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Scott Smith, Chair, *Lexington*
Jason DeLambre, Co-Chair, *Lexington*
Dr. Kimberly Holmes, *Lexington*
Tom Herman, *Louisville*
Laura Knoth, *Grand Rivers*
Martha Tarrant, *Lexington*
Mark Grisham, *Paducah*

EQC Public Forum

Feb. 21, 2013

Host site:

Kentucky State University
Academic Services Building

Video sites available were:

University of Louisville
Murray State University at Paducah

EQC Commissioners Present:

Kimberly Holmes
Tom Herman
Jason Delambre
Mark Grisham
Martha Tarrant

EQC Staff present:

Arnita Gadson, Executive Director
Janet Pinkston, Executive Assistant

No public speakers

Presenters: Brandon Nuttall, Kentucky Geological Survey
Gregory Guess, Department for Energy Development and Independence
Clark Dorman, Division of Water

Meeting called to order at 6:10 p.m. by Jason DeLambre, Vice Chair.

Brandon Nuttall of the Kentucky Geological Survey

Fracture Stimulation in Kentucky.

The International Energy Agency estimates that the United States can become a net energy exporter in the next five to 10 years. We could be a natural gas OPEC. Instead of buying transportation fuels from overseas, we could be using natural gas, compressed liquids and refining it and using our own fuels.

The increase in the last 5-10 years in natural gas production has been all due to hydraulic fracking and application of that technology.

Of all sources, including imported natural gas, the U.S. uses 24.3 trillion cubic feet (Tcf) per year

It is estimated that the U.S. has:



1. Shale gas “proved reserves” (location known, technology available and economically feasible to produce) of 97.4 trillion cubic feet per year
2. “Technically recoverable” shale gas of 862 trillion cubic feet
3. Of total gas in place, estimated 3000 trillion cubic feet.

What is fracking? It is the completion method used to enhance the output of natural gas wells. Once drilling has been completed and a well built, fracking is performed to boost its production. It is separate from drilling.

Fracture stimulation uses pressurized or energized fluids to crack rock underground. In the past, various explosives like black powder, nitroglycerine and ammonium nitrate (fuel oil) were used. Now, energized liquids like water, diesel, carbon dioxide and nitrogen are used. Experiments with propane are under way. In Kentucky, nitrogen is primarily used.

Oil and gas are held in the porous part of an underground reservoir. Devonian shale type rock, prominent in Kentucky, forms a seal. Experts have discovered that there is oil or gas in the shale, but a technique must be applied to produce it.

Shale requires stimulation. When energized fluids under pressure are applied, more of the reservoir can be accessed without drilling more wells.

Why frack? The bottom line is energy. There are many places in the United States with shale resources appropriate for recovering oil and natural gas.

What chemicals are being used? What is going underground?

Most of it is 95.5 percent water with some sand. In Marcellus, Pennsylvania, New York and parts of Ohio, 5 million gallons of water and 10,000 gallons of chemicals, were used in a fracture stimulation. Chemicals of concerns are biocide, antifreeze, scale inhibitors, gelling agents, friction reducers, and brick cleaner.

To locate chemicals used, go to Fracfocus.org , a site sponsored by the Groundwater Protection Council and Interstate Oil and Gas Compact Commission. Kentucky is not on the site because there is no water fracking in the Commonwealth.

Fracking with gas has been common since the mid 1970s. Kentucky uses primarily nitrogen. Not every chemical is used in every stimulation.

Reporting by drillers is voluntary, except in five states. Individual wells list ingredients at a particular site.

How is the water protected?

Well construction is the first line of protection for groundwater.

In Kentucky, well construction standards are governed by KRS 353 adopted in 1960. The law sets permitting, construction and drilling standards. Drilling records are required and wells must be plugged.

Safe Drinking Water Act guidelines are designed to protect water.

The drillers are obligated to know the elevation of the surface, the fresh saline interface. Drillers must protect this minimum depth, plus 30 to 50 or more feet. The information has been available since 1966. Another key protection for freshwater is EPA's Spill Prevention Control and Counter Measures.

What can go wrong in oil and gas operations? How?

Groundwater can be and is, contaminated sometimes, but fracking is not the source. Typically, the problem is a construction flaw.

1. Well construction (problem with casing or cement). In Kentucky, there are few standards on construction of domestic water supply wells. About 5-10 percent of Kentuckians use groundwater for drinking water.
2. Frac out of zone. Can encounter an unexpected fracture or old wellbore. A plugging fund, financial support, addresses leaking wells. There is an emergency provision if oil seeps out of an old well. It can be fixed. Plugging without bids is permitted when there is obvious and immediate need.

Does fracking cause earthquakes? Yes, two in Texas and two in Arkansas to date. But according to the USGS and National Research Council it is rare:

- Risk is higher for wastewater disposal and injection wells, referring to UIC Class II type wells
- Waste injection is safe and regulated to protect fresh water.

Of quakes caused, no property damage to date and no injuries or fatalities have been reported. The risk is small.

Regarding these problems, the EPA has investigated degraded water quality in Pavillion, Wyoming in 2011 and Dimmock, Pennsylvania in 2009-10. Basic findings:

- Lack of baseline data
- Found diesel and gasoline in Underground Sources of Drinking Water (USDWs). Sources unknown.

In Pennsylvania, an operator damaged an underground source of drinking water, signed consent order to remediate and performed clean up. If antifreeze is spilled, it's not irreparable.

EPA asked for greater transparency, pointed to Fracfocus. EPA and state regulators have investigated reports of burning water. In the film Gasland, tap water catches fire. What the film did not say is that these cases have been investigated and fracking was not at fault.

In Parker County, Texas and in Eastern Kentucky, findings reveal that gas is commonly co-produced with water from shallow aquifers. Methane in the soil dissolves in the water as it rains and can mix with the groundwater system.

Bacteria metabolizes the coal to produce methane and if a domestic well and pump house are not ventilated, it will produce explosions and fires.

These are historic occurrences that predate fracking by centuries, people don't realize their freshwater is coming from an oil and gas reservoir.

Horizontal wells are drilled because so the operator can access more reservoir volume and minimize surface impact of the operation. There are less than 13,000 horizontal wells in Eastern KY.

Fracture stimulation has been used in Kentucky for 200 years. John Shaw used black powder in 1806 to improve water well flow.

The first use of explosives for oil wells in Kentucky was in Warren County in 1888. Hydraulic fracking was invented in the U.S. in 1946 and first used in Kansas. The technique came to Kentucky in 1966 but when it was tried in Kentucky's shale wells, clay minerals absorbed the water and expanded it; so water actually damaged, rather than enhanced, production.

In 1972, nitrogen under pressure was used. According to records since the late '70s, all wells have been nitrogen fracked because this reduces damage to shale.

Today, Kentucky has a healthy natural gas industry with production in 35 counties, as many as 18,000 to 20,000 producing wells. Approximately 10,000 to 15,000 of those wells have been fracked. Most gas comes from Eastern Kentucky, the Big Sandy field, which includes Pike, Martin, Perry, Floyd, Harlan and Letcher counties.

Natural gas production is up in recent years. With the installation of a stripping plant in Floyd County, we are now collecting data on natural gas liquids produced. Severance tax money has increased.

Enforcement of fracking is done through the state Division of Oil & Gas.

Most companies will do production logs, but in Kentucky, these logs are not public information. Public records are available through the Kentucky Geological Survey; online searches and interactive maps are available.

Documentation on 180,000 wells is available.

Conclusions:

- There will probably be new EPA best management practices for siting, monitoring and operation. This will cut down on incidents like the one in Ohio, where a small earthquake was caused

EQC: How is gas gathered from rural areas?

Nuttall: In Eastern Kentucky there is a gathering line system, to compressor, to processing station, to product pipeline, then to market. But there are many abandoned wells. There is some discussion on putting a natural gas fuel cell on an isolated well to sell electrons onto the grid.

People are looking at natural gas turbines for power generation on a local scale to run a drilling rig for example. There are options. Fueling stations are being built, one in Louisville with Waste Management and one to open near Pikeville. A vendor will convert all machinery over to compressed natural gas for trucks in their mines, and will be open to the public. The market for this gas is emerging.

EQC: From a climate change point of view, it is a relief to know we are moving to natural gas at the utility level. It has been noted that the carbon footprint has dropped back to 1995 levels, which is amazing. Upon reaching the supply line to the utilities, it doesn't look as well because of leaks in pipes.

Nuttall: Howarth of Cornell published a paper prior to being peer reviewed, citing leaks around Rangely, Colorado using old data. He was unaware the Colorado Corporate Commission had noted the problem and operators were installing capture and recycle equipment which reduced emissions significantly.

Howarth used leaky pipeline from Russia as a model due to the fact it was one with available data. But it was not a good analogy because of the tens of thousands of miles of pipeline in the U.S.

EQC: Working at a chemical compound, toxic chemicals are used, many that will gasify. The federal government requires leak detection and repair. Is there any set standard for these operators to do the same?

Nuttall: No, at this time, I don't know about emissions standards. First, there is no clear idea how much is being emitted. This is a criticism, Howarth made assumptions. There is a study at MIT of emissions during drilling, and the flowback and recovery of water. EPA has requested the findings.

During drilling, all operators in Eastern KY have a sniffer on their drilling equipment, which is an alarm system that causes shutdown and allows time for evacuation. That's qualitative not quantitative monitoring.

EQC: What is the range of depth on horizontal wells?

Nuttall: Some as shallow as 2,000 feet, but 3,500 to 5,000 is typical. Laterally, the longest one is over a mile.

EQC: If oversight into the operations were to be increased, what is most important? Reporting?

Nuttall: My personal opinion is the best place to focus is on verifying well construction. Methods exist to do that but there is no requirement for that information to be submitted every time, and no staff in the Division of Oil & Gas to interpret that data to make sure it says this is a good well. It boils down to time and money.

EQC: There are things done incorrectly with geothermal well drilling.

KY has been losing inspectors, they cannot physically be at every site when cementing.

EQC: We must get ahead of the curve, there is misinformation. The average depth of one of these wells is 5,000 to 20,000 feet deep, well below the water table. An average inquiry is "What about radioactive materials injected into these wells?"

There are tracers with radioactive materials embedded in glass beads with short half-life of a few hours or few days, so risk is minimal. There are real opportunities here. If it is done with transparency, everyone wins.

Nuttall: There is a new British film produced called Frack Nations. It is perhaps a rebuttal to Gasland. Added information for the public.

Greg Guess, KY Department for Energy Development and Independence

DEDI is administering an environmental mitigation fund, which is the result of a settlement of a suit filed against TVA (EPA + 4 states)

Kentucky's share is \$11.2 million-five payments over 5 years @ \$2.2 million/year. The following projects were chosen:

1. **Kentucky School Boards Association (KSBA): \$700,000** to support School Energy Managers Project in school districts in and adjacent to TVA counties. Cost avoidance of \$2.4 million in annual energy cost by FY 2016 projected.
2. **Pennyrile RECC: \$3.1 million** to construct a 5MW solar photovoltaic project at Fort Campbell in Christian County. Grant leveraged with \$15 million in financing from Fort Campbell. Completed system will generate more than 6,651 mWh/year of electricity, enough to power 463 homes, while avoiding 4.7 million tons per year of CO2 emission.
3. **Kentucky Housing Corporation (KHC), Frankfort: \$3 million** to support ongoing KY Home Performance Program. Grant funds three years of operations during which at least 611 additional energy efficient units will be completed. The program will focus on owner-occupied, single-family energy efficiency loans ranging from \$1,000-\$25,000 per home.
4. **Governor's Office of Agricultural Policy (GOAP): \$750,000** to support KY On-Farm Efficiency and Production project. Statewide loan program offers farmers up to \$15,000 to adopt new technologies, renovate existing facilities, produce energy related crops and invest in other energy efficient measures. GOAP will invest half of the funds in TVA counties.
5. **Murray State University: \$309,000** to install, test and demonstrate biomass heating at MSU Equine Center designed to offset fossil fuels with renewables at a rate of 40 mWh per year of electricity. One unit will be portable to demonstrate a model to farmers, industry and others.
6. **Fayette County Public Schools: \$335,000** to support integrated live energy metering project. Project comprises live energy monitoring equipment, live data analysis software, and a district-wide public-facing energy and sustainability education portal. Project will save more than \$1.1 million a year in energy costs and reduce CO2 emissions by more than 11,000 tons per year.

7. **Perdue Farms Inc., Beaver Dam: \$145,000** to divert poultry waste from the county landfill to an anaerobic digestion and generator system. Result will be removal of 1,500 tons per year of organic waste from county landfill and the subsequent generation of 620 mWh/year of electricity.
8. **Bowling Green Independent Schools: \$34,000** to install a solar thermal domestic hot water system for school kitchens as well as a solar photovoltaic system to offset a portion of the total building energy. In addition to saving over 140 Mbtu/year of fossil fuel heating, the systems will be incorporated into the school's science curriculum as teaching tools.
9. **Southern Tier Housing Corp., London: \$504,000** to support energy modeling and design research to develop a generation systems to be installed in the Kentucky TVA service area. More cost effective and energy efficient, Houseboats to Energy Efficient Residences (HBEER) factory-built structures. The project will include construction of four new energy efficient, factory-built structures equipped with photovoltaic generation systems to be installed in the Kentucky TVA service area. Use for the structures: Temporary classrooms.. School districts intending to use them for say 3 years usually have them for 20 years.
10. **Hickman-Fulton Counties RECC: \$316,000** to replace inefficient outdoor lighting fixtures with energy efficient, long-life bulbs. Project to save 600 mWh/year of electricity and reduce CO2 emission by 440 tons/year. The project is leveraged dollar-for-dollar by HFCRECC.
11. **Mountain Association for Community Economic Development (MACED), Berea: \$300,000** to support On-Bill Financing Residential Energy Efficiency Retrofit Program. The program will perform 150 energy efficient retrofits to area residences. Retrofits will save approximately 825 mWh/year of electricity representing more than \$90,000 a year of savings to participating customers' utility bills. Participants don't have to borrow money from the bank. People are paying more attention to their energy bills and realize energy is a controllable cost.
12. **Department for Local Government (DLG): \$1.2 million** to support continuation of the Energy Efficiency and Conservation Block Grant (EECBG) program, grants to local governments for programs that reduce energy consumption and greenhouse gas emissions, reaping utility costs savings for local governments.
13. **Lord Corporation, Bowling Green: \$504,000** to manufacturer adhesive coating and motion management technologies, to improve the site's chilled water and boiler plants. Savings achieved from the project comprise more than 1,256 mWh/year of electricity and more than 113,000 therms/year of natural gas. Lord is leveraging the grant dollar-for-dollar.

All projects should be completed up by 2015.

Another DEDI project is SEE KY, an acronym for Stimulating Energy Efficiency in Kentucky. Utilities are preparing for rate increases in the face of proposed EPA Clean Air Act regulations that will cost billions for compliance.

SEE KY is an agreement between the Federal Dept. of Energy and KY DEDI. Kentucky's obligation is to achieve a 1 percent increase in electrical energy efficiency across the state and in all economic sectors. It will take a few years to achieve. Must build policies and programs via stakeholders. Some states mandate getting x- percent of power from efficiency, or from renewables, but we didn't feel that this approach would work in Kentucky.

Improvement is needed because KY has enjoyed some of the lowest electricity rates in the nation, but that is changing. Electric rates here are fourth lowest but ninth fastest rising and prices have significant impact on how we fare economically. There have been announcements from aluminum smelters saying they will shut down if there is no rate relief. Together, they account for 70 or 80 percent of the power produced by Big Rivers. If they close their doors, there will be an economic enormous negative impact.

Big Rivers customers will have to make up some of that difference. Unemployment would rise significantly in that area.

In meetings with stakeholders, i.e. contractors, utilities and environmental organizations, advocacy and housing groups, the goal was to get broad input to develop consensus. What we've found:

- No support for mandatory energy efficiency standards/actions to the utilities
- Support for the current Demand Side Mgt. statute—IOUs
- Programs for low income consumers needed
- Rate Design—Co-ops
- Older manufacturing housing/mobile homes negatively impact energy efficiency, they are a significant drain. Before 1976, HUD had no standards for homes.
- For DSM programs run by industry, they can opt out. They pay no surcharge, nor do they get any benefit from DSM programs.

We must include industry. Toyota, for example, has outstanding efforts on efficiency. Other industries have developed energy efficient alternatives.

The Sherwin Williams plant in Richmond pledged to 2.5% improvement annually over a period of 10 years, or 25 percent over a decade. However; in the first year, the plant saved 27 percent following recommendations of their contractor, the Ky. Pollution Prevention Center.

EQC: How do we stack up against other states in energy efficiency?

Guess: We're behind except in certain areas, like schools. We have the nation's first net zero energy school in Bowling Green and others are extremely energy efficient. Not only are they energy efficient, the kids and occupants are involved in controlling energy use. It has become a curricular issue for kids. It is *inquiry* based. A tool to boost knowledge so as citizens later will make wiser choices than the current generation.

Because energy has been cheap, there are low rates but high bills. For example, data collection—utilities agreed to give data on what energy efficiency programs they have and what is working.

how much is spent and the estimated savings. These won't be directly comparable from one utility to another or one year to the next due to rebates on appliances, etc.

We also encourage utilities to get together at peer exchange group meetings so that if one utility has an efficiently run program, they can share information.

LGE-KU commitment was \$1.4 million over two years--they agreed to pay a portion of energy managers' salary with school districts paying a portion. Also, energy managers must be dedicated to that task and not split with other duties.

EQC: Lessons learned can be transferred?

Guess: Yes, it is an opportunity to exchange ideas. We've funded high-performance sustainability workshops for several years and key audiences are school officials who will be building soon. Architects and engineers were shown what can be done. This year, a tour to visit a school in Northern KY is scheduled. Articles have been written in Forbes Magazine on Kentucky schools. Martha has been a speaker for us.

EQC: Net zero school. Did you see any proposals for new construction in your RFPs?

Guess: Not from the environmental mitigation fund. We funded Richardsville Elementary solar panels for \$1.3 million. We also funded Turkey Foot Middle for \$2 million. It's twice as big as Richardsville with twice the enrollment. Turkey Foot uses their middle school for many after-school activities because it is the cheapest building to operate.

Typically we measure thousands of BTUs per school per year. Most are at 72,000 KBTUs in a school built to code. At the beginning of building more energy efficient schools, 50 KBTUs qualified as Energy Star.

Warren County is a leader. The advantage in Richardsville is TVA, which has a feed-in tariff, which means they will pay more for electricity generated than they would charge the school for what the school would use.

Most utilities are opposite. They want to charge schools more than their cost. Richardsville pays 10 or 12 cents per kilowatt hour and gets 22 cents for what goes back on the grid, and as a result received a check for \$37,000 this fall from the local utility. They paid zero.

EQC: Can we transfer this philosophy to modular homes and the rest?

Guess: Some, yes.

EQC: Modular homes and modular classrooms are being manufactured very energy efficient and at net zero. The problem, firms are selling them in the West and are not marketing them in this region. We have not attracted those industries to sell here.

Clark Dorman, Manager of Water Quality Branch, Division of Water

There are two TMDLs—a bacteria TMDL which should be approved in the next two to three months.

There is a nutrient TMDL for total phosphorous and total nitrogen. This is the most controversial. For the last year and half, we have engaged in a stakeholder process. EQC produced an article in the *Land, Air & Water, Magazine*.

The stakeholder process focuses on model development for TMDL. We must use a computer model for EPA. Their contractor, Tetra Tech, is assisting us in making decisions on how to allocate pollution loading when it is time to write the TMDL We should be completed by June.

The TMDL writing process itself will take between one and two years and will depend on data we are collecting in the field this year, and next year.

We realize Floyd's Fork is the most challenging watershed we could have chosen for a nutrient TMDL. The Stakeholder process has been so good that it will be a model for how we produce nutrient TMDLs in the rest of the state. From this process we have developed a nutrient target methodology.

The current narrative standard is "don't create odors or objectionable solids" in the water. It's an aesthetic standard, but we must translate it into waste load allocation for TMDL. One of our scientists created a method on how to accomplish that, and did so at a cutting edge level. The community expects us to produce nutrient criteria at some point and we are moving in that direction.

We expect TMDL will be written early in 2015. This is quick due to our level of staffing. We have 6 people working on it, out of 30.

In a recent public meeting, there was a drop in negative comments from earlier in the process. The technical advisory committee has been very effective. This is a subset of stakeholder engagement meetings focusing on technical aspects of modeling. We have engaged MSD, Oldham County, UK, USGS and many other stakeholders. Subcommittees go into specific subject areas such as modeling scenarios, agriculture and point source. In approximately six months, we will be fairly autonomous and will use the model once the staff is trained.. We will use that model for other TMDLs across the state.

EQC Business:

Delambre made motion to approve minutes of Oct. 25, 2012 as submitted. Holmes seconded. Approved by unanimous vote

Election of officers for the coming year:

Tom Herman nominated Kimberly Holmes for position of Chair. Jason Delambre seconded and motion carried. Approval by unanimous vote.

Kimberly Holmes nominated Mark Grisham for Vice Chair. Martha Tarrant seconded and motion carried. Approved by unanimous vote.

Date of next meeting set for March 28.

No further comments. Herman made motion to adjourn, seconded by Martha Tarrant. Meeting adjourned at 8:17 p.m.

THESE ACTIONS, ALONG WITH THE AGENDA ITEMS, MAKE UP THE OFFICIAL MINUTES, WHICH ARE ON FILE IN THE OFFICE OF THE SECRETARY

Signed by:

Dr. Kimberly Holmes, Chair

Date: _____