The evolution of maintenance management and engineering in the pulp and paper industry over the past fifty years

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The basic issues confronting maintenance managers and engineers have not changed much in the past 50 years. However, the methods of addressing these issues have changed dramatically.

The issues confronting maintenance engineers 50 years ago were very similar to those facing us today. Then, as now, engineers sought to reduce the duration and frequency of machinery shutdowns through improved materials of construction and innovative designs. Training, scheduling, planning, and cost control also remain essential considerations in fulfilling the maintenance function.

Although the issues and concerns of maintenance managers and engineers have not changed much in the past 50 years, the methods by which they are addressed have changed dramatically. The concept of predictive maintenance was unknown in 1946, as were the management practices of self-directed work teams, electronic communication, and multicraft mechanics. With today's advanced control systems, maintenance mechanics can readily detect the source of malfunctions and quickly replace faulty components.

This article traces the growth of maintenance management and engineering in the pulp and paper industry over the past 50 years and suggests the direction in which this growth might continue.

Maintenance issues—1946 vs. today

When the TAPPI Engineering Division held its first meeting in 1946, the subject of mill maintenance was certainly on the minds of the founders. The division began with eight committees, one of which was named "Mill Maintenance and Materials." A panel on "maintenance-free systems" sponsored by this committee focused on several important issues of the day:

- Maintenance training
- Work scheduling
- Work control
- Purchasing.

These issues remain central to the mission of maintenance managers today.

This committee met irregularly until 1962, when it was resurrected as the Maintenance Engineering Committee. The concepts of predictive maintenance were discussed for the first time in 1964, with the focus on vibration analysis.

Meanwhile, a Mechanical Engineering Committee had been formed in 1959. This group was concerned with drives, bearings, noise, and hydraulic pulsations. The committee was dominated by suppliers, so the Mechanical Engineering and Maintenance Engineering committees were merged in 1975 in an effort to bolster mill participation. The committee that emerged is known today as the Maintenance and Mechanical Engineering Committee.

As this committee has developed and grown, it has addressed—and continues to address—a wide range of significant issues. Still, it is interesting to compare the issues that attracted maintenance managers in 1946 with the issues that concern the maintenance managers of today.

Instrument maintenance. The importance of instrument maintenance was recognized in 1946, and the instrument mechanic was considered "elite" even then. That was in the day of electropneumatic single-loop controls! Today's instrument mechanics are not really mechanics. Rather, they are electronics technicians capable of troubleshooting and modifying complex programmable controls and sensitive sensors. There has been a literal revolution in this field, creating serious training challenges. Suppliers of these systems have become valuable providers of training.

Accurate records and cost accounting. The importance of accurate records and cost accounting was discussed in those early years, but few companies really practiced good paperwork. Labor and capital costs were relatively low, so downtime and repetitive maintenance were not as important. Today's high capital costs demand high uptimes, and high labor costs require close attention to efficiency and lasting repairs.

Scheduling, planning, and control. Scheduling, planning, and control of maintenance was also discussed in the 1940s, but only in the simplest terms. Today, downtime is minimized through careful planning of shutdowns by a team from Engineering, Maintenance, and Operations. Computer programs

are available—or can be developed internally—to optimize time and labor requirements.

Minimizing downtime. The increased desire to minimize downtime has led today's maintenance managers to pay more attention to:

- Replacement of maintenance-prone equipment with more modern and reliable units
- Replacement of corrosion-prone equipment with equipment made of corrosion-resistant materials
- Design of more easily maintained equipment (access, disassembly, modular design, commonality of spares).

Lubrication. Oilers have been around since the beginning of the Industrial Age, but their work has changed immensely! I remember seeing the stereotype of an oiler walking around with an oil can and rag. Today, oiling is called lubrication and recently has graduated to the science of tribology. The choice, application, and management of lubricants often determine whether or not a machine can operate reliably. In most mills, oilers have become the eyes and ears of the maintenance department, earning equal pay status with traditional mechanics. A predictive-maintenance program also can be incorporated into the lubrication function.

Maintenance tools and techniques—1946 vs. today

What has changed in this business over the past 50 years?

Resource deployment. We have become more sophisticated managers. We are insisting on accountability at all levels, with emphasis on responsible development and deployment of all of our resources, particularly our employees. At our mill, our mechanics spend an average of 8% of their time learning new skills and honing old ones. Technology is growing at such a fast pace that a journeyman mechanic is never fully trained. The willingness to continue learning new skills has required a new mind-set among traditional mechanics.

Management techniques. Many companies are trying new management techniques, such as self-directed work teams, networked information systems for planning and materials procurement, and the use of multicraft mechanics. Although the jury is still out on self-directed teams, there is little doubt that networking and multicraft training will grow and become widely accepted. Computerized maintenance-management systems can provide a thorough maintenance history. Such histories can be used to make timely and rational decisions on equipment modifications or replacements, and they can expose errors in maintenance procedures.

Predictive-maintenance techniques. Predictive-maintenance techniques, which can predict when a machine component is likely to malfunction, have greatly increased the efficiency of our maintenance. I have seen a remarkable reduction of catastrophic breakdowns in the past 20 years as a result. Our industry once was known for its philosophy of "fix it when it breaks." That philosophy has changed, largely through the development of new diagnostic techniques:

- Vibration analysis
- Ferrography
- Thermography.

New maintenance tools. New tools developed in the past 50 years have made maintenance easier and more effective.

- Portable access equipment, such as platforms and lifting devices
- Dynamic balancing
- Laser alignment.

Data processing. Dramatic advances in data microprocessing have made it possible to monitor machinery conditions on a real-time basis so that operators can be alerted immediately when a machine is beginning to show signs of distress. This allows us to plan maintenance shutdowns most efficiently. Another dramatic advance has been the availability of diagnostic tools that can pinpoint the exact component that is malfunctioning within an assembly. This is particularly valuable in complex control systems.

Workplace environment. A new social consciousness, spurred by sometimes overzealous governmental regulations, has entered our industry. We are now very much concerned with the elimination of accidents and industrial health problems, forcing us to focus on such things as power assists, easy access to work sites, minimal exposure of mechanics to toxic materials, and the rapidly emerging science of ergonomics.

Guidelines regarding equal-employment opportunities have led to the hiring of female mechanics. This was almost unheard of 20 years ago. Similarly, job descriptions and assignments must be carefully defined so that we can ensure that persons with disabilities are "reasonably accommodated." The day of the stereotypically burly male millwright is coming to an end.

Summary

Maintenance and mechanical engineers in the pulp and paper industry will continue in their mission to ensure the mechanical integrity of all the machines in our mills. This must be done at the lowest possible cost. The latter is a daunting assignment, since cost accounting is based on many factors, including the effect of downtime, the cost of materials and labor, the effect on paper quality, and the effect of violating permits and regulations because of equipment breakdowns.

Maintenance managers, superintendents, and engineers will have to be more than master mechanics. They must become skilled managers, capable of working within a multidisciplinary management team, and they must remain knowledgeable in the latest technical developments in training techniques, machinery design, planning, and diagnostic techniques. The Maintenance and Mechanical Engineering Committee is committed to helping these people become successful in this mission. TJ

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