PULP & PAPER

Using new technology and paying attention to details has helped a paper mill save more than $200,000/yr over a 9-year period

Control Valve Management Can Pay Off Big

By **JEFF KLATT**

When I accepted an assignment in 1995 to be a large paper mill's valve asset manager, little did I realize the significant financial effect that role would have on the mill, nor did I know how much evolving technologies would help extend asset life and actually improve the entire process. Control valves were the "assets" of choice because their performance is so critical to the papermaking process, and one of the mill's objectives was to extend control valve life to get the most out of a huge investment in valves.

The mill was already distinguished as the low-cost producer among all the facilities operated by a major paper company, so few members of the management team believed an asset manager could wring more than $2 million in additional savings out of the control valves.

However, that is exactly what happened. A well-documented financial benefit in excess of $200,000 per year was achieved, directly through cost reductions as well as indirectly through lower expenditures. This amount covers the cost of the asset manager program, but does not reflect process benefits realized as a result of improved control valve performance throughout the mill. Figure 1 shows financial benefits derived through direct savings, technical support, and process improvements from 1998 through 2006.

Examples of direct savings are cost avoidance by preventing unexpected valve failures and subsequent downtime, inventory reductions and asset recovery. Indirect savings result from technical support through better planning for outages, valve application and troubleshooting, life-cycle extensions resulting in reduced replacement costs, a valuable control valve database, and training mill personnel to take care of their control valves.

Taken for Granted

How could all these benefits be achieved in a mill that was already known for management excellence? The fact is that control valve operation is frequently taken for granted in many facilities, and no one knows for sure whether or not their valves are performing up to the requirements of a particular service. A survey conducted by Emerson's Fisher Valve Division a few years ago found that 80% of the control valves in process industry plants were not operating within optimum parameters. Yet excellent control valve performance is absolutely essential to efficient production, and they should never be ignored.

Underperforming valves can undermine even the best-run processes. For example, an expensive fluid leaking through a valve that is not completely closed when it is supposed to be shut off may be lost forever. Valve variability (failure to maintain a given setpoint or slowness in getting to the setpoint) may result in an off-spec product with reduced value. And of course, an unexpected valve failure due to internal damage can result in expensive downtime. Poorly operating control valves are costly, and the losses will continue until the importance of valves to a process is recognized and an effort made to improve their operation.

Fortunately, technology now provides a giant assist for anyone interested in identifying problem valves and learning the causes so that these key components can truly be assets, not liabilities, in the process. But when I went to work three days a week as the valve asset manager in that paper mill, the technology was not that well defined.

The mill's maintenance superintendent, who was an early believer in reliability-centered maintenance as a means of reducing the total cost of equipment ownership, strongly supported my role. He challenged me, saying, "I want these assets (several million dollars worth of control valves) to run to their maximum performance with a minimum cost until they are fully depreciated, and then I want to really start taking advantage of them." He wanted to minimize the cost of valve ownership by making sure they delivered excellent performance for as long as possible. But he could offer no guidelines for me to follow.

First Steps

It seemed logical to first get acquainted with the valves in the mill and understand their roles in the papermaking process. One-by-one, I visited valves throughout the three main sections of the mill — utilities, fibers and product (papermaking) — documenting every one and building a personal database. Identifying, locating, and visually inspecting nearly 1,600 control valves in the mill turned out to be a monumental task that took months to complete.

At the same time, operations personnel explained which control loops had the greatest effect on product quality, productivity, and safety/environmental considerations. This knowledge was essential in establishing the most important valves, and in the end about 25% of all the valves were prioritized as critical to the mill's mission. These became the valves on which the majority of maintenance attention was focused.

It didn't take long to realize that the inventory of spare control valves and parts was in disarray. No one seemed to know what was available, so when a valve or a part was needed in a hurry, it was easier to order a new one than hunt through the storage area. A lengthy review of the existing contents of the storeroom revealed some 30,000 items that had to be identified, tagged and cataloged along with their locations. Since Fisher had manufactured 95% of the installed valves, most of the spares came from Fisher, which made this task somewhat easier.

While this was a mundane, time-consuming task, the payback continues to this day. When a part is needed, it's generally there, so fewer new parts have to be purchased. Also, stores have been consolidated, and in some cases parts no longer used in the mill have been written off or traded for widely used models.

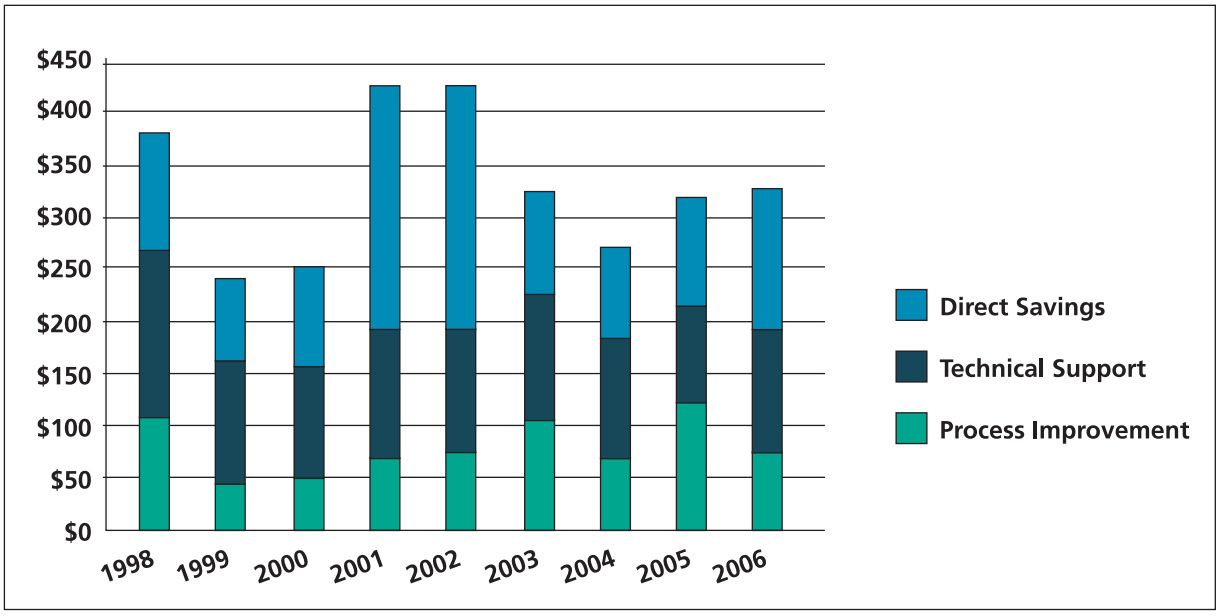
More money was saved by carefully managing the valve "bone yard", a veritable "used car lot" for valves, where a knowledgeable person could pick up a serviceable valve that with a little refurbishing could run for years in the mill. The bone yard is actually a storage area for valves that have been removed for one reason or another, possibly for repair of during a change in the process. In many cases, they are perfectly good valves that have simply been forgotten. By making a list of the valve types in the yard, sizes, trims, etc. and circulating it to the engineering and maintenance groups, we have caused many of those units to be returned to service at a minimum cost and with a saving for the mill. In 2001, for example, 20 control valves were returned to service through the Asset Recovery Program saving the mill approximately $55,000. This program is one of the efforts of which I am most proud, because it has reduced waste in the mill, taking perfectly good equipment from the bone yard and putting it back to work.

Using Technology

It became necessary to find out more about the condition of the highest priority valves in order to know better where maintenance resources should be concentrated. Initially, the Emerson FlowScanner™ was used for this purpose. This device can be connected directly to a control valve in the field,

FIGURE 1.

Financial benefits: 1998-2006



providing a look into that valve as never before possible to reveal conditions not visually apparent.

Soon the mill began equipping the most critical valves with FIELDVUE® digital valve controllers (DVC). These smart instruments not only position a valve precisely and quickly in response to control signals, they generate a vast amount of feedback regarding the valves to which they're mounted. At a recent count, 350 valves had been equipped with FieldVue advanced diagnostic instruments.

These devices make it easier for technician to evaluate control valves. To provide an even better way for them to access diagnostics generated by DVCs, Emerson developed the AMS ValveLink™ software that could be loaded into a laptop computer that was then hooked up to control valves the field.

In about 2001, the AMS™ Suite: Intelligent Device Manager predictive maintenance software was purchased for use in the mill. This advanced application enables access to the diagnostic data generated by DVCs directly from the mill's distributed control system. For the first time, a technician could gather current information on the condition of valves spread throughout the mill without ever leaving the comfort and safety of the control room or instrument shop. Data obtained in this way are processed in a server, stored in a comprehensive database of all valves, and presented in a logical series of screens. This field-generated information has become the cornerstone for predictive maintenance of valves in the mill.

Predictive Maintenance

Being able to obtain diagnostics on a valve suspected of underperforming led to the practice of predictive maintenance, which relies on accurate information about the condition of field devices, including DVCs and other smart instrumentation. Using such information to estimate how long production equipment might be expected to operate satisfactorily, knowledgeable personnel can prevent unexpected breakdowns. In addition, valves can be watched as long as they continue to perform, enabling the mill to get the most out of them before taking them out of service for repairs. It took some time to convince various maintenance managers that data extracted from control valves could be used to predict what was going to happen inside those devices, but they became believers when they realized how much money could be saved. Of course, having the support of the mill's maintenance superintendent was a great help.

With more key people accepting our role, we initiated a program of annual testing of the critical control valves, focusing on the finished products area. In 1999, 34 valves were tested using the FlowScanner, resulting in fewer valve repairs by an off-site service. Since then, the utilization of diagnostics obtained through annual testing of control valves in lieu of preventive maintenance has resulted in savings of more than $50,000 per year in maintenance costs.

Cost avoidance contributed in a major way to the direct savings achieved through asset management, helped in no small way by developing a vast control valve database. All control valves in the mill are included along with their tag numbers, locations, loops, configuration parameters and repair histories. Having that information readily available served as a handy source of knowledge whenever it was necessary to investigate any valve suspected of malfunctioning. A "valve signature" was generally on file, showing how that valve was performing earlier and giving a perfect basis for comparison to use in identifying a problem and determining what needed to be done to alleviate it.

Using this technology to identify and fix just one malfunctioning valve can make a terrific difference. For example, in 2001 a valve variability problem on a ClO_2 flow valve was solved, returning a whopping savings of $140,000 that year. Results like that convinced a few more key people of the viability of the valve asset management program. But it didn't end there.

From 1998 through 2006, regular testing of critical valves using the best available technology at the time, resulted in indirect savings of more than half a million dollars through extending the lives of working valves and keeping them in service longer than anyone expected them to run. In 2003 alone, the useful life cycles of 162 valves tested were increased by an average of two years by using diagnostics to maintain correct calibration, seat loads, and in-service performance. This produced a cost savings for the mill that year of $86,400.

As the program evolved and shortcomings in the maintenance program were uncovered, training was recognized as a solution of itself. As more workers developed a healthy respect for their control valves, they were taught in one-on-one sessions how to conduct a valve test, what to look for, and how to influence future performance based on the evidence.

Moving on

Interestingly, as more mill employees became invested in control valve performance, the role of the valve asset manager was diminished from a three-times-per-week job a twice-a-week visit, which is my current level of involvement.

So, I'm slowly working myself out of a job, but I'm not concerned because I know there are plenty of other mills and process industry plants needing help in managing their control valves. My experience says it loud and clear: Control valve asset management is the way to go. P&P

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