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This process can help move a maintenance department to the next level and better prepare for the future.

Maintenance cost or maintenance loss? Maintenance in today's plant is a dynamic function of the ability to adapt to quick changes and to new policies and management techniques. An inherent problem common to many maintenance programs is that cutting manpower is one of the first things considered to reduce costs. The loss of manpower poses challenges to any maintenance manager who is striving for world class status. Corrective maintenance experience is one of the critical areas of expertise that is often lost when manpower is reduced.

Plants are changing and expanding at an ever-increasing pace to keep up with the competitive environment. Plant equipment has become more efficient and reliable to meet the growing demand for productivity. With this increase in efficiency and reliability, a lot of plant equipment has more complex mechanical, electrical, hydraulic, and pneumatic systems. A majority of plants now require a degree or specialized certification as qualifications for employment.

There are many programs that recommend corrective maintenance task development as an improvement to a maintenance program. Reliability centered maintenance (RCM) and business process reengineering (BPR) are designed to move maintenance and management programs to the next level. Such programs consider processes and provide recommendations for changes to improve the reliability and productivity of equipment and processes.

These kinds of programs can be a great investment and should be researched thoroughly before undertaking the long-term changes that may be involved. Although the programs can reap large rewards in short- and long-term benefits, implementation and follow-through are the keys to truly effective programs. This includes implementing the results, periodic update analyses, and progress reports. Commitment to continuous improvement is paramount to the success of such programs.

Program improvement
RCM is a process that is conducted to improve maintenance programs. The focus of RCM is function preservation through the most cost effective, safest, and technically feasible methods. RCM can improve a company's maintenance system and help increase the overall productivity of most processes. If a company is planning on conducting an RCM analysis, a good corrective maintenance program can reduce RCM analysis time

and improve the results of the analysis. If a company has not already implemented an effective corrective maintenance program, it will generally become a recommendation of an RCM analysis to implement one.

BPR is similar to RCM, but on a different scale. RCM is historically focused on maintenance. BPR, as an expansion of RCM principles, focuses on change in any area of a company with any function. BPR is an effective tool at finding improvable areas in a management system. Manpower reduction, when it is cost effective, may be an effect of a BPR process. Note that manpower reduction, especially in the maintenance department, is not always the best answer for cost reductions.

Reducing costs
Managers must continuously consider cost reductions. The quickest routes to cost reduction are not always the wisest choices. The popular place to go for quick cost reduction is manpower. Companies stress that employees are their greatest assets. Yet, when it comes time for reductions, employees are one of the first assets to be reduced.

Manpower experience embodies a company's tribal knowledge. When an employee is released, a certain amount of tribal knowledge is lost. After releasing personnel, some companies find themselves short-handed and find they have to hire new employees. Training time and costs can be higher than the cost of retaining the personnel who were released.

Corporate knowledge of experienced employees is an asset to a company. By effectively capturing and maintaining corporate knowledge, the impact of personnel losses is reduced. This is not a new concept to experienced managers who know the trials of maintaining an experienced workforce. A reduction of man-hours required to perform maintenance tasks does not necessarily mean that the next logical step is to reduce the number of employees.

Continuous improvement
An option for those managers who want to prepare for the future is to implement a continuous improvement billet. This option for cost reduction is corrective maintenance task generation.

Corrective maintenance task generation is best performed by the same personnel who perform corrective maintenance. A technician's normal schedule does not allow the time to document tasks in detail. Some companies rely on the maintenance supervisor to document and implement new preventive and corrective maintenance tasks. Maintenance supervisors are often too heavily tasked to make this option feasible without risking lost productivity. In addition, maintenance supervisors do not perform corrective maintenance tasks on a regular basis. Therefore, the process of remembering how to perform the task can take longer and be incomplete. Detail is the key to effective corrective maintenance tasks.

One solution to the manpower issue is to assign an extra technician to documenting corrective maintenance tasks. Technicians can be rotated on a periodic basis by area of expertise to document corrective maintenance tasks, perform parts research, and perform lockout/tagout verification for those tasks. Corrective maintenance tasks then can be input to a computerized maintenance management system (CMMS) or a database kept by the maintenance manager. Whenever a corrective maintenance task needs to be performed, the technician can print the work instruction detailing the procedure for locking out equipment, parts needed, and how to perform the task. This kind of corporate knowledge cannot be easily passed from person to person by word of mouth.

Benefits

The benefits of corrective maintenance task generation can be seen in many areas. The first benefit is that the time for completion of common corrective maintenance tasks can be reduced by a conservative estimate of 10 percent. For example, a task that takes 30 minutes on a normal basis can be reduced by 3 minutes.

For a production line that loses $60 for every minute it is down, this can save $180. The task generation will take about 3 hours at an estimated rate of $90 ($20 for salary and $10 for benefits per hour). If the problem recurs five times per year on average, the cost of lost operation alone would be $9000 ($60/min X 30 min X 5 incidents). With the detailed maintenance task it would be $8100 ($60/min X 27 min X 5 incidents). The savings in the first year would be $810 ($900 savings minus $90 for the task generation). Over the long term, the cost savings would more than pay for the extra technician.

By itself, this task may seem like a small savings, but combined with other tasks the savings can soar. An example of a corrective maintenance task with no written task compared to a written task on the replacement of a leaking hydraulic cylinder is described in Table 1 . The comparison assumes that the system will restart properly

after the lockout is cleared. With no written procedures, the system is less likely to restart properly.

The knowledge technicians gain while performing the task writing process will help prepare them for future positions in supervisory or planning capacities. Technicians normally spend very little time honing their administrative skills in preparation to become supervisors. Too many technicians become supervisors who are not educated on the behind-the-scenes skills and concentrate on shop floor direction instead of growing their personnel. The better trained technicians are, the easier it becomes to supervise and manage them.

It is generally accepted that working in a plant is stressful especially when the onus is on to get the plant running again. When corrective maintenance tasks are in place, technicians can get a small break from the reactive nature of their jobs. The morale benefits of the downtime can improve overall work atmosphere and, in turn, the productivity of the personnel.

The safety of performing tasks can be increased by having lockout lists and safety warnings for every task. When the pressure is on to get equipment running, mistakes are more likely to happen. The possible reduction of safety hazards alone can be a large cost savings.

The level of detail of the corrective maintenance tasks can be written to include the realignment of the equipment after the task. This will increase the probability that when the system is started up the system will perform to specifications.

The final and probably most important benefit for the maintenance manager is building a corporate expert system. Building an experienced and well-trained workforce is expensive. Corporate expert systems can build experience more quickly in new technicians than can the school of hard knocks. Such learning from mistakes can be costly.

Corrective maintenance task generation can produce long-term cost reduction, especially when used to implement the results of an RCM or BPR analysis. Task

documentation can be used in any system in conjunction with any other continuous improvement plan. Most companies can perform this process improvement plan in some fashion, even if only on a periodic basis. In doing so, they will reap the benefits of years of tribal knowledge.

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Table 1. Savings with written corrective maintenance tasks for leaking hydraulic cylinder

Written corrective maintenance task

No written corrective maintenance task

1. Print out corrective task (3 min)

1. Lock-out system (5 min)

2. Lock-out system (4 min)

2. Find part number and retrieve part (7 min)

3. Retrieve part (3 min)

3. Replace cylinder (15 min.)

4. Replace cylinder (13 min)

4. Clear locks and restart system (3 min)

5. Clear locks, restart system, and sign off corrective maintenance task (4 min)

Total time: **27 minutes**

Total time: **30 minutes**

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