Neuroscience and Physiology Seminar

Friday, Noon,

22 February 2019

SLB 121

Chlorinated Chromosomes: The Mutagenicity of Swimming Pools and Hot Tubs

David DeMarini

U.S. Environmental Protection Agency, Research Triangle Park, North Carolina

Using 28 water samples from 7 sites, we report the first integrated mutagenicity and comprehensive analytical chemistry of hot tubs (spas) treated with chlorine, bromine, or ozone, along with swimming pools treated with these same disinfectants. Gas chromatography with high-resolution mass spectrometry and membrane-introduction mass spectrometry were used to comprehensively quantify 21 disinfection byproducts (DBPs) and identify others.

Mutagenicity was assessed by the *Salmonella* mutagenicity assay. More than 100 DBPs were identified, including a new class of DBPs, bromoimidazoles. Brominated pool/spa waters were 1.8X more mutagenic than chlorinated ones; spa waters were 1.7X more mutagenic than pools. Pool and spa samples were 2.4 and 4.1X more mutagenic, respectively, than corresponding tap waters. The concentration of the sum of 21 DBPs increased from finished to tap to pool to spa; and mutagenic potency increased from finished/tap to pools to spas. Mutagenic potencies of samples from a chlorinated site correlated best with brominated haloacetic acid concentrations (Br-HAAs) (r = 0.98) and nitrogen-containing DBPs (N-DBPs) (r = 0.97) and the least with Br-trihalomethanes (r = 0.29) and Br-N-DBPs (r = 0.04). The mutagenic potencies of samples from a brominated site correlated best (r = 0.82) with the concentrations of the 9 HAAs, Br-HAAs, and Br-DBPs. Human use increased significantly the DBP concentrations and mutagenic potencies for most pools and spas.

These data provide evidence that human inputs can increase mutagenic potencies of pools and spas and that this increase is associated with increased DBP concentrations. [Abstract does not reflect views/policies of the USEPA.]