SPRING
2014
The Official Publication of the Water Environment Association of Utah

DIGESTED news

Celebrating 50 Years of Clean Water

2014 WEAU Annual Conference *Preview*

April 30-May 2
Dixie Center, St. George, Utah

Orem Water Reclamation Facility
1797 West 1000 South
Orem, Utah 84058
Address service requested

INSIDE:

Managing Water Quality in Your Distribution Tanks ▪ Relative Performance of Grit Removal Systems

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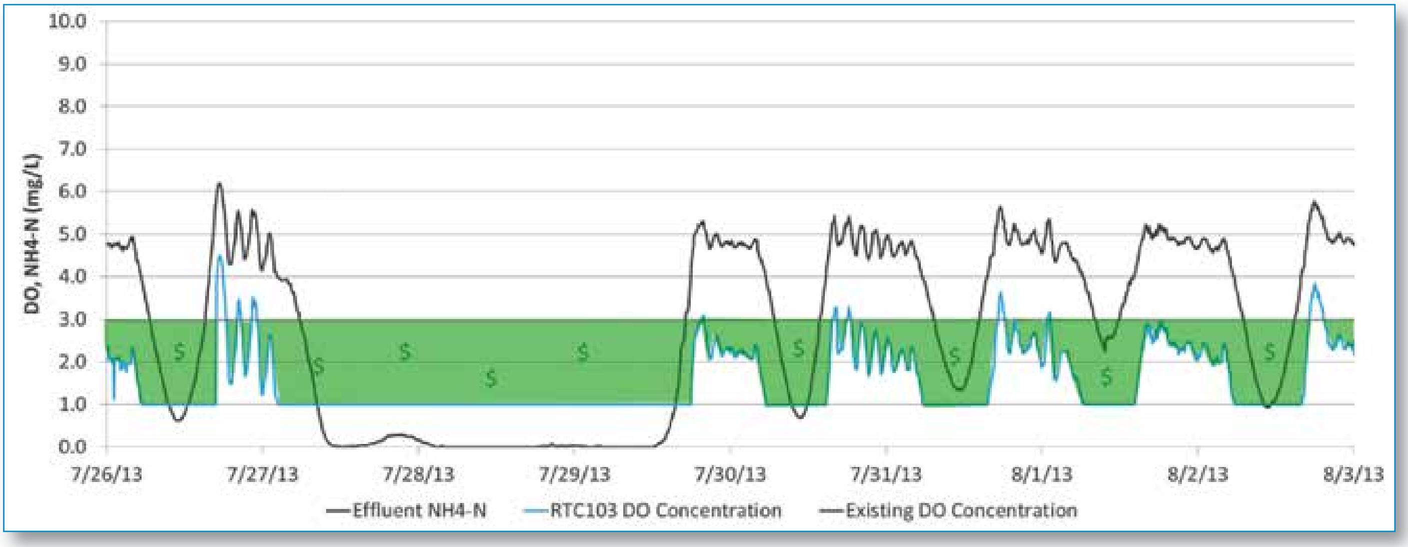

A conventional activated sludge plant using Hach's RTC-N to control nitrification. Area in green indicates total savings.

Why overtreat? Simply set your process control limits and let RTC do the rest.

Situation:

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Phosphorus Removal | Nitrification Control | Sludge Treatment

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Contents

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On behalf of the WEAU

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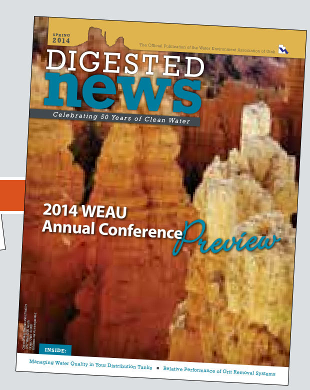
FEATURES

Departments

Digested News available online



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

A user-friendly, interactive Media Rich PDF format that includes:

1. Active hyper-links to all websites and e-mails contained in the publication
2. Active links to the specific stories from the front cover and contents page
3. Active links to advertiser websites from their ads

Innovation

Dru Whitlock

This morning I met with colleagues at WesTech Engineering to share concepts about ways to innovate and options for alternative delivery packages. This same day, MaxWest received an award for a design-build-own-operate gasification project – 67,000 wet tons of wastewater residuals per year from several facilities in the California Bay Area (Bay Area Biosolids to Energy). This will be a demonstration project that those publically owned treatment works (POTWs) are investing in to promote innovation. Many POTWs are executing alternative delivery approaches such as design-build, design-build-operate, and design-build-own-operate.

Our industry is quickly evolving, and why? Well, some of it is driven by regulatory changes. Some of it is driven by commodity prices, such as, vehicle fuel, power, and natural gas. But I reckon most of this innovation is an indication of a thriving industry. Innovation has always been part of our industry; it seems to be part of our culture; part of our DNA. That coupled with alternative delivery approaches and globalization seems to have accelerated innovative thinking in our industry.

> "Many POTWs are executing alternative delivery approaches such as design-build, design-build-operate, and design-build-own-operate."

Like many industries, wastewater processing is now a global industry. There are many ideas and concepts that are exported and many that are imported from our brethren abroad. As developing nations/continents are modernized, many of us will be exporting our concepts and ourselves outside of North America. Many of us already are.

I have been working quite a bit with Cambi and Veolia/Kruger on their thermal hydrolysis processes, which originated in Europe and are being heavily marketed now in North America. The SH+E Group, out of Germany, has also developed a thermal hydrolysis process. Technologies, like thermal hydrolysis, are of interest to POTWs because they do two things: save money and facilitate resource recovery. That is this is the value proposition that fuels this innovation, and, indeed, is how our POTWs are now interfacing with rate payers and stakeholders – saving money and recovering resources for beneficial use.

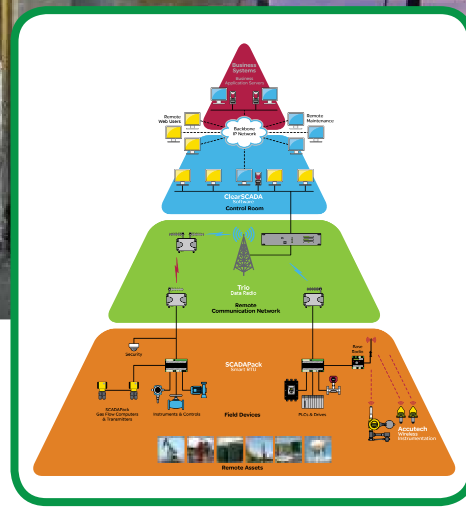
It is an exciting time to be in our industry. I feel fortunate to be part it. I look forward to working with you as we continue to make innovations and improvements to our delivery packages; and ultimately the value of our services. We have the technology now to create a sustainable future – and with this continued innovation, the technology is only going to get better. DN

Dru Whitlock
President

> "We have the technology now to create a sustainable future."

Need help in transforming remote asset data into valuable business insight?

Let's talk!



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Public education

I have recently been reminded of how important public education is when it comes to the industry of wastewater treatment. My current employment puts me in the field much more than before dealing with industries and businesses that discharge into our sewer systems and therefore are monitored, inspected, or in some cases regulated by our facilities. This is one of the areas where the old adage is true that says, "An ounce of prevention is worth a pound of cure." Many of our collection systems have many miles of sewer line to convey wastewater to our treatment facilities. Maintenance and upgrade on these facilities is extremely costly even when everything is done right. Anything that can be done to prevent excessive pollutants from entering the waste stream in the first place should be regarded as a great accomplishment. I find that in most cases business and industry wants to be on board with doing the right thing and is willing to take steps to improve things at their facilities that will help downstream. This brings us to the other great adage, "what's good for the goose is good for the gander." By educating the public about what happens past their floor drains, grease traps, and sinks they will understand that what we require on their behalf will end up benefiting them just as much. Odors may be eliminated, backups prevented, and most attractively, fines will be avoided!

> "Anything that can be done to prevent excessive pollutants from entering the waste stream in the first place should be regarded as a great accomplishment."

Ironically this education goes the other direction as well. As important as it may be for industrial uses to be educated on the subject of wastewater treatment, we need to take steps to ensure that those that are elected or appointed officials within our organizations are educated. Many of these officials have no experience in the wastewater field. These officials have the challenging job of representing the public and making the financial decisions that can have a negative or positive affect on the overall success of what our jobs entail. DN

Collection QUIZ

Questions to drive you crazy!

It is the little things in life that can really bug you.

By Lonn Rasmussen

1. Only treatment plant operators need to worry about Blood Borne Pathogens.
   True or False
2. You can contract several diseases from human blood, including Hepatitis B and HIV (Aids).
   True or False
3. An important part of a safety policy to deal with blood borne pathogen hazards is?
   a. Include it in Haz-Comm
   b. Employer paid Aids vaccine
   c. Written policy against blood borne infections d-Universal precautions
4. It's ok to pick up broken glass with your hands.
   True or False
5. What should be assumed about all blood and body fluids you may contact?
   a. That if you don't see any pathogens in the blood or fluid your ok.
   b. If the color is bright red it's not infected.
   c. All blood and fluids should be considered deadly.
   d. Blood borne pathogens can't live outside the body.
6. Unless you are a nurse or doctor you do not have to take precautions.
   True or False
7. HIV, which causes AIDS, is not a blood borne pathogen.
   True or False
8. Hepatitis B, a potentially fatal liver disease, is caused by what virus?
   a. HBV b. HIV
   c. BVD d. BIV
9. What you do not know about viruses can kill you. So you need to?
   a. Get educated
   b. Get vaccinated
   c. Follow Universal Precautions
   d. Teach others
   e. All of the above

Answers:
1-F, 2-T, 3-D, 4-F, 5-C, 6-F, 7-F, 8-A, 9-E

PWO reflection

By: John Marteliz

As we get ready for our Annual Conference here in a couple of months, I have started to reflect on this past year and being the PWO Rep Elect. What has surprised me the most is how much work goes into all of the WEAU events. I now realize why they do not tell you that before hand when you volunteer to be on a committee or any other position for WEAU.

Needless to say, we are very fortunate to have a good board that supports all of us. I would also like to recognize all of the committees for their hard work. We have benefited from your efforts with some very good training seminars this year. Keep up the good work.

I have met a lot of people through this experience and have found it interesting to hear about some of their entities' policies. For example, Mike Forester was kind enough to share with us at our last board meeting that South Valley has a policy that there is no ten second rule if you drop food on the floor. Considering where we all work, that is probably a good policy for every facility. Another one should be, do not bite your fingernails either.

> "We are very fortunate to have a good board that supports all of us."

To all the teams participating this year in the Operators Challenge, good luck. We have nine teams representing Utah this year and four from Nevada. This should be one of the most competitive years for the Operators Challenge. Every year teams raise the bar and get better and better. Just remember that you all now belong to a brotherhood, the brotherhood of simple-minded sewer workers. I hope that each of us remember the real meaning of this competition, which is sportsmanship.

I have met some of my best friends through the Operators Challenge competition. I would not trade them for anything in this world. Well, maybe for some cash or something with some bling on it. No, but seriously, I am grateful for the Operators Challenge and being a part of it. I would encourage you to get involved at any level.

Last but not least, I wanted to thank Brett Olson for mentoring me this past year. Brett has been great to work with and has taught me so much. He has been a terrific PWO Rep and has left some pretty big shoes for me to fill. I also wanted to recognize Ron Clements, Gary Hill, and Chris Reilly. Each and every year you guys always raised the standard and expectations of the PWO Elect. DN

WEAU ANNUAL CONFERENCE

2014 Pre-Conference Workshop

Strategic Planning of Utah's Water Reuse Infrastructure

Tuesday, April 29, 2014
The Dixie Center, St. George, Utah

The 2014 WEAU Pre-Conference addresses the challenges of building the water reuse infrastructure that Utah will need to help meet its future water requirements. As our population grows to 6.8 million people by 2060, how will wastewater use contribute to the overall needs for water? How will the public accept reuse in our communities? What are the legal and regulatory requirements? How will we manage byproducts from advanced treatment? And how will we pay for the necessary infrastructure? The Pre-Conference will examine regulatory framework, reuse market development strategies, planning and funding options for infrastructure backbone and network development, salinity management approaches, and technical innovations needed for maximizing reuse in Utah's future. Included will be real-world examples of how reuse systems are being planned and used to meet water supply needs in the arid western United States. Register online at *http://www.weau.org/conferences/online-registration*. This is a half day program running from 8:00 AM until 12:45 PM. The registration cost is $100.00 including break snacks and a box lunch to go so you can still get out and enjoy the WEAU sponsored golf tournament, shoot some skeet or mountain bike in beautiful St. George!

John Mackey

Fran Burlingham
2013-2014 Board of Trustees

Fran Burlingham, PE, PMP is a member of the 2013-2014 Board of Trustees for the Water Environment Federation (WEF), an international organization of water quality professionals headquartered in Alexandria, VA.

Fran is a Senior Engineer with Brown and Caldwell in Walnut Creek, Calif. She has over 10 years experience with municipal and industrial wastewater systems and treatment plants. Fran's process engineering experience includes secondary clarifier testing to optimize operations and meet regulatory requirements; and plant capacity testing, including high-rate nitrification rate testing, to help identify recommended upgrades to increase capacity. Fran has experience in master plan projects for both small and large wastewater treatment systems, and has also provided pre-design services on digesters, solids handling facilities, and aeration and dewatering upgrade projects. Fran's expertise also includes planning, optimization testing and treatability studies for industrial wastewater from refineries and food processors.

A WEF member since 2002, Fran has held multiple leadership and committee roles within WEF. She has served as a member and speaker of the House of Delegates and as a member of the Students & Young Professionals and the Public Education committees.

Also an active member of the California Water Environment Association (CWEA), Fran has served as the co-chair of CWEA's Students and Young Professionals Committee, as a member of the San Francisco Bay Section Professional Development Committee, and as a State CWEA Board Member.

Fran has received the Outstanding Young Professional Award from both WEF and the California Water Environment and San Francisco Bay Section. Fran has been awarded the WEF Canham Graduate Studies Scholarship and the Georgia Association of Water Professionals Philip R. Karr, III Scholarship.

Fran is a registered professional engineer in the state of California. She received a B.S. in Engineering from Swarthmore College and an M.S. in Environmental Engineering from the University of California-Berkeley.

About WEF

Founded in 1928, the Water Environment Federation (WEF) is a not-for-profit technical and educational organization of 36,000 individual members and 75 affiliated Member Associations representing water quality professionals around the world. WEF members, Member Associations and staff proudly work to achieve our mission to provide bold leadership, champion innovation, connect water professionals, and leverage knowledge to support clean and safe water worldwide. To learn more, visit *www.wef.org*.

2014 Conference
Technical Program

Wednesday	Sunbrook A	Sunbrook B	Sunbrook C	Entrada A	Entrada B	Entrada C
8:00 - 11:30	Operators Challenge (in Exhibit Hall)				Water Quality Board Meeting (8 a.m. to 1 p.m.)	
SESSION A Wednesday, April 30	Sunbrook A	Sunbrook B	Sunbrook C	Entrada A	Entrada B	Entrada C
	Public Outreach	Utility Management/ Finance	Sustainability	Collection Systems		
	Moderator - TBD	Moderator - TBD	Moderator - TBD	Moderator - Don Telford		
1:30 - 2:05	WEAU Website - How to maximize your experience (Q&A)	Funding and Bonding for Public Works Projects – What the Utah Supreme Court Had to Say About the Santaquin Water Reclamation Facility Project and What it Might Mean for Future Bond Issues	Climate Change Implications to Salt Lake City's Water Resources	Tailoring Collection System Modeling to System Specific Issues		
	Steve Myers, PE	Benjamin A. Reeves	Laura Briefer	Jacob Young		
2:10 - 2:45	Public Relations 101	What's the Frac?: The Emerging Technology of the Oil Field and its Potential Impact on Utah's Municipal Infrastructure	"Practicing Sustainability at CH2M HILL: GHG Inventory Development, Carbon Reduction Targets, and Offsets from WWTPs"	Asset Management and Condition Assessment for the NDSD Sewer Collection System		
	Chip Dawson	Nathan Zaugg	Sean Menk	Andrew Fugal		
2:45 - 3:30	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall		
3:30 - 4:05	Engaging the Public - Strategies for Estimating the Right Level of Public Involvement	Understanding Financial Uncertainty	Am I Running Dirty?	Trenchless Sewer Line Rehabilitation Comes to a Street Near You! - PART 2		
	Dan Adams	Matt Millis	Kelly Brown	Brandon Heidelberger		
4:10 - 4:45	Verbal Defense and Influence	The Changing World of Risk for Waste Water Organizations		"Breakthroughs in Trenchless Technology for Rehabilitating Sanitary Sewers: UV Cured Fiberglass CIPP"		
	Joanne Glantz	B. Darrell Child		Christopher Larson		

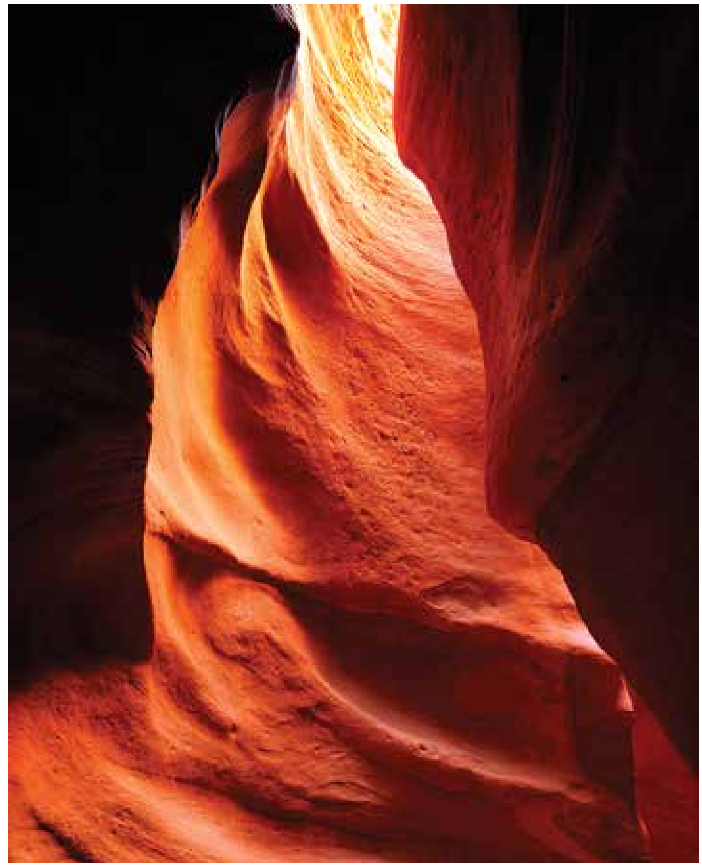
SESSION B Thursday, May 1	Sunbrook A	Sunbrook B	Sunbrook C	Entrada A	Entrada B	Entrada C
	Safety	Water Reuse	Nutrients	Collection Systems	Innovative Equipment	Operators
	Moderator - TBD	Moderator - TBD	Moderator - TBD	Moderator - Greg Neff	Moderator - TBD	Moderator - TBD
7:00 - 8:30						POTW Managers Meeting
8:30 - 9:05	Introduction To Arc Flash and Arc Flash Hazard Analysis	Satellite Reuse with Aquifer Storage and Recovery - Is it feasible?	Implementation of USEPA's 2013 Ammonia Criteria	Concrete Manhole Barrels Disintegrate While Lined Manhole Bases Remain Unscathed	Fine Bubble Diffusers: Life after the Clean Water Test	"Burnin Gas Biogas Cogeneration Basics for Wastewater Operators"
	Anthony Morroni	Brent Packer	Christopher Bittner	Peter Keefe, M. Sc.	Steve Myers, PE	Phil Heck
9:10 - 9:45	NFPA 70E Qualified Personnel.	Reuse of Hyrum City's Wastewater to Reduce the Impact of Phosphorus on the Environment	"Process Design and Operational Strategies to Comply with Tight Ammonia Limits"	Dirty Little Secrets About Sewer Backups	Belt Press Technology - Uses and Application	Biogas Storage: What it is (& isn't)
	Blaine Bowden	Brad Rasmussen	Tanja Rauch-Williams	Jason A Watterson, CIH	Kelly Brown	Matthew Williams
9:45 - 10:30	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall
10:30 - 11:05	Will Your Plant Be Operational After The Big One?	Overcoming Effluent Disposal Challenges in a Small Community	Using SBR Technology to Effectively Accommodate Future BNR Requirements	Do's and Don'ts for Large Diameter Pipe Design and Installation	Benefits of Grit Removal Technology and Testing	Santaquin City WRF Startup- A Balancing Act
	Stephen Cohen	Prithviraj Chavan	Francis Pastors	Steven Meyer	Ryan Asbury	James Goodley
11:10 - 11:45	Chlorine and Disinfection	Santaquin Water Reclamation Facility - Supplementing a Community's Irrigation Supply with Type I Reclaimed Water	What Does Optimization Mean to You?	Central Weber SID BDO Outfall - Critical Crossings	Quality of Washed and compacted Screenings	Operations via iPad
	Gordon Call	Trevor R. Lindley	Ted Holt	Mike Kobe	John Lewis	Tom Anderson

2014 Conference
Technical Program

SESSION C Thursday, May 1	Sunbrook A	Sunbrook B	Sunbrook C	Entrada A	Entrada B	Entrada C
	Facility Design	Biosolids	Nutrients	Collection Systems	Innovative Equipment	Laboratory
	Moderator - TBD	Moderator - TBD	Moderator - TBD	Moderator - L. Rasmussen	Moderator - TBD	Moderator - TBD
1:30 - 2:05	UV Disinfection: the How of Horizontal Systems	Beyond the Liquid Stream - Organic Micropollutants in Biosolids	Fate of estrogen and illicit drugs during urine separation and management	Advances in Non-Contact Flow Meter Technology	Benefits of Reciprocating "Non Close-Tolerance" Positive Displacement Pumps in Sludge Pumping Applications	Chemical Pre-treatment of Industrial Wastewaters for Suspended Solids Removal and/or Reduction of COD/BOD and Phosphorous
	Christina Osborn	Tanja Rauch-Williams	Huang Pei	Rick Dey	Bill Ormsby	Marcus G. Theodore
2:10 - 2:45	Open Channel UV Systems	Anaerobic Digester Mixing: A Delicate Balance	Achieving Varying Nutrient Removal Criteria - An Overview of Existing Treatment Facilities	Effective Use of Flumes for Wastewater Metering	Innovative disk thickener improves performance of digester at Chiquita Water Reclamation Facility in California.	Fun with Chemistry
	Adam Donnellan	Matthew Williams	William Leaf	Ryan Christensen	John Lewis	Anthony Daw
2:45 - 3:30	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall	Break - Exhibit Hall
3:30 - 4:05	How Accurate was your Basis of Design?	Covered Aerated Static Pile Composting at Central Valley-- An Unexpected Journey	Developing operation strategies for pilot scale one-stage deammonification reactor in Utah North Davis Sewer District (NDSD)	So You Have Flow Data . . . Now What	Mitigating Variable Frequency Drive (VFD) Noise in Instrumentation Loops	Nondestructive Extraction, Recovery and Identification of Water Contaminants
	Randal Zollinger	Tom Holstrom	Sha Hu	Michael Foerster	Mark Klee	Rico Del Sesto
4:10 - 4:45	Lagoons vs. Mechanical Plants - The Fight of the Century?	Updated O & M Costs to Thermally Dry Biosolids	Improving Effluent Water Quality by Retrofitting an Existing Conventional Activated Sludge Plant to MBR	Understanding CENTRIFUGAL SEWAGE PUMPS so that DESIGN and TROUBLESHOOTING Become Easier	Bearing Isolators/ Labyrinth Technology - Reduce Mean Time Between Failures (MTBF) on rotating equipment and improve efficiency of plant operations.	Confessions of a Laboratory Assessor
	Kraig Johnson, PhD, PE	Taigon Worthen	Hiro Kuge	David L Hutchinson	Doug Edwards	Tony Francis, PhD

SESSION D Friday, May 2	Sunbrook A	Sunbrook B	Sunbrook C	Entrada A	Entrada B	Entrada C
			Nutrients	Collection Systems		
			Moderator - TBD	Moderator - Chris Brown		
8:30 - 9:05			Historic Nutrient Performance of Utah Wastewater Systems by Type	Collection System Spotlight		
			Paul Krauth	Midvalley Improvement District		
9:10 - 9:45			Numeric Nutrient Criteria, DWQ Implementation of Nutrient Removal	Discoveries from Creating a Comprehensive GIS based Municipal Sewer Model and Master Plan		
			Walt Baker	Tim Heyrend		
9:50 -10:30			Numeric Nutrient Criteria, DWQ Implementation of Nutrient Removal	Collection Systems Jeopardy		
			Leland Myers	Michael Foerster		

Operator Challenge and Young Professionals BBQ



PLACE: FIESTA FUN CENTER
171 E 1160 S, St George, UT 84770

DATE: Wednesday, April 30th

TIME: 4:30pm – 7:30pm

COST: FREE BBQ, unlimited 3 hr. pass
$5 per person

WHO IS INVITED:

Operator Challenge Team Members and Family
Operator Challenge Judges and Family
WEAU Board Members and Family
Young Professional and Family

RSVP REQUIRED

To: Brett Olson – 801-389-2128 or *bretto@centralweber.com* by April 15th

You're Invited
2014 WEAU Annual Golf Tournament

FORMAT:
Four-person scramble

WHEN:
Tuesday, April 29, 2014
Tee times starting at 1:00p.m.

WHERE:
Sunbrook Golf Course
St. George, Utah

GREEN FEES:
$50.00 per person
(includes cart and lunch)

LUNCH:
Box lunches and drink provided
(available at noon)

LUNCH:
Jeff Beckman
Bowen, Collins & Associates
154 East 14000 South
Draper, UT 84020
801.495.2224
jbeckman@bowencollins.com

REGISTRATION FORMS AND FEES ARE DUE BY APRIL 15TH, 2014.

Register online at *www.weau.org* or by returning this registration form to Jeff Beckman (see above) along with a check payable to WEAU Golf Tournament.

Contact Jeff Beckman at (801) 495-2224 for team preference, or we will match single players to fill foursomes. Twelve foursome spots are available on a first-come, first-served basis.

Name	Phone

Young Professional Breakfast

WHEN:
Thursday, May 1, 2014

TIME:
7:00a.m.

WHERE:
Black Bear Diner
1245 S. Main St.
St. George, UT 84770

WHY:
Connect with other Young Professionals in the WEAU, friends and FOOD!!!

RSVP:
YP@weau.org by April 25, 2014

Are You a Young Professional?

- ☐ Are you an Operator, Engineer, Regulator, Technician or Researcher?
- ☐ 35 years old or younger?
- ☐ Recent WEAU member?
- ☐ University Student?
- ☐ <5 years in Wastewater Industry?

YES TO ANY ABOVE MEANS YOU ARE A YP!

For More Information contact Becky Tanner 801-205-2816 or Clint Dilley 801-509-1699

WEAU Annual Conference - 2014

April 30 to May 2, 2014 | Dixie Center St. George, Utah

Registration Form

Members can pay online at www.weau.org or register by filling out this form and sending in a check. To expedite processing, we encourage you to register online. When you register online, you will have pay with a credit card.

Name ____

Company ______________________________ Membership Number ______________

Address ____

City ______________________________ State ____________ Zip ____________

Phone ______________ Fax ____________ e-mail ______________________

Late registration cannot guarantee a registration gift

General Conference Registration Fees			
	Pre-Register – Prior to April 18, 2014	Registration after April 18, 2014	Amount
Member	$275.00	$300.00	
Non-Member	$320	$340.00	
Student	FREE		
Wednesday or Thursday (one day)	$175.00 member $190.00 non-member	$185.00 member $200.00 non-member	
Pre-Conference: April 29*	$100.00 (Includes Box Lunch)		
Extra Lunch**	$20		
Banquet Dinner**	$30		
		Total Enclosed:	

* See *www.weau.org* for details
** For guests of conference attendees

Please do not submit your form without payment!
Registrations received without payment will not be processed (No P.O.s, No Credit Cards except online).

TO REGISTER: Go online and use a credit card or complete this form and make checks payable to WEAU and mail to:
WEAU, PO Box 651028, Salt Lake City, UT 84165-1028

PLEASE DO NOT SEND REGISTRATION AFTER April 11, 2014
AFTER THIS DATE YOU MUST REGISTER ON-SITE OR ONLINE.

View the draft Conference Program at: *www.weau.org*
Conference Program will be updated regularly on the website; check back often.

Conference Information

When you register for the WEAU annual conference the following is included in your fee:

	Wednesday Opening Luncheon	Thursday Luncheon	Thursday Awards Banquet	Break Refreshments
Full Conference	Yes	Yes	Yes	Yes
Student	Yes	Yes	Yes	Yes
Wednesday Only	Yes			Yes
Thursday Only		Yes	Yes	Yes

Constantly Changing

By Lawrence Burton

I have worked for Orem City for over 30 years. There has never been a more active and busy time. For years I worked with a pretty stable work force and it seemed like these same people would be there forever. Recently I was in Costco though and ran into an old friend who retired from the Orem Water Reclamation Facility 20 years ago. I could not believe it had been that long. He looked a little more mature but other than that he was the same good person he had been when I was privileged to work and associate with him every day.

I stopped the other day to look at the bronze plaque that is on the outside of our solids handling building to see the year it was built. It was 1994. I read who the Mayor was, the Public Works Director, the Water Resources Division Manager, the Water Reclamation Section Manager, and then the names of all of the people who worked in Water Reclamation at the time and was surprised at how few of that list of names were still here. Some had moved on. Some had retired, and yes, some had passed away.

This caused me to ponder the relationships that I have had with the many different people who have been a big part of my life during my career. I can honestly say that every person that I have been privileged to work with has had a positive influence on my life. As I look back I realize that I have spent more of my awake hours with my coworkers than I have with my family. My coworkers have in some ways become a second family.

Recently there has been a lot of change. Both in the plant and in the people who work here. Orem has planned for some upgrades for several years. That project finally came and was completed a couple of years ago. A new learning process began. New technology required new training of people. It is always fun to learn new things but to keep the system performing and staying in compliance with our UPDES permit in conjunction with learning the new process took patience and perseverance. Now two years later some of our key people wanted to spread their wings and explore new opportunities. This created opportunities for movement and wing spreading within the organization. New people have been hired to fill vacancies by upward movement and the learning curve has started all over again.

The future looks good. We will start another small upgrade to install Ultra Violet disinfection and everyone is anxious for the change. No more chlorine! No more RMP! I am impressed with the high caliber of people that have come to join the Water Reclamation Family here at Orem City and look forward to getting to know them and growing together. I know that my life is better for positive influence and can only hope that my influence on past and future employees will someday be looked at as positive as well. DN

North Davis Sewer District Digester Rehabilitation

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.
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- 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.

Grit Particle Settling – Refining the Approach

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Problem
Grit is a nuisance material that causes abrasive wear to equipment increasing maintenance and operational costs while reducing equipment performance and useful life. Grit that is not captured in the headworks accumulates in processes throughout the plant, reducing capacity and detention time, and adversely influencing flow and circulation patterns. Deposited grit must be manually removed, handled, hauled and disposed. Abrasive wear, process inefficiencies and basin cleaning operations can significantly increase treatment plant O & M expenses.

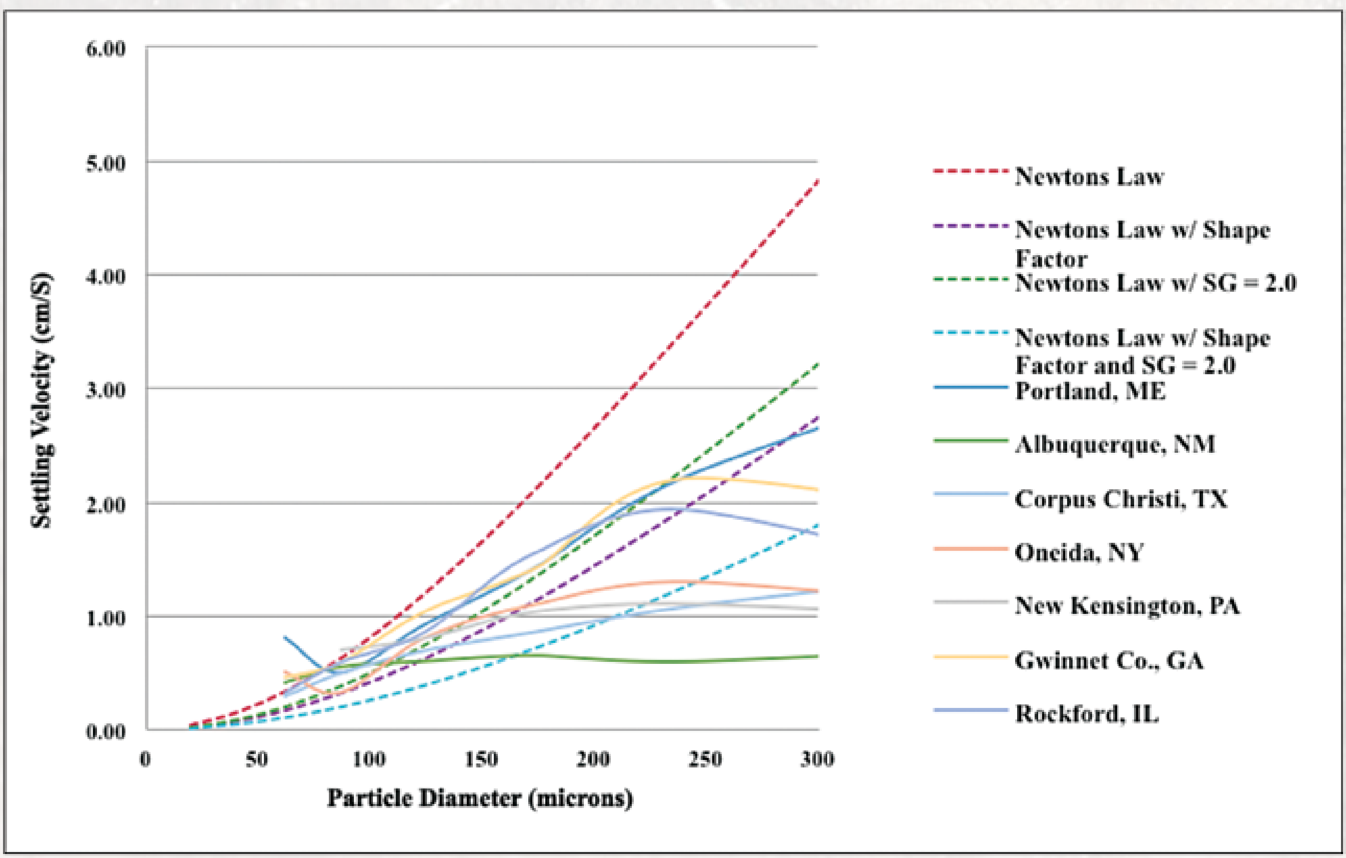
Grit system design is heavily influenced by factors affecting the settling behavior of the targeted grit particle. As such, the classic correlations of sedimentation for discrete solids, Stokes' or Newton's Law, are commonly used to guide design. To simplify the design process, it has been common to assume that grit is spherical with the density of silica sand.

Unfortunately, grit particles are rarely ideal spheres with the assumed textbook density of 2.65 for silica sand. Grit settling velocity is significantly impacted by variability in size, density and shape. Less than ideal settling characteristics are frequently measured or observed. Therefore, the conventional assumption of spheres with a specific gravity of 2.65 is inadequate for characterizing grit and designing a grit removal system.

Objective
Accurately sizing a grit system can be a challenge given several variables that are often difficult to measure. Refining assumptions for shape and density provides an increased level of reliability that a grit system will perform as anticipated. By utilizing well established sedimentation theory corrections from other fields of engineering, these correlations can be refined to provide a useful tool to improve grit system design.

Results
Stokes' Law is a common tool for estimating the settling velocity of grit particles, based on the assumption of

Measured settling velocity vs. calculated settling velocity



laminar flow. It has been found to be accurate where Reynolds numbers are less than 1. A review of the Reynolds number for grit particles in the typical design range of 50-500 micron for wastewater grit removal systems, shows that the impact of transitional flow begins to affect particle settling above the 100 micron range resulting in a departure in predicted accuracy using Stokes' Law. Therefore, Stokes' Law is an oversimplification and should not be used in grit removal system design.

When the laminar assumption is removed a force balance or Newton's Law results. While a force balance requires an iterative process to determine settling velocity additional physical characteristic corrections can be layered in resulting in a more realistic design in the critical 50-300 micron range. One typical assumption is that grit / sand is a perfect sphere, when this over-simplification is eliminated and the equation is corrected for the angularity of the particles the calculated settling velocity is reduced. An additional adjustment can be made for the density of the particle based on field observations. When all refinements are combined and plotted a level of realism is incorporated.

The below figure shows that the commonly used Stokes' Law may not be the best approach to ensure an appropriate design to capture grit particles larger than 150 micron. This paper suggests that while a force balance requires an iterative process to determine settling velocity, it can be an irreplaceable tool by virtue of the corrections that can be layered in to refine the results to more accurately emulate real world measurements. DN

Managing Water Quality in Your Distribution Tanks

By Jeff Harrison, CDG Engineers & Associates, Inc.

As I sat and heard the conference speaker's response, I could not believe what he was saying, "….the tanks in your system are just hand grenades getting ready to go off…" "*Grenade in your tank! Ready to go off! How could he say that,*" I mumbled to myself. At that time, it was my job to provide, sell and build water storage tanks. This answer to a question by a water operator was undoing my every reason for being at the conference. It took me a minute to comprehend his answer to the simple question of why have we been told for so long by the regulatory agencies to have more storage only now to face the daunting task of managing disinfection by-products (affectionately referred to as DBPs) at the risk of severe penalties. Bewildered, aggravated and in shock, I searched for a way to respond to this claim with prospective customers that would surely come up to me after this presentation. The question asked by the operator was borne of frustration but the answer he received was ill-timed and reckless.

As I regained my composure and regained focus on this exchange, I realized there was a tremendous opportunity for to me to place a positive focus on water storage tanks instead of the negative connotation of "grenade" coined by this speaker. We can focus on utilizing the existing tanks as a treatment source in areas where DBPs are a problem and design/build our new distribution storage tanks in a way to help the operators manage the water quality in their distribution tanks. There is the answer! Managing the water quality by ***utilizing*** the distribution tanks.

Before we can manage the water quality in your system, I think it is best to first understand how and why DBPs are formed. For years now, articles, reports and white papers have been written and presentations have been made that detail the science of disinfectants interaction with source water but I want to simplify it down to these common factors: organics, age of water, temperature, pH and the disinfectants utilized to treat

"The most critical aspect of maintaining the water quality in your system is by understanding the factors that contribute to poor water quality."

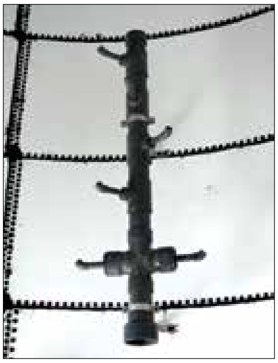
pathogens in your water source. The key to managing DBPs in your system is actually understanding the precursors, properly identifying the type of DBP and then manipulating those common denominators in such a way that the operator can see improvements (i.e. reduction) in the levels of DBPs in their distribution system. A step by step approach that will lead to success.

The first step in determining the treatment solution that will offer you the best results is identifying the DBP common to your system. Based upon your water source (i.e. lakes, rivers, wells, etc.), time of year and the chemistry of that water, there are several types of DBPs that can formed as a result of the treatment and disinfection of source water. The most commonly recognized and discussed DBPs found in treatment processes, distribution system and storage tanks are trihalomethanes (THM), halocetic acids (HAA5), bromates and chlorites.

According to recent nationwide surveys, approximately 85% of ground water systems utilized chlorine as their primary disinfectant. The common misconception is that ground water systems do not have DBP problems but, as we have seen through sampling and testing, THMs are quite prevalent in both surface and ground water. Although organics should not be found in ground water, other contributing factors within the ground water distribution system can lead to the formation of THMs such as tuberculated distribution piping (i.e. aged cast iron, galvanized, etc.), inorganic matter, microbial growth on the profile of the tank walls and settled debris within the storage tanks. Given the type of THM species borne under these conditions, four (4) chemicals can be found and measured to ascertain the Total Trihalomethanes (TTHMs) in your system. These chemicals are trichlormethanes (most common), dibromochloremethane (most serious), bromodichloromethane and tribromomethanes. Once formed, these THMs now can be classified as a volatile organic compound (VOC) that we can now identify, treat and reduce in our distribution tanks thereby decreasing its occurrence in the distribution system.

In identifying how THMs are formed, it was discussed earlier that





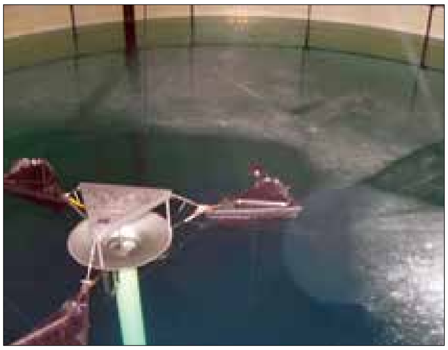
age and temperature of the water in the distribution system and tank(s) were two (2) main contributing factors. Either by water modeling the dynamics of the system or estimating the theoretical residency time, an operator must come to understand how long treated, potable water flows through and stays within the system. By having a better grasp of the residency time, the water system can now reduce the age of the water and reduce the temperature stratifications that occur when water lines and, more specifically, distribution tanks do not turnover properly. Each state regulatory agency differs in their design guidelines but most require water systems to cycle their tanks anywhere from 20% to 50% daily and theoretically draining and refilling the tank every 2 to 3 days. Given temperature stratification issues within tanks, how the water gets in and out is just as critically important as saying the tanks cycled between ¾ full and full 3 times today.

Achievable and attainable results are the goal for managing water quality issues like THM in your system. Dependent upon concentration levels, THMs and the factors forming DBPs can be addressed at the distribution storage tanks by assessing and modifying tank piping, installing a mixing system, installing an in-tank or outside tank aeration system or changing operational procedures to match system demands. Although each system offers varying measures of success, it is not the intent of this article to promote one system over another. The water system, the engineer and the consultant must assess each option based upon the specific concentration level of the THM and determine the method of treatment that meets the treatment and fiscal goals set forth by the water system. The most viable options for achieving tank mixing and certain levels of treatment are tank piping modifications, in-tank mixing systems, inside and outside-tank aeration systems and operations to include usage control.

TANK PIPING MODIFICATIONS: The most common issue related to poor water quality and temperature stratification in existing distribution tanks is inlet and outlet piping. The worst case scenario and one that can be easily remedied is the single inlet and outlet in the bottom of the tank where the last fresh water in the tank is the first water to leave the tank. This layout allows the water above the draining zone to become aged and stratified. With the installation of an outlet check valve, tee, a vertical pipe to fill the tank and a horizontal pipe towards to the center of the tank, we can make a bad situation tolerable by breaking the temperature stratification and allowing the older water to be drawn out from the bottom while filling into the top of the tank.

In recent years, design of tank piping has evolved to address the issue of single inlet/outlet piping by separating the inlet and outlet piping into a high level fill line and bottom drain line. The principle is the same. Fresh water in the top of the tank and older water leaving out the bottom. Simplistic yet effective when THM levels are not excessive and the tanks are being cycled properly.
The tank piping and mixing combination that offers the most movement of water within the tank is the vertical fill line with specifically designed nozzles (e.g. Tideflex® Mixing System) utilized to enhance the entrance velocity of the water entering the quiescent tank. This piping and nozzle configuration also prevents water from being trapped in dead zones or stratified by temperature. Arrangement of the nozzles allow the incoming water to be distributed at various levels throughout the tank and to enter into the storage tank with a velocity greater than that of an open ended pipe. By increasing the velocity at the nozzle, the water entering the tank now has a specific momentum that will allow the water to mix at a more rapid rate than a fixed open ended pipe thereby achieving a homogenous blend of old and new water.

Tank Mixing Technologies: In situations where a tank is **cycling** properly, water systems can deploy mixers either in the top or in the bottom of the tank to create mixing zones to combat several water quality and operational issues. These include blending old and new water, uniformly distributing



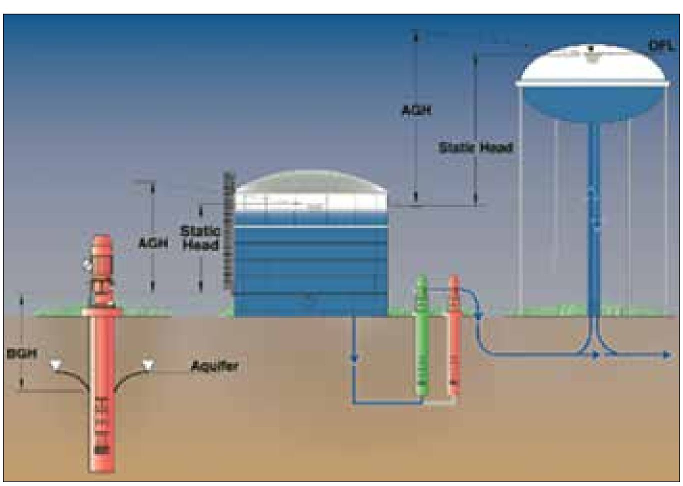

disinfectants, reducing temperature stratification, keeping water in motion to prevent ice formation during the winter months and moving THMs from the lower levels of the tank towards the surface so that the THMs can be brought in contact with air.

In-Tank Mixing Systems: The in-tank mixings systems can be classified into two (2) categories: (1) Surface (2) Submerged. *Surface mixing systems* (e.g. Solar Bee®) utilizes a floating platform with a mixing motor attached and a draft tube that pulls water directly from the bottom of the tank and then evenly disperses it away from the floating mixing unit. This mixing system allows the cooler and denser water to be mixed with the less dense and warmer water in the upper elevations of the tank so that a blending occurs thereby reducing temperature stratification. If properly sized for the tank capacity, the unit is effective in mixing the system in a short time frame. The unit is electric and powered through solar panels.

Submerged mixing systems (e.g. Pax, Tank Shark, GridBee®) are designed to be deployed on the floor of the tank and utilized various methods of mixing technologies to move the water from the floor upward to the top of the water surface in the tank. By forcing the water upward, the heavier cool water is then pushed through the various temperature strata in the tank and then, once the water is in close contact with the surface, the water is redirected in all directions towards the walls of the tank. Once the water reaches the barrier of the tank wall, the water is forced down the sidewall and completes a full circuit of mixing. By circulating water in this manner, the cooler water is blended with the warmer water thereby reducing temperature stratification and dead zones within the tank. From a practical installation view point, these units are set on the bottom of the tank and do not require a physical connection to the floor. With the exception of one unit (i.e. Tank Shark), all other units require a nominal amount of power; therefore, availability and capacity of electric service at the tank site are critical considerations when selecting your submerged mixing system.

Aeration Technologies: In situations where mixing may not be the best method for either controlling or reducing THMs in your system, aeration of the water either entering the tank or within the tank is recommended. THMs are volatile organic compounds (VOC) and a method of reducing THMs in your tank is by bringing them in contact with air. When in the presence of air, the VOCs will evaporate and then can be removed from the tank through a combination of blowers and vents. The two (2) methods recognized throughout the water industry for providing this air contacts are "In-Tank" and "Outside" Tank Aeration.

"In-Tank" Aeration: In-tank aeration solutions can be in the form of bubble aeration through course bubble diffusers, surface aeration with jets spraying into the water surface or spray aeration with nozzles spraying water droplets into the headspace. By either a floating aerator



or spray, the unit is designed to bring THMs into contact with air so that the THMs can be stripped from the water molecules, evaporate into the tank and then evacuated from the tank. In every installation, power is either power the pumps to send it to the nozzles and aerators or to operate the blower to provide air for the bubbler diffuser system. Floating aeration units such as the GridBee™, Pax TRS and the Air Shark include a mixing unit to provide a full mixing and aeration system. In addition to mixing and aerating equipment, each THM reduction system requires an adequately designed blower system to be mounted on the tank plus a properly sized ventilation system. Each unit is designed specific for the installation but typical published THM reduction results in tanks actively utilizing these systems vary from 25% to 60%.

Outside Tank Aeration: Outside tank aeration also referred to as waterfall aeration utilizes equipment on the outside of the tank for aeration and stripping of THMs from the incoming water. This can be accomplished either by induced or forced draft aeration (e.g. De Loach Industries, Tonka). By means of either blowing (i.e. forced draft) or drawing (i.e. induced draft) air through a structure with media, influent water contaminated with THMs are sprayed over the media and brought into direct contact with air. Once the THMs are forced into contact with air, the contaminant is released from the water and evacuates into the atmosphere. With the water free flowing through the tower, water must either be collected and pumped into the tank or the unit must be built on a structure adjacent to the tank so that it can gravity flow from the unit into the top of the tank. The outside tank aeration system requires the aeration tower, packed plastic media/slats and blower. Each unit is designed specific for the installation but typical published THM reduction results in tanks actively utilizing a waterfall aeration system vary from 25% to 50%.

Operations and Usage: The most critical aspect of maintaining the water quality in your system is by understanding the factors that contribute to poor water quality. As we have discussed, the age of water in the distribution system is one of the key components that leads to the formation of THMs. By altering drain and fill cycles in the distribution tanks based upon system demands, tanks can be allowed to cycle more frequently thereby allowing the tanks to turnover properly. This can be accomplished by utilizing pump storage wherein water is pumped from the tank and pumped into the system based upon the varying demands on the water system. Pumped storage can work to augment either elevated or set hydraulic grade line systems by allowing those systems to drain to lower levels and then be replenished by the pumped storage system, which can meet the instantaneous plus peak demands.

Mixing and aerating a tank can work only as effectively as the system cycles based upon usage. The best analogy I ever heard is "if I have a 5 gallon bucket with bad water, it doesn't matter how much I stir it up if I don't take out the bad water and put good in it!"

These are practical applications and solutions for consideration based upon the technologies available today. I encourage you the reader to investigate each alternative and determine if it is applicable to your situation. In some cases, mixing may be the answer but, in others, you may need to take the next step in aeration. Know your system and choose the best, most practical and most affordable solution to manage your quality challenges. DN

Relative Performance of Grit Removal Systems

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ABSTRACT

Biological processes continue to evolve toward better effluent quality in a smaller footprint. The fact that these processes are housed in a small footprint means that they have an inherent inability to store grit and debris. This, in conjunction with the trend towards reductions in plant personnel, drives the need for advanced headworks processes that are more effective at removing grit and debris. Screening, for example, has trended toward progressively smaller openings with 6 mm (1/4") screens commonly used. Smaller openings are required for certain biological processes, specifically Membrane Bio-Reactors for which some manufacturers require openings as small as 1 mm (0.040") [1]. This trend towards finer screening is also reflected in the increasing demand for improved grit removal processes as a part of plant design and upgrades.

Grit is a nuisance material that causes abrasive wear to mechanical equipment increasing maintenance and operational costs while reducing equipment performance and useful life. Grit that is not captured in the headworks accumulates in processes throughout the plant, reducing capacity and detention time, and adversely influencing flow and circulation patterns[2]. Deposited grit must be manually removed, handled, hauled and disposed. Abrasive wear, process inefficiencies and basin cleaning operations increase treatment plant operating expenses.

Choosing a grit removal technology has often been based on equipment price with little regard for device efficacy and consequent grit removal efficiency. Owners and engineers are forced to navigate a field of, what can be conflicting, performance claims made by various equipment manufacturers. This situation is perpetuated by the fact that there is no accepted, peer reviewed test standard for grit sampling and analysis.

The purpose of this paper is to encapsulate various grit removal system performance data generated by a repeatable sampling and analysis methodology for the purpose of comparing virtually all grit removal technologies in terms of their effectiveness.

Keywords: Grit, removal efficiency, aerated grit basin, mechanically induced vortex unit, stacked tray system, structured flow unit, detritus tank, test methodology, grit sampling, surface loading rate

INTRODUCTION

Biological processes continue to evolve toward better effluent quality in a smaller footprint. The current trend of housing these processes and systems in smaller and smaller footprints imply an inherent inability to store grit and debris. Treatment plants now operate with reduced numbers of maintenance and operations staff, which in turn is resulting in significant reductions in the available resources and time to tackle and address the negative impacts of grit and debris.

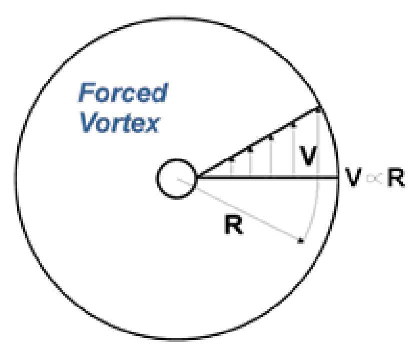
Headworks screening and grit removal are the primary protection for all treatment processes and equipment in a wastewater treatment plant, yet it has been the most neglected part of the plant. To improve solids removal, screen openings on influent screens have trended progressively smaller over the past 10-15 years. Years ago, screen openings were frequently 25 mm (1") and larger. Today, screens are commonly supplied with 6 mm (¼") openings. It is logical that advancing grit removal processes, to effectively remove incoming grit, are becoming a higher priority in plant designs.

Selecting grit removal technologies can be a challenge due to the lack of comparative performance data available within the wastewater industry. Owners and engineers are forced to navigate a field of, what can be conflicting, performance claims made by various equipment manufacturers. This situation is perpetuated by the fact that there is no accepted, peer reviewed test standard for grit sampling and analysis.

As, there are no Standard Methods for the comprehensive measurement and analysis of sampled grit, most parties utilize conventional ASTM D-422 to obtain the physical particle size distribution of grit collected by various means. Standard Method 2540 for solids testing is used for determining Total, Fixed, and Volatile Solids. A method that Engineers and Owners have found effective, splits the sample with half being tested via ASTM D-422 and the other half being wet sieved and characterized based on settling velocity[3]. In addition to physical size distribution, settling velocity is often the most important and useful criterion in grit system design.

Settling velocity is central to grit system design as technologies used to collect influent grit are predominantly sedimentation processes[2]. Sedimentation basins and aerated grit basins (AGB) are recognized as gravity processes. Vortex processes utilizing a forced vortex type flow regime also rely predominantly on gravity for separation. When the force balance on a particle is evaluated within a forced vortex type flow regime in a basin, gravity is shown to be the predominant force, well in excess of the centrifugal forces generated by slow rotational velocity.

- Wall velocity is greater than at the center
- Increasing performanceas flows decrease
- Gravity is dominant force
- Low headloss < 0.3 M



While settling velocity is an important criterion in grit system design, the removal efficiency data presented in this paper is based on particle size distribution alone and does not consider settling velocity. Settling velocity is discussed elsewhere[4]. As most performance guarantees are based on 2.65 specific gravity (SG) it is worth noting that observed performance can vary widely from performance claims. While some of the variance is certainly attributed to the SG of grit being less than 2.65 and other factors[4], wide variations from performance claims are likely influenced by other factors such as short circuiting and/or inaccurate sizing.

METHODOLOGY

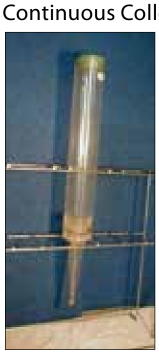
Effective test methodology must provide accurate, consistent, repeatable and reproducible results. One of several grit sampling methods used by owners and engineers is the vertical slot sampler (VSS). The VSS is designed to draw off a known vertical slice of the influent water column to provide an accurate sample of incoming solids. Although not detailed in ASTM manuals or Standard Methods, sampling using the VSS has been found to produce results that are repeatable, effective and allow efficiency comparisons at different treatment plants[5]. Further, results determined with the VSS corroborates with the operating history and performance at those plants with respect to grit removal, suggesting the accuracy of the test method[6]. This same test methodology can be used for comparison of grit removal efficiency of various technologies.

The VSS methodology used in the referenced studies provides a repeatable sampling and analysis methodology that allows for the relative comparison of removal efficiency for different devices. The test methodology typically includes a margin of error of +/- 5% and is described eslewhere[3,5]. Data collected and presented herein has been made available in various industry publications and reports as cited.


Vertical Slot Sampler (VSS)


Continuous Collector


Wet Sieve Size


Settling Rate

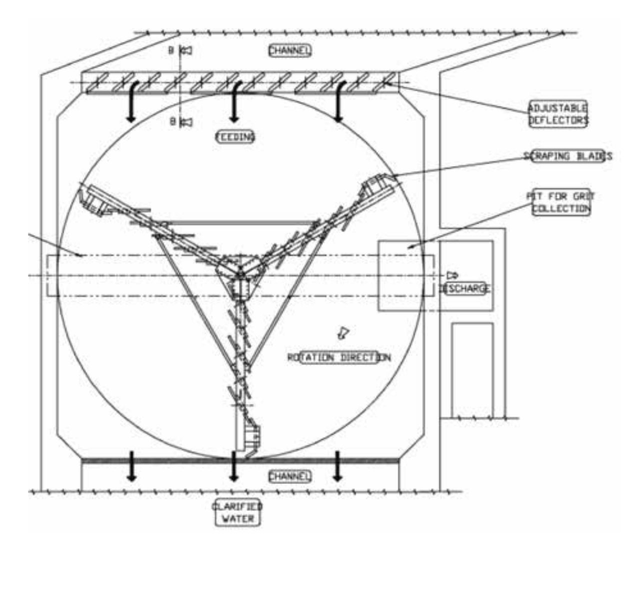
Hampton Roads Sanitation District (HRSD) performed comprehensive testing at five of their wastewater treatment plants in 2007 and 2008 utilizing the VSS sampling method. The equipment tested included three different mechanically induced vortex systems (MIV), a Detritor system and an aerated grit system (AGB)[5]. During the same period, HRSD conducted a side-by-side pilot test comparing the stacked tray Eutek HeadCell® unit and the structured flow Grit King® unit. Both systems were tested for removal efficiency using the VSS sampling method[7].

Data collected on the HRSD AGB has been excluded from this paper. During the above referenced testing, which was performed on dry weather flows, it was determined that the grit was settling in the force main as there was not sufficient energy in the collection system to transport grit to the plant. At peak diurnal flows the velocity in the force main was 0.5 m/s (1.7 fps), when 0.9 – 1.5 m/s (3.5-5.0 fps) is needed to re-suspend settled solids and grit[6]. Therefore, data from testing on the AGB was inconclusive. However, the same collection and analysis methodology was used in Columbus GA on an AGB, that data is included in this paper.

This paper provides removal efficiency, utilizing identical and consistent sampling and analysis methodology, of virtually every type of grit removal technology, thus allowing comparison of removal efficiency of these technologies. The processes represented include AGB, vortex grit removal systems, and detritus tanks. The vortex units include mechanically induced vortex (MIV) units, stacked tray units and structured flow vortex units.

RESULTS

Mechanically Induced Vortex (MIV) Units



HRSD Chesapeake-Elizabeth Treatment Plant

The Chesapeake Elizabeth Treatment Plant (CETP) is a 91 ML/d (24 MGD) capacity plant operating with an average flow of approximately 72 ML/d (19 MGD). Grit removal equipment consists of two (2) 7.3 m (24') diameter MIV units, one unit was in operation during the study. Design removal parameter for each unit is 95% removal of 150 μm particles, 2.65 SG, at 114 ML/d (30 MGD), and 95% removal of 270 μm particles, 2.65 SG, at 265 ML/d (70 MGD). Average flow during testing was 71.1 ML/d (18.79 MGD), which is well below the rated capacity of the grit unit. The observed removal efficiency was 48-52% of all grit 150 μm and larger and 45-50% of all grit 106 micron and larger. Removal efficiency of particles > 297 microns, a slightly larger particle than the performance claim, was 72-78% or roughly 20% less than the claimed removal.

Table #1 Removal Efficiency of MIV

% Removal Efficiency					
CETP	#50 Mesh (>297 microns)	#70 Mesh (<297 microns >211 microns)	#100 Mesh (<211 microns >150 microns)	Total % Removal 150 μm and up	Total % Removal 106 μm and up
May 17, 2007	72.6	19.1	7.0	48.1	45.8
May 18, 2007	77.8	28.9	14.7	52.1	50.9

HRSD Virginia Initiative Plant

The Virginia Initiative Plant (VIP) is a 151 ML/d (40 MGD) capacity plant with an average flow of approximately 110 ML/d (29 MGD). The plant employs three 6.1 m (20 ft) diameter MIV units, one unit was in operation during the study. The vortex manufacturer states that each unit will remove 65% of 150 μm grit, 2.0 SG, at 101 ML/d (26.7 MGD). Average flow during three days of testing was 99.2 ML/d (26.23 MGD), very near the rated capacity of the grit units. The observed removal efficiency was 43-45% of all grit 150 μm and larger, 20% below the claimed efficiency, and 43-44% of all grit 106 micron and larger.

Table #2 Removal Efficiency of MIV

% Removal Efficiency					
VIP	#50 Mesh (>297 microns)	#70 Mesh (<297 microns >211 microns)	#100 Mesh (<211 microns >150 microns)	Total % Removal 150 μm and up	Total % Removal 106 μm and up
May 20, 2007	57.7	29.8	22.7	45.3	44.3
May 21, 2007	60.5	26.8	23.2	45.1	43.7
May 22, 2007	59.3	33.2	27.9	43.3	43.3

Detritus Tank

HRSD James River Treatment Plant History

The testing at HRSD included testing at the James River Treatment Plant (JRTP) which operates detritus tanks for grit removal. The JRTP is a 76 ML/d (20 MGD) capacity plant with an average flow of approximately 49 ML/d (13 MGD). The JRTP employs four detritors. Each detritor is 8.5m (28') diameter with a design capacity of 24.6 ML/d (6.5 MGD). Each unit is designed to remove grit particles 150 μm and larger, with 2.65 SG. Average flow to the plant during three days of testing was 48.75 ML/d (12.88 MGD) with one of the detritor units out of service; therefore each unit was processing approximately 16.27 ML/d (4.3 MGD) or roughly 33% below their rated capacity. The observed removal efficiency was 66-73% of all grit 150 μm and larger and 57-68% of all grit 106 micron and larger.

Table #3 Removal Efficiency of Detritus Tank

% Removal Efficiency					
JRTP	#50 Mesh (>297 microns)	#70 Mesh (<297 microns >211 microns)	#100 Mesh (<211 microns >150 microns)	Total % Removal 150 μm and up	Total % Removal 106 μm and up
June 17, 2007	81.8	72.6	41.7	66.2	57.3
June 18, 2007	76.9	77.2	66.6	73.2	67.7
June 19, 2007	82.6	74.7	55.3	71.2	64.2

Aerated Grit Basin

Columbus GA South Water Reclamation Facility

The City of Columbus, GA South Water Reclamation Facility (SWRC) operates four AGB units that receive a combined average daily flow of approximately 106 ML/d (28.0 MGD). A rain event occurred on January 28th, 2008 resulting in an increase in the flow to 143.84 ML/d (38 MGD) with a maximum hourly flow of 185.5 ML/d (49 MGD). As can be seen from the results below, when the flow to the grit chamber increased the removal efficiency decreased, as would be expected.

The plant has two AGB that are 5.18m x 11.89m (17' x 39') and two basins 3.96m x 10.97m (13' x 36'). While no design removal efficiency data exists, total surface area available for grit settling is 210 m^2 (2,262 ft^2). Based on the average flow of 106 ML/d (28.0 MGD), the AGB system has a surface loading rate (SLR) of 0.35 m^3/min./m^2 (8.6 gpm/ft^2) and would be expected to remove a significant percentage of fine particles, 106 micron and below. The plant notices a decrease in removal efficiency at flows in excess of 132.5 ML/d (35 MGD). Once the flow reaches 132.5 ML/d (35 MGD) the SLR increases to 0.435 m^3/min./m^2 (10.7 gpm/ft^2). Based on SLR alone the basin would still be expected to retain a percentage of fine particles at 132.5 ML/d (35 MGD) with particle size retained increasing, and overall capture efficiency decreasing, as flow continues to rise.

The observed removal efficiency was 35-70% of all grit 150 μm and larger and 32-67% of all grit 106 micron and larger when the wet weather data is included. Removal efficiency improves to 58-70% of all grit 150 μm and larger and 53-67% of all grit 106 micron and larger during average flow of 106 ML/d (28.0 MGD). While excluding the performance during the wet weather event indicates improved performance, removal efficiency is well below what would be expected based solely on SLR.

Table #4 Removal Efficiency of Aerated Grit Basin

% Removal Efficiency					
Columbus	#50 Mesh (>297 microns)	#70 Mesh (<297 microns >211 microns)	#100 Mesh (<211 microns >150 microns)	Total % Removal 150 μm and up	Total % Removal 106 μm and up
Jan 27, 2008	81.8	49.8	42.2	70.5	67.2
Jan 28, 2008	53.0	13.5	21.7	35.6	32.5
Jan 29, 2008	66.3	60.0	44.4	58.7	53.1

Stacked Tray System

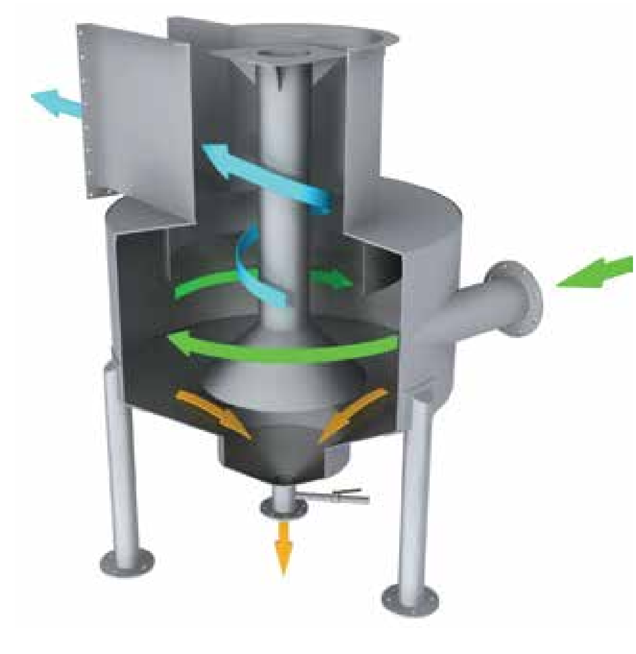
- Performance – Varies by design:
  - 95% removal of 75 micron
- Surface overflow rate based sizing
- Forced vortex

While considering a new grit system for their Army Base Treatment Plant (ABTP), HRSD tested two grit removal technologies side-by-side in December of 2007. The stacked tray Eutek HeadCell® unit was tested side-by-side a Grit King® structured flow unit using the same sampling and testing methodology. During the pilot test the stacked tray HeadCell unit was fed at 38.6-38.8 m³/hr (170-171 gpm). At that flow rate the Stacked Tray unit was designed to remove 95% of all grit 75 micron and larger, with 2.65 SG, however performance was not tested for 75 micron particles. The observed removal efficiency was 92-93% of all grit 150 μm and larger and 89-90% of all grit 106 micron and larger.

Table #5 Removal Efficiency of Stacked Tray System

% Removal Efficiency					
Stacked Tray	#50 Mesh (>297 microns)	#70 Mesh (<297 microns >211 microns)	#100 Mesh (<211 microns >150 microns)	Total % Removal 150 μm and up	Total % Removal 106 μm and up
Dec 17, 2007	95.8	90.4	81.5	91.9	88.8
Dec 19, 2007	95.7	93.0	85.6	92.5	89.3

Structured Flow System



During the side-by-side testing the 1.2 m (4') diameter structured flow Grit King pilot unit was fed at a rate of 38.8 m³/hr (170 gpm) on December 17th and 25.4 m³/hr (112 gpm) on December 19th. Design removal parameter at the higher flow is 95% of all grit 106 micron and larger, 2.65 SG. At the lower flow of 25.4 m³/hr (112 gpm) the removal would be expected to be 95% of all grit 75 micron and larger, 2.65 SG, however removal efficiency for 75 micron particles was not reported. As would be expected, the removal efficiency improves at the lower flow rate as loading rate to the unit is reduced. The observed removal efficiency was 90-95% of all grit 150 μm and larger and 87-93% of all grit 106 micron and larger.

Table #6 Removal Efficiency of Structured Flow Vortex Unit

% Removal Efficiency					
Structured Flow	#50 Mesh (>297 microns)	#70 Mesh (<297 microns >211 microns)	#100 Mesh (<211 microns >150 microns)	Total % Removal 150 μm and up	Total % Removal 106 μm and up
Dec 17, 2007	93.6	89.4	78.7	90.3	87.5
Dec 19, 2007 - 112 gpm	97.4	94.3	89.0	95.0	92.7

DISCUSSION

As can be seen from the above data, testing results for the mechanically induced vortex technology were considerably below the manufacturers' claimed removal efficiency even when running the unit well below design flows. The testing results indicate this technology had its highest observed removal efficiencies for large grit particles, approximately 60%+ removal of particles larger than 297 micron, and very low performance removing smaller particles, with less than 30% removal of particles 210 micron and smaller.

At CETP the MIV was designed to remove 95% of grit 150 micron and larger, with 2.65 SG at a flow of 114 ML/d (30 MGD). When operating at 63% of the design flow (71.1 ML/d (18.79 MGD), the observed removal efficiency of grit particles 150 microns and larger was 48-52%, which is more than 40% less than the stated claim. The 7.3 m (24') diameter MIV unit has a surface area of 41.83 m^2 (452 ft^2), which results in an estimated SLR of 1.18 m^3/min./m^2 (28.97 gpm/ft^2) at 71.1 ML/d (18.79 MGD). Based on the SLR the MIV technology would, in theory, be expected to retain a large percentage of particles approximately 165 micron and larger. The observed removal efficiency for much larger particles, 297 microns and larger, was only 72-78%. The low removal efficiency suggests the importance of considering the likely effects of grit settling velocity and other criteria.

Based on operational data from VIP it was found that placing more vortex units into service improved grit removal. During 2007 the plant averaged 99 ML/d (26.2 MGD) and used one vortex unit 83% of the year. For 2008, two vortex units were in service for 75% of the year and grit production increased 50% over 2007 performance. HRSD determined that operating a vortex close to the maximum rated hydraulic efficiency may not be advisable for some treatment plants. Further they concluded that with this technology placing additional grit removal units in service during high hydraulic events can minimize the impacts of grit slug loads on downstream unit processes.

While test data indicates the Detritus tank achieves higher removal efficiency than the MIV technology, the Detritus tank also fell short of design removal efficiency while operating at 66% of design flow. Test data shows relatively high removal efficiencies of large grit particles, 77%+ removal of particles larger than 297 micron and, as would be expected, reduced capability of removing smaller particles, 64%+ removal of particles 210 micron and smaller. Although an older style technology, sampling and analysis for the detritus tank displayed some of the higher removal efficiencies of the technologies tested. Removal efficiency would be expected to decline at peak design flow.

The AGB results were comparable to those for the Detritus tank during the plant average flow, 58-67% of all grit 106 microns and larger was removed. During wet weather when the system received the design flow rate, removal efficiency was reduced to 32.5%. Even considering the small increase in flow during the rain event, which was in the region of 135-175% of average, the quantity of grit increased substantially from 3.36 g/m^3 (28.1 lbs./MG) to 8.89 g/m^3 (74.2 lbs./MG). The fraction of grit smaller than 297-microns also increased significantly. The increased grit quantity and elevated fraction of small grit resulted in the observed poor removal efficiencies. A reduction in removal efficiency at higher flows is expected, however, during the elevated flow, influent grit concentration also increased by a factor of more than 2.5 times the prior day dry weather influent levels. A removal efficiency of 32-35% of the heavier grit load will obviously not be adequate to protect the plant from deposition and abrasive wear.

The stacked tray system and structured flow unit test results exhibited very high removal rates. While the performance results for these two technologies were performed as a pilot study they are consistent with full scale performance tests, using the identical test method, at other facilities[8,9]. Measured removal efficiency for both technologies was slightly below manufacturers claimed removal efficiencies, within +/- 8%. This small deviation is very near the margin of error in testing. Comparatively, these two technologies provide very high removal efficiencies of large grit particles, 93%+ removal of particles larger than 300 micron. The observed removal efficiency of particles 150 - 210 micron was only slightly less and ranged from 78-90%+. Both of these technologies displayed the highest removal efficiency of the technologies tested, in all cases >87.5% of all influent grit 106 micron and larger was captured.

CONCLUSIONS

Grit sampling using the VSS method produces results that are repeatable, accurate and effective. The results corroborate with grit system performance and plant operating history therefore this data provides insight into what most operators' experience. Using this common testing method allows comparison of performance of various grit removal technologies and can assist in improving grit system design and justifying advanced processes.

Table #7 Relative Performance of Grit Removal Devices

Technology	% of Design Flow	Design Removal Efficiency at 100% Flow	Observed Total % Removal 150 μm and up	Observed Total % Removal 106 μm and up
MIV	27-90	95% removal of 270 μm, 2.65 SG 65% removal of 150 μm, 2.0 SG	43-52	43 - 50
Detritus Tank	66	150 μm and larger, 2.65 SG	66-71	57 - 68
AGB	66 -100	Unknown	35-70	32 - 67
Stacked Tray	100	95% removal of 75 μm, 2.65 SG	91-92.5	89 - 90
Structured Flow Vortex	66-100	95% removal of 106 μm, 2.65 SG	90-95	87 - 93

Based on the reported and referenced testing, the technologies that displayed the lowest removal efficiencies were the AGB and the MIV technology. The observed removal efficiency for both technologies was well below claimed removal at peak flows. The AGB displayed a relative removal of only 32% of all grit 106 micron and larger when operated at peak design flow. Results for the AGB improve to 53-67% when influent flow to the unit is reduced to 66% of design.

The MIV technology removed 43-51% of incoming grit 106 micron and larger when operated at 27-90% of design flows. As is true of all SLR based technologies, the MIV technology shows higher removal efficiencies at lower flows. When operating near design flow rate, removal efficiency was in the 43-45% range for all grit 106 micron and larger. As flows decrease, to 63% of average flow and 12% of peak flow, the efficiency increases, but only marginally, to 45-50% removal of grit 106 micron and larger.

The detritus tank displayed a higher removal rate, removing 57-69% of all grit 106 micron and larger when operating at average flows, in the region of 66% of peak design flow. The AGB displayed similar results when operated at 66% of peak flow. When flows increased to peak, the AGB removal efficiency dropped to 32% and the detritus tanks would be expected to have similar results as flows increase.

The structured flow vortex and stacked tray vortex units had very high removal rates, none lower than 87.5% of incoming grit 106 micron and larger. These results are significantly (20% to 55%) higher than any of the other technologies tested. Over the life of the facility, the difference in captured grit is substantial. Also of note, is the fact that high removal results were achieved with the equipment running at peak design flow. None of the technologies tested met their performance claim exactly, although the technologies that targeted the finest particles displayed the best results and came closest to achieving their performance claim. Systems designed for high removal efficiency of small particles, 106 micron and finer, should remove 85% or more of grit entering the plant.

The observed decrease in performance with increased flows provides strong evidence that the tested technologies are strongly influenced by loading rate and gravity to capture and retain grit. A better understanding of in situ grit settling velocity will allow for more efficient design which would afford the plant increased protection from abrasive wear and deposition.

Wet weather is an important consideration in grit system design. The impact of wet weather flows was documented during testing of the ABG in Columbus, GA. Considering the small increase in flow during the rain event, 135-160% of average, the quantity of grit increased much more dramatically, to more than 2.5 times the volume entering the plant during the prior day average flow. One would expect the greatest increase would be of coarse grit particles but the overall gradation was finer. Grit quantities increased across all size ranges but the grit fraction larger than 297 micron decreased, from 61.7% to 39.0%, while particles in the 105-210 micron range increased from 20.6% to 39.7% of the total. Overall, a 60% increase in flow resulted in a 48% decrease in performance.

Significant increase in grit volumes during wet weather events is a common phenomenon[10] and indicates the need to design the grit system for effective removal at peak hydraulic loadings. The AGB and MIV performed poorly at peak design flow and based on the data the detritus tank would be expected to perform similarly to the AGB. Observed removal efficiencies were less than what would be expected based on SLR alone indicating process inefficiencies or grit settling velocity implications.

Designing the grit removal system for high removal efficiency at peak hydraulic loading will protect the plant from the negative impacts of grit. Advanced, compact, high-efficiency grit removal processes are therefore the more appropriate proven choice to protect plants from deposition, abrasive wear and associated costs from this nuisance material. DN

ACKNOWLEDGEMENTS

The authors would like to thank Mr. Cliff Arnett, Senior Vice President, Columbus Water Works and Mr. Mike Taylor, Superintendant, Columbus Water Works, South Columbus Water Resources Facility for permission to use data from their testing and providing the additional information needed to compile the comparisons.

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Darin Morris

By John Marteliz

Where do you begin to write a member spotlight on someone like Darin Morris?

Well, let us start out with his age, which is 43. Really, he's only 43? Jeez Darin, you do not look a day over 50, which is good because you move like you are an 80 year old man. Darin has also been married for 20 years. Wow, someone could actually put up with you for that long? If I am around him for 20 minutes, I want to strangle the guy. She must be a real trooper. God bless her heart. If you have not caught on yet Darin, this is like a Comedy Central Roast and you are the guest of honor. Darin surprisingly also has three kids. Well the story goes that they are his kids. Good thing they got their looks and brains from their mother's side of the family. Darin works, scratch that, is 'employed' at Central Valley Water Reclamation Facility. Darin also has a part-time job being part of the Operators Challenge team for Central Valley. He has competed seven times for them in St. George at our annual conference. Darin has also competed at Nationals a total of five times where his team has placed in the top five multiple times, which gives him a total of 12 times combined of competition experience. Dang Darin, you have competed in a lot of competitions. I wonder if that has anything to do with you carpooling to work with your boss, Gary Faulkner? Hmm, well at least we know who is driving the car then right. Darin has also competed in Division 1 at Nationals where his team Placed 6th overall. Darin is an immense competitor to say the least. Just ask his twins about when he coached them both in football. They were only eight years old when Darin was kicked out of a game for the first time for being a little too 'passionate' over a bad call. Darin is what we call a 'slow learner.' You would think after four more years of coaching and three more ejections he would get it but no, that is our Darin for you. Or better yet, just ask Chris Reilly how 'passionate' Darin can be. For those of you who do not know what I mean by that, let me explain. Chris accidently tried to take Darin out one day by hitting him in the back with the tripod when they were practicing the safety event. Darin let Chris know how much he 'appreciated' that in the only way Darin could, if you know what I mean. Too bad Chris failed, because you would have done everyone a big favor. I have faith in you Chris that you will one day get the job done. All kidding aside, Darin is a great husband, father, coworker, coach, and friend. He is the type of guy that would help anyone out in need. He is a fierce competitor and a great ambassador for WEAU and the Operators Challenge. Thanks Darin for being a good sport and we will see you in St. George… again.

> "Darin has competed seven times at our annual conference. He has also competed at Nationals a total of five times where his team has placed in the top five multiple times, which gives him a total of 12 times combined of competition experience."

Darin Morris

Gordon Evans

By Gary Hill

Just sitting here thinking about what one could say about a guy one has known for over 20 years. Still thinking… ummm…let us see…ok, between a few of us, we finally came up with the one thing that has benefitted all of SBWRD. Now Gordon, we will admit, had good fabrication, welding and piping skills. And he was a pretty doggone good maintenance guy. So about five years ago, the crew at Silver Creek WRF had to replace the old potable water tank, and we were wondering what to do with the old tank. Well, some ideas were battered about, and lo and behold, Gordon Blurted out the winning suggestion. How about we make a smoker out of it? Yep, good idea, so Gordon and Laine Mair set about designing, fabricating and putting together one heck of a smoker. It was a 500 gallon tank with a bladder that was taken out, sanded, painted and mounted on a single axle trailer, along with propane tanks, and an old tool box for utensils. Stainless piping and jets, racks, gauges, and an air dampening system were added to the tank. This smoker has seen a lot of action. From racks of ribs, brisket, chickens, and even a 100 lb pig, under the Arkansas BBQ talents of Mike Luers. So, we thank Gordon every time it is fired up and raise a smoked rib in his honor. Seriously, Gordon has been a good operator and was an asset to Snyderville for many years, even contributing his talents to the WEAU OP Challenge by writing the process tests we have come to love. DN

Gordon Evans and the Snyderville Basin Crew

"Gordon has been a good operator and was an asset to Snyderville for many years, even contributing his talents to the WEAU OP Challenge by writing the process tests we have come to love."

WEAU sponsors Engineering Week 2014 at Utah State University

By Riley Bradshaw

WEAU joined Utah State University last month in celebrating National Engineering Week. Held each year during the week of President's Day (in honor of George Washington, considered the nation's first engineer), Engineering Week provides an occasion to recognize the many engineering vocations that are so critical to the world's economy, health, comfort, and safety.

The College of Engineering at USU put on many events throughout the week that gave students a chance to highlight the work they are doing, as well as to prepare for professional engineering careers. USU's chapter of the Society of Women Engineers (SWE) held their annual 'Evening with Industry,' a formal dinner event that provides students with the opportunity to network with employers in their field. SWE also put on the annual 'Ms. Engineering Pageant,' where the intrepid woman of the college demonstrated not only brains, but beauty and class as well. Dick Rutan, pilot of the first non-stop, non-refueled flight around the earth, was the keynote speaker at the annual College of Engineering awards luncheon. In addition to expounding on the unique engineering challenges of that flight, he inspired students with his message that great success eventually comes to those who are willing to challenge what is considered 'impossible.'

The week was also full of competitions held by various engineering clubs and societies, including the Jeopardy-style 'Beta-Bowl,' a coding competition, and even a cardboard-and-duct-tape boat race held in the HPER swimming pool (engineering at its finest!).

The crowning moment of the week was undoubtedly the 'Engineering Community Expo,' a tradition started four years ago at USU that is aimed at exposing the public to the engineering disciplines that affect their life each day. This event also fulfills a primary purpose of National Engineering Week: to engage the rising generation and spark an interest in pursuing engineering fields. Each year, the Community Expo attracts hundreds of residents of Cache Valley and beyond, many of whom are K-12 students. Attendees enjoyed dozens of hands on exhibits from all disciplines, including a souped-up pinewood derby, vacuum powered wall climbers, and USU's 'spider-goats' which are genetically engineered to produce spider silk in their milk. Budding civil/environmental engineers played in a 20 foot erosion table constructed specially for the event by the engineering student council.

The College of Engineering Student Council would like to thank the WEAU board for its sponsorship of Engineering Week events at USU and for its continued efforts to make student and YP involvement a key part of its efforts to bring together those in the water quality community.

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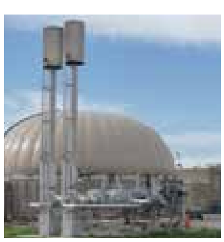
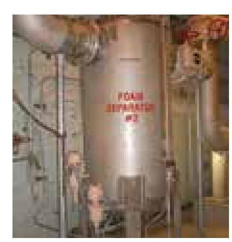


Ground Level Pilot Waste Gas System

Regulator and Flame Trap Assembly

evo 2600 Level Radar Gauge (wireless shown)

Sediment Trap with Electrically Actuated and Manual Drip Traps



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The SludgePro XL sampler is designed to handle tough, everyday use in plant conditions that cause similar models to fail. The SludgePro XL is marked with waterproof tape in 1 foot increments, with the bottom section numbered through 4 feet to simplify calculation of sludge levels. A tape strip package is also provided.