Request for Proposal (RFP) No. NTRY12R16
Issued by the
WATER ENVIRONMENT RESEARCH FOUNDATION (WERF)
Proposals must be received by **4:00 pm** United States Eastern Standard Time
Tuesday, March 1, 2016

Unintended Consequences of Resource Recovery on Overall Plant Performance: Solving the Impacts on Dewaterability Properties

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PROJECT BACKGROUND AND RATIONALE

Over the last few years, the Water Environment Research Foundation (WERF) has funded research on the removal and recovery of nutrients from wastewater systems. It has recently been reported that some water resource recovery facilities (WRRFs) that operate for enhanced biological phosphorus removal (EBPR) and/or phosphorus recovery are experiencing difficulties with the dewatering of anaerobically digested biosolids. This request for proposals (RFP) will build upon the prior and ongoing body of research to determine if this phenomenon is more widespread, and to better understand and address dewaterability performance and its impact on overall resource recovery operations.

EBPR is viewed as the sustainable compliance approach for phosphorus removal and it offers an economical way for phosphorus recovery. However, EBPR seems to negatively affect the dewatering of sludge which is already limited in non-EBPR facilities. Biosolids handling at EBPR facilities often includes anaerobic digestion, dewatering, hauling, and disposal at landfills, land application, or beneficial reuse. Dewatering generates one of the highest operational costs, in particular for the use of polymer. WRRFs have seen a considerable decrease in dewatered cake solids, about three to six percentage points total solids (Benisch, et al., 2014), as much as with double or triple the amount of polymer needed to obtain an optimal dosage. This decreased concentration of solids leads to larger volumes of cake and higher treatment costs either for more hauling of the solids to landfills or composting, or for higher fuel costs for incineration.

Furthermore, an increase in the amount of soluble phosphorus in the digested sludge (as polyphosphate granules which are solubilized in the digester) can lead to reactions with ammonium and a limiting amount of magnesium to form an insoluble mineral known as struvite. Struvite formation shifts the ratio of monovalent to divalent cations in the biosolids. Recent studies have correlated monovalent to divalent cation ratios, higher orthophosphate concentrations, and higher interstitial water concentrations to decreased dewaterability in biological phosphorus (bio-P). The structure and role of floc have a relation with the dewatering requirement of biological sludges (Novak et al., 2001). Dewatering properties often get poorer as the efficiency of anaerobic digestion increases, which require further investigation (Higgins, 2010).

During the 2015 WEF/WERF/LIFT Intensification of Resource Recovery (IR^2) Forum event, a discussion group on dewaterability reported that there is a significant data gap and lack of consensus on reporting dewaterability parameters based on a widely accepted standardized protocol. There has not been any defined singular mechanism for the dewaterability impact. Thus, a detailed investigation addressing the relevant fundamental mechanisms (physical, chemical, biological, and thermal) on dewaterability, effective plant operating parameters, and overall performance of different EPBR biosolids treatment and resources recovery processes is required.

PROJECT GOALS AND OBJECTIVES

The primary goal for this research effort is to identify pathways for improving bio-P biosolids dewaterability in relation to EBPR and phosphorus recovery. The work proposed should build upon existing experience and ongoing research globally. The research needs and gaps include, but are not limited to:

- The investigation of multiple EBPR sludges from a variety of different WRRFs to determine whether the dewatering impact observed in some WRRFs is consistent with a broader sampling of EBPR WRRFs.
- A better understanding of the physical, thermal, chemical, and biological mechanisms affecting dewaterability for EBPR sludges.
- An integrated, full plant system understanding of the impacts on dewaterability and phosphorus recovery potential.
- Standardized methods and approaches for dewaterability of EBPR sludges to be adopted and applied. This can include methods for dewatering potential (characteristics) of sludge and/or approaches to polymer evaluation and optimum dose determination to compare among facilities.
- The development of a laboratory-scale dewatering device that mimics full-scale dewatering equipment (such as centrifuges), and that can be followed by a pilot plant or full scale validation in a suitable plant.

SCOPE OF THE PROJECT

This RFP is purposely not overly prescriptive to encourage innovation and creativity, thereby enabling proposers to demonstrate their understanding of the importance and need for this project and their approach to address this need.

However, proposers are expected to successfully achieve the primary goal above (i.e., the goal from previous section*)* and should address the key elements outlined below in their proposal:

1) **Project Significance** *(to demonstrate understanding of need for project)*
   - Statement of Importance: Concisely state why the proposed work is of importance and relevant to the mission of WERF and the greater water quality community.
   - State-of-Knowledge Supporting the Research: Describe the current state-of-knowledge regarding dewaterability properties and issues related to EPBR sludge and its impact on phosphorus recovery; as well as the scientific and technological advances in this subject. Experience in EBPR and phosphorus recovery is highly encouraged for the proposer. Make a strong and compelling case for the originality and innovation of the proposed work.
   - Science/Technology Outcomes Potential: Describe how the proposed work will advance our understanding in this area and how it could lead to a transformation in how WERF subscribers perform their business.

2) **Project Approach** *(to demonstrate creative solutions / approach to address the need)*
   An appropriate research approach is expected to provide:
   - Description of the specific objectives that will be addressed by the proposed work.
   - Details of the experimental design and procedures to be used to achieve all stated objectives in a scientifically defensible manner.
   - Details of how progress will be measured and successfully accomplished as the project progresses.

ANTICIPATED DELIVERABLES AND MILESTONES

The proposal should include a detailed scope of work, budget, as well as a list of deliverables and milestones to track, communicate, and measure progress for this research. Deliverables include, but is not limited to, written progress reports, conference calls, and presentations for seminars / meetings / webinars / workshops / conference technical sessions. Draft and final reports that can be published and distributed by WERF are among the required deliverables. The Final Report (and / or other deliverables) submitted at the conclusion of the research should satisfactorily address technical peer review comments and provides useful, actionable outcomes.

This research anticipates the following deliverables submitted to WERF in a timely manner:

- Progress reports describing technical progress and implications for the industry.
- Draft final report.
- Final Report (at conclusion of research).
- Presentations and/or proceedings that can be used to transfer significant findings to end users including sponsors of the research.

There are various ways to communicate the findings of the research. It is highly recommended that proposers review WERF's guidance document on communications deliverables and planning, which is available online. Progress reports and deliverables should be provided to WERF based on the schedule that is proposed in the scope of work. WERF will distribute these to a technical peer review committee for review and input. The selected contractor is expected to be available for teleconferences and/or online discussions with the technical peer review committee during the course of the research, and for one or more workshops/seminars.

SELECTION PROCESS AND CRITERIA

Selection of proposals is a very competitive process. Proposals will be reviewed by WERF and the Issue Area Team (IAT) for the Resource Recovery challenge. This external review team may be complemented as needed by subject matter experts. As part of the evaluation process, WERF reserves the right to request interviews, either via conference call or in person, with qualified proposers if necessary.

Proposers are encouraged to develop and submit their intended research plan that meets the research goals of this RFP, provides sufficient details of their budget, as well as schedules and milestones that can successfully deliver on the stated research goals, objectives, and tasks that are proposed.

WERF will evaluate proposals on the following components:

- Research team whose member's education, knowledge, and experience directly relates to the project scope. (30%)
- A clear, focused, and creative research approach that demonstrates the ability to achieve the research objective(s), and provides tangible outcomes that industry can use as the project progresses. (30%)
- A competitive, realistic budget that includes leveraging opportunities (external funds, partnerships, collaborations, in-kind contributions, etc.). (20%)
- A detailed communications plan specifying outreach products (workshops, webinars, articles, etc.) and the intention to work in coordination with WERF. (10%)
- A proposed schedule that moves the project forward as quickly as practical to achieve the objective(s) with decision points for consultation with WERF. (10%)

PERIOD OF PERFORMANCE:

The anticipated period of performance is to be 24 months (2 years) from notice to proceed (NTP). A NTP is planned to be issued to the selected proposer after WERF's Board of Directors approval in April 2016, with an anticipated project start date of June 1, 2016.

FUNDING AVAILABLE:

The total WERF cost/budget for this research effort is anticipated to be about US $175,000.

Proposers are strongly encouraged to seek additional partners, collaborators, test sites, case studies, etc., to further leverage the level of effort and funding, as well as to successfully complete the research. Additional in-cash and in-kind contributions, for example, through technology providers, water resource recovery facilities, personnel, laboratories, etc., are also encouraged. The due date for this RFP has been extended to provide additional time for potential teaming and partnership arrangements, collaboration opportunities, and to obtain in-kind or in-cash contributions.

The budgeted amount (including in-kind/in-cash contributions) is expected to cover the entire scope of work of the research team.

INSTRUCTIONS:

Proposers must follow WERF solicited RFP instructions for submitting proposal applications. Instructions for preparing a proposal are on the WERF website. Additional guidance on the communications plan and a sample contract may also be accessed online.

Proposals are due in WERF's offices by 4:00 p.m., Eastern Standard Time on Tuesday, March 1, 2016. Proposals received after the due date will be returned to the sender. As part of the evaluation process, WERF reserves the right to request interviews, either via conference call or in person, with qualified proposers if necessary.

REFERENCES

Alm, R., Sealock, A., Koo, A., & Sprouse, G. (2015*) Investigations into Improving Dewaterability at a Bio-P/Anaerobic Digestion Plant*. Proceedings of WEF Residuals and Biosolids Conference 2015. Washington, D.C.

Benisch, M., Schauer, P., & Neethling, J. (2014) *Improving Dewaterability of Digested Sludge from EBPR Facilities*. Proceedings of WEF Residuals and Biosolids Conference 2014. Austin, TX.

deBarbadillo, C., & Barnard, J.L. (2015). *Evaluation of Performance and Greenhouse Gas Emissions for Plants Achieving Low Phosphorus Effluents* (Report No. NUTR1R06v). Alexandria, VA. WERF.

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Higgins, M., Bott, C., Schauer., P., & Beightol, S. (2014) *Does Bio-P Impact Dewatering After Anaerobic Digestion? Yes, and Not in a Good Way!* Proceedings of WEF Residuals and Biosolids Conference 2014. Austin, TX.

Latimer, R., Khunjar, W.O., & Jeyanayagam, S. (2015). *Towards a Renewable Future: Assessing Resource Recovery as a Viable Treatment Alternative – State of the Science and Market Assessment* (Report No. NTRY1R12a). Alexandria, VA. WERF.

Novak, J.T., Muller, C.D., & Murthy, S.N. (2001) *Floc structure and the role of cations*. Water Sci. Tech, 44(10), 209-213.

WEF, WERF, LIFT. (2015). *Overcoming Dewaterability Impacts: Bio P, Anaerobic Digestion, and Struvite*. Breakout Notes from Intensification of Resource Recovery (IR^2) Forum. Manhattan College, NY.