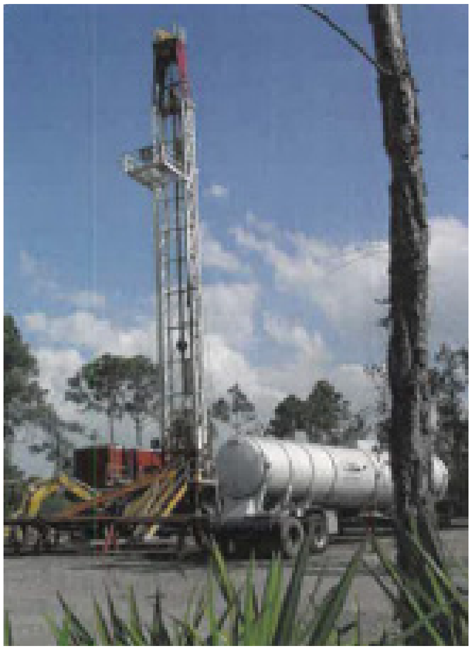
RECOVERY ZONE
SPRING 2022

Tropical Farms Water Treatment Plant

Author: Todd Leyland, Martin County Utilities

In the late 1980s, the need for consolidated centralized water and wastewater treatment facilities became evident for a group of landowners in the area generally known as Tropical Farms, located in the vicinity of 1-95, Florida's Turnpike, and SR 76. These landowners formed the nucleus of a group dedicated to securing centralized treatment services. One option would be a series of small "package-type" treatment systems. As a far better alternative to these non-expendable systems, centralized water and wastewater treatment services developed under the leadership of the Utilities Department would offer service expansion capabilities while being consistent with the Martin County Comprehensive Land Development Plan.

In 1990, Martin County took over the development of the Tropical Farms utility project. Several consulting engineering firms were selected to design, permit, bid, and construct the water and wastewater treatment plants on a 13-acre site secured by the landowners group. The County considered several innovative approaches to treatment in the new Tropical Farms area, and the potential for the facilities to offer services to a larger area than the initial landowner group was an interesting and promising possibility.



At about the same time, an older treatment facility serving the Vista Salerno customer area relied on receiving raw water from a series of surficial aquifer wells. The plant had demonstrated the influence of contamination and the potential to adversely impact adjacent wetlands. The South Florida Water Management District (SFWMD) and Martin County agreed to a reduction in the withdrawal of water from the surficial wells in the Vista Salerno area. The absence of a readily available water supply thus became an issue.

In addition, the County recognized that because the Vista Salerno plant did not provide softened water, the water quality was not as high as that being produced by the North Martin County and Martin Downs systems. In keeping with the Utilities Department's goal to provide all customers with the same high-quality water, the Vista Salerno plant would require costly enhancements to improve the water quality. The possibility of better serving the Vista Salerno customers from the new Tropical Farms plant became a logical opportunity.

Continued on page 3 >

Message From Our President

Greetings SEDA Members,

As I write this last message as president of SEDA, I would like to thank all of the Board members and volunteers who with patience and dedication serve our membership.

I hope all of you are doing well and are ready for the upcoming Hurricane season, despite the ongoing supply chain issues, long lead times and high cost for numerous construction materials and operational costs. As an industry, we need to continue to be resilient, prepare and adapt to maintain the same high levels of service to our customers.

We are in full gear working diligently preparing the upcoming 2022 Spring Symposium in Hutchinson Island scheduled for June 5-8, 2022. Registration is now open here: https://seda.memberclicks.net/2022

I would like to remind you that all applications for the Annual Awards are open; and notify you that the 2022 Annual SEDA Election Ballots will be sent in the next few weeks. We hope that everyone is able to participate in the elections. The new Board members elected will be announced at the Spring Symposium. I hope to see all of you in Hutchinson Island.

I am happy to report that we have a full schedule of training classes and Membrane Operator Certification courses available, as promised, at the beginning of the year.

Visit our website for a full list of the upcoming events: https://www.southeastdesalting.com

It has been an honor, and a great learning experience, to serve as SEDA's president.

Take care and keep up the good work!

Karla V. Berroterán Castellón, Village of Wellington
Water Treatment Facility Superintendent

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The advanced treatment methods of membrane technology required somewhat higher capital and operating costs when compared to conventional treatment means, but these were costs reasonable in light of the superior water quality achieved. The Tropical Farms plant was designed as a membrane treatment facility and would therefore produce very high quality water. The opportunity to support the Vista Salerno area with water produced by Tropical Farms also presented some technical challenges. Interconnecting the two plants relied upon hydraulics for proper functioning, and additional water supply wells had to be located. Properly planning the Tropical Farms operations for higher flows was also required to provide additional treated water to both the Vista Salerno and Tropical Farms areas.

The membrane softening treatment produces a byproduct water called concentrate, which must be disposed. An opportunity to effectively dispose of this byproduct was developed by blending concentrate with advanced treated wastewater for golf course irrigation. The unique blending of these two waters, byproduct and final effluent, also provided the County an avenue to seek additional funding from the SFWMD. The innovative blending qualified the County for the maximum grant for this creative approach.

Reuse of water is an integral aspect of prudent water conservation and is widely practiced by Martin County. Currently, eight golf courses throughout Martin County receive and use advanced treated wastewater or reclaimed water for irrigation purposes.

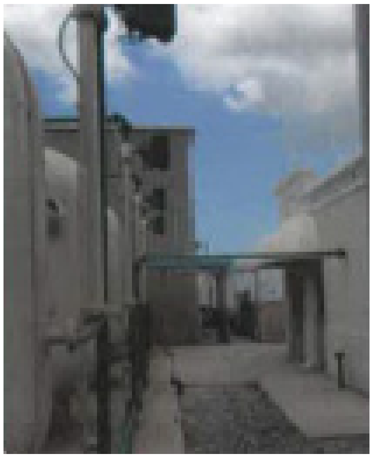
The membrane softening (or nanofiltration (NF)) WTP was released for use by the Department of Environmental Protection on June 3, 1997. Initial system flushing was completed and the treatment system was placed into active service shortly thereafter. The NF facility provided over 1.5 million gallons/day of advanced treatment, superior quality for the Tropical Farms and Vista Salerno area customers. This water, coupled with the water provided by the North Martin County WTP, offers softened water to more than 30,000 people at the time.

The membrane softening facility consisted of the following:

- Ten supply wells from surficial aquifer
- Screened wells ranging from 50 to 120 feet in depth
- Capacities from 150 gpm to 400 gpm each
- All remote operated through radio communication
- Total dissolved solids (TDS) range from 275 to 350 mg/I
- Iron range from 0.1 to 3.5 mg/I
- Acid injection to 6.0 pH
- Anti-sealant injection
- Four horizontal cartridge filters units with 21 five-micron elements each
- Continuous monitoring of flow, conductivity, pH, and pressure

Three NF trains each with the following characteristics:

- Permeate capacity of 0.5 MGD (347 gpm) to 0.6 MGD- 4.7 gpm
- 14 tubes, 25-feet-long each
- 9.5 two-stage array
- 98 40-foot-long membrane elements, 8-foot diameter, with 7 elements per tube
- Horizontal, single-stage stainless steel feedwater pumps with 60-HP motors (3,550 rpm) and variable-frequency drives (VFDs)
- Operating feedwater pressures of 110 psi to 125 psi with first-stage permeate flow control
- Train permeate flow and recovery control by feedwater pump VFD and concentrate control valve, respectively
- Continuous monitoring of conductivity, flow, pressure, and temperature
- Membranes are ESPA3 by Hydranautics
- TDS ranges from 60 mg/I to 110 mg/I; hardness from 15 mg/I to 25 mg/I, and color< 5.0
- Continuous monitoring of pH and conductivity
- One 7-inch diameter degasifier for removal of hydrogen sulfide, carbon dioxide, and THMs
- Two 5,400-cfm blowers, each 25 HP
- Chlorine injection equipment to chlorinate permeate after degasification
- Ammonia injection for chloramine formation
- Sodium hydroxide injection to raise pH of finished product water
- Product clearwell for mixing (76,750 gallon capacity) with two 1,050-gpm vertical turbine transfer pumps (20-HP motors) to storage
- Treatment of concentrate using chlorine injection



Sand Filtration Pretreatment

- Four 12-foot-diameter (installed 2001) multimedia sand filters
- Rated for 0.75 mgd each
- Remove iron and sulfide
- Sand, anthracite, and gravel media
- Treatment of concentrate using chlorine injection
- Treated concentrate blended with treated IQ quality wastewater, pumped to golf course irrigation system
- Two 0.5-million-gallon tanks for finish water storage; future 5.0-MGO tank added

- Tank constructed of pre-stressed reinforced concrete, with interior curtain wall for short-circuiting prevention, inlet standpipe, and outlet vortex breaker
- Continuous monitoring of tank levels
- Four horizontal, split-case high service pumps rated for 3000 gpm with 3,550-rpm motors driven by variable speed drives
- Controls maintain constant distribution pressure to customers
- 800-kW generator provides standby power for all water plant equipment, and starts automatically within 20 seconds of loss of FPL power
- 8,000-gallon diesel fuel storage tank with full 6-inch thick concrete containment wall
- Aluminum enclosure reduces noise of generator and protects generator equipment from weather
- Sodium hydroxide solution (25%) stored in 4,000-gallon high density polyethylene (HDPE) tanks with concrete containment structure
- 300-gallon day tank with five caustic diaphragm metering pumps
- 8,000-gallon HDPE tank provides bulk storage for 93% sulfuric acid, and 300-gallon per day tank provides supply to two acid diaphragm metering pumps
- Anhydrous ammonia gas stored in 1,000-gallon steel storage tank; gas feed to product water clearwell
- Anti-scalant feed through two diaphragm metering pumps and 55-gallon storage tanks
- All liquid chemical storage tanks monitored continuously for tank level

Phase III: Water Treatment Plant (WTP) Processes/Improvements

The existing WTP included a nanofiltration (NF) system supplied by surficial aquifer wells, chlorination, and water storage facilities. The existing facilities included NF, iron treatment (Phase II), and 6 million gallons in ground storage tanks.

General construction requirements of the WTP expansion included installation of two 4.0-MGD reverse osmosis (RO) treatment systems, including new process and control equipment enclosed in a new building sized for 8 MGD. The upgraded RO facilities included four RO trains, a new lab area, a conference room, offices, locker rooms, as well as a generator, electrical room, and bulk acid and scale inhibitor storage. The RO treatment process was installed in two 2.0-MGD skids and the County directly purchased two additional 2.0-MGD skids for a total RO treatment capacity of 8.0 MGD, including five RO pumps. The RO skids are high efficiency units with energy recovery turbines installed between the first and second stage. These energy recovery turbines save operating costs by reducing the horsepower of the feed pumps required to treat the water.

The demolition of the existing water plant facilities included modifying the existing high-service pumps and demolishing the caustic feed system, scrubber system, and chlorine building. A new sodium hypochlorite system utilizing the existing facilities is included and is used in both the water and wastewater plants. The new source water addition includes the addition of five Floridan wells by others. Surficial aquifer water use has been limited by the Florida Water Management District due to its limited availability for supply. These requirements forced Martin County to utilize the deeper brackish water of the Floridan Aquifer, which requires RO treatment.

RO Membrane Treatment

- Four new 2.0-MGD RO trains within an RO Process Building
- New Administration Office Building and Laboratory
- Five Floridan Aquifer wellheads (including pumps, piping, electrical, and controls)
- Pretreatment equipment
- Four horizontal cartridge filters
- Chemical systems, including pumps, tanks, piping, and controls for sulfuric acid, scale inhibitor, chlorine, caustic, and fluoride (not used)
- Modified existing ammonia system to serve new flow
- Post-treatment system (including degasifiers, blowers, scrubber system, concrete clearwell, and transfer pumps)
- Modifications of existing chemical systems and scrubber system
- High-service pump modifications and additions
- Valve and piping
- Electrical, instrumentation, and Supervisory Control and Data Acquisition (SCADA) system
- Paintings and coatings

The existing NF plant remained in operation throughout the project. The primary interface was at the existing clearwell structure which Astaldi added on to handle the additional treated water. Astaldi carefully dowelled reinforcing steel into the clearwell walls for the addition while maintaining the water-tightness of the structure. Once the clearwell addition was completed and the new WTP was cleared for services by the Florida Department of Environmental Protection, plant operators gave Astaldi a three-day window to core into the clearwell tank and connect new piping and transfer pumps.

Through the use of careful and coordinated construction techniques, installation of new equipment in close proximity to vital components of the WTP did not cause any interruption of service at the existing WTP.

Membrane Treatment Technologies Transforming the Florida Department of Environmental Protection Administrative Codes Chapters

Author: Dave MacNevin, PhD PE, CDM & Pierre Vignier, City of Pt St Lucie

Draft revisions of the Florida Administrative Codes Chapters 62-550, 62-555, 62-600, 62-610, 62-625 are available to the public. The revisions include the introduction of indirect and direct potable reuse (IPR and DPR) standards and reclaim discharge reductions. Revised Chapters are a result of the 2021 Clean Waterways Act (Senate Bill 712) for reducing nutrients pollution, and the recent signing of Senate Bill 64 whereas non beneficial reuse of surface water discharges must cease by 2032. Mitigation measures of proposed rules are the start of IPR and DRP implementation as means of recharging aquifers or supplementing tap water.

Action for advanced treated water (ATW) methods in Chapters 62-500 and 62-555 are milestones for the State legislation within a short period since the governor's signing of the new bills. While the wastewater rule change in 62-600 complemented the urgency of redirecting reclaimed for replenishing drinking water resources, a common theme in the proposed drinking water rules is the acceptance of reverse osmosis as a leading technology in eliminating pathogens for advanced treated water.

According to the Potable Reuse Commission of Florida 2020 Framework Report, there are more than a dozen previous and ongoing Florida IPR and DRP pilot studies since 2007. The pilot studies have successfully purified reclaim water that exceed current state drinking water quality regulations. The ATW studies have been a combination of several processes such as membrane bioreactors, reverse osmosis, ultrafiltration, ion exchange, ozone, activated carbon filtration and ultraviolet advanced oxidation.

It is a unique time seeing the Florida legislative branches in action creating new opportunities to protect environment nutrient impacts and reinforcing groundwater replenishment. Florida is outspokenly endorsing IPR along with acknowledging DPR practices soon. This provides additional opportunities and supports those utilities looking to utilize IPR or DPR for diversifying their water supply. For viewing of proposed Florida Administrative Codes, google search "Florida draft rules 62-500, 62-555, 62-600, 62-110, 62-625".

How Not to Drown While Replacing Membrane Elements as a Project Manager

Authors: Pierre Vignier, City of Pt. St. Lucie

Project managing membrane element replacements in an existing plant creates challenges for even the most highly experienced professional operators. The project will impact plant production capacities when the train is out of service, place a strain on the capital budget, and require a great deal of planning before work can commence. Before a replacement project begins it is important to select your team members, identify your goals and estimate your budget. Keep in mind that not all things are inclusive to the train itself. Be sure to consider organizational assets that will help the project be successful, such as procuring office policies for hiring of the consultant, installer/original equipment manufacturer (OEM), and equipment purchases. These undertakings must be carefully selected to take advantage of saving time and properly allocating resources. Managing the seven challenges below will help keep your head above water throughout the process of replacing membrane elements.

Vessel Delivery

Delivery of Rented RO Pilot Testing Unit

The first challenge of the replacement project is planning the budget for selecting and procuring the latest membrane technologies. Newer membrane elements can offer greater square footage per element as well as a variety of flux rates depending upon the element performance. The trade-off for having more square footage is slightly higher feed pressures, therefore it is important to develop key performance indicators to help select appropriate feed pressure, permeate water quality parameters, consider raw water degradation, and plant hydraulics. Membrane element selection options can include relying on software projections, single element testing, and pilot testing. Additionally, municipalities often require competitive bidding for all equipment purchased. Utilizing a desktop selection method comparing performance projections from five to six membrane element suppliers (MES) can determine the best three or so elements to allow for competitive bidding. Quantifying the best elements can be accomplished by renting or buying a pilot testing unit depending on the organization's needs. The pilot testing results will identify the best performing membrane element for a single source supplier and an opportunity to sole source the highest performing membrane elements.

The second challenge is the procurement of the consultant to provide accountability for the project among stakeholders. Knowing how the owner plans to procure membrane elements beforehand saves cost when developing the consultant's scope of work for the request for proposal (RFP). Hiring the consultant should be based on the experience of the firm as well as the professional engineering team assigned to the plant project. Understanding the engineer's approach to replacing membrane elements within the constraints of the organization's budget and schedule is imperative. The RFP includes tasks such as developing bid documents to rent a pilot testing unit, selecting a contractor, developing feed pressure and water quality goals, evaluate plant hydraulics, certifying the train's performance, and providing installation supervision for the upgrades. Where available, systems can also hire an OEM directly or utilize and existing contract for the work.

The third challenge is procuring membrane elements through competitive bidding or direct purchase. Although an owner direct purchase is a win for the municipality affording the opportunity to save state sales tax, it is an increased risk of delivery responsibility that remains with the owner until delivered. Using owner direct purchase, the owner is accountable for coordinating with the membrane element supplier (MES) for all logistics including delivery location, scheduling offloading equipment and staff, materials storage, payment, shipment times, and shipping delays. Also, the owner is responsible for requesting, collecting and coordinating the consultant's review and acceptance of the element's wet test data reports. However, the OEM can purchase the membrane elements and assume all the risk at an increased cost if the organization is not a risk-taking entity. Another membrane element cost saving approach can be evaluating a single element warranty rather than a system performance warranty. Single element warranties can offer lower overall membrane cost for the overall project.

The fourth challenge is the owner and consultant's collaboration in identifying the plant's deficiencies in the membrane element replacement project. The identification process includes the evaluation of all train components and conditions such as the feed pump, VFD equipment, existing leaks, instrumentation and meter calibrations, feed valves, pressure vessels age and remaining lifespan, concentrate valves, permeate valves, concentrate check valves, isolation valves, pressure vessel end cap bearing plates, and pressure vessel end cap sealing assemblies. Although the cost to replace any of these known deficiencies will likely be beyond the project's budget, it is best to mitigate issues prior to membrane element delivery. For example, valves can lose seating capabilities from years of use. Regarding isolation valves and check valves, replacing concentrate valves are a greater priority than replacing permeate valves. Prioritization orders and ranks what is important now and what can wait later when additional budget can be planned.

Unloading of Direct Purchased Membrane Elements


Pilot Testing of Membrane Element Types

Train Unloading of Old Membranes Elements

Unpacking of New Membrane Elements for Installation

The fifth challenge is procuring the OEM services that can be executed as a request for quotation (RFQ). Company experience of similar plant size is important in selection that fits the plant's capacity needs. Previous plant design experience can be of value, although it should not be the limiting choice. One of the consultant's jobs should be developing the OEM bid documents to fit within the project team's objectives. The bid schedule of values should be unit quantities in case item quantities are overlooked or if equipment internals are found to be in disrepair. Another important line item is including a contingency for any unforeseen issues. For example, estimating a time and material rate for an unbudgeted risk can help keep the schedule on track when surprises occur. Careful compromise planning with the procurement department is an effective means in covering risks that appear when an aged system is taken out of service.

The sixth challenge is validating the completed work to the project scope requirements. The consultant can develop standard operating procedures for unloading and loading to clarify project expectations for the OEM. Equally important is identifying a matrix for project teams' acceptance project criteria. For instance, the consultant accepts the wet test data, permeate water quality, feed stage pressures, element changeout and bacteriological clearance. The MES accepts the loading sequence and handling by the OEM. The Chief Operator accepts the train's functionality. The Project Manager ensures that the team is performing as agreed. Integrating these acceptance tasks establishes quality assurance among stakeholders and is good practice because the team can identify issues and assign responsibility for the unknowns that can occur during the unloading and loading process. Issues can range from pressure vessel age conditions, membrane wear conditions, corrosion issues, proper disinfecting methods, fixing leaks, and handling of new membrane elements.

The seventh, and final challenge is closing the project if you have not already drowned. A checklist review of scope requirements helps the team to measure the desired objectives. Ensuring that all punch list outstanding issues are mitigated during the work process will allow the Project Manager to keep the list manageable for a smooth close-out. Developing a lessons learned log should include the wins, losses, and learnings of the project for any other future project management planning. The project is not complete until all final pay applications are paid, final contract paperwork, bonds, and insurance forms are executed. At closeout, letting the team know they are appreciated goes a long way for their honorable effort. If you want to take the membrane replacement challenge task further, finding a resale opportunity for the discarded membrane elements could avoid premature waste and recycle the valued asset to another industry .

Ask The Experts...

Author: Mo Malki, American Water Chemicals

Question:
Can I use citric acid to descale/clean a reverse osmosis (RO) Membrane?

Citric acid is an organic acid that is often used for removal of calcium carbonate scale and is often mistakenly believed to be effective at dissolving iron fouling. It actually has only marginal impact on iron hydroxide deposits, and is very poor at dissolving phosphate salts such as calcium and iron phosphates. It cannot be used to dissolve sulfate, fluoride or silicate scales, and is ineffective for biofilm removal.

Although it is often recommended for organics removal, it can actually worsen membrane performance due to the protonation of the carboxylic acid functional groups in natural organic matter (NOM) - in layman's terms, this means that low pH makes the organic foulants lose their negative charges. Since permeate is always produced during CIP, the lack of repulsive negative charges allows organic foulants to compact, making them more difficult to clean, or even irreversible. For that reason, a high pH cleaning should always be performed ahead of a citric acid cleaning when organics are suspected to be present.

Citric acid is therefore only useful for dissolving calcium carbonate scaling or reversing membrane swelling to "retighten membrane pores" after a high pH cleaning.

Certain anti-caking agents present in citric acid can act as membrane foulants, and it is therefore always safer to use specialty RO CIP chemicals for membrane cleaning. Furthermore, in the United States, citric acid prices have been inflated due to anti-dumping duties imposed on imports, making it similarly priced to higher performing specialty chemicals.

Tech Transfer

Author: Karla Berroteran, City of Wellington

On February 10, 2022, SEDA held a workshop taught by Jim Andersen and Claudio Zuccarelli, both from JLA Geosciences, Inc., entitled "Operation & Maintenance of Raw Water Supply Wells for Membrane Treatment." The workshop was held at the Village of Wellington Water Treatment Facility; and the training class had 32 participants.

First, Jim Andersen provided an overview of Well theory, design, construction, development methods, and standard testing approaches. Then the attendees were divided into groups to be able to cover the hands-on section. The hands-on section was cover by Claudio Zuccarelli. He demonstrated how to properly set-up silt density index (SDI) manifold and the Rossum Sand tester on the Well head and how water quality equipment and Well performance data collection equipment should be set-up at the Well site. All tests were performed on a Well located in the plant site. Attendees were able to perform water quality tests and learn how to use Well performance testing equipment. The attendees were also able to collect data and use the equipment.

All attendees returned to the training room where both instructors spoke about evaluation of Well performance, problem solving, monitoring of data, Well rehab action trigger points, and discussed the results from the field test.

Near the end of the workshop, all attendees were taken on a tour of the Village of Wellington Water Treatment Facility. The tour was given by Karla Berroteran, Wellington's Water Treatment Facility Superintendent.

Workshop sponsored by:

- JLA Geosciences, Inc. and
- Florida Design Drilling Corporation

Field testing: Well performance data collection testing

Well #3, Wellington Water Plant

Field testing Equipment set up overview

Wellington Water Plant grounds to well site testing

Welcome to Our New Members

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TULSI SHUKLA
UNIVERSITY OF CENTRAL FLORIDA

SEE YOU THERE

2022 SEDA Spring Symposium
Hutchinson Island Marriott, Stuart Florida
June 5th – 8th, 2022

SEDA QUIZ

By: Fred Greiner, City of Palm Coast Utility Chief Operator

1. In the membrane treatment process what describes the pore size or rejection capability of a membrane?
   A. Concentration polarization
   B. µmhos/cm
   C. MWCO
   D. SDI

2. If a feed water has high turbidity (>15NTU), which type of hollow fine fiber system should you select in your UF system to avoid clogging?
   A. Outside-in flow
   B. Inside-out flow
   C. Upside-down flow
   D. Perpendicular flow pattern

3. What type of hardness exist when your total hardness exceeds your total alkalinity?
   A. Carbonate hardness only
   B. Non-carbonate hardness only
   C. Carbonate hardness and non-carbonate hardness
   D. None of the above

4. In which zone of the chlorine breakpoint curve does the formation of monochloramine and chlororganics occur?
   A. Zone 1
   B. Zone 2
   C. Zone 3
   D. Zone 4

5. Which of these THM's species are the easiest to remove with adsorption?
   A. Bromoform
   B. Dibromochloromethane
   C. Bromodichloromethane
   D. Chloroform

6. Metallic corrosion in potable water is almost always a result of
   A. a biochemical reaction
   B. a biological reaction
   C. a photosynthetic reaction
   D. an electrochemical reaction

7. Which of these THM's species is the easiest to remove through aeration?
   A. Bromoform
   B. Dibromochloromethane
   C. Bromodichloromethane
   D. Chloroform

8. A circular clearwell has a diameter of 60 feet. How many gallons of water are in the clearwell if the clearwell water level is 12 feet?
   A. 1,014,647 gals
   B. 33,912 gals
   C. 43,200 gals
   D. 253,661 gals

9. What is the detention time (days) for a tank 50 ft. high & 40 ft. diameter & flow is 0.5 MGD?
   A. 1.01 days
   B. 1.17 days
   C. 939 days
   D. 2.42 days

10. The amount of water per foot of drawdown from a well is commonly referred to as:
   A. Specific Capacity
   B. Safe yield
   C. Pumping level
   D. Static level

Answers can be found on the SEDA website at https://seda.memberclicks.net/newsletters

JAWS

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