

Why Maintenance Procedures are Critical to Success

By Ricky Smith CMRP, CMRT

“My maintenance staff are highly trained and do not like using procedures.”

- Unnamed Maintenance Supervisor

If the statement above is valid, and the cost of asset failure is not important to our operation, then your staff must have an unlimited and infallible memory – congratulations!

“A repeatable procedure should be written at a level that any maintenance technician could follow to specifications every time.”

Human error rate is high and thus without repeatable, effective maintenance procedures create errors which are called failures. Maintenance professionals think procedures are not required because they “know how to do it”. However, this couldn’t be further from the truth.

Over our careers we have seen thousands of examples of human variation creating equipment failure. We as humans are built to produce variation in almost everything we do. Most people deny this human variation exists. However, when managers are asked if they ever could not find their car keys, they look at me sheepishly and say, “Yes, great point”.

Human Error Rate

Description	Probability
General rate for errors involving very high stress levels	30%
Complicated non-routine task, with stress	30%
Supervisor does not recognize the operator's error	10%
Non-routine operation, with other duties at the same time	10%
Operator fails to act correctly in the first 30 minutes of stressful emergency situations	10%
Errors in simple arithmetic with self-checking	3%
General error rate for oral communication	3%
Failure to return the manually operated test valve to the correct configuration after maintenance	1%
Operator fails to act correctly after the first few hours in a high stress scenario	1%
General error of omission	1%
General error rate for an act performed incorrectly	0.3%
Error in simple routine operation	0.1%
Selection of the wrong switch (dissimilar in shape)	0.1%
Selection of a key-operated switch rather than a non-key-operated switch (EOC)	0.01%
Human performance limit: single operator	0.01%
Human performance limit: team of operators performing a well-designed task	0.001%

Many companies honestly believe their maintenance staff members are paid to “know how to do it” without a procedure with specifications and step by step instructions, etc.

What if a maintenance employee does “know how to do perform any Maintenance Task Repeatably every time you should consider if they have the following to execute the procedure to specifications?

1. Corrective Skill level
2. Stable state of mind everyday
3. Stable working conditions
4. Low Stress Level at Work
5. Etc.



What would happen if new information presented itself based on failure data? The only way to ensure this new information is used effectively would be to write or change a procedure.

Equipment Block ID: SeaRock Mine, 2-ROTOR MARIETTA MINERS					
Equipment Hierarchy: E560XXX Miner					
Project Description: 2-Rotor Miner Front End Inspection					
Job Description: Inspect shear pin plates					
Frequency: Monthly					
Estimated Craft Hours: 1 x 1.0		Estimated Elapsed Time: 1.0			
Estimated Production Downtime:					
Originator:	Dave Stone	Origination Date:	03/12/2012		
Owner:	Mine Maintenance	Version #:	1		
Previous Version(s) Modifications:					
Approval:	DS	Version #:	1.0		
Warnings:	Always use face shield over safety glasses when blowing off equipment Lockout procedure must be followed				
Cautions:	Failure to follow torque specs can result in equipment failure				
Personal Protective Equipment Required: Gloves, face shield, hearing protection					
Part # (Stores ID)	Part Description	Quantity	Quantity Description		
Bolt bin	1/2" x 2" Gr. 5 socket head bolts	6	each		
Consumables Needed: Degreaser, paper towels					
Special Tools Required: 2' pry bar 1/2" torque wrench					
Mobile/Special Equipment:					
Required Departmental Coordination: Production shutdown / position / blow off equipment					
Other Procedures Referenced: Job Preparation / Lockout Procedure #XXX					
ID	Description	Craft	# of Crafts	Clock Hours	Craft Hours
1	Clean area to be inspected using compressed air or degreaser as required Warning: use face shield when blowing with compressed air Warning: Ensure hydraulic pump drive motor is racked out; Jog test before proceeding	Mech	1	0.2	0.2
2	Inspect shear pin plates	Mech	1	0.3	0.3
2-1	Visually check for cracks on shear pin plates Are any cracks evident Yes _____ No _____				
2-2	Insert 2' pry bar between plates to check for movement. Is any movement present? Yes _____ No _____				
3	Inspect sprocket	Mech	1	0.3	0.3
3-1	Visually inspect for: Cracks Yes _____ No _____ Broken Teeth Yes _____ No _____ Visible Signs of Wear? If indicated, report findings below and to immediate supervisor for appropriate actions				
4	Inspect retainer cap	Mech	1	0.2	0.2
4-1	Visually inspect for broken bolts Are there any broken bolts? Yes _____ No _____				
4-2	If broken bolts are found, replace as required Torque bolts to 80 ft. lbs				

In the Example above you can see if you were to assign this work order to any technician they should be able to complete the work to specification.

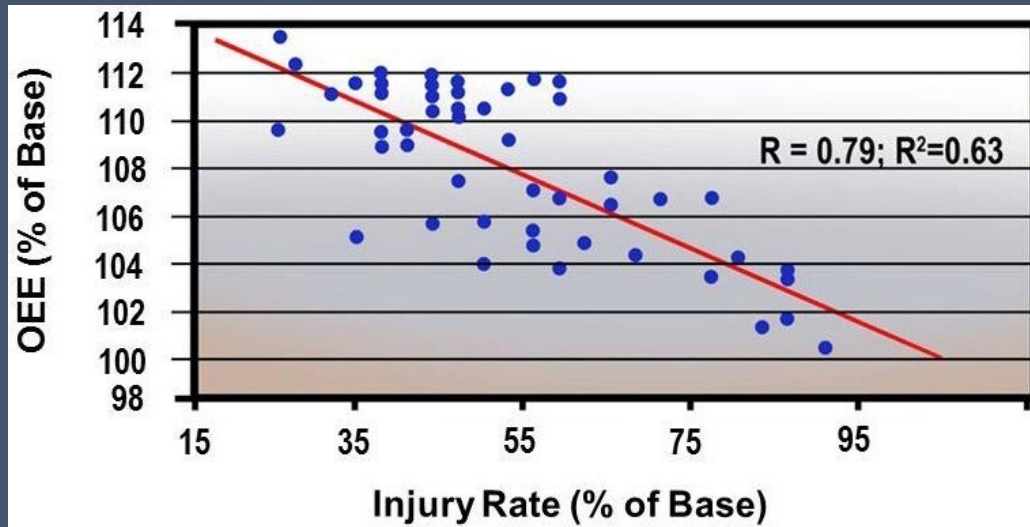
Well-designed maintenance procedures provide feedback and follow-up process which will mitigate human induced failures and allow for continuous improvement to occur naturally.

If a company wants to optimize asset reliability, then repeatable, effective procedures cannot be optional. If an unacceptable failure occurs there are only 2 reasons why it failed.

1. The technician did not follow the procedure or
2. The procedure need to be reviewed for effectiveness

Did you know that the most complex equipment ever built was a nuclear submarine and that the first nuclear submarines experienced failures due to lack of effective procedures, thus ending in catastrophic failure?

If safety is number one in your organization, then repeatable, effective work procedures should be as well. See figure below which shows the correlation between injury rate and OEE.



We may not know why a bearing failed as shown in the picture below. It is easy to surmise that the correct lubricant, quantity, and re-lubrication interval were likely not clearly specified in the maintenance instructions related to the equipment or there was no procedure with step by step instructions or technicians are not follow a repeatable procedure.



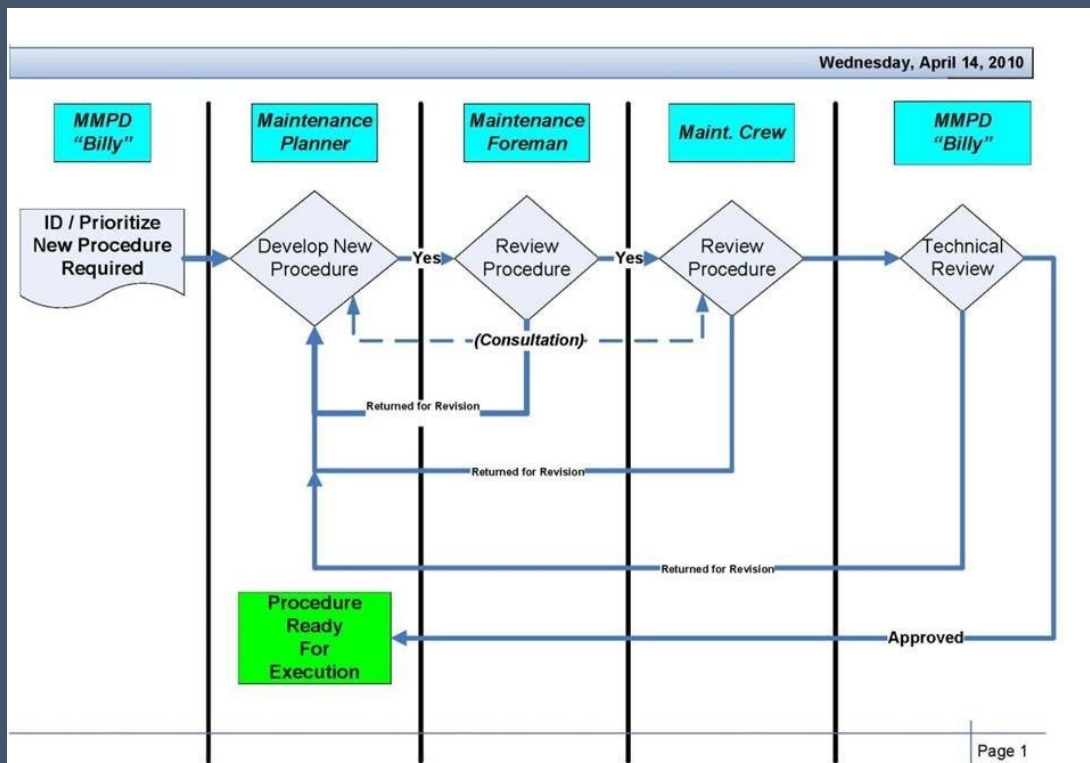
In the field of maintenance, the traditional approach has been to rely upon the intuitive knowledge and skill of the craftspeople who conduct it. There is a corollary that accompanies all of this that many skilled craftspeople believe and would like management to believe firmly is...

“There are too many variables in maintenance, making compliance with written procedures impossible and impractical; that the 'way we've always done it' is the best and only way to conduct maintenance.” - Jack Nicholas

The bottom line is effective, repeatable procedures are a requirement if a company wants a true continuous improvement process for optimizing asset reliability.

There is a problem when moving from current state to this future of repeatable, effective procedures and that is “change”. Change is not easy. Here are proven steps to success in this area:

1. Send a few hard-core individuals to training in developing repeatable, effective procedures. Be sure they will come back excited so select the right training.
2. Upon return from the training sit down with the employees who received the training and work with them to develop a plan to move from current state to future state with effective, repeatable procedures.
3. Be sure this plan has imbedded the following items:
 - a. Training for maintenance technicians, planners, supervisors, managers, reliability and maintenance engineers (2-4 hours for most)
 - b. Develop a process map for procedure development and approval along with defining roles and responsibilities. See Figures Below.



Procedure Development Process Map

Developing effective, repeatable procedures is the only choice an organization has if it wants to mitigate risk and invoke continuous improvement into the reliability of its assets.

Mitigate human induced failure and optimize reliability and cost through the use of effective, repeatable preventive, predictive and corrective maintenance and operator-care procedures.

If you have questions, comments or would like a “Procedure Template”, please send them to Ricky Smith CMRP at rsmith@worldclassmaintenance.org or go to my website at: www.worldclassmaintenance.org

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