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Retractable Geomembrane Covers Help Reduce DBPs, Control Algae and Speed Maintenance at California Drinking Water Plants

System upgrades at both Santa Clara Valley and Palmdale Water Districts reduce DBPs and comply with Disinfectants and Disinfection Byproducts Rules. Retractable, geomembrane structurally-supported covers from Geomembrane Technologies Inc.(GTI) reduce algae growth and provide easier access to water treatment systems for maintenance.

by Jim McMahon

Public drinking water systems use varied methods of water treatment to provide safe water for their communities. These systems are selected based on several criteria including the quality of water entering the treatment plant, the quality of finished water desired, the capital investment required and ongoing operational costs needed to maintain these systems. For many drinking water facilities, meeting progressively stricter water quality regulations may require the implementation of newer technologies and treatment practices than what a municipal plant is accustomed to operating. Weighing the options for reducing disinfection byproducts (DBPs) such as trihalomethanes and haloacetic acids, as mandated by the EPA's Disinfectants and Disinfection Byproducts Rules, against the economics and efficiencies of various systems to achieve compliance can be a challenging task for municipal drinking water facilities.

By 2012, EPA regulations will require a higher level of compliance for DBPs in drinking water. This has forced a large number of water districts to shift their water treatment

processes to chloramination, granular activated carbon (GAC) filtration or ozonation to achieve compliance with these DBPs. In conjunction with this is the use of system tank covers to reduce algae growth in process basins, launders and tube settlers. By blocking sunlight that the algae requires, the need for chlorine, chloramines and hypochlorite is reduced, saving money for chemicals and cutting DBP production. The most versatile of these cover designs is the retractable, structurally supported geomembrane cover system by GTI, which provides not only sunlight blockage to reduce algae growth, but facilitates easier access to water treatment processes for maintenance and repairs – a critical factor in systems like GAC contactors that require frequent maintenance.

Santa Clara Valley Water District –
GTI Covers Control Algae Growth in Sedimentation Basins to Reduce DBPs

The Santa Clara Valley Water District is one such community that has embraced system changes to reduce DBPs, and implemented structurally-supported covers to facilitate the process.

This district is the primary water resource agency for Santa Clara County, California, serving approximately 1.8 million people in 15 cities. About 50 percent of the water used in the county originates hundreds of miles away and is delivered through the Sacramento-San Joaquin River Delta . The remaining water comes from local rainfall, much of which is captured in the district's ten local reservoirs. The water utility manages and operates a complex and integrated water supply infrastructure, including dams, reservoirs, pipelines, pump stations, treatment plants and recycled water facilities. Its three water treatment plants produce as much as 180 million gallons of drinking water per day (mgd), serving drinking water to its 1.8 million residents.

Penitencia, is one of two treatment facilities to integrate the use of ozone gas in its water treatment process to reduce the formation of chlorination byproducts and improve drinking water quality.

The Penitencia plant delivers up to 40 million gallons of water per day to 270,000 residential and commercial users, utilizing ozone as the primary disinfectant. Ozone disinfection is more effective than chlorine at inactivating microbial contaminants like Giardia and Cryptosporidium, and when used in place of chlorine can significantly reduce the formation of trihalomethanes (THMs). Prior to the switch to ozonation, the plant used chlorine as its primary and secondary disinfectants.

Penitencia also uses a high-rate sedimentation process with tightly packed tube settlers to increase the rate of sedimentation. But the tubes, which are not very large in size, are particularly prone to algae growth and can become plugged. In the past, this has produced a noticeable degradation in water quality.

"With the change to ozone, the plan was to reduce or eliminate chlorine use at the head of the plant to reduce DBPs," says Angela Cheung, Operations Manager with Santa Clara Valley Water District. "But any attempts in the past to reduce the chlorine feed resulted in algae growth in the sedimentation basins and tube settlers. If we were to continue with a high dose of chlorine up front – to basically cut algae down more than anything else – we would still be creating the disinfection byproducts that we were trying to avoid."

"The solution was to cover the sedimentation basins so we no longer needed to apply chlorine to control algae growth," explains Cheung. "Our first consideration was to use floating covers, but because we needed regular access to the basins for cleaning and maintenance, the floating covers would be somewhat difficult to remove. After staff input, we ended up selecting retractable, structurally-supported geomembrane covers because they are easy to open and close for tank access."

Santa Clara's retractable, structurally-supported cover system was designed, engineered and manufactured by Geomembrane Technologies Inc. (GTI), and consists of a composite sheet of high-strength, UV-protected, coated fabric tensioned across a series of low-profile aluminum arches which span the tank openings. The basin has a total of 18 openings, each 21 x 31 feet in size.

The geomembrane covers consist of a top layer that is a laminated sheet of 30 mil specialty PVC (Ethylene Interpolymer Alloy). It also incorporates a highly specialized weave design that provides maximum strength-to-weight ratios. Since this sheet of geomembrane material is exposed to the sun, it is equipped with advanced UV inhibitors. The material can withstand temperatures from minus 30 degrees F to temperatures as extreme as those in the California desert. This cover has exceptional seam strength, extreme puncture and tear resistance, low thermal expansion and contraction properties, a wide range of chemical resistance, high flexibility, dimensional stability under high loads and temperature fluctuations, and it has NSF 61 certification for potable water applications.

The covers can be quickly detached and easily rolled up along the frame. This gives Penitencia operators easy access to inspect and maintain internal components of the basins. Reattaching the geomembrane covers is quick and easy, making for a time-efficient and safe process. Fabric hatches built right into the covers allow additional access by plant operators without having to retract the covers.

"The first time we rolled back the retractable covers to inspect the sedimentation basins after the cover installation, the tube settlers were clean," continues Cheung. "There was no algae present. This significantly reduces the amount of maintenance required. DBP levels are also down and we are saving money through reduced chlorine feed. We do apply some chlorine, but just to help with the coagulation process. If needed, we can easily cut it back without creating an algae problem in our tube settlers."

The Penitencia plant is saving about $48,000 annually in reduced usage of hypochlorite, compared to chemical expenses before the sedimentary basin covers were installed.

"Our primary focus was to look for ways to cut costs and come up with ideas where we could be more efficient and save the district money," Cheung says. "These structurally-supported basin covers made by GTI definitely fit the plan."

The plant's ozonation process and the implementation of the sedimentation basin covers have reduced the potential for formation of unsafe DBPs. This, and the removal of unpleasant tastes and odors, have significantly improved the quality of the district's drinking water.

Palmdale Water District –

Geomembrane covers for GAC Contactors Facilitate Maintenance

Current EPA standards allow an average system-wide compiled sampling of DBPs to be under 80 ppb. In 2012, each individual site throughout a district's distribution system must be averaged separately for DBP compliance below 80 ppb. For some drinking water producers the use of chloramination to manage DBPs is highly problematic, since successful chloramination requires carefully balancing the chlorine and ammonia ratios. This is a huge challenge for utilities which obtain their supply from surface water and

multiple ground water sources, particularly if their distribution system is a large one requiring many storage tanks and booster pump stations. The logistics involved in monitoring and maintaining the extremely delicate chlorine-to-ammonia ratios throughout a mixed surface-water/well-water system, and the high probability of producing nitrification byproducts makes chloramination a difficult disinfection treatment option. For these water producers, other disinfection options can become more attractive for achieving 2012 compliance for DBPs.

One of these drinking water producers is the Palmdale Water District. Palmdale, California is the fastest growing city in Los Angeles County and the largest desert city in California. The city has grown by 30 percent since 2000, with a current population exceeding 150,000 residents. This rapid growth has put continual pressure on its water district to evolve and expand its drinking water treatment processes. The district maintains a drinking water treatment plant producing 28 mgd, over 345 miles of pipeline, multiple well sites, booster pumping stations, and water storage tanks with a total capacity of over 52 million gallons.

Palmdale receives its water from a combination of surface and groundwater sources. The surface water represents 60 percent of the district's water, and primarily comes from the Sacramento River delta, some 400 miles away, via the California Aqueduct. Additional surface water comes from the local San Gabriel Mountains. Surface water is filtered and disinfected at Palmdale's treatment plant. The district's groundwater is pumped and treated with chlorine before being released into its distribution system. This well water makes up 40 percent of the district's annual production, and is sourced from three separate aquifers.

Because of the district's split surface-water/well-water sourcing, using chloramination to meet the EPA's 2012 guidelines for DBPs was not an ideal option.

"We went in a different direction from most of the water industry to comply with EPA 2012 guidelines," says Peter Thompson, Plant Superintendent for the Palmdale Water District. "We chose not to go with chloramination in our system because we have multiple wells and pump stations. We would have had to very carefully monitor the chlorine to ammonia ratios throughout the system with additions along the way, and that appeared to be a very difficult task. If the ammonia to chlorine ratio is not carefully monitored, nitrogen bacteria can form in the water distribution system which will cause taste and odor problems."

"Also, we had concerns that with chloramination an additional chemical, ammonia, is being added to the process," continues Thompson. "Nothing is being removed from the water, it is just changing the chemical process. We had issues with that based on maintaining water quality. When ammonia is added to the water along with chlorine, it inhibits the formation of the regulated disinfection byproducts. But the nitrogen molecules from the ammonia in chloramination can create additional byproducts within the disinfection process that are as of yet unregulated. There is the potential, however, for these to be researched and regulated by the EPA at some point in the future, which would require a system change for many water producers using chloramination."

For these reasons, Palmdale opted to build eight GAC contactors to act as secondary polishing filters, following primary filtration and hypochlorite disinfection, to not only comply with 2012 DBP guidelines but to provide a strong barrier for EPA compliance well into the future. Also, should the district have any problems with water received from the California Aqueduct, such as with contamination from pesticides or pharmaceuticals, additional technology to remove them would not be needed. This water polishing is excellent for sustaining water quality – the GAC contactors can strip out a wide variety of contaminants, dissolved organics, and taste and odor compounds from the water.

The water district selected a cover system for these large polishing filters, as its finished water was now exposed. A major concern was the need for frequent access to each of the eight contactors as often as every month for backwashing, servicing, cleaning of debris and replacement of the GAC media. Carollo Engineers, an environmental engineering firm specializing in the planning, design and construction of water and wastewater facilities, recommended the use of retractable, structurally-supported covers manufactured by Geomembrane Technologies Inc. (GTI), for installation on the GACs.

"Being experienced with other cover designs, I was concerned that when we needed to access the contactors for backwashing it was going to be a difficult process to open the covers," Thompson explains. "But, it turns out to be a fairly quick and easy two-man job. Five to ten minutes and it is done. Of all the cover systems we looked at, these were the easiest for opening and closing. The beauty of these retractable geomembrane covers is that they are a very simple system to operate."

A critical point in Palmdale's selection of the covers was the ability of GTI's retractable, structurally-supported geomembrane systems to withstand extreme environmental conditions that exist in Palmdale. This area is a desert, extremely dry and receiving only seven inches of rain annually. Temperatures can range from more than 115 degrees F in the summer to less than 10 degrees F in the winter. Gusty winds blow over Palmdale almost every day of the year, so consistently that wind turbines are used to generate electricity, and peak wind speeds of 70 mph are not uncommon.

"At first, the idea of having covers with a fabric material didn't seem like they would hold up very well," Thompson adds. "But, these covers have held up exceptionally well despite the harsh environment they are in. After seeing their performance for almost two years now, with wind and debris hitting them, the extreme temperatures and 300 days a year of relentless sunshine, I have absolutely no concerns over their durability."

GTI's retractable, structurally-supported geomembrane covers are an attractive option for municipal drinking water facilities operating under almost any operational and climatic conditions. UV stabilized with NSF 61 certification, they are designed to last for 15 to 20 years in the field. The first structurally supported cover system applications, installed in 1999 in Louisiana, are still in place and functioning as designed with full structural integrity. The full line of GTI's custom geomembrane cover systems have been installed in hundreds of water and wastewater plants throughout the world.

With the growing need for drinking water plants to upgrade their facilities to accommodate DBP requirements as mandated by the EPA's Disinfectants and Disinfection Byproducts Rules, retractable, structurally-supported geomembrane covers provide an extremely versatile and reliable solution for plant operators.

About Geomembrane Technologies Inc.

Geomembrane Technologies Inc. (GTI) is a world leader in providing innovative and reliable lagoon and tank cover systems, including structurally supported cover systems for potable water . In addition, GTI designs, engineers, fabricates, installs and maintains complete odor control cover systems for companies worldwide. Projects include liners, floating covers, and gas handling cover systems for the agricultural sector, as well as for municipal and industrial wastewater treatment plants.

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Carollo Engineers is an environmental engineering firm specializing in the planning, design and construction of water and wastewater facilities. It can be reached at 3033 North 44th Street, Suite 101, Phoenix, AZ 85018; Phone 800-523-5822; www.carollo.com.

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