A SMARTER WAY OF PREVENTATIVE MAINTENANCE

4 PROVEN STEPS TO IMPROVE PROFITABILITY THROUGH SMARTER PMS

JAMES KOVACEVIC
HIGH PERFORMANCE RELIABILITY

A Smarter Way of Preventative Maintenance

4 Simple Steps to Improving Profitability through Smart PMs

By James Kovacevic of

High Performance Reliability

This eBook is dedicated to my two daughters, Olivia & Norah, and my beautiful wife Michelle. You support me in everything and are my inspiration for what I do.

Solve, Achieve, Sustain

Having the right equipment strategy and preventative maintenance (PM) routines can mean the difference of a profitable business or one that fails. But how does one ensure the right equipment strategy and preventative maintenance routines in place?

I wrote this eBook to help all manufacturers and professionals involved in maintaining the integrity of physical assets and systems. Earlier in my career, I was put in charge of the maintenance department of a small manufacturer. Without any knowledge or experience in the development of PM routines, I took the OEM recommendations as the Holy Grail. With the OEM recommendations in place, the equipment did not perform to the level of performance expected.

Too often equipment strategies and PM routines are copied from the OEM recommendation, which do not take the operating context or the business needs into account. This eBook is a guide to designing, writing, evaluating and improving PM routines that make sense for the business.

This is not a get reliable quick scheme. It requires hard work, resources and time. But by following the information contained within this eBook, you can begin to build a highly effective equipment strategy with nothing but value added PM routines.

QUESTION?

If at any time while you are reading this eBook you have any questions, please do not hesitate to contact me. You can reach me on twitter @HPReliability or you can reach me in private at james.kovacevic@HPReliability.com. Even if you don't have any questions, I'd love to hear your comments, stories, or just to say hi.

If this eBook helps one manufacturer, one professional, or one community, then I accomplished my goal.

To all of my subscribers, followers and friends, thank you for all of the support you have given me. I only hope this eBook can begin to repay you for your time and attention that you have given. Here's to you, a profitable business, and prosperous communities!

James Kovacevic
Founder High Performance Reliability

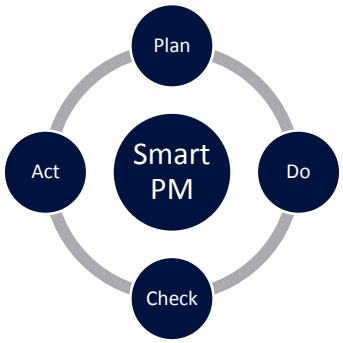
Table of Contents

Introduction

What Can A Smarter Way of Preventative Maintenance Do For You?

Simply put, smart preventative maintenance translates into increased profitability to the business. How does smart preventative maintenance achieve this improved profitability?

- Smart PM routines target failure modes that can be detected or prevented, not failure modes that can't be
- Smart PM Routines are not blanket work orders, which are open to interruption
- Once an Existing PM program is converted to a Smart PM program, all non-targeted PM routines are removed, reducing the total PM work load.



What Results Can Be Expected With Smart Preventative Maintenance?

Once a PM program has been made smarter, the benefits to the business will be tremendous.

- 28% average reduction in re-occurring PM workload.
- 4% average increase in OEE

These two figures are significant, but are real and could be yours if you choose to make your Preventative Maintenance program smarter.

A SMARTER WAY OF PREVENTATIVE MAINTENANCE:
28% reduction in PM work load
4% increase in OEE

How Can Smart Preventative Maintenance Be Created?

Using four simple steps, you too can create a Smarter Way of Preventative Maintenance;

- Design A Smart PM Routine: How do you determine what activities will be value added to the business?
- Write a Repeatable PM Procedure: The PM routine needs to be broken down into a repeatable procedure to ensure quality and consistency in execution and measurements
- Evaluate PM Effectiveness: With the PM routine in place and moving along, the outcomes of the PM routine needs to be evaluated to ensure the business needs are met.
- Continuous Improvement: The final step in the Smarter PM process, involves taking the learnings from the technicians and the previous step and further improving the routine.

A smarter way of preventative maintenance awaits, what are you waiting for?

Design a Smart PM Routine

How do you determine what activities will be value added to the business? Knowing what to do is just as important as what not to do.

This section focuses on designing and developing smart PM Routines from scratch. The principles covered can also be applied when reviewing existing PMs for applicability and value.

Preparations for Designing a Smart PM Routine

When using this methodology, it is important to properly prepare for it. Having the right information and team in place will ensure that this process yields results. Some things to keep in mind are:

- Appoint a lead to the PM development process.
- Gather a diverse team. The team should include the maintenance planner, a mechanic, electrician and possibly an operator.
- Populate the supplied template as you progress through the steps. This will ensure all information is accurate and each step builds upon each other.

With the preparations in place, developing the Smart PMs can commence.

What Failure Mode Will The PM Address?

Before any PM routine can be developed the failure mode needs to be determined. A smart PM address not just production stoppages, but all other failure mode(s):

- Stoppages: prevents equipment from operating for a period of time. These could be contributed to the equipment not starting, stopping during operation, or failing to stop on command. Intermitted stoppages should also be included such as jams, trips and blockages.
- Deteriorating Capability: prevents equipment from operating at the desired performance. This is usually observed through reduced throughput, decreased flow rates, etc. Having equipment operate below the desire performance can greatly affect the profitability of the business, no matter how small the decrease in performance is.
- Other: this failure mode category is a catch bucket for all other issues that may be realized. These include an increase in defect rates, the use of additional man power, or additional energy.

It is important to keep in mind that no matter how smart a PM routine is, it will not overcome any initial incapability found within the process or equipment.

If the failure mode cannot be determined the process should not continue, as the risk of introducing a non-value added PM routine is high.

What Is The Root Cause Of The Failure Mode(s)?

The root cause of each failure mode needs to be determined in order to develop an effective preventative or detective measure to mitigate the failure.

If the root cause cannot be determined than the likelihood of developing an effective counter measure is almost negligible. Unfortunately this step is often skipped when PM routines are developed. This leads the high amount of reoccurring PM workloads in plants without any improvement in line efficiencies.

Most failure modes can be attributed to a small amount of root causes:

- Design Related: causes can be attributed to improper capacity, material or technology.
- Fabrication / Installation Related: causes are attributed to defects in materials and improper installation.
- Operation / Maintenance Related: is the largest category of causes. The causes may be operating the equipment out of the design window, an error in the operation of the equipment, and error in the maintenance of the equipment, or expected wear and tear within the equipment.
- Management Related: causes are typically related to improper / incorrect documentation or improper planning, organization or reporting
- Miscellaneous: this category is used when multiple simultaneous causes occur at the same time, the cause is unknown or if cause does fall into one of the other causes.

If the cause of the failure falls into the design, fabrication, installation or management category than a PM routine will not be effective. Other measures can be implemented to address the failure mode, such as redesign of the equipment, training, etc. However do not proceed any further unless the cause is within the operation / maintenance category.

What Are The Consequences Of The Failure?

Now that the failure is known, it is important to understand the consequences that will be experienced by the business if the failure were to occur. It is these consequences that will be used to assist in determining if PM routine will be value added to the business.

- Hidden: Hidden consequences occur when a failure occurs and it is not evident to the users during normal operation. These types of

failures are typically found in protective and safety systems.

- Safety & Environmental Effects: The safety consequences can range from small injuries to death, while the environmental consequences can range from a small contained leak to a contravention of environmental regulations and a large scale environmental realise.
- Secondary Damage & Production Effects: These are upsets in production such as downtime or quality losses. Also included are all failures that can cause further damage in another piece of equipment. All of these failures have a cost value associated with them.
- Non Production Effects: The consequences of a Non Production related failures are usually only the cost of the repair.

With the type of consequence determine, the probability and severity of the failure needs to be determined, which in turn provides a risk number.

The risk number is used to determine if the PM routine makes fiscal sense or if it is better to run to failure. It may also be used to determine the work priority once the PM routine is in use.

The probability of the failure, hence the consequence, occurring should be consistent across all consequences. The timeline should be appropriate to the industry as well and should be adjusted as needed

Probability	
6	1x per day
5	1x per week
4	1x per month
3	1x per quarter
2	1x every year
1	1x every 5 years or more

To determine the appropriate probability and severity, clearly defined criteria should be used:

Safety & Environmental	
6	1 or more killed / Environmental disaster
5	1 or more critically injured / Large release into the environment
4	1 or more serious injury / Minor release into the environment
3	Hospital visit / Contained large release
2	Minor first aid / Contained minor release
1	Near Miss

Hidden, Secondary Damage & Production, and Non Production	
6	Stoppage of a week or more
5	Stoppage of several days
4	Stoppage of a day
3	Stoppage of shift
2	Stoppage of a few hours
1	Stoppage of a few minutes

With the probability and severity determined, the risk number can be calculated.

Probability						
	6	12	18	24	30	36
	5	10	15	20	25	30
	4	8	12	16	20	24
	3	6	9	12	15	18
	2	4	6	8	10	12
	1	2	3	4	5	6
	Severity					

It is important to note, that depending on where and how the equipment is used will greatly affect the severity and the risk number. For example, if the equipment has a built in redundant back up then the severity of a failure is low.

How Will The Failure Manifest Itself and What Can Be Done?

Knowing the failure causes will facilitate and identify how the failure manifest itself. This is critical to determining what activities can be done to prevent or detect it.

For example, there will be warning signs that can be monitored, as the failure begins to develop. These include specific measurables such as flow, pressure, temperature, vibration, thickness etc. With these warning signs determined, the PM routine than becomes a Condition Based Maintenance (CBM) activity. This approach allows the monitoring of equipment, without replacing materials unnecessarily.

If there are no specific warning signs, can the life (cycles, days, widgets) of the equipment be determined to a degree of accuracy? If so than a Time Based PM routine can be implemented to replace specific components to prevent the failure from occurring. Note that time based PM routine should only account for 11% of the total PM program.

For the CBM and Time Based PM routines, it is vitally important to determine how these activities will be carried out and when. This will assist in determining if the preventative or detective measures will be able to happen. Often times warning signs are known, but cannot be collected or acted upon due to access, technology or a host of other issues. By identifying these issues ahead of time, resources and tools can be identified and the activity can be made technically applicable.

If an activity is not technically applicable, it means that the business is unable to perform it because it does not have the resources, tools, or knowledge to complete. If the activity cannot be made technically applicable, then it should not be implemented.

What happens when the life of the component or system cannot be

accurately predicted and there are no warning signs? There is little that can be done to prevent or detect the failure. In most circumstances, where there is no way to prevent or detect the failure, and the consequences dictate that the equipment cannot be left to fail than basic care should be used.

Basic care is the ensuring that the equipment is clean, lubricated and settings are correct. This basic care should be developed as a Time Based Cleaning & lubrication PM Routine.

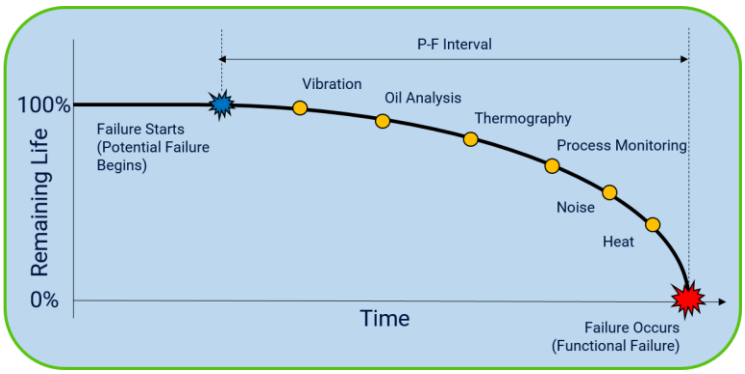
What Is The Proper Frequency Of Task?

One of the most difficult tasks in developing a Smart PM routine is getting the frequency of the activity right. Now there are many ways to do this, with some being very advanced to some simple ways.

Often times, the experience and knowledge of the team will be enough to determine the appropriate frequency without any failure history.

For example, ask the team how long a bearing operating at 10,000 RPM will last once it starts to squeak. Next ask them how long a large bearing moving at 20 RPM will last once it begins to squeak. The answers should be a few minutes to a few hours and days to weeks. This approach often is overlooked, but can create a great starting point.

Regardless of which approach is used, the frequency must be shorter than the P-F interval. The P-F interval is the time it takes from the start of a failure (Potential Failure) occurring to the time it actually fails (Failure).



Depending on which method is used to prevent or detect the failure, the P-F interval will vary. Keeping this in mind, the frequency should allow for enough time to detect, and repair the potential failure before the failure actually occurs.

If the P-F interval is short enough that it does not allow for time to detect and repair the potential failure, than CBM or PM activities are most likely not the right solution for this preventing or detecting the failure. Value added solutions may be online condition monitoring, or a redesign of the equipment or process.

If a CBM or PM routine does not pass the P-F interval check, than do not

proceed any further. To many times, I have seen PM workloads extremely high, as the P-F interval is not understood, and despite all of the hard work, results do not arise from the CBM activities.

Does It Make Financial Sense?

The last criteria to determine if a PM routine should be implemented is to ensure that it makes financial sense. For example, does it make sense to spend 4 hours each week performing inspections and cleaning activities to prevent a failure that results in 30 seconds of downtime? The answer depends on the industry, but I am betting the answer is no.

Remember, that the best maintenance programs are aligned with the business needs. So unless the business requires 99.9% uptime, chances are a little downtime will be accepted to offset the tremendous amount of overtime and wasted time of the technicians.

Do not be afraid to say that the PM routine does not make sense based on the cost of downtime vs the cost of the PM routines. By doing so the business consciously adopted a run to failure approach and is completely acceptable, provided there are no significant risks or consequences from that failure.

This single step will dramatically assist in reducing the total reoccurring PM workload.

DID YOU KNOW?

Run to Failure (RTF) is often not viewed as a viable option. It is felt that all failures must be prevented. This is a costly misunderstanding. What must be prevented are the consequences of the failure, not the failure itself. So if the failure results in minimal risk to the site, the most cost effective option is RTF.

The RTF option must be decided only after the analysis has been completed and risk evaluated.

Who Will Do The Work?

The final step to designing the Smart PM Routine is to determine who will do the work. The most common answer is the maintenance technicians, but often the operator is the ideal candidate to perform many of the inspections and cleaning activities.

The operators are at the machine, and will be able to take advantage of any time to clean the equipment. They can also take process readings as the equipment is running.

The more activities that can be transitioned to the operators, the more time the maintenance technicians will have for more skilled work, providing greater value to the business.

This is often easier said than done, but start the conversation with your operational counterparts now so the business can begin to reap the rewards.

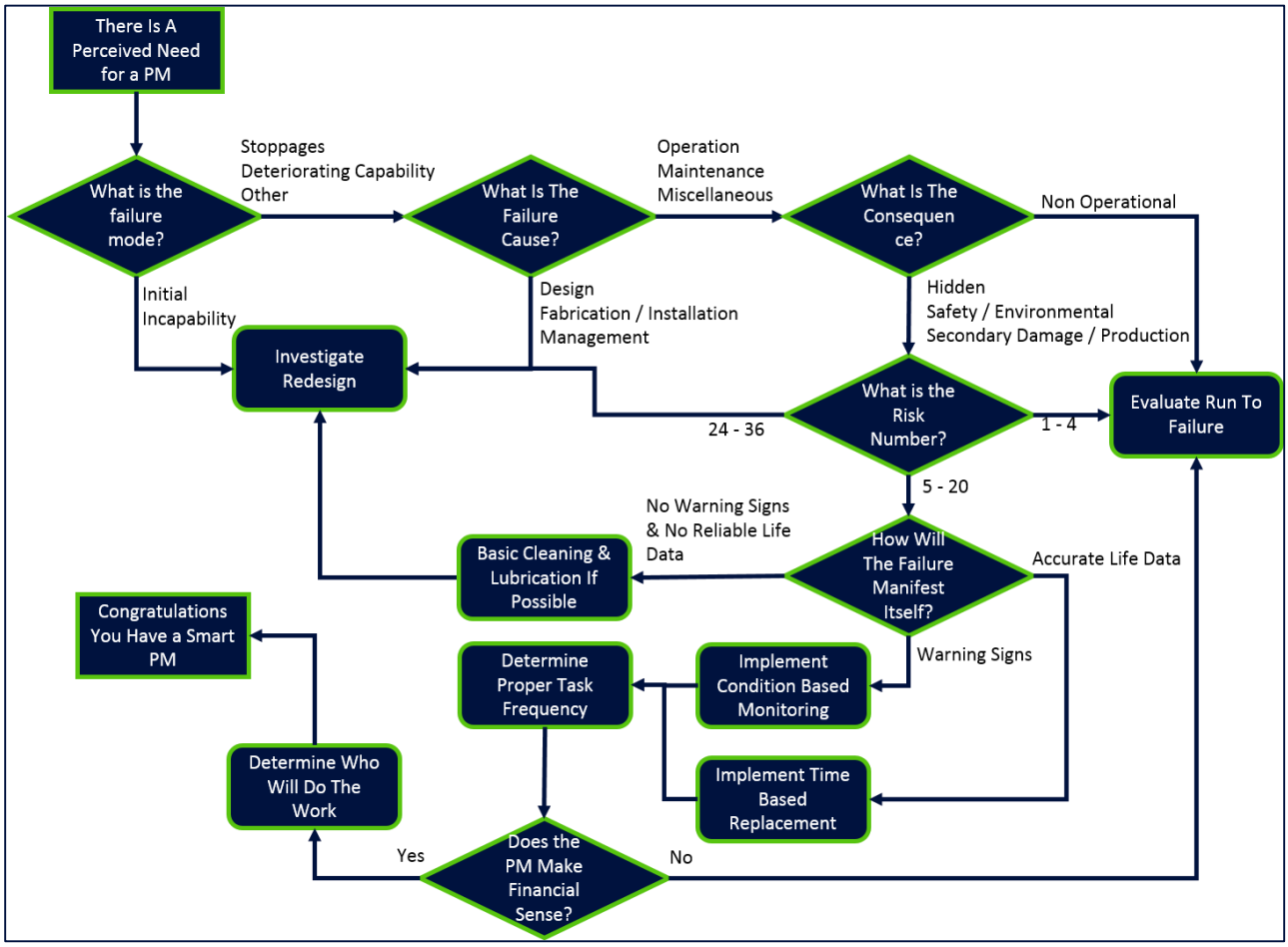
Tying It All Together

Congratulations on developing a Smart Preventative Maintenance Routine. These steps should be as many times as necessary for each piece of equipment before moving on to the next step, as the routines should be bundled into as few PM procedures as possible.

By beginning to review or develop new PM routines with this method, you will not only save time, but improve plant performance.

Please use the template included to assist you with starting the Smarter Preventative Maintenance journey.

This is only step one of the journey, as now that only value added PM routines will be completed, we need to ensure that they are done correctly and provide repeatable measurements. This is accomplished by writing a repeatable PM procedure.



Ref No.	Failure Mode	Root Cause of Failure	Conseque nce type	Pr	Se	Risk	Warning Signs or Estimated Life	Frequency of Task	Financially Acceptable	Who Will Do the

Write a Repeatable PM Procedure

With a Smart PM routine developed, the routine needs to be written into a repeatable procedure. This ensures each routine is executed the exact same way, regardless who completes the work.

This consistency is required to ensure the quality of the measurements and activities. It also serves to reduce any maintenance induced failures, and to expedite the training of new technicians.

What Needs to Be Included In a Procedure?

To convert the PM Routine into a repeatable procedure, there are certain pieces of information required on each and every procedure:

- The routine has a clear definition of the task and the failure mode it is trying to prevent.
- The routine has necessary safety warnings, appropriate tools, required parts & consumables listed
- The routine has specific steps with detailed quantitative measures, ensuring that a target measure is provided with a tolerance.
- The routine requires the use of measurement tools such as calipers, micrometers, torque wrenches, etc.
- If a qualitative measure must be used, the criteria must be described in a repeatable way
- The routine has an area to record the “As Found” and “As Left” measurements or comments
- The routine has an area to record improvements to the PM and the revisions identified.

The routine should be written in an easy to read format, clearly outlining each individual step.

IMPORTANCE OF PROCEDURES

Procedures are used by highly trained, qualified professional every day. Pilots, nuclear engineers, astronauts are all incredibly talented and smart people. However they all rely on checklists and procedures to ensure the task they set out to accomplish are done correctly. If they find value in procedures, shouldn’t your technicians?

Tangible and Specific Values

The most effective procedures are ones that provide tangible, specific (quantitative) values within the procedure. This ensures that the procedure is executed the same way to the same quality standard each time. Provided are some examples for Quantitative Measures:

- Use the Vernier calipers and measure the thickness of the table top in 8 different places equally spaced across the length of the table top conveyor and record the values. If the table top is less than 2.4mm thick, in more than 2 places, note that the table top has exceeded the minimum

wear value and it requires replacement.

Measurement Point	1	2	3	4	5	6	7	8
Measurement	3mm	2.8mm	2.2mm	2.9mm	3.1mm	2.3mm	3mm	2.7mm

Another example with the As Found / As Left approach would be:

- Use the torque wrench and validate that the 8 mounting bolts are torqued to 50 ft-lb +/- 10%. Record the As Found and As Left values.

Bolt #	As Found	As Left
1	46 ft-lbs	50 ft-lbs
2	40 ft-lbs	51 ft-lbs
3	50 ft-lbs	50 ft-lbs
4	55 ft-lbs	55 ft-lbs
5	47 ft-lbs	50 ft-lbs
6	48 ft-lbs	51 ft-lbs
7	47 ft-lbs	50 ft-lbs
8	45 ft-lbs	50 ft-lbs

But There Are No Numbers!

In the event that there are quantitative values that can be used to describe the steps or process, descriptive or qualitative measures must be used. Be sure to provide detailed descriptions of the various states that the equipment may be found in. For example:

- Inspect the belt for wear looking for the following; 1) is there any cracking in the belt? 2) Is the belt frayed around the edge? 3) is there any grease or oil on the belt?, 4) is there a buildup of debris under the belt?. If any of the following conditions are met, record and create a follow-up work order
- Provide pictures of acceptable conditions, and different levels of unacceptable conditions.

By providing detailed criteria for the PM routines, we can ensure the quality of the work that is performed and ensure that it is adding value to the business.

Evaluate PM Effectiveness

With the PM routine in place and moving along, the outcomes of the PM routine needs to be evaluated to ensure the business needs are met.

How do we ensure that the smart PM routines we are completing are in fact adding value to the site and improving performance? Here are a few quick steps that can help you evaluate the effectiveness of the smart PM.

Do the Math

Evaluating the effectiveness of the PM routines is as simple as basic arithmetic. Anyone of the principles below can be used to evaluate the PM routines, depending on which data is available.

- Is the cost of doing the PM more than the consequences we are trying to avoid?
- Is the PM routine developing follow up work at least once out of every five inspections?
- Is the PM routine discovering at least 30 minutes of follow up work for every 1 hour of PM work?

If the PM routine does not meet any of the above, then it may not be providing the right value to the business. But before removing the PM routines…

Stop and Think

Before stopping any PM routines that did not pass the criteria above, certain questions must be asked to ensure that the business is not put at risk.

- Does this PM routine preserve the manufacturing output or is it regulatory, environmental, or safety related? If unsure, review against the consequences and risk levels defined above.
- Is the inspection method being applied appropriate for the specific failure mode we are trying to address? Are there specific measures or criteria that the equipment is evaluated against, and will provide warning of a Potential Failure?
- Is the inspection being conduct properly? Ensure the PM procedure is written with detail and requires specific as-found measurements to prevent pencil whipping.
- Is the frequency of the inspection correct? The inspection interval should be half of the time required for the problem to enter the system and fail. This allows two opportunities to mitigate the consequences prior to failure

If the answer to these questions are No, then the PM routine needs to go through a detailed revision or it is removed. Remember that only 11% of failures are age related, so it is vitally important that most of the PM routines are condition based.

The Fine Line

There is a fine line between doing too much, too little, and just the right amount of PM. As seen, there is a point at which equipment reliability adds too much unnecessary costs, therefore the optimum level of PM must be defined within the needs of the business.

Continuous Improvement

The final step in the Smarter PM process, involves taking the learnings from the technicians and the previous steps and further improving the routine.

Evaluating the PM routines with the criteria defined in the previous steps will generate significant results to the business. However one of the greatest sources of improvements to the PM routine is the feedback and input from the maintenance technicians.

The feedback received from the technicians allow the PM routines to further evolve in not only what is checked, how it is checked, and what is required to perform the routine, but also specific tip, tricks and hints which improve the job procedure.

Please Provide Feedback

The first step to gathering great feedback from the technicians is to educate them on why feedback is required, the benefits that feedback will provide to them and the business. Finally the technicians need to know specifically what data points and information should be provided.

Education on the What's In It For Me (WIIFM) will greatly increase the engagement from the technicians on the feedback. A few of the benefits that the technicians will realize are:

- Reduced trips to the storeroom
- Reduction in number of times the technicians are pulled from proactive work to address breakdowns

To assist in educating the technicians in the value of providing feedback, and what is required a toolbox talk has been developed and provided on page 19. Use the toolbox talk to launch the program to start receiving feedback and to periodically refresh the memories of why the feedback is provided.

WHAT'S IN IT FOR ME (WIFFM)

WIIFM is often used in sales to demonstrate to the buyer the benefits that they will experience as a result of the purchase.

It is used to connect on an emotional level and avoids promoting the features and specifications.

By taking about the WIIFM, the technicians will be able to see how they will personally benefit from providing the feedback.

A System Must Be In Place

In order to take advantage of the feedback from the technicians, systems must be in place to utilize the feedback. Nothing is worse than having the technicians provide feedback and go unused. When this happens the craft will stop providing feedback and it is very difficult to restart.

Having a system in place will ensure the feedback is utilized. The system can be simple, but it has to be followed:

- Feedback should be provided via a consistent process, i.e. on the PM routine, or in the confirmation text of the CMMS. Regardless which approach is used, there should only be one way that feedback is provided by the craft.
- All feedback should be utilized and the PM routine updated before the next time the PM routine comes due.
- All revisions to the PM should be validated and approved prior to the PM routine being changed.
- Use a revision log for each PM routine, keeping track of all changes and who provided the feedback.

With a system in place, and the feedback being utilized the PM routines will continue to improve over time, and further the value to the business.

Take an Hour a Week

With the feedback being utilized, one final step can be implemented to ensure the continued evolution of the smart PM routine, and that is taking an hour a week to review a PM routine.

The routine can be selected based on the last revision date, or on any bad actors from the previous week. It is not important how they are selected, but that the time is taken to review a PM routine.

This can typically be performed by the maintenance planner and a technician. The review should consist of reviewing the PM routine through the first two steps in the Smart PM process. This ensures that all PM routines are reviewed on a regular basis, ensuring relevance and value to the business.

The PM Review Meeting;
A successful PM Review meeting has 3 specific parts, each require 33% of the time.

Prep Work: During this phase the PM should be selected. All feedback and findings from past PM routines should be gathered, along with all relevant equipment history

The Meeting: During the meeting, the PM routine is reviewed to ensure that it is designed correctly, and has a detailed repeatable procedure. The history and feedback is then reviewed for additional failure modes, and causes which may need to be added to the specific routine. If any new failure modes or causes are discovered, they should be evaluated using the steps about.

The Follow Up: Write the repeatable procedure to include the new failure modes, causes and any additional updates to the procedure that may be required. Have a technician review the new procedure and provide feedback prior to releasing for use.

Tool Box Talk – PM Feedback

Most organizations have a percentage of PM routines that were put in that do not address the failure cause. These PM routines do little for the business expect to consume valuable technician time.

Eliminating these non-value added PMs must be a top priority for the business and requires the full support of the technicians to make it a reality.

What's In It for the Technicians?

There are numerous benefits to the technicians once the non-valued added PMs are removed. These include:

- Reduction in the number of trips to the storeroom
- Reduction in the number of interruptions during planned work
- Having all parts available prior to starting the work
- Having enough time to complete the work
- Legal protection. By providing feedback it demonstrates that the PM routine was completed, and not just checked off.

Talking Points for the Supervisor;

- Ask for other benefits to providing feedback
- Explain how checking off PMs without actually doing the inspection is against company policy and may be in violation of the law.
- Ask for other types of feedback
- Explain that providing feedback is expected moving forward

What Feedback Is Required From The Technicians?

The feedback provided by the craft should include specific data points, which will improve the effectiveness and repeatability of the PM routine:

- Length of time to complete the task
- Any parts or consumables used, not listed in the procedure
- Any changes to the procedure, including the order of the steps, specifications, etc.
- Any tips, tricks or hints to complete the routine
- Any changes to drawings, documents and equipment information
- Any issues encounter during the routine
- If the activities are of any perceived value
- Any follow up work identified

Utilizing this feedback allows the PM routine to be completed in the safest, most efficient way possible. It also identifies any non-value added tasks for removal.

Final Words

Congratulations on taking a step to improving the profitability of your business and contributing to a prosperous community. I know I have provided a lot of information in this eBook, but you now have the knowledge to make a difference with smarter preventative maintenance. Here are a few final thoughts I'd like to share with you

The Results You Achieve Are Up To You

What you apply from this eBook and the rigour in which it is applied will greatly affect the results you achieve.

Start small by applying the techniques in this eBook for an hour a week.

Don't worry about perfection, that's why the 4th step is continuous improvement. The PM routine is continuously evolving, based on experience and learnings.

Lastly, Results take time and this is no exception.

Once the PM routines are improved, it will take time to see the results in the equipment performance.

Continue the Learning

Don't be afraid to ask for help. Many people, including myself are happy to help you out.

Continue to stay up to date with the latest by following High Performance Reliability on Twitter, Facebook and myself on LinkedIn.

Please!

Please do not share this eBook. I put a lot of time into the creation of it and would appreciate it if you would refer anyone interested in it to this link to get a copy for themselves

Thank You!

I hope you enjoyed this eBook as much as I enjoyed writing it for you.

I appreciate each and every one of you for taking the time out to read this, and if you have an extra second, **I would love to hear what you think about it.**

Please leave a comment on twitter (@HPReliability) or on my Facebook Page. If you prefer to provide feedback in private, you can send me an email. I will read each and every comment and work to improve this eBook.

Thanks again, and I wish you nothing but success in your journey to improved maintenance and reliability.

James Kovacevic

Solve.Achieve.Sustain