W15 There Is Light at the End of the Pipe! Causes and Control of Struvite and Vivianite Scaling at WRRFs

Location New Orleans Convention Center, Room 256
Date Sunday, Sep 30 8:30 AM
Duration 8 hours 30 minutes

Workshop Fee: Member $199/Nonmember $229 Struvite and vivianite deposition occurs at many water resource recovery facility (WRRF) that operates anaerobic digesters. Nuisance scaling pose significant operational challenges. In addition, the cost of scale mitigation/management can be exorbitant. This workshop disseminates salient information about struvite and vivianite formation mechanisms and outlines preventive strategies that can be quickly implemented to realize operating cost savings. The presentations and interactive component are designed to enable informed decision making by the participants.

- 8:30 AM Welcome and Workshop Introduction
  Samuel Jeyanayagam
  Workshop Speaker

  Dr. Jeyanayagam is Vice President and Senior Principal Technologist at Jacobs CH2M. He has over 38 years of academic and consulting experience and has completed projects in seven countries. His areas of expertise include resource recovery, nutrient removal, disinfection, and biosolids processing.

  Sam was recently inducted as Fellow of the Water Environment Federation (WEF) for his distinguished contributions to the global water industry. He has written and presented over 180 papers and co-authored over 27 WEF manuals. Sam also served as Task Force Chair of WEF's special publication, *The Nutrient Roadmap*. He is on the Editorial Board of the *Water Environment Research* and *Water Environment & Technology* journals.

  Sam is regularly featured as an instructor in the University of Wisconsin wastewater treatment courses. He is a registered professional engineer and Board Certified Environmental Engineer. Sam received his MS and PhD degrees from Virginia Tech.

- 8:40 AM Fundamentals of Struvite and Vivianite Scaling
  Bruce R Johnson
  Workshop Speaker

  Bruce has been working in the wastewater industry for over 25 years and has been with CH2M/Jacobs for the last 20 years. With CH2M/Jacobs, Bruce has led the wastewater treatment technology organization and is currently responsible for the wastewater modeling program. He has been active outside of CH2M/Jacobs both in WEF and IWA. Within WEF, he led the development of the new Nutrient Removal MOP, vice chaired the committee that developed the Wastewater Simulation MOP

and was a contributing author in MOP 8's suspended growth chapter. He also chaired the WEFTEC wastewater symposia committee and was a founding member and past chair of WEF's Modeling Experts Group of the Americas. Within IWA, Mr. Johnson helped develop the wastewater treatment modelling seminar series (WWTmod) and is a past scientific chair. He also was a founding member of the IWA Design and Operations Uncertainty Task Group and is currently participating in the Physical Chemical Modelling Task Group.

BACKGROUND DATA The International Water Association (IWA) hosted its 2015 Nutrient Removal and Recovery Conference in Gdansk, Poland, from May 18-21. CH2M's Samuel Jeyanayagam presented disruptive technologies and innovative practices for sustainable nutrient management.

 *By: Samuel Jeyanayagam, CH2M Technologist*

Samuel presented his paper, "Accelerating the Implementation of Extractive Nutrient Recovery as an Integral Component of Sustainable Nutrient Management," co-authored by R. Latimer, W. Khunjar, A. Pramanik, C. Mehta, and D. Batstone, on Monday, May 18, during the 2015 International Water Association's Nutrient Removal and Recovery Conference. He also moderated the session, "Source Separation for Nutrient Recovery," on Tuesday, May 19, at 10:30.

Growing populations and rapid urbanization have strained our world's resources. A recent study conducted by the Water Environment Research Foundation (WERF) identified innovative opportunities and technologies to enable water resource recovery facilities (WRRF) to make the paradigm shift to adopt **extractive nutrient recovery** to support the water-energy-nutrient nexus—a pivotal component of the Basins of the Future initiative.

Extractive nutrient recovery, defined as the production of chemical nutrient products devoid of significant organic matter, is seen as a disruptive technology in the wastewater industry.

Nitrogen (N) and phosphorus (P) are life essential macronutrients that are extensively used in agricultural applications. Production of synthetic fertilizers containing N and P is an energy intensive process that uses non-renewable resources. To minimize the

accumulation of these nutrients in the environment, the current approach is to remove N and P prior to discharge to a water body. In this scenario, energy and other non-renewable resources are supplied to replenish nutrient supply for agricultural uses and again to remove these nutrients from wastewater before discharge to the environment. This linear approach, which assumes unlimited and cheap supply of energy and resources, is unsustainable, and therefore, disruptive approaches like extractive nutrient recovery are needed to reverse the status quo.

By implementing nutrient recovery, WRRFs can:

- Manage **recycle** loads and enhance P removal process
- Achieve **chemical and energy savings**
- **Reduce solids** production
- Achieve **lower biosolids** P content
- Minimize struvite nuisance scaling and **lower maintenance requirements/cost**
- Generate an **environmentally-friendly product**
- Create **potential revenue stream** from a highly desirable fertilizer product
- Enhance sludge dewaterability
- Achieve overall **sustainability** benefits

While nutrient recovery is being practiced via land application of biosolids and effluent reuse, extraction of a chemical nutrient product with low organic matter content has not been widely applied within the wastewater treatment industry. The nutrient concentration in municipal wastewater typically ranges from 10 to 50 mg N/L and from 1 to 10 mg P/L. Since the efficiency of extractive nutrient recovery is lower at these concentrations, a three-step framework is needed which includes **accumulation of nutrients** to high concentrations, **release of nutrients** to a small liquid flow with low COD and **extraction of a chemical nutrient product** that is marketable and could potentially off-set operating costs and synthetic fertilizer use.

Taking this approach, WRRFs can be part of the solution to optimizing the water-energy-nutrient nexus, in addition to accelerating the shift in industry perception of wastewater from ‘waste’ that must be treated to valuable ‘resource’ that can be recovered and reused.

Included in the WERF study, is an Excel™ based tool which allows users to perform a site-specific triple bottom line evaluation and explore payback scenarios of the treatment options by considering 13 factors, such as net present value, environmental benefits, technology maturity and treatment plant impacts, among others. Utilities, such as the Hampton Roads Sanitation District’s Nansemond Treatment Plant in Virginia, USA, have used this tool and adopted sustainable nutrient management practices.

Nutrient Removal and Recovery Symposium 2018 Provides the conference data with committee members, speakers and presentation titleshttps://www.wef.org/globalassets/assets-wef/4---events/conferences/nutrients-2019/2018/wef-nrr-2018-onsite-program.pdf

Nutrient Management A guide for Decision Makers by CDM Smith-Jane Madden
http://www.newea.org/wp-content/uploads/2016/02/JMadden_NEWEA_AC16_Session7.pdf