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This year is almost over and it feels like it just got started! It has been a year of unusual weather patterns that have created many challenges for us in our industry. It has also been a year of change, with transition in our state leadership and in our regulatory community. Our Association has been going through change with the continued development of our new organizational structure and the development of our new strategic plan. Our Association continues to thrive as a strong organization supporting many programs, activities, and initiatives, while maintaining financial stability. We are trying to respond to our members’ needs through our programming, and hope that you have had the opportunity to share in something this year.

One challenge we continue to face in our industry is workforce. We continue to see daily changes and are experiencing the retirement of many seasoned professionals. We need to develop our current workers to take on new roles as they progress through their careers. One of the most significant challenges is helping them (and us) gain new knowledge and skills. Our education programs, such as our schools and seminars, respond to these needs through the quality and diversity offered. Our endowment is also a way in which we reach out and encourage people to join our industry.

To provide a little history, the endowment was first proposed by Steve Shoaf when he was chair of our Association. He shared with me the original goal was “to offer significant scholarships to students and professionals to further their development in our field”; the reason being that we were starting to experience the knowledge and skills loss I mentioned above. As you are aware, our original scholarship, the Carol Bond scholarship, included scholarships for teachers, university students, and community college students. However, it was limited, and we were not able to create a sizeable outreach effort to students and teachers. The endowment provided the vehicle to grow a ‘scholarship program’ into something more significant and far-reaching. In three short years, the endowment has raised $368,096.82 in pledges and donations, with $263,499.82 received as of the date this article was prepared.

The endowment is the opportunity we need to encourage and support those interested in pursuing careers in our industry. It provides teachers the resources to teach students about water and water quality in their classrooms and encourage students to pursue water careers. The scholarships are diverse in career choices and include construction management, engineering, business, and finance. They are for four-year, two-year and graduate degrees. The endowment is a tool for opening doors to let more people into the industry as a profession, but it is also your tool, intended to help current professionals grow and stay in the profession. Have you thought about pursuing a two-year or four-year degree? Or a graduate degree? Support of the endowment may help support your education or your child’s education. Take a moment to look and learn about our endowment and the diverse scholarships that are offered.

This year, collaboration has been the name of the game. The programs and activities I mentioned above have all been successful through teamwork. Another way we have looked at collaboration is through relationships with organizations that...
Message from the Chair

have similar interests. This has been a positive addition to the way we are approaching some of our activities. Examples that come to mind are the Regulatory Affairs Committee, the Joint Public Outreach Work Group, and our Association organization. Early this year, the Regulatory Affairs Committee responded to and commented on the NC Nutrient Criteria Development Plan proposal. Since then, it continues to stay abreast of the many state bills and the changing regulatory environment. The Joint Public Outreach Committee is continuing to look for outlets to share our public service announcement. In addition, common ground is being identified in other areas such as backflow prevention. A workgroup has been organized to develop a proposal for a possible statewide certification for backflow testers for consideration by the NC Water Treatment Facility Operators (NCWTFO) board. We had a great board/committee workshop in May, where the four councils and their associated committees met to discuss ideas and initiatives for the coming year. Working together like this will help us provide members with valuable experience and opportunities with our Association. Our parent organizations, the American Water Works Association (AWWA) and the Water Environment Federation (WEF), provide many resources to us by offering regional meetings and providing a forum to exchange ideas with other state association leaders. All these efforts help us remain a sustainable organization.

This is my last article as chair. It truly has been a great honor to have the opportunity to serve in this capacity and with an exceptional board of trustees. This Association is very special to me, both professionally and personally. Thank you to those of you who have provided ideas, support, and guidance throughout the year. I look forward to seeing you all at our Annual Conference in Concord in November.
The outstanding volunteers on the Communication Committee, currently led by Committee Chair Tom Bach, work extremely hard to deliver a quarterly magazine to you (our members) that extends the educational reach of NC AWWA-WEA. The Communication Committee selects topics of focus for each issue, and solicits feature articles that will enhance the knowledge, skills, awareness, and understanding of water professionals in North Carolina on that topic.

The featured topic for this issue is Emerging/Potential Contaminants. I found it difficult to write an article relatable to this topic until the Spring 2013 edition of the University of California (UCR) at Riverside’s alumni magazine appeared in my home mailbox. My daughter Angelica is a 2001 graduate of UCR, and, as it has a strong environmental engineering program, I remain interested in the happenings at this institution. This particular issue of the magazine features an article by Sean Nealon on Dr. Sharon Walker, the John Babbage chair in environmental engineering, and asks about her current research, Dr. Walker responded:

“The biggest thing I’m working on now is the fate of nanomaterials that are getting into our environment. Nanomaterials are being used in everything from cosmetics to food to paints to tennis rackets. Gym socks don’t smell because there are silver nanoparticles in there. They are what make our cell phones small and light. They are part of our new lifestyle.”

She goes on to talk about the release of nanomaterials into water during production and use. Currently studying whether nanomaterials can be removed by traditional engineering, she says that, if they are not, she will study “…how to change the design of treatment plants to make sure our water is safe.”

Dr. Walker and her students work at the UCR Environmental Particle Fate and Transport Laboratory where they study optimization of effective water treatment and distribution, and wastewater reclamation. They also investigate factors that control bacteria as well as nanoparticle fate and transport, and study the interaction of particles with surfaces, including membranes and filter media.

My interest was captured, and this article became an easy one to write!

The US Geological Survey (USGS) has an ‘Emerging Contaminants Project’, and a great website – http://toxics.usgs.gov. As such, it was my next ‘port of call’ in discovering more about emerging contaminants. The website has a definition for ‘emerging contaminants:’

“Emerging contaminants can be broadly defined as any synthetic or naturally occurring chemical or any microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and (or) human health effects. In some cases, release of emerging chemical or microbial contaminants to the environment has likely occurred for a long time, but may not have been recognized until new detection methods were developed. In other cases, synthesis of new chemicals or changes in use and disposal of existing chemicals can create new sources of emerging contaminants.”

Nanomaterials are substances where at least one dimension is less than 100 nanometers (a nanometer is 1/millionth of a millimeter – 100,000 times smaller than the diameter of a human hair).

“Emerging contaminants can be broadly defined as any synthetic or naturally occurring chemical or any microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and (or) human health effects.”
Nanomaterials can be organic or inorganic. Valued for their unusual mechanical, electrical and magnetic properties, they are in virtually everything, including sunscreen cosmetics, wrinkle-free clothing, stain-resistant fabrics, tires, electronics, medicine, paints, varnishes, coatings on glass products and dental fillings to list a few.

The USGS Emerging Contaminants Project has a number of goals:
1. Development of analytic methods to measure chemicals and microorganisms in water, sediment and waste;
2. Determining the level of environmental occurrence of potential contaminants;
3. Characterization of sources and source pathways that determine release of contaminants to the environment; and
4. Ecologic effects from exposure to these chemicals or microorganisms.

The US Environmental Protection Agency (EPA) released a Nanotechnology White Paper in 2007 with preliminary findings on the sources, fate and transport exposure of nanomaterials and is evaluating application of the Toxic Substances Control Act to nanotechnology.

It is worthwhile to remember that the advancements in analytical instruments in recent years are allowing us to measure substances at levels once unimaginable. Many of the substances we are now identifying in water were there all along. John Kiviniemi suggested the Hubble telescope as an analogy for this enlarged awareness, noting that a more powerful telescope does not mean that there are suddenly more stars in the sky. However, once we can detect and measure them, these substances take on an interest and role that requires greater scrutiny, just as stars recently identified draw new interest.

Regardless of whether we are now simply able to see and measure them, or that there are indeed more different substances, the area of ‘emerging contaminants’ will unquestionably be an area of increasing focus in all ways – research, treatment design, environmental risk assessment and also in regulatory oversight. All of this will be of great consequence for you who, as water professionals, are responsible every day for designing, building, operating, maintaining, treatment plants that may or may not be enough to deal with the barrage of chemicals that enter water.

The story of what you do each day of your working lives, to protect the health of the public and the environment is every bit as riveting as a Dan Brown cliff-hanging best-seller, and it matters more with each passing day.

I am always incredibly proud to be associated with NC AWWA-WEA, and the work that water professionals do, including meeting the highest standards in achieving clean water for North Carolina and facilitating exceptional work for developing and maintaining the best in continuing education. When I read about the challenges that our industry faces, I am even more compelled to acknowledge these contributions because I know that you are equal to the task at hand.

Thank you so much for all that you do to keep our precious waters clean. The quality of life in North Carolina is among the best in the world, and the education and training at NC AWWA-WEA is on the cutting edge because of the work you do!
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During this hot and rainy summer, our volunteers have continued to work hard planning, developing, and delivering quality training that enriches the knowledge base of water and wastewater professionals.

The Seminars and Workshops Committee has steadily worked to finalize the remaining 2013 seminars that focus on such topics as automation and operator in responsible charge designations. In addition, they have raced out of the starting gates in the planning for the 2014 events. Our schools committees are in full swing as we have reached the half way mark of year. They continue to train hundreds of operators as they go along their career paths in seeking professional certifications.

If you are interested in speaking or getting more involved in our education committees, you can contact the committee chair for the corresponding committee (listing can be found in this magazine) or you may contact Catrice Jones in the NC AWWA-WEA office for assistance.

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cbelk@hazenandsawyer.com

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GHD
Phone: (704) 342-4919
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cbroadbent@hazenandsawyer.com

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jhellman@hach.com

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CDM Smith
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paynejf@cdmsmith.com

WEF DELEGATE – 1st Year, Barry Gullet
Charlotte Mecklenburg Utilities
Phone: (704) 336-4962
bgullet@charlottenc.gov

AWWA DIRECTOR, Steve Shoaf
City of Asheville
Phone: (828) 259-5955
sshoa@asheville.gov

TRUSTEE – 2nd Year, Paul Jackson
Interstate Utility Sales
Phone: (704) 367-1970
pjackson@iusinc.com

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GHD
Phone: (704) 342-4915
leslie.jones@ghd.com

TRUSTEE – 1st Year, TJ Lynch
City of Raleigh
Phone: (919) 250-7824
tj.lynch@raleighnc.gov

TRUSTEE – 1st Year, David Saunders
HDR Engineering
Phone: (704) 338-6800
david.saunders@hdrinc.com

PROF WATER OPS REP – 2nd Year,
Mark Wessel
City of Raleigh
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The following actions were taken during this meeting:

1. **Governance Discussion:**
   - Board self-evaluation follow-up from March presentation by Christopher McGinness, American Waterworks Association (AWWA) Senior Section Services representative:
     - Board Policies: All Board policies have been reviewed and updated this year by the Board, and are provided on the NC Safewater website so they are available to Board members and committee chairs, and any member, on request.
     - Annual training will be provided to incoming Board members and committee chairs in October.
     - Board job descriptions have been prepared by Mike Osborne and John Kiviniemi, and are now available to assist those considering seeking election to the Board and will be featured in Board training annually.
     - Board and committee structure has undergone change in the past two years, with the development of the council structure. The intent is to increase effectiveness of the Board and to allow more work to be accomplished in a more effective manner.
     - A revised agenda format that allows for governance discussion at the beginning of the meeting, and use of the consent calendar as the last item on the agenda for approval of reports and other routine items is working to allow most effective use of the Board members’ time.
     - There is an annual orientation by the executive director and financial coordinator for the new board treasurer.
     - A more detailed job description is still needed for the Public Water and Wastewater Operators Board positions, which covers the required review of abstracts of all training topics for continuing education unit approval.

2. **Action Items:**
   - Self-paced e-learning policy – was approved, in preparation for the initiation of the e-learning training that will ‘go-live’ within the next few months.
   - Wastewater Board of Education and Examiners appointments – Todd Norman, Orange Water and Sewer Authority, was appointed as Biological Representative on WWBOEE; Steve Hamilton, Wayne Water Districts, was appointed as at-large representative on WWBOEE. An amendment to the WWBOEE application was recommended to WWBOEE, to clarify that all candidates affirm that they are willing and able to participate in WWBOEE meetings if they are appointed.
   - Endowment Allocation for 2014 - $9,000 was set as the total amount for all scholarship awards for 2014, with the balance of the corpus at year-end 2013 of each named fund determining the amount for each fund.
   - Interstate Water Issues/Confluence Conference future – The Board discussed the pros and cons of entering into another three-year memorandum of understanding with Georgia and South Carolina for the continuation of the Confluence Conference. Total attendance has declined to 75 in 2012, with 19 of those being from NC. A decision was deferred until July, to allow for more consideration.

3. **Chair’s Report**
   - Minutes of the Executive Committee meetings are now included in the Board packet.
   - Chair Jarrell reviewed highlights of the discussion between representatives of the Board and the Endowment Committee.
     - Named fund donors have the option of combining proceeds of their funds with another fund, or may provide additional funds to raise the minimum of award level to $1,000, or may roll interest and dividends into the corpus of their funds.
     - It was the consensus of the Board that criteria for the NC...
Safewater and Carol Bond funds be expanded to allow members to apply for funds to attend community colleges to support professional growth.

iii. A focus on informing members of the benefits of the endowment is needed.

iv. Efforts continue to get named fund donors to provide authorization for the Board to make determinations about the funds after the demise of the original donor.

v. Role and responsibilities of Board appointees on the endowment were discussed.

c. Appointment of Mike Richardson and Bill Brewer as NC AWWA-WEA representatives to a Division of Water Quality National Pollutant Discharge Elimination System Stakeholder Group were approved.

4. Executive Director Report

a. Membership report was provided. The Board was advised that the Membership Committee will be reviewing the current practice of providing membership services to all employees of AWWA Utility members and will make a recommendation to the Board at a future meeting.

5. Consent Calendar

a. Approved minutes of the meeting of March 7, 2013 with meeting location amended to read “Charlotte”.

b. Accepted the financial report for March and April 2013, with revenue in March of $132,330.74 and expenses of $89,125.10 for a net income of $43,205.64. Total assets as of March 31, 2013 were $1,094,041.64 with $1,074,768.70 in checking/savings, of which $246,117.33 is endowment funds. The balance of unrestricted net assets (checking minus outreach and endowment) is $828,651.37, and revenue in April of $117,986.71 and expenses of $135,841.54 for a net income of -$17,854.83. Total assets as of April 30, 2013 were $1,076,186.81 with $1,056,913.87 in checking/savings, of which $253,067.33 is endowment. The balance of unrestricted net assets is $823,119.48.

c. Accepted Committee reports as presented.

d. Accepted the Water Environment Federation report, including Water Environment Executive Director Jeff Eger’s report on the Water Infrastructure Summit.

e. Accepted the AWWA Report, including Real Time Management System Online and Washington D.C. Fly-In reports, and information about ACE 2013.

6. Other Business

Chair Jarrell expressed appreciation to Steve Drew for his leadership of the strategic planning process.

7. Adjourned the meeting to July 19 at the Asheville Public Works Department at 10 a.m.

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<th>Chair</th>
<th>Company</th>
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<td>Hach Company</td>
<td>(704) 619-2458</td>
<td><a href="mailto:jhellman@hach.com">jhellman@hach.com</a></td>
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<tr>
<td>Nominating/Canvass</td>
<td>John Kiviniemi</td>
<td>OWASA</td>
<td>(919) 537-4352</td>
<td><a href="mailto:jkiviniemi@owasa.org">jkiviniemi@owasa.org</a></td>
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<td>Strategic Planning</td>
<td>Steve Drew</td>
<td>City of Greensboro</td>
<td>(336) 373-2055</td>
<td><a href="mailto:steve.drew@greensboro-nc.gov">steve.drew@greensboro-nc.gov</a></td>
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### Conference Coordinating Council

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<td>COUNCIL CHAIR:</td>
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<tr>
<td>Annual Conference Local Arrangements</td>
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<td>Schnabel Engineering</td>
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<td>Daparak</td>
<td>(704) 323-7031</td>
<td><a href="mailto:janderson@daparak.com">janderson@daparak.com</a></td>
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<td>CDM Smith</td>
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<td>Highfill Infrastructure Engine</td>
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<td><a href="mailto:thighfill@hiepc.com">thighfill@hiepc.com</a></td>
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<td>WSACC</td>
<td>(704) 786-1783</td>
<td><a href="mailto:tbach@wsacc.org">tbach@wsacc.org</a></td>
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<td>Endowment</td>
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<td>Willis Engineering</td>
<td>(336) 338-4668</td>
<td><a href="mailto:chuck@willisengineers.com">chuck@willisengineers.com</a></td>
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<td>Membership Services</td>
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<td>Water for People</td>
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<td>CDM Smith</td>
<td>(336) 771-5073</td>
<td><a href="mailto:lisa.edwards@rdcnr.gov">lisa.edwards@rdcnr.gov</a></td>
</tr>
<tr>
<td>Young Professionals &amp; Students</td>
<td>Leigh-Ann Dudley</td>
<td>Dewberry</td>
<td></td>
<td><a href="mailto:ldudley@dewberry.com">ldudley@dewberry.com</a></td>
</tr>
<tr>
<td></td>
<td>Ryan Le Blanc</td>
<td>Black and Veatch</td>
<td></td>
<td><a href="mailto:leblanc@bv.com">leblanc@bv.com</a></td>
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### Technical Program Council

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<th>Committee</th>
<th>Chair</th>
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<tbody>
<tr>
<td>COUNCIL CHAIR:</td>
<td>Jonathan Lapsley</td>
<td>CDM Smith</td>
<td>(704) 342-4546</td>
<td><a href="mailto:lapsleyjs@cdmsmith.com">lapsleyjs@cdmsmith.com</a></td>
</tr>
<tr>
<td>Annual Conference Program</td>
<td>Chuck Shue</td>
<td>McKim &amp; Creed</td>
<td>(704) 841-2588</td>
<td><a href="mailto:lapsleyjs@cdmsmith.com">lapsleyjs@cdmsmith.com</a></td>
</tr>
<tr>
<td>eLearning Task Force</td>
<td>Jonathan Lapsley</td>
<td>CDM Smith</td>
<td>(704) 342-4546</td>
<td><a href="mailto:lapsleyjs@cdmsmith.com">lapsleyjs@cdmsmith.com</a></td>
</tr>
<tr>
<td>2014 Spring Conference Program</td>
<td>Christene Mitchell</td>
<td>CFPUA</td>
<td>(910) 332-6354</td>
<td><a href="mailto:christene.mitchell@cfpua.org">christene.mitchell@cfpua.org</a></td>
</tr>
<tr>
<td>SEMINARS &amp; WORKSHOPS COMMITTEES:</td>
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<tr>
<td>Automation</td>
<td>Greg Czerniejewski</td>
<td>CDM Smith</td>
<td>(919) 325-3500</td>
<td><a href="mailto:czerniejewski@gcdsmith.com">czerniejewski@gcdsmith.com</a></td>
</tr>
<tr>
<td>Finance &amp; Management</td>
<td>Elaine Vastis</td>
<td>RafTelis Financial Consultants</td>
<td>(704) 373-1199</td>
<td><a href="mailto:evastis@rafTELIS.com">evastis@rafTELIS.com</a></td>
</tr>
<tr>
<td>Industrial</td>
<td>Katie Jones</td>
<td>Dewberry</td>
<td>(919) 424-3723</td>
<td><a href="mailto:kjones@dewberry.com">kjones@dewberry.com</a></td>
</tr>
<tr>
<td>Regulatory Affairs</td>
<td>Ron Hargrove</td>
<td>City of Winston-Salem</td>
<td>(336) 747-7312</td>
<td><a href="mailto:ronhargrove@cityofwso.org">ronhargrove@cityofwso.org</a></td>
</tr>
<tr>
<td>Resource Recovery and Reuse</td>
<td>Marla Dalton</td>
<td>City of Raleigh</td>
<td>(919) 996-3700</td>
<td><a href="mailto:marla.dalton@raleighncc.gov">marla.dalton@raleighncc.gov</a></td>
</tr>
<tr>
<td>Risk Management</td>
<td>Jack Moyer</td>
<td>URS Corporation</td>
<td>(919) 461-1100</td>
<td><a href="mailto:jack_moyer@urscorp.com">jack_moyer@urscorp.com</a></td>
</tr>
<tr>
<td>Seminars and Workshops</td>
<td>Betsy Drake</td>
<td>Town of Cary</td>
<td>(919) 481-5093</td>
<td><a href="mailto:betsy.drake@townofcary.org">betsy.drake@townofcary.org</a></td>
</tr>
<tr>
<td>Sustainability</td>
<td>Randy Foulke</td>
<td>URS Corporation</td>
<td>(919) 461-1466</td>
<td><a href="mailto:randy.foulke@urscorp.com">randy.foulke@urscorp.com</a></td>
</tr>
<tr>
<td>Water Collection &amp; Water Distribution Systems</td>
<td>Terri Benson</td>
<td>Brown and Caldwell</td>
<td>(704) 373-9178</td>
<td>t <a href="mailto:Benson@brwncald.com">Benson@brwncald.com</a></td>
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### Schools Council

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<tbody>
<tr>
<td>COUNCIL CHAIR:</td>
<td>John Kiviniemi</td>
<td>OWASA</td>
<td>(919) 537-4352</td>
<td><a href="mailto:jkiviniemi@owasa.org">jkiviniemi@owasa.org</a></td>
</tr>
<tr>
<td>Collection &amp; Distribution Schools</td>
<td>Andy Brogden</td>
<td>City of Durham</td>
<td>(919) 560-4344</td>
<td><a href="mailto:andy.brogden@durhamnc.gov">andy.brogden@durhamnc.gov</a></td>
</tr>
<tr>
<td>Plant Operations &amp; Maintenance</td>
<td>Bob Fritts</td>
<td>CMUD</td>
<td>(704) 363-8241</td>
<td><a href="mailto:rfritts@ci.charlotte.nc.us">rfritts@ci.charlotte.nc.us</a></td>
</tr>
<tr>
<td>Professional Wastewater Operators</td>
<td>Tony Mencome</td>
<td>Hayward</td>
<td>(980) 395-3926</td>
<td><a href="mailto:tmmacenom@heyward.net">tmmacenom@heyward.net</a></td>
</tr>
<tr>
<td>Wastewater Board of Education &amp; Examiners</td>
<td>David Wagoner</td>
<td>CDM Smith</td>
<td>(704) 302-3301</td>
<td><a href="mailto:wagonerd@cdmsmith.com">wagonerd@cdmsmith.com</a></td>
</tr>
<tr>
<td>Wastewater Laboratory Analyst</td>
<td>Vacant - Contact Catrice Jones</td>
<td></td>
<td>(919) 784-9030 x220</td>
<td><a href="mailto:cjones@ncsafewater.org">cjones@ncsafewater.org</a></td>
</tr>
<tr>
<td>Wastewater Schools</td>
<td>John Dodson</td>
<td>City of Durham</td>
<td>(919) 560-4384</td>
<td><a href="mailto:johndodson@durhamnc.gov">johndodson@durhamnc.gov</a></td>
</tr>
<tr>
<td>Water Board of Education &amp; Examiners</td>
<td>Daniel Williams</td>
<td></td>
<td>(252) 726-6853</td>
<td><a href="mailto:mcwater@bizerc.r.com">mcwater@bizerc.r.com</a></td>
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Committee Spotlights

Collection & Distribution Schools
Ongoing education and training is a vital, mandatory requirement of certification in the industry. The role of the Collection & Distribution Schools Committee is to ensure the planning and operation of annual schools that teach the necessary curricula surrounding collection, distribution, backflow/cross connection and meter technician. All committee members have taught in the schools and most still do. Chair Andy Brogden is no exception. “I have done all of them at one point or another,” says the City of Durham’s Water & Sewer Maintenance Superintendent.

“Pretty much everybody on the committee can fill in when necessary, and teach a class on any subject.”

The committee develops curricula that follow the Needs to Know document developed by the Board of Education & Examiners for the certification program. In order for industry professionals to meet their contact hour requirements, a certain amount of time must be dedicated to each subject. Content is continuously updated to keep up with current trends. The committee also strives to incorporate feedback provided by those who attend the schools.

Promoting the classes begins about three months prior to the school date. Working with a basic outline of the schedule, coordinators on the committee then recruit the volunteer instructors and coordinators according to their availability while setting fees and finalizing the details for each track. The coordinators work closely with NC AWWA-WEA Educational Events Manager Catrice Jones throughout the process.

“We do this three times a year,” notes Brogden, who teaches Distribution system operation and maintenance in all three schools. “Each time, there are more than 100 volunteers involved with putting on one school. This would not be possible without the municipalities, private employers and vendors allowing their employees the time to participate.”

Also important to the success of the schools are the community colleges and universities that provide space for teaching the classes.

Brogden takes pride in the quality of the schools and in the role he plays in helping the 1600 participants who attend annually learn how to make systems safer for their customers. In the process he hopes he is changing the perception of field operation personnel to understand the importance and value of the work they do. Part of that professional development is the opportunity to participate in organizing the Collection & Distribution schools. “The committee is very open,” says Brogden who is finishing the first of a two-year term as chair. “If you are involved in the school as an instructor, you are welcome to participate in the committee.” Meetings are held three to four times a year.

Recently, the committee changed the student banquet from a dinner to a lunch, a move welcomed by everyone. The group is also trying to standardize and digitize presentations to create a database of resources for instructors asked to fill in at the last minute. Says Brogden: “There are a lot of opportunities to help.”

Plant Operations & Maintenance
Originally called the Operations Liaison Committee when it was formed in 1987, the Plant Operations & Maintenance (PO&M) Committee has evolved over the years, from focusing only on wastewater to encompassing both aspects of the profession. Throughout the late ‘80s and early ‘90s, the committee was preoccupied with developing a comprehensive inventory of all the available equipment at the state’s wastewater plants.

Today, the primary work of PO&M involves developing and maintaining the Maintenance Technologist Certification Program. In 2013, the committee organized its fifth year of annual four-day schools, one in the west at Morganton and one in the east at Raleigh, coordinating the delivery of approximately 60 presentations each time. Over 600 certifications have been earned by technicians across the state.

PO&M holds approximately six meetings a year, with several subcommittees working continuously in between. For instance, the Maintenance Technologist Certification Oversight Subcommittee keeps policies up to date and answers any questions pertaining to the training program.

Another subcommittee is responsible for the Maintenance Technologist of the Year Award given at the Annual Conference. There is also a Communication Subcommittee, which selects quarterly Plant Spotlights for NC Currents and contributes to website resources such as Tricks of the Trade.

Other committee members are involved in organizing the O&M track at the Spring Conference, everything from soliciting professionals and industry experts to present pertinent topics; to coordinating moderators and room monitors; to assisting at the committee’s table in the exhibit area. This past spring, the O&M Track provided 1½ days of training by holding several 30-minute presentations.

Meanwhile, the Instructor Support Subcommittee supports all schools and their coordinators, schedules and presentations along with, class schedules, and instructor coordination, schedules and notices, etc. There is also
Committee Spotlights

a subcommittee devoted to curriculum development, which works on the Maintenance Technologist Curriculum and the Need to Know documents while supporting the instructors.

Members of the PO&M Committee can participate in any number of subcommittees or serve as a general member, offering insight and feedback on committee activities. “A lot of the work could not be done without the members’ continuous volunteer support,” says Robert Fritts, who joined the committee in December 2006 and became chair in 2012. “Committee members are constantly working on presentations, curricula and instructor training needs.”

In return, members gain access to a vast amount of knowledge and tremendous networking opportunities. Members report how much they enjoy being active in a professional group who share a passion for educating operators and maintenance personnel, and how comfortable they feel calling their committee colleagues with technical and professional questions. At the same time, they have a chance to work with other members of the industry, including plant personnel, vendors, engineers, administrators, etc.

Says PO&MC member Scott Oliver: “I wanted to use my experience and training to help educate our professionals in properly and safely operating and maintaining the highly technical and expensive equipment of our industry, for full utilization during its design life.”

In the coming year, the committee will continue to oversee the evolution and growth of the Maintenance Technologist Certification Program, with the goal of making continuing education units a requirement for Maintenance Technologist Certification. Refining the school is an ongoing commitment. “Every time we put on a school, there is a wealth of feedback from students, instructors and the team of coordinators who are involved,” says Vice Chair Dell Harney. “This feedback is our barometer to what we are doing well and where we need to focus on doing better. An attitude of continuous improvement permeates the entire program. One of our priorities is to bring new volunteers into this process every year. The combination of seasoned hands and new faces makes for these tremendous teams who keep things fresh, keep the ideas coming, but also know how to get things done.”

Professional Wastewater Operators

Every year, the Professional Wastewater Operators Committee (PWOC) organizes visits to 12 wastewater treatment plants across North Carolina. Attendees receive two hours of continuing education units along with the opportunity to network with other professionals and learn about different
systems and skill sets. The first hour involves a technical session with a guest speaker discussing a specific topic. The session is followed by a plant tour.

“We are too small of a community to miss the opportunity to help one another,” says Heyward Incorporated’s Tony Mencome, who became the chair last November, after four years on the committee. “I enjoy helping people get their CEUs for free while learning from the presenters.” He adds that the tours are not just for operators or members. Everyone is welcome to attend.

PWOC has divided the state into three regions – western, central, and eastern – and holds a meeting in each section quarterly. This means that the committee is responsible for finding the plants to host the tours on a monthly, rotating basis. The focus is on finding the broadest variety of plants possible, with a wide range of operations. The technical sessions also touch on a wide range of topics.

Through this program, the PWOC fosters networking and professionalism among North Carolina’s more than 3,000 Wastewater Operators. “This is particularly important to rural areas and small systems which often have difficulty either traveling long distances or getting coverage because they have a small staff and finding someone to operate the plant so they can attend education events,” notes Tony.

To assist in its outreach efforts, the committee annually recognizes a plant in each region with the Wastewater Treatment Plant Operation & Maintenance Excellence Award. This honor is awarded at the Annual Conference to recognize wastewater plant personnel who serve their community with a high level of professionalism and diligent work in the operation and maintenance of their wastewater treatment facility, no matter how large or small.

Other efforts to support the NC AWWA-WEA include mentioning the Tricks of the Trade and Plant Spotlight pages on the ncsafewater.com website. The NC AWWA-WEA is always looking for people to submit ideas and suggestions for these two activities.

**Wastewater Board of Education and Examiners**

The Association created the Wastewater Board of Education and Examiners (WWBOEE) to serve as a resource to the North Carolina Water Pollution Control Systems Operators Certification Commission (NCWPCSOCC) in its various tasks related to wastewater certifications.

The WWBOEE is composed of 10-15 members, appointed by the NC AWWA-WEA Chair for three-year renewable terms. The current chair, CDM Smith’s David Wagoner, has been involved in operator training for nearly 30 years. “I enjoy the process of helping to educate operators and to see them advance in their profession,” says Wagoner, who joined the WWBOEE in October 2009. “Accepting the appointment gave me the opportunity to work with other dedicated members and contribute directly to the continuing efforts to maintain exceptionally well-trained operators in North Carolina.”

Members of the WWBOEE include professionals at municipal, county, and industrial systems as well as consulting engineers. The WWBOEE includes two members from each of the following types of systems: those serving a population of less than 10,000; Physical/Chemical Grade II; Biological Grade IV; and Collections Grade IV. “All members must hold the highest certification available for the category they are appointed,” notes Wagoner.

Members participate in establishing, reviewing and validating the curricula, content and references for the certification courses. They are also involved in developing and maintaining the Train Course Standards or more commonly called Needs To Know Manuals. Other areas of involvement may include test question assistance, course instructor guidance, class audits, assisting with exam application processing, exam review, training evaluations, exam proctoring, and appeals. The WWBOEE meets every other month while the three subcommittees – Collections, Biological and Chemical/Physical – meet more often, depending on scheduled tasks.

The WWBOEE is sometimes informally supported/assisted by non-voting advisers, including the NC Water Pollution Control System Operators Certification Commission (NCWPCSOCC) representative, the NC AWWA-WEA Wastewater Treatment Operators School Committee Chair and the Association’s Collection/Distribution System Operators School Committee Chair. “Their roles are to bring perspectives and special concerns to the board from their committees or the commission and to assist the WWBOEE in addressing issues or concerns related to operator training,” explains Wagoner.

In the coming year, the WWBOEE plans to complete the updates to the Needs to Know Manual for Collection Systems Operators on which it has been working. The WWBOEE has also made significant headway on the Biological Needs to Know document review and updates, with a first draft expected soon.

**Water Board of Education and Examiners**

The Water Board of Education and Examiners WBOEE was established to assist the North Carolina Water Pollution Control System Operators Certification Commission (NCWPCSOCC) and the North Carolina Water Treatment Facility Operators Certification Board (NCWTFOCB) in fulfilling their responsibilities relating to distribution and collection. The WBOEE consists of nine to 15 official members serving three-year terms. At least two members are from systems serving less than 10,000 people and two hold a valid A-Distribution certification issued by the NCWTFOCB. All members have achieved the highest level or grade in Distribution, Meter, or Cross Connection unless otherwise approved by the NCWTFOCB.

Meeting four times a year, the WBOEE helps develop curricula related to voluntary certification of meter technicians. At the same time, WBOEE makes reference material available while providing guidance to instructors and
assistance to the Distribution & Collection Schools Committee.

As such, members of the WBOEE review each application prior to seating the applicant for the Meter Technician exam. In addition to helping prepare the exam, they also administer and monitor the entire process. This includes scoring exams and reviewing scores and experience before awarding certificates. The WBOEE is also responsible for reviewing appeals and preparing reports to the NC AWWA-WEA Board of Trustees.

Members of the WBOEE have similar responsibilities related to Distribution and Backflow/Cross Connection Certification. Once again, they develop exam questions; administer and monitor exams; and then review the completed exams and scores.

Another duty related to the NCWPCSOCC and NCWTFOCB is the selection of recipients for the Raymond E. “Red” Ebert, Distribution Operator of the Year and Collection Operator of the Year Award. The purpose of these tributes is to recognize the outstanding contributions of individuals in their particular field of practice.

“It’s a good feeling to participate in helping these associations with all these tasks,” says Daniel Williams, who joined the WBOEE in 2008 and became chair in 2013. “It’s a way to give back.” Williams is the Director of Public Utilities for the Town of Morehead City. He notes that the WBOEE tries to move meetings around the state to accommodate all members, with a substantial portion of the work also completed via group email.

Wastewater Laboratory Analyst

By promoting communication among the state’s wastewater laboratory analysts and providing them with educational opportunities, the Wastewater Laboratory Analyst Committee helps insure that laboratories generate precise and accurate data to protect water resources. “I have always felt that the greatest value of this committee is the opportunity for peer networking,” says Glenn McGirt, chair from 2005 to 2013. “It is so infrequent to be exposed to that number of people in similar jobs, and who, therefore have similar tasks, problems and issues. The feedback and conversation between these different municipalities is priceless.”

He explains that the committee is in the unique position of meeting more like an organization than a committee. Notices of meetings and other announcements are sent out to more than a hundred individuals from the Piedmont section and the Eastern sections. Typical attendance at the meetings ranges from 30 to 40 people. The majority of attendees are from municipal wastewater labs. However, there are also quite a few people from NC Division of Water Quality (NC-DWQ) lab certification as well as representatives from various vendors.
and several educational institutions. In the past the committee has met quarterly. Members are encouraged to suggest topics, speakers and locations, or volunteer themselves for future meeting programs/presentations. They also have the opportunity to participate in the organization process of the annual Lab Tech Day seminar or, if qualified, can help with the Wastewater Lab Analyst Certification Program.

Over the past year, the committee helped organize and determine the agenda for a very successful Lab Tech Day in May. The Wastewater Lab Analyst Exam was administered twice and the committee met as a group several times, listening to presentations on changing regulations and regulatory organization. “I feel one of the best meetings we had was a couple years ago when we organized a round table discussion of a particular laboratory analysis that is commonly known to present headaches to lab personnel,” recalls McGirt. The discussion revolved around how the particulars of the test were accomplished in several different labs.

In the coming year, NC AWWA-WEA is working to focus more resources on the Wastewater Lab Analyst Certification program. If you are interested in being involved contact John Kiviniemi at jkiviniemi@owasa.org.

### Constitution & Bylaws

Aligning the bylaws of the North Carolina Section, the American Water Works Association (NC-AWWA) and the North Carolina Water Environment Association (NC-WEA) is at the very root of the working relationship between the state’s water and wastewater professionals. As the committee chair since 2009, Chuck Willis of Willis Engineers works closely with the Director of the AWWA, the Directors of the Water Environment Federation (WEF) and the Association Executive Director to review the bylaws and recommend changes or amendments.

The chair can also pull in any active Association members deemed beneficial to accomplishing the purpose of the committee at any given time. Periodically, ad hoc sub-committees are created to focus on particular issues. This was the case a few years ago, when the Association created student chapters at NC State and UNC - Charlotte. At the same time, the committee worked closely with the Students and Young Professionals committee and the student chapters in the writing of their constitutions.

Periodically, the committee must also make changes to modernize the constitution and bylaws. At other times, the task at hand involves aligning the bylaws and/or constitution with changes in the underlying documents of the parent organizations. All constitutional or bylaw changes must be approved by the membership. This is done through a balloting process incorporated into the selection of officers at the Annual Conference.

The way that balloting is conducted for the selection process itself was one of several substantial changes on which the committee worked over the past year. Another was adjusting the composition of the nominating committee. “The Constitution & Bylaws Committee has a behind-the-scenes kind of function that has more impact than it might appear,” says Willis. He looks forward to putting his talent as wordsmith to good use again in the coming year.

### Students & Young Professionals

The NC AWWA-WEA created this committee to serve as a stepping-stone for students and young professionals to become part of the organization. “We want them to network and meet other young professionals,” says Co-Chair Leigh-Ann Dudley, who was a student on the committee before transitioning to a Young Professional (YP) when she became a process engineer with Dewberry. “At the same time we want them to use their involvement as an opportunity to explore what other committees and Association activities they can get involved in.”

One of the committee’s goals is to help members find other ways to be active in the Association. To encourage involvement and networking, the Student & Young Professionals (S&YP) organizes lunch seminars and happy hours. Other activities include helping the student chapters find speakers for their lunches as well as providing judges and professional mentors for the end-of-term competition leading up to the national Water Environment Federation Technical Exhibition and Conference (WEFTEC) Poster Competition, which is now part of NC State’s Senior Design Class curriculum.

These activities have kept the S&YP busy over the past year. As an alumna of NC State working in Raleigh, Dudley serves as a natural liaison to NC State. Meanwhile Co-Chair Ryan LeBlanc liaises with UNC Charlotte, which was very busy over the past year organizing a number of socials and networking opportunities.

At the Annual Conference, S&YP once again paired up students with professionals that they could ‘shadow’ on the Monday morning. The committee also coordinated the poster competition and solicited judges for the event.

Goals for the coming year include continuing with ongoing activities while encouraging members to join or try out other committees. “I think that we do a good job working with the student chapters,” says Dudley. “Now we have to see how we can better serve the Young Professionals.” Several committees have indicated that they would be happy to have YPs help with their website or social networking, things at which YPs are generally thought to be more proficient than their older colleagues.
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A nyone who has ever met outgoing Communication Committee Chair Tom Bach knows how good he is at connecting with others. Over the years, the civil engineer has put this talent to good use through his involvement with various professional, educational and community organizations. “In tough economic times, networking is more important than ever,” says Bach, who currently works at the Water & Sewer Authority of Cabarrus County (WSACC) as the Utility Systems Engineer. “Whether you are helping people find work or exchanging information, it is all about sharing and supporting one another. I wanted to become involved in the NC AWWA-WEA not only for the networking, but also because it is such a wonderful platform for learning from experienced individuals about the industry and beyond.”

Recently, Bach took that concept to the Technology Student Association (TSA). He leveraged his connections to obtain approval from the TSA Competition Regulations Committee for the launch of a national competition for middle school students. As a director on the Board of JETS, Bach met educators, CEOs and executive directors of non-profit organizations from all over the country. The following year JETS was acquired by the TSA. Bach became a member of the TSA advisory council primarily working with other volunteers for TEAMS (Tests of Engineering Aptitude, Mathematics and Science), a TSA competition for students in middle and high school that allows them to apply their knowledge of skills in science, technology, engineering and mathematics (STEM) to issues facing our global society.

“As a result of this involvement, I then brought representatives from TSA and the Water Environment Federation (WEF) together to create a national middle school competition dealing with water,” explains Bach, adding that he also convinced his alma mater, the University of Tennessee at Knoxville, to host the TEAMS competition starting in 2012. “I think this sort of activity for kids is so important, especially in the years when they are starting to think of potential careers.” He sees immense potential in these and other competitions for encouraging more students to enter the field of engineering with a focus on water and wastewater.

Bach actually started his own engineering career with the NC Department of Transportation (DOT), the department where he completed his university co-op program. He first became involved with water and wastewater during some utility relocation work for the John Belk Freeway located in uptown Charlotte, a $63 million project undertaken in the mid-1980s. “One of my tasks was to coordinate complex relocations of water and wastewater systems in uptown Charlotte, a $63 million project undertaken in the mid-1980s. ‘One of my tasks was to coordinate complex relocations of water and wastewater

utilities with the Charlotte-Mecklenburg Utilities Department (CMUD),” he recalls.

It proved to be good preparation for the next stage of his career. After four years at the DOT, Bach joined CMUD, working there for almost 10 years. “I wanted to get more involved with the design aspect of civil engineering,” he explains, adding that doing more design calculations was excellent preparation for his engineering exams. “CMUD gave me that opportunity, and working on various water and wastewater projects really interested me. I felt that it was a very dynamic field, much more so than transportation. Our water and wastewater industry changes constantly and I like that aspect.”

Nonetheless, he still uses his background in transportation when doing projects with the DOT. Since joining WSACC over seven years ago, Bach has become responsible for reviewing all capital projects, from planning to preliminary design, right through to construction. He is also responsible for the sewer flow acceptance program at WSACC and works with operations and maintenance personnel on projects for the wastewater treatment plants. Other responsibilities include evaluating life cycle costs, checking the capacity of existing sewer lines, and keeping track of daily flows. “I wear a lot of hats,” notes Bach. “I could be doing something administratively one morning and at other times be out at a job site talking with contractors.”

Despite a busy schedule, he still finds time to be actively involved in the NC AWWA-WEA. He joined the association in 2000 and has been involved with the
Committee. He plans to apply these particular, with the Communication involved with the Association and, in is to get more young professionals as a member of the NC AWWA-WEA own membership. His personal goal helped the committee quadruple its own membership. His personal goal as a member of the NC AWWA-WEA is to get more young professionals involved with the Association...
Despite Leigh-Ann Dudley’s busy schedule as a process engineer for Dewberry, the 25-year-old is still actively involved with the NC AWWA-WEA as co-chair of the Students and Young Professionals Committee. “I have a lot to learn from other professionals,” she explains. “I think I would be doing myself a disservice if I limited my professional interactions. Requirements of the industry continue to change and I want to make sure I continue to keep up with them.”

Dudley has always been eager to capitalize on every opportunity to learn. For instance, during her freshman year in chemical engineering at NC State University, she decided she wanted to participate in the co-op program. There were 17 different openings and since she was not quite sure what she wanted to do, she applied for every one of them. “All the job descriptions were very similar except for one,” she recalls. “The position at O’Brien and Gere was very different. It was the only posting in the field of water and wastewater. I was very excited when I got a call to come in for an interview. I felt like I got my first choice.”

One of the aspects of the work that attracted her was the variety of projects. Dudley knew that she would have the opportunity to be involved in a number of different projects at any one time, everything from wastewater plant design to bench scale testing to regulatory support. “I like the idea of not working on the same process every day,” she explains. “It seemed like an interesting application of what I learned in school.”

O’Brien and Gere proved to be very good at incorporating Dudley into all sorts of projects, whether they involved filling out permit applications or designing pilot scale tests and running them on site. “They were great about letting me try all sorts of different things,” she confirms. “That is an important part of being a co-op student or an intern.”

During her senior undergraduate year, she interned at Dewberry, working there until 2010, when she decided to attend graduate school full time. Two years later, her master’s degree in Environmental Engineering completed, she joined Dewberry full time as a process engineer.

“Co-op and intern programs are really beneficial,” says Dudley. “Employers get to try students out and students get to try out employers.”

During her first year in graduate school, when NC AWWA-WEA’s Students and Young Professionals Committee approached NC State to start a student chapter, she was immediately on board. Dudley had noticed that professional associations in other branches of engineering already offered opportunities for student involvement, but, up to that point, environmental engineering students interested in water and wastewater treatment had no such connections. “Suddenly, there was an opportunity to connect with professionals,” recalls Dudley, adding that John Kivienimi, NC AWWA-WEA president at the time, had come down to the university to personally make the pitch. “The networking was definitely a huge benefit. As students, it was great to be able to connect with people in all different parts of the water and wastewater industry.”
to be able to connect with people in all different parts of the water and wastewater industry."

After working to get the student chapter off the ground, it felt like a natural transition to continue participating in the Students and Young Professionals Committee after graduation. Dudley’s favorite part of participating in the committee is helping with student activities at the Annual Conference, such as the student poster competition and the shadow program in which students are paired up with seasoned industry professionals during the conference. "The Association has done a lot to make the students feel welcome as a true part of the conference, not just visitors," she adds. These days, she attends the conference not only as a member of the committee but also as a working professional representing Dewberry.

As one of the company’s process engineer, Dudley deals mainly with industry clients. “When our clients have treatment plant upsets, we help them get their plant operating again while still maintaining both the production schedule and regulatory compliance,” she explains. “It involves a lot of site work, which I enjoy. I absolutely learn the most when I am in the field and getting hands-on experience operating treatment processes.”

Part of her work also involves plant upgrades and modifications in design. Where possible, she tries to get involved in other parts of a project, beyond process engineering. “I want to learn more about what other design disciplines do so that when we get to work together on projects, we can add the most value to our clients,” she explains, noting that the group with which she currently works gives her the opportunity to manage small projects. Dudley looks forward to someday becoming a project manager.

No matter where her work takes her, one thing is certain: being an active member of the Association will always be an important part of her career.  

“I absolutely learn the most when I am in the field and getting hands-on experience operating treatment processes.”
Plant Spotlight

Plant Spotlight:
Thomas Z. Osborne Water Reclamation Facility –
Greensboro, NC

Information provided by: Don Howard (Water Reclamation Manager) and Lori Cooper (WRF ORC/Superintendent)
Article created by: David Hamilton, PE / ARCADIS (NC AWWA-WEA Plant Operations & Maintenance Committee)

General
The Greensboro Thomas Z. Osborne Water Reclamation Facility (TZO WRF), which began operation in 1984, is located east of Greensboro in McLeansville, NC and discharges to South Buffalo Creek, a tributary of Buffalo Creek and the Haw River in the Cape Fear River basin. The plant, together with the North Buffalo Creek WRF – also operated by the City of Greensboro – provides sewer service to a population of approximately 277,000. The wastewater collection system is comprised of nearly 1,600 miles of collection lines, 47 pumping stations and related force mains, and approximately 102,000 service connections. Wastewater flow to the plant is primarily domestic, but 33 significant industrial user discharges and 10 non-significant user discharges are treated as well. (Significant users are those discharges to the wastewater system greater than 25,000 gal/d average, or those subject to pretreatment standards, especially discharges containing metals, or if there is a reasonable potential for that user to negatively affect the treatment plant). The TZO WRF is currently permitted for 40 mgd and the North Buffalo Creek WRF is currently permitted for 16 mgd. The combined average daily flow (ADF) is 30 mgd with a combined peak of 100 mgd. The annual facility operating cost for the TZO WRF is between $12M and $14M.

Treatment Processes
The key TZO treatment processes are as follows:

Preliminary Treatment
• Mechanical screening
• Stirred vortex grit removal system

Primary Treatment
• Pre-aeration
• Primary clarification
• Flow equalization

Secondary Treatment
• Single-stage activated sludge with nitrification
• Phosphorous precipitation
• Final clarification
• Effluent filtration
• Disinfection
• Dechlorination
• Post-aeration

Biosolids Treatment
• Thickening
• Storage
• Dewatering
• Incineration
• Disposal
The detailed description of these processes is as follows:
Flow comes into a number of mechanical bar screens, then to stirred vortex aerated grit removal, and on to the six primary clarifiers (four rectangular and two circular). A 3.5 million gallon equalization basin handles excess primary effluent.

The activated sludge process is single stage with nitrification along with chemical addition of polyaluminum chloride for phosphorus removal. Flow then goes to seven final clarifiers, traveling bridge sand filters, chlorination using hypochlorite, dechlorination using bisulfite, four cascade aerators, then into the South Buffalo Creek. The TZO WRF effluent discharge is roughly 97% of the flow in this very small receiving stream.

Thickened sludge from the North Buffalo Creek WRF is pumped via a five-mile-long line to the TZO WRF for further thickening and blending. Four sludge thickeners, two sludge holding tanks, three centrifuges, two fluid bed incinerators, and a belt filter press for the ash produced during incineration are part of the dewatering process. The ash is taken to City’s landfill for use as cover material.

Some of the major equipment brands are: Gorman-Rupp Pumps, Lamson Blowers, Schwing BioSet Sludge Pumps, WSG & Solutions Grit Classifiers, Moyno Pumps, and Lightnin Mixers.

Processes are automated with monitoring and control on most processes and equipment.

Aeration basins.
and time for employees to undertake the course work and testing to attending Wastewater Operator Schools. The City provides funding opportunity to advance their State level wastewater certifications by Wastewater Operator Schools. Staff Development

Personnel Staff

Personnel at TZO include 38 Operations and Maintenance staff (37 male, one female), eight laboratory staff (three male, five female), and nine Administrative staff (four male, five female).

Staff Development

Wastewater Operator Schools. Plant Operators are given the opportunity to advance their State level wastewater certifications by attending Wastewater Operator Schools. The City provides funding and time for employees to undertake the course work and testing to achieve these certifications.

Leadership Training. The Utility offers a six month long Foundations of Management and Foundations of Supervision class for supervisors and managers.

Continuing Education. The six hours of annual continuing education required by the State for operators to maintain their license is paid for by the City.

Expansions and Upgrades

Greensboro is in the planning stages of expanding the TZO plant to a 56 mgd permitted flow and decommissioning the smaller North Buffalo Creek plant. North Buffalo sends thickened solids to the TZO plant for disposal now. The City is evaluating potentially going from a single stage activated sludge plant to a conventional five stage biological nutrient removal during this proposed upgrade and expansion project.

Challenges

The older fluid bed incinerator historically lost around a ton of bed sand per day. This made dewatering the incinerator ash very easy due to the high sand content in the ash. The City rebuilt one of the two fluid bed incinerators and put it on line in September of 2011. The new unit loses no more than a few hundred pounds of sand per month. Consequently, the plant started having trouble dewatering the ash. A review of what made this difference revealed the reduced sand loss was the culprit. To improve dewatering the City is now designing a replacement for the aging belt filter press. A Fournier rotary press will be used. This press is expected to achieve higher cake solids concentration and impressive capture rates. The Fournier press will have six lobes; three lobes will handle our entire ash flow, so there will be three in-line spares. What began as a dewatering capacity loss mystery ended with the facility getting a very satisfactory piece of equipment and very dry ash.

Personnel

Staff

Personnel at TZO include 38 Operations and Maintenance staff (37 male, one female), eight laboratory staff (three male, five female), and nine Administrative staff (four male, five female).

Health & Safety

Monthly safety meetings are held at each location. Greensboro has a Water Area Resource Team (WART) that audits all the individual Water Resources department areas. Two people from each Water Reclamation Facility are on the WART audit team. The City also has a defensive driving course each employee takes every three years, lock out tag out recertification each year, and the City offers classes in first aid and CPR regularly.

Also offered are classes in healthy cooking, meal planning, and grocery shopping. A weekly 30-minute cardio/fitness class is also offered at alternating locations throughout the City for Utility staff.

Awards and Recognition

The TZO WRF has received the following recognitions and awards:

- American Council of Engineering Companies (ACEC) – Grand Award for Engineering Excellence Water and Wastewater for the project Nutrient Removal Master Plan and Piloting; 2011
- National Association of Clean Water Agencies (NACWA) – Peak Performance Awards; 2008 & 2009 Silver Award; 2011 Gold Award
- Associated Builders and Contractors Inc. – Eagle Award for TZO Fluid Bed Incinerator Renovation/Restoration Owner Award (Engineer: CDM Smith); 2012
- Association of General Contractors (AGC) – (National) Build America Award for the TZO Fluid Bed Incinerator Construction (Contractor: Crowder Construction Company); 2013.

Unique Attributes

Coupled with North Carolina having some of the most stringent stream standards in the country, is the fact that Greensboro is a large city located on very small streams. The TZO WRF discharge flow constitutes almost the entire flow in the stream below the discharge point at the lowest stream-flows. Therefore, TZO WRF discharge limits are naturally very low. (South Buffalo Creek is part of the Cape Fear River Basin, home of diverse wildlife habitats and host to 85 species of native fish and 22 species of non-native fish).

The permitting of treated wastewater discharges makes the assumption that stream flow is at the lowest volume so as to offer the protection needed when stream flow is at its lowest. North Carolina bases its calculations on the “7 Q 10’ flow, or the lowest seven days of flow expected every 10 years in a given stream. The permit limits for wastewater discharges takes this level of stream protection into account in calculating the limits, yet it is applicable every day (24 hours per day, seven days per week, 365 days per year). Greensboro meets this challenge through the good planning, operations and maintenance, and dedication of the Utility managers and staff.

Contact Information for More on the Greensboro Thomas Z. Osborne Water reclamation Facility

Lori Cooper, Water reclamation Facility ORC/Superintendent (lori.cooper@greensboro-nc.gov); ph: (336) 433-7221.
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North Carolina • South Carolina
Excitement is building for North Carolina’s largest and most important gathering of water and wastewater professionals - the NC AWWA-WEA Annual Conference! The Association’s 93rd Annual Conference will be held November 10-13, 2013 at the Embassy Suites Charlotte-Concord Golf Resort & Spa in Concord, NC. This conference is North Carolina’s primary forum where industry decision-makers and others involved in the water and wastewater industry gather to exchange fresh ideas and share proven successes. Attendees will learn from informative and interesting technical sessions, network at the many social events and, of course, enjoy visiting with leading edge companies in the exhibit hall.

Concord, the host city, is best known for its unequalled concentration of motorsports attractions, from the Charlotte Motor Speedway and zMAX Dragway to Hendrick Motorsports. The Embassy Suites Charlotte-Concord offers easy access to nearby Great Wolf Lodge indoor water park and Concord Mills Mall, a 1.4 million square foot shopping mall touted as one of North Carolina’s largest tourist attractions. Concord’s proximity to I-85 put it in the heart of the highest growth corridor in North Carolina and just a short drive away from all the amenities of Charlotte, North Carolina’s largest city and a community rich in captivating culture, colorful cityscapes and cosmopolitan character.

Join us on Sunday, November 10th to kick-off your conference experience with one of two great recreational events. Set your sites on a day of sporting clays or choose to tee-off in our annual golf tournament. We look forward to seeing you!

Hunting Creek (www.huntingcreekpreserves1.com) in Harmony will host the sporting clays event with registration and lunch to begin at 11:30 am and the shoot to begin following lunch. Hunting Creek has a 13-station sporting clays course that offers more than a mile of trails. The course meanders through various elevations before ending on a lowland next to a stream. Each of the stations on the course are located well out of sight of the previous station and are equipped with two Promatic traps and operated with push button ease. A 45-foot tower adds greater variety to the sportsman’s clay experience. This event includes 100 targets and lunch for a fee of $70 per person. All participants will be required to sign a waiver on-site.

The golf tournament will take place at Rocky River Golf Club (www.rockyrivergolf.com), currently rated in the Top 100 Golf Courses in North Carolina, and located next to the Embassy Suites convention center. The course features 18 sensational holes carved out of beautiful rolling hills and natural wetlands. Registration will begin at 9:00am and the tee-time is at 10:00am. The golf package is $95 per golfer, and includes a round of golf, box lunch and prizes.

The exhibit hall will feature 130 booths filling the Concord Convention Hall and the surrounding hallway. These vendors are eager to share their knowledge with attendees, and there will be ample time to talk, with the flexible conference schedule. The exhibit hall will open Sunday evening at 5:00pm with an extended reception where we will announce the golf and clay shoot winners, induct new members into 5-S, and present the Golden Manhole Awards and Collection and Distribution Systems of the Year Awards.

On Monday and Tuesday, buffet-style lunches will be served in the exhibit hall with tables scattered throughout so that everyone can conveniently stop and talk as they eat. Another social will take place in the exhibit hall on Monday from 5:15pm – 6:45pm with complimentary hors d’oeuvres, sodas and a cash bar.

NEW THIS YEAR! You can pre-register to earn continuing education units in the exhibit hall! Attendees that select this option will visit four exhibitors within 70 minutes to attend four 15-minute presentations and receive 1.0 continuing education unit (CEU). These exhibitor CEU sessions will take place three times during the conference: Monday 9:10am and 1:20pm and Tuesday 8:30am. During each time period, two tracks of sessions will run. Space is limited for this new learning experience.

As you plan your conference attendance you will want to make sure you are present in the exhibit hall for the six door prize drawings that will take place Sunday through Tuesday. Every attendee will have multiple chances to win great prizes donated by our generous exhibitors. Door prize tickets are included in attendee registration. Exhibitors will also be able to get in on the competitive atmosphere with a ‘Best in Show’ award. On Monday, secret shoppers will roam the exhibit hall seeking out exhibitors that really set themselves apart from the others. The winner will receive $100 off the purchase of an exhibit booth at the 2014 conference.

With so much to do inside and outside of the exhibit hall, do not forget that the exhibit hall will close on Tuesday at 1:20pm before the conference adjourns.

At the core of everyone’s conference experience is the technical program, and this year’s line-up will not disappoint. The program will begin on Monday morning with the Opening
**Session & Operator Awards** from 7:45am to 9:05am. Lieutenant General (Ret.) R.L. VanAntwerp will be our opening session speaker and will discuss ‘Water Challenges and the US Army Corp of Engineers.’ We will be fortunate to have in attendance national officers from both of our parent organizations, John Alston the 2013-2014 Vice-President from the American Water Works Association (AWWA) and Charles Bott a 2012-2013 Trustees from the Water Environment Federation (WEF). Time will be set-aside during the Opening Session & Operator Awards to hear remarks from these national representatives on the state of the industry. In celebration of our operations personnel, operator awards will also be presented during this time. The remainder of Monday and all of Tuesday will be filled with 30-minute technical sessions being offered all day! Technical session tracks include water, wastewater, collection and distribution, policy and management, and special topics.

Wednesday’s program will consist of a forum entitled ‘Changes in State Government and Regulations…and how they Affect North Carolina’s Water and Wastewater Systems.’ This forum seeks to bring together a panel of experts in the water and wastewater industry to discuss important water and wastewater regulations and legislation in North Carolina. Specific forum topics may include enhancements or suggestions of new legislation and/or regulations for the following: interbasin transfer (IBTs), water supply, direct and/or indirect reuse, nutrient management, design-build, and other water policy and regulatory matters. The goal of the forum is to inform those who manage water and wastewater systems in North Carolina of the real and potential changes in policy and regulations that will have a significant effect on how these systems will be managed in the future. Individuals will also have the opportunity to voice their opinion regarding these changes.

**CEUs** will be offered for the Opening Session, technical sessions, forum, the exhibit hall pass program, and facility tours. Details on how to ensure you receive credit are available in the Annual Conference Registration Brochure and instructions will be available again at the conference.

The **facility tours** will highlight two local facilities. Space for both tours will be limited so don’t forget to register and pay for a tour with your conference registration. A tour of the **Water & Sewer Authority of Cabarrus County’s Rocky River Wastewater Treatment Plant (WWTP)** will highlight the sludge incineration facility and the newly installed waste to energy project using heat from the incinerator to generate electricity. The project is based on regional collection of sludge from adjoining jurisdictions and turning the waste into energy through incineration. This should be a very interesting tour that involves green energy and disposal of wastewater sludge in a very safe and efficient manner. A visit to the **Great Wolf Lodge** will include a guided tour of the facility, water filtration and pumping facilities, and waterpark. Discussions will include the volume of water needed to supply the facility, pump maintenance, and the filtration process to help meet local and state codes for swimming facilities/waterparks.

The popular **Pipe Tapping Contest** will take place Monday, November 11th at 1:45pm. In this competition of skill, teams compete for the best time opening a cement-lined, ductile iron pipe and installing a tap.

To accommodate the expanding **Operations Challenge** contest, these four events will be held at various times on Monday and Tuesday. In the Operations Challenge events, four-person teams, along with their coach, compete in events that challenge their skills in various wastewater related activities. The winner is determined by a weighted point system. At the National WEFTEC level, there are five events in the Operations Challenge: Collection System Event, Laboratory Event, Process Control Event, Pump Maintenance Event, and the Safety Event. The 2013 NC AWWA-WEA Operations Challenge Competition will include four of the five events. The Safety Event will be debuted at the 2014 Annual Conference, and will bring the NC AWWA-WEA Operations Challenge up to par with other WEF Member Associations.

The Collection System Event simulates the connecting of a 4-inch PVC lateral sewer to an existing 8-inch PVC sewer pipe while in service and the simulated Closed Circuit TV Inspection of a gravity sewer line using National Association of Sewer Service Companies standards. The Pump Maintenance Event features a submersible pump and submersible mixer that will have to be serviced, have the mechanical seals replaced, and be ‘placed back into service.’ During the Laboratory Event, teams will setup and perform a simulated biochemical oxygen demand analysis using YSI instruments. The Process Control Event is a timed event giving teams the opportunity to demonstrate their accumulated knowledge and skill in the areas of wastewater treatment plant process control, collections system operation, maintenance, safety, and troubleshooting through a written test including multiple choice questions and short math questions.

On Monday evening, after dinner on your own, join your fellow conference attendees at the Embassy Suites for the **Chair’s Dessert Reception**. All conference attendees are invited to relax with dessert, beverages and live acoustic music.

Again this year the **Best Tasting Water Contest** will be held on Tuesday at 11:30am. All utilities are invited to submit a sample and see how the taste of their drinking water measures up to the taste of others in the state. A panel of volunteer judges will rank individual samples and results will be combined to establish the overall rankings. Awards will be given for first, second and third place. In order to participate, samples must be turned in at the conference registration desk by 5:00pm on Sunday, November 10th.

The Annual Conference shines the spotlight not only on the water/wastewater industry as a whole, but more specifically on NC AWWA-WEA, and Tuesday afternoon and
Unifilt Corporation introduces Uni Liners for rehabilitation of Wheeler filter bottoms. Constructed of durable HDPE the patented liner mechanically locks into place requiring no adhesives. Spheres and media can be immediately installed after the liners are placed. Rehabilitates wheeler bottoms to a perfect form without tedious and costly hand work. Replace worn out liners for a fraction of the cost. Unifilt Corporation is proud to be recognized as the only full-service filter material company. Unifilt’s experienced staff and extensive lines of equipment are provided to efficiently remove and replace your filter media and support material. Unifilt offers equipment rentals and supervision for the delivery of your filter materials, and Unifilt’s field technicians are available for underdrain repairs or replacements. We specialize in the manufacture and supply of anthracite filter coal, filter sand, filter gravel, and high density material (ilmenite and garnet). Unifilt’s superior products meet or exceed AWWA B100-09 and NSF standard 61.
evening will highlight the inner-workings of the Association and the committees and people that make things happen. Starting with the Gavel Gala & Awards at 5:30pm you can sit in on the Annual Business meeting, witness the installation of the 2014 Board of Trustees and the formal passing of the gavel as well as congratulate those earning membership awards and winning contests that took place during the conference. The official Awards Banquet will get started at 7:00pm and will honor several outstanding people in our industry.

Students are encouraged to attend and get a jump-start on their career by participating in our Student Activities. To make conference attendance a little easier, students are eligible for FREE MONDAY ONLY REGISTRATION. To take advantage of this offer, or learn more about any of the available student activates, contact Ryan LeBlanc at (704) 510-8419 or leblancr@bv.com. Since one of the most beneficial aspects of conference attendance is network building and making contacts, the Student Guide Program gets students started by pairing them with an established professional to answer questions, show them around the conference, and introduce them to others in the industry. Monday’s Student Appreciation Lunch is also a great place to meet students from other schools and professionals interested in getting the next generation involved. Students are encouraged to attend the Monday evening social and gather with other industry newcomers in the exhibit hall.

Students involved in research related to water resources topics will want to enter the Student Poster Contest and show off their work to others. The poster contest will take place on Monday. Monetary prizes will be awarded for first, second and third place posters. The first place winner will be awarded the opportunity to present their poster at the national AWWA Annual Conference and Exhibition!

Make the most of your conference attendance and stay close by at the Embassy Suites Charlotte-Concord Hotel. Special room reservation rates are available until October 24, 2013.

There are so many exciting things at this year’s conference that you will not want to miss. If you are not already a member, considering joining AWWA, WEF or NC SLAM to take advantage of the benefits these organizations offer as well as a discounted conference registration rate. Join your industry peers and take advantage of the countless opportunities this conference has to offer. We look forward to seeing you in Concord!
Visit us online, www.ncsafewater.org

Our concern for the environment

is more than just talk

As we continue to deliver valuable information through the pages of this magazine, in a printed format that is appealing, reader-friendly and not lost in the proliferation of electronic messages that are bombarding our senses, we are also well aware of the need to be respectful of our environment. That is why we are committed to publishing the magazine in the most environmentally-friendly process possible. Here is what we mean:

• We use lighter publication stock that consists of recycled paper. This paper has been certified to meet the environmental and social standards of the Forest Stewardship Council (FSC®) and comes from responsibly managed forests, and verified recycled sources making this a RENEWABLE and SUSTAINABLE resource.
• Our computer-to-plate technology reduces the amount of chemistry required to create plates for the printing process. The resulting chemistry is neutralized to the extent that it can be safely discharged to the drain.
• We use vegetable oil-based inks to print the magazine. This means that we are not using resource-depleting petroleum-based ink products and that the subsequent recycling of the paper in this magazine is much more environment friendly.
• During the printing process, we use a solvent recycling system that separates the water from the recovered solvents and leaves only about 5% residue. This results in reduced solvent usage, handling and hazardous hauling.
• We ensure that an efficient recycling program is used for all printing plates and all waste paper.
• Within the pages of each issue, we actively encourage our readers to REUSE and RECYCLE.
• In order to reduce our carbon footprint on the planet, we utilize a carbon offset program in conjunction with any air travel we undertake related to our publishing responsibilities for the magazine.

So enjoy this magazine...and KEEP THINKING GREEN.

With print and electronic communication operating hand-in-hand you can take advantage of the fact that NC Currents magazine is available online in a highly interactive format.

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to return to Table of Contents
The Making of a Conference – The Conferences Coordinating Council

The Annual Conference is NC AWWA-WEAs largest event, requiring the entire year to plan and a small army of volunteers to handle details. For several years, so many people have attended the Annual Conference, that only a handful of venues in North Carolina are big enough to accommodate the event. Dates are often booked years in advance, rotating through most of the state’s major cities. Consistent with the Association’s council structure, all Annual Conference committees are aligned under the Conferences Coordinating Council, led by Mary Knoosby, 2013 council chair and project manager at HDR Engineering, Inc. Within the Conferences Coordinating Council are six committees, each with its own segment of the conference to plan and manage.

Lori Brogden, with Schnabel Engineering, chairs the Annual Conference Local Arrangements Committee, which pulls together all details – large and small – from the onsite volunteers to the golf tournament, clay shoot event, facility tours, publicity, and fun events that make each conference stand out. For every item, and many others who are not mentioned, there is a volunteer planning and securing the details, with Lori coordinating them all.

Separate sub-committees organize the popular Pipe Tapping and Operations Challenge contests, with Brandon Miller from the City of Raleigh handling Pipe Tapping, and Billy Allen from Charlotte-Mecklenburg Utilities and Greg Morgan from Union County Public Utilities taking on the Operations Challenge. For both events, these committees make sure that all of equipment and supplies are in place, appropriate space has been reserved and teams of volunteers are on-hand during the conference to help with set-up, breakdown and running the competitions. They also receive all team registrations and make sure competitors know where to be during the conference.

What would the conference be without the Exhibit Hall, and how would it get organized without the Exhibits Committee under the direction of Jim Anderson from Daparak? For both the Spring and Annual Conferences, this group lays out the floor plan, works out booth details, manages exhibit set-up and break-down, and serves as MC for the door prize drawings and other events. This year, the group has initiated a new Exhibit Hall Pass program that offers as many of the same duties required to put on the Annual Conference, but on a smaller, more laid back scale with a recent focus on the educational environment.

Another much-anticipated staple of the Annual Conference is the awards program, where NC AWWA-WEA gives out more than 30 awards, each selected by a different group or criteria. Awards Committee Chair Adrianne Coombes, from McKim and Creed, is tasked with coordinating advertising for the awards, compiling a list of winners and ensuring awards are ordered, and information is collected, in time to invite the recipients to the Annual Conference where their names are announced. Adrianne is also responsible for monitoring available awards from AWWA and WEF and ensuring that applications are completed so NC AWWA-WEA and our members can be recognized at the national level.

Not aligned under the Conferences Coordinating Council, but still a critical part of the Annual Conference is the Annual Conference Program Committee chaired by Chuck Shue of McKim and Creed. This committee, along with the Spring Conference Program Committee, is coordinated through the Technical Program Council along with the Association’s other educational programs. This group receives and reviews all of the abstract submissions and then meets several times to select and organize them into sessions, providing quality information on a broad range topics from a variety of sources and perspectives. Chuck and his committee members are responsible for collecting information from speakers and ensuring the program runs smoothly. Committee members serve as moderators in session rooms, assisting the speakers, making announcements, and monitoring continuing education unit credit collection. In addition to the technical sessions, this group also recruits the Opening Session speaker and plans the Wednesday morning forum.

While almost everyone’s focus is currently turned towards the 2013 Annual Conference, there is a group looking further into the future – April 6-8, 2014 in Wilmington. This group of forward-thinkers is the Spring Conference Committee, chaired in 2013 by Paul Shivers from Highfill Infrastructure Engineering and aligned under the Conferences Coordinating Council. This group performs many of the same duties required to put on the Annual Conference, but on a smaller, more laid back scale with a recent focus on the needs of operations personnel.

This description of the team involved in planning the Annual Conference by no means acknowledges everyone responsible. Mentioned here or not, all contributions are greatly appreciated and enhance our attendees’ overall conference experience. If you are interested in helping with a future Spring or Annual Conference, contact information for the committee chairs is available on page 18.
ISSUES:

Fats, Oil and Grease (FOG) is one of the major issues within the wastewater industry. FOG is responsible for ~47% of all SSOs. The impact also is seen throughout the system as well as within the Wastewater Treatment Plant.

Solution:

Through expansive research and our partnership with Scarab Environmental Solution, SES has a proven, economical solution to solving issues concerning FOG. The patented biological strand quickly remediates FOG while only having a bi-product of carbon dioxide and water. There will be no re-coagulation as the FOG simply is not there. Our patent pending application was designed to quickly and efficiently reproduce the biological complex for continuous use and introduction into the system. The small footprint and aesthetic appeal will be perfect for any setting.

Studies have also shown additional benefits of reducing BODs, TSSs, and ammonia, along with the removal and prevention of FOG build-up.

Equipment:

The application is self contained to include everything needed to solve all of your FOG issues. SES will install and service the units, meaning no additional work for municipal employees. There are also no expensive upfront equipment costs.

Requirements by the municipality only include access to the stations, water supply and electricity.

An economical solution providing benefits throughout the wastewater collection system.

About SES

A family owned, service oriented company committed to providing exceptional products to the wastewater industry.
## 2013 Annual Conference Overview

### Sunday, November 10

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00am - 3:30pm</td>
<td>Exhibit Set-up</td>
</tr>
<tr>
<td>9:00am</td>
<td>Golf Tournament at Rocky River Golf Club (Tee-time is 10:00am)</td>
</tr>
<tr>
<td>11:30am</td>
<td>Clay Shoot at Hunting Creek Preserves*</td>
</tr>
<tr>
<td>12:00pm - 6:00pm</td>
<td>Committee Display Tables</td>
</tr>
<tr>
<td>3:00pm - 5:00pm</td>
<td>Board of Trustees Meeting</td>
</tr>
<tr>
<td>3:00pm - 6:00pm</td>
<td>Conference Registration Desk Open</td>
</tr>
<tr>
<td>5:00pm</td>
<td>Best Tasting Water Contest Entries Due</td>
</tr>
<tr>
<td>5:00pm - 7:30pm</td>
<td>Exhibit Hall Open for Social</td>
</tr>
<tr>
<td>5:30pm - 6:00pm</td>
<td>Moderator’s Meeting</td>
</tr>
</tbody>
</table>

### Monday, November 11

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00am - 5:30pm</td>
<td>Conference Registration Desk Open</td>
</tr>
<tr>
<td>7:00am - 7:30am</td>
<td>Moderator’s Meeting</td>
</tr>
<tr>
<td>7:00am - 7:00pm</td>
<td>Committee Display Tables</td>
</tr>
<tr>
<td>7:45am - 9:05am</td>
<td>Opening Session &amp; Operator Awards: Water Challenges and the US Army Corps of Engineers - Lieutenant General (Ret.) R.L. VanAntwerp^</td>
</tr>
<tr>
<td>8:00am - 5:00pm</td>
<td>Student Poster Contest</td>
</tr>
<tr>
<td>9:00am - 6:45pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>9:10am - 10:20am</td>
<td>NEW! Exhibit Hall Pass Session 1^</td>
</tr>
<tr>
<td>9:15am - 5:10pm</td>
<td>Technical Sessions (Detailed schedule on page 44-45)^</td>
</tr>
<tr>
<td>9:30am - 4:30pm</td>
<td>Operations Challenge: Collection System &amp; Pump Maintenance Events*</td>
</tr>
<tr>
<td>9:30am - 12:00pm</td>
<td>Operations Challenge Laboratory Event*</td>
</tr>
<tr>
<td>11:30am - 1:20pm</td>
<td>Association Buffet Lunch*</td>
</tr>
<tr>
<td>12:30pm - 1:15pm</td>
<td>Student Lunch*</td>
</tr>
<tr>
<td>1:30pm</td>
<td>Facility Tours of WSACC Rocky River WWTP Sludge Incineration Facility and Great Wolf Lodge (Exact times are staggered throughout the afternoon) ^</td>
</tr>
<tr>
<td>1:15pm</td>
<td>Pipe Tapping Contest*</td>
</tr>
</tbody>
</table>

### Monday, November 11 continued

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:20pm - 2:30pm</td>
<td>NEW! Exhibit Hall Pass Session 2^</td>
</tr>
<tr>
<td>3:00pm - 3:30pm</td>
<td>Afternoon Break</td>
</tr>
<tr>
<td>3:30pm - 4:45pm</td>
<td>Committee Reception*</td>
</tr>
<tr>
<td>5:15pm - 6:45pm</td>
<td>Social Hour in Exhibit Hall* Featuring meeting areas for the traditional Industrial, Industry Newcomer and Water Resources Committee receptions.</td>
</tr>
<tr>
<td>8:45pm - 11:00pm</td>
<td>Chair’s Endowment Dessert Reception</td>
</tr>
</tbody>
</table>

### Tuesday, November 12

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00am - 8:00am</td>
<td>5S Breakfast (5S Members Only)</td>
</tr>
<tr>
<td>7:30am - 10:15am</td>
<td>Committee Display Tables</td>
</tr>
<tr>
<td>7:30am - 5:30pm</td>
<td>Conference Registration Desk Open</td>
</tr>
<tr>
<td>7:30am - 1:20pm</td>
<td>Exhibit Hall Open</td>
</tr>
<tr>
<td>8:00am - 5:00pm</td>
<td>Technical Sessions (Detailed schedule on page 44-45)^</td>
</tr>
<tr>
<td>8:30am - 9:40am</td>
<td>NEW! Exhibit Hall Pass Session 3^</td>
</tr>
<tr>
<td>9:00am - 10:00am</td>
<td>Operations Challenge: Process Control Event*</td>
</tr>
<tr>
<td>9:40am - 10:15am</td>
<td>Morning Break</td>
</tr>
<tr>
<td>10:30am - 3:30pm</td>
<td>Operations Challenge: Laboratory Event*</td>
</tr>
<tr>
<td>11:30am</td>
<td>Best Tasting Water Contest</td>
</tr>
<tr>
<td>11:30am - 1:20pm</td>
<td>Association Buffet Lunch*</td>
</tr>
<tr>
<td>2:15pm - 2:45pm</td>
<td>Afternoon Break</td>
</tr>
<tr>
<td>5:30pm - 7:00pm</td>
<td>Gavel Gala*</td>
</tr>
<tr>
<td>7:00pm - 10:00pm</td>
<td>Awards Banquet*</td>
</tr>
</tbody>
</table>

### Wednesday, November 13

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00am - 11:30am</td>
<td>Conference Registration Desk Open</td>
</tr>
<tr>
<td>9:00am - 11:00am</td>
<td>Forum: Changes in State Government and Regulations…and How they Affect North Carolina’s Water and Wastewater Systems^</td>
</tr>
<tr>
<td>11:30am - 2:30pm</td>
<td>Board of Trustees Meeting</td>
</tr>
</tbody>
</table>

* These events are available for sponsorship.

^ These events offer CEUs.
<table>
<thead>
<tr>
<th>TIME</th>
<th>WATER WASTEWATER COLLECTION &amp; DISTRIBUTION POLICY &amp; MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00 am</td>
<td>Challenges of Retrofitting Existing WTP’s with UV Disinfection for Microbial &amp; DBP Rules Compliance David S. Blyrk, Hazen and Sawyer Activated Sludge Aeration Control Systems Extreme Lift Station Makeover: The Rehabilitation and Re-Design of the Largest Wastewater Station on Fort Bragg Randy Fouque, URS Integrated Design-Build Delivery Provides Solutions to Complex Collection System Challenges Jon Lapalay, CDM Smith Size and Asset Type Does Not Matter – Case Study – Whole of Government Asset Management Program Crystal McNeely, QHD, Inc.</td>
</tr>
<tr>
<td>11:35 am</td>
<td>A Regional Solution to Water Supply Mike Richardson, Cape Fear Public Utility Authority Ryan Hager, WK Dickson Design-Build Construction of $15.5M Water Reuse System Jeff Chappin, Dewberry Developing Emerging Leaders in the US Army Corps of Engineers LFD Van Antwerp, Flippen Group</td>
</tr>
<tr>
<td>12:10 pm</td>
<td>What’s Up with DrWAT? Evaluation of an “Off the Shelf” Automated Chemical Phosphorus Removal System John Rutledge, Hach Company</td>
</tr>
<tr>
<td>12:45 pm</td>
<td>The Bromide Problem in Fayetteville Michael Wang, Hazen and Sawyer Nutrient Recovery Delivers Economic &amp; Environmental Sustainability, &amp; Helps You Meet Effluent &amp; Biosolids nutrient Permits Improving Capacity and Reliability of Water Service to NC’s Coast: Evaluation of the Brunswick County Water System Tina Whitefield, HDR Faster Access to Vertical Facility Assets (Objects) Using a GIS Based EAMS Using Business Planning to Improve Utility Performance: A Case Study Shawn Coffman, CMOU Joe Stover, McKim &amp; Creed</td>
</tr>
<tr>
<td>1:55 pm</td>
<td>Total Trihalomethanes (THM) Mitigation Study and Pilot Testing Perry Gayle, URS Design Build of SBR Uplift Filter WWTP to Achieve ENR Limits: A Case Study Peter Schuler, Brown &amp; Caldwell Under the River and Through the Woods: Installing a Water Main Across the Catawba River By HDD Mike Osborne, McKim &amp; Creed Confronting Climate Change with Vulnerability Assessments and Asset Management Adam Sharpe, CH2M HILL Taking Care of Business: Applying a Business Model to WWTP Operations Dan Miklos, Hazen and Sawyer</td>
</tr>
<tr>
<td>2:30 pm</td>
<td>Comparing Centralized and Decentralized Treatment for Reduction of SBPs through Bench &amp; Pilot-Scale Studies Chandra Moyer, QHD Unlocking Millard Creek’s Hidden Aeration Capacity Advances In Pipeline Rehabilitation Technologies Back to Square One: A Case Study in Value Engineering A Program Management Approach to Critical Collection System Improvements Bret Reuss, Black &amp; Veatch</td>
</tr>
<tr>
<td>3:00 pm</td>
<td>BREAK IN EXHIBIT HALL</td>
</tr>
<tr>
<td>4:05 pm</td>
<td>Meeting the Challenges of Upgrading the Plant Control System Yields Major Operations Benefits Mike Richardson, Cape Fear Public Utility Authority Two Towns, One County; A Regional Approach to Wastewater Capacity Advances in Sewer Modeling: Applying Models to Meet the Multiple Demands of Managing Sewer Systems Nitrogen Management in Landfill Leachate Discharged to a POTW Under an Industrial User Permit Procurement Pitfalls: Bid Phase Management, Case Studies, and Lessons Learned Ryan Ames, Dewberry Lauren Hava, Freese and Nichols</td>
</tr>
<tr>
<td>TIME</td>
<td>WATER</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>8:00 am - 8:30 am</td>
<td>The Use of Alternate Processes at New Water Treatment Plants</td>
</tr>
<tr>
<td>9:10 am - 9:40 am</td>
<td>What Do You Know? Getting the Best Information Out of Your System and from the Folks Running It!</td>
</tr>
<tr>
<td>10:15 am - 10:45 am</td>
<td>Assessing the Impact of Climate Change Related Hazards on the Vulnerability of NC Drinking Water Systems</td>
</tr>
<tr>
<td>12:00 pm - 12:30 pm</td>
<td>Micro-Tunneling Large Diameter Sewer May Be the Best Option for You</td>
</tr>
<tr>
<td>12:35 pm - 1:05 pm</td>
<td>From Raw Water Intake to Distribution Network: The Journey of DBP Control</td>
</tr>
<tr>
<td>1:10 pm - 1:40 pm</td>
<td>Turning Data into Action to Quantify Fat, Oil, and Grease</td>
</tr>
<tr>
<td>1:45 pm - 2:15 pm</td>
<td>Turning Data into Action to Quantify Fat, Oil, and Grease</td>
</tr>
<tr>
<td>2:15 pm - 2:45 pm</td>
<td>Turning Data into Action to Quantify Fat, Oil, and Grease</td>
</tr>
<tr>
<td>2:45 pm - 3:15 pm</td>
<td>Turning Data into Action to Quantify Fat, Oil, and Grease</td>
</tr>
<tr>
<td>3:55 pm - 4:25 pm</td>
<td>Turning Data into Action to Quantify Fat, Oil, and Grease</td>
</tr>
<tr>
<td>4:30 pm - 5:00 pm</td>
<td>Turning Data into Action to Quantify Fat, Oil, and Grease</td>
</tr>
</tbody>
</table>

**Wednesday, November 13, 2013**

<table>
<thead>
<tr>
<th>TIME</th>
<th>FORUM</th>
<th>PANELISTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 am - 11:00 am</td>
<td>Changes in State Government and Regulations</td>
<td>TBA</td>
</tr>
</tbody>
</table>
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Exhibitors

This list is current as of August 27, 2013. An updated list is available at http://www.ncsafewater.org/events_education/conferences/ac2013/exhibits/

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  Annual dues for 2013 are $40.
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Exhibit map.
Why PRINT Continues to Make an IMPRESSION

GETTING ATTENTION
There are fewer magazines and print newsletters in the mail, so more attention is paid to each piece.

WHAT’S OLD IS NEW AGAIN
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On January 30, 2013, the five ‘Shovelers’ statues, carved by the late Lee Dukes, were reunited for the first time at the Willis Engineer’s Charlotte office since their creation. These five statues were part of a 1988 NC Select Society of Sanitary Sludge Shovelers (5-S) fundraising project in support of the Water Environment Federation Building (WEF) Fund for the ‘new office’ in Alexandria Virginia. The five ‘Shovelers’ are owned by six North Carolina-5-S chapter members that live throughout North Carolina, namely Richard Huffman, Ed Morris, Terry Rolan, Joe Stowe, Arthur White, and Charlie Willis. After many years of trying to have a ‘statue’ reunion at a NC AWWA-WEA Annual Conference, but never being able to achieve full attendance, a plan was hatched to hold a special ‘called’ meeting in January 2013. Charlie Willis with Willis Engineers, agreed to coordinate and host this meeting. Despite one failed attempt to meet, Charlie was finally successful in bringing the group together on January 30, 2013.

The story behind these five little statues is interesting. Lee Dukes carved the first statue for auction at the annual 5-S Breakfast at the 1988 Conference, where Joe Stowe (Chair Elect) was the successful bidder with a donation of $100 for the WEF Building Fund. After some discussion and encouragement, Lee Dukes agreed to carve four more for equal donations from those who wanted one of the unique statues. As a result, Richard Huffman and Arthur White (Director WEF) made a joint donation for Greensboro, Ed Morris (Director WEF), Terry Rolan (Past Chair), and Charlie Willis (WEF Building Fund Chair) rounded out the donations for four more carvings. These initial donations toward the Building Fund served as the impetus for the North Carolina Water Pollution Control Association becoming the largest donor to the Fund among all of the associations of the Federation.

You might ask, what would motivate these six statue owners to drive, in some cases, over 100 miles to reunite five little wood carvings? The same exemplary dedication towards outstanding service that motivates each selected 5-S member is what brought these six individuals back together again. This reunion became a great opportunity to renew old acquaintances and reminisce about great times and great friendships and to remember a very special and dedicated 5-S member, Lee Dukes, the talented creator of these five little ‘Shovelers’ statues. With his many years of service to water, American Water Works Association (AWWA), Water Environment Federation (WEF), and the protection of public health, Lee Dukes truly exemplified the Select Society of Sanitary Sludge Shovelers.

**History of NC Select Society of Sanitary Sludge Shovelers**

The Select Society of Sanitary Sludge Shovelers (5-S) Society was created to encourage what is now known as ‘getting involved.’ Attesting to the success of this organization is the fact that, as of now, there are members all over the United States, Canada, England and Australia; all of whom have been inducted, integrated and initiated into the 5-S Society. You cannot join – you must be ‘selected’ – on the basis of merit. This is a society for those who contribute their efforts, their time and their energies. Criteria for selection are as follows:

1. Five years of active membership in the NC AWWA-WEA.
2. Outstanding service consisting of any two of the following three activities:
   a. Membership on one or more of the working committees.
   b. Service in one or more of the following positions:
      1. Chairman of one or more of the working committees
      2. One or more terms as a Director of NC AWWA-WEA
      3. An officer of NC AWWA-WEA
   c. Active in the professional community as the result of employment, presentation of water or wastewater related paper(s), or other sustained interest in environmental matters.

Honorary membership is limited to two persons per year. Five-year membership in NC AWWA-WEA is not required.

The Society had its beginnings in Arizona in 1940 with the stated purpose of recognizing those members who have contributed their time and energy for the betterment of their Water Pollution Control Association. Today, the distinctive shovels are recognized worldwide by those in our profession as a symbol of service to environmental concerns.
“You cannot join – you must be ‘selected’ – on the basis of merit. This is a society for those who contribute their efforts, their time and their energies”

The North Carolina chapter had its origin in 1986, when Section Chairman Earl Weisner became aware of the tremendous amount of work being done by the Section’s various committees. In seeking ways to recognize these people – many of whom would not likely receive such established awards as the Bedell, Hatfield, etc. – Mr. Weisner came upon the organization known as the Select Society of Sanitary Sludge Shovelers. Many of these chapters sought to honor those people who might not otherwise receive due recognition.

In May of 1986, the Board of Directors appointed an Ad Hoc committee to pursue the development of a North Carolina chapter. This committee later presented its recommendation that a chapter be formed, which was approved by the Board at its July 1986 meeting.

Briefly stated, one cannot join the Society; selection is made on the basis of merit. All members of the Association are eligible. There are no dues or officers, except for the ‘Influential Integrator’ who is designated by the neutral ‘pH 7’ and is elected by his fellow Society members. Each member is presented with a gold badge in the form of a shovel and a certificate which proclaims that the recipient is “this day Elevated on the Official Shovel to the Highest Ridge on the Sludge Bed, with the title of Select Sanitary Sludge Shoveler with all the Honor, Atmosphere, Prerequisites, and Dignity appertaining thereunto.”

In a secret ballot, a total of 25 were selected by the Board to become charter members of the North Carolina Chapter. These were inducted into the Society at the November 1986 annual conference in Winston-Salem. Mr. J. C. Goldman of the Georgia Select Society of Sanitary Sludge Shovelers conducted the initiation ceremony.

A long-standing tradition of the NC 5-S is that the candidate must be present at Sunday night’s program at the Annual Conference in order to be inducted. A further tradition is that it is not appropriate to ‘arrange’ for the recipient to come to the event if he/she had not planned to attend.

MEMBERS

<table>
<thead>
<tr>
<th>Year</th>
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<tr>
<td>1982</td>
<td>Melinda King, Don Safrit, Bob Fritts, Crystal Broadbent</td>
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<td>Thurman Green, Terry L. Houk, Jonathan S. Lapsley, T.J. Lynch, Kevin Mosteller</td>
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<td>Tony Dubois, Leslie Jones, Bob Norris</td>
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<td>Steve Drew, Lynda Elliott, Ken Vogt, David Wagoner, Andy Brogden</td>
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<td>Vance Brooks, Lori Crossland, Julie Hellmann, Howard Corey, Brent Reuss</td>
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<td>Paul Jackson, Mary Knobl, Buddy Edmisten, Angela Lee</td>
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<td>Tyler Highfill, Marty Wilson, Maggie Macomber, John Kiviniemi, Jackie Jarrell</td>
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<td>Roy Purgason, Greg Wells, Dave Heiser, Chris deBarbadillo</td>
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<td>Sandy Tripp, Jeff Payne, Jack Moyer, Harold Falls, Clarence Sell</td>
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<td>Wayne Miles, Kevin Easton, David Zimmer, Chuck Willis</td>
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<td>Roger Spach, Richard Tsang, Dwight Lancaster, Coleman Keeter, Arlene Roman</td>
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<td>1996</td>
<td>Robert J. Walters, Richard A. Carrier, Michael Wang, Barry D. Shearin</td>
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<td>Steve Shoaf, Pam Moss, Jim Hawkins, Bill Dowbiggin</td>
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<td>1998</td>
<td>Martie Groome, Luis A. Concha, John C. Vest, John C. Murdoch</td>
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<td>1999</td>
<td>Ronald Elks, Linda Sewall, David Cain, Cindy Finan, Bob Forbes</td>
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<td>2001</td>
<td>Newt Colston, Melvin Allen, Kasey Monroe, Howard Kimbrell</td>
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Michael Knight
mike@clearwaterinc.net
Emerging/Potential CONTAMINANTS

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In recent years, the term ‘emerging contaminants’ has often been used to refer mostly to trace organic compounds such as pharmaceuticals and personal care products (PPCPs). However, the term is in reality much more broadly defined as a group of contaminants that is of emerging concern due to (a) new information about the presence, prevalence or sources of the contaminant(s), (b) new information about the toxicity or exposure to the contaminant(s), or (c) new regulatory perspectives that indicate a change in existing regulation or the eventual promulgation of a new regulation for the contaminant(s). Thus, ‘emerging contaminants’ can in fact apply to a wide variety of compounds that may be of concern to drinking water utilities and/or wastewater utilities due to their potential human or environmental health effects.

Furthermore, emerging contaminants may be either chemical or biological in nature. Given our broadening understanding of the relationship between water quality, water treatment, the presence of contaminants, and climate change, and new directions from the US Environmental Protection Agency (US EPA), this article will focus on several groups of ‘emerging contaminants’ that may be on the future regulatory timeline from a drinking water perspective.

Regulatory Update
Currently, no single regulatory program in the US considers the entirety of the potential risk of emerging contaminants, which can lead to over-regulation as well as under-regulation. Commercial regulation, the Safe Drinking Water Act (SDWA), and the Clean Water Act (CWA) are the primary avenues for chemical regulation. Commercial regulation evaluates chemicals for potential risk before they are approved for use and then released into the environment. The Food and Drug Administration (FDA) and the US EPA have regulatory jurisdiction over commercial regulation. The US EPA has sole regulatory authority over the SDWA and the CWA. The SDWA and CWA regulations address the fate and effects of chemicals after release into the environment. From a drinking water perspective, the national primary drinking water regulations (NPDWR) are used as the major mechanism for regulating contaminants in drinking water.

The US EPA has several programs to evaluate the public health impact and potential regulation of the many known and emerging compounds and microorganisms that are not currently subject to proposed or promulgated NPDWR. These contaminants are known to occur or anticipated to occur in drinking water supplies. Many of these unregulated contaminants are listed in either the Drinking Water Contaminant Candidate List (CCL) or in the Unregulated Contaminant Monitoring Rule (UCMR) program. The more well-known contaminants that may be the subject of either future regulations or an increase in regulation stringency include perchlorate, chlorite, additional non-regulated VOCs, chromium VI, nitrosamines and emerging contaminants. However, there is a great deal of uncertainty regarding potential regulation in light of current workloads in the US EPA’s Office of Groundwater and Water, budgetary cuts, and evolving strategies for attempting to regulate contaminants by group. Furthermore, new regulations can be proposed through political action, essentially bypassing the typical process for developing a national drinking water standard. Adding to the uncertainty in predicting future regulations is the US EPA’s deviation from the use of no observable adverse effect levels (NOAEL) in the development of standards towards the use of no observable effect levels (NOEL). This deviation could represent a significant shift in US EPA’s approach to regulatory determinations (Lynch, 2013).

Despite the uncertainty involved in future regulatory prediction, information is included herein based on discussion with staff at the American Water Works Association (AWWA) staff at the US EPA, data collected during UCMR2, and information published in the Federal Register.

Perchlorate and Chlorate
The US EPA has decided to regulate perchlorate ($\text{ClO}_4^-$) under the SDWA with a maximum contaminant level (MCL) to be proposed before the end of 2013, though this date is uncertain based on recent recommendations from the Science Advisory Board (SAB) to pursue a pharmacokinetic-based model. Perchlorate is a potential health concern because it can disrupt the thyroid’s ability to produce hormones needed for normal growth and development (both prenatal and postnatal), though the effects are closely related to dietary iodide intake. The US EPA’s health reference level (HRL) for perchlorate sets the stage for regulation as low as 1 µg/L, while the general opinion of experts in the field is that the proposed MCL will likely be in the range of 15 - 20 µg/L. Several states have already established a perchlorate MCL including California (6 µg/L) and Massachusetts (2 µg/L). Nevada has an action level of 18 µg/L. New Jersey has proposed a MCL of 5 µg/L although the state is waiting until a decision from the US EPA before deciding on a perchlorate MCL. Sources of perchlorate include munitions, rocket fuel, industrial sites, and hypochlorite.

In addition to perchlorate, chlorate ($\text{ClO}_3^-$) is another impurity commonly occurring in drinking water facilities that use bulk hypochlorite or on-site generated (OSG) hypochlorite. While ingestion of chlorate can impact the human thyroid in a manner analogous to perchlorate, it can also cause methemoglobinemia (blood with increased levels of methemoglobin, which causes...
a decreased ability to bind oxygen and therefore reduced oxygen flow to organs and tissues), anuria, abdominal pain, and renal failure. However, these effects are all observed from the very high doses typically associated with accidental exposure to chlorate-containing pesticides and not from concentrations typically found in drinking water. In hypochlorite solutions, chlorate may form during manufacture, transport, or storage and the concentration of chlorate increases with the increase of time and/or temperature (Stanford et al., 2011). Chlorate has been placed on the US EPA’s third Contaminant Candidate List (CCL3) and consequently, it has also been included in the third Unregulated Contaminants Monitoring Rule proposed list (UCMR3). The US EPA has also announced a chlorate health reference level of 210 µg/L. Therefore, chlorate is likely to be regulated in the future and could be relevant to any utility that uses OSG hypochlorite systems. There is no known control strategy at this time for chlorate in OSG hypochlorite, so obtaining additional baseline data for OSG chlorate production may be a future need.

Treatment technologies and practices for both chlorate and perchlorate focus on contaminant removal and include ion exchange, biological reactors, electrochemical reduction and control of hypochlorite storage and handling.

**Volatile Organic Compounds (VOCs)**

Volatile organic compounds (VOCs) are a group of contaminants for which the US EPA has recently decided to increase regulation stringency. Many VOCs are found in groundwater and have been evaluated for potential human health effects. VOCs have been found to cause eye, nose and throat irritation in addition to liver, kidney and central nervous system damage. Some VOCs are also suspected or known human carcinogens (US EPA). There are currently eight regulated VOCs. The US EPA plans to regulate eight additional compounds as well as revise the regulations for the currently regulated VOCs. In particular, the currently regulated compounds trichloroethylene (TCE) and tetrachloroethylene (PCE) will receive more strict regulations due to scientific advances allowing for treatment and monitoring at a lower MCL. The following eight VOCs are proposed to be regulated as part of US EPA’s contaminant grouping strategy (in addition to the eight VOCs that are currently regulated): aniline; benzyl chloride; 1,3-butadiene; 1,1-dichloroethane; nitrobenzene; oxirane methyl; 1,2,3-trichloropropane; and urethane. Common treatment methods for VOCs include granular activated carbon (GAC), air stripping, reverse osmosis, and conventional filtration.

**Chromium VI**

A recent report from the Environmental Working Group has sparked renewed interest from the US EPA in chromium VI. Chromium VI, previously thought to be only a contact hazard causing allergic dermatitis at long exposures to high concentration, has more recently been associated with oral cancer in rats and cancer of the small intestine in mice via oral exposure routes. Chromium is a naturally occurring metal in rocks, plants, humans, soil and volcanic dust, and animals. It is mostly present as chromium III, chromium VI, and the metal form of chromium, the latter two of which are produced in industrial processes. The ‘III’ and ‘VI’ indicate the oxidation state of the compound. Major sources of chromium include steel and pulp mills and natural deposit erosion. Instead of regulating chromium VI as a single contaminant, the US EPA currently regulates the total concentration of chromium in drinking water, with an MCL of 0.1 mg/L. California regulates the total chromium concentration at 0.05 mg/L and has a draft public health goal of 0.02 µg/L for chromium VI. Due to emerging research, the US EPA has proposed in the September 2010 draft human health assessment that chronic chromium VI exposure be classified as a probable carcinogen. When the draft human health assessment is finalized, a comprehensive review will be completed to determine if a new chromium standard should be set (US EPA, 2010). While the chemical fate and transport of chromium III and VI is not well understood in the distribution system, there are treatment technologies for the removal of chromium VI in source water including the reduction/coagulation/filtration (RCF) process, weak base anion exchange, strong base anion exchange, reverse osmosis and electrodialysis.
Nitrosamines
The rise in the popularity of chloramines for secondary disinfection purposes has also brought increasing awareness to the prevalence of nitrosamines in drinking water, in particular N-nitrosodimethylamine (NDMA). Nitrosamines are disinfection byproducts (DBPs) that form from the oxidation of precursors in chlorinated and chloraminated waters. They have been found to strongly correlate with chloramine usage. Additionally, nitrosamines can be associated with the use of certain polymers (e.g., POLYDADMAC) and ion exchange resins (e.g., MIEX) in water treatment processes (Gan et al., 2013). Research has indicated that nitrosamines are likely carcinogenic and are linked to other diseases such as Alzheimer’s, Parkinson’s, and type 2 diabetes. Their presence in drinking water may pose a serious health risk to consumers. Nitrosamines are not yet regulated with a standard MCL, but the US EPA has placed five nitrosamines on the final third CCL3. The US EPA is also considering a specific nitrosamine rule. Based on the California regulation, the US EPA’s regulatory limit may be as low as 10 ng/L with a MCL goal (MCLG) of zero due to the fact that nitrosamines are considered carcinogenic compounds. Treatment for nitrosamines typically involves the use of GAC, biologically active carbon (BAC), or high-energy photolysis by ultraviolet light (at doses typically 10 – 40 times higher than disinfection doses).

Endocrine Disrupting Compounds, Pharmaceuticals, and Personal Care Products
Another well-popularized group of contaminants that may be increasingly regulated in the future is emerging contaminants, also known as microconstituents, micropolutants, or trace organics. These contaminants include pharmaceutically-active compounds (PhACs), personal care products (PCPs), endocrine-disrupting compounds (EDCs), and other organic compounds. There has been a recent increase in scientific and public interest in these compounds as they are being discovered in surface waters, groundwater, wastewater treatment plant effluents, and drinking water. The potential...
impact of these compounds on human health and wildlife, especially at the nanogram per liter (ng/L) concentrations typically encountered in surface waters, is not yet completely known, though risk to human health is generally quite low. Sources of endocrine-disrupting compounds as well as other emerging contaminants include domestic sources such as human excretion and flushing of expired drugs, agricultural runoff, industrial sources, and solid waste. There are currently no sets of federal or state regulations that specifically address PhACs, PCPs or EDCs, although there are national primary drinking water standards for many synthetic organic chemicals.

Many personal care products fit within the emerging contaminants category, though the one of current regulatory concern are the perfluorinated compounds (PFCs), which can be found in Scotch Guard™, Gore Tex™, and Teflon™. The regulatory fate of PFCs is currently uncertain, as little is known about its occurrence or effective treatment. While specific treatment technologies for PFCs are unknown, it is suspected that GAC and high-pressure membranes, such as reverse osmosis (RO) and nanofiltration (NF), will be effective barriers.

The US EPA has included seven endocrine disrupting compounds (all being steroid hormones) on the UCMR3 released in 2010. However, it is unlikely for US EPA to regulate these particular emerging contaminants due to their low occurrence levels and generally rapid oxidation by free chlorine. In general, treatment technologies for the group of emerging contaminants include GAC, powdered activated carbon (PAC), free chlorine, ozone, ozone/peroxide, UV/peroxide and RO/NF membranes. The US EPA is currently very active in research and analysis of these compounds and is developing strategies to protect the health of both the public and the environment. Additionally, some states and local communities are becoming more involved in helping consumers properly dispose of pharmaceuticals and personal care products.

**Algal Toxins**
An additional group of contaminants that may potentially be regulated are algal toxins that occur as a result of algal blooms. While algal toxins may also co-occur with taste and odor-causing compounds, they are not strongly correlated with each other. Treatment processes for algal toxins include GAC, PAC, ozone and UV advanced oxidation. While the regulatory future of algal toxins is uncertain, it may be prudent to conduct targeted analysis (i.e., during algal blooms and/or taste and odor events) to monitor for compounds such as microcystin and anatoxin-a along with 2-methylisoborneol (MIB) and geosmin in the raw water to determine if there is a co-occurrence.

**Disinfection Byproducts**
Emerging disinfection byproducts consist of myriad compounds that are produced as a result of reactions between disinfectants and natural organic matter (more than 700 have been identified to date). These byproducts include trihalomethanes, haloacetic acids, chloral hydrate, bromochloroacetic acid, among others, and a category of unknown organic halogens. Due to the uncertainty in the occurrence and toxicity of the emerging DBPs, there is much debate regarding potential public health relevance. One primary concern among scientists, as well as the public, is the comparison of DBPs that are formed using chlorine disinfection with those that are formed using chloramine disinfection, though there is no evidence that individuals in the US drinking chloraminated water have any different cancer risk than those drinking chlorinated water. Also, the use of chloramines reduces the overall exposure to DBPs relative to free chlorine, which may be of potentially greater benefit. Treatment process and control methods for the removal of DBPs, including emerging DBPs, include changing the point of chlorination or chloramination, enhanced coagulation, UV or ozone disinfection, GAC, ion exchange, and high-pressure membranes.
Microbial Contaminants

Microbial contaminants are pathogenic organisms that include bacteria, viruses, and protozoa. Microbial contaminants associated with drinking water may cause acute illness. Microorganisms, such as Cryptosporidium or Giardia lamblia, can cause gastrointestinal illness; additionally, microorganisms such as Legionella can cause Legionnaire’s Disease, which is a type of pneumonia. In general, most disease caused by microbial contamination (e.g., bacteria, viruses, spores, fungi, amoebas) of water is associated with symptoms of diarrhea, cramps, nausea, jaundice, and headaches and fatigue. Enteroviruses and noroviruses are currently on the UCMR3 due to concern regarding their presence in ground water supply systems. Pathogens in biofilms, such as Legionella and Naegleria fowleri, are also microbial contaminants of concern as they can thrive in plumbing systems of hospitals, hotels, schools, homes, and factories. Additionally, as detection methods for Cryptosporidium and Giardia testing improve over time (as required by the Surface Water Treatment Rule), the detection frequencies of these pathogens may increase, and consequently shift the bin placement for some utilities. Examples of possible measures for controlling microbial contaminants include changing filtration or disinfection practices, altering the distribution system residual disinfectant, and improving private management practices of premise plumbing systems.

In general, contaminants that are likely to be regulated in the near future include perchlorate, chlorate, VOCs, nitrosamines, manganese, and UCMR3 compounds. Furthermore, the USEPA is re-evaluating the MCL for chromium III and may be adding an MCL for chromium VI. Considered holistically, the USEPA has a very full plate and the largest uptick in potential regulated contaminants seen since 1996, and therefore many of these regulatory deadlines may be pushed out several more years into the future. Thus, many of the contaminants (or potential contaminants) listed in the preceding descriptions may not receive a positive or negative regulatory determination (i.e., deciding to move forward with creating a regulation and MCL (‘positive’), or deciding NOT to regulate (‘negative’) until the 2017 – 2025 timeframe. The exceptions to this are nitrosamines and chlorate, which could receive a positive regulatory determination by the end of 2013 and a final rule by 2017.

The Public Challenge

Information management requires a non-linear and indirect approach when conveying information to the public. Communication to the public must be carefully managed, and can take the form of having information ready when needed, an established website with a Frequently Asked Questions page, or a full-blown media response plan. Utilities around the country have taken either reactive or pro-active approaches to risk communication. A utility poll conducted by the Water Environment Federation in 2009 revealed a mixed review on the public reaction to utility pro-active approaches. Several utilities reported that they gained credibility on the emerging contaminant issue and other issues while other utilities acknowledged that public reaction was short lived.

Utilities are also becoming increasingly aware of the importance of internal management. The emerging contaminant issue is extremely complex such that the issue affects many different aspects of water and wastewater, including laboratory, storm water, pretreatment, treatment, and regulatory compliance. A challenge is managing the data collection and issues arising from multiple departments. In response, many utilities have assembled a task force with members drawn from multiple departments and levels of management to help stay current with the latest research and regulatory issues.

Author Bios

Mary E. Sadler, PE has a BS in Civil Engineering and an MS in Environmental Engineering from Virginia Tech. She has fifteen years of experience in the water and wastewater industry. Ms. Sadler specializes in municipal wastewater treatment processes and modeling, the planning and design of wastewater treatment facilities, water quality issues, and environmental permitting.

Lamya Badr, EI graduated from Virginia Tech with a Bachelor’s and Master’s Degree in Environmental Engineering. Her experience includes environmental permitting, master planning, wastewater treatment technology evaluations, and performing hydraulic analyses.

Ben Stanford, PhD is the Director of Applied Research at Hazen and Sawyer where he manages a portfolio of over 22 research grants and supports the firm’s water, water reuse, and wastewater projects. Ben earned his Ph.D. in Environmental Sciences and Engineering from the University of North Carolina at Chapel Hill and has conducted studies on a variety of topics ranging from membrane applications in water reuse to climate change to chlorine chemistry. Dr. Stanford has over two dozen peer-reviewed publications, and was awarded the 2012 Publications Award by the American Water Works Association.

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Compounds of potential concern (CPCs), including endocrine disrupting compounds (EDCs), have received increasing attention in the water and wastewater industry over the past several years, particularly in the area of water reuse. CPCs are defined as “natural and manmade substances, including elements and inorganic and organic chemicals, detected within water and the environment for which a prudent course of action is suggested for the continued assessment of the potential impact on human health and the environment” (WEF Technical Practice Committee, 2007). CPCs include a broad range of compounds that potentially have adverse effects on human health and the environment, but may not be currently regulated by the US EPA. Water and wastewater utilities have become increasingly concerned about CPCs and EDCs, but very little guidance exists regarding how to define the problem or develop action plans to improve the quality of public water supplies. Many CPCs and EDCs are derived from municipal, agricultural, and industrial wastewater sources and pathways. Major classes of CPCs include:

- Pharmaceuticals and Personal Care Products (PPCPs)
  - prescription drugs
  - non-prescription drugs
  - antibiotics (human and veterinary)
  - steroids
  - hormones
- Industrial and Commercial Products
  - flavorants/fragrances
  - detergents and metabolites
  - plasticizers
  - flame retardants
  - pesticides

CPCs may potentially act as carcinogens, toxins, or endocrine disruptors. EDCs pose a significant concern because of their potentially detrimental effect on human reproductive and growth processes. Three major classes of EDCs are (Snyder et al., 2003):

- Compounds that mimic or block natural testosterone
- Compounds that impact the thyroid gland

Information is limited on the extent of environmental occurrence, transport, and ultimate fate of CPCs after their intended use, particularly hormonally active chemicals and other PPCPs that are designed to simulate a physiological response in humans, plants, and animals. Although many CPCs have been identified as toxins for aquatic species (e.g., fish), their toxicity for humans (at the low concentrations found in surface waters) is generally unknown. The assessment of CPC effects on the human endocrine system is the major focus of EPA’s Endocrine Disruptor Screening Program (EDSP). This article describes the current knowledge base for toxicity assessment methods for CPCs and EDCs.

Overview of the Endocrine System

The endocrine system is comprised of glandular tissues located throughout the body (e.g., adrenal and thyroid glands), hormones that are manufactured by the glands (e.g., adrenaline and thyroxin) and secreted into the bloodstream, and receptors located throughout tissues of the body to which the hormones attach and elicit a response. The role of the endocrine system is to control and regulate reproduction, development, and behavior, and to assist in the maintenance of homeostasis, a process through which the body maintains its vital functions despite external and internal change. Specific functions controlled by the endocrine system include maintenance of blood sugar, growth and function of the reproductive system, regulation of metabolism, development of the nervous system, and development of the organism from conception to death.

There are more than 50 hormones that are synthesized and controlled by the endocrine system. These hormones can be separated into four classes: (1) steroid hormones to which the sex hormones belong; (2) amine hormones, which give rise to thyroid hormones and catecholamines; (3) peptide hormones such as growth hormone; and (4) eicosanoids, derived from fatty acids and including prostaglandins. Peptide hormones and large amine hormones (e.g., catecholamines), due to their inability to cross biological membranes, bind to receptors on the cell surface and trigger a cellular response through second messenger systems (e.g., cyclic AMP). Steroid hormones, small amine hormones (e.g., thyroid hormones), and eicosanoids can cross biological membranes and bind to receptors that are present within the interior of the cell, including the nucleus. Cells contain many hormone receptors, depending on the specific cell type. The DNA of each cell contains specific genes that are responsive to hormone/receptor binding. The gene products (i.e., proteins) are responsible for producing the ultimate endocrine-mediated response.

Toxicity of Endocrine Disrupting Compounds

EDCs encompass a broad group of exogenous substances that cause adverse health effects in an intact organism or its offspring by eliciting alterations in endocrine function. EDCs are described as ‘hormonally active’ (e.g., estrogenic or androgenic compounds) if they interact directly with endogenous hormone receptors present within cells or at the cell surface, or as ‘endocrine modulators’ (e.g., estrogen-like or androgen-like compounds, or anti-hormones) if they affect the endocrine system through interference with other relevant pathways. EDCs are extremely diverse in chemical structure and physical properties, and may affect a wide variety of endocrine-related functions through a broad range of mechanisms of action. The following lists some of the varied ways EDCs can affect the endocrine system:

- Damaging tissues that produce hormones
- Altering the synthesis or degradation of hormones
- Mimicking or blocking hormone responses
- Interfering with hormone transport
- Altering hormone secretion and/or elimination

It is important to note that effects produced on the endocrine system are a function of both toxicity and exposure. Toxicity is an inherent property of a material, related to the ability of a chemical to elicit a target response over a range of doses, i.e., the dose-response relationship. Toxicity can be modulated by individual variability—for example, how different individuals metabolize and excrete the material—which alters the dose at which the material produces the target response (i.e., its potency). The hazard posed by a material is a function of both inherent toxicity and exposure, and is related to the total dose received by an individual, the inherent toxicity of the material, and an individual's response to the material. Therefore, in order to characterize hazard associated with water applications, there must be a way to characterize the toxicity of the compounds present in the water, including inter-individual variability, and to measure their concentrations as an indicator of exposure.

Many compounds produce toxic effects that are represented by simple linear dose-response relationships, i.e., the greater the dose, the greater the response. Because EDCs may either induce or inhibit endocrine responses, many EDCs produce ‘U-shaped’ dose-response curves. This type of dose-response relationship indicates that any effect that results in deviations, either above or below the optimum range, will produce adverse effects to the organism.

Because of these issues, a study of the toxicology of EDCs is extremely challenging and complex. To simplify the toxicity assessment, EDCs in this document are discussed in terms of their ability to produce the following broad effects:
- Estrogen-related effects
- Androgen-related effects
- Thyroid-related effects

The most extensively studied category is effects produced that resemble those caused by endogenous estrogens, caused by estrogenic or estrogen-like compounds. Estrogenic compounds produce effects through direct binding to estrogen receptors, while estrogen-like compounds mediate effects through interactions with other pathways that alter estrogen signaling.

To briefly describe the mechanism of action for effects mediated through estrogen receptor binding, an estrogenic compound enters the nucleus of a cell and binds to an estrogen receptor. Once binding of the receptor to the compound occurs, an active compound/receptor complex is formed, allowing attachment of the complex to DNA at specific sequences called estrogen response elements. The binding of the active complex to the estrogen response element causes modulation of gene transcription (i.e., induction or inhibition). Altered gene transcription ultimately results in increased or decreased production of proteins that regulate endocrine-related functions.

There are two estrogen receptor forms, termed alpha and beta. Compounds with structural similarity to estrogens may bind to one or both of the estrogen receptor forms, but a wide variety of compounds unrelated to estrogens in structure may also attach to the receptor proteins, producing effects similar to those of endogenous estrogens. Though receptor binding can be easily quantified through in vitro testing, binding itself is not sufficient to determine whether the interaction will result in positive, negative, or no modulation of the estrogen response.

Though EDCs tend to have lower binding affinity for endogenous receptors than endogenous estrogens and androgens, mixtures of EDCs may produce a synergistic (i.e., more than additive) response that...
is much more potent than each EDC alone. Therefore, dose is an important variable for EDC activity. However, the potency of EDCs also appears to be related to the developmental stage of the organism at the time of exposure and the length of time an organism is exposed to the EDC.

In contrast to estrogenic compounds, estrogen-like compounds do not directly attach to the estrogen receptor, but exert their effects in variable ways; for example, through binding with circulating steroid binding proteins. Steroid binding proteins carry hormones throughout the body and include alpha-fetoprotein, sex hormone binding globulin, and serum albumin. The attachment of an estrogen-like compound to a steroid binding protein may result in an increase in availability of the endogenous hormone through displacement.

A second, less well-studied effects category is associated with androgenic or androgen-like responses, produced through binding to the androgen receptor or altering androgenic pathways, similar to the mechanisms described for estrogenic and estrogen-like compounds.

Thyroid dysfunction can lead to abnormal development, altered growth patterns, and a variety of physiological manifestations. Cells of the thyroid are responsive to a hormone released from the pituitary, thyrotropin (TSH), which triggers an increase in the release of thyroid hormones. The biological actions of thyroid hormones are believed to be mediated by nuclear receptors for thyroid hormones or by a direct action of the thyroid hormones on developing tissues. Compounds that inhibit thyroid-related activity may act by a number of different mechanisms, including (1) interference with receptor binding; (2) inhibition of hormone synthesis or breakdown; (3) alteration of second messenger systems that trigger the release of thyroid hormones; and (4) inhibition of iodine transport, coupling to protein, or release from proteins due to the dependency of the thyroid function on iodine.

EDC Toxicity Testing Protocols

A number of efforts have been made to determine the best ways to assess the toxicological significance of compound with respect to the endocrine system. EPA tasked the Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC) with developing a suitable framework to use for screening the large number of potential environmental pollutants for effects on the endocrine system. The EDSTAC Final Report (EDSTAC, 1998) summarizes the large body of information considered by, and the specific recommendations provided by, the committee. The remainder of this article provides a summary of available toxicity protocols from the EDSTAC Final Report, as well as the findings from literature reviews performed by others (Linden and Kullman, 2007; Drewes et al., 2006).

The most reliable way to test for the ability of a compound to produce endocrine-related effects is to use in vivo (i.e., whole organism) studies, using both males and females and assessing the

Figure 2: Endocrine Disruptors
effects of each compound of interest on growth, development, systemic impacts, and reproductive success over more than one generation. However, multigenerational protocols examining a broad range of endocrine-related endpoints are extremely costly and would require many years to complete. Therefore, efforts have been made to develop in vitro screening-level tests that quickly and cost-effectively indicate the potential for a compound to affect the endocrine system in a reliable manner.

In Vitro Test Systems
A number of in vitro assays have been developed to screen substances for endocrine-related effects (Zacharewski, 1997). In vitro systems are useful because they are based on known mechanisms, are cost-effective, use small sample volumes, can be performed rapidly, and are relatively sensitive. Most of these assays focus on estrogenic effects with relatively few testing procedures available to characterize androgenic, thyroid, or other hormonal effects. Because screening assays do not use the entire organism (i.e., lack consideration of the importance of the whole-body processes of absorption, distribution, metabolism, and excretion), cannot capture effects that occur only after repeated exposures (e.g., multigenerational reproductive effects), and only examine one or a small number of possible mechanisms of action, false positive or false negative findings may result. Because of these limitations, a battery of in vitro tests may be required to fully and reliably evaluate the potential for a test compound to affect the endocrine system (i.e., a negative result in a single in vitro test should not be used to conclude a negative potential for endocrine-related effects). The following paragraphs describe the positive and negative attributes of a number of available in vitro assays.

1) Competitive ligand binding assays. This type of assay assesses the ability of a compound to directly compete with endogenous hormones for receptor binding, and provides limited insight into the ability of the test agent to cause altered gene expression or protein production. These assays simply test the ability of an agent to compete for binding to endogenous receptors, but do not test the ability of the compound to produce an actual effect subsequent to binding. These tests also do not test the ability of an agent to cross cell membranes and gain access to intracellular receptors since the testing is typically performed using cell-free extracts, although intact mammalian cells may also be used. One example of a competitive ligand binding assay is the Rat Estrogen Receptor Equilibrium Exchange Assay, which uses adult female rat reproductive tissue as a source of estrogen receptors. In this assay, the ability of an estrogenic compound to compete with a radiolabeled synthetic estrogen for the receptors is measured. The binding affinity of the test compound is expressed relative to the binding affinity of the synthetic hormone as an indicator of relative potency. Similar assays have been developed for androgen-receptor binding using adult male rat reproductive tissue and synthetic radiolabeled androgens.

2) Cell proliferation assays. A second type of in vitro assay measures the ability of a test agent to cause increased or decreased cell replication, called cell proliferation assays. One cell proliferation assay that has been developed is termed E-Screen, which uses MCF-7 cells that naturally express estrogen receptors (Zacharewski, 1997). This assay relies on the ability of a test compound to alter the normal rate of cell division in a human breast cancer cell line, presumably through binding to estrogen receptors. Advantages of the test include its reported sensitivity of 2-3 ng/L and its use of a human cell line. A major disadvantage of cell proliferation assays in general is that they do not necessarily provide a causative link between cell replication and endocrine-related effects since it has been shown that many agents that cause alterations in cell division do not cause altered endocrine function.

An analogous cell proliferation test has been developed for androgens and is called A-Screen (Soto et al., 1998). This test also uses MCF-7 cells, but the cells are modified through the introduction of a DNA plasmid coding for the human androgen receptor. The genetically altered cells are termed MCF7-AR1 cells. These cells retain the ability to respond to estrogen through cellular proliferation, but should androgen receptor interaction occur, synthesis of the AS3 protein results, which turns off the estrogen-mediated proliferative response. This system has the same advantages and disadvantages as described for the E-Screen assay.

3) Yeast cell assays. In vitro systems developed using yeast address cause and effect by providing a gene transcription endpoint (Gaido et al., 1997). In these tests, yeast cells, which do not naturally express estrogen or androgen receptors, are
transfected with DNA such that receptor expression occurs. The yeast cells are also transfected with a reported gene construct that codes for a protein (e.g., the enzyme β-galactosidase) that can be easily measured. The protein is produced in response to receptor binding by a test agent. The yeast estrogen screen is called the YES or ER-yeast assay, while the yeast androgen screen is called the AR-yeast assay. These assays are as sensitive as cell proliferation assays, but are easier and faster to perform. However, the responses of EDCs in yeast-based systems have been shown to be somewhat unreliable indicators of the ability of EDCs to produce responses in humans due to large differences between human and yeast cell structure (e.g., cell membrane permeability) and function (e.g., metabolism).

4) Transcriptional Activation Assays. The most reliable in vitro assays for EDC screening appear to be Transcriptional Activation Assays, which use intact cells, modified to contain a reporter gene that codes for a specific, easily-identified protein product. Transcriptional Activation Assays, also called Reporter Gene Assays, provide a specific, responsive, and rapid means to screen substances for potential estrogenic effects. In these assays, cells that express estrogen receptors are altered through the insertion of an estrogen-responsive reporter gene construct into the cellular DNA. The reporter gene construct consists of three estrogen response elements that regulate the expression of the reporter gene and the ultimate production of the protein product. One commonly used reporter gene codes for the production of luciferase, derived from fireflies. If a test compound is able to enter the cell and bind to the endogenous receptor, the activated complex attaches to the estrogen response element of the reporter gene construct, activating the luciferase reporter gene and triggering the production of the luciferase enzyme. The presence of the luciferase enzyme is measured by the amount of light produced when the substrate, luciferin, is added with appropriate cofactors. The amount of light produced is directly related to the estrogenicity of the test compound. The MVLN Assay uses stably transfected MCF-7 cells (Pons et al, 1990) modified to express alpha estrogen receptors. A second common cell line is T47D-KBluc, created by the transfection of human breast adenocarcinoma cells that express both alpha and beta estrogen receptors with the luciferase reporter construct. The use of intact cells may make this type of assay more relevant to potential whole organism effects. However, the cells may not perform the same metabolic conversions as the whole organism, and it is possible that the response produced may be unrelated to receptor binding. Testing is performed both with and without additional metabolic enzymes to attempt to account for the differential metabolic capacity of the cell line and intact organisms.

Transcriptional Activation Assays have also been developed to test for androgen-related and thyroid-related effects. In these tests, appropriate cells lines (e.g., monkey kidney CV-1 cells) with the ability to express androgen or thyroid hormone receptors, naturally or through transfection, are used. The reporter genes used for the androgen and thyroid testing are responsive to either androgen or thyroid hormone activation. Thyroid receptor binding has not been shown to be a key mechanism through which substances exert thyroid-related effects, a potentially important limitation for use of this type of test for thyroid-related effects.

5) Steroidogenesis Assays. To test the ability of agents to interfere with hormone production, assays that measure the activity of enzymes involved in hormone synthesis are also available. These tests are referred to as Steroidogenesis Assays and measure the activity of P450-mediated enzymes in the steroid pathway. Minced rodent tissue (e.g., testes) or mammalian cells (e.g., Leydig cell cultures) are used as the source of steroid enzymes. The tissue or cells are incubated with the test material, and the activity of a number of steroidogenesis enzymes is measured following the addition of applicable substrates. However, due to the large number of enzymes involved in the synthesis of the more than 50 hormones present in the body, this type of testing may not be feasible or reliable for screening large numbers of compounds for potential effects.

In Vivo Test Systems. In vivo systems have some advantages over in vitro systems, the most important of which is their ability to incorporate the processes of absorption, distribution, metabolism, and excretion. In addition, in vivo systems are more comprehensive than in vitro systems and provide an evaluation of the entire endocrine system as a functional unit. In vivo endpoints that can be evaluated include reproductive organ and gland weights and histology, serum hormone levels, gene
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activation and protein synthesis, behavior, growth, development, and reproductive success. However, in vivo systems tend to be costly, time-consuming, and require the use of large numbers of animal test subjects. In vivo test protocols already exist that can be used to assess endocrine-related effects, including multi-generational protocols, simply by expanding the endpoints to be examined following exposure. The following describes a few of the relatively simple and short-term assays currently available for use in EDC screening.

1) Rodent Assays. One short-term, relatively sensitive test for estrogenic compounds is the Rodent Uterotrophic Assay. Immature or ovariectomized female rats or mice are dosed with the test compound by an applicable route of administration and the weight of the uterus is measured at a defined time post-exposure, typically three days. Histology of the reproductive organs may also be examined along with quantification of serum hormone levels. In the Rodent Pubertal Assay, the age of onset of puberty in males and females is recorded following daily doses of test compound begun on the day of weaning. Following puberty, animals are sacrificed and also assessed for other endocrine-related endpoints such as thyroid hormones levels, enzyme activity, and histopathological effects in endocrine tissues. To assess androgenic effects, the Rodent Hershberger Assay may be used. In this assay, the weights of male accessory glands are measured in castrated males following treatment with test compound for up to seven days. Supplemental endpoints to be examined include hormone levels and histopathology of endocrine tissues. This test is a fairly simple, short-term, and relatively specific test for androgenic effects. Each of these general protocols may be varied to use animals of different ages and/or administration of agents for varying lengths of time.

2) Tadpole Assays. To determine the effects of chemicals on the thyroid system, tadpole metamorphosis is one useful endpoint due to its dependence on thyroid function (Degitz, et al., 2005). In this in vivo assay, frog larvae are exposed to test solutions for approximately two weeks. Multiple endpoints associated with metamorphosis are characterized, including rate of metamorphosis (tail resorption), histology of the thyroid gland, and thyroid hormone levels. Similar tests have been developed using fish as the test organism, though their relevance to humans is questionable. There are many other well-established and generally accepted in vivo protocols available to test for endocrine-related effects. The tests vary in species, sex, and age of test subjects used, duration of exposure, and specific endpoints examined. For each in vivo test system, appropriate controls, positive and negative, should be utilized, along with statistically relevant numbers in each test group and multiple dose levels to demonstrate a dose-dependent relationship. EPA has invested in the development of high-throughput (HTP) in vitro assays and in silico models for the rapid screening of potential chemical targets, including endocrine-related endpoints. HTP in vitro effects-based assays and in silico models are referred to jointly as ‘computational toxicology tools’ (US EPA, 2012).

Future Research Needs
There are multiple bio-analytical techniques available for assessing the endocrine disrupting potential of CPCs in water, employing either in vivo or in vitro methods. Each of these techniques has limitations, and no one method is an ideal indicator of endocrine disrupting activity in humans. Indeed, research in this area is a major focus of EPA’s Endocrine Disrupting Screening Program. For further information on this program, the reader is referred to http://www.epa.gov/endo/.

About the Author
Dr. Chandra Mysore is a National Practice Leader for Water in GHD, Inc. His experience includes development of innovative...
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solutions to the environmental challenges in water quality and treatment, reuse and desalination. He has participated in numerous WRF/EPA-funded projects on water treatment and authored over 100 technical papers and several book chapters. 

References


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Emerging Contaminants: A Proactive Approach to Enhance Drinking Water Quality

By Mike Lutz, Dewberry Engineers, Denver Colorado; and Marco Menendez, Dewberry Engineers, Raleigh, North Carolina

Natural rivers, streams, and groundwater, which serve as drinking water sources, contain trace amounts of chemical contaminants that are currently unregulated and are not completely removed by most drinking water treatment systems. Some of these emerging contaminants are generated from pharmaceuticals, hormones, detergents, plasticizers, flame retardants, and their metabolites. Awareness of emerging contaminants has increased in correlation with improvements to sensitive analytical methods, which can identify low concentrations of chemicals that were previously undetectable.

The long-term health effects of exposure to low concentrations of emerging contaminants in drinking water are not well understood. Nonetheless, potential health risks from the numerous emerging contaminants are creating growing concern among regulatory agencies’ and drinking water providers.

Raw water sources near urban centers and agricultural activities frequently contain emerging contaminants. The US Geological Survey (USGS) analyzed water samples from 139 streams in 30 states located downstream from urban areas and livestock production areas. Low concentrations of natural and synthetic organic contaminants were found in 80% of the streams sampled during 1999 and 2000. Unregulated organic compounds, such as detergents, steroids, plasticizers, and non-prescription drugs, were measured in the surface and ground waters, and were found at low concentrations—generally less than 1 ug/L. In 2007, the USGS analyzed 100 analytes in 25 groundwater and 49 surface water sources of drinking water in the United States. The most frequently detected chemicals are summarized in Table 1. The sample sites contained a median of four targeted chemicals, often near detection limits. Most of the chemicals detected in the survey are currently unregulated but some may have long-term health effects at low concentrations.

USGS measured organic wastewater compounds at eight sites, which are drinking water sources in the Triangle Area of North Carolina, from 2002 through mid-2005 (M.J. Giorgino, R.B. Rasmussen, and C.A. Pfeifle, June 2007, Occurrence of Organic Wastewater Compounds in Selected Surface-Water Supplies, Triangle Area of North Carolina, 2002–2005). A total of 24 target compounds were detected at low concentrations (< 1 ug/L) in at least one sample. The most frequently detected compounds included:

- acetaminophen (nonprescription analgesic);
- caffeine (nonprescription stimulant);
- cotinine (nicotine metabolite);
- metolachlor (herbicide);
- 3 fire retardants - tri(2-chloroethyl) phosphate, tri(dichloroisopropyl) phosphate, and tributyl phosphate;
- 2 synthetic musk fragrances (known endocrine disruptors) - acetyl-hexamethyl tetrahydrophthalene and hexahydro-hexamethyl cyclopentabenzopyran.

Table 1: Emerging Contaminants in Groundwater and Surface Water Sources of Drinking Water

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Detection Frequency, percent</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surface water</td>
<td>Groundwater</td>
</tr>
<tr>
<td>Bisphenol-A</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>ß-sitosterol</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Carbamazepine</td>
<td>20</td>
<td></td>
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<tr>
<td>Cholesterol</td>
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<td></td>
</tr>
<tr>
<td>Cotinine</td>
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<td></td>
</tr>
<tr>
<td>1,7-dimethylxanthine</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>Metolachlor</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Tetrachloroethylene</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Tri(2-chloroethyl) phosphate</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

Endocrine Disrupting Compounds (EDCs)
The physiological functions of living organisms are regulated by natural hormones produced by the endocrine system. Hormones are normally present in the body at very low concentrations and regulate many critical metabolic functions. Many emerging contaminants can interfere with or disrupt normal hormonal functions. Trace amounts of endocrine disrupting compounds (EDCs) can have significant ecological and biological effects.

Estrogens are hormones that regulate the female reproductive system. Estrogens are steroid compounds that have chemical structures similar to synthetic steroid medications. Due to their essential biological function, natural estrogens and synthetic compounds that mimic estrogens can have endocrine-disrupting effects that adversely impact aquatic wildlife and other exposed organisms at very low concentrations.

Widely used medications such as ibuprofen, acetaminophen, phenazone, and carbamazepine (anti-epilepsy drug) exhibit estrogenic activity. Nonylphenols (NP) formed from detergents exhibit well known endocrine-disrupting effects. Other common EDCs include 4-tert-octylphenol (OP), 4-nonylphenol (NP), bisphenol-A (BPA), and several phthalates (plasticizers).

Both natural estrogens and synthetic organic compounds, which mimic estrogen, are present in all domestic wastewaters. Aqueous-phase estrogenic activity in raw domestic wastewater is reduced significantly during secondary wastewater treatment. However, conventional wastewater treatment processes only partially remove many pharmaceuticals and their derivatives and these biologically active chemicals are discharged into receiving surface waters. Steroid hormones are the most significant endocrine disrupting chemicals in wastewater effluent. Reproductive hormones have been identified in 40% of surface waters and estrogenic alkylphenols in 70% of surface waters in the United States by the US Geological Survey. Concentrations of the

Endocrine-Disturbing Compounds

Endocrine-disrupting chemicals (EDCs) mimic or block the action of natural hormones that regulate metabolism, growth, development, and reproduction in animals. Most EDCs affect the action of estrogen, androgen, or thyroid hormones. EDCs include natural and synthetic hormones excreted from the human body, many prescription drugs, and non-prescription medicines. Some detergent degradation products are estrogenic.

- sulfamethoxazole (prescription antibiotic)
- acetaminophen, cotinine, tri(2-chloroethyl) phosphate, and metolachlor, were detected at numerous sites and in numerous samples, indicating that they are widely distributed in the environment. Synthetic musk fragrances were detected in numerous samples but at only one location. In general, concentrations of organic wastewater compounds detected in the Triangle Area were within ranges of concentrations reported for other areas. Municipal wastewater and storm water runoff from agricultural, urban, and residential areas were probable sources of these organic compounds.
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Pesticides and herbicides are frequently found in surface streams and ground water. The National Water-Quality Assessment (NAWQA, USGS, 1998) found that more than 50% of all stream samples contained five or more pesticides and about 25% of ground water samples had two or more pesticides. Although pesticides and herbicides are present in most surface waters, the concentrations are generally below 1 ug/L and are substantially below US Environmental Protection Agency (EPA) drinking water standards.

The United States Department of Agriculture (USDA) Pesticide Data Program (PDP) surveyed drinking water systems in several states for pesticide and herbicide residues. In 2005, PDP analyzed 750 drinking water samples for more than 200 pesticides and metabolites. Treatment plants participating in the 2005 survey draw from surface water as their primary source waters. Drinking water sampling sites were located in watersheds where pesticides were heavily applied. A total of 48 residues were detected in the untreated intake water and 43 in the treated drinking water. Treated drinking water exhibited little or no reduction in most pesticides compared with the raw water. None of the pesticides detected in the finished water samples exceeded EPA Maximum Contaminant Levels (MCL) or Health Advisory (HA) levels.

Future Regulated Compounds

US EPA periodically publishes the Contaminant Candidate List (CCL) to identify chemicals that are known or anticipated to occur in public water systems and may be regulated in the future. US EPA published the third Contaminant Candidate List (CCL3) in February 2008. The CCL3 lists 104 chemicals or chemical groups, many of which are synthetic organic compounds. The final CCL3 list includes pharmaceutical products, synthetic hormones, pesticides, endocrine-disrupting chemicals (EDCs), nitrosamines, three cyanotoxins and several microorganisms. In addition, several chemicals, which are currently regulated under the national primary drinking water standards (NPDWRs), are being reviewed or revised for more stringent MCLs by recent or ongoing regulatory actions.

When new contaminants become regulated or when currently regulated contaminants receive more stringent MCLs, existing drinking water treatment systems may need to be upgraded. Existing drinking water treatment systems, which plan to expand, and new water treatment systems should anticipate low MCLs for emerging contaminants and be designed to remove emerging contaminants or be planned for future upgrades to remove emerging contaminants that may be in their raw water sources.

Treatment Alternatives to Remove Emerging Contaminants

Most of the emerging contaminants are natural or synthetic dissolved organic compounds (DOC), which are not removed or are partially removed by conventional water treatment processes. US EPA published an extensive database of capabilities for wastewater and drinking water treatment processes to remove emerging contaminants (US EPA, August 2010, Treatment Contaminants of Emerging Concern, A Literature Review Database). The removal percentages for specific emerging contaminants vary over a wide range. The most effective treatment process depends on the specific emerging contaminants that are present in the source water.

Treatment technologies, which have the capability to remove high percentages of a broad range of DOC from the raw water, would eliminate most of the emerging contaminants, endocrine-disrupting chemicals (EDCs), and provide the ability to meet future regulatory limits for synthetic organic compounds. Removal of high percentages of DOC from the raw water would also reduce disinfection by-product (DBP) formation potential. Treatment technologies that can reduce DOC to low concentrations are summarized in Table 2.

Ruerter-Hess Water Treatment Plant

The Parker Water and Sanitation District (PWSD) located in Parker, Colorado constructed the Rueter-Hess Reservoir and is currently constructing the Rueter-Hess Water Treatment Plant (RHWTP) to maximize reuse of groundwater and alternative renewable surface water sources. The RHWTP will treat surface water from local

Table 2: Treatment Processes to Remove Emerging Contaminants

<table>
<thead>
<tr>
<th>Treatment Process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activated carbon</td>
<td>Adsorption of organic compounds onto activated carbon surface</td>
</tr>
<tr>
<td>Biological filtration</td>
<td>Ozonation followed by biological oxidation in granular activated carbon filters</td>
</tr>
<tr>
<td>Ion exchange</td>
<td>Adsorption of specific ions onto exchange media surface</td>
</tr>
<tr>
<td>Advanced oxidation</td>
<td>Ultraviolet (UV) light combined with hydrogen peroxide or ozone to generate hydroxyl radicals, which oxidize DOC</td>
</tr>
<tr>
<td>Nanofiltration</td>
<td>Excludes molecules &gt; 0.001 microns in size (multivalent ion range); removes many heavy metals and most EDCs</td>
</tr>
<tr>
<td>Reverse osmosis</td>
<td>Membrane separation removes dissolved solids &lt; 0.001 microns in size including pharmaceuticals and endocrine disrupters</td>
</tr>
</tbody>
</table>
Global Technologies, Local Solutions.

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Emerging/Potential CONTAMINANTS

Rueter Hess Reservoir partially filled, water treatment plant construction site in lower right corner (photo by Jackie Schumaker)

streams and reclaimed tertiary wastewater effluent, which will be stored in the 72,000-acre-foot Rueter-Hess Reservoir. All of the water flowing into the reservoir is retained for water supply except for evaporation and seepage losses. Rueter-Hess Reservoir has no downstream release of water (except for emergency overflows).

The RHWTP will treat reclaimed effluent for indirect potable reuse for drinking water supply. The local surface water sources and the reclaimed water have high organic content. Average dissolved organic carbon (DOC) levels in the raw water within the reservoir are expected to be 10 to 12 mg/L, especially during the summer. The raw water sources are expected to contain a mixture of emerging contaminants. Significant amounts of many of the dissolved natural and synthetic organic chemicals would not be removed by conventional water treatment processes.

The RHWTP was designed to eliminate most of the natural organic matter and synthetic organic chemicals in the finished drinking water by removing a high percentage of DOC. Removing most of the DOC from the raw water will achieve compliance with drinking water standards for DBPs and will proactively remove most of the organic emerging contaminants and EDCs, which might be regulated in the future.

The treatment process selected for the Rueter-Hess WTP consists of enhanced coagulation using ferric chloride in a ballasted sedimentation system, adsorption of DOC with powdered activated carbon (PAC), ceramic membrane filtration, and sodium hypochlorite disinfection. Enhanced coagulation will remove approximately half of the DOC in the raw water. Adsorption on recirculating PAC will remove most of the DOC remaining in the water after enhanced coagulation. Pilot tests conducted by Dewberry Engineers showed that recirculating PAC at an equivalent PAC dose of 25 mg/L achieved 70% DOC removal and pre-filter DOC less than 2 mg/L using 100% reclaimed wastewater effluent as the source water. In addition, the PAC dose can be increased to achieve up to 90% DOC removal if necessary. The recirculating PAC system, originally developed in France to comply with European Union standards for pesticide removal, will be one of the first US applications.

Although ceramic membrane microfilters for drinking water are new to the US, the technology is well established with over 15 years of full scale operating experience. There are more than 100 ceramic membrane drinking water facilities in Japan with over 140 mgd of total installed ceramic membrane capacity. Ceramic membrane microfilters were selected for the RHWTP because they have several advantages over conventional polymeric membranes, including:

- 20+ year membrane life
- 0.1 micron pores are absolute barrier to bacteria, Giardia and Cryptosporidium
- Low trans-membrane pressure
- No irreversible fouling or progressive flux decline
- No membrane damage from exposure to strong chemical oxidants and extreme pH
- Ceramic membranes have never failed a membrane integrity test
- Ceramic membranes have never needed to be replaced over 15 years of operation

Construction of the RHWTP started in the fall of 2012. The ceramic membrane microfilters have been fabricated, delivered to the site, and will be installed this summer. When completed in 2014, the RHWTP will produce drinking water from reclaimed effluent and native surface water. The innovative PAC adsorption process will remove most of the DOC and organic emerging contaminants, which will achieve compliance with drinking water standards for DBPs and proactively address potential future regulations for many organic emerging contaminants.

Authors
Mike Lutz is an Associate Vice President with Dewberry Engineers. He participated in pilot testing, planning, and design of the 10-mgd Rueter-Hess water treatment plant. The unique treatment process features the first ceramic membrane filters and one of the first recirculating PAC adsorption systems in the US.

Marco R. Menendez, P.E. is the Carolinas Water Service Line Leader for Dewberry Engineers, and has 19 years of experience with a variety of water, wastewater, and reclaimed water systems.

Contact information:
Michael P. Lutz, PE, Associate Vice President
Dewberry Engineers
1095 South Monaco Parkway
Denver, CO 80224
303.951.0612 mlutz@dewberry.com

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Denver, CO 80224
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The Institute for Sustainable Infrastructure and the Evolution of Sustainability

By Mary T. Brice, PE, LEED AP BD+C, Project Manager, Dewberry; Jeff M. Miller, PE, ENV SP, Automation Manager, Dewberry; Shallan Fitzgerald, PE, ENV SP, Project Manager, Dewberry; and Lidia Berger, MEM, LEED Fellow, National Sustainability Director, Dewberry

Most professionals think of the US Green Building Council’s LEED certification program when thinking of a green rating system – even in the water/wastewater industry. While appropriate for commercial type buildings, this certification, does not really fit most of the facilities in the water/wastewater industry, including treatment plants, pump stations, tanks, etc. Yet these facilities embody the very core of environmental sustainability and greatly benefit from sustainable design and management practices. A new rating system has been developed to address this gap and promote sustainable design and management practices within the US.

The Institute for Sustainable Infrastructure (ISI) is a not-for-profit organization structured to develop and maintain a sustainability rating system for the civil infrastructure of the United States. It was founded by the American Council of Engineering Companies (ACEC), the American Public Works Association (APWA), and the American Society of Civil Engineers (ASCE). A joint collaboration between ISI and the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design developed the Envision rating system for infrastructure projects. The Envision rating system was designed to evaluate civil infrastructure such as roads, bridges, pipelines, dams, landfills, water supplies, wastewater treatment plants, and public spaces.

Similar to the LEED rating system, projects and their components are evaluated in several categories and credits are assigned based upon the project’s ability to satisfy the objectives of each category. The five categories are Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. An online Project Application Tool is used to assess the project and apply for credits. A third party is used for verification of the credits claimed. Using the final credit total, projects may be awarded recognitions ranging from an Acknowledgement of Merit to a Platinum Level Award.

Taking a closer look at the five categories, the latter three – Resource Allocation, Natural World, and Climate and Risk – focus on the engineered aspects of the project. These are the categories where the ecological footprint of the project is scrutinized in terms of material selections, energy consumption, habitat protection, and emission and contaminant discharge reductions. The design team’s solutions for meeting the objectives of these categories embody what the engineering community traditionally defines as sustainable design. Materials, product, and process innovations hold promise that sustainable design will continue to evolve.

Also evolving is the significance of financial sustainability and the role that managers and elected officials play in making infrastructure planning, replacement, and operation choices while faced with seemingly endless needs.

The publication Governing, which covers state and local politics, policy, and management, reports that 33 utility authorities and other municipalities throughout the United States have filed for Chapter 9 bankruptcy protection since January of 2010. Even states without laws authorizing municipal bankruptcies often have provisions that allow them to exercise some degree of emergency financial management over distressed localities, and recently several are employing those options. ISI challenges these trends within the Envision rating system. The categories Quality of Life and Leadership offer project credits for providing effective leadership, collaboration, and commitment – for doing the right project. The objectives in these categories encourage managers to expand opportunities for performance improvement and can equip locally-elected officials with the tools necessary to evaluate assets and reallocate energy expenditures in a responsible and sustainable manner.

Work in the area of financial sustainability continues to evolve. Earlier this year ISI, in partnership with ASCE, Autodesk, and the Environmental Financial Consulting Group, hosted Making the Grade: New Ideas Symposium for Innovation in Infrastructure Development.
The goal of this symposium was “to produce a set of recommendations to be published and disseminated to policy makers and to the public for improving how infrastructure should be planned, designed, built, and financed in order to support US economic competitiveness, environmental sustainability, and social equity in an era of severe fiscal constraints.”

As financially-strapped governments shift away from formula grant-making to merit-based funding, understanding how to craft a detailed business case analysis is crucial. An important question raised during the symposium was “What do we need to show project sponsors and funders to persuade them that my project should go first?” It is imperative that sustainable infrastructure advocates shift subjective discussion like ‘improved quality of life’ to quantitative business case models to capture key opportunities with private investors and public-sector project sponsors.

Moving from subjective discussion about green benefits to quantitative business cases that monetize social and environmental impacts offers a new way of thinking about infrastructure development in order to leverage natural systems to create a more resilient infrastructure. ISI is leading the way in this effort and will continue to shape the evolution of sustainable infrastructure planning, design, and management.
You may remember from the Summer issue of NC Currents that the NC Safewater Endowment was created to help produce a sustained, educated and trained workforce by supporting the following activities:

- Provide annual scholarships to university and community college students
- Provide educational awards for programs that increase safe water awareness
- Promote greater involvement in schools to encourage more students to consider a career in a water profession
- Promote public safe water education
- Enhance safe water research
- Encourage leadership development among industry professionals

We are pleased to announce that the NC Safewater Endowment has awarded its first scholarships since becoming a comprehensive endowment program (numerous awards have been made from the Carol Bond Scholarship Fund that preceded the current program). The 2013 NC Safewater Endowment award recipients are identified below.

The Endowment Committee is excited to note that the scholarship pool available for award in 2014 is more than twice the amount awarded this year. Applications are available through the NC AWWA-WEA website.

Our objective of developing a sustained, educated and trained workforce for safe water in North Carolina is not only a lofty goal, but also an essential requirement for the future of safe water in our state. NC AWWA-WEA is nearly 3,500 members strong. Even an annual contribution of $10 by each member will make a huge difference in the growth of the endowment program and the ability to accomplish the activities mentioned in the first paragraph of this article. If you are not currently contributing to this vital program, please consider doing so today. Visit our website or contact the Endowment Committee chairman, Ray Cox at rcox@hiepc.com or (910) 313-1516.

<table>
<thead>
<tr>
<th>Award Amount</th>
<th>Award Recipient</th>
<th>School or Program</th>
<th>Source of Award*</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,000</td>
<td>Amber Greune</td>
<td>NCSU</td>
<td>NC Safewater Fund/GHD Clean Water Fund</td>
</tr>
<tr>
<td>$1,000</td>
<td>Alma Beciragic</td>
<td>Queens University</td>
<td>Carol Bond Fund/NC Safewater Fund</td>
</tr>
<tr>
<td>$500</td>
<td>Jennifer Doll</td>
<td>Wake Technical Community College</td>
<td>Carol Bond Fund/NC Safewater Fund</td>
</tr>
<tr>
<td>$1,000</td>
<td>Maggie Hennessy</td>
<td>NC AWWA-WEA Water Tower Competition</td>
<td>Raftelis Foundation Elementary Education Scholarship</td>
</tr>
</tbody>
</table>

*At this early stage of the program, awards are sometimes made by combining the available scholarship money from multiple funds

CONGRATULATIONS TO ALL AWARD WINNERS!
Amber Greune, a graduate student at NCSU and recipient of a $1,000 scholarship from the NC Safewater Fund and the GHD Clean Water Fund, had this to say about the importance of the award, “I am honored to receive the…Endowment Scholarship. Thank you so much for your generosity. This will greatly help me on my way to finishing a master’s degree in environmental engineering at NC State University. I am deeply inspired to do my part in keeping our water clean and safe. It is great to be a part of a community with the same mission.”

Jennifer Doll, a student at Wake Technical Community College and recipient of a $500 scholarship from the NC Safewater Fund and Carol Bond Scholarship expressed her gratitude for her award with these words, “I am exceedingly appreciative of the NC AWWA-WEA for sponsoring the NC Safewater Carol Bond Community College Scholarship. Knowing that the community is supporting my decision and offering financial assistance to further my education in Environmental Science has been a great boost to my self-esteem. Safe water is a necessity in insuring the future of the environment. Water pollution has had an effect on my family personally. My father is a fisherman and because of water pollution his livelihood was severely altered. Thank you for offering this scholarship and I look forward to being part of the solution to further the safety of clean water.”

“We are pleased to announce that the NC Safewater Endowment has awarded its first scholarships since becoming a comprehensive endowment program.”
Welcome New Members!

The people listed below became members of NC AWWA-WEA in April, May or June of 2013 either by joining AWWA or WEF and choosing NC as their home state or as an additional membership state, or by joining at the state level with a NC SLAM membership. We welcome these professionals to the Association and look forward to seeing them at future events and working with them on various projects and committees.

For information on how to join, and the membership options available, please visit www.ncsafewater.org/about/membership. Most of the Association’s work is carried out through committees. To learn more about each committee review the list of active committees at www.ncsafewater.org/committees, and click on a committee’s name to learn more about them. To express your interest in learning more about a committee, contact the committee chair directly, or complete the Online Volunteer Form available at www.ncsafewater.org/committees.

Next to some new members names, you may see the name of their endorser or sponsor that recruited them to become a member. The endorser/sponsor who recruits the greatest number of members may be recognized at the NC AWWA-WEA Annual Conference with one of the following awards.

The Maffitt Membership Cup honors Mr. McKean Maffitt and is given annually to the member of the NC Section AWWA who secures the greatest number of new members.

The William M. Piatt Membership Award honors Mr. William M. Piatt and is given annually to the member of the NC WEF Member Association who secures the greatest number of new members.

**New Members**

**American Water Works Association (AWWA)**
- Dwayne Hayes, Alligood
- Christopher Boyette, Moore County Public Utilities
- Jeremy Brashears, URS Corp
- Robert Forand, Jr., Pender Utility Operation
- David Hall (Endorsed by Mike Shelton)
- James Hemphill, Metropolitan Sewerage District
- Jim Hendery
- Monroe Huckaby, III, WK Dickson & Co. Inc.
- Christa Kenan, City of Durham
- Jim Louya, Davidson Water Inc.
- Bryan McCabe, Pender County Utilities
- Kelly McCorkle, Black & Veatch Corp. - Consulting Division
- Andrew McNeill, Moore County Public Utility
- Jerry Morrone, City of Durham
- Ryann Neal
- Michael Neff, Lincoln County
- Sandra Shaw, Northwest Onslow Water Association
- Charlie Weimer, Clearwater
- Martha Zeigler, City of Durham

**Water Environment Federation (WEF)**
- Sean Byrd, Town of Holly Springs
- Larry Campbell, Charlotte Mecklenberg Utilities
- Jimmy Coats, Old North Utility Services Inc.
- Clarence Cross, City of Gastonia
- Michael Davis, Heyward Incorporated
- Jon Forrest, Fortech (Sponsored by Charles Willis, Jr.)
- Keith Gass, Metropolitan Sewerage District Of Buncombe County
- Michael Godfrey, Graybar
- Jonathan Lapsley, CDM Smith
- Michele Mallette, City of Raleigh
- Todd Massey, Godwin Pumps
- Michael McGettigan, Perkinelmer Inc.
- Matthew Raynor, Raynor Environmental Enterprises
- Will Rice
- Mickey Roberts, Metropolitan Sewerage District of Buncombe County
- James Robinson, Entex Technologies
- Patrick Seay, Xylem-Godwin
- Matthew Vessie, City of Raleigh
- Parsons Brinckerhoff (organizational member)

**NC SLAM**
- Paul Allen, Sr., Domtar
- Envin Atwood, Davie County Public Utilities
- Tony Black, Piedmont, Triad Regional Water Authority
- Christopher Brinkley, City of Sanford
- Alphonso Brown, City of Elizabeth City
- Paul Bryan, City of Washington
- Kevin Campbell, City of Winston Salem
- Stephen Carver, City of Elizabeth City
- Xiaolin Chen, Smithfield Packing Co.
- David Cole, Broad River Water Authority
- Nancy Deputy, City of Winston Salem
- William Dodson, City of Brevard
- Larry Durgin, Greenway Irrigation
- Floyd Edwards, Town of Boonville
- Maja Fahey, City of Burlington
- Kenneth Friday, Two Rivers Utilities/City of Gastonia
- Donald Geddings, Pamlico County Water Department
- Christopher Graham, South Granville Water & Sewer Authority
- Ralph Gross, Jr., Kace Environmental
- Amanda Hair, Aranco Wood Panels
- Darrick Hunt, Town of Red Springs
- David Jackson, City of Greensboro
- Jonathan Jones, Jr., Davie County Public Utilities
For information on how to join, and the membership options available, please visit www.ncsafewater.org/about/membership.
MAINTENANCE TECHNOLOGIST QUESTIONS

Questions provided by the NC AWWA-WEA Plant Operations & Maintenance Committee.

1. Which is a potential energy source that must be locked out or blocked before equipment can be safely worked on according to OSHA 29 CFR 1910.147 – The Control of Hazardous Energy?
   a) electrical   b) pneumatic
   c) hydraulic   d) mechanical plus all of the above

2. Grease is made by adding oil to a thickening agent called:
   a) Soap   b) Wax
   c) Graphite   d) Thickener

3. In a split case centrifugal pump the shaft size is 3¼" and the stuffing box is 5". What size packing would you need to correctly pack the pump?
   a) 9 ½"   b) ½"
   c) ¾"   d) 1 ½"

4. This valve is excellent for controlling the flows of slurries and sludges found in water treatment facilities:
   a) Backflow preventer   b) Eccentric Plug Valve
   c) Butterfly Valve   d) Check Valve

Answers:
1. d)
2. a) Source: Electrical fundamentals for Water and Wastewater page 380.
3. c) Source: Pumps and Pumping by Arasmith page 174.

WASTEWATER CERTIFICATION QUESTIONS

Questions provided by the NC AWWA-WEA Wastewater Board of Education & Examiners.

1. Nanofiltration uses a membrane pore size between reverse osmosis and microfiltration.
   a) ultra filtration.   b) cross flow filtration.   c) tangential filtration.

2. This type of membrane filtration module requires the highest degree of pretreatment of all membrane configurations:
   a) Spiral membranes   b) Tubular membranes
   c) Hollow fiber membranes   d) Plate and frame membranes

3. In terms of solids analysis, volatile solids refer to materials lost during ignition in a muffle furnace for 60 minutes, at
   a) 450°C.   b) 500°C.
   c) 525°C.   d) 550°C.

4. Spent activated carbon from most industrial uses are judged to be:
   a) Non-hazardous wastes   b) Biodegradable wastes
   c) Hazardous wastes   d) Chemical wastes

5. Cyanide destruction uses this process:
   a) Hydroxide floc formation   b) Wet oxidation
   c) Alkaline hypochlorite oxidation   d) Ion exchange

Answers:
# WATER CERTIFICATION QUESTIONS

Questions provided by the NC AWWA-WEA Water Board of Education & Examiners.

1. **The most desirable residential pressure ranges from?**
   - a) 20 to 35 psi
   - b) 35 to 50 psi
   - c) 50 to 75 psi
   - d) 75 to 90 psi

2. **Regarding fire flow, mains smaller than 6 inches should only be used**
   - a) in residential areas.
   - b) in low-value districts.
   - c) in rural areas.
   - d) to complete a grid.

3. **If special bedding material is required by the design engineer due to poor local soil conditions,**
   - the material should not contain more than ____ clay or silt that can be sensitive to water.
   - a) 5%
   - b) 10%
   - c) 12%
   - d) 18%

4. **Meter sizes up to 1 in. usually have screw-type connections, whereas larger meters usually have ____________ connections**
   - a) mechanical joint
   - b) flanged
   - c) coupling
   - d) yoke

## Answers


---

# CERTIFICATION INFORMATION

If you have any questions regarding operator/engineering certification and exams please contact the appropriate agency.

**NC Board of Examiners for Engineers & Surveyors**

919-791-2000  
www.ncbels.org  
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Responsible for Professional Engineers

**NC Water Treatment Facility Operators Certification Board**

919-707-9040  
http://www.ncwater.org/pws/  
Exam Dates: 10/31/13, 2/27/14, 5/29/14, 8/28/14, 10/30/14  
Responsible for Drinking Water Certifications (Surface, Well, Distribution, & Backflow/Cross-Connection)

**Water Pollution Control System Operators Certification Commission**

919-807-6353  
http://portal.ncdenr.org/web/wq/admin/tacu  
Exam Dates: 12/12/13 (Postmarked by 11/12/13), 3/13/14, 6/12/14, 9/11/14, 12/11/14  
Responsible for Wastewater Certifications (Animal Waste, Biological WW, Physical/Chemical, Land Application, Spray Irrigation, Collections, Subsurface, and OIT)
2013 Drinking Water Week Poster Contest Rules

Each year, the NC AWWA-WEA’s Public Education Committee (PEC) sponsors a poster contest in conjunction with the celebration of Drinking Water Week in May. Students in grades K-8 are eligible to participate and are separated into three divisions: K-2, 3-5, and 6-8. All utilities in the state are encouraged to promote the contest among local schools (public and private) and home schoolers. Participating members select first place winners from their city/utility, which are submitted for the statewide competition. PEC members then select first, second and third place winners in each division. This year’s winners are as follows:

Grades 6-8: (All from Durham)
1st Place – Tyara Brand
2nd Place – Brandy Rodriguez
3rd Place – Chelsea Castor

Grades 3-5: (All from Durham)
1st Place – Caroline Aldridge
2nd Place – Helene Worthington
3rd Place – Noor Jerath

Grades K-2: (all from Greensboro)
1st Place – Symiah Davis
2nd Place – Sandith Gannewage
3rd Place – Madison Young

Visits from the Stork

Tina Whitfield, an active member of the Annual Conference Local Arrangements Committee, along with her husband and daughter proudly welcomed George Edmund into their family on June 24, 2013. Little George made his arrival a few weeks early and was 6lbs 2oz and 20 inches long.

Ryan Le Blanc, Chair of the Young Professionals Committee, and his wife welcomed their son Henry Alexander LeBlanc on Saturday July 27, 2013. Baby Henry is also the nephew of Mary Knosby, NC AWWA-WEA Conferences Coordinating Chair.

Membership Services Committee Vice-Chair, Jana Stewart and her husband had their second child, Jodi Lynn Stewart on July 30, 2013. Baby Jodi weighed 8 lbs., 4 oz. and measured 22 inches.

Condolences

NC AWWA-WEA extends their condolences to Buddy Edmisten and his family. Mack Calvin Edmisten, Buddy’s father, passed away on July 27, 2013. Mr. Edmisten was retired Assistant Fire Chief for Lenoir Fire Department, served as chief of Valmead Fire Department for 12 years, and was instrumental in organizing this fire department. He was a life-long member of Lenoir Community Church, where he served as a Deacon, collector and trustee. He was also a United States World War II Army Veteran.

Memorial contributions may be made to: Caldwell Hospice and Palliative Care, 902 Kirkwood St., Lenoir, N.C. 28645 or Lenoir Community Church, 1002 Lower Creek Dr., Lenoir, N.C. 28645.

NC AWWA-WEA Members at ACE

The American Water Works Association, one of the national parent organizations of NC AWW-WEA, held their Annual Conference & Exposition (ACE) June 9-13, 2013 in Denver, CO. NC AWWA was represented by the attendance of over 70 of our members. These professionals benefitted from an available 112 professional sessions and six workshops, 451 exhibiting companies, and the opportunity to network with over 10,000 other water professionals from around the world. Here are some photos of our attendees while in Denver. Thanks to Steve Shoaf, Robert Walters and Gary Visser for sharing the photos.
Schnabel Engineering, Inc. is pleased to announce that they have been ranked 13th on the “Best Civil Engineering Firms to Work For” list by Zweig White. The criteria used to make the selection included culture, benefits, compensation, performance/recognition, recruiting and employee retention, and professional development, as well as an employee satisfaction survey.

Schnabel’s CEO, Dr. Gordon M. Matheson, PE, PG, stated, “Schnabel’s management team and employees are honored by this achievement. We are committed to creating an inviting workplace to attract and retain quality employees.”

About Schnabel: Schnabel, an employee-owned company, is an ENR Top 10 geotechnical engineering firm, employing more than 250 in 18 offices nationwide. Schnabel’s specialized services include geotechnical and

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Robert Walters and several NC State students during lunch in the exhibit hall. From left to right: Rachel Ingham, Allison Reinert, Elisa Arevalo, Elizabeth Gwinn, Viking Edeback, Robert Walters, and Tate Rogers. Photo take by Gary Visser, Hach Company.

Viking Edeback (NCSU) and Robert Walters (Davidson Water)

Amber Gruene (NCSU) recipient of the 2013 NC AWWA-WEA GHD Clean Water Fund scholarship.

Bill Dowbiggin (CDM Smith), 2012 NC AWWA-WEA recipient of the George Warren Fuller award, and his wife Terri after receiving his award at ACE13.

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- No moving parts

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geostructural engineering, as well as dam and tunnel engineering; environmental services; geophysical and geosciences services; construction monitoring; and resident engineering. These coordinated efforts provide an integrated approach to every project from subsurface explorations and soil testing, through engineering analysis, design, and construction support. For more information, please visit us at schnabel-eng.com.

HUBER Technology has been selected to provide its BT Medium Temperature Belt Dryer in an upcoming project for the Sheboygan Wastewater Treatment Plant.

The Sheboygan WWTP biogas system upgrade project recently won the ACEC Grand Award for the state of Wisconsin for achieving Net Zero Energy using biogas and combined heat and power (CHP). Sheboygan's strategic plan for sustaining its Net Zero Energy status includes adding the HUBER biosolids indirect drying system in a project that is slated to take place next year. The drying system will use the waste heat from the biogas system upgrade to dry the biosolids to Class A quality.

This will be a model plant because of the environmental implications of its systems. Being selected as part of the team to provide the technology that supports what this plant has already achieved is an honor and a powerful validation of HUBER’s quality standards, said HUBER Technology President, Dana Hicks. Sheboygan is already looked to as a leader so the steps they take in fostering what they have initiated will guide others in their decision-making.

HUBER Technology is a leading expert in liquid/solid separation technologies, offering a comprehensive line of screening, grit and sludge handling processes. HUBER serves the municipal and industrial wastewater treatment market with precision-fabricated stainless steel equipment that is sought after by those in the municipal and industrial wastewater treatment sector.

Located in Huntersville, NC, HUBER Technology, Inc. is a member of the HUBER Group as the wholly owned US subsidiary of Huber SE, based in Bavaria, Germany. HUBER SE, the holder of multiple patents, is the inventor and original manufacturer for the renowned ROTAMAT® and STEP SCREEN® products. HUBER’s experience and expertise is proven in over 25,000 installations worldwide. HUBER’s 175 years of commitment to high quality technology supports its focus on developing innovative solutions to lead the way in resource recovery. More information is available at www.huber-technology.com.

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*Initial cost of Motorola telemetry equipment to monitor lift station = $3600/16 years of service = 62¢ per day

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**Sequencing Batch Reactors (SBRs)**
- Optimized process design with proven performance lower than 10 mg/l average BOD/TSS
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- Superior ownership value backed by hundreds of installations
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**DrumFilters**
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Sanitaire is a brand of Xylem, whose 12,000 employees are addressing the most complex issues in the global water market.
Kimley-Horn and Associates Welcomes Matt Shoesmith, PE

Kimley-Horn is pleased to announce the addition of Matthew Shoesmith, P.E., to our Charlotte, NC office to further build our water and wastewater team in the Carolinas. Matt brings experience with water distribution pipelines, elevated storage tanks, booster pump stations, sanitary sewer collection, sewer rehabilitation, and water and wastewater treatment processes, including chemical systems and plant upgrades.

Kimley-Horn and Associates, Inc., a national consulting firm with 60+ offices, provides services related to water and wastewater utility, the environmental, land development, landscape architecture, transit, market research/economic development, transportation, urban planning, aviation, and structures.

News from Highfill

Highfill is pleased to announce the addition of Breanne Long to our Cary office project engineering staff.

Breanne graduated from North Carolina State University in May 2013 with a B.S. in Biological Engineering and a concentration in Environmental Engineering.

Over the past year, she has gained valuable experience working with the City of Raleigh Public Utilities Department to complete numerous infrastructure projects, including the Capital Improvements Projects Prioritization Plan. In her time at NC State, she has participated in Engineering Ambassadors, Engineers’ Council, and the American Society of Agricultural and Biological Engineers.

In Breanne’s free time, she enjoys boating on Smith Mountain Lake, training her dogs in competition obedience and agility, riding hunter/jumper horses, and spending time with family and friends.

About HIGHFILL: Highfill Infrastructure Engineering (HIGHFILL) is an engineering consulting firm that specializes in community and municipal water infrastructure. From initial planning through construction, our team members have the expertise and leadership skills to execute successful projects with efficiency. The company’s decisions are grounded in tenets of integrity, honesty, humility, and excellence.

Highfill places service before profit, the profession before personal gain, and the public welfare above all other considerations. Employees utilize proven principles, insightful ideas, and extensive experience to provide sustainable, enduring designs. Attention to the appropriate details and a focus on the client enable Highfill to deliver consistent quality service.

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Kruger, a subsidiary of Veolia Water Solutions & Technologies, was established in 1989 and is located in Cary, NC. Kruger has quickly become a leader in the industry by providing resource efficient service to improve operations, offering unique, value added equipment to achieve sustainable goals and taking responsibility in our community to decrease dependency on limited resources for local treatment facilities.
**NC Currents Future Themes & Submission Deadlines**

*NC Currents* is the official publication of the NC AWWA-WEA. Members, individuals, and committees are encouraged to submit content for the magazine. If you would like to submit an article to be considered for publication in *NC Currents* please complete the Submission Form & Publication Agreement (available at [www.ncsafewater.org](http://www.ncsafewater.org)) and email both the completed form and your article to Nicole Banks at nbanks@ncsafewater.org. Articles must be received by 5:00pm EST on the listed submission deadline.

The editors of *NC Currents* welcome the submission of all articles related to the water and wastewater industry. Themes serve as general guidance for each issue, but articles are not limited to an issue’s specific theme. Submission of an article does not guarantee publication. The editorial committee will review and select all articles, and authors will be notified of the status of their submission.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Theme: Human Assets – Are you doing all you can for them? Are they ready to do all you need?</th>
<th>Submission deadline October 1, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter 2014</td>
<td>Today’s workforce is changing significantly, shifting from gray-haired workers nearing retirement to ‘green’ newbies just beginning their careers. Has a lot of institutional knowledge already walked out the door due to retirement? Or, have long-term employees remained a part of your workforce due to pressures of the current economy? What are you doing to develop your junior and/or new employees so that they are positioned to assume new responsibilities and your job when you retire? The <em>NC Currents</em> Winter Issue will focus on planning efforts and successful programs that members of our industry are implementing to ensure the workforce of tomorrow. Please submit your articles describing recruitment, workforce development, knowledge retention, and succession planning.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Theme Leaders:</strong> Lori Brogden (Schnabel Engineering, <a href="mailto:lbrogder@schnabel-eng.com">lbrogder@schnabel-eng.com</a>, (919) 818-8072), Jonathan Ham (Cape Fear Public Utility Authority, <a href="mailto:jonathan.ham@cfpua.org">jonathan.ham@cfpua.org</a>, (910) 332-6634), Steve Hilderhoff (GHD, <a href="mailto:steven.hilderhoff@ghd.com">steven.hilderhoff@ghd.com</a>), and Vicki Westbrook (City of Durham, <a href="mailto:Vicki.Westbrook@Durhamnc.gov">Vicki.Westbrook@Durhamnc.gov</a>, (919) 560-4381 x35266)</td>
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<thead>
<tr>
<th>Issue</th>
<th>Theme: Technical Enhancements (Submission deadline January 6, 2014)</th>
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<tbody>
<tr>
<td>Spring 2014</td>
<td>As our nation continues to evolve exponentially and our budgets tighten due to the current state of the US economy, our future approach to planning, designing, constructing and managing water/wastewater infrastructure projects is challenged to find more innovative and cost effective ways to expand our current systems and to enhance and/or prolong our existing infrastructure. This particular issue will feature and explore the assessment of methodologies surrounding existing infrastructure using advanced technology and will explain the process of developing more innovative approaches to proposed infrastructure, thus, finding the most cost effective ways to improve the life and overall operation of our entire infrastructure using newer technical enhancements. Specifically, we, as water and wastewater professionals, need to concentrate on developing sound strategies for capital improvement planning by utilizing as much new technology as possible, improving our infrastructural action plans based on sound engineering practices, and integrating proven technical enhancements. This will determine the best possible plan and/or approach, technologies present, and management tools that will help equip the majority of our current water and wastewater professionals with more technology-based solutions for many years to come.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Theme Leaders:</strong> Shameka Collins (City of Greensboro, <a href="mailto:shameka.collins@greensboro-nc.gov">shameka.collins@greensboro-nc.gov</a>, 336-433-7370), Tom Bach (Water &amp; Sewer Authority of Cabarrus County, <a href="mailto:tbach@wsacc.org">tbach@wsacc.org</a>, 704-786-1783x228) and Kelly Boone (CDM Smith, <a href="mailto:BooneKr@cdmsmith.com">BooneKr@cdmsmith.com</a>)</td>
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<thead>
<tr>
<th>Issue</th>
<th>Theme: Utility Management Best Practices (Submission deadline April 7, 2014)</th>
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<tbody>
<tr>
<td>Summer 2014</td>
<td>Managers for water and wastewater utilities face increasingly complex challenges. Since utility management entails the financial, business, and resource allocation practices, which allow individual employees to work in synch as an organization, effective utility managers must inspire staff to capably operate the critical systems that ultimately serve our customers. What practices lead to peak performance? AWWA’s QualServ program found these common characteristics among top performing utilities: sound fiscal policies and asset management, highly skilled staff and an investment in ongoing training and career planning, and an overriding focus on customer satisfaction (reference: AWWA M5). <em>NC Currents</em> wants to highlight your proven best practices for utility management. We request your articles for the Summer 2014 issue which describes your best management practices:</td>
<td></td>
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<tr>
<td></td>
<td>• What are your best practices for financial management; such as paying for aging infrastructure improvements, capital improvements, and maintenance operations?</td>
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<td></td>
<td>• How have you gained a competitive edge, increased profitability, or maximized support for employees?</td>
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<td></td>
<td>• What benchmarking metrics do you rely on to compare your utilities performance with your peers?</td>
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<td></td>
<td>• How do you minimize rate increases and still provide competitive compensation to utility staff?</td>
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<td></td>
<td>• How do you manage the tension between providing the superior service that customers expect and controlling costs?</td>
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<td></td>
<td>• What approaches have worked well for meeting increasingly stringent environmental regulations?</td>
<td></td>
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<tr>
<td></td>
<td><strong>Theme Leaders:</strong> Sherri Moore (City of Concord, <a href="mailto:moores@concordnc.gov">moores@concordnc.gov</a>, (704) 920-5415), Mike Shelton (Kimley-Horn Associates, <a href="mailto:mike.shelton@kimley-horn.com">mike.shelton@kimley-horn.com</a>, (704) 964-5906), and David Hamilton (Malcolm Pirnie/ARCADIS, <a href="mailto:david.hamilton@arcadis-us.com">david.hamilton@arcadis-us.com</a>)</td>
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<thead>
<tr>
<th>Issue</th>
<th>Theme: Safety* (Submission deadline July 7, 2014)</th>
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</thead>
<tbody>
<tr>
<td>Fall 2014</td>
<td>*Description for this theme will be posted at <a href="http://www.ncsafewater.org">www.ncsafewater.org</a> once it becomes available.</td>
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</table>
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## 2013 Schedule of Events

The following schedule is current as of July 22, 2013. For updates or more information please contact the organization listed with each event. If no organization is listed it is an NC AWWA-WEA event, and details may be obtained by calling the NC AWWA-WEA office at (919) 784-9030 or visiting www.ncsafewater.org.

### October 2013

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>NC AWWA-WEA Seminar: The Glass Half Full</td>
<td>Clemmons, NC</td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>WEFTEC</td>
<td>Chicago, IL</td>
<td>WEF 800-666-0206</td>
</tr>
<tr>
<td>14-18</td>
<td>NC AWWA-WEA Coastal Collection &amp; Distribution School</td>
<td>Morehead City, NC</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>NCWTFOCB Exams (application deadline 30 days prior)</td>
<td>Kinston, Morganton, and Raleigh</td>
<td>NCWTFOCB (919) 707-9040</td>
</tr>
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### November 2013

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<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>10-13</td>
<td>NC AWWA-WEA Annual Conference</td>
<td>Concord, NC</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Professional Wastewater Operators Committee Meeting, Eastern Region</td>
<td>Moore County, NC</td>
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### December 2013

<table>
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<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>1</td>
<td>NC AWWA-WEA Seminar: Industrial Committee Seminar (Tentative)</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>NC AWWA-WEA Seminar: Asset Management (Tentative)</td>
<td>Winston-Salem, NC</td>
<td></td>
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<tr>
<td>4</td>
<td>NC AWWA-WEA Seminar: Construction Issues</td>
<td>Raleigh, NC</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>NCWPCSOCC Exams (application postmarked by 11/12/13)</td>
<td>Kenansville, Morganton, Raleigh, Salisbury, &amp; Williamston</td>
<td>NCWPCSOCC (919) 807-6353</td>
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### March 2014

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<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>10-14</td>
<td>NC AWWA-WEA Eastern Collection &amp; Distribution School</td>
<td>Raleigh, NC</td>
<td></td>
</tr>
<tr>
<td>31-Apr 4</td>
<td>NCWOA Spring Water School</td>
<td>Morganton, NC</td>
<td>NCWOA (252) 764-2094</td>
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### April 2014

<table>
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<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>6-8</td>
<td>NC AWWA-WEA Spring Conference</td>
<td>Wilmington, NC</td>
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### May 2014

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<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>4-10</td>
<td>National Drinking Water Week</td>
<td>AWWA (800) 926-7337</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Lab Tech Day</td>
<td>Raleigh, NC</td>
<td>NCWOA (252) 764-2094</td>
</tr>
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### June 2014

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>8-12</td>
<td>AWWA ACE Annual Conference</td>
<td>Boston, MA</td>
<td>AWWA (800) 926-7337</td>
</tr>
</tbody>
</table>

### September 2014

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
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<tbody>
<tr>
<td>22-26</td>
<td>NCWOA Annual Water School</td>
<td>Raleigh, NC</td>
<td>NCWOA (252) 764-2094</td>
</tr>
<tr>
<td>27-Oct 1</td>
<td>WEFTEC</td>
<td>New Orleans, LA</td>
<td>WEF (800) 666-0206</td>
</tr>
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</table>

### November 2014

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-19</td>
<td>NC AWWA-WEA Annual Conference</td>
<td>Winston-Salem, NC</td>
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For more information see www.safewater.org

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  - Automation
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  - Industrial
  - Regulatory Affairs
  - Residuals Mgmt/GW
  - Risk Management
  - Sustainability
  - Col & Dist Systems
  - Water Reuse
  - Schools Committees
    - Col & Dist Schools
    - Plant O&M
    - Prof WW Operators
    - WW Lab Analyst
    - WW Operators Schools

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