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Gaining Plant Efficiency with Asset Management Software

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Un système d'utilisation des avoirs intègre divers technologies et procédés, chacun avec différents besoins en matière de collecte et exploitation des données pour assurer 3 fonctions importantes qui entraînent une réduction des coûts de maintenance. Il collecte des données produites par des instruments de terre qui fonctionnent bien, organise ces données pour différentes fonctions de maintenance et cherche à avoir des avertissements rapide de pression ou de détérioration du matériel de terrain de sorte qu'une action corrective soit prise avant que de sérieux dysfonctionnements de l'équipement se manifestent.

Le logiciel utilisation des avoirs fournis un accès en ligne aux instruments de terrain depuis une plateforme unique et recueille les informations relatives à la maintenance pour les organes de l'unité en une seule banque de données. Il permet aux utilisateurs de concevoir, organiser et éviter les difficultés des instruments de qualité et de documenter exactement toutes les activités de maintenance y compris la calibration. Les bénéfices comportent une baisse des coûts de réception de l'unité et moins d'arrêts de fonctionnement.

Abstract

An asset management system integrates diverse technologies and processes, each with different data collection and data processing requirements, to provide three important functions that help reduce maintenance costs. It collects data generated by “smart” field instruments, organizes this data for various maintenance functions, and monitors for early warning signs of field device stress or deterioration so that corrective action can be taken before a serious equipment failure occurs.

Asset management software provides on-line access to field instrumentation from a single platform and gathers maintenance-related information about plant devices in a single database. It allows users to configure, monitor, and troubleshoot smart instruments, and to accurately document all maintenance activities, including calibration. The benefits include reduced plant commissioning costs, reduced loop maintenance costs, and less process downtime.

Introduction

The smart, microprocessor-based field instruments now permeating the process industries, including fertilizer manufacturing, generate vast amounts of information that can be useful far beyond the control room. For many years, this kind of data was accessible only with handheld communicators connected one-at-a-time to instrumentation throughout the plant. In some cases, portable computers were carried into the field in an attempt to retrieve more information from each instrument. This was very time consuming because the technicians had to locate the instruments, some of which were nearly inaccessible and do maintenance in potentially hazardous plant environments.

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This has changed in the last five years with the introduction of open system architecture and advanced asset management software. Now, information from a wide array of smart instrumentation is delivered by open communication protocols such as the HART® (Highway Addressable Remote Transducer) or the FOUNDATION ™ Fieldbus protocol to a desktop computer where it is processed by asset management software.

Such packages perform three functions that help users reduce maintenance costs:

- Collect data from smart instruments located throughout a plant
- Process data for the purpose of diagnostics and maintenance
- Monitor the field instruments for early warning signs of impending problems.

The instrumentation in fertilizer plants provides a rich opportunity for process improvement and for reducing costs. As shown in Figure 1, process instrumentation requires a large portion of maintenance budgets, the cost of which can be as high as 14 percent of the value of goods sold. A report issued not long ago by the Dupont Company stated, “The largest single controllable expenditure in a plant today is maintenance, and in many plants the maintenance budget exceeds annual net profit.”[1]

Asset management is the endeavor to control these costs by properly maintaining production equipment for maximum performance and extended service life at minimal cost. The power of smart field instrumentation is being harnessed to reduce the high cost of maintaining those instruments – while simultaneously lowering the risk of unwanted downtime. Saving time and avoiding equipment failures are key benefits of effective asset management programs. For example, using advanced software such as Fisher-Rosemount’s Asset Management Solutions (AMS), calibration of field instrumentation can be performed in half the time, while built-in diagnostics enable technicians to troubleshoot suspected problems without making time-consuming trips into the plant.

Window Into The Process

Process and maintenance engineers are now able to look ***inside*** the process to see how well production equipment is operating and whether critically important field devices are reporting signs of trouble. The software can be configured to monitor for certain device characteristics, such as the limits of valve travel or temperature, which if exceeded, indicate potential problems in the process or the instrument. Online access to and monitoring of field devices are essential elements of advanced asset management software. Other important features include:

- A complete database of all devices in the plant, including configuration specifications, locations, and repair histories
- Graphic displays enabling maintenance personnel to use the collected information for a variety of routine maintenance tasks
- Diagnostic capabilities allowing troubleshooting from the comfort and safety of the instrument shop
- Automatic documentation of maintenance activities

A number of companies in the fertilizer industry already use AMS software – notably phosphate processors in Florida. AMS is used in sulfuric acid and phosphoric acid units, where it is safer to communicate with field devices remotely than to send personnel into the plant. Asset management is also practiced in several potash processing facilities in Saskatchewan. At the largest of these, with a 500 tag AMS system installed in 1998, the customer reported that maintenance personnel have successfully used the diagnostics to reduce unnecessary trips into the field to check instrument problems. In most of these plants, smart, HART-compatible instruments are replacing older instrumentation on an as-needed basis.

Applying Asset Management Software

These and other fertilizer plants apply the asset management technology in five key ways to reduce the amount of time spent by technicians on instrument maintenance. They are :

- Commissioning and startup of smart instruments
- Instrument calibration
- Routine maintenance practices
- Troubleshooting
- Documentation

Commissioning & Start-up. Commissioning new instrumentation and starting a process, whether in a new or upgraded plant, is traditionally a time-consuming activity. This usually involves three plant employees. One technician locates devices in the field and simulates inputs to the control system, while an operator in the control room checks the accuracy of engineering units, ranges, etc. for each input/output. A third individual in the rack room makes sure field devices are connected to the right terminations and control system I/O. A series of “real world” tests conducted by engineers at Noltex LLC chemical plant in LaPorte, Texas, showed that an expected three-week start-up period for a retrofitted plant could be reduced to two weeks using advanced asset management technology.[2] These engineers used scientific procedures to prove to their management that commissioning activities could be greatly simplified. As a matter of record, reduced instrument commissioning time alone enabled the unit to actually start operating 12 days sooner than originally planned.

Calibration. Periodic calibration is one of the most time-consuming of all instrument maintenance activities, but one that is important for the efficient operation of any process and essential to satisfy the requirements of regulatory agencies. Much of the time is spent in pre-calibration planning and post-calibration documentation. Personnel must first look up the calibration specifications and procedures for each individual device – and there can be thousands of them in a large processing plant. With calibrations now commonly performed on-site, the test details are keyed into a handheld calibrator one device at a time, and the technician must then do the calibration. After completing the calibration, the technician fills out and files all the forms required to document the activities. Technicians can spend from one to four hours per device (average is about 95 minutes) using generally accepted conventional calibration procedures.

Asset management software automates and greatly streamlines pre-calibration planning and post-calibration documentation. This translates into saved time, improved work accuracy, and better use of resources. For example, the lead electrical engineer at an Eastman Chemical

plant in Malaysia reported that “AMS saves at least 20 minutes per device calibration because our technicians no longer waste time hunting for the information they need. Accurate, up-to-date specifications on the 750 HART-compliant devices in the AMS database make it possible to save more than 250 man-hours annually on device calibrations,” he said.

The senior instrument engineer of a plant in Texas reported that technicians save 30 minutes per device by not having to pull out and later file a calibration record sheet on every instrument. The information is quickly and easily downloaded from the database. Also maintained are historical records of the calibration tests, which can support increasing the calibration intervals if instruments consistently meet accuracy requirements.

Routine Maintenance Practices. According to Automation Research Corporation (ARC), 65 percent of all maintenance is corrective or reactive, with an additional 30 percent being preventive. Currently, only 5 percent of maintenance is predictive, which is widely acclaimed to be the most cost-effective method, costing approximately one-tenth of reactive maintenance.

However, intelligent field devices combined with asset management software are now helping process industry companies move toward predictive maintenance in their plants. Based on status and condition information received from intelligent field devices, maintenance resources can be efficiently deployed to keep critically important equipment operating. Repair or replacement is done only when actually needed. Predictive maintenance is based on the “just in time” approach in order to utilize production assets as long as possible and maximize process uptime while minimizing maintenance costs.

Troubleshooting. The Dow Chemical Company has reported that “only 36 percent of trips to the field (to troubleshoot reported problems) result in any corrective action taken. "At a cost of approximately $300 per trip by technicians, companies cannot afford to chase “ghost” problems that do not exist. By utilizing information from field devices, problems can be accurately diagnosed without entering a production area. Using asset management software, personnel learn what is wrong and generally know what must be done to correct a problem before they ever leave the maintenance shop. One electrical engineer who regularly uses asset management software on a desktop PC to diagnose processing problems said it took him “just five minutes” to identify a debilitating problem that was costing his company $75,000 per hour in downtime.

The chief process control engineer at a plant in Illinois called troubleshooting the most valuable function of AMS. Recently, a maintenance crew was ready to shut down the process to replace a valve that was thought to be leaking. Using AMS, he took a look inside the process, and quickly determined that the valve was not leaking and did not need to be replaced. The “problem” was corrected by re-calibrating the valve positioner. Without this diagnostic tool, the process would have been shut down for four or five hours at a cost of “several thousand dollars per hour of lost production.”

Documentation. It often takes as long to write maintenance reports as it does to do the work. For example, out of 30 minutes required to initially configure a device, 15 minutes are spent documenting the parameters. And, more than half of an average 95-minute calibration is typically required for documentation. Of course, keeping an accurate record of what was done with each piece of equipment is essential to any well-structured maintenance program and the key to predicting future problems. In this information age, there is a better, more

accurate method than hand-written reports. With asset management software in place to support maintenance personnel, all documentation of maintenance activity on each device is automatically generated. The comprehensive Audit Trail is created simply by using AMS. One AMS user recently told us they had “rediscovered” the Audit Trail and that it produced an “astonishing” amount of information about the field devices and associated equipment.

Benefits

We’ve already mentioned some instances in which the users of asset management software have benefited financially. In general, these benefits come in the form of time saved in performing various maintenance tasks. Savings can be realized in both startup and ongoing maintenance activities, including loop checkout, calibration, eliminating trips to the field, reduced rebuilding of equipment, and automatic documentation.

Because downtime is expensive, one of management’s top priorities is to keep the process running. One maintenance person pegged the cost of downtime at $1600 per minute in his paper mill. Preventing or minimizing downtime definitely saves money, and asset management does just that.

The benefits of asset management tools generally fall into these categories:

- Reduced instrument commissioning costs
- Reduced loop maintenance costs
- Reduced equipment maintenance costs
- Decreased process downtime

All of the following figures are based on the experience of AMS software users.

A conservative review of one-time commissioning and start-up costs reveals savings of $150 per device, enough in most cases to pay for the software, hardware, and installation. A Texas company saved more than $73,000 during startup following a scheduled shutdown, according to our representative in that area. Part of this was money saved by reducing the time required for loop checks, but the majority was attributed to efficient troubleshooting. In this case, a perceived transmitter problem was quickly identified, enabling the plant to resume production in minimum time.

When it comes to routine tasks such as configuration, calibration, ongoing maintenance, and record keeping, as much as $280 per device is saved on average every year.

Configuration time is reduced because entire configurations can be downloaded to field devices via “drag and drop” techniques rather than by keying in the parameters one at a time. One company, which configures approximately 500 devices annually, reported configuration savings of $50,000 per year, or about $100 per device.

As discussed previously, calibration time is also reduced with software that stores all calibration information about each device in a database rather than a filing cabinet. A calibration menu leads technicians efficiently through the procedure. One company that calibrates some 8,000 devices per year, reported estimated annual savings in reduced calibration time of $264,000. Device alerts are the basis for a predictive maintenance environment that helps reduce unnecessary maintenance activity, for even more dramatic

savings. Automatic scanning identifies devices truly in need of attention, allowing maintenance resources to be deployed appropriately, thus reducing maintenance costs by $100 per device per year.

Many companies annually pull and rebuild equipment that is in critical service that wastes time and resources. British Petroleum reported that valve diagnostics helped reduce valve maintenance costs by 50 percent and spare parts costs by 75 percent, because technicians were able to limit repairs to only those devices that needed immediate attention.

Similarly, a predictive maintenance program to eliminate unnecessarily pulling valves resulted in estimated annual savings at the DuPont plant in Orange, Texas, of $6l7 per valve.

Based on all of the above numbers, the ongoing savings possible through the application of field-based asset management could be as much as $1,000 per device per year plus start-up savings of $150 per device.

Obviously, results will vary from one plant to the next, depending on maintenance practices, local costs, and regulatory pressures. But field-based asset management will almost certainly reduce your costs significantly, an objective most fertilizer manufacturers have been pursuing for years.

Will It Work For You?

At this point, you may be wondering whether asset management would be a worthwhile investment in your own plants. The same question was nagging those Texas engineers whose plant was being upgraded. Charged with getting the plant started as soon as possible, they were determined to find out how much time could be saved by utilizing AMS software during startup. Using a similar production unit as a basis for comparison, the engineers devised a series of tests to determine the time saved in commissioning 34 smart transmitters and 4 digital valve controllers. When the results were projected against the number of instruments to be installed in the new plant, they calculated that 8776 minutes, or nearly 15 man days, could be saved.

Since AMS is scalable, establishing an asset management program can be done all at once or in small steps. If no smart devices are used in your plant at this time, start replacing older instrumentation, when necessary, with HART based devices, especially where those instruments are connected to critical equipment. More than 60 manufacturers now build equipment complying with the HART standard.

If your plant is currently equipped with any HART devices, you are already on the way. It is possible, with a handheld communicator, to obtain information from any HART based field device and later upload that information into a PC running asset management software. HART modems can also be used to facilitate communication between individual devices and a PC running the asset management software. The modem can be either a serial or PCMCIA type of connection that plugs directly into the PC. This is only temporary until all such devices can be permanently wired via HART multiplexers. Each multiplexer is the equivalent of 32 individual device modems, enabling direct, continuous, online access to vast amounts of field-based information by a PC in the Maintenance Department.

In many cases, proprietary control systems can be retrofitted with termination panels that incorporate HART multiplexers, making it possible to easily pass status information from a variety of field devices through the control system directly to the asset management software.

Conclusion

The overall value of asset management in reducing maintenance costs was underscored by Stephan Zikeli, lead project engineer for a new, highly automated plant in Austria. He said, "Fewer instrumentation and electrical maintenance technicians are needed in this plant than in our older plants having approximately the same production volume, even though there are more than twice as many field devices installed here."[3]

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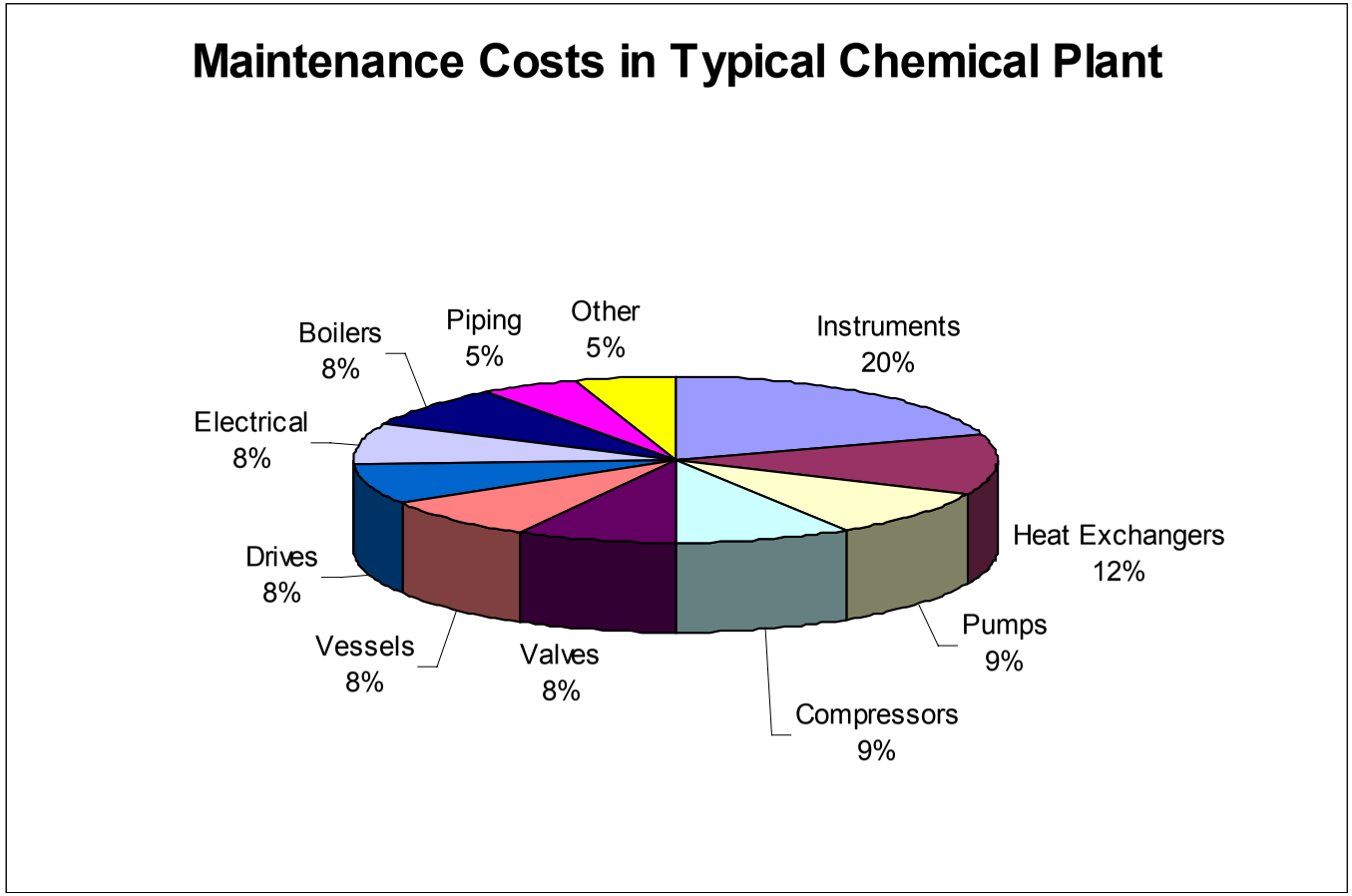
Maintenance Costs



Anheuser Busch Visit

- **AMS Addresses Today's Challenges-Masterson (.5 hour)**
- **AMS Product Demonstration - Krisi Bailey (1 hour)**
- **Performance Solutions - (1 hour)**
  - Remote monitoring
- **Diagnostics - Evren Eryurek (1 hour)**
- **Future Direction - (1.5 hours)**
  - Consolidation Plan (HART/FF) Jim Masterson
  - Advanced Flow Diagnostics - Dave Wehrs
  - Energy Management - Stuart Harris