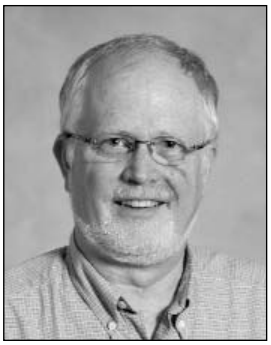
by Pat McCool

Evaluating treatment chemical costs

One major responsibility of all operators, managers, and elected officials should be to keep the treatment and distribution costs of water as low as possible. Reduced operating costs mean less revenue necessary from ratepayers. Some of the major treatment and distribution costs include treatment chemicals, electricity, replacement parts, laboratory monitoring, and fuel. Treatment chemical cost savings may be possible in many treatment situations.

The water supplier that only chlorinates well water or purchases water from another supplier should not have high treatment chemical costs. The water supplier that operates a treatment plant to treat surface water or remove iron/ manganese from well water has higher treatment chemical costs and a better opportunity to possibly reduce treatment chemical costs.



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Determining chemical cost

In determining treatment chemical cost, the cost should be calculated in the unit of *cost per 1,000 gallons* treated (for example $0.20 / 1,000 gallons, or 20 cents per 1,000 gallons). This will allow the evaluation of the chemical cost regardless of the amount of water pumped. Remember, the total cost may be misleading in the evaluation of the data when addressing whether costs can be reduced.

The *annual* cost for each chemical should first be calculated. This should be completed for the last two or three years so that any trends will be noticed. Be sure that the invoice data used includes only the cost for the particular chemical including surcharges for fuel, insurance, and taxes.

If chemical dosages vary significantly during certain times of the year or during different raw water quality, then monthly costs for each chemical should be calculated. A good evaluation of costs for treatment chemicals requires an inventory of use on a monthly basis, information from the purchase invoice. There will be variances due to different operating conditions.

Recently, a water supplier's financial auditor pointed out that *total* cost of "chemicals" at the treatment plant had dramatically

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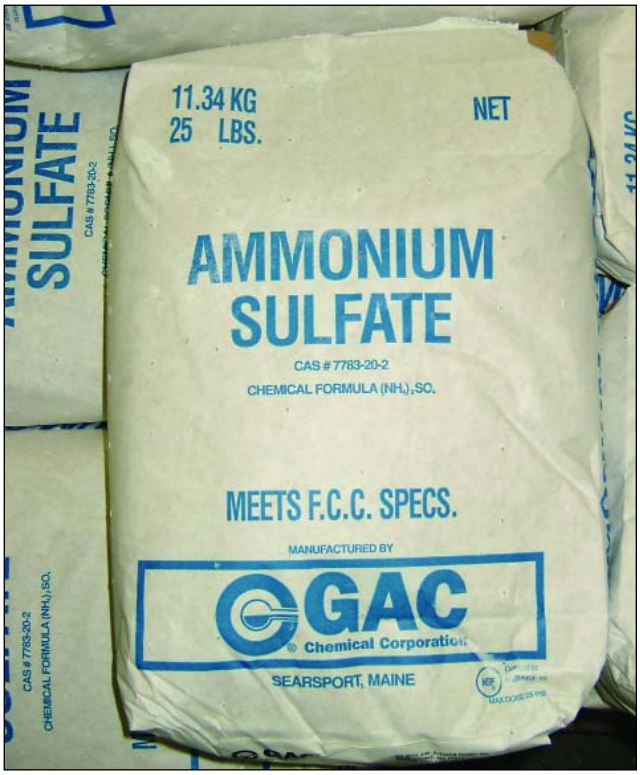


Purchasing granular ammonium sulfate in bags is preferred in treatment plants of 1,000 GPM capacity or less.

increased 58% on a yearly basis. This concerned the elected officials who then wanted to know why. They thought the operators were adding too much chemical.

However, after detailed examination of the billing data, the increase in treatment chemical cost was determined to be nowhere near 58%. After excluding laboratory monitoring chemicals, chemical pumps, and parts, and after adjusting for inventory, the yearly, total treatment chemical costs (for all chemicals per 1,000 gallons treated) increased only 8%. The data showed that the 8% increase was due mostly to an 18% increase in two particular chemicals that were a small part of the overall chemical costs.

Evaluation of increase

If the cost for use of a particular chemical is increasing, it should be determine what the cause is. The two major causes of increased cost ($ / 1,000 gallons treated) are increased dosage and increase cost for the chemical.

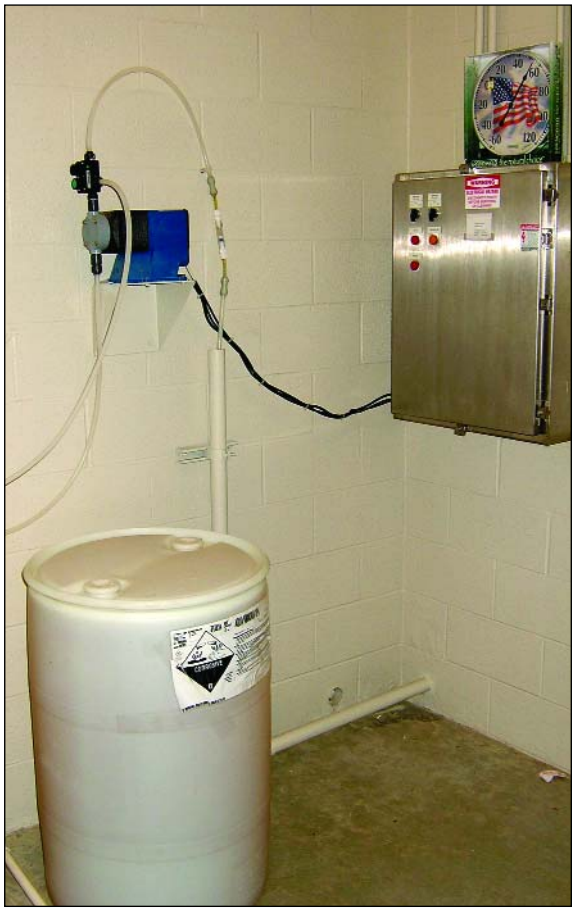
The cost increase may be due to an increase in the chemical dosage. For example, the coagulants and pH adjustment chemical dosages increase when very turbid surface water is being treated at a treatment plant. In this example, the dosage is explainable and most likely unavoidable. If changing raw water quality is suspected, then usually monthly evaluation of chemical cost will show up in the months of rainfall runoff and increased raw water turbidity.

Another example of increased dosage is that the chlorine and ammonia dosages may increase if the ratio of chlorine to ammonia is too high. Adding chlorine and ammonia incorrectly results in the destruction of both chemicals in the water and a resultant increase in costs. In this example, the dosages can be lowered and monies saved.

With increasing costs of manufacturing chemicals and of energy in recent years, the cost per pound of

Left: Granular ammonium sulfate is added to water to make the chemical feed solution. A small solution feed pump is used to add the solution to the water being treated.

Above: Ammonium sulfate already mixed with water can be purchased in totes. The cost of already-made solutions can be much higher than mixing the dry, granular chemical yourself.



Liquid ammonia is more difficult to handle and feed than ammonium sulfate solutions; but liquid ammonia is cheaper and is usually preferred in treatment plants of 1,500 GPM capacity or more.

most chemicals is increasing. Also, the surcharges for fuel, insurance and taxes to the supplier are increasing and are listed separately on invoices. All these costs must be considered when evaluating unit cost for treatment chemicals.

For example, for one water supplier the cost of gas chlorine in 150-pound cylinders increased 18% from early 2005 to late 2006. However, the unit costs increased 20% during the same time when surcharges are added into the cost. Be sure to include in the evaluation all costs associated with each chemical.

Reducing chemical costs

If the cost per pound of a chemical is increasing significantly or you suspect the cost is too high, you can ask your supplier for the same chemical in a different form or a substitute chemical that accomplishes the same treatment. Coagulants and ammonia are two examples where costs might be reduced.

Coagulants are used to remove turbidity and TOC when treating surface water. The use of different coagulants or combination of coagulants might reduce costs. Such coagulants include: hydrolyzing metal salt coagulants such as alum and ferric chloride; prehydrolyzed metal salts such as poly aluminum chloride; and, synthetic organic polyelectrolytes such as polydiallylthyl ammonium chloride and polyacrylamide.

Switching to different coagulants or changing coagulants at different times of the year due to raw water quality changes can result in significant savings. Recently, a Kansas water treatment plant changed from the use of a prehydrolixed metal salt and a polyelectrolyte to a ferric metal salt and polyelectrolyte. The unit cost of coagulants per 1,000 gallons treated was reduced to $0.033 from $0.133. For the utility treating 175 million gallons per year, the estimated cost savings is $17,500 per year.

The most important chemical evaluation at a surface water treatment plant is determining and evaluating the cost of coagulants. In most small and medium size plants, the coagulant(s) cost can be around 80% of the total chemical costs. Thus, these chemicals offer the best opportunity for cost savings.

Another example of possibly reducing cost is using different forms of the same chemical. For example, ammonium sulfate is added to the water to add

ammonia to form combined chlorine residual. Ammonium sulfate can be purchased in either the dry, granular form in 50-pound bags or the liquid form in 55-gallon barrels.

When determining and comparing the two different forms of ammonium sulfate to determine costs of chemical, the cost should be determined on the *ammonia* added basis (that is, the cost per pound of ammonia) and not the chemical poundage purchased basis. This will eliminate the error caused by the liquid form being priced per pound of solution (including water), and the dry form being priced per pound of dry ammonium sulfate.

In two situations the cost of adding the two forms of ammonia sulfate were compared. The difference in cost *per pound of ammonia added* was *4.5 times more for the liquid* than for the bagged chemical. Both chemicals are easily fed so that the increased cost is not justified.

In two situations the cost of adding the two forms of ammonia sulfate were compared. The difference in cost *per pound of ammonia added* was *4.5 times more for the liquid* than for the bagged chemical.

KRWA will be glad to assist in determining and evaluating chemical dosages and costs. Such an endeavor could result in optimizing the dosages and possibly reducing costs involved in adding treatment chemicals. Please contact Lonnie Boller or me if you wish to request such assistance.

Also, ammonia can be purchased in the liquid ammonia form (be sure not to confuse this with the liquid ammonium sulfate form). When comparing liquid ammonia to either ammonium sulfate form, be sure to compare on a cost per pound of ammonia/ammonium added basis. Liquid ammonia is usually less expensive but it is more difficult to handle and set up. it also present difficulties in feeding during warm weather because of vapor locks in feed pumps and feeding lines.

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