H2Oregon Winter 2018 Vol. 40, No. 1

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March 5-9, 2018

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Please mail your photo to our office. If we use your photo on the cover you will receive an official OAWU shirt and hat.

We are also seeking articles, clean jokes, Oregon trivia, letters to the editor and interesting stories. Please send submissions (no more than two pages in length) to:

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Send your articles with full color photographs, in digital format if possible, to the address listed above.

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OAWU's mission is to provide service, support and solutions for Oregon water & wastewater utilities to meet the challenges of today & tomorrow.

A Man of Encouragement

Jason Green, Executive Director

We are saddened to share the news of retired OAWU Board Member and Past President, Mark Snyder's passing on October 18th, 2017. Mark served on the OAWU Board of Directors from 2001 until his retirement in 2016. He was the OAWU Vice President from 2008 until 2011 and President from 2011 through 2014. Mark was the Kernville-Gleneden Beach-Lincoln Beach Water and Wastewater Utilities Manager for many years.



In my observations, Mr. Snyder was firstly a family man, always speaking highly of his wife Suzi, son Grant, daughter Lauren, and would regularly mention grandchildren and close friends. He always had a smile and welcoming handshake—the type of person who made you feel center stage. One of the most kind, gentle, and selfless people I have known. An enthusiastic supporter and member of the Association and those serving in the water and wastewater profession. He loved to share stories about his family and time serving in the Coast Guard. A capable speaker, leader, and always one to identify the positives in life and compliment others for their value, work, and efforts.

One of the most prominent qualities, among the many, that I respected and appreciated in Mark, was his keen ability to identify positives and the efforts of others, then follow with praise and encouragement. He seemed to never tire nor miss an opportunity to recognize and motivate others in this way - a master at genuine appreciation of others. In a culture where we so often hear negatives, failures and frustrations, Mr. Snyder would drop a gem in the lap of folks he would visit with. For many, encouragement, recognition, or a compliment is just what someone laboring at work or in life needs. Who knows the impact of a gracious kind word to someone struggling? The person thinking of giving up, changing jobs, or who is just tired. The employee who has already put in ten or fifteen years and thinks they are just treading water and not of great value or the young person who dearly needs someone to simply acknowledge them. Encouragement is greatly needed today. I will miss that and many other attributes and visits with Mark Snyder. He left a large swath through the field of life. Our deepest condolences to his wonderful family. \blacklozenge

Oregon Association of Water Utilities



Leak Detection Options

by Hans Schroeder

This summer I have had numerous calls from Cities that are part of the Association to assist in helping find leaks within their systems. Leakage is usually the major cause of water loss in water-distribution systems. To minimize public health risk, economic loss, and to conserve water utilities regularly audit their distribution systems and conduct leak-detection surveys. Although we all know that several of the smaller water systems find it difficult to conduct these surveys. They typically rely on the citizens to complain of low water pressure at their houses or outrageous water bills.

Water audits provide an overall view of water loss and identify areas of the distribution system having excessive leakage, while leak-detection surveys determine the exact location of the leaks by using acoustic listening devices, modern leak noise correlators along with other methods. Acoustic equipment is effective for metal pipes such as Cast Iron, but could be problematic for plastic pipe. Leaks in both metal and plastic pipes could also be located with non-acoustic techniques such as tracer gas, infrared imaging and ground-penetrating radar. The use of these techniques is still very limited and their effectiveness is not as well established as that of acoustic methods.

To help our members OAWU has invested in a correlator detector and the new LD-18. The LD-18 offers 5 High frequency filters, 3 Low frequency filers and 2 Notch filters to remove continuous interfering noises from A/C hum, motors, wind, etc. It also has automatic noise reduction capability for intermittent noises such as pedes-trian footsteps, people talking and passing vehicles. It can store the information from multiple locations along the pipe which can be downloaded to the City's computers.

The following are methods that many Cities have used to find leaks: Taken from "Detecting Leaks in Water-Distribution Pipes," by Osama Hunaidi.

Acoustic Emissions :

Leak detection in pipelines using acoustic emissions technology is based on the principle that escaping liquid creates an acoustic signal as it passes through a perforation in the pipe. Acoustic sensors affixed to the outside of the pipe monitor internal pipeline noise levels and locations. The data is used to create a baseline "acoustic map" of the line. When a leak occurs, the resulting low frequency acoustic signal is detected and analyzed by system processors. Deviations from the baseline acoustic profile will signal an alarm. The received signal is stronger near the leak site thus enabling leak location.

Acoustic sensing can be applied externally to buried pipelines by using steel rods driven into the ground to conduct the sound to a sensor mounted on the rod. The rods are inserted at intervals along the pipeline.

Listening Devices:

These devices include listening rods, aqua-phones, and geophones or ground microphones and may be either mechanical or electronic. They use sensitive mechanisms or materials such as piezoelectric elements to sense leak-induced sound or vibration. Modern electronic devices have signal amplifiers and noise filters to make the leak signal stand out. The operation of listening devices is usually straight- forward, but their effectiveness depends on the experience of the user.

Leak Noise Correlators :

These are portable microprocessor-based devices that pinpoint leaks automatically based on the cross-correlation method. In this method, acoustic leak signals are measured with vibration sensors or hydrophones at two pipe contact points (usually fire hydrants or valves) that bracket the location of a suspected leak. Leak signals are transmitted from the sensors to the correlator wirelessly. The leak is in most cases located asymmetrically between measurement points and consequently there is a time lag between the measured leak signals. The time lag is found from the cross-correlation function of the leak signals. In the presence of a leak, the cross-correlation function has a distinct peak at the time shift between leak signals. The location of the leak is calculated based on an algebraic relationship between the time lag, the sensor-to-sensor distance, and the propagation velocity of sound waves in the pipe. The distance between sensors is measured on site or read from distribution system maps. Propagation velocities for various pipe types and sizes are usually available in most commercial devices, or they can be measured easily on site.

Tracer Gas Technique :

With this technique, a non-toxic, water- insoluble and lighterthan-air gas, such as helium or hydrogen, is injected into an isolated segment of a water pipe. The gas escapes at a leak opening and then, being lighter than air, permeates to the surface through the soil and pavement. The leak is located by scanning the ground surface directly above the pipe with a highly sensitive gas detector.

Ground-penetrating Radar:

Radar can be used to locate leaks in buried water pipes either by detecting voids in the soil created by leaking water as it circulates near the pipe, or by detecting segments of pipe which appear deeper than they are because of the increase in the dielectric constant of adjacent soil saturated by leaking water. Groundpenetrating radar waves are partially reflected back to the ground surface when they encounter an anomaly in dielectric properties, for example, a void or pipe. An image of the size and shape of the object is formed by radar time-traces obtained by scanning the ground surface. The time lag between transmitted and reflected radar waves determines the depth of the reflecting object.

Difficulties with Plastic Pipes:

Most professional users consider acoustic methods to be effective for finding leaks in metal pipes but problematic when used for plastic pipes. Acoustic leak-detection equipment was developed mainly for metal pipes. Leak signals in plastic and metal pipes, however, have substantially different acoustical characteristics. Plastic pipes are "quieter" and do not transmit sound as efficiently as metal pipes. Also, leak sounds in plastic pipes are dominated by low-frequency components, unlike leak sounds in metal pipes.

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Leak Detection Options continued

A recent study by IRC funded by the American Water Works Association Research Foundation showed that leaks in plastic pipes can be located using acoustic techniques; however, there are several difficulties with these techniques. Leak noise correlators operated in automatic mode rarely succeeded in locating leaks, because the frequency range selected by the correlator was usually too high. Operators using the correlators in manual mode also tended to select a high frequency range and therefore missed leaks. It was also found that accelerometers (a type of vibration sensor) were effective only for large leaks. For small leaks, hydrophones were necessary.

It was also found that leak-detection professionals were not able to hear leak sounds in plastic pipes using headphones attached to leak noise correlators. According to popular wisdom, if no noise is heard then no leak exists. The professionals were therefore surprised when they succeeded in locating leaks that they could not hear. Leak signals in plastic pipes were found to be dominated by frequency components lower than 50 Hz. The human ear is not sensitive to sounds in this low frequency range. For the same reason, listening rods and aqua-phones were not effective unless they were attached at access points that were very close to leaks (within about 5.5 feet). In practice, these results imply that detecting leaks in plastic pipes may have to rely solely on leak noise correlators. High-resolution surveys using ground microphones at intervals of, say, 3 feet or less can still be used but these surveys are time-consuming and therefore impractical.

The IRC study revealed several modifications that can improve the effectiveness of leak noise correlators in locating leaks in plastic pipes: revision of automatic mode algorithms, higher sensitivity sensors (especially accelerometers), low-frequency capability, and finely tunable high- and low-pass filters. Several changes to practice in the field can also improve the equipment's effectiveness: use of low- frequency components of leak signals, on-site measurement of sound propagation velocity in pipes, verification of the proper functioning of leak sensors (especially hydrophones), and use of hydrophones or sensitive vibration accelerometers attached to pressurized fire hydrants.

Summary:

Leaks in your water distrubution system are huge revenue loss! They can also increase wear on the pumps and more chemical usage in Cities having to disinfect their water systems.

If you need help please consider relying on your neighboring systems that may be able to help quickly and also PLEASE remember to call OAWU they can send out Hans or Health to help with detecting your water leaks. Your membership offers this service to you!

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Hiring Contract Engineers

by Jeff Crowther, Wastewater Technician

Working with personnel outside of our agency may seem overwhelming, and can feel like we lose control over the development of a project that our constituents and agency both need. One type of outside help, that is often needed by small cities or agencies, is a contract engineer. Although working with a contract engineer may be different than our typical workload, and sometimes may even be challenging, knowing how to approach the relationship and project can have a significant impact on the finished product and budget.

First, it is important to note that professional engineering services are not bid on like a construction project. We must request qualifications and select the most qualified firm based on our set of criteria. Once we select a firm we may negotiate the price based on our agency's guidelines and needs. This process helps us get the best product, as we can verify the engineer has completed similar projects in the past and has the necessary qualifications. It is also important to set up a thorough contract that clearly defines the work required at this point in time to avoid change orders later in the process.

Next, remember the final product is there to benefit the users. This means that we should plan to have meetings with the contract engineer to discuss the features we want included in the design, and any nuances of the proposed project. Remember, although the engineer may have completed many similar projects, no project is exactly like the others. Thinking of these project meetings needs to happen when we draft the contract, since we pay the engineer by the hour, therefore we will pay for each individual meeting. During these meeting we should take clear and concise notes so that in the future we can refer back to discussions regarding the project to help mitigate confusion.

Reviewing the project plans early and often during development can help avoid change orders during design and have a benefit on the relationship with the engineer. The designers would much rather find a potential issue in the design or functionality of the project early rather than after all calculations and plans have been completed, as this can require rework that the engineer did not schedule into their workload. A last minute change based on the owner's preferences can also lead to change orders that cost the jurisdictions additional money.

Finally, and most importantly, keep lines of communication open between ourselves and the contract engineer. Make the designers feel comfortable asking questions, so they get all of the necessary information and don't make design assumptions that could be detrimental to the project. Open communication can also help us manage the project, as the engineer will keep us informed of any schedules or cost issues they are encountering along the way.



Oregon Association of Water Utilities

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Lagoons: A Deeper Understanding

by Tim Tice, Projects Manager

One type of project the Oregon Association of Water Utilities performs is "lagoon profiling," which provides typically unobtainable data that can be useful to Wastewater Operations Specialist. The primary idea behind routine profiling is to ascertain the depth of the sludge, the migration/accumulation of the sludge and, if necessary, sample to determine the composition of the sludge.

Prior to arriving, the Association discusses with the wastewater operations specialist key points of the lagoon. Pending the size of the lagoon, the Association creates a grid pattern which will assist the field workers in sampling locations. Often, the grid pattern is laid out on two sides of the lagoon, using either fifty or one-hundred-foot intervals (this is provided to the operator) marked with traffic cones or high visibility markers.

The sample locations are based on the grid pattern, which is laid out in an Excel spreadsheet and transferred to Rite in the Rain paper; one never knows how the weather may change or what may end up landing on the paperwork. A side note on timing, most profiling is completed May through September.

Upon arrival, profiling is completed using a tube style sludge judge sized 1.5-inch diameter and 15 feet in length. Data from the field is returned to the office and inputted to process for the report.

Typical field notes for a report are as follows:

- Consistency of the sludge (sticky, loose, color, any raw sewage)
- Clarity and hue of water
- Plant life (both surface and sub-surface)
- Microorganisms (Daphnia)

The report outlines general information regarding the lagoon's characteristics, number of measurements taken, operating depth of the lagoon, the average depth of the sludge, percentage of sludge compared to the operating level, and if available, an increase or decrease of the sludge based on a previous profile (1-3 years).

A chart depicting levels of sludge accumulation is provided as well as a comparison from previous years, if available. The cell indicates either an increase or decrease from the previous year. Also noted are areas of inconsistency with the normal parameters (sludge appearances).

The depth chart shows two examples of sludge migration in the same lagoon from one year to the next. As wastewater lagoon sludge volumes reach 15 percent, operational concerns may begin. However, most of the problems that come from an increase in sludge are not visibly noticeable at the time. After sludge levels reach 33-percent, it becomes challenging to remain in compliance with the NPDES permit. Once sludge levels reach a 50 percent level, the lagoon ceases to function properly. One concern with a lagoon is when the amount of sludge creates a shorter path for the solids, not allowing sufficient hydraulic detention time. This can create raw sewage solids in the effluent.

Profiling on a routine schedule can provide a more thorough understanding to the functioning of the lagoons. If you would like more information regarding profiling lagoons at your facility, please contact the OAWU office at 503-837-1212.

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TRAINING & EVENTS SCHEDULE

Date	Class Title	Location	CEU Information	ESAC#, Fee	/Free
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February 6	Water & Wastewater Field Operations & Safety	Sutherlin	0.4 Water/Wastewater	3568	Fee
February 6	Hazardous Communication Standard (Global Harmonization)	Sutherlin	0.3 Water/Wastewater	3459	Fee
February 21	Math for Operators	Turner	0.4 Water/Wastewater	3562	Fee
February 21	Pumps and Pumping	Turner	0.3 Water/Wastewater/Onsite	3560	Fee
February 27	Math for Operators	Newport	0.4 Water/Wastewater	3562	Fee
February 27	Preparing for a W System Survey & WW System Inspection	Newport	0.3 Water/Wastewater	3561	Fee
March 5	Effective Utility Management	Sunriver	0.6 Water/Wastewater	TBA	FREE
March 5-9	40 th Annual Management & Technical Conference	Sunriver	2.7 Water/Wastewater	TBA	Fee
March 13-14	Wastewater Treatment/Collections Certification Review	Salem	1.4 Wastewater	3559	Fee
April 3-4	Water Treatment, Water Distribution Certification Review	Salem	1.4 Water/0.5 Wastewater/Onsit	e 3394	Fee
April 5	W. Treatment & Dist. Level 3,4 & Filtration Endorsement	Salem	0.6 Water/Onsite	3370	Fee
April 10	Math for Operators	Independence	0.4 Water/Wastewater	3562	Fee
April 10	Preparing for a W System Survey & WW System Inspection	Independence	0.3 Water/Wastewater	3561	Fee

Levels 1–4 Water Operator Exams

Trained and certified operators are necessary to ensure that the systems are managed in a manner that fully protects public health and the environment. The OARs for certification stipulate that the qualifying experience for applicants for certification as a water treatment plant operator must attain at least half the required operating experience at a public water purification plant that uses complex filtration technology and is not more than one classification lower than the level of certification they are seeking. In other words, if you have only worked for a Class 2 treatment plant, we allow you to apply for a Level 3 certification but not a Level 4 certification. If you move on to a Class 3 plant, then you must have ½ the qualifying experience (at the Level 3 plant) before allowing to apply for a Level 4 certification. Reciprocity from state-to-state ensures that the operator have the operating experience for which they are certified.

For additional information, please visit http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/OperatorCertification/Levels1-4/Pages/exams.aspx

More Resources

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 https://yourwater.oregon.gov

 Center for Health Protection
 http://public.health.oregon.gov/PHD/Directory/Pages/Program.aspx?pid=4

 Drinking Water Services
 http://public.health.oregon.gov/PHD/Directory/Pages/Program.aspx?pid=58

Training class dates, class topic and/or locations may be subject to change as needed.

For more information on any class by OAWU, please contact the office at 503-837-1212, office@oawu.net or visit www.oawu.net.

NRWA Fleet Program

The National Rural Water Association has created partnerships with the Ford Motor Company and the Chrysler Group to offer special fleet discounts to State Rural Water Associations and their utility system members. This partnership combines the buying power of 31,000 individual utilities to provide reduced fleet pricing on utility vehicles.

The Rural Water Fleet Program is a valuable member benefit for water and wastewater utilities. State Rural Water Associations determine eligibility for their members, and provide a fleet code that allows access to substantial vehicle discounts to fill the need for reliable work vehicles.

Contact your State Rural Water Association to access the Rural Water Fleet Program. Vehicles may be purchased at your local dealer or



through the national fleet auto group at www.nrwafleet.com. Incentive discount pricing is available on fuel efficient cars, vans, SUVs and trucks. Systems can save up to \$6,750 off factory invoice per vehicle.

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Competitive Wage

by Heath Cokeley, Programs Manager/Circuit Rider

The water and wastewater industry is great for many reasons; some of these reasons include the interesting work, year-round employment and the security of knowing that the System Operations Specialist's day to day work can't easily be outsourced. The one thing people don't openly talk about are the wages employees earn doing these jobs. These wages are determined by the management of the system, or boards and council members and are a large factor in attracting and keeping the best talent.

The first, and most obvious, bonus to paying employees a competitive wage is that we attract the most qualified talent for our positions. This can be applicable training, schooling, years of experience, or ability. These individuals will bring insight and techniques to our organization that can save money and lead to a better functioning system.

The next incentive to paying employees a competitive wage is that it will help to retain the workers we already have. It's my belief some employees may leave a job they truly enjoy at a small utility, just to go to a larger municipality because the pay is better, and they must think of supporting their families. If we can compete on wage, the other factors such as work environment will drive an employee's decisions. Employees that feel they are treated fairly will also often go above and beyond in their work and make the utility more successful.

By keeping our employees for the long term, we will greatly reduce the costs associated with hiring and training. This can quickly offset the increase in wages we have offered the workers. The employees will also have a better background in the system. There is a huge benefit to having the same worker that oversaw the mainline construction still working for the utility when it is time to maintain or repair that line. They can provide insight into the intricacies of the construction, or anything that may have been shown incorrectly in the as-built drawings. These insights can save the system a large amount of money during subsequent construction projects and will offset the cost of keeping the employee.

As a final note, the difference in paying employees a competitive wage is typically fairly small compared to the budget of the utility. The difference may be an insignificant percentage of the utility's total budget, but will have a huge impact on the pay of the employee, and the outlook the employees have on the utility as an employer. •

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Scope Creep

by Scott Berry, Operations Manager

The topic of scope creep, and the repercussions of not doing all I could to avoid it, occurred to me this past August while doing a little project at home. I had requested a few weeks off of work to do some camping, fishing, and scouting. On day 2 of my vacation, my son came in and told me there was something wrong in the bathroom. That news is never good.

I went in for an inspection and had a look around. Sure enough, there was sewage backed up in the shower stall. I geared up and started crawling around under the house to see what was going on. The plumbing looked old but okay on the outside, but after peeling the insulation away from the floor I started noticing a LOT of dry rot. I started peeling more insulation trying to find the end of the dry rot.

Circuit Rider, Heath Cokeley, stopped by a few days later to find me, still with crowbar in hand, with half of my house torn off. Literally, half of my house, including foundation and roof, was gone. My esteemed colleague commented, "You do know how to unplug a drain, don't you?"

"Yes. Shut up and hand me the chainsaw."

What is scope creep? Scope creep, in project management, refers to uncontrolled changes or continuous growth in a project's scope.

Scope creep can be caused by any one of many factors:

- Lack of communication between you, the contractors, and the subcontractors.
- Failure to use proper contract procedures.
- Poor analysis and understanding of the original goals for the project.
- Failure to establish and comply with procedures for dealing with change orders.
- Contractors who seek to increase revenue.
- Clients who seek to get more work out of the contractor for free.

It would be great to eliminate scope creep entirely, but that's not very realistic. Every project is going to require at least some small adjustments to the original scope of work. These little tweaks are not necessarily damaging if the increase in the scope of work is handled and documented correctly. Two critical ways to manage change orders are through proper communication and contract procedures.

The importance of proper communication between contractors and clients can't be overstated. The client has to have a clear understanding of what services the contractors can provide and their level of expertise in those services. This should be outlined during the initial meeting with the contractor and solidified prior to the pre-construction meeting. The client needs to provide a clear definition of the scope of work to be performed, and excluded, under that contract.

Any change orders that arise during the project should be treated as a separate and new agreement with the contractor. Lawsuits can arise when the agreement between client and contractor are poorly understood and adhered to.

There is also an, often, underutilized word, a word that my coworkers have exhausted hours trying to teach me. That word is "No." All parties in a contract need to have the ability and wisdom to say no when asked to expand the scope of work in an area that is not beneficial to the original project's goals.

Which is what I should have said when it was suggested that I, a diabetic that hadn't eaten anything for about 9 hours, should climb a ladder carrying a $4'' \times 14'' \times 16'$ long beam on my shoulder. In my notes for future projects file: never carry anything up a ladder that's too heavy for my wife and son to lift off of me.

Try to avoid the use of general terminology when defining the scope of work. The use of more specific language, when explaining the project and its limitations, should be included



in the scope of work section of the contract. Scope creep is often the result of undocumented verbal communications. In order to be protected, it should be noted in the original contract that all change orders should be clearly defined, and terms agreed upon in writing before work starts on that change order.

Which is what I should have done when my wife said, "Since you're already this far into it, wouldn't it be nice to have a bigger kitchen?"

Protocols need to be established to deal with expanding work scopes. Before the project outline begins to change, have a standard protocol set up to accept, confirm, and document changes to the scope of work. While the expensive, time-consuming, and sometimes damaging effects of scope creep can't be eliminated, they can be managed and controlled through good communication and proper contract procedures.





Here Comes Winter

by Mike Collier, Deputy Director/Sourcewater Specialist

The drizzly, gray, cool days and the long, cold, dark nights. I don't know about you, but seasonal affective disorder begins to set in on me around this time of year – I get a little down as winter progresses, but can't really put my finger on anything in particular. Then, usually sometime in March, the sun comes out briefly, probably to just play with our emotions, but when this happens the entire world seems to change, birds start chirping and it feels like a large weight has been lifted from me. At this point I realize just how much the gloomy long winter has been impacting me. The longing for sun had been affecting me over the months, not just on a physical level, but also a psychological level, and probably chemical. This may not be the case for all Oregonians. Some live in the East, where they still get plenty of sun throughout the winter. Some are born with webbed feet and they love the wet overcast weather and may even like it better than the sunny warm weather, but for the rest of us, we were born with the need of some sun.

It is important to get to know ourselves so we can better identify the things that impact us in a positive or negative manner. If we get a better grasp on the things that impact us, we may be able to avoid certain situations or be able to take steps to help us through different stages in our lives. In the case of the seasonal affective disorder, knowing we have it is half the battle, then taking steps so that it won't impact our work or relationships is the next step. This can be accomplished through exercise, eating right, getting enough sleep, enjoying some different events or parties with friends, taking extra vitamin D, etc.

The question that now comes to mind is: How do we get to know ourselves better?

There are a few different things that may be worth trying to better know ourselves. One of them is to take time to talk with a counselor or mentor, they can help us to think things through, process situations, and help us to realize why we are feeling the way we are feeling. Another option is to stop for a few minutes after we acted a certain way and consider why we behaved that way. What types of factors were involved, were they physical factors (tiered, hungry, etc.), was it the time of year, was it because we were overwhelmed with other things at that moment, was it a specific person? Was this behavior acceptable? Do we have a particular reason for our behavior or an excuse?

We can use a similar process when needing a pick-me-up. Take some time to figure out what factors came together to help you feel upbeat and happy. Then, when we need that little pick-me-up, we can try to pursue some things that seemed to be part of the equation the last time. Maybe we slept well, exercised that morning, then ate healthy, or maybe we checked a few items off our list at work. Try to set yourself up for accomplishment, have a few simple or quick tasks that you can easily complete may be enough to give us a little extra boost. The next time we are happy, angry, excited, or in a funk, we should be willing to take a few minutes and try to figure out why. What are the external and internal things at play that may have set us up to feel this way. Taking a quick moment to get to know ourselves a little better may be just the thing we need to get through the winter times of our life with some positivity and some co-worker appreciation.

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External Organic Carbon Source for BNR

by Herb Fancher, MS and Rick Allen, CEO, GSD, MSU of BioLynceus

What is it?

External organic carbon is a product used by wastewater facilities to enhance biological processes, normally nutrient removal to achieve Discharge Permit requirements. External organic carbon can be anything from Candy Carbon^{*} to methanol. Some of the currently used formulations can have positive and negative aspects. Methanol is widely used, but does have a little bit of a hazardous component; it is flammable, others may be synthetic chemicals and could cause plant upsets. Please note external organic carbon is not inorganic carbon (alkalinity)- which is required and consumed during the wastewater nitrification process (conversion of ammonia to nitrate).

Uses External organic carbon has been used in wastewater applications for:

- Enhancing Denitrification Processes
- Enhancing Phosphorus Uptake (Enhancing Biological Phosphorous Removal/Uptake)

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• Balancing the F:M ratios (Food to Microbe or Biomass (MLSS)

Where else may external organic carbon be needed?

External organic carbon may be used in any wastewater stream (Industrial, Municipal, Animal) that needs additional BOD/COD, Volatile Fatty Acid (VFA) production or organic carbon to achieve permit requirements.

It may also be used in any wastewater stream that is needing more food due to specific processes, low inflow BOD/COD, seasonal use (resorts, septic, etc.) or temporary overdesigned facilities where anticipated inputs have not yet been developed.

Some of the currently used products are:

- Candy Carbon[®]
- Methanol
- Molasses
- Return Activated Sludge (RAS)
- Micro C[™]

- Sugar
- Dog or Pig Food
- Beer Waste
- Acetic Acid
- Raw sewage



Denitrification & Phosphorous Reduction

The above products contain high COD/BOD, and may be biological accessible organic carbon materials.

Denitrification Organic Carbon is required by denitrifying bacteria under anoxic conditions to convert (nitrate) NO3 to (nitrite) NO2 and then nitrogen gas N2. Most engineering designs state that 1.90 grams of methanol or 2.86 grams of COD are required to convert 1 gram of NO3-N to N2 gas. Our experience with Candy Carbon indicates that it takes a lot less of this product to accomplish the same thing. Investigations are underway but currently there is no explanation for this. Studies conducted at small, medium and large facilities show that it works very well.

One important aspect of the denitrification process is that the denitrification zone must be truly anoxic (no free oxygen). If free oxygen is present, the facultative denitrifying bacteria will use this more readily available oxygen source and not consume oxygen from the nitrate and nitrite molecules. It is a waste of money to feed any form of organic carbon to achieve denitrification if the denitrification zone is not anoxic. Anoxic conditions are best measured with an oxidation reduction potential (ORP) meter and usually fall in the range of -100 to +100 mV.

Biological Phosphorous Removal aka "BioP" - In this process Volatile Fatty Acids ([VFAs] a specific type of organic carbon) are required to "feed" the Phosphorous Accumulation Organisms (PAOs) in the anaerobic (no free oxygen or combined oxygen in the form of nitrate, nitrite, sulfate, carbon dioxide, etc.) zone of the treatment plant. When PAOs have VFAs to feed on, the PAOs drop or release phosphorous. When these phosphorous depleted organisms move into the aerated zone of the plant they take up (eat, accumulate, uptake, consume, gobble up) phosphorous, commonly known as luxury phosphorous uptake. These phosphorous engorged bacteria settle out in the clarifier and are removed, along with the phosphorous they consumed, in the waste active sludge (WAS). Facilities should be careful about how this sludge is handled because phosphorous can be released if the conditions become anaerobic. Water returned to the head of the treatment plant from sludge dewatering processes could contain high amounts of phosphorous if the sludge goes anaerobic.



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External Organic Carbon Source for BNR Denitrification & Phosphorous Reduction continued

Improve food to biomass ratio (F:M) When a wastewater treatment plant has a F:M (Food to Microbe) ratio that is too low (facility specific), additional food (organic carbon) is needed to keep the activated sludge (living biomass of waste eating organisms) alive. When the influent BOD/COD (a measurement of the amount organic carbon coming into the wastewater treatment plant) is too low the biomass begins to die. Dying activated sludge does not settle well and could lead to TSS effluent violations. Dead sludge doesn't treat waste material when it does resume coming into the plant. The influent BOD may drop off for several reasons including: the service area population is intermittent (resort areas), there is high seasonal or permanent intrusion and infiltration (I&I), the wastewater treatment facility is over-designed for the current population or use. During these times of low BOD (food) input, the influent can be supplemented with external carbon to keep the biomass alive and ready to digest waste when the influent BOD is back to normal (design) ranges.

Application Rates for external carbon will vary due to the client's desired results, type of waste stream (Industrial or Municipal), flow rates and contact time.

If you are considering the use of external source, there a few things to consider:

- Availability Will the product be available in the quantities you need at the right time? Beer waste, wasted solids, commodities like sugar and molasses may be in short supply.
- Hazards Are there challenges with products being explosive or corrosive?
 - Methanol flammable and may require secondary containment (explosion proof).
 - Acetic Acid may be corrosive and require secondary containment.
 - Special Handling Some products will require special handling and storage.

External carbon sources have been proven to be a costeffective means to achieve your desired results. Contact BioLynceus directly today to receive the best recommended protocols needed for your specific project.

Authored by Herb Fancher, MS and Rick Allen, CEO, GSD, MSU of BioLynceus. If you need more information contact us at 970-586-3391 or by email at sales@biolynceus.com



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Christmas Lights on the Barn! Throwing My Loop ...

When was your best Christmas? I certainly remember mine.

Like it was yesterday. I had experienced some rather trying years back then and let's just say the "Christmas Spirit" hadn't been around for some time. Spent the last few years alone. No gifts exchanged, no Christmas tree, and no Christmas lights. Then something happened. The phone rang, and I said...

"Hello?"

"Dr. Johnson? This is Patsy Bolton. Do you remember me?"

"Certainly I do, Mrs. Bolton. I never forget impressive people."

"Remember when you came to our school and I bought your audio books for my granddaughter?"

I took a deep breath and said to myself, "How could I ever forget that."

On that day, Mrs. Bolton, the Superintendent of Sulphur Springs, Texas ISD had appeared before my booth with an armload of audio CDs.

"My goodness," I said. "Why so many? Are you buying those for the school?"

"No," she said. "I'm buying them for my granddaughter. She's nine years old and she loves audio books. She's blind, you see." Her words slammed into me like a hollow-point. That was the moment in my life when I knew what it must feel like to be shot. The child had "retinoblastoma" and in her case, was left with a family that had to decide to take her eyes because of the cancer or let her die.

"We chose life," said Mrs. Bolton.

"And now on this day," Mrs. Bolton continued, "Of course we have all sorts of presents for Tacey, but when we asked her what she wanted Santa to bring her, she said, 'More than anything else in the world, I wish I could talk to Little Blue on the phone? She has fallen in love with that horse in your book who speaks so rapidly with his speech impediment that prevents him from saying "R's". So we were wondering if it might be possible to "hire" Little Blue to give that precious child a special gift from Santa? Would Blue do that-and what might he "charge" us?"

"Yes, he would, Mrs. Bolton," I said. "But let me suggest something that I think Blue would want to do even more for no charge. Why don't you bring that child to our farm and let her not only talk to Blue...but she could ride him!" Shortly before their arrival, I had a Christmas tree in the den and found myself furiously stringing Christmas lights all over the barn. I was a bit worried when I saw them coming up the lane to the farm because I didn't know exactly what I would do when I met Tacey. She stepped from the back seat holding her grandmother's hand—a beautiful child not deformed from the illness. And her grandmother said, "Here's Michael, dear." She didn't say hello, she didn't giggle, she just looked so intently at me and said, "You know that story you wrote about going to the North Pole and roping on those reindeer with Santa and Mrs. Clause and how you rode those reindeer and they were so warm and fuzzy that you weren't even cold? You 'member that?"

"Yes," I said. "I do."

"Well," she said, "I just want to ask you something, and I want you to tell me true...

...was that real?"

I bent down by her pretty face with my mouth close to her ear and whispered, "Of course it was, you silly child. Do you think I could make something like that up?"

And to the arena we went where Blue, Shine, and Joe Ben were saddled and waiting. I lifted her up onto Blue





by Michael Johnson

and after just a moment, I heard something come from inside her. Soft and low, but I could hear it. It was laughter with joy in it. And then to my surprise, I heard it again. This time it came from Blue.

And round and round we went from one end of the arena to the other, with Tacey laughing all the way. A sunny, crisp, cold, starched shirt of a winter day. Round and round we went. Dusk was coming on when they drove away and the barn lights twinkled on. The thought occurred to me those lights on the barn gave me such joy, and I told Sherry that.

"Me, too," she said.

"But it's funny, you know," I said. "I put the barn lights up for Tacey and Blue—but since Blue never goes around to the front of the barn, he can't see them. And Tacey...well, she can't see them either 'cause...well, 'cause she can't see them."

"Oh, I think they knew they were there," Sherry said, smiling.

Their car lights disappeared from view and we stood there looking at the Christmas barn lights.

"Boy," Sherry said. "We got the Christmas Spirt now, don't we."





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OAWU's 2018 Annual Conference Awards



Based on exceptional accomplishments of an individual during 2017. Criteria for nominee:

- 1. Employer / System of nominee must be an OAWU member.
- 2. Employer / System must be in state compliance.
- 3. Minimum of two years employed with system.
- 4. Demonstrates leadership in dealing with daily utility operations and/or concerns.
- 5. Nominee must be State Certified.

Wastewater operator of the year:

Based on exceptional accomplishments of an individual during 2017. Criteria for nominee:

- 1. Employer / System of nominee must be an OAWU member.
- 2. Employer / System must be in state compliance.
- 3. Minimum of two years employed with system.
- 4. Demonstrates leadership in dealing with daily utility operations and/or concerns.
- 5. Nominee must be State Certified.

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Based on exceptional accomplishments of an individual during 2017. Criteria for nominee:

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- 2. Employer / System must be in state compliance.
- 3. Minimum of two years employed with system.
- 4. Demonstrates leadership in meeting office / system demands.

Nominee's full name:				
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OAWU's mission is to provide service, support, and solutions for Oregon water and wastewater utilities to meet the challenges of today and tomorrow.

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