

## NETWORKED IN-SITU WATER MONITORING

MAJ Joseph R. Geary, Gary Nijak, Jr., Dr. Jeffrey W. Talley, P.E.  
Department of Civil Engineering and Geological Sciences, University of Notre Dame  
156 Fitzpatrick Hall  
Notre Dame, IN 46556-5637

### ABSTRACT

The Talley Research Group at the University of Notre Dame has developed an exciting technique for the in-situ monitoring of fecal matter indicator organisms in recreational and source water. The ruggedized sensor is coupled with an embedded wireless node which processes information and transmits it to a central monitoring station. Using fiber optics and targeting organism specific enzymes, our sensor is capable of detecting low concentrations in less than 7 hours. Higher concentrations indicative of a sewage discharge or biological attack can be detected in less than 1 hour. Additional attributes include the ability to leave unattended for up to 3 months, durability due to limited moving parts, low power requirements and the ability to test for multiple organisms.

### KEYWORDS

Biosensor, In-Situ, Wireless, Water Monitoring

### INTRODUCTION

EPA approved methods require an 18-24 hour incubation period prior to manually quantifying *Escherichia Coli* (EC). By this time the event has passed and the count is no longer an accurate assessment of the water quality. Our system allows automated, continuous near-real time pathogen monitoring, quickly alerting officials to the presence of fecal matter and allowing them to make informed decisions as to the use of their water. An initial field demonstration of 3-5 networked sensors is scheduled in Spring 2008, in South Bend's (IN) St. Joseph River. The poster will include results of this demonstration.

### Initial results

In the bench level tests of the sensor prototype, we chose EC as the indicator organism. This sensor utilizes fiber optic waveguides to transport light to a reactor filled with sample and reagent. A spectrometer is used for the detection of a fluorescent byproduct hydrolyzed by the  $\beta$ -glucuronidase enzyme unique to EC. As the fluorescent byproduct is hydrophilic it can be targeted without separating it from the sample. An  $R^2 = 0.94$  ( $n=50$ ) correlation between initial EC counts and fluorescent intensity indicates the sensor's ability to semi-quantify. Low levels (100-500 CFU/100mL) were detected within 4-7 hours of sample introduction. Higher levels (>5000 CFU/100mL) were detected within 1 hour. The effects of turbidity, tested at levels common to recreational waters, were minimal and did not hinder or lengthen the detection times.