

RND Biotech Case Study: Implementing Predictive Maintenance for Ultra-Low Temperature Freezers October 2008

CHALLENGE:

- RND Biotech operates 300 ultra-low freezers (-80°C) that frequently fail, even though maintenance activities are performed on a quarterly basis.
- RND Biotech is currently replacing freezers as they fail, rather than trying to repair them, to keep up with the required freezer capacity.
- When freezers fail, RND Biotech potentially loses product development samples that represent months of research.
- RND Biotech would like to implement a predictive maintenance strategy and continuously monitor freezer function, which they believe will improve uptime, and free up skilled labor for other tasks.
- However, they have not found a comprehensive method that is cost-efficient and non-invasive to implement a predictive maintenance strategy. Most alternatives only monitor freezer temperature which is not enough for predictive monitoring.

SOLUTION:

- RND Biotech installed a new automation technology which did not incur any disruption to ongoing processes and required minimal installation cost. The solution, a non-invasive wireless sensor system, allowed RND Biotech to monitor multiple freezer data points, including chamber temperature and compressor amperage.

RESULTS:

- RND Biotech immediately found distressed freezers and were able to prevent failures. The freezers were able to be repaired, as opposed to replaced, saving approximately \$7,000 per freezer.
- RND Biotech is now able to implement a predictive maintenance strategy for their freezers.

Challenge

RND Biotech is a biotechnology research and development company. The company has 300 ultra-low freezers (-80°C), used to store research samples. These freezers are critical to RND Biotech because the samples stored in them represent ongoing research that comprise the company's product pipeline. Failures of these freezers could potentially result in a loss of years worth of research for new products that could be worth billions of dollars in revenue.

The facilities group reports that it spends a significant amount of time addressing freezer failures. Records show that approximately twenty work orders per month are freezer related.

Additionally, researchers complain that frequent freezer failures impact their ability to focus on their research. When a freezer fails, researchers have to scramble to find space in other freezers to store samples. If the failure occurs during non-working hours, both facilities and research personnel have to come to the facility in order to address the failure. If the failure is not addressed in time, the freezer contents - critical research samples or products - are lost.



The empty freezers have to be defrosted and decontaminated before they can be moved to the maintenance area for troubleshooting and repairs. This process alone can take up to a week. Failures have occurred frequently enough that it is now more convenient for RND Biotech to simply replace the freezers as opposed to repairing them, even though it is not a cost efficient solution.

The primary failure mode on ultra-low freezers is at the compressors. The ultra-low freezers each have two compressors. Failure of either compressor directly impacts the freezer's ability to maintain temperature. Simply monitoring the temperature of the freezer is not enough to preventatively catch failures. By the time the temperature rises, everyone has to react to the impending failure as opposed to preventing it.

The primary function of the preventative maintenance procedures is to ensure that the compressors are functioning efficiently. To accomplish this, specific maintenance activities include:

- measuring compressor amperage on a quarterly basis to ensure that the compressors are operating within specification and are not overworked
- de-icing the door gasket on a quarterly basis so that the freezer chamber is properly sealed
- maintaining the filters on a semi-annual basis so that proper air flow and temperature is achieved around the compressors
- defrosting and de-icing the freezer on an annual basis to prevent ice buildup in the freezer chamber

Even with such rigorous maintenance of the ultra-low freezers, there are still a significant number of failures occurring and disrupting operations. The facilities group is looking for a way to be able to detect potential problems with freezers before they fail so that the impact on operations is minimized.

Implementing Predictive Maintenance

RND Biotech would like to implement a predictive maintenance strategy for their ultra-low freezers. Their goal is to get ahead of their failures and maximize equipment uptime. In order to accomplish this, the facilities group would need to be able to monitor the freezer compressors on a frequent and regular basis, in order to observe the normal mode of operation of the freezers. Current preventative maintenance procedures only allow facilities to take a snapshot of compressor operation at the time the maintenance is performed.

The Cypress Solution

Cypress Systems offers a Wireless Freezer Monitor (WFM) designed to check the overall health of the freezers. This battery operated device can be installed on a freezer to monitor compressor amperage and freezer temperature on pre-defined intervals. The data is wirelessly transmitted back to the Cypress server, where it can be trended via a web interface. Wireless data collection allows the freezers to be moved if needed without reinstalling hard-wired sensors. The battery operated device eliminates the need to have additional power available for monitoring tools.



Results

RND Biotech tested the Cypress wireless freezer monitor solution and installed WFM's on a pilot of twenty freezers, at a cost of \$2000 per freezer. Figure 1 below breaks down the cost of the project to RND Biotech.

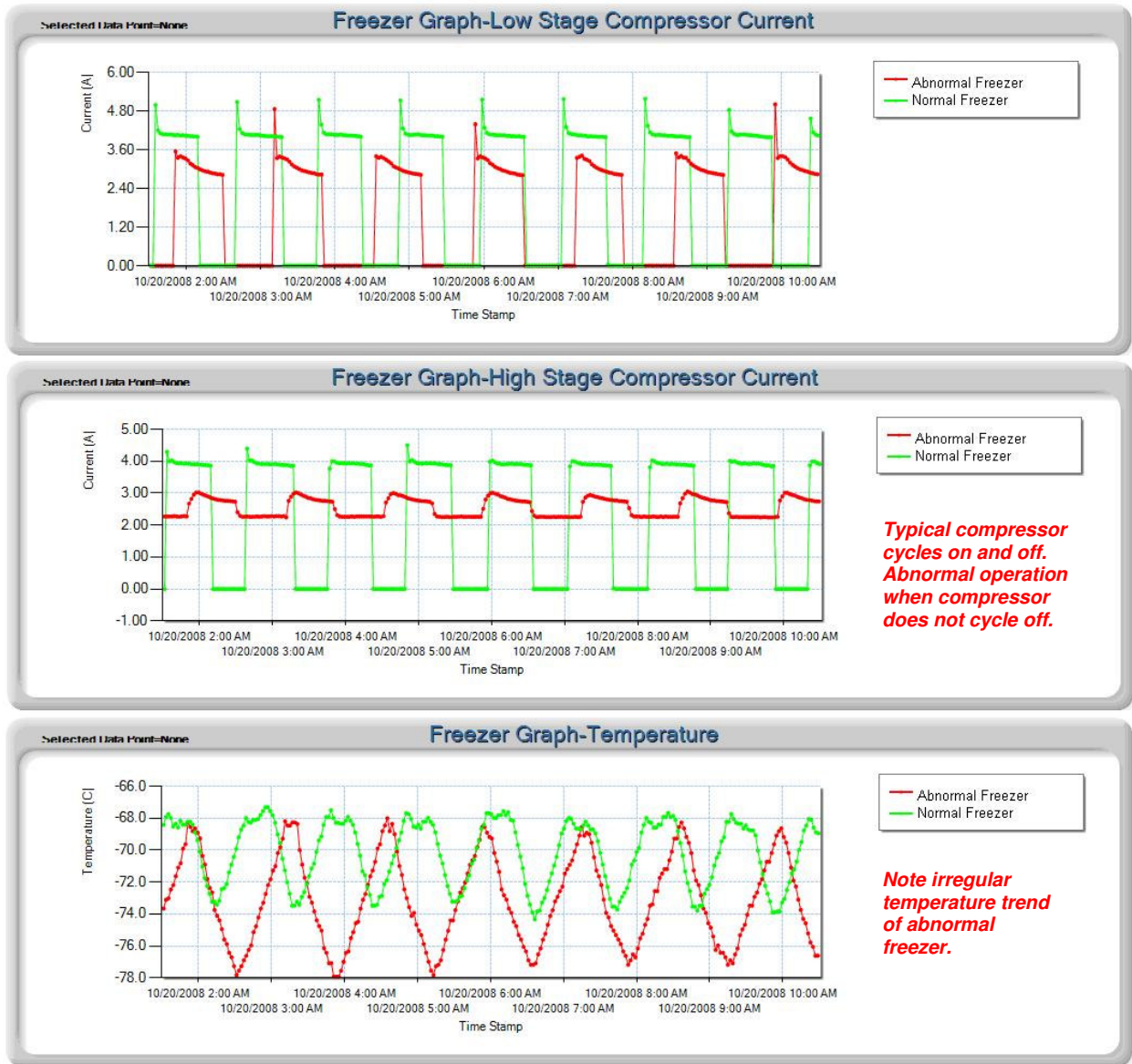
Figure 1 - Cost of Implementing the Cypress Solution for RND Biotech

| | Cost per Point | Total Cost, 20 Freezers |
|-------------------------------------------------------|-----------------------|------------------------------------|
| Initial Investment (1st year maintenance included) | \$2,000 | \$40,000 |
| Annual Maintenance | \$150 | \$3,000 |
| Total Cost of Ownership, 10 yrs | \$3,350 | \$67,000 |

At the onset of the project, the expectation was that 10% of the freezers were not performing optimally. RND Biotech immediately found 20%, or four, of their freezers that were now monitored were not functioning optimally. Problems they saw included compressors not cycling off or compressors cycling on and off too frequently. Both situations indicated that the freezers were working harder than they should and needed to be repaired. Figure 2 below is a comparison of normal freezer operation versus abnormal freezer operation.

All four freezers were all eventually repaired rather than replaced. The replacement cost per freezer would have been \$12,000. The repair cost was approximately \$5,000 per freezer. RND Biotech was able to save \$28,000. Additionally, if a researcher had to reproduce lost samples, it could potentially cost \$7,000 or more in labor and material costs. The initial investment in the Cypress solution for the twenty freezers was \$40,000. The financial payback was under two years. RND Biotech was greatly impressed with the ability they gained to coordinate the repair activities without having to scramble.

Figure 2 – Freezer Operation Trends



Value of Predictive Maintenance for Freezers

The immediate benefit of the Cypress Wireless Freezer Monitor system was that the facilities group could plan their repair activities with research, rather than have to scramble to find freezer space for their samples. They were able to prioritize which freezers were more critical to address.

Financially, the project had an immediate payback, based on the number of freezers that were in distress and the new capability for RND Biotech to coordinate repairing their freezers before they fail as opposed to purchasing new ones.

The value that they see includes:

- reducing the frequency of freezer failures and emergency response situations
- mitigating the risk of loss in RND Biotech's product pipeline
- troubleshooting freezer work orders more easily by viewing amperage and temperature trends, and even reducing the number of work orders submitted for freezer problems
- minimizing required maintenance activities, reducing maintenance time
- having the ability to plan maintenance and repair activities around research activities
- becoming more "green" by replacing fewer freezers
- saving energy by repairing compressors as soon as problems becomes evident, rather than only observing problems during maintenance or when failures occur

Based on these overall benefits and proven utility, RND Biotech now plans to install the Cypress wireless freezer monitors on all their ultra-low freezers.