

ADAPTING MARINE IN SITU PHOTOMETRIC NUTRIENT MONITORS FOR FRESHWATER APPLICATIONS

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Biographical Sketch of Authors

Charles Patton is a Research Chemist in the Methods Research and Development Program at the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) where he applies his knowledge of analytical chemistry and continuous flow analysis to solve problems related to nutrient, ion, and trace metal analyses, automated sample preparation, and field monitoring techniques. Before joining the NWQL in 1988, Patton designed and developed continuous-flow analyzer hardware and software at the Alpkem Corporation. He earned a BA in Chemistry from the College of Wooster, and MS and Ph.D. degrees in Analytical Chemistry from Michigan State University. Peter F. Rogerson is the Senior Chemist of the USGS Office of Water Quality. In earlier assignments, he established the Methods Research and Development Program at the NWQL and later served as Chief of the NWQL. Prior to joining the USGS in 1986, Rogerson developed analytical methods for contaminants in marine systems at the Narragansett Environmental Research Laboratory of the U.S. Environmental Protection Agency. Rogerson earned a BS in Chemistry from the University of Vermont, a Ph.D. in Analytical Chemistry from the University of North Carolina, and was a postdoctoral fellow with Prof. Fred W. McLafferty at Cornell University.

Abstract

Submersible, colorimetric nitrate analyzers became commercially available to marine scientists in the early 1990s. Over the past 5 years the use of these in situ nutrient monitors in oceanographic research has increased steadily. More recently U.S. Geological Survey (USGS) scientists have used these analyzers for unattended nitrate determinations in freshwater regimes at remote locations. Programmable sampling rates on the order of 1 to 4 per hour—sampling rates greater than 4 per hour are actually possible—over periods ranging from a few days to several weeks provide temporal resolution of concentration changes that would be difficult or prohibitively expensive to obtain by conventional means. In addition, real-time chemical analysis eliminates costs and potential errors associated with sample processing, shipping, and storage. Because the use of in situ nutrient analyzers in USGS programs is likely to expand substantially in the near future, we were motivated to evaluate analytical performance of such analyzers under laboratory and field conditions and to explore data-quality assessment issues. In this presentation we describe the functional basis of these photometric analyzers, suggest modifications to chemical methods for improved operation in freshwater regimes, discuss merits of near-stream rather than in-stream deployment, and provide accuracy and precision estimates for nutrient concentration data collected in the laboratory and at remote locations.