

ONLINE  
TOTAL ORGANIC CARBON  
(TOC) ANALYZERS FOR  
INDUSTRIAL WASTEWATER

A PERFORMANCE EVALUATION REPORT

*2012*

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## ITA's PERFORMANCE EVALUATION REPORTS

The Instrumentation Testing Association (ITA) was established on March 1, 1984 at a United States Environmental Protection Agency (U.S. EPA) meeting held in Chicago, Illinois to address the need for obtaining unbiased and objective field test performance evaluations of online instruments used in the water and wastewater treatment industry. ITA was formed as a 501(c)(3) non-profit organization to conduct charitable, educational, and scientific testing for public safety. ITA's mission: *to advance the theory and practice of instrumentation and automation for water and wastewater treatment and other public works facilities by promoting the reliable performance of environmental instrumentation and automation technologies*: was developed by its volunteer Board of Directors representative of public and private, water and wastewater treatment utilities, throughout the U.S. and Canada. ITA's mission is designed to advance treatment that will result in providing better public water service and enhancing public health. ITA carries out its mission by developing and disseminating information on instrumentation and automation technologies and conducting educational programs in the field of instrumentation and automation.

ITA's performance evaluation reports are intended to provide evaluation information through a review of technical practices and detailed procedures that research and experience have shown to be functional and practical. ITA's test results can be used for different treatment plants. There is the common (mis)conception that everyone needs to test at their facility because their plant is different. In the ITA tests, we attempt to force variable conditions (lower DO, changing blanket level, etc....) to make the tests more applicable to varied conditions. We also publish the chemical and physical conditions during the test for this comparative assessment.

Instrumentation testing by ITA is entirely independent of the influences of manufacturers during the test and ITA does not draw conclusions on performance based upon the results of the test. However, ITA serves to involve manufacturers and users in the development of test protocols. This approach sets ITA apart from other testing organizations who do not allow manufacturer input. We at ITA believe this approach provides a better testing regime where those who own significant general and specific knowledge can help design the best possible test protocol.

ITA's cooperative testing process provides unbiased evaluations and provides a unique organization in the openness of protocol development. All participating manufacturers assist with the development of the test protocol and procedures along with the ITA committee members from various member utilities. In addition, all manufacturers get to review and provide published comments to their respective test results and the manufacturer's comments are included in the final report. Readers can judge the test outcome by these comments and ITA's unbiased reporting.

ITA's Performance Evaluation Reports provide performance evaluation statistical and graphical data for comparison of average and variability results. ITA not only reports factually on accuracy of instrumentation, but also documents instrument operation, flexibility, and maintenance, based on real field experience by test facility plant staff. ITA's test reports will not provide a "Consumer's Report" type rating or opinion, but ITA will supply the facts you need to know to make an informed decision for selecting the best instrument for your treatment plant.

## ABSTRACT

This performance evaluation report presents the results of tests conducted on online total organic carbon (TOC) analyzers to evaluate the accuracy, reliability, and maintenance requirements of each analyzer for industrial wastewater treatment applications. The Instrumentation Testing Association (ITA) and Gulf Coast Waste Disposal Authority (GCWDA), Bayport Industrial Wastewater Treatment Plant (WWTP), sponsored this test. The performance of five online TOC analyzers was tested and evaluated over a period of four months.

Chapter 1 provides an introduction to online TOC analyzers and describes the purpose and scope of this test. Chapters 2 through 4 present information regarding test site description, procedures, and test data. Chapters 5 through 9 describe participating manufacturers' online TOC analyzers and present respective test results. Chapter 10 provides a comparative analysis and report summary.

## EXECUTIVE SUMMARY

The Gulf Coast Waste Disposal Authority (GCWDA) Bayport industrial plant provides wastewater treatment for a host of industries (largely petrochemical) located in a chemical complex outside of Houston, Texas. The GCWDA Bayport Wastewater Treatment Plant has a treatment capacity of 30 million gallons per day (MGD) and serves approximately 65 customers in the Pasadena, Texas industrial area. GCWDA customers tie into one of 9 stations along a 2.5 mile long “*Biosan*” influent pipeline to the plant. Each of the 65 customer streams are monitored with a dedicated flow meter and 24-hour composite sampler.

GCWDA manually performs up to 66 TOC laboratory analyses per day. GCWDA performs TOC analysis for two primary purposes: 1. To monitor influent wastewater characteristics to conduct process control and detect waste loading upsets; and 2. To monitor wastewater characteristics of each customer for monitoring and billing purposes. Plant operators perform a TOC analysis at the influent sample building for process control and monitoring upsets and the laboratory performs TOC analysis separately for the composite samples collected from customers along the BioSan influent pipeline for billing and monitoring purposes.

By testing online TOC analyzers, GCWDA plans (in the short term) to replace the manual TOC analysis conducted by operators to monitor wastewater influent for upsets and perform process control. GCWDA also has a long-term goal of potentially automating process control and installing online TOC analyzers along the BioSan influent pipeline to actively monitor customers. By implementing online TOC analyzers at the influent sample building and along the 9 stations of the influent pipeline, GCWDA hopes to reduce labor costs of manually conducting TOC analysis and are very interested in using online TOC data to better monitor, control and automate their treatment process and billing methods.

Gulf Coast Waste Disposal Authority (GCWDA) partnered with the Instrumentation Testing Association (ITA) to conduct a cooperative field test of online total organic carbon (TOC) analyzers. GCWDA and other ITA members have a keen interest in the ability to continuously monitor TOC concentration in an industrial wastewater treatment application to benefit from having more timely information for enhanced process control and a reduction in labor requirements. This cooperative test project was supported by GCWDA and other ITA members representing treatment facilities, industry, consultants, and manufacturers, including Gulf Coast Waste Disposal Authority, Pasadena, Texas; Endress+Hauser, GE Analytical Systems, Hach Biotector, Liquid Analytic Resource (LAR), and Shimadzu.

This report provides an overview of ITA's testing approach starting with committee development of test protocol and procedures; design of test site reference measurements; test site personnel training; and analyzer installation, calibration, operation, and maintenance requirements and presentation of ITA test data results in statistical and graphical formats.

The online TOC analyzer field test project was conducted at the Bayport Industrial WWTP over a period of four months (April through July 2011) to evaluate the side-by-side performance of five online, ex-situ TOC analyzers

field-tested in an industrial application. Table 2-2 lists the manufacturers, models, and technology of the online TOC analyzers tested at GCWDA.

The ITA TOC field test performed at GCWDA Bayport Industrial WWTP introduced real-life circumstances such as power outages, changes in personnel, and climatic variations, including exposure to severe weather conditions. The test project not only recorded instrument performance and maintenance requirements but also noted how the analyzers held up to everyday "real-life" situations that are difficult to account for with laboratory/pilot testing.

## PREFACE

The purpose of this publication is to report on the performance of online Total Organic Carbon (TOC) analyzer technologies for industrial wastewater treatment applications. This evaluation report is intended to provide information regarding online TOC analyzer operational conformance to conditions and standards typical of a specific testing environment. It is also intended to provide designers and operators with an information package to assist with the selection of online TOC analyzers and provide instrument manufacturers with information regarding equipment requirements for specific applications.

This report presents results of field test data in tables of parameters and graphs of data that quantify performance and accuracy. It is difficult to compare these results in a general methodology because instrument applications and conditions vary greatly. Therefore, the reader of this report is responsible for determining which parameters are of most importance to his or her application and to select the most suitable instrument for his or her respective needs. It is also emphasized that a complete assessment of the information presented herein requires that the report be read in its entirety.

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## Manufacturers

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