Economic Recycling of Wastewater reduces Water Shortage.

By

George Alther, Biomin, Inc. Ferndale, MI.

And

Peter Cartwright, Cartwright Consulting, St. Paul, MN.

Water shortages have become a problem in America, due to an ever-increasing population and a dwindling water supply. Areas where water is being restricted are the west coast states, the southwestern states, and even New England states.

People are restricted in their use of lawn sprinklers in these states; it will become worse, unless some measures are taken to increase the water supply.

This article attempts to address this fundamental question: 1. Are there sources of water, which are untapped? 2. Can water be recycled by industry at a cost which does not cripple smaller users?

The answer is yes. Lets first look at the regulatory environment, particularly regulations pertaining to the discharge of oily wastewater by industry to POTW (publicly owned treatment works). The current limits for the discharge of oily wastewater for industry by the EPA are 100 mg/L. But some local limits in states like NC it are as high as 300 ppm. These limits are based on the different industries which generate these wastewaters. There are no known data on how much wastewater industry discharges which contains oil and grease, but it is substantial. Large water users are laundry processors, refineries, steel mills, car and truck washes, military bases, construction sites, and so on. Lets suppose that the EPA decides to lower discharge limits for oil and grease to 10, or even 5 mg/L. Would that cripple many industries because they would have to install expensive treatment systems? In Minnesota and Ohio, the standards are already at 10 ppm. Furthermore, there are industries which need a near zero level of oil and grease in order to prevent fouling of the media that removes heavy metals and hazardous organic compounds from water, such as the plating industry. These industries are surviving. What will industry do if they have to treat the water to pass such stringent oil and grease limits? They will obviously start recycling their wastewater, lowering the cost of use and discharge of fresh water. The question is, are there technologies available to reach such standards at an economical cost? The answer is yes. Oil/water separators have been in use for many years, but they are not reliable to guarantee reduction to below 10 ppm consistently, so fines for violations are a possibility. However, organically modified clay, which removes small amounts of oils from water, are being used, and are permitted by the EPA and Army Corps of Engineers. Thus, in its simplest form, a treatment train of an oil/water separator, a bag filter, and an adsorber filled with organoclay are all that is needed. If the oil is chemically emulsified, treatment becomes more complicated, but systems to break emulsions are well established.

Lets look at the cost of water first. In Minneapolis and St. Paul, the Metropolitan Council is responsible to the wastewater treatment plant. In addition to the “connection fees”, the user fee is $134.-/100,000 gallon. Charges for the treatment of "High Strength" wastewater, where concentrations for COD exceed 500 mg/L and 250 mg/L for TSS, encumber a charge of 88.- for drinking water and an additional $231.- for sewer discharge, for a total of $300.- per 100,000 gallons of water. In other cities, such as Elgin, IL, the same costs are $420.-, in Las Vegas they are $980.-.

Supposing you are in charge of a linen service in a hotel in Las Vegas, and you use 24 million gpy (gallon per year), your annual cost is: $235,200.-. Reducing the amount of water used to gpm (gallons per minute), you need a system that can handle about 44 gpm, 24 hrs per day, 7 days a week. Due to the presence of soaps, and soil, the system requires methods to break chemical emulsions. An oil/water separator that can handle such a flow costs around $10,000.-. An adsorber to house the organoclay, probably a unit that can handle at least 2000 lb or 40 ft3 organoclay, costs another 10,000.-. Ancillary equipment, which could be an ozonation unit to break down the emulsion, and an activated carbon adsorber to remove the surfactants, may be another $20,000.-, for a total of less than $50,000.- initial capitalization cost. Annual costs include maintenance and replacement of the organoclay and activated carbon, which adds 20,000.- per year. The bottom line is, if that facility can recycle one half of its wastewater, it saves $$116,000.-. The one time capitalization cost is recuperated in less than one year. That means the hotel saves itself $116,000.- per year, does not have to worry about inspectors entering its facility, and incurring possible fines, and the city of Las Vegas has 12,000,000 gallons of extra water available.

A second example might be a steel mill in St. Paul, MN. They might use 2 million gallon per year, at a cost of $12,000.- per year. If this water is flowing 24 hours per day, 7 days a week, their flow rate is 4 gpm. This is a very small system. Assuming spikes in flow, one would propose an oil/water separator- organoclay system to handle 20 gpm. Such a system would cost about $10,000.-, meaning that it is paid for within one year. If the steel mill cuts its water use to 1 mill gpy, the annual maintenance of the system will be about $7,000.-, the citizens have an extra million gallons available, and the steel mill adds a small amount of money to its bottom line. If these numbers of gpy water saved per year are multiplied across the country, it is obvious that hundreds of millions of gallons are saved. To extend this to the use of storm water, the following scenario is envisioned: A refinery, for example, or a parking lot, sets up a catch basin to collect storm water, treats it, and uses it as a fresh water supply in its operation, further saving water from the municipality. In states
such as Florida, sinkholes could potentially be lined and used to collect storm water.

Oil/water separators are well known in the industry, and have been in use for many years. But the lynch pin of the system is the organoclay, which is not as well know (but has been on the market since 1985). Organoclays consist of bentonite, which is modified with a quaternary amine. Combining the two by means of ion exchange, renders a product that can be used to remove smaller amounts of oil from water. It does this by the amine chains partitioning into the oil droplets, which are then fixated. The organoclay is blended with anthracite, which has a similar bulk density, to prevent early plugging of interstitial pores. The organoclay/anthracite is capable of removing more than 50% of its weight in oil, 7 times as much as activated carbon. That means 2,000 lb of organoclay CAN REMOVE 1000 LB OF OIL. It is a granular media, placed into the same types of filter vessels as activated carbon. No special handling is necessary. Disposal is usually into a back yard dumpster or a landfill, as long as it is not considered hazardous waste due to the removal of VOC's such as benzene.

Based on this treatise, it is clear that 1. the water supply in the US can be increased at no additional cost, and that industry can recycle a good portion of its wastewater at no extra cost. 2. The technology to do so is available and economical. If municipalities agree to extend tax breaks to ease the capitalization costs, all the better.