Pharmaceuticals and personal care products (PPCPs) are finding their way into surface waters, and that represents a growing concern to Utah’s water managers. Prescription drugs, over-the-counter medications, lotions, fragrances, and soaps are all considered PPCPs, but the term PPCPs has also been adopted to represent a wide variety of chemicals used in consumer products, including plasticizers and fire retardants. Wastewater effluents have been shown to be a major source of PPCPs in East Canyon Creek, Utah.
PPCPs in surface waters since most are disposed of, directly or indirectly, into domestic sewage systems that are not specifically designed to treat them.

Several PPCPs have been identified in fish collected from East Canyon Creek, Utah, below the Snyderville wastewater treatment plant (WWTP). In late summer, effluent from the WWTP can be a major component of the stream flow.

Research

To better understand the potential impact of PPCPs originating from the Snyderville WWTP, UCWRR researchers are:

- Determining the seasonal variation in PPCP loading to East Canyon Creek from the WWTP.
- Acertaining the extent of PPCP concentrations in the sediments, sediment dwelling organisms, and aquatic plants downstream from the WWTP.

These activities will help delineate the potential fate of PPCPs in East Canyon Creek. Research to date has identified several PPCPs at and below the WWTP but not above, strongly suggesting that the source is the influent to the WWTP.

Benefits to the State

WWTPs are located throughout the state, so the results of this study will:

- Contribute to our overall understanding of the environmental fate and impact of PPCPs originating from WWTPs.
- Help regulatory agencies such as the Utah Department of Environmental Quality (DEQ) to prioritize risk management activities and expenditure of public dollars.

Looking to the Future

Continued field sampling and analysis will give researchers the data they need to examine the relationship between PPCP concentrations in water, sediments, and plants to better understand the fate of these compounds in effluent dominated rivers.

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Climatic change concerns have prompted efforts to reduce greenhouse gas emissions (GHGs), particularly methane, which is 21 times more efficient at trapping heat in the atmosphere than carbon dioxide. The EPA estimates that 76% of wastewater sector methane emissions in the US are from onsite (septic) systems due to the large number of individual septic systems in use and the anaerobic conditions present in the septic tanks. Methane also contributes to the formation of particulate matter less than 2.5 microns (PM$_{2.5}$), which in turn contributes to the poor air quality that occurs in Cache Valley and other areas of Utah during winter inversions.

**Research**

UWRL researchers are developing new technologies to control GHG emissions from on-site wastewater systems. This research investigates the potential effectiveness of a compost biofilter system that would collect and treat methane by converting it to carbon dioxide, which can then be used by plants growing on the compost. Researchers have so far:

- Constructed a bench scale and a full scale compost biofilter system.
- Selected a potential field site.
- Developed gene probes to follow the dynamics of groups of methanotrophs involved in the methane to carbon dioxide conversion process.
- Designed a gas sampling apparatus.

**Benefits to the State**

The project benefits the State of Utah, and especially the Cache Valley area, by targeting an environmental source of methane for reduction. This can potentially reduce the amount of methane that is a precursor for the formation of PM$_{2.5}$ and GHG.

**Looking to the Future**

Data from the bench scale experiments will be used to compare operation of the biofilters under varying temperature and moisture conditions and to establish a mathematical model for optimizing the operation of future compost biofilters.

The field scale system will include a compost biofilter connected to a full-scale septic tank. The system will assess methane production using biochemical methane potential (BMP) assays within the septic tank and will monitor several biofilter parameters correlated with methane removal efficiency.

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In the News

Dr. Abdelhaleem Khader has recently returned to the Utah Water Research Laboratory as a visiting scientist. Dr. Khader received his Ph.D. from USU in Civil Engineering, and afterward secured a faculty position at the An Najah National University in the City of Nablus in the Occupied Palestinian Territories of the West Bank. This summer, he is working with UCWRR faculty member Dr. Randy Martin on air quality research. Dr. Khader ultimately plans to implement a similar research program when he returns home to Palestine.

Far Afield

The UCWRR has recently welcomed numerous dignitaries and other visitors including a delegation of irrigation representatives from the Mendoza Province of Argentina. Our faculty have also traveled far and wide conducting and presenting their research and sharing their extensive water resources expertise.

Future Issues

Research Highlights:

How the Great Salt Lake influences air quality
(UCWRR researchers are examining the potential influence of the Great Salt Lake (GSL) on ground level ozone observed in populated areas along the Wasatch Front.)

Life on the edge: Modes and rates of invasive Phragmites australis patch expansion
(The understanding UCWRR researchers have gained about its growth and expansion can help wetland managers predict and manage the spread of this aggressive wetlands invader.)

Faculty Awards

Dr. Blake Tullis: received the Eldon J. Gardner Teacher of the Year Award for 2016 for the College of Engineering.

Dr. Bethany Neilson: selected as the Graduate Student Mentor of the Year for 2016 for the College of Engineering.

Dr. R. Ryan Dupont: selected as the Undergraduate Mentor of the Year for 2016 for the College of Engineering.

Student Awards

Caleb Buahin: awarded College of Engineering Graduate Scholar 2016 and Martin Luther King Fellowship 2016.

Ayman Alaffi: selected as 2016 J. Paul Riley AWRA Utah Section Student Paper Competition winner.

Tyler King: awarded Outstanding Student Paper at AGU Fall Meeting, December 2015.

USU Engineering Team: won 1st Place in the Annual WEAU Student Design Competition.

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