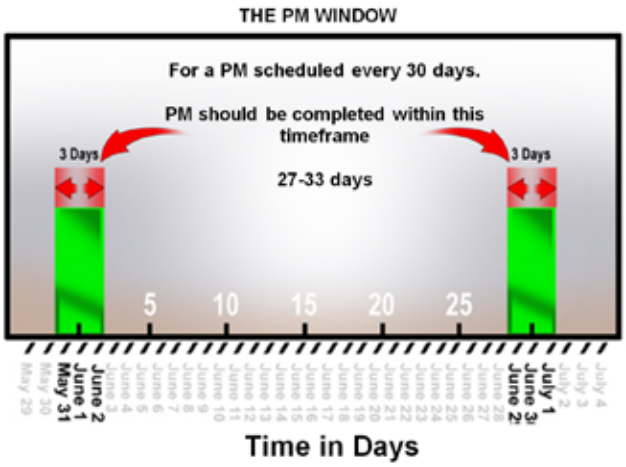
14. Consider the Time Factor

Do you struggle to find the time to perform PMs? Is there a significant number of PMs not being completed on time? Are PMs frequently deferred?

If so, that's another red flag.

All PMs are time-based, so it is important to do them "on time." This means that a PM should be done within a timeframe of plus or minus 10% of its due date.

For example, if a PM is scheduled every thirty days, it should be completed within a three-day window of the due date. The following chart illustrates:



Frankly, one of the hidden problems of PM is that there is no immediate, observable consequence of not doing it.

For example, if you do not change the oil in your car at 3,000 miles, it is probably not going to break down the next day.

However, you cannot defer PM if you want to have an effective reliability program. PM may not be the most urgent or exciting work you do, but it is definitely among the most important.

15. Why Maintenance People Don't Like PM

What is the first thing your maintenance crews think when they hear the term "PM"?

Would you say, "boring"?

Let's take a look at the three main types of maintenance work:

- Routine maintenance – including PM and PdM inspections, lubrication, etc.
- Backlog relief – dealing with investigations, repairs, and restoration activities.
- Emergency response – immediate action to address breakdowns.

Here is a suggestion: put your best troubleshooters and maintenance "heroes" in emergency response, put the methodical, disciplined workers on PM; put new people on backlog.

This will send a clear message to your entire organization about the importance of preventive maintenance.

As the father of modern management, Peter Drucker, once said:

"The productivity of work is not the

responsibility of the worker, but of the manager."

16. Get a Professional, Independent Evaluation of Your PM Program

A lot of companies know they need to downsize – or "right-size" – their PM programs. The problem though, is that they do not have the time, tools, or processes they need to do it.

That is why firms like GP*Allied* offer formal, in-depth PM evaluations.

The process begins with loading your key PM data into custom software analysis tools. Then the PMs are sorted, reviewed and evaluated according to their content.

The results can be eye-popping. Take a look at the table below results from a recent PM evaluation involving 20,000 PMs at a steel mill:

Now you can see the opportunities to save time and money – in real dollars:

- Save $716,010 by eliminating the non-value added PMs or reassigning them to operations.
- Replace $846,660 worth of PMs with more cost-effective PdM.
- Reengineer $786,630 worth of PMs so they truly add value.

In sum, over half of all the PM work at this plant could be stopped – or replaced with PdM – without consequences.

And that is just the tip of the iceberg. That is why an independent evaluation of your PM program is the fastest, easiest, surest way to get your costs under control.

For more details about GP*Allied*'s PM Evaluations (PMEs), call 888.335.8276 or send an email to info@gpallied.com.

PM EVALUATION

PM Task Action Recommendation	# of Tasks	% of Tasks	Man-Hours Represented	Cost at $30 per hour
Non-Value Added or Reassign	**5,876**	**29.4%**	**23,867**	**$716,010**
Replace with PdM	**6,437**	**32.2%**	**28,222**	**$846,660**
Reengineer	**5,200**	**26.0%**	**26,221**	**$786,630**
No Modifications Required	**2,487**	**12.4%**	**8,988**	**$269,610**
Totals	**20,000**	**100.0%**	**87,298**	**$2,618,910**

Summary

It all comes down to this: PM is a business, so it should be run like a business.
Simply put, every PM work order is an authorization to spend money. That is why it is important to do the least amount of work at the least cost that will still meet your expectations for reliability.

Now you know the *16 Ways to Save Time and Money on Preventive Maintenance*, and you can begin applying these practices to your organization to improve your bottom line.

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GP*Allied* is the most diverse manufacturing and industrial reliability and operations consulting, training, and services company in the world. This diversity enables us to develop significant value propositions for our clients by delivering solutions across different industries, geographies, and—most importantly—across different aspects of an operation.

GP*Allied* serves clients in asset-intensive industries, such as petrochemical, mining, energy, manufacturing, food and beverage, and life sciences to name a few. GP*Allied* brings together unique capabilities and synergistic strengths of thought leaders and allows for global implementation never before realized by the industry. The result is the joining of People, Processes, and Technologies in one total package never before realized - now available to the global marketplace.

North America • Latin America • Europe • Middle East • Asia-Pacific

World Headquarters
Charleston, SC USA
o. 888.335.8276 | f. 843.414.5779

GP*Allied* Europe
Merelbeke, Belgium
o. +32(0)9.210.17.20 | f. +32(0)9.210.17.28

GP*Allied* Canada
Laval, QC Canada
o. 450.902.2569 | f. 450.902.2568

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WORLD HEADQUARTERS
4200 Faber Place Drive
Charleston, SC 29405
O. 888.335.8276
F. 843.414.5779

GP*Allied* EUROPE
Guldensporenpark 21-Blok C
B-9820 Merelbeke, Belgium
O. +32(0)9.210.17.20
F. +32(0)9.210.17.28

GP*Allied* CANADA
2572 Daniel Johnson, 2nd Floor
Laval, QC | Canada H7T 2R3
O. 450.902.2569
F. 450.902.2568

WWW.GPALLIED.COM | INFO@GPALLIED.COM