B3: A Distributed Sensing and Monitoring System: applications to SWTR compliance and point of use devices - Development of new, inexpensive disposable sensor with specific utility for small systems.

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Introduction

• *Brief Description:* Develop inexpensive disposable sensors with specific utility for small systems.
  
  ➢ Potential cost in range of $0.5 - $1 /sensor
  ➢ Fast, accurate, sensitive, and specific

• *Anticipated target utility characteristics:*  
  
  ➢ All utilities could potentially benefit. Especially those that may consider monitoring specific points-of-entry devices.

• *Continuum of technology development:*

![Continuum of technology development diagram]
Nanostructured Silver-modified Electrodes for Detection of Nitrate

Carbon Fiber Microelectrode (10-µm diameter)

Silver Wire Microelectrode (15-µm diameter)

Electrode Characterization: Increase in Surface Area

A ~8X increase

B ~15X increase
Sensor Response: Dose-response Curves in CV

10 ppm nitrate as N equals 45 ppm nitrate as NO$_3^-$ (~726 µM NO$_3^-$)
Method 10-107-04-1-A (0.2 – 20 ppm N) = 14.52 – 1452 µM NO$_3^-$
Sensor Response in Synthetic Aquifer Sample

South Dakota Minnelusa Aquifer Surface Water
127 mg/L Ca(II), 32 mg/L Mg(II), 521 mg/L Na(I), 3 mg/L K(I), 252 mg/L bicarbonate, 257 mg/L sulfate, 12 mg/L chloride, 0.5 mg/L fluoride, 0.3 mg/L bromide, and 0.01 mg/L iodide
Sensor Fabricated on Disposable Paper Electrodes

H₂SO₄ acidified samples from Nebraska Public Health Environmental Lab Lachat 8500 (Method 10-107-04-1-A) (EPA 353.2) (0.2 – 20 ppm N as NO₃⁻)
Outputs and Outreach

Completed:
• Electrochemistry Conference, University of Texas at Austin, Austin, TX (Feb 2015)
• University of California at Riverside, Department of Chemistry, Riverside, CA (Jun 2015)
• Michigan State University, Department of Chemistry, East Lansing, MI (Apr 2015)
• University of Nebraska-Omaha, Department of Chemistry, Omaha, NE (Sep 2015)

Scheduled:
• “Finding common ground for standardized approaches for state regulatory approval of new technologies ”, AWWAACE, Chicago, June 2016.
• Data Sharing with WINSSS State Regulation Workgroup, Feb. 2016
• Truman State University, Department of Chemistry, Kirksville, MO (Apr 2016)

Publications

Anticipated:
• Short description for WINSSS website, Fall 2016.
• Possible WINSSS Webinar – 2017