Stantec

Memo

To:	Core Area Wastewater Treatment Program Board	From:	Dr. David Lycon, P.Eng. Stantec Surrey
File:	111700431	Date:	September 6, 2016

Reference: CRD Core Area Wastewater Treatment – Compounds of Emerging Concern (CECs)

The purpose of this white paper is to provide a brief overview of the definition of compounds of emerging concern (CEC), and how they relate to wastewater treatment. Both secondary and tertiary treatment processes are capable of reducing the concentrations of these compounds, and a brief discussion will be provided on the treatment efficacy of each. Due to the variability and number of CEC compounds, no single process will remove all compounds.

The analytical capability has improved with technology advancement and it is now possible to monitor many compounds down to the part per trillion level. CECs have existed for many years and with the advent of newer analytical technology their concentrations are only now being detected.

BACKGROUND

Compounds of emerging concern (CEC) or emerging contaminants are constituents within domestic wastewater that are being considered for regulatory action pending the development of additional information on health and environmental impacts. They consist of synthetic or naturally occurring chemicals which have the potential to enter the environment and cause known or suspected adverse ecological or adverse health effects. There are numerous such compounds and they are described in broad categories including pharmaceuticals, personal care products, micro- plastics , plasticizers , flame retardants, herbicides, pesticides, and other industrial chemicals. These compounds are found in a variety of products including antibiotics, cosmetics, insect repellants and many other products used by the human population. There are thousands of these compounds and although some of these compounds are removed through conventional secondary and tertiary treatment processes many are not.

Tertiary treatment will remove many of the non soluble compounds of emerging concern, however some will not be removed because they are in a soluble form. Tertiary treatment will remove l compounds that are adsorbed onto solids which pass through the secondary treatment process.

Significant research is being completed to determine the effects of CECs on human and ecosystem health. There is significant debate on the actual versus perceived impacts and the degree of exposure that is required to cause long term impacts to health and ecosystems. As of 2016 there were no Canadian regulations which require removal of CECs from the wastewater discharges. Most wastewater treatment operators have not implemented advanced treatment technologies to deal with CECs because the treatment process selection to deal with CECs is still uncertain and available advanced technologies are costly to construct and operate. Many municipalities are promoting source control as a low cost method of CEC control.

TREATMENT PROCESSES FOR CECS

Several studies have been conducted to determine the degree of treatment required for removal of CECs. These studies typically examine the fate of a given compound or series of compounds in

relation to the treatment process(es) used to treat the influent wastewater stream. Treatment of CECs occurs by a combination of three primary means: (1) adsorption, (2) volatilization and (3) degradation. The degree of treatment attained by each mechanism, will depend on the nature of the CEC and the type of treatment processes used. As such, there are no hard and fast guidelines that dictate what form of treatment is best for the removal of the varying make-up of CECs. In addition the type of CECs differ from location to location.

A study published in 2015 entitled, *Emerging Contaminant Removal In Wastewater Treatment Trains Under Canadian Conditions* (Wayne Parker, University of Waterloo), compared the effectiveness of the most common treatment technologies to remove the more common CECs from wastewater including: activated sludge configurations, membrane bioreactors, and lagoons. The study determined that processes that had longer sludge ages (nitrifying activated sludge processes) tended to remove more CECs than conventional high rate activated sludge. The study also indicated that there was little difference in treatment efficiency between conventional activated sludge and the membrane bioreactor process.

OPTIONS AVAILABLE TO CRD FOR CEC TREATMENT

Several options are available to the CRD to deal with CECs. One option would be to construct secondary treatment facilities and add the required facilities for CEC in the future to deal with the specific CECs that are identified in the effluent. A second option would be to add tertiary filtration at this time which would provide additional CEC removal and would also have other benefits such as producing a water quality suitable for water reclamation. Given the CRD's desire to provide leadership in this area, the CRD may wish to install tertiary filtration during initial construction of the plant. This would be the most cost effective approach. This can be accomplished quite by addition of tertiary filtration downstream of the secondary treatment process. The filtration process could use compact disc filters or sand filters. Similar type facilities are located at the tertiary treatment plants located in the BC Interior at Kelowna, Penticton and Westbank.

Tertiary treatment will provide benefits beyond CEC control for the CRD. These benefits include reducing the solids and BOD load to the receiving environment and producing a reclaimed water quality (with disinfection) that can be considered for other uses such as irrigation.