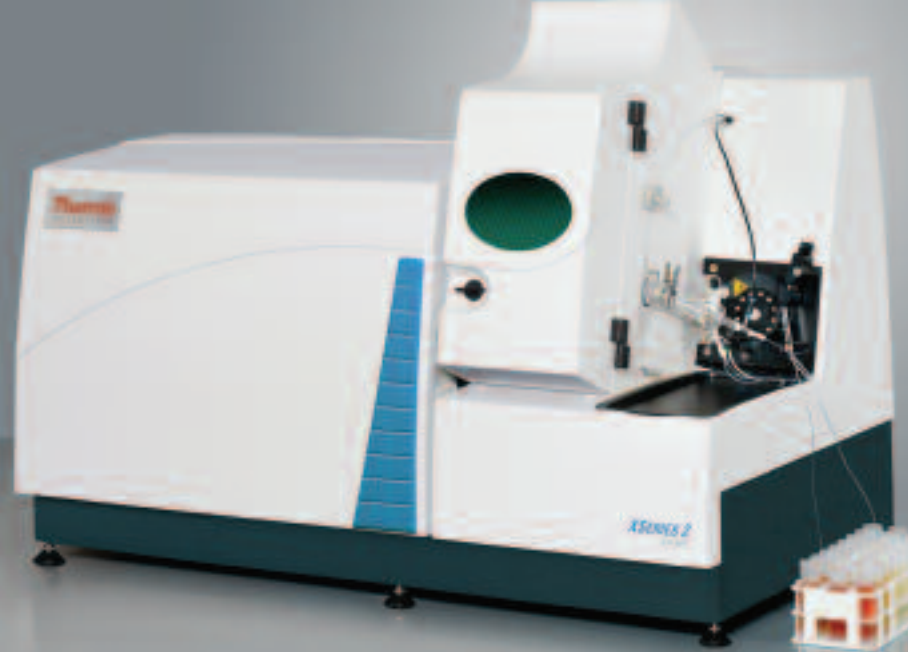


## XSERIES 2 ICP-MS: EPA Methods Productivity Packs



Achieve fast and simple EPA method compliance, saving your lab valuable time and generating greater revenue.

### Introduction

The US Environmental Protection Agency (EPA) has produced several ICP-MS methods:

1. Method 200.8 for the analysis of drinking water and waste water samples;
2. SW-846 Method 6020 for analysis of solid and liquid environmental samples; and
3. Contract Laboratory Program (CLP) statement of work ILM05.3, Exhibit D, Part B, for the analysis of aqueous samples for suspected contaminated site clean-up.

Thermo Fisher Scientific has developed a total solution for the implementation of these methods, by supplying productivity packs to compliment the Thermo Scientific XSERIES 2 ICP-MS. Implementing the methods from scratch can be a daunting task, especially if the analyst is new to ICP-MS. These packs offers all the tools required to begin running EPA method-compliant analyses immediately after XSERIES 2 installation. They are simple, usable packages, enabling consistent, reproducible, high quality analytical data and allowing rapid start-up for laboratories needing to comply with the detailed protocols described in the EPA methods. The packages contain:

- Sourced customized stock solutions for optimization, setup, and calibration of the instrument, running the QC requirements, checking for interferences and running samples with spikes.

- A step-by-step customized instruction manual detailing an initial method of how to use the solutions with the instrument to produce protocol compliant analyses.
- A CD containing the instructions in a read-only format and an editable format (for users to easily adapt into their own standard operating procedure), reference documents and information sources, and an executable file that installs method templates and custom autotune and performance report sequences.
- An on-line internal standard addition kit.

Two separate packs are available: one for method 200.8 and a separate pack covering methods 6020 and ILM05.3. Use of the packs can be integrated into an optional on-site training course by a Thermo Fisher Scientific application specialist. With simple, instrument specific instructions, tried and tested methodology in combination with robust, high-quality instrumentation and experienced applications support, Thermo Fisher provides the complete solution for elemental environmental analysis.

Typical data produced when using these productivity packs are given in application notes *AN40722\_E US EPA Method 200.8 using the XSeries<sup>II</sup> ICP-MS*, *AN40619 US EPA SW-846 Method 6020A using the XSeries<sup>II</sup> ICP-MS* and *AN40620 US EPA Method ILM05.3 using the XSeries<sup>II</sup> ICP-MS*.



"I can't say enough  
good things about the  
Productivity Pack.  
Ready to go,  
everything you need."

Paul Milne  
Complete Environmental Testing

## Features

### Setting the Standards

One of the biggest problems encountered when attempting to implement EPA methods is related to finding or preparing appropriate solutions for the multitude of multi-element calibrations and QC checks that are required. Furthermore, interference check standards can be a consistent source of contamination due to the high concentrations of elements present. To alleviate these problems, certified, quality checked and factory proven solutions have been sourced for supply direct to the laboratory, ensuring that the highest quality analytical data is obtained. This includes a supply of second source stock solution for independent QC validation. The solutions provided include: calibration stocks, independent quality control stocks, interference check stocks and analyte addition stock, as well as a sample QC spiking solution. The solutions are fully labeled in a consistent manner with the supplied documentation for rapid, easy identification.

### Giving Direction

There are a multitude of approaches to implementing EPA methods as they remain very much open to interpretation. The methods also give no guidance on how a specific instrument must be adjusted to obtain the required performance. Our pack contains a printed instruction manual that gives full step-by-step instructions on how to prepare the analytical solutions from the stocks provided, how to set-up, optimize and calibrate the XSERIES 2 and run an analysis from a pre-defined method. Learning a new software package can often be tedious, regardless of the intuitiveness. However, the manual provides assistance by walking the user through each stage of the process, including navigating the software.

### But, All Labs are Different...

The CD contains two versions of the instruction manual: a read-only version and an editable version in Microsoft® Word format. The editable version is provided as a framework around which the user can build their own method documentation (standard operating procedure). It can easily be adapted into the laboratory's own format, and irrelevant or unnecessary portions can be deleted.

### Optimize and Check

The CD also contains an executable file that installs tailored autotune and performance report sequences into the XSERIES 2 software package, PlasmaLab. Specially written autotune sequences have been developed to satisfy the criteria required in the EPA methods. Similarly, the methods call for daily checking of certain performance characteristics, such as mass calibration error and peak width. A custom performance report function is provided to check these parameters against the requirements of each method. A simple, printable report is produced with an unambiguous PASS or FAIL statement.

### Tailored Method Templates

The CD will also automatically install tailored method templates into PlasmaLab. Once installed, the template can be opened with a click of the mouse. The template stores the analytes, acquisition parameters, internal standardization techniques, calibration details, QC parameters and the basic sample list. The user needs only to type in the unknown sample labels and run the analysis or import them from a LIMS. The QC software automatically checks the results in real-time and can be set-up to take action upon failure. Failed QCs are highlighted with a color-coded system on both the sample list and the results display.

### Information Source

Useful information is also provided, including weblinks to appropriate parts of the EPA website. This valuable information source enables the user to keep abreast of new developments in methodology.

### Go On-Line

Addition of an internal standard is not only standard practice in ICP-MS, it is also dictated by the EPA methods. Addition of internal standards can be tedious and labor-intensive as it involves accurately dispensing a known volume of each analytical solution and then spiking it with a constant fraction of an internal standard mix. To avoid this time-consuming step, an internal standard can be mixed with each analytical solution by pumping through two separate tubes and teeing the flows prior to the nebulizer. An on-line internal standard addition kit is supplied with the package to allow this more efficient operation of the instrument. This comprises all the components required to easily set-up online internal standard addition: peristaltic pump tubes, connectors, Y-piece, and an internal standard bottle.

### Data Processing and Reporting

In addition to our fully featured PlasmaLab software package, available as an option, is EISC's metals reporting software package MARRS (see [www.eisc.net/products.htm](http://www.eisc.net/products.htm)). The Thermo Scientific PlasmaLab software package produces XML reports that mesh seamlessly with MARRS. The MARRS package can then fully validate analytical data, create upload files for a LIMS and generate CLP report forms.

### A Financial Analysis

Our industry survey revealed that most labs purchasing their first ICP-MS take over six months to produce billable sample results after installation of the instrument. During this time the lab has made the capitol outlay of the instrument purchase and service contract, is paying consumable costs such as argon and laboratory reagents and is paying fixed costs such as rent, power and the operator's wages. This is a very long period where no revenue is generated by an instrument that is costing money to keep. Table 1 shows a typical calendar of events following installation of an ICP-MS in an environmental lab.

MONTH	WEEK	EVENT
1	1	Installation, test, sign off and familiarization training.
	2	User familiarization period.
	3	User familiarization period.
	4	User familiarization period.
2	5	User familiarization period.
	6	User training.
	7	Source solutions.
	8	Post training orientation period.
3	9	Post training orientation period.
	10	Method development
	11	Method development
	12	Method development
	13	Method development
4	14	Method development
	15	Performance evaluation
	16	Performance evaluation
	17	Process data.
5	18	Rerun as necessary
	19	Method refinement
	20	Method refinement
	21	Rerun performance evaluation as necessary. Process data.
6	22	Write SOP
	23	Take delivery of real samples. Configure electronic data processes.
	24	Running and reporting billable samples.

**Table 1: Typical Calendar of Events for an Environmental Lab After Installation of their First ICP-MS without a Productivity Pack**

When one of our Productivity Packs is used, the calendar of events looks markedly different, with the lab able to report billable samples in the second month after installation. Table 2 shows the calendar of events when using our Productivity Pack.

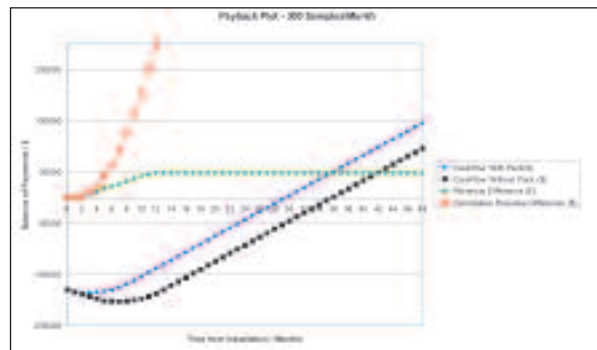
MONTH	WEEK	EVENT
1	1	Install and test. Sign off and receive familiarization training.
	2	Implement pack - methods running by day 2. Performance evaluation.
	3	Process data and rerun as necessary. Transfer SOP into lab format.
	4	Take delivery of real samples. Configure electronic data processes.
2	5	Running and reporting billable samples.

**Table 2: Typical Calendar of Events for an Environmental Lab after Installation of their First ICP-MS with a Productivity Pack**

When using our unique Productivity Pack your lab could be productive (reporting billable sample results) around 4 months faster than without the pack. Furthermore, the pack saves the lab large amounts of money that are normally consumed during the lengthy operator familiarization and training, method development, SOP creation, and performance evaluation stages as all this is done for you. An example of the costs is set out below, in Table 3.

Graphs 1-3 show hypothetical lab cash flows for ICP-MS based on the figures in Table 3 and the following sample analysis criteria:

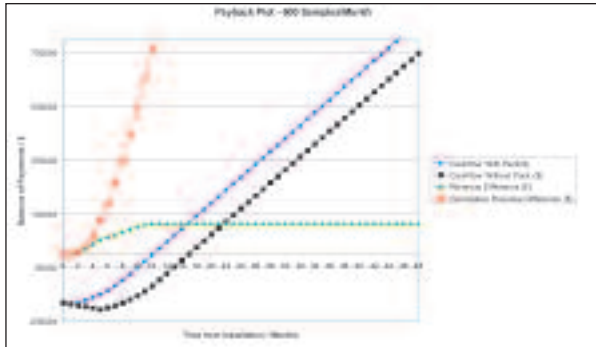
- only 50 % of the normal sample load analyzed during the first month of productive operation of the instrument as client interest is unlikely to be at its maximum initially;
- sample load increases by 10 % per subsequent month and flattens off at a maximum of 300 samples per month (Graph 1), 600 samples per month (Graph 2) or 1500 samples per month (Graph 3);
- an average price-to-client of \$60 per sample is charged, based on an average of 6 analytes per sample reported, at \$10 per analyte;
- calculations assume usage of the instrument 5 days per week for 45 weeks per year for each plot.



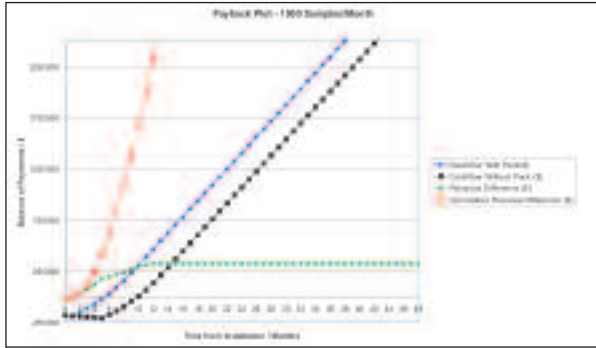
**Graph 1: Payback Plot for 300 Samples/Month**

PARAMETER	COST (USD \$)	NOTES
<b>One-off Costs:</b>		
Instrument	173500	
Autosampler	6500	
Service Contract / year	16060	Typical cost for an annual service contract (1 visits per year), including labor and parts for emergency breakdown
<b>Consumables:</b>		
Argon	6590	Based on Ar flows 15 L min <sup>-1</sup> and a cost per Ar cylinder of \$96 for a standard 6ft cylinder containing 1.65x10 <sup>5</sup> litres of Ar gas
Torches / year (3)	798	
Cones / year (2 sets)	830	
Detector / year	2200	
Reagents / year	3000	Estimate based on preparation of 50 water samples per day at 50 ml per sample.
<b>Fixed Costs:</b>		
Electricity / year	5257	Based on electricity unit costs of \$0.07 per kWh, using power consumption figures 5.96 kW for the ICP-MS. Factors such as standing charges and electricity supplier service contracts are not included.
Building costs / year	5000	Estimated for the lab proportional space for an ICP-MS and sample preparation only.
Operator / year	45000	Estimate.
<b>Total</b>	<b>264735</b>	

**Table 3: Summary of Approximate Costs for Purchase and Annual Use of an ICP-MS**



**Graph 2: Payback Plot for 600 Samples/Month**



**Graph 3: Payback Plot for 1500 Samples/Month**

In each case, when using a Productivity Pack, it is about 4 months quicker to become productive. The time for the instrument to pay for itself depends upon the sample throughput: the greater the number of samples, the faster the payback. Comparing the payback with and without the productivity pack, it is about 6 months faster for 300 samples/month, 5 months faster for 600 samples per month and 4 months faster for 1500 samples/month compared to without the pack. This is due to the fact that without the pack the lab continues to lose money for longer through fixed running costs when non-productive. Crucially, the revenue difference is the most significant point: when the pack is used, the lab generates revenue earlier and loses less money on non-productive costs. This deficit can never be made up and results in a cumulative revenue difference 12 months after installation of close to \$300K when the sample load is 300/month, \$800K for 600/month, or \$2.3M for 1500/month. With this significant revenue difference, you cannot afford to be without a

Thermo Scientific EPA Methods Productivity Pack for ICP-MS.

Furthermore the model used here does not take the extra efficiency of the optimized method provided in the pack into account. Use of this method provides efficiency benefits such as the following:

- optimized for maximum productivity - therefore uses less consumables such as argon;
- established and tested method – therefore fewer problems and questionable results;
- Thermo Scientific-developed method – therefore easier diagnosis of problems, meaning less downtime.

**ORDER DETAILS:**

EPA Methods Productivity Pack (for methods 6020 and CLP ILM05.3)	Part Number 4600541
EPA Method 200.8 Productivity Pack	Part Number 4600542

## Conclusion

The Thermo Scientific EPA Methods Productivity Packs provide all the tools required to generate simple and rapid method compliant analytical data. By providing proven stock solutions it simplifies the analysts' job and guarantees freedom from solution associated problems by eliminating the variability of solution quality. The clear, documented instructions immediately allow the novice user access to advanced levels of instrument use whilst avoiding basic mistakes. Since a proven analysis template is provided, the method development process is effectively removed. The editable documentation gives a platform upon which the laboratory's own SOP can be written. This dramatically reduces the long and tedious process of method authorship. The on-line internal standard addition kit provides the user with the necessary components to easily run the XSERIES 2 in the most efficient manner, removing the need for labor intensive accurate sample dispensing and spiking.

In summary, the pack provides the fastest, simplest route to EPA method compliant analysis by side-stepping the method-development process and providing the tools for rapid SOP implementation. This saves the laboratory time, money and risk in addition to generating significant amounts of extra revenue in rapid timescales.

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