According to Jim Obland, who is developing the predictive maintenance program at the Montana Power Project in Colstrip, MT, the two greatest enemies of cost-effective maintenance are guessing and second-guessing. His goal is to achieve condition-based maintenance to decrease downtime and increase production. His department is responsible for predictive maintenance programs at four power plants—two are 333 MW and the other two, 800 MW.

Montana Power uses a variety of machine condition monitoring techniques, including vibration analysis and lube oil analysis. The Colstrip plants were seeking earlier, more accurate identification of bearing problems, and decided to purchase complementary technology specifically designed for early detection of bearing damage. They chose Shock Pulse Analyzers from SPM Instrument, Inc., Marlborough, CT. In a single reading, with no prior trending, the analyzer indicates bearing condition as good, reduced, or bad, and further codes the “bad” condition according to its severity.

While taking readings on one of the motors at the plant, Obland and his coworker, Norm Evans, found a bearing that showed “COND 65—Severe Damage,” indicating the need to perform maintenance immediately. “We couldn’t get the bearing changed without confirmation by vibration analysis—that was the policy. But when we checked with a vibration analyzer, we didn’t find anything that would indicate a damaged bearing,” Obland said.

Because vibration analysis looks at all the signals being generated in a rotating mass, the bearing signal may have been masked by other, stronger nonbearing signals. Vibration analysis involves trending data to determine if there has been a change in a signal and that it is a bad change. Historical data on the Colstrip bearing signal was not available.

A decision from management broke the impasse. The motor was taken apart. The bearing was found to be within days of complete failure. That bearing was the first of a series of bad bearings that were identified with the analyzers before equipment failure occurred.

The instrument analyses the compression waves caused at the first moment of impact between the rolling elements and the raceway, an extremely brief period during which no surface deformation has occurred. The molecular contact at points of impact produces material acceleration, propagated ultrasonically in compression waves (shock pulses). The

magnitude of those shock pulses depends on the condition of the surface and on the peripheral velocity of the bearing.

Shock pulses generated by a bearing can increase 1000 percent between the time when the bearing condition is good, to when it needs to be replaced. The company has charted typical shock patterns of the most common bearing types under various load, speed, temperature, and lubrication conditions; the data is part of the instrument's permanent program.

The analyzer indicates bearing damage by displaying an arrow against the red section of the condition scale; a condition number increases with the severity of surface damage.

The predictive maintenance department at the Colstrip plants has already made a contribution to the bottom line through improved bearing condition monitoring. The team has been diligent at keeping track of its activities and presenting the results of the program to management. "In the first eight months, we had direct traceable savings of $19,696.57 in maintenance hours and parts, by avoiding outage just because we were able to identify and replace bad bearings so quickly," Obland reports. **MT**

Information supplied by SPM Instrument, Inc., Marlborough, CT 06447; (860) 295-8241; Internet www.spminstrument.com