

# Contaminants of Emerging Concern Released from Wastewater Treatment Plants

## BACKGROUND

As of 2016, there were no Canadian regulations which required removal of Contaminants of Emerging Concern (CECs) from wastewater (WW) discharges. To that end, the Canadian Water Network, with funding by Environment and Climate Change Canada, put together an expert panel in 2017 in order to conduct a national review of contaminants in WW. The resulting publication, *Canada's Challenges and Opportunities to Address Contaminants in Wastewater*, declared that there was a need for active and integrated research and technology transfer to support science informed decision making in WW management. This, in recognition of the fact that most CECs enter receiving environments via WWTPs.

"CECs" is a term used to define pollutants that may impact ecological and human health. Contaminants include pathogens, nutrients, metals, pharmaceuticals, hormones, and chemicals. CECs are not yet regulated as their effects on ecology and human health are not fully understood by the scientific community. Some examples of CECs are: pesticides, illegal drugs, synthetic and natural hormones, personal care products, antibiotic resistant bacteria, genes and pharmaceuticals. Some common household CECs are: acetaminophens, Viagra, Prozac, Venlafaxine, antibiotics, and oral contraceptives which enter WWTPs via urine and feces. Pharmaceuticals represent an increasingly complex array of chemicals, and that list is growing.

One of the big questions by the expert panel was, "Which WW contaminants do we need to worry about most, now and in the future?" In 2013, new federal government regulations spelled out secondary treatment, which added bacterial breakdown of waste as the minimum standard required for sewage treatment. Secondary WWTPs do not filter out CECs, however.

The Canadian government has published that CECs are one of 3 serious threats contributing to the rapid decimation of the Salish Sea's Southern Resident Killer Whale (SSSRKW) population. There is also growing evidence of CECs found in the tissue of juvenile salmon. In 2018, the Canadian government pledged \$61.5 million to protect the SSSRKW population in an effort to circumvent extinction. Contaminants accumulate in the whale's body fat, largely from the contaminants within their salmon diet and their oceanic environment. These cause damage to their brains and nervous systems, reduce their immune system and impair their reproductive capabilities. Less than 50% of female Killer Whales from the South Salish Pod are able to carry calves, while many miscarry during term possibly in part due to CECs built up within their bodies. Of calves born, 40% do not survive their first year of life.

According to the Government of Canada's publication, *Wastewater Pollution*, "The process of collection and treatment of wastewater also results in the release of certain volatile chemicals into the air. The chemicals typically released in the largest volume include; methane, carbon dioxide, oxides of nitrogen, hydrogen sulfide, mercaptans, chlorine (if used in the treatment process) and various other chemicals can be released to a smaller extent." (1)

According to a review written by Ewa Korzeniewska, "Sewage and unstable sludge contain various pathogens such as viruses, bacteria, and human and animal parasites. These

microorganisms can be transmitted to the ambient air in wastewater droplets, which are generated during aeration or mechanical moving of the sewage.” (2)

According to an article written in the Journal of Environmental and Public Health Volume 2016, “Wastewater treatment plant (WTP), due to its working conditions, is considered as a major source of aerosols and may constitute an important health risk for plant workers as well as the surrounding inhabitants [2-5].” (3)

Citing an article written in the Journal of Environmental and Public Health Volume 2016, “The concentration of airborne pathogenic microorganisms in aerosol samples collected around the wastewater treatment plant was investigated. Significant risk for symptoms such as headache, unusual tiredness, and concentration difficulties was recorded and an increased possibility for respiratory and skin diseases was reported.” “Bioaerosols may contain different types of microorganisms such as viruses, pathogenic bacteria, and fungi, capable of causing skin, digestive system, respiratory, and nervous system diseases and human allergies [9]. Specifically, bioaerosols emitted by WTPs can impact the air quality.” (3)

According to a review written by Ewa Korzeniewska in section 3.2 entitled “Meteorological factors and bioaerosol concentration”, “...the magnitude of air currents, relative humidity, and temperature are the significant environmental parameters.” According to a review written by Ewa Korzeniewska in section 4.3 entitled “WWTPs as a source of bioaerosols”, “..these small particles can be very easily carried by the wind to distances ranging from a few hundred metres to several kilometres, posing a potential biological hazard not only to site workers but also to local residents (91).” (2)

Airborne contaminants of emerging concern (“CEC’s”) and pathogens generated in wastewater treatment plants are predisposed to drop into marine receiving environments. CEC’s and pathogens also flow through secondarily treated sewage from a wastewater treatment plant into marine receiving environments.

Biosolids from WWTP applied to land are regulated by the Organic Matter Recycling Regulation (OMRR). According to the 2018 OMRR Intentions Paper, section 7 entitled “Land Application and Distribution of Organic Matter”, “Consultation feedback received on the 2016 intentions paper indicated support in principle for introducing standards for contaminants of emerging concern.” It goes on to say, “Currently available scientific information indicates that there is not enough information to determine if biosolids contain unsafe concentrations of CECs” but that “The ministry is proposing to enable a director to request sampling of biosolids for specific CECs to potentially inform future conclusions.”

Human and ecological health face adverse risk due to the growing presence of contaminants of emerging concern (CECs) in WWTPs’ receiving environments of air, land, and water.

## REFERENCES

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