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MnTAP

Minnesota Technical Assistance Program

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preventing pollution

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MnTAP intern Steffen Springborn investigated nearly 20,000 feet of steam and condensate lines.

Blowing off steam is a waste of energy

With the legwork of a MnTAP intern, Rock-Tenn developed an insulation plan for steam and condensate lines.

Papermaking is energy intensive. According to the U.S. Department of Energy the pulp and paper industry is the third-largest user of fossil fuels in the U.S. industrial sector, spending about $6 billion per year on energy.

Rock-Tenn Company, a recycled paperboard mill in St. Paul, has been working to lessen the bite of its energy bills. Its electricity use dropped approximately six percent after installing over 200 variable speed drives on pumps and some fans. When the Xcel Energy High Bridge power plant shared its plan to convert from coal to gas power, eliminating the paper mill's source of steam, the mill redoubled its energy efficiency efforts to prepare for bringing its own steam system online.

The company has reduced its thermal energy use from steam by 31 percent since it began installing its new steam system. Insulating steam and condensate lines is saving $171,000 in energy use annually. The company has also instituted a steam trap management plan.

Steam and condensate lines

The company's steam lines transport heat energy to run electrical generators and dry paper as it progresses through the paper machine. After transferring its heat, the steam condenses into warm water which is returned to the boiler via condensate lines to be turned into steam again.

Often in older production facilities, such as Rock-Tenn's 1908 paper mill, steam and condensate lines were not insulated because energy used to be inexpensive.

Of the nearly 20,000 feet of steam and condensate lines, only a small fraction were uninsulated, primarily the condensate lines. But these provided significant heat recovery opportunity. Uninsulated lines at the mill lost millions of Btus annually—enough heat to keep 350 homes warm through a Minnesota winter—at a cost of $190,000.

Because Rock-Tenn did not have enough staff time to investigate 20,000 linear feet the company requested a

(continued)

(Rock-Tenn, continued from cover)

MnTAP intern to help. The intern researched steam and condensate line insulation and found that heat loss could possibly be reduced by 90 percent.

"Our need required more legwork than we had resources to accomplish," said Gary Myhrman, Rock-Tenn plant engineer. "The MnTAP intern could dedicate 100 percent of his time to walk the pipes and do the calculations."

As a rule of thumb, insulating steam lines that are currently uninsulated is generally cost effective.

The intern gathered data from CAD prints, interviews with plant personnel and plant walkthroughs. Using the 3E Plus Insulation Thickness Computer Program developed by the North American Insulation Manufacturers Association, the intern determined the optimal thickness of insulation for the condensate and steam lines and developed a cost/benefit analysis. As a result of the intern's work, the company changed its insulation standard for the steam lines and set a standard for the condensate lines, commented Myhrman. The mill is nearly complete with its phased-in plan to insulate all lines.

Steam trap management

The company mapped, numbered and catalogued all of its 1,000 plus steam traps and established a leak program. A staff technician checks all of the traps once a year to ensure they are functioning properly. Condensate return levels are monitored in order to flag steam losses and keep leaks under control.

A consultant helped the company determine if the traps had the proper orifice size. If openings are too small water can backup into the pipes, decreasing performance; too large, the trap can lose steam after it drains water and if traps get stuck open even more steam/energy is lost. Oversized traps are being retrapped for better sizing and improved design efficiency.

Benchmarking data from the Recycled Paperboard Technical Association shows the average unreturned condensate as 18 percent. With condensate losses as low as 12 percent, Rock-Tenn's steam line is now one of the most efficient in the business.

Beyond the bottom line

In addition to the economic impact at Rock-Tenn, reducing energy use alone from insulating the pipes has an estimated annual environmental impact of reducing five million pounds (2,500 tons) of carbon dioxide emissions from coal burning to generate the steam. Carbon dioxide is a greenhouse gas associated with global warming.

The complete Rock-Tenn intern project summary is available online at <mntap.umn.edu/intern/projects/Rock-Tenn.htm>. ■

Software: analyze steam efficiency

3E Plus

3E Plus Insulation Thickness Computer Program was developed by the North American Insulation Manufacturers Association (NAIMA) to simplify the task of determining how much insulation is needed to reduce energy use. The 3E Plus program can:

- Calculate the thermal performance of both insulated and uninsulated piping, ducts and equipment
- Translate Btu losses into actual dollars
- Calculate greenhouse gas emission and reductions

Steam System Tool Suite

U.S. Department of Energy (DOE) makes available a suite of tools for evaluating and identifying steam system improvements. In many facilities, steam system improvements can save 10 to 20 percent in fuel costs.

Links to the NAIMA software and DOE tools are available through this article online. ■

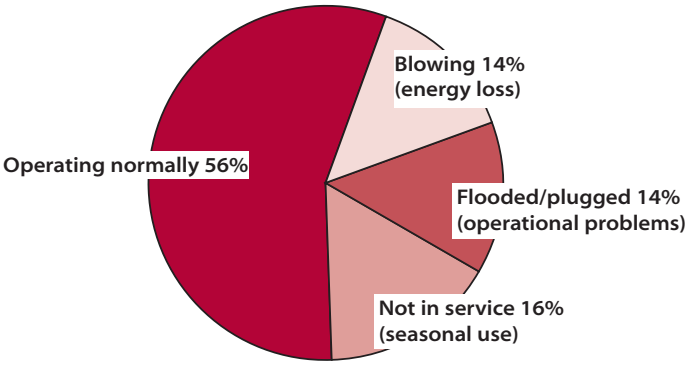
Assessing steam traps

Steam traps are automatic valves that release condensed steam (condensate) while preventing the loss of live steam. Facilities can have numerous traps and many are hidden along pipeline highways. With the mechanical stress of frequent opening and closing—traps fail. When they do, energy goes to waste.

According to the U.S. Department of Energy, if steam systems that have not been maintained for three to five years, 15 to 30 percent of their traps may have failed. In systems with a regularly scheduled maintenance program, leaking traps should account for less than five percent of the traps.

MnTAP recently conducted a steam trap assessment at the Metropolitan Council Environmental Services (MCES) St. Paul wastewater treatment facility, assessing over 91 high-pressure traps to demonstrate the payback of steam trap assessments. Nearly one-third of the traps were malfunctioning—either losing steam (blowing) or flooded or plugged, costing the facility over $7,000 annually.* The assessment findings underscored the value of more-frequent trap testing and continuous monitoring of critical traps.

Trap Assessment Results



Energy assistance

Xcel Energy funded the assessment as part of a pilot promotion through its Boiler Efficiency program, ConservationWise. The promotion aims to encourage Xcel Energy's natural gas customers to perform routine maintenance on steam distribution systems to improve energy efficiency. The utility also provides rebates for materials used to repair or replace non-functioning traps.

Check with your gas utility to see if it offers similar rebates.

Trap testing

Economic analyses shows that the cost of testing steam traps and repairing and replacing them is generally less than a one year payback.

MnTAP staff use ultrasonic listening instruments, infrared temperature measurement and visual inspection of trap discharge to diagnose the condition of steam traps. Company maintenance staff would use these same tools when conducting their routine trap management inspections.

Call MnTAP to request a steam trap assessment demonstration at your facility. ■

Trap ranking

Prioritize steam traps for management by their potential for energy loss when they blow:

1. High pressure distribution, 24/7 operation, boiler room
2. Low pressure distribution
3. High pressure modulated: process heat, ovens, high temperature fluid heat
4. Low pressure modulated: comfort heating, buildings, potable water

* MCES derives energy from an, eh hem, alternate fuel source that is delivered regularly by pipeline to its facility. Using the wastewater treatment sludge helps decrease the natural gas needed to generate steam.

Airport puts steam trap monitoring on autopilot

Steam trap testing and repair are always on a facility's maintenance to-do list, but emergencies take precedence. A frozen coil today means a frozen pump that could stop production now. So trap maintenance gets delayed as staff perform triage on their projects. Maintenance staff know that if steam traps do not get fixed today that they will not be that much worse tomorrow.

Jamie Chatelle showed off a few of the wireless transmitters in MAC's steam trap monitoring system.

The Metropolitan Airports Commission (MAC) has over 700 traps in its steam system, used for domestic hot water and air tempering. "We're restricted on personnel so we've never had the time to monitor our steam traps as often as we'd like to," said Steve Shuppert, chief engineer at MAC. "We had no way of knowing if a trap failed until there was noise in the line or people complained about the temperature."

After learning at a utility workshop about SteamEye, a steam trap monitoring system, MAC decided to pilot the system. Maintenance staff installed sensors on 66 steam traps in its energy management center and tested the system for one year.

"It worked fantastic," said Shuppert. MAC installed its complete trap monitoring system in three phases.

How it works

The steam trap monitoring system uses radio frequency wireless transmitters, threaded into the bottom of the traps, to detect temperature and conductivity fluctuations. The transmitters periodically send a signal to repeaters which send the signal on to a central receiver that notifies system operators of trap condition and instantly alerts them to failures.

MAC's system is set up using a Web-based interface that relates the trap number, location and when the transmitter signal last checked in. The system uses simple, spreadsheet-like software.

"You know whether the traps are blowing through, cold or OK," said Jamie Chatelle, MAC assistant chief engineer. "When there's a problem, we get an audible alarm and we can check the 'failed points' screen."

Maintenance and boiler operators can install and reprogram the transmitters themselves. Transmitters need to have their batteries replaced every three to five years.

System specifications

Automated steam monitoring systems are appropriate for facilities using high pressure steam, such as food processors, pulp and paper mills, chemical manufacturers and facilities with large steam distribution networks, like some hospitals and universities. Facilities with the following characteristics may want to evaluate an automated system:

- Industrial process and high-pressure (up to 600 psi) applications
- More than 100 traps
- Hard-to-reach traps, miles of steam tunnels, and traps in unsafe, confined spaces

Shuppert estimates MAC's system has a two-and-a-half year payback, before the CenterPoint Energy rebate. "The rebate was gravy on top," he noted.

If you decide to evaluate a steam trap monitoring system for your facility, check with your gas utility about a custom rebate *before* you begin work. Rebate eligibility requires pre-approval. ■

where's your waste?

Summer of solutions

Not enough time or money to work on solving waste-related problems? A MnTAP student intern might be able to do the legwork you need to justify changes at your facility. MnTAP sponsors college students to work full time for the summer at Minnesota businesses to research solutions to its specific waste-related challenges, such as:

- Energy use
- Defects
- Raw material use
- Scrap
- Water use
- Wastewater
- Solid or hazardous waste
- Air emissions, VOCs, HAPs

By participating in the MnTAP intern program, companies receive:

- A motivated college student with technical background and research skills, working full time at your facility for the summer.
- Technical guidance from a MnTAP technical specialist who will also help develop the project's scope and oversee the student's work.
- Human resources management: MnTAP recruits, hires and pays the student. We cover payroll and workers compensation.

In 2006, MnTAP interns helped seven companies save $74,800 by reducing seven million gallons of water, 24 pounds of pharmaceuticals, 400,000 kWh and 1,121 therms per year. Using the research of a MnTAP intern, Hennepin County Medical Center (HCMC) will save over $85,900 by reducing 380 pounds of pharmaceutical waste. Federal Cartridge/ATK will reduce water use by 6.7 million gallons, saving $28,500 annually.

MnTAP intern Jonathon Schulz and Catherine Zimmer, MnTAP health care specialist, review HCMC's outdated medications.

Have an intern work on improving efficiency and reducing your facility's waste this summer. Project proposal deadline is February 1, 2007. Contact Deb McKinley, intern program coordinator, at 612/624-4697. More information online at <mntap.umn.edu/intern>. ■

Hospitals using EtO sterilization

The U.S. Environmental Protection Agency (EPA) published a proposed air quality National Emission Standard for Hazardous Air Pollutant (NESHAP) affecting hospitals using ethylene oxide (EtO) sterilizers. The proposed regulation covers sterilization management practices, equipment certification, compliance reporting and other record-keeping requirements.

EPA is accepting comments on the proposed rule until January 5, 2007. A final rule is expected by December 2007.

EtO—used as a gas for sterilization—is flammable and highly reactive. Acute exposures to EtO gas may result in symptoms such as respiratory irritation and lung injury. Chronic exposure has been associated with cancer, reproductive effects and other conditions. To reduce health risks, Ridgeview Medical Center uses hydrogen peroxide plasma instead of EtO.

Links to the Federal Register notice and information on EtO substitution are available through this article in the online *Source*. ■

Dubious defects

The Lean Manufacturing Consortium (LMC) contends that the true cost of poor quality is usually underestimated. Defects can involve wasted labor, machine hours and time delays, but often only the cost of wasted raw materials is accounted for. To illustrate its point, LMC calculated the defect cost of a bent flange in window manufacturing—$135 in lost raw materials grew to $2,673 when hidden costs were included.

Finding the root cause of defects and tracking defect data over time can make operations more effective and profitable.

Understanding

Comparing your situation to how a process should work can offer clues to sources of defects. A fiberglass fabricator was having trouble getting OEM specified low-HAP (hazardous air pollutants) resins to work at his facility. After repeated failures, the owner probed the OEM about how it was able to get the resin to work. He learned that the OEM was adding solvent (the HAPs) to make it flow better!

Analysis

Many shops don't have the process scale or mathematical training for applying the statistical analysis of Six Sigma. But with good data collection, you can identify weaknesses in your operations, from inadequate personnel training to poor-quality incoming materials. Keep a record of defects, recording type of defect and associated costs.

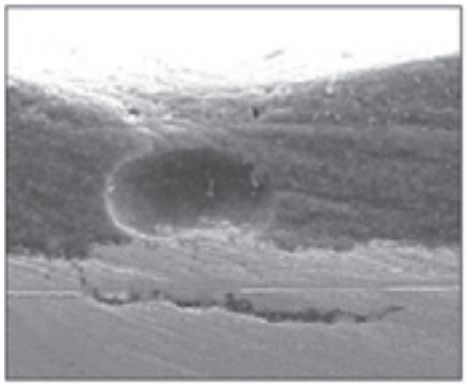
An Aberdeen Group study found that manufacturers who monitored DPMOs (defects per million opportunities) produced the best results (99.9 percent good quality), better than those that measured percentage of defects (94 to 96 percent good quality), rolled throughput or first-pass yield.

Whether you're trying to eliminate micro solder balls on circuit board assemblies, poor thermoplastic butt-weld integrity or gas porosity in castings, tracking defects can help you pinpoint—and prevent—their causes. Links to more information are available through this article in the online *Source*. ■

Low quality steel

Getting at the cause of defects can be a lot like the ever-present "Not me" in the Family Circus cartoon. With a coating defect, painters point to the pretreatment baths, the chemical vendors point to the quality of the steel being painted...

Maybe it is the steel. While China's growth feeds increased steel demand, U.S. manufactures more frequently get lower quality steel. Inability to identify the poor quality until parts rust, show zebra striping or break after forming or painting results in defects that waste time and money.



Crater caused by steel defect

At a recent Chemical Coaters Association educational program, David B. Chalk, Ph.D., of Galaxy Associates, Inc., explained the steel making process to help people better identify and manage defects, and to stand a better chance of getting satisfactory steel from the mill. His tips:

- Specify a steel sulfur-content of less than 0.0085 percent. It will cost a little more, but it's worth the improved performance and consistency of final products. The phosphorus and silicon content will be reduced in these steels as well.
- Always use a phosphate conversion coating to prepare for painting. The phosphate passivates the surface and minimizes the corrosion problems presented by contaminants.
- Reject and return steel that has a "speckled" corrosion pattern on the surface, shows signs of excess surface carbon, or does not exhibit the required mechanical properties. Often, the cause is high levels of impurities. ■

materials exchange

A materials exchange program lists one company's unwanted material and makes it available for use by another company. The lists below are examples from the Minnesota Materials Exchange.

For more information, call MnTAP at 612/624-1300 or 800/247-0015. Or, visit **<www.mnexchange.org>.**

Materials available

AC/heat controls: Three. Carrier. For HVAC system. Dual zone heat and cool. Minneapolis. [18607]

Computer monitor accessories: 700 one-inch plastic risers. 80 15-inch anti-glare screens. Must pick up or pay shipping. Free. Owatonna. [18938]

Desks and credenza: Two oak-laminate desks (one light and one medium-dark). One light oak-laminate credenza. Free. Bloomington. [18981]

Dichloromethane: One gallon. Unopened. Free. Brooklyn Park. [18870]

Light fixtures and lamps: 350. Pulse start, metal halide, high bay fixtures. 350 watt, 277 volt or wired to 120 volt. $20, or less for quantities. Brooklyn Park. [18944]

Pallets, wood: Amount varies. Most six foot and larger. Must pick up. Free. Eagan. [18914]

Salt, etching: Over 20 pounds. Technic TSC 1501. Free. Brooklyn Park. [18871]

Scale, postal: One. 70-pound parcel scale. Memory lock. $25. New Brighton. [18922]

Materials wanted

Bags and film, plastic: Any amount. HDPE and LDPE. Grocery bags, shrink wrap and stretch film. Must be clean and dry. Free. Vadnais Heights. [18884]

Conference table and chairs: One set. For a nonprofit. New Ulm. [18945]

Dehumidifiers: Five. Any model. With drain hose or drip pan. Prefer free. Goodhue. [18574]

Footwear: Any amount. Any condition. Prefer free. St. Paul Park. [18929]

Forklift or tractor with lift: One. Capable of lifting 1,000 pounds. Prefer free. Hill City. [18969]

Highway dividers, concrete: Any amount. Will load and haul. Prefer free. Rosemount. [18949]

Shelving units: One. Approximately 30 x 16 x 72 inches. Sturdy, metal, multiple shelves. Prefer free. Cloquet. [18964]

Storage hoppers, metal: Any amount. Any size. Prefer self dumping. Will pick up. Prefer free. Rosemount. [18948]

Successful exchanges

- A Golden Valley school donated over 4,300 pounds of office furniture to various organizations.
- An auto shop in Big Lake received 87 metal bins—weighing 26,000 pounds—from an office furniture manufacturer.
- A Duluth grocery store sold a forklift to an agricultural sales business.*
- A Faribault school donated $7,200 of computer systems to local organizations. ■

*Items may be sold for a nominal fee—20 percent or less than the value of an item. An item's value must be based on its current condition.

DOE energy savings assessments

U.S. manufacturing facilities are eligible for U.S. Department of Energy (DOE) assessments, that focus on reducing natural gas. DOE is now accepting online applications for industrial energy savings assessments for facilities that have energy consumption in excess of one trillion Btu per year.

The application period opened on October 2 and will remain open until January 19, 2007, or until the target of 250 assessments for calendar year 2007 is reached. DOE will initially select applications in late November. Additional selections will be announced periodically. All assessments will be completed by December 31, 2007.

The following Minnesota companies have previously been selected by DOE to receive onsite assessments: American Crystal Sugar Company, Crookston; Boise Cascade Corporation, International Falls; Gerdau Ameristeel, St. Paul; Rahr Malting Company, Shakopee; and United States Steel Corporation, Mountain Iron.

To be considered for an energy savings assessment, complete and submit the online application form. The link is available through this article in the online *Source*. ■

helping businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution and reduce costs and energy use

mntap

The **Minnesota Technical Assistance Program** helps businesses and industries develop and implement industry-tailored solutions that maximize resource efficiency, prevent pollution and reduce costs and energy use to improve public health and the environment. As an outreach program at the University of Minnesota, MnTAP provides free technical assistance tailored to individual businesses. By reducing waste and increasing efficiency, companies save on disposal and raw-material costs and make working conditions healthier and safer for employees.

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calendar

Greening the Supply Chain: Environmental Innovations in Freight Transportation, Annual Freight and Logistics Symposium December 1, Minneapolis, MN. 612/624-3708.

Lean Dreams December 7, Mankato, MN. Sponsored by Minnesota Technology Inc., 612/373-2900.

Lean Manufacturing Simulation December 7, Plymouth, MN. Sponsored by Manufacturers Alliance, 763/383-9445.

MnTAP Intern Program Project Application Deadline February 1. Call Deb McKinley, intern program coordinator, to discuss potential project ideas, 612/624-4697.

Innovative Approaches to Wastewater Operational Problems Conference February 20, St. Cloud, MN. Sponsored by the Minnesota Section of the Central States Water Environment Association.

Minnesota Air, Water and Waste Environmental Conference February 27-March 1, Bloomington, MN. Sponsored by the Minnesota Pollution Control Agency (MPCA), 651/297-5754.

70th Annual Wastewater Operations Conference March 28-30, Brooklyn Park, MN. Sponsored by MPCA, 651/296-8868.

For more information and links to Web pages for these events, visit MnTAP's online calendar at <mntap.umn.edu/resources/cal.htm>.

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