

Analysis of Metals in Waste Samples Using Agilent 5800 Vertical Dual View (VDV) ICP-OES Systems

Consumable workflow ordering guide for EPA 6010D

In support of its waste management program, the US Environmental Protection Agency (EPA) has developed various methods to test for contaminants in environmental samples. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846) includes method 6010D, a performance-based method, which outlines the procedure for the determination of 31 elements in soils, sediment, and sludges using ICP-OES.

The Agilent 5800 Vertical Dual View (VDV) ICP-OES meets the demands of typical environmental testing laboratories that need instrument performance that is reliable and stable over long periods of processing large sample loads. A series of smart tools, accessible through the software, simplify method development and minimize the need to remeasure samples:

- The IntelliQuant screening function uses data analytics to automatically identify spectral overlap & recommends the emission wavelength, to prevent false-positives and generate accurate results.
- Outlier conditional formatting (OCF) compares analytical results from different wavelengths of the same element and provides a quick visual overview of the results, to help laboratories assess and manage the quality of the data set.
- Early maintenance feedback (EMF) allows the user to set up alerts to prompt maintenance after a specified number of samples has been run, ensuring consistent, high-level analytical performance, even of complex samples such as soils.

Internal standard correction (10 mg/L of yttrium and lutetium) is used to correct for matrix effects and easily ionizable element (EIE) interferences. (1, 2)



Table 1. 5800 VDV ICP-OES instrument and method parameters.

Parameter	Radial	Axial
Read Time (s)	10	10
Replicates	3	
Sample Uptake Delay (s)	0	
Stabilization Time (s)	10	0
Rinse Time (s)	0	
Pump Speed (rpm)	12	
RF Power (kW)	1.5	
Aux Flow (mL/min)	1	
Plasma Flow (mL/min)	12	
Nebulizer Flow (mL/min)	0.7	
Viewing Height (mm)	8	NA
Nebulizer	SeaSpray concentric	
Spray Chamber	Double pass cyclonic	
Torch	Easy-fit demountable VDV, 1.8 mm injector	
Sample Pump Tubing	White-white	
Internal Standard Pump Tubing	Black-black	
Waste Pump Tubing	Blue-blue	
Background Correction	Off Peak left/right	

Results were stable over an extended analytical period without the need to recalibrate, as shown by the six-hour QC stability-test results. All results for the ICV were within $\pm 10\%$ of expected values, and the RSD was $< 2\%$ for all elements.

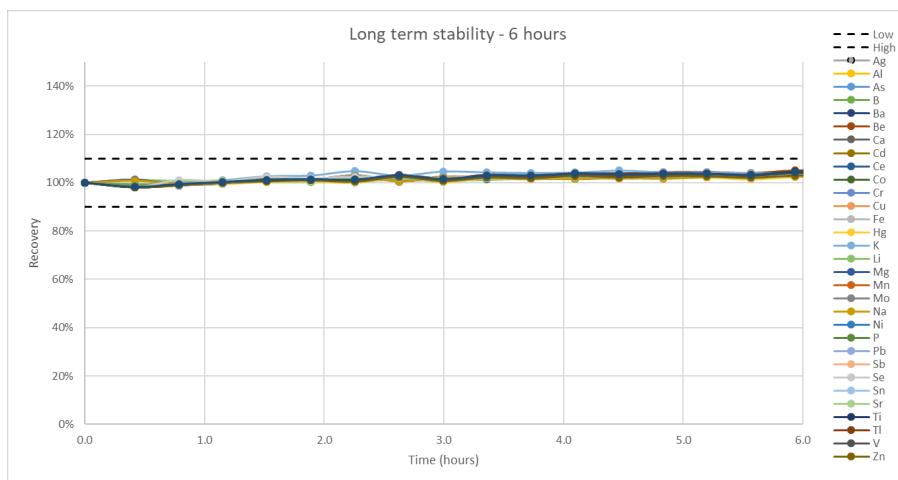


Figure 1. Long-term stability test showing recovery of the ICV solution analyzed

The high performance of the 5800 VDV ICP-OES was demonstrated by the recovery data of 23 elements in a soil SRM and recoveries for all 32 elements in a matrix spike sample. Antimony did not recover in the soil SRM digest as HCl was not used during the digestion. However, the matrix spike test showed that good recovery of antimony was possible if it had been solubilized during digestion. All other SRM recoveries were within $\pm 10\%$ of the expected value, demonstrating the accuracy of the method.

Easy selection and ordering information

This guide provides recommendations for Agilent products used in this analysis, so you can find what you're looking for quickly. Click the MyList* links in the header below to add items to your "Favorite Products" list at the Agilent online store. Then, enter the quantities for the products you need. Your list will remain under "Favorite Products" for your use with future orders.

MyList of Standards for EPA 6010D Analysis	
5190-9418	Quality Control Standard, QCstd-27, 100 mL
5190-8599	ICS interference A for EPA 200.7, 5 mg/mL, 500 mL
5190-8477	Lithium (Li) – Single element standard 1000 µg/mL, 100mL
5190-8555	Yttrium (Y) – internal standard, 1000 µg/mL, 100 mL
5190-8517	Scandium (Sc) – Internal standard, 1000 µg/mL, 100 mL
5190-8479	Lutetium (Lu) – Internal standard, 1000 µg/mL, 100 mL

MyList of Filtration Supplies	
5190-5268	Captiva Econofilter, polypropylene housing, polytetrafluoroethylene (PTFE) membrane, 25 mm diameter, 0.45 µm pore size, 1000/pk
5190-5103	Captiva Disposable Syringe, 20 mL, Polypropylene, 100/pk

MyList of Supplies for EPA 6010D Analysis of Standard Aqueous Matrix (no HF)	
9910124100	ICP internal standard kit, no 2. orange/white tubing
3710034400	Sample peristaltic pump tubing white/white, 12/pk
3710034600	Drain peristaltic pump tubing blue/blue, 12/pk
G8010-60256	Double-pass glass cyclonic spray chamber
G8010-60255	Seaspray concentric glass nebulizer for 5000 series ICP-OES
G8010-60236	Easy-fit dual-view semi demountable 1.8 mm torch
0000001600L	16.5 mL polypropylene sample test tubes, 17 mm o.d. 1000/case
190065200	50 mL polypropylene centrifuge sample tubes, 29 mm o.d., 500/pk

MyList of Supplies for EPA 6010D Analysis Using HF acid Digestion	
3710034800	ICP-OES peristaltic pump tubing, black/black 2 bridged. 12/pk
3710035000	Peristaltic pump tubing, white/white, 12/pk
3710067900	Peristaltic pump tubing, PVC Solvaflex, for waste, blue/blue, 15/pk
1610132400	Y- connector for internal standard/ionization buffer
G8010-60293	OneNeb series 2 inert concentric nebulizer
G8010-60231	Easy-fit Dual-View inert semi-demountable 1.8 mm torch
G8014-68002	Inert double pass spray chamber
0000001600L	16.5 mL, polypropylene sample tubes, 1000/case
190065200	50 mL polypropylene centrifuge tubes, 500/pk

* First time using "MyList"? You will be asked to enter your email address for account verification. If you have an existing Agilent account, you will be able to log in. If you don't have a registered Agilent account, you will need to [register for one](#). This feature is valid only in countries that are e-commerce enabled. All items can also be ordered through your regular sales and distributor channels.

References

1. Analysis of Waste Samples according to US EPA Method 6010D using the smart features of the Agilent 5800 VDV ICP-OES to simplify method development and quality assure the results. [5994-2027EN](#).
2. Analysis of Soils, Sediments, and Sludges by ICP-OES per US EPA 6010. Improved data quality with the use of smart tools. [5994-2307EN](#).

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