



Effective Maintenance Management at Doe Run

By

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The Doe Run Company is the largest producer of primary lead in North America with mines, mills (concentrators) and smelters all located in Missouri, U.S. Doe Run is at present entering the secondary lead recycling business by adding a lead recycling facility to the Buick Smelter.

Like many other companies during the later 1980's, Doe Run experienced rising maintenance costs. The new general manager at Doe Run's South-east Missouri Mining and Milling Division (SEMO) determined that inaccurate and incomplete maintenance data was a major contributing factor preventing effective management of maintenance costs. SEMO's management then decided to obtain the necessary knowledge and tools which would allow implementation and operation of an effective maintenance management program. The company chose to pilot a program at one of the mines, and depending on its success, the program would be expanded to other areas within the division, as well as making the program available to the company's Herculaneum Smelting Division

SEMO's operations

SEMO's structure consists of six mines, four mills, and a central support group. Lead is the principal metal mined and milled with zinc and copper also being produced. All of the mines use primarily diesel powered rubber-tyred mobile equipment for production and development while most of the equipment used at the mills is stationary.

Since a labour strike in 1984, SEMO's work force has been sharply reduced, while overall production has increased. The smaller maintenance work force and the lack of a formalized maintenance management system were not providing adequate preventive and corrective maintenance to ensure optimum equipment availability, nor were they providing adequate manhour and cost efficiency.

SEMO, using a high degree of mechanization with its attendant maintenance costs, was committed to obtaining a good maintenance management system. The company uses a main frame-based maintenance system at its Herculaneum smelter, and while it is basically a good system, it is not capable of managing mobile equipment maintenance effectively. SEMO was also aware of personal computer (PC) based maintenance management systems (MMS) used by other mining companies.

In late 1988, with the assistance and recommendations of two maintenance consultants from different consulting firms, SEMO decided to select a PC based system. A good PC based system would provide the flexibility needed to manage the maintenance of both mobile and stationary equipment.

In early 1989 SEMO engaged Performance Associates, Inc. (PAI), a consulting firm located in Danville, California, (now located in Tucson, Arizona) to provide PC based MMS software along with

assistance during implementation to train the personnel who would be directly or indirectly using the system. PAI's experience indicates that where MMS software is installed with little or no specific maintenance management training, the desired maintenance management program, as well as the computer system itself is doomed to failure.

PAI is committed to proper user training in both the use of the software and most importantly, effectively using the data to effect the necessary improvements to maintenance results. A customized maintenance management training and procedures manual is produced for each client. An experienced maintenance consultant spends sufficient time at the client's site for proper system installation and specific maintenance management training. Each manual contains general information about maintenance management and specific information about the client's maintenance management program.

Since proper installation of an MMS system and specific maintenance management training seemed to be the key to a successful system, SEMO agreed to the proposed program of implementing a pilot MMS at its Viburnum No 28 mine and mill in early 1989. The pilot program was so successful, in a short period of time, that SEMO quickly had the program expanded to all mining and milling operations in mid 1989.

Equipment maintenance philosophy

SEMO's equipment maintenance philosophy and the MMS it uses are based on the following principles:

- Proper preventive maintenance (PM) provides for safer equipment, better equipment availability for production, and lower maintenance costs;
- Active planning, forecasting, scheduling and follow-up of most work minimizes downtime, and the need for emergency repairs; and
- Accurate and complete recording of equipment maintenance activities and its associated costs (material and labour) provides the necessary maintenance data for maintenance managers to analyze and control maintenance costs.

The typical MMS hardware at each SEMO location consists of a personal computer. There is also a modem which allows for communication and outside support.

Performance manager

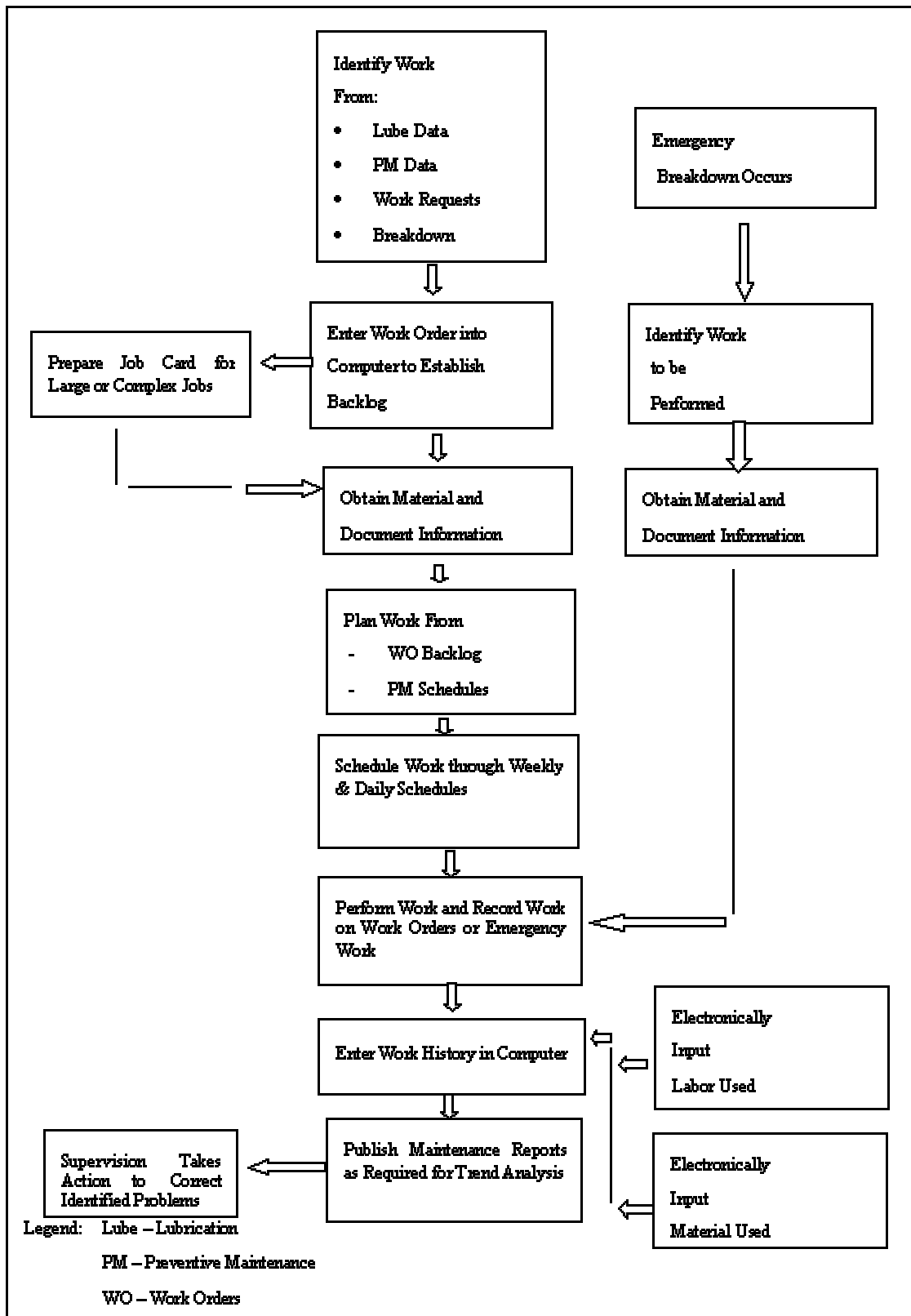
The software used for the MMS program was developed by Performance Associates, Inc. and operates with the R:BASE database interpreter. RBASE is a relational database available for PC's, complete with its own programming language. It also comes with a report writer, application generator and a gateway module which allows import/export of data to other programs such as Microsoft Excel. A major plus to this system is the ability of users to customize the system relatively easily, through a custom application module.

The system has been designed to provide maintenance planners with the necessary tools to plan, forecast, and schedule equipment maintenance (repairs, PM services, and lubrication of stationary and mobile equipment) while capturing equipment and component maintenance history and associated costs (material and labour). Reports on equipment data in the system can be made, as required, for any specified time frame.

The MMS software provides:

- Equipment and component identification and inventory;
- Equipment and major component tracking;
- Work order creation and tracking;
- Backlog status;
- Job masters;
- Job scheduling;
- Collection of equipment operating units (hours, tons, feet, etc);
- Equipment and component maintenance history recording;
- Maintenance cost collection material and labour;
- Preventive maintenance scheduling (by specified criteria);
- Lubrication scheduling (by specified criteria);
- Spare parts catalogue;
- Tyre tracing and costing;
- Fuel and lubrication tracking;
- User custom applications program;
- On-line, on request reporting of all maintenance data.

Fig 1: A sequential flowsheet for a maintenance management system (MMS) of the kind used at SEMO and subsequently successfully introduced at the Herculaneum smelter.



The importance of maintenance management

SEMO has discovered that an effective maintenance management program plays a major role in reducing emergency repairs and their related maintenance costs. It also provides operators with higher equipment availability, resulting in steady production at lower overall maintenance costs. SEMO's maintenance costs were reduced by some 20% with the new maintenance management program.

One portion of the reduction in maintenance costs came from the improvements made in maintenance management structure, procedures and activities associated with both maintenance and operations. The balance resulted from the implementation of the maintenance management system. The two factors complement one another and the substantial benefits are realized when both are implemented.

Three of the most important improvements were:

- Getting equipment operators involved in effectively inspecting their equipment for maintenance problems and documenting them so corrective action can be efficiently performed prior to equipment breakdown;
- Getting operations supervisors to participate in weekly work forecasting and daily work scheduling meetings, and
- Following the agreed-upon daily work schedules.

The results of the maintenance management system implementation were startling. Approximately \$2 million in reduced maintenance costs were realized by the operations during the first ten months of 1990 as compared to the same period in 1989.

Introduction at Herculaneum

As a result of the positive impact that the newly implemented maintenance management program had at SEMO, Herculaneum's management requested it for their plant.

After a survey of the existing Herculaneum maintenance management system using a main frame computer, it was concluded that it would be acceptable with some enhancements. Some of the proposed enhancements included: weekly maintenance commitment forecasting; daily maintenance shift scheduling and specific equipment; and components maintenance cost reports. It was also decided that specific training would be given in the use of the system to manage the maintenance effort more effectively.

The maintenance management training program along with the system enhancements implemented in early 1991, are now experiencing initial success. The personnel who are actively using it are starting to realize maintenance cost savings each month.

Conclusion

Doe Run's new maintenance management program at SEMO and Herculaneum is proving to be very successful. SEMO and Herculaneum are now positioned to take full advantage of their new approach to maintenance to control maintenance costs. At both SEMO and Herculaneum, maintenance costs have been reduced with maintenance repairs being shifted from reaction to emergency breakdowns to scheduled preventive maintenance.

The remaining challenge for managers at both SEMO and Herculaneum is to make full use of their new maintenance management program's powerful data handling capacity to make timely and effective decisions. Present and future production is based on today's maintenance decisions and these decisions need to be based on factual equipment data. The company's future could very well depend on how well maintenance is being managed today.