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WATER LOGS

National Water Quality Laboratory Newsletter

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In this issue....

U.S. Department of the Interior
U.S. Geological Survey

NWQL biologists meet taxonomic needs and data-quality objectives

The Biological Group at the NWQL was established in 1993. To date, the group has sorted and identified about 6,000 benthic macroinvertebrate samples from nearly all of the lower 48 states, Alaska, and Hawaii.

Currently, the group has a staff of five, including three experienced full-time taxonomists. The Biological Group processes all benthic macroinvertebrate samples for the National Water Quality Assessment (NAWQA) Program and continues to process samples for many other U.S. Geological Survey (USGS) customers using NAWQA and other custom methods.

In addition to sample processing, the Biological Group has verified voucher collections submitted by the USGS and continues to verify specimens for the U.S. Environmental Protection Agency through an interagency agreement.

Methods. The Biological Group offers qualitative and quantitative processing methods. These standard methods are documented in Moulton and others (2000) and the five supporting NWQL standard operating procedures (SOPs).

The goal of the qualitative method (NWQL Lab Code 2176) is to produce a comprehensive list of benthic macroinvertebrate taxa present in a sample. As many distinct taxa as possible are sorted within a 2-hour time limit. Sorting focuses on mature, undamaged specimens that contribute to successful genus- or species-level identification, but unique immature or damaged specimens may be sorted. Taxa are reported only as present; individual abundances are not reported.

Baetisca (Ephemeroptera: Baetiscidae) nymph

The goal of the quantitative method (NWQL Lab Code 2172) is to sort, identify, and enumerate a specified minimum number of benthic macroinvertebrates. This minimum is defined by a project's data-quality objectives. The standard method specifies a minimum of 300 specimens, but other minimums can be requested. When necessary, samples are subsampled by using a subsampling frame (Moulton and others, 2000), and multiple, randomly selected uniform portions of the sample are sorted. Large-rare specimens are removed from any remaining unsorted portion of the sample to help assess taxonomic richness.

Custom methods, such as basic identification or verification services, are available on request.

(continued on following page)

Quality. Quality-assurance (QA) and quality-control (QC) measures are in place from the time the NWQL receives the samples to the release of data. We are fortunate to use Zeiss optics, have digital image capabilities, and work in a facility that is likely unsurpassed in its commitment to safety, health, and the environment.

When requesting the standard methods, a second member of the staff checks every significant step of sample processing. For example, we check and document the sorting effectiveness for all quantitatively sorted samples and confirm the appropriateness of the sorting effort on all qualitatively processed samples. The key is that we check the sorting and documentation for all samples, not just a subset.

We currently have voucher material for most released data on site, so even after the release of data, the Biological Group can review and update data as requested or if we discover problems. Samples are processed according to approved internal SOPs, and the NWQL's Quality Assurance Section confirms compliance with these SOPs annually through internal audits.

The NWQL continues to improve the original internal taxonomic QC process (Grotheer and others, 2000) by monitoring and minimizing the error and bias associated with taxonomic identifications.

The current process was presented during a taxonomic QA/QC workshop at the 2004 North American Benthological Society meeting in Vancouver, British Columbia, and ensures that all new determinations (taxa) produced by each taxonomist are internally verified by a second taxonomist. Each week, we randomly select and check 10 percent of all remaining taxa. If a taxon is not selected for 3 years in this weekly monitoring process, we re-check that taxon the next time it occurs. Recognizing that unique life stages require specific literature and taxonomic knowledge, we also ensure that all life stages produced for each taxon are selected and verified.

SAMPLE DETRITUS—Technician Zachary Najacht works with sample detritus in a 42-grid subsampling frame.

IDENTIFICATION—Biologist Rob Hood identifies benthic macroinvertebrates at a binocular microscope.

Working toward long-term national consistency, we use and maintain a national reference collection of benthic macroinvertebrates. Recognized taxonomic experts have verified many of the taxa, and all of it has been checked by at least two Biological Group taxonomists. We continue to use and update this collection regularly, and it has proven to be a valuable tool for maintaining consistency in day-to-day production. Archived original paperwork, SOPs, and custom internal programs are available for review if needed.

Production. The group typically meets or exceeds deadlines for data release and can work with customers who have urgent needs using the NWQL custom proposal process.

Training. The Biological Group taxonomists regularly attend or present, or both, at relevant scientific meetings, such as the annual meeting of the North American Benthological Society (NABS) and the North American Plecoptera Symposium. Taxonomic education is continued by participating in workshops held by taxonomic specialists. Taxonomists have attended Odonata and Trichoptera workshops held at recent NABS meetings and attended a recent chironomid workshop at the Humbolt Field Research Institute in Maine.

Resources. The Biological Group library contains about 3,500 peer-reviewed papers and books relating to the taxonomy, ecology, and life history of benthic macroinvertebrates. Through interactions with specialists and review of the literature, we continue to update our library by obtaining the most up-to-date publications and checklists as they become available. The taxonomic portion of the data base

(continued on following page)

is reviewed and updated as necessary to reflect current taxonomic nomenclature.

Summary. The Biological Group currently provides sorting, identification, QC, and release of data to the NAWQA program, and also processes samples according to custom project-specific data-quality objectives. The group can provide custom services for any study involving benthic macroinvertebrates. Contact the Business Development Team to obtain more information on custom (non-NAWQA) sample processing or other laboratory services related to benthic macroinvertebrates.

• SCOTT GROTHEER

References

Grotheer, S.A., Moulton, S.R., II, Carter, J.L., Cuffney, T.F., and Short, T.M, 2000, Quality control of benthic macroinvertebrate identification: A taxon-based approach. Presented at the North American Benthological Society Meeting in Keystone, Colo. (poster), May 2000; accessed March 9, 2005, at *http://www.benthos.org/meeting/nabs2000/nabstracts2000.cfm/id/233*.

Moulton, S.R., II, Carter, J.L., Grotheer, S.A., Cuffney, T.F., and Short, T.M., 2000, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory—Processing, taxonomy, and quality control of benthic macroinvertebrate samples: U.S. Geological Survey Open-File Report 00-212, 49 p.

NWQL seminar schedule, 2005

- Robert Wershaw, National Research Program, "A learned community-based publication model for dissemination of the results of research," **January 25**
- John Schabron, Western Research Institute, University of Wyoming, "Field screening technologies developed at Western Research Institute," **January 26**
- Michael Zumwalt, Agilent Technologies, "LC/MS: Essential tool for environmental analysis," **February 8**
- John Hughes, Agilent Technologies, "Environmental applications of routine accurate-mass LC/MS," **February 8**

Lab achieved 98 percent on NELAC performance evaluation last summer

The National Water Quality Laboratory participates in a variety of performance evaluations. For several years, the NWQL has made it a policy to log in and treat all performance-evaluation samples as regular samples. Unless the performance-evaluation provider specifically requests multiple analyses, all samples are analyzed once.

By logging in these samples, the NWQL tests multiple laboratory systems, specifically the log-in process, analytical systems, and data-collection and evaluation processes. This manner of analyzing performance-evaluation samples is more rigorous when compared to other laboratories.

The NWQL receives National Environmental Laboratory Accreditation Conference (NELAC) accreditation through the New York State Department of Health (NYSDOH). Twice yearly, the NWQL takes part in the nonpotable water tests using standard USGS methods. The Lab is currently accredited for 131 total constituent-methods. Accreditation is by constituent and method. For several constituents (primarily trace metals), the NWQL is accredited by multiple methods. All NYSDOH results can be accessed through *http://nwql.usgs.gov/Public/Performance/publicnyresults.html*.

The NWQL received excellent scores on the most recent nonpotable performance evaluation; it achieved an overall success rate of 98.47 percent. The evaluation period, July 19 through September 2, 2004, occurred during the water-year peak when all of the NWQL's systems were operating at high capacities. To achieve single-pass results with a 98 percent acceptable rating is an indication of overall NWQL systems' competence. Complete results are at URL *http://nwql.usgs.gov/Public/Performance/publicny0904.html*.

The accompanying table lists NWQL performance for the inorganic and organic constituents, the best overall performance to date for the nonpotable samples from New York.

• MARY CAST

Results for the NYSDOH nonpotable chemistry evaluations, 3rd quarter, 2004

	Acceptable	Unsatisfactory	Totals	Percent acceptable
Organic	84	1	85	98.82
Inorganic	45	1	46	97.83
Total	**129**	**2**	**131**	**98.47**

NWQL scores well in Fall 2004 BQS interlaboratory comparison evaluations

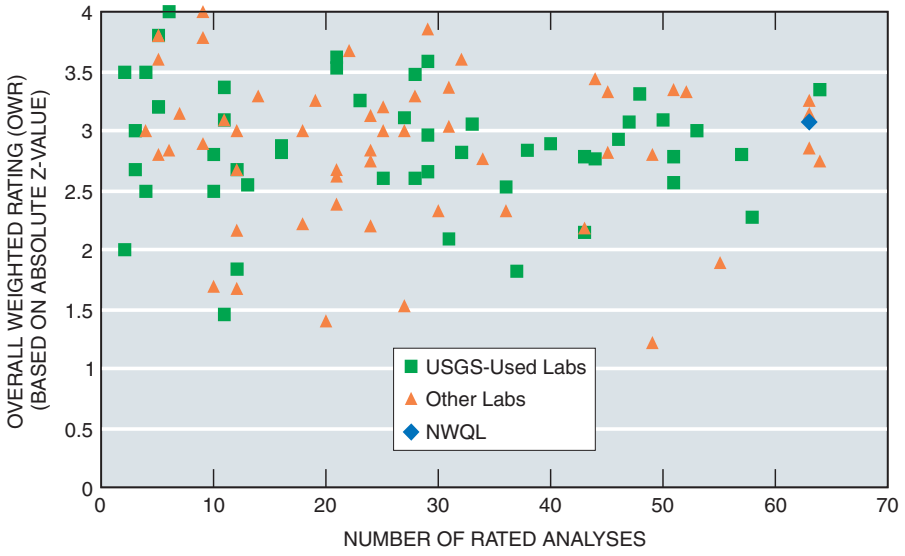
The NWQL posted a very good score in the USGS Branch of Quality Systems (BQS) semiannual interlaboratory comparison (round robin) evaluations. Samples for the Fall 2004 comparison evaluations were analyzed between mid-August and mid-September 2004.

The NWQL received an overall rating of 3.1 and analyzed a total of 63 of a possible 67 constituents. The NWQL was among the five top-rated laboratories performing this number of analyses. Two laboratories analyzed 64 constituents and only one of them had a higher overall rating (3.3) than the NWQL. Complete results are available on the BQS web site for the Fall 2004 interlaboratory comparison at URL *http://bqs.usgs.gov/srs/SRS_Fall04/F04results.htm*. (The NWQL is designated Lab 1 on the web site.)

The following three graphs show the consistent high-level performance of the NWQL over the past three studies. In each of these studies, the NWQL placed high within the upper right-hand quadrant of the graph, indicating that the laboratory analyzed nearly all of the available constituents with an overall rating between "good" and "excellent." See the BQS fact sheet at URL *http://bqs.usgs.gov/srs/FactSheet.htm* for a detailed explanation of the ratings. BQS will no longer use descriptive terms (Excellent to Unsatisfactory) to categorize absolute Z-value ranges beginning with the Spring 2005 interlaboratory comparison evaluations.

• MARY CAST

Rating	Absolute Z-value
4 — Excellent	0.00–0.50
3 — Good	0.51–1.00
2 — Satisfactory	1.01–1.50
1 — Marginal	1.51–2.00
0 — Unsatisfactory	Greater than 2
NR — Not rated	



Fall 2004 Interlaboratory Comparison BQS Standard Reference Samples

Spring 2004 Interlaboratory Comparison BQS Standard Reference Samples

Fall 2003 Interlaboratory Comparison BQS Standard Reference Samples

Nutrients group analysts achieve landmark score

The analysts of the Nutrients group have achieved a landmark in data quality. They operated all nutrient analytical systems monitored by the Inorganic Blind Sample Project (administered by the Branch of Quality Systems) for 13 months without significant bias or variability.

The Inorganic Blind Sample Project (IBSP) submits reference water samples in a double-blind manner to the inorganic analytical systems at the NWQL throughout each year. "Double blind" means that the NWQL analysts are unaware that the samples are anything other than routine environmental samples, nor are they aware of the expected concentrations of the analytes. The absence of notable bias or variability for 13 months is exceptional because the analysts produce environmental sample data for filtered and whole-water-recoverable ammonia, orthophosphate, nitrate, nitrite, nitrogen, phosphorus, Kjeldahl nitrogen, Kjeldahl phosphorus, fluoride, and silica, for a total of 24 different analytical systems monitored by the IBSP. About 2,700 IBSP blind samples were analyzed by the Nutrients group for these constituents in fiscal year 2004.

The only anomaly to this excellent record was the observation of a negative bias for orthophosphate (filtered) in the second half of November 2004. This was the first record of bias or variability for any constituent determined by the Nutrients group since November 2003. The negative bias was independently detected by the analysts last November, with most results corrected before being released to the customer. This negative bias was reported in the IBSP's February 2005 QADATA Summary.

The control charts for blind samples submitted for nutrient analyses, as well as other inorganic tests, can be viewed at *http://bqs.usgs.gov/bsp/mainpage.html*. Summaries (QADATA Summary) with comments on only those analyses for which the quality-control charts indicate or have indicated a bias or higher than expected variability also are available on the aforementioned web page.

The analysts who contributed to the landmark score are Harold Ardourel (supervisor), Allan Bumgartner, Armin Burdick, Jack DeGiacomo, Sue Fell, Colleen Gupta, Chris Klimper, Pete Marcogliese, Rebecca Murillo, Rhiannan ReVello, Eric Schwab, Steve Van Valkenberg, and Tom White.

• AL DRISCOLL

Harold Ardourel (left), supervisor of the Nutrients group, and Al Driscoll, quality-assurance chemist, contributed to the success of the Inorganic Blind Sample Project. They are shown next to a robotic clinical analyzer that will be used for dissolved nutrient determinations in water samples. Plans call for bringing the new instrument online later in the year following testing and workarounds.

Lab well represented in photo competition

Winners have been announced in the 30th Annual USGS National Photographic Competition. The NWQL placed six photographers, as follows:

Amateur, color, nature
Honorable Mention (HM) – Linda Oasheim

Amateur, color, people and animals
3rd – Jim Kammer

Amateur, color, man-made structures
3rd – Carmen Reed-Parker
HM – Jon Raese

Advanced amateur, black and white (B&W), nature
2nd – Chris Lindley
3rd – Chris Lindley

Advanced amateur, B&W, people and animals
2nd – Sonja Abney

Advanced amateur, color, man-made structures
2nd – Sonja Abney

Advanced amateur, color, nature
3rd – Sonja Abney

Winning photographs were exhibited in the main corridor, building 810, at the Denver Federal Center. Visit the NWQL Photo Club web site at *http://www.lablens.net*

Training opportunity

Water-Quality Principles, Course No. QW1022, April 25–29, 2005, Denver. To register, contact Gloria Armstrong, 303-445-4676. The class is designed as a general introduction to water quality.

Fire retardants, insecticides, caffeine, and household cleaners among chemicals found in Colorado's streams and water wells

A report released January 19 by the U.S. Geological Survey describes the detection of insecticides, caffeine, detergents, fire retardants, fragrances, household cleaners, steroids, and other contaminants in Colorado's streams and ground water. USGS scientists examined 62 wastewater chemicals in urban and mountain streams and in ground water from municipal wells in the southern metropolitan area of Denver and domestic wells southwest of Denver.

Data from about 125 water samples collected during studies in 2001 and 2003 were combined for the first time to provide a better understanding of how and where wastewater chemicals are entering Colorado's streams and ground water. These contaminants can be released to the environment through the discharges from industrial facilities, animal feedlots, wastewater-treatment plants, septic disposal systems, or through runoff from land.

The water samples were analyzed by the USGS National Water Quality Laboratory.

"Chemicals that we use every day in homes, industry, and agriculture can enter our streams and ground water with wastewater," said Lori Sprague, a USGS scientist and chief author of the new report. "The human health and environmental effects of these contaminants are not well understood, and standards to protect humans or aquatic life have not been established for most of these substances," added Sprague.

Some of the chemicals found in Colorado streams, such as the detergent degradation product nonylphenol and the fragrances AHTN and HHCB, have been shown to disrupt reproduction and growth in fish by affecting endocrine systems. Researchers also detected triclosan and other antimicrobial disinfectants that are commonly found in liquid soaps, dishwasher powders, and plastics. These chemicals are suspected of increasing the antibiotic resistance of bacteria in the environment.

Results of the findings are published in USGS Fact Sheet 2004-3127, entitled "Wastewater Chemicals in Colorado's Steams and Ground Water."

• HEIDI KOONTZ

NEWS CONFERENCE—Lori Sprague (center), USGS scientist and chief author of a new report, speaks to reporters January 19 at Confluence Park, in Denver, regarding the presence of 62 wastewater chemicals in urban and mountain streams of Colorado and in ground water in the metropolitan Denver area. She said urban streams were the most vulnerable to contamination. Sites sampled included the South Platte River basin, Arkansas River basin, and the Upper Colorado River basin. Flanking Sprague are Suzanne Paschke and William Battaglin, hydrologists with the Colorado District.

Contract restructured; carbon-14 prices reduced

The NWQL's contract for analytical services with the University of Waterloo has been restructured to save time and lower costs. Analyses for tritium as well as analyses for C-14 and C-13/C-12 are now covered by this contract.

This restructuring has resulted in the following changes:

1. Samples for tritium (with data packages) C-14 and C-13/C-12 are now sent directly to the contract laboratory (University of Waterloo).

2. Another Accelerator Mass Spectrometry (AMS) lab has been added as a subcontract laboratory: the University of Arizona AMS facility in Tucson, Arizona. Prices for all C-14 analyses by AMS have been reduced.

Refer to NWQL Rapi-Note #04-028 for collection and submittal procedures, shipping instructions, and new prices.

NWQL update on microbiology field kits

After closure of the Ocala Water Quality and Research Laboratory (OWQRL) last September, the National Water Quality Laboratory (NWQL) assumed the responsibility for many of the OWQRL's supply functions, including the preparation and sale of the microbiology field kits and support materials.

In the interim, the NWQL has worked together with the Ohio District Microbiology Laboratory (ODML) (Rebecca Bushon, laboratory coordinator) to improve microbiology processes and reduce costs to USGS field personnel for bacterial supplies.

With support from the ODML and the Office of Water Quality, the NWQL eliminated production of two products in November 2004: the magnesium chloride buffer and the peptone buffer solutions. These buffers were replaced by a certified and less expensive commercially prepared product, resulting in annual savings to the USGS of about $40,000 based on the buffer sales of water year 2003 (water year is the 12-month period ending Sept. 30 each year).

In addition, microbiology field kits currently being produced by the NWQL soon will be replaced by commercially available media and prepoured plates. The ODML is working with the Office of Water Quality and the NWQL to produce a technical memorandum detailing replacement of bacteriological procedures. It is estimated that by converting to the commercially available sources, the NWQL will save about 0.3 full-time equivalent by no longer producing the bacteriological supplies. It is anticipated that savings similar to the buffer solution may be expected by outsourcing the microbiology field kits.

• KIMBERLY PARDUE WELCH

DEAR LABBY'S ADVICE

How many sample bottles do I send with my ASR?

Dear Labby:

I am planning a major sampling expedition and need some help. I will be combining lots of schedules onto my Analytical Services Request (ASR) forms, and need to know how many of each type of sample bottle to send. Also, is there any way not to have to write six schedules and add and delete lab codes on the ASR forms to get the analyses I need?

Answer:

If you have concerns about getting all needed tests on a limited volume of sample (Lysimeter, slow-flowing well, etc.), please contact Labhelp. We can determine the best way for you to get the work you need.

In general, we will never need more than one FA, RA, RU, FCC, FCA, or WCA* bottle, even if you are combining several schedules. If you are requesting tests from an FU bottle, you may need to send either a 500-mL bottle, or an additional 250-mL bottle. The tests from the FU bottle that require a large sample volume are alkalinity and residue on evaporation. If you have any questions, feel free to e-mail Labhelp@usgs.gov, and we will make sure you are sending enough volume for your requests.

For the organic schedules, we still need a single 1-L GCC bottle for each schedule. For example, if you request schedules 1433, 2060, 2001, and 1379, you still need to send four GCC bottles.

For the volatile organic compound schedules, we will always need a minimum of three GCV vials.

For other bottle types not listed above, please contact Labhelp for volume requirements.

Labhelp also can provide your project with a schedule designed especially for you. It is quick to do, and can be quite useful. You may only have to write a couple of schedule numbers on the ASR form. If you would like to discuss this possibility, contact Labhelp.

• LABBY (aka GLENDA BROWN)

*All bottle abbreviations are defined as follows: FA, filtered acidified; FCA, filtered chilled acidified; FCC, filtered chilled; FU, filtered untreated; GCC, glass chilled container; GCV, glass chilled vial; RA, raw acidified; RU, raw untreated; WCA, whole water chilled acidified.

Does the United States have enough water?

The short answer is nobody really knows. According to a just released government report, scientists do not have a clear picture of how much fresh water is available. Monitoring and assessment of water storage and flow in rivers, lakes, snowpacks, soil, and aquifers is incomplete. The report, *Science and Technology to Support Fresh Water Availability in the United States*, was released to the public February 14. It was prepared by the Office of Science and Technology Policy, Committee on Environment and Natural Resources, Subcommittee on Water Availability and Quality, co-chaired by the USGS Associate Director for Water, Robert Hirsch. The report reflects information from water research and technology directors from about a dozen Federal agencies.

• GLENN PATTERSON,
RESTON, VA,
703-648-6876

Postdoc joins Methods Program

Melissa Schultz joined the Methods Research and Development Program December 20 as a National Research Council Postdoctoral Research Associate. She will be working with Ed Furlong. Her position is jointly supported by the NWQL, the Toxics Substances Hydrology Program, and the Office of the Chief Scientist for Hydrology.

Schultz completed her Ph.D. in the Department of Chemistry at Oregon State University, under Prof. Jennifer Field (who completed her Ph.D. at Colorado School of Mines working with Mike Thurman and Jerry Leenheer of the USGS/NRP), and Professor Douglas Barofsky. Schultz's Ph.D. dissertation title is "Determination of Fluorinated Alkyl Substances in Aqueous Systems."

Melissa's successful proposal for her National Research Council Associateship is titled "Determination of Selective Serotonin Reuptake Inhibitors and their Metabolites in Municipal Wastewaters and Sludge and in Receiving Surface Waters and Sediment." Selective serotonin reuptake inhibitors (SSRIs) are of emerging environmental interest. SSRIs are widely prescribed anti-depressant pharmaceuticals that include Prozac, Paxil, and Zoloft.

Few analytical methods exist to detect SSRIs in environmental matrices, thus little is known about their distribution and fate in the environment. This project will develop a method to quantitate SSRIs and their metabolites in aqueous and solid samples. Laboratory adsorption studies will create a model to predict the partitioning of SSRIs and their metabolites between solid and aqueous phases. Field studies will involve describing wastewater discharges and biosolids to determine wastewater-treatment removal efficiencies, and to quantify these sources of SSRIs and their metabolites and their potential to contribute to surface and groundwater SSRI loads. Receiving waters and sediment samples from two well-characterized watersheds will be used to evaluate the persistence and fate of SSRIs and their metabolites.

Melissa Schultz

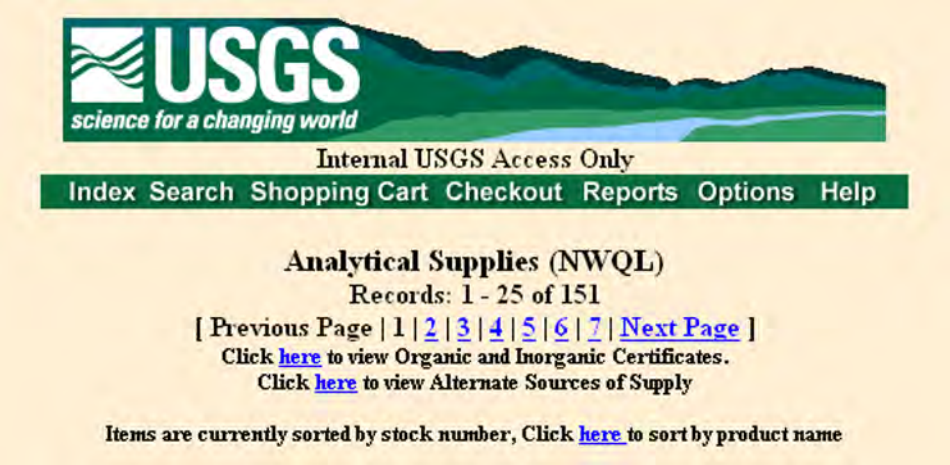
Schultz initially will work at field sites in the Boulder Creek Watershed (Larry Barber, CR-NRP), Boulder County, Colo., and in the Hudson River Watershed (Pat Phillips, NY District). Pat Phillips and Larry Barber are collaborators and active participants in the Toxics Program's Emerging Contaminants Project.

In addition to the proposed research, Schultz brings to the NWQL extensive experience in the analysis of perflourinated compounds. These environmental contaminants are a high priority of the emerging contaminants project, and the NWQL may implement the methods she has developed and include them as a custom analysis for Toxics Program projects.

• ED FURLONG

GUESTS FROM PAKISTAN—The NWQL hosted seven visitors Feb. 10 and 11 from the Pakistan Council of Research in Water Resources (PCRWR). The delegation is interested in USGS approaches for evaluating water-resources development and management and for water-quality monitoring, data collection, and sample analysis, among other topics. Shown (left to right) are Zia-ul-Haque Sheikh; Muhammad Azam; George Leavesley, Surface Water Hydrology, USGS; Greg Mohrman, NWQL Lab Chief; Ingrid Verstraeten, International Water Resources Branch, USGS, Reston; Dr. Muhammad Akram Kahlown, Director, PCRWR; Dr. Muhammad Ashraf; Abdur Raoof, Regional Director; Muhammad Aslam Tahir; Dr. Ashfaq Ahmed Sheikh; and Gary Cottrell, Chief, NWQL Business Development Team.

Update to National Field Supply Service



1Stop Enhancements

Since assuming responsibility for the National Field Supply Service (NFSS), the Hydrologic Instrumentation Facility, Office of Water Quality, and the National Water Quality Laboratory (NWQL) have enhanced the 1Stop Shopping catalog.

The catalog is now available by product name in addition to stock number sequence, and a listing of alternate sources for those items previously stocked by the Ocala Laboratory is provided. To access these enhancements, go to the first page of the NWQL section (see above) of the catalog and click sort by product name or Alternate Sources of Supply.

E-mail notification

In addition to the changes listed above, the NFSS is now sending an e-mail by way of Federal Express when an order is shipped that includes the Federal Express tracking number. Customers can now track their orders through the Federal Express transportation system, which will provide an estimated delivery date. For customers who have questions regarding order delivery, check the Federal Express tracking number prior to contacting the NFSS. Orders can be tracked on the Federal Express web site at *fedex.com*.

Price reductions

The NWQL has decreased prices in the 1Stop Shopping catalog because of changes in procurement strategies. Four examples of the price reductions are as follows:

Item number N1560 VIAL, GLASS, AMBER, SEPTUM, 40 mL, VOC – Reduced from $100.00 to $64.00 per case.

Item number N1210 CARTRIDGE, SPE, C-18, SCHEDULE 2010 – Reduced from $428.00 to $295.00 per case.

Item number N1300 KIT, CAPILLARY GLASS BORES, BAKED/REPLACEMENT – Reduced from $20.00 to $9.84 each.

Item number N1200 CARTRIDGE, SPE, C-18, SCHEDULE 2010 – Reduced from $10.70 to $7.46 each.

If you have questions, comments, or suggestions regarding the NFSS, contact Will Lanier at wdlanier@usgs.gov or call 303-236-3710.

• Will Lanier

New publications

(NWQL authors in **boldface**)

Bednar, A.J., Garbarino, J.R., Ranville, J.F., and Wildeman, T.R., 2005, Effects of iron on arsenic speciation and redox chemistry in acid mine water: *Journal of Geochemical Exploration*, v. 85, no. 2, February 2005, p. 55–62.

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Suzanne Roberts, Layout and Design

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