Evaluation of Disinfection Byproduct Formation during Potable Reuse Treatment

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Background

-Potable reuse is a new potential source of drinking water that involves the treatment of wastewater into potable water
-The process is carried out at a Advanced Water Treatment Facility (AWTF) and is flexible to varying treatment train configurations
-Chemical compounds formed during the water treatment process, such as disinfection byproducts (DBPs), pose a risk to human health
-A deeper understanding of DBPs is needed, to further the regulation and viability of potable reuse

Research Objectives

1) Compare the toxicity of DBPs found in water generated through potable reuse to conventional drinking water
2) Examining the formation and removal of DBPs at each stage in the treatment train

Project Description

-6 participating AWTFs (four in U.S. and two international)
-Samples were taken at each stage in the treatment train and an additional sample was collected from the regions conventional drinking water source

Methods

-35 DBPs were examined in the laboratory
-Extraction methods were outlined by USEPA and were dictated by the chemical structure of the DBP under analysis
-Concentrations were then quantified through analysis by gas chromatography – mass spectrometry or ion chromatography (bromate only)
-To better gauge the potential for DBP formation, a duplicate set of samples (UFC) were spiked with a disinfection agent (free chlorine or chloramines) to simulate distribution system conditions

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Results

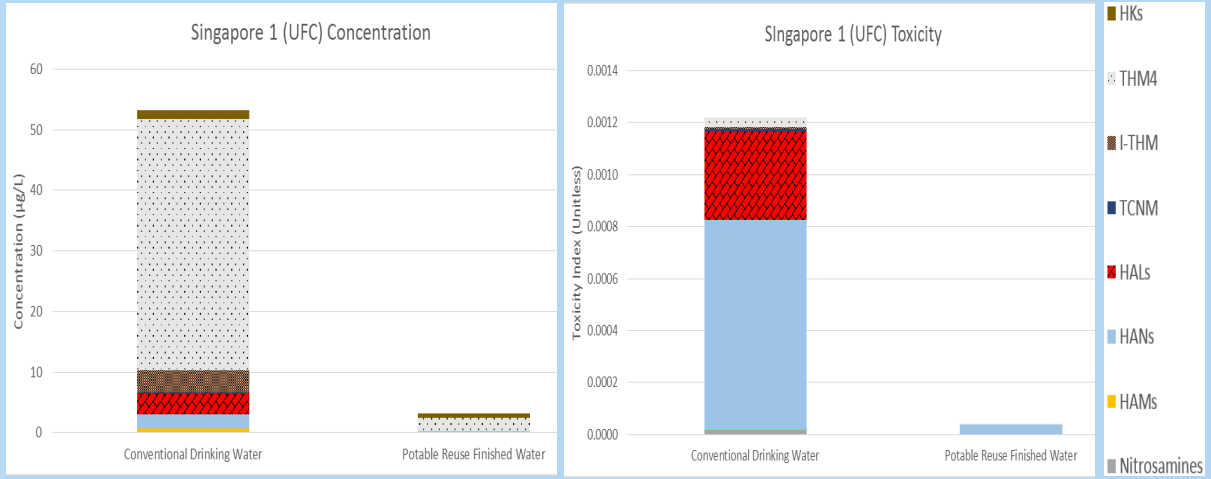

Figure 1: compares potable reuse finished water to conventional drinking water, by looking at the cumulative concentration (left) and cumulative toxicity (right)

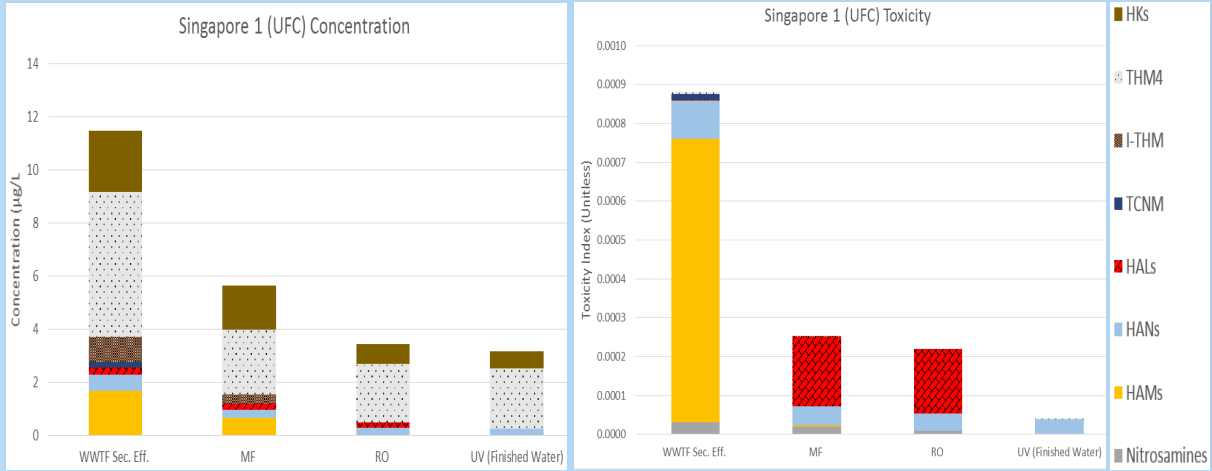

Figure 2: exams how the cumulative concentration (left) and cumulative toxicity (right) levels fall/rise through each stage in the Singapore AWTF treatment train

Preliminary Conclusion

1) Early results (figure 1), support the notion that there is no increased risk to human health by drinking potable reuse finished water in comparison to conventional drinking water

2) Early results (figure 2), indicate that the concentration and toxicity of DBPs drop through the AWTF treatment train

3) Regulation for potable reuse must be reassessed to set concentration limits on DBPs that are most harmful to human health

Moving Forward

-Samples will continue to be delivered into early 2018, from the 6 AWTFs, more general conclusions will be drawn once all data is analyzed

-To fully access the viability of potable reuse, further research will need to be conducted looking at other possible impediments: pathogen inactivation, pharmaceuticals and personal care products, and endocrine disrupting compounds

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