Water Equipment & Policy (WEP) NSF I/UCRC
at University of Wisconsin-Milwaukee (UWM) and Marquette University
Call for 2025 Proposals

Overview: University of Wisconsin-Milwaukee (UWM) and Marquette University (MU) collaborate in an NSF Industry/University Cooperative Research Center (I/UCRC) on Water Equipment & Policy (WEP) (www.wepiucrc.com). Funding for research in the center comes from industries/various organizations who are members of the center. The center currently has eleven members:

A.O. Smith Corporation, Badger Meter, GE Appliance, Milwaukee Metropolitan Sewerage District (MMSD), NEW Water (Green Bay), Sentry Equipment, Sloan, Pentair Inc., US Environmental Protection Agency (EPA), Watts Water Technologies, and The Wisconsin Department of Natural Resources (DNR).

These companies/organizations are also members of the center Industrial Advisory Board (IAB). The IAB is responsible for selecting the projects that are funded. The WEP center is pleased to announce that it will award around $500,000 in 2025. These awards will be made to seed promising research in areas that are defined in the center technology roadmap and will benefit member companies/organizations.

Research Areas: The center seeks to emphasize the following research areas that are of interest to its IAB members. Ideas that are not included in the following list but can significantly impact the water industry will also be considered.

Materials

Time Release minerals

- Materials that time-release minerals, such as calcium, magnesium, vitamins, etc. into the water. A preferred embodiment is one where the minerals feed at a constant rate (+/- 10%) without the use of mechanical feeding mechanisms or by-pass even with changes in flowrate and periods of stagnation. These materials must be compliant with FDA and NSF standards for drinking water. The materials are expected to be non-friable.
    - *Members to contact for more information: A.O. Smith, Pentair, GE Appliances*

Inorganic biocides

- Passive (non-electronic) inorganic biocides that can be used in POU systems. The new biocides must not contain silver, quats, or other contaminants of concerns according to RCRA/TSCA. The material may be in a powder or granular form. Members of the IAB would like the project to produce 3-5 hypotheses / materials to develop with a down-selection. The goal of this 1-year program is not to produce a final product, but to provide the members with a technology that can be optimized with internal R&D programs. There is need in a subset of the members for versions that can be formulated into thermoplastic materials commonly used to mold or extrude plastic components.
    - *Members to contact for more information: A.O. Smith, GE Appliances*

Heavy Metal Removal

- Adsorbent materials that can offer a performance or cost benefit over existing technologies for heavy metal removal: Lead, mercury, arsenic, cadmium, chromium, selenium, etc. Performance improvements could include advancements in capacity or kinetics or the ability to capture chelated metals. The industrial partners are interested in selective removal and recovery in particular, and regeneration of the media.
    - *Members to contact for more information: A.O. Smith, Pentair, Watts, GE Appliances*

PFAS/POPs/Pharmaceuticals Removal

- Materials that can sorb Per and Poly-Fluoroalkyl Substances (PFAS), persistent organic pollutants (POPs), NDMA, consumer by-products, micro-pollutants, and pharmaceuticals. The materials must be able to withstand high temperature (200 C) for incorporation into POU carbon blocks. In this Phase 1 research, we are interested in the development of powder materials and how to tune them to be specific for PFAS vs POPs. We would like an increase of capacity of 20% or more from conventional materials.
    - *Members to contact for more information: A.O. Smith, Pentair, Watts, GE Appliances*

Ammonia Removal

- Adsorbents that can remove low levels of ammonia from drinking water. The ammonia is present as a byproduct of chloramination, occurrence in source waters or residual levels after the use of activated carbon to remove chloramines.
    - *Members to contact for more information: A.O. Smith*

Catalytic Scale Reduction

- Catalytic materials to prevent calcium carbonate scale adhesion (crystal structure modifiers, etc.) in premise plumbing, water heaters, and water using appliances in residential and commercial applications. These materials should be able to reduce scale to greater than 80% when tested to DVGW 512 standard test method.
    - *Members to contact for more information: A.O. Smith, Pentair, Watts, GE Appliances*

Oxyanion Removal

- Removal technologies are needed for improved oxy-anion (e.g. arsenic, selenium, etc.) removal from wastewater. Materials in the oxyanion form are not effectively removed with these traditional approaches. New technologies that will remove oxyanions to meet discharge limits. (<100 ppb depending on the element) are needed. The new technologies could be chemical additives. Materials of concern include arsenic, selenium, and chromium oxyanions.

- Heavy metals (lead, mercury, arsenic, cadmium, chromium, selenium, etc.) detection and quantification for inlet, treated, and waste waters. Sensor applications would include hand-held sensors for field testing and sensors that can be integrated into point-of-entry or point-of use water treatment systems (i.e. on-line). Treated water sensors need to be able to measure to less than EPA limits. One sensor that can measure multiple metals would be highly beneficial.
    - *Members to contact for more information: A.O. Smith, Pentair, Watts, GE Appliances, Badger Meter*

Sensors

Microbial Sensors

- Microbiological contamination detection and quantification, in particular of e coli and other regulated microbial contaminants, legionella or other waterborne pathogens, at concentrations that have regulator or compliance significance. (Must be able to speciate between target contaminants and non-pathogenic strains). This does not need to be on-line; it can be a rapid (<15 minute) off-line test with adequate detection. The intent is not to immediately replace existing techniques but to supplement them with a rapid indication of water quality.
    - *Members to contact for more information: A.O. Smith, Pentair, Watts, GE Appliances, Badger Meter*

Flow

- Low cost flow measurement technology with a focus on moderate to low flow rates and small size technology (with no moving parts).
    - One application is the ability to detect very low flow conditions (down to drip level) for determination of system leakage without shutting off the system to do a pressure decay test.
    - Another application is flow for partially filled pipes – i.e., be able to calculate discharge from a partially filled pipe accurately
    - Another application is leak detection for distribution systems
    - Another application is for very inexpensive but reliable measurement of flows of 50-150 ml/min.
    - Target technologies can be battery operated, require low power to operate, and demonstrate a 5+ year lifetime potential

- *Members to contact for more information: A.O. Smith, Pentair, Watts, Sloan, GE Appliances, Badger Meter*

- Incorporate pressure sensing capability (e.g. MEMS-like sensor package) to state of art flow sensing technologies.
    - Sensors must be easily integrated into existing products and capable of information communication (IIoT)
    - Applications call for low cost sensor technologies, comparable in cost & scale to MEMS devices (< $5/device)
    - *Member companies to contact for more information: GE Appliances, Sentry Equipment Corp*

Solid / Liquid Particulate Sensor

- Technology should be capable of differentiating particulates by size and speciation (i.e. shape, agglomerate, etc.) at particulate volume fractions greater than or equal to 10%.
- Cost position for proposed technology should be comparable to that of commercially available solutions.
    - *Members to contact for more information: MMSD*

Monovalent vs. Polyvalent ions

- Sensors to detect and differentiate between monovalent ions and polyvalent ions – for example, the sensor should be able to quantify Calcium vs. Sodium, Sulfate vs. Chloride.
    - *Members to contact for more information: Pentair, AO Smith*

Odor Control Sensors

- Development of low-cost odor sensors that can be deployed in harsh environments and detect odors related to H2S, Methyl Mercaptan, Ammonia etc. Most of odor monitoring for the industry focuses on H2S, CH4 with safety from inhalation and LEL in mind, would like a robust sensing technology for identifying odors beyond using wind direction to activate active control measures.
    - *Members to contact for more information: , MMSD, NEW Water, GE Appliances*

Systems

Sludge Densification

- Evaluate sludge densification strategies for improving Sludge Volume Index for improved settleability and energy and cost savings
    - *Member to contact for more information: MMSD, Sentry Equipment*

Scum to Biodiesel

- Evaluate the feasibility for refining scum (fats, oils, and grease) collected by MMSD into biodiesel as an internal renewable energy source
    - *Member to contact for more information: MMSD*

Pyrolysis of Fines from Biosolids (Chaff)

- MMSD produces a large amount of fines in manufacturing Milorganite®. These fines are disposed of at a landfill. MMSD is interested in evaluating the ability to convert this mass into energy via pyrolysis.
    - *Member to contact for more information: MMSD*

Hardness removal

- Remove hardness (Ca or Mg) from water without using chemicals (i.e. not salt or acid-based ion exchange) with high water efficiency (>90%). Needs to be suitable for point-of-entry residential applications – up to 10 gpm with daily production of 300 gpd.
    - *Members to contact for more information: A.O. Smith, Pentair, Watts, GE Appliances*

Surface Modifications - fouling

- Surface treatments for fouling mitigation / prevention – fouling including organic, biofilm, or scaling.
    - *Members to contact for more information: A.O. Smith, Watts, GE Appliances, Badger Meter*

Surface Modifications – corrosion resistance / hydrophobic

- Optimized materials selection for corrosion resistance of common water handling products.
- Scalable application technologies of performance enhancing coatings (hydrophobic, bio-film resistant, corrosion resistant, anti-fouling, etc.) to metal pipes.
    - How can hydrophobic coatings be applied in scalable fashion?
    - How can lifetime of bio-film / scaling / anti-fouling prevention coatings be extended?

- What are low-cost methods to apply corrosion resistant coatings to interior pipe geometries?
- *Members to contact for more information: Sloan, GE Appliances, Badger Meter, Sentry Equipment Corp*

Surface Modifications – corrosion resistance/ pumping efficiency

- Surface coatings for wastewater pump casings that improve pumping efficiency and reduce corrosion.
  - *Members to contact for more information: MMSD*

Prevalence of PFCs in air emissions resulting from the heat drying of biosolids.

- *Members to contact for more information: MMSD*

High Water Recovery Membrane

- Membrane technology that can operate at >75% recovery without fouling or scaling.
  - *Members to contact for more information: A.O. Smith, Pentair, GE Appliances*

Alternate TDS Reduction technologies

- Alternate technologies that can remove TDS by 90% + and operate at >75% recovery without fouling or scaling and operate under low water pressure / gravity.
  - *Members to contact for more information: A.O. Smith, Pentair, GE Appliances*

Filtration technology

- Filtration technology including system level evaluations and novel filtration media for drinking water applications.
  - *Members to contact for more information: GE Appliances, AO Smith*

Temperature control

- Understanding of methods to control temperature between 120 – 140F for mixing valve applications.
  - *Members to contact for more information: Sloan*

Wastewater treatment

- Wastewater treatment technology focused on efficiency, reduced cost, and energy use.

- *Members to contact for more information: NEW Water, MMSD, Sentry Equipment*

Sewage Sludge Incineration

- Air pollution control technology enhancements focused on efficiency, reduced cost, safety, and reduction in pollution. Of specific need, is an improved method for mercury emissions that outperforms granular activated carbon and to develop the understanding the fate of PFAS in the incineration and air pollution control equipment.
    - *Members to contact for more information: NEW Water*

Improved UV Disinfection

- Improved UV disinfection technology (lower energy, resistance to fouling, fast starting).
    - *Members to contact for more information: A.O. Smith, Watts, GE Appliances*

Lifetime of brass, elastomers, and plastics in chloramine environments

- Understanding of how long-term mechanical behavior of plastics and elastomers is impacted when components are operated in chloramine environments.
- How does technology enable predictive understanding of how chloramine impacts lifetime of brass products?
- How does technology enable accurate accelerated predictive lifetime testing for stress corrosion cracking?
    - *Members to contact for more information: Sloan, GE Appliances, Badger Meter, AO Smith*

Wastewater Process/Sludge Handling

- Co-fermentation for generating carbon for waste activated sludge stripping to remove internal phosphorus/biological phosphorus removal.
    - *Members to contact for more information: MMSD, NEW Water*
- Cost efficient nutrient recovery technologies for phosphorus and/or ammonia.
    - *Members to contact for more information: MMSD, NEW Water, WNDR*

Smart Alarm Logic for Wastewater

- Using Industry standard analyzers or analyzing techniques, develop the logic to determine core, low occurrence upset conditions and mitigation steps for wastewater treatment. A parallel industrial example would be using pH and conductivity to determine if a steam condenser has a condenser tube leak. This is a bottom top approach to AI/machine learning. Most machine learning applications need an extensive amount of data and repeated situations to "teach" the algorithms, however in low occurrence situations, there might not be enough occurrences to teach. Using deductive logic, most upset conditions can be determined by using concurrent sensor readings. The idea is to turn multiple "dumb" alarms and integrate them together to make them "smart".
    - *Members to contact for more information: Sentry Equipment Corp*

Policy

Point and non-point source pollutant control

- Modification of Storm Water Treatment Practices for Enhanced Phosphorus and Fecal/E. Coli Control: Preliminary evaluation of alternatives for improving phosphorus and harmful bacteria control in existing storm water management treatment practices. The evaluation should include literature review and identification of alternatives. For each alternative, identify potential effectiveness, estimated costs and barriers for use in Wisconsin. Results of the preliminary evaluation may be used to identify and monitor alternatives for pollutant reductions in greater detail.
    - *Members to contact for more information: WDNR*

- Total Suspended Solids and Phosphorus Removal in Detention Basins: Research suggests that detention basins are prone to re-suspension and/or discharge of previously removed storm water pollutants. However, it's unclear how significant pollutant re-suspension is or if it can be mitigated using alternative designs and/or vegetation. Storm water pollutant monitoring should be conducted at representative detention basins in Wisconsin to quantify pollutant re-suspension. Monitoring results should be compared with detention basin design and vegetation features to determine if any features can potentially mitigate pollutant re-suspension.
    - *Members to contact for more information: WDNR*

- Urban Soil Mitigation for Infiltration: Evaluate alternatives for improving infiltration capacity in urban areas. Identify recommended practices and potential barriers based on land use type, soil type, groundwater conditions and other factors if appropriate.
    - *Members to contact for more information: WDNR*

- Storm Water Illicit Discharge Monitoring: More frequent detection of phenol has been reported during dry-weather field screening of some municipal storm sewer outfalls in southeast

Wisconsin. It's unclear if the phenol detects represent actual illicit discharges, background levels of phenol in the environmental or some other factor. Evaluate municipal storm water outfalls with recent phenol detection to determine the source.

  - *Members to contact for more information: WDNR*

- Watershed approach for control and management of pollutants, such as chloride and nutrients, from both point and non-point sources; particularly agricultural runoff eutrophication.

  - *Members to contact for more information: NEW Water, WDNR*

Odor Control Strategies

- Development of odor control strategies for large CSO reservoirs, clarifiers, and biosolids handling activities.

  - *Members to contact for more information: MMSD, NEW Water*

PFAS

- Human and environmental impacts of PFOA & PFOS in Class A biosolids, including sludge & final product analysis, determination of concentrations of concern, and conducting growing study to determine plant uptake.

  - *Members to contact for more information: MMSD, WDNR*

Point/Non-Point Pollution Mitigation

- Vegetation Considerations for BMPs: Should vegetative growth on safety shelf or bottom be prevented/controlled (by what measures); if the former is okay, what species are preferred (what maintenance is required); can floating islands enhance pollutant removal in wet ponds; can wetland vegetation control re-suspension in wet ponds; is there ratio of wetland vegetation are to open water are where P release becomes significant; and how does P assimilation-storage-release work in Wisconsin/Illinois.

  - *Member to contact for more information: WDNR*

- Interactions of green infrastructure with conveyance structures, specifically the impact on private property inflow and infiltration and evaluation of infiltration practice design to reduce risks of exacerbating I/I.

  - *Members to contact for more information: MMSD, WDNR*

Point of use (POU)/Point of entry (POE) for SDWA Compliance – Case Studies

- Compile a database and summary report of existing case studies on use of POU/POE solutions for compliance to the SDWA (by small systems). Also compile a list of communities which are currently using POU/POE systems for compliance to the SDWA. And publish a gap analysis of any future research needs to support the use of POU/POE treatment for compliance to SDWA. Previous work to build on is EPA report 815-R-06-010, published April 2006.

    - Members to contact for more information: *GE Appliances, AO Smith*

Award Amounts: The maximum award size for new projects is $50,000/year, but the maximum award size for continuing projects may be up to $100,000/year, including 10% indirect costs. Proposals also must include $100 in funding for project management training for PIs, Postdocs and students who have not previously participated in the project management workshop. Funding periods shall initially be for one year, with clear deliverables stated. In the case of continuing projects, proposals need to be submitted annually with a summary of prior accomplishments and well-defined milestones and deliverables for funding requested for the specific year. Continuing projects will compete with new proposals received in the same round. The total funds awarded for this cycle is about $500,000.

Process: Investigators will be asked to submit a project executive summary, a project narrative no more than three pages, including references, a proposal budget with justifications (template provided), and a two-page CV for each PI. **The project narrative should include a detailed review on relevant patents, commercial products, and technologies (benchmarking)**. **It should also include a detailed discussion on potential risks, their probabilities, risk management plan, technology readiness level (TRL), and how WEP members could implement the technology or benefit from the technology upon successful execution of the project.** The PIs are encouraged to communicate with the IAB members to formulate their proposal ideas. Collaborative proposals between UWM and MU are encouraged. As a quality control, proposals will first be reviewed by center administrators to ensure they are complete with all of the information required by the IAB. Satisfactory proposals will then be reviewed by the IAB with possible iterations. There will be a two-week holding period for the IAB to quickly review the project scopes of all proposals received by the deadline. The IAB reserves the right to request any directional proposals during this holding period. If such proposals are requested and subsequently received, they will be considered along with all other proposals received by the deadline for the current funding period. PIs of selected proposals will be invited by the IAB to present at the center fall meeting when successful projects will be selected by the IAB.

Qualification Criteria: Qualifying proposals must meet the following criteria:

- **Field of Study** – water-related research areas defined by the IAB.
- **Researchers** – project is for UWM or MU-based research.

- **Funding period** – funding periods shall initially be for one year, with clear deliverables stated. In the case of continuing projects, proposals need to be submitted annually with a summary of prior accomplishments and well-defined milestones and deliverables for funding requested for the specific year.
- **Amount of funding** – up to $50,000/year for new projects and up to $100,000/year for continuing projects (including 10% indirect costs).
- **Intellectual property** – research can lead to potential intellectual property.

Scientific Evaluation Criteria: Complete proposals will undergo scientific evaluation by the IAB using the following criteria.

- **Quality –** Excellence and novelty of concept, approach, and methodology; benchmarking analysis; clarity and appropriateness of project plans; clear goals and deliverables for each funding period; desirability and impact of potential results on the IAB member companies and national /international scholarly community.
- **Return –** Return on investment (ROI) through direct implementation of the technology by member companies, research funding from external sources, potential for intellectual property, strengthening partnerships with IAB members, start-up companies and other commercial return measures.
- **Risk –** Availability of necessary skills and experience, likelihood of achieving the intended outcomes; probability of securing extramural funding or engaging in commercialization with the IAB member companies.

Timeline: TBD

Current IAB members and contact information:

1. A.O. Smith - Becky Tallon, Director Water Treatment Technologies, RMTallon@aosmith.com;
2. Badger Meter - Dan Fellers, Manager – Research and Development, dfellers@badgermeter.com;
3. GE Appliances – Gregory Chernov, Technical Expert – Filtration & Separation, Gregory.Chernov@geappliances.com, Amin Firouzi, Senior Chemist Amin.Firouzi@geappliances.com;
4. Milwaukee Metropolitan Sewage District (MMSD) - Matt Magruder, Environmental Research Manager, mmagruder@mmsd.com;
5. NEW Water - Nathan Qualls, Director of Technical Services, nqualls@newwater.us;
6. Pentair - Mike Beck, Senior Research Engineer, Mike.Beck@Pentair.com;
7. Sentry Equipment – David Nowak, VP Engineering, david.nowak@sentry-equip.com;
8. Sloan - Kay Herbert, Chief Scientist, Kay.Herbert@sloan.com; (Vice Chair)
9. U.S. Environmental Protection Agency – Jeff Yang, yang.jeff@epa.gov

10. Watts Water Technologies – Joe Burke, Joe.Burke@wattswater.com;
11. Wisconsin DNR – Jesse Jensen, jesse.jensen@wisconsin.gov