Most operators either manage a municipal wastewater facility or an industrial one, but not both at the same time. I own a water/wastewater management and consulting company that, for nearly four decades, has operated both industrial and municipal WWTFs simultaneously. My company’s industrial treatment clients comprise those with direct discharges (regulated by State Pollutant Discharge Elimination System permits), as well as discharges into municipal systems (regulated by a municipality’s Industrial Pretreatment permits). I also manage municipal wastewater treatment systems with and without significant industrial contributions and discharges.

Clearly, moving from one project to another has afforded me a wide ranging perspective. My experience sitting on both sides of the table – representing the regulated industry and the municipality/regulator – gives me the benefit of understanding the challenges that confront these contrasting partners in wastewater management.

Profitability Always Key

Successful industries have to be razor sharp at a wide range of business management activities to remain sustainable in a challenging, competitive global marketplace. Few industries stay in business very long if they are not profitable.

A wastewater treatment system can be a significant expense for an industry, so industrial owners typically desire to minimize this expense. Many industries producing wastewater have located near municipalities that can accommodate their wastewater needs. Studies by the US Environmental Protection Agency have shown this cost is significantly lower than having to construct and maintain their own wastewater facilities. The federal 1972 Construction Grants Program had incentives for municipalities to build in “excess capacity,” which made it feasible for many municipalities to accept industrial wastewater for a fee. In many cases, this fee has offset the cost of treating a community’s wastewater – creating a win-win for both entities. In most cases, regulators encourage industries to discharge to municipal systems if the municipal system has the capacity available. It is often more beneficial for an industry to provide the required pretreatment for its more complex wastewater constituents and then discharge to a publicly owned treatment works (POTW) than attempt to obtain a SPDES permit for direct discharge.

In the 40 years since the Construction Grants Program began, much of the POTW capacity has been used up. So, what is next for industries and municipalities?

Municipal waste-based surcharges to commercial and industrial facilities for biological oxygen demand (BOD) and total suspended solids (TSS) typically range from 12–28 cents per pound, depending on the municipal plant size, process and available capacity. As municipal treatment facilities age and reach their capacity, industrial waste-based surcharges are likely to increase which, from a cost perspective, may tip the scales for industries to consider the cost effectiveness of constructing their own wastewater facilities with a direct discharge. Without new federal funding to replace aging municipal facilities, it’s likely that POTWs will no longer be able to accept non-municipal wastewaters – an arrangement which had supported much of the industrial development from the 1970s to today.

Contrasts and Similarities in Treatment Systems

Many industries are not located near a municipal system, so they construct and manage their own independent treatment systems. Managing an industrial wastewater facility is vastly different than managing a municipal system that collects the majority of its wastewater from residential users. There are as many different types of industrial wastewater facilities as there are different types of industries and products. Typically, there is only a handful of municipal technologies commonly employed for treating domestic wastewater. To list the different types of industries and their treatment methods here would be endless. So, for an apples-to-apples comparison, I will describe industrial systems that use similar treatment methods to most municipalities.

Most industrial systems that produce a biologically degradable wastewater with limited chemicals in their discharge utilize activated sludge systems similar to most municipal systems. Most industries have to augment their treatment processes with additional upstream and downstream treatment components, depending on the industrial wastewater makeup and discharge requirements. Unlike an old, leaky underground public sanitary sewer system, industrial continued on page 14
wastewater is usually collected from the manufacturing site all within the manufacturer’s buildings. Industry does not suffer from the uncontrolled hydraulic impacts from groundwater leaking into its pipes, or wet weather storm events. With my municipal operator hat on, I am on guard when a large rain event is about to happen. It is not a concern for an industrial facility. Piping on the inside of a building is also much easier to modify and repair, and the cost to do so is far less than finding leaks and repairing a sewer system under streets.

Industrial wastewater production can have significant flow peaks and organic loading spikes that match variable manufacturing production schedules. Industries typically use an equalization and/or neutralization holding tank to help adjust for pH, temperature, food augmentation, nutrient addition, mixing, pre-aeration, pre-oxidation and, sometimes, chemical precipitation. This is a big advantage that a municipal system typically does not have designed into its facility due to the very large flow a municipality processes daily. Although I have seen a few municipalities with flow equalization tanks to help shave peak wet weather events, they certainly are not the norm because of their expense.

I have found that a well-mixed flow equalization tank that holds approximately one day’s industrial production can be extremely useful to the treatment plant operator. A single grab sample of the day’s mixture from the equalization tank can be tested for target control parameters, allowing the operator to set feed rates to the next process treatment unit based on load, not just on flow. One can also capture a spill and contain it, or treat it, before allowing it to enter other process units. Numerous times, I’ve observed surface oils and been able to skim them off the top to prevent the oil from entering the biological process. Simple visual observations, such as color, foam, odor and floating objects, can provide a quick read of a potential problem. Most municipal operators do not have the luxury of this tankage, and the subsequent data for process control.

Waste Flows: The equalized and neutralized industrial wastewater is typically flow paced based on the concentration of the organic load retained in the tank. The goal is to provide the downstream biological process with a wastewater that is biodegradable, nontoxic, and has a consistent organic load to enhance biological assimilation without spike loading. Although the industrial wastewater flow volume is usually much less than what a municipal system experiences, the organic loading can be very concentrated. As an example, one industrial facility has an average flow of 100,000 GPD with an aeration basin equivalent to a 10 MGD municipal facility. It sometimes seems quite strange to see a two-inch influent pump feeding a massive multi-million gallon aeration tank with a 500 hp blower, followed by a 20-foot diameter, tiny final clarifier.

As an industrial troubleshooter, I find it important not to make comparisons to municipal facilities from both a design point of view and process management perspective. I have observed municipal industrial pretreatment inspectors making some rather outlandish judgments based on their municipal treatment points of view.

Temperature Shifts: Wastewater temperature entering most municipal facilities is fairly constant with gradual, seasonal changes. Industrial wastewater temperatures can have drastic swings. These temperature swings can impact operations by causing changes in the bioreactors that microbiology cannot tolerate, impacting dissolved oxygen levels and soluble oils. These in turn can cause biological inhibition. The biology can invert within a clarifier as a result of a sudden temperature shift. Effluent temperature violations can also occur. A loss of temperature can also be experienced when an industry closes for Christmas vacation or takes a production line down for maintenance. Cold winter periods with a sudden loss of temperature in an industrial wastewater facility can have negative results on a biological process, especially if nitrification is required.

At one industrial facility, 50,000 round plastic balls that float were added on the activated sludge tank’s surface to help retain temperature (see photo page 15). They work very well as a floating insulation blanket. Another industrial wastewater facility has a steam heating system diffused into the flow equalization tank that controls the equalization wastewater temperature before going to the biological process. In this, the temperature can be set and held constant, which is outstanding for growing microbiology, but not outstanding from an energy cost point of view!

Good and Bad Sludge: Sludge at an industrial facility can be an extremely variable product. A food processor, like a brewery, could compost its biosolids to produce a product that is easily marketable (i.e., agriculture and landscaping) with little downside. A municipal, however, could perform the same composting process but, with the potential pathogen risks, can create a negative public response. Another industry with heavy chemical usage may produce a sludge that might only be accepted at a hazardous waste landfill.

Industrial dischargers quite often impact the sludge disposal options municipalities may have. Strict pretreatment standards not only have to insure that industrial wastewater products do not make it into the receiving waters (pass through), but also that municipal sludge does not become concentrated with the ever-growing list of heavy metals and inorganic, synthetic, volatile and organic carbon compounds.

A mysterious sludge problem arose when a wastewater facility for a nuclear power generating site piping in only domestic sanitary wastewater had tested its aerobically digested dewatered sludge and found radiation that should not have been present. There was no piping connection into the secure side of the reactors. After a great deal of study, it was found that the dust on workers’ shoes brought minute particles over from the secure side. The floor mop water collected it and the wastewater facility concentrated it in the
Plastic balls placed on top of an activated sludge bioreactor tank at a pharmaceuticals wastewater treatment plant form a floating insulation blanket helping to retain temperatures.

**Product Related Impacts:** While municipal operations tend to be fairly constant over a period of time – except for the occasional large wet weather events creating huge flow peaks – industrial wastewater facilities are impacted by manufacturing cycles and the addition or loss of products. At one industrial facility, for instance, the production and resulting treatment plant was primarily focused around a high volume process for dying cloth. The treatment plant received a substantial flow and organic loading seven days a week. Offshore, competitive price pressures suddenly forced the manufacturer to shut down the cloth dying production line. You might think that the wastewater plant operator would be elated, not having to manage such a high volume and high strength wastewater – but it was just the opposite. The wastewater facility was now so large that the biological process did not work in the same single large aeration basin. The heat from the former process kept the wastewater plant warm which enhanced the biological process. The sudden loss of the dye process wastewater created an entirely new chemical matrix and the loss of heat – both had negative impacts on the biological process almost overnight. For the short term, the wastewater was heated and dog food was added to keep the process alive until structural changes could be made to the existing process. This took about a year to finish and tons of dog food. (No, the biology did not start to bark!)

The plant’s new configurations worked well until one day a new product line was added by the industry, which meant a total reconfiguration of the plant’s wastewater treatment again. Never a boring moment for the industrial operator!

Municipalities without significant industrial input do not have to think about reconfiguring their plants; although, recently, I have witnessed a few municipal plants that have each lost a large industry, causing them similar situations with too much plant capacity and a huge loss of revenue.

**Regulatory Standards:** I have observed that regulatory inspectors tend to hold industrial wastewater facilities with direct discharges to a higher standard than municipal facilities. This is likely because industries tend to deal with more toxic chemicals. Industrial SPDES permits require a greater level of monitoring with a larger list of compounds that are strictly regulated. Analytical testing costs are often much higher at an industrial direct discharger. The potential environmental risk that an industrial direct discharger poses as a result of manufacturing (with chemicals, production variability and spills that may take only minutes to arrive at the treatment plant) is justification for regulators to ensure proper systems are employed to manage releases effectively. I believe the public mistrusts manufacturers due to past events like Love Canal and numerous other chemical discharges into the environment. Recently, New York State has made great efforts, at great expense, to remove the accumulated toxic sediments on the bottom of its lakes and rivers. On the other hand, I have worked for industries that have safeguards and treatment systems that outspend and outperform municipal treatment facilities many times over.

**Management Methods and Job Dynamics**

I had signed an agreement with an industrial client and operated the facility for about one month. One day I was headed to its aeration basin to grab a sample and I was met with 10 feet of foam on the basin. The foam was red and blowing into the parking lot. I have seen that much foam on initial startups of new municipal wastewater plants, but not a red foam which was stripping the paint off the cars in the parking lot! I immediately called my contact...
inside the manufacturing plant who claimed that he did not know of anything in production that was red that was spilled. (Sound familiar?) After a week, the process was back growing successfully, when it happened again. This time my inside contact was on vacation. I was transferred to his assistant who had recently had her car repainted and was under the impression I was responsible for the recent foaming event. The initial conversation was somewhat edgy, when I asked, again: “What product do you have that is red and recently discharged to the treatment facility?” To my surprise, she replied that several products are red. “Let’s go walk around and see if there has been a spill,” I advised.

**Team Coordination:** That day started a long relationship linking the wastewater plant managers with the production managers. Daily meetings to review production schedules and specific products, allowed the treatment operators to become proactive instead of reactive, resulting in full permit compliance (and no more cars had to be re-painted!). In my opinion, to improve industrial treatment plant management, it is important to become an integral part of a team formed between manufacturing and wastewater treatment management.

It can be difficult for a municipality to create a team relationship like this with large industrial dischargers; however, such a team can materialize with a great deal of effort to establish and maintain it. Industry may look at a municipality as another regulator that wants to increase its expenses. It’s essential that the municipality understands the industry’s production process and products, making an effort to promote a team approach. This often results in the industry understanding the municipal operator’s issues and the impacts of spills and production changes on the municipal facility. For example, I encourage and set up meetings and tours at the wastewater plants I manage with local industries. This coordinated extra effort makes a big difference, and has been successful at solving problems that keep occurring without the added face-to-face time. Industrial managers usually call me when they have a spill because they know it helps us to take a proactive measure at the municipal plant they use. If one makes the effort to work with an industry but still receives the same type of response I received from the person who said his facility had “no such red product,” the only option may be to kick-start enforcement capabilities. While this is not the preferred method of gaining compliance, it may get the industry’s attention and, if handled properly, begin a positive working relationship.

**Working Conditions:** Employee working conditions at industrial versus municipal facilities can be quite different. Industrial chemicals create a higher level of concern for the industrial plant operator, as illustrated by the red dye that stripped paint off cars. Respiratory exposure can be a higher concern at an industrial facility as well. Spills and the mixing of chemicals together can create off gasses for which the industrial plant operator must keep a constant watch. Municipal operators have the potential for a higher level of bacterial exposures and deadly sewer generated gases that may not be as prevalent at an industrial facility.

Another observation is that industrial plant operators are typically paid at higher rates than municipal plant operators; yet, industrial pay benefits are not as good as municipal pay benefits. Also, industrial job security is not as stable in the long term. What perplexes me is that industrial operators, who often deal with much more complex and wide-ranging chemical treatment processes, are not mandated to be certified as industrial wastewater operators unless they treat domestic wastewater at direct discharge industrial facilities. Many extremely complex industrial pretreatment plants which discharge into municipal systems are not required to have operator certification either. In my opinion, this is an oversight by regulators. Ironically, I have been hired by a number of the larger industrial manufacturers to provide operator training at their plant sites. Most of the larger industries will spend much more money on training than municipalities do.

My experiences at both industrial and municipal treatment facilities are that the operators always want to produce the best effluent that they can; however, poor plant design, lack of training, inadequate equipment, lack of tools, or lack of sufficient funding can make these jobs more difficult for some than for others.

**Procurement Policies:** One aspect of managing an industrial facility versus a municipal facility is the procurement policies for purchasing new equipment and supplies. Municipalities are required to obtain a number of bids or quotes to purchase equipment. Writing bid specifications, sometimes involving engineers and attorneys, with advertising, reviewing and awarding to the low bidder can be costly and time consuming. In contrast, most industries look for the best equipment that will be reliable and will last to insure their production is not impacted. Quite often, it is not the low bid item that an industry will purchase. Such bidding may result in lower short-term costs, but when reviewed over a long period, the higher quality equipment that most industry purchases tends to be more cost effective and avoids lost down time. It also takes less time and money to procure – so they receive what equipment is needed, when needed. State municipal law sets requirements that must be followed, and I always comply with the low bid requirements for municipal facilities but, like the old saying goes, “You get what you pay for.”

**Future Outlook**

I am hopeful that American industry will start to outperform competitors globally, and there will be a resurgence of industry in New York State. This state has enormous water resources that industry will need as global climate change occurs and other areas suffer from dwindling water supplies. At the same time, because clean and abundant water is so important for the production of goods and services, we need to stay vigilant in mandating that the best technologies be used for pollution free discharges from both industrial and municipal treatment facilities. A good industry in a community is a blessing that can provide many good paying jobs for generations; but at the same time, handling their wastewaters can be a real burden to the municipal operator without sufficient capacity or good coordination with the manufacturer. Without adequate water and wastewater infrastructure and capacity, there will be limited industrial growth.

It is certainly worth the effort to properly fund and maintain wastewater treatment infrastructure, and to pass along operator knowledge on how. Whether you are an industrial or municipal facility manager/operator, the economic future depends on clean water for growth and a healthy environment. Although industrial and municipal management jobs may differ, the individuals in them hold the same goals in mind – producing clean water for future generations to use and enjoy.

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