

CITY OF MONTREAL SAVES OVER \$100,000 ANNUALLY THROUGH IMPROVED ASSET RELIABILITY

The City of Montreal's Wastewater Treatment Plant is the largest primary physico-chemical water treatment plant in North America and one of the largest in the world. Operating 24 hours a day, 365 days a year, the plant processes 50 percent of the waste water of the entire Province of Quebec, with a capacity of 7.6 million cubic meters (2 billion U.S. gallons) per day.

The Situation

The City of Montreal's Wastewater Treatment Plant is in place to protect the health of the people and the environment. As such, the ultimate goal is to ensure the availability of plant assets to meet demand for wastewater treatment while contributing to the improvement of waterways and preserving resources. The organizational strategy to meet this goal is to focus on asset reliability. By managing asset health and maximizing efficiency and effectiveness, the plant would ensure availability when it was needed, reduce costs, slow equipment degradation and extend equipment life.

The Wastewater Treatment Plant receives rain and waste water from public sewers, homes and businesses through an elaborate network of channels throughout the island of Montreal. The water collects in deep wells, and then flows through vertical bull screens to strain out solid garbage.

The bull screen system includes the eight screens themselves, the shovels that scrape down the screens, gate valves that control water flow to and from the screens, two conveyors that remove the detritus on pallets moved by hydraulic cylinders, and presses that remove most of the water from the collected waste.

Under normal conditions, the system operates at a fraction of its capacity, using only one to two bull screens; however, weather and seasonal fluctuations can rapidly cause large variances in operating conditions. As a result, the system must be available to handle enormous increases in waste water whenever it is needed.

If the screens are not fully operational when needed, the untreated water flows into the St. Lawrence River, with the potential for severe environmental impact. Since bull screen performance and plant efficiency was being measured according to percentage availability on a monthly basis, the plant was understandably reluctant to take the screens out of service at any time. As a result, it was difficult to perform routine maintenance and the screens were taken offline only when they malfunctioned. Since

breakdowns were unpredictable, it was impossible to be sure that the full system would be available when needed.

Under this operational philosophy, the plant found it impossible to meet its performance targets. Additionally, although costs were on the rise, operating budgets were fixed. It would be necessary, therefore, to find a way to meet the increased operational and availability demands within the existing budget.

The Challenge

The plant recognized that a change in focus was necessary if it wanted to meet its average availability target of 7.5 bull screens at all times.

Weather and season are the dominant factors in predicting peak system use; daily fluctuations tend to be much less significant. Through increasingly sophisticated weather forecasting, plant operators now have the ability to predict fluctuations in system demand with a high degree of accuracy.

With that in mind, it was determined that instead of measuring availability according to a monthly average, it would be much more useful to measure system availability during peak demand: is the system available when it is actually needed?

This change in thinking not only represented a significant paradigm shift, involving the priorities of virtually everyone in the water treatment plant, it also meant implementing an entirely new maintenance and operational methodology.

The Solution

The City of Montreal Wastewater Treatment Plant approached Ivara for help in applying Reliability Centered Maintenance (RCM2) as the first step in meeting the plant's performance and maintenance goals.

RCM2 is well-known as the most effective work identification methodology that determines failure management strategies and provides objective criteria for defining an effective maintenance program.

Ivara's RCM2 experts worked with the plant's employees to conduct an RCM analysis that would be

the foundation for the asset reliability strategy and a maintenance process that would ensure the plant was doing the right work, on the right equipment, at the right time to meet its operating objectives.

In the reliability analysis, a cross-functional team of maintenance, operations and other subject matter experts identified all the predictive, condition-based, preventive maintenance and run-to-failure tasks to manage asset health and optimize reliability. In addition to moving the plant from reactive to proactive maintenance, the process offers some extremely valuable benefits:

- Gathering operational and maintenance information and enabling operator knowledge to be linked to maintenance activities. Implementing a reliability process creates a standardized information pathway along which observations about equipment condition is logged through operator maintenance inspections. This asset health information is reported to maintenance in a timely manner.
- Linking maintenance and operational activities has the added benefit of creating a strong sense of teamwork, as both departments begin to clearly understand the benefits of a cooperative effort.
- As maintenance activities are both quantified and qualified, it clarifies which work is the right work to conduct. This ensures that maintenance activities consistently have the maximum possible benefit and changes the mindset of maintenance personnel from a repair mode to a failure consequence mode. Rather than reacting to equipment failure, the goal becomes to prevent equipment failure, with priority given to equipment at highest risk to the business (ie. failure consequence is high and the probability of failure is high).

The Result

Performing the right work at the right time to optimize asset reliability has enabled the City of Montreal's Wastewater Treatment Plant to achieve its operating target availability (7.5 bull screens). Further, with this focus on reliability, the plant was able to reduce the maintenance costs of the eight bull screens from \$133,000 to \$55,000 per year, for a total annual saving of \$78,000. For all eight complete systems, the savings are actually over \$100,000 annually and are expected to increase in the next few years.

In addition to the important cost-saving benefits, a focus on reliability has resulted in some important safety and productivity benefits:

- Analysis of the bull screens revealed a serious level of degradation. The screens required remediation before they could be maintained at the optimum level of operational health.
- Analysis of the total system showed that some bull screens were used more often than others. The solution was to change the frequency of maintenance tasks from straight calendar-based frequencies to frequencies based on the hours of operation of each screen and the screen system's current condition. This linked maintenance easily and effectively to the individual requirements of each screen. Some of the maintenance cost savings were realized by reducing unnecessary maintenance on screens that did not need it.
- Standardization of visual inspections means that operator knowledge is effectively captured and can be easily shared, both with maintenance and with other operators. Too often, operator knowledge gained over many years of experience, retires with the operator.
- Both tooling and security were improved. Analysis of the maintenance procedures revealed that some tools and safety devices were missing or that operators were not aware of them. In fact, environmental safety analysis is a standard part of the RCM2 implementation process.

Conclusion

RCM2 is an extremely effective work identification methodology that ensures the effectiveness of maintenance practices on an asset-by-asset and task-by-task basis – in any kind of asset-based operation. With a cross-functional focus on asset reliability, availability was increased and costs reduced. The process drove a closer relationship between operations and maintenance that better met the requirements of both groups. It not only reduced costs, it also minimized both the financial and safety risks associated with degrading equipment.

Optimally maintained assets have extended life spans, significantly reducing the capital expenditure cycle. In addition, the City of Montreal enjoys increased confidence that the Wastewater Treatment Plant will be at full operation, whenever it is needed, protecting the water supply, the environment and ultimately the health of the people.