CIM MAGAZINE

Published in *CIM Magazine*, March/April 2013 issue, Vol. 8, No. 2, pages 40-41.
Reprinted with permission of the Canadian Institute of Mining, Metallurgy and Petroleum
www.cim.org

upfront

MAINTENANCE

Spare necessities

Parts stocking software saves Teck millions

by Herb Mathisen

Courtesy of Teck

Teck used spares optimization software developed by the University of Toronto's C-MORE to stock parts for 18 separate critical components for its Komatsu 930E fleet at its three Elk Valley, B.C., coal operations.

Teck Resources made the Komatsu 930E its primary haul truck in 2010 and, over the following two years at its three Elk Valley, B.C., coal mines, the number of those trucks nearly doubled from 51 to 99. With the expanding fleet, the company needed to find a way to keep just the right number of the critical spare parts in stock.

Hitting that moving target proved difficult because the company's inventory management software at the time was not able to add new trucks as they came into operation, says Rob Kalwarowsky, reliability analyst with Teck. He had to look elsewhere, and because Teck is a member of the University of Toronto's Centre for Maintenance Optimization and Reliability Engineering (C-MORE) consortium, Kalwarowsky had access to spares management software designed to solve this specific problem. Using resources from C-MORE, it quickly became apparent that stocked parts were not keeping up with the burgeoning fleet. "In all of the cases, we weren't carrying enough," he points out.

Since June 2011, Kalwarowsky says Teck has saved more than $30 million by getting critical spares stocks to optimal levels.

Smarter stocking finds costs to cut

Spares management is an area companies often overlook for potential cost savings, Kalwarowsky says. "If we step back and look at why we are here, it is to make money for the shareholders," he explains, adding that fulfilling this purpose is closely tied to spares management.

"We have a value for downtime," says Kalwarowksy. "If our truck runs for so long, it produces 'x' amount of coal. Given that, we can sell that coal for 'y' dollars and then we get that profitability. Do we hold more parts and reduce how many hours we're going to be down? Or are we going to hold fewer parts and increase the number of hours we're down?"

Teck used the program to stock parts for 18 separate critical components for its Komatsu 930E fleet. For example, at the end of 2011, Teck carried five GE GDY-106 wheel motor spares, worth $1.2 million each. Using the C-MORE software, Kalwarowsky concluded that holding eight spares was the optimal stocking option for 2012. The average cost of holding five spares was $4,683.08 per hour, while holding eight parts costs $3,196.93 per hour. Taking the difference between the two options' hourly costs and multiplying it by 6,000 hours – the amount each truck operates per year – the calculated savings comes out to more than $8.9 million.

Teck's calculations take into account the component's probable rate of failure, its repair and manufacturer lead times, and the truck's fleet number and age, while also factoring in potential downtime costs, the part's overall cost and the $250,000 it costs to rebuild it. Holding more than eight

parts would further reduce the likelihood of equipment downtime but would wind up being less economical since the probability of needing those added spares would not outweigh their cost.

Identify what is critical

Before using the software, Teck had managed its spares inventory through a combination of two conventional parts-stocking philosophies: criticality and turns. But there was no systematic way to evaluate when each ought to be applied.

Criticality-based stocking increases the number of spares held when a component is vitally important for continuous operation. Consider a mine using 10 transformers, each with a 100-year lifespan: "If one transformer goes out, we lose power to the plant and we can't produce," says Kalwarowsky. "By criticality, we would hold 10 transformers. Now is that correct? If the transformers are five to 10 years old, that might not be the right answer. If they're 95 years old, then that's probably the right answer."

Managing by turns, on the other hand, is based on how often spare part stocks are expected to turn over in a given time; if a component fails four times in one year and a company stocks two spares, the company would have two turns. Companies often have between two to five turns a year, Kalwarowsky says, but that range creates a lot of uncertainty over cost. If a company were to manage by turns alone, components like transformers, which rarely turn but have significant failure consequences, would not theoretically have any spares, thus increasing the risk of production disruptions.

Before applying the software, companies must first identify parts they consider critical, says Neil Montgomery, senior research associate with C-MORE. These components are often considered highly reliable yet vital to operations, and investigating past rush orders can pinpoint such items.

With these components identified, companies must then determine probable failure rates for them. These can be found using historical failure information gathered internally over the years, through reliability engineer assessments, data provided by original equipment manufacturers (OEMs), or even by dividing the number of overall components by their failures. "It's often the case that if a part is so important that it deserves to have spares, then there is a very good chance that you are keeping track of how often they fail, even if you are doing it by accident in your computerized maintenance management system," says Montgomery.

Setting a standard

The software has been evolving since 2003, with more options added and becoming easier to use with each version, says Andrew Jardine, C-MORE director. An updated version of the spares management software will facilitate spare analysis on multiple components for a project instead of just one at a time, he says.

Jardine has been researching asset management since 1967. He founded C-MORE in 1994, with the realization that partnering with industry was required in order to get the organization's research into the field. A consortium of companies from the mining, energy and defence sectors provides C-MORE with funding, and every six months the centre meets with members to update them on its work and let them suggest future projects or focus areas.

For instance, C-MORE developed condition-based maintenance software and later spares management software from its theoretical research at the request of consortium members. "They don't explicitly want the mathematics or the statistics behind getting the answer, they just want something that's easy to use, knowing that underneath the tool, there is rigour in the underlying mathematics going on," says Jardine.

Rio Tinto's Iron Ore Company of Canada (IOC) recently became a consortium member and getting access to the software provided an incentive to do so, according to Jon Gibbons, asset management reliability advisor with IOC. The company wants to adopt the software at its Carol iron ore project in Labrador City, Newfoundland, where spares across the site are currently stocked based on a combination of OEM recommendations, hunches and past history, Gibbons says. "That's not to say that some people may not have their own statistical method, but as far as a standard method across the business, we currently don't have one here at IOC specifically."

In January, C-MORE demonstrated the software in Labrador City, using IOC's current data to find out how effectively the company was stocking spares. "In some cases, they were being managed quite well, in other cases, not so well," Gibbons says, adding the statistical analysis showed spare parts for the company's haul truck fleet was lower than optimal.

Next, Gibbons wants to use the software to optimize the stocking of spare parts for the concentrator plant's 32 horizontal filter pans, which extract moisture from the product at the end of the concentration process. The $200,000 pans consist of several different parts. The company rebuilds three filter pans each year, and the cost and time associated with the rebuilds depend on the age of the components that make up the filter pans.

Jardine says C-MORE can help many companies use information they already own to make better management decisions. "Companies are collecting more and more data these days, and they are looking for tools to smartly interrogate the databases and that really is what our group is all about." CIM