

## The Sievers InnovOx TOC Analyzer: Compliance with USEPA Performance Criteria

### Overview

The USEPA has approved several official methods for determining Total Organic Carbon (TOC). In addition to its own methods, the USEPA recognizes the work of other organizations such as SM (Standard Methods), ISO (International Standards Organization), ASTM (American Society for Testing and Materials), and AOAC (Association of Official Analytical Chemists). All these groups have or share TOC methods that include wet chemical oxidation; the protocol used by the Sievers\* InnovOx Laboratory TOC Analyzer. Current methods that are observed as official methods by the USEPA for TOC analysis are EPA 415.3, 9060A; SM5310C; ISO 8245; ASTM D2579; AOAC 973.47.

### Methods Flexibility

With analytical advances occurring so rapidly, the USEPA and other regulatory bodies are unable to initiate and promulgate new methods for each unique method modification. To provide greater methods flexibility, the USEPA designed the streamlining initiative, which includes the following statements:

“One of the primary goals of the streamlining initiative [of the USEPA] is to encourage the use of innovative technologies by increasing method flexibility so that laboratories can modify approved reference methods without formal USEPA review. Under the streamlining program, it will no longer be necessary to apply for Alternate Test Procedure (ATP) approval of modified methods. Rather, laboratories will be required to demonstrate and document that the modified method produces results equal or superior to results produced by the unmodified reference method. To ensure data



quality, the USEPA is building in well-defined controls on this increased flexibility. These include designation of a reference method that contains quality control (QC) acceptance criteria for use in demonstrating equivalency, and specific requirements for validating modified methods and documenting equivalency.”<sup>1</sup>

The streamlining initiative specifically includes the Methods Update Rule (MUR) and the Methods Innovation Rule (MIR). The MUR and MIR add provisions that provide the regulated community with flexibility, including modifying reaction time and temperature as needed to achieve the chemical reactions defined in the unmodified method.

In addition, 40 CFR Part 136 has been modified so that laboratories using a modification to a currently approved method in compliance with the requirements of Section 136.6 no longer require an Alternate Test Procedure (ATP) determination letter.



## Sievers InnovOx Methodology

By invoking the MUR and MIR, the Sievers InnovOx simply elevates the temperature of the wet chemical oxidation method. This innovation achieves more efficient oxidation, which results in better accuracy and precision. The principle of the wet chemical oxidation method is to add an acid and an oxidizer to the sample of interest. The inorganic carbon is removed by purging, and the sample is then oxidized with persulfate at elevated temperatures. The resultant carbon dioxide is measured by a non-dispersive infrared spectrometer.

**Table 1.** EPA vs Sievers InnovOx Results

	Expected TOC Concentration ppm	Mean ppm	Std Dev ppm	%RSD
EPA	2	2.2	0.13	5.9
InnovOx	2	2.1	0.05	2.4
EPA	5	5.3	0.15	2.8
InnovOx	5	5.1	0.09	1.8
EPA	10	9.9	0.11	1.1
InnovOx	10	10.0	0.11	1.1
EPA	40	38.0	1.40	3.7
InnovOx	40	40.5	1.10	2.7

## EPA's Precision and Bias Statement vs. the Sievers InnovOx

The USEPA outlines the precision and bias expectations when analyzing potassium hydrogen phthalate (KHP). **Table 1** demonstrates the Sievers InnovOx's performance compared to the USEPA's performance criteria. The mean values for the Sievers InnovOx were calculated from nine consecutive runs for each concentration.

## Conclusion

The USEPA recognizes that companies like GE Analytical Instruments can contribute to analytical advances and has developed vehicles to accelerate the use of these new products. The Method Update Rule and Method Innovation Rule allow the immediate use of the Sievers InnovOx for compliance testing.

<sup>1</sup> Introduction, Chapter 2, Methods Flexibility, Streamlining Guide, EPA, 1996.

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