

ENVIRONMENTAL

# Evaporation Solves Waste Water Disposal Problems



*The SAMSCO Water Evaporator system paid for itself within the first three months of operation through savings in hauling and disposal costs.*

**T**here could hardly be a metalworking shop in the U.S. that is unaware of federal and state environmental regulations concerning the

disposal of industrial waste water. And while virtually every shop makes efforts toward compliance, very few waste water management programs that are now in place can

be considered entirely successful. Problems range from excessively complex treatment systems that require substantial manpower skills to operate, to unreliable haulers



whose actions can subject a shop to virtually unlimited liability. But the single most common problem associated with industrial waste water management is cost: whether a shop treats on site or hauls off site, compliance efforts usually run into serious money.

Cross Manufacturing, Inc., Lewis, KS, a leading manufacturer of hydraulic components, recently solved its waste water disposal problems by installing a SAMSCO Water Evaporator, cutting its disposal requirements by over 95 percent. According to Cross, the advanced evaporative technology from SAMSCO, Inc., paid for itself within the first three months of operation.

Founded in 1949, Cross Manufacturing produces a complete hydraulic line: cylinders, valves, pumps, motors, and adapters. The company employs about 300, with manufacturing operations at three facilities: Lewis, KS (cylinders), Hays, KS (valves, pumps and motors), and Pratt, KS (adapters). Cross supplies hydraulic components for a variety of markets, which include agriculture, material handling, utility, and construction. Cross hydraulic products are marketed and used worldwide.

Operations at the Lewis plant include machining, grinding, parts washing, painting, and assembly, creating multiple sources of industrial waste water. In addition to cutting fluids, the waste stream includes alkaline parts washing solutions from baths and spray-wash equipment; a paint pre-treatment solution; and floor scrub detergent that typically contains all of the above.

Cross installed a SAMSCO 600 Series Wastewater Evaporator to handle this diverse and changeable waste stream. The system runs around the clock, and requires no adjustments to handle the frequent changes in effluent composition from the various sources. Once a

week, the system is shut down and a small volume of sludge is removed for off-site disposal.

"Evaporation has proven to be far superior to the alternatives of on-site treatment or hauling thousands of gallons of waste off site," said Raymond Law, Cross's Environmental Health & Safety Coordinator.

The SAMSCO system, he added, is "very easy to operate, requires minimal maintenance, and has substantially reduced our costs for waste water management."

### Seeking a Compliance Solution

Cross's search for an effective waste water disposal system began when effluent discharge monitoring in Lewis detected periodic "spikes" in metals concentrations that were close to the new federal limits. (For some chemicals, concentrations may be no higher than the levels found in drinking water - extremely tough target to meet.) The source of the metals was traced to cleaning processes that the company used for its products. But rather than continually chase after waste stream variables, and risk the imposition of fines for unpredictable incidents of non-compliance, Cross decided to cut its sewer connection, and haul its waste water for off-site treatment and disposal.

But this quickly proved expensive. Paying \$1.50 per gallon for hauling, treatment, and off-site disposal, Cross would have to spend between \$150,000 and \$200,000 to dispose of the roughly 100,000 gallons of water-based waste that the Lewis plant generates annually. Cross carefully investigated other options, including both evaporation, and on-site treatment. Evaporation was selected as the most practical, cost-effective alternative.

The primary benefit of evaporation as a waste management approach is the substantial reduction in waste volume - typically between 95 and 98 percent. Once the aqueous component of a waste stream is evaporated,

the remaining sludge is cleaned out for treatment or disposal. Costs are reduced nearly in proportion to the reduction of volume and, because only the concentrated residue remains, the need for sewer system permitting is eliminated.

In comparison, on-site treatment of waste water does not reduce the volume of effluent. Waste water must still be sent to sewer, so the facility is still responsible for compliance with sewer regulations.

Furthermore, on-site treatment tends to be technically complex. Most treatments are waste-stream specific, and a great deal of care is required to ensure that a particular waste stream receives the proper treatments, in the proper order. Evaporation, by contrast, is not waste-stream specific: several waste streams can be combined and evaporated simultaneously with no loss of efficiency or added risk of non-compliance.

### An Engineered Solution

Cross examined the range of available water evaporation systems, and eventually narrowed the field to a choice between two suppliers. One of the suppliers offered a vacuum-based evaporator; the other, SAMSCO, offered a thermal system.

Vacuum-based systems operate on the principle that water boils at lower temperatures at reduced atmospheric pressure. Rather than sending the purified water vapor "up the stack," vacuum-based systems can recondense it by bringing it back to atmospheric pressure. The condensate can then be sent to sewer or reused in industrial process applications.

Cross initially found this "closed-loop" capability attractive because of concerns about future air quality regulations. But further investigation revealed that vacuum evaporators are complicated to operate, and vacuum seal integrity is a critical maintenance issue. The difficulty of maintaining a vacuum forces





*Cutting fluids are just one of the components of the complex and changeable waste water stream at Cross Manufacturing.*

most designs to have small evaporating vessels, and this tends to make them awkward to clean out. The unit that Cross investigated would have required a worker to enter the vessel in order to clean it, and this would have entailed special safety measures for confined space entry. "In general, the vacuum-based system appeared to require a fairly high level of operator skill and intervention," said Law.

The other unit, from SAMSCO, operated on the thermal principle, bringing the water to 212 degrees F to boil it off at atmospheric pressure. Initial concerns about air emissions were satisfied by the availability of an optional condenser from SAMSCO that can be retrofitted at any time to achieve closed-loop operation. The large, heavy gauge, stainless-steel tank permits easy clean-out, and the simpler control system is designed to run without operator intervention. The system also cost considerably less to purchase than the more

complex vacuum-based unit. SAMSCO's ability to assess Cross's waste stream and design a facility plan to handle it was another important factor in the purchasing decision, said Law.

SAMSCO applications engineer William Noble said the company conducted full functional testing of Cross's waste stream. This is far more comprehensive than a simple analysis of EPA-regulated chemicals as performed by some companies, and actually involved test evaporation of waste stream samples from the Lewis facility, accurately simulating the proposed installation. In addition, environmental testing showed that stack emissions would easily pass current regulatory muster without a condenser.

SAMSCO's facility design combines several waste streams upstream of the evaporator. The combined streams run through a weir tank, which separates out free-floating oil, then into an 8,000-gallon storage tank. This feeds automatically into the Series 600 evaporator, which is rated for 33 gallons per hour.

The evaporator features a serpentine heat exchanger that is elevated above the tank bottom to resist fouling. (Cross's unit is gas-fired, but other heat sources are available.) A blower draws air across the surface of the heated liquid and draws vapor away, increasing evaporative efficiency. The moisture-saturated air and flue gases leave the tank separately. They are mixed in the blower and released up the stack. Meanwhile, oils that were not removed at the weir tank float to the surface and are removed through an overflow trough into an external waste receptacle. Precipitated solids collect in a sloped trough at the bottom of the tank.

At the Lewis plant, the automatic transfer of liquid from the storage tank to the evaporator is shut off every Friday, and the evaporator is allowed to "cook down" on Saturday. (The storage tank has sufficient

capacity to hold all liquid wastes generated during the weekend.) On Sunday, Cross allows the unit to cool - an optional procedure, says SAMSCO's Noble. On Monday morning, a worker spends just one hour transferring sludge from the trough into a holding tank. The system is then brought back on line, reaching operating temperature in about an hour. The small volume of sludge is later removed by a registered hauler.

The SAMSCO evaporator integrates several important safety features, including solid state sensors that automatically shut the unit down in case of low liquid level, excessive temperature, and fan or burner failure. The evaporator is laid out with distinct "wet" and "dry" ends for additional safety and convenience. Controls are straightforward, and the unit can be set for batch operation or automatic feed.

#### **Quantified Savings**

Cross reports that system installation was straightforward, and that technical support was excellent. "We don't have a strong base of technical expertise in rural Kansas," Law said. "We selected a supplier who could engineer a system to keep us in compliance." Cross's own maintenance department installed the system in just a few days, relying on comprehensive plans and instructions that SAMSCO provided. SAMSCO's technical service engineers walked the company through system start up, and confirmed that it was operating properly.

During the first quarter in which the SAMSCO Water Evaporator was in use, the Lewis facility generated 44,918 gallons of waste water. Waste reduced to just 2,165 gallons, or 4.8 percent of the original volume.

The first three-month gas bill for the unit ran to \$1,796, or \$.04 per gallon. Combined with sludge disposal, at \$3,247 (or \$1.50 per gallon), operational costs totaled just \$5,043. Even if the \$27,000 cost of the equipment were entirely



expensed during the first three months, the total is just \$32,043. Compared to the \$67,377 it would have cost to haul and dispose of 44,918 gallons of waste water, Cross completely paid for the equipment and saved an additional \$35,334 in the very first quarter.

#### Waste Water Alternatives

According to SAMSCO's president and founder, Sam Travis, the metalworking industry can choose from four primary alternatives to handle non-hazardous aqueous waste streams: sewer discharge; hauling off site; on-site treatment or separation; and evaporation.

With sewer discharge regulations becoming stricter all the time, this option is fast disappearing for most shops. While hauling off site is an apparently easy course of action, it is expensive, and it exposes shops to potential liabilities if the hauler fails to dispose of the waste properly. ("Corporate veils" may be easily pierced, and owners held directly, personally accountable, in some pollution incidents, said Travis.)



*Cross uses both spray-wash equipment, and parts washing baths, as shown, at its hydraulic components facility in Lewis, KS. All water-borne wastes are combined into a single stream and reduced in volume by more than 95% by a SAMSCO Water Evaporator.*

The third option, on-site treatment, is technically complex. Separation by chemical means or filtration tends to be waste-stream specific, and does not readily accommodate changes in effluent compo-

sition. A skilled, full-time treatment operator may be required to manage the waste stream, and to ensure that the system remains in good operating condition. After separation is accomplished, the "clean" effluent is then discharged to sewer; if any problems prevented successful separation, the company might expose itself to liability.

"Evaporation is the only approach that substantially reduces the waste stream," said Travis. "The smaller volume of waste is more reliably and economically managed, and sewer discharge and compliance issues are eliminated in their entirety."

Cross Manufacturing is in agreement. The company is so satisfied with its first SAMSCO installation that it recently acquired and brought another unit on-line in its Hays, KS, facility.

**For Additional Information**  
**SAMSCO, Inc.**  
**18 Cote Avenue**  
**Goffstown, NH 03045**