

# THE STANDARD

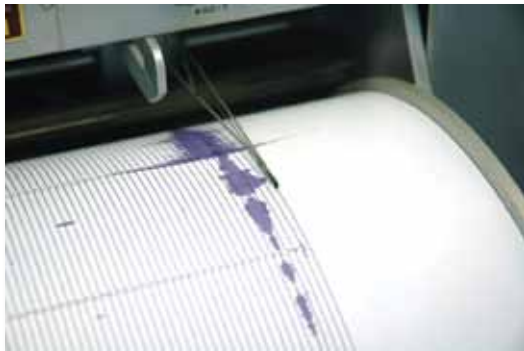
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[www.envstd.com](http://www.envstd.com)

## Does Injection of Hydraulic Fracturing Fluid Waste Cause Earthquakes in Ohio?

Given media coverage of the recent seismic events in Youngstown, Ohio, an understanding of the history and process of using injection wells as a disposal method certainly is important.

According to US EPA, the use of injection wells to dispose of wastes underground was documented as early as 300 AD during the reign of Constantine the Great. The first documented project for the disposal of oil field brine (salt water that is produced along with oil and gas) into the originating formation began in Texas in the 1930s. Enhancing the recovery of oil by injecting water or other fluids into a formation to extract additional oil and gas also began in the 1930s. Refineries began injecting liquid wastes in the 1940s and, eventually, it was determined that federal regulation



was necessary (i.e., to regulate the injection of wastewaters into the subsurface).

The use of injection wells is regulated under the Underground Injection Control (UIC) program of the federal Safe Drinking Water Act (SDWA), passed by Congress in 1974. The SDWA was signed by then President Richard Nixon, who also signed the Clean Air Act and several other environmental-control regulatory bills. Today, US EPA administers the UIC program and delegates regulatory authority over the SDWA to individual states, including Ohio.

The state of Ohio (via Ohio Department of Natural Resources [DNR]) issues UIC permits for Class II wells, but the standards in place for construction, maintenance, and continuous monitoring of those wells are set by the US EPA. Ohio EPA issues permits for Class I wells (Class I wells store industrial waste). Roughly 144,000 Class II injection wells are in operation in the United States today. On average, US EPA reports that those wells accept more



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## Announcing Environmental Standards' Newest Office Location – Houston, Texas

As we celebrate our 25<sup>th</sup> anniversary, Environmental Standards is pleased to announce the opening of our Houston, Texas, office location under the direction of Principal Chemist and Vice President Ruth L. Forman, CEAC. Senior Consulting Geoscientist David Lehmann, P.G., has joined the company and will assist with the growth of the Houston office. Mr. Lehmann brings over 15 years of experience in health, safety, and environmental services to Environmental Standards.

The new office, located at 11200 Richmond Avenue on the west side of Houston in the WestChase business district, opened March 5, 2012, and allows Environmental Standards to better serve our existing local clients as well as to grow the company. Be on the look-out for an invitation to our grand opening/open house and other related announcements.

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(Ohio, Continued from Page 1)

than 2 billion gallons a day of wastewater associated with oil and natural gas development. The state of Ohio is home to 181 of those Class II injection wells – or 0.12 percent of the nation's total. In 2011, records indicate that Ohio accepted an estimated 1.03 million gallons of wastewater for disposal per day – or less than 0.05 percent of the nation's total.

The oil and gas industry is not the only industry that has used injection wells as a safe and well-regulated disposal means in the US. Other sectors that rely on injection wells include chemicals, manufacturing, food and agriculture, plastics, and metal/steel. According to US EPA, "Injection [is] a safe and inexpensive option for the disposal of unwanted ... industrial byproducts."

In a December 19, 2011, interview on NPR with Diane Rehm, Dr. William Leith, seismologist with the US Geological Survey said, "The fracking itself probably does not put enough energy into the ground to trigger an earthquake. They're not a safety hazard. They're really not something that we should be concerned about." That stated, the USGS has also produced more than a dozen reports on the connection between seismicity and

deep-well injection since 1956. In a report issued in 1992, the USGS research team suggested "the phenomena of earthquakes triggered by deep well activities are certainly not new or unusual." On the other hand, Ohio DNR's Jim Zehringer noted in *The Wall Street Journal* on January 2, 2012, that, "The seismic events are not a direct result of fracking."

Although no clear linkage has been established connecting injection wells with the Youngstown seismic events, it is important to recognize that, for the most part, it appears that the public conversation on the topic is limited to a single injection well in the Mahoning Valley and not the centuries-old method of waste disposal itself – or the hundreds of other wells permitted and in operation across the country.

Injection of produced fluids deep underground has proven to be safe and a highly-effective means of protecting the environment, while generating much-needed revenue for Youngstown and the state of Ohio. Unfortunately, some of the stakeholders speaking with the loudest voices right now in opposition to these wells appear to be among the individuals with the least awareness of the decades-long history associated with Ohio's UIC program.

Governor Kasich and Ohio DNR have made the decision to temporarily halt injections at the Youngstown UIC well until "more facts come to light." But the oil and gas industry is, and has been, committed to making sure the issue is resolved scientifically, with facts and not hyperbole – only then can an informed decision be made.

Managing Partner and Principal Geoscientist Gerald Kirkpatrick has a former classmate, David Hill, from his Ohio Alma Mater (Muskingum University) who is involved in the industry. As Mr. Hill recently said, "...what's unfortunate is that some folks are attempting to use these events as a justification for stopping oil and natural gas development in Ohio – kind of like trying to argue that the auto industry should be shut down because a scrap tire dump caught fire somewhere. Hopefully, though, the facts will prevail and a reasonable course of action will be pursued. Ohioans deserve nothing less, and we ask for nothing more."

Environmental Standards will follow the Youngstown earthquake story as it evolves and resist the urge for sensationalism; as the facts emerge, *The Standard* will report. ■

## BP Launches *Gulf Snapshot*

In January 2012, BP Exploration & Production, Inc. (BP) issued its inaugural issue of *Gulf Snapshot*, which is designed as a bi-weekly newsletter to provide updates to the public on BP's commitment and ongoing activities related to the Gulf of Mexico cleanup. The inaugural issue featured top stories on a few of BP's continued efforts in the Deepwater Horizon response effort. In the weeks following the Deepwater Horizon incident, BP paid \$7.55 billion in claims to support economic restoration to the Gulf Coast community. Of that \$7.55 billion, \$1.3 billion went toward government entities and \$6.25 billion went toward individuals and businesses affected by the spill. As part of the Trustee's efforts to restore and enhance wildlife and habitats, increase fishing and boating locations, and provide related recreational uses in the Gulf Coast region, eight initial project proposals have been announced. BP has volunteered to provide up to \$1 billion to fund these projects.

As part of BP's continued effort to help the Gulf Coast in recovery and restoration, the company has initiated television ads to provide updates on BP's ongoing work in the Gulf of Mexico region and the continued efforts to re-attract tourism into the region. A recent example of this continued effort includes the January 2012 "Gulf Coast Seafood & Tourism Bash." This event was presented by BP in conjunction with the Allstate Sugar Bowl and the Allstate BCS National Championship in New Orleans, Louisiana. The event celebrated 2 weeks of Gulf Coast seafood, culture, and tourism in order to maximize exposure for the Gulf Coast during the Allstate events. An estimated 140,000 people

(Source: [www.bpgulfupdate.com](http://www.bpgulfupdate.com))

purchased tickets to the football games, while another estimated 150,000 fans came to New Orleans to cheer on their favorite team. Featured events included promotional announcements, vacation giveaways, guest celebrity chefs, seafood galas, pre-game parties, and more. For more information, visit BP's website, [www.bp.com](http://www.bp.com). ■

## US EPA Corrects Cleanup Standard For 1,4-Dioxane

The US EPA admitted in January 2012 that it had published an incorrect cleanup standard for 1,4-dioxane, an industrial solvent characterized as “likely to be carcinogenic to humans.” Although US EPA notified state agencies on January 10, 2012, about the mix-up, which dramatically relaxed the cleanup standard for 1,4-dioxane, the Agency will not publish a corrected number until March 2012.

When issuing its 2011 Edition of the Drinking Water Standards and Health Advisories, US EPA published a lifetime health advisory level (HAL) for 1,4-dioxane of 0.2 mg/L. As stated in a letter from the US EPA received January 10, 2012, by PA DEP, “the lifetime HAL was based on the recently released noncancer reference dose (RfD) for 1,4-dioxane. However, it is the policy of the US EPA Office of Water that lifetime HALs should not be developed for chemicals that are considered “known,” “probable,” or “likely to be carcinogenic to humans.” US EPA characterizes 1,4-dioxane as “likely to be carcinogenic to humans”; therefore, no lifetime HAL should have been derived for 1,4-dioxane.”

Public Employees for Environmental Responsibility (PEER) has asked US EPA

to identify the number of cleanups affected by the dioxane mix-up. Most toxic cleanups are overseen at the state level but many states adopt federal cleanup standards. Thus, any US EPA error is copied forward nationally through state regulatory systems. The Agency has not offered an estimate of the number of sites completed using unprotective standards.

PEER is also asking the US EPA to perform an audit of its drinking water standards and health advisories to ensure there are not any other mistakes. “We have been told that this official oops originated with unknown persons at EPA Headquarters,” added PEER Counsel Kathryn Douglass. “We do not know whether these errors are rife or rare but, given their significance, it would behoove EPA to take a second look at all of its cleanup standards.”

A copy of the US EPA letter to PA DEP is available at [http://peer.org/docs/epa/1\\_10\\_12\\_1\\_4\\_dioxane.pdf](http://peer.org/docs/epa/1_10_12_1_4_dioxane.pdf).

The US EPA announced that a contractor for external scientific peer review (Versar, Inc.) will conduct an external peer review meeting to review the draft human health assessment titled, “Toxicological Review of 1,4-Dioxane: In Support of Summary

Information on the Integrated Risk Information System (IRIS).” The peer review independent panel of experts meeting on the draft 1,4-dioxane assessment was held on March 19, 2012, in Morrisville, North Carolina.

The 1,4-dioxane mix-up is certainly not the first error admitted by US EPA.

In May 2011, US EPA acknowledged in a letter to Utility Air Regulatory Group (UARG) that it made a conversion error in the way mercury emissions data were calculated to set limits for the Agency’s mercury maximum achievable control technology (MACT) floor in the proposed Mercury and Air Toxics Standards (MATS) rule.

The US EPA issued the Mandatory Reporting of Greenhouse Gases Rule (40 CFR Part 98) on October 30, 2009, requiring reporting of greenhouse gas data and other relevant information from large sources and suppliers in the United States. More than 2 years later, on December 23, 2011, US EPA issued a final rule amending specific provisions in subparts A and W of 40 CFR Part 98. The revisions corrected technical and editorial errors in the original rule. ■

### 1987 – 2012: 25 Years of Innovative Environmental Solutions



Environmental Standards celebrates its 25<sup>th</sup> anniversary of business in 2012. On November 1, 1987, we opened the doors of our original Valley Forge, Pennsylvania, office as a niche provider of environmental services to the industrial sector – with a staff of two technical experts and one administrative professional. Today, Environmental Standards operates from our headquarters in Valley Forge and branch offices in Charlottesville, Virginia; Kingston, Tennessee; and Houston, Texas, with a unique mix of talented partners and more than 100 employees (many have been with the firm for more than 15 years).

Often referred to as a “think tank,” Environmental Standards is routinely asked by our clients to think about their projects and provide innovative solutions to address their environmental liabilities. Our clients include many Fortune 50 corporations in the oil and petrochemical, pharmaceutical, transportation, mining, automotive, and aircraft manufacturing industries; we have completed projects in virtually all 50 states, Canada, Mexico, Europe, South America, Asia, and Australia.

Environmental Standards plans to celebrate our 25th Anniversary in the fall with an Open House at our Valley Forge headquarters. We hope to see you then. ■

## Laboratory News

### Air Toxics, Ltd. Acquired By Eurofins/Lancaster Laboratories

Eurofins recently announced the acquisition of Air Toxics, Ltd., an air testing laboratory founded in 1989 and based in Folsom, California. This key move, coupled with the acquisition of Lancaster Laboratories in 2011, strengthens Eurofins' growing presence in the US environmental testing market. ■

## Uranium Mining in Virginia

Approximately 92 percent of the uranium used in the United States to power nuclear submarines and power plants is imported from other countries.

Historically, there has been little uranium mining east of the Mississippi River and none in Virginia. Virginia Uranium Inc., founded in 2007, would like that to change. Discovered over 30 years ago in Pittsylvania County, the Coles Hill deposit is valued by the company at \$7 billion. One of the largest deposits in the world, Coles Hills mining would occur over 35 years according to company officials, providing for 300 - 350 permanent jobs and an annual economic impact of upwards of \$35 million.

It has been called a "game changer" for Southside Virginia, but Virginia is a house divided. There are staunch supporters on both sides of the issue. Proponents cite jobs, economic impact, energy independence, and new mining technologies as strong reasons to lift the uranium mining moratorium imposed by Virginia's General Assembly in 1982. Detractors cite environmental and human health impacts as reasons to maintain the moratorium.

On December 19, 2011, the National Research Council of the National Academy of Sciences issued its findings in a report. The study did not make a recommendation on whether to lift the ban; rather, the

## Study Questions Conclusions of Duke Researchers On Marcellus Shale Methane Contamination

A December 5, 2011, article in the *Oil and Gas Journal* entitled "Methane in Pennsylvania water wells unrelated to Marcellus shale fracturing" discusses the results from more than 1,700 water wells sampled and tested prior to proposed gas drilling in Susquehanna County, Pennsylvania. The study identified that over 78% of the water wells exhibited detectable methane concentrations and that elevated methane concentrations in water wells in Susquehanna County are common and correlate with topography rather than proximity to oil and gas operations. The study also evaluated isotopic signatures of data from five gas wells, fourteen water wells (sampled by PA DEP and Cabot Oil and Gas), one natural spring, and nine water well samples analyzed by a team from Duke University.

The PA DEP evaluated the isotopic data collected (gas wells and water wells) and determined that the isotopic signatures of the shallower thermogenic Upper/Middle Devonian gases and the deeper Marcellus Shale production gases are distinguishable from each other. The study



also compared the isotopic results of the PA DEP/Cabot data to the isotopic signatures presented in a Duke University study that is commonly cited in the press. The comparison of the isotopic data between the two studies indicates that eight of the nine samples collected during the Duke study have isotopic signatures consistent with the Upper/Middle Devonian formations, which overlay the Marcellus Shale (the presence of methane gas is due to naturally occurring geologic formation emissions). The study concluded that methane concentrations in water wells in Susquehanna County are common occurrences and are related to topography and geologic origin, rather than proximity to oil and gas operations, including hydraulic fracturing. ■

report indicated that, "If the Commonwealth of Virginia removes the moratorium on uranium mining, there are steep hurdles to be surmounted before mining and processing could be established in a way that is appropriately protective of the health and safety of workers, the public and the environment." ([www.nap.edu/catalog.php?record\\_id=13266](http://www.nap.edu/catalog.php?record_id=13266))

Governor McDonnell intends to make Virginia the "energy capital of the East Coast." He has proposed legislation to expand natural gas use, provide certificates for utilities that invest in renewable energy, and provide funding to convert the state's vehicle fleet to those that run

on alternative fuels. He has requested uranium mining draft regulations from Virginia's mining and environmental regulatory agencies for the General Assembly to consider in 2013.

The ban will be in place through 2012, but the subject of uranium mining in the United States is likely to remain in the headlines. Interior Department Secretary Ken Salazar recently imposed a 20-year ban on new uranium mining claims on one million acres of public land near the Grand Canyon. ■

## President's Award: TVA's Team of the Year

Tennessee Valley Authority's Salute to Excellence award recipients were recognized at a ceremony held January 26, 2012, in Chattanooga, Tennessee. Congratulations to our clients and colleagues on the Kingston Recovery team, who were awarded the President's Award. It has been Environmental Standards' honor and privilege to work side-by-side with the team since early 2009. ■

## Article Published In Ground Water Monitoring & Remediation

"Rapid Analysis of 1,4-Dioxane in Groundwater by Frozen Micro-Extraction with Gas Chromatography/Mass Spectrometry" was published in the Fall 2011 issue of Ground Water Monitoring & Remediation.

Ground Water  
Monitoring & Remediation

Authored by Mengyan Li, Rice University; Patrick Conlon, Environmental Standards, Inc.; Stephanie Fiorenza, BP America; Rock J. Vitale, Environmental Standards, Inc.; and Pedro J.J. Alvarez, Rice University, the paper covers the development of an innovative micro-extraction of aqueous samples coupled with gas chromatography/mass spectrometry in selective ion-monitoring mode to selectively analyze for 1,4-dioxane with low part-per-billion detection sensitivity. This method requires a relatively small sample volume and can be considered a green analytical method as it minimizes the use of solvents and the associated laboratory wastes.

The full article can be viewed in Ground Water Monitoring & Remediation 31, No. 4, Fall 2011, pages 70-76. The complete abstract is available at [onlinelibrary.wiley.com/doi/10.1111/j.1745-6592.2011.01350.x/abstract](http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6592.2011.01350.x/abstract). The authors dedicated this article to the memory of their co-author, Patrick Conlon, who passed away in 2010. ■

## Mercury And Air Toxics Standards Issued By US EPA



*Emissions sources, like the coal-fired power plant shown here, will have up to 4 years to comply with MATS.*

On December 16, 2011, the United States Environment Protection Agency (US EPA) issued the long-anticipated Mercury and Air Toxics Standards (MATS), the first national standards to limit mercury and toxic metals emissions at coal-fired and oil-fired power plants. This rule will apply at about 600 power plants across the United States that emit air pollutants including mercury, non-mercury metallic toxics, acid gases, and organic air toxics including dioxin.

Power plants currently emit 50% of the mercury, 75% of the acid gases, and between 20% and 60% of the toxic metals (percentages vary per metal) released in the United States. Emissions sources will have up to 4 years to comply with MATS. A report in *The New York Times* estimated that when the standards are in full effect, the standards will reduce mercury emissions from power plants by 90% and acid gas emissions from power plants by 88%. The standards apply to all hazardous air pollutants emitted by coal-fired and oil-fired electric generating units with a capacity of 25 megawatts or more. Unlike the Clean Air Act, which allowed some older power plants to be grandfathered into the act due to their lack of "advanced pollution control equipment," MATS applies to all new and existing power plants. About 40% of coal-fired plants do not have the necessary pollution controls to meet the new standards.

According to the US EPA, MATS will cost \$9.6 billion a year, but will save lives and create \$90 billion in annual benefits. The new standards will prevent up to 530 premature deaths in Pennsylvania alone. Those who oppose the standards say that MATS will raise the cost of electricity, force older plants to close prematurely, and reduce employment in the power industry. ■

# The Changing Face of the TVA Kingston, Tennessee, Ash Spill Recovery

Things have changed a great deal since the coal ash spill that occurred on the morning of December 22, 2008, at the Tennessee Valley Authority plant in Kingston, Tennessee. Three years later, most of the ash has been removed from the river system, the remaining ash is being reshaped into geotechnically stable configurations, and many of the impacted land areas are being redeveloped for recreational use.

TVA has developed a long-term use plan that involves three recreation concepts - a ball field area on a 45-acre site, a 32-acre developed recreation area, and 60 acres of green space intended for bird/wildlife watching and wetland restoration.

## Initial Cleanup Effort

Immediately after the spill, emergency response actions were taken that included closing the Emory River to boat traffic; using controlled dam releases to manage flows; building weirs to control ash migration; repairing damaged railroads, roads, and utilities; collecting floating ash residue and debris; installing storm water management and dust control systems; and stabilizing the dikes.

TVA's massive response also involved dredging that eventually removed more than 3.5 million cubic yards of ash and sediment from the river system in less than 14 months. The ash and debris was dried and loaded into railcars for shipment to a disposal facility in US EPA-approved Arrowhead Landfill in Perry County, Alabama.

## Ongoing Work

Since the summer of 2011, TVA has worked to consolidate spilled ash that did not enter the river system. More than 1.6 million cubic yards of ash has been excavated from the northern and middle sections of the adjacent Swan Pond Embayment. The ash is being stored on-site in the dredge cell that is being rebuilt and reinforced to resist

earthquakes. The new dredge cell is designed with engineered slopes, a cover system to promote runoff and prevent infiltration, and a perimeter wall that is tied into bedrock. Work on the perimeter wall stabilization project to reinforce the dredge cell began in the summer of 2011 and will be completed by 2014.

TVA purchased some 900 acres of residential properties in the immediate vicinity of the spill and has retained ownership of these properties. The proposed long-term use plan has designated some of the area as recreational and green space areas for community benefit, while retaining some as permanent plant buffer. Work currently underway includes demolition of houses and other structures on the land designated for recreation reuse. The landscape of the proposed recreation areas has and will continue to evolve into a park-like atmosphere with soccer fields, ball fields, a boat ramp, fishing piers, walking trails, and wildlife viewing areas.

## Environmental Monitoring Programs

Along with cleanup and redevelopment work, TVA undertook an environmental

monitoring program to ensure protection of human health and to assess impacts to the environment. The program included monitoring dredging plumes, air monitoring, assessing surface water quality, and assessing potential impacts to a diverse biological community. The environmental monitoring programs will continue to evolve into a long-term monitoring strategy.

The long-term strategy is being shaped by findings of the environmental monitoring program as well as by TVA-funded research conducted by Oak Ridge National Laboratory and major university research programs. The findings of much of the research have been presented, discussed, and debated at two TVA-sponsored Environmental Research Symposiums.

Environmental Standards has provided Quality Assurance Oversight support for the TVA Kingston Ash Spill Recovery Project throughout the evolution of the program. As new project needs have been identified, we continue to provide services to ensure the quality and usability of the data produced by TVA, its contractors, and third-party researchers. ■

*Below: Aerial views of TVA's Kingston Fossil Plant on December 23, 2008 (left) and 3 years later on December 31, 2011 (right).*



## The Emergency Response Quality Assurance Oversight Program From Environmental Standards

Environmental Standards, Inc. recently introduced our Emergency Response Quality Assurance (QA) Oversight Program. The individual components of our QA Program – Chemistry QA, Consulting Geosciences, and Information Technologies – have always been offered; the components are now bundled together in one convenient program for our clients. The Emergency Response QA Oversight Program ensures higher data quality and defensibility during an Emergency Response.

### What is the Emergency Response QA Oversight Program?

In short, this is the program that will ensure that the quality of your data being generated and communicated to the media, regulators, and the public following an incident are legally defensible. One phone call to our Toll Free number (855-374-7272) activates our team of experts to respond to your emergency site - the very same experts who worked on the three largest environmental incidents in the United States.

### Prepare Now

Clients can prepare now by engaging Environmental Standards as their Emergency Response QA Oversight consultant. By doing so, clients will ensure “bullet-proof” data and minimize the demands on staff during an emergency response.

To learn more about the program or to schedule an introductory meeting, call Rock Vitale at 610-935-5577. ■



## Conferences

**Southern Gas Association Technical Conference on Environmental Permitting & Construction**, January 30 - February 2, 2012, New Orleans, LA. On behalf of the Marcellus Shale Coalition, Vice President/Principal Kevin Renninger, P.E., presented in a panel discussion titled “Working in the Marcellus – The Challenges of Developing Infrastructure in a Rapidly Changing Economic and Regulatory Environment.”

**The NELAC Institute Forum on Laboratory Accreditation**, January 30 - February 2, 2012, Sarasota, FL. Representatives from Environmental Standards attended.

**West Virginia Coal Mining Symposium**, February 1-3, 2012, Charleston, WV. Representatives from Environmental Standards attended.

**IOGA West Virginia Winter Meeting**, February 21-22, 2012, Charleston, WV. Representatives from Environmental Standards attended.

**Louisiana Oil & Gas Association Annual Meeting**, February 26-28, 2012, Lake Charles, LA. Representatives from Environmental Standards attended.

**Gulf Coast Environmental Affairs Group Meeting**, March 7-8, 2012, Lafayette,

LA. Representatives from Environmental Standards attended.

**Tennessee Environmental Conference**, March 13-14, 2012, Kingsport, TN. Representatives from Environmental Standards attended.

**Ohio Oil & Gas Association (OOGA)**, March 14-16, 2012, Columbus, OH. Representatives from Environmental Standards attended.

**Central New York Association of Professional Geologists (CNYAPG) Meeting**, March 15, 2012, Syracuse, NY. Senior Consulting Geoscientist David Lehmann, P.G., presented “Shale Gas Formation during the Paleozoic in the Appalachian Basin: The Perfect Storm.”

**Emerging Shale Plays USA**, March 21-22, 2012, Houston, TX. Representatives from Environmental Standards attended.

**Environment Virginia Symposium**, April 11-12, 2012, Lexington, VA. Technical Director of Chemistry Rock J. Vitale, CEAC, will present “Generating Meaningful Environmental Information In The Midst Of An Emergency Response.”

**41<sup>st</sup> Annual Tennessee Solid/Hazardous Waste Conference & Exhibition**, April 25-27, 2012, Gatlinburg, TN. Proj-

ect Geoscientist Jacob Gruzalski will present “Regulatory Acceptable Alternatives to RCRA Covers.” Environmental Standards is exhibiting.

**TCEQ Environmental Trade Fair & Conference**, May 1-2, 2012, Austin, TX. Mr. Vitale will present “Analytical Considerations During Natural Gas Fracturing Activities.” Visit Environmental Standards at Booth 918.

**Battelle Eighth International Conference on Remediation of Chlorinated and Recalcitrant Compounds**, May 21-24, 2012, Monterey, CA. Staff Geoscientist Scott Nash will present “Case Study: Use of Pressure-Pulsing Technology to Aid in the Development of a Subsurface Treatment Barrier.”

**Fifth International Symposium on Contaminated Sediments**, May 23-25, 2012, Montreal, Quebec. Staff Geoscientist Christopher Hawk will present “How the Use of a Quality Assurance Program Assisted in the Efficient and Legally Defensible Evaluation and Selection of Coal Ash Delineation Methodologies in Response to the TVA Coal Ash Release.”

If you would like a copy of a presentation or poster, please e-mail your request to akoss@envstd.com. ■



Setting the Standards for Innovative Environmental Solutions

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