



State of West Virginia
 Department of Administration
 Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER
LBS90127

PAGE
1

ADDRESS CORRESPONDENCE TO ATTENTION OF
ROBERTA WAGNER 304-558-0067

VENDOR

*709001549 03 800-762-4000
 PERKIN ELMER Health Sciences, Inc.
 710 BRIDGEPORT AVENUE
 MAIL STOP 172
 SHELTON CT 06484-4794

SHIP TO

HEALTH AND HUMAN RESOURCES
 ENVIRONMENTAL CHEMISTRY LAB

 4710 CHIMNEY DRIVE
 CHARLESTON, WV
 25302 304-558-3530

DATE PRINTED 04/07/2009	TERMS OF SALE Due Upon Receipt	SHIP VIA Best Way	F.O.B. Destination	FREIGHT TERMS Freight Quoted
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BID OPENING DATE: 05/07/2009 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
0001	1	EA		493-96 PerkinElmer ELAN 9000 INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETER Part# N8120536	\$ 108,075.30	\$ 108,075.30
<p>REQUEST TO PURCHASE AN INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETER (ICP-MS) INSTRUMENT TO ANALYZE METALS IN DRINKING WATER TO FULFILL REQUIREMENTS OF US EPA REGULATIONS FOR COMPLIANCE MONITORING OF PUBLIC WATER SYSTEMS AND OF PRIVATE WELLS.</p> <p>CANCELLATION: THE DIRECTOR OF PURCHASING RESERVES THE RIGHT TO CANCEL THIS CONTRACT IMMEDIATELY UPON WRITTEN NOTICE TO THE VENDOR IF THE COMMODITIES AND/OR SERVICES SUPPLIED ARE OF AN INFERIOR QUALITY OR DO NOT CONFORM TO THE SPECIFICATIONS OF THE BID AND CONTRACT HEREIN.</p> <p>BANKRUPTCY: IN THE EVENT THE VENDOR/CONTRACTOR FILES FOR BANKRUPTCY PROTECTION, THIS CONTRACT IS AUTOMATICALLY NULL AND VOID, AND IS TERMINATED WITHOUT FURTHER ORDER.</p> <p>INQUIRIES: WRITTEN QUESTIONS SHALL BE ACCEPTED THROUGH CLOSE OF BUSINESS ON 4/21/2009. QUESTIONS MAY BE SENT VIA USPS, FAX, COURIER OR E-MAIL. IN ORDER TO ASSURE NO VENDOR RECEIVES AN UNFAIR ADVANTAGE, NO SUBSTANTIVE QUESTIONS WILL BE ANSWERED ORALLY. IF POSSIBLE, E-MAIL QUESTIONS ARE PREFERRED. ADDRESS INQUIRIES TO:</p> <p>ROBERTA WAGNER</p>						

RECEIVED

2009 MAY -6 P 3:18

PURCHASING DIVISION
STATE OF WV

SEE REVERSE SIDE FOR TERMS AND CONDITIONS			
SIGNATURE 	TELEPHONE 800-762-4000	DATE 5/5/09	
TITLE Manager Business Team	FEIN 04-336-1624	ADDRESS CHANGES TO BE NOTED ABOVE	

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

Bid in accordance with PerkinElmer Health Sciences Inc. quotation 20298599 attached.



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04/07/2009				

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LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
DEPARTMENT OF ADMINISTRATION PURCHASING DIVISION 2019 WASHINGTON STREET, EAST CHARLESTON, WV 25311 FAX: 304-558-4115 E-MAIL: ROBERTA.A.WAGNER@WV.GOV <p style="text-align: center;">NOTICE</p> A SIGNED BID MUST BE SUBMITTED TO: DEPARTMENT OF ADMINISTRATION PURCHASING DIVISION BUILDING 15 2019 WASHINGTON STREET, EAST CHARLESTON, WV 25305-0130 PLEASE NOTE: A CONVENIENCE COPY WOULD BE APPRECIATED. THE BID SHOULD CONTAIN THIS INFORMATION ON THE FACE OF THE ENVELOPE OR THE BID MAY NOT BE CONSIDERED: SEALED BID BUYER:-----RW/FILE 22----- RFQ. NO.:-----LBS90127-----						

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BID OPENING DATE: **05/07/2009** BID OPENING TIME **01:30PM**

LINE	QUANTITY	UOP	CAT NO	ITEM NUMBER	UNIT PRICE	AMOUNT
<p>BID OPENING DATE: -----5/7/2009-----</p> <p>BID OPENING TIME: -----1:30 PM-----</p> <p>PLEASE PROVIDE A FAX NUMBER IN CASE IT IS NECESSARY TO CONTACT YOU REGARDING YOUR BID: -----203-944-4914-----</p> <p>CONTACT PERSON (PLEASE PRINT CLEARLY): -----Judith Albrecht-----</p> <p>***** THIS IS THE END OF RFQ LBS90127 ***** TOTAL: <u>\$108,075.30</u></p> <p>Bid in accordance with PerkinElmer Health Sciences, Inc. quotation 20298599 attached.</p>						

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Instrument Specifications:

1. Inductively Coupled Plasma – Mass Spectrometer (ICP-MS) instrument to analyze metals in drinking water to fulfill requirements of USEPA regulations for compliance monitoring of public water systems and of private wells. ICP-MS is a class of technology offered by several vendors listed below. This instrument is to be purchased for use by the Office of Laboratory Services / Environmental Chemistry Laboratory at the Big Chimney facility in support of West Virginia's Drinking Water Program.
2. Technology must be compatible with and fulfill the requirements of US EPA method 200.8, including pneumatic nebulization sample introduction, and a quadrupole mass spectrometer.
3. ICP-MS must be equipped with a system software controlled autosampler capable of random access.
4. Must be fully automated for analysis (excluding digestion) with necessary software provided for system controller that is compatible with Windows XP, with assurance that data can be exported to Laboratory Information Management System (LIMS).
5. Must include a re-circulating water chiller or equivalent device for cooling system components of ICP-MS instrument.
6. Instrument must be a floor-mounted model with wheels to conserve available bench space and to facilitate mobility and serviceability.
7. Instrument must come equipped with a PC controlled, variable temperature, cooled spray chamber to enhance stability and reduce oxide ion interferences; or equivalent technology.
8. The vacuum system must be fully contained within the instrument to conserve floor space.

Installation/Training Requirements:

1. Vendor must install instrument equipment within 90 days of its delivery date at the Big Chimney Environmental Chemistry Laboratory facility location. Cost of installation must be included in the bid price.
2. Vendor must provide on-site user training on all basic aspects of the equipment and software and must be included in the cost of the equipment package in the bid price. This On-site basic training must include all rudimentary aspects of instrument operation with respect to set up and running analytical methods via software operations, as well as routine maintenance, exclusive of theory and advanced operations techniques. This basic training must be provided by the vendor upon completion of installation and must last at least one day.
3. The Vendor must provide an advanced and complete training course that will last at least 2 days. This course must include theory of ICP-MS, workshops demonstrating all

aspects of proprietary software capabilities, and hands-on lab work. The cost for this course must be included in the submitted total bid price.

4. Vendor must provide all manufacturers user manuals upon delivery.

Warranty Requirements:

1. Must include at least one year equipment warranty to include parts and labor and must be provided at no additional cost.
2. Software support must be included as part of one-year warranty. Vendor must agree to provide software support for any subsequent service agreements that may follow the original one-year standard warranty.
3. Warranty must include on-site service including labor, travel time, and expenses with a 24-hour on-site response time at no extra cost.
4. Vendor must include all warranty information upon delivery.
5. Warranty to begin upon completion of installation and on-site training.

Shipping and Delivery Requirements:

1. ICP-MS and its components to be "inside delivery" by freight delivery company.
2. Shipping terms to be F.O.B. Destination, Prepaid unless vendor states differently when submitting quotation. If shipping costs are incurred, they must be included as a separate line item and a part of the total cost of the equipment.
3. Payment will be made in arrears.

RFQ COST SHEET

Bidders shall provide a cost for the following:

Inductively Coupled Plasma–Mass Spectrometer (ICP-MS) System \$ 108,075.30

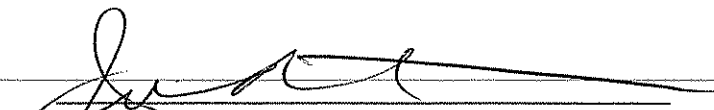
On-site Basic User Training (1 day at installation of equipment) \$ Included

Advanced Training Course (2 days) \$ Included

Total Cost \$ 108,075.30

Bid in accordance with PerkinElmer Health Sciences, Inc. Quotation 20298599 attached.

The award will be made to the vendor with the lowest overall total cost of the equipment which meets all requested specifications and requirements.



Vendor Signature

5/5/09

Date

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

VENDOR OWING A DEBT TO THE STATE:

West Virginia Code §5A-3-10a provides that: No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owed is an amount greater than one thousand dollars in the aggregate.

PUBLIC IMPROVEMENT CONTRACTS & DRUG-FREE WORKPLACE ACT:

If this is a solicitation for a public improvement construction contract, the vendor, by its signature below, affirms that it has a written plan for a drug-free workplace policy in compliance with Article 1D, Chapter 21 of the *West Virginia Code*. The vendor **must** make said affirmation with its bid submission. Further, public improvement construction contract may not be awarded to a vendor who does not have a written plan for a drug-free workplace policy in compliance with Article 1D, Chapter 21 of the *West Virginia Code* and who has not submitted that plan to the appropriate contracting authority in timely fashion. For a vendor who is a subcontractor, compliance with Section 5, Article 1D, Chapter 21 of the *West Virginia Code* may take place before their work on the public improvement is begun.

ANTITRUST:

In submitting a bid to any agency for the state of West Virginia, the bidder offers and agrees that if the bid is accepted the bidder will convey, sell, assign or transfer to the state of West Virginia all rights, title and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the state of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the state of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to the bidder.

I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm, limited liability company, partnership or person or entity submitting a bid for the same materials, supplies, equipment or services and is in all respects fair and without collusion or fraud. I further certify that I am authorized to sign the certification on behalf of the bidder or this bid.

LICENSING:

Vendors must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agencies or political subdivision. Furthermore, the vendor must provide all necessary releases to obtain information to enable the Director or spending unit to verify that the vendor is licensed and in good standing with the above entities.

CONFIDENTIALITY:

The vendor agrees that he or she will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the agency's policies, procedures and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in <http://www.state.wv.us/admin/purchase/privacy/noticeConfidentiality.pdf>.

Under penalty of law for false swearing (*West Virginia Code* §61-5-3), it is hereby certified that the vendor affirms and acknowledges the information in this affidavit and is in compliance with the requirements as stated.

Vendor's Name: PerkinElmer Health Sciences, Inc.

Authorized Signature: _____

Date: 5/5/09

State of West Virginia **VENDOR PREFERENCE CERTIFICATE**

Certification and application* is hereby made for Preference in accordance with **West Virginia Code, §5A-3-37**. (Does not apply to construction contracts). **West Virginia Code, §5A-3-37**, provides an opportunity for qualifying vendors to request (at the time of bid) preference for their residency status. Such preference is an evaluation method only and will be applied only to the cost bid in accordance with the **West Virginia Code**. This certificate for application is to be used to request such preference. The Purchasing Division will make the determination of the Resident Vendor Preference, if applicable.

1. Application is made for 2.5% resident vendor preference for the reason checked:

- _____ Bidder is an individual resident vendor and has resided continuously in West Virginia for four (4) years immediately preceding the date of this certification; **or**,
- _____ Bidder is a partnership, association or corporation resident vendor and has maintained its headquarters or principal place of business continuously in West Virginia for four (4) years immediately preceding the date of this certification; **or** 80% of the ownership interest of Bidder is held by another individual, partnership, association or corporation resident vendor who has maintained its headquarters or principal place of business continuously in West Virginia for four (4) years immediately preceding the date of this certification; **or**,
- _____ Bidder is a nonresident vendor which has an affiliate or subsidiary which employs a minimum of one hundred state residents and which has maintained its headquarters or principal place of business within West Virginia continuously for the four (4) years immediately preceding the date of this certification; **or**,

2. Application is made for 2.5% resident vendor preference for the reason checked:

- _____ Bidder is a resident vendor who certifies that, during the life of the contract, on average at least 75% of the employees working on the project being bid are residents of West Virginia who have resided in the state continuously for the two years immediately preceding submission of this bid; **or**,

3. Application is made for 2.5% resident vendor preference for the reason checked:

- _____ Bidder is a nonresident vendor employing a minimum of one hundred state residents or is a nonresident vendor with an affiliate or subsidiary which maintains its headquarters or principal place of business within West Virginia employing a minimum of one hundred state residents who certifies that, during the life of the contract, on average at least 75% of the employees or Bidder's affiliate's or subsidiary's employees are residents of West Virginia who have resided in the state continuously for the two years immediately preceding submission of this bid; **or**,

4. Application is made for 5% resident vendor preference for the reason checked:

- _____ Bidder meets either the requirement of both subdivisions (1) and (2) or subdivision (1) and (3) as stated above; **or**,

5. Application is made for 3.5% resident vendor preference who is a veteran for the reason checked:

- _____ Bidder is an individual resident vendor who is a veteran of the United States armed forces, the reserves or the National Guard and has resided in West Virginia continuously for the four years immediately preceding the date on which the bid is submitted; **or**,

6. Application is made for 3.5% resident vendor preference who is a veteran for the reason checked:

- _____ Bidder is a resident vendor who is a veteran of the United States armed forces, the reserves or the National Guard, if, for purposes of producing or distributing the commodities or completing the project which is the subject of the vendor's bid and continuously over the entire term of the project, on average at least seventy-five percent of the vendor's employees are residents of West Virginia who have resided in the state continuously for the two immediately preceding years.

Bidder understands if the Secretary of Revenue determines that a Bidder receiving preference has failed to continue to meet the requirements for such preference, the Secretary may order the Director of Purchasing to: (a) reject the bid; or (b) assess a penalty against such Bidder in an amount not to exceed 5% of the bid amount and that such penalty will be paid to the contracting agency or deducted from any unpaid balance on the contract or purchase order.

By submission of this certificate, Bidder agrees to disclose any reasonably requested information to the Purchasing Division and authorizes the Department of Revenue to disclose to the Director of Purchasing appropriate information verifying that Bidder has paid the required business taxes, provided that such information does not contain the amounts of taxes paid nor any other information deemed by the Tax Commissioner to be confidential.

Under penalty of law for false swearing (West Virginia Code, §61-5-3), Bidder hereby certifies that this certificate is true and accurate in all respects; and that if a contract is issued to Bidder and if anything contained within this certificate changes during the term of the contract, Bidder will notify the Purchasing Division in writing immediately.

Bidder: _____ **Signed:** _____

Date: _____ **Title:** _____

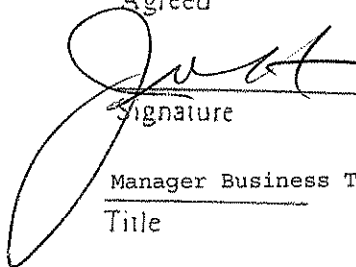
**Check any combination of preference consideration(s) indicated above, which you are entitled to receive.*

ATTACHMENT
P.O.# LB390127

This agreement constitutes the entire agreement between the parties, and there are no other terms and conditions applicable to the licenses granted hereunder.

PerkinElmer Health Sciences, Inc. recognizes WV as a sovereign state and agrees to be bound by the laws of WV. However, the State must be aware of the function and operation of the PerkinElmer warranty and remedies which the UCC requires to be clearly disclosed. It is not PerkinElmer's intent to usurp the WV rules and regulations or purchase but instead to supplement same. Submitted in accordance with PerkinElmer Health Sciences, Inc. Quotation# 20298599. In the event of a conflict between the two parties terms and conditions, the terms of the State of WV will prevail.

Agreed



Signature Date 5/5/09

Manager Business Team
Title

PerkinElmer Health Sciences, Inc.
Company Name

Signature Date

Title

Agency/Division

WV-96
Rev. 10/07

AGREEMENT ADDENDUM

In the event of conflict between this addendum and the agreement, this addendum shall control:

1. **DISPUTES** - Any references in the agreement to arbitration or to the jurisdiction of any court are hereby deleted. Disputes arising out of the agreement shall be presented to the West Virginia Court of Claims.
2. **HOLD HARMLESS** - Any clause requiring the Agency to indemnify or hold harmless any party is hereby deleted in its entirety.
3. **GOVERNING LAW** - The agreement shall be governed by the laws of the State of West Virginia. This provision replaces any references to any other State's governing law.
4. **TAXES** - Provisions in the agreement requiring the Agency to pay taxes are deleted. As a State entity, the Agency is exempt from Federal, State, and local taxes and will not pay taxes for any Vendor including individuals, nor will the Agency file any tax returns or reports on behalf of Vendor or any other party.
5. **PAYMENT** - Any references to prepayment are deleted. Payment will be in arrears.
6. **INTEREST** - Should the agreement include a provision for interest on late payments, the Agency agrees to pay the maximum legal rate under West Virginia law. All other references to interest or late charges are deleted.
7. **RECOUPMENT** - Any language in the agreement waiving the Agency's right to set-off, counterclaim, recoupment, or other defense is hereby deleted.
8. **FISCAL YEAR FUNDING** - Service performed under the agreement may be continued in succeeding fiscal years for the term of the agreement, contingent upon funds being appropriated by the Legislature or otherwise being available for this service. In the event funds are not appropriated or otherwise available for this service, the agreement shall terminate without penalty on June 30. After that date, the agreement becomes of no effect and is null and void. However, the Agency agrees to use its best efforts to have the amounts contemplated under the agreement included in its budget. Non-appropriation or non-funding shall not be considered an event of default.
9. **STATUTE OF LIMITATION** - Any clauses limiting the time in which the Agency may bring suit against the Vendor, lessor, individual, or any other party are deleted.
10. **SIMILAR SERVICES** - Any provisions limiting the Agency's right to obtain similar services or equipment in the event of default or non-funding during the term of the agreement are hereby deleted.
11. **ATTORNEY FEES** - The Agency recognizes an obligation to pay attorney's fees or costs only when assessed by a court of competent jurisdiction. Any other provision is invalid and considered null and void.
12. **ASSIGNMENT** - Notwithstanding any clause to the contrary, the Agency reserves the right to assign the agreement to another State of West Virginia agency, board or commission upon thirty (30) days written notice to the Vendor and Vendor shall obtain the written consent of Agency prior to assigning the agreement.
13. **LIMITATION OF LIABILITY** - The Agency, as a State entity, cannot agree to assume the potential liability of a Vendor. Accordingly, any provision limiting the Vendor's liability for direct damages to a certain dollar amount or to the amount of the agreement is hereby deleted. Limitations on special, incidental or consequential damages are acceptable. In addition, any limitation is null and void to the extent that it precludes any action for injury to persons or for damages to personal property.
14. **RIGHT TO TERMINATE** - Agency shall have the right to terminate the agreement upon thirty (30) days written notice to Vendor. Agency agrees to pay Vendor for services rendered or goods received prior to the effective date of termination.
15. **TERMINATION CHARGES** - Any provision requiring the Agency to pay a fixed amount or liquidated damages upon termination of the agreement is hereby deleted. The Agency may only agree to reimburse a Vendor for actual costs incurred or losses sustained during the current fiscal year due to wrongful termination by the Agency prior to the end of any current agreement term.
16. **RENEWAL** - Any reference to automatic renewal is hereby deleted. The agreement may be renewed only upon mutual written agreement of the parties.
17. **INSURANCE** - Any provision requiring the Agency to insure equipment or property of any kind and name the Vendor as beneficiary or as an additional insured is hereby deleted.
18. **RIGHT TO NOTICE** - Any provision for repossession of equipment without notice is hereby deleted. However, the Agency does recognize a right of repossession with notice.
19. **ACCELERATION** - Any reference to acceleration of payments in the event of default or non-funding is hereby deleted.
20. **CONFIDENTIALITY** - Any provision regarding confidentiality of the terms and conditions of the agreement is hereby deleted. State contracts are public records under the West Virginia Freedom of Information Act.
21. **AMENDMENTS** - All amendments, modifications, alterations or changes to the agreement shall be in writing and signed by both parties. No amendment, modification, alteration or change may be made to this addendum without the express written approval of the Purchasing Division and the Attorney General.

ACCEPTED BY:

STATE OF WEST VIRGINIA

Spending Unit: _____

Signed: _____

Title: _____

Date: _____

VENDOR

Company Name: PerkinElmer Health Sciences, Inc.

Signed: _____

Title: Manager Business Team

Date: 5/5/09

GENERAL TERMS & CONDITIONS
REQUEST FOR QUOTATION (RFQ) AND REQUEST FOR PROPOSAL (RFP)

1. Awards will be made in the best interest of the State of West Virginia.
2. The State may accept or reject in part, or in whole, any bid.
3. All quotations are governed by the *West Virginia Code* and the *Legislative Rules* of the Purchasing Division.
4. Prior to any award, the apparent successful vendor must be properly registered with the Purchasing Division and have paid the required \$125 fee.
5. All services performed or goods delivered under State Purchase Order/Contracts are to be continued for the term of the Purchase Order/Contracts, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise available for these services or goods, this Purchase Order/Contract becomes void and of no effect after June 30.
6. Payment may only be made after the delivery and acceptance of goods or services.
7. Interest may be paid for late payment in accordance with the *West Virginia Code*.
8. Vendor preference will be granted upon written request in accordance with the *West Virginia Code*.
9. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.
10. The Director of Purchasing may cancel any Purchase Order/Contract upon 30 days written notice to the seller.
11. The laws of the State of West Virginia and the *Legislative Rules* of the Purchasing Division shall govern all rights and duties under the Contract, including without limitation the validity of this Purchase Order/Contract.
12. Any reference to automatic renewal is hereby deleted. The Contract may be renewed only upon mutual written agreement of the parties.
13. **BANKRUPTCY:** In the event the vendor/contractor files for bankruptcy protection, this Contract may be deemed null and void, and terminated without further order.
14. **HIPAA BUSINESS ASSOCIATE ADDENDUM:** The West Virginia State Government HIPAA Business Associate Addendum (BAA), approved by the Attorney General, and available online at the Purchasing Division's web site (<http://www.state.wv.us/admin/purchase/vrc/hipaa.htm>) is hereby made part of the agreement. Provided that, the Agency meets the definition of a Cover Entity (45 CFR §160.103) and will be disclosing Protected Health Information (45 CFR §160.103) to the vendor.
15. **WEST VIRGINIA ALCOHOL & DRUG-FREE WORKPLACE ACT:** If this Contract constitutes a public improvement construction contract as set forth in Article 1D, Chapter 21 of the West Virginia Code ("The West Virginia Alcohol and Drug-Free Workplace Act"), then the following language shall hereby become part of this Contract: "The contractor and its subcontractors shall implement and maintain a written drug-free workplace policy in compliance with the West Virginia Alcohol and Drug-Free Workplace Act, as set forth in Article 1D, Chapter 21 of the West Virginia Code. The contractor and its subcontractors shall provide a sworn statement in writing, under the penalties of perjury, that they maintain a valid drug-free work place policy in compliance with the West Virginia and Drug-Free Workplace Act. It is understood and agreed that this Contract shall be cancelled by the awarding authority if the Contractor: 1) Fails to implement its drug-free workplace policy; 2) Fails to provide information regarding implementation of the contractor's drug-free workplace policy at the request of the public authority; or 3) Provides to the public authority false information regarding the contractor's drug-free workplace policy."

INSTRUCTIONS TO BIDDERS

1. Use the quotation forms provided by the Purchasing Division.
2. **SPECIFICATIONS:** Items offered must be in compliance with the specifications. Any deviation from the specifications must be clearly indicated by the bidder. Alternates offered by the bidder as **EQUAL** to the specifications must be clearly defined. A bidder offering an alternate should attach complete specifications and literature to the bid. The Purchasing Division may waive minor deviations to specifications.
3. Complete all sections of the quotation form.
4. Unit prices shall prevail in case of discrepancy.
5. All quotations are considered F.O.B. destination unless alternate shipping terms are clearly identified in the quotation.
6. **BID SUBMISSION:** All quotations must be delivered by the bidder to the office listed below prior to the date and time of the bid opening. Failure of the bidder to deliver the quotations on time will result in bid disqualifications: Department of Administration, Purchasing Division, 2019 Washington Street East, P.O. Box 50130, Charleston, WV 25305-0130



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BID OPENING DATE: 05/07/2009 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
<p>ADDENDUM NO. 1</p> <p>1. QUESTIONS AND ANSWERS ARE ATTACHED.</p> <p>2. ADDENDUM ACKNOWLEDGMENT IS ATTACHED. THIS DOCUMENT SHOULD BE SIGNED AND RETURNED WITH YOUR BID. FAILURE TO SIGN AND RETURN MAY RESULT IN DISQUALIFICATION OF YOUR BID.</p> <p>EXHIBIT 10</p> <p>REQUISITION NO.: LBS90127</p> <p>ADDENDUM ACKNOWLEDGEMENT</p> <p>I HEREBY ACKNOWLEDGE RECEIPT OF THE FOLLOWING CHECKED ADDENDUM(S) AND HAVE MADE THE NECESSARY REVISIONS TO MY PROPOSAL, PLANS AND/OR SPECIFICATION, ETC.</p> <p>ADDENDUM NO.'S:</p> <p>NO. 1</p> <p>NO. 2</p> <p>NO. 3</p> <p>NO. 4</p> <p>NO. 5</p> <p>I UNDERSTAND THAT FAILURE TO CONFIRM THE RECEIPT OF THE ADDENDUM(S) MAY BE CAUSE FOR REJECTION OF BIDS.</p>						

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE <i>[Signature]</i>	TELEPHONE 800-762-4000	DATE 5/5/09
TITLE Manager Business Team	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'



State of West Virginia
 Department of Administration
 Purchasing Division
 2019 Washington Street East
 Post Office Box 50130
 Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER:
LBS90127

PAGE:
2

ADDRESS CORRESPONDENCE TO ATTENTION OF:
ROBERTA WAGNER 304-558-0067

VENDOR

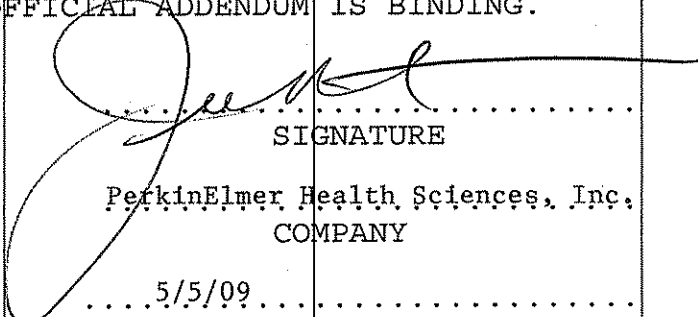
*709001549 03 800-762-4000
 PERKIN ELMER INSTRUMENTS LLC
 710 BRIDGEPORT AVENUE
 MAIL STOP 172
 SHELTON CT 06484-4794

SHIP TO

HEALTH AND HUMAN RESOURCES
 ENVIRONMENTAL CHEMISTRY LAB
 4710 CHIMNEY DRIVE
 CHARLESTON, WV
 25302 304-558-3530

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
04/23/2009				

BID OPENING DATE: 05/07/2009 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
<p>VENDOR MUST CLEARLY UNDERSTAND THAT ANY VERBAL REPRESENTATION MADE OR ASSUMED TO BE MADE DURING ANY ORAL DISCUSSION HELD BETWEEN VENDOR'S REPRESENTATIVES AND ANY STATE PERSONNEL IS NOT BINDING. ONLY THE INFORMATION ISSUED IN WRITING AND ADDED TO THE SPECIFICATIONS BY AN OFFICIAL ADDENDUM IS BINDING.</p> <p style="text-align: center;">  SIGNATURE PerkinElmer Health Sciences, Inc. COMPANY 5/5/09 DATE </p> <p>REV. 11/96</p> <p style="text-align: center;">END OF ADDENDUM NO. 1</p>						

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Purchasing Division



PURCHASE REQUISITION

Requisition No. LBS90127	Buyer RW-22	Requisition Date 04/22/09
Agency/Invoice To: Health and Human Resources BPH - Laboratory Services 167 Eleventh Ave South Charleston, WV 25303 TEAM Code _____		WVFIMS Document # Suggested Vendors: 1. 2. 3. <i>Additional Vendors on Reverse Side</i>
Agency/Ship To: Health and Human Resources Environmental Chemistry Lab 4710 Chimney Drive Charleston, WV 25302 TEAM Code _____		PURCHASING DIVISION'S USE ONLY Commodity Code: _____ Instructions: _____
This Section Only For: <i>Releases, Direct Purchases, Emergency Purchases and Agreements</i> Vendor Name and Address:		
WVFIMS Vendor #	TEAM Vendor #	
Terms	F.O.B.	

Item No.	Quantity	Description	Unit Price	Amount
		Addendum #1 <i>Type of Purchase</i> Response to vendor question: Question: Under Specifications, Installation/Training Requirements, item 3: Is this 2 day training course to be conducted at vendor site or on-site at WV Env Chem Lab for how many people? Response: One state employee will be receiving the advanced training course which may be conducted at either the WV Environmental Laboratory or at the vendor's location.		

Authorized Signature _____

 Title _____

 Telephone _____

Total Estimated Value of this Requisition: _____

Maximum Budgeted Amount: _____

**STATE OF WEST VIRGINIA
PURCHASE CONTINUATION SHEET**

Page <u>2</u> of <u>2</u> Pages		Requisition / P.O. No.: LBS90127
File: RW22	Acct. No.: 5201-2009-3045-099-072-15384	
Spending Unit: DHHR/OLS		

Vendor: _____ P.O. Date: _____

Item No.	Quantity	Description	Unit Price	Amount
		<p>VENDOR QUESTION #1:</p> <p>I have a question/concern regarding Request for Quotation LBS90127 that I hope you can assist with. This is in regards to the supplied Instrument Specifications, Items #6 and #8, and these items happen to be related as it pertains to ICP-MS systems. These specifications state:</p> <p>6. Instrument must be floor-mounted model with wheels to conserve available bench space and to facilitate mobility and serviceability.</p> <p>8. The vacuum system must be fully contained within the instrument to conserve floor space.</p> <p>The vendor question is: Can items #6 and #8 be removed from consideration on RFQ LBS90137?</p> <p>RESPONSE: No.</p> <p>6. The floor-mounted model is requested as specified.</p> <p>8. The vacuum system is requested as specified.</p>		



Quotation

710 Bridgeport Avenue
Shelton, CT 06484-4794

Phone: 1-800-762-4000
Fax: 203-944-4914

To: ROBERTA WAGNER
STATE OF WEST VIRGINIA
DEPT OF ADMINISTRATION
PURCHASING DIVISION BLDG.15
2019 WASHINGTON STREET, EAST
CHARLESTON WV 25305-0130

QUOTE NO.: 20298599
QUOTE VALID TO: 06/14/2009
QUOTE DATE: 04/15/2009
PAY. TERMS: Due Upon Receipt
FREIGHT TERMS: FOB Destination - Frt Quoted
ULTIMATE DEST.: UNITED STATES OF AMERICA

TELEPHONE NO. 304-558-0067
FAX NO. 304-558-4115
YOUR REFERENCE BID#LSB90127

ITEM	MATERIAL	DESCRIPTION	QTY/EA	UNIT PRICE	TOTAL
1	N8120536	ELAN 9000 Sales Discount	1	128,700.00	128,700.00 32,175.00-
<p>The ELAN® 9000 simplifies ICP-MS by providing an easy-to-use, easy-to-maintain tool for routine ultratrace level analysis. Backed by the industry's most extensive service and support network and over 40 years of experience developing inorganic solutions, the ELAN 9000 is ideal for environmental, clinical, geochemical, and general testing laboratories with moderate to heavy loads of ultratrace level samples. The proven design of the ELAN 9000 ensures accuracy, improves method development, and consistently delivers the correct answer, reducing rework and improving productivity. Design enhancements provide increased reliability and reduced cost of ownership when compared with other ICP-MS systems.</p> <p>The PerkinElmer SCIEX ELAN 9000 is a fully computer controlled, bench mounted style ICP Mass Spectrometer consisting of the ELAN 9000 spectrometer and ELAN application software which runs under the Windows XP® operating system. It includes an installation kit, gas lines, cooling lines, flexible vent tubing, waste container, IEEE cable, IEEE interface card, instruction manuals and sample introduction, torch and interface spares kits.</p> <p>Some of the features include an HF-resistant sample introduction system with a GemClean cross-flow nebulizer; a built-in 40 MHz free-running Inductively Coupled Plasma source with patented PlasmaLok interface to control ion energies; New cassette torch mount that provides one handed removal and replacement; EasyGlide torch alignment system which allows the plasma to be ignited in position; New SwiftMount II quick-change demountable lens which can be removed and replaced without tools in less than three minutes; AutoLens, a computer-controlled ion lens system for maximum ion transmission; a triple-stage vacuum system, utilizing a dual inlet turbomolecular</p>					
<p>SEND PURCHASE ORDERS TO: PerkinElmer Life and Analytical Sciences 710 Bridgeport Ave. Shelton, CT 06484-4794 Phone: 1-800-762-4000 Fax: 203-944-4914</p>					
<p>SALES REPRESENTATIVE: ED BURT PREPARED BY: Sandra A Biasetti</p>					

Quotation

710 Bridgeport Avenue
Shelton, CT 06484-4794

Phone: 1-800-762-4000
Fax: 203-944-4914

To: ROBERTA WAGNER
STATE OF WEST VIRGINIA

QUOTE NO.: 20298599
QUOTE VALID TO: 06/14/2009
QUOTE DATE: 04/15/2009

ITEM	MATERIAL	DESCRIPTION	QTY/EA	UNIT PRICE	TOTAL
		pump; a binary gold metalized ceramic quadrupole producing hyperbolic fields for excellent abundance sensitivity and on-the-fly variable resolution; 2.5 MHz thermally stabilized quadrupole power supply for outstanding mass stability; and SimulScan ion detection circuitry for automatic extended dynamic range of up to eight orders of magnitude in a single scan; an integrated 3-channel channel peristaltic pump.			
2	N8120522	KIT-E6100 / 9000 TEST SOLUTION Mat'l Disc Exculsiv	1	302.00	302.00 302.00-
3	N0772036	CHILLER-6106PE LOW NOISE 60HZ Sales Discount	1	3,550.00	3,550.00 887.50-
4	09406118	PC LENOVO M58P (XPSP3) USA NON-ATO	1	1,512.00	1,512.00
5	09404759	19" LCD MONITOR WIDE SCREEN (for ADC)	1	642.00	642.00
6	09421125	PRINTER-HP LASER JET P4014	1	1,483.00	1,483.00
7	N0200008	TRAINING-ICP-MS WITH ELAN SOFTWARE New Inst Train Disc 3 day ICP-MS User Training Course. This course provides an introduction to the ICP-MS analytical technique. Some theoretical background of ICP-Mass Spectrometry will be taught. Laboratory experiments will be conducted to show how to set up, optimize and maintain the ICP-MS instrument. Also, data will be collected using various analytical methods available with this technique. This course is conducted at a PerkinElmer Technical Center.	1	2,370.00	2,370.00 2,370.00-
8	N2020007	S10 Autosampler for ICPMS incl. GPIB box Sales Discount	1	8,400.00	8,400.00 4,200.00-
9	N8120545	KIT-EPA METHOD 200.8 Ver.1.0 Material Discount	1	1,169.00	1,169.00 935.20-
Freight/Handling:					817.00
Total Net Price in USD:					108,075.30



Quotation

710 Bridgeport Avenue
Shelton, CT 06484-4794

Phone: 1-800-762-4000
Fax: 203-944-4914

To: ROBERTA WAGNER
STATE OF WEST VIRGINIA

QUOTE NO.: 20298599
QUOTE VALID TO: 06/14/2009
QUOTE DATE: 04/15/2009

ITEM	MATERIAL	DESCRIPTION	QTY/EA	UNIT PRICE	TOTAL
<p>Customized Financing Solutions are available - We offer competitive rates with a wide range of structures to assist in acquiring your PerkinElmer technology - Speak to your Sales Engineer today or call us at 1-800-559-2755 ext. 69608</p> <p>MATERIAL DISCOUNT REFLECTS A PROMOTIONAL DISCOUNT. PROMO: MAS-009</p> <p>Includes INSIDE DELIVERY charges in the freight charge.</p> <p>The amount displayed does not include tax. This charge will be added to the invoice if applicable. * Includes installation and one year warranty (parts, labor and travel). * Estimated delivery: 5 weeks after receipt of order. * Terms subject to credit approval.</p> <p><i>Ed Burt</i> SA ED BURT</p>					

TERMS AND CONDITIONS OF SALE

1. Delivery Dates and Prices

a) All delivery and shipment dates indicated on the face hereof are approximate and subject to Seller's availability schedule. Seller will make reasonable efforts to meet the delivery date(s) quoted. However, Seller will not be liable for its failure to meet the quoted delivery dates or for any delay in performance hereunder due to unforeseen circumstances or shortages, due to causes beyond its control, or due to its voluntary or mandatory compliance with any governmental act, regulation, or request. If, by reason of such circumstances, Seller's supplies of the equipment or service (hereinafter the "Product(s)") covered hereby are limited, Seller shall have the right to allocate the available supply among its customers in such manner as it, in its sole discretion, determines appropriate. b) All orders are priced on the basis of an estimated shipment date within ninety (90) days of the date of order to the stated destination. Should Buyer request a change in the estimated shipment date or otherwise cause delay in delivery beyond ninety (90) days from the date of order or request that the Products be shipped outside the country of original delivery, the prices established by this quote shall no longer apply, and Seller's list prices in effect on the actual date of shipment shall be used in determining the price to be paid. Except as provided above, if the price is stated by reference to a published price list, then the price shall be the price on the published price list in effect at the time Seller receives Buyer's purchase order, without regard to the requested delivery date. However, if any Product is ordered prior to the effective date of a published price change and the delivery date is rescheduled, the price in effect at the time of the initial delivery date shall apply. c) If Buyer requests shipment to a country other than the country originally requested, and if Seller elects not to cancel the order pursuant to Paragraph 12 hereof, Seller's applicable surcharge for the actual country of delivery shall be added to the price. d) Notwithstanding any provision to the contrary herein, all prices are subject to increase without notice to reflect changes in: (1) Federal or State laws taxing raw material or processed materials; (2) applicable laws or regulations governing working hours or compensation of labor; and/or (3) freight charges, insurance costs, duty or other factors affecting costs of shipment.

2. **Packing and Loss or Damage in Transit.** Products will be packed for shipment in a manner suitable to the method of shipment specified by Buyer, or to the method selected by Seller in the absence of instructions. Unless otherwise indicated on the face hereof, all sales hereunder are f.o.b. shipping point, and all risk of loss or damage to equipment in transit is upon Buyer. Payment will be made in accordance with Paragraph 5 below.

3. **Payment Due For Partial Deliveries.** Seller may, in its sole discretion, deliver any portion of the Products ordered, regardless of utility to Buyer in the absence of the undelivered portion, and all such partial deliveries shall be accepted and paid for in accordance with the terms of Paragraphs 4 and 5 below. Likewise, completion of any installation services shall not be a condition to Buyer's obligation to remit payment. The making of a partial delivery that, to any extent, is not in accordance with the contract of sale shall not affect the Buyer's obligation hereunder to remit payment.

4. **Inspection, Acceptance and Return of Products or Trade-Ins.** Buyer shall inspect the Products immediately upon receipt and shall, within five (5) business days after receipt, give written notice to Seller of any claim for shortage or that the Products do not conform with the terms of the contract of sale. If Buyer shall fail to give such notice, the Products shall be deemed accepted and to conform with the terms of the contract of sale, and Buyer shall be bound to pay for the Products in accordance with the terms of Paragraph 5 below. Return of Products, defective or otherwise, will not be accepted by Seller without (i) written notification from Buyer to Seller within 30 days of receipt of invoice and (ii) receipt of a return authorization number from Seller. Products authorized to be returned shall be shipped f.o.b. destination, freight pre-paid. When return of nonconforming goods has been accepted by Seller, conforming shipment may be made in accordance with Paragraph 1 above and Paragraph 8 below without further liability on Seller's part. Buyer will be liable for restocking charges in the event Products are returned to the Seller which are not defective and are in accordance with these terms. When a trade-in is authorized by Seller, Buyer shall ship, f.o.b. destination, freight pre-paid, the material or equipment so authorized for trade-in, to Seller's specified location.

5. **Payment and Credit Terms.** Unless otherwise indicated on the face hereof, Buyer agrees to remit payment in full to the address provided on the face of Seller's invoice for all shipments, including shipments of any portion of the Products ordered, upon receipt of invoice. This obligation shall not be contingent upon the completion of any installation services included in the purchase price. No cash discounts will be granted. Account balances not paid in accordance with these terms are subject to the maximum prevailing legal interest rate calculated from date of delinquency. In the event Seller finds it necessary to refer an account to an attorney or an agent for collection of delinquent accounts, Buyer shall pay all costs of collection including, without limitation, reasonable attorneys' fees. Buyer agrees that Seller shall retain a security interest in the Products sold hereunder to secure any portion of the price not paid on delivery and will, on request, execute a security agreement in such form as is required by Seller, which, at Seller's option, may be filed with appropriate local, state, or other relevant authorities. Should Buyer become delinquent in the payment of any sum due hereunder, or if Buyer becomes insolvent, or if any proceedings are commenced under any bankruptcy or similar laws for Buyer's reorganization or other debt adjustment, Seller will not be obligated to continue performance. Seller reserves the right to change the credit terms provided herein when, in Seller's opinion, the financial condition or previous payment record of Buyer so warrants. If, within thirty (30) days of receipt of written notice of such change, Buyer fails to agree and comply with different terms of credit, and/or fails to give adequate assurance of due performance, Seller may (a) by notice to Buyer, treat such failure or refusal as a repudiation by Buyer of the portion of the purchase order not then fully performed, whereupon Seller may cancel all further deliveries and any amounts unpaid hereunder shall immediately become due and payable; or (b) make shipments under reservation of a demand for advance payment or payment against tender of documents of title. Buyer's acceptance of delivery of any Products shall constitute a representation that Buyer is solvent.

6. **Taxes.** Buyer is responsible for the ultimate payment of all taxes which may be assessed or levied on or on account of Products sold hereunder to Buyer, whether termed a gross receipts tax, use tax, property tax, sales tax or otherwise. Where Buyer claims that a transaction is not subject to any such tax, that Buyer is exempt, or that Seller is not required to collect such tax, Buyer agrees to provide Seller with any documentation necessary to support such a claim, to allow Seller to document its decision not to collect such tax(es), and to indemnify and hold Seller harmless from and against any and all fines, penalties, interest, taxes, and other expenses, including, without limitation, reasonable attorney's fees, incurred by Seller as a result of reliance upon Buyer's position.

7. **Installation and Site Preparation.** Installation services are included in the purchase price of the Products sold hereunder only if expressly

ed on the face of Seller's quotation or in Seller's applicable price list. Installation services for Products transferred outside the country of original delivery by Buyer's actions may be subject to additional charges based on the actual installation site location. For Products requiring installation by Seller's service personnel, it is the responsibility of Buyer to prepare the site environmentally and provide the required services, power, water, drain, air, bottled gases, permits, licenses, approvals, etc., as well as whatever is required to uncrate and transport the Product to its appropriate location for use. Failure to do so, prior to Seller's service personnel arriving at Buyer's site on the mutually agreed upon installation date, will result in a service charge by Seller to cover the lost time of its service personnel. Should Seller be unable to perform the required installation services within twelve months of a Product's shipment date as a result of Buyer's inability to prepare the site as required, Buyer may be responsible for additional costs associated with required hardware, software and firmware updates. Because Seller's service personnel may be required to enter upon Buyer's premises for the purpose of providing service to the Products sold hereunder, Buyer hereby undertakes to maintain its premises in a safe condition and to comply with all applicable laws, statutes and regulations governing workplace health and safety, and hereby accepts full responsibility for any harm or injury to, or liability arising from work performed by, Seller's personnel while on Buyer's premises, except to the extent caused solely by the gross negligence or willful misconduct of Seller's personnel. Seller's sales and service personnel are not authorized to enter into any indemnity or hold harmless agreements on behalf of Seller.

8. Limited Warranty.

a) Warranty.

i) Seller warrants to Buyer that the Products sold to Buyer are, at the time of shipment to Buyer from Seller, free from defects in materials and workmanship.

ii) This warranty shall be valid for a period of 90 days from the date of shipment to Buyer, unless a different period is specified herein, or in Seller's applicable price list in which case such specified period shall apply. Notwithstanding anything to the contrary contained herein, the warranty period for data processing equipment, including data storage devices, processors, printers, terminals, communication interfaces, tape drives and all similar devices, is in all cases limited to ninety (90) days from the date of shipment to Buyer.

iii) Except in the case of an authorized distributor of Seller, authorized in writing by Seller to extend this warranty to distributor's customers, the warranty herein applies only to Buyer as the original purchaser from Seller and may not be assigned, sold or otherwise transferred to any third party.

iv) As Buyer's sole and exclusive remedy under this warranty, Seller agrees either to repair or replace, at Seller's sole option, any part or parts of such Products which, under proper and normal conditions of use, prove(s) to be defective within the applicable warranty period. Alternatively, Seller may at any time, in its sole discretion, elect to discharge its warranty obligation hereunder by accepting the return of any defective Product pursuant to the terms set forth herein and refunding the purchase price paid by Buyer.

b) Exclusions and Limitations.

i) It is recognized that some parts by their nature may not function for the warranty period applicable to the Product. Therefore, expressly excluded from the warranty herein are chromatography columns, filaments, energy sources, lamps, power amplifier tubes, graphite tubes, sample cell holders, burner and furnace chambers, nebulizers, and other similar parts referenced in the Product's applicable operating manual.

ii) The warranty herein excludes any equipment or accessories which are identified on applicable price lists, quotations, special promotional materials, or on the face hereof, for which this limited warranty may be further limited. Included within this category are items produced by third party manufacturers (as to which Seller passes to Buyer the warranty it has been provided by the manufacturer) and items which are sold at specially reduced prices with reduced warranty protection (in some cases, extended warranty protection may be available at an increased price).

iii) This warranty does not cover loss, damage, or defects resulting from: transportation to the Buyer's facility, improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the Product or improper site preparation or maintenance.

iv) No warranty is made with respect to used, reconstructed, refurbished or previously owned Products, which will be so marked on the face hereof and, unless otherwise indicated on the face hereof, shall be sold "As Is".

v) The warranty herein applies only to Products within the country of original delivery. Products transferred outside the country of original delivery, either by Seller at the direction of Buyer or by Buyer's actions subsequent to delivery, may be subject to additional charges prior to warranty repair or replacement of such Products based on the actual location of such Products and Seller's warranty and/or service surcharges for such locations(s).

c) **Place of Service.** Except when otherwise provided in Seller's current applicable price list, Seller shall use reasonable efforts to perform all warranty services hereunder at Buyer's facility, as soon as reasonably practicable after notification by Buyer of a possible defect, provided, however, that Seller reserves the right to require that Buyer return the Product to Seller's production facility, transportation charges prepaid, when necessary to provide proper warranty service.

d) **Software and Firmware Products.** The sole and exclusive warranty applicable to software and firmware products provided by Seller for use with a processor is as follows: Seller warrants that such software and firmware will conform to Seller's program manuals current at the time of shipment to Buyer when properly installed on the processor, provided, however, that Seller does not warrant that the operation of the processor or software or firmware will be uninterrupted or error-free.

SELLER MAKES NO OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCTS, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

9. Exclusive Remedies.

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. SELLER SHALL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, WHETHER BASED ON CONTRACT, TORT, STRICT LIABILITY OR OTHERWISE, ARISING OUT OF THE DESIGN, MANUFACTURE, SALE, DELIVERY, INSTALLATION, SERVICE OR USE OF THE PRODUCTS.

10. Patent Indemnity.

Seller agrees to defend, at its own expense, any suit or legal proceeding which may be brought against Buyer alleging infringement by Buyer of any

patent of the United States, as a result of Buyer's use of the Product sold hereunder for its intended purposes, provided that Buyer shall give Seller prompt written notice of any claim, threat, or institution of any such suit or legal proceeding, and provided further that Seller shall then have the sole right to control and conduct the defense and/or settlement of such claim, threat, suit or legal proceeding, either in the name of Seller or Buyer or both, and Buyer shall, at Seller's request and expense, provide relevant information and reasonable cooperation. Seller shall pay all final judgments and all costs and attorney's fees assessed against Buyer in any such suit or legal proceeding, provided Buyer has complied with the conditions hereof with respect to prompt notice and cooperation in connection with such suit or legal proceeding and given exclusive control thereof to Seller. Notwithstanding the foregoing, Seller shall not be liable for any attorney's fees or other legal expenses incurred by Buyer without the knowledge and prior written consent of Seller. Seller shall have the right, at its own expense, to procure for Buyer the right to continue using the Product claimed to infringe, replace said Product with an equally satisfactory non-infringing Product, modify said Product so that it becomes non-infringing, or remove such Product and refund the purchase price thereof less a reasonable amount for use, damage or obsolescence.

The foregoing indemnity fully defines Seller's obligation for patent infringement. Such obligations shall specifically not apply to:

a) an infringement claim resulting from additions or changes in or to the Product made by Buyer or any third party or from use in combination with other equipment; or b) an infringement claim which is settled without the prior written consent of Seller; or c) an infringement claim which results from compliance by Seller with specifications furnished by Buyer.

The total amount of Seller's obligation and liability under this Section shall not exceed the price paid by Buyer to Seller for the Product held to infringe, and in no event will Seller be held accountable for consequential damages under this indemnity, such as loss of business profits or goodwill. With respect to any infringement claim arising from Product manufactured in whole or in part to Buyer's specifications or from use of such Product in conjunction with any other goods, Buyer will indemnify and hold harmless Seller from and against all such claims for damages or profits arising from infringement of patents, designs, copyrights or trademarks.

11. Modification of Terms.

BUYER'S ACCEPTANCE OF ANY QUOTATION IS EXPRESSLY SUBJECT TO BUYER'S ASSENT TO EACH AND ALL OF THE TERMS AND CONDITIONS SET FORTH IN SELLER'S QUOTATION, AND BUYER'S ASSENT TO THESE TERMS AND CONDITIONS OF SALE SHALL BE CONCLUSIVELY PRESUMED FROM BUYER'S SUBMISSION OF ITS PURCHASE ORDER. NO ADDITION TO OR MODIFICATION OF SAID TERMS AND CONDITIONS SHALL BE BINDING UPON SELLER UNLESS SPECIFICALLY AGREED TO BY SELLER IN WRITING. IF BUYER'S PURCHASE ORDER OR OTHER CORRESPONDENCE CONTAINS TERMS OR CONDITIONS CONTRARY TO OR IN ADDITION TO THE TERMS AND CONDITIONS CONTAINED HEREIN OR IN SELLER'S QUOTATION, ACCEPTANCE OF ANY ORDER BY SELLER SHALL NOT BE CONSTRUED AS ASSENT TO SUCH CONTRARY OR ADDITIONAL TERMS AND CONDITIONS OR CONSTITUTE A WAIVER BY SELLER OF ANY OF THE TERMS AND CONDITIONS CONTAINED HEREIN OR IN SELLER'S QUOTATION. SELLER'S ACCEPTANCE OF BUYER'S PURCHASE ORDER IS EXPRESSLY CONDITIONED ON BUYER'S ASSENT TO THESE TERMS AND CONDITIONS. NO MODIFICATION OR WAIVER OF THESE TERMS AND CONDITIONS IS VALID, UNLESS CONFIRMED IN WRITING BY AN AUTHORIZED REPRESENTATIVE OF SELLER.

12. Authority to Export.

ALL ORDERS ACCEPTED FOR EXPORT (AND/OR RE-EXPORT) ARE SUBJECT TO: 1) UNITED STATES GOVERNMENT EXPORT REGULATIONS; AND 2) BUYER PROVIDING SELLER WITH ALL DOCUMENTATION NECESSARY FOR SHIPMENT TO THE DESTINATION COUNTRY.

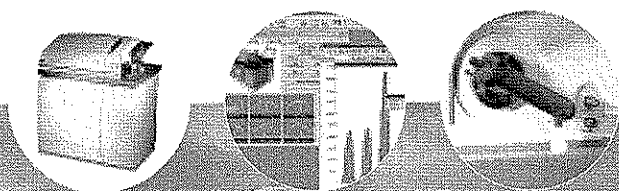
13. Software Licenses and Copyrighted Material.

a) Seller provides software products by license only. The terms of the license are available from Seller and are deemed accepted by Buyer on delivery of licensed software.

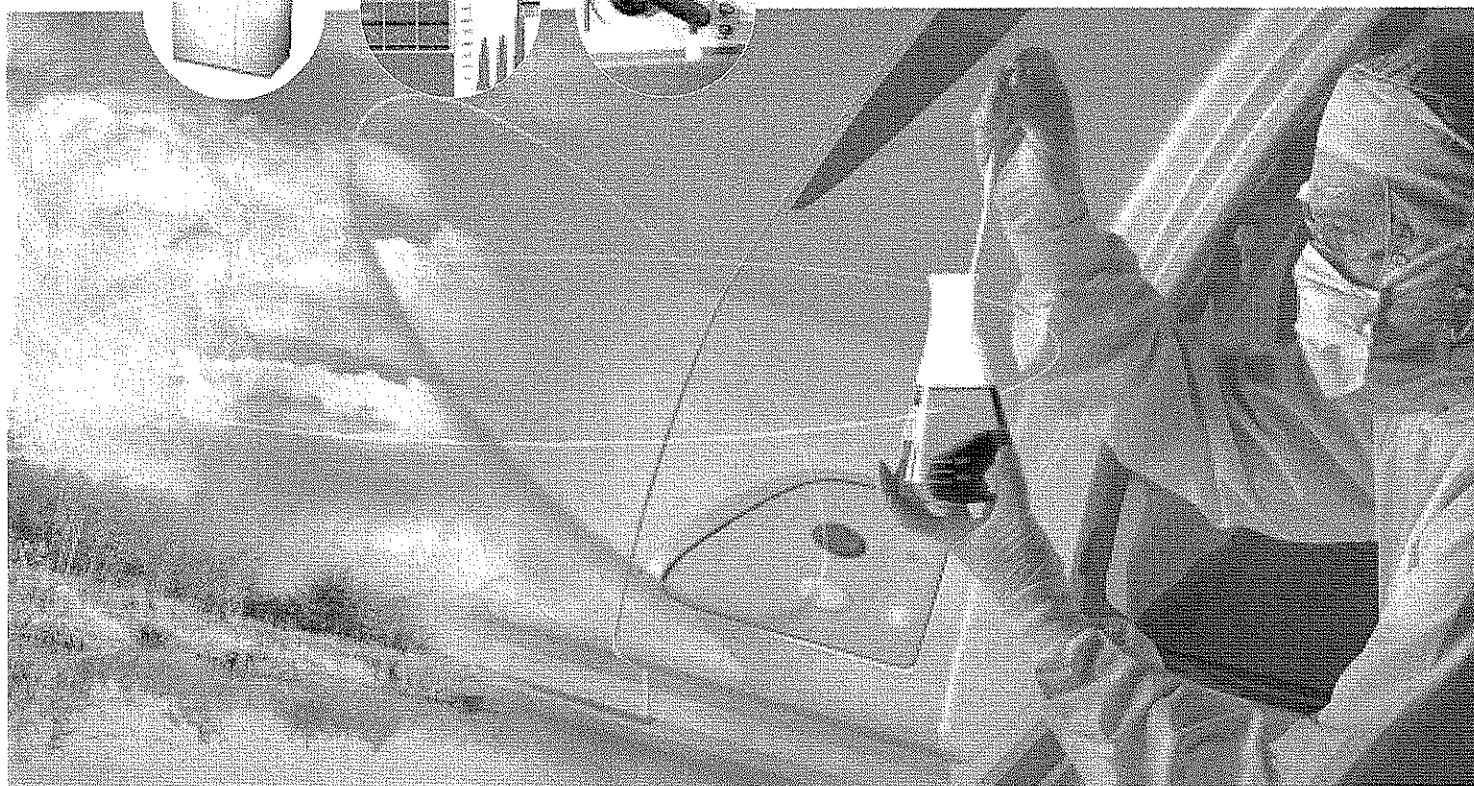
b) Unless otherwise specified, Seller's copyrighted material (software, firmware, and printed documentation) may not be copied except for archive purposes, to replace a defective copy, or for program error verification by Buyer.

14. Miscellaneous.

a) **Excusable Delays.** Seller shall not be liable for delays in delivery or failure to manufacture or deliver goods due to acts of God, acts or failures to act of Buyer, acts of civil military authority, fires, strikes, floods, epidemics, attack, war, delays in transportation or other causes beyond Seller's reasonable control, including, without limitation, delays in obtaining or inability to obtain necessary labor, materials, components, or manufacturing facilities. b) **Governing Law.** The contract of sale shall be governed by and construed in accordance with the laws of the Commonwealth of Massachusetts, U.S.A., without regard to its principles of conflict of laws. Any disputes relating to the contract of sale between Buyer and Seller shall be adjudicated in the state or federal courts in the Commonwealth of Massachusetts, U.S.A., and both parties hereby consent to the exclusive jurisdiction of said courts for purposes of any such litigation. The parties expressly agree to waive application of the United Nations Convention on Contracts for the International Sale of Goods. c) **Confidential Data and Information.** If, in connection with the sale, purchase, use, or maintenance of the Products, Seller is requested, required, or deems it advisable to furnish data or information which it, in its sole discretion, deems proprietary, confidential, or both, Seller shall not, in any event, submit or be required to furnish such data or information unless Buyer enters into an agreement concerning the handling, use, copying, retention and return of such information, the form of which agreement is available to Buyer on request. Seller does not agree to accept any proprietary or confidential information of Buyer in the absence of such a written agreement signed by an authorized representative of Seller. d) **Assignment.** Buyer may not assign, transfer or delegate any of its rights or obligations herein without the prior written consent of Seller, and any purported assignment of such rights or obligations without such consent shall be null and void. e) **Severability.** If any provision herein is deemed unenforceable by a court of competent jurisdiction, the other provisions shall remain in full force and effect as if the unenforceable provision had not been included.

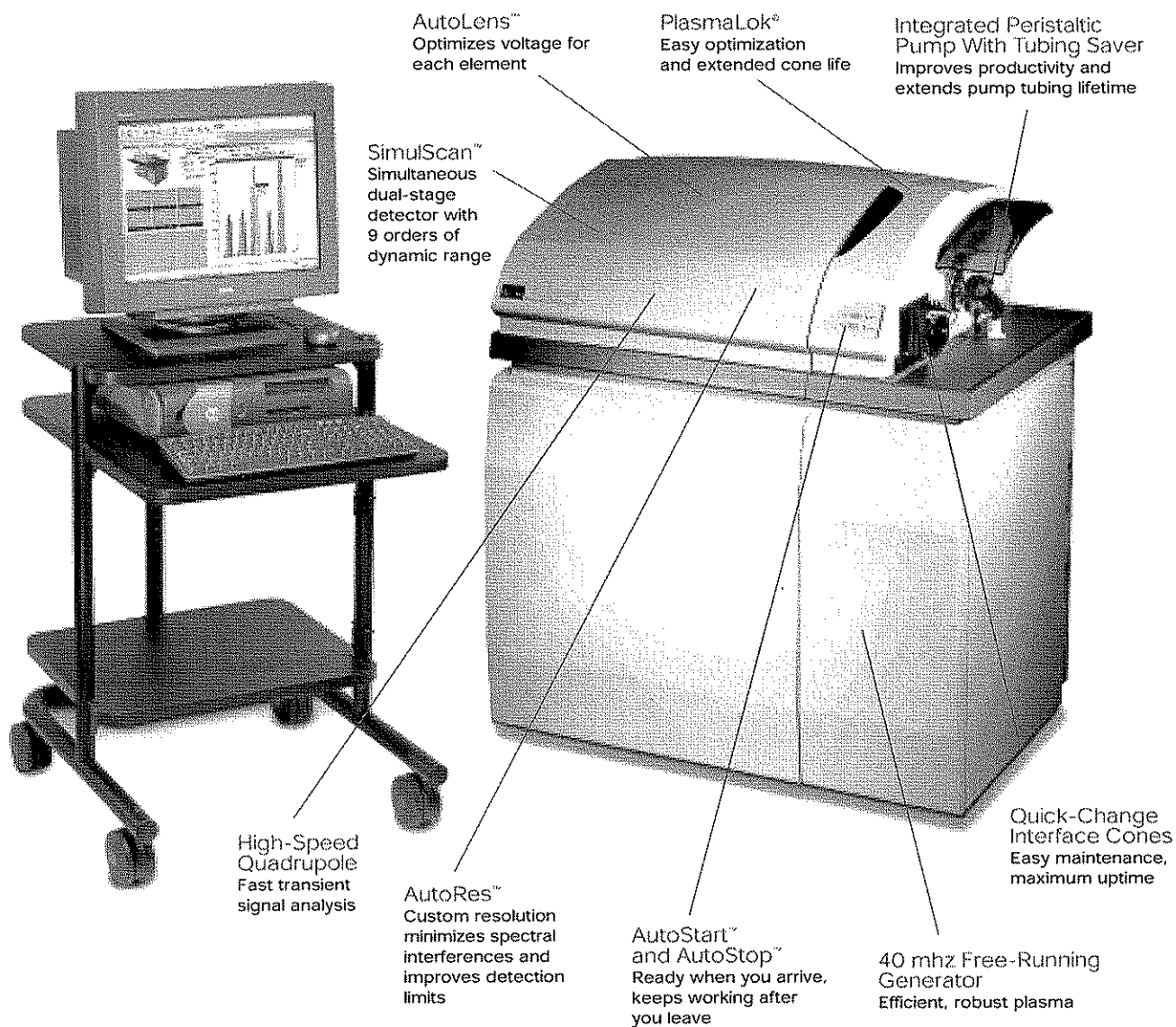


ELAN 9000 ICP-MS



optimized for routine ultratrace analysis

the right answer, right away



The ELAN® 9000 simplifies ICP-MS by providing an easy-to-use, easy-to-maintain tool for routine ultratrace level analysis. Backed by the industry's most extensive service and support network and over 40 years of experience developing inorganic solutions, the ELAN 9000 is ideal for environmental, clinical, geochemical, and general testing laboratories with moderate to heavy loads of ultratrace level samples.

The proven design of the ELAN 9000 ensures accuracy, improves method development, and consistently delivers the correct answer, reducing rework and improving productivity. In high-throughput environments, the system offers a speed and performance advantage over Graphite Furnace Atomic Absorption Spectrometry. Design enhancements provide increased reliability and reduced cost of ownership when compared with other ICP-MS systems.



Superior detection limits

The ELAN 9000 performs analyses at the parts-per-trillion level and lower. The custom resolution feature allows you to selectively adjust resolution for individual masses, while maintaining nominal resolution across the mass range, minimizing spectral interferences, extending working ranges and improving detection limits. The unique AutoLens feature optimizes the lens voltage for each element. This powerful system maximizes analyte signals and minimizes matrix interferences during multi-element runs, providing maximum sensitivity.

Unlike other ICP-MS systems that drift and may require a time-consuming multi-point data collection process, the ELAN 9000 is stable enough to perform single-point, peak-hopping data collection without any compromises, achieving the best detection limits in the shortest time. Excellent long-term quadrupole stability means peaks don't shift over time, so you don't need to repeat time-consuming mass calibrations.

More samples, less time

With over 20 years of experience in ICP-MS, we've built efficiency into every system. The sample introduction system uses an integrated peristaltic pump to dramatically reduce sample uptake time. The non-cooled spray chamber provides unequalled sample washout. This minimizes time between samples and ensures that the matrix from the previous sample is eliminated before you start the next sample.

The sample introduction system is completely HF-resistant, so you can run any liquid sample, including corrosive matrices, without risking damage to the system. The ELAN 9000 features an innovative torch design. Because the torch ignites in place, the signal is always optimized. The ICP load coil requires no external cooling and there is no need to spend time adjusting and

re-optimizing the torch position prior to beginning work. And, the unique PlasmaLok interface reduces background and eliminates secondary discharges, guaranteeing excellent signal precision and long-term stability. You can use one standard set of conditions to run all the elements without affecting the signal—you can go from wet to dry or from cool to hot plasma conditions without making adjustments.

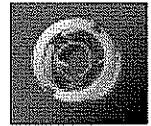
Additionally, the SimulScan dual-stage detector measures both high- and low-level analytes simultaneously. This conserves valuable or limited samples, eliminates the need to perform time-consuming sample dilutions, and allows you to quickly identify uncharacterized samples.

Rugged design ensures stability

Rugged construction means the system will perform even in the most difficult environments with the dirtiest of samples. The ELAN 9000 is the instrument of choice for geological exploration laboratories where rock digests are run 24 hours per day.

The PerkinElmer SCIEX patented ShadowStop™ prevents photons and un-ionized matrix constituents from entering the quadrupole, lowering system background and eliminating drift. This innovation also enhances ease of use because the ShadowStop is grounded, making it a passive part of the ion optic design. Unlike systems that use active lens elements to bend the ion beam away from photons emitted by the plasma, the ELAN does not require continual lens voltage adjustments.

Our advanced design permits use of a heat exchanger-based cooling system, replacing expensive and unreliable chillers without compromising speed or sensitivity. Plus, the overall system design allows you to run more samples between calibrations. Large orifice cones provide superior long-term stability and resist clogging, allowing analysis under both high or low sample uptake conditions.



SwiftMount single ion lens is easy to install.



easy operation and maintenance

The ELAN 9000 brings a whole new level of ease of use to ICP-MS. Based on the powerful Windows 2000® operating system, the simple, intuitive software makes ICP-MS accessible to novices and experts alike. The software is designed specifically for ICP-MS and includes helpful guidelines that assist users in selecting the best mass for their particular matrices. Users appreciate the flexible setup that allows creation of customized workspaces. The software includes a library of standard reports or allows you to customize reports for your methods without having to use a complicated macro language or exit to another program.

One-touch ion lens adjustment

Unlike other systems, which require iterative adjustments to the ion optics, the ELAN's single ion lens is adjusted automatically with the touch of a button. Computer-controlled auto-optimization of the ion optics eliminates the possibility of mis-adjustment that can lead to poor performance.

The industry's only single ion lens

Changing the exclusive SwiftMount™ single ion lens is as easy as changing a lightbulb. In fact, the

process takes less than 3 minutes, while competitive lens systems that have 30 to 40 pieces are very difficult to clean and reassemble. And, since the lens has only one piece, there is no need to restabilize the system after cleaning. The single ion lens is also inexpensive, making replacement an affordable option.

Method development made easy

With the ELAN system, method development is easier than ever. The PathFinder™ guide acts as an on-line consultant, leading you step-by-step through the method development process. Simply select the elements you need to measure; the software will help you pick the appropriate mass based on abundance and potential interferences. Additionally, several turnkey environmental and clinical methods are available, eliminating method development for these applications.

Using ELAN's TotalQuant™ feature, only one standard is required to obtain estimated concentrations for all elements. This is particularly useful for survey work since it helps identify what is in unknown samples while providing an approximate concentration.

Designed for regulatory compliance

All raw data, including methods and parameters used, are stored in an encrypted dataset. The ELAN 9000 guards against data tampering in compliance with the requirements of regulated environments. The powerful quality control system allows you to set limits, parameters, and standards based on U.S. EPA or other quality control guidelines, then interprets data and takes user-specified actions if results fall out of range.

And, automatic start and stop means the system can begin working while you travel to work and continue running unattended after you've left for the day, extending productivity beyond normal

QUICK GLANCE

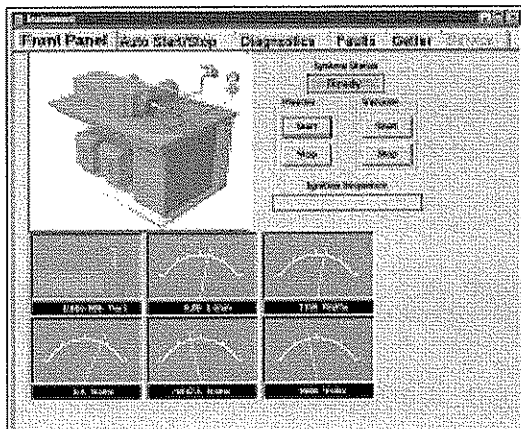
ELAN 9000 High-Productivity ICP-MS

- Auto-optimization makes operation simple
- The industry's first and only single ion lens
- Windows 2000® software is the industry standard in ease-of-use
- Reliable and efficient recirculator-based cooling system
- Designed for routine, high-throughput multi-element analysis
- AutoStart and AutoStop with TubingSaver
- Unsurpassed stability on real-world samples



PathFinder on-line consultant leads you through method development.

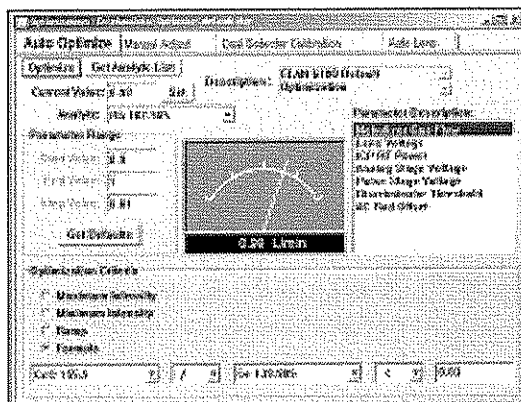
“The ELAN is amazing. It works great and is very reliable. Its sample throughput and precision are impressive.”



Instrument status and control provides a snapshot of all instrument components.

Easy maintenance, low cost of ownership

The ELAN 9000 is not only easy to use, it is easy to maintain as well. Designed with accessibility in mind, the compact instrument has doors on all four sides, making it easy to reach any part of the system. The vacuum chamber design provides independent access to each vacuum region, allowing maintenance to be performed in one region without affecting the other. The compact design and integrated castors allow the instrument to be easily relocated as laboratory needs change. Additionally, video clips of maintenance procedures help your staff fully understand and perform routine system maintenance.

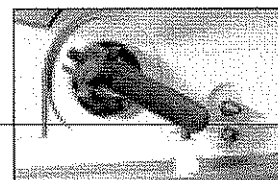


The system automatically optimizes all parameters.

The dual inlet turbo pump replaces costly multi-pump configurations, increasing reliability while reducing cost of ownership. The pump features built-in corrosive purge capability, enabling any system to analyze phosphoric acid samples by adding an optional tubing kit.

working hours. Tubing save ensures optimum measurement precision and prolongs peristaltic tube lifetimes. The feature allows clamping of pump tubing prior to an unattended run without damaging the tubing. This capability, combined with automatic quality control checking, instrument sensors, and software protocols that monitor over 70 test points, ensures that the system is operating safely and accurately even when you aren't there.

The system also offers the industry's lowest cost of ownership. PerkinElmer SCIEX's sixth-generation ICP-MS has proven exceptional uptime. Plus, the minimal routine maintenance and long-lasting consumables help minimize ongoing financial commitments. For example, the PlasmaLok interface minimizes clogging and discharge erosion on the cones reducing cleaning, routine maintenance and replacement costs. The ELAN cone design makes removal and replacement easy because cones simply thread or glide into place and are easily accessible, allowing you to change them in less than 30 seconds.



Large orifice cones resist clogging.

trust the inorganic analysis leader

With over 40 years of experience and a product line that extends from entry-level Atomic Absorption systems to flexible ICP-OES instruments to the powerful ELAN ICP-MS systems, PerkinElmer is the undisputed leader in inorganic analysis. The company has over 42,000 systems solving analytical problems in laboratories throughout the world. With a wealth of applications knowledge, your PerkinElmer representative can put together an inorganic solution that meets your analytical as well as your budget needs.

Developed the first commercial ICP-MS

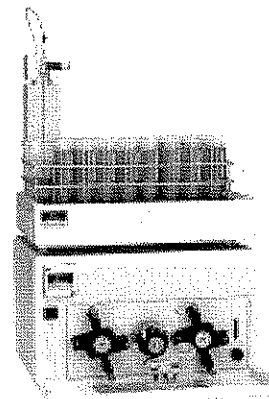
For over 15 years, PerkinElmer and MDS SCIEX have partnered to develop and distribute the most innovative and powerful ICP-MS systems. There are over 1,500 units installed in industries ranging from environmental and clinical to semiconductor, geochemical, and metallurgical. Unlike competitive systems that are relatively unproven, the ELAN 9000 is a sixth-generation instrument. With each generation, the systems have become more reliable, more rugged, more accurate, more economical and much easier to use.

We know ICP AND MS

Since the late 1970s, PerkinElmer has been perfecting ICP and SCIEX has been an innovation leader in mass spectrometry. Through our partnership as PerkinElmer SCIEX, we are able to provide unequalled expertise on both sides of the interface. This is essential to providing superior instrumentation. On the ICP side, the ability to ensure proper sample introduction and awareness of potential interferences puts PerkinElmer SCIEX systems ahead of others in terms of performance and reliability. At the same time, the innovative ion optics and quadrupole designs of the mass spectrometer are optimized to eliminate interferences and provide superior performance.

Integrated solutions for every application

The ELAN 9000 provides the flexibility required to handle even the most difficult applications. Using a wide selection of options and accessories, PerkinElmer can build a complete, fully integrated system that fits your specific application.



FIAS-400MS flow injection system helps manage liquid samples.

PerkinElmer is the leader in Flow Injection Atomic Spectroscopy (FIAS™) which is an extremely efficient liquid sample management technique. The two-pump FIAS accessory is available with both 5- and 8-port injection valves and provides low carryover, enhancing productivity. The FIAS is used for such applications as low-level Hg and Se determinations.

- A variety of autosamplers are available as well.

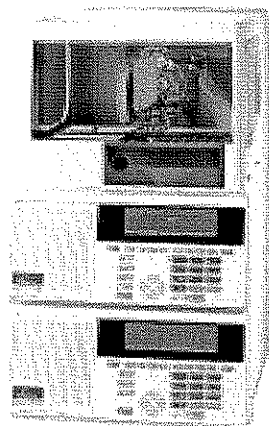
These corrosion-resistant samplers feature a continuous flow-through rinse station which virtually eliminates sample carryover and cross-contamination.



AS-93plus autosampler maximizes laboratory productivity.

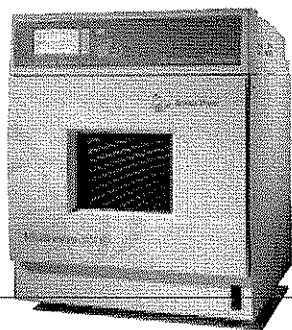


- The ELAN is easily integrated with liquid chromatography (LC) and ion chromatography (IC) systems, providing a complete solution for the separation and determination of individual metal compounds. With TotalChrom™ chromatography software, the ELAN provides a complete solution for your speciation needs.



Series 200 LC pump and autosampler integrates with the ELAN system.

- A variety of sample introduction accessories such as ultrasonic, desolvating, and micro-volume nebulizers and cyclonic and cooled spray chambers are also available.
- Laser sampling accessories make solids analyses routine. Variable power UV lasers automatically vaporize a portion of the sample and transport it to the ELAN for analysis. Using laser sampling, applications such as small-inclusion analysis, spatial profiling, and bulk solids analysis are made easy.
- The Multiwave® microwave digestion system simplifies sample preparation for all sample types, including foods, oils, plastics, environmental samples, and many more.



Multiwave microwave digestion system simplifies sample preparation.

- The ELAN 9000 seamlessly interfaces to a piston-driven autodilution system, diluting samples up to 100X with unequalled precision. Unlike dilution systems that incorporate peristaltic pumps, the system uses piston-driven pumps to provide precise dilution measurements ensuring consistent, accurate and repeatable results.

SUPERIOR VALUE

- Proven quality product
- Intuitive software designed for inorganic analysis—built on 35 years of experience in atomic spectroscopy
- Rugged interface with large orifice cones
- Patented PlasmaLok interface
- Quick-washout sample introduction system combined with rapid-scanning quadrupole
- Wide variety of sampling accessories available

UNRIVALED BENEFITS

- Provides quick installation and extremely high uptime, maximizing investment
- Easier to learn, easier to use with functionality needed for ultratrace analysis
- Unmatched stability with real-world samples that contain high-dissolved solids
- Less time optimizing, more time running samples
- Unsurpassed sample throughput and productivity
- Flexibility allows you to expand into new application areas, including speciation

PerkinElmer, Inc.

PerkinElmer Instruments is part of the PerkinElmer, Inc. family, which also includes Optoelectronics and Life Sciences.

Unbeatable service and support— worldwide

Maybe you're new to ICP-MS or maybe you're an expert who wants to discuss an application with a knowledgeable ICP-MS scientist. In either case, PerkinElmer SCIEX has more people focused on ICP-MS applications than any other company. With extensive applications experience and knowledgeable, factory-trained service specialists, you can be assured that our organization is here.

Whatever you're looking for, we've got it

PerkinElmer Instruments is a world leader in chemical analysis and imaging. Our Analytical Instrument technologies serve the fast-evolving pharmaceutical, chemical, environmental and semiconductor industries, providing integrated solutions—from sample handling to interpretation and communication of test results.

As one of the best known brands in research, analysis and testing, ours was probably the first analytical instrument you ever used. In addition to our ICP MS systems, we offer a broad range of solutions in Luminescence, AA, UV-Vis, NIR, GC, GC/MS, HPLC, ICP, Thermal Analysis and FTIR. There are over 60 years of experience built into every product we make. So, for leading edge R&D and demanding QA/QC, you get the speed, accuracy and reliability you seek—for the productivity you need.

Our service and support people are located in 125 countries throughout the world and are factory trained. Compliance doesn't get any easier than with our software, including 21 CFR Part 11 technical compliance on many products. And online consumables and accessories ordering lets you get your hands on what you need fast.

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PerkinElmerSCIEX
instruments.

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ICP Mass Spectrometry

ELAN[®] 9000 ICP MASS SPECTROMETER

guaranteed shipping specifications

Detection limits	Based on three times the standard deviation of the blank and three-second integration time using peak hopping at 1point per mass. ng/L (ppt) ⁹ Be < 9 ⁵⁹ Co < 2.0 ¹¹⁵ In < 0.5 ²³⁸ U < 0.5
Sensitivity	M cps/mg/L ²⁴ Mg > 10 ¹¹⁵ In > 40 ²³⁸ U > 30
Oxide and doubly charged species	Measured without the use of a desolvation device such as a chilled spray chamber and using the same operating conditions to achieve sensitivity and detection limit specifications. CeO ⁺ /Ce ⁺ < 3% Ba ²⁺ /Ba ⁺ < 3%
Background noise	Stability of the background defined as the standard deviation of the background signal. Mass 220 < 5 cps
Short-term precision	Defined as the coefficient of variation (% RSD) for a 10-µg/L multielement solution, measuring ²⁴ Mg, ⁶³ Cu, ¹¹⁴ Cd and ²⁰⁸ Pb, using a 3-second integration time, without an internal standard. < 3% RSD
Long-term stability	Relative stability after a one-hour warm-up. Defined as the standard deviation of the mean signal for ²⁴ Mg, ⁶³ Cu, ¹¹⁴ Cd and ²⁰⁸ Pb in a 10-µg/L multielement solution, measured once every 10 minutes, using no internal standardization. < 4% RSD over 4 hours
Isotope ratio precision	Defined for the isotope ratio of ¹⁰⁷ Ag/ ¹⁰⁹ Ag using a 50-µg/L solution. Obtained using single-point peak hopping over a total measurement time of 5 minutes. < 0.2% RSD
Mass calibration stability	Measured using a 10-µg/L multielement solution containing ²⁴ Mg, ¹⁰³ Rh and ²⁰⁸ Pb. Defined in terms of the shift in spectral position corresponding to maximum spectral peak intensity for each element, obtained without the use of multiple-point, peak-searching algorithms. < 0.05 amu over 8 hours of continuous operation.
Peak hopping settling time	Defined as the time taken to settle electronics after peak hopping to a discrete mass position. Normal Pulse Counting Mode: 200 µsec Extended Dynamic Range Mode: 3 msec

Quadrupole scan speed	Defined as the maximum rate at which the quadrupole can be scanned. 2400 amu/sec
Abundance sensitivity	Defined as the intensity of a given isotope at spectral peak maximum, relative to the intensity of that isotope at 1 amu lower, and at 1 amu higher than the mass position corresponding to peak maximum. Measured at ²³ Na: Better than 1.0 x 10 ⁶ at low mass side of peak Better than 1.0 x 10 ⁷ at high mass side of peak
Detector linear range	The SimulScan™ detection system operates from 1 cps to 10 ⁹ cps. This provides over 8 orders of magnitude of linear dynamic range in a single continuous scan.
Sample washout	Measured after introduction of a 1% nitric acid solution immediately following continuous aspiration of 100 µg/L Rh for one minute: Signal for ¹⁰³ Rh drops by at least three orders of magnitude in less than 30 seconds.
Regulatory and safety compliance	The ELAN 9000 carries the CE Mark and fully meets the regulatory and safety standards below: <ul style="list-style-type: none"> • CAN CSA C22.2 No. 1010-1; Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use • UL Std. No. 3101-1; Electrical Equipment for Laboratory Use • FCC Part 15, Class A • European Low Voltage Directive 73/23/EEC (LVD) and its standards EN61010-1, and EN61010-2-061 • European EMC Directive 89/336/EEC and 92/31/EEC and its standards EN55011:1998 (Class A) and EN61326-1:1997
Dimensions and installation requirements	For a detailed description of instrument dimensions, services, power and environmental requirements, please refer to "Preparing Your Laboratory for the PerkinElmer SCIEX® ELAN 9000 ICP Mass Spectrometer" (D-6039C).

Specifications valid for all ELAN 9000 ICP-MS instruments manufactured after May 2002.
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ICP-Mass Spectrometry

Preparing Your Laboratory for the ELAN 9000 ICP-Mass Spectrometer

PerkinElmer SCIEX ICP-MS instruments are complete systems with the exception of the following items which must be provided by the customer: electrical power, exhaust vents, argon gas supplies with approved regulator, and coolant system. The items shown in the following checklist need to be considered when preparing the laboratory for the instrument.

- Environmental conditions
- Electrical requirements
- Space requirements
- Exhaust ventilation
- Coolant requirements
- Gases
- Computer and printer table

Environmental Conditions

The environment in which the instrument is installed should meet the following conditions.

- The room temperature should be between 15 and 30°C (59-86°F) with a maximum rate of change of 2.8°C (5°F) per hour.
- The relative humidity should be between 20 and 80%, noncondensing. For optimum performance, the room temperature should be controlled at 20 ± 2°C (68 ± 3.6°F) and the relative humidity should be between 35 and 50%.

In order to minimize contamination problems, a relatively dust-free environment is necessary. This is especially important when working with ultra-trace techniques, such as

ICP-MS. Maximum dust levels can not exceed 1,000,000 particles (0.5 micron or larger) per cubic foot of air (Class 1,000,000). A normal office environment would be 500,000 to 1,000,000 particles per cubic foot.

If the ELAN 9000 is going to be used to carry out ultra-trace determinations, such as in the semiconductor industry, it is advised that the instrument be installed in at least a Class 1000 clean room.

In addition, the instrument should be located in an area that is:

- Free of smoke and corrosive fumes
- Not prone to excessive vibration
- Out of direct sunlight
- Away from heat radiators

PerkinElmer SCIEX ICP-MS instruments have been designed for indoor use. The ELAN 9000 can be installed into a mobile laboratory if the instrument is isolated from vibrations.

WARNING:
Do not use the instrument in an area where explosion hazards may exist.

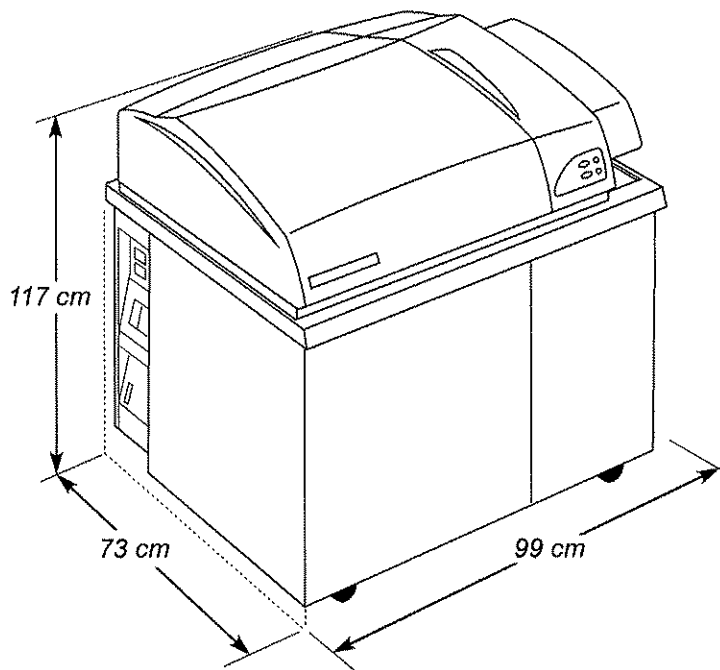


Figure 1. Dimensions of the ELAN 9000 ICP-MS.

Space Requirements

The system should be located near the required electrical and gas supplies. The spectrometer also requires liquid cooling. A suitable cooling system can be purchased from PerkinElmer.

The ELAN 9000 is on wheels and can be moved for service and preventative maintenance. However, a space of at least 30 cm (12 in.) behind the instrument is recommended. This space behind the instrument provides clearance for the vent hoses. Access for most service procedures will be through the front of the instrument. Allow space on the right side of the instrument for an accessory cart or table.

System Layout

The ICP-MS consists of the main instrument, the computer controller assembly and a printer, the dimensions of which are given in Figure 1 and Table I.

The ELAN 9000 ICP-MS can be positioned in either a linear or an L-shaped configuration. In the L-shaped configuration, the computer and printer are positioned on one leg of the L. The instrument and an accessory table make up the other leg.

There should be sufficient space near the spectrometer for the various accessories (autosampler, FIAS, electrothermal vaporizer, laser sampler, ultrasonic nebulizer, etc). It is recommended that the accessories be placed on a movable cart or table to allow for easy servicing access. Table II lists the dimensions of the accessories.

The system computer may be placed on a bench or a separate computer table. A suitable computer worktable is available from PerkinElmer (Part No. N058-1451).

Drain Vessels

A 15-liter drain vessel is supplied with the ELAN 9000 ICP-MS. The vessel is made of HDPE (high density polyethylene) and is used to collect the effluent from the ICP sample introduction system.

The drain vessel should be placed to the right of the instrument. The drain vessel should NOT be stored in an enclosed storage area. The drain system should be checked regularly and replaced when necessary. Should it become necessary to replace the drain vessel, it should be made from a material not likely to be attacked by samples being analyzed. Glass or other brittle materials must not be used.

Liquid waste should always be segregated and clearly labeled. Never mix organic and inorganic liquids in the same drain vessel. Organic and inorganic drain vessels should never be stored in the same area.

Safe Handling of Gas Cylinders

Notice: The permanent installation of gas supplies is the responsibility of the user and should conform to local safety and building codes.

- Fasten all gas cylinders securely to an immovable bulkhead or a permanent wall.
- When gas cylinders are stored in confined areas, such as a room, ventilation should be adequate to prevent toxic or explosive accumulations. Move or store gas cylinders only in a vertical position with the valve cap in place.
- Locate gas cylinders away from heat or ignition sources, including heat lamps. Cylinders have a pressure-relief device that will release the contents of the cylinder if the temperature exceeds 52°C (125°F).

Table I. Dimensions of the Instrument and Computer

Instrument	Width cm (in.)	Height cm (in.)	Depth cm (in.)	Weight kg (lb.)
ELAN 9000	99 (39)	117 (46)	73 (29)	295 (650)
Work Surface Height		87 (34)		
DELL Computer	Dimensions will vary by model			
DELL Monitor	Dimensions will vary by model			
HP LaserJet 4100	39 (15.3)	34.6 (13.6)	50.7 (19.9)	17 (37.5)

Table II. Dimensions of the Accessories

Accessory	Width cm (in.)	Height cm (in.)	Depth cm (in.)	Weight kg (lb.)
Cooling System:				
Heat Exchanger (PolyScience 3370)	38 (15)	63.5 (25)	38 (15)	31.3 (69)
Refrigerated Chiller (PolyScience 6105PE)	38 (15)	63.5 (25)	67.3 (26.5)	81 (178)
FIAS 400MS	41.5 (16)	18.4 (7)	41 (16)	11 (24)
AS 93plus Autosampler	44 (17)	37 (15)	34 (14)	4 (9)

- When storing cylinders external to a building, the cylinders should be stored so that they are protected against temperature extremes (including the direct rays of the sun) and should be stored above ground on a suitable floor.
- Mark gas cylinders clearly to identify the contents and status (full, empty, etc.).
- Do not attempt to refill gas cylinders yourself.
- Use only approved regulators and hose connectors. Left-hand thread fittings are used for fuel gas tank connections whereas right-hand fittings are used for oxidant and support gas connections.
- Arrange gas hoses where they will not be damaged or stepped on and where things will not be dropped on them.
- Perform periodic gas leak tests by applying a soap solution to all joints and seals.

Facilities Requirements

Table III provides information on the gas and liquid services required for the ELAN 9000. Tables IV and V show the electrical supply requirements and approximate power consumption of the ELAN 9000 and its major accessories.

Electrical Requirements

Power to the ELAN 9000 is to be delivered from two 30A single-phase 200-240V dedicated electrical branch circuits according to the power specifications in Table IV. Table V provides the electrical supply requirements and approximate power consumption of the major accessories and options. If the power line is unstable, fluctuates or is subject to surges, additional control of the incoming power may be required. A means of electrically grounding the instrument must be available.

60-Hertz-Operation Connections

The instrument is shipped with two 400 cm line cord cables. The installation kit includes two Hubbell No. 2621 plugs and two Hubbell No. 2620 receptacles for use with two 60 Hz single phase outlets. The instrument is wired for power at the time of installation.

50-Hertz-Operation Connections

The instrument is shipped with two 400 cm line cord cables. It is up to the service person installing the instrument to wire it according to the power available at the lab. The single phase connectors must be supplied by either the customer or the local PerkinElmer office. For 50 Hz operation, Hubbell Number 2351 plugs and

Hubbell No. 2350 receptacles are recommended. Note that the installation kit includes 2 Hubbell No. 2621 plugs and a No. 6 AWG ground wire. A means of electrically grounding the instrument must be available.

Three-Phase-Operation Connections

If a three phase connection is required (by local electrical code), the instrument can be connected via a single line cord to two of the three sides of the three phase line. The three-phase line cord and connectors must be supplied by either the customer or the local PerkinElmer office. A means of electrically grounding the instrument must be available. Four meters of grounding wire are provided with the instrument.

Table III. Services Required for the ELAN 9000

Gases	Argon, 350 ± 7 kPa (51 ± 1 psi) at 20 L/min flow
Cooling	Coolant circulation of at least 3.8 L/min (1.0 gpm) at an operating pressure of 344 ± 14 kPa (50 ± 2 psi)

Table IV. ELAN 9000 Power Specifications

Power Consumption	
Maximum Volt Amperes (total, both circuits)	6000 VA
Maximum Continuous Current (per circuit)	20 A
Voltage Amplitude Specification	
Operating Voltage	200 - 240 V
Maximum Allowable Percent Sag	5%
Maximum Allowable Percent Swell	5%
Phase (single or three)	Single phase or three phase
Frequency Specification	
Operating Frequency	50 or 60 Hz
Allowable Frequency Variance	± 1 Hz
Waveform Specification	
Maximum Supply Voltage Total Distortion	5%
Maximum Supply Voltage Distortion by Single Harmonic	3%

Table V. Electrical Requirements of ELAN Accessories

Equipment	Voltage (AC)	Power
Computer	Depends on Model	Depends on Model
Printer: HP LaserJet 4100	100-127 V/220-240 V, 50/60 Hz	330 W
Cooling System:		
Heat Exchanger (PolyScience 3370)	208-240 V, 50/60 Hz	800 W
Refrigerated Chiller (PolyScience 6105PE)	208-230 V, 60 Hz, 8 A 240 V, 50 Hz, 8.5 A	2000 W
FIAS 400MS	110/220 V	600 W

Exhaust Vents

The ELAN 9000 ICP-MS requires two separate vents, one for the ICP Power Supply/Roughing Pump exhaust and another vent for the Torch Box exhaust. The main venting system is required to remove combustion fumes and vapors from the torch housing. Exhaust venting is important for the following reasons:

- It protects laboratory personnel from toxic vapors that may be produced by some samples.
- It will minimize the effects of room drafts and the laboratory atmosphere on ICP torch stability.
- It will help protect the instrument from corrosive vapors which may originate from the samples.
- It will remove dissipated heat which is produced by the ICP torch, RF power supply, and the pump motors.

WARNING:

The use of ICP-MS instruments without adequate ventilation to outside air may constitute a health hazard. For example, the combustion of halogenated hydrocarbons produces toxic vapors. Extreme care should be taken that exhaust gases are vented properly.

The main 100 mm (4 inch) venting system must provide a flow rate of approximately 70 liters/sec \pm 10% (150 cubic feet/min). The 150 mm (6 inch) venting system must provide a flow rate of approximately 210 liters/sec \pm 10% (450 cubic feet/min). Both of the exhaust ports should be connected directly to flexible exhaust hoses.

The main torch box must be installed, but there is an option for the coaxial RF generator and roughing pump exhaust. If a 150-mm (6-in.) duct is not available, a 100-mm (4-in., 150 ft³/min) duct can be connected to the inner duct. Only the RF generator is exhausted in this case. The heat from the roughing pumps is released into the laboratory.

We recommend a 100 mm (4 inch) ID torch box exhaust hose and a 150 mm (6 inch) ID ICP Power Supply/Roughing Pump air exhaust hose. The ELAN 9000 is supplied with 3 m (10 ft.) of 100 mm (4 inch) and 3 m (10 ft.) of 150 mm (6 inch) flexible tubing. This tubing permits the movement of the instrument without disconnecting the vents from the laboratory system. See Tables VI and VII for vent specifications.

Table VI. Flow Rates and Anemometer Readings

Hose Diameter	Flow Rate	Anemometer Reading
100 mm (4 in.)	70 L/s (150 ft ³ /min)	9 m/s (1695 fpm)
150 mm (6 in.)	210 L/s (450 ft ³ /min)	11.5 m/s (2250 fpm)

Table VII. Hose Diameter and Venting Capabilities

Hose	Hose Diameter	Vented Outside Lab Watts (BTU/hr)
Torch Box Exhaust	100 mm (4 in.)	200 (680)
ICP Power Supply/Roughing Pump	150 mm (6 in.)*	2800 (9400)
ICP Power Supply Only	100 mm (4 in.)	1400 (4700)

*If only the 100-mm (4-in.) ID ICP power supply exhaust hose is used, approximately 1400 W (4700 BTU/hr) of heat is vented into the lab. An independent room air conditioner [3000 W (10 000 BTU/hr)] is recommended to remove this additional heat.

Vent Positions

Both of the ELAN 9000 vents are located on the back of the instrument. See Figure 2. The Torch Box exhaust vent is 23.75 cm (9.5 in) from the left side of the instrument when viewed from the rear and 101.25 cm (40.5 in) above the floor. The ICP Power Supply/Roughing pump exhaust vent is 23.75 cm (9.5 in) from the left side of the instrument (rear view) and 64.4 cm (25.75 in) above the floor.

Venting System Recommendations

The exhaust flow rate at the instrument (the ability to vent the system) is dependent on customer provided blower, the duct length, material and the number of elbows or bends used. If an excessively long duct system or a system with many bends is used, a stronger blower may be necessary to provide sufficient exhaust volume at the instrument. Smooth stainless steel tubing should be used instead of flexible stainless steel tubing where flexibility is not required to reduce system friction loss or "drag." A length of smooth stainless steel ducting has 20-30% less friction loss than a comparable length of flexible ducting. When smooth stainless steel tubing is used, elbows must be used to turn corners. These elbows should turn at no more than 45 degrees between straight sections to reduce friction losses, and the number of elbows should be minimized.

Additional recommendations on the venting system include:

- The duct casing and venting system should be made of materials suitable for temperatures as high as 70°C (160°F) and be installed to meet local building code requirements.
- Locate the blower as close to the discharge outlet as possible. All joints on the discharge side should be airtight, especially if toxic vapors are being carried.

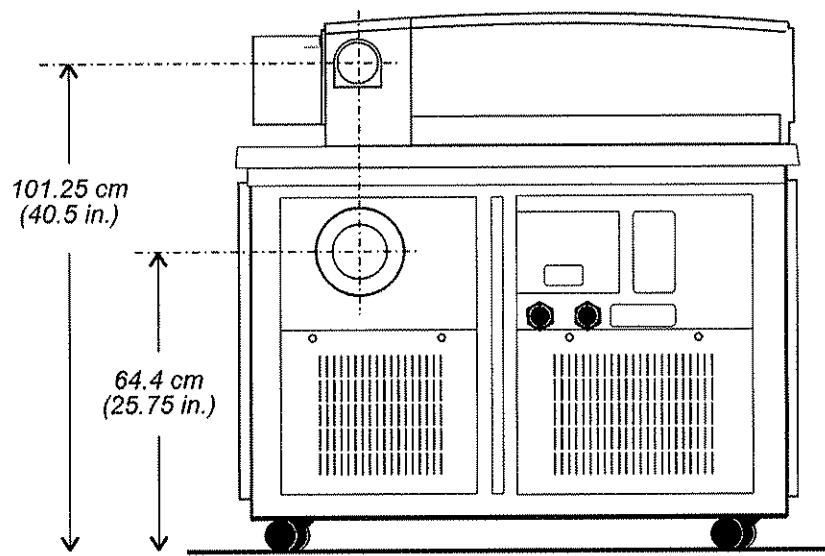


Figure 2. Vent locations, rear of the ELAN 9000 ICP-MS.

- Equip the outlet end of the system with a backdraft damper. Keep the exhaust outlet away from open windows or inlet vents and to extend it above the roof of the building for proper dispersal of the exhaust.
- Equip the exhaust end of the system with an exhaust stack to improve the overall efficiency of the system.
- For best efficiency, make sure the length of the duct that enters into the blower is a straight length at least ten times the duct diameter. An elbow entrance into the blower inlet causes a loss in efficiency.
- Provide make-up air in the same quantity as is exhausted by the system. An "airtight" lab will cause an efficiency loss in the exhaust system.
- Ensure that the system is drawing properly by placing a piece of cardboard over the mouth of the vent.
- Equip the blower with an indicator light located near the instrument to indicate to the operator when the blower is on.

Cleaning the Instrument

Before using any cleaning or decontamination methods, except those specified by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

Cleaning procedures for the ELAN 9000 can be found in the ELAN 9000 Hardware Guide.

Coolant Requirements

The ELAN 9000 system requires a regulated source of filtered coolant for the purpose of cooling. The coolant supply should be filtered (free of sediment) and have a pH between 6.5 and 8.5. It should be hardness-free with <1ppm of heavy minerals. The recirculator operating pressure should be 344 ± 13 kPa (50 ± 2 psi). A coolant flow of at least 3.8 L/min (1.0 gpm) is required.

A recirculating system containing a corrosion inhibitor is specified to protect the aluminum components of the cooling system and the interface. Sufficient pre-mixed coolant (Part No. WE01-6558) is supplied for the Heat Exchanger or Refrigerated chiller.

If laboratory temperatures do not exceed 30°C (86°F), the heat exchanger can be used in place of a refrigerated chiller. For laboratories where the temperature can exceed 30°C (86°F), a refrigerated chiller is required. The heat exchanger must be located in a well ventilated area where the air temperature will not exceed 30°C (86°F).

Argon Gas Requirements

Argon is used as the ICP torch gas with the ELAN 9000. The quality criteria for argon is listed below.

Purity	≥ 99.996%
Oxygen	< 5 ppm
Hydrogen	< 1 ppm
Nitrogen	< 20 ppm
Water	< 4 ppm

Either liquid or gaseous argon can be used with an ICP-MS system. The choice of liquid argon or gaseous argon tanks is determined primarily by the availability of each and the usage rate. Liquid argon is usually less expensive per unit volume to purchase, but cannot be stored for extended periods. If liquid argon is used, the tank should be fitted with an over-pressure regulator which will vent the tank as necessary in order to prevent the tank from becoming a safety hazard.

Gaseous argon tanks do not require venting and consequently can be stored for extended periods without loss. A tank of liquid argon containing 4300 cubic feet will last for approximately 100 hours of continuous ICP running time. A tank of gaseous argon will last 5 to 6 hours of ICP running time. The normal argon gas usage is 14-20 L/min.

A cylinder regulator (Part No. 0303-0284) which can be used with argon is available from PerkinElmer. The regulator can be used with CGA 580 or CGA 590 fittings and includes a color-coded hose with 1/4-inch Swagelok fittings to permit direct connection to the regulator and to the instrument gas controls. Liquid argon may be purchased from your gas supplier.

PerkinElmer SCIEX ICP-MS instruments include the hoses necessary for connecting the argon to the instrument.

Suggested Safety Practices

This advice is intended to supplement, not supersede, the normal safety codes in the user's country. The information provided here does not cover every safety procedure that should be practiced. Ultimately, maintenance of a safe laboratory environment is the responsibility of the analyst and the analyst's organization.

General

- Never view the ICP discharge directly without protective eye wear. Potentially hazardous ultraviolet radiation may be emitted. Ordinary safety glasses will in general provide sufficient protection, but additional side shields will insure a further margin of safety. Safety glasses will also provide mechanical protection for the eyes.
- ICP-MS instruments generate high amounts of radio frequency energy in their RF power supply and torch boxes, which is potentially hazardous if allowed

to escape. Safety devices and screening interlocks should not be bypassed or disconnected.

- The power supply of an ICP-MS is capable of generating potentially lethal voltages. No maintenance should be performed by anyone other than a PerkinElmer Service Specialist or the customer's own PerkinElmer trained maintenance personnel.
- Coolant lines should be located away from electrical connections. Condensation and possible leaks may create an unsafe situation if in proximity to electrical connections.

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U.S. EPA Method 200.8 for the Analysis of Drinking Waters and Wastewaters

Introduction

The Safe Drinking Water Act (SDWA) as amended in 1986 requires the U.S. EPA (United States Environmental Protection Agency) to promulgate national primary drinking water regulations (NPDWRs), which specify maximum contaminant levels (MCLs) or treatment techniques for drinking water contaminants in public water systems. The Safe Drinking Water Act also authorizes the Administrator to establish regulations for monitoring to assist in determining whether persons are acting in compliance with the SDWA. The EPA has promulgated analytical methods for all currently regulated drinking water contaminants for which MCLs or monitoring requirements have been promulgated. In most cases, the Agency has promulgated regulations specifying (i.e., approving) the use of more than one analytical method for a particular contaminant and laboratories may use any one of them for determining compliance with an MCL or monitoring requirement. On December 5, 1994 (FR 59 (232) pp. 62456-62468) the EPA promulgated the use of several new analytical methods and updated versions of previously approved methods for a number of regulated contaminants in drinking water, including Method 200.8 "Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma Mass Spectrometry, Revision 5.4" [1]. This expanded approval for Method 200.8 for the analysis of Drinking Water became effective on January 4, 1995 [2].

Although the scope of Method 200.8 includes the 21 metals listed in Table 1, only the primary contaminants including antimony, arsenic, barium, beryllium, cadmium, chromium, mercury, nickel, selenium, thallium, lead, and copper may be determined in drinking waters using Method 200.8 under 40 CFR Part 141§ 141.23 as of the date of this application note. In addition, 40 CFR Part 143 § 143.4 allows the use of Method 200.8 for the analysis of secondary contaminants including aluminum, manganese, silver, and zinc under the National Secondary Drinking Water Regulations.

Table 1. Applicable elements for Method 200.8

Analyte	Symbol	Recommended Analytical Mass
Aluminum	Al	27
Antimony	Sb	123
Arsenic	As	75
Barium	Ba	137
Beryllium	Be	9
Cadmium	Cd	111
Chromium	Cr	52
Cobalt	Co	59
Copper	Cu	63
Lead	Pb	206,207, 208
Manganese	Mn	55
Mercury	Hg	202
Molybdenum	Mo	98
Nickel	Ni	60
Selenium	Se	82
Silver	Ag	107
Thallium	Tl	205
Thorium	T	232
Uranium	U	238
Vanadium	V	51
Zinc	Zn	66

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On January 27, 2000 (FR 65 (18), pp 4360-4385), Method 200.8 was also approved for use in monitoring of wastes in the Commercial Hazardous Waste Combustor Subcategory, otherwise known as incinerators, under the NPDES (National Pollutant Discharge Elimination System). In addition, until the method is approved for the entire NPDES program, Method 200.8 may be used for some NPDES monitoring with Alternate Test Procedure approval or with approval from the regional EPA authority [2].

Method 200.8 is a general analytical method that provides specific instructions concerning sample collection, preservation, and treatment as well as required and recommended procedures for instrument calibration, tuning, and correction for interferences. In addition, Method 200.8 also requires a specific set of quality assurance samples to be run along with any samples in order to ensure the quality of the data obtained using the method.

This application note describes the performance of the ELAN® 6000 ICP-MS for Method 200.8 [1] for all elements for which Method 200.8 is applicable [3]. Results for certified reference materials also include results for major constituents such as Na, Ca, Mg, and K where applicable, and are given for informational value and to illustrate that typical levels of these elements may be determined at the same time as trace levels of the elements in Method 200.8.

Summary of Method

As with all EPA Methods, Method 200.8 is a rather lengthy document (58 pages) with many sections describing both mandatory and recommended analytical procedures. Since many of the recommended procedures are also open for interpretation by the reader a brief synopsis of the method is given below:

Summary of Method 200.8

Establish Initial

Performance Data

1. Linear Range
2. Perform IDLs and MDLs
3. Analyze Quality Control Sample with acceptable performance

Daily Analysis

1. Light plasma, allow 30 minute warm-up
2. Tune instrument
 - a. Per manufacturer's instructions
 - b. Use tuning solution specified in 200.8 (10 ppb Be, Mg, Co, In, Pb)
3. Perform mass calibration check, adjust if change > 0.1amu
4. Perform resolution check, adjust if >0.75 amu at 5% peak height
5. Calibrate using blank and standards
 - a. Monitor all masses necessary for interference correction
6. Screen new samples for relative levels and presence of internal standards
7. Run instrument performance quality control samples
8. Run analytical batch quality control samples
9. Run analytical samples.
10. Review results of quality control samples for PASS/FAIL criteria.

Experimental

Instrument

The PerkinElmer SCIEX ELAN 6000 ICP-MS was used for the analysis of a number of natural and reference water samples. The ELAN 6000 combines high sensitivities and superior detection limits with ease of use and high sample throughput. Instrument conditions and general method parameters used for the results presented in this application note are noted in Table 2.

Standards

Due to the sensitivity of ICP-MS, ultrapure acids and stock standard solutions must be used. For this application note, all solutions were prepared using ultrapure acids and Type I water (> 18 megaohm-cm) from a laboratory reagent grade water system. Calibration standards, quality control standards, and reference materials for Method 200.8 were obtained from PerkinElmer Pure™, PerkinElmer Instruments, Shelton, CT; High Purity Standards, Charleston, SC; Inorganic Ventures, Inc., Lakewood, NJ; VHG Labs, Manchester, NH; and NIST, Gaithersburg, MD. Ultrapure nitric and hydrochloric acids were obtained from Seastar Chemicals, Inc., Sidney, BC, Canada.

Table 2. ELAN 6000 Instrumental Conditions and Method Parameters

RF Power	1000 watts
Plasma Gas Flow	15 L/min
Auxiliary Gas Flow	1 L/min
Nebulizer Gas Flow	0.725 - 0.775 L/min
Solution Pump Rate	1.5 mL/min
Sample Introduction System	Cross-flow with Scott spray chamber
Rinse Time	35 seconds @ 48 rpm
Sample Uptake Time	25 seconds @ 48 rpm
Equilibration Time	10 seconds @ 24 rpm
Analysis Time (total)	2:06 minutes
Detector Mode	Dual Mode
Lens	AutoLens Enabled
Sampler/Skimmer Cones	Nickel
Scanning Mode	Peak Hopping
Number of Points/Peak	1
Dwell Time	100 ms per point
Number of Sweeps/Reading	8
Number of Readings/Replicate	1
Number of Replicates	3
Total Acquisition Time	3:16 minutes

Tuning:

The tuning solution specified in Method 200.8 was modified by adding, Ba, Rh, and Ce in order to monitor the isotopes used by the instrument manufacturer to assess daily instrument performance, including the instrument response for Rh and the CeO and Ba⁺⁺ levels to indicate the level of formation of oxides and double charged ions [4]. The concentration of the tuning solution was reduced to 10 ppb due to the sensitivity of the ELAN 6000. This tuning solution was used to perform the mass calibration, resolution check, optimization, AutoLens tuning, and daily stability test. A 10 ppm stock solution was prepared by combining 0.50 mL of 1000 ppm single element stock solutions (PerkinElmer Pure Standards part numbers N930-0172, N930-0179, N930-0113, N930-0124, N930-0175, N930-0144, N930-0103, and N930-0110) in 2% nitric acid. This stock solution was diluted 1000-fold to prepare the 10 ppb daily tuning solution as needed.

Internal Standards:

A stock internal standard spiking solution was prepared from single element stock standards (PerkinElmer Pure) and a multi-element stock solution containing ⁶Li, Sc, In, Tb, and Bi (VHG Labs -Cat # LIS-100). The final concentrations of the stock solution are as follows: 10 ppm ⁶Li, Sc, In, Tb, Bi, Rh, Y and 50 ppm Ge and Au. All blanks, standards, and samples were spiked with this internal standard stock solution to give a final concentration of 20 ppb ⁶Li, Sc, Y, In, Rh, Tb, Bi, and 100 ppb Ge. Au was added to the internal standard stock solution to give a final gold concentration of 100 ppb for all solutions where Hg was to be determined. Germanium was added to the internal standard mixture because it was found to be a more suitable internal standard for As, Se, and Zn in samples with significant (ppm) levels of Na, Ca, Mg, or K than either Sc, Y, In, or Rh. The ionization potential of Ge (see Table 3) is much closer to those of As, Se, and Zn, and better mimics the ion-

ization interferences that can occur in samples containing moderately high levels of easily ionizable elements such as Na and K.

Calibration:

Since the samples to be analyzed with this method are primarily drinking waters, the elements of interest were calibrated at levels typical of the samples analyzed. In addition to the elements listed in Method 200.8 the levels of Ca, Mg, Na, and K were also monitored using isotopes 44, 24, 23, and 39, respectively. The calibration blank and standards were prepared in 1% nitric acid. The levels used for calibration are given in Table 4. It was found that the combination of the three standards listed below gave the best performance for a wide range of sample matrices; however, the number and content of these standards may be modified, depending on the needs of the individual laboratory.

Monitored Isotopes

In ICP-MS it is often necessary to monitor more than just the isotopes to be quantitated in order to perform mathematical corrections for isobaric

and molecular interferences. An isobaric interference is when one isotope of an element is at the same nominal mass as an isotope of another element. For example, tin and cadmium both have isotopes at mass 114. If cadmium is to be measured at mass 114 in the presence of tin, a correction must be made for the amount of tin present at mass 114. This is usually done by measuring the amount of Sn at an alternate isotope (e.g., Sn 118) and using the known natural abundance to correct for the amount of Sn present at mass 114. Molecular interferences also occur with species formed in the plasma such as chlorides and oxides and may be corrected for in a similar fashion. Table 5 shows the isotopes monitored and interference equations used for Method 200.8 using the ELAN 6000. All analyses were done in peak-hopping mode with a total integration time of 100 ms per reading per isotope.

Initial Performance Demonstration

IDLs:

Instrument detection limits (IDLs) were determined using the procedure referenced in Section 3.5 of Method 200.8, which defines the IDL as the concentration equal to the analyte signal which is equal to three times the standard deviation of a series of ten replicate measurements of the calibration blank signal at the selected analytical masses. Table 6 shows the IDLs that were achieved using the ELAN 6000 on the 1% nitric acid calibration blank.

Table 3. Ionization Potentials

Element	1st Ionization Potential (v)
Y	6.30
Sc	6.54
Ge	7.90
Zn	9.34
Se	9.75
As	9.81

Table 4. Calibration Standard Concentrations

Analytes	Standard 1 Concentration (µg/L)	Standard 2 Concentration (µg/L)	Standard 3 Concentration (µg/L)
Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Ti, Th, U, V, Zn	10	20	100
Hg	1	2	5
Na, Ca, Mg, K, Fe	100	1,000	10,000

Table 5. Isotopes Monitored and Correction Equations Used for Method 200.8.

Analyte	Symbol	Isotopes Monitored	Correction Equations
Aluminum	Al	27	
Antimony	Sb	121,123	Sb 123 = Sb 123 - 0.127189 * Te 125
Arsenic	As	75	As 75 = As 75 - 3.127 * [Se 77 - (0.815*Se 82)]
Barium	Ba	135,137	
Beryllium	Be	9	
Cadmium	Cd	106,108, 111,114	Cd 111 = Cd 111 - 1.073 * Pd 108 -(0.712*Pd 106)] Cd 114 = Cd 114 - 0.026826 * Sn 118
Chromium	Cr	52,53	
Cobalt	Co	59	
Copper	Cu	63,65	
Lead	Pb	206,207, 208	Pb 108 = Pb 108 + 1 * Pb 106 + 1 * Pb 107
Manganese	Mn	55	
Mercury	Hg	202	
Molybdenum	Mo	95,97,98	Mo 98 = Mo 98 - 0.110588 * Ru 101
Nickel	Ni	60,62	
Selenium	Se	77,82	Se 82 = Se 82 - 1.008696 * Kr 83
Silver	Ag	107,109	
Thallium	Tl	203,205	
Thorium	Th	232	
Uranium	U	238	
Vanadium	V	51	V 51 = V 51 - 3.127*[Cr 53 - (0.113*Cr 52)]
Zinc	Zn	66,67,68	
Internal Standards			
Lithium	Li	6	
Scandium	Sc	45	
Yttrium	Y	89	
Rhodium	Rh	103	
Indium	In	115	
Terbium	Tb	159	
Bismuth	Bi	209	
Germanium	Ge	72	
(Information Only)			
Calcium	Ca	44	
Magnesium	Mg	24	
Sodium	Na	23	
Potassium	K	39	
Iron	Fe	54	Fe 54 = Fe 54 - 0.028226 * Cr 52

MDLs:

Method detection limits (MDLs) for the determination of dissolved analytes in drinking waters were determined using the blank solution fortified with analyte at concentrations between 2 and 5 times the estimated IDL. The MDLs were calculated using the following equation:

$$MDL = (t) X (S)$$

where: t = Student's t value for a 99% confidence levels and a standard deviation estimate with n-1 degrees of freedom (t = 3.14 for seven replicates).

S = standard deviation (n-1 degrees of freedom) of the replicate analyses.

MDLs were obtained by analyzing 7 replicate aliquots of the spiked calibration blank (a t-value of 3.14 was used). Since the primary purpose of this application note was to use Method 200.8 for the determination of regulated analytes in drinking waters as dissolved samples that are not subject to any sample digestion procedures, the method detection limits were determined on undigested calibration blanks fortified at the appropriate level. The resulting MDLs and the spiking levels are given Table 6. Different spike concentrations were used to obtain the MDLs since Method 200.8 specifies that MDL determinations should be made on spikes at levels 2-5 times the IDL.

Linear Range

Linear calibration ranges were established for each isotope measured. The dual detector mode of the ELAN extends the linear range by using the analog-mode of the detector in conjunction with the pulse-counting mode. A detector cross-calibration was performed for each analyte at the isotope used for quantitation. In addition, the detector was set up to extend the upper linear range by using an analog target gain of 7000 for 200 ppb Na during the analog optimization procedure. The detector cross-calibration was performed during initial instrument setup using a multielement standard at a suitable level to give between 200,000 and 1 million cps in pulse counting (a 250-500 ppb solution is usually adequate). The detector cross-calibration is an automated procedure that consists of calling up the cross-calibration method and analyzing a single calibration standard. The time required for cross-calibration varies on the number of isotopes calibrated; however, a full calibration with all the elements listed in Table 1 takes approximately 6 minutes.

After calibrating the ELAN 6000 with a blank and the standards listed in Table 4, a series of standards of increasing concentration were analyzed in order to determine the linear range. The linear dynamic range (LDR) was defined as being the concentration for which the results (in concentration units) were within +/- 10% of the true value (prepared value) of the standard. The linear dynamic ranges obtained are given in Table 6.

Linear dynamic ranges were found to vary somewhat with solution make-up. For various reasons, including precipitation, total dissolved solids content, and matrix interferences, multielement solutions containing high levels (10-100 ppm) of all the elements in Method 200.8 resulted in lower linear dynamic ranges for some elements. As a result, caution is encouraged when applying linear dynamic ranges determined with single element solutions to real samples where several to many analytes may have high concentrations. For the most accurate results, it is suggested that the linear dynamic range should

be determined in a matrix as similar to the samples as possible or by using multielement standards.

Memory Effects

Method 200.8 requires that the rinse times necessary for a particular element be estimated before analysis. Method 200.8 suggests running a high level standard at a concentration of 10 times the upper linear range for a normal sample analysis period and then measuring a blank at designated intervals until the blank signal is reduced to within a factor of 10 of that of the Method Detection Limit. The rinse times used on the ELAN were estimated by running a memory check standard at the concentrations near the upper linear range shown in the table below. A rinse solution containing 2% nitric acid and 100 ppb gold was used. The calibration blank was then run at intervals determined by the length of each analysis cycle (see insert).

Analysis Cycle Time

Rinse time	35 sec @ 48 rpm
Uptake time	25 sec @ 48 rpm
Stabilize time	10 sec @ 24 rpm
Analysis time	2:06 min @ 24 rpm
Total time	3:16 min

As Table 7 shows, nearly all elements were rinsed out at or below 10 times the MDL after one analysis cycle. This indicates that the rinse time of 35 seconds was sufficient to rinse out sample solutions at concentrations tested. The quality control software was used to monitor sample concentrations and flag samples that were above 90% of the upper linear range for dilution.

Quality Control

Quality control procedures specified in Method 200.8 were followed throughout. A quality control sample (QCS) was run immediately after calibration for all sample analyses. The measured results for the QCS were compared to the true values using the QC checking ability of the ELAN software to calculate the percent recoveries (see Table 10 for QCS results). If QCS results were not within $\pm 10\%$ of the true value, the analysis was terminated and the problem corrected. The QC checking features of the ELAN software were also used to monitor continuing cali-

Table 6. ELAN 6000 IDLs, MDLs, and Linear Ranges for Method 200.8

Analyte	Mass	IDL ($\mu\text{g/L}$)	MDL ($\mu\text{g/L}$)	MDL Spike Level ($\mu\text{g/L}$)	Linear Range (mg/L)
Be	9	0.008	0.04	0.05	5
Al	27	0.007	0.03	0.5	5
V	51	0.02	0.03	0.5	5
Cr	52	0.05	0.06	0.5	5
Mn	55	0.002	0.01	0.5	5
Co	59	0.001	0.002	0.005	5
Ni	60	0.004	0.01	0.05	10
Cu	63	0.005	0.008	0.05	10
Zn	66	0.02	0.03	0.5	10
As	75	0.06	0.05	0.5	10
Se	82	0.15	0.23	0.5	5
Mo	98	0.003	0.01	0.05	10
Ag	107	0.002	0.003	0.05	10
Cd	111	0.02	0.02	0.05	10
Sb	123	0.002	0.004	0.005	20
Ba	135	0.008	0.018	0.05	10
Hg	202	0.02	0.02	0.05	20 ppb
Tl	205	0.0004	0.001	0.005	10
Pb	208	0.004	0.008	0.05	10
Th	232	0.001	0.001	0.005	10
U	238	0.0003	0.0009	0.005	10
Na*	23	0.6	4	10	50
Ca*	44	15	20	50	100
Mg*	24	0.02	0.04	0.5	50
K*	39	9	9	10	50
Fe*	54	4	4	10	100

* For information only

Table 7. Estimated Rinse Times

Analyte	Tested Conc. ($\mu\text{g/L}$)	Measured Concentration (in ppb)			MDL	10* MDL
		Cycle #1	Cycle #2	Cycle #3		
Be	5000	0.476	0.310	0.246	0.07	0.7
Al	5000	0.492	0.350	0.440	0.03	0.3
V	5000	0.113	0.048	0.041	0.03	0.3
Cr	5000	0.247	0.199	0.207	0.06	0.6
Mn	5000	0.108	0.027	0.027	0.012	0.12
Co	5000	0.093	0.009	0.006	0.02	0.2
Ni	5000	0.101	0.036	0.014	0.07	0.7
Cu	5000	0.129	0.048	0.059	0.03	0.3
Zn	20000	0.360	0.189	0.184	0.03	0.3
As	20000	0.434	0.404	0.284	0.05	0.5
Se	20000	0.182	-0.330	-0.169	0.05	0.5
Mo	5000	0.204	0.037	0.032	0.03	0.3
Ag	500	0.371	0.139	0.117	0.01	0.1
Cd	5000	0.119	0.023	0.022	0.04	0.4
Sb	10000	0.369	0.094	0.066	0.04	0.4
Ba	5000	0.110	0.039	0.025	0.04	0.4
Hg	20	0.125	0.090	0.071	0.02	0.2
Tl	5000	0.098	0.024	0.019	0.02	0.2
Pb	5000	0.154	0.044	0.036	0.02	0.2
Th	5000	0.314	0.077	0.048	0.02	0.2
U	5000	0.124	0.016	0.012	0.02	0.2

bration blank levels, internal standard levels, spike recoveries, duplicate recoveries, and continuing calibration standards. An example of the QC report for the initial QCS sample during and analytical run showing the calculated recoveries for the QCS solution is shown in Appendix I. Appendix II shows a similar QC report for a spiked sample where the results for three elements were out of limits. As illustrated by the report, the automated QC checking capabilities of the ELAN software can calculate internal standard recoveries, spike recoveries, and print a message informing the analyst that there were QC checks that were outside of the preset limits. Two interacting actions may also be programmed to perform a variety of functions whenever the set acceptance limits for any QC standard or sample have been exceeded. These actions include items such as recalibration, rerunning the check standard, washing for a selected period of time and many others.

The QCS was also used as the calibration check standard throughout the course of the run. The stability

of the calibration check standard over the course of a "typical" day of over nine hours is shown in Figure 1. For the sake of clarity, a limited number of elements across the entire mass range is shown in Figure 1.

Data Handling

All results including sample concentrations, internal standard recoveries, QC sample, and QC standard results were calculated using the ELAN software. Analytical results were sent to a file as a result report, which was then imported into Microsoft Excel® and Word® to generate this application note and all supporting data tables.

Sample Analysis

Accuracy and precision of the method were tested by analyzing certified reference materials and local drinking water samples to determine both accuracy as compared to the certified values and the recoveries of spiked aliquots of the reference materials and drinking water samples. The results obtained for High Purity "Trace Metals in Drinking Water", NIST SRM 1643C "Trace Metals in Drinking Water", and a local drinking water sample are given in Tables 8, 9, and 10, respectively. Table 11 gives the results for the analysis of a reference standard containing Hg along with several other analytes in Method 200.8.

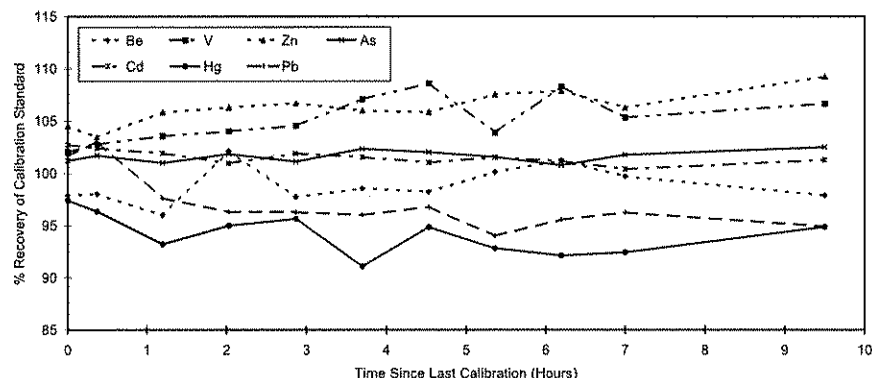


Figure 1. Calibration Stability Over a Nine-hour Period.

Table 8. Precision and Recovery Data for High Purity "Trace Metals in Drinking Water" (CRM)

Analyte	Isotope	Average Measured Conc. (µg/L)	Std. Dev.	Rel. % Dif.	High Purity Certified Value (µg/L)	Recovery of Certified Value (%)	Spike Level (µg/L)	Ave. Spike Recovery (%)	Std. Dev. of Spike Rec	Rel. % Dif.
Be	9	17.17	0.13	0.75	20	85.8	50	92.1	1.0	1.1
Na	23	5711.45	113.71	1.99	6000	95.2	---	---	---	---
Mg	24	8544.22	11.45	0.13	9000	94.9	---	---	---	---
Al	27	113.60	0.37	0.33	115	98.8	50	106.7	3.8	3.5
K	39	2421.85	22.01	0.91	2500	96.9	---	---	---	---
Ca	44	33871.41	611.84	1.81	35000	96.8	---	---	---	---
V	51	28.92	0.08	0.28	30	96.4	50	101.0	1.3	1.2
Cr	52	18.99	0.04	0.22	20	94.9	50	103.2	5.6	5.4
Mn	55	33.58	0.73	2.18	35	95.9	50	99.0	2.6	2.6
Co	59	23.71	0.81	3.41	25	94.8	50	100.9	2.2	2.2
Ni	60	60.46	0.26	0.43	60	100.8	50	102.6	3.9	3.8
Cu	63	19.32	0.51	2.64	20	96.6	50	101.1	4.6	4.5
Zn	66	68.98	1.29	1.87	70	98.5	50	101.2	3.2	3.2
As	75	78.67	0.54	0.68	80	98.3	50	108.4	0.0	0.0
Se	82	9.21	0.15	1.61	10	92.1	50	91.7	0.6	0.7
Mo	98	94.93	3.23	3.40	100	94.9	50	105.4	1.1	1.0
Ag	107	2.34	0.04	1.78	2.5	93.6	50	99.4	1.0	1.0
Cd	111	11.35	0.01	0.12	12	94.6	50	96.3	1.1	1.2
Sb	121	9.55	0.03	0.31	10	95.5	50	99.8	1.0	1.0
Ba	135	48.49	0.73	1.51	50	97.0	50	117.5	0.3	0.2
Hg	202	0.11	0.03	27.27	NA	---	1.5	100.7	0.04	0.04
Tl	205	10.21	0.14	1.34	10	102.1	50	106.3	2.1	2.0
Pb	208	34.85	0.73	2.10	35	99.6	50	109.7	4.8	4.4
Th	232	0.01	0.01	79.75	NA	---	50	107.6	0.8	0.8
U	238	10.16	0.20	1.97	10	101.6	50	106.7	2.7	2.5

NA = Not Applicable

Table 9. Precision and Recovery Data for NIST SRM 1643C "Trace Metals in Drinking Water"

Analyte	Mass	1643C		Rel. % Dif.	NIST Certified Value (µg/L)	Recovery of Cert. Value	Spike Value (µg/L)	Average Spike Rec. (%)	Std. Dev. of Spike Rec.	Rel. % Dif.
		Average Results (µg/L)	Std. Dev.							
Be	9	23.28	0.06	0.25	23.2 ± 2.2	100.3	50	94.5	1.3	1.4
Na	23	12546.24	153.49	1.22	12190 ± 360	102.9	---	---	---	---
Mg	24	9821.49	61.83	0.63	9450 ± 270	103.9	---	---	---	---
Al	27	122.36	0.63	0.51	114.6 ± 5.1	106.8	50	88.5	14.0	15.8
K	39	2413.32	15.43	0.64	2300*	104.9	---	---	---	---
Ca	44	37097.15	978.44	2.64	36800 ± 1400	100.8	---	---	---	---
V	51	31.32	0.23	0.74	31.4 ± 2.8	99.8	50	98.4	0.1	0.1
Cr	52	19.15	0.34	1.78	19 ± 0.6	100.8	50	98.8	4.8	4.8
Mn	55	35.78	0.88	2.45	35.1 ± 2.2	101.9	50	91.6	5.6	6.1
Co	59	24.71	0.49	1.99	23.5 ± 0.8	105.2	50	95.1	3.3	3.4
Ni	60	64.68	0.89	1.38	60.6 ± 7.3	106.7	50	88.7	4.4	4.9
Cu	63	22.98	0.39	1.68	22.3 ± 2.8	103.0	50	98.1	2.9	3.0
Zn	66	78.69	0.38	0.48	73.9 ± 0.9	106.5	50	98.0	2.6	2.6
As	75	87.78	1.06	1.20	82.1 ± 1.2	106.9	50	104.1	2.4	2.3
Se	82	12.41	0.92	7.39	12.7 ± 0.7	97.7	50	94.6	4.1	4.4
Mo	98	112.46	3.66	3.26	104.3 ± 1.9	107.8	50	94.9	10.5	11.0
Ag	107	2.40	0.10	4.33	2.21 ± 0.3	108.4	50	103.5	7.4	7.1
Cd	111	12.39	0.10	0.82	12.2 ± 1	101.6	50	94.0	0.4	0.4
Sb	121	0.04	0.02	63.57	n/a	---	50	99.2	1.8	1.8
Ba	135	54.52	2.43	4.47	49.6 ± 3.1	109.9	50	94.2	7.7	8.2
Tl	205	8.71	0.01	0.15	7.9*	---	50	100.5	2.0	2.0
Pb	208	37.67	0.37	0.99	35.3 ± 0.9	106.7	50	94.4	2.6	2.7
Th	232	<0.02	0.01	396.13	n/a	---	50	102.6	1.8	1.8
U	238	0.03	0.01	18.32	n/a	---	50	100.9	0.7	0.7

* Not certified value by NIST, given for information only, n/a = not available.

Table 10. QCS Results and Spike Recoveries for Local Drinking Water

Analyte	Mass	QCS	QC	LDW	Low Spike	Low Spike	Low Spike	High Spike	High Spike	High Spike
		Level (µg/L)	Std % Recovery	Result (µg/L)	Level (µg/L)	Results (µg/L)	% Rec.	Level (µg/L)	Results (µg/L)	% Rec.
Be	9	50	109.9	<0.04	10	10.62	106.1	50	51.34	102.7
Na	23	5000	95.3	46033.97	---	45730.99	---	---	46347.54	---
Mg	24	5000	96.5	9055.54	---	8971.28	---	---	9016.69	---
Al	27	50	98.7	90.20	10	98.65	84.5	50	142.55	104.7
K	39	5000	98.6	2173.89	---	2135.20	---	---	2145.07	---
Ca	44	5000	98.6	43931.86	---	43213.64	---	---	43588.15	---
V	51	50	98.0	2.69	10	12.14	94.5	50	49.15	92.9
Cr	52	50	102.3	11.21	10	19.31	81.0	50	56.21	90.0
Mn	55	50	98.4	7.69	10	16.55	88.6	50	51.98	88.6
Fe	57	5000	96.1	272.00	---	265.88	---	---	335.49	---
Co	59	50	99.9	0.20	10	9.46	92.6	50	46.04	91.7
Ni	60	50	101.3	15.29	---	---	---	50	61.42	92.3
Cu	63	50	105.2	28.42	---	---	---	50	77.73	98.6
Zn	68	50	107.9	20.02	---	---	---	50	62.52	85.0
As	75	50	105.5	1.49	10	14.91	134.2	50	65.57	128.2
Se	82	50	109.9	2.85	10	15.99	131.4	50	66.75	127.8
Mo	98	50	100.8	5.62	10	16.13	105.1	50	56.86	102.5
Ag	107	50	106.8	<0.003	10	10.01	101.8	50	47.64	95.6
Cd	111	50	103.7	<0.02	10	9.95	99.8	50	49.13	98.3
Sb	121	50	99.5	0.28	10	10.57	102.9	50	50.92	101.3
Ba	137	50	101.1	25.16	10	33.99	88.2	50	72.60	94.9
Hg	202	1	94.6	<0.02	1	0.90	88.8	4	3.43	85.5
Tl	205	50	104.5	<0.004	10	9.84	98.4	50	47.75	95.5
Pb	208	50	104.8	5.36	10	13.22	78.6	50	52.34	94.0
Th	232	50	103.6	<0.002	10	10.16	101.8	50	50.84	101.7
U	238	50	105.2	5.32	10	15.53	102.0	50	57.45	104.3

Table 11. Results for High Purity INFCS I + INFCS IV

Analyte	Mass	INFCS run #1 (µg/L)	INFCS run #2 (µg/L)	INFCS AVG Result (µg/L)	Duplicate RPD	INFCS True Value (µg/L)	% Recovery
Be	9	10.38	10.69	10.54	3.0	10	105.4
Mg	24	5406.76	5552.29	5479.53	2.7	5000	109.6
Al	27	5770.40	5852.48	5811.44	1.4	5000	116.2
Ca	44	5021.99	5048.09	5035.04	0.5	5000	100.7
V	51	29.84	30.47	30.16	2.1	30	100.5
Cr	52	30.54	31.02	30.78	1.6	30	102.6
Mn	55	20.66	20.84	20.75	0.9	20	103.7
Fe	54	4712.78	4754.76	4733.77	0.9	5000	94.7
Co	59	30.31	30.83	30.57	1.7	30	101.9
Ni	60	30.87	31.32	31.10	1.4	30	103.7
Cu	63	31.57	32.04	31.80	1.5	30	106.0
Zn	66	30.15	30.36	30.26	0.7	30	100.9
As	75	96.62	96.65	96.63	0.0	100	96.6
Se	82	47.36	47.81	47.59	0.9	50	95.2
Cd	111	30.37	29.88	30.12	1.6	30	100.4
Cd	114	30.00	29.98	29.99	0.1	30	100.0
Ba	135	32.29	31.75	32.02	1.7	30	106.7
Ba	137	32.36	32.56	32.46	0.6	30	108.2
Hg	202	4.92	4.81	4.86	2.3	5	97.3
Tl	205	106.52	106.66	106.59	0.1	100	106.6
Pb	208	107.01	106.53	106.77	0.5	100	106.8

Note: INFCS I was diluted 10,000 fold and added to INFCS IV to prepare this solution.

Advantages of the ELAN

The high level of automation of the ELAN 6000 affords many possibilities to the production laboratory. The autostart feature allows the instrument to turn itself on and warm-up before you arrive. The autostop feature allows unattended overnight runs to be set up and allows the instrument to shut itself down when the last run is complete. Use of an autosampler along with the built in quality control checking features of the software allow true unattended operation, even to the point of generating Method 200.8 compliant data where intermittent QC samples and user defined action protocols assure overall data quality and integrity. User set actions include options such as washing for specified times and rerunning the sample or standard, recalibration, flagging out of limits samples and quality control standards, autodilution of over-range samples, and many others.

Another advantage of the ELAN is SimulScan™, which allows both pulse count and analog data to be taken at the same time. This eliminates the wasteful pre-scans necessary on older instruments to establish the detector mode used. The use of SimulScan and dual-mode detection also allows the determination of the trace elements and major constituents for Method 200.8 from the

IDL up to high levels (10-100 ppm) with a single mass scan.

The DynaRinse™ feature can also be used to decrease rinse times and use longer rinse times in batch mode autoruns for high levels standards versus lower level samples. This eliminates the need to establish an unnecessarily long rinse time for all samples, as a preventative measure. The ELAN quality control checking protocols can be configured to monitor all sample results and rinse for an extra period of time if the sample concentrations exceed established sample limits, or if combined with the autodilution accessory, automatically dilute over-range samples.

Financial Analysis

Before the approval of Method 200.8 for the 12 primary drinking water contaminants, a variety of different methods had to be used to cover all the elements (see Table 12 below). Since the approval of Method 200.8, the separate GFAA analyses typically done for Sb, Pb, Se, and Tl and the time-consuming Hg analyses by Cold Vapor Atomic Absorption (CVAA) or hydride generation (which requires a two-hour digestion) may be replaced with a single ICP-MS analysis. The use of ICP-MS also allows the determination of the other 7 trace elements typically determined by ICP-OES. Additionally, many small water-quality testing laboratories still perform all metals analyses by GFAA, direct aspiration AA, and

Table 12. Methods Allowed for Analysis of Drinking Waters

Element	GFAA Allowed	ICP-OES Allowed	CVAA/Hydride Allowed	ICP-MS Allowed
Sb	200.9			200.8
As	200.9	200.7	3114B	200.8
Ba	3113B	200.7		200.8
Be	200.9, 3113B	200.7		200.8
Cd	200.9, 3113B	200.7		200.8
Cr	200.9, 3113B	200.7		200.8
Hg			245.1, 245.2	200.8
Ni	200.9, 3113B	200.7		200.8
Se	200.9, 3113B		3114B	200.8
Tl	200.9			200.8
Pb	200.9, 3113B			200.8
Cu	200.9, 3113B	200.7		200.8

hydride techniques. These various methods may also be replaced by a single ICP-MS determination. The following productivity analysis shows how the use of ICP-MS can improve sample throughput and decrease analysis time in the laboratory.

Some typical scenarios that were used in this financial analysis for the elements in Table 12 are shown below. One scenario is a small water lab using a combination of GFAA and Flame AA to perform the determinations of the required 11 analytes with CVAA being used for Hg. The second scenario is a large lab using GFAA and ICP-OES for the 11 metals and CVAA for mercury. The final scenario is a lab choosing to use ICP-MS for all 12 primary contaminants, including Hg. The assumptions being made for times of analysis are also given in the table below. All times are for a batch of 20 samples, not including method-specific quality control samples. Note that an ICP-MS performing Method 200.8 is 8 times more productive than the all AA scenario, and over 5 times as

productive than even the ICP-OES with AA scenario.

The advantages of changing to a single ICP-MS method for the determination of the 12 elements listed in Table 12 becomes apparent when looking at Table 13. By using Method 200.8 the two-hour sample preparation time required under Method 245.1 (Hg by CVAA) is eliminated. In addition, ICP-MS is a multielement technique that can determine all 12 elements in the same analytical run as compared to the 12 individual runs required when using single-element techniques such as Graphite Furnace AA (GFAA) and Flame AA. By using Method 200.8 the overall analysis time can be reduced by nearly nine hours compared to GFAA/FLAA and over five hours as compared to the ICP-OES/GFAA combination. Using simultaneous multielement GFAA will allow four elements to be determined simultaneously, which will reduce the time required for scenarios one and two, however ICP-MS will still be faster by approximately 3 hours per batch.

Two common financial calculations are used for a stand-alone analysis to show that, although ICP-MS requires a significant initial capital investment, it can very quickly become profitable for the environmental laboratory. Based on the assumptions and definitions used, the ELAN 6000 ICP-MS will pay back the initial investment in less than 12 months in most cases, depending on the appropriate analytical scenario for the individual laboratory. Table 14 summarizes the payback period and internal rate of return (IRR) calculation for several scenarios. The monthly IRR for ICP-MS in an environmental laboratory, even with the conservative assumptions used is very good. It becomes exceptional at higher sample levels and higher prices per sample.

Conclusions

The ELAN 6000 ICP-MS has been demonstrated to be compliant with the requirements of U. S. EPA Method 200.8. In addition, it is simple to use and provides advantages for automated quality control checking and rugged sample introduction. The increased productivity that can be achieved by using this methodology in place of methodologies using older technologies can significantly increase the productivity of the routine environmental laboratory.

References

1. "Methods for the Determination of Metals in Environmental Samples - Supplement 1", EPA-600/R-94-111, May 1994, Available at NTIS, PB 94-184942.
2. Since approval of specific methods for various compliance monitoring programs may be updated on a frequent basis, please consult the appropriate sections of the Code of Federal Regulation (40 CFR Part 136, Table 1B for NPDES and 40 CFR Part 141.23 for SDWA) and the latest Federal Register notices as well as contacting your local regulatory authority before using this or any other method for compliance monitoring.
3. The data presented is also applicable to the ELAN 6100 ICP-MS.
4. ELAN 6000 ICP Mass Spectrometer Hardware Guide, available from PerkinElmer Instruments, Order No. L-1883.

Table 13. Financial Analysis for Method 200.8 Using the ELAN 6000 ICP-MS

Analysis Time/sample	Scenario 1 GFAA+FLAA+CVAA	Scenario 2 GFAA+ICP-OES + CVAA	Scenario 3 ICP-MS
GFAA and FLAA (2min/elem)	11 elem x 2 x 20 = 440 min	4 elem x 2 x 20 = 160 min	0 min
ICP-OES (3.5 min/sample)	0 min	70 min	0 min
Hg Prep (Method 245.1) - 2 hours	batch of 20 together = 120 min	batch of 20 together = 120 min	0 min
Hg Analysis (2 min/sample)	40 min	40 min	0 min
ICP-MS analysis (3.7 min/sample)	0 min	0 min	74 min
TOTAL time/batch	600 min	390 min	74 min
Samples/8 shift	16	25	130 min

Table 14. Financial Return Summary for the ELAN 6000

Samples per Month	Analysis Price per Sample (\$)	Monthly IRR (%)	Payback Period (months)
180	75.00	0	--
500	75.00	7	12.4
1,000	75.00	17	6.9
180	125.00	0	>24
500	125.00	17	7
1,000	125.00	31	4.5
180	300.00	14	8
500	300.00	42	3.7
1,000	300.00	68	3

Appendix I

Elan 6000 - Quantitative Analysis Method 200.8

Sample ID: QCS
Sample Date/Time: Thursday, March 09, 1995 11:41:55
Method File: C:\ElanData\Method\200_3QC.mth
Dataset File: c:\elandata\dataset\march 9\QC Std 2.006
Number of Replicates: 3
Analysis Summary

Analyte	Mass	Meas. Intens.		Net Intens.		Net Intens. RSD	Conc. Mean	Sample Unit	QC Calculated Values			Duplicate RPD
		Mean		Mean					Int Std % Recovery	QC Std % Recovery	Spike % Recovery	
> Li	6	16652.99	16652.98991	3.05997	3.05997	ug/L			90.771			
- Be	9	14371.097	0.862562	2.23354	2.23354	ug/L	49.525845	ug/L	99.052			
- Na	23	35406242.89	94.745306	0.47121	0.47121	ug/L	4860.157826	ug/L	97.203			
- Mg	24	22542537.14	60.339963	0.63951	0.63951	ug/L	4895.466131	ug/L	97.909			
- Al	27	355864.938	0.944514	0.7473	0.7473	ug/L	50.164066	ug/L	100.328			
- K	39	88758127.7	234.694727	1.29193	1.29193	ug/L	4956.728688	ug/L	99.135			
- Ca	44	2410293.462	6.39152	0.80223	0.80223	ug/L	4836.356571	ug/L	96.727			
> V	51	373556.297	373556.2971	1.48375	1.48375	ug/L			94.682			
- Cr	52	688529.501	1.831554	0.80741	0.80741	ug/L	48.526933	ug/L	97.054			
- Cr	53	593346.894	1.502314	0.76947	0.76947	ug/L	49.814614	ug/L	99.629			
- Cr	55	68775.758	0.176993	0.63421	0.63421	ug/L	50.382044	ug/L	100.764			
- Mn	55	901675.304	2.411947	0.83008	0.83008	ug/L	49.802212	ug/L	99.604			
- Fe	54	4689802.148	12.434002	0.84346	0.84346	ug/L	4743.148011	ug/L	94.863			
- Co	59	759996.558	2.034171	1.50218	1.50218	ug/L	51.16845	ug/L	102.337			
- Ni	60	167460.892	0.447957	1.60304	1.60304	ug/L	51.268612	ug/L	102.537			
- Cu	63	382393.302	1.022843	0.84055	0.84055	ug/L	51.905717	ug/L	103.811			
- Cu	65	187572.164	0.501866	2.81795	2.81795	ug/L	52.605741	ug/L	105.211			
- Zn	66	115396.296	0.314145	2.45508	2.45508	ug/L	50.959706	ug/L	101.919			
- Zn	67	20802.333	0.056683	1.40816	1.40816	ug/L	50.478527	ug/L	100.957			
- Zn	68	85894.597	0.233729	0.72035	0.72035	ug/L	51.238063	ug/L	102.476			
> Ge	72	362670.695	362670.6946	0.40309	0.40309	ug/L			94.503			
- As	75	129269.99	0.359781	0.39227	0.39227	ug/L	49.353302	ug/L	98.707			
- Se	77	12778.971	0.033588	3.40811	3.40811	ug/L	50.258213	ug/L	100.516			
- Se	82	16308.339	0.044901	1.83352	1.83352	ug/L	50.012829	ug/L	100.026			
- Kr	83	163.813	-6.666865	197.94857	197.94857	ug/L						
- Y	89	769505.586	-65502.19647	15.44667	15.44667	ug/L	53.100374	ug/L	106.201			
- Mo	98	421134.337	0.464972	0.11411	0.11411	ug/L						
- Rh	103	761278.595	-0.01808	19.0422	19.0422	ug/L						
- Ag	107	842013.462	0.92838	1.02262	1.02262	ug/L	49.967364	ug/L	99.935			
- Cd	111	196546.465	0.216362	0.78033	0.78033	ug/L	50.378596	ug/L	100.757			
- Cd	114	441372.507	0.487401	2.03718	2.03718	ug/L	49.859063	ug/L	99.718			
> In	115	905489.282	905489.2825	0.89421	0.89421	ug/L			95.096			
- Sb	121	505526.802	0.558132	1.35422	1.35422	ug/L	53.96941	ug/L	107.939			
- Sb	123	380880.475	0.420483	0.9535	0.9535	ug/L	53.793169	ug/L	107.586			
- Ba	135	139965.322	0.128835	2.14962	2.14962	ug/L	48.152858	ug/L	96.306			
- Ba	137	240868.46	0.221678	2.53769	2.53769	ug/L	47.811871	ug/L	95.624			
- Tl	159	1053265.168	0.000211	12350.22271	12350.22271	ug/L						
> Ho	165	1084321.845	1084321.845	1.8491	1.8491	ug/L			94.102			
- Hg	200	7137.889	0.006344	2.21063	2.21063	ug/L	2.509383	ug/L	100.375			
- Hg	202	9334.843	0.008301	2.94804	2.94804	ug/L	2.569553	ug/L	102.782			
- Tl	205	1691540.372	1.560153	2.14232	2.14232	ug/L	49.858712	ug/L	99.717			
- Pb	208	2250767.606	2.074868	2.19862	2.19862	ug/L	50.304988	ug/L	100.61			
- Bi	209	769839.177	0.007516	203.48286	203.48286	ug/L						
- Th	232	1952901.326	1.800529	2.74407	2.74407	ug/L	49.526607	ug/L	99.053			
- U	238	2008869.574	1.853213	3.04696	3.04696	ug/L	49.2662	ug/L	98.532			

QC Out of Limits

AnalyteMass Out of Limits Message
 No out of limits detected

Appendix II

Elan 6000 - Quantitative Analysis Method 200.8

Sample ID: Filtered Water
 Sample Date/Time: Thursday, March 09, 1995 12:15:09
 Sample Type: Spike - 1
 Method File: C:\ElanData\Method\200_3QC.mth
 Dataset File: c:\elandata\dataset\march 9\filtered water.015
 Number of Replicates: 3
 Analysis Summary

Analyte	Mass	Meas. Intens. Mean	Net Intens. Mean	Net Intens. RSD	Conc. Mean	Sample Unit	QC Calculated Values	QC Std % Recovery	Spike % Recovery	Duplicate RPD
>	Li	16847.679	16847.67877	4.28851	58.673271	ug/L	91.833		117.347	
+	Be	17205.536	1.021878	5.02185	8374.605213	ug/L				
+	Na	60615812.58	163.256947	1.52165	270.25349	ug/L				
+	Mg	1239052.192	3.331059	0.8671	50.266564	ug/L			100.533	
+	Al	354345.232	0.946444	1.26892	427.127302	ug/L				
+	K	8591934.626	20.223928	0.79739	1468.705505	ug/L				
+	Ca	743238.704	1.940978	0.22273		ug/L	94.093			
>	Sc	371231.477	371231.4767	0.61277	49.592813	ug/L			99.186	
+	V	699210.159	1.871783	0.63982	51.290254	ug/L			102.581	
+	Cr	606134.507	1.546817	0.28626	49.500407	ug/L			99.001	
+	Cr	67192.878	0.173896	1.78442	49.315571	ug/L			98.631	
+	Mn	887183.254	2.388379	2.42239	-28.313753	ug/L				
+	Fe	17134.653	-0.074224	13.00246	50.409861	ug/L			100.82	
+	Co	744082.604	2.004013	1.89571	51.498114	ug/L			102.996	
+	Ni	167177.231	0.449962	1.50802	54.545901	ug/L			109.092	
+	Cu	399305.076	1.07487	2.45807	54.361152	ug/L			108.722	
+	Cu	192662.061	0.518612	1.72433	121.808395	ug/L			130.024	
+	Zn	260064.237	0.750898	1.08257	108.840846	ug/L			122.152	
+	Zn	42333.408	0.122218	1.18074	118.913938	ug/L			129.506	
+	Zn	187937.028	0.542442	1.05733		ug/L	89.764			
>	Ge	344484.282	344484.2802	1.58218	58.345453	ug/L			116.691	
+	As	145361.506	0.425333	0.48079	67.548892	ug/L			135.098	
+	Se	16120.03	0.045144	2.13983	69.90926	ug/L			139.819	
+	Se	21644.324	0.062764	0.59401		ug/L				
+	Kr	182.861	12.381337	64.2435		ug/L				
+	Y	752724.891	-82282.89125	7.94547		ug/L				
+	Mo	411830.661	0.469077	0.50627	53.569236	ug/L			107.138	
+	Rh	738347.063	-0.017623	44.48509		ug/L				
+	Ag	865093.869	0.984099	0.34133	52.966262	ug/L			105.933	
+	Cd	214260.889	0.243423	1.55295	56.679606	ug/L			113.359	
+	Cd	485867.565	0.535525	1.87245	56.62332	ug/L			113.247	
>	In	877711.709	877711.7087	0.80739		ug/L	92.178			
+	Sb	529948.395	0.603608	1.02125	58.366834	ug/L			116.734	
+	Sb	398193.511	0.453508	0.51395	58.018078	ug/L			116.036	
+	Ba	146302.913	0.135807	2.30369	50.758761	ug/L			101.518	
+	Ba	250288.444	0.232339	2.22895	50.111367	ug/L			100.223	
+	Tb	1034866.159	-0.0086	49.31144		ug/L				
>	Ho	1075254.668	1075254.668	0.84056		ug/L	93.315			
+	Hg	240.482	-0.000017	210.23341	-0.006827	ug/L			-0.273	
+	Hg	342.391	0.000008	265.56715	0.002403	ug/L			0.096	
+	Tl	1692411.263	1.573897	1.50378	50.297934	ug/L			100.596	
+	Pb	2314618.251	2.151197	1.12676	52.155568	ug/L			104.311	
+	Bi	754735.114	-0.00074	3327.27301		ug/L				
+	Th	2012052.785	1.870046	1.99022	51.438795	ug/L			102.878	
+	U	2055661.086	1.911697	1.32493	50.820942	ug/L			101.642	

QC Out Of Limits

Analyte	Mass	Out of Limits Message
Zn	66	SPIKE RECOVERY OUT OF LIMITS (30%)
Se	77	SPIKE RECOVERY OUT OF LIMITS (30%)
Se	82	SPIKE RECOVERY OUT OF LIMITS (30%)
Hg	200	SPIKE RECOVERY OUT OF LIMITS (30%)
Hg	202	SPIKE RECOVERY OUT OF LIMITS (30%)

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