Pathogens in Water: Value and Limits of Correlation with Microbial Indicators

by

Pierre Payment, Ph.D., Professeur
Centre INRS-Institut Armand-Frappier, Laval, Québec, Canada
Institut national de la recherche scientifique

Dr. Payment will discuss the value and limitations of using microbial indicators to predict occurrence of enteric pathogens in water. Raw or treated sewage is a primary source of fecal contamination of the receiving surface water or groundwater; hence, understanding the relationship between pathogens and indicators in sewage is an important step in understanding the correlation in receiving waters. This seminar presents three different datasets representing different concentrations of pathogens and microbial indicators: sewage containing high concentrations of pathogens and indicators, surface water with variable concentrations, and groundwater with low concentrations. In sewage, even with very high levels of microorganisms, no mathematical correlation can predict the type or concentration of any pathogen. After discharge in the environment, direct correlation becomes biologically improbable as dilution, transport, and different inactivation rates occur in various environments. In surface waters, advanced statistical methods such as logistic regression have provided some level of predictability of the occurrence of pathogens but not specific counts. In groundwater, the continuous absence of indicators indicates an improbable occurrence of pathogen. In contrast, when these indicators are detected, pathogen occurrence probability increases significantly. In groundwater, given the nature and dissemination pattern of pathogenic microorganisms, a direct correlation with fecal microbial indicators is not observed and should not be expected. However, the indicators are still useful as a measure of risk. In summary, many pathogens of public health importance do not behave like fecal microbial indicators, and there is still no absolute indicator of their presence, only a probability of their co-occurrence.