Toxic Metals

Toxic metals including Cadmium, Lead, Manganese, Copper, Zinc, Chromium, Mercury, Arsenic, Iron, and Nickel often end up in our wastewater. Sources of these metals include industries such as textiles, leather, tanneries, electroplating, galvanizing, pigment and dyes, metallurgical and paint industries. These metals bioaccumulate throughout the food chain leading to increased levels found in animals at higher trophic levels. Most metals have regulated effluent limits in wastewater plants, however, the health effects of many of these metals are not fully understood.

Per- and Polyfluoroalkyl Substances (PFAS)

PFAS are a family of thousands of compounds defined by their carbon-fluorine structures. The perfluoroalkyl forms are of greatest concern, as their carbon chains are fully populated with fluorine and extremely stable due to strong carbon-fluorine bonds; polyfluoroalkyl forms can degrade to perfluoroalkyl forms. PFAS have been used in commerce for more than 60 years in products such as food packaging, fire-fighting foam, stain- and water-resistant materials, and waxes. They enter the environment through accidental and intentional discharge, and through routine commercial use (examples: laundering a PFAS-treated garment, household dust generated by walking on treated carpeting). PFAS are ubiquitous and found in soil, water, dust, food, and human blood serums.

Water Environment Federation®
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Joining the CEC

If you would like to join the CEC, please reach out to either of the following contacts:

Janine Burke-Wells
Janine@nebiosolids.org

We hope to see more professionals involved in this committee as these contaminants become more prevalent in our industry and our water environment.

Note: Email Brendan Curran for all referenced material and further reading.
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Contaminants of Emerging Concern Committee
NEWEA 2020

Contents of Pamphlet

The purpose of this pamphlet is to provide a brief background on contaminants of emerging concern found within our water environment. You will find information about several contaminants of emerging concern, possible health effects from them, treatment methods to remove them, and information about the New England Water and Environment Association (NEWEA) committee dedicated to these contaminants within our environment.

Contaminants of Emerging Concern Committee

The Contaminants of Emerging Concern Committee (CEC) in NEWEA is a group of professionals in the New England Region interested in being more active in technical aspects and volunteer events involving the mainly unregulated contaminants in our water, wastewater, and biosolids. We meet once a quarter to discuss opportunities, new information involving these contaminants, and how they have affected our industry. It is an opportunity for professionals to join forces, discuss, learn, and solve problems of the future.

Pharmaceuticals (PhACs) and Personal Care Products (PCPs)

Pharmaceuticals, or pharmaceutically active compounds (PhACs), and personal care products (PCPs) have been frequently detected in the environment ranging in concentrations from ppt to ppb (ng/L to µg/L). Many common PCP compounds include parabens, triclosan, preservatives, fragrances, and other compounds found in common household substances. The source of PhACs and PCPs originate from manufacturing, consumer use by excretion, washing and rinsing, and disposal by means of toilet flushing. These compounds then end up in waste streams such as domestic wastewater systems and landfills. These waste streams are treated by water resource recovery facilities (WRRFs) and septic systems, providing a pathway for recalcitrant contaminants to enter the environment via discharges of treated wastewater effluent. Currently there are no non-potable wastewater effluent discharge regulations for PhACs and PCPs in the United States and still much to be understood of the long-term exposure to environmental ecosystems and humans.

Treatment and Removal Methods

The wide variety of CECs in wastewater, each with their unique chemistry, lead to varying reuse or disposal treatment goals. These situations dictate the treatment means and technologies.

For municipal wastewater treatment facilities, some CEC removal is typically achieved not by design, but by the existing physical, biological, and chemical treatment processes. Conventional activated sludge processes with chlorine disinfection can achieve over 95% removal for many of the more prevalent CECs in wastewater. However, some CEC constituents, such the family of PFAS compounds, have very low removal ability by conventional wastewater treatment technologies.

As water supply shortages lead to indirect potable reuse (IPR) and direct potable reuse (DPR) of reclaimed water, treatment for CECs becomes a definitive goal. Granular activated carbon treatment (GAC) following traditional processes is one such method of removal that is effective in removing CECs, including some PFAS compounds. Treatment process trains that follow good secondary treatment could be microfiltration or ultrafiltration followed by reverse osmosis (RO), and then an advanced oxidation processes (AOP). DPR quality water can also be achieved with a non-RO technology process train following secondary treatment, such as ozone, biofiltration, microfiltration/ultrafiltration, GAC, and AOP.

As professionals in our industry begin to understand more about the presence of CECs in wastewater, policies on water quality are being re-evaluated. Removal technologies and the costs of those technologies will be considerations in these critical decisions.

Health Effects

Many of these contaminants have been found to have adverse effects on human health and the environment. The health effects of each are described in the following paragraphs.

Heavy metals are regulated at certain levels by the EPA in the effluent of wastewater. These regulations are constantly changing as more studies are done on their effects. Heavy metals have been linked to neurotoxicity, cancer, cell damage, and loss of cellular function. Heavy metals that have the most effects on humans are Arsenic, lead, Mercury, Nickel, and Cadmium.

Adverse health effects have been associated with PFOA and PFAS including the following; lowered immune response, increased risk of cancer development, lower fertility rates in woman, and increased cholesterol levels. These chemicals are still being investigated at the federal level to understand the health effects fully. Regulations may come about in future regarding manufacturing sources, water, wastewater and biosolids.

Regarding PhACs and PCPs, the concern for these compounds in the environment stem from eco-toxilogical impacts on the organisms vulnerable to exposure. Much of the research has concluded that some PhACs and PCPs act as endocrine disruptors that impact development, reproduction, metabolism, growth, and other physiological functions of aquatic and semi-aquatic species.