

# American Institute of Professional Geologists

## KENTUCKY SECTION

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Kentucky Section AIPG  
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Lexington, KY 40524-4690

# Newsletter

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## ELECTION RESULTS

### 2009 Executive Committee

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## IN MEMORY

Ronald W. Yost CPG 05068

Yost, Ronald W., Lexington, KY, 62, died Saturday, November 29, in Chapel Hill, NC after a brief illness. He is survived by his wife, Christine Dunn; his daughter and son-in-law, Erin Yost and Barry Duncil, Raleigh, NC; his mother, Betty J. Yost, Painted Post, NY and his brother and sister-in-law, Jeffrey and Sandy Yost, Halifax, MA. Ron was also a loving uncle to Gina Snow, Greg Yost and Courtney Yost. A memorial gathering for family and friends who wish to celebrate Ron's life is planned for Saturday, December 20, beginning at 6 pm at his home. In honor of his love for his "golden girls" Big Bird and Bailey, Ron has requested donations be made to the Lexington Humane Society. (taken from the Lexington Herald –Leader, November 3, 2008)

## **SOME THINGS TO THINK ABOUT.....**

Members, do you know someone deserving of the Geologist of the Year Award? This person must be a geologist in Kentucky, but not necessarily a KY-AIPG member. Please submit along with this person's name, a letter as to why this person is deserving of the award. Letters must be in by **MARCH 1, 2009**, addressed to:

Larry Rhodes, Nominating Chairman  
KY-AIPG  
P.O. Box 24690  
Lexington, KY 40524-4690

Also do you know someone deserving of the Lifetime Achievement Award? This person must be a Kentucky resident and a member of the KY-AIPG. Names and letters should also be submitted by **MARCH 1, 2009** to:

Larry Rhodes, Nominating Chairman  
KY-AIPG  
P.O. Box 24690  
Lexington, KY 40524-4690

Each Persons chosen will be invited along with a guest to attend the KY-AIPG Spring Field Trip and Awards Banquet at no charge.

Tentative plans for the spring field trip will be to see the granitic dropstone, the Borden Formation, and the Black Shales around the Morehead area.

# GLOBAL CLIMATE CHANGE SYMPOSIUM



Dr. R. Timothy Patterson



PHOTO by John Beam

Dr. Kurt M. Cuffey

On Monday, November 10, 7 p.m., at the University of Kentucky's Memorial Hall, two internationally recognized experts on climate change presented their views on whether climate stressors are from natural or man-made causes.

The event was attended by about 175 people.

In the end, the point that was brought forth was that the mean global temperature is increasing and human activity is a possible contributor, but not necessarily the only factor. Some natural factors may be impossible to control, and even changing habits of humans may be difficult, but it is the most possible contributor to change.

Picture taken by John Beam may be viewed on his Web site, [www.jdbeamphoto.smugmug.com](http://www.jdbeamphoto.smugmug.com). Go to "Professional" directory, then "Climate Change Symposium." Pictures can be viewed and downloaded.

## HONORS AND AWARDS BESTOWED UPON AIPG MEMBERS



Dr. James F. Howard, CPG 2536, Owensboro, was the 2008 recipient of the Presidential Certificate of Merit at the American Institute of Professional Geologists (AIPG) 45<sup>th</sup> Annual Meeting, and the Arizona Hydrological Society (AHS) 21<sup>st</sup> Annual Symposium in conjunction with the 3<sup>rd</sup> International Professional Geologic Conference (IPGC). This award was given to acknowledge Dr. Howard's leadership and extraordinary investment of his time, personal resources, and energy in the AIPG outreach and educational efforts.

Larry Rhodes, CPG 2250, Lexington, was the 2008 recipient of the AIPG Martin Van Couvering Memorial Award at the same meeting. Martin Van Couvering served as AIPG's first president from 1963 to 1965. Van Couvering made it his goal to dedicate his time and effort into getting the institute off in the right direction. This award is given to a person who follows those sets of standards by giving his or her time and effort in the affairs of the institute.



David A. Williams, CPG 4810, Henderson, was 2008 recipient of the Eastern Section AAPG Gordon H. Wood Jr. Memorial Award. This award was established in 1989 and is presented in recognition of outstanding contributions to the geology of coal and other energy-related minerals, and the goals of the Association's Energy Minerals Division in the Eastern Section.

Daniel Phelps, MEM 0236, Lexington, was presented the Kentucky Academy of Science Distinguished Professional Scientist in a Non-Academic Position Award at the 2008 meeting



## FALL FIELD TRIP

The KSPG fall field trip, to which members of KY-AIPG were invited, took place November 21-22. Special thanks to the field trip leaders, Dr. Ken Kuehn and Dr. Mike May, professors at Western Kentucky University, and Scott Waninger and Dave Williams from the Kentucky Geological Survey. KSPG covered complete costs for any geology student who wished to attend the field trip.

On Friday, the field trip started at the Rough River Dam State Resort Park, with a visit to the dam. U.S. Army Corps of Engineers', Wendy Warren (a 2007 graduate in the geography program at WKU) gave us a tour of the dam improvements and repairs that have taken place. She also gave an overall Corps history of the lake and its surroundings. For more information, visit the U.S. Army Corps of Engineers Web site at [www.lrl.usace.army.mil/rnl/](http://www.lrl.usace.army.mil/rnl/).

That evening was a buffet-style dinner at the lodge, with after-dinner presentations. The first was by Carrie Pulliam of the Kentucky Geological Survey, whose presentation was on the features of the KGS oil and gas database. Donnie Lumm, Marshall Miller & Associates, wrapped up with a presentation on the criteria used to identify lower Pennsylvanian and Chesterian strata using outcrop and subsurface data.

On a cloudy, cold Saturday, after a great buffet breakfast at the lodge, we set off to view the middle Chesterian rocks of the area. Our first stop was on the Green family farm to view the Falls of the Rough. Here we got a geological history of the Falls and then toured the property to explore an arch bridge built in 1877 and the Green Mill.



Green Mill

We then proceeded 2 miles north of Caneysville on Ky. 79 to a salvage yard and quarry, where the basal Pennsylvanian Caseyville Formation can be seen unconformably overlying the Mississippian Kincaid Limestone Member of the Buffalo Wallow Formation.



Quarry Wall showing the contact of the Caseyville Formation (above yellow line) with the Kincaid Limestone Member (below yellow line).



Kincaid Limestone Member showing the skeletal intervals.

The next stop was on the Western Kentucky Parkway, near milepost 99, to view a paleoslump feature within the Caseyville Formation.



Good exposure of an ancient slump located above the Mississippian-Pennsylvanian contact. The slump is composed of fluvial sandstones, shale, and coal.



Next was milepost 100 on the WKP to view the systemic unconformity between the Pennsylvanian Caseyville Formation (above the yellow line) and the Mississippian Menard Limestone marker bed (below the yellow line) of the Buffalo Wallow Formation.



At milepost 105 on the WKP we viewed the asphaltic sandstone of the Caseyville Formation being terminated against the fault.



After lunch in Leitchfield, we proceeded to the Renegade Marine Boat Shop parking lot to view the contact of the Vienna Limestone, displayed by the red staining and weathered chert residuum, with the lowermost unit of the upper Chesterian Series of the Mississippian Tar Springs Formation. The double yellow arrow in the photo at left is a concretion/burrowed zone that separates the silty shaly upper zone from the carbonate-cemented sandy shale rhythmic-bedded lower zone.



We continued to the intersection of U.S. 62 and Ky 1365 to a new exposure of the Glen Dean Limestone. Fossils were numerous in the shales.



Photographs by Dr. Michael May (scale is 6 inches in length)



We then drove back to the lodge and walked down to the lake edge (the lake was down below its summer pool level) and saw great exposures of some sedimentary structures present in the Mississippian Big Clifty Sandstone Member.

The field trip concluded back at the emergency spillway of the dam where we viewed the Mississippian Haney Limestone Member and the Hardinsburg Sandstone.

# **GUEST COLUMN**

## **Sequestration for Managing Carbon**

**Brandon C. Nuttall, Kentucky Geological Survey**

Carbon dioxide ( $\text{CO}_2$ ) is a natural part of Earth's atmosphere that is essential to life. Climate change and energy issues are serving to focus scientific, public, media, and political attention on the fate of  $\text{CO}_2$  emitted as the result of burning fossil fuels. According to 2004 data (U.S. EPA), United States  $\text{CO}_2$  emissions from all sources exceeded 5.9 billion metric tonnes (113 trillion cubic feet). In Kentucky, more than 150 million metric tonnes of  $\text{CO}_2$  were emitted from all sources, including 87 million tonnes from power plants and 34 million tonnes from cars and trucks.

Emissions from the transportation fleet can be mitigated by increasing fuel economy, reducing the number of miles driven, switching to less carbon-intensive fuels (natural gas or hydrogen, for example), and other strategies. Different technologies are required to manage emissions from large-volume, stationary sources such as coal-fired power plants, however. Sequestration, or carbon capture and safe storage (CCS), is an integrated carbon management strategy that includes  $\text{CO}_2$  capture, transportation, and underground storage.

Carbon capture for reducing  $\text{CO}_2$  emissions can be accomplished either before or after burning fossil fuels. Pre-combustion capture involves reacting coal with steam at high temperature and pressure to produce synthetic gas containing mostly carbon monoxide and hydrogen. The reduced-carbon "syngas" can then be used to fuel integrated gasification combined cycle units for power or used to make liquid fuels (for example, the Fischer-Tropsch process to produce diesel fuel). Using chemical solvents can capture the high-pressure,  $\text{CO}_2$ -enriched exhaust from this process.

Post-combustion capture requires processing the relatively low concentrations of  $\text{CO}_2$  in flue gases. The exhaust gas is processed using chemical sorbants (amines and others) or microporous filters (sieves). Using amines for carbon capture requires heat to regenerate the solvent. Some solvent will be lost because of impurities in the gas and must be replaced. Both pre- and post-combustion carbon capture have an energy penalty; the power required to capture and compress the  $\text{CO}_2$  must be generated by the same facility emitting the  $\text{CO}_2$ . The cost of building new power plants that provide relatively simple and efficient carbon capture must be weighed against the cost of retrofitting older existing conventional combustion units with post-combustion capture facilities.

Once captured, CO<sub>2</sub> will be transported to consumers or to permanent storage. Much of the commercial CO<sub>2</sub> for the beverage industry and others is currently transported as a liquid by truck or rail. The volumes of CO<sub>2</sub> captured at power plants, however, will require pipelines used for decades in the petroleum industry. CO<sub>2</sub> from natural underground sources has been used in West Texas since the 1970's for enhanced oil recovery in older fields. Almost 2,000 miles of pipeline delivers 1 billion cubic feet of CO<sub>2</sub> per day (53,000 tonnes per day) to Texas oil fields, where it is injected to produce an additional 140,000 barrels of oil per day.

Enhanced oil recovery projects differ depending on whether the CO<sub>2</sub> is a gas or a liquid in the underground reservoir. In shallower fields like many in Kentucky that are less than 2,500 feet deep, the CO<sub>2</sub> is a gas that displaces oil much like a piston toward producing wells. In deeper reservoirs, liquid CO<sub>2</sub> interacts with the oil acting as a solvent to change the properties of the oil, making it easier to produce. While much of the injected CO<sub>2</sub> remains in the underground reservoir in enhanced recovery projects, some is produced with oil, captured, and recycled.

CO<sub>2</sub> injection for enhanced gas production has been successfully demonstrated in coal beds. When CO<sub>2</sub> is injected into coal, the coalbed methane (natural gas) is displaced and the CO<sub>2</sub> is preferentially retained. It remains to be demonstrated whether other rocks, such as gas shales, exhibit the same potential for enhancing natural gas production.

Calculations indicate that the volume of emitted CO<sub>2</sub> available for capture exceeds the amount that could be used for enhanced recovery nationwide, even if CO<sub>2</sub> EOR were implemented in all appropriate reservoirs. The large volumes of captured CO<sub>2</sub> not used for EOR will require other handling.

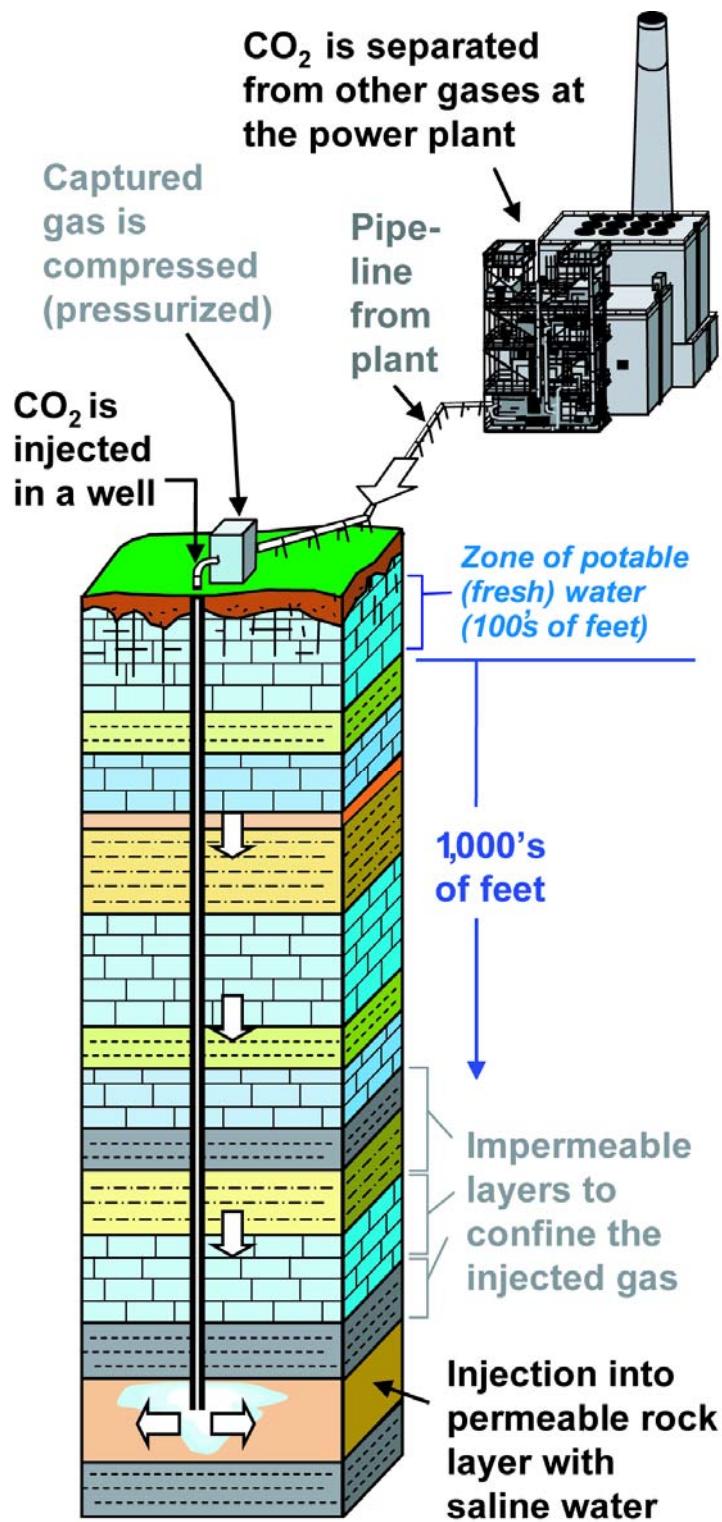
Current studies and technology alternatives suggest the best strategy for managing such volumes is to store it in deep underground reservoirs that contain salt water (brine). At the pressure and temperature conditions of deeper reservoirs, CO<sub>2</sub> will be in a higher-density liquid phase (supercritical fluid), thus allowing more CO<sub>2</sub> to be stored per volume of rock. The challenge of finding these reservoirs is basically the same as that of locating oil and natural gas resources, reservoirs that have contained mobile fluids for millions of years. For successful storage, deep underground rock units must be located that have sufficient volume to contain the CO<sub>2</sub> (porosity) and a seal to prevent its migration. Selecting a site for permanent storage involves many factors: the geometry of the porous zone; the ability of the rock unit to take fluid (injectivity); the chemistry of the CO<sub>2</sub>, rock, and brine interactions; the integrity of the seal (permeability, faulting, fracturing); the presence of secondary seals; drilling and well construction costs; and other factors.

Can these strategies for carbon management work? In addition to the CO<sub>2</sub> pipelines and injection wells associated with enhanced oil recovery projects in Texas, other industries and projects have demonstrated the requisite underground storage and materials-handling technologies. The natural gas storage industry maintains more than 8 trillion cubic feet of natural gas in nearly 400 underground reservoirs, including deep saline aquifers. This gas is gathered and distributed by nearly 300,000 miles of pipelines.

The Great Plains Synfuel Plant operated by the Dakota Gasification Co., North Dakota, is successfully converting coals to synthetic fuels. CO<sub>2</sub> captured from the facility is delivered by pipeline to the Weyburn Oil Field in Canada for enhanced recovery. Statoil of Norway is stripping CO<sub>2</sub> from natural gas produced from their Sleipner West Field in the North Sea and has been injecting approximately 1 million tonnes of CO<sub>2</sub> per year (since 1996) into a saline aquifer approximately 1,000 meters below the sea floor. The In Salah project, Algeria, is re-injecting CO<sub>2</sub> removed from their produced natural gas stream into the lower end of a steeply tilted reservoir as a part of their long-term field management plan.

In Kentucky, coal is expected to remain an important part of our energy future, and carbon management will likely be an essential factor to be addressed by regulators, utilities, investors, and rate-paying customers. What Kentucky lacks is hard data conclusively demonstrating the required storage is present in our underground reservoirs. Kentucky House Bill 1, sponsored by Rep. Rocky Adkins and others and passed in a 2007 special summer session, is a proactive initiative that charges the Kentucky Geological Survey with investigating and testing underground storage strategies in the commonwealth. The survey will test carbon storage with two deep wells, one in each of the state's coal basins, and will test both enhanced oil and natural gas recovery. Successful completion of this multiyear project will demonstrate that utilities and industries using Kentucky's coal, its "ace in the hole," will be able to economically address clean air and environmental concerns.

***Disclaimer-*** *This article represents the views of the author and does not necessarily reflect the views of the entire Kentucky Section of the American Institute of professional Geologists membership.*



Carbon management involves capture, transport, and storage of carbon dioxide  
 (Illustration courtesy of Steve Greb, used by permission of artist).