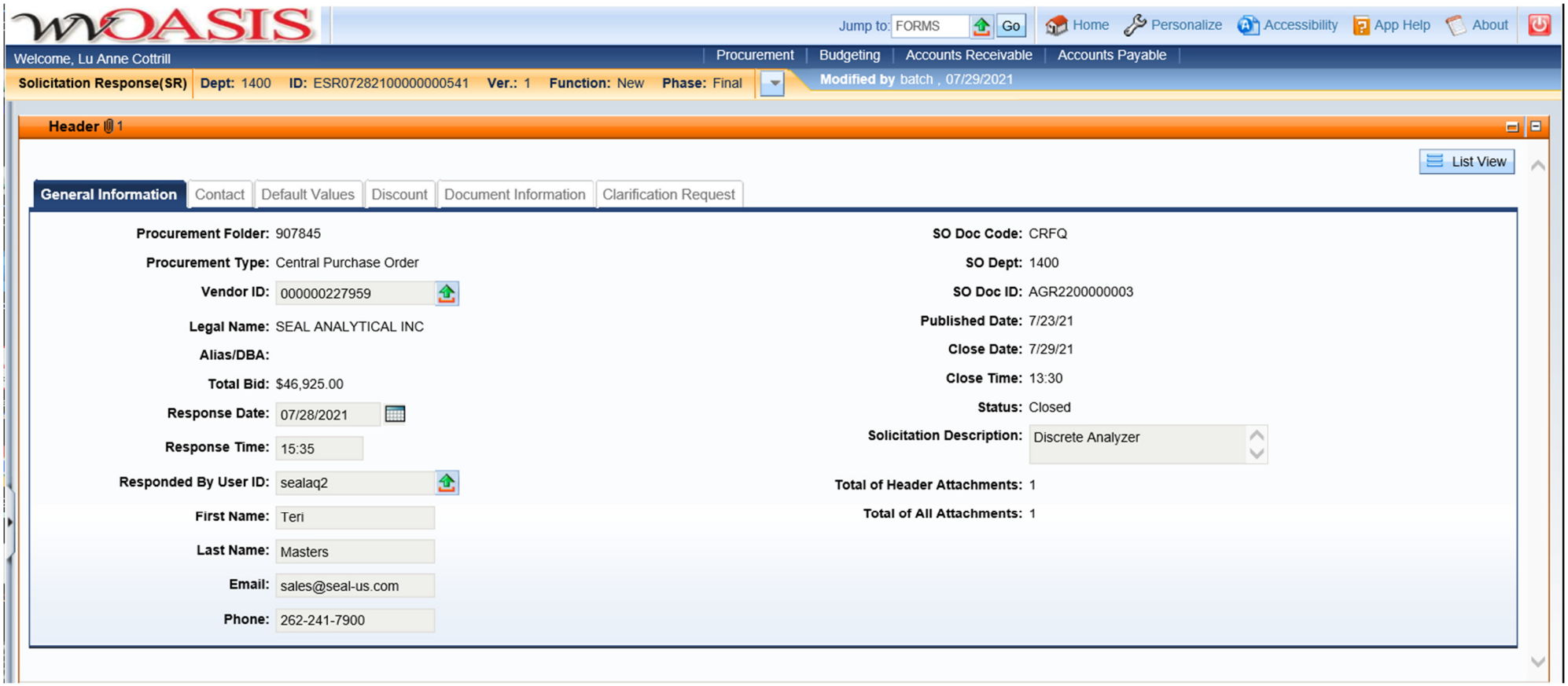
The following documentation is an electronically-submitted vendor response to an advertised solicitation from the *West Virginia Purchasing Bulletin* within the Vendor Self-Service portal at ***wvOASIS.gov***. As part of the State of West Virginia's procurement process, and to maintain the transparency of the bid-opening process, this documentation submitted online is publicly posted by the West Virginia Purchasing Division at ***WVPurchasing.gov*** with any other vendor responses to this solicitation submitted to the Purchasing Division in hard copy format.


WVOASIS
Jump to: FORMS Go
Home
Personalize
Accessibility
App Help
About
Welcome, Lu Anne Cottrill
Procurement | Budgeting | Accounts Receivable | Accounts Payable
Solicitation Response(SR) Dept: 1400 ID: ESR07282100000000541 Ver.: 1 Function: New Phase: Final
Modified by batch , 07/29/2021
Header 1
List View
General Information
Contact
Default Values
Discount
Document Information
Clarification Request
Procurement Folder: 907845
Procurement Type: Central Purchase Order
Vendor ID: 000000227959
Legal Name: SEAL ANALYTICAL INC
Alias/DBA:
Total Bid: $46,925.00
Response Date: 07/28/2021
Response Time: 15:35
Responded By User ID: sealaq2
First Name: Teri
Last Name: Masters
Email: sales@seal-us.com
Phone: 262-241-7900
SO Doc Code: CRFQ
SO Dept: 1400
SO Doc ID: AGR2200000003
Published Date: 7/23/21
Close Date: 7/29/21
Close Time: 13:30
Status: Closed
Solicitation Description: Discrete Analyzer
Total of Header Attachments: 1
Total of All Attachments: 1

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

State of West Virginia
Solicitation Response

Proc Folder:	907845
Solicitation Description:	Discrete Analyzer
Proc Type:	Central Purchase Order

Solicitation Closes	Solicitation Response	Version
2021-07-29 13:30	SR 1400 ESR07282100000000541	1

VENDOR

000000227959
SEAL ANALYTICAL INC

Solicitation Number: CRFQ 1400 AGR2200000003

Total Bid: 46925 **Response Date:** 2021-07-28 **Response Time:** 15:35:39

Comments:

FOR INFORMATION CONTACT THE BUYER
Jessica S Chambers
(304) 558-0246
jessica.s.chambers@wv.gov

Vendor
Signature X **FEIN#** **DATE**

All offers subject to all terms and conditions contained in this solicitation

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Ln Total Or Contract Amount
1	Discrete Analyzer	1.00000	EA	46925.000000	46925.00

Comm Code	Manufacturer	Specification	Model #
41113007			

Commodity Line Comments:

Extended Description:

Complete the attached Exhibit Pricing Page.

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

State of West Virginia
Centralized Request for Quote
Miscellaneous

Proc Folder:	907845
Doc Description:	Discrete Analyzer
Proc Type:	Central Purchase Order

Reason for Modification:

Addendum No. 01 is being issued to address all technical questions received.

No other changes.

Date Issued	Solicitation Closes	Solicitation No	Version
2021-07-23	2021-07-29 13:30	CRFQ 1400 AGR2200000003	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON WV 25305
US

VENDOR

Vendor Customer Code:

Vendor Name : SEAL Analytical Inc.

Address : 6501 West Donges Bay Road

Street :

City : Mequon

State : WI **Country :** US **Zip :** 53092

Principal Contact : Joey Redovich

Vendor Contact Phone: 262-241-7900 **Extension:**

FOR INFORMATION CONTACT THE BUYER
Jessica S Chambers
(304) 558-0246
jessica.s.chambers@wv.gov

Vendor Signature X James D Ronnel **FEIN#** 81-0565037 **DATE** 07/28/2021

All offers subject to all terms and conditions contained in this solicitation

ADDITIONAL INFORMATION

The West Virginia Purchasing Division is soliciting bids on behalf of West Virginia Department of Agriculture, R.E.A.D. to establish a contract for the one-time purchase of a Discrete Analyzer per the terms and conditions and specifications as attached.

INVOICE TO		SHIP TO	
AGRICULTURE DEPARTMENT OF		AGRICULTURE DEPARTMENT OF	
ADMINISTRATIVE SERVICES		MOOREFIELD FIELD OFFICE	
1900 KANAWHA BLVD E		60B INDUSTRIAL PARK RD	
CHARLESTON	WV	MOOREFIELD	WV
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	Discrete Analyzer	1.00000	EA		

Comm Code	Manufacturer	Specification	Model #
41113007			

Extended Description:
Complete the attached Exhibit Pricing Page.

SCHEDULE OF EVENTS

Line	Event	Event Date
1	Deadline is at 9:00 AM (ET)	2021-07-23

SOLICITATION NUMBER: CRFQ AGR2200000003
Addendum Number: No.01

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Applicable Addendum Category:

[ ] Modify bid opening date and time

[ ] Modify specifications of product or service being sought

[✔] Attachment of vendor questions and responses

[ ] Attachment of pre-bid sign-in sheet

[ ] Correction of error

[ ] Other

Description of Modification to Solicitation:

Addendum issued to publish and distribute the attached documentation to the vendor community.

1. The purpose of this addendum is to address all technical questions received.

No other Changes.

Additional Documentation: Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

Terms and Conditions:

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

ATTACHMENT A

Technical Questions for
CRFQ AGR2200000003

Q: 3.1.1.5 Discrete Analyzer must have the ability to heat cuvettes in the range of 25-60 degrees Celsius for specific methods which require heating. Must have a minimum cuvette pathlength of 10mm. Must have the capability to wash cuvettes and perform any necessary system QC.

The chemistries that are required only require going up to 40 degrees Celsius and our EPA system which has these applications set up on the instrument meet and exceeds the mandatory requirements, but it has not been developed to reach 60 degrees like our enzymatic system for beer and wine can reach that temperature, but that setup does not allow for the lower detection limits needed for water and soil samples. Is the ability to reach 60 degrees Celsius necessary for one of the applications required on the system or would our EPA version analyzer be acceptable?

A: Yes, it must reach 60 degrees Celsius and no the EPA version will not be acceptable.

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: _____

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[X]	Addendum No. 1	[ ]	Addendum No. 6
[ ]	Addendum No. 2	[ ]	Addendum No. 7
[ ]	Addendum No. 3	[ ]	Addendum No. 8
[ ]	Addendum No. 4	[ ]	Addendum No. 9
[ ]	Addendum No. 5	[ ]	Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further 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.

SEAL Analytical Inc.
Company

James D Lonnel
Authorized Signature

July 28, 2021
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.
Revised 6/8/2012

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Technical Sales & Product Manager
(Name, Title)
F. Joseph Redovich, Jr.
(Printed Name and Title)
6501 W. Donges Bay Road
(Address)
262-241-7900
(Phone Number) / (Fax Number)
sales@seal-us.com
(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that: I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law.

SEAL Analytical Inc.
(Company)

(Authorized Signature) (Representative Name, Title)

James D. Romnek, Controller
(Printed Name and Title of Authorized Representative)

07/28/2021
(Date)

262-241-7900
(Phone Number) (Fax Number)

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

CONSTRUCTION CONTRACTS: Under W. Va. Code § 5-22-1(i), the contracting public entity shall not award a construction contract to any bidder that is known to be in default on any monetary obligation owed to the state or a political subdivision of the state, including, but not limited to, obligations related to payroll taxes, property taxes, sales and use taxes, fire service fees, or other fines or fees.

ALL CONTRACTS: Under W. Va. Code §5A-3-10a, 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: (1) the debt owed is an amount greater than one thousand dollars in the aggregate; or (2) the debtor is in employer default.

EXCEPTION: The prohibition listed above does not apply where a vendor has contested any tax administered pursuant to chapter eleven of the W. Va. Code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

DEFINITIONS:

"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Employer default" means having an outstanding balance or liability to the old fund or to the uninsured employers' fund or being in policy default, as defined in W. Va. Code § 23-2c-2, failure to maintain mandatory workers' compensation coverage, or failure to fully meet its obligations as a workers' compensation self-insured employer. An employer is not in employer default if it has entered into a repayment agreement with the Insurance Commissioner and remains in compliance with the obligations under the repayment agreement.

"Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

AFFIRMATION: By signing this form, the vendor's authorized signer affirms and acknowledges under penalty of law for false swearing (*W. Va. Code* §61-5-3) that: (1) for construction contracts, the vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, that neither vendor nor any related party owe a debt as defined above and that neither vendor nor any related party are in employer default as defined above, unless the debt or employer default is permitted under the exception above.

WITNESS THE FOLLOWING SIGNATURE:

Vendor's Name: SEAL Analytical Inc.

Authorized Signature: James D Connel Date: 07/28/2021

State of Wisconsin

County of Ozaukee, to-wit:

Taken, subscribed, and sworn to before me this 28 day of July, 20 21.

My Commission expires September 27, 2021.

AFFIX SEAL HERE

NOTARY PUBLIC Theresa Masters

Response to Specifications

STATE OF WEST VIRGINIA

BID REQUEST FOR:

AUTOMATED DISCRETE ANALYZER
Attn: Jessica S Chambers
Jessica.S.Chambers@wv.gov

The system offered is the SEAL AQ400 Discrete Automated Multiple Chemistry Analyzer. The quoted Discrete Analyzer from SEAL Analytical meets or exceeds all listed specifications. All specifications are answered.

The AQ400 system is suitable for the analysis of untreated and treated waste, wastewater, sludge, soil and manure extracts, run-off, ground, surface and brackish waters.

SEAL Analytical are the global leaders in manufacture and supply of Segmented Flow and Discrete Analyzers. We work very closely with the leading Water and Environmental Research Centers around the world. This ensures our hardware, software and method development for the environmental community remain at the technological forefront of development.

The SEAL AQ400 system is using Discrete Analysis (DA). The benefits of the SEAL AQ400 include:

1. Automation of standard curve from one top standard.
2. Automated bracketing of samples with relevant QCs required.
3. Automated sample spiking.
4. Automated test changeover and washout of system.
5. Lowest reagent usage – lower cost per test, reduced waste generated.
6. Flexibility to run any test at any time without hardware changeover or additional purchase.

Installation requirements:
The AQ400 does not require any special set-up or installation requirements - no fume hood, gas tanks or direct water supply. It can be set up on a standard laboratory bench. Approximately one (1) meter of space will be required for the complete system including system controller.

RESPONSE TO SPECIFICATIONS:

The AQ400 from SEAL Analytical meets or exceeds all listed requirements. See confirmation of each listed below. For further clarification, please contact Rachel Timmerman, US Technical Sales Manager, 262-241-7900 or rtimmerman@seal-us.com

The AQ400 Discrete Analyzer comes supplied with everything required for complete installation and training. The AQ400 performs rapid, on demand analysis of a wide range of nutrients in untreated and treated waste, sludge, ground, surface, and brackish waters. Up to 10 different analytes can be programed in a single run – with no limit on the number of runs or different chemistries. The AQ400 methods follow the EPA and Standard Methods methodology replicating the required sample and reagent ratios. A complete method list and the front pages of the requested methods are attached. If more detailed method information is required or more specific

approval information is needed, it can be made available from SEAL Analytical upon request.

The SEAL AQ400 employs a robust, robotic sampling arm working in conjunction with a stepper motor-driven syringe. The syringe is used for aspirating, dispensing and mixing accurate and precise quantities of sample and reagent into miniaturized test tubes, called reaction wells. The sample and reagents are incubated in the reaction wells for a pre-programmed time. A single aliquot is then transferred into the 10 mm optical quality glass cuvette. The absorbance of the reaction is read in the stationary optical bench to assure the best possible signal to noise ratio ensuring highest sensitivity and lowest detection limits.

The SEAL AQ400 provides true unattended operation. Once the run is set up and started no further operator intervention is needed. Each sample is tested only for the chemistries required on it – all programmable from the software. No manual switching is required, all changeovers are automatic. Extra samples can be added at any time during a run with no issues or errors. When all required analyses are completed the analyzer will automatically clean itself out and enter stand-by mode.

The AQ400 is further automated with available limits for QCs, spikes and standard curve. If any of these go outside of the user defined limits, the system knows what the operator expects and can go back and rerun those QC and associated samples for EPA/NELAC compliant results. If the standard curve is outside of the established limit, it can also be automatically rerun or the run stopped for operator intervention, depending on what the lab would prefer.

SPECIFICATIONS

1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of West Virginia Department of Agriculture, R.E.A.D. to establish a contract for the one-time purchase of a Discrete Analyzer.

   Understood.

2. **DEFINITIONS:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions.

   Understood.

   2.1 "Contract Item" means a Discrete Analyzer as more fully described by these specifications.

   Understood.

   2.2 "Pricing Page" means the pages, contained in wvOASIS, or attached as Exhibit A, upon which Vendor should list its proposed price for the Contract Items.

   Understood.

   2.3 "Solicitation" means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.

   Understood.

3. **GENERAL REQUIREMENTS:**

   3.1 Mandatory Contract Item Requirements: Contract Item must meet or exceed the mandatory requirements listed below.

   Understood and complies.

   3.1.1 Discrete Analyzer

   3.1.1.1 Discrete Analyzer must have a minimum of 30 sample positions and a minimum of 20 reagent positions in the racks.

   Complies and exceeds. The AQ400 has 26 reagent positions. 20 of these positions are cooled by an on-board Peltier cooling system, while the other 6 are stored at ambient temperature. These reagent wedges can hold up to 40 mL of reagent, standard, diluent, or QC solution. Both the 20 and 6 position reagent trays can be removed from the system for storage when the instrument is not in use. The ample reagent positions allow the AQ400 the ability to run samples

with different matrices in the same run, including preserved samples or samples that have been digested for TP, TN, or TKN.

There are two different sample tray options for the AQ400. One option has 80 sample positions, 60 are for 2 mL cups and 20 are for 5 mL cups. The second option has 120 sample positions, 100 are for 1.2 mL cups and 20 are for 2 mL cups. The quoted system comes with two trays, and the lab can select whether they one of each or two of the same type. The sample trays themselves are made of precision cut, stainless steel and the position numbers are laser etched – not stickers like most competing systems. This ensures that the trays will last the lifetime of the instrument. All trays, both reagent and sample, are keyed so that they cannot be loaded incorrectly to eliminate alignment issues. While both reagent racks are loaded during a single run, only one sample tray will be on the instrument at a time. This allows the analyst to prep the next run while the first is in progress.

3.1.1.2 Discrete Analyzer must have real time monitoring of samples and reagents and be able to run multiple tests in any order. Must have a filter wavelength range of at least 340-880nm.

Complies. Results from the AQ400 are displayed in real-time within AQ Software. The AQ400 can run any of the listed methods in any order with automatic method changeover. No user interaction is required. Each AQ400 Method is stored within AQ Software. This information includes sample volume, reagent information (name, location, volume required, etc.), reaction times, and detector wavelength settings. An analyst simply loads the samples onto the AQ400, selects which methods are to be ran, and starts the run. The methods are selectable per sample, meaning individual tests will run on the selected samples only to save time and minimize operational expenses. Once the run has started the AQ400 will perform an automatic changeover between each method.

3.1.1.3 Discrete Analyzer must have disposable cuvettes with continuous access to the cuvettes without interrupting test processing. Must be able to apply a minimum of 4 different wavelengths during a run. Must have methods for Ammonia, Nitrate/Nitrite, Orthophosphate, Total phosphate, TKN.

Complies. The AQ400 utilizes disposable cuvettes, which SEAL labels as Reaction Wells, for the reaction to take place in. The instrument has continuous access to more than 200 reaction wells for

continuous runs without interrupting the test processing.

The AQ00 is equipped with 9 different wavelengths, and can run as many as 15 different tests in a single run, including the listed chemistries: Ammonia, Nitrate/Nitrite, Orthophosphate, Total Phosphorus, and TKN.

3.1.1.4 Discrete Analyzer must be able to prepare working standards and spike samples from a stock solution. Must also have auto start-up, shutdown, and dilution capabilities.

Complies. The AQ400 will generate an auto-calibration with user-defined calibration points. The operator simply needs to enter the top standard concentration into the software and place the solution onto the instrument. By default, the AQ400 will use DI Water to dilute the standard and generate a calibration curve. However, the operator can designate a method specific diluent to matrix match with any preservation or digestion matrix.

The AQ400 will shut itself down following a completed run, and can be ran overnight/unattended. An analyst has to place the samples and reagents on the system, but beyond that the system will automatically start-up, prime and prep itself, monitor motor functionality, and start the run.

Various dilution options are provided. Programmable pre-dilution of samples is available, predefined by the user, and entered in the sample table. Unique dilutions are selectable per sample and per test. The results are calculated and reported as final concentrations.

Additionally, the SEAL AQ400 auto-dilutor will automatically dilute samples that are over range. If a sample that is undiluted or has a prescheduled dilution goes over range for the test, the software will take the raw absorbance of the result, compare it to the absorbance of the top calibration standard, and, if appropriate, schedule an automatic dilution. This auto dilution factor is user selectable. Should the diluted sample still be over range, the AQ400 will automatically dilute again using the square of the first dilution and analyze the diluted sample again. Unlike some competing systems, these dilutions do not require space to be reserved on the sample wheel.

SEAL's AQ Software also includes a 'Smart-Dilution' option. If this is selected, the analyzer will take a look at the absorbance of the sample, and calculate a dilution factor to attempt to place the diluted sample's absorbance in the middle of the calibration range. If the system performs this dilution, and the sample is still out of range, the

instrument will make a second attempt with a larger dilution factor.

All dilutions are performed by a 1000 µL syringe for the best possible accuracy, and all instrument dilutions are prepared in a discrete, unused reaction well, automatically, in the same run. Dilutions can be performed by using various predefined matrices, e.g. DI Water, acidified water, or Kjeldahl digestion matrix. Over range samples can be automatically bracketed with QC sets to validate diluted results.

3.1.1.5 Discrete Analyzer must have the ability to heat cuvettes in the range of 25-60 degrees Celsius for specific methods which require heating. Must have a minimum cuvette pathlength of 10mm. Must have the capability to wash cuvettes and perform any necessary system QC.

Complies. The default setting for reaction incubation is 37 degrees Celsius, but this can be increased if needed. Temperature of the reaction ring is monitored in the software.

All SEAL Analytical Discrete Analyzers (DAs) are designed specifically for the environmental market. SEAL Analytical does not work with, nor does it manufacture, any clinical analyzers.

This is most evident through how the AQ400 physically does the readings. All of SEAL's DAs come standard with a 10mm, optical glass, flow-through cuvette. (Additional path length options are available and addressed below). This is the EPA recommended size for colorimetric analysis. The cuvette does not move, ensuring each sample is read in the same position to maximize reproducibility. There is not a need to worry about the cuvette aligning itself for each reading – the AQ400 moves the liquid, not the cuvette. The cuvette is thoroughly washed between each sample and a blank reading is taken to ensure the cuvette is clean. This is one of the main factors as to why SEAL AQ400 results are so reproducible. The design is based off decades of experience with Segmented Flow Analyzers – and SEAL has found a way to implement it into their Discrete Analyzers. While an optically pure, glass cuvette is more expensive to make, the one on the AQ400 is not a consumable. It will not need to be replaced over the lifetime of the instrument.

Competing systems, based on clinical design, will use individual styrene cuvettes instead of optically pure glass. Each sample is read in a different well, meaning that not only is the system judging the reproducibility of the chemistry, but also of the manufacturing of those individual wells. There is also the factor in the mechanics of moving each well into the light path for the reading. Ensuring that each one lines up exactly the same is challenging.

The software can be programmed to automatically insert controls at a user defined frequency, and any automatic post-run dilutions or manual reschedules will be bracketed with controls to validate results. The AQ400 is further automated with available limits for QCs, spikes and standard curve. If any of these go outside of the user defined limits, the system knows what the operator expects and can go back and rerun those QC and associated samples for EPA/NELAC compliant results. By having a robust QC setup within the software, AQ Software is able to automatically set up re-runs and dilutions based on rules given to it by an analyst. This helps to ensure hold times are hit, and also allows the instrument to stop itself if QCs are not passing to prevent waste of sample and reagent. The system can be set to automatically turn off the lamp and/or the entire system following a completed run to save energy and lamp-life.

The AQ400 and AQ Software allow for both Automatic and Manual Spike preparation. Either option will result in a Spike Recovery calculation. Automatically spiking the sample on the instrument will not only save analyst time, but will use less volume of sample and standard to do so as the sample will not need to be made in a large volume volumetric flask.

For the Automatic Spike the operator loads a stock spike solution onto the AQ400 and programs the desired spike concentration. The AQ400 will then pull two aliquots of the sample. The first one will be ran as a normal, reference sample. The second aliquot will have the required volume of spike solution added before the necessary reagents. Once the absorbance of each sample is read, the software will calculate the Spike Recovery. For the Manual Spike option the operator loads separate reference and pre-spiked samples onto the analyzer and indicates what the theoretical spike concentration should be. The software then runs both samples as normal, reads the absorbance, and calculates the spike recovery. AQ Software can also run a Spike Duplicate calculation. Using a single reference sample, Spike Recovery will be calculated for both the Spike and the Spike Duplicate. Additionally, the %RPD will be calculated.

3.1.1.6 Discrete Analyzer must have the ability to export data to LIMS.

Complies and exceeds. AQ Software is LIMS compatible, and data can be easily imported or exported directly to and from the software. The structure of the import and export files can be customized within AQ Software to match that of the labs LIMS.

AQ Software allows for the import of sample information, including

Sample ID, dilution requirements, and requested tests, from a LIMS or similar source. The import file is typically a .csv, .txt, or .xlsx file, and can be completely customized by the analyst.

AQ Software allows data to be exported in .csv file format. This file is fully customizable by the operator. Data fields can be selected or deselected for exportation, and the column order and column heading text is user-defined.

3.1.1.7 Discrete Analyzer must have installation and training included. The system must be fully operational upon receipt. Delivery of the instrument may be outside of the facility and the system must have a minimum warranty of one year on all parts and service.

Understood and complies. The AQ400 Discrete Analyzer comes supplied with everything required for complete installation and training. The quoted price includes a 3 day on site training. This will be done by a SEAL staff Technical Support Chemist (TSC) from our Milwaukee, WI factory location. This SEAL chemist will be well qualified to install the AQ400 and AQ software. All SEAL chemists are also part of our tech support, method development and product development team. They are well versed in all aspects of SEAL analyzers and can provide the highest quality and most in depth installation and training available. All method documentation will be delivered via email after order acknowledgement to allow the lab time to read and prepare for the system. Onsite programming of the software will include all listed chemistries.
The standard warranty from SEAL Analytical is 12 months. This is included with the price of the instrument. The warranty is fully explained on the last page of the attached quote.

State of West Virginia
West Virginia Dept. of Agr.-Moorefield Field Office
R.E.A.D., 60B Industrial Park Road
Moorefield, WV 26836

July 28, 2021

Dear Jessica,

Thank you for choosing to investigate the benefits of our **AQ400 Series** Discrete system. Please find enclosed our quotation as requested.

SEAL Analytical have been producing and supporting discrete analyzers for over twenty-five years. The AQ400 series is the latest instrument we offer which brings our experience and expertise to assist your productivity needs for the laboratory. It is designed and built entirely in the USA – at the SEAL headquarters in Milwaukee. Building on the success of the AQ2, with extra capacity, speed and flexibility, the AQ400 is at the forefront of discrete technology.

The advantage of the AQ400 Discrete analyzer is the automation and flexibility. Some of the automation capabilities of the AQ400 include generating a calibration curve from one standard, pre-dilutions and post-dilutions, and automatic scheduling of quality controls.

While it is not essential that you purchase the computer from us, we do recommend that you do. This allows us to ensure you have a computer with sufficient specifications.

We will be in contact with you in the near future. In the meantime, if I can be of any further service please do not hesitate to contact me.

Yours sincerely,
On behalf of SEAL Analytical Inc.

F. Joseph Redovich Jr.
Technical Sales & Product Manager

Commercial in confidence

Quote No: JR-210728-JC AQ400 Quote **Issue Date: July 28, 2021**

Price Quotation for **Valid Until: January 28, 2022**

State of West Virginia
West Virginia Dept. of Agr.-Moorefield Field Office
R.E.A.D., 60B Industrial Park Road
Moorefield, WV 26836

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For the attention of Jessica S Chambers

AQ400 Automated Multi-Chemistry Discrete Analyzer Package

- AQ400 Chemistry Unit, 120V/60Hz (for up to 9 filter wavelengths)
- AQ series Operating Software
- Start-up accessories kit to include -
  1 Spare Lamp assembly, 1 Spare Probe flusher
  1 Pack Reaction segments, 1 Pack Sample cups,
  1 Pack Reagent containers
- 2 Sample Trays (80 or 120 position)
- Operation Manual, Software Manual & Method SOP's
- AQ400 Customer Support Manual
- Integrated Cadmium Reduction Hardware for Nitrate analysis
  (includes 2 cadmium coils)

Package Price	**$ 51,250**
Less Government Discount (10%)	**- $ 5,125**
Training and Installation package, 3 Days	**included**
Warranty, 12 month parts & labor	**included**
Freight and Handling	**$ 800**
Discounted OFFER Price	**$ 46,925**

Terms and Conditions:

Terms:	Net 30
Delivery:	3-6 weeks after receipt of order
Freight and Handling:	$800. FOB Destination.
Sales Tax:	Not Included. It will be payable unless you are exempt.

OPTIONS:

1.	**Hi Spec Computer: includes 24" flat panel monitor and laser printer**		**$ 1,600**
2.	**APC Back-UPS Pro 1000VA**		**$ 320**
3.	**3 month AQ400 maintenance kit (to be used months 3-6)**		**$ 93**
4.	**6 month AQ400 maintenance kit (to be used months 6-9)**		**$ 730**
5.	**9 month AQ400 maintenance kit (to be used months 9-12)**		**$ 93**
6.	**Extra Cadmium coil**		**$ 195**
7.	**Consumable kit (10 bags reaction segments, 4 bags 2ml sample cups, and 25 reagent Wedges)** **Contains reaction wells for 18,000 tests, 4000 sample cups**		**$ 997**
8.	**Annual Service contract including on site PM visit** **Please see Service contract brochure for details**	**Basic** **Premium**	**$ 4,510** **$ 6,310**

NOTE:
The PC may be purchased by your company; however, you must meet our minimum specifications - available on request.

SEAL Analytical will not assume responsibility for damage caused to instrument from power outages or power surges in the laboratory.

Technical Support Services

Technical Support:

We provide a telephone/email/fax service desk at our Milwaukee facility from 8:00 AM to 5:30 PM as part of our standard service to our customers. All service calls are logged and an in-house Engineer or Chemist will trouble-shoot the problem by telephone. Our statistics show that over 90% of user questions are diagnosed and corrected by telephone and/or email intervention, without a site visit being necessary.

If this does not resolve the problem, a field-based Technical Specialist is assigned to visit the site.

Response Time / Repair Time:

Our typical response time for a Specialist to reach a site would be less than 24 working hours. We use state of the art messaging equipment to communicate with field staff before, during, and after each service episode. All support staff are our own employees, and not contract labor, and therefore would be dispatched from the Milwaukee site.

Technical Support Service Contracts:

A full range of customer support contracts are available. It is our aim to supply a fully-installed system and provide the application, software and engineering back up to ensure the highest performance from your new analytical system.

Focus Groups:

SEAL actively supports and sponsors Analyzer User Groups, arranging meetings on a regular basis, typically annually. The Company finds this an invaluable means of ensuring continued high levels of customer satisfaction and a useful forum for prioritizing product developments, and to introduce product enhancements.

AQ400 Automated Multi-Chemistry Discrete Analyzer

The **AQ400 Analyzer** is a **bench top Analyzer** that has been developed to meet the specific need for a modern, automated discrete analyzer in the environmental laboratory.

This analyzer has been developed to address the needs of laboratories that require high levels of **automation**, a wide range of chemistries, limits of detection that ensure **compliance with regulatory requirements** and the advantages of integration with **LIMS** systems. The AQ400 is a flexible system that meets these requirements and can be configured via the industry specific software to meet the operational needs of laboratories with a wide range of analytical and throughput levels.

Design & Functional Specifications

The design concept of the SEAL Analyzers is to enhance productivity of analytical services in busy laboratories by streamlining the workflow of samples and information through the total analytical process. Extensive experience in environmental laboratories has shown that the key to increasing productivity is the avoidance of multiple types of equipment and analytical procedures. In a laboratory where the routine range of colorimetric determinants requires the use of a range of instruments with restricted test menu, low throughput and multiple calibration/maintenance needs, the workflow involves several processes which are labor intensive, subject to potential error, and costly to operate.

These include:

- The need to produce separate work-lists/load-lists for the different analyzers, with associated test order entry.
- The splitting of samples and maintaining integrity of identity of the sub-aliquots.
- Separate calibration, operation, and quality control regimens on multiple analyzers.
- Collating results from multiple analyzers for final reports, possibly with multiple interfaces to LIMS.

When these elements are rigorously costed, inclusive of personnel time, instrument maintenance costs, space requirements, duplicated consumables, I.T. costs, etc., it becomes clear that the overall cost of analysis per sample is greatly reduced by consolidating the workflow onto a single nutrients system. Thus, the design specification of the SEAL Analyzers was to develop a family of units based on a standard software platform, utilizing the same range of

chemistries, which have the breadth of test menu, speed of throughput, and flexibility to process a workload that would otherwise require a combination of different contemporary analyzers and manual assay techniques.

Equally, it is a requirement that any analyzer selected meets the analytical performance criteria set out by the US EPA and other Standard bodies. Whereas, many contemporary analyzers in this market are required to operate at the extreme edge of their detection capability to meet these limits, the SEAL Analyzers routinely meet these criteria.

Finally, SEAL recognizes that the environment within which our systems operate is subject to change, whether from new technical demands, regulatory affairs, or changing practices of the Water & Environmental Industry. Therefore, we commit continuing resources to system development, including hardware enhancements, applications, software and chemistry methods.

Environmental Policy

SEAL is a manufacturer of high-quality automated analyzers and supplier of reagent systems for use in the Water, Soils and Environmental analysis sectors. The Company is aware that its products do have an impact on the environment in both the production and end-user stages of the product life cycle. The Company is therefore making every effort to determine the environmental impact of its operation and products and, where possible, implement a policy of reduction.

Specifically:

- Design new reagents and analyzers to take account of environmental issues such as waste production, power consumption, and low heat dissipation.
- Reformulate reagent systems to reduce harmful waste without affecting analytical performance.
- Provide full COSHH safety data on all products.
- Recycle, where practical, in-house produced waste.
- Minimize energy consumption within the factory and in the transport provided to employees.

Environmental Issues

- Discrete analysis by definition uses less than 10% of the reagents used by Continuous Flow systems.

AQ400 Training

The AQ400 system and software design has been strongly influenced by listening to SEAL users and regulatory requirements. As a result, the system is easy and intuitive to use. An on-site training course is conducted at installation covering the following aspects of the system:

- Introduction
- Hardware overview
- Principles of operation
- Daily routine
- System software operation, including:
  Test parameters, Reagent parameters, Standard definition, QC definition, Scheduling, Routine running Acceptance, Data storage routines LIMS interface
- Analyzer routine maintenance
- Troubleshooting/corrective maintenance
- Method Applications

Warranty Policy:

- Subject to the conditions set out below, the Company warrants that the Goods will correspond with their specification at the time of delivery and will be free from defects in material and workmanship for a period of 12 months from the date of the initial use or 15 months from delivery, whichever is the first to expire.
- The above warranty given by the Company subject to the following conditions:
- The Company shall be under no liability in respect of any defect in the Goods arising from any drawings, design or specification supplied by the Buyer;
- The Company shall be under no liability in respect of any defect arising from fair wear and tear, willful damage, negligence, abnormal working conditions, failure to follow the Company's instruction (whether oral or in writing) (including instructions regarding preventative maintenance), misuse or alteration or repair of the Goods without the Company's approval;
- The Company shall be under no liability under the above warranty (or any other warranty, conditions of guarantee) if the total price of the Goods has not been paid by the due date of payment;
- The above warranty does not extend to parts, materials or equipment not manufactured by the Company, in respect of which the Buyer shall only be entitled to the benefit of any such warranty or guarantee as is given by the manufacturer to the Company.
- Any claim by the Buyer which is based on any defect in the quality or condition of the Goods or their failure to correspond with specification shall (whether or not delivery is refused by the Buyer) be notified by the Company within 7 days from the date of delivery (where the defect or failure was not apparent on reasonable inspection) within a reasonable time within discovery of the defect or failure. If delivery is not refused and the Buyer does not notify the Company accordingly, the Buyer shall not be entitled to reject the Goods and the Company shall have no liability for such defects or failure and the Buyer shall be bound to pay the price as if the Goods had been delivered in accordance with the Contract.
- Where any valid claim in respect of any of the Goods which is based on any defect in the quality of condition of the Goods or their failure to meet specification is notified to the Company in accordance with these Conditions, the Company shall be entitled to replace the Goods (or the part in question) free of charge, at the Company's sole discretion, refund to the Buyer the price of the Goods (or a proportionate part of the price), but the Company shall have no further liability to the Buyer.
- Except in respect of the death or personal injury caused by the Company's negligence, the Company shall not be liable to the Buyer by reason of any representation, or any implied warranty, condition or other term, or any duty at common law, or under the express terms of the Contract, for any consequential loss or damage (whether for loss of profit or otherwise), costs expenses or other claims for consequential compensation whatsoever (and whether caused by the negligence of the Company, its employees or agents or otherwise) which arise out of or in connection with the supply of Goods or their use resale by the Buyer except as expressly provided in these Terms.
- The Company shall not be liable to the Buyer or be deemed to be in breach of the Contract by reason of any delay in performing, or any failure to perform, any of the Company's obligations in relation to the Goods, if the delay or failure was due to any cause beyond the Company's reasonable control. Without prejudice to the generality of the foregoing, the following shall be regarded as causes beyond the Company's reasonable control; Act of God, explosion, flood, tempest, fire or accident; war or threat of war, sabotage, insurrection, civil disturbance or requisition, acts, requisition, regulations, bye laws, prohibition or measures of any kind of the part of any Governmental, Local Authority; import or export regulations or embargo's, strike, lock-outs or other industrial actions or trade disputes (whether involving employees of the Company or of a third party); difficulties in obtaining raw materials, labor, fuel, parts or machinery; power failure or breakdown in machinery.

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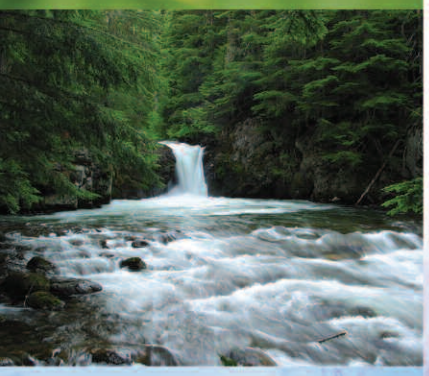


SEAL Analytical

AQ400

DISCRETE ANALYZER FOR ENVIRONMENTAL TESTING

AQ400 is a flexible analyzer that uses the principle of discrete analysis where each test occurs in a separate or discrete reaction vessel.

AQ400

AQ400 is ideal when many and varied tests are needed on different samples and/or individual results are needed immediately.

USEPA, ASTM, ISO
and other international regulatory compliant methods are available.

METHODS INCLUDE

Alkalinity
Ammonia
Chloride
Cyanides
Nitrate/Nitrite
Nitrite
Phenol
Phosphate, ortho
Phosphorus, total
Silicate
Sulfate
Total Kjeldahl Nitrogen

PLUS MANY MORE

HOW DOES THE AQ400 WORK?

The AQ400 robotic sampling arm works in conjunction with a stepper motor-driven syringe that is responsible for aspirating, dispensing and mixing accurate and precise quantities of sample and reagent in miniaturized test tubes called reaction wells.

The sample and reagent mixture are incubated in heated reaction wells until the reaction is complete. A single aliquot is then transferred into a 10 mm path length optical glass cuvette where the absorbance is read. Each sample is read in the same cuvette, in the same position in front of the detector. This is similar to SEAL colorimetric flow systems, known for their high reproducibility and lowest detection limits. The flow through cuvette eliminates the issue of reaction well variability and scratching found in direct read discrete systems. In the SEAL AQ series, liquid is moved not the cuvette – fewer moving parts equal higher stability and reliability of the system.

Once the absorbance is read, the glass cuvette is thoroughly cleaned and checked, ensuring no carryover or cross contamination.

***As a market leader**, SEAL has over 1,000 applications available and under continual development. Markets include water, wastewater, soil, plant, fertilizer, food and beverage. Please contact us for your specific application.*

AQ400 – The latest in discrete analyzer technology

Designed specifically for the environmental market

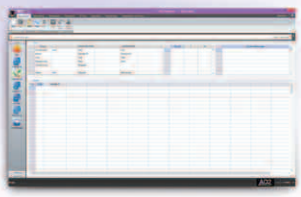
ADVANTAGES AND BENEFITS

- 100% optical glass stop-flow cuvette
- 10 mm optimum path length
- Longer path lengths available

- Low cost, disposable wells used for each discrete reaction
- Constant heating and programmable reaction time ensure reaction reaches completion
- Automatic reagent level sensing verifies sufficient reagent volume

- Optional integrated cadmium coil reduction for nitrate/nitrite determination
- Cadmium coil is sealed and valve controlled
- In situ coil regeneration is fully automated

- Unique probe washer for cleaning sample probe between sample and reagent
- Eliminates cross contamination
- Ideal for wastewater



- Highly flexible software designed with user input
- QCPro™ Data Quality System – allows the user to specify QC types, limits and corrective actions

- ***True unattended operation – including ability to run overnight***
- ***Automated standard preparation and dilution of over range samples***
- ***Tests programmable per sample to reduce analysis time***
- ***Add samples after a run has started***
- ***Total volume per test only 500 – 600 µL***
- ***Different size sample trays are available to accommodate different workloads***
- ***Segregated chemical waste and wash minimizes waste disposal***
- ***LIMS compatible – export in .csv format***

SIMPLE ***USER MAINTENANCE***

The AQ400 can be used as a standalone spectrophotometer.

The optional vial adaptor can accept vials of different sizes for reading tests such as COD.

SEAL Analytical

www.seal-analytical.com

Colorimetric Nutrient Analyzers

DISCRETE ANALYZERS

AQ270

AQ300

AQ400

SEGMENTED FLOW ANALYZERS

AA100

AA500

QuAAtro39

50 Years' Experience in Environmental Analysis Built into Every Analyzer

50 years' experience in designing, developing and manufacturing automated wet chemistry analyzers specifically for very low detection levels in environmental applications has helped SEAL to apply the most useful, easy to use features into the SEAL range of Discrete and Segmented Flow analyzers. The SEAL analyzers are widely acknowledged as the best for environmental analysis, giving you everything you need to achieve equal or superior results to the manual and approved laboratory methods the SEAL analyzer replaces.

Digestion Systems

FOR METALS AND TKN, TP DIGESTION

BD50

SmartBlock II

DEENA 3

SEAL Analyzers are monitoring environmental samples in every corner of the globe. They are manufactured in the USA, Germany and the Netherlands. Engineering and chemistry support is provided from SEAL global facilities in USA, Germany, England, the Netherlands and China along with a worldwide network of specialist distributors.

COMPREHENSIVE SUPPORT

We offer comprehensive applications, technical service and software support.

INCLUDING

- A choice of preventative maintenance and service contracts to meet your specific requirements
- In-house and online training
- Guaranteed availability of genuine consumables and spare parts
- Adaptation of methods to specific requirements such as matrix, range or detection limit
- Continuous in-house development of software to incorporate new customer requested features

Robotic Handling Systems

SEAL Robotic MiniLab systems for automating sample pretreatment in the laboratory — improving your sample handling efficiency. Typical applications include BOD, pH, COD, Alkalinity, and conductivity measurements with options such as decapping/capping, sample splitting, and filtration. Call us about your laboratory needs and we will design a robot to suit you.

SEAL MiniLab

SEAL Analytical

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ENVIRONMENTAL METHODS LIST – USEPA

Method Detection Limits are calculated using USEPA procedure 40 CFR, Part 136, Appendix B

00ANALYTE	METHOD DESCRIPTION	SEAL METHOD	MDL	Range	EQUIVALENCE
ALKALINITY	Buffered methyl orange color reduction	EPA-100-A	6.5 mg $CaCO_3$/L	10 – 100 mg $CaCO_3$/L	EPA 310.2 (1974)
		EPA-101-A	8.0 mg $CaCO_3$/L	15 – 200 mg $CaCO_3$/L	
		EPA-102-A	16 mg $CaCO_3$/L	50 – 500 mg $CaCO_3$/L	
AMMONIA	Alkaline phenate method with hypochlorite and sodium nitroprusside (indophenol blue)	EPA-103-A	0.004 mg N/L	0.02 – 2.0 mg N/L	EPA 350.1, version 2 (1993) Std. Methods 4500-NH_3 G (19^{th},20^{th})
		EPA-129-C	0.04 mg N/L	0.2 – 10 mg N/L	
AMMONIA	Alkaline phenate method with hypochlorite and sodium nitroprusside (indophenol blue). This is a brackish method.	EPA-104-A	0.07 mg N/L	0.2 – 5.0 mg N/L	EPA 350.1, version 2 (1993) Std. Methods 4500-NH_3 G (19th,20^{th})
AMMONIA	Alkaline salicylate method with hypochlorite and sodium nitroprusside	EPA-148-C	0.002 mg N/L	0.02 – 1.0 mg N/L	EPA 350.1, version 2 (1993) Std. Methods 4500-NH_3 G (19th,20^{th})
		EPA-150-C	0.005 mg N/L	0.1 – 5.0 mg N/L	
		EPA-153-C	0.011 mg N/L	0.2 – 10 mg N/L	
CHLORIDE	Mercuric thiocyanate reaction in the presence of ferric nitrate	EPA-105-C	0.3 mg Cl/L	2.0 – 100 mg Cl/L	Std. Methods 4500-Cl^- E (18^{th},19^{th},20^{th})
		EPA-124-C	0.4 mg Cl/L	5.0 – 200 mg Cl/L	
CHROMIUM, Hexavalent	Hexavalent chromium reaction with diphenylcarbazide	EPA-108-C	0.0005 mg/L	0.003 – 0.5 mg Cr(VI)/L	Std, Methods 4500-Cr B (20^{th})
		EPA-109-A	0.011 mg/L	0.3 – 5.0 mg Cr(VI)/L	
COLOR	Platinum-cobalt standard comparison (480 nm)	EPA-140-A	2 Color Units	5 – 150 Color Units	Std. Methods 2120 B (18^{th},19^{th},20^{th})
COLOR	Platinum-cobalt standard comparison (450nm)	EPA-147-A	2 Color Units	2 – 150 Color Units	Std. Methods 2120 B (18^{th}, 19^{th}, 20^{th}) Std. Methods 2120 C (21^{st} ed).
CYANIDE	Chloramine-T with pyridine barbituric acid color reaction (Manual distillation required)	EPA-130-C	0.7 µg CN/L	2.0 – 250 µg CN/L	EPA 335.4, version 1 (1993) Std. Methods 4500-CN E (18^{th}, 19^{th}, 20^{th})
CYANIDE	Amenable to chlorination (Without distillation)	EPA-133-A	0.4 µg CN/L	2.0 – 300 µg CN/L	Std. Methods 4500-CN H (20^{th})

ENVIRONMENTAL METHODS LIST – USEPA

Method Detection Limits are calculated using USEPA procedure 40 CFR, Part 136, Appendix B

00ANALYTE	METHOD DESCRIPTION	SEAL METHOD	MDL	Range	EQUIVALENCE
HARDNESS, Total	Calmagite indicator reaction	EPA-106-C	10 mg $CaCO_3$ /L	25 – 400 mg $CaCO_3$/L	EPA 130.1 (1971)
NITROGEN, Total Kjeldahl (TKN)	Kjeldahl digests (Hg catalyst) are reacted with alkaline salicylate in the presence of hypochlorite and sodium nitroprusside (Digestion required)	EPA-125-A	0.03 mg N/L	0.1 – 4.0 mg N/L	EPA 351.2, version 2 (1993)
		EPA-110-A	0.2 mg N/L	0.5 – 24 mg N/L	
NITROGEN, Total Kjeldahl (TKN)	Kjeldahl digests (Cu catalyst) are reacted with alkaline salicylate in the presence of hypochlorite and sodium nitroprusside (Digestion required)	EPA-111-A	0.07 mg N/L	0.2 – 4.0 mg N/L	EPA 351.2, version 2 (1993)
		EPA-136-A	0.12 mg N/L	0.5 – 25 mg N/L	
NITRATE + NITRITE	Cadmium coil reduction followed by sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride	EPA-127-C	0.003 mg N/L	0.012 – 2.0 mg N/L	EPA 353.2, version 2 (1993) Std. Methods 4500-NO_3 F (18^{th}, 19^{th}, 20^{th})
		EPA-126-C	0.007 mg N/L	0.04 – 5.0 mg N/L	
		EPA-114-A	0.03 mg N/L	0.25 – 15 mg N/L	
NITRATE + NITRITE	Nitrate is chemically reduced to nitrite by alkaline hydrazine sulfate, in the presence of copper(II).	EPA-141-A	0.005 mg N/L	0.02 – 1.5 mg N/L	EPA 353.1(1978) Std. Methods 4500-NO_3–H (18^{th}, 19^{th}, 20^{th})
		EPA-142-A	0.03 mg N/L	0.2 – 5.0 mg N/L	
NITRATE + NITRITE	Cadmium coil reduction followed by sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride (Imidazole buffer used)	EPA-132-A	0.004 mg N/L	0.012 – 2.0 mg N/L	N/A
NITRATE + NITRITE	Vanadium(III) chloride reduction followed by sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride	EPA-160-A	0.004 mg N/L	0.025 – 1.0 mg N/L	40 CFR, Part 136.3
NITRITE	Sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride	EPA-115-C	0.0008 mg N/L	0.015 – 1.5 mg N/L	EPA 353.2, version 2 (1993) Std. Methods 4500-NO_3 F (18^{th}, 19^{th}, 20^{th})
		EPA-137-A	0.0001 mg N/L	0.0009 – 0.2 mg N/L	
NITRITE	Sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride (no buffer used)	EPA-116-C	0.0002 mg N/L	0.001 – 0.2 mg N/L	Std. Methods 4500-NO_2 B (18^{th}, 19^{th}, 20^{th})
		EPA-112-C	0.0005 mg N/L	0.015 – 1.5 mg N/L	

ENVIRONMENTAL METHODS LIST – USEPA

Method Detection Limits are calculated using USEPA procedure 40 CFR, Part 136, Appendix B

00ANALYTE	METHOD DESCRIPTION	SEAL METHOD	MDL	Range	EQUIVALENCE
PHENOLICS	Sample distillates are reacted with alkaline ferricyanide and 4-aminoantipyrine (Manual distillation required)	EPA-117-C	0.002 mg Phenol/L	0.005 – 0.25 mg Phenol/L	EPA 420.4, version 1 (1993)
PHOSPHATE, Ortho	Acidic molybdate/antimony with ascorbic acid reduction (phosphomolybdenum blue)	EPA-156-C	0.0004 mg P/L	0.003 – 0.2 mg P/L	EPA 365.1, version 2 (1993) Std. Methods 4500-P F (18^{th}, 19^{th}, 20^{th})
		EPA-118-C	0.0015 mg P/L	0.005 – 1.0 mg P/L	
		EPA-145-C	0.005 mg P/L	0.05 – 5 mg P/L	
		EPA-146-A	0.013 mg P/L	0.125 – 12.5 mg P/L	
PHOSPHORUS, Total (TP)	Acidic molybdate/antimony with ascorbic acid reduction (Manual persulfate digestion required)	EPA-119-A	0.003 mg P/L	0.01 – 1.0 mg P/L	EPA 365.1, version 2 (1993) Std. Methods 4500-P B, F (18^{th}, 19^{th}, 20^{th})
		EPA-134-A	0.006 mg P/L	0.05 – 5.0 mg P/L	
PHOSPHORUS, Total Kjeldahl (TKP)	Kjeldahl digests (Hg catalyst) are reacted with acidic molybdate/antimony with ascorbic acid reduction	EPA-120-A	0.007 mg P/L	0.04 – 3.2 mg P/L	EPA 365.4 (1983)
PHOSPHORUS, Total Kjeldahl (TKP)	Kjeldahl digests (Cu catalyst) are reacted with acidic molybdate/antimony with ascorbic acid reduction. Method range depends on digestion protocol	EPA-135-A	0.009 mg P/L	0.04 – 3.2 mg P/L	N/A
SILICA (Reactive silica)	Acidic molybdate, no reduction (molybdo-silicic acid)	EPA-121-A	0.1 mg silica/L	0.25 – 25 mg silica/L	Std. Methods 4500-SiO_2 C (20th)
SILICA (Reactive silica)	Acidic molybdate with ANSA reduction (silico-molybdenum blue)	EPA-122-C	0.0042 mg silica/L	0.1 – 10.0 mg silica/L	Std. Methods 4500-SiO_2 D (20^{th})
SULFATE	Barium chloride turbidimetric method	EPA-123-A	1.0 mg/L	5.0 – 40 mg/L	ASTM D516-90, 02
SULFATE	Barium chloride turbidimetric method with use of gelatin as suspension agent	EPA-165-A	0.09 mg/L	5.0 – 40 mg/L	ASTM D516-11

SEAWATER METHODS LIST

Method Detection Limits are calculated using USEPA procedure 40 CFR, Part 136, Appendix B

ANALYTE	METHOD DESCRIPTION	SEAL METHOD	MDL	RANGE	EQUIVALENCE
PHOSPHATE, Ortho	Acidic molybdate/antimony with ascorbic acid reduction (phosphomolybdenum blue)	SEA-156-C	0.015 µM (0.46 µg P/L)	0.1 – 7.0 µM (3.1 – 217 µg P/L)	EPA 365.1, version 2 (1993) Std. Methods 4500-P F (18^{th}, 19^{th}, 20^{th})
SILICA (Reactive silica)	Acidic molybdate with ANSA reduction (silico-molybdenum blue)	SEA-122-C	0.011 mg silica/L	0.1 – 10.0 mg silica/L	Std. Methods 4500-SiO_2 D (20^{th})

AGRICULTURE METHODS LIST

Method Detection Limits are calculated using USEPA procedure 40 CFR, Part 136, Appendix B

ANALYTE	METHOD DESCRIPTION	EXTRACT	SEAL METHOD	MDL	RANGE
AMMONIA	Alkaline phenate method with hypochlorite and sodium nitroprusside (indophenol blue)	2 M KCl	AGR-210-C	0.021 mg N/L	0.2 – 10 mg N/L
NITRATE + NITRITE	Cadmium coil reduction followed by sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride	2 M KCl	AGR-231-A	0.015 mg N/L	0.06 – 5.0 mg N/L
			AGR-232-C	0.022 mg N/L	0.2 – 10 mg N/L
NITRATE + NITRITE	Cadmium coil reduction followed by sulfanilamide reaction in the presence of N-(1-naphthylethylenediamine) dihydrochloride	2 M KCl	AGR-231-A	0.015 mg N/L	0.06 – 5.0 mg N/L
PHOSPHATE, Ortho	Acidic molybdate/antimony with ascorbic acid reduction (phosphomolybdenum blue) for o-phosphate	Bray's P1 or P2, or similar extract	AGR-201-A	0.015 mg P/L	0.05 – 5.0 mg P/L
PHOSPHATE, Ortho	Acidic molybdate/antimony with ascorbic acid reduction (phosphomolybdenum blue) for o-phosphate	Modified Morgan's or similar acetate/acetic acid extract	AGR-202-A	0.01 mg P/L	0.2 – 8.0 mg P/L
PHOSPHATE, Ortho	Acidic molybdate/antimony with ascorbic acid reduction (phosphomolybdenum blue) for o-phosphate	Olsen 0.5 M sodium bicarbonate extract	AGR-203-A	0.01 mg P/L	0.1 – 5.0 mg P/L
PHOSPHATE, Ortho	Acidic molybdate/antimony with ascorbic acid reduction (phosphomolybdenum blue) for o-phosphate	2 M KCl	AGR-204-A	0.04 mg P/L	0.1 – 5.0 mg P/L
SULFATE	Barium chloride turbidimetric method	KH_2PO_4, or similar extraction	AGR-290-A Rev 1	0.75 mg SO_4/L	5.0 – 40 mg SO_4/L

SEAL Analytical is continually developing methods. Please note that others may exist.

If you do not see your chosen method on this list, please consult your SEAL Analytical Technical Support Team at:

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