



# Instrumentation Testing Association

Promoting Reliability & Performance of Environmental  
Instrumentation and Automation Technologies

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TO: ITA Members and Associates

RE: ITA TOC Research Project Team Invitation

Dear ITA Members and Associates in the Wastewater Industry,

Having reliable and accurate measurements of waste loading can **save wastewater treatment plants thousands of dollars in labor, energy, chemical costs**, and provide real-time monitoring and process control capabilities. These savings are not currently available with the standard practice of measuring the 5-day biochemical oxygen demand (BOD<sub>5</sub>).

**ITA is seeking participants** for its total organic carbon (TOC) research project which will investigate the performance and reliability of on-line TOC analyzers and demonstrate a correlation of BOD<sub>5</sub> and chemical oxygen demand (COD) to TOC for substitution of BOD<sub>5</sub> for reporting purposes.

ITA is teaming with **Dr. Krishna Pagilla of the Illinois Institute of Technology (IIT)** and is looking for up to 50 wastewater treatment plants to participate in this large study.

Enclosed you will find a project brochure and commitment form that **invites you to join our research team.**

Please take a moment to review how you can benefit from participating in the TOC research project and simply fill-in the project commitment form to become a member of our team.

With best regards,

You can  
benefit by:

Receiving  
specific BOD<sub>5</sub>  
correlation  
algorithms for  
your plant



Improving  
response to  
waste loading  
upsets



Reducing  
energy,  
chemical and  
operating  
costs



Reducing or  
eliminating  
BOD<sub>5</sub>  
measurements



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A non-profit 501(c)(3) technical and  
educational association

Letter of Commitment for Participation in ITA's Research Project:

## ENHANCING ENVIRONMENTAL MONITORING USING TOTAL ORGANIC CARBON (TOC)

**Return To:** ITA TOC Research Project  
PMB 23805 PO Box 2428  
Pensacola, FL 32513 USA

Fax: 702-568-1446

Email: ita.instrument@earthlink.net

**FROM:**

<b>Name:</b>			
<b>Position/Title:</b>			
<b>Organization:</b>			
<b>Address:</b>			
<b>Phone:</b>		<b>Email:</b>	

**TREATMENT PLANT DESCRIPTION:**

Treatment Plant Type	Treatment Technology (please check all that apply and attach additional documentation for treatment technology description)	Parameters your in-house laboratory routinely measures and frequency				
		Parameter	1 x /wk	2x /wk	3x /wk	>4x /wk
<input type="checkbox"/> Industrial	<input type="checkbox"/> Activated Sludge w/o Nitrification	<input type="checkbox"/> Nitrifying Activated Sludge				
<input type="checkbox"/> Municipal	<input type="checkbox"/> Pure Oxygen w/o Nitrification	<input type="checkbox"/> Biological Nitrogen Removal	<input type="checkbox"/> BOD <sub>5</sub>			
<input type="checkbox"/> Combination (specify %)	<input type="checkbox"/> Biological Nitrogen & Phosphorus Removal	<input type="checkbox"/> Chemical Coagulation for Phosphorus Removal	<input type="checkbox"/> CBOD <sub>5</sub>			
<input type="checkbox"/> Other (specify)	<input type="checkbox"/> Disinfection (UV/Chlorine)	<input type="checkbox"/> Trickling Filters	<input type="checkbox"/> COD			
	<input type="checkbox"/> Membrane Filtration	<input type="checkbox"/> Effluent Screening	<input type="checkbox"/> TOC			

**RESEARCH PROJECT COMMITMENT (please indicate all that apply):**

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

1. BOD<sub>5</sub>:TOC CORRELATION STUDY
2. COD:TOC CORRELATION STUDY
3. TEST SITE FOR ONLINE TOC INSTRUMENT TEST
4. PROJECT ADVISORY PANEL MEMBER
5. MANUFACTURER INSTRUMENT DONATION

I would be pleased to participate in the above-referenced 2 year ITA TOC Study and will donate resources and expenses, within reason, including time (about \_\_\_\_\_ hours) per year and expenses with a value of approximately \_\_\_\_\_ to provide in-kind support for the following selected portion(s) of the project:

**CORRELATION STUDY:** by providing the project team with laboratory test results for BOD<sub>5</sub>, and/or COD and TOC for the BOD<sub>5</sub>:TOC and/or COD:TOC correlation portion of the project over a period of 6 to 12 months. It is my understanding that the final project report will anonymously report correlation data and that correlation data will remain confidential to each treatment plant participating in the study.

**ONLINE TOC ANALYZER TEST SITE:** to provide in-kind support for approximately 3 to 6 months for the online instrument performance test portion of the project as a test-site which would include laboratory test results for TOC, SCADA data collection and real-time control of test instrument measurements, maintenance of test instruments, and test site meetings;

**ADVISORY PANEL MEMBER:** to provide advisory and review services for project QA/QC;

**INSTRUMENT MANUFACTURER:** as a manufacturer participant to donate online TOC analyzer(s) for approximately 3 to 6 months, per test site (up to 3 test sites, consecutively), to provide support for instrument installation, training and repair for the performance test portion of this project.

**SIGNATURE:**

**DATE:**

Please Return to ITA TOC PROJECT

FAX: 877-236-1256



# TOC Research

## Objectives

- Demonstrate the long-term correlation of BOD and COD to TOC.
- Critically assess the performance and reliability of online TOC analyzers installed at wastewater treatment facilities.
- Develop a step-by-step guide of protocol and procedures to be used as a tool for wastewater treatment plants to assist with the modification of permits relating to BOD<sub>5</sub> reporting.

## Benefits

- Reduce or eliminate BOD<sub>5</sub> measurements which are a labor intensive and time consuming.
- Reduce energy and chemical costs associated with treatment processes.
- Increase plant operations efficiency and response to waste loading upsets.
- Reduce the impact of waste loading discharged to the environment.
- Provide treatment plants with a more precise and quantifiable measurement for regulatory reporting and process control.

**“The City of Santa Cruz, California was successful in demonstrating a correlation between BOD and TOC and now reports a monthly average of TOC.”**

## References

APHA, A. a. (1998). Standard Methods for the Examination of Water and Wastewater 20th Edition.

Babatola, A. (2006). TOC NPDES Limit Letter. Santa Cruz, California: City of Santa Cruz.

Bourgeois W, B. J. (2001). On-line monitoring of wastewater quality: a review. Journal of Chemical Technology and Biotechnology , pp. 337-348.

Constable. (1979). BOD/TOC Correlations and Their Application to Water Quality Evaluation. Water, Air and Soil Pollution , 363-375.

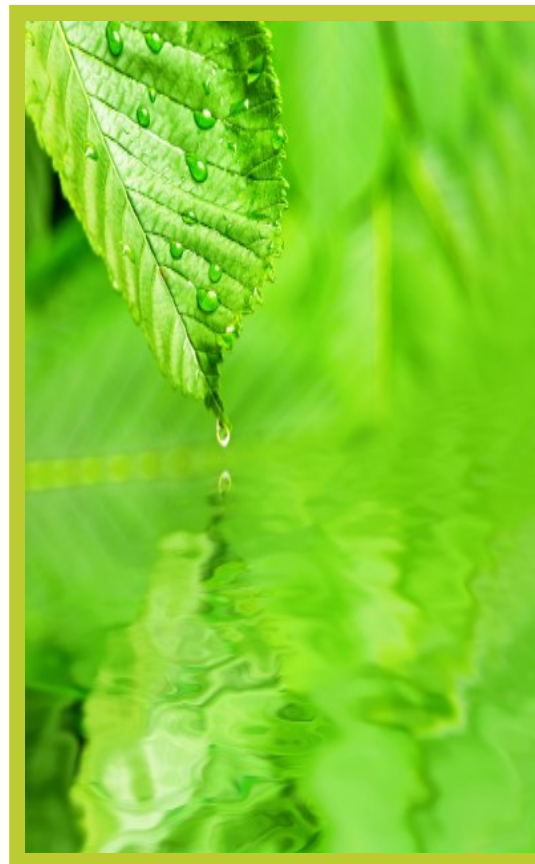
USEPA. (2000). Progress in Water Quality, An Evaluation of the National Investment in Municipal Wastewater Treatment EPA-832-R-00-008, Chapter 2, An Examination of BOD Loadings Before and After the CWA. Washington, D.C.: US EPA Office of Water.



## Instrumentation Testing Association (ITA)

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## ENHANCING ENVIRONMENTAL MONITORING USING TOTAL ORGANIC CARBON (TOC)

### ITA Collaborative Research

**Instrumentation Testing Association (ITA)**  
Krishna Pagilla, Ph.D., P.E.  
Illinois Institute of Technology (IIT)

# TOC ENHANCES WWTP OPERATIONS

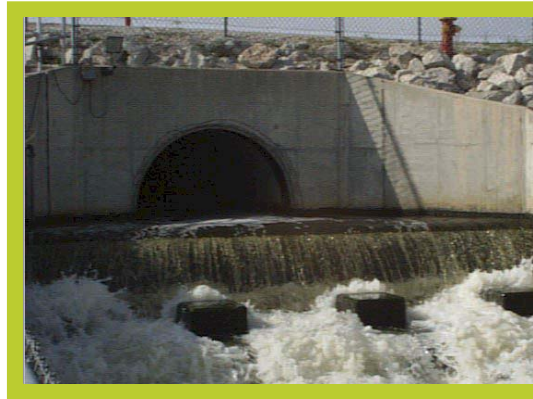
## The Challenge

Wastewater treatment plants (WWTPs) are challenged with the objective of treating wastewater at a level that is acceptable for discharge into receiving waters. Regulatory agencies require that WWTPs routinely measure the biochemical oxygen demand (BOD) of treated wastewater to determine the strength and rates of wastewater loadings to and from wastewater treatment plants (USEPA, 2000). BOD measures the amount of molecular oxygen used during the biochemical degradation of organic material and the amount of oxygen used to oxidize inorganic material, during a specified incubation period, typically 5-days and is referred to as the BOD<sub>5</sub>.

The BOD test was first introduced in Standard Methods in 1917 and although refined since then, continues to be used to define the quality of treated wastewater even though many studies document issues associated with the application of the test, the meaning of the results and the limitations of the test itself (Bourgeois W, 2001).

## BOD<sub>5</sub> Limitations

BOD by its standard laboratory procedures and dilution method is a costly, labor intensive test that has a lower detection limit of 2 mg/L (APHA, 1998), a reproducibility only in the order of +/- 10 to 20% (Constable, 1979) and an uncertainty of 15 to 20% (Bourgeois W, 2001). BOD is an empirical test (APHA, 1998) that is insensitive to measuring the affects of toxic substances and is imprecise at low concentrations (Bourgeois W, 2001). Although the BOD test is still a widely accepted parameter for characterizing water quality, it cannot be used for process control or real-time monitoring, due to the time it takes to receive test results, at least 5 days (Constable, 1979).



## TOC: A New Approach

The wastewater industry has expressed a need for a new approach to BOD<sub>5</sub> that can provide quantifiable and precise measurements of receiving stream wastewater loadings and plant removal efficiencies in addition to providing monitoring and process control capabilities. Global regulations allow chemical oxygen demand (COD) or total organic carbon (TOC) to be substituted for BOD<sub>5</sub> when a long-term BOD:COD or BOD:TOC correlation has been demonstrated (40 CRF 133.104 (b)).

## TOC Research Scope

ITA is teaming with Dr. Krishna Pagilla of Illinois Institute of Technology (IIT) to demonstrate a long-term correlation of TOC to BOD<sub>5</sub> and COD to offer a faster, more accurate, and cost-effective measurement as an alternative to measuring BOD<sub>5</sub>. As part of this research, ITA will be field-testing online TOC analyzers to critically assess performance and reliability and to demonstrate monitoring and control capabilities. The findings of this research project will be documented in a report that will include a step-by-step guide of protocol and procedures to be used as a tool for wastewater treatment plants to develop a plan for the modification of permits relating to BOD<sub>5</sub> reporting.

## Instrumentation Testing Association (ITA)

ITA is a non-profit 501(c)(3), technical and educational association established at a U.S. EPA meeting in 1984 to conduct charitable, educational, and scientific research in order to enhance public health. For the past 26 years, ITA has successfully conducted and funded its own research and completed research funded by the U.S. EPA, U.S. Homeland Security, the Water Environment Research Foundation (WERF) and the American Water Works Association (AWWA). ITA is governed by a Board of Directors, representative of municipal and industrial treatment facilities and a membership comprised of wastewater treatment professionals.

## Join the Research Team

### WWTPs Needed for Correlation Study

ITA is looking for wastewater treatment plants who are interested in receiving specific correlation algorithms for their treatment plant and who routinely measure BOD<sub>5</sub>, TOC and/or COD. All participating treatment plants will receive acknowledgement and a full copy of the project report. All participating treatment plant correlation data will remain confidential and will be reported anonymously in the final report. The research team's goal is to collect correlation data for up to 50 WWTP's over a period of 6 to 12 months. Please contact ITA if your WWTP is interested in participating in this TOC research project.

### Contribute Funding

The research team is looking for organizations to contribute funding for this very important research project. All funding organizations will receive acknowledgement and a full copy of the project final report. Please contact ITA if your organization is interested in contributing funding.

**Contact ITA for more information.**  
**Phone: 1-877-236-1256**  
**Email: [ita.instrument@earthlink.net](mailto:ita.instrument@earthlink.net)**