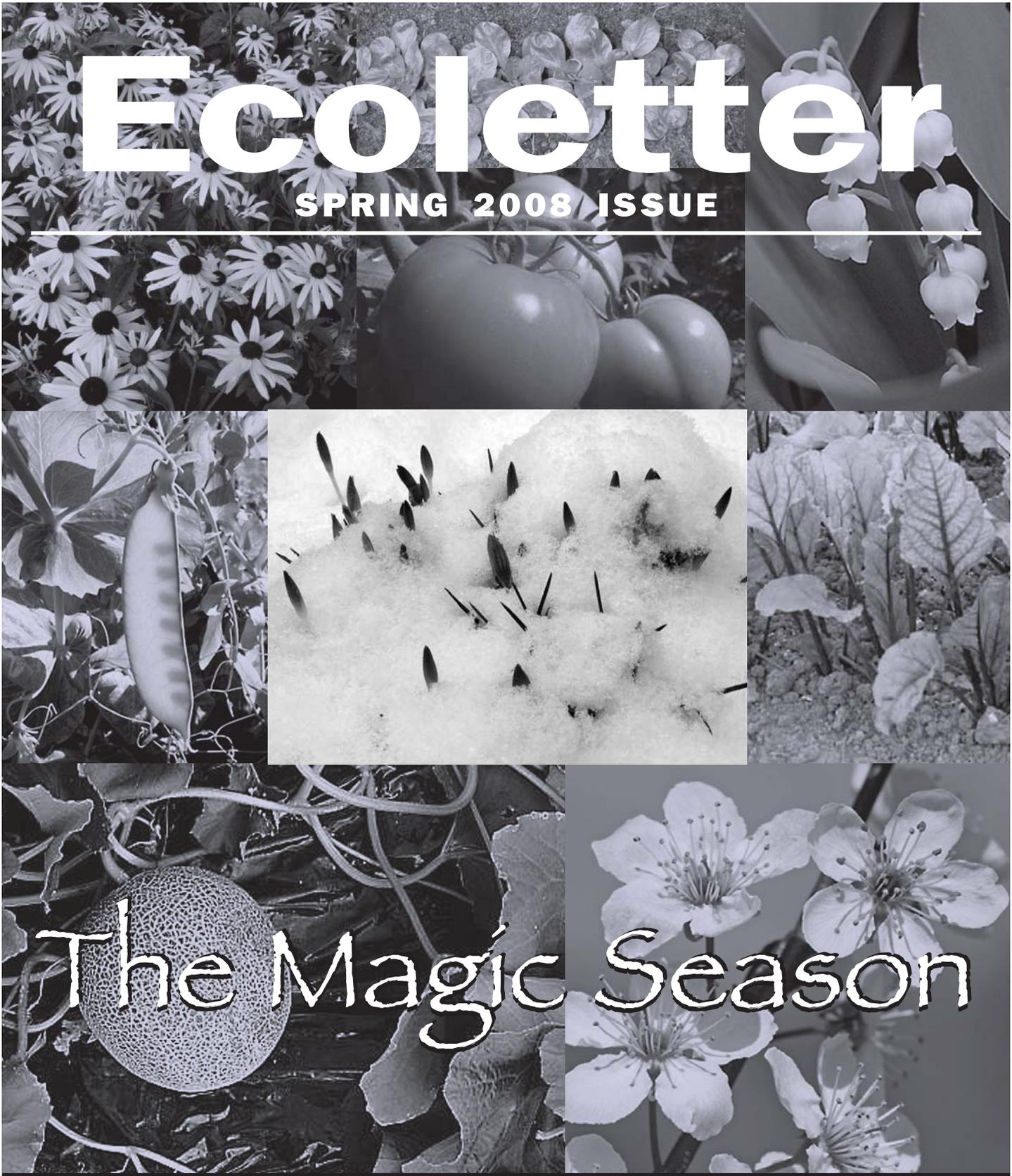


# Ecoletter

SPRING 2008 ISSUE



# The Magic Season

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*A Publication of the  
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# PRESIDENT'S MESSAGE



## WWOA President

—DuWayne Potter

**"The difference between 'involvement' and 'commitment' is like an eggs-and-ham breakfast: the chicken was 'involved,' the pig was 'committed.'" —Unknown**

### What are you? Involved or committed?

This is my third President's message and I'm guessing it will be in the issue of the *Ecoletter* that comes out prior to the first Tri Conference at the Ocean City Convention Center. I want to start off by thanking all of those people that were committed to making this a successful transition from the Clarion to the Convention Center. For those of you that have never been involved in the process of putting one of these together, let me tell you it takes a group of very dedicated people who by the end of it all may think they really need to be committed to an institution for a while to recover. The majority of them will however, step back up to the plate when called upon, forgetting the trials and tribulations of pulling this off and do it again for us next year. Thanks for going the extra mile for us.

I'd also like to thank the dedicated Officers and Committee Chairs of our four sections and Executive Board for their commitment to making the WWOA a viable, meaningful organization for our members. Without the commitment of a great many of people throughout the organization, we wouldn't have had the many training and social opportunities presented to us this year. Way to go, don't think your efforts aren't appreciated.

While I'm at it, who in the organization is more committed to bringing us a quality product year after year than the Short Course Committee? You'd have to look long and hard for a more dedicated group than those folks. So, thanks Short Course Committee!!! I appreciate the effort put into this.

Wrapping things up, (because I'm late with this and need to get it to Floyd) get involved, stay involved and see if it leads to your commitment. You will be with of fine group of people who if not already committed are certifiably committable. In the words of a fine actor, Mr. Foghorn Leghorn, "That's a joke... I say, that's a joke, son."

DuWayne



## CWEA President

—Karl Ott

Nearly three quarters of my term has already expired and I feel as though I'm just beginning to get a handle on this job. Although I have been associated with CWEA for over 25 years, and thought I knew most everything

about the organization, I had no idea what was in store in being president.

But, as I am not serving cheese with this whine, I will move on.

Your Association has been extremely active over the past nine months. You may read or have read about some of the following events in other places, but I think bringing them all in one location demonstrates the level of commitment and professionalism demonstrated by CWEA Members.

- On May 22, the Joint CWEA/CSAWWA Water Reuse Committee sponsored a seminar, "You Can Do It! Financing and Executing Your Water Reuse Project," on the issues utilities face when trying to finance and execute a water reuse project. This is a prime example of exploration of common grounds between our organizations. Kudos to Cynthia Lane, Bob Beringer, and the rest of the Joint Reuse Committee.

- The Stockholm Junior Water Prize winner for the State of Maryland this year is Brendan McMurtray of Ellicott City, Maryland, for his paper "The Effect of Chlorine on The Control of Zebra Mussels." Brendan is a ninth-grader at Marriotts Ridge High School in Marriottsville, Maryland. CWEA will sponsor Brendan and his teacher to attend the National Competition in Orlando, Florida in June. Many thanks to the Kathleen Kharkar and the Public Education Committee for their fine work in judging and selecting the winner.

- The Short Course Committee labors year-in and year-out to produce one of the finest training opportunities for water and wastewater operators in the region. The 59th Annual CSAWWA/CWEA/WWOA Short Courses for Water and Wastewater Operators will take place June 1–6, 2008 at Washington College, Chestertown, Maryland. For additional information, point your web browser to: [www.wwoa.cwea.org/short\\_course/short\\_course.html](http://www.wwoa.cwea.org/short_course/short_course.html).

- CWEA will be partnering with EPA, WEF, VWEA and FWQA in co-sponsoring a national WEF workshop, *Sustain-*

*Continued on page 28*

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## CALENDAR OF EVENTS

### Summer/Fall

**August 26–29, 2008**  
Tri-Conference  
Ocean City, Maryland

**September, 2008**  
Instrumentation Seminar  
Location: TBD

**November 14, 2008**  
FOG Seminar  
Linthicum, Maryland

[www.wwoa-cwea.org](http://www.wwoa-cwea.org)

## TO ALL MEMBERS:

**When completing membership renewals, make sure all information is correct and current. We use WMBA (WEF Membership By Access) for membership information. If there is an e-mail address, please include it.**

## CHANGE OF ADDRESS

*Please forward your change of address and membership number to the appropriate organization:*

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# EDITOR'S CORNER

Many areas of the Bay region received much rain, and in big doses, this spring. And in no surprise, there were many overflows of various sized facilities during high flow stresses. According to MDE, there were 1,380 overflows in Maryland, totaling 300.2 MG in 2007. The May rains will surely contribute to potentially bigger numbers in 2008. As for the immediate impact on the Bay of all the rain, turbidity reported at mid-Bay on MD DNR's Eyes on The Bay website peaked at 100 NTUs before returning to less than 10 NTUs in a couple of days. The impact on the submerged aquatic vegetation (SAV) by the high sediment and nutrient load will be assessed in the coming months.



Up in Pennsylvania, The Department of Environmental Protection has for the first time approved nutrient credits for reduction in ammonia air emissions. Using an integrated system of methods, a 1,400 head Lancaster County dairy farm will generate 175,000 Lbs. of nitrogen credits per year through not only traditional control of runoff, but also by control of airborne ammonia. Currently nutrient credits are selling for \$7-\$9 Lb./yr. in Pennsylvania's nutrient trading program, and the price could be headed higher with estimates to upgrade some state WWTP's to Bay standards in excess of \$10/Lb./yr. Pennsylvania allows trading between point and non-point sources.



A big shoe dropped on one of the Bay's hallmark seafood industries in May when Maryland and Virginia jointly announced emergency plans to reduce the harvest of female blue crabs by 34% to increase future populations above current low numbers. If this isn't enough, Susquehanna shad numbers are off 90% in the last seven years. Of course over fishing and poor water quality has been blamed, but so has the numerous rockfish that eat shad. Back in the 80's rockfish numbers were so low fishing was stopped. Talk about a restored fishery, and talk about a system out of balance. This brings up the ultimate system out of balance story; global warming. Maps are circulating showing what a predicted 27-inch rise in sea level will do to land in and around the Bay during the next century. Try the submergence of 415 square miles of dry land and marsh. Imagine Anne Arundel County, Maryland going away. That's how big an area that is. But we could try to look at the bright side and think about

the increased volume of Bay water and the associated solution to pollution is dilution effect. Essentially, the Bay will be going ocean.



In our further coverage of all the states in the watershed, Peter Thomson reported in this issue on what cleaning up the Bay means in Pennsylvania and West Virginia. As he reports, it means big trouble. And a similar situation is brewing way up in New York where state officials will issue NPDES permits during the next two years that will allow the state to live up to it's Bay commitment of reducing nitrogen by 38% and phosphorus by 52%. In the state furthest from the Bay, finding the money and the willpower to make these reductions will be more big trouble.



In what could be filed under weird news, The White House recently asked a local utility to examine wastewater samples for drugs such as cocaine with an idea it would give them a better determination of drug use. This certainly takes drug testing to another level, albeit a lower one. There's no word on whether the American Civil Liberties Union is looking into this matter.



We thank Janet Owens and Chris Peot of DCWASA for sharing some research projects undertaken at Blue Plains WWTP. Since their facility is the largest in the entire Bay watershed, these projects can have a major impact on how biosolids are used.



The article in this issue on the Delaware operator of the year awards reported that long time *Ecoletter* staff member, Steve Rohm, received a lifetime achievement award. After starting his career with the City of Baltimore, he worked over 20 years for The State of Delaware where he became manager of the solids program. In that role he came up with innovative solutions for end use of waste products from commercial food operations. He was also instrumental in establishing a training program for operators in Bulgaria and for many years taught courses at Delaware Tech. If this publication gave such an award, Steve would get one. Good for you Steve on a well deserved award.

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# Water/Wastewater Operators Honored at Environmental Awards Ceremony

—By Leanne Phillips-Lowe

Georgetown—Delaware’s water and wastewater operators were honored at the annual Operator of the Year awards ceremony, held May 1 at Delaware Technical & Community College, Owens Campus.

**Richard L. Buckler**, of Georgetown, who is the public works assistant for the Town of Millsboro, was the recipient of the 2007 Wastewater Operator of the Year award. There were seven nominees in this category.

The recipient of the 2007 Water Operator of the Year was **Ralph Hughes**, of Felton, who is employed as the public works superintendent for the Town of Felton. There were six nominees in this category.

**Lisa Wood**, of Ocean View, who works for Terra Firma Consulting, Inc., was the recipient of the 2007 On-Site Professional of the Year. This category had five nominees.

Each honoree received a wall plaque, a commendation from the Delaware House of Representatives, and a monetary award.

In addition, Environmental Lifetime Achievement Awards were presented to **Steve Rohm** of Milford; **Keith Hudson** of Georgetown; **Wayne Hudson** of Milford; and **John (Jack) A. Hanley** of Bethany Beach in recognition of their “sustained meritorious achievement and significant contributions to Delaware’s environment.”



Four Environmental Lifetime Achievement Awards were presented to, from left to right: Keith Hudson, Wayne Hudson, Steve Rohm, and John (Jack) Hanley was absent from photo.

Rohm is a retired program manager for the Department of Natural Resources and Environmental Control; Keith Hudson is a Level IV operator for the Town of Georgetown; Wayne Hudson was the former owner of Clean Delaware, and Hanley was a city engineer for the City of Wilmington.

The statewide Operator of the Year awards ceremony serves to highlight the role of Delaware’s water and wastewater operators in protecting the environment.

Award winners are chosen for their “outstanding technical excellence and exemplary work ethic contributing to the high level of water quality in Delaware.” The awards ceremony is held each year on the Owens Campus, which provides a state-of-the-art Environmental Training Center for hands-on education of operators from all over Delaware and surrounding states. The center has achieved international recognition for the excellence of its training programs.

Co-sponsors for the Operator of the Year awards ceremony were the Delaware Rural Water Association; the Delaware Department of Health and Social Services, Division of Public Health, Office of Drinking Water; the Department of Natural Resources and Environmental Control, Division of Water Resources; the Delaware On-Site Wastewater Recyclers’ Association; the Eastern Shore Chapter of the Water and Wastewater Operators Association; and Delaware Tech.



From left to right: 2007 On-Site Professional of the Year Lisa Wood, 2007 Wastewater Operator of the Year Richard L. Buckler and 2007 Water Operator of the Year Ralph Hughes.

# 2008 Student Career Fair

—By Carrie A. DeSimone, CBE Associates

The Chesapeake Section of the American Water Works Association (CSAWWA) and the Chesapeake Water Environment Association (CWEA) Student Activities Committees jointly hosted a Student Career Fair on February 22, 2008. The event was held at the scenic Back River Wastewater Treatment Plant (WWTP) which is owned and operated by the City of Baltimore.



Over 30 students registered for the event and submitted resumes. The students who attended the event were able to sign up for 20-minute interviews with 15 local water and wastewater engineering companies, utilities, and regulatory agencies.

City of Baltimore personnel graciously offered the students three separate tours of the Back River WWTP. The tour began at the headworks and continued throughout the treatment process up to the beautiful cascade aeration that allows the clean effluent to flow to Back River. Some students excitedly went to the top of the plant's unique golden egg-shaped anaerobic digesters!



Students received packets containing contact information and company profiles

for all of the employers present while employers received packets containing resumes from all of the students who had attended the event. Membership information from CSAWWA and CWEA was included in the student and employer packets. Additionally, several committee members were on hand to talk with students between interviews.



In conjunction with the Career Day, the CWEA, Virginia Water Environment Association (VWEA), and CSAWWA Young Professional Committees held a presentation entitled "Digester Gas Powers Energy Conservation at Baltimore's Back River Wastewater Treatment Plant." The presentation was given by Rusty Schroedel of Earth Tech—Global Water & Environmental Services, who was the project manager of the energy conservation project. Rusty pointed out that the project not only saves the City energy costs, but is also an environment sustainable project by decreasing green house gas emissions.

Following the presentation was a half-hour Young Professionals Question and Answer session where students had the opportunity to ask water and wastewater professionals questions. The Young Professionals panel included Josh Mah of New Castle County, Delaware, Matthew Marshal of the Maryland Department of the Environment, and Teresa DiGenova of Black and Veatch. The students were able to hear about differences in working for utilities, regulatory agencies and consulting firms.

CSAWWA, CWEA, and VWEA would like to thank John Martin for use of their impressive Back River Facility. We would also like to thank the following companies for their participation in the Student Career Day:

- Black & Veatch
- Brown and Caldwell
- CBE Associates, Inc.
- The City of Baltimore
- DCWASA
- EA Engineering
- Environmental Protection Agency
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- Heery International
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# DCWASA Research Project Progress Report and Summary

---

**Title: Determination of Optimum Tree Density and Biosolid Application Rate and the Effect on Water Quality and Tree Growth Using the Deep Row Biosolids Incorporation Method**

**Date:** February 18, 2008

**Main Contact:** Jonathan Kays, University of Maryland, [jkays@umd.edu](mailto:jkays@umd.edu) . (301) 432-2767 x323  
18330 Keedysville Road, Keedysville, MD 21756

## **Abstract:**

Deep row incorporation of biosolids at rates of 171 to 294 dry tons per acre using hybrid poplar has been an operational technique on a 100-acre gravel spoil in Maryland since 1984. Developed by ERCO, Inc, this technique involves the placement of biosolids at application rates of 171 to 294 dry tons per acre into trenches that are immediately covered with overburden, eliminating odor problems and maintaining the biosolids in a fairly stable, anaerobic environment. The site is then planted with hybrid poplar trees, the roots of which provide a natural recycling system that utilizes the nutrients over a six-year period in most cases.

This technique has great potential for application on thousands of acres of gravel spoils in the region; however, replicated research is needed to determine water quality impacts, soil limitations, and the best production methods at different application rates and tree densities. An initial three year research project started in 2002 on the ERCO site established a 3.1 acre research area that was followed by another three year research project to continue monitoring of the experimental treatments. The objectives are:

- To determine the effect of biosolids application rate and tree density on water quality around the deep rows on a gravel mine spoil, and the nutrient losses to the vadose zone,
- Nutrient removal by the trees, as well as growth and survival of hybrid poplar,
- Education of state and local environmental professionals about deep row applications to develop sustainable forest crops and simultaneously rehabilitate disturbed soils.

After five years of experimentation the movement of nitrogen through the soil profile and through woody biomass is becoming clearer from a landscape perspective using the water quality data, as well from the use

of geotechnical exploration. This report summarizes research on the 3-acre site within the ERCO property, and from the operational part of the property.

## **Summary of Work to Date:**

### **Introduction**

In 1983, ERCO Inc. developed the deep row application technique in response to the need to utilize large volumes of biosolids from the Washington, D.C. area and reclaim sand and gravel surface mine spoils. The company received a permit from the Maryland Department of Environment (MDE) for application of biosolids to grow nutrient-demanding hybrid poplar trees on nutrient-poor sand and gravel strip mine spoil. The trees were harvested at about 7 years of age when foliar leaf samples were below 3.5 percent nitrogen and total nitrogen mineralization in the biosolids reached 70 percent.

Approximately 10 acres were treated each year starting in 1984. The deep row technique initially involved the application of biosolids at a rate of 171 dry tons per acre and, for a special demonstration plot, at a rate of 294 dry tons per acre. Biosolids were placed in trenches that were 30 inches deep, 42 inches wide, and spaced approximately 8 feet on center. Trenches were filled with 18 inches of biosolids. The remaining 8–12 inches of trench were filled with overburden. The overburden soils were limed to obtain a pH of 6.2 as per permit requirements. Between 1984 and 1996, fast-growing, nitrogen-demanding, hybrid poplar cuttings were planted at a dense spacing of 3,000–4,000 trees per acre to utilize the nitrogen over a planned 6-year rotation. Since 1996, the tree spacing has been changed to 10 foot by 10 foot because the trees were found to grow much more with this spacing. Competing vegetation was controlled by mowing (no herbicides were used). After six or more years, a 10-acre section was harvested and subsequently cross-trenched for another biosolid application.

### **Site Location & Description**

The ERCO Beneficial Reuse Tree Farm site is a privately-owned 122 ac sand and gravel mine spoil in Prince George's County, MD within 25 miles of many large municipal wastewater treatment plants. The site is in the coastal plains physiographic region, approximately 20 miles east of the escarpment region that identifies the piedmont physiographic region. The site is approximately three miles north of Waldorf, MD.

The site consists of a plateau with steep banks that fall away to incised streams. The edges of the plateau

are bermed and runoff is routed to one of seven detention ponds. The elevation drop across the site is between 5-10 feet.

The research site is an existing reclamation site that has utilized deep row biosolid application with forest trees for 15 years. Prior to any biosolid application, the reclamation site was representative of thousands of acres of sand and gravel mines in the Metro Washington, D.C. area. At any one time, only one or two sections (10 acres each) are cleared and replanted. Hence, only 8-16% of the site is subject to significant surface runoff. In addition, the surface water flow on the site is significantly reduced due to the tree crops.

### Design/Methods

The 3.1 ac study site is located on the existing ERCO property and has previously received one biosolids application. A replicated treatment design was used to determine the effect of three tree densities and three deep row biosolid application rates on water quality and tree production (Table 1).

**Table 1. Treatment rates, depth of biosolids in the deep row, total deep row depth, and approximate biosolids application rate.**

Application lbs N/ac	Depth of Biosolids in	Total Depth of Deep Row in.	Biosolids Rate dry tons/ac
4,000	12.5	24	172
8,000	25	37	345
12,000	37.5	49	517

The width of the deep rows was maintained at 42 in and the depth was adjusted to accommodate the required amount of biosolids and allow for 8-12 in of cover on top of the biosolids. The maximum depth of the deep rows is limited by the depth to which the poplar tree roots can reliably grow.

In spring 2002, plots were established at the ERCO site. The site was partitioned into three blocks based on a north-south gradient. Each block contained each biosolids application rate/tree density combination. There were 30 treatments: 3 densities (0,290, 430 trees/ac), 3 application rates (4000, 8000, 12000 lbs N/ac), 3 replicates, and 3 control treatments (no biosolids, no trees). The result was an incomplete split block experimental design.

Within each treatment, the outer two rows of trees around the perimeter were used as buffers to isolate treatments. The sample collection areas within each treatment consisted of the innermost 16 trees, to reduce possible edge effects. The central area of four rows by four columns of trees contained all soil water sample collection equipment. The three control treatments (no trees, no biosolids) were instrumented in the central portion of the plots.

Biosolids application rates were randomly assigned within each block. Tree plantings were not randomized due to logistical considerations associated with the equipment and labor used.

### Water Quality Instrumentation and Measurement.

Each treatment (application rate x tree density combination) within each block contained several types of sampling instrumentation to evaluate hydrology and/or nutrient transport: 1) in each of the 30 treatments, one zero-tension pan lysimeter positioned 12 in directly below the bottom of a deep row; and 2) in each of the 30 treatments, suction lysimeters nested under and around the deep row.

Overall water quality in the ground water has been assessed by regular measurement from previously installed groundwater monitoring wells. Water quality sampling began in April, 2003. All subsurface water samples have been sampled for pH, nitrate, nitrite, total nitrogen, orthophosphate, total phosphorus, sulfate, and chloride.

### Tree Planting Method

The operational technique for planting hybrid poplar cuttings outside the 3.1 ac research area uses a low ground surface pressure bulldozer with a subsoiling bar to create a deep row about 1 ft deep. Trees are planted on a 10 ft. grid. The research site was planted in June 2003 using hand-planting with a dibble bar. The bulldozer weight had the potential to collapse the pan lysimeters. Vegetation management on the research area was implemented by applying pre-emergent herbicides such as Goal® and Pendulum®. The total height and basal diameter (5 mm above the growth from the cutting) was measured for each cutting after the first and second growing seasons (2003 & 2004) in the research plot and for a subset of trees in adjacent plots.

### Foliar Leaf Collection and Analysis

The collection of foliar leaf samples of hybrid poplar trees is an accepted method to assess the uptake of available nutrients by the trees and the impact of various treatments on tree growth.

### Results & Conclusions:

#### Deep Row Forestry and Nitrate

After five years of research the trends in nitrate movement around the trenches is started to provide clear patterns and estimates of potential losses of nitrate from the system. However, nitrate losses from deep row application using biosolids must be couched in comparisons with other common land uses, such as nitrate losses for agronomic soils amended with biosolids or inorganic fertilizer to grow corn-soybean rotations, and biosolids application on strip mines to establish vegetative cover.

Nitrate concentration has been measured in pan and suction lysimeters in the deep row forestry system

*Continued on page 14*

# DCWASA Project—Kays

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from November 2003 to October 2006, a period of 3 years. Up until July 2005, nitrate was not found in the pan lysimeters. Since then, the control treatment has reached levels of 2-3 mg/L and the treatments reached levels of 10 mg/L. At the same time, nitrate in the soil water as measured by the suction lysimeters increased. The two highest application rates had the lowest nitrate concentration and the lower application rate had the highest nitrate concentrations, hovering around 10 mg/L. Between July 2005 and October 2006, all nitrate levels remained between 1 and 10 mg/L. *The nitrate concentration draining from corn on agronomic soils using fertilizer or biosolids as the N source is as much as triple the nitrate level found beneath deep row forestry system, even with the highest biosolids application level.*

## Deep Row Forestry and Ammonium

Ammonium is a precursor to the formation of nitrate and trends in this nutrient have been carefully followed from November 2003 to October 2006 to determine trends. Ammonium is clearly increasing with depth for all biosolids treatments, with significant differences between treatments becoming apparent from November 2003 to November 2005. Ammonium levels in November 2005 at 15 and 60 cm. increased to 2000 and 400 mg/L, respectively. While ammonium levels at 30 and 60 cm may have leveled off, additional suction lysimeters were installed at 120 cm below the biosolids trench in all plots during summer of 2007 to determine ammonium movement in the profile. Data collection will commence in October 2007.

## Hybrid Poplar Survival and Growth (2003–2007)

During the first two growing seasons survival of trees in the research plot was excellent at 86% and 97%, even though height growth was reduced for seedlings damaged by deer browsing and 17-year locusts. Drought in the last three growing seasons (2005, 2006 & 2007) resulted in significant mortality with survival plummeting to 74%, 65%, and 70%, respectively. A separate study found that tree shelters did eliminate browsing by deer the first year but resulted in now differences in height growth. Drought may have been a factor.

There were no changes in survival between Blocks in 2003 & 2004; however there was a clear increase in survival from Block 1 to Block 3 (of about 20%) for the three drought years of 2005 to 2007. The trend is attributed to difference in soil composition that effect water availability during drought periods.

There were clear differences in height growth between blocks, tree density, application rate, and biomass, although the differences for tree density and application rate are difficult to explain. A trend of increasing tree height from Block 1 to Block 3 started in 2004 and became more pronounced by 2007. The

difference is attributed to the better moisture holding capacity of the soils in Block 3 that improved growth during the drought years of 2005 to 2007.

Destructive sampling was completed for trees from 2-6 year's old in the operational area of the property and the dry weight and nutrient content determined through lab analysis. Biomass equations were developed that only require the measurement of diameter at breast height (4.5 ft).

## Comparison of Trees in Research Plots and Operational Area

At three years of age, trees in the operational area of ERCO had more than double the height (4.9 m) compared to trees in the research area. After five years, height and diameter of trees in the operational area were almost three times as high and biomass eight times as high. The combined impacts of no subsoiling for site preparation, deer browsing, and drought explains much of the poorer growth on the research plots.

## Recommendations to Improve Growth and Survival

Other research supports the significant impact of drought stress on the biomass production of hybrid poplar. Irrigation could provide significant improvements in survival and growth on the ERCO site that is exposed to extremes of drought, soil composition, and deer browsing. The best strategy to reduce the impact of increasing levels of deer browsing is to get trees to 5-6 feet tall as quickly as possible to get them out of the reach of deer. Irrigation could help to maximize early height growth.

## Foliar Nutrient Analysis

The overall foliar levels of %N range from 2.89 to 3.39 across the research plots over the first three years, and fall on both sides of the 3% N suggested for fast growth. Foliar levels for N of 3.5% and higher are regularly reported on the ERCO operational area. The taller heights reported for trees in Block 3 are correlated with higher levels of foliar N and K.

## Conclusion

The research plots at ERCO represent a worst-case scenario for growth hybrid poplar due to the multiple effects of deer browsing, drought, and soil composition changes. Given the importance of rapid tree rotations to the deep row business model, the use of irrigation to assure good survival and growth, especially during times of drought, may be well justified but more research is needed.

## Project Schedule and Progress:

The project will reach the end of its sixth and to-date final year of funding in June 2008. Additional funding will be sought to continue water quality monitoring and assessment of growth and biomass production, as well funding for irrigation studies with hybrid poplar trees.

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- Felix, E., D. R. Tilly, and G. F. Felton. (2006) Biomass production of hybrid poplar (*Populus* spp.) grown on municipal biosolids. Department of Environmental Science & Technology, University of Maryland, College Park (in peer review).
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- Kays, J. S., E. Hammond, G. Felton, E. J. Flamino. (2006). **Biosolids Fact Sheet Series: Effect of Deep Row Incorporation on Water Quality**. Keedysville, MD: MCE.
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- Kays, J. S., D. Johnson, E. Hammond, G. Felton, E. J. Flamino. (2006). **Biosolids Fact Sheet Series: Hypothetical Business Scenario for Deep Row Biosolid Incorporation for a Hybrid Poplar Forestry Operation**. Keedysville, MD: MCE.
- Kays, J. S., E. Hammond, G. Felton, E. J. Flamino. (2006). **Biosolids Fact Sheet Series: Five-Year Results of Hybrid Poplar Clonal Study Using Deep Row Incorporation**. Keedysville, MD: MCE.



Gary Wyatt, P.E. receives the Golden Manhole Award from Carlos Espinosa, P.E., Collection System Committee Chair and Laurie Terry, P.E., Collection System Committee Vice-Chair

## CWEA Collection System Committee Awards Golden Manhole Award

The CWEA Collection System Committee awarded the Golden Manhole Award to Mr. Gary Wyatt, P.E. during the committee's spring luncheon seminar on March 27th. Mr. Wyatt recently retired from the City of Baltimore Department of Public Works after 30 years of service. He dedicated his entire career to serving the citizens of Baltimore City by improving the City's aging infrastructure. His dedication to the community and to his profession has been exemplary. Mr. Wyatt led the City's \$1 Billion Consent Decree Wet Weather Program, providing leadership and innovative initiatives such as the Comprehensive Flow Monitoring Program, the development of the **Baltimore Sewer Evaluation Standards Manual (BaSES Manual)**, and the Data Collection Quality Assurance Clearinghouse to name a few. Mr. Wyatt has co-authored numerous papers for local, regional, and national conferences. These include the 2007 WEFTEC Conference, where he co-authored a paper titled "Comprehensive Flow Monitoring Program—The Baltimore City Approach."

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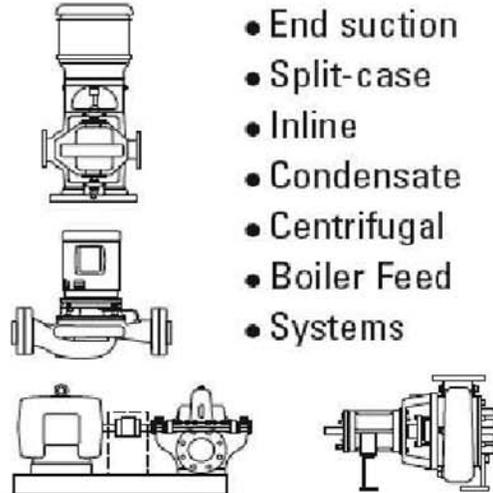
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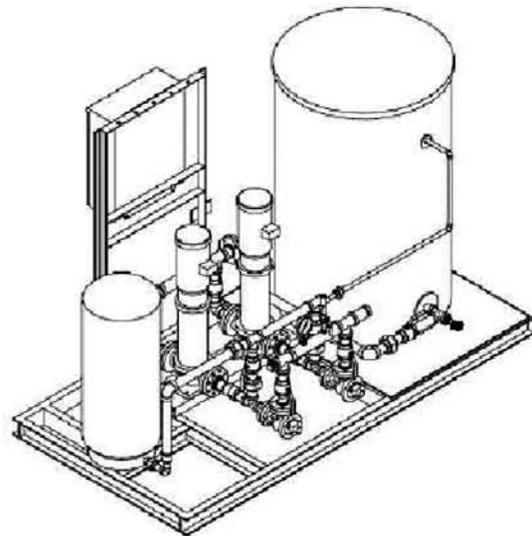
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# DCWASA Research Project Progress Report and Summary

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**Title:** Application of Deep Row Biosolids Incorporation for Production of Hybrid Poplar in Virginia Coastal Plain Mineland Reclamation Sites

**Date:** February 11, 2008

**Main Contact:** Greg Evanylo, Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, VA 24061-0403; Ph: 540-231-9739; Email: gevanylo@vt.edu

## Abstract

We initiated a study at a heavy mineral mine reclamation site in 2006 to determine whether we can use hybrid poplars to assimilate high amounts of deep row incorporated (i.e., entrenched) biosolids-applied N and P with no detrimental impact of N, P, and heavy metal leaching during the reclamation of coarse-textured soils. Two rates each of anaerobically digested and lime-stabilized biosolids and four annual fertilizer N rates for poplar were established. All treatment plots were instrumented with zero tension lysimeters below and suction lysimeters adjacent to the trenches to collect and analyze leachate for potential groundwater impairing pollutants. Denitrification potential above each trench and redox potential within the trenches are being monitored monthly. Hybrid poplar seedlings were planted directly over the trench at a spacing of 3 m between plants for a total of 5 trees/row (10 trees/plot) in March 2007. Based on the analytical results of the samples collected 6–7 months following biosolids application, entrenchment of biosolids in very coarse-textured soils containing little organic matter poses leaching risk of nitrogen, occurring initially as ammonia N. We expect nitrate N leaching to begin to increase as nitrification proceeds, but the magnitude of this loss will depend on the capability of the poplar trees to assimilate N and the extent of nitrification permitted in the coarse-textured soils. While the concentrations of P in leachate were initially higher than eutrophication standards, P transport declined rapidly. The potential loss of P via leaching through coarse-textured soils will likely be controlled by the content of P-binding capacity constituents (i.e., Fe, Al) in the biosolids. Transport of heavy metals was undetectable for most of the metals studied. Where detectable, metals were largely transported in particulate phase. With time, transport of Ba, Cd, Ni, Pb, Fe and Mn was increased under some of the biosolids treatments.

## Summary of Work to Date

### Introduction:

Deep row incorporation of biosolids on sand & gravel and mineral sands mine reclamation sites for the production of energy biomass offers an agriculture land application alternative. With this approach, the biosolids are placed into long trenches and covered with 6 to 12 inches of excavated mine soil. Employing a hybrid poplar short-rotation plantation enables the production of non-food chain, forest products and wildlife habitat and the restoration of abandoned, organic matter-depleted soils resulting from surface mining.

Despite total N and P application rates that are much higher than typical for high N-assimilating agronomic crops, University of Maryland researchers measured minimal losses of nitrate-N in shallow groundwater monitoring wells and lysimeters. The lack of nitrate-N leaching has been attributed to (1) the maintenance of very low redox conditions in the biosolids which limits nitrification rates and (2) the presence of a fine-textured, semi-confining stratum immediately below the trench.

The potential application of this technology to extensive areas of sand & gravel and mineral sands mines in Virginia raises several questions. Daniels et al. measured significant losses of nitrate-N from conventional surface incorporation of biosolids applied at three to ten times the agronomic N rates on gravel mined lands in Virginia. Increases in the nitrate-N concentration of local groundwater, when present, have been short-lived. Coastal Plain sites in Virginia are often underlain by a thick gravelly or sandy/loamy backfill with a seasonal water table within several feet of the soil surface, which poses the potential for groundwater impairment. The objectives of our project are:

1. To determine the concentration and mass losses of N, P, DOC, and heavy metals in leachate from biosolids trenches under intensive poplar culture in a coarse-textured mine backfill hydrologic system.
2. To measure the net effect of any such losses of N, P, C, and heavy metals on local groundwater under and around the deep row biosolids incorporation system.
3. To develop a mass balance estimate for N, P, C, and heavy metals in the deep row biosolids incorporation soil-plant system over three years under Virginia mine conditions.

## Methods:

We established this study at the Iluka Resources, Inc. heavy mineral mine reclamation site in Sussex County, Virginia. Trenches were excavated in all plots and instrumented with lysimeters prior to biosolids application. Zero-tension lysimeters were placed below each trench and suction lysimeters were placed between trenches to assess the concentrations and masses of potential pollutants transported from the biosolids.

We established the following 8 treatments, replicated 4x in a randomized complete block:

1. 0 kg fertilizer N/ha/yr
2. 168 kg fertilizer N/ha/yr
3. 337 kg fertilizer N/ha/yr
4. 505 kg fertilizer N/ha/yr
5. Lime stabilized (Source: Blue Plains) biosolids entrenched 45cm (w) x 75cm (d)
6. Lime stabilized (Source: Blue Plains) biosolids entrenched 90cm (w) x 75cm (d)
7. Anaerobically digested (Source: Alexandria) biosolids entrenched 45cm (w) x 75cm (d)
8. Anaerobically digested (Source: Alexandria) biosolids entrenched 90cm (w) x 75cm (d)

Biosolids were delivered to the site on June 26-28, 2006 (Alexandria) and July 17-19, 2006 (Blue Plains), placed into trenches, and covered with fill from the trenches, and the entire area was graded to provide a soil cover of approximately 30 cm over the entrenched biosolids.

Biosolids were sampled at time of application and analyzed for chemical and physical properties that enabled us to assess the biosolids quality and calculate the constituent loading rates.

Leachate is being sampled bi-monthly from all lysimeters for analysis of particulate and dissolved forms of nitrate (NO<sub>3</sub>-), ammonium (NH<sub>4</sub>+), and total Kjeldahl N; orthophosphate (PO<sub>4</sub>-3) and total Kjeldahl P; the metals silver (Ag), aluminum (Al), barium (Ba), beryllium (Be), cadmium (Cd), copper (Cu), iron (Fe), manganese (Mn), nickel (Ni), lead (Pb), tin (Sn), tungsten (W), and zinc (Zn); and the metal ligands sulfate (SO<sub>4</sub>-2) and dissolved organic carbon (DOC).

Platinum electrode assemblies are being used to measure redox conditions in the biosolids amended and unamended trenches in order to understand conditions that may affect N transformations (i.e., nitrification, denitrification). Denitrification potential employing acetylene reduction is being determined by measuring N<sub>2</sub>O emanating from the biosolids, fertilizer, and control treatments.

## Results:

### Zero-tension lysimeters (N):

1) Higher concentrations of ammonia N were found under all biosolids treatments than under the control, and ammonia was higher under lime-stabilized than

anaerobically-digested biosolids. Nearly all inorganic N leaching from the biosolids was in the ammonia form; thus, considerably higher concentrations of ammonia than nitrate N leached into the lysimeters.

2) Nitrate N concentration in the lysimeter leachate was initially low but began to increase from the biosolids treatments at concentrations higher than the unamended control by late fall following the summer of application. Greater concentrations of nitrate N were detected below the lime stabilized than the anaerobically-digested biosolids.

3) Higher concentrations of TKN were found under all biosolids treatments than under the control, and the lime-stabilized tended to have higher TKN concentrations than the anaerobically-digested biosolids.

4) Higher amounts of total N leached from the biosolids treatments than from the control.

### Denitrification:

5) Greater amounts of N were lost via denitrification from the biosolids than from the control treatment in 2006 and from the fertilizer treatments in 2007. Denitrification rates were highest in summer 2006 following biosolids application, decreased during the cooler winter months, and increased again as air and soil temperatures increased in spring and summer 2007. Denitrification losses were higher from the anaerobically digested than from the lime stabilized biosolids, possibly because the high pH of the lime-stabilized biosolids does not provide a favorable environment for denitrifying bacteria.

### Zero-tension lysimeters (P):

6) Ortho-phosphate (O-P) concentration in the lysimeter leachate followed the same patterns as N, but the O-P concentrations were very much lower than N. The fall O-P concentrations under the biosolids treatments (ranging from <0.01 mg/l to as high as 0.15 mg/l) were lower than O-P concentrations in some potable water and in reclaimed water subjected to advanced nutrient removal processes at wastewater treatment facilities.

7) Total Kjeldahl P concentrations in the lysimeter leachate were initially highest shortly after application of biosolids and declined with time. The TKP concentrations were an order of magnitude higher than the O-P concentrations, which indicated that nearly all of the transported P was bound to some particulate matter (e.g., Fe, Al, organic matter). The reduction in TKP with time indicates an increase in P binding with aging.

8) Biosolids O-P and total Kjeldahl P mass loadings were higher than the control treatments during the initial sampling period, but treatment effects diminished by early fall.

*Continued on page 20*

# DCWASA Project—Evanylo

Continued from page 19

## Zero tension lysimetry (Metals):

9) The concentrations and, thus, the loadings of Ag, Be, Sn, W, and Pb in the zero tension lysimeters were non-detectable and not significantly greater than the control during the first 6 months. Cadmium, Cu, Ni, and Zn were never different from the control concentration. The only metals that were higher in a biosolids treatment than in the control were Fe and Mn, trace metals whose mobility is known to increase under reducing conditions favored by the saturated soil. Nearly the entire fraction of all detectable metals occurred as particulate rather than dissolved, indicating that the metals were transported through the coarse-textured, reclaimed mine soil adsorbed to or precipitated on colloidal/particulate matter.

## Conclusions:

Entrenchment of biosolids in very coarse-textured soils containing little organic matter poses environmental risks of nitrogen leaching, occurring initially as ammonia and, later, as nitrate. The magnitude of the nitrate loss will depend on the capability of the poplar trees to assimilate N and on the extent of nitrification that occurs through the coarse-textured soils. Considerable amounts of N were also lost via Denitrification, which likely served to reduced the amount of nitrate leached.

While the concentrations of P in leachate were initially higher than eutrophication standards, P transport began to decline quickly. The potential loss of P via leaching through coarse-textured soils will likely be controlled by the content of P-binding capacity constituents (i.e., Fe, Al) in the biosolids. The Fe and Al contents of the Alexandria and Blue Plains biosolids provide high binding capacity media that should limit P solubility and transport.

Transport of heavy metals was undetectable for most of the metals studied. The metals were largely transported in particulate phase, possibly bound by colloidal organic matter-metal (e.g., Fe, Al) complexes. With time, transport of Ba, Cd, Ni, and Pb was increased under the lime-stabilized biosolids, and transport of Fe and Mn was increased under anaerobically-digested biosolids. Only Cd, Ni, and Pb were increased in their soluble fractions under the lime-stabilized biosolids. The mobility of such metals have been shown to increase when complexed by fulvic acids under high pH conditions of alkaline stabilized biosolids. Despite some mobility, the mass of leached metals was extremely low. It remains to be seen the fate of such metals as the entrenched biosolids continue to age.

## Project Schedule and Progress

### 2008:

1) Continue to collect and analyze lysimeter water samples to determine chemistry and fate of various forms

of N, P, and heavy metals as affected by treatments under hybrid poplar culture

2) Determine metal speciation in leachate solution using the MINTEQA2 model to elucidate the forms of the metals being transported from the entrenched biosolids

3) Collect and analyze intact core samples from the biosolids seam for analysis of total and key fractions of N, P and C to determine chemical and biochemical.

### 2009:

1) Continue to collect and analyze lysimeter water samples to determine chemistry and fate of various forms of N, P, and heavy metals as affected by treatments under hybrid poplar culture.

2) Determine biomass and nutrient uptake patterns of the hybrid poplar overstory, herbaceous vegetation and litter layers to develop nutrient balance.

3) Excavate soil pits and volumetrically remove the cover soil layers, biosolids pack and underlying soil to allow calculation of N, P and C on a volume basis to enable calculation of N and P balance and C sequestration.

## Publications to Date

Kostyanovskiy, K., K. Lasley, G.K. Evanylo, B.F. Sukkariyah, and K.C. Haering. 2007. Environmental consequences of deep row biosolids incorporation technology in coastal plain mining sites in Virginia. Virginia Tech Deans' Forum on the Environment. Blacksburg, VA. February 25. p. 183.

Kostyanovskiy, K., K. Lasley, G.K. Evanylo, B.F. Sukkariyah, and C. Shang. 2007. Transformation of Phosphorus and Nitrogen in Deep Row Biosolids Incorporation Technology at Coastal Plain Mining Sites in Virginia. American Society of Agronomy Annual meeting. New Orleans, LA. November 4-8. <http://a-c-s.confex.com/a-c-s/2007am/techprogram/P36228.HTM>

Lasley, K., Kostyanovskiy, K., G.K. Evanylo, and B.F. Sukkariyah. 2007. Metal Forms, Mobility, and Transport through Entrenched Biosolids at a Titanium (Ti) Mining Site in Dinwiddie County, Virginia. American Society of Agronomy Annual meeting. New Orleans, LA. November 4-8. <http://a-c-s.confex.com/a-c-s/2007am/techprogram/P34615.HTM>

Evanylo, G.K., Kirill Kostyanovsky, Katrina Lasley, Beshr Sukkariyah, and Chao Shang. 2008. Environmental effects of biosolids trenching for reclaiming mined land for hybrid poplar production. In Proceedings of the Water Environment Federation Residuals and Biosolids Conference. Philadelphia, PA. March 30-April 2. (In press)

# CWEA Collection Systems Committee Presents: Cutting Through the FOG

—By Ted DeBoda, P.E., URS Corporation

The CWEA Collection System Committee held a luncheon seminar entitled “Cutting through the FOG,” on March 27, 2008. The seminar was conducted at the spacious Richlin Ballroom in Edgewood, Maryland, just off Interstate 95. Approximately 100 wastewater professionals from both public and private sectors came out to participate in this roundtable discussion on the issues surrounding implementing a Fats, Oils and Grease program.

John Fletcher, an active member of the CWEA Collection System Committee, introduced the diverse and very qualified panel of experts in the topic of Fats, Oils, and Grease (FOG). The panel included Charles Card, FOG Program Coordinator for WSSC; Karl Ott, Pretreatment Coordinator for Charles County, Maryland; Sandy Harley, of Sahara Communications; Bob Wimmer, Engineer, JMT; and Justin Price, of Environmental Biotech, Inc.

The first speaker, Charles Card, provided a history of the WSSC FOG program (following a brief analogy of Homer Simpson’s FOG plan), which has been in place since 1992. Their FOG program was initially a reactive program, addressing primarily backup and overflow emergencies. The consent decree issued to WSSC in 2005 changed FOG to a proactive program, including an expansive public outreach campaign. Partnered with the Restaurant Association of Maryland, WSSC developed a “Restaurant Manager’s Guide to Controlling FOG Discharges” which was published in five languages to educate the food service industry on the need for responsible regulation of discharges.

WSSC also implemented a Food Service Establishment Enforcement Response Plan modeled after its Industrial Pretreatment Program. Inspection software can be used to generate enforcement documents on-site using tablet computers. By revising the Plumbing and Fuel Gas Code, WSSC was able to expand its regulatory authority to implement the new permitting and inspection programs. New enforcement options enacted under the consent decree include civil fines of \$250 to \$1000, compliance directives, and injunctions against continuing violators. Deadlines for corrections range from 30 to 90 days, depending on the nature of the repairs needed, and extensions could be requested where needed. Although



Karl Ott, CWEA President, answers questions from the audience.



An attentive audience listens to the panel of FOG experts.

no changes were immediately made to the plumbing requirements for grease abatement systems, WSSC has plans to do so later this year.

Karl Ott provided a brief outline of Charles County’s initiatives to address FOG in the sewers. Although Charles County does not consider their FOG program to be “comprehensive,” they have created an aggressive grease program. Under this program, all food handlers must have

an in-ground greasetrap with a 2,000 gallon minimum capacity that is pumped and cleaned at least every quarter. Facilities using only prepackaged or microwaveable foods can be exempt from the program’s requirements.

Residential grease remains a problem because the County cannot regulate residential accounts. Public Education has become instrumental to Charles County’s grease control program. The GreaseBusters educational program, which won the 2003 WEF Award, targeted elementary schools, the county fair, and civic associations. The program has made great strides in educating the public about FOG-related concerns. Since 2000, grease-related SSO events and backups have shown a tremendous decrease throughout Charles County.

Sandy Harley spoke next about strategies for incorporating public awareness into a FOG program. Whether the target audience is a residential community or the food service industry, a short, catchy campaign theme, informative brochures and fact sheets, and a comprehensive ad campaign can go a long way to securing public cooperation and support. She suggested taking advantage of opportunities provided by a variety of media outlets, including advertising on websites, billboards, local radio and television shows, and newspaper supplements. Emphasizing the eco-friendly aspects of the campaign and reaching out to bi-lingual constituents, as well as holding regular meetings with residential and commercial groups, can also provide valuable support for a FOG program.

Next, Bob Wimmer introduced the concept of “Grease Floats,” which describes the nature of grease  
*Continued on page 22*

## Cutting Though The FOG

Continued from page 21

problems that occur in wastewater treatment plants as well as collection systems. "Grease Floats" anywhere it has the opportunity to accumulate, and particularly during time of high flows. The buildup of grease and other FOG discharges cause a blinding of the screen in the plant's headworks that is difficult to remove.

The periodic nature of these concentrated grease loadings is a challenge. Coordination between a municipality's collection system staff and the treatment plant staff is vital to success. Treatment plant staff should be notified when sewers are being cleaned in areas where grease is a problem so that they can be prepared to clean the screen at the plant's headworks and address components of the solids handling system.

The final panelist to speak was Justin Price of Environmental Biotech, Inc. He described a myriad of impacts of FOG in the sewers. In addition to blockages in gravity lines and pump stations, FOG can impact treatment system components (as described by Bob Wimmer), and cause equipment breakages, increased odors, vermin, and sewer overflows. He also discussed the importance of incorporating education and Best Management Practices (BMPs) into an overall solution. The requirement of grease interceptors will have little effect on grease entering the sewers if not coupled with maintenance monitoring and

education. Biological solutions can also be effective if incorporated into a comprehensive program.

Mr. Price closed his discussion right before lunch with some wonderful close-up photographs of FOG laden manholes, sewers, and grease interceptors.

John Fletcher wrapped up the session by citing that 40 to 60 percent of sewer stoppages are related to grease. For 60 to 70 percent of those grease-related stoppages, there is an underlying reason for the grease buildup, such as roots or sewer defects. A common theme related to all effective FOG programs was education, both to gain the cooperation of commercial food establishments and to reach out to the general public as a way of decreasing grease-related stoppages.

Carlos Espinosa, Chairman of the Collection Systems Committee (CSC), took the opportunity to introduce Gary Wyatt, the Chief of Utilities for the City of Baltimore. CSC awarded Mr. Wyatt with the Golden Manhole and welcomed him into the Golden Manhole Society in recognition for his years of service and dedication to wastewater management over the last 30 years. Mr. Wyatt said the honor left him "at a loss for words."

The broad spectrum of expertise covered by the panelists sparked quite a few questions for the Question and Answer session after lunch. These questions will be addressed in the Collection System Committee's full-day FOG conference scheduled for November 14, 2008. Stay tuned for more information.

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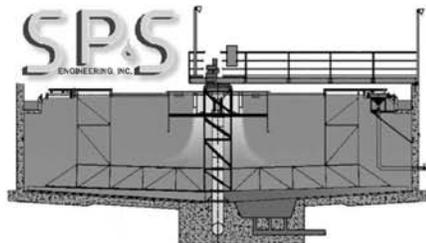
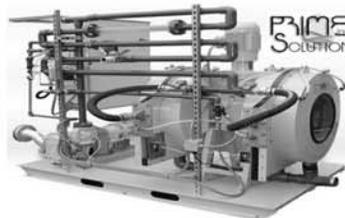
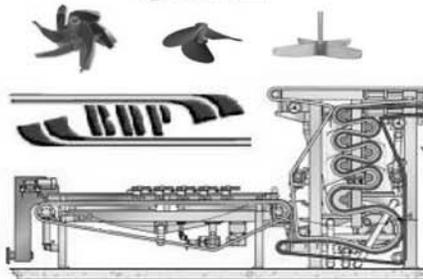
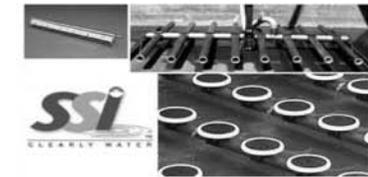
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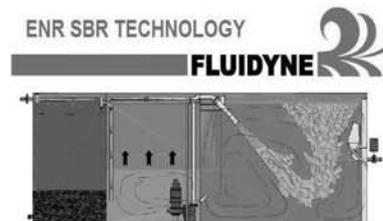
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# ARE YOU A LEADER IN SAVING ENERGY?



—By Chip Wood, Ecoletter staff

As if recent demands such as asset management, homeland security management, nutrient management, inflow & infiltration reduction, safety awareness, operator training, beneficial residual use, vehicle fuel conservation, etc. are not enough to keep an operator occupied, now we have energy conservation concerns. Prior to the energy vogue, many shift operators could set their process parameters and not have to be bothered for a few hours—no more—operators now must work to do quality treatment at minimal energy use. This means more planning, analysis, tweaking and doing projects.

Unlike the Maryland government, the state of Wisconsin Department of Natural Resources (WDNR) has required the State's water and wastewater industry to develop positive programs for efficient use of energy. In doing this, many water and wastewater systems in the state were studied to provide energy usage and flow data to the WDNR. The state of Wisconsin has approximately 1010 wastewater systems and 581 drinking water systems. The article here presents concepts excerpted from the Wisconsin WDNR program.

## QUIZ: DO YOU HAVE AN ACTIVE ENERGY MANAGEMENT PROGRAM?

### Have you:

- Performed assessments to identify best practices to save energy?
- Appointed an energy advocate among facility staff to champion energy-efficiency projects?
- Instituted a program to continuously monitor, review and assess energy consumption on a monthly and yearly basis?
- Established an internet-based program to share energy data among various functions?
- Established a capital improvement program to generate funds?
- Made energy reduction a factor in the evaluation of new projects?
- Developed and maintained communications with management to increase awareness of the value of energy management?

### More specifically, has your facility staff performed calculations, improvements or measurements such as:

- KWH per MG pumped or treated?
- Cost of KWH energy per time of day
- Cost of KW peak-energy-use per time of day
- Installed Power Meters on Motors?
- Used ammeters to check motor loadings?
- Instituted a Premium Efficiency Motor program?
- Installed power factor correction capacitors on your blowers?
- Made Electric Bill Copies available to Chief Operator and Shift Operators?
- Know terms on electric bill and understand how charges are computed?—energy-use awareness is first step toward energy management.
- Know difference between Demand and Energy cost savings?
- Installed sub-metering on individual buildings or sub-process systems?
- Compared your facility energy consumption with other similar facilities?

**If your facility lacks any of these essential ingredients, then you have room to improve.**

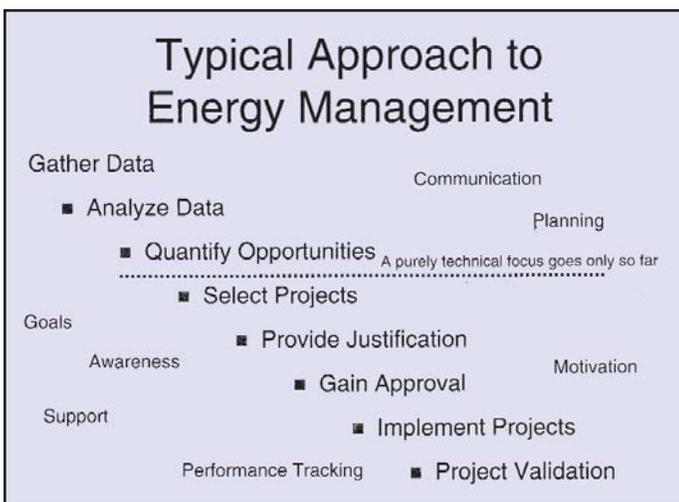
The following slide reproductions will provide suggested steps, i.e., "Management Best Practices" to get started:

### Table 1) Establish an Energy Management Program—Theory versus Practice

## Energy Management ....

...in Theory	...in Practice
• Management Commitment...	...Management Concern
• Energy Champion...	...Another "Hat" for Someone
• Measure & Monitor...	...No Payback on Sub-Meters
• Report & Communicate...	...Monthly Actual vs. Budget
• Set Energy Savings Goal...	...Based on What?
• Implement Projects...	...No Support

**Table 2) Typical Approach to Energy Management**



Upper half is the “technical” stage—that is easy. Bottom half is the “people” stage—that is most challenging.

**Table 3) Steps to Getting Started—only six simple actions—looks inviting**

- ## Steps to Getting Started
1. Establish a Baseline Energy Use and Facility Profile
  2. Estimate Energy Use for Major Systems
  3. Identify Best Practice Opportunities
  4. Quantify Savings and Project Costs of Opportunities
  5. Prioritize Projects
  6. Project Management

**Table 4) Baseline Energy Data for “Clearwater” Wastewater Treatment Plant in 2005**

## Baseline Energy Use

Clearwater Wastewater Treatment Facility

Month	MWh MG	Consumption (MWh*)	Prod Units MG of Wastewater	Billed Demand (kW)	Total Electric Cost
Jan	6.88	330	48	320	\$19,800
Feb	6.42	308	48	320	\$18,480
Mar	6.22	336	54	360	\$20,160
Apr	6.07	364	60	400	\$21,840
May	6.14	387	63	420	\$23,220
Jun	6.02	397	66	440	\$23,820
Jul	6.06	400	66	440	\$24,000
Aug	6.00	414	69	460	\$24,840
Sep	5.71	394	69	460	\$23,640
Oct	5.52	348	63	420	\$20,880
Nov	5.67	340	60	400	\$20,400
Dec	5.59	302	54	360	\$18,120
<b>AVG</b>	<b>6.02</b>			<b>400</b>	
<b>TOTAL</b>		<b>4,320</b>	<b>720</b>		<b>\$259,200</b>
<b>5% GOAL</b>	<b>5.72</b>				<b>-\$12,960</b>

\* One megawatt-hour (MWh) = 1000 kilowatt-hours (kWh)

Now is the tedious part. Table 4 shows marriage of electrical billing data with operator’s monthly flow data for one year. Data in 2nd column from left is energy used to treat one MG of wastewater. “MWh” refers to a megawatt hour, which equals 1000-kilowatt hours of energy, i.e. a megawatt is one million watts. Data in the 2nd column is computed by taking data in 3rd column and dividing it by data in 4th column. Data in 5th column is peak energy demand, in kW (kilowatts) for the month. Data in 6th column is monthly electrical energy cost at an average rate \$0.06 per KWh, and was computed by taking data in 3rd column and multiplying it first by 1000 and then by \$0.06. Notice there is no separate cost breakdown for the KW peak demand usage in 5th column.

A Central purpose of the tabular baseline data is shown at bottom line. The goal is to reduce the 2005 annual average of 6.02 MWh/MG by 5 per cent to 5.72 MWh/MG for the next year 2006 and to reduce the total annual cost of \$259,200 by 5 per cent or reduce by \$12,960, assuming constant electricity rate.

This means operations staff must focus on reducing the energy used to treat every million gallons without exceeding plant effluent limits.

**Table 5) Plant (Facility) Profile for Clearwater WWTP for the three years 2003 thru 2005.**

## Facility Profile

Facility Energy Profile - Summary  
(Does not include gas, water or other utilities that should also be tracked.)  
Clearwater Wastewater Treatment Facility

Electricity	2005	2004	2003	% Change 2004 to 2005
Consumption (MWh)	4,320	4,500	4,872	-4.00%
Electrical Cost (\$)	\$259,200	\$247,500	\$243,600	4.73%
\$ per MWh	\$60.00	\$55.00	\$50.00	9.09%
<b>Key Performance Indicators</b>				
Millions of Gallons (MG/ Yr)	720	740	761	-2.66%
MWh per MG	6.00	6.08	6.40	-1.37%
Electric \$ per MG	\$360.00	\$334.60	\$320.19	7.59%
<b>Business Indicators</b>				
Operating Costs	\$2,700,000	\$2,750,000	\$2,800,000	
Electricity as % Oper. Costs	9.60%	9.00%	8.70%	

This table is a good representation of the numerical complexity in dealing a situation where operators improved the efficiency every year but the result is partially negated by increasing electrical rates every year. Notice that the flows (water treated), MG/Yr, went down every year from 2003 thru 2005 and that the corresponding electrical consumption, MWh, went down every year. Also total operating costs went down every year. This is expected. Also, the electrical energy used

Continued on page 26

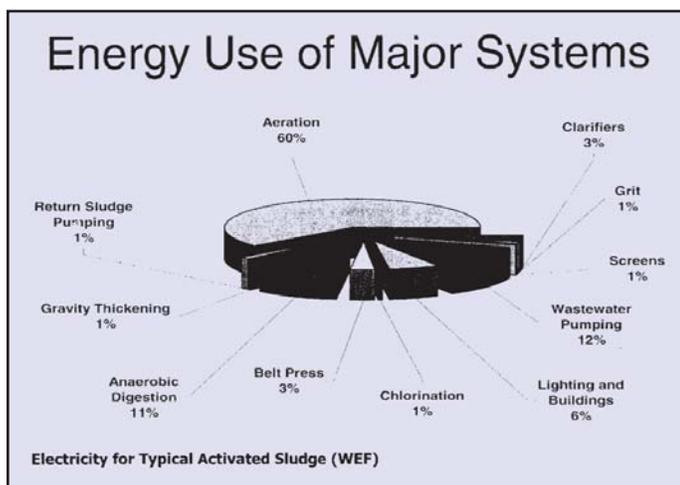
# Are You Saving Energy?

Continued from page 25

for treatment, in MWh/MG, went down every year. This means operators improved energy efficiency – great job. However, the improvements in energy efficiency were over come by increases in electricity rates, causing the \$ per MG to increase every year. So even though operators became more efficient every year, and that the total operating cost (electricity plus everything else) went down every year, this caused the electricity cost as per cent of operating cost to go up every year. This trend was apparently due to operators increasing efficiency in means other than electrical energy, so when electrical cost went up every year, the effect was offset by the operators increasing efficiency in ways other than electrical energy.

What the table does not show directly is what would have happened if the operators had not made energy efficiency improvements. Take the 2005 flow at 720 MG and multiply it by the 2003 treatment efficiency rate of 6.40 MWh/MG and multiply this times the 2005 rate of \$60/MWh and get \$276,480 hypothetical electricity cost for the year 2005. Actual electricity cost for 2003 was \$259,200, so operators saved \$17,280 for 2005. So you could say that the chart does not directly show the results from improvements in energy efficiency for treatment.

**Table 6) Energy Use by Major Systems of a Typical WWTP**



Notice that biggest electrical energy users are aeration at 60 per cent and pumping at 12 per cent.

**Table 7) Energy KPI for 85 WWTPs in state of Wisconsin.**

TREATMENT TYPE	FLOW RANGE (MGD)	NUMBER OF FACILITIES SURVEYED	kWh per MILLION GALLONS	kWh per 1,000 LB OF BOD	kWh per 1,000 POPULATION EQUIVALENT
Activated Sludge <sup>6</sup>	0 - 1	26	5,440	3,178	242,032
	1 - 5	14	2,503	1,426	88,465
	> 5	11	2,288	1,505	93,365
	All AS	51	3,954	2,258	162,934
Aerated Lagoon	0 - 1	15	7,288	4,232	262,569
Oxidation Ditch	0 - 1.2 <sup>6</sup>	19	6,895	3,696	229,316

KPI means “Key Performance Indicator.” Notice the smaller the activated sludge plant, the more energy per MG is used. Also, the typical activated sludge plant is much more energy efficient than aerated lagoons and oxidation ditches. How does your plant compare with the kWh per MG energy used here?

**Table 8) Energy KPI (Best Practice) Benchmarking—85 WWTPs**

FACILITY TYPE	FLOW RANGE (MGD)	AVERAGE ENERGY USE (kWh/MG)	TOP PERFORMANCE QUARTILE (kWh/MG)	Best Practice Benchmark (kWh/MG)	Average Potential Savings <sup>1</sup>
Activated Sludge	0 - 1	5,440	< 3,280	3060	44%
	1 - 5	2,503	< 1,510	1650	34%
	> 5	2,288	< 1,350	1760	23%
Aerated Lagoon	< 1	7,288	< 4,000 <sup>2</sup>	3540	51%
Oxidation Ditch	< 1.2	6,895	< 4,000 <sup>3</sup>	4320	37%

This is an extension of Table 7, showing the potential for energy savings. For example, for the activated sludge plants with capacity exceeding 5 MGD, the average energy use is 2,288 kWh/MG. According to state experts, an energy use of 1,760 kWh/MG is attainable, meaning a 23 per cent reduction is attainable.

## Operational Scheduling

### Strategies

1. Minimize operation during peaks
2. Eliminate operation during peaks

### Methods

1. Use system computer model
2. Evaluate Electric Rate Opportunity

## Operational Scheduling

### Rate Structure

1. Peak Hours – 10 a.m to 9 p.m.
2. Peak Days – Monday to Friday
3. Summer – Mid June to Mid October
4. Rate Reduction
  - Winter – 24.6%
  - Summer – 33 %

These show a simplified set of first steps for an energy management program

A good website for energy program info is USEPA's [www.energystar.gov](http://www.energystar.gov).

**Good luck with your energy program.**

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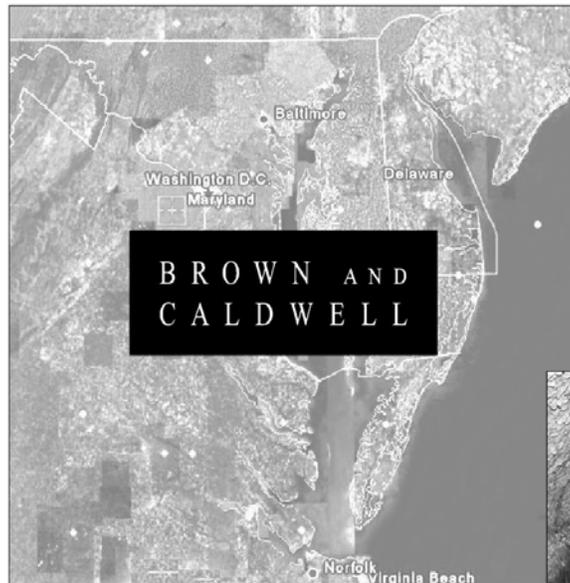
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## CWEA President Message

Continued from page 3

ability 2008, June 22–25, 2008, at the Gaylord National on the Potomac, National Harbor, Maryland. This conference will bring together researchers, regulators, designers, planners, technology developers, students, municipal agencies/utilities, facility managers/operators, industrial dischargers, and other environmental professionals from around the world to share and debate the current state of knowledge for sustainable approaches and green practices in the water environment. For information, go to: [www.wef.org/Conferences-Training/ConferencesEvents/Sustainability](http://www.wef.org/Conferences-Training/ConferencesEvents/Sustainability).

- The 2008 Tri-Association Conference will be held in Ocean City, Maryland, August 26–29, 2008. This year, we've moved from the Clarion Fontainebleau to the Ocean City Convention Center. This is shaping up to be the largest Tri-Association Conference yet! The Tri-Con committee has scheduled 95 technical presentations and 119 exhibitors, along with the usual assortment of social events, not the least of which is an evening at Seacrets, complete with food and live music. Kick your shoes off and wiggle your toes in the sand. You should note that in an effort to make room for all the technical sessions, the Opening Session will be held **Tuesday** afternoon from 4:30 to 6 PM. The Conference Brochure should be printed, mailed and in mailboxes in June. It will also be available on-line at [www.wwoa-cwea.org](http://www.wwoa-cwea.org) in early June. Please plan on attending this annual event. Remember that the CWEA Annual Business Meeting is part of the conference.

- The CWEA Plant O&M Committee is planning to hold an all-day seminar on *Instrumentation and Control Strategies* in September 2008 (actual date TBD). Look for a notice coming to your e-mailbox soon.

- After a successful luncheon seminar on March 27 in Edgewood, MD, the CWEA Collection System Committee will present a Full-Day Fall Seminar on November 14, 2008, on "CUTTING THROUGH THE FOG (continued)" at the Maritime Institute of Technology and Graduate Studies (MITAGS) in Linthicum, Maryland. Again, look for a program announcement coming soon.

- CWEA will be joining a growing number of WEF Member Associations helping to sponsor World Water Quality Day. CWEA has committed to purchase a number of water quality testing kits for distribution to teachers, schools, scout troops and other community organizations. From the World Water Monitoring Day website ([www.worldwatermonitoringday.com](http://www.worldwatermonitoringday.com)):

*World Water Monitoring Day™ is an international education and outreach program that builds public awareness and involvement in protecting water resources around the world by engaging citizens to conduct basic monitoring of their local water bodies.*

What could be better suited to CWEA's mission? This is a really fun method of generating awareness of water quality locally and globally. If you would like to participate, or if you know of a teacher, school, scout troop or other organization that would like to participate, please contact Kathleen Kharkar, Public Education Committee chair at 301-362-5290, Salil Kharkar, DC Trustee at 202-787-4146 or Tim Wolfe, Secretary at 410-316-7800. The program kicks off each year on September 18 with a data entry deadline of December 18.

Lastly, our website, [wwoa-cwea.org](http://wwoa-cwea.org), is due for a face-lift. Tony Rocco has been doing a great job of keeping the website up-to-date with current information, but the basic website format hasn't changed since its inception in 1998. An overhaul of the site, utilizing more of the current website technologies (java, JavaScript, asp, jsp, xml, and the like), is due. We will be holding discussions with our website partner, WWOA, to look at ways to improve the site. If you know of a website designer who might be interested in helping us out, please let us know by contacting Tim Wolfe at 410-316-7800.

As you can see, the organization has been very busy. I know I probably left out some very important events and people, and to them I apologize, but I wanted to provide an overview of the issues and topics that your Association is dealing with. As always, we can use your help. If you'd like to get more involved with your Association and participate in these and other adventures, please contact us. Tim Wolfe, the Association Secretary (at least until the Annual Meeting), can be reached at 410-316-7800, or visit our website at [www.wwoa-cwea.org/cwea.html#board](http://www.wwoa-cwea.org/cwea.html#board) and give any of the Board members a call or send them an email. They will be happy to direct you to the proper person.

That's it for now. I hope to see many of you at the Tri-Association Conference in Ocean City in August.

*I write down everything I want to remember.*

*That way, instead of spending a lot of time trying to remember what it is I wrote down, I spend the time looking for the paper I wrote it down on.*

—Beryl Pfizer



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# A Climate Change Update

—BY Cynthia Lane, Ecoletter Co-Editor

One of the things I would like to do as an Editor of the *Ecoletter* is to keep readers updated regarding the regulatory and legislative activities of the water organizations. Recently, representatives from eight major organizations within the water sector worked together to develop a joint message on climate change to present to Congress. The organizations include:

- American Water Works Association
- Association of Metropolitan Water Agencies
- National Association of Clean Water Agencies
- National Association of Flood and Stormwater Management Agencies
- National Association of Water Companies
- Water Environment Federation
- Western Urban Water Coalition
- Water Utility Climate Alliance

These groups felt that it was necessary to present a unified front on this major issue as it affects water utilities all across the country, although in radically different ways. By presenting this message to Congress, we hope to increase funding for research of the impacts of climate change on water resources, as well as draw attention to the need for increases in funding for climate adaptation projects. Provided below are the press release that was distributed to all the major news organizations, the letter to Congress, and the entirety of the Climate Change Message. If you have any questions, or want to get more involved in this issue, you can contact me at [clane@awwa.org](mailto:clane@awwa.org) or (202) 628-8303.



## Groups Urge Congress to Address Water Resource Impacts of Climate Change

**Washington, D.C.** As Congress prepares to begin consideration of climate change legislation, a coalition of eight national water organizations today called on senators and representatives to recognize the severe impacts that global climate change will likely have on water resources in the United States.

The groups—whose members serve the vast majority of U.S. water and wastewater consumers—urged Congress to ensure that upcoming climate change legislation includes federal support and incentives to help drinking

water providers, flood and stormwater agencies and wastewater systems confront the impacts of climate change.

In a statement (attached) sent to members of the House and Senate in advance of next month’s planned consideration of S. 2191, the “Lieberman-Warner Climate Security Act,” the water organizations stressed that “[m]any of the most critical impacts of global climate change will manifest themselves through the hydrologic system, and there is already strong evidence that climate change is having an impact on the world’s water resources.” Most experts believe drinking water providers, flood and stormwater agencies and wastewater systems will experience serious repercussions from climate change, such as reduced snow pack, increased storm frequency and drought, and rising sea levels.

The organizations identified three broad objectives that Congress should include in comprehensive climate change legislation:

1. Research to develop and improve climate prediction models, necessary data resources, alternative water sources, new water management techniques, and evaluations of new carbon control technologies;
2. Federal and other financial support for climate adaptation projects, including infrastructure enhancements, that may be needed to neutralize the regional impacts of climate change; and
3. Incentives that encourage utilities, along with other small-scale emitters, to voluntarily reduce their greenhouse gas emissions.

The water organizations believe their statement should serve as a framework for Congressional action on the nexus between climate change and water. According to the organizations, enactment of their recommendations would be a significant contribution toward the sector’s efforts to continue providing critical water service in spite of the effects of climate change.



## Water Resource Impacts of Climate Change

May 20, 2008

Dear Members of Congress:

As the Senate prepares to begin consideration of S. 2191, the “Lieberman-Warner Climate Security Act,” our

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# A Climate Change Update

Continued from page 29

organizations strongly urge you to recognize the severe impacts that global climate change will likely have on water resources in the United States. Legislation should include federal support and incentives to help drinking water providers, flood and stormwater agencies and wastewater systems confront the impacts of climate change.

There is already strong evidence that climate change is having an impact on the world's water resources. Most experts believe drinking water providers, flood and stormwater agencies and wastewater systems will experience serious repercussions from climate change, such as reduced snow pack, increased storm frequency and drought, and rising sea levels.

Outlined in the attached statement from our eight organizations are three broad objectives that Congress should include in comprehensive climate change legislation.

Your support of our recommendations would be a significant step toward ensuring that our members can continue to provide critical water service in spite of the effects of climate change.

We look forward to working with you on this important national issue.

Thank you for your consideration.

- American Water Works Association
- Association of Metropolitan Water Agencies
- National Association of Clean Water Agencies
- National Association of Flood and Stormwater Management Agencies
- National Association of Water Companies
- Water Environment Federation
- Western Urban Water Coalition
- Water Utility Climate Alliance

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## Water Sector Statement on Climate Change and Water Resources

To address the water resource challenges that climate change will bring, this coalition of major water associations calls on Congress to ensure that water resources are a central element of any federal legislation that establishes a framework for a comprehensive national response to climate change. The nation's existing drinking water, stormwater, flood management, and wastewater infrastructure is already in need of significant investments to maintain current levels of service over the coming decades, and climate change only exacerbates the need for additional resources. Federal law and policy on climate change must fully consider the

effects on water supply and all elements of water management and treatment, and include provisions for increases in federal financial support and incentives to stimulate other forms of investment for responses ranging from research to mitigation and adaptation tools to infrastructure needs. These responses will be most effective when support and investments are undertaken in partnership with states, local governments, and the private sector.

Many of the most critical impacts of global climate change will manifest themselves through the hydrologic system, and there is already strong evidence that climate change is having an impact on the world's water resources. These impacts include changing precipitation patterns that may result in more severe drought or floods, changing snowpack amount and elevation, varying stream flow patterns, and rising sea levels along the coasts. Because the exact effects of climate change on water resources are uncertain and will vary by region, the drinking water, wastewater, flood management, and stormwater utilities responsible for managing water resources for local communities face daunting challenges. These utilities have relied upon historical precipitation patterns to manage source water supplies, stormwater runoff, and wastewater conveyance and treatment. Even as these patterns change, water systems must continue to provide uninterrupted, high-quality service to their present customers, and many must also accommodate rapidly growing populations.

### Specifically, our coalition calls on Congress to:

1. Establish a comprehensive, coordinated and federally sponsored applied research program that addresses:
  - Predictive and decision-support tools, including necessary data resources, to help utilities plan for the future impacts of climate change. These tools and resources should include climate models that forecast precipitation changes and address other issues pertinent to water quantity and quality on a national, regional, and subregional scale; climate models that address sea level rise and its effect on coastal water supplies; and assessments to determine—on a national, regional, and subregional scale—the vulnerability of different regions to the anticipated impacts of climate change over different timeframes.
  - Mitigation and adaptation strategies focused specifically on impacts of climate change on water quality and quantity, stormwater and flood control management and wastewater treatment. Examples of areas where research is needed include methods to increase water conservation; energy efficiency management techniques that help water utilities reduce their own greenhouse gas emissions; the development of alternative water

sources such as reuse, recycling, and desalination; and multiple benefit quantification analysis of such practices as urban tree cover and green roofs to both control stormwater runoff and help cities adapt to the consequences of climate change.

- Surface and ground water resource impacts of new energy technologies such as biofuel development and mitigation strategies such as carbon sequestration projects.
2. Increase federal and other financial support, including the utilization of greenhouse gas emission auction revenues, to assist drinking water, stormwater, flood management, and wastewater utilities to adapt to climate change and address environmental and public health risks that could result from changes to the hydrologic environment. For example, we anticipate that potential public health risks could result from higher water temperatures breeding higher concentrations of certain organisms, from changes in ambient water quality, or from more intense rainfall events. These factors could compromise treatment processes, restrict wastewater utilities' ability to discharge effluent and cause greater risk of sewage overflows. We also anticipate that drinking water, wastewater and stormwater infrastructure enhancements will be necessary to deal with regionalized impacts of these consequences.

3. Provide federal support and incentives to enable utilities to reduce greenhouse gas emissions when feasible. While most greenhouse gas reductions will come from other sectors, utility managers around the country are nevertheless engaged in a variety of efforts to lower the greenhouse gas emissions of their utilities. Utilities that have taken proactive steps to reduce their emissions should be given credit for these advanced efforts under any new regulatory program that is implemented, including cap and trade programs.

Drinking water, wastewater, flood management and stormwater utilities will be among the principal actors dealing with the challenges that climate change will force upon our communities. Our members already struggle daily in meeting current demands placed on our water infrastructure and climate change will only exacerbate the resources needed to provide safe and clean water to the American people. We call upon our nation's leaders to consider water resources as a key element in upcoming climate change legislation and to provide the necessary support and leadership to ensure that the nation's water utilities have the tools and resources necessary to address the climate change challenge.

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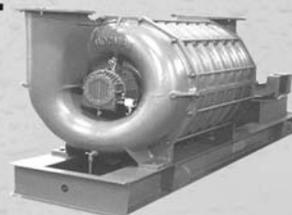
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# Building a better world, one community at a time: Engineers Without Borders Students and Professionals Make a Difference

“There is no better feeling in the world than seeing a project through to completion that you know will help others live a better life,” remarks Emily Kloc, Senior Civil Engineering student at the University of Maryland, College Park. During her college career Emily volunteered her time to be a co-leader of a University of Maryland Engineers Without Borders project. Students, in association with practicing engineers and a professor, designed, raised funds for, and then built a water distribution and treatment system for a hill tribe orphanage and village in northern Thailand. “It is a wonderful experience on a personal level,” she explains, “to know that your efforts have helped improve people’s lives.”

The effect of this experience on Dr. Amadei and on the students was inspiring. Dr. Amadei saw the potential of this template of simple engineering applied to marginalized communities in developing countries, an approach emphasizing environmental, technological, and cultural sustainability in the design, addressing a need the community identified itself. He also saw the potential to educate a new engineer and to redefine the image of engineering. This vision was translated into Engineers Without Borders-USA.

—By Kristen Markham, Senior, Civil Engineering, UMCP  
Chapter of Engineers Without Borders

Engineers Without Borders-USA was created eight years ago by Professor Bernard Amadei of the University of Colorado, Boulder, starting as an unconventional design project for his civil engineering students. Typical of many communities in the developing world, the girls in this village in Belize devoted hours every day to carrying water from the river to their homes. The project was to design and construct a simple water supply and storage system for the village. Finding a solution, in this case a ram pump that lifted the water from the river to the village powered by the energy of the flow of the river, freed the girls to go to school.





In 2004, the University of Maryland founded its own chapter of Engineers Without Borders. Five engineering students and a professor took part in a joint project with established Engineers Without Borders chapters at UCLA and Columbia University. Together they built a health clinic in northern Thailand to serve a cluster of hill tribe villages. The effect of that project on students and faculty was as inspiring as Dr. Amadei's first project on his team. Now, four years



later, the University of Maryland chapter works hand in hand with professionals from the Chesapeake Chapter of Engineers Without Borders to design and implement up to four projects a year, expanding to work in Ecuador, Brazil, and Bukina Faso in west Africa. This past January alone, the University of Maryland chapter sent teams of students, faculty, and professionals to implement two projects.



One of those projects was in Dissin, Burkina Faso, a country with a literacy rate among the lowest in the world. Because villagers on the outskirts of Dissin work long hours during the day, the absence of electric lights makes evening study of reading and writing difficult. To respond to this need, the Engineers Without Borders University of Maryland team worked in fourteen villages surrounding Dissin to install solar lighting systems in schools. The active participation of the villagers in the construction is a routine project requirement, and is essential in establishing both their familiarity with, and their ownership of, the system.

In Brazil, the location of the second January project, approximately 90% of all wastewater from households is untreated. It is discharged into the streets, and directly into streams and the ocean. In Bebedoro, an impoverished suburb of Maceio, a charity school under construction to serve 160 children, asked the University of Maryland chapter to develop a solution to treat the wastewater from the school. Students, a professor, and a practicing engineer designed and built, again with the residents, a basic septic tank system that can later be converted into a biodigester. When converted, the system is capable of collecting methane gas produced by the waste, for use as cooking fuel in the school's kitchens. In the longer term, this project is an example for the community of how to address serious issues of basic sanitation.

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# Engineers Without Borders

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The primary beneficiaries of these projects are the villagers in Burkina Faso, and the residents in Brazil. However the students are co-equal beneficiaries in the process. Experience in project management and application of classroom learning are only part of the benefits. Understanding the importance of foreign language is another. On a much deeper level, however, the students learn firsthand the key role of engineering in international poverty reduction. They develop a comfort with, and respect for, largely uneducated yet able people eager to improve their lives. They become global citizen-engineers. Tristan San Buenaventura, a University of Maryland Senior Civil Engineering major explains: “[J]oining Engineers Without Borders has given new meaning to my education, and helped me realize my dream of making a difference that I have had since I began my college education.”

Engineers Without Borders projects are not experiments in basic engineering. They must be sustainable, robust designs, adapted to the realities of the community and the site. This necessity makes the guidance of practicing engineers essential to project success success. Kevin Diehn, a sophomore Chemical Engineering major who participated on the Brazil project this year, has no doubts. “[H]aving a professional on the Brazil project was a key factor in the project's quality and success. It was nice having someone experienced to answer our questions, keep us within our bounds, and

show us the ropes,” Diehn explains.

Pete Thomson, a professional engineer and project manager from Black & Veatch, and an active member of the Chesapeake Chapter of Engineers Without Borders was the engineer on that Brazil project. He praises both the students and the experience. “I have gotten the opportunity to do something I would never have done otherwise. I have not regretted it one bit. The best part of the project was working with the students. I fully enjoyed being a part of this project. It was fun working in the field to adjust and adapt to what we found and making sure that the project met the community's needs.” Pete has also returned to the chapter to lead practical project management workshops for the students since his return, emphasizing the unique challenges of Engineers Without Borders projects.

This summer the University of Maryland chapter will be sending another team to Burkina Faso to build a solar powered water pumping and storage system for the villagers in Dissin to give the village a more readily accessible water supply during the dry season. This fall the chapter is developing new projects in Burkina Faso, Brazil, and Ecuador, possibly expanding to Peru, Honduras, Paraguay, or Ethiopia.

If you are interested in joining or in finding out more about Engineers Without Borders, visit the University of Maryland Chapter's website at <http://www.eng.umd.edu/Engineers Without Borders> or the Chesapeake Chapter's website at <http://www.chesapeakeEngineers Without Borders.org/>.



# Nutrient Removal Update: What's Going on in West Virginia and Pennsylvania?

—Peter J.H. Thomson, PE, Ecoletter staff

Maryland and Virginia continue to move forward with upgrades to their wastewater treatment plants to improve the nutrient removal performance. Both states are providing grant funding for the upgrades:

- Maryland is offering 100% grant funding for upgrades from BNR to ENR levels (8 mg/l Total Nitrogen and 1 mg/l Total Phosphorus to 3 mg/l Total Nitrogen and 0.3 mg/l Total Phosphorus).
- Virginia is offering a need-based (rates as percentage of median household income) grant funding program.

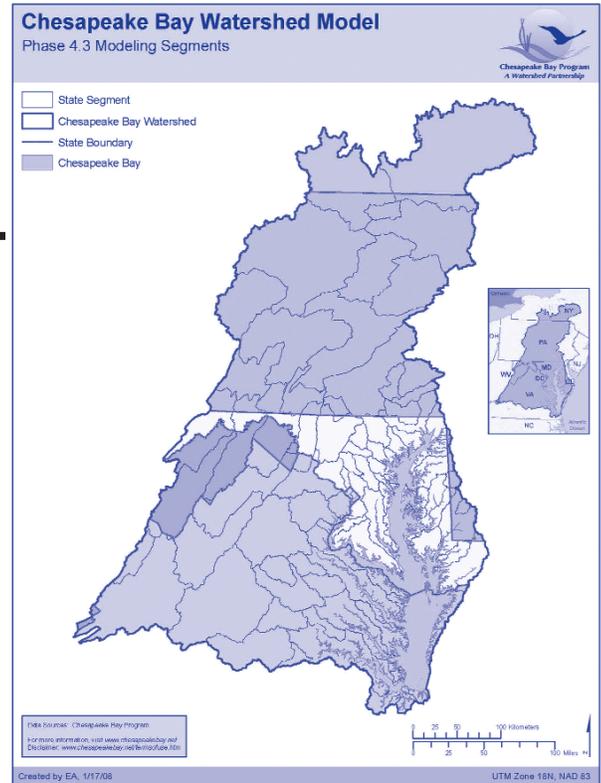
Both programs appear to be working reasonably well with most communities moving forward with their programs. The only serious issue that has come up in both states is arguments over funding, where the communities are arguing for higher funding levels and the states are arguing for lower levels. These disagreements are only natural, but seem to be rooted in the fact that the actual costs of both programs are coming in much higher than predicted (and funded). However, to this point, all disagreements appear to have been worked out to both sides' satisfaction.

The story is very different in two other Chesapeake Bay Watershed States—West Virginia and Pennsylvania.

## West Virginia

Only a fairly small portion of West Virginia is in the Chesapeake Bay Watershed, primarily the Eastern Panhandle area with communities along the Potomac and Shenandoah Rivers. West Virginia is a signatory to the Chesapeake Bay Agreement—Governor Wise signed the agreement as he left office—and West Virginia prepared a Tributary Strategy under the agreement.

The Tributary Strategy says that upgrades are to be completed at treatment plants *as grant funding is available* and indicates that without grant funding, the upgrades are not affordable to the ratepayers. The Chesapeake Watershed in West Virginia contains some relatively affluent communities like Shepherdstown and Charles Town, who might be able to afford the upgrades, but would incur large rate increases, and some very depressed communities like Keyser, who seem very unlikely to be able to afford the substantial upgrades needed without outside assistance.



The Division of Environmental Protection, however, is issuing permit renewals with nutrient limits and five-year compliance schedules. There is no mention of grant funding and the legislature has not introduced any proposals to this point for such funding. The communities are left holding the bag.

Martinsburg has appealed the nutrient provisions in its draft permit and is making several arguments:

- Per the Tributary Strategy, the state must provide grant funding for the upgrades if it is to impose the limits.
- The legislature never ratified the Governor's signature on the agreement, making West Virginia's participation in it illegal.
- The Tributary Strategy is not enforceable because it was not promulgated as a rule—West Virginia requires that all rule-making be approved through the legislature.

The appeal appears to be a method of pressuring the state government into providing funding similar to that in Maryland and Virginia, rather than an attempt to avoid upgrading at all. To that end, the Chesapeake Bay Foundation has filed to intervene in Martinsburg's appeal.

The results of this appeal may have an effect that reaches beyond West Virginia.

## Pennsylvania

The situation in Pennsylvania is strangely similar, though there are many more treatment plants affected

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# The Next Issue on the Horizon: Pharmaceuticals in the Environment

—By Cynthia Lane, Ecoletter Co-Editor

Recent news coverage related to the occurrence of trace amounts of pharmaceuticals and personal care products (PPCPs) in drinking water has elevated this issue in the minds of many legislators and consumers. Water professionals, toxicologists and public health experts have been researching the occurrence of personal care products and pharmaceutical compounds in the environment for many years.

This has not been an issue before because what has changed recently is detection technology. Water professionals have the technology today to detect more substances—at lower levels—than ever before. As analytical methods improve, pharmaceutical compounds and personal care products are being found at very low levels in many of our nation's lakes, rivers and streams and even drinking water. What many people do not understand is that just because a substance is detectable does not mean the substance is harmful to humans. To date, research throughout the world has not demonstrated an impact on human health from pharmaceuticals and endocrine disrupting compounds in drinking water.

## Health Effects Research

Many water organizations believe that as an industry, we need more health effects research to determine if it is even necessary to regulate and treat for PPCPs. The public interest in this issue demonstrates the importance of forward-looking scientific research on water quality and human health impacts. The question of whether to regulate pharmaceutical and personal care compounds should be answered through the U.S. Environmental Protection Agency's thorough regulatory review process, which takes into account both occurrence data and human health impacts. Congress should support increased federal funding for research into human health impacts associated with these compounds. Responsible regulatory determinations cannot be made without this information. More occurrence data, while helpful in understanding the scope of the pharmaceuticals issue, does not answer the critical questions about whether these compounds present any threat to human health.

Some studies suggest that these compounds may affect fish and other aquatic wildlife in lakes, rivers or other bodies of water. However, it is important to remember that fish, reptiles and humans differ significantly in physiology and their exposure to water, and that science has not demonstrated human health impacts at the trace levels found in drinking water.

EPA maintains an active program called the Contaminant Candidate List (CCL) to identify new contaminants in public drinking water that warrant detailed study. At this point, the pharmaceutical compounds being discussed are not on this list. EPA also has a protocol for requiring utilities to monitor for unregulated substances. The scientific community has not developed uniform methods for analyzing compounds for pharmaceutical and personal care products.

## Public Communication

Water utilities need to be committed to communicating openly, honestly and clearly about the safety of the water delivered to customers. Part of this commitment includes providing context to help customers understand potential health impacts. To communicate in a meaningful way about substances in water, utilities should know at a minimum:

- The substances for which they should monitor.
- The best scientific methods to identify and measure those substances.
- The health effects associated with those substances and at what levels.

The water community is currently encouraging legislators to work for increased funding of water research projects that help utilities communicate clearly on the issue of pharmaceuticals and inform the regulatory process.

## Reducing Inappropriate Disposal of Pharmaceuticals

While research has not demonstrated human health impacts from these compounds, the ongoing conversation should remind us of how precious our source waters are and the need to protect them. The best and most cost-effective way to ensure safe water at the tap is to keep our source waters clean. A growing number of communities are implementing pharmaceutical take-back programs as a way to limit unwanted compounds that end up in our wastewater systems. The federal Office of National Drug Control Policy recommends not flushing prescription drugs down the toilet unless the accompanying patient information specifically instructs it is safe to do so.

While it's a smart step to encourage responsible disposal of unused medications, preventing the flushing of these items will not eliminate the occurrence of these compounds in the wastewater system. People and animals do not completely absorb the medicines they take, and some concentrations of these of com-

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# Pharmaceuticals

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pounds pass through digestive systems and end up in wastewater.

## In Summary

There has been a great deal of activity on this issue in the past few months from the article written by the Associated Press to the hearings held before the Senate Subcommittee on Transportation Safety, Infrastructure Security and Water Quality. It remains to be seen what steps EPA will take to address the issue of pharmaceuticals in the environment. The next few years could bring about big changes in treatment methodologies for water and wastewater utilities with elevated levels of PPCPs in their water.

For extra background on this subject, the following is the testimony provided by Dr. Shane Snyder of the Southern Nevada Water Authority during a hearing on "Pharmaceuticals in the Nation's Water: Assessing Potential Risks and Actions to Address the Issue." This hearing was held on April 15, 2008 by the Senate Subcommittee on Transportation Safety, Infrastructure Security, and Water Quality.



Good afternoon. My name is Dr. Shane Snyder and I am the Research and Development Project Manager for the Southern Nevada Water Authority. I have conducted research related to trace contaminants in water, including pharmaceuticals, for nearly 15 years. I have served as principal investigator for numerous research projects related to the trace-level detection, removal, and toxicology of pharmaceuticals in water supplies, and have published approximately 50 peer-reviewed articles and book chapters on this topic. I would like to make it perfectly clear that I am a scientist, not a policy maker. While I am honored to share some of my findings with you today, please keep in mind that I do not establish, suggest, or enforce policy decisions. I am appearing today on behalf of the American Water Works Association (AWWA). AWWA is the world's oldest and largest association dedicated to safe water. Our utility members serve safe and affordable drinking water to over 80 percent of the American people.

Contrary to recent reports that characterize pharmaceuticals in water as an entirely new issue, pharmaceuticals were first reported in US waters by the EPA in 1975. The fact that more pharmaceuticals are detected today is not due to greater contamination of our nation's water, but a reflection of the increasingly sensitive analytical technology that allows us to identify and quantify diminishingly minute concentrations of these chemicals in water.

My research related to trace pharmaceuticals in drinking water has been conducted entirely without federal mandate through the volunteer efforts of our nation's water utilities. The fact is, the cities that participated in my current study by submitting water samples for analy-

sis, did so in the absence of any regulatory requirement, going well above and beyond the regulations in the interest of furthering understanding of this issue.

My previous studies have been transparent, and have been published in open literature and frequently presented in public forums. I will do that again when my current research is complete. However, as a scientist, I would strongly caution against presenting preliminary findings of partially completed studies. In order to provide meaningful information on pharmaceutical compounds and other substances in water, scientists need both occurrence data and human health effects information. It is scientifically inadequate to communicate solely on what we can measure at any level without a frame of reference for what that means.

I have frequently been asked about the sources of these products in our waters. I will not go into it here in detail, but will note that both nonpoint source runoff and sewage effluent from properly operated waste treatment plants may contain minute traces of these compounds. Some minute quantities of these products will pass through animals and humans who use them, and enter the waste stream. They are typically not completely destroyed or removed by waste water treatment processes.

A more central point about our studies is that the few pharmaceuticals we did detect in US drinking waters occurred at unfathomably low concentrations. To illustrate that point, consider this: If our study had been constrained by the ability to find these compounds at parts-per-billion levels instead of delving into the parts-per-trillion range, none of them—not a single one—would have been found.

This raises a critical question. Are we going to make decisions based upon our ability to find contaminants, or based upon protection of public health? I am not a policy-maker; I am a scientist. However, I can tell you with absolute certainty that, if we regulate contaminants based upon detection rather than health effects, we are embarking on a futile journey without end. The reason is simple: Decades ago, we could only detect contaminants at parts per million levels. Years ago, we advanced to parts per billion. We are now able to detect compounds at the parts-per-trillion level, and are breaching the parts-per-quadrillion boundary in some cases. The truth is that the concentrations of pharmaceuticals found in water supplies are millions of times lower than a medical dose. Consider that the highest concentration of any pharmaceutical we detected in US drinking waters is approximately 5,000,000 times lower than the therapeutic dose. This concentration is difficult to perceive, so consider these analogies. This concentration is roughly equivalent to ? of an inch in the distance between the earth and the moon, or in terms of time, this concentration would be equivalent to approximately one second in approximately 750 years. Based upon our four-year study of the health relevance of trace pharmaceuticals, using the highest concentrations found and the most conservative safety factors to protect susceptible populations such as infants and pregnant women, our report will

demonstrate that one could safely consume more than 50,000 eight-ounce glasses of this water per day without any health effects. While the report will not be published until later this year, I can tell you that the bottom-line conclusion is that the concentrations of pharmaceuticals we studied are orders of magnitude lower than would pose a public health threat. I am not suggesting that this is the final, definitive study on this issue; in fact, I urge you to support further health effects research.

That said, the Safe Drinking Water Act already has established processes for identifying and regulating drinking water contaminants to protect human health. The Candidate Contaminant List and the Unregulated Contaminant Monitoring Rule are appropriate processes that entail great scientific rigor. As a scientist, I would caution against regulating pharmaceuticals any differently than the scores of contaminants currently covered by the Safe Drinking Water Act, because in reality they are no different. Our decision as humans to improve and extend our lives by using pharmaceuticals dictates that some infinitely small amount of these products can and will make their way into the environment. The fact that we can detect trace contaminants does not alone imply risk.

With regard to removing these compounds through treatment, my team has tested the effectiveness of a diverse array of water treatment technologies on removal of pharmaceutical compounds, and to be certain, some technologies are more effective than others. However, the pinnacle question is whether the use of these treatment technologies is warranted to protect public health, because there are environmental and societal costs associated with using them. In an age where we are concerned about greenhouse gas emissions and minimizing our nation's energy demands, is it wise to dictate energy-intensive water treatment systems when there is no evidence of public health benefits? Additionally, there is a looming crisis related to aging water infrastructure that will require a vast financial investment by utilities. Should that be set aside so they can chase down the last nanogram of a compound?

So what should we do? A couple of things make sense. This issue does highlight the need to better protect America's sources of drinking water from various sources of contamination. And clearly there is a pressing need for additional research on this issue. As a scientist, I recommend we focus on research related to health effects from trace pharmaceuticals with a lesser emphasis on occurrence, in order to determine whether there is in fact a problem to solve. The critical question we must address is not "Do they exist?" but rather, "At what concentration are these compounds harmful to human health?" Only then can we make intelligent, rational decisions that protect the health of this country's municipal water customers.

**Our recommendations are spelled out in more detail below:**

1. EPA should work with states, water and wastewater utilities, and the agricultural community to minimize

contamination of source waters by pharmaceutical products as well as other contaminants.

It is imperative that the nation do a better job of protecting its waters, and especially sources of drinking water, from contamination. We have said previously that there is an imbalance between the enforceable controls on point sources, such as Publicly Owned Treatment Works, and the less rigorous programs used to limit nonpoint sources of pollution, such as agricultural runoff. Congress may wish to evaluate this issue to assure that all sources of pollution are equitably contributing to the protection of the nation's waters.

2. We urge support for proper pharmaceutical disposal programs to reduce the flushing of pharmaceutical products into sewage systems to the greatest degree possible, while recognizing that this addresses only a small part of the problem.

Although more research would be needed to accurately characterize this issue, we believe it is likely that more pharmaceuticals end up in the environment after passing through humans than after flushing unused products. However, some unused pharmaceutical products are undeniably flushed into waste streams, contributing to the problem but also offering an opportunity to make reductions in the pollutant loading through a "pollution prevention" approach. We urge support for pharmacy "take back" programs that make doing the right thing obvious and convenient for consumers.

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# Pharmaceuticals

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3. Elevate EPA's drinking water health effects research budget at least equivalent to the air pollution health effects research budget. Even though this Subcommittee does not appropriate funds, we ask you to support this increase.

To date, no peer reviewed published research has found ill effects on humans from pharmaceuticals in the environment at the trace levels we have seen in drinking water. However, drinking water providers would like to see more research on this matter, so that we can either take appropriate action to address an actual health risk if there is one, or reassure the public that there is not one. Treatment to completely remove all traces of pharmaceuticals from drinking water will be very expensive, and our customers have a right to expect that we will only undertake the investment necessary to do this—and increase their utility bills to pay this expense—if doing so addresses an actual health risk.

We also specifically support 1) a dedicated authorization in the Research Title of the Agriculture Reauthorization bill for collaborative research between the drinking water community and the agriculture industry on ways to limit contaminants from entering water supplies; and 2) a dedicated research authorization to support decisions on contaminant listing and rulemaking by EPA's Office of Ground

Water and Drinking Water. These funds should be used to focus research on priority drinking water areas of concern.

4. We should continue to rely upon EPA's science-driven Contaminant Candidate List (CCL) process to identify candidates for new drinking water standards.

Though at times this process appears to move slowly, a methodical, science-based process is necessary for determining which contaminants need to be regulated, so that we focus on actual risk and on the higher risks first. The standard setting process detailed in the Safe Drinking Water Act is sound, and setting standards through a science-driven process gives the public confidence that the regulations they pay for are necessary, reasonable, and protect public health. An increase in human health effects research, as mentioned in Item 3 above, would improve this process.

5. We should continue to rely upon the Unregulated Contaminant Monitoring Rule (UCMR) for decisions concerning testing and reporting to customers about contaminants that are not currently regulated.

EPA employs a comprehensive and science-based approach to determining which unregulated contaminants utilities should monitor for, and what utilities should say about these contaminants (if detected) to their customers. It is appropriate to use this kind of science-based process to determine which, if any, additional currently unregulated contaminants utilities should investigate.



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# Nutrient Removal Update

Continued from page 35

than there are in West Virginia. The state has begun issuing permits to facilities requiring compliance with nutrient limits by the end of the permit cycle. Pennsylvania has not provided any direct funding for this effort. The state has, however, implemented a nutrient trading program that they hope will provide funding for upgrades and incentive to reduce nutrient emissions. However, early results from the trading program are not promising.

Pennsylvania DEP has already started back-peddling a bit on the compliance dates and has been offering communities longer compliance periods in response to loud complaints regarding availability of funding. This has satisfied some communities, but others are still unhappy.

More than sixty of these unhappy communities have filed an appeal against the state in an attempt to prevent DEP from enforcing nutrient limits. Similar to West Virginia, the communities have a number of points:

- DEP did not follow proper procedures in implementing the policy and, thus, the requirements are an illegal regulation.
- They indicate that Pennsylvania is not taking reasonable action to cause non-point sources to reduce emissions, which will be necessary to meet the state's obligations.
- The 2000 agreement with Maryland and Virginia was not legal and cannot be enforced.

Again, this litigation appears to be primarily an attempt to get funding for the upgrades, which are estimated to cost at least \$1 billion. The attempt may be having some effect. In April, a group including the Chesapeake Bay Foundation, Pennsylvania Municipal Authorities Association, Pennsylvania Farm Bureau, and others proposed the Fair Share for Clean Water Plan, which proposes \$100 million for waste water treatment plant upgrades and \$70 million for agricultural programs in the next fiscal year. While this is not in the budget, it is receiving favorable press and it seems likely that some funding will come available in the future.

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