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Innovations Edition

THE TOP 12 WATER TECHNOLOGY SITES IN AMERICA

Does Your City Make The List?

Also In This Issue:

Is Deep Drilling For Groundwater The Drought Solution?

W. Virginia Chemical Spill Aftermath: Tightening Tank Regulations

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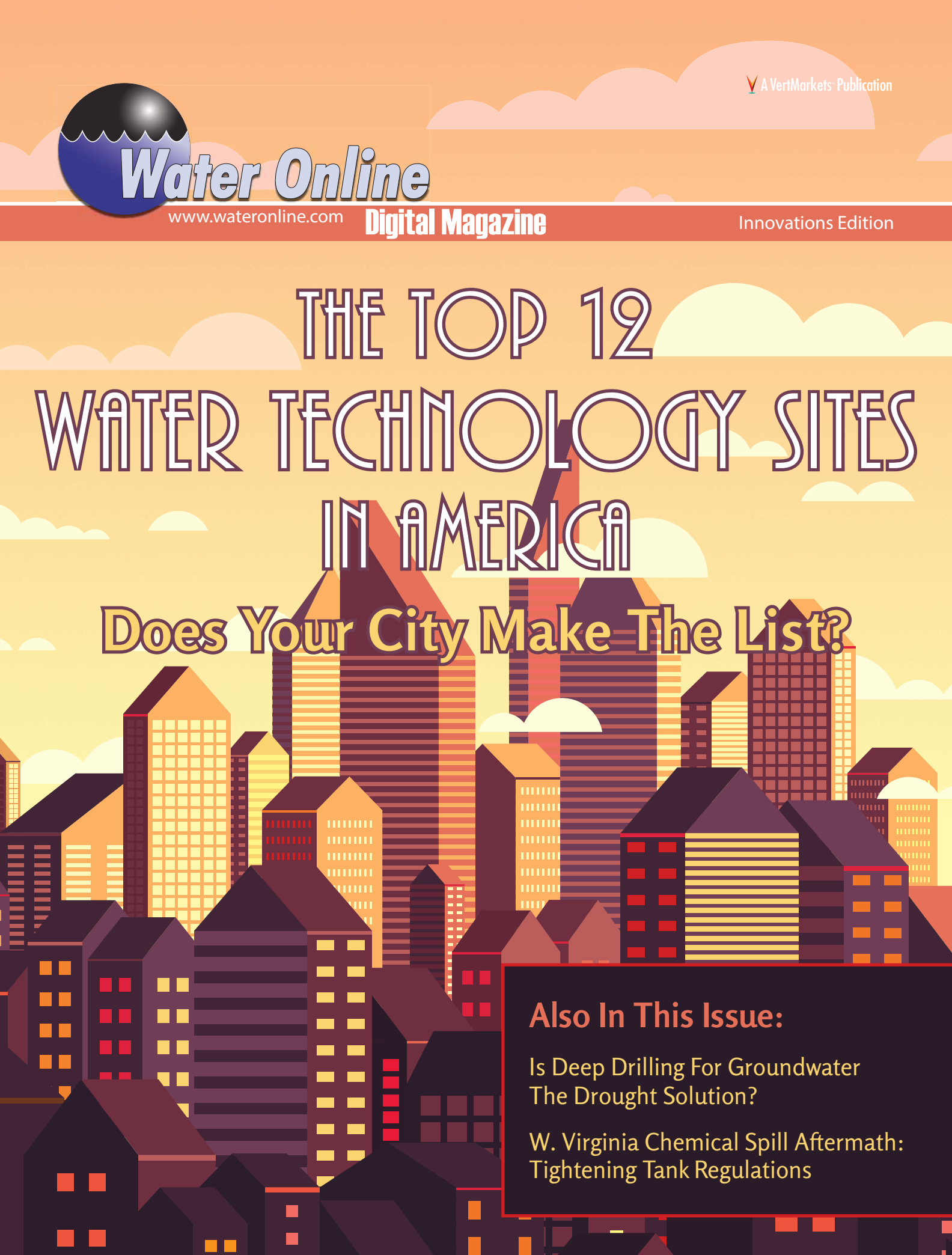

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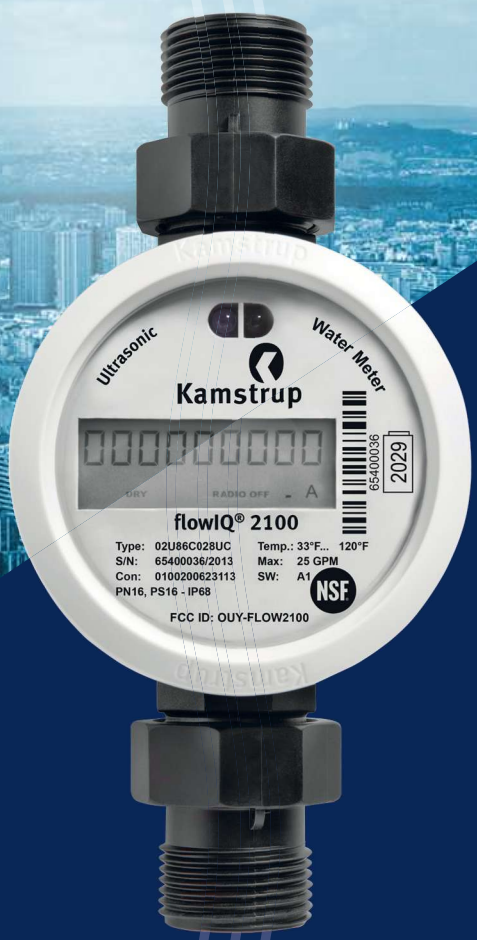

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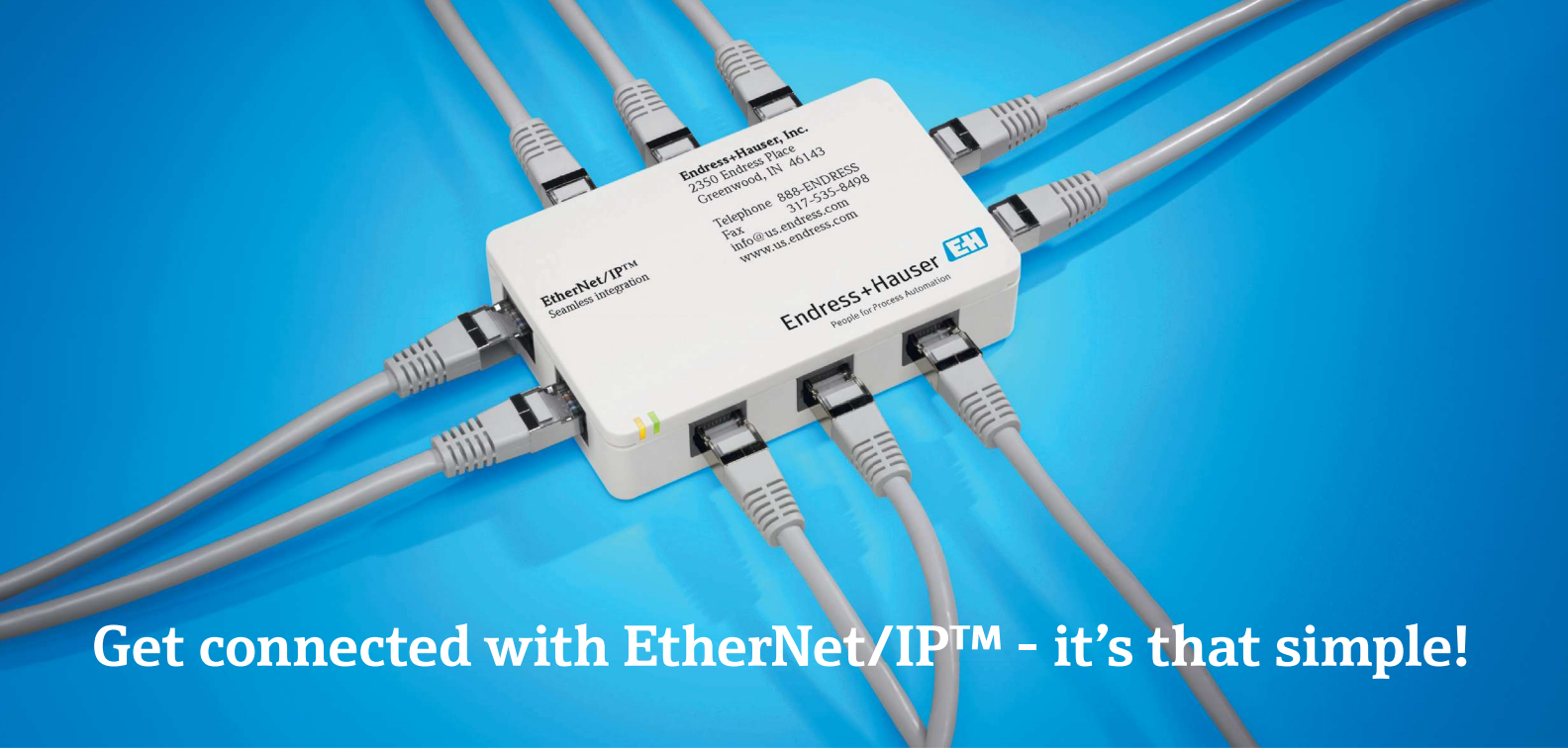

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CONTENTS

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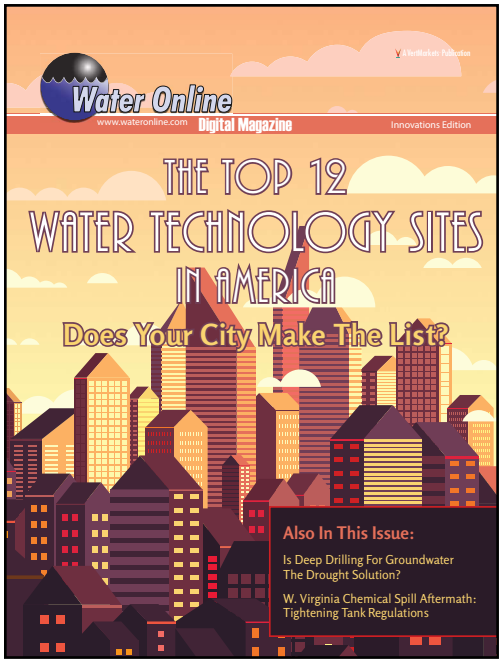

Advertiser Index

Editor's Letter

Feature

Case Study

Legislation

White Paper

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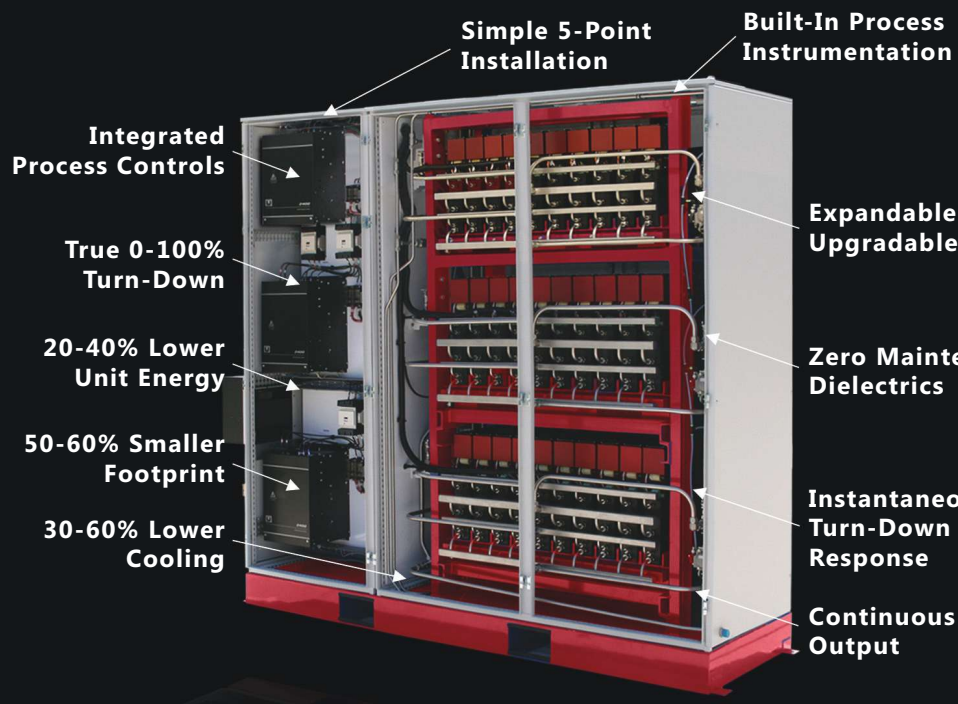

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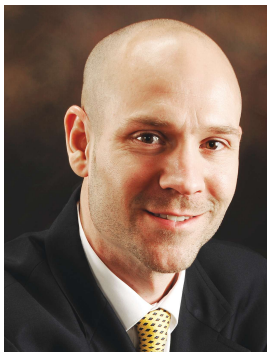

New Standard Applies To Every Water Manager, Everywhere

Innovation can take many forms. In the water and wastewater industry, new and emerging technologies get most of the credit for being innovative and potentially transformative. However, new modes of thinking can have equal and sometimes greater impact.

Importantly, innovative thinking in the form of policy or operational changes often requires little expenditure — at least when compared with treatment plant overhauls, for instance — but it does require an open mind and the courage to diverge from the beaten path.

The Alliance for Water Stewardship (AWS) devoted four years to a concept that may indeed prove to be transformative, though naysayers may call it overly ambitious. The lofty idea, introduced by AWS in April 2014, is a water sustainability standardization and certification process that applies to any water manager around the world — regardless of size, environment, or type of water being handled. The AWS Standard is detailed in a document befitting its scope (188 pages long), put together by an impressive coalition of water organizations and companies that compose AWS. To name just a few of its international members, AWS includes the Water Environment Federation (WEF), the European Water Partnership (EWP), the United Nations Environment Programme (UNEP), The Pacific Institute, The Nature Conservancy, and Water Stewardship Australia — the latter three having founded the organization in 2008.

Though "sustainability" is the stated goal, the underlying mission is to help solve, or at least mitigate, the worsening problem of global water scarcity. AWS cites a U.N. report stating that 47 percent of the world's population will be living in areas of high water stress by 2030. If the existing supply is managed irresponsibly, AWS contends, the situation could lead to millions of people without access to safe water and sanitation, while also sending economies and environmental systems into turmoil.

Instead of sitting back and viewing water scarcity as a purely local issue, AWS took the opposite approach and decided to give the whole world a collective kick in the pants. The result was a common, voluntary standard applicable to all — public, private, municipal, or industrial — those working with clean water, wastewater, or anywhere in between.

"Standard" Requirements

Due to this all-of-the-above approach, the guidelines are necessarily overarching, though they are quite detailed. The AWS Standard is designed to achieve four outcomes: (1) good water governance, (2) sustainable water balance, (3) good water quality status, and (4) healthy status of "important water-related areas" — i.e., "areas of a catchment that, if impaired or lost, would adversely impact the environmental, social, cultural, or economic benefits derived from the catchment in a significant or disproportionate manner."

To gauge performance, a point system was created based on criteria (actions that must be undertaken) and indicators (evidence that the actions were completed). The many criteria and indicators are spread throughout six core tasks: (1) commit, (2) gather and understand, (3) plan, (4) implement, (5) evaluate, and (6) communicate and disclose. Reaching a certain score will certify the participant as a "sustainable water steward." Visit www.allianceforwaterstewardship.org to learn more about the standard and perhaps set a path toward certification.

Of course, as stated at the outset, there are many different forms of innovation. This issue of *Water Online, The Magazine* features four articles, each discussing different situations and all providing solutions that are ahead of the curve. Whether it's a regulatory first, taking a technology farther than ever before (literally) or creating whole communities around water technology, it's all innovation.

When it comes to embracing innovative technologies and concepts — as with the new AWS Standard — participation may vary, but it is highly recommended.

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Innovation Nation: The Top 12 Water Technology Hot Spots In America

By Laura Martin, associate editor, *Water Online*

Milwaukee is known as "Brew City," while steel is Pittsburgh's claim to fame. Tacoma, WA, is the birthplace of Bing Crosby, while Beyoncé calls Houston home. Tucson, AZ, is sunny 85 percent of the time, while Cincinnati experienced one of its snowiest winters this year.

Despite their differences, all of these cities have one big thing in common — they are committed to furthering water technology.

Those six cities, along with Colorado, Michigan, Massachusetts, Nevada, Northeast Ohio, and Central/Southern California, have been identified by the EPA as water technology innovation clusters — regional groupings of businesses, government, research institutions, and other organizations focused on the future of water. It is expected that additional clusters will be identified as water research and technology efforts grow nationwide.

"The Water Technology Innovation Cluster program is a way to solve water problems and create economic opportunities at the same time," said Sally Gutierrez, EPA environmental technology innovation cluster development and support program director. "The idea is to try and leverage the significant and robust assets in each region — like very innovative water utilities, a strong investment network, and significant research organizations."

The cluster focuses particularly on technologies that are sustainable, water- and energy-efficient, cost-effective for the utilities and consumers, address a broad array of contaminants, and improve public health.

Many of the identified clusters have existed for some time, but the EPA didn't begin taking an active role in supporting them until 2010. For now, only water clusters have been identified, but plans to identify other types of environmental technology innovation clusters are in the works.

The cluster program grew out of Cincinnati, where the Southwest Ohio/Northern Kentucky/Southeast Indiana cluster is now based. EPA Cincinnati is one of the largest federal research and development water laboratories in the country with more than 180 laboratories. The rest of the clusters were identified because there are similarly robust water research or water technology business hubs or because they had the potential to become one.

"One of the drivers for selecting the clusters was to look for areas of strength where you could say 'wow, we could really bring innovation to bear here,'" explained Gutierrez. "Many of these efforts are still growing and have been more grass roots, driven by people in the area that really care about their communities."

The clusters are working to tackle a variety of barriers to water technology innovation, including patenting and intellectual property protection, regulatory restrictions, access to research and information about new technology, and funding. Water scarcity, reuse, and water-related agriculture challenges are the focus at many of the Western-based clusters, while the Midwestern and Eastern clusters are more concerned about aging water infrastructure and preventing combined sewer overflows (CSOs).

Despite the different goals each cluster has, all work closely together. "What we are trying to do is build a network of these clusters across the country and invite them to talk to each other and work on common issues," said Gutierrez.

So far, increased communication between technology providers, research organizations, utilities, and investors has been the biggest success of the cluster program.

"End users now have a way to really articulate the kind of technology they need to the organizations that have the ability to make those technologies happen," said Gutierrez. "When you bring everyone working in the water space together, you can do some marvelous things."

Here's a closer look at each of the 12 clusters. This list only includes currently identified clusters and may not include all that are currently working with the EPA cluster program. The list appears in no particular order.

EASTERN U.S. CLUSTERS

Pittsburgh — *Cluster:* *Pittsburgh Water Economy Network*

The Pittsburgh area has always been a mecca for industrial innovation, and today the Water Economy Network is utilizing that strong history to further water. The region has numerous water technology companies — including 173 that provide treatment and remediation products and

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Several Midwestern- and Eastern-based clusters are focused on preventing combined sewer overflows (CSOs).

services and 416 that produce devices and instruments for measurement, control, and security — and several academic institutions with programs focused on water. The cluster's initiatives include supporting water innovation pilot projects, developing training, finding more efficient uses of water for energy and agriculture, and promoting green water management infrastructure.

Massachusetts — *Cluster:* *New England Water Innovation Network*
The New England Water Innovation network, primarily in Massachusetts, is one of the newest clusters to dive into the water innovation space. The state, with some of the most prestigious universities in the country, is known for its innovative efforts across a variety of sectors, but only recently began making a calculated effort to work toward water innovation. Efforts include the Global Water Innovation Network (Global WIN), a new initiative founded by Massachusetts and Israel, which was created to advance the adoption of water technologies in global markets, and the Massachusetts-Israel Innovation Partnership (MIIP) water innovation challenge. The water innovation challenge rewards companies in Massachusetts and Israel for partnering to develop and test devices to help reduce the amount of sewage sludge generated in the treatment of wastewater.

MIDWEST U.S. CLUSTERS

Cincinnati • SW Ohio • N Kentucky • SE Indiana
Cluster: *Confluence Water Technology Innovation Cluster*
The water cluster that spearheaded the cluster program, Confluence, based in Cincinnati, is dedicated to the core concepts the EPA cluster program is all about — identifying, testing, developing, and commercializing innovative technologies that solve water challenges and create jobs. The cluster focuses particularly on technologies that are sustainable, water- and energy-efficient, cost-effective for the utilities and consumers, address a broad array of contaminants, and improve public health. To facilitate this, the Confluence cluster hosts an annual water symposium, which brings together leaders from the water industry, government, and universities, to network and share perspectives on regional, national, and global water challenges.

NE Ohio — *Cluster:* *NorTech*
In Northeast Ohio, the water innovation cluster is the result of a larger technology initiative. NorTech, a technology-focused group that works to accelerate the pace of innovation in Northeast Ohio, recently moved into the water space. They are focusing specifically on developing technologies to address water contaminants generated by industrial water cleaning and treatment, hydraulic fracturing, CSOs, and stormwater runoff. NorTech is also targeting specific water sectors for growth and job creation. They have determined that the most promising technologies needed in the water space are automation and control, sorbents, and water system corrosion protection. Together, the three sectors have the potential to create 3,510 jobs by 2019.

Milwaukee — *Cluster:* *Milwaukee Water Council*
Milwaukee is home to more than 150 water technology companies including A. O. Smith, Badger Meter, Kohler, Pentair, Siemens, and Veolia. In addition to water businesses, there are numerous academic institutions focused on water research in the area including the University of Wisconsin-Milwaukee School of Freshwater Sciences (the first of its kind in the nation) and the Institute for Water Business program at the University of Wisconsin-Whitewater. There are more than 100 academic scientists and researchers focused on water solutions throughout Milwaukee and the surrounding area, with emphasis placed on stormwater management, extracting renewable energy from waste products, and mitigating and adapting to climate change. To further leverage these efforts, the Milwaukee Water Council created the Global Water Center, which houses water-related research facilities for universities, existing water-related companies, and new emerging water-related companies.

Michigan — *Cluster:* *Michigan Water Technologies Initiative*
In the heart of the Great Lakes region, water is a top priority in Michigan. The Michigan Economic Development Corporation launched the Michigan Water Technologies Cluster Initiative (MWTCI) to more effectively coordinate and leverage the state's existing water assets. These include, in addition to an abundance of freshwater, extensive university expertise, research and development capabilities, manufacturing expertise, and environmental leadership. Nearly every major university in Michigan is involved with the water cluster, along with the governor's office, the Michigan Department of Environmental Quality, the Michigan Department of Agriculture, and industry experts like Siemens Water Technologies, which has an office in Holland, MI. Michigan is also involved with water innovation on a global scale. Former Governor Jennifer Granholm visited with business leaders in water treatment technology in both Israel and Jordan to discuss partnerships with the state. As a result, Detroit and Farmington Hills partnered with the Israeli company Miya for demonstration projects to lower energy costs by reducing water loss caused by aging infrastructure.

SOUTHWEST U.S. CLUSTERS

Tucson, AZ — *Cluster:* *Southwest Water Cluster Initiative*


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The University of Arizona in Tucson, AZ, is spearheading the Southwest Water Cluster. The college is home to multiple research centers dedicated to environmental sustainability and water quality. They are collaborating with Pima County on a plan that will enable the regional wastewater reclamation department to meet regulatory requirements while protecting the county's environment and water supplies. The university is also home to a water sustainability program which aims to educate children and college students on water issues, foster a skilled workforce, and strengthen relationships across disciplines within the University of Arizona to spur more interdisciplinary solutions to real-world problems.

Houston — *Cluster:* *SURGE Accelerator*
Houston is home to SURGE, a program that supplies start-ups with a small amount of seed capital and access to substantial program benefits in return for a small amount of equity. They've been primarily focused on the energy industry, but recently identified that the energy industry can alleviate or exacerbate the issue of water shortage. They are taking a "holistic" viewpoint and grouping energy and water into one sector. This initiative has caused the EPA to identify them as a water innovation cluster, as they invest in both the future of water technology and energy.

Colorado — *Cluster:* *Colorado Water Innovation Cluster*
Colorado has a thriving agricultural community, growing energy and oil and gas sectors, and extensive urban infrastructure. Accommodating every sector requires water, and lots of it. That's why the Colorado Water Innovation Cluster (CWIC) has a strong focus on net zero water planning. Similar to the concept of net zero energy, net zero water aims to achieve total water neutrality. This is done by reducing water use as much as possible, maximizing water reuse and recycling on-site, increasing on-site rain capture, minimizing the impacts of stormwater runoff by reducing impervious areas, and generating markets for water quantity and quality trading credits similar to those used in energy industry. The CWIC hopes to be a national leader in net zero water planning and has enlisted engineers, sustainability planners, landscape and irrigation designers, and others to work toward this goal.

Nevada — *Cluster:* *Nevada Center of Excellence in Water*
In Nevada, water innovation is a collaborative effort. The Nevada System of Higher Education; the Department of Employment, Training, and Rehabilitation; the Nevada Governor's Office of Economic Development; the Southern Nevada Water Authority; and IBM have joined forces to create Centers of Excellence (COEs), which support innovation and economic development. The first COE is focused on water — specifically water resource management and Big Data analytics, and will utilize IBM's cloud infrastructure systems for predictive analytics. The team hopes to position Nevada as a national leader in water resource sustainability and management.

Currently there are 12 water technology innovation clusters in the U.S. While they all share the common goal of identifying, testing, developing, and commercializing innovative technologies, each is also working to address their individual regional water challenges.

WESTERN/NORTHWEST U.S. CLUSTERS

Tacoma, WA — *Cluster:* *Urban Waters*
The Tacoma area has a high population; large industrial, commercial, residential, and recreational areas; and 38 miles of waterfront. The goal of Urban Waters is to serve all of the sectors in Tacoma, WA, while still maintaining the health of their water landscape. So far they have invested more than $460 million in environmental cleanup, restoration, and mitigation; opened the Leadership in Energy and Environmental Design Platinum Center for Urban Waters; and created four habitat mitigation sites across 22 acres of aquatic habitat. Future plans include reducing contaminants of concern in stormwater runoff by 40 to 80 percent and developing shoreline habitats along once contaminated areas.

Central and Southern California — *Cluster:* *BlueTech*
The Blue Tech Alliance, a nonprofit organization focused on facilitating investment opportunities in sectors where water and wastewater technologies play a critical role, is a large part of the water innovation effort in California. The organization is actively working to bring water and wastewater technologies to the market in the energy, agriculture, urban planning, manufacturing, and health sectors. The International Center for Water Technology and the Center for Irrigation Technology at California State University in Fresno have also been leading the way in water and fluid science technology and research and development for decades.

Think your area has what it takes to be identified as a water innovation cluster by the EPA? Interested in getting involved in a local cluster? Learn how at www2.epa.gov/clusters-program. ■

Laura Martin is the associate editor for Water Online. She is responsible for creating and managing engaging and relevant content on a variety of water and wastewater industry topics. Her background is in print and digital journalism, and she has a bachelor's degree in journalism from Michigan State University. She can be reached at lmartin@wateronline.com.

What Drought? Deep Drilling For Groundwater Yields Rewards

The Utah Water District took a unique approach to discover new water for a rising population, with better-than-expected results.

By Dr. David E. Hansen

Utah, like many arid Western states, depends upon winter snow accumulations and surface water storage for much of its water supply. However, groundwater has also been a very significant portion of sustainable yields for many communities and suppliers.

To meet growing demands, the Central Utah Water Conservancy District (CUWCD) has taken a progressive step forward to acquire and develop significant groundwater rights within Utah County. The process started in 2005 when CUWCD purchased and received state approval to utilize in excess of 42,000 acre-feet of groundwater rights historically associated with the former site of Geneva Steel Mill in Vineyard, UT, next to Utah Lake and 30 miles south of Salt Lake City. The existing water rights and wells (23 total on-site wells) had furnished water for the steel mill for more than 60 years.

Finding A Solution

Because existing industrial wells were failing, shallow, or not constructed to meet current drinking water standards, CUWCD developed and implemented an aggressive plan to plug all 23 existing wells and to drill 14 new deep, large-diameter wells to meet anticipated growth demands. In January 2011, CUWCD contracted with the engineering firm Hansen, Allen & Luce, Inc. (HAL), a Salt Lake City-based civil and water resource engineering firm, to assist them with the project. HAL's contract included the groundwater evaluation, design, and construction oversight of two deep triple-nested piezometer monitoring wells, five production wells, and two well pump stations.

Well #12 at sunset

Each production well was anticipated by CUWCD and HAL to yield approximately 3,500 gpm. Following the evaluation and design, a well drilling contract was entered into in September 2011 with Hydro Resources of Fort Lupton, CO, to complete the wells. Hydro completed construction on the fifth well in October 2013. Widdison Turbine Service of Draper, UT, is completing well development under contract with Hydro using the dual-swab while pumping development technique.

To date, four of the five wells have been fully developed and tested (work on the remaining well is scheduled for completion in August 2014). The owner and the engineer were both pleased to learn that the wells tested to date are capable of producing nearly double the original flow estimate.

"In all instances, the wells have exceeded our design estimate in terms of production," said KC Shaw, the project manager with CUWCD. In fact, each well is good for about 6,000 gpm.

HAL is not aware of any other Utah project that matches this one in overall scope. This is believed to be the largest single groundwater development project of its type ever undertaken in the state.

Completing The Job

As required in the specification, Hydro used the flooded-reverse rotary drilling method, using one of their Challenger 320 drilling rigs. This drilling method has been found locally to be preferred to maintain a stable borehole and reduce development time in the unconsolidated materials typical of the area, including interspersed clay, silt,

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Well #14 installation of surface conductor casing

sand, gravel, and large cobbles. Aquifers in the area that have historically been identified and developed include the Shallow Unconfined Aquifer (0 to 50' below ground surface [bgs]), the Shallow Confined Aquifer (100 to 200' bgs), the Intermediate Confined Aquifer (275 to 425' bgs), and the Deep Confined Aquifer (620 to 1,100' bgs), each separated by significant clay zones. The confined aquifers are most often developed for culinary water supplies due to their depth, production capacity, and protection against surface contamination. During exploration it was found that a significant, previously unexplored aquifer was found at depths exceeding 1,400', separated from the Deep Confined Aquifer by 100 to 200' of clay. This lower aquifer was named the Basement Aquifer to distinguish it from those previously identified.

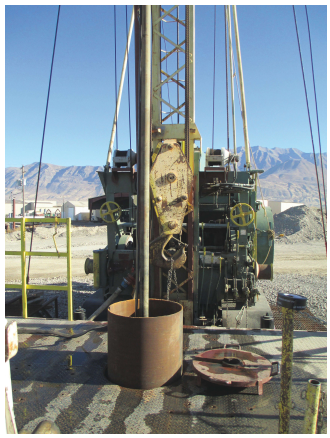
The three main aquifers encountered below 100' are in many instances under artesian pressure and created some drilling bit and mud challenges for the driller.

A great deal was learned about the required mud program and the best bit to use during drilling of the first well. A mill tooth bit designed for medium formations, clays, and gravel was initially used, but it was quickly learned that the coarse materials encountered were not uniform in nature, resulting in early failure of mill tooth bits. Each bit would last only 400'. It wasn't until Hydro switched to long-toothed, carbide-tipped button bits that they found they could move through several thousand feet with a single bit. Even with the lessons learned, completion of the project was a challenge due to varying conditions at each well site.

Each well drilled included a 54" borehole with a 48" surface casing set to a depth of about 80' and a 45" borehole with a 36" intermediate casing set to a depth of about 300' bgs. A 32" borehole was then drilled to the target depth wherein a 24" well screen and casing was set. The wells are separated by about 2,500 to 3,000' to minimize potential interference.

New Challenges

In spite of the efforts required to oversee and control the mud program, lost circulation was an issue that required careful attention. Drilling in flowing artesian conditions requires a proper weight of drilling mud. If it is not heavy enough, then pressures encountered within the formation overcome the weight of the fluid, resulting in a flowing well with possible well collapse. If muds are too heavy then drilling muds go out into the formation. To overcome these issues drillers often attempt to use lost circulation materials (LCM), which are designed to plug the aquifer and prevent the dispersion of drilling fluids. Some drillers have historically used sawdust, hulls, or similar LCM to stop the loss of muds into the formation. Utah regulations for well drillers specifically state that "organic substances shall not be introduced into the well or borehole during drilling or construction." The state does, however, allow the use of acid-soluble calcium carbonate fiber LCM that can be dissolved and removed from the well.


Well #14 development

"We were reluctant to allow use of LCM in the drilling because our experience, and our consultant's experience, has been that that's a difficult thing to be able to get out," Shaw said. "But the zones were so porous that it was very challenging to drill through those without the use of LCM."

After losing a large amount of mud to a porous zone in one of the holes, Hydro, CUWCD, and HAL met to discuss the issue and worked together to develop a fluids program that allowed an acid-soluble LCM to be used downhole. This program minimized its use by allowing it to be used only when porous zones were encountered that required stabilization. The acceptable use of these materials required the contractor to develop and implement a very controlled development method that would remove, with verification, the LCM from the aquifers.

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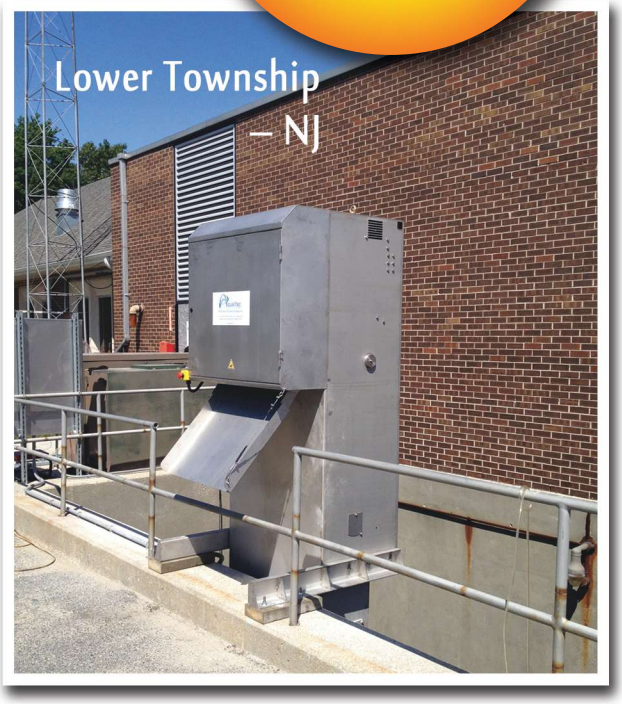

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Stainless steel well screen *(Photo Credit: Johnson Screens)*

Million-Dollar Results

It is believed that the deepest of the wells, at just over 1,630', set a new state record for the depth of a 24" culinary well. That well uses a Roscoe Moss louvered screen, which Hydro used on three of the five wells drilled. The other two wells used stainless steel wire-wrapped screens from Johnson Screens shown in the image above. The screens shown on the right and left are heavy duty screens developed for other projects. The screen shown in the middle is the screen developed specifically for CUWCD's project.

In a discussion with Johnson Screens, special consideration was required to ensure adequate tensile and collapse strength for the anticipated installation depths. Johnson Screens also indicated that square rods were used in lieu of the round rods typical of their design to gain strength, and that a new method of welding the vertical rods to the end fittings was developed for this project. When tested, this new method provided full tensile rod strength, a feat that had not previously been achieved. The tested tensile strength for the screen was more than 200,000 lbs, well over the calculated string weight of 164,100 lbs.

Tying It All Together

CUWCD's new wells will supply water for the $325 million water development project that includes the use and blending of treated surface water, over 20 miles of large diameter (36" to 60") pipeline with daily flow rates ranging from 21,050 to 56,700 gpm, a 40-million gallon water storage reservoir, water treatment plant upgrades, pump stations, and well houses. When complete, the project is expected to provide water to more than 225,000 people living in Utah and Salt Lake Counties.

Welding the well screen

The well project designed for CUWCD sits on the former site of the Geneva Steel Mill. The mill opened in the 1940s but closed permanently in 2002 following bankruptcy action. Groundwater rights equaling 43,400 acre-feet per year used for this project were purchased in 2005 from the company in liquidation for $88.5 million. Those rights, combined with previously purchased rights, formed the basis of this project. The Geneva water rights came with almost two dozen existing wells ranging from 160 to 1,300'. Those wells underwent geophysical analysis and video logging to investigate their condition.

"In the end, [we] determined that we couldn't rehab them; we had to plug them all and then drill new wells," Shaw said. "But it did provide us with a wealth of information about what to expect. We felt very confident in not only the water quality, but the water quantity and availability after doing all that work."

Well #14 framed by Mount Timpanogos

HAL engineers attribute the success of the wells to a client that was willing to go the extra mile exploring previously untapped aquifer zones to depths exceeding 1,600' (400 to 500' deeper than other known large-diameter production wells in the state), to efficient on-site observation and coordination, to a well driller who paid attention to detail and worked to make things right, and to the well development contractor Widdison Turbine Service who efficiently developed each source.

The historic and unique project has been a success. All involved — the owner, the engineer, the driller, and the consumer — have all come out winners. ■

***Dr. David Hansen**, a principal of Hansen, Allen & Luce, Inc., has more than 30 years' experience in the management of water-related engineering studies and design projects. Hansen has a B.S.C.E. degree from the University of Utah, and an M.S. degree in civil and environmental engineering and a Ph.D. degree in fluid mechanics and hydraulics from Utah State University.*

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Freedom Industries Fallout: Tightening Water Regulations For Aboveground Storage Tanks

Five months after leaked chemicals contaminated the public water supply, West Virginia passed legislation to prevent future tank failures – and perhaps serve as a model for others.

By Yves Pollart

As the cold snap intensified this winter in West Virginia, chemicals began silently leaking through a small, 1" hole in a steel aboveground storage tank (AST) near Charleston, WV, in early January. From its source, the fluid streamed into the Elk River, part of the water source for the city's public water supply. More than 300,000 residents were affected by the incident, losing access to potable water for almost a month.

Following that situation, the West Virginia state leadership finalized a bill in April designed to tighten regulations on aboveground storage tanks and protect public water supplies from possible contamination. The law went into effect in early June, with guidelines exploring the process details released by the West Virginia Department of Environmental Protection (WVDEP) in early July.

Cold weather often contributes to deteriorating tank conditions.

What Happened?

Within the crude fluid that leaked was 4-methylcyclohexane methanol, known as MCHM. The chemical is used to separate, then clean coal products in a process known as froth flotation. Freedom Industries, owner of the storage tank, was acting as a middleman by storing chemicals and then selling them to coal companies for use in their processes.

Estimates of the number of gallons released range from 4,000 to 10,000. The aboveground storage tank was about 1.5 miles north of the Charleston water treatment plant, which provides water to parts of nine counties in the southwestern region of West Virginia. Showering, drinking, and cooking with tap water were banned for a few weeks while the treatment plant worked to provide purified water.

Where The Incident Led

Within a few days, a West Virginia senator introduced Senate Bill 373, outlining steps such as registration, signage, reporting, and inspection for aboveground storage tanks. The bill also contains a section detailing protection of public and private water supplies through expanded reporting of possible contaminants.

Both the Senate and the House of Representatives, after adding more than 100 amendments, eventually passed the bill by early March. Governor Earl Tomblin signed it into law April 1, and the statute took effect June 6, 2014.

Large Quantity Users

The first part of the bill amends the Water Resources Protection and Management Act, originally passed in 2004 and amended in 2008. The act details gathering information on the volume and intended use of surface water and groundwater resources throughout West Virginia. Previous amendments added requirements for water utilities to develop a water resources management plan. This act now maintains that large-quantity users will report monthly water withdrawals for the previous calendar year. The legislature redefined a large-

quantity user as any entity withdrawing more than 350,000 gallons of water in any 30-day period from the state's water supply (previously it was more than 75,000 gallons in a calendar month). Currently, there is only one large-quantity utility user in the state of West Virginia.

Although this amendment requires further detail, it is likely that large public, industry, or energy users of state waters already provided such reporting under other regulatory standards.

How far will storage tank regulations extend?

Aboveground Storage Tank Act

The Aboveground Storage Tank Act (ASTA) makes up the bulk of the new regulation. The legislators define such a tank as holding more than 1,320 gallons of fluid with at least 90 percent of the storage above ground level. Tanks can be made of a variety of materials, and the ruling applies to both stationary and some mobile tanks — those remaining in one location for more than 60 days. Associated piping (aboveground or below it) will also be regulated under this rule; WVDEP can amend existing site permits to include these new tank regulations. The legislation does provide an exemption for "process vessels," which notably includes sewage treatment tanks.

Tanks can be made of a variety of materials, and the ruling applies to both stationary and some mobile tanks – those remaining in one location for more than 60 days.

ASTA requires owners and operators to register any existing tanks by Oct. 1, 2014, whether they are operational or not. The registration will include ownership, installation date, volume, capacity, type of fluid stored within, identification, and location of the nearest groundwater public water supply or surface water intake (which will be provided by WVDEP). If the tank is already regulated by another program in West Virginia, this information should be noted as well. Those registering ASTs must place signs on them detailing emergency contact numbers and identifying registration information. Owners and operators are also responsible for providing financial documentation to the WVDEP showing their ability to cover the cost of any possible environmental liability. Further details of the ASTA include requirements for a spill-prevention response plan, a leak-detection system, corrective-action plans, annual inspections by qualified personnel, and notice to public water systems.

A permitting program will also be installed by the WVDEP for existing and newly built ASTs, to be finalized in 2015. The permit will include details such as design, construction, maintenance, leak detection, corrosion detection, and secondary containment. Also part of the permit requirements will be an inventory control system, regular tank testing, immediate reporting of any leaks, and remediation plans following closure. All tanks will require inspection and certification by a licensed professional engineer by Jan. 1, 2015. The WVDEP is able to assess fees to provide

Tank Registration

The WVDEP (West Virginia Department of Environmental Protection) announced on May 28 that tank owners who do not already use the agency's online electronic submission system should sign up for access immediately. The stringent security approvals involved to validate and authorize those registering online is time-consuming.

The WVDEP is also working to revise its Electronic Submission System to accept tank registrations online for easy collection, storage, and access.

Tank owners should visit **www.dep.wv.gov/tanks** for requirements, deadlines, and other details. The site also includes a survey to identify if tank owners need to register their tank(s), as well as frequently asked questions.

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Any potential source of significant contamination – not just fluids, but any type of compound with the possibility of contaminating the public water supply – falls under this new act.

for the administration of these regulations, and failure to comply could result in civil and criminal penalties, and/or up to $25,000 per day in fines.

S.B. 373 does include the caveat that aboveground storage tanks already falling under other permits, such as general permits for oil and gas operations, will likely be waived from the new permitting. However, this waiver will not apply to registration, signage, and notification of nearby public water sources. The WVDEP may also include other permit waivers as it develops the specific guidelines.

Serene settings can quickly become disaster areas in the event of a chemical spill.

Public Water Supply Protection Act

Although some aboveground storage tanks might not require additional permitting, if they are located in a newly defined zone of critical concern as part of the Public Water Supply Protection Act (PWSPA), no such waivers will apply.

The last part of S.B. 373 outlines these zones as one-quarter mile downstream from any public water intakes, as well as any sites upstream of an intake at a distance defined by the time it takes water to travel 5 hours (plus 1,000' measured horizontally from the stream bank and 500' from any tributary streams). The WVDEP is responsible for defining the zones.

Any potential source of significant contamination — not just fluids, but any type of compound with the possibility of contaminating the public water supply — falls under this new act. All of these possible contaminants must be registered by Oct. 1, 2014, whether they are from a facility or activity storing, using, or producing such fluids or compounds. Regardless of how the potential contaminate is stored, it will require an individual National Pollutant Discharge Elimination System (NPDES) permit. For those possible contaminant sources that are already permitted under another program, the WVDEP may decide to waive the new, additional permit. Presence of such possible contaminants must be communicated to local governments (municipality and county) and companies providing public water within the same zone of critical concern, with details such as the operator or owner's pollution-avoidance and spill-response plans.

What To Do Now

For any companies with aboveground storage tanks or possible contaminants, the first step is to find out from the WVDEP if your facilities are located within a zone of critical concern. If so, be sure to register the substance with the WVDEP by the early fall.

Also make a point to register any aboveground storage tanks with the WVDEP by October — registration opened on June 10 — as well as add the appropriate signage. If you haven't already, consider researching (through a consultant, if necessary) the development of spill-prevention and protection plans, leak-notification systems, and inventory-control programs.

The WVDEP will likely release draft guidelines detailing standard practices, inspection requirements, and permitting outlines in the summer of 2014 for review and comment. Companies should watch the developments closely and stay abreast of potential impacts. ■

*As vice president, **Yves Pollart** is responsible for overseeing RETTEW's water treatment and safety consulting services. He has nearly 35 years of industrial and municipal wastewater treatment experience including water and oil separation, filtration, chemical and physical treatment, and sludge dewatering.*

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Evaporation Retardation – Helping Surface Supplies Stay Put

Are chemical evaporative retardants a good method to prevent losses from reservoirs?

By Charlie Anderson

Water is the universal solvent and the underpinning of developed economies — a precious resource that we literally can't live without.

Water use trends indicate that less is being used now than in 1975. According to a 2009 United States Geological Survey report[1], for the first time in decades, the total water use (in 2005) was lower than it was in 1975, and per-capita water use was lower in 2005 than it has been since the 1950s. Much of this reduced use is due to better awareness of the need to manage water resources more effectively, implementing water conservation measures, improved technology, and legislatively mandated low-water-use fixtures in new construction.

Yet that is not the end of the water resources story; water resource professionals still face more stressing news and issues. Even with more awareness and best conservation practices, water resource management remains a hot topic due to the fact that water is a limited resource and mounting pressure from population increases. For a variety of reasons, the U.S. population is migrating away from water-rich states to states in the arid and semiarid Sun Belt and Southwest. A recently published American Water Works Association (AWWA) report[2] surveyed 485 utilities from zero to 5,000 connections to those with more than 150,000 connections. The reporting utilities were 90 percent public and 10 percent private. The report showed drought and periodic water shortages as the eighth most-important issue facing water professionals.

As evidenced by a 2009 USGS report, water sector professionals have done a good job of implementing sustainable practices, triple-bottom-line business models, sound science and engineering practices, water conservation rate structures, and water efficiency and conservation measures to better preserve water resources.

So the question is: Do we have any other tools in our toolbox to help improve our water resource management and preservation? The answer is … maybe.

What constitutes the maybe? One significant area of water loss for utilities that depend on surface supplies is evaporation. Yet little has been done to provide a good repeatable, sustainable way to retard evaporative losses in surface supplies.

In a recent *AWWA Journal* paper[3], the Southern Nevada Water Authority (SNWA) reported on the performance of a proprietary monomolecular evaporative suppressant composed of a mixture of steryl and cetyl alcohols and calcium hydroxide. When applied as a dry powder to water surfaces, the chemical quickly disperses and spreads on the surface, forming a monolayer film, which has been shown to retard evaporation. Although the journal article was not conclusive about the potential for large-scale use of similar evaporative retardants, it did report several key and promising findings. First, it indicated that the monolayer evaporative suppressant tested in controlled evaporation pans saved water when compared to a control with no evaporative chemical. Treatment containers averaged 30 percent less evaporative loss, and they ranged from 18 to more than 51 percent reduction in evaporative loss. The field trial applying the chemical to a small residential lake, Lake Sahara, did not show statistically significant savings, but the authors speculated the suppressant's use may have saved significant volumes of water during the trial. And finally, the SNWA results of water quality testing found no evidence of either short-term limnological health threats or environmental concerns arising out of the use of the chemical suppressant.

Many other jurisdictions and agencies between 1964 and the present have investigated the efficacy of chemical evaporative retardants in drinking water

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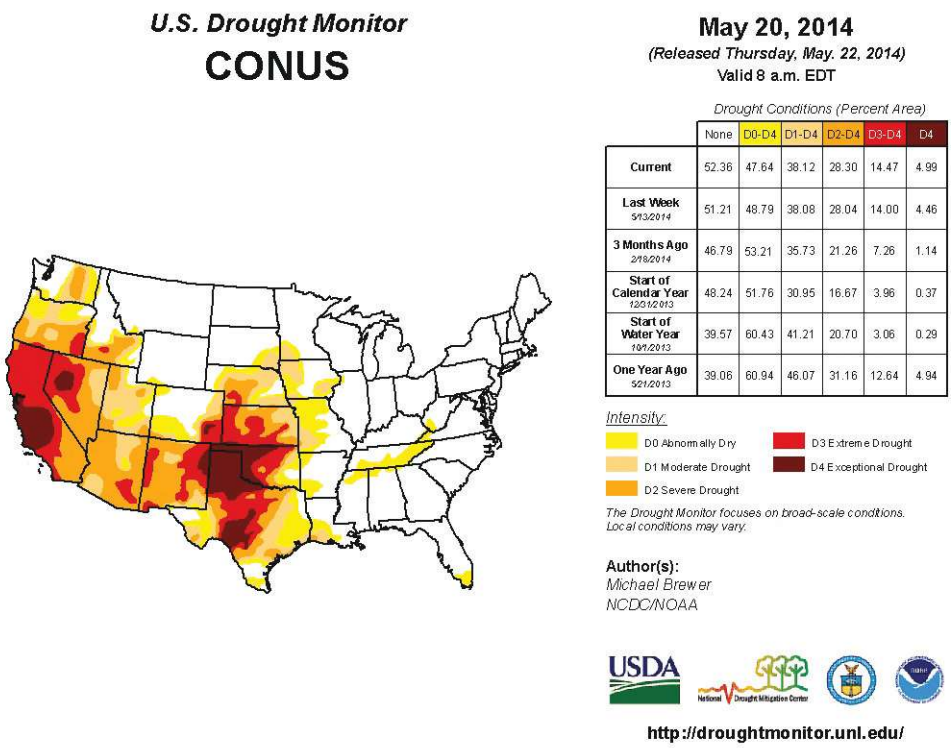
Climate variability, population migration to less water-rich states, and increasingly more frequent drought in the U.S. are pushing water resources to the limit.

surface sources. Among those are Australia[4,5], Singapore's Public Utilities Board[6], Kingdom of Saudi Arabia[7], Sandia National Laboratories[8], and the Texas Water Commission[9]. These investigations and the recent SNWA study point to the potential for chemical evaporative retardants to save significant quantities of water lost to evaporation.

Why is this important? It is important because climate variability, population migration to less water-rich states, and increasingly more frequent drought in the U.S. are pushing water resources to the limit. Every drop saved can make a difference. The U.S. Drought Monitor map (upper right) indicates the severity of drought and water stress (darker color = more severe) in the continental U.S. as of May 2014. It also illustrates that the most drought-stricken areas are in states that have experienced large population increases that are placing even more stress on the states' limited water resources.



Drought conditions in the continental U.S. (CONUS). *(Photo Credit: National Drought Mitigation Center)*.

Evaporative retardant chemicals that have received U.S. EPA approval for use in raw water resources that serve as sources of drinking water are available in today's marketplaces.

These chemicals may provide another tool for water professionals to better preserve source water resources. Perhaps this article will encourage utilities and researchers to jump in and pilot full-scale investigations in large surface lakes and water sources to answer whether or not these chemicals can truly provide another important tool for utilities in today's stressed water resource environment. ■

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Charlie Anderson *of CDM Smith has served as the director of utilities and deputy city manager for Arlington, TX, and was on the American Water Works Association (AWWA) board of directors for six years until his term as immediate past president ended at the conclusion of AWWA's 2014 annual conference in Boston.*

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