VALE MEETS INCREASED MARKET DEMAND FOR ITS HIGH QUALITY NICKEL WHILE LOWERING MAINTENANCE COSTS

RCM2 plays a key role at Vale's Copper Cliff Nickel Refinery in developing a formal and technically sound understanding of the potential for failure, and implementing the right proactive work. The Sudbury Nickel Refinery eliminated mechanical breakdowns at the Pellet Decomposer and was able to extend the operating period between overhauls from one to three weeks. Vale has experienced no unscheduled downtime of its reactor ball mill since implementing the findings of the RCM2 analysis.

Vale is one of the world's premier mining and metals companies and the world's second largest producer of nickel. The company is also a major producer of copper, cobalt, precious metals and specialty nickel products. In 2010, there were 12,000 employees working with nickel in Canada, the United States, Indonesia, Asia, New Caledonia, the United Kingdom and Brazil.

The Situation

In operation for over 100 years, Vale is a leader in the mining and metals industry, currently producing 20% of the world's nickel. The company has successfully embraced a three-part corporate strategy to maintain its leadership:

1. Pursue profitable growth.
2. Enhance global marketing position, including value-added products.
3. Maintain low-cost operations focused on high-margin production.

To continue to deliver on these strategies, Vale's Copper Cliff Nickel Refinery in Sudbury, Ontario, recognized that optimizing asset performance is critical. In particular, the Nickel Refinery needed to address failures on two critical pieces of equipment in the refining process: the reactor ball mill and the pellet decomposers.

The reactor ball mill is used at the end of the second stage of the refining process and removes trapped gases from the ore. As

these gases are toxic, this is an essential step in the refining process. Historically, frequent breakdowns of the reactor ball mill have resulted in a significant loss in production capacity.

Vale's Copper Cliff Nickel Refinery had experienced similar performance issues with its 18 pellet decomposers - equipment that is used to produce high value, 99.999% pure nickel. Constant equipment induced stoppages of the pellet decomposers compromised the company's ability to meet market demands. Despite the presence of weekly overhauls, failures were not avoided and the maintenance costs in terms of manpower, parts and overtime was excessive.

The Challenge

Vale's Copper Cliff Nickel Refinery required an increase in throughput in 2005 to meet market demand while reducing operating costs. The Nickel Refinery recognized that a significant portion of this increase could be achieved through improved reliability of key assets; specifically the reactor ball mill and pellet decomposers. In order to improve reliability, Vale also recognized that it had to change its approach to maintaining these key assets. Clearly, with all of the money being invested in maintenance, and the resulting poor asset performance, the current maintenance strategy was inadequate and more of the same would not bridge the performance gap.

Reactor Ball Mill

Pellet Decomposer

The Solution

With the assistance of Ivara Corporation, Vale conducted RCM2 analyses on the reactor ball mill and pellet decomposers to develop a maintenance strategy that ensured the execution of the right work at the right time.

This RCM work involved workshops with the maintenance and operations personnel, lead by Ivara trained RCM2 facilitators. The groups defined optimal proactive maintenance programs, identified critical spare parts, validated equipment modifications and documented standard operating practices.

Reactor Ball Mill

The reactor ball mill RCM analysis resulted in the creation of new condition based PM tasks, most of which were not time-intensive and could be executed by the operator during regular rounds. The previous maintenance program was predominantly time based and reactive in nature. A key finding was the need for a spare floating trunnion. The economics of avoiding failure-related downtime justified the cost of carrying the extra trunnion.

During the RCM analysis, the group identified equipment modifications that were necessary to ensure the reliability of the reactor ball mill. These modifications were not costly and included:

- Installing an automatic pre-lube system to the Babbitt bearings
- Installing infrared temperature indicators to monitor the Babbitt bearing temperature
- Installing a new oil spray system on the bull gear

Pellet Decomposers

As with the reactor ball mill, the RCM analysis resulted in the creation of new condition based PM tasks. Most of the tasks were not time-intensive and could be executed by the operator during regular rounds or maintenance personel during PM rounds. Similar to the reactor ball mill, the previous maintenance program was predominantly time based and reactive in nature. As well, the frequency of overhauls was reduced and operational best practices were identified.

Key findings from the RCM2 analysis included:

- Replacing incandescent lights with non-vibration sensitive LED lights
- Developing a bucket elevator alignment procedure

The Result

Reactor Ball Mill

Vale's Copper Cliff Nickel Refinery has experienced no unscheduled downtime of its reactor ball mill since implementing the findings of the RCM2 analysis three years ago. The findings resulted in changes to the maintenance program as well as established new procurement, operational and maintenance best practices. For example, the Copper Refinery now manages maintenance with an understanding of the consequence of failures to its business – such as a trunnion failure that results in 26 weeks of downtime (delivery duration) representing millions of dollars in losses.

Pellet Decomposers

The RCM2 analysis on the pellet decomposers also resulted in dramatic performance improvements. Again, the findings led to changes to the maintenance program as well as established new procurement, operational and maintenance best practices. Key outcomes of the RCM2 analysis include:

- Elimination of all mechanical breakdowns
- Extending the operating period between overhauls from one to three weeks

In addition to these gains, the implementation of the RCM2 findings for both the reactor ball mill and the pellet decomposer helped increase Vale's Copper Cliff Nickel Refinery production levels by 20%.

Conclusion

Vale's Copper Cliff Nickel Refinery achieved its goal of reduced maintenance costs while meeting increased market demands by employing RCM2 to develop a formal and technically sound understanding of the potential for failure, and implementing the right proactive work. The Nickel Refinery also changed its related procurement and spares management strategies and involved operators to conduct condition based inspections. In addtion, RCM2 enabled Vale's Copper Cliff Nickel Refinery to review, validate and justify redesigns.

Finally, the RCM2 process helped the Nickel Refinery better understand its equipment, capture employee knowledge before key individuals retired and avoid the risk associated with equipment failures.

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