On the Water Front

First Quarter 2005

Treated Wastewater Reuse Programs

By George Luzniak-PCWA

In the western U.S., most of the available surface and groundwater has been claimed and appropriated. Additional supplies of freshwater and potable water for new or increased consumer demands may not be readily available. As freshwater supplies diminish and water demands escalate, the practice of water reuse gains momentum as a viable means of conservation. The reuse of municipal wastewater for beneficial purposes is a vital element for the world's total water resources management. The sale of wastewater produces additional revenue, as well as career opportunities in the field. Owners and operators of wastewater treatment systems are now urged to adopt the attitude that they are performing resource recovery in addition to treatment. Their operations are significant to environmental and public health. It is not just the treatment of wastewater anymore, but the recovery of a precious, natural resource.

Wastewater reuse programs have a wide range of applications. These environmentally sound business practices are spreading worldwide through education, public awareness and training. Industrial reuse of wastewater is becoming a regulated compliance business in many countries. In 2005, Thailand's government is mandating reuse for all industrial processes, including boiler feed and systems cooling. About 230 reuse water projects in Israel in 1987 produced approximately 70 mgd of reclaimed water from a population of over 4 million people. The majority of reuse projects in Israel make use of surface impoundments to store the water during the winter and have it available for the summer irrigation season. In California, high quality reuse water is being used for agricultural irrigation as follows; mixed agriculture (44%), harvested feed and seed (37%), pastures (12%), orchards and vineyards (3%), nursery and sod (2%), and food crops (2%). Reuse water for crop irrigation has also become a very popular

practice in South America. The Bellagio Hotel in Las Vegas is even using it for their fountain show.

In Orlando, Florida, a regulated wetland system was created using reclaimed overflow water due to a 20 mgd expansion of a water treatment plant. This successful Florida wetland consists of 1200 acres of dikes, mixed marshland, hardwood swamp and wildlife habitat, attracting hundreds of species of birds, aquatic and land animals. Environmental wetlands serve as nutrient sinks and buffer zones, have aesthetic and environment benefits, and can provide cost effective treatment through natural systems. Highly treated wastewater can also be used for indirect potable reuse by artificially recharging aquifers through streambeds or slow percolation through sand filters.

At the Plum Creek Wastewater Authority (PCWA) in Castle Rock, CO, effluent from the treatment plant is being pumped to several golf courses (including Castle Pines) for turf irrigation.

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Water For People Internship at Plum Creek

By Tammy Hill-PCWA

Centralized Regeneration Facility – a WFP project in India used to remove arsenic from drinking water

Water For People (WFP) is an international nonprofit organization committed to the long-term impact of access to safe drinking water and improved sanitation for the health of people in developing countries. Last spring, the laboratory and operations staff at Plum Creek Wastewater Authority and Castle Pines Metropolitan District had a unique opportunity to host Claudia Cossio, a chemical engineer with WFP in Bolivia. Her focus of study was the design, operation, and monitoring of water and wastewater treatment systems, with emphasis on testing to evaluate the quality of drinking water in rural systems.

Claudia spent the majority of her internship at Plum Creek Wastewater Authority, a 3 MGD wastewater treatment facility. She assisted with laboratory analyses and effluent quality monitoring, including *E. coli*, TSS, total residual chlorine, ammonia, and BOD. She also studied the process of activated sludge wastewater treatment, shadowed plant operations staff, and assisted with sample collection for process control. The remainder of her time was spent at the Castle Pines Metro District water treatment plant and distribution system, capable of processing 1 MGD of groundwater. She worked with district staff to study chlorination, iron removal, and turbidity monitoring.

Claudia also accompanied Plum Creek engineering, operations, and laboratory staff on tours of various other water and wastewater treatment systems and research laboratories to study alternate options for treatment and analysis. These locations included the small water treatment systems for the town of Sedalia and St. Francis of Assisi Church, Colorado School of Mines engineering laboratory, Golden treatment plants, Perry Park wastewater plant with a reverse biological contact (RBC) system, and the 45 MGD Denver Water Recycling facility.

Sharing time with Claudia undoubtedly enriched our staff. Her bravery in traveling around the United States to learn how to help people in her home country was inspiring, and she helped us realize the critical role that a supply of clean water plays in the health of developing nations. Our hope was to give her the opportunity to gain useful knowledge for her return to Bolivia, but we ended up learning from her as well. She is still working with WFP, teaching rural communities to install and maintain simple water treatment systems.

For more information on Water For People and a similar organization, Lifewater, see websites: www.waterforpeople.org and www.lifewater.org.

Recycled Domestic Water

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The reuse water is collected in large wells located at the PCWA plant. This recreational reuse water is sampled twice a week and tested for fecal coliforms and TSS, according to state of Colorado reuse guidelines. The reuse water is pumped through a distribution system of underground pipes and impounded in specially lined ponds on the golf course fairways. Signs are posted around the private ponds warning, "Recycled Domestic Water Do Not Drink". The individual golf courses have their own irrigation systems, which draw from the private ponds to water all the manicured turf grass and putting greens. Wastewater reuse for golf course irrigation provides a cost-effective water supply compared to potable water. Many states have already mandated that new courses use reclaimed water for irrigation purposes. Several courses are retrofitting existing systems to adapt to wastewater reuse programs. And why wouldn't they, considering that the reclaimed water is about 50% less expensive than potable water and is nutrient rich with phosphorus and nitrogen, a built in fertilizer for their expensive turf.

The golf courses are self-contained in terms of water emissions outside their property boundaries, meaning that their watering systems do not intentionally empty or tie into any offsite water supplies such as streams, creeks, public ponds or lakes. Even runoff is minimized by the landscape design curvature of the golf course grounds. An environmental concern is that nutrient loadings fed by the highly organic effluent will runoff, leech away and collect in alluvium or reservoir basins. This historical problem can promote algae growth in reservoirs, making them become eutrophic and anoxic. To closely monitor this situation, lysimeters are distributed around the golf courses to collect post-application reuse water samples to monitor organic nutrient levels. Lysimeters are approximately 2 feet deep, underground water collection basins, filled with layers of pea gravel, sand and soil, and developed to model natural ground filtration. The lysimeter samples are tested for nutrient levels on a weekly basis for as long as the golf courses are watering. In theory, nutrient uptake by turf and soil column will exceed application amounts and not allow any excess seepage to escape into the alluvium or reservoir basin.

The main consideration in developing a reuse program is that the quality of the reclaimed water be appropriate for its intended use. Higher level uses, such as food crop irrigation, require more treatment prior to reuse. In urbanized areas, where there is a high potential for human exposure to reclaimed water (landscape irrigation, industrial processes, toilet flushing, etc.) a minimum hazard does exist due to pathogens such as fecal coliforms. Chlorination, ozonation and ultraviolet radiation treatments are all applicable, proven disinfection techniques for wastewater. Important water quality objectives for reuse are adequate disinfection and maintaining chlorine residual in the distribution system. Reclaimed water must be clear, colorless, odorless and aesthetically acceptable to the public and to users. Reuse water research conducted in L.A. demonstrated that a high quality secondary effluent treatment (small doses of coagulant, polymer, or both, with direct conventional sand filtration and chlorine disinfection) can easily and consistently provide a satisfactory product. The Middle Eastern country of Kuwait provides tertiary treatment (activated sludge treatment, filtration and chlorination) for reclaimed water for agricultural irrigation.

In the U.S., 40 states have enacted reuse standards or guidelines. Because of their novelty, many programs are still evaluated on a case by case basis. Land application of wastewater effluent began in the U.S. for irrigation purposes in the late 1800s and for groundwater recharge in the early 1900s. The simplicity of the practice of sewage treatment and disposal, the natural fertilization of vegetation derived from the practice, and water recycling and reuse were recognized as benefits in these early uses of land application of wastewater. Today, the demands of a growing human population mandate the need for better management of finite freshwater resources. The floodgates are wide open for future career opportunities in wastewater reuse programs in the U.S.A. and around the world.

For References email newsletter@rmwqaa.org

Have You Ever Wondered...

Contributed by the EPA and Denver Water websites.

...Why and when water treatment began.

According to Twenty-Five Years of the Safe Drinking Water Act: History and Trends (EPA816-R-99-007), "People first treated water to improve its aesthetic qualities." Methods to improve the taste and odor of drinking water were recorded as early as 4000 B.C. Ancient Sanskrit and Greek writings recommended water treatment methods such as filtering through charcoal, exposing to sunlight, boiling, and straining. Visible cloudiness (turbidity) was the driving force behind early water treatments, as many source waters contained particles that had an objectionable taste and appearance. The Egyptians reportedly were the first to use the coagulant alum (a chemical that causes suspended particles to settle out of water) to clarify water in 1500 B.C.

...What causes aesthetic issues in drinking water.

The discoloration is usually rust from aging pipes. It is not harmful, but is aesthetically displeasing. Discoloration of the water can be a result of disturbances in the water line due to routine hydrant flushing, installing new pipe, or shutting off the water to a local area for system maintenance. Home plumbing can also cause discoloration of the water. Quarterly flushing of home water heaters can help.

Water can pick up tastes and odors from new pipes, low usage in the treated water, or from natural elements in the source water. Taste and odor events often occur seasonally during blooms of algae or aquatic plants. While the plant material is removed during treatment, sometimes the odors persist. Tastes and odors in treated water are not harmful and can usually be eliminated.

Have You Ever Heard Of...

Contributed by I. C. Pea

...Someone So Health Conscious?

A call came into a local water treatment facility where the customer was worried about the safety of her drinking water. A field sampler was sent to take a routine sample of her water to analyze for potential hazards. When the sampler arrived at the mobile home, the woman answered the door. She was clearly 9 months pregnant and had a cigarette hanging out of her mouth. She let the sampler into the disheveled home and says "I want to make sure my water is OK 'cause I don't want my baby comin' out all funny" as she takes a long drag off her cigarette.

Official Business:

In the last RMWQAA newsletter it was stated that Ted D. Miller had not paid for the 2004 seminar. There was a misunderstanding in registration and there is no discrepancy. We apologize for any negative publicity this may have caused.

... Someone so Ambitious?

A few years back I was conducting job interviews for the City. The next candidate was a polite young man with pretty good credentials. The interview was going well and I asked what he thought his best accomplishment was. He told me he once went drinking with his friends for 3 days straight.

To anonymously share your stories and events, or things you've wondered about email Newsletter@rmwqaa.org

Remember to check out our new website

www.rmwqaa.org

Check the site for info on a tours of Kodak and DIA laboratories, and the Analyst Certification exams in May.

Also, look for articles coming on Pregnancy in the Laboratory, Taste and Odor issues, Audits, and more!

Why are my fingers numb?...Lab Ergonomics

By Blair Corning-SACWSD

If you work in a water or wastewater laboratory, you've probably realized by now that there are certain tasks you must perform over and over again. Although this may be good for job security, it can take its toll on muscles, tendons, nerves, and joints in your upper extremities. Injuries of this type are often referred to by a variety of names including cumulative trauma disorders, repetitive stress injuries, or repetitive motion injuries. Examples of specific injuries common to laboratory workers include tenosynovitis, carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and wrist ganglion. These conditions are usually caused by the stress and strain of repetitive movements and static or awkward postures. Body parts can be placed out of their neutral position in many typical laboratory activities.

Twisting, bending, and over-reaching when unloading a laboratory dishwasher may put a strain on musculoskeletal system components. Exertion is another source of ergonomic related laboratory injuries. I'm not talking about "Lumberjack Challenge"-type exertion either. I'm talking about laboratory tasks like manipulating a pipette suction bulb, or squeezing a DI water bottle, that results in pressure or force being placed on soft tissues or rarely used muscles. Repetition of a high number of similar body movements over extended periods of time can also lead lab analysts to develop a repetitive strain injury. Activities such as unscrewing test tube caps, using forceps to manipulate coliform filters during an analysis, and pipetting are a few everyday examples of these repetitive movements. Another source of cumulative trauma disorders in the laboratory comes from the contact pressure caused by resting a body part on a sharp edge or hard surface. Leaning arms or hands on lab benches or hood airfoils can pinch nerves or restrict blood flow.

The table below contains some laboratory ergonomic tips. If you haven't already, hopefully you can institute some of them before you are confronted with the pain, aching, tingling, loss of strength or coordination, tenderness and swelling that can signify the onset of an ergonomic-related injury in the laboratory.

Task	Tips	Equipment Examples
Pipetting	Keep elbows close to body. Keep wrists straight. Keep waste bins, beakers etc. as close as possible. Alternate hands. Take frequent microbreaks.	Ergonomically designed light-touch pipettes for multiple finger use. Makers include Eppendorf, Rainin, and Finipipette.
Test Tube Handling	Arrange tubes to minimize reaching. Use both hands to open. Use tubes that are easy to cap and thread. Raise tube racks when needed.	Cap removers for test tubes and water bottles. Makers include Nalg Nunc International.
Microscope/ Viewing Scope	Take frequent microbreaks. Pad bench edges where forearms rest. Stand microscope at slight slant. Keep lens and eyepiece clean.	Ergonomic microscopy support by Wedge-Ease. Extended eyetube by Bay Optical.
Hoods	Relax arms while working in hood. Keep glassware, tubes, receptacles low profile. Alternate sitting and standing. Pad hood airfoil where forearms rest.	Arm and elbow rests. Manufacturers include Pacific Science and Wedge-Ease.
Benches	Use benches of appropriate height for work task. Use benches with padded or rounded edges. Work at a cut-out in the lab bench to get close to equip. Wear supportive shoes and install floor mats at benches.	Variable height bench by Labconco. Ortho Stand Mat by Wearwell.
Miscellaneous	Try holding forceps between index and middle finger. Keep water bottles full; match tip hole size to bottle size. Unload glassware washer from both sides. Chairs should have adequate support and adjustability.	Easy-Squeeze water bottle by Fisher. Ergonomic forceps by Mopec or LSS.

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