A history of predictive maintenance at James River's Wauna Mill, Clatskanie, Ore.

Richard L. Zaharko

It is possible not only to schedule repairs prior to failure, but to determine the cause of failure and schedule corrective action.

As a preface to this article I feel a need to define my definition of preventive versus predictive maintenance:

Preventive maintenance is maintenance conducted on a machine based on empirical data, e.g., a bearing replaced every 6 months because it has historically failed every 8 months. This is an "effect" type of repair, where the cause of failure is either not at issue or unknown.

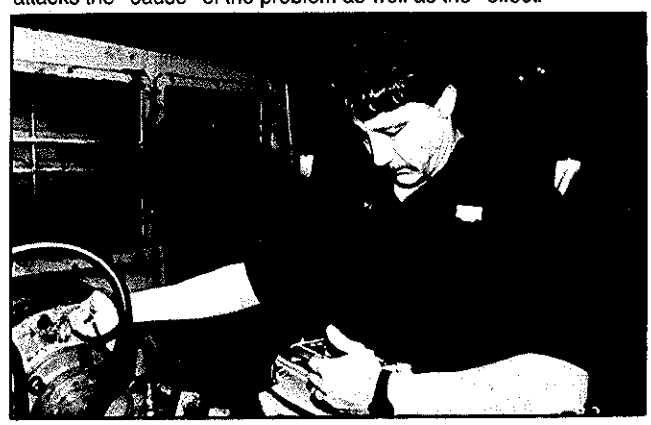
Predictive maintenance is maintenance conducted on a machine based on scientific data collected during its up or running time by the use of some type of machinery monitoring equipment. In this type of repair, "cause" is at issue and both the cause and effect are corrected simultaneously.

The James River Corp.'s mill in Wauna, Ore., developed its predictive maintenance program in the fall of 1968, just two years after startup. As with most new mills, the maintenance department was primarily breakdown responsive. Preventive maintenance was scheduled and completed only as time allowed, leaving the mechanical maintenance group to move only from fire to fire.

The idea of a predictive maintenance program surfaced as a result of presentations made during the late '60s. These presentations pointed out that by studying the vibration of a given machine it was possible to identify defects in bearings, misalignment, and imbalance as well as a wide range of other causes of destructive vibration. This technique was currently being used in the chemical and petroleum industries with much success.

The program was piloted by one project engineer and two mechanics. Using one handheld displacement meter capable of measuring only unfiltered vibration, they began gathering overall vibration readings on every piece of equipment in the mill. During the infancy of the program, "trending" of machinery vibration was the method used in monitoring overall machinery condition. If a problem was detected, a sweepfilter displacement analyzer was taken to the field and a more detailed analysis was conducted. Though the displacement analyzer was effective in diagnosing low frequency vibration such as imbalance and misalignment, it was not found to be reliable in diagnosing higher frequency vibration associated with bearing defects. As the program progressed it became evident that the "trending" of unfiltered vibration in displacement was not a reliable indicator of machinery condition. As production rates and thermal conditions changed so did the unfiltered amplitudes and often equipment was scheduled for repair based on invalid data. This led the program to lack the credibility needed for success.

As part of the predictive maintenance program, **Richard L. Zaharko** attacks the "cause" of the problem as well as the "effect."



By the fall of 1969 the need for training had become evident. Both the mechanics and their supervisor attended basic training in vibration analysis and balance, which pointed out the need for studies in both velocity and displacement modes of machinery vibration. It was found that by adding the capability of studying velocity, we could then diagnose bearing failures far enough in advance to schedule corrective action and study the cause and effect relationships associated with destructive vibration. Equipment capable of measuring velocity and displacement was purchased. Armed with this equipment and the newly acquired training, a shift in program direction was soon to come. It was not only possible to predict bearing failures with some degree of success, but additionally possible to diagnose cause. Standards

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for balance of mill equipment had by now been established and most balancing was being completed in house. As a result, newly found credibility began to surface and the program began to gain solid footing.

The use of consultants for vibration analysis first began in the fall of 1973 and continued for 5 years. Their use was limited to the paper machine area where we were experiencing premature bearing failures. Using scientific tape recorders and real-time analyzers they were able to identify specific bearing defects with a much higher degree of success than our own sweepfilter analyzers.

In the fall of 1973, three additional mechanics joined the group. The need for training upgrades had become clear and all five mechanics were required to complete a five-step course on vibration analysis and balancing. By this time all balance work was being conducted in-house. After the advanced training had been completed, new state-of-the-art equipment was purchased. This included a scientific tape recorder and real-time analyzer. The training needed to operate this equipment was provided by the same consulting firm that conducted our paper machine surveys.

During the course of the next 5 years, a decentralization of the maintenance department occurred, coupled with an increased emphasis on preventive maintenance. This resulted in the area maintenance foremen developing their own preventive maintenance programs and relying less on the services of the predictive maintenance group. This could in part be attributed to the analysis equipment being too sophisticated and time consuming to use efficiently.

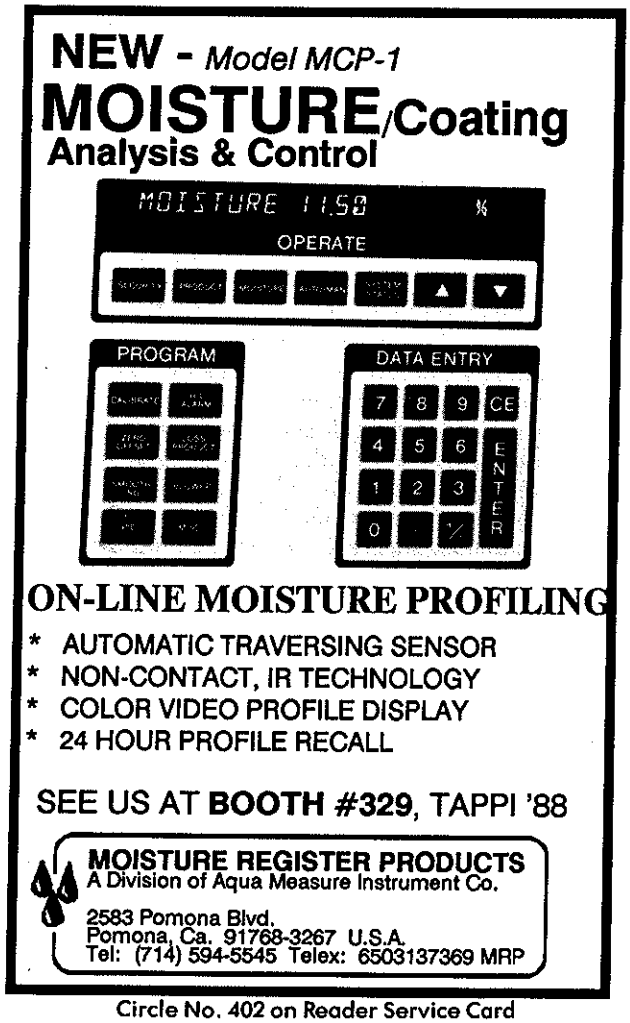
In the fall of 1977 the needs of the program were again re-evaluated. Three of the mechanics were moved back to their maintenance areas, leaving only one mechanic on the paper machines and one mechanic to cover the utilities and steam plant areas. These mechanics reported directly to the area maintenance foreman.

The actual revitalization of the program occurred in the spring of 1982. One of our maintenance superintendents attended a basic training seminar on vibration, during which a number of modern, compact pieces of vibration monitoring equipment was displayed. Later that year the mill purchased several compact handhelds capable of measuring velocity, displacement, and spike energy. These were distributed to two of the area preventive maintenance personnel who were then trained in their use. By mid-1983 the mill had purchased four more handhelds and four more preventive mill maintenance personnel had been trained in their use. Later that year a compact microprocessor sweepfilter analyzer, capable of generating vibration signatures, was purchased.

Today most of our preventive maintenance personnel are capable of using handheld equipment. Some of our oilers now use very basic vibration monitoring equipment on their daily rounds. Equipment is being scheduled for either more extensive analysis by one of our two full time vibration analysis people, or for repair based on the data gathered by our preventive maintenance personnel. A new dual channel real-time analyzer capable of frequency domain processing, synchronous time averaging, full frequency, time amplitude, and window control allows us to probe much more deeply into the cause and effect relationships of destructive vibration.

Our predictive maintenance program has demonstrated that by analyzing the vibration in machinery, it is possible not only to schedule repairs prior to failure, but to determine the cause of failure and schedule corrective action. The needs of a successful program are dependent upon trained, dedicated, full-time personnel and the support of both first line supervision and mill management.

Based on a presentation given at TAPPI-WEST 87.



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