



# Using Microwave Sample Prep to Determine Trace Metals Analysis in Environmental Matrices

## Digestion of Environmental Samples Using the Milestone Ethos UP

### Summary

Demand for trace metals analysis in the environmental laboratory is growing strongly due to stricter environmental regulations. ICP has previously been the standard for metals analysis, but as demand for lower detection levels grows, labs are experiencing a significant transition to ICP-MS. This transition is placing increased emphasis on the sample preparation method. Traditional sample preparation techniques for environmental matrices include hot block digestion, closed-vessel microwave digestion, and ashing; all which include different challenges.

Hot block digestions suffer from long run times, airborne contamination, poor digestion quality, and poor recovery of volatile compounds. Closed-vessel microwave digestion has proven to be an effective alternative with fast, complete digestions, a clean environment, and full recovery of volatile compounds.

Closed-vessel microwave digestion is now included in the U.S. EPA official sample preparation methods for most environmental samples.



The Milestone Ethos UP microwave digestion system incorporates all of the benefits of closed vessel digestion – speed, data quality, ease-of-use- in a safe and compact bench-top system.

Ethos technology is perfectly designed for the following methods:

**EPA 3015:** Microwave assisted acid digestion of aqueous samples and extracts.

**EPA 3051:** Microwave assisted acid digestion of sediments, sludges, soils and oils.

**EPA 3052:** Microwave assisted acid digestion of siliceous and organically based matrices.

This technical note evaluates the digestion quality of BCR 277R Estuarine Sediment using EPA Method 3051.



Figure 1. The Milestone Ethos UP

## Instrumentation

The Milestone Ethos UP matches the main requirements of many environmental labs, thanks to its unique benefits:

- High throughput to increase productivity
- Flexibility to digest a variety of matrices
- Intuitive software
- Industry leading safety

The Milestone Ethos UP is a very flexible and high performing platform used for trace elements and routine analysis in environmental labs. It is available with multiple configurations, such as the SK-15 high pressure rotor and MAXI-44 high throughput rotor. The SK-15 and the Maxi-44 work with the Milestone “vent-and-reseal” technology for controlling and limiting the internal pressure of each vessel.

## SK-15 High Pressure Rotor

The SK-15 rotor perfectly matches the environmental lab's needs to determine trace elements, thanks to its capability to digest large sample amounts and its high temperature (300°C) and pressure (100 bar) capabilities.

The 15 position high-pressure rotor is safely controlled by a direct temperature sensor that constantly controls the digestion temperature during the run, ensuring complete and reproducible digestions of even the most difficult and reactive samples.



Figure 2. The SK-15 High Pressure Rotor

## MAXI-44 High Throughput Rotor

The MAXI-44 is a high throughput rotor capable of digesting a large variety of environmental samples. The Maxi-44 rotor is fully controlled by contact-less sensors that directly control the temperature and pressure of each vessel. The Maxi-44 assures maximum safety and digestion quality, while greatly improving throughput for the environmental laboratory.





Figure 3. The MAXI-44 High Throughput Rotor

## Analytical Procedure

Table 1 shows results of the digestion BCR 277R Estuarine Sediment with the SK-15 and Maxi-44 rotors using the following

**Table 1. Digestion BCR 277R Estuarine Sediment**

Sample Name	SK-15 Procedure	Maxi-44 Procedure
BCR 277R Estuarine Sediment	0.5 g, 9 mL HNO <sub>3</sub> 65%, 3 mL of HCl 37%	0.5 g, 9 mL HNO <sub>3</sub> 65%, 3 mL of HCl 37%

The Ethos UP is equipped with pre-installed libraries of methods with hundreds of applications.

**Table 2. Method & Temperature Profile for SK-15 and Mazi-44 Rotors**

	Method	Temperature Profile
SK-15 EPA 3051		
Maxi-44 3051		

## ICP-OES Results

Tables 3 and 4 show the results of the digestion of BCR 277R as referenced in EPA Method 3051, in the SK 15 and MAXI 44 rotors. The results were obtained using an Agilent ICP-OES (710 Series)

**Table 3. BCR 277R with the SK-15 Rotor**

	Cert Value	Vessel 1	Vessel 2	Avg.
Cr	188	159.2	161.1	160.15
Pb	-	17.3	14.7	1.6
Cu	63.0 ± 7.00	55.74	56.9	56.3
Zn	178 ± 20	153.9	157.2	155.55
Mo	-	1.34	1.14	1.24
Ni	130 ± 8.0	109.4	112.1	110.75

**Table 4. BCR 277R with the MAXI-44 Rotor**

	Cert Value	Vessel 1	Vessel 2	Avg.
Cr	257 ± 16	162.3	163.6	162.95
Pb	-	12.4	13.2	12.8
Cu	63.0 ± 7.00	56.8	57.1	56.95
Zn	178 ± 20	156.3	163	159.65
Mo	-	1.28	1.16	1.22
Ni	130 ± 8.0	111.5	111.3	111.4

## Conclusion

The Milestone Ethos UP offers significant benefits for trace metals analysis sample prep and is a great solution for labs with high throughput and large sample amounts. Due to its higher sample capacity, the SK-15 rotor offers 30 - 90% higher productivity than any other high pressure rotor on the market. The data in this tech note demonstrates full compatibility of Ethos system with official EPA environmental methods.

## About Milestone

With over 50 patents and more than 18,000 instruments installed in laboratories around the world, Milestone has been widely recognized as the global leader in metals prep technology for the past 26 years. Committed to providing safe, reliable and flexible platforms to enhance your lab's productivity, customers worldwide look to Milestone for their metals digestion, organic extractions, mercury analysis and clean chemistry processing needs.

