People who tour City of San Diego's demonstration project learn about the various stages of water purification.

How Does the Advanced Water Purification Process Work?

Currently*, most advanced water purification processes involve a multi-stage process of micro-filtration, reverse osmosis, and ultraviolet light with advanced oxidation:

- The water first goes through micro-filtration, a pretreatment process, where water is either pushed or pulled through tiny tube-like membranes. Each membrane is like a straw with microscopic holes in the sides of the straws, 1/300th the width of a human hair! As the water moves through the tubes, protozoa, solids and bacteria are removed from the water.

- The water then is treated through reverse osmosis where it's forced through the molecular structure of membranes. Things like fertilizers, pharmaceutical, viruses and finally salts or minerals are removed. The result is near distilled quality water.

- Now the water is purified, but one more step provides a safety barrier: The water is exposed to ultraviolet light with advanced oxidation to cause any remaining organic molecules to break down into safe simple elements, like oxygen, nitrogen, carbon, etc.

After this process the water is cleaner than most bottled water.

(*Alternative processes are being evaluated.)

West Basin's Water Reliability 2020 program is designed to shift their future water supplies to more locally controlled and reliable sources of water. Their Edward C. Little Water Recycling Facility produces five different qualities of "designer" or custom-made recycled water that meet the unique needs of West Basin's municipal, commercial and industrial customers.

"Case Study" continued from page 3...

Recycled Water Policy established aggressive goals to increase recycled water production in order to help meet the State's overall water supply goal (by 2020, increase recycled water use by 1 million acre-feet per year over 2002 levels). While recycled water for agriculture, landscape, industrial and other purposes will always be needed in California, they will probably not be able to meet their recycled water goals without fully expanding potable reuse options.

Significant legislation promoting potable reuse in California has been SB 918 (Pavley 2010), which requires the State to evaluate the feasibility of direct potable reuse by the end of 2016.

California's potable reuse effort aims to contribute to this effort by providing independent, peer-reviewed research for regulators, utilities and communities as they consider the implementation of potable reuse in various communities in the State of California and beyond. Subsequent legislation, SB 322 (Hueso 2013), directed the Department of Public Health, in consultation with the State Water Resources Control Board, to develop a public review draft of the potable reuse report available by September 2016 and established an advisory group representative of the public to provide a forum for public discussion and to assist the expert panel in its deliberations.

In his SB 322 signing message, California Governor Jerry Brown wrote "This information is past due … California needs more high quality water and recycling is key to getting there."

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Spring 2015 – Water Reuse Solutions

WATEREUSE

Understanding Potable Reuse

A Key Part of Our Water Supply Solutions

Potable Reuse Education — Sharing Solutions to Water Supply Challenges

Numerous regions of the world are experiencing drought and resulting lack of water supplies. While using purified water for drinking is not new, innovative projects in Australia, Texas, California and elsewhere are currently providing advanced water purification to increase water supplies. These projects can serve as models for other states and municipalities.

WateReuse provides countries, states, municipalities and water districts with information and tools that can lead to establishment of Direct Potable Reuse (DPR) or Indirect Potable Reuse (IPR) projects that are both sustainable and protective of public health. As new water supply options, DPR projects treat wastewater, including sewer water, that has been cleaned for return to the environment and actually further clean or purify it to meet all drinking water standards. This purified water is regulated by water quality and health officials and implemented by water utilities in a safe, cost-effective and environmentally responsible manner. Uses may include purifying water to distilled quality for industrial processes, as well as for drinking. IPR projects add the step of passing the highly treated water through an environmental buffer, such as a groundwater aquifer or surface water reservoir.

Since 2012, two Texas cities (see page 3) have been operating the nation's first DPR plants. Likewise, in 2012, California has embarked on an awareness effort to help establish DPR as a water supply option. The ongoing effort is to address the regulatory, scientific, technical, and attitudinal issues surrounding potable reuse projects. This is being accomplished through funding of independent and rigorous scientific research and communicating findings and data through public outreach and awareness programs.

WateReuse is sharing solutions and best practices from 26 independent research projects, made with investments of over $11.5 million, to evaluate and demonstrate the feasibility of DPR. The research revolves around developing a robust monitoring and redundant water purification system. These projects will help inform other communities and governments moving forward when considering a range of potable reuse projects.

Wichita Falls' DPR Project went online July 9, 2014 following extensive testing by the City of Wichita Falls and the Texas Commission on Environmental Quality (TCEQ). Shown here is one of their clarifers.

What is Potable Reuse?

Potable reuse refers to purified water you can drink. It's highly treated to meet or exceed federal and state drinking water standards and is safe for human consumption. How potable reused water is delivered determines if it is called Indirect Potable Reuse (IPR) or Direct Potable Reuse (DPR).

Indirect Potable Reuse means the water is delivered to you indirectly. After it is purified, the reused water blends with other supplies and/or sits a while in some sort of man-made or natural storage before it gets delivered to a pipeline that leads to a drinking water plant or distribution system. That storage could be a groundwater basin or a surface water reservoir.

Direct Potable Reuse means the purified water is put directly into pipelines that go to a drinking water plant or distribution system. Direct potable reuse may occur with or without "engineered storage" such as underground or above ground tanks.

Multiple Benefits of Potable Reuse

Many states experiencing growing population and chronic water shortages continue to stretch the limits of their water supplies. But each community is different and has its own unique reason to develop new water supplies, including potable reuse. Here are just a few:

Safe, reliable water supply
Potable reuse uses proven technology to purify recycled water to provide a safe water source. Multiple treatment barriers separate pollutants from water. The purification process produces water that is cleaner than most bottled water.

Sustainable water supply option
Potable reuse provides a sustainable and cost-competitive water supply option that is less energy intensive than many alternative options.

Environmental benefits
Potable reuse allows us to leave more water in rivers, lakes and streams for the fish, plants and wildlife, while reducing discharges to these water bodies and the ocean.

Drought proof
Potable reuse is a drought-proof water supply. It can help ensure safe, sustainable water now and into the future.

Responsive to weather variability
Potable reuse is part of a diversified water portfolio and is independent of climate or weather.

Water Reuse Happens Naturally

Recycled water is water that is used more than one time before it passes back into the natural water cycle. It is wastewater, including sewage, which has been treated or purified to a level that allows for reuse for beneficial purposes.

Potable Reuse — Direct and Indirect
Potable reuse refers to reused water that meets all federal and state drinking water standards and is safe for human consumption. Potable reuse may be characterized as either indirect potable reuse (IPR) or direct potable reuse (DPR). In IPR, wastewater that has been highly purified is introduced into an environmental buffer for a specified period of time before being withdrawn for potable purposes. The environmental buffer may be a groundwater aquifer or a surface water reservoir. The purpose of the environmental buffer is to provide an additional barrier for the protection of public health.

In DPR, highly purified recycled water is introduced with or without the use of an engineered buffer into the raw water supply feeding a water treatment plant, or into the distribution system downstream of a water treatment plant. To date, proposals have been to introduce DPR water into a water treatment plant intake rather than into the distribution system.

The way in which potable reused water is delivered determines whether it is called indirect potable reuse or direct potable reuse.

Water reuse, including potable reuse, happens naturally all over the planet.

Water reuse happens daily on rivers and other water bodies everywhere. If you live in a community downstream of another, chances are you are reusing its water and likewise communities downstream of you are most likely reusing your water. This has been called "de facto" or unacknowledged/unplanned potable reuse.

The amount of water on the planet does not change, so through nature all water has been used and reused since the beginning of time. Using advanced technology to purify recycled water merely speeds up a natural process. In fact, potable reuse provides a needed water supply that is of higher quality than what occurs naturally.

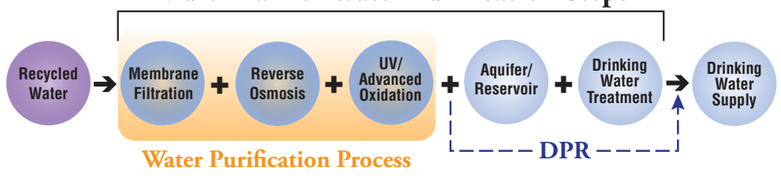
Building Trust is Key to Public Acceptance

Understanding and addressing community and stakeholder concerns can be a significant challenge toward fostering acceptance for potable reuse projects in a community. Research activities have included gauging a general understanding of perceptions of recycled water use, identifying primary concerns, and developing educational and communication tools that can provide greater assurance, awareness and education.

Research in this area includes various assessments; in-depth interviews, focus groups, surveying, and communication research (message testing and evaluation) with a focus on fostering awareness, education and acceptance by:

- Identifying and clarifying health and safety concerns;
- Identifying and addressing concerns about reliability and the ability to stop production;
- Developing a public outreach framework and communication tools that address concerns in layperson terms and in ways that can be adapted by utilities for a variety of community audiences.

Multi-Barrier Water Purification Steps



Advanced Purified Water is on the Rise: Lessons from the Pioneers

Numerous regions and states, such as Australia, Texas, Florida and the Pacific Northwest, are experiencing drought and lack of water supply. Using purified water for drinking is not new. Projects in Texas, Arizona and California, are currently providing advanced water purification. These projects can serve as models for other states and municipalities, and include:

Colorado River Municipal Water District (CRMWD), Big Spring TX — Big Spring took over a decade to research, test, and determine DPR as viable. In 2013 they opened the first U.S. DPR plant, capable of treating up to 2 million gallons of wastewater effluent per day to drinking water standards. Also in Texas, the **City of Wichita Falls**, 230 miles away, opened their plant in June of 2014, which can treat up to 10 million gallons of wastewater effluent per day.

City of Scottsdale's Water Campus, AZ — Scottsdale's potable reuse program purifies water for irrigation purposes, preserving more drinking water. The city operates two recycled water treatment systems with the ability to process over twenty million gallons of wastewater a day, 365 days a year. Most recycled water is distributed to 23 golf courses with the remainder put through further treatment and pumped back into the groundwater aquifer and recharged.

Santa Clara Valley Water District, Silicon Valley Advanced Water Purification Center, CA — Began deliveries of advanced purified water for non-potable uses in 2014. The District also began conducting a potable reuse demonstration and piloting effort in September 2014 demonstrating highly purified water that can be used for various purposes, including expanding future drinking water supplies.

City of San Diego, CA — The city began operating a one million gallon a day Advanced Water Purification Facility (AWPF) in 2011. The project successfully evaluated how purified water could be blended with imported and local water supplies in San Vicente Reservoir before going to a drinking water treatment plant. The AWPF is open for tours and is testing additional equipment for direct potable reuse research.

Advanced purified water has also been used since the early 2000s for the seawater barriers in Southern California (Dominguez Gap Barrier and the Los Alamitos Barrier).

Scottsdale's Advanced Water Treatment Facility uses reverse osmosis (pictured), ultrafilitration, UV and ozone to treat the water to exceed drinking water standards.

Case Study:

California's Potable Reuse Awareness Effort

Sustainable, Cost-Effective Water Supplies

Consideration of a range of potable reuse projects is very timely given the decline in traditional water supply sources along with growing demand and the uncertainty of climate change.

California's efforts will provide information for regulators, utilities, and communities as they consider the implementation of potable reuse.

For communities that have limited or no groundwater basins or limited reservoir augmentation options, potable reuse may be an additional approach to large-scale recycled water use.

Potable reuse projects can be advantageous and feasible when:

- Technologies to purify wastewater are well established and proven through existing potable reuse projects;
- they offer a cost-effective approach to diversifying a water portfolio;
- they require less energy than other alternatives; and
- they avoid potential water quality issues associated with groundwater and surface water sources.

Potable reuse potentially provides communities with another viable water supply alternative to increase water supply reliability, diversify water portfolios, and provide maximum flexibility in managing water supply choices.

Legislative Action
Another key driver for potable reuse success is legislative action. California's

continued on page 4...