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Risks of Manmade Chemicals in Drinking Water the Focus of 2013 NWRI Clarke Prize Lecture

FOUNTAIN VALLEY, Calif. – Due to rapid advancements in analytical chemistry, a variety of manmade chemicals, such as pharmaceuticals, can now be detected at very low (trace) levels in all municipal wastewaters and most surface waters. But what does the presence of these chemicals mean, and how do we define the risks (if any) to the public? This year's Clarke Prize Lecture, delivered by 2013 Clarke Prize recipient R. Rhodes Trussell, Ph.D., P.E., offered insights on addressing the increasing presence of trace organic chemicals in drinking water supplies.

A prominent engineer in the global water industry, Trussell specializes in helping utilities manage complex water supply projects involving the use of advanced treatment technologies for applications such as desalination and groundwater replenishment. He has worked on hundreds of water and wastewater engineering projects across the globe, and has developed the process design for treatment plants ranging in size from 1 to 900 million gallons per day in capacity. He currently serves as Chairman and CEO of Trussell Technologies, Inc., an environmental engineering consulting firm based in Pasadena, California.

Trussell was selected to receive the 2013 NWRI Athalie Richardson Irvine Clarke Prize for excellence in water research because of his accomplishments in using fundamental science and current research findings to solve water quality problems and improve the design of new water treatment plants and technologies. Consisting of a medallion and $50,000 award, the Clarke Prize is given out each year by the National Water Research Institute (NWRI), a nonprofit based in Southern California, to recognize researchers in the U.S. who solve real-world water challenges and to highlight the importance and need to continue funding this type of research. The Clarke Prize is supported by the Joan Irvine Smith & Athalie R. Clarke Foundation, which helped established NWRI.

"Dr. Trussell is an outstanding choice for the Clarke Prize," said Jeff Mosher, Executive Director of NWRI. "He is recognized worldwide as an authority in methods and criteria for water quality and in the development of advanced processes for treating water or wastewater to achieve the highest standards. But that only covers a small part of his contributions to the water industry. I am deeply impressed with his knowledge, his broad grasp of the issues, and his ability to communicate this understanding to others."

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Trussell received the Clarke Prize and presented his lecture at the Twentieth Annual NWRI Clarke Prize Conference and Award Ceremony, held on Friday, November 15, 2013, in Newport Beach, California. Over 180 guests from local universities and the water industry attended the event, as well as members of Trussell's family. His Lecture was titled, "How Safe Is Safe in the Treatment of Drinking Water for the Public?"

According to Trussell, the types of manmade chemicals being found at trace levels in water supplies in the U.S. and abroad include:

- Residuals from drugs taken as medication and returned to the environment through urine.
- Residuals of consumer products like perfume, insect repellent, and sunscreen.
- Natural hormones and synthetic hormones, such as those used in birth control.
- Compounds like sucralose (an artificial sweetener).

At face value, these are chemicals that help improve our daily lives when we use them. But history has shown us that some of the most helpful chemicals have unintended health and environmental effects. For instance, as Trussell mentioned, the insecticide DDT was effective in reducing malaria outbreaks, but also interferes with the endocrine (hormone) system in mammals and birds. DDT is now banned in the U.S.

Now that these chemicals are being found in our water supplies, what is their potential to cause adverse public health effects?

At issue is the fact that these types of chemicals occur at the part-per-trillion (ppt) level, which is equivalent to one drop of water diluted into 20 Olympic-sized swimming pools. In other words, these levels are so low that, as Trussell stated, "It is hard to know the best course of action." Using treatment processes, the water industry can remove these types of chemicals to below the level of detection. However, as the science of water analysis continues to improve, the level of detection is becoming lower and lower – to the parts-per-quadrillion level and even lower.

"Increasingly, our chemists can show something is in the water," said Trussell, "but today's science cannot tell us what its being there, at that level, means. The question we must answer is: when is the water safe?"

During his Lecture, Trussell recommended that *de minimus* risk guidelines be developed to help the water industry determine and manage public health risks associated with these trace organic chemicals. *De minimus* risk refers to a risk that is too small to be concerned with; that is, someone exposed to the risk is considered "virtually safe." The challenge is, when it comes to trace organic chemicals, general agreement does not exist as to what level of risk is *de minimus*.

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Trussell pointed out that approaches already exist for considering *de minimus* risk for human exposure to chemicals in medicine, agriculture, food, and water. *De minimus* benchmarks that are directly applicable to drinking water have also been offered by recognized authorities like the World Health Organization and U.S. Environmental Protection Agency, and studies are currently being undertaken to use benchmarks like these to estimate *de minimus* levels for emerging chemicals. Such information could potentially be used to develop and formalize *de minimus* risk criteria guidelines for trace organic chemicals in drinking water. What is needed is time and investment to do so.

At the conclusion of his Lecture, Trussell noted that while attention has focused on trace organic chemicals in water supplies, pathogenic microorganisms are still the most important threat to human health. More than 26-million cases of gastroenteritis occur in the U.S. each year, with the pathogen Norovirus being the most common cause. Often, a Norovirus infection is accompanied by intense diarrhea and vomiting, and easily spreads from person to person. "For anyone who drinks water with 2,700 virus particles," said Trussell, "odds are about 50/50 for contracting 48 hours of acute gastroenteritis after one exposure." Compare that one exposure of Norovirus – with its swift, unpleasant consequences – to drinking water with billions of particles of the chemical NDMA in it. At that concentration, it would take over 70 years of daily exposure to NDMA to increase the odds of developing cancer to one in a million.

Trussell is the twentieth recipient of the NWRI Clarke Prize, which is named after NWRI co-founder Athalie Richardson Irvine Clarke, a leading Southern Californian philanthropist who helped establish the City of Irvine and the University of California, Irvine. Her grandson, James Irvine Swinden, presented Trussell with the Clarke medallion and check on behalf of the Joan Irvine Smith & Athalie R. Clarke Foundation. Also in attendance at the award ceremony was Morton Irvine Smith, another grandson of Clarke.

More information about the Clarke Prize, including downloadable copies of the 2013 Clarke Lecture, is available at www.clarkeprize.com.

A 501c3 nonprofit, the National Water Research Institute (NWRI) was founded in 1991 by a group of California water and wastewater agencies in partnership with the Joan Irvine Smith and Athalie R. Clarke Foundation to promote the protection, maintenance, and restoration of water supplies and to protect the freshwater and marine environments through the development of cooperative research work. NWRI's member agencies include Inland Empire Utilities Agency, Irvine Ranch Water District, Los Angeles Department of Water and Power, Orange County Sanitation District, Orange County Water District, and West Basin Municipal Water District.

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