

WHY MAINTENANCE PROCEDURES ARE CRITICAL TO SUCCESS

BY: **RICKY SMITH,
CMRP, CMRT, CRL**



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% |

Why Maintenance Procedures are Critical to Success

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 | | | | Required Departmental Coordination: Production shutdown / position / blow off equipment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|-------------------------------------|----------------------|--|------------------|----------|----------------------|----------|-----------------------------------|-------|-------------|-------------|-------------|---|--|------|---|-----|-----|---|--------------------------|------|---|-----|-----|-----|---|--|--|--|--|-----|---|--|--|--|--|---|------------------|------|---|-----|-----|-----|--|--|--|--|--|---|----------------------|------|---|-----|-----|-----|---|--|--|--|--|-----|---|--|--|--|--|
| Equipment Hierarchy: E560XXX Miner | | | | Other Procedures Referenced: Job Preparation / Lockout Procedure #XXX | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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: bS | | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Part # (Stores ID)</th> <th>Part Description</th> <th>Quantity</th> <th>Quantity Description</th> </tr> </thead> <tbody> <tr> <td>Bolt bin</td> <td>1/2" x 2" Gr. 5 socket head bolts</td> <td>6</td> <td>each</td> </tr> </tbody> </table> | | | | Part # (Stores ID) | Part Description | Quantity | Quantity Description | Bolt bin | 1/2" x 2" Gr. 5 socket head bolts | 6 | each | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Consumables Needed: Degreaser, paper towels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Special Tools Required: 2' pry bar 3/4" torque wrench | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mobile/Special Equipment: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 4 | Inspect retainer cap | Mech | 1 | 0.2 | 0.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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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.

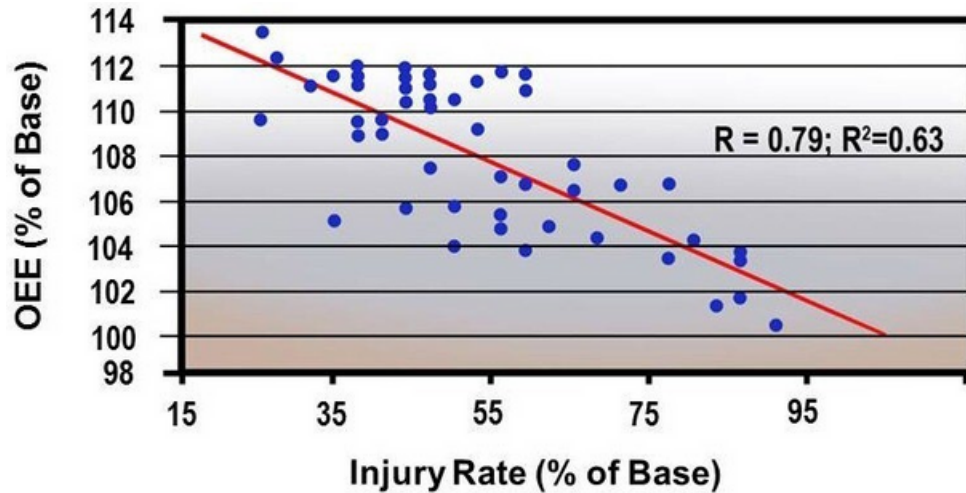
If a company wants to optimize asset reliability, then repeatable, effective procedures cannot be optional. If an unacceptable failure occurs there are only 2 reasons why it failed.

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

Why Maintenance Procedures are Critical to Success

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 their 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...

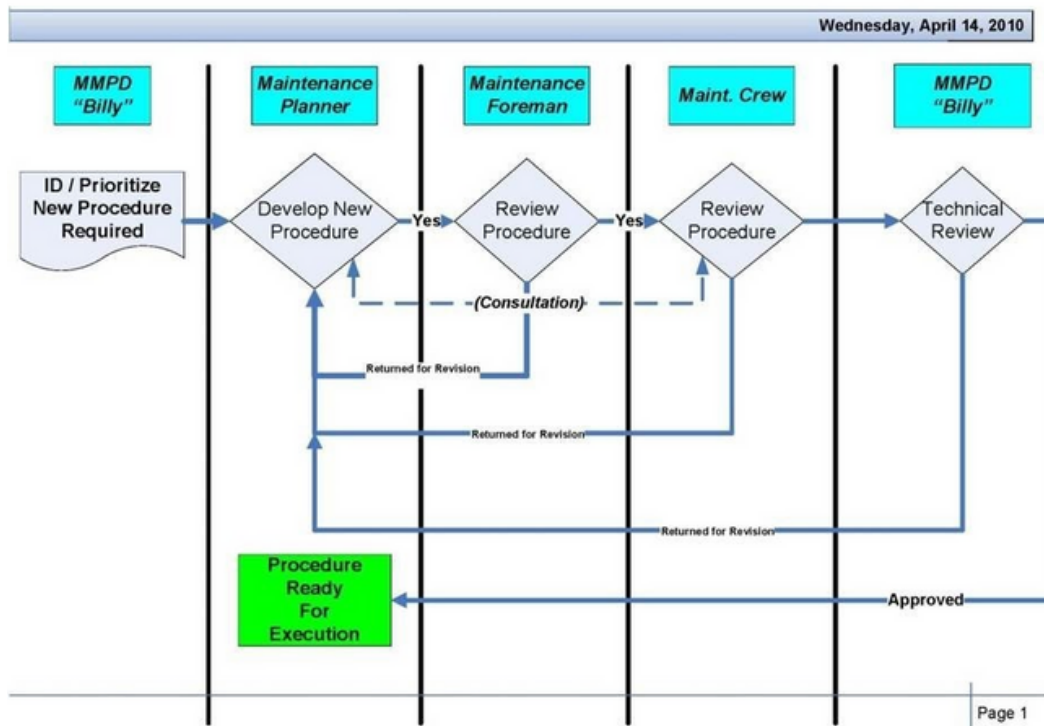
“There are too many variables in maintenance, making compliance with written procedures impossible and impractical; that the ‘way we’ve always done it’ is the best and only way to conduct maintenance.” - Jack Nicholas

Why Maintenance Procedures are Critical to Success

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

Why Maintenance Procedures are Critical to Success

- a. Roles and Responsibilities should be well defined for Maintenance Procedures using the RACI Chart
- b. Use the previously shown process map to use as a guide

| RACI CHART FOR WORK PROCEDURES | | | | | | | |
|---------------------------------------|------------------------|---------------------|------------------------|---------------------|----------------------|-----------------------------|---------------------------|
| Tasks Decisions / Functions | Maintenance Supervisor | Maintenance Planner | Maintenance Technician | Maintenance Manager | Reliability Engineer | Maint support administrator | Plant engineering manager |
| DEFINE THE PROCESS | I | C | I | A | R | R | C |
| VERIFY EQUIPMENT CRITICALITY | C | I | I | A | R | R | I |
| MEASURE MTBF/EMERGENCY UNPLANNED WORK | I | I | I | A | R | R | I |
| DEVELOP PROCEDURES | R | C | C | A | R | R | I |
| EXECUTE PROCEDURES | A | C | R | I | I | I | I |
| MEASURE AFFECT OF PROCEDURES | C | I | I | A | R | R | I |
| MANAGEMENT OF CHANGE | C | R | C | I | A | R | I |

R – Responsible “the doer” C – Consulted “2 way communication”
 A – Accountable “the buck stops here” I – Informed “1 way communication”

- c. Invite all stakeholders in this process, ie. Production manager, maintenance supervisor, maintenance planner, stores manager, safety, reliability engineering
- d. Focus on the process map and identify each person’s role in it.
 - i. R – Responsible (the doer – could be multiple positions)
 - ii. A – Accountable (the buck stops here – one person only)
 - iii. C – Consulted (two-way communication)
 - iv. I – Informed (one-way communication – no reply expected nor accepted)

There is really no valid excuse today for not moving towards procedure-based maintenance.

The basic conclusion is worth repeating...

...the more detailed the procedures and the more insistence on compliance with procedures an organization becomes, the more precise and less error prone its maintenance will become. The result will be an increase in reliability to as close to the limit that design and other factors will permit.

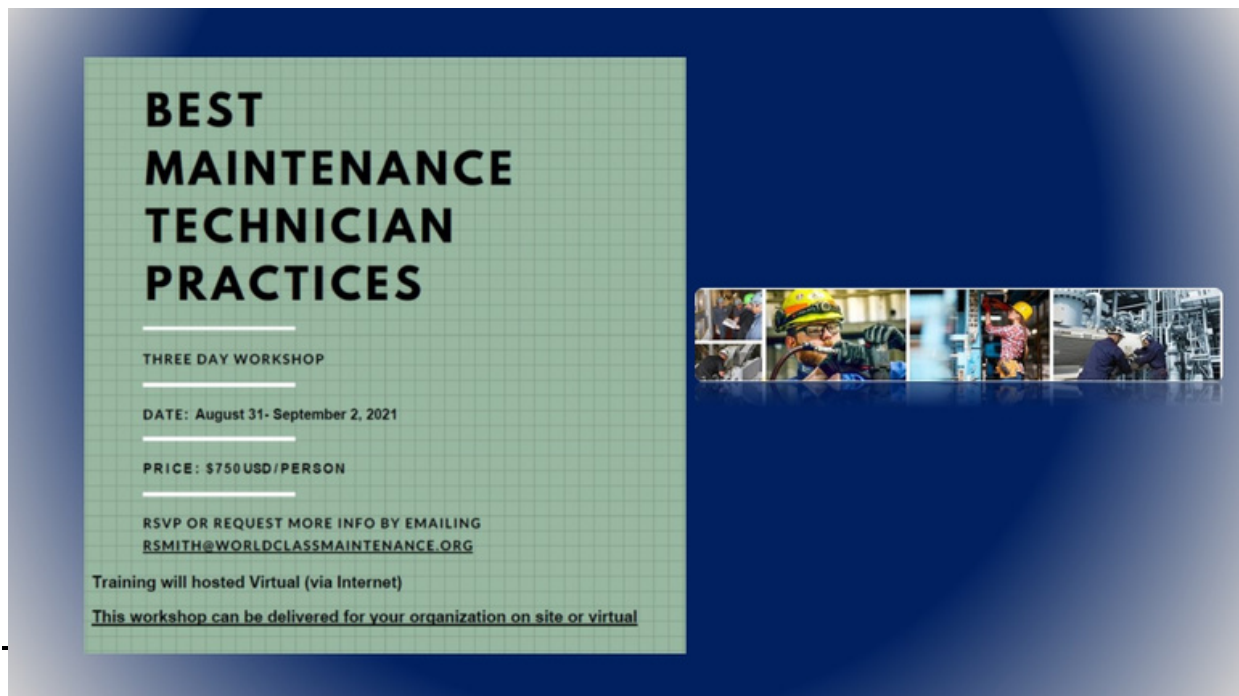
If one makes the decision to not use effective, repeatable procedures you must prepared to accept the consequences of this action which would be higher equipment failure, higher maintenance cost, along with higher safety and environmental risk.

Why Maintenance Procedures are Critical to Success

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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MAINTENANCE
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Training will hosted Virtual (via Internet)

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#1 Software for Maintenance & Reliability Teams

UpKeep is a service-first company that builds software designed to make maintenance easier for technicians and managers everywhere. Reduce downtime up to 18% by switching over to a preventative maintenance solution!

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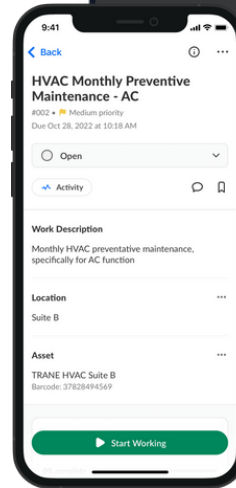
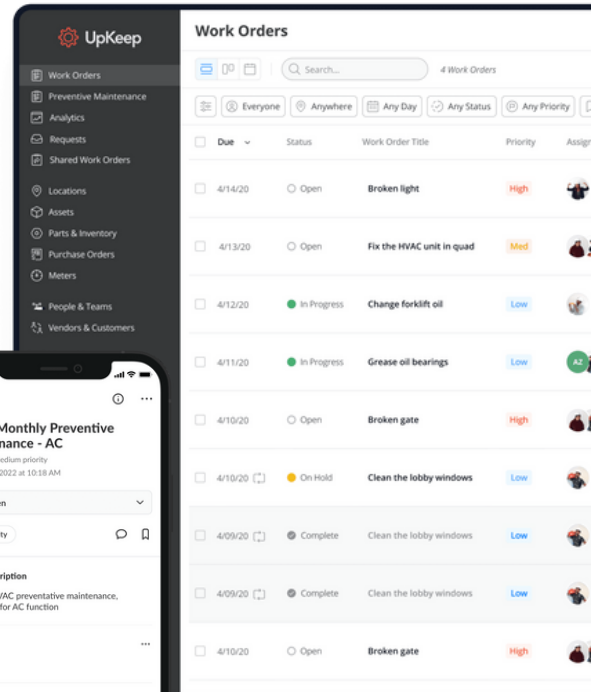
Our Products



Mobile-first maintenance management and collaboration across all location, assets, and teams

With nearly 340 different machines in our work environment, it's an impossible task to manually assign and track PM's. **With UpKeep we can schedule regular maintenance without overlapping tasks with other critical jobs."**

★★★★★ Paul D, Health and Safety Coordinator



An end-to-end solution for remote condition-based monitoring

Connected and secure IoT sensors for real-time remote condition asset monitoring



Integrated & Centralized Data Ecosystem for World Class Asset Operations

The only purpose built Asset Data Platform. Asset Focused ELT Solution for advanced analytics and integrated, real-time asset data.

The Maintenance Community Coalition was founded on the belief that working together will benefit everyone within our community

Committed to helping each other thrive in our individual professional journeys by sharing resources and expertise, granting scholarships, hosting events, and unlocking knowledge – always at no cost.

