U.S. EPA Environmental Technology Verification Program
Advanced Monitoring Systems Center

Water Stakeholder Committee Meeting

November 4, 2004
Denver, Colorado

Meeting Minutes

ATTENDEES

Stakeholder Committee Members:
John Carlton, Alabama Department of Environmental Management (retired), Mobile, AL
Marty Link, Nebraska Department of Environmental Quality, Lincoln, NE
Alan Mearns, Ph.D., NOAA HazMat, Seattle, WA
Vito Minei, P.E., Division of Environmental Quality Suffolk County Department of Health Services, Hauppauge, NY
Richard Sakaji, Ph.D., California Department of Health Services, Berkeley, CA
Ken Wood, DuPont, Wilmington, DE

Observers:
Tanya Bayha, Metro Wastewater Reclamation District, Denver, CO
Jim Dorsch, Metro Wastewater Reclamation District, Denver, CO
Jon Evans, USGS, Stennis Space Center, MS
Janice Fulford, USGS, Stennis Space Center, MS
Jord Gertson, SourceWater Consulting, Buena Vista, CO
Michael Lewis, USGS, Denver, CO
Tony Medrano, U.S. EPA, Denver, CO
Lisa Olsen, USGS, Baltimore, MD
Toney Ott, U.S. EPA, Denver, CO
Steve Posavec, AWWA, Denver, CO
Karen Reed, U.S. EPA, Denver, CO
Bob Reehoorn, Battelle, Colorado Springs, CO
Don Smith, U.S. EPA, Denver, CO

EPA/Battelle AMS Center Staff:
Karen Riggs, Battelle, Columbus, OH
Rachel Sell, Battelle, Columbus, OH
Ann Louise Sumner, Battelle, Columbus, OH

Guest Speakers:
Gary Cottrell, USGS National Water Quality Laboratory, Denver, CO
Charles J. Patton, Ph.D., USGS, National Water Quality Laboratory, Denver, CO
Ken Moss, U.S. EPA, Washington, DC, (on Detail to EPA-Denver, CO)

OPENING SESSION: WELCOME, AGENDA, AND MEETING OBJECTIVES

Karen Riggs, Battelle's ETV program manager, opened the meeting by welcoming the committee stakeholders and observers and thanked USGS representative, Gary Cottrell, for hosting the event.

Due to the considerable number of observers present at the meeting, Ms. Riggs provided background on the ETV Program. ETV was established in 1995 by the U.S. Environmental Protection Agency to verify the performance of innovative environmental technologies. ETV provides third-party, quality-assured performance data so the buyers and users of these technologies can make informed purchase and application decisions. ETV now operates through six verification centers. Battelle, a nonprofit research organization based in Columbus, Ohio, is EPA's partner in the Advanced Monitoring Systems (AMS) Center. Battelle has been operating the AMS Center since 1997. The ETV AMS Center with Battelle verifies the performance of commercially-available environmental monitoring technologies that monitor natural species and contaminants in air, water, and soil.

Ms. Riggs stated two stakeholder groups, one focused on water and soil monitoring and a second on air monitoring, drive the verification process. Stakeholders represent the buyer and user community and help set priority technologies and technology categories for testing; identify commercially available technologies within priority technology categories; provide technical guidance and input to experimental design of verification tests; serve as technical peer reviewers for test/QA plans, verification reports, and verification statements; and serve as testing partners providing critical elements of the testing such as test sites, operators, and reference analyses. The stakeholder committees are also part of the extensive outreach the ETV Program provides.

Ms. Riggs then reviewed the agenda and the meeting's objectives:

- Update the committee on the status of the beach monitoring and nutrient monitor verification tests
- Identify next technologies to consider for verification
- Inform the committee about: ongoing nutrient monitoring activities at the USGS; EPA's waste program monitoring technology needs and the importance of ETV in meeting program objectives; and emerging toxic chemicals namely polybrominated diphenyl ethers (PBDEs)

STAKEHOLDER INTRODUCTIONS

Ms. Riggs invited the stakeholders as well as other observers to introduce themselves, provide any background of what they have been working on, and briefly describe any recent water quality monitoring activities, needs, or concerns.

Rick Sakaji of the California Department of Health Services said that as a regulatory agency they require the use of on-line instrumentation to monitor process performance in wastewater reclamation plants that produce recycled water for applications with varying degree of public exposure. The on-line process monitoring provides them with some degree of assurance that the plant is being operated in a manner that does not compromise public health when the public is exposed to the final product.

Vito Minei is the Director of the Division of Environmental Quality Suffolk County Department of Health Services. He described several activities his group his working on such as groundwater investigations for 60,000 to 70,000 homeowners wells (approx. 1.5 million residents), 200 industrial facility cleanups a year, an overseas marine monitoring program, and all applications for new development (i.e. the design and construction of water and wastewater treatment facilities). He said his group has an interest in beach monitoring as well as the measurement of pesticides and pharmaceuticals. He also stated his group has a longstanding relationship with USGS.

Marty Link of the Nebraska Department of Environmental Quality (NDEQ) announced she is now the Associate Director of NDEQ's Water Quality Division. Her scope of interest has broadened with this new assignment. She said her Division deals with a variety of issues, namely groundwater and surface water monitoring, TMDLs, USTs, and NPDES permits. She also noted NDEQ used the atrazine ETV verification reports to help make a purchasing decision this past summer. Ms. Link indicated her interest in blue-green algal toxins, which are a serious health concern.

Alan Mearns is an ecologist and marine biologist at NOAA. His current work includes chemical and oil fate models, and new tools to monitor nearshore and coastal waters. He is also concerned with hazardous algal blooms. He is also involved at other parts of NOAA and stated that NOAA's Pacific Marine Environmental Laboratory has just started a project to obtain real-time water quality data using detectors aboard Alaska State ferries.

John Carlton, retired from the Alabama Department of Environmental Management (ADEM), described some of his job functions at ADEM, which included responsibility for wastewater discharge monitoring, groundwater quality, ambient water quality in rivers and streams, beach monitoring, and oil spills. He indicated his group used the multi-parameter water quality probe verification reports to make a purchasing decision for a monitoring effort at ADEM.

Ken Wood of DuPont works on water and wastewater facility projects within Dupont and has also been involved in groundwater remediation projects over the years. He has an interest in nutrient monitoring programs at one of their plants as well as algae issues. Mr. Wood added that EPA is developing regulations under Section §316(b) of the Clean Water Act requiring cooling water intake structures to reflect the best technology available for minimizing adverse environmental impact. The proposed rule was recently published in the Federal Register. More than 1,500 industrial facilities use large volumes of cooling water from lakes, rivers, estuaries or oceans to cool their plants.

VERIFICATION STATUS: BEACH MONITORING
Karen Riggs, Battelle

Ms. Riggs described verifying the performance of beach monitoring technologies. From a historical perspective, beach monitoring has been a long-standing high priority category for this

Stakeholder Committee; however technology maturity has prohibited test initiation.

The application focus for the test was identified as rapid detection technologies (< 8 hrs) for quantification of enterococci in estuarine and marine waters. Current methods take too long (24 to 48 hours) to produce a result. The standard for marine recreational waters is 104 enterococcus colonies/100 mL. Vendor technology detection capabilities for enterococci were on the order of 100 to 1000 times higher than the regulatory level. Furthermore, most vendors had not worked very much with real matrices and had interference issues.

Ms. Riggs informed the group that several partners have been identified including:

- Southern California Coastal Water Research Program (SCCWRP);
- Alabama Department of Environmental Management (ADEM); and
- Several other stakeholders/states have expressed interest in participating (NY, TX)

In terms of other partner interest, Rick Sakaji suggested the FDA National Shellfish Sanitation Program (see http://vm.cfsan.fda.gov/~ear/nss2-toc.html). He said if they shift to enterococcus as an indicator organism they might have an interest in this verification test. John Carlton suggested the Interstate Shellfish Sanitation Conference (www.issc.org) as a resource for partnering information. He also asked that the vendors be made aware of the partner interest and market demand of a faster method of detection. Alan Mearns suggested NOAA's Mussel Watch Project, the longest continuous contaminant monitoring program in U.S. coastal waters, as another potential resource.

The first potential partner, SCCWRP, invited the AMS Center to participate in a planning meeting for testing of prototype technologies in March 2004. The technologies tested by SCCWRP were not mature enough for ETV verification and/or not commercially available, however all participants indicated high interest in ETV verification at later time. The beach monitoring verification test would include a more rigorous experimental design and would not just be focused on California water matrices.

Ms. Riggs outlined the approach that SCCWRP used in their testing. Samples were processed using both new technologies and traditional methods to evaluate equivalency to existing methods. Reference analyses were provided by five local microbiology labs which used membrane filtration (EPA Method 1600) and the IDEXX chromogenic substrate method. SCCWRP tested four new technologies:

1. Quantitative polymerase chain reaction (Q-PCR)
2. Immunomagnetic separation coupled with ATP quantification (IMS/ATP)
3. Flow cytometry (FC)
4. Dual wave fluorimetry (DWF).

Two phases of testing were conducted in June 2004. During Phase I, 18 samples were processed daily by technology developers over a three day period totaling 54 samples. During, Phase II samples were processed by local microbiology laboratory technicians to test the method transferability. The testing lasted one day and nine samples were measured.

Phase I test samples consisted of seawater inoculated with sewage, seawater inoculated with sewage, sewage-inoculated seawater with interferences added (e.g. humic acids and suspended solids), seawater inoculated with urban runoff, natural samples (one marine, three freshwater), as well as four blank samples. Blind triplicates of each sample were taken. The Phase II test design consisted of seawater inoculated with sewage at three concentrations with blind triplicates taken. Each technology was operated by two microbiologists from local labs. The individuals performing the analyses were experienced, but not experts in the area; training took place during Phase I. Technology developers also prepared methods manuals.

Ms. Riggs then summarized the SCCWRP findings. The first point is that none of the new technologies are ready for ETV verification right now; however Q-PCR seems the closest. Only one of the instruments was commercially available and was participating in the SCCWRP prototype testing before committing to ETV verification testing. Many of the technologies were also still working through interference issues. Errors were generally on the high side, which is consistent with an early warning application; the results produced by the technologies were repeatable. Developers and water quality specialists were able to perform the tests with minimal training. Three of the developers intend to continue technology development.

SCCWRP has plans for additional prototype testing in spring 2005 (March-April). Additional developers have indicated an interest in participating in the testing.

As far as ETV, new vendors have contacted the AMS Center with interest in participating in a beach monitoring verification. The current vendor list includes:

- OBIE Corporation
- Gen-Probe
- Gas Technology Institute
- Colifast (E.coli only)
- Silver Lake Research
- Designs & Prototypes
- SCCWRP prototype test participants (once they have commercially available technologies).

Lisa Olsen mentioned another vendor, Advanced Analytical Technologies, Inc. They have a product called the RBD 3000, a fully-automated bacteria detector. (See http://www.aati-us.com/).

Ms. Riggs explained that the plan for the beach monitoring verification is to cycle back to vendors in 3-5 months to check on verification readiness as developers continue to fine tune their equipment. The test is being planned for the 2005 beach season (June-August). The AMS Center continues to communicate with SCCWRP regarding their willingness to support ETV testing “on any level”. In addition, the Spring SCCWRP test could serve as final readiness check for vendors. The AMS Center also plans to identify potential funding partners within the EPA.

ADAPTING MARINE *IN-SITU* PHOTOMETRIC NUTRIENT MONITORS FOR FRESHWATER APPLICATIONS
Charles J. Patton, U.S. Geological Survey, National Water Quality Laboratory

Charlie Patton provided a brief introduction about his work at the USGS. Dr. Patton is a Research Chemist in the Methods Research and Development Program at the USGS and develops new analytical methods for the USGS's nutrient monitoring programs. Other interests include evaluating and developing "green" analytical methods for the USGS. Dr. Patton stated there is quite a bit of expertise within USGS with respect to nutrient monitoring and that he started working on this particular issue three years ago.

In situ analyzers can rely on different measurement approaches using electrochemical, colorimetric, or photometric (UV) instrumentation. Dr. Patton noted that instruments that use Ion Selective Electrodes (ISE) have measurement problems including lack of analytical sensitivity, interference from other ions, membrane fouling, and long term deployment issues.

Dr. Patton summarized that submersible, colorimetric nitrate analyzers became commercially available to marine scientists in the early 1990s. Over the past 10 years the use of these *in situ* nutrient monitors in oceanographic research has steadily increased. More recently, USGS has used these analyzers for unattended nitrate determinations in freshwater regimes at remote locations. Programmable sampling rates on the order of 1 to 4 per hour (sampling rates greater than 4 per hour are also possible) over periods ranging from a few days to several weeks provide temporal resolution of concentration changes that would be difficult or prohibitively expensive to obtain by conventional means. In addition, real-time *in situ* analyzers provide high temporal resolution of event-driven phenomena (e.g. tides, storms, etc.), allow for unattended operation, and eliminate costs and potential errors associated with sample processing, shipping, and storage. These analyzers also cost less than taking samples manually.

Because the use of *in situ* nutrient analyzers in USGS programs is likely to expand significantly in the future, Dr. Patton and other USGS scientists were motivated to evaluate analytical performance of these analyzers under laboratory and field conditions and to explore data-quality issues. Dr. Patton described the functional basis of photometric analyzers, suggested changes to chemical methods for improved operation in freshwater regimes, discussed the qualities of near-stream rather than in-stream deployment, and provided accuracy and precision estimates for nutrient concentration data collected in their laboratory and at remote locations. Collaborations with other USGS districts, such as the Oregon District's Klamath Lake site, were initiated to characterize chemistries and establish QC parameters for nitrate, orthophosphate, silicate, and ammonium analysis with NAS and EcoLAB analyzers.

In conclusion, Dr. Patton reiterated that *in situ* nutrient analyzers actually work and can be used for unattended operation. He noted some challenges associated with *in situ* analyzers such as the steep learning curve to operate the analyzers, the substantial amount of hazardous waste generated, and data telemetry. Dr. Patton also presented a comparison of the two types of analyzers he evaluated:

NAS-2E	*EcoLAB*
• One parameter	• Multi-Parameter
• Program Movements	• Build Macros
• No External Controls	• Control Pumps, etc.
• Simpler System	• Complex System

VERIFICATION STATUS: NUTRIENT MONITORS
Ann Louise Sumner, Ph.D., Battelle

Ann Louise Sumner, Battelle AMS Center Verification Test Coordinator, described the status of the test(s) of nutrient monitors, currently in the planning stage. Testing of nutrient monitors has two apparent applications, which include environmental and industrial monitoring. Dr. Sumner discussed the three types of technologies identified for monitoring nutrients: on-line monitors, in-line probes, and *in-situ* analyzers. The potential nutrient monitor vendors were reported based on the primary market targeted by the vendor websites.

Industrial Monitoring	Environmental Monitoring	Industrial and Environmental Monitoring
Applied Spectrometry Bran+Luebbe Danfoss Dionex Endress+Hauser Galvanic Hach Myratek* WTW	Applikon* Ecotech Greenspan Shimadzu* Systea* Teledyne-ISCO YSI ZAPS	Chelsea EnviroTech Hydrolab In-Situ Inc.* Satlantic SubChem

* Vendors have expressed interest in participation.

Dr. Sumner discussed the developing partnership for the industrial monitoring application with Ken Wood at DuPont. Nutrient monitors may be tested at an industrial wastewater plant through a common manifold. Ken Wood is still working to find a DuPont testing location. For the environmental monitoring application, USGS contacts Janice Fulford and Jon Evans have agreed to partner on a test.

Dr. Sumner summarized the potential testing plan, which would consist of a one-week "laboratory" phase, which would include spiking experiments in a controlled setting, and two 4-week extended deployments at two sites. For the industrial monitoring application, the two extended deployments may be at the plant influent and the plant discharge. USGS has identified a fresh water site for testing and are investigating the use of a brackish water test site. John Carlton suggested an alternate test site at the Gulf Coast Research Lab (see http://www.usm.edu/gcrl/about_us/index.php), but Janice Fulford indicated that it would be too far from the USGS Hydrologic Instrumentation Facility to be logistically feasible. Vito Minei suggested that longer or multiple deployments would provide more realistic information. Mr. Minei indicated that it would also be useful to evaluate the durability of the environmental monitoring technologies during transport to the test site (so-called "pick-up truck test") and would prefer that the analyzers be installed by test staff at the test site. It was acceptable to most to have the vendors perform the installation during the laboratory phase of testing. Dr. Sumner presented the potential test parameters according to the test phase during which they would be evaluated. Richard Sakaji suggested that evaluating the limit of detection would be useful.

Laboratory Phase	Extended Deployment	Overall
Accuracy	Long-term operability	Inter-unit comparability (?)
Precision	Matrix effects	Ease of use
Linearity	Comparability to reference method	Waste generation
Interference effects	Data completeness	
Temperature dependence (environmental only)	Maintenance	

The usefulness and logistical feasibility of evaluating inter-unit comparability was discussed. John Carlton suggested that this be offered as an option in the verification test during the laboratory phase. For the extended deployment, a second analyzer may be provided for use in case of analyzer failure. Vito Minei mentioned that the evaluation of long-term operability is very important and that data download procedures can be problematic.

The specific nutrients Dr. Sumner discussed for including in the test were nitrate, nitrite, ammonium, total nitrogen, phosphate, and total phosphate. The total nitrogen and total phosphate were recognized by Ken Wood as important since the regulatory criteria are for total nitrogen and total phosphorous. Vito Minei mentioned that organic nitrogen, which would be included in the total nitrogen measurement, is of growing interest. Organic nitrogen may be especially important at the sediment-water interface, which is an area of interest in environmental monitoring, although the technologies have difficulty monitoring in water containing sediment.

The evaluations to be included in the laboratory phase were discussed. Monitors would be provided with water samples spiked with nutrients, using reference measurements as the basis of comparison. Water parameters, such as temperature, pH, salinity/conductivity, and turbidity will also be monitored during the testing. The concentration ranges of interest vary depending on nutrient and testing application (environmental vs. industrial). The range of testing should bracket the concentrations expected during the extended deployment and the specifications for the technologies. For industrial monitoring, these levels will be in the part per million range and are expected to be in the part per billion range for environmental monitoring. Data collected from the test sites should be used to develop a reasonable range. Marty Link said there would be no phosphate in groundwater. Additional evaluations were suggested, which include varying pH (test at pH = 4 and 9) and testing colored water (potential of interference from tannins). Varying pH would not be necessary for the industrial application. Observer Lisa Olson suggested use of Suwanee River Humic Acid Standard for colored water, while Richard Sakaji mentioned that instant coffee and lignosulfonic acid have been used for this purpose. Battery life changes might also be important to evaluate.

Dr. Sumner presented a potential schedule for collection of reference samples during the extended deployment stage. It was agreed by the group that one reference sample may be collected every other day for the industrial monitoring application since little variation on that time scale is expected. However, for the environmental monitoring application, more intensive sampling periods may be needed. Observer Charles Patton suggested that sampling should occur at different times of the day (avoids Nyquist frequency problems and capture diel patterns) and observer Michael Lewis suggested that we sample during extreme hydrologic conditions (tides, wind, time of day). He also suggested that sites be picked that have measurable levels of nutrients so you don't end up with all non-detects.

Dr. Sumner stated that reference samples would be analyzed by the test partners using standard methods. The quality control samples are to include blind blanks and standards (10% of total), with an expectation of agreement within 25%. Rather than collect duplicate reference samples, Marty Link suggested testing sample splits to focus on analytical performance. Agreement within 25% is expected for sample splits. The schedule outlined by Dr. Sumner showed testing to occur in April and May 2005. Vito Minei suggested that it would be nice to push some testing into the summer months for both applications. The target report publication date is by September 30, 2005.

The question of which monitoring application (environmental or industrial) had higher priority was posed to the stakeholder committee. The stakeholder consensus was to proceed with both tests provided sufficient vendors commit and funding is available. Conducting the tests sequentially would allow common vendors to participate in both tests. The committee suggested broadening the scope of "industrial" monitoring to include applicability to sewage treatment by referring to it as "Plant Monitoring." It would also be important to have someone with a sewage treatment background review the test/QA plan.

Since the November 4 meeting, a potential plant monitoring test site was identified by DuPont. The site is located in Richmond, Virginia at a wastewater treatment plant. Discussions are still being held with USGS to determine a potential environmental monitoring test. Plans for the verification test(s) are ongoing.

AMS CENTER UPDATE AND DISCUSSION OF NEXT WATER TECHNOLOGY VERIFICATION CATEGORIES
Karen Riggs, Battelle

Ms. Riggs reviewed progress since the committee's last meeting. In addition to the verification tests discussed in this meeting, the AMS Center also finalized two reports on a second round of multi-parameter water quality probes, finalized four reports for atrazine test kits, and initiated vendor and partner recruitment for a third round of arsenic monitors. Ms. Riggs pointed out that six vendor agreements sent out in January and only one vendor, Wagtech International, was interested in signing the vendor agreement. Wagtech International's technology is the ARSENATOR™. Other vendors cited maturity issues or lack of available resources to participate. Vendors will be re-contacted in the next few months and testing schedule will be established if significant interest is generated at that time

Ms. Riggs then turned the discussion to next technology categories to verify. She reminded stakeholders that in order to proceed with a new water monitoring technology category information such as the vendor names (and their commercial technologies), potential partner names (and their organization and point of contact), and names of stakeholders to support test were needed. Ms. Riggs also stated that, for new technology categories, risk outcomes should be considered (i.e. what benefits will the technology have on the environmental conditions and human health in the long term).

Ms. Riggs asked stakeholders to review the priority for verification of past recommendations and to provide new recommendations. Past recommendations *(and stakeholder comments)* included:

- ***Non-membrane dissolved oxygen (DO) probes/multi-parameter water probes, Round 3***

Stakeholders still indicated a need for better DO probes and weren't convinced that the current generation (even non-membrane) was good enough. Vito Minei said the industry needed to be pressed to develop something better. Janice Fulford mentioned that they have done testing of optical DO sensors at the Hydrologic Instrumentation Facility and they didn't see much difference in performance, although the optical sensors were easier to maintain. Testing data from this project are not available to the public.

After the meeting, Ken Wood sent an email that said In-Situ has a luminescence-based DO probe available for their new line of multiparameter sondes (See: http://www.in-situ.com/In-Situ/Products/RDO/RDO.html.) He also listed Hach's "LDO" probe. He has looked at this probe for waste treatment applications. As a follow up, Vito Minei added that In-Situ calls the sensor their Multi-Parameter TROLL 9000. The Troll 9000 eliminates the need for membranes, stirring, and cleaning while allowing deployment for many months without need for re-calibration. Janice Fulford said the sensor that Ken Wood referred to is the same sensor that Aanderra uses. In-Situ has an agreement with Aaanderra to sell it on their Troll units

Following the meeting, additional information on the Aanderaa technology and the In-Situ technology was collected. The In-Situ DO probe is the same technology as the Aanderaa probe. In-Situ targets their technology in the freshwater market, while Aanderaa focuses on salt water applications. The Alliance for Coastal Technologies (ACT) conducted their first ACT Technology Evaluation of commercially available in situ DO sensors. The DO sensors were deployed in July 2004. All instruments were placed on a mooring frame that situated the dissolved oxygen sensors at 1-meter below the surface of the water. Testing parameters include accuracy, bias, precision, instrument drift, and reliability. Two main types of DO sensors are being tested: polargraphic membrane sensors, and new optical luminescence sensors. Four manufacturers that use DO technologies on their data sondes are participating in this first evaluation, including Aanderaa, In-Situ Inc., Greenspan Analytical, and YSI Environmental. A second round of tests is currently underway and the DO verification is expected to be completed by the end of September, 2004. Reports outlining the results for each instrument should be available in the spring of 2005. (See: http://www.actonline.ws/Alliance/Northeast/.) The Aanderaa DO probe was also verified in the Multi-Parameter Water Quality Probe Round 2 ETV testing (report published in July 2004).

- ***Microcystin ELISA test kits***

Marty Link said they used the Abraxis Microcystins ELISA this summer.

- ***Lead monitors/test kits***

The consensus was that there are numerous lead test kits available in the market and are currently EPA approved.

- ***Pesticide (alachlor, metachlor) immunoassays***

Stakeholders felt that, since atrazine has already been verified, testing alachlor and metachlor immunoassays would be a good technology category. The same vendors for the atrazine test should be contacted. In terms of partnering, it was suggested to contact the Office of Pesticides at EPA dealing with FIFRA.

- ***In-situ fluorometers***

Jeff Schloss was to provide names and manufacturers of scanning fluorometers and was not at the meeting to respond to this technology category.

Ken Wood said that DuPont has purchased several instruments from Turner Designs. They are marketing a new instrument called "AlgaeWatch" that purports to be able to give early warning of algal blooms.

- ***Polyaromatic hydrocarbon immunoassay kits***

No new vendor or partner information was supplied by stakeholders for this category.

Stakeholders recommended another technology category be considered for performance verification:

Vito Minei said that perchlorate is being seen all over the country and suggested it be another technology category. There is currently no federal National Primary Drinking Water Regulation for perchlorate, however is on the EPA's Safe Drinking Water Act's Contaminant Candidate List. In terms of measuring perchlorate, ion chromatography (IC) is the state-of-the-art analytical method for the measurement of perchlorate in water. Rick Sakaji mentioned Dionex as having an online perchlorate analyzer and thought that utilities in California would be interested in partnering in such a verification test.

The stakeholders felt that all identified categories were important for verification. Rather than assigning priorities, the stakeholders recommended that Battelle publicize the list of identified categories to the vendor community and verify whichever technologies are submitted first for verification. The October 2005 WEFTEC meeting in Washington DC might be a good forum to get the word out.

Tour of USGS National Water Quality Laboratory
Gary Cottrell, U.S. Geological Survey, National Water Quality Laboratory

Mr. Cottrell provided background on the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL) before the tour of the laboratory (See: http://nwql.usgs.gov/) He indicated NWQL is a fee-for-service laboratory whose primary mission is to support USGS programs requiring environmental analyses that provide consistent methodology for national assessment and trends analysis. In spring 1999, the NWQL moved into its current space at the Denver Federal Center campus. This 145,000 square foot facility was designed to maximize efficiency while maintaining an environment capable of detecting constituents at very low concentrations. The laboratory environment is computer controlled to minimize costs by using variable air handling and placing the building into sleep "mode" when no employees are present.

The NWQL determines organic and inorganic constituents in samples of ground and surface water, river and lake sediment, aquatic plant and animal tissues, and atmospheric precipitation collected in the United States. At present, about 60,000 samples collected with USGS field protocols are sent to the NWQL each year, making it one of the largest environmental water-testing laboratories in the United States. More than 2.3 million individual chemical determinations are made each year from these samples through agreements with USGS offices relating to national assessment and cooperative programs with other Federal, State, and local agencies. Analytical work intended for the NWQL flows through these USGS offices throughout the United States.

The NWQL provides the following types of environmental analytical testing:

- Organic chemistry
- Inorganic chemistry
- Radiochemistry
- Trace- and ultra-trace level detection
- Sorting and identification of benthic invertebrates
- Methods research and development.

The NWQL produces scientifically and legally defensible data supported by its own approved and published USGS analytical methods, and by U.S. EPA methods, along with three levels of chain-of-custody procedures when requested. A primary role of the research chemists at the NWQL is to develop new analytical methods. These methods are validated, approved, documented, published, and added to NWQL's analytical capabilities.

U.S. EPA MEASUREMENT AND MONITORING TECHNOLOGIES FOR THE 21ST CENTURY (21M^2) PROGRAM AND OFFICE OF SOLID WASTE MONITORING NEEDS

Dan Powell, U.S. EPA Office of Superfund Remediation and Technology Innovation

Dan Powell from EPA's Office of Superfund Remediation and Technology Innovation gave an overview of their waste program monitoring technology needs and the importance of ETV in meeting their program objectives. He stated that ETV and the Office of Solid Waste and Emergency Response (OSWER)/ Technology Innovation Program (TIP) have historically interacted in pre-ETV Centers, the SCMT Pilot, and for the identification of technology needs, vendors, and stakeholders.

The TIP role is to create an infrastructure for technology use and acceptance (See: http://clu-in.com/tiomiss.cfm). TIP provides technology and market information and works to eliminate policy and institutional barriers related to the deployment of these technologies. ETV and OSWER continue to work together because there are continued needs for new technology tools; current OSWER technology initiatives require reliable information on the performance of these new tools. Mr. Powell indicated there hasn't been as much interaction with the AMS Center previously as their focus was on air and water; however interaction could increase given the soil monitoring scope of the AMS Center.

Mr. Powell stated several programs are in place such as ETV, SITE, and outside research (i.e. SBIR) that complement their waste program needs. The first initiative Dan illustrated was the Measurement and Monitoring Technologies for the 21st Century or the $21M^2$ Program. The $21M^2$ Program was established to ensure continued development and application of technologies for evolving EPA waste program needs with a focus on all waste clean-up programs. The $21M^2$ website (see: http://clu-in.org/21M2) communicates program needs, vendor opportunities, project success stories. Relevant activities within the $21M^2$ Program to the AMS Center includes supporting EPA projects for the testing of a field method for detecting perchlorate, particulate matter CEMs, and most notably an ETV verification test of dioxin emission monitoring systems. Dan then listed waste program needs as part of the $21M^2$ Program. This list included:

- Air Emissions Monitoring
  - Continuous emissions monitors for use with thermal hazardous waste treatment systems
  - Remote sensing for fence-line monitoring for fugitive emissions/enforcement activities
- Characterizing and Monitoring Mining Sites
  - Monitoring technologies for mining waste sites
- Contaminated Sediment Characterization
  - Sampling and analytical technologies for potentially contaminated sediment
- Field Methods and Laboratory
  - New monitoring methods for total cyanides and cyanide speciation
  - Test kits or other alternatives to reduce the cost of safely screening for dioxin contamination
  - Develop robust field analytical methods for the detection of perchlorate, particularly in water samples.
  - Analytical techniques for pesticides and their degradation products

  - Field-based monitoring and measurement technologies for MTBE in soil and groundwater
- Indoor Air Quality
  - Monitoring vapor intrusion into buildings
- In-Situ Monitoring Systems
  - Sensor technologies for long term monitoring of groundwater
  - In situ sensors for monitoring groundwater contamination/treatment system performance
  - Leak detection technologies for small municipal landfills
- Monitoring Effectiveness of In-Situ Remedies
  - Monitors of natural attenuation and other in-situ systems
- Subsurface Chemical Detection Systems
  - Technologies for locating and monitoring DNAPL contamination
  - Non-invasive monitoring technologies for mercury and heavy metals in soils
- Underground Storage Tanks
  - Internal inspection methods for internally lined underground storage tanks (USTs)
  - Leak detection methods for underground storage tanks and pipes.

Another waste initiative was focused on DNAPL, or dense nonaqueous phase liquids. A recent expert panel report, *The DNAPL Remediation Challenge: Is There a Case for Source Depletion?,* concluded that the "range of benefits, from a risk management perspective," may result from DNAPL source-zone depletion, but the MCL goal is "...not likely to be achieved within a reasonable time frame in source zones at the vast majority of DNAPL sites". He further went on to state that EPA knows of cases (not Superfund sites) where project managers have reported that in situ treatment technologies have attained MCLs in a DNAPL source zone. However, EPA agrees with the panel report that better field data are needed from DNAPL source treatment sites to help determine types of sites where MCLs may be a reasonable cleanup goal. Dan said that DNAPL cleanup options include thermal cleaning (e.g. heating, steam), chemical oxidation, or surfactants/co-solvents and that adequate characterization is essential for efficient cleanup.

A final waste initiative Dan reviewed was Long-Term Monitoring Optimization (LTMO). Long term groundwater monitoring is a growing problem and represents a significant, persistent, and growing burden to site owners. The Navy and Air Force estimate annual long term monitoring to cost $35M and $52M, respectively. LTMO offers the opportunity to confirm that the monitoring program meets monitoring objectives (e.g. site conceptual model, hydrogeology and contaminant distribution, sampling and analytical methods, etc.). Newer 'quantitative' methods are available for evaluating sampling locations and sampling frequencies that employ statistics and geostatistics to evaluate redundancies or deficiencies in monitoring networks and answer the questions: 1) am I sampling at appropriate frequencies? and 2) am I sampling in the 'optimal' locations? Quantitative methods are used to support overall decisions regarding monitoring network (i.e., must be coupled with qualitative review).

At the conclusion of Mr. Powell's presentation he reviewed cross over interests between the AMS Center and EPA's needs. For air they include open path monitoring for: 1) fence-line monitoring, 2) hotspot identification, and 3) remediation monitoring/system operations, and for indoor air: vapor intrusion. For water quality they include characterization and monitoring of priority contaminants, namely, arsenic, perchlorate, and MTBE.

STRATEGY FOR AMS CENTER SOIL MONITORING
Karen Riggs, Battelle

Ms. Riggs provided a historical perspective on ETV soil monitoring as well as a summary of the discussion from the last meeting. The ETV Site Characterization and Monitoring Technologies (SCMT) Pilot conducted verification testing in soil monitoring. Technology categories verified included x-ray fluorescent analyzers, gas chromatographs/mass spectrometers, infrared monitors, immunoassay kits, ion mobility spectrometers and ion specific electrodes. Implementation of the six-center approach after the ETV Program's five-year pilot phase incorporated SCMT activities into the AMS Center. Ms. Riggs noted that the AMS Center's scope has always included soil monitoring technologies but to date the Center had not verified any soil/sediment monitoring technologies

Ms. Riggs discussed a possible approach to expand the current AMS Center Water Stakeholder Committee to include soil monitoring technologies. Stakeholders on this committee not interested or not having expertise in soil monitoring are not obligated to participate. She also stated there would be no significant changes to committee members since there are current water stakeholders with interest/expertise in soil monitoring. Soil experts would be added as identified.

She said the approach for the soil monitoring verification would be to look for opportunities to test technologies that are applicable to both soil and water matrices if such exist in high priority categories. Another suggestion was to consider Round 2 testing of SCMT technology categories, as those verifications are becoming dated and test/QA plans already exist. It would also be important to establish new partnerships in soil monitoring area (i.e. EPA Office of Solid Waste). She also pointed out that an agency like the USGS could bridge the gap between soil and water matrices. She stressed again it is important to consider risk outcomes for the verifications.

Ms. Riggs then asked the stakeholders for their input if they felt the AMS Center Water Stakeholder Committee could be broadened to include soil monitoring technologies. Vito Minei would consider including soil monitoring technologies as they tie in with groundwater technologies and said USGS would be a good link into the area of both. He said soil screening technologies could provide guidance to land developers. One stakeholder commented that he thought this idea force fit soil monitoring technologies into the water stakeholder committee and asked if resources were available to create a third stakeholder committee focused entirely on soil. Another committee member asked if the air stakeholder committee had been approached about this concept as soil can be suspended as particulate. Stakeholder committee members indicated they were still very much dedicated to water monitoring technologies.

It was suggested to look to see what the Environmental Security Technology Certification Program (ESTCP) is doing in this area. ESTCP is a DoD program that promotes innovative, cost-effective, environmental technologies through demonstration at DoD facilities and sites. One of the program areas looks at both site characterization and monitoring technologies (See: http://www.estcp.org/). It was also suggested to review the Strategic Environmental Research and Development Program (SERDP) Web site. SERDP is a multi-Agency program funded through the DoD that responds to environmental requirements of DoD and those that the DoD shares with DOE, EPA, and many other Government agencies, including NOAA and USGS. The program focuses on cleanup, compliance, conservation, pollution prevention, and UXO technologies (See: http://www.serdp.org/default.html).

Ms. Riggs then moved into a discussion on soil monitoring technologies to consider for verification. She said under the ETV SCMT Pilot several field analytical technologies were verified, including field portable X-Ray fluorescence analyzers, field portable gas chromatograph/mass spectrometers, photoacoustic infrared monitors, immunoassay kits, field portable gas chromatographs, ion mobility spectrometers, ion specific electrodes, decision support software systems, and soil, soil gas, groundwater, and sediment sampling technologies.

The next technology Ms. Riggs discussed was lead in soil technologies. She said it was an immediate need area identified by EPA's Environmental Technology Council. They are seeking vendors of test kits for lead in soil, paint, and dust that residents and consumers can use. EPA Regions, the Office of Pollution Prevention and Toxics, and HUD are also involved in this area as well.

Additional technology categories suggested to the group were:

- Immunoassay test kits (e.g., PAH or pesticide) for soil and water
- Perchlorates in soil
- MTBE detection technologies
- Near-real time UV fluorescence for PAH characterization
- Second round testing in SCMT technology categories (e.g. field portable GC or GC/MS)

There was some general agreement among stakeholders of the potential benefit of looking at lead technologies since lead is an issue in both soil and water. Stakeholders again recommended the addition of a committee of experts in soil monitoring for the AMS Center along with approaching the air stakeholder committee about considering monitoring technologies as well.

EMERGING TOXIC CHEMICALS: POLYBROMINATED DIPHENYL ETHERS (PBDES)

Kenneth Moss, U.S. EPA, Office of Pollution Prevention and Toxics

Ken Moss from EPA's Office of Pollution Prevention and Toxics delivered the final presentation on emerging toxic chemicals, specifically polybrominated diphenyl ethers (PBDEs). PBDEs are members of a broader class of brominated chemicals used as flame retardants called brominated flame retardants, or BFRs. Ken indicated these chemicals are very similar to PCBs. Ken suggested that down the road ETV could offer assistance in the area of verifying sampling techniques in lieu of detection technologies for this class of chemicals.

There are three commercial mixtures of PBDEs with differing average amounts of bromination: penta-, octa-, and decaBDE. These chemicals are major components of commercial formulations often used as flame retardants in commercial products such as furniture foam, plastics, fabrics, and appliances. The benefit of these chemicals is their ability to slow ignition and rate of fire growth, and as a result increase available escape time in the event of a fire. Mr. Moss indicated that there is growing evidence that PBDEs persist in the environment and accumulate in living organisms, as well as animal testing that indicates these chemicals may cause liver toxicity, thyroid toxicity, and developmental neurotoxicity. He said there is rapidly growing literature on PBDEs that have been measured in human breast milk, blood, food, wildlife, air, sludge and sediment, and elsewhere in the environment. Higher levels of PDBEs have been measured in North America than in Europe and Asia. In Europe, the European Union enacted a ban on PentaBDE and OctaBDE in all products which took effect August 2004. The State of California has enacted a law banning use of PentaBDE and OctaBDE by 2008 (now June 1, 2006.) Other states (including Hawaii, Washington, and New York) are also considering or have passed similar actions.

Environmental monitoring programs in Europe, Asia, North America, and the Arctic have found traces of several PBDEs in human breast milk, fish, aquatic birds, and elsewhere in the environment. Potential mechanisms or pathways through which PBDEs get into the environment or humans could include releases from manufacturing or processing of the chemicals into products like plastics or textiles, aging and wear of the end consumer products, and direct exposure during use (e.g., furniture).

Mr. Moss stated that EPA is taking action on the issue of PBDEs and is currently evaluating a risk assessment and data needs on PBDEs developed by chemical manufacturing industry for the Voluntary Children's Chemical Evaluation Program (VCCEP). The assessment evaluates the potential risks to children and prospective parents from all potential exposure scenarios. (See: http://www.tera.org/peer/VCCEP/OctaPenta/OctaPentaWelcome.html or http://www.tera.org/peer/VCCEP/DECA/DecaWelcome.html.) Ken said that existing data are not yet sufficient to make risk findings to support control action under the Toxic Substances Control Act (TSCA). More data are needed and EPA as well as other Federal agencies has been supporting research aimed at a range of topics related to PBDEs.

Mr. Moss went on to discuss that EPA has issued proposed rulemaking that will ensure that no new manufacture or import of these two chemicals can occur after January 1, 2005, without first being subject to EPA evaluation. This course of action, known as a Significant New Use Rule (SNUR), allows EPA under TSCA to require manufacturers, importers, or processors to notify EPA 90 days in advance of commercialization of a chemical for a significant new use. When a Significant New Use Notice (SNUN) is submitted, EPA can take action to limit or prohibit the new use, as it does for new chemicals. Furthermore, EPA is developing alternatives to PBDEs through the New Chemicals Program and EPA's Design for Environment (DfE) Program Furniture Flame Retardancy Partnership. EPA is also developing a PBDE Action Plan being prepared by a cross-agency workgroup. The plan will include a review of risk concerns, regulatory status, and current scientific understanding of PDBEs.

Next Steps/Next Meeting
Rachel Sell, Battelle

Rachel Sell, stakeholder coordinator for the AMS Center's Water Stakeholder Committee thanked stakeholders and observers for attending the meeting. She also extended thanks to Gary

Cottrell and USGS for serving as host for the meeting. Ms. Sell brought up several locations to host the next meeting to be held in sometime in summer 2005. Stakeholders indicated that July would be a tough month to hold a meeting and that the first part of August would be better. Stakeholders preferred either Maine or the Minneapolis area for the committee's next meeting in late July or August.