Wastewater: Reuse and Recycle

Part Three of a Series

Parts One and Two of our series on wastewater, published in the last two issues, reviewed the historical development of wastewater regulations, the impact on laundries, and examined the key steps on the path to compliance with these regulations.

There is a trend within in the industry to reuse or recycle the water that is being used on the wash floor. This is typically driven by the business or economics of the cost to purchase water and its disposal into the sewer. If you must treat your wastewater due to permit requirements, then the reuse or recycle option is an extension of that requirement.

Under all circumstances the decision comes down to the return on investment (ROI) or the payback calculation and the potential tax advantages of leasing or buying the equipment necessary to achieve your goal. Simply stated these factors must be weighed against any modification needed on the wash floor and the operational costs (electrical, chemical, labor, and by-product sludge disposal) in order to make a smart business decision.

Example One: Install a piece of equipment or a modification costing $50,000 that will save 30% of a $10,000 monthly combined water and sewer bill resulting, in a $3,000/month savings. However if an additional $500 is needed in operation and maintenance, then the true savings is $2,500/month. The resulting payback is $50,000 divided by $2,500 which equates to 20 months for a full payback. This payback calculation does not consider any potential tax effects which should be researched during each large equipment purchase/lease evaluation.

Example Two: Install a piece of equipment or a modification costing $250,000 that will save 70% of a $10,000 monthly combined water and sewer bill, resulting in a $7,000/month savings. However if an additional $500 is needed in operation and maintenance, then the true savings is $6,500/month. The resulting payback calculation is $250,000 divided by $6,500 which equates to 38.5 months. Much more time must be invested to achieve a positive goal. Again, this payback calculation does not consider any potential tax effects which should be researched during each large equipment purchase/lease evaluation.

The take away from these examples is that these investment and payback factors should always be evaluated when making a decision to reuse or recycle. Many organizations look for a payback period of under 24 months mainly because, as payback periods extend over longer periods of time, the risk factors increase and the time-value of money is not included in the analysis.

Reuse versus Recycle

Reuse of water in the laundry process involves the capture of certain cleaner effluents and redirecting that water to another use, generally upstream of the wash process. A tunnel washer is a very elaborate water reuse system that reducing water use by as much as 75% or more in certain types of laundering operations.

Recycle of wastewater is considered to be the ultimate in a water savings goal where over 85% of the intake water is recycled. Recycling of water will require some type of treatment to help remove certain impurities or soils prior to re-introducing the water to the wash process.

Types of Reuse

Passive Reuse: This type requires the least capital investment, and in the case of a tunnel washer may be integral to the unit itself (uphill counter-flow of modules). In conventional washers this may be the use of rinse waters being sent to a tank which is then used for the initial breaks and flushes of mat and heavy solids loading. This is by far the least expense technique rendering savings of up to 30% in usage. The ROI can be measured in months not years. If facilities must treat their wastewater for compliance, this should be the first step in order to lower gallons to be treated downstream and the cost associated monies needed via capital, chemicals, and maintenance of the system.

Active Reuse: Open up a laundry trade magazine and you will find at least two advertisements for these types of systems. Most tout a percent savings but at what cost?

Neither endorsing nor refuting any type of system let us try to describe the base system while weighing factors of:

- Percent efficiency
- Capital Investment
- Maintenance
- Electricity
- Chemical cost
- Sludge disposal
- Labor
- Application

Filtration - These systems rely on the use of physical filtration to remove particles in the washfloor wastewater which is then followed by activated carbon absorption for organics removal. Susceptible to bacterial growth, this factor is kept in check via disinfection by ultraviolet light, ozone, and chlorine. These types of units are found in lighter soil applications with a low level oil and grease, such as healthcare and hotel linen applications. They can reach their claims of reuse efficiency percentages of 30-60% more frequently on the lower end of the scale.

Filtration systems must be maintained to the manufacturer's specifications meticulously, especially on the cleaning schedule. If this is not done then bacterial growth will begin immediately and will rapidly affect the reuse water. This is usually caused by the type of bacterial growth being anaerobic in nature with a byproduct of hydrogen sulfide.

Maintenance costs include the periodic replacement of the ozone generators and ultraviolet lights. Also these subcomponents consume electricity in conjunction with pump or screening devices. Chemical costs include the semiannual carbon change outs and alkaline cleaning of the carbon columns. All of these actions equal labor in the range of 1-3 hours per day.

Ceramic Micro Filtration/Reverse Osmosis (CMF/RO) - These units are very much gaining popularity in the industry due to the claim of highest percentage of reuse. CMF systems usually will achieve about 60% recycle levels. When coupled with reverse osmosis, recycle efficiency levels reach 85% of incoming water usage according to vendor claims.

The theory of operation is easily grasped. After equalization of the wastewater through the use of a tank and mixing system, large solids are removed by screening devices, followed by medium-sized as well as some emulsified oils which can be taken out of the waste stream via centrifuges. True filtration then begins by using ceramic filters of decreasing porosity until the desired quality of the recycled water is reached. It is akin to passing the wastewater through an ever decreasing door leaving behind only what can't fit through. However, filtration does not eliminate any dissolved solids, such as dissolved detergents and builders or certain dissolved organic soils. Reverse osmosis is a technology that will remove dissolved solids and organic soils. This process will also reduce BOD and COD levels in the treated water.

These types of systems can be used for all varieties of laundry wastewater. They do require cleaning ranging from

Ceramic Micro Filtration/Reverse Osmosis

once a week with light soil to once a day for industrial laundry wastewater. Sludge produced in these units must either be dewatered or hauled and may be classified as hazardous in industrial wastewater applications

CMF/RO systems are the most costly application in terms of both capital cost (typically >$1M minimum without RO or >$1.5M with RO) and electrical consumption (>75hp). Cleaning agents can equal that used for chemical demulsification. Typical maintenance runs 4-6 hours per day. The ROI for such a system can stretch beyond the depreciation schedules allowed by tax codes.

Dissolved Air Flotation Unit - Similar to the CMF/


Dissolved Air Flotation Unit

RO unit, the water in a DAF must be equalized. The water is then treated with two to four chemicals to demulsify the water which creates a by-product sludge that must be removed and dewatered. This sludge is typically nonhazardous and can be disposed of as a commercial waste.

A large number of companies manufacture DAFs. They are used in our industry and other industries ranging from slaughter facilities to cosmetics manufacturers. The chemical programs are varied with compliance, chemical cost control, and sludge reduction being the main goals. If the water softener brine is not a part of the water to treat, then reuse of the DAF effluent is possible. Furthermore if color on the wash floor is not an issue or if that water can be segregated the reuse stream can be increased. Other components such as TDS and TSS effluent metering coupled with diversion valves can insure a level of consistent quality allowing sand or strainer technologies to bring the reused volume upwards and beyond 65%. The use of stream and current technologies can automate the system to the point where operations personnel are interfacing with the system to process sludge and maintain instrumentation.

The cost to treat is typically >$3/1000 gallons of wastewater. The capital outlay, without the equalization tank, is generalized at $10,000 per 10 gallons per minute of flow needed for the DAF with an additional $20,000 to $60,000 for the sludge press (with haul and disposal cost varying widely based on local regulations). Electrical consumption is typically less than 15hp total.

In summary, it is highly recommended that whatever technology is under consideration that the following three exercises be conducted:

1. Conduct a thorough cost/benefit analysis.
2. Negotiate a performance guarantee.
3. Run a minimum one month pilot test.

Finally, as the last portion in this series, it is the wishes of this author that you have gained an insight into this once daunting subject and it has been made to seem a bit less a "force to be reckoned with."

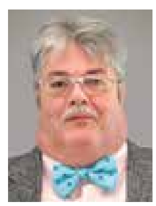

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Table I: Laundry Wastewater Reuse/Recycling Technologies

Type of System	Efficiency	Capital Outlay	Electrical Cost	Chemical Cost	Maintenance	By-Product
Passive	30%	Minimal	Slight	None	Low	None
Filtration	30-60%	>$300,000	High	High	Very High	Medium
CMF/RO	60-80%	>$1,500,000	Very High	High	Highest	High to Extremely High
DAF	50-70%	~$500,000	Low	High	Medium	Medium to High