

**Mini-Track Session Descriptions**

**2020 Virtual Onsite Wastewater Mega-Conference**

**Innovative Thinking**

**Wednesday, November 18, 2020 – 9:00 am – 12:00 pm**

**Session title: Use of permeable reactive barriers for passive nitrate removal from onsite wastewater effluent (30 min.)**

*Presenter: Bryer Manwell*

Operation of onsite wastewater systems has the potential to create deleterious effects on human health and the environment. Nutrient and pathogen loading from onsite wastewater systems to surface water bodies is of particular concern in areas of high population density and high groundwater. Nutrient loading to surface waters can cause algal blooms and negatively effect fish spawning habitat. Permeable reactive barriers (PRB) are a cost-effective inground passive polishing treatment for onsite wastewater effluent elevated in nutrients and pathogenic bacteria. This presentation will outline case studies in British Columbia, Canada where PRBs have been utilized to sequester nitrogen (as nitrate) for on-site wastewater systems installed near lake foreshore.

**Session title: Degradation of Commercial Hygienic Paper in a Septic Tank Environment (30 min.)**

*Presenter: Dominic Mercier*

Septic users are encouraged to use 'septic-friendly' hygienic paper that is generally thinner than traditional paper and quickly dissolved in contact with water. Specialized companies performing septic system pump outs as well as septic system service providers have observed that some toilet papers can cause important accumulation resulting in premature pump-outs or major blockage, this even if they advertise to be 'septic-friendly'. While we would expect that septic-friendly hygienic paper rapidly dissolve in water to settle to the bottom of the tank in small flaky particles, it appears that in some cases, the paper clusters entering the primary tank retain their structural integrity and either accumulate rapidly at the bottom of the tank or in the floating zone of the primary treatment tank. This results in a higher risk of blockage, more frequent need for pumping and potential washouts to the downstream treatment system. Inevitably, operational and maintenance cost of such systems significantly increase. This study has evaluated the behavior of popular brands of hygienic paper in term of degradation in water and potential for blockage. Tests have been performed in clear water as well as in primary effluent environment. Findings of this study may help in better guiding septic system owners in regards to wiser choices or at least inform them more accurately on potential risks and impacts on maintenance frequency and costs.

**Session title: The Art (and maybe Science) of Creating a Nitrogen Mass Balance (1 hour)**

*Presenter: John Buchanan*

A mass balance is a fundamental engineering principle. You define a system boundary, measure how much of a constituent moves into and out of the boundary, and the balance is still within the system. Thus, for the land application of wastewater, a mass balance approach should be the ideal means of estimating how much nitrogen will enter the groundwater. However, it hard to measure what you cannot see. As nitrogen-containing wastewater moves through the soil, the nitrogenous compounds can be converted to ammonia (ammonification), to nitrite/nitrate (nitrification), to protein (organic nitrogen), or to nitrogen gas (denitrification). The biotransformation of these nitrogenous compounds requires certain conditions to exist (i.e., certain electron acceptors/donors, bioavailable carbon). Further, the transformation rate is dependent on environmental factors such as temperature and moisture. Lastly, each of the nitrogenous forms have unique means of crossing the system boundary. Scientists and engineers understand these processes. However, these processes take place in subsurface environment where it is difficult to take measurements. So, if we cannot quantify all the transformations and fates of nitrogen in the soil, is creating a nitrogen mass balance an art form rather than a science? If so, should wastewater professionals focus on nitrogen removal before the effluent is applied to the soil and/or nitrogen removal via the cover crop and pretend like the soil provides no nitrogen removal

**Session title: ULTRON: Electro-peroxone process for degradation of wastewater contaminants (30 min.)**

*Presenter: Leopold Dobelle*

Despite the lack of safely managed sanitation and water supply systems, the developing countries with rapid urbanization cannot afford to implement the advanced treatment technologies that are highly centralized, calling for the development of practical onsite wastewater treatment. As an effective yet feasible solution to the water crisis, we have invented an ultra-portable three-stage ozone-assisted nanofiltration (ULTRON) system, which can be provided to individual or small numbers of homes as a decentralized wastewater treatment system. Based on a cost-effective flow-through electrochemical reactor, this system uses an electro-peroxone process to remove chemical oxygen demand (COD) and pathogens from wastewater. Hydrogen peroxide generated by inexpensive carbon-based electrodes (i.e. polytetrafluoroethylene-coated carbon papers) reacts with ozone, producing hydroxyl radicals to treat the influent, which then passes through granular activated carbon filtering as post-treatment. With the help of the strong oxidants, the system achieved a 6-fold log E. coli reduction and 90% reduction in COD for human urine. This system does not need any chemical additive, utilizes the energy-efficient electro-peroxone process, and comprises cheap, accessible components reducing capital and operational costs. The promising results and cost-effectiveness of the ULTRON system show that it can provide a viable solution for the treatment of greywater and human wastewater in low-resource settings.

**Session title: Case Study-A SMARTER Way to Treat (30 min.)**

*Presenter: Charles Otis*

The presentation highlights innovative ways to improve decentralized advanced treatment processes which reduce equipment components, vastly reduce maintenance, improve energy efficiency, and allow for intelligent decision making. An integrated fixed-film Moving Bed Biofilm Reactor (MBBR) treatment system has been developed which is scalable from smaller onsite applications to much larger flow applications, and operates via a single air source to provide all aeration, mixing, and pumping processes powered by the single air source. These revolutionary smart systems have innovations in technology with very few mechanical or electrical moving parts below water, only where required. A case study describes a staged combination of aerated fixed film media and mixing equipment which uses accumulated air to agitate without aerating. The same air-accumulating equipment with modifications is used in pumping in a controlled fashion, which eliminates the need for flow meters and underwater electrical pumps and mixers. The case study features a new and unique combination of equipment used to both remove high strength organic matter to extremely low concentrations (89-98 % removal) and reduce nitrogen 59% to near 80%. It also describes installation, operation, and maintenance advantages which are additive and may tend to collectively favor an economic advantage over competitive processes in some cases.