Sheryl DeBoer
136 Hickory Lane
Luthersburg, PA 15848

September 8, 2013

EPA Region III
Ground Water & Enforcement Branch (3WP22)
Office of Drinking Water & Source Water Protection
1650 Arch Street
Philadelphia, PA 19103

Dear EPA:

RE: PAS2D020BCLE - Brady Township, Clearfield County, PA

This letter is to provide comment on the EPA Public Comment period for seismicity concerns for the Brady Township Underground Injection Control Permit PAS2D020BCLE. The EPA received extensive comments during 2012 that requested this permit be denied and seismicity was one of the listed concerns since area water sources could be contaminated.

1) Studies specific to injection wells need to be done before this proposed injection well is located in a residential area that is near so many private wells, multiple municipal water sources and our local municipal water reservoir.

2) Stating that seismic events are extremely rare in Clearfield County is an incorrect assumption that needs further study. Studies need to be specific to our area before it is assumed that "seismic events are extremely rare."

3) Monitoring pressure is insufficient to protect residents from an injection well failure since damage to water sources will have happened before shutdown procedures could be taken.

4) Local area has already experienced seismicity concerns when the affects of an earthquake shook our local homes around a year ago.

5) Man induced seismic concerns have already affected homes when a natural gas line blew up a home in the past. Blasting for coal in our township has cracked foundations of homes in the past and coal mining continues to operate in Brady township.

6) Prior public hearing testimony presented demonstrated residents concerns of fault lines present in the review area that deeply concern residents of the chances being taken to cause seismic activities. The fault lines that exist cause concern and fluids traveling along the fault to flow towards abandoned deep gas wells and abandoned coal mines through old casings or a syncline is just a way to cause trouble in the future for residents.

7) The changes in underground pressures have the potential to affect the faults and cause seismicity concerns. Fluids may lubricate the faults causing seismic activity and possible earthquakes.

8) No one can predict the future and taking a chance with our properties and water sources is an unsafe risk.

9) One study shed enough doubt on injection wells and seismic activities to stop this permit (Science Magazine on July 12, 2013 citied William Ellsworth from the Earthquake Science Center, U. S. Geological Survey, Menlo Park, California. Article is here with much info that could be cited: http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/). Other studies and recent happenings in four states cause grave concerns that back up denying this permit.

10) Resident aren't willing to accept the risk of it "might happen" when they have already seen mistakes happen first hand in our area at another injection well that was rurally located. **EXCO OPERATED THE IRVIN INJECTION WELL AT A PRESSURE EXCEEDING ITS PERMITTED MAXIMUM INJECTION PRESSURE FOR A THREE MONTH PERIOD IN 2010. EXCO VIOLATED THE TERMS OF ITS UIC PERMIT BY FAILING TO IMMEDIATELY CEASE INJECTION OF BRINE INTO THE IRVIN A-19 BRINE DISPOSAL WELL ("IRVIN WELL") UPON DISCOVERING THAT THE WELL HAD FAILED MECHANICAL INTEGRITY.**

This permit for a proposed disposal injection well in Brady Township should be denied due to the proximity of a City and all the local property owners in the review area.

Sincerely,

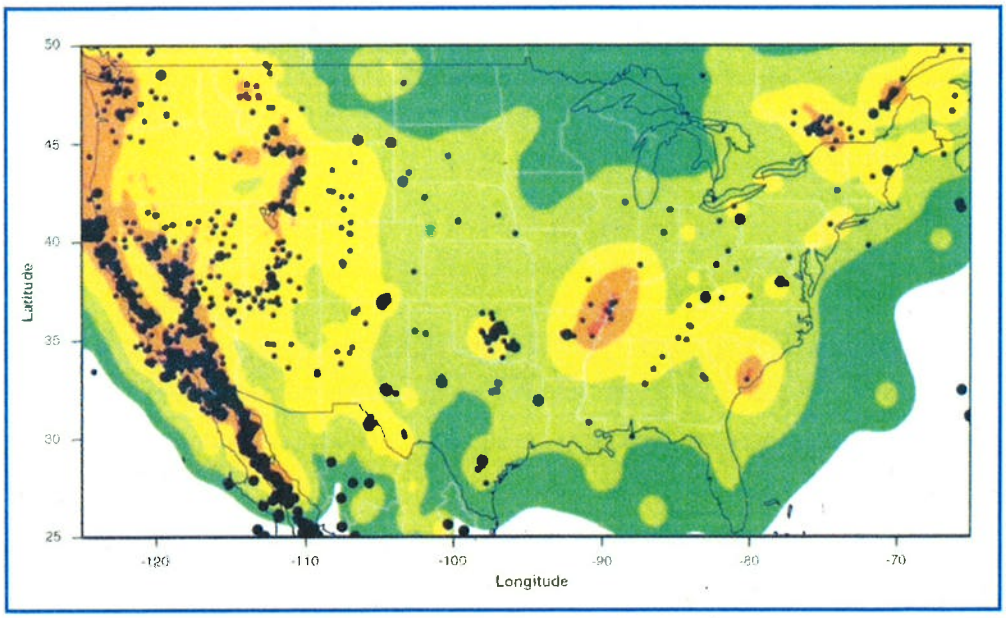
Sheryl DeBoer

Sheryl DeBoer

Man-Made Earthquakes Update

This Science Feature can be found at: http://www.usgs.gov/blogs/features/usgs_top_story/man-made-earthquakes/
Categories: Featured, Natural Hazards
Posted on July 12, 2013 at 9:30 am **By: William Ellsworth (ellsworth@usgs.gov), Jessica Robertson (jrobertson@usgs.gov), and Christopher Hook (703-648-4460)**

The number of earthquakes has increased dramatically over the past few years within the central and eastern United States. More than 300 earthquakes above a magnitude 3.0 occurred in the three years from 2010-2012, compared with an average rate of 21 events per year observed from 1967-2000.



Seismicity of the coterminous United States and surrounding regions, 2009–2012. Black dots denote earthquakes with a magnitude ≥ 3.0 are shown; larger dots denote events with a magnitude ≥ 4.0. Background colors indicate earthquake hazard levels from the U.S. National Seismic Hazard Map (NSHM). Learn more about the NSHM at http://earthquake.usgs.gov/hazards/?source=sitenav.

This increase in earthquakes prompts two important questions: Are they natural, or man-made? And what should be done in the future as we address the causes and consequences of these events to reduce associated risks? USGS scientists have been analyzing the changes in the rate of earthquakes as well as the likely causes, and they have some answers.

USGS scientists have found that at some locations the increase in seismicity coincides with the injection of wastewater in deep disposal wells. Much of this wastewater is a byproduct of oil and gas

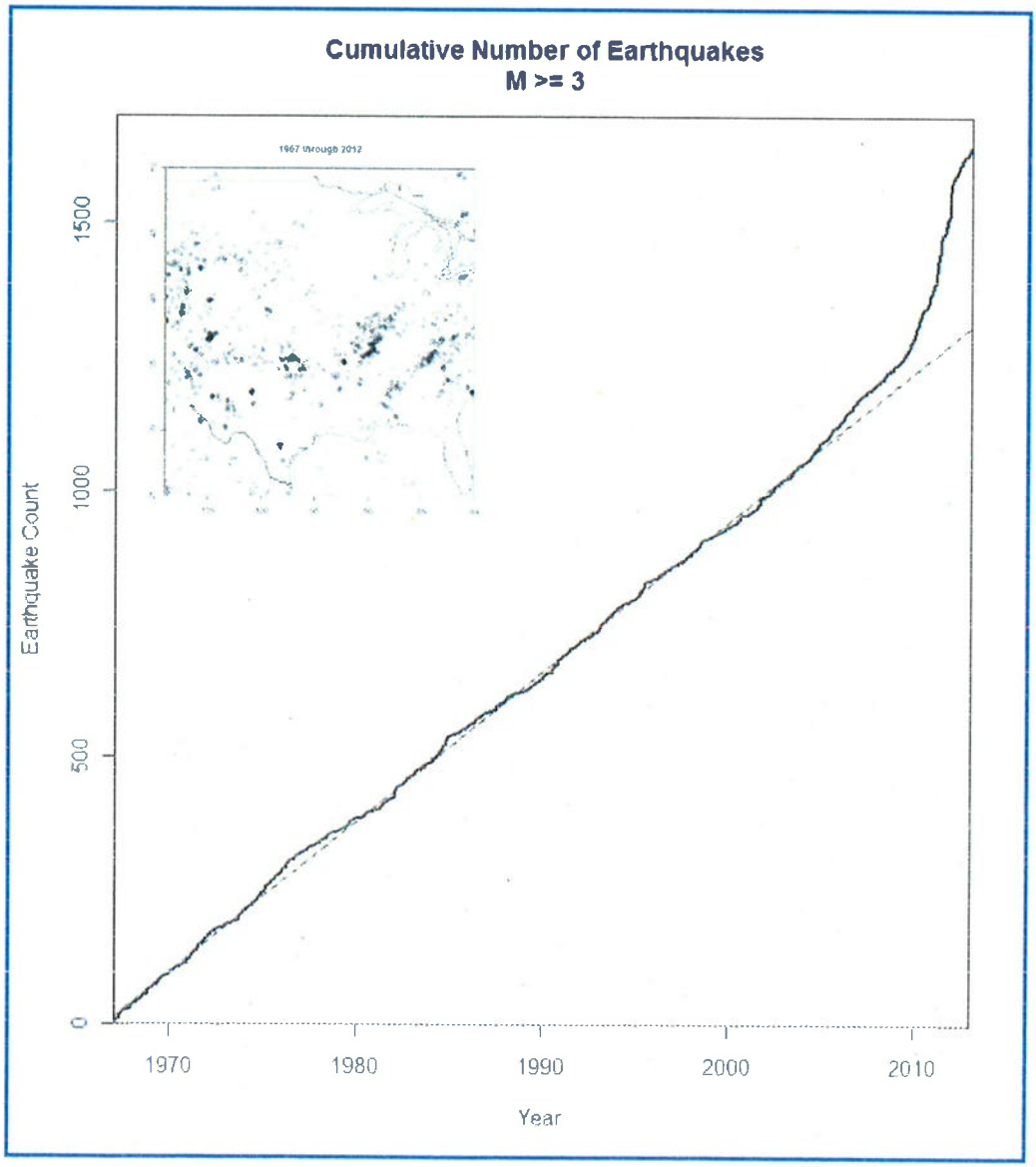
production and is routinely disposed of by injection into wells specifically designed and approved for this purpose.

Review Article on Injection-Induced Earthquakes

U.S. Geological Survey geophysicist William Ellsworth reviewed the issue of injection-induced earthquakes in a recent study published in the journal *Science*. The article focused on the injection of fluids into deep wells as a common practice for disposal of wastewater, and discusses recent events and key scientific challenges for assessing this hazard and moving forward to reduce associated risks.

What is Induced Seismicity?

Although it may seem like science fiction, man-made earthquakes have been a reality for decades. It has long been understood that earthquakes can be induced by impoundment of water in reservoirs, surface and underground mining, withdrawal of fluids and gas from the subsurface, and injection of fluids into underground formations.



What is Wastewater Disposal?

Water that is salty or polluted by chemicals needs to be disposed of in a manner that prevents it from contaminating freshwater sources. Often, it is most economical to geologically sequester such wastewaters by injecting them underground, deep below any aquifers that provide drinking water.

Wastewater can result from a variety of processes related to

Cumulative count of earthquakes with a magnitude ≥ 3.0 in the central and eastern United States, 1967–2012. The dashed line corresponds to the long-term rate of 21.2 earthquakes per year, with an increase in the rate of earthquake events starting around 2009.

energy production. For example, water is usually present in rock formations containing oil and gas and therefore will be co-produced during oil and gas production. Wastewater can also occur as flow back from hydraulic fracturing operations that involve injecting water under high pressure into a rock formation to stimulate the movement of oil and gas to a well for production.

When wastewater disposal takes place near faults, and underground conditions are right, earthquakes may be more likely to occur, Ellsworth's research showed. Specifically, an earthquake can be triggered by the well-understood mechanism of raising the water pressure inside a fault. If the pressure increases enough, the fault may fail, releasing stored tectonic stress in the form of an earthquake. Even faults that have not moved in millions of years can be made to slip and cause an earthquake if conditions underground are right.

While the disposal process has the potential to trigger earthquakes, not every wastewater disposal well produces earthquakes. In fact, very few of the more than 30,000 wells designed for this purpose appear to cause earthquakes.

Hydraulic Fracturing

Many questions have been raised about whether hydraulic fracturing — commonly known as "fracking"— is responsible for the recent increase of earthquakes. USGS's studies suggest that the actual hydraulic fracturing process is only very rarely the direct cause of felt earthquakes. While hydraulic fracturing works by making thousands of extremely small "microearthquakes," they are rarely felt and are too small to cause structural damage. As noted previously, wastewater associated with hydraulic fracturing has been linked to some, but not all, of the induced earthquakes.

Unknowns and Questions Moving Forward

USGS scientists are dedicated to gaining a better understanding of the geological conditions and industrial practices associated with induced earthquakes, and to determining how seismic risk can be managed.

One risk-management approach highlighted in Ellsworth's article involves the setting of seismic activity thresholds for safe operation. Under this "traffic-light" system, if seismic activity exceeds preset thresholds, reductions in injection would be made. If seismicity continued or escalated, operations could be suspended.

The current regulatory framework for wastewater disposal wells was designed to protect drinking water sources from contamination and does not address earthquake safety. Ellsworth noted that one consequence is that both the quantity and timeliness of information on injection volumes and pressures reported to the regulatory agencies is far from ideal for managing earthquake risk from injection activities.

Thus, improvements in the collection and reporting of injection data to regulatory agencies would provide much-needed information on conditions potentially associated with induced seismicity. In

particular, said Ellsworth, daily reporting of injection volumes, and peak and average injection pressures would be a step in the right direction, as would measurement of the pre-injection water pressure and tectonic stress.

House damage in central Oklahoma from the magnitude 5.6 earthquake on Nov. 6, 2011. Research conducted by USGS geophysicist Elizabeth Cochran and her university-based colleagues suggests that this earthquake was induced by injection into deep disposal wells in the Wilzetta North field. Learn more about that research at: http://geology.gsapubs.org/content/early/2013/03/26/G34045.1.abstract. Photo Credit: Brian Sherrod, USGS.

Importance of

Understanding Hazards and Risks

There is a growing interest in understanding the risks associated with injection-induced earthquakes, especially in the areas of the country where damaging earthquakes are rare.

For example, wastewater disposal appears to have induced the magnitude-5.6 earthquake that struck rural central Oklahoma in 2011, leading to a few injuries and damage to more than a dozen homes. Damage from an earthquake of this magnitude would be even worse if it were to happen in a more densely populated area.

The USGS and Oklahoma Geological Survey (OGS) have conducted research quantifying the changes in earthquake rate in the Oklahoma City region, assessing and evaluating possible links between these earthquakes and wastewater disposal related to oil and gas production activities in the region.

Studies show one to three magnitude 3.0 earthquakes or larger occurred yearly from 1975 to 2008, while the average grew to around 40 earthquakes per year from 2009 to mid-2013.

"We've statistically analyzed the recent earthquake rate changes and found that they do not seem to be due to typical, random fluctuations in natural seismicity rates," said Bill Leith, USGS seismologist. "These results suggest that significant changes in both the background rate of events and earthquake triggering properties needed to have occurred in order to explain the increases in seismicity. This is in contrast to what is typically observed when modeling natural earthquake swarms."

The OK analysis suggests that a contributing factor to the increase in earthquakes triggers may be from injection-induced seismicity from activities such as wastewater disposal. The OGS has examined the behavior of the seismicity through the state assessing the optimal fault orientations and stresses within the region of increased seismicity, particularly the unique behavior of the swarm just east of Oklahoma City.

Oilfield waste arrives by tanker truck at a wastewater disposal facility near Platteville, Colo. After removal of solids and oil, the wastewater is injected into a deep well for permanent storage underground. This disposal process has the potential to trigger earthquakes, but very few wastewater disposal wells produce earthquakes. No earthquakes are associated with injection at the site in this photograph. Photo taken on Jan. 15, 2013. Photo Credit: William Ellsworth, USGS

Start with Science

As the use of injection for disposal of wastewater increases, the importance of knowing the associated risks also grows. To meet these challenges, the USGS hopes to increase research efforts to understand the causes and effects of injection-induced earthquakes.

More Information

The USGS has FAQs online that provide additional details and background on induced seismicity. You can also learn more by reading a story by the Department of the Interior on this topic.

Vivan Marshall
St. Michaels Terrace
111 West Long Avenue Apt. 5E
DuBois, PA 15801

September 8, 2013

Mr. Stephen Platt, EPA Region III
Ground Water & Enforcement Branch
Office of Drinking Water & Source Water Protection (3WP22)
1650 Arch Street
Philadelphia, PA 19103

RE: UIC Permit PAS2D020BCLE (Windfall/Zelman #1)

Dear Mr. Platt:

My concerns deal with contamination of USDWs by seismic activity through an injection well for waste disposal. As I told you in December having water on a daily basis that's safe is important to my family. Also, I stated more research should be done. The USGS also stated this after what happened in Ohio with an injection well causing earthquakes where none had never been before. I remember the last quake we had here & we don't need to repeat Ohio's mistakes here.

Sincerely, Vivian Marshall

Ethel Marshall
1154 Highland St Ext
DuBois, PA 15801

EPA Region III
Ground Water + Enforcement Branch (3WP22)
1650 Arch St.
Philadelphia, PA 19103

September 8, 2013

RE: PAS2D020BCLE
Brady Township
Clearfield County, PA

DEAR EPA,

My specific concerns deal with water contamination of USDWs from seismic activities created by man from permitting disposal injection wells. As I stated on 12/7/12 we have "outstanding" water now + we are concerned this will not be the case if the EPA doesn't deny the Zelman #1 Injection Well permit. Coal mines are under our area, faults & we have deep gas wells that are old. A USGS study shows injection wells near faults have caused earthquakes. Won-Young Kim, a seismologist at Columbia University's Lamont-Doherty Earth Observatory found wastewater injection pressure caused a fault to rupture in Ohio, which was caused by a traveling front of pressure generated by injected fluid in an area that never had quakes before injection of waste happened. Don't repeat this mistake here + take any chance with our USDWs + homes.

Sincerely, Ethel Marshall Ethel Marshall

Robert Marshall
1154 Highland St Ext
DuBois, PA 15801

EPA Region III
Ground Water & Enforcement Branch (3WP22)
1650 Arch St.
Philadelphia, PA 19103

September 8, 2013

Brady Twp, Clearfield, PA
RE: PAS2D020BCLE

Dear EPA,

On December 7, 2012 I'd provided testimony on the Zelman #1 Injection Well proposed for Brady Township in Clearfield County, PA. My testimony states I've always had good drinking water and the hydrology report shows this permit would inject fluids below my home near faults where water flows from the proposed site towards my home. Additionally I stated concerns of earthquakes (seismic activity) and enclosed an article on the USGS asking you to deny the permit.

Now more disposal injection wells have caused quakes proven in Ohio, Arkansas, Oklahoma & Texas. Lawsuits are pending.

Sincerely, Robert Marshall Robert Marshall

September 5, 2013

EPA Region III
Ground Water & Enforcement Branch (3WP22)
Office of Drinking Water & Source Water Protection
1650 Arch Street
Philadelphia, PA 19103

Dear EPA:

RE: PAS2D020BCLE - Brady Township, Clearfield County, PA

This letter is to provide comment on the EPA Public Comment period for seismicity concerns for the Brady Township Underground Injection Control Permit PAS2D020BCLE. The EPA received extensive comments during 2012 that requested this permit be denied and seismicity was one of the listed concerns since area water sources could be contaminated.

1) Studies specific to injection wells need to be done before this proposed injection well is located in a residential area that is near so many private wells, multiple municipal water sources and our local reservoir.

2) Stating seismic events are extremely rare in Clearfield County is an incorrect assumption that needs further study. Studies need to be specific to our area before it is assumed that "seismic events are extremely rare."

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5) Man induced seismic concerns have already affected homes when a natural gas line blew up a home in the past. Blasting for coal in our township has cracked foundations of homes in the past and coal mining continues to operate in our township.

6) Prior public hearing testimony presented demonstrated residents concerns of fault lines present in the review area that deeply concern residents of the chances being taken to cause seismic activities. The fault lines that exist cause concern and fluids traveling along the fault to flow towards abandoned deep gas wells and abandoned coal mines through old casings or a syncline is just a way to cause trouble in the future for residents.

7) The changes in underground pressures have the potential to affect the faults and cause seismicity concerns. Fluids may lubricate the faults causing activity.

8) No one can predict the future and taking a chance with our properties and water sources is an unsafe risk.

9) One study shed enough doubt on injection wells and seismic activities to stop this permit (Science Magazine on July 12, 2013 citied William Ellsworth from the Earthquake Science Center, U. S. Geological Survey, Menlo Park, California). Other studies and recent happenings in four states cause grave concerns that back up denying this permit.

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Sincerely,

Ted & Ronia Crytser
1500 Highland St. Ext.
DuBois, Pa. 15801

email: Ronated@comcast.net

Brady Township Supervisors

3906 Shamokin Trail
P.O. Box 125
Luthersburg, PA 15848-0125

Township Office
Tel 814-583-7660
Fax 814-583-7660

Municipal Building
814-583-5324
Sheryl DeBoer, Secretary
Home 814-583-5652

Sept. 3, 2013

EPA Region III
Ground Water and Enforcement Branch (3WP22)
1650 Arch Street
Philadelphia, PA 19103

To Whom It May Concern:

This letter is in response to your extended comment period concerning seismic activity and injection wells. The Brady Township Supervisors would like to express their concern with the proposed injection well to be constructed on Highland Street Extension by Windfall Oil & Gas (Permit #PAS2D02OBCLE) in Brady Township, Clearfield County.

The Board of Supervisors cannot submit geological data, but request that you consider data and studies from the US Geological Survey showing the increased chance of seismic activity caused by an injection well. We have seen maps showing that there are already fault lines in the Highland Street area and wonder if a high pressure injection well and the additional high-pressure of waste water would cause seismic activity.

As a Board of Supervisors we are concerned for our citizens' health, safety, and welfare.

Sincerely,

Darryl Beatty
Bryan Hartzfeld

Bryan Hartzfeld, Supervisor

Darryl Beatty, Supervisor

ProChemTech
International, Inc.
51 ProChemTech Drive • P.O. Box 214
Brockway, PA 15824

August 30, 2013

US Environmental Protection Agency, Region III
Water Protection Division, Office of Drinking Water & Source Water Protection
Ground Water & Enforcement Branch (3WP22)
1650 Arch Street
Philadelphia, PA 19103

RE: Underground Injection Control Permit PAS2D020BCLE
Windfall Oil and Gas, Inc.
Brady Township, Clearfield County, Pennsylvania

Gentlemen,

The seismicity concerns raised during the public comment period are valid and grounds for not issuing the above permit. Please review the attached article published in the July/August issue of Industrial Waterworld. This article details some of the concerns expressed by the USGS as to the "strong possibility" that underground injection of wastewater is linked to an increase in earthquakes.

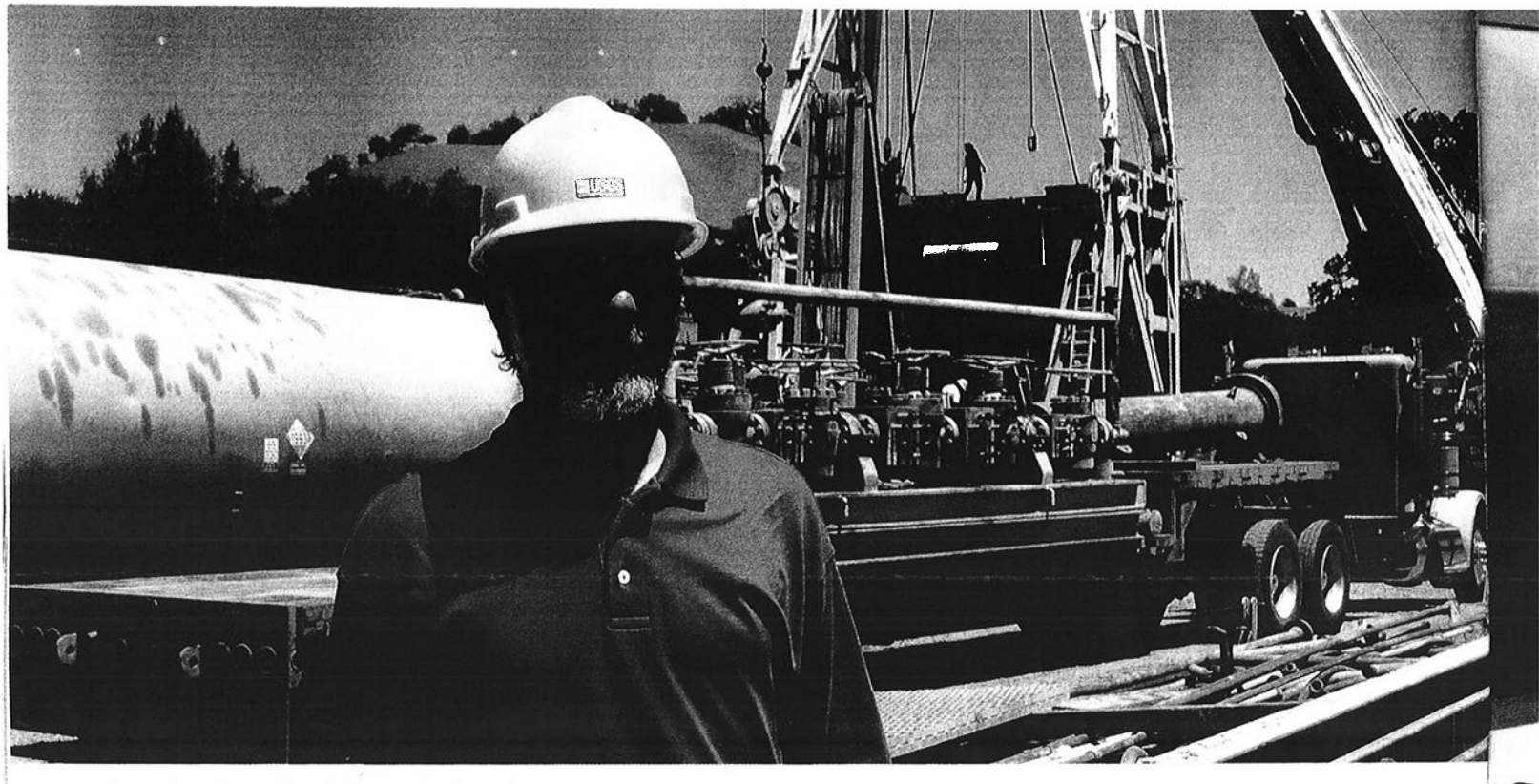
It is an established fact that the area where the proposed injection well will be located has numerous faults. Injection of wastewater into such strata has a high potential to induce earthquake activity based on the on-going USGS research. Accordingly, issue of the above permit will potentially cause harm to the local population.

Please note my opposition to the above permit based on this information.

Thank you,

Timothy Keister, CWT FAIC
Chief Chemist/President

Phone (814) 265-0959
Fax (814) 265-1263
http://www.prochemtech.com



Ellsworth in front of the drill rig used to bore the San Andreas Fault Observatory at Depth (SAFOD) — the first scientific drill hole into a major active fault at the depth where earthquakes occur.

Underground Unrest

USGS Examines Connection Between Earthquakes and Injection Wells

BY ART HADDAWAY

Could an increase in the occurrence of earthquakes across the United States be the result of an ever-enlarging industrial footprint? According to a recent U.S. Geological Survey (USGS) report, it's a strong possibility.

The article "Injection-Induced Earthquakes," written by Bill Ellsworth, a USGS geophysicist, explains that there has been a significant increase in earthquake activity in unusual locations throughout the U.S. within the last several years. Moreover, a large amount of these tremors could be attributed to a surge in industrial activity, particularly oil and gas processes.

For the most part, earthquakes have naturally occurred predominantly in the western U.S. in states like California where movement of the Pacific and North American Plates regularly occurs along the San Andreas fault line. However, more quakes have arisen in the central and eastern parts of the U.S. in areas where "specific types of nearby industrial activities raise the possibility that these events were induced by human activity," said Ellsworth.

He explained that these man-made earthquakes may be triggered by pressure changes in faults occurring from operations such as the "impoundment of reservoirs, surface and underground mining, withdrawal of fluids and gas from the subsurface, and injection of fluids into underground formations." Throughout the earth's crust, there are already naturally-occurring stresses within these faults, and "if that pressure rise can communicate with a fault that is near its breaking point, an earthquake will be the result," he said. Ellsworth further described that hydraulic fracturing and wastewater injection of deep wells may be the source of the majority of these shocks.

As stated in the study, hydraulic fracturing contributes to a large number of earthquakes but has a relatively low risk of producing damaging tremors, whereas wastewater injection poses a higher risk.

Hydraulic fracturing is the practice of injecting high-pressure liquid below the earth's surface to create fractures in underground rock formations in order to extract natural gases. According to the research, this high-stressed pressure from the fracking process "intentionally induces numerous micro-earthquakes" but notes that they are too insignificant to be considered a harmful threat to property or the public.

States like Ohio, Pennsylvania, Oklahoma, and many others, as well as the prov-

ince of British Columbia, are locations where "more than 100,000 wells have been subjected to fracking in recent years, and the largest induced earthquake was magnitude 3.6, which is too small to pose a serious risk," said Ellsworth. "Where we think most of the recent induced earthquakes have been occurring is in connection with wastewater disposal wells."

Unlike hydraulic fracturing, wastewater injection is done at lower pressures to permanently store the fluid deep underground. Because it operates at considerable depth and often with considerable volumes of fluid, the wastewater discarding process may exert significant stress within multiple subterranean levels that can potentially cause unavoidable disturbances. In fact, Ellsworth's article indicates that several of the biggest earthquakes occurring in the midcontinent between 2011 and 2012 may have been prompted by these types of wells, with the largest measuring at a magnitude of 5.6 in central Oklahoma that destroyed 14 homes and injured two people.

Also known as brine or "class II" wells, these sites are regulated by the Environmental Protection Agency (EPA) through the Underground Injection Control Program (UIC), which requires the injection of effluent to be as far below the earth's surface as possible to avoid the contamination of drinking water resources, further preserving overall water quality and public health. These federal statutes, however, do not monitor underground pore or injection pressures that are believed to lead to dangerous shifts within the surface.

"Wells with very high volumes of injection and deep into the sedimentary

With the increase of earthquakes occurring in uncommon locations across the U.S. **potentially induced by injection-based applications,** water and wastewater professionals in the industrial sector are growing more aware of its effects and are starting to take the proper steps to prevent future incidents.

column can have somewhat of a higher potential for triggering earthquakes than operations that are perhaps better situated," said Ellsworth. "UIC class II wells (of which there are roughly 150,000 in the U.S., and about 30,000 of those are for wastewater disposal) are designed and regulated so that they don't cross-contaminate portable aquifers, and its consequences are quite deep; 5,000 to 10,000 feet is not unusual. It's these wells that have a clear correlation with the induced earthquakes."

Although a certain number of earthquakes that have occurred throughout specific parts of the country can potentially be linked to injection-induced processes, Ellsworth clarified that it's still difficult to distinguish between tremors that are natural and those that are man-made.

"Induced earthquakes sometimes occur at the source of the stress or pressure perturbation; at other times, these events take place deep below and kilometers away from the source," he said. "Sometimes induced events occur shortly after the industrial activity begins, but in other cases they happen long after it has been underway or even ceased."

Factors that contribute to the likelihood of pressure-induced earthquakes occurring, however, can include the magnitude of the stress or disturbance, its frequency and geographic reach, the conditions of local natural strain, and the presence of impaired faults in proximity to the stress field. Likewise, new developments in seismology have been underway in recent years to not only discern the causes of these earthquakes but to also recognize when and where they occur, as well as identify short-term and long-term predictabilities to help better manage them across the board. As Ellsworth illustrated, "methods for anticipating the time of failure have long been the 'Holy Grail' of seismology."

One method of reducing the risk of these man-made earthquakes is what the industry calls "traffic light" systems, which involve setting guidelines that restrict or even suspend injection activity based on monitoring for earthquake activity; accordingly, it's a way to recognize if there are naturally-invoked tremors occurring alongside the injections, said Ellsworth.

"Are there ways of treating the waters so they can be disposed of without injection? Or reduce the volume of fluid that is being injected?" he asked. "Can we ensure that wells being used for injection are sited and monitored in a way that reduces the risk? This is why this 'traffic light' system makes sense."

Other solutions Ellsworth proposed include the recycling of fluids for applications in the development of shale gas as well as the delegation of water for aquifer support or oil recovery in the production of petroleum. He also recommended that improvements be made in the way data of injection-induced sites is collected so that regulatory agencies could receive the necessary information to set appropriate standards for operation as well as provide more information on "hydrologic conditions potentially associated with induced seismicity."

"If we understood what the stresses were in the earth and we understood what the pressures were and we understood more about the hydrology, then we could do a pretty good job predicting whether a particular injection operation would have a higher or lower potential to induce earthquakes," Ellsworth said.

With the increase of earthquakes occurring in uncommon locations across the U.S. potentially induced by injection-based applications, water and wastewater professionals in the industrial sector are growing more aware of its effects and are starting to take the proper steps to prevent future incidents. "It's a manageable risk," he said, "and so the hope is that as we develop a better understanding, it will lead to perhaps the elimination of this particular risk." **IWW**

Clearfield County Commissioners
212 East Locust Street
Clearfield PA 16830

August 30, 2013

EPA Region III
Ground Water and Enforcement Branch (3WP22)
1650 Arch Street
Philadelphia PA 19103

To whom it may concern,

Recently, the EPA advertised for additional public comment on the subject of seismic activity that could result if the permit is approved for the injection well proposed by Seneca Resources Corporation, (Permit # PAS2D025BELK), to be constructed on Highland Street Extension in Brady Township, Clearfield County.

While I personally have no expertise in the field of geology, I would request that the EPA consider all valid data and studies from US Geological Survey concerning the increased likelihood of earthquakes brought on by the high pressure injection of waste water into deep wells. Additionally I would offer that seismic activity caused by the injection well could cause the water tables for many miles around the site to be irrevocably damaged thus ruining the water supplies for many generations.

Sincerely,

Mark B. McCracken
Clearfield County Commissioner

Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

From the Supplement to the Statement of Basis:

> The Huntersville Chert/Oriskany formation, the intended injection zone, has been a prolific producer of natural gas in this area since the late 1950s/early 1960s. The removal of both natural gas and brine from this formation has lowered the formation's pore pressure and has created available pore space (storage capacity) making this reservoir a good candidate for the disposal of fluids. Sites such as depleted oil and gas reservoirs can make excellent disposal zones, because

There is not much available pore space in the intended injection zone due to gas production. A relatively small amount of brine has been removed compared to the 30,000 bbls per month that could be permitted to be injected. The natural gas that has been produced was in solution under high pressure in the existing brine fluids. When a gas well was drilled and the underground pressure was released, the gas came out of solution, but the total volume of fluid decreased insignificantly. Therefore, there is very little newly available pore space due to gas production for the injected fluids to go into. The waste water would have to make room for itself by displacing native fluids.

An analogy would be opening a can of beer. When the pressure in the beer can is released, the carbon dioxide dissolved in the beer is released. The beer will go flat, but its volume in the can is virtually the same, even though a significant amount of carbon dioxide gas has escaped.

Therefore, there is little or no available pore space for the injection of waste fluids into the proposed Windfall DIW, since the pore space is already filled with brine. Brine pressure on faults will be increased because of the injected waste water. The pore pressure in the injection zone is going to increase because the waste water has to make room for itself by pushing away the existing fluids. Since liquids have a very low compressibility, any nearby faults will be hydraulically linked to the injection well pressure. Thereby, fluid pressure on the faults will increase, possibly inducing earthquakes.

Marianne Atkinson ~ 221 Deer Lane, DuBois, PA 15801 marianne5@windstream.net

Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

There was human activity which induced seismic events that occurred at the Northstar 1 Class 2 injection well in the Youngstown, OH area.

Before January 2011, Youngstown, Ohio, which is located on the Marcellus Shale, had never experienced an earthquake, at least not since researchers began observations in 1776. However, in December 2010, the Northstar 1 injection well came online to pump wastewater from fracking projects in Pennsylvania into storage deep underground. In the year that followed, seismometers in and around Youngstown recorded 109 earthquakes, the strongest registering a magnitude-3.9 earthquake on Dec. 31, 2011. The well was shut down after the quake.

The map below shows basement faults in the vicinity of the proposed Windfall/Zelman #1 DIW. If the UIC permit is issued, the same fate could happen in Brady Township as happened near Youngstown, Ohio. The UIC permit should be denied.

Structural contour map of basement with major faults, modified from Schumaker, 1996

The proposed Windfall/Zelman #1 injection well is the black dot below the black arrow.

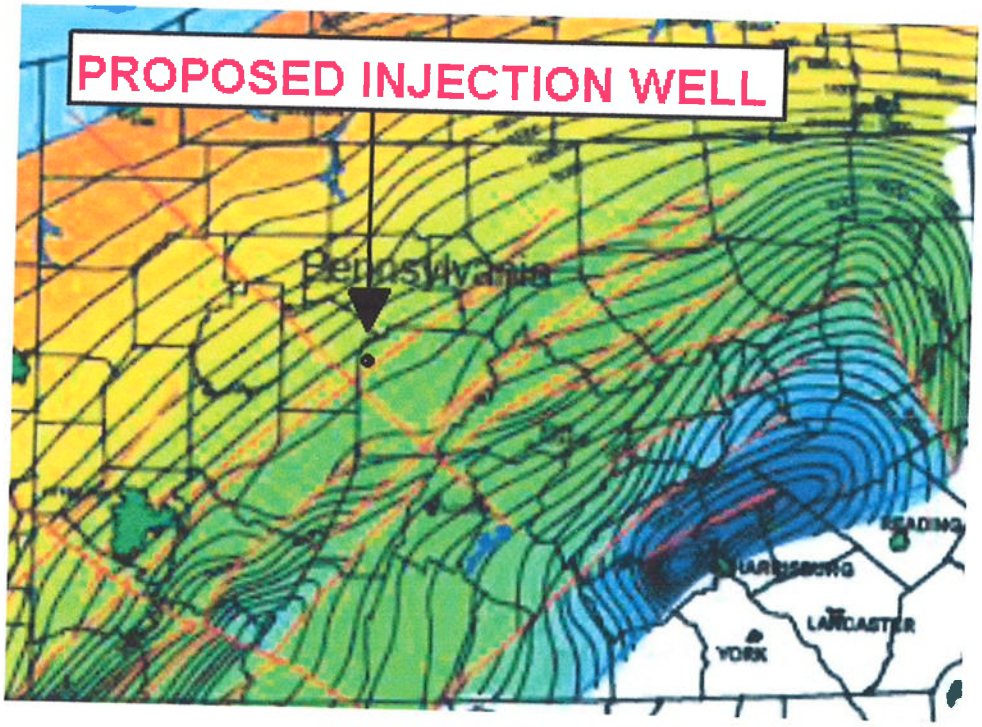


Figure 1. Structural contour map of basement with major faults, modified from Schumaker, 1996

Marianne Atkinson ~ 221 Deer Lane, DuBois, PA 15801 marianne5@windstream.net

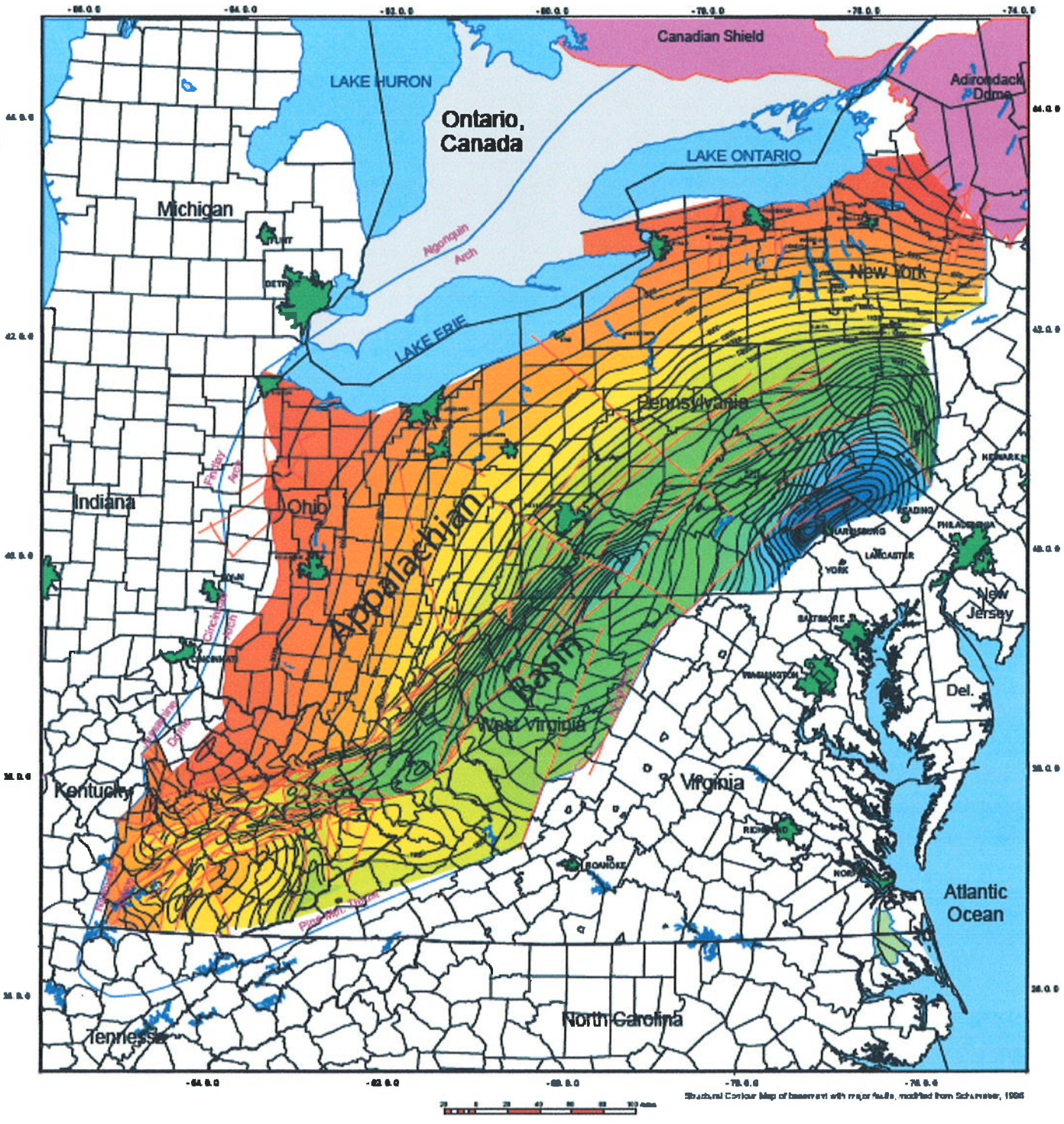


Figure 1. Structural contour map of basement with major faults, modified from Schumaker, 1996

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Windfall/Zelman #1 DIW ~ Permit # PAS2D020BCLE

There was human activity which induced seismic events that occurred at the Northstar 1 Class 2 injection well in the Youngstown, OH area.

Before January 2011, Youngstown, Ohio, which is located on the Marcellus Shale, had never experienced an earthquake, at least not since researchers began observations in 1776. However, in December 2010, the Northstar 1 injection well came online to pump wastewater from fracking projects in Pennsylvania into storage deep underground. In the year that followed, seismometers in and around Youngstown recorded 109 earthquakes, the strongest registering a magnitude-3.9 earthquake on Dec. 31, 2011. The well was shut down after that quake.

With only one seismometer deployed in the Youngstown area, state geologists lacked the necessary data on the earthquakes' depth and exact location to draw a direct correlation between the seismic events and the deep injection well.

Once sufficient monitoring equipment was in place, the focal depths of events were found to be about 4,000 ft (1,220 m) laterally and 2,500 ft (760 m) vertically from the wellbore terminus.

There is only one seismometer in the vicinity of the proposed Windfall/Zelman #1 DIW. This seismometer is located at the Penn State-DuBois Campus. It is part of the Penn State Seismic Network.

The reforms listed below will make Ohio's Class II deep injection wells among the most carefully monitored and stringently regulated disposal wells in the nation. Ohio will seek the following reforms to its Class II deep injection well program:

- Requires a review of existing geologic data for known faulted areas within the state and avoid the locating of new Class II disposal wells within these areas;
- Requires a complete suite of geophysical logs (including, at a minimum, gamma ray, compensated density-neutron, and resistivity logs) to be run on newly drilled Class II disposal wells. A copy of the completed log, with analytical interpretation will be submitted to ODNR;
- Evaluates the potential for conducting seismic surveys;
- Requires operators to plug back with cement, prior to injection, any well drilled in Precambrian basement rock for testing purposes.
- Requires the submission, at time of permit application, of any information available concerning the existence of known geological faults within a specified distance of the proposed well location, and submission of a plan for monitoring any seismic activity that may occur;
- Requires a measurement or calculation of original downhole reservoir pressure prior to initial injection;\
- Requires the installation of a continuous pressure monitoring system, with results being electronically available to ODNR for review;
- Requires the installation of an automatic shut-off system set to operate if the fluid injection pressure exceeds a maximum pressure to be set by ODNR;
- Requires the installation of an electronic data recording system for purposes of tracking all fluids brought by a brine transporter for injection;

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To bolster its earthquake monitoring capabilities, ODNR will purchase four additional portable seismometers. These sophisticated monitoring devices will augment existing seismometers where necessary, and provide state geologists with quick access to detailed data on seismic activity. In addition, ODNR is in the process of identifying an "outside" expert with experience in seismicity, induced seismicity, and Class II injection wells to conduct an independent review of the currently available technical information, as well as information to be supplied by the injection well owners in the vicinity of the Northstar 1 well. This independent analysis will provide a scientific third party evaluation and analysis of all technical information to ensure thoroughness of the process.

The Region 3 EPA should copy the ODNR and institute the same reforms for their Class 2 Disposal Injection Well program.

The following, "PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA" shows seismic faults in the general area of the proposed Zelman #1 DIW, which is in the northwestern part of Clearfield County.

Seismic faults are seismically active geologic faults. This is a category of all geologic faults which may be seismically active and cause earthquakes or be long inactive.

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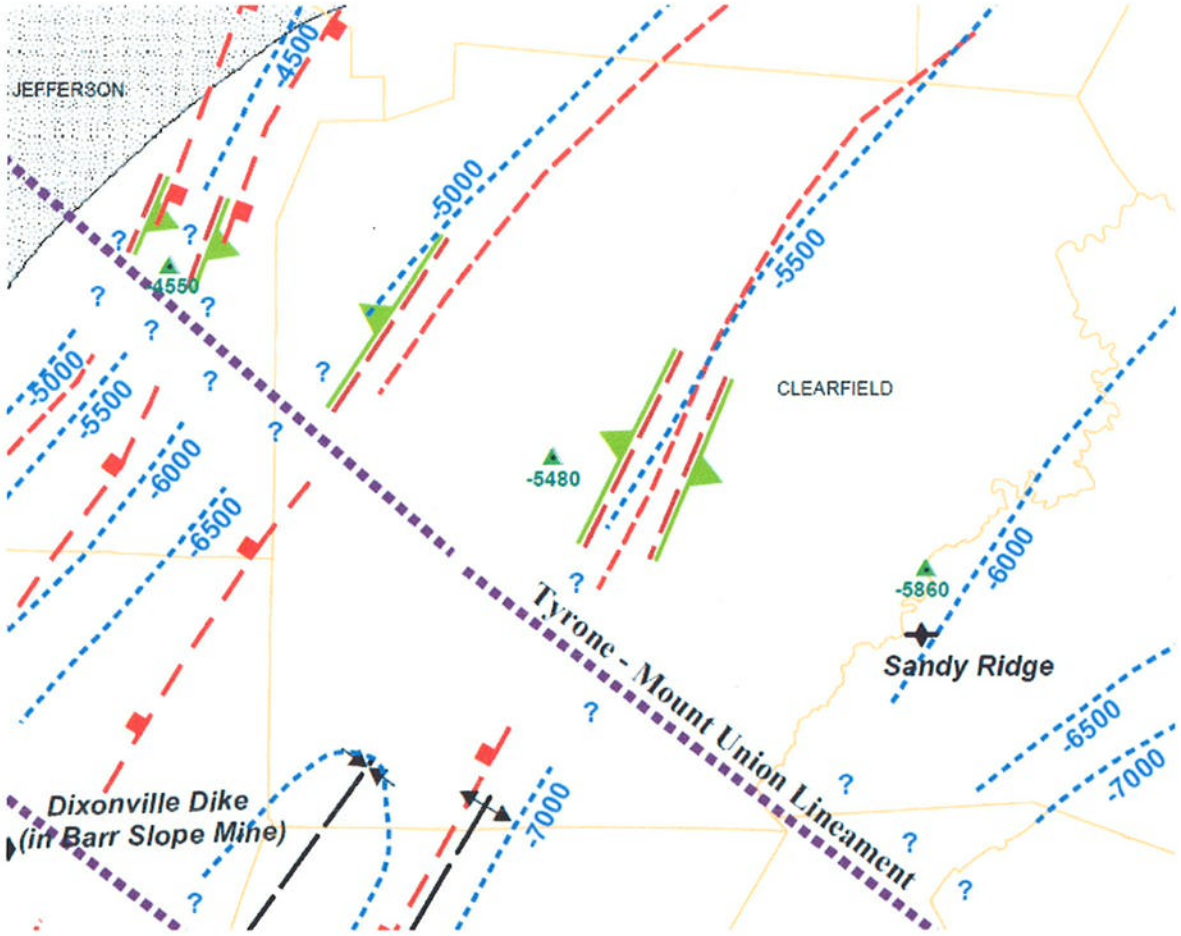
PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA

SYMBOLS LEGEND

Pennsylvania database

- Fault (tab indicates dip direction)
- Fault, inferred
- Fault, mapped
- Seismic fault (barb indicates inferred dip direction)



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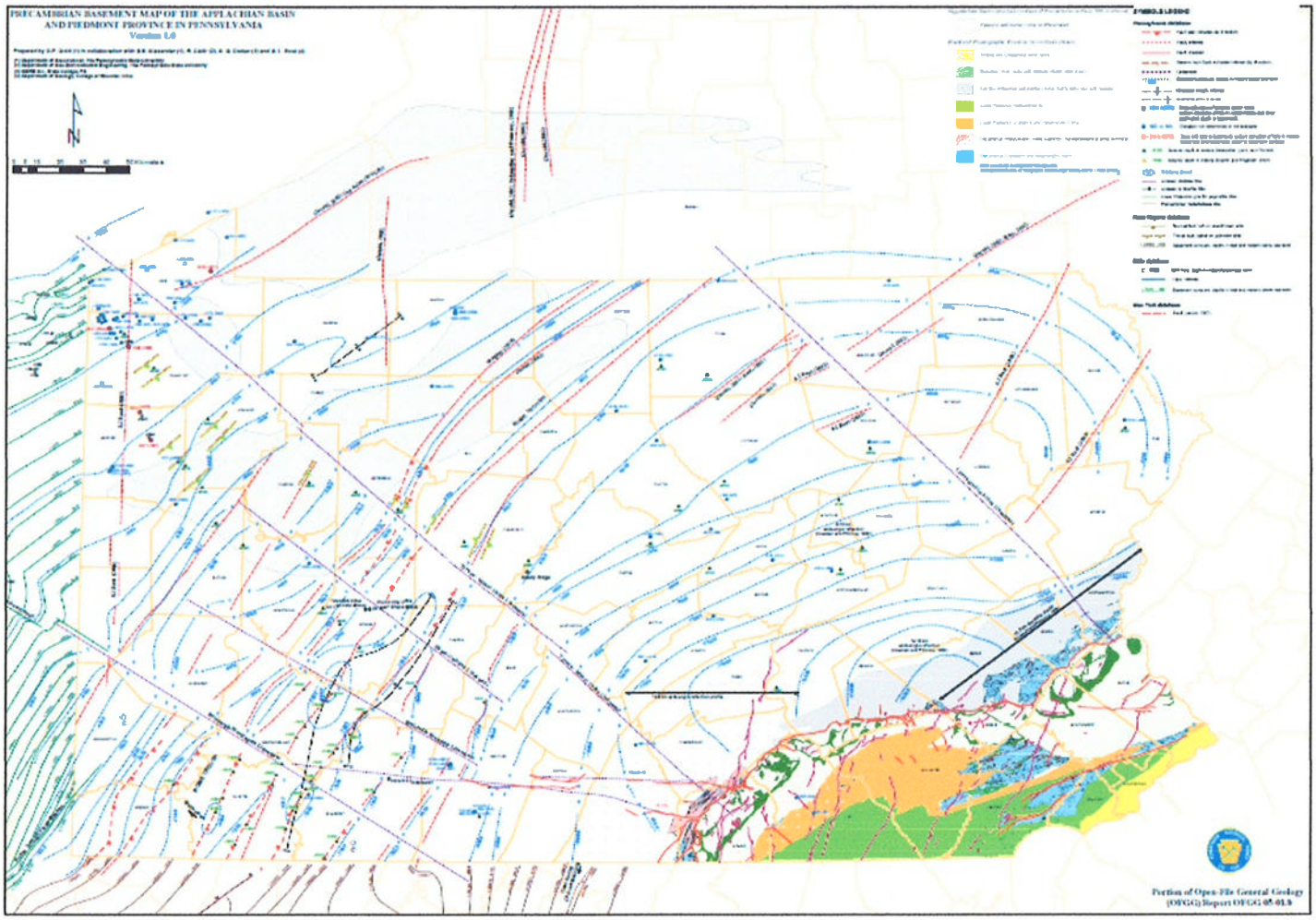
PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN AND PIEDMONT PROVINCE IN PENNSYLVANIA



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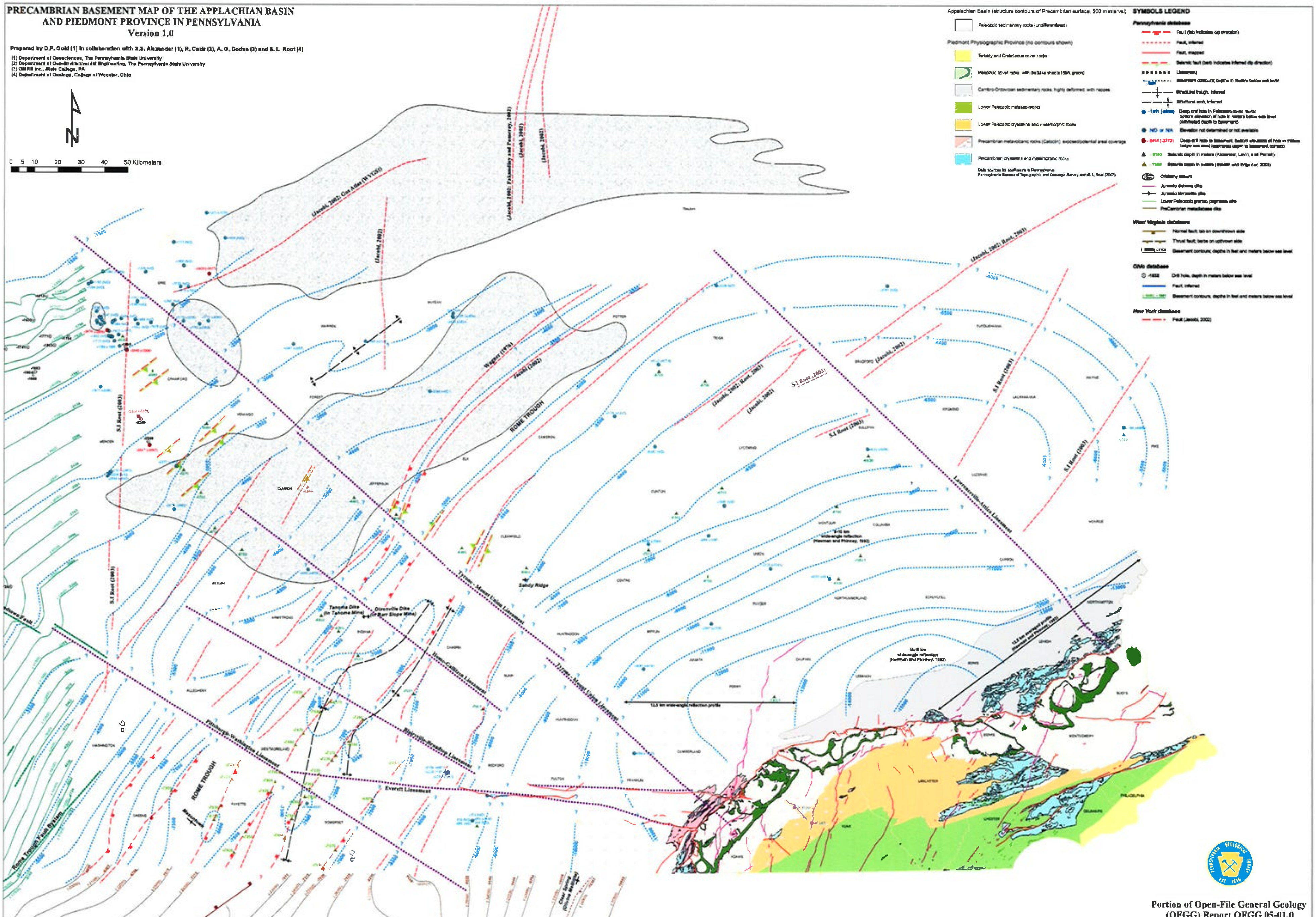
PRECAMBRIAN BASEMENT MAP OF THE APPLACHIAN BASIN
AND PIEDMONT PROVINCE IN PENNSYLVANIA
Version 1.0
Prepared by D.P. Gold (1) in collaboration with S.S. Alexander (1), R. Cakir (2), A. G. Doden (3) and S. L. Root (4)
(1) Department of Geosciences, The Pennsylvania State University
(2) Department of Geo-Environmental Engineering, The Pennsylvania State University
(3) GMRE Inc., State College, PA
(4) Department of Geology, College of Wooster, Ohio
N
0 5 10 20 30 40 50 Kilometers
Appalachian Basin (structure contours of Precambrian surface, 500 m interval)
Paleozoic sedimentary rocks (undifferentiated)
Piedmont Physiographic Province (no contours shown)
Tertiary and Cretaceous cover rocks
Mesozoic cover rocks with diabase sheets (dark green)
Cambro-Ordovician sedimentary rocks, highly deformed, with nappes
Lower Paleozoic metasediments
Lower Paleozoic crystalline and metamorphic rocks
Precambrian metavolcanic rocks (Catoctin): exposed/potential areal coverage
Precambrian crystalline and metamorphic rocks
Data sources for southeastern Pennsylvania
Pennsylvania Bureau of Topographic and Geologic Survey and S. L. Root (2003)
SYMBOLS LEGEND
ROME TROUGH
Sandy Ridge
Tanoma Dike (in Tanoma Mine)
Dixonville Dike (in Barr Slope Mine)
Everett Lineament
Tyrone - Mount Union Lineament
Lawrenceville-Attica Lineament
Rome Trough Fault System
12.5 km wide-angle reflection profile
14-15 km wide-angle reflection (Hawman and Phinney, 1992)
Wagner (1976)
S.J Root (2003)
(Jacobi, 2002)
(Jacobi, 2002; Root, 2003)
(Jacobi, 2002; Gas Atlas (WVGS))
(Jacobi, 2002; Fakundiny and Pomeroy, 2002)
Portion of Open-File General Geology
(OFGG) Report OFGG 05-01.0