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House of Representatives
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG

COMMITTEES

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Nov. 27, 2012

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

RE: UIC Permit PAS2D020BCLE (Windfall/Zelman 1)

Dear Mr. Platt:

Please accept the dual intent of this letter: 1) to request a public hearing on the Zelman #1 Class 2 Disposal Injection Well proposed for Brady Township, Clearfield County, PA.; and 2) as my comments for the record on the Zelman 1 injection well proposal.

I will not dwell on the public hearing, tentatively scheduled for 7 p.m. Dec. 10 at the Brady Township Community Center in Luthersburg, Pa. The intense public interest in the meeting and the issue is evident from the July 23 EPA Information Sharing meeting on the issue that was attended by two of my staff members.

My comments on the Brady Twp. injection well proposal focus on the threat to public and private water supplies. Simply put, geologic and hydrological conditions in the area make the proposed site an egregiously poor one for such a well.

As the state representative from the adjacent district and longtime chair of the Pa. House of Representatives' Environmental Resources & Energy Committee, I have great familiarity with the area's incredibly complex geology. As a state geologist said of Clearfield County, "the geology was not as difficult as you thought it... It was worse!" It is infamous for its high pyrite and sulfur concentrations, which have had local ramifications. An environmental assessment omitted for an Interstate 99 construction project in adjacent Centre County has cost taxpayers tens of millions of dollars for remediation as the disturbed pyrite ruined water resources.

In the 1972 Pa. Department of Environmental Resources report, "Subsurface Liquid Waste Disposal and Its Feasibility in Pennsylvania," it was noted, ***"It cannot be overstressed that the introduction of waste liquids into the subsurface is a permanent alteration of the subsurface environment... "The magnitude of these changes may be small, but they are cumulative."***

Brady Township is strategically situated near two watersheds – the Susquehanna and Ohio river basins. The injection well is perilously close to the DuBois Reservoir, the main water source for

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the city, and the supply for Brady Township and the Borough of Troutville. Many private water wells are located within two miles of the proposed injection well. Old, deep gas wells have been drilled in the area, abandoned gas wells are very close to the proposed site and abandoned mines are significantly close to the proposed site. Springs, water wells and headwaters also are close to the proposed disposal injection well.

Earthquakes in Ohio have been linked to injection wells. Underground injection of wastewater produced by hydraulic fracturing and other energy technologies has a higher risk of causing such earthquakes, according to a June report from the National Research Council. Clearfield County straddles known faults and it does not receive the highest rating for storage of carbon dioxide, never mind fracking wastewater.

A May 2012 study by the Nicholas School of the Environment at Duke University spotlighted the "Geochemical evidence for possible natural migration of Marcellus Formation brine to shallow aquifers in Pennsylvania." It "suggests that these areas could be at greater risk of contamination from shale gas development because of a preexisting network of cross-formational pathways that has enhanced hydraulic connectivity to deeper geological formations."

Knowing all this, I believe the EPA must reject the Windfall Oil and Gas permit application.

However, I believe the economic anomalies presented by this permit application also must be considered. The federal Economic Development Administration is providing a $1.2 million grant for a demonstration plant in Johnstown to treat Marcellus wastewater. The project, being pursued by Aspen Johnstown LLC, would reportedly employ hundreds.

Another wastewater treatment facility is proposed by Reserved Environmental Services in Pine Creek Township, Clinton County. RES has two such facilities already operational, including one in Westmoreland County, which is the largest such water treatment facility in the state.

Eureka Resources LLC is building a facility in Standing Stone Township, Bradford County, to treat Marcellus wastewater. It, like the plant proposed in Johnstown, plans for beneficial reuse of valuable byproducts that can be extracted from the wastewater.

Given the dubious environmental, hydrological and geological underpinnings of the well proposed in Brady Township, permit approval of it would subvert private and public investments being made across the state. Injection wells may be convenient and profitable for their owners, but the benefits, if any, to future generations of Commonwealth citizens is highly suspect.

Thank you for your consideration of these comments.

Sincerely,

Camille "Bud" George
STATE REPRESENTATIVE
D-74 of Clearfield County, and chair (D)
Pa. House of Representatives'
Environmental Resources &
Energy Committee

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

Dear Mr. Platt,

This letter is to request a public hearing on the Zelman #1 Class 2 Disposal Injection Well proposed for Brady Township, Clearfield County, PA.

Please put this comment of mine on the record:

I am very concerned that the proposed disposal injection well will lead to long term, unknown, and devastating effects for not only my family and the citizens of Clearfield County but for all of Pennsylvania and possibly the country by allowing such dangerous, experimental, unknown, and useless practices to proceed.

Some of my concerns include that fact that a toxic surface spill could go directly into the aquifer, as well as the threat of Methane migration into the aquifer. There is also the possibility that nearby deep mines could transmit toxic fluid into water wells and eventually into all of Dubois. Abandoned gas wells could provide a pathway for methane migration into drinking water wells and also provides a pathway for toxic fluid to get into water wells. Finally, and most importantly I am concerned for the people who work in the industry itself and for the unsafe, unknown working environments they are exposed to around these toxic chemicals which are known carcinogens. I am trying to protect my environment and fellow citizens, I am wondering where the Environment Protection Agency and I are disconnecting when it comes to this major threat to our people and state.

Thank you for your consideration.
Sincerely,

Jack Donahue
1059 Treasure Lake
Dubois, PA 15801

EPA Letter.doc

Dear Mr. Platt;

I would like to request a hearing for the proposed Class 2D injection well for Tower Lane, Brady Township, Clearfield County, Pennsylvania, 15801.
(Zelman #1) Permit App. #PAS2D020BCLE

Some of my reasons for this request are as follows:

1. Within 1 mile of the proposed well is a number of old gas wells that were previously fracked. Fractures can open to 600ft or more from the well bore according to the industry. This would/could provide a path for frack waste to travel to aquifers.

2. Rusted well casings and failed cement seals in these old wells create a pathway and a threat to aquifers.

3. Five of these old wells are into the same formation as the injection target. They are all located very close to the edge of the 1/4 mile review area. Some are only several paces from the review area. Two were supposedly plugged many years ago but I would question the integrity of the cement seals and casings because of age and an earthquake we experienced here last year. Many of the residents, including myself, felt this tremor which would/could have compromised all wells in the area. One of these plugged wells has been ignited at the vent pipe to burn off the noxious gas fumes coming from it. It's open to 1176 ft. I feel this well is definitely suspect and would provide a pathway for frack fluid to enter aquifers.

4. One of the producing deep oriskany wells is also suspect. Two of my neighbors say that whenever anyone does any maintenance on this well, their water wells exhibit changes in turbidity etc. This well is only a few paces from the review area and into the same formation listed for injection. This well uses a pump jack. Considering these wells were fracked, and those fractures could be out around 600 ft., this could possibly be another path for frack waste to migrate to our aquifers. Six hundred feet would also put these fractures inside the quarter mile review area. One of these neighbors died of cancer and his spouse had a cancerous kidney removed.

5. The Caledonia syncline is very close to our area. Synclines are typically not places where you want to inject fluids because it tends to travel up the arms of the syncline toward upper strata and to who knows where from there, thus threatening fresh water aquifers. (Schlumberger dictionary).

Steve Platt Letter.doc

6. Pennsylvania's geology is not conducive to injection of fluids as per the 1972 Pa. DER publication, "Subsurface Liquid Waste Disposal and its Feasibility in Pennsylvania". This publication also states that Pennsylvania's subsurface is rarely as it appears and has many unknown fractures. This all lends itself to injected fluids finding their way to areas where they are likely to contaminate aquifers or leach into other unknown voids and fissures which could carry them to one of the many "mine shafts" underlying this area.

7. Since I was once employed in this industry, (Schlumberger), I know how it operates. Spills and well failures are all to frequent. A spill or well failure at this proposed well site could/would be catastrophic since it is located on a hill above the existing water wells, springs, drainages and homes.

8. Should our water be contaminated, there are no other sources close by that would be available to the residents. The "North West Clearfield County Region Comprehensive Plan" for Brady Township states, "No significant expansion of the their water system is recommended". The Brady Township water authority says that they are running at or close to their limit at the present time. I don't want a water buffalo in my yard nor can I live here if that becomes a reality. I want the water & air I have now and have an inalienable right to without the daily stress and worry that anyone of us in the neighborhood may become ill or worse from consuming or breathing toxic chemical waste water & fumes.

9. The area of review is much to small. "This stuff plumes out for miles", stated one professor involved in the investigation of the earthquakes recently near Youngstown, Ohio. The review area should be extended to no less than 2 miles from the proposed well. That would encompass many more residents and water sources that may eventually be affected by leaks, spills, accidents, well failures and leaching toxic waste from this well.

10. Earthquakes are also a legitimate concern in our area. Faulting is prevalent within and just outside the review area. We all know about Youngstown, Ohio and what an injection well caused there. That same thing could happen here, which would compromise the casing and cement in the well bore and jeopardize aquifers.

11. Drilling is a risk by this industries own admission. So why are they increasing the risk 100 fold and placing it squarely on the backs of the residents of our community by placing this well on a hill & in such close proximity to our homes and fresh water supplies??
Real protection comes before not after the fact.

12. How can this waste be classified residual? Many of the chemicals that we know are in frack can also be found on the U.S. Governments list of hazardous, toxic, carcenigenic chemicals. The "Halliburton Loophole" does not make these chemicals benign, thank you Mr. Dick Cheney!!

13. Deficiencies in the drillers paper work will be brought out at the hearing.

There are many more concerns with this well, some of which I know the EPA has no control over. Thus, there is no mention of them here. From location, to the driller constructing this well, this is a disaster waiting to happen.

Thank you for your consideration in this serious matter.

Sincerely,
Randall R. Baird
1273 Highland St. EXT
DuBois, Pa. 15801

Sherry Green
815 Reynoldsville Sykesville Road
Reynoldsville, PA 15851

November 30, 2012

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

Dear Mr. Platt,

RE: UIC Permit PAS2D020BCLE (Windfall/Zelman 1)

This letter is testimony on the Zelman #1 Injection Well proposed for Brady Township, Clearfield County due December 10, 2012. Please hold the EPA hearing in Brady Township, Clearfield County on December 10, 2012. My concerns deal with contamination of the underground sources of water.

We have lived in the Reynoldsville area for many years with water wells. Our home is above the coal mines creating an issue with having good water. Recently our area was provided the City of DuBois water through an extension of the lines into Sykesville, PA. My concern is the potential of the DuBois City water source to be contaminated through the disposal of waste in Brady Township, Clearfield County.

Coal mines are located in the ¼ mile radius of review that intersected with the mines near Sykesville and probably connect to those below my home. Any potential leak into these mines would be disastrous and could affect the Sandy Lick Creek because the coal mines stretch under the DuBois Mall. We know the coal mine water could be cleaned up and used. If this waste being disposed of went into the mines accidentally it would go below many homes and has a serious far reaching affect.

Deep and shallow gas wells are located all around this proposed disposal injection well site and have the potential to leak waste around old casings. They could provide a pathway for methane migration into drinking water wells in the aquifer. Some of these abandoned wells may not be plugged. Just a few feet outside the ¼ mile review at least 5 deep wells are located in the same formation (Oriskany) that are able to transmit toxic fluid into water wells. Near my family is a deep gas well that we are concerned needs plugged.

Please extend the 1/4 mile area of review since it is not sufficient to understand the scope of the area. The City of DuBois being located so closely is a consideration. Water supplies for many city and township residents are very close to this proposed site along with many private water wells. These water supplies extend to us between Sykesville and Reynoldsville. Please make the cost to plug the disposal injection well higher than $30,000 as we feel this is insufficient. It is also important to ensure funds are available for any potential costs incurred if water becomes contaminated in the area. Please deny this permit.

Sincerely,

Sherry Green

Testimony-Sherry-green.doc

Rev. James Green
815 Reynoldsville Sykesville Road
Reynoldsville, PA 15851

November 30, 2012

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

Dear Mr. Platt,

RE: UIC Permit PAS2D020BCLE (Windfall/Zelman 1)

This letter is testimony on the Zelman #1 Injection Well proposed for Brady Township, Clearfield County due December 10, 2012. Thank you for holding the EPA hearing in Brady Township, Clearfield County on December 10, 2012 and consider this letter my request to hold this EPA hearing. My specific concerns deal with contamination of the underground sources of water:

#1 - My drinking water source is now the City of DuBois as my home is in Sykesville where they just brought water lines. Previously we've had well water. I'm concerned with the potential of this water source to be contaminated through the disposal of waste in Brady Township, Clearfield County.
#2 - Ground faults are located in the area close to the proposed disposal injection site. The proposed injection well may be located in an earthquake prone area. An earthquake near a disposal injection well would not be good because the casing would crack and leak.
#3 - Coal mines are located in the ¼ mile radius of review and any small fracture or leak has the potential to seep into these mines and carry waste under the City of DuBois. These mines are full of water and are all over our area, so these deep mines would transmit toxic fluid into water sources. These mines even come over into the Sykesville area where I live and down towards Reynoldsville where my church is located.
#4 - Abandoned wells could provide a pathway for methane migration into drinking water wells into the aquifer. Some of these abandoned wells may not be plugged.
#5 - Just a few feet outside the ¼ mile review at least 5 deep wells are located in the same formation (Oriskany) that are able to transmit toxic fluid into water wells.
#6 - The 1/4 mile area of review is not sufficient to understand the scope of the area and all the deep wells right outside the 1/4 mile review are potential sources of contamination to our drinking water. The City of DuBois being located so closely is another major consideration. Water supplies for many city and township residents are very close to this proposed site along with many private water wells. These water supplies extend to us between Sykesville and Reynoldsville
#7 - The cost to plug the disposal injection well should be much higher than $30,000 and we feel this is insufficient. It is also important to ensure funds are available for any potential costs incurred if water becomes contaminated in the area.

Sincerely,

Rev. James Green

Testimony_James_green.doc

December 6, 2012

Laurie Wayne
5498A Wayne Rd
DuBois PA 15801

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 PAS2D02BCLE (Windfall / Zelma 1)

Dear Mr. Platt,

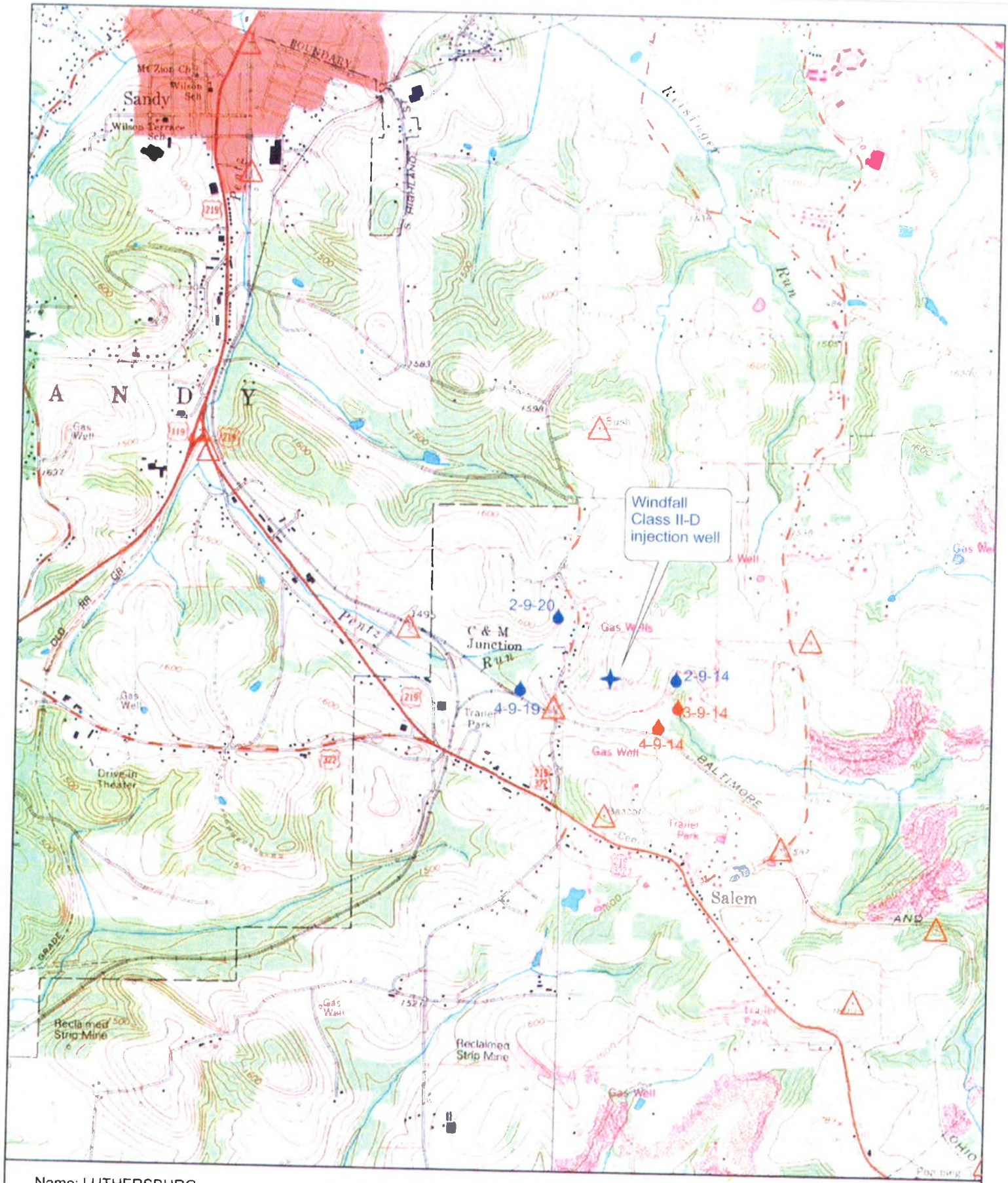
This letter is testimony on the Zelman #1 Injection Well proposed for Brady Township, Clearfield Count. Many local residents are very concerned about the underground sources of water being contaminated and want to have their concerns heard. Just some of our concerns are:

1. Possibility of a surface spill that would go directly into the aquifer.
2. Methane migration into the aquifer
3. Deep mines transmitting toxic fluid into water wells
4. Deep wells transmitting toxic fluid into water wells (near proposed injection well site we already have six deep wells in some formation)
5. Deep coal mines transmitting toxic fluid under the whole City of DuBois out to the DuBois Mall or towards Sykesville.
6. Proposed injection wells could be located in an earthquake prone area
7. Concerns that the gas well on Zelman property needs plugged (site of proposed disposal injection well)
8. Abandoned wells could provide a pathway for methane migration into drinking water wells.
9. Why is a toxic waste dump or toxic industrial activity being put into a residential area?

Sincerely,

Laurie Wayne

Injection Well Letter.pdf



Name: LUTHERSBURG
Date: 12/10/2012
Scale: 1 inch equals 2000 feet

Location: 041° 05' 8.77" N 078° 45' 12.54" W
Caption: Exhibit 1. Blue symbols: Monit. points contained in the application. Red symbols: Additional monit. points

windfall Exhibit 1. pdf

BRADY TOWNSHIP
P.O. BOX 125
LUTHERSBURG, PA 15858

Dec. 12, 2012

U. S. Environmental Protection Agency
Region III
Attn: S. Stephen Platt
1650 Arch Street
Philadelphia, PA 19103-2029

Dear Mr. Platt,

After attending the hearing on Monday, Dec. 10, 2012 at the Brady Township Community Center I have a recommendation.

I feel that the applicant for an injection well should have a study done listing the number of homes within a certain radius. Would this be something that the EPA could include on future requirements?

Respectfully,

Charles Muth
Brady Township Board Chairman

EPA letterDec.doc

Darlene Marshall
1070 Highland Street Extension
DuBois, PA 15801
(814) 583-7945
mrdewy@yahoo.com

December 11, 2012

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 PAS2D025BELK for Seneca Resources Corporation (Seneca)

Dear Mr. Platt,

This testimony is based on a quick review of the EPA's summary documents for this disposal injection well permit. All my concerns deal directly with the potential contamination of the underground sources of drinking water (USDWs).

First, I'd like to thank the EPA for holding this public hearing. Secondly, I'm requesting an extended period of time to review this permit application based on several concerns that we see with the application statement of basis and the need for the community to more fully review the geology, hydrology and affects a disposal injection well will have in Highland Township (Elk County).

We understand this is an area that makes their living on oil and gas production. So we understand the need to dispose of these waste products. My involvement with a disposal injection well in Clearfield County has helped me to learn a lot over the last year. What is decided for this disposal injection well site will have an effect on our watersheds and our future generations. You may ask why I am concerned and it is because I work in Jefferson County at the library in Brockway. The water we use and our watershed may be affected by what is decided in Highland Township, Elk County. Clarion County is probably definitely affected by this final decision to place this proposed injection well.

The Statement of Basis gives me great concern to see the following statements:

1. reusing an existing traditional gas well for purposes of waste disposal
2. the proposed depth of the traditional gas well is very shallow and disposal of waste fluids have potential to quickly migrate up natural pathways into water sources in a two mile radius or more since waste goes out underground for miles
3. the fluids (waste) that would be disposed into this proposed disposal well need to be defined since Marcellus Shale gas waste is known to be toxic and are totally different fluids than fluids disposed of from traditional gas well brines
4. if the fluids being disposed of are able to come from Marcellus Shale gas production than this permit needs to have an area of review for two miles showing all water sources in the area

Testimony_Darlene_Highland_Township.pdf

Darlene Marshall
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DuBois, PA 15801
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5. the confining layer looks to be shale and from what I have learned shale is not a good barrier for fluids, so more information needs to be done on the confining cap rock
6. Pennsylvania geology is not ideal for disposal of waste or disposal injection wells and more research should be done by the community on the actual geology in the area

After a year of volunteer work to learn and educate leaders on disposal injection wells I have learned a lot about this process and the EPA process.

Adequate review time for this permit needs to be provided to the community and I request the EPA take into consideration some key points:

- the permit applicant has as long as it takes to answer all the questions and find the answers for an EPA permit application for a disposal injection well to be submitted
- any deficiencies found in the disposal injection well application are provided to the permit applicant with no restraint on time frame
- the community has approximately thirty days to respond to something they have limited knowledge about and limited resources to research so they can fully understand
- community leaders need to be involved in the process and often they have limited time to learn about the disposal injection well process and understand the ramifications
- representatives for the community need to have input from geologists and engineers, which they don't have adequate time to employee or contact within the EPA public comment period
- local residents who have experience in the drilling industry and the water sources for the area need to be involved and provide input

These are just some of the reasons the permit application review time for the public needs to be extended.

This community has just experienced a major issue of an environmental nature due to their sewage treatment plant. Wastes were being discharged into Wolf Run. Human error is what caused this environmental impact. This is a good case for the EPA to consider that allowing those who are doing the work for a disposal injection well company to monitor and self report can be an issue that needs to be addressed now before a permit is issued.

As a librarian with a Master's Degree the first thing I did once learning about a proposed disposal injection well in my neighborhood was attend a session at a library conference with Richard Alley, a Penn State Geology Professor. He explained to me the pumping of waste into the ground has an effect and will cause the subsurface to move. His specific example demonstrated pushing on a desk showing it would eventually move and he related this to the pumping of waste underground. His book "Earth: the operator's manual" states we have known since the 1960s that pumping waste underground can cause earthquakes.

"We have long known that injecting fluids into Earth, for whatever reason, can trigger earthquakes. One famous series of quakes in the early to mid 1960s near Denver, Colorado, with

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many having magnitudes of between 3 and 4, was triggered when people tried to dispose of waste fluids by injecting them under pressure into deep rocks (Richard B. Alley in "Earth: the operator's manual" originally from "The Denver Earthquakes" in "Science")." Richard Alley also states, "If the old cracks are oriented such that today's stresses are trying to reopen them, then the 'fracking' from gas extraction or *waste disposal* or geothermal-power generation will just help reopen the old cracks." We already know that deep gas wells used the "fracking" process in our area with two deep gas wells that would have affects into the ¼ mile area of review. Even though the permit application states no "fracture data" is available in the area on the confining zones. An excellent statement about our situation is found in **Richard Alley's book "Earth: the operator's manual" stating, "hydrogeologists have lent their weight to efforts to keep pollutants out of the ground, because keeping them out is often a lot easier than getting them back out."**

Please explain how the EPA plans to protect all the water sources in the area from contamination even those outside the ¼ mile area of review since we know waste will go for miles underground. For example, the Irvin Well (Clearfield County) was over pressurized and fined. How will residents feel safe? How will residents be notified of a violation? How was the waste cleaned up? It appears this Irvin well had prior violations before. Violations happened in 1987, 1997 & 2010. This last violation took a significant amount of time to be fined. For example, in the violation case of the Irvin Well (Clearfield County) it was stated that, "if a well owner had their water tested regularly and now, finds an issue with the water, the EPA wants to know and EXCO could be forced to provide an alternative water supply. EPA suggests well owners have their water tested regularly to protect their rights." Disposal injection wells should be required to monitor quarterly or more regularly water sources in the area. This waste will be pumped underground continuously and will stay for many years with the potential to come up any "naturally occurring pathway" or any old gas well casing already in the same formation. This is not a risk that should be taken, especially near our springs or sources of public water.

Monitoring wells need to be used and tested regularly although we know this still might not find contamination in underground sources of water (USDWs) in time to protect residents since undocumented boreholes or natural transmissive conduits (faults or fractures) would endanger water sources (USDWs) before testing results are conducted and injection processes are halted. Also, the possibility of a surface spill that would go directly into the aquifer is a concern.

We request all old gas wells be reviewed before any permit is issued for a disposal injection well. Abandoned wells could provide a pathway for methane migration into drinking water wells into the aquifer. Some of these abandoned wells may not be plugged properly. The fractures from these old gas wells are an important concern because they may have affected the proposed confining layers and made pathways to allow waste migration into aquifers.

It is also important to residents to ensure funds are available for any potential costs incurred if water becomes contaminated in the area. We request that the EPA extend the area of review and

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look beyond the original ¼ mile area of review due to the problems we have already seen in Clearfield County with the Irvin Well. A better understanding of the area should be researched due to all the oil and gas production that this area depends upon for its economy.

It has been stated that Pennsylvania's geology is not conducive to disposal injection wells, so why are we discussing utilizing them more often in Pennsylvania? This permit application is trying to state the ideal conditions and unfortunately Pennsylvania studies show we don't have ideal conditions due to our history of drilling and fracturing the ground. The Environmental Geology Report titled "Subsurface Liquid Waste Disposal and Its Feasibility in Pennsylvania" by Neilson Rudd states extended effects of waste disposal, "The area of effect of an injection operation is considered to be defined by the extent of the effluent in its reservoir. While this area may be difficult to define, the area of pressure effect is even greater and more difficult to predict." It also states, "Oil field and ground-water experience shows too many examples of far-ranging and unpredictable displacement and pressure responses to justify confidence in simplistic calculations based upon idealized conditions." In summary the report states, "It cannot be overstressed that the introduction of waste liquids into the subsurface is a permanent alteration of the subsurface environment. The magnitude of these changes may be small, but they are cumulative." *Another finding in the report states, "The long-term injection of large volumes of waste must eventually result in the upward displacement of the brine intraformationally or through fractures into the fresh-water zone.* The concentration of subsurface brines is so great, up to the order of 300,000 parts per million, that the intermixing of even one gallon will render several thousands of gallons of fresh water unfit for human use." The final summary statement of the report mentions, "It is, however, an endeavor requiring careful planning and foresight, together with careful operation and observation, to prevent the ultimate environmental damage which outweighs the immediate benefit. The planners of subsurface disposal projects must think in terms of the whole rock-fluid system, in terms of tectonism, regional stratigraphic relationships, structural discontinuities and stresses, hydrodynamics, and interactive chemistry between all components of the systems, not just in terms of the immediate problems of fluid flow and storage in the vicinity of the injection site."

Let us not repeat history. Just look at the first Pennsylvania disposal injection well that failed because fluid was found to be coming back to the surface five miles away? Hammermill Paper Co, Erie, Pa. 1968 leaked five miles away and gas came up five miles away in an abandoned gas well. Look at a similar Class II Enhanced well in McKean County 1990's residents water wells were contaminated near Custer City south of Bradford Co, petroleum products showed up in private residential water wells down- gradient from the disposal well (Don Hopey, Pittsburgh *Post Gazette, Wastewater disposal wells under scrutiny following Irvin leak).* The most recent issue was with the Irvin A-19, Clearfield Co., overpressurized for 3 months and leaked -- Violations for EXCO Resources fined $159,000 for brine disposal well issues, failed mechanical integrity, exceeded knowingly permitted maximum pressure for 3 months in 2010, ordered to pay $159,624 penalty & repair well.

Darlene Marshall
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DuBois, PA 15801
(814) 583-7945
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In May 2012, Duke University presented that we are at greater risk of USDWs being contaminated due to all the shale gas development. Wastewater treatment facilities are being built and becoming operational reducing the need for disposal injection wells. ProChem Tech International has a local chemist, Tim Keister, that has two patents pending to recycle wastewater using total resource recovery to make chemical products for sale. The company is currently talking with Shell Oil, which states the significance of this accomplishment. This is an option that would protect our area and our underground sources of water (USDWs).

This waste may be radioactive. EPA has Class II Injection rules that aren't as strict as Class I Injection rules but they need to be for this site due to the potential conduits that exist within the area of review or zone of endangering influence that penetrate the proposed injection zone. No chances should be taken with the USDWs in the area.

The use of monitoring fluid levels in the injection zone during injection operations is done to ensure pressure created by the injection operation will not cause migration of fluid up abandoned gas wells that could exist. Due to the example of the Irvin Well in Clearfield County being over pressurized this monitoring process isn't sufficient to ensure USDWs remain uncontaminated. We request constant monitoring even after the disposal injection well is plugged and want a comprehensive monitoring plan. Please have a full survey of water wells in a two mile radius completed before this permit is issued.

Residents request a way to prevent the over pressurizing of this injection well and not knowing about it for months. They want drinking water protections in place that protect against what happened in the Irvin A-19 Well (Clearfield County).

Please characterize the wastewater being disposed. Please explain the density and corrosiveness of injection fluids.

Please provide residents a list of all producing gas wells, abandoned gas wells, dry holes, surface bodies of water, springs, mines, other pertinent surface features, faults, roads, public sources of water, residences and water wells in a two mile radius. Residents feel all these are factors that contribute to protect USDWs.

Please provide a description of all known gas wells that penetrate formations affected by the increase in pressure. Residents know this information is important to protect our USDWs.

Please explain further all vertical limits and lateral limits of all underground sources of drinking water and their position in relation to the proposed disposal injection well and the direction of water movement (every USDWs that may be affected with name and depth). We want to ensure that the public water sources will not be affected.

Further research needs done on the geological structure of the area. The information provided in

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the permit application needs double checked by local area experts, geologists and engineers from the community.

Further information needs to be provided in a plan that demonstrates no significant fluid movement into USDWs, oil or gas zone, underground gas storage horizon through vertical channels adjacent to the injection well bore.

Please identify the closest public source of water allowed to be located to a disposal injection well. Explain how the public sources of water will be monitored.

Please explain how the EPA will track disposal injection well failures, issues impacting USDWs, permit denials, revocations, fines. Residents need to understand who is ultimately responsible for risk assessment in local communities.

If this disposal injection well is planned for fracking wastewater (production waste) some of it will be radioactive. A plan should address the types of radioactive isotopes found in this water and what actions would be taken in the event of a spill, leak or violation of over pressurizing since this could affect our USDWs. The Penn State Extension office report states, "Untreated flowback water is toxic to aquatic life, particularly trout and other sensitive species."

Future and current Marcellus activity, fracturing and over pressurization may open a natural fracture joint into the disposal injection well zone. So how will this be avoided? We know this area depends on oil and gas production. This could affect our USDWs. What measures will be taken to protect the residents for the future? Will owners of the gas be limited in their potential development of the gas fields knowing that the disposal injection well is in the area?

Background monitoring should be required of all water wells, springs and public water sources including enough samples over a long period of time to demonstrate natural deviations or cyclic trends. Not just a single background sample that can later say that future samples don't show pollution, just some deviations from the single background sample.

It seems like enough pressure could be underground already, and no one is sure if a geyser of waste will be created if a crack is anywhere underground in this area. Also, pressures used for the disposal of waste have the potential to fracture the ground more. Please require the use of an electronic log be required before this permit is considered.

All these concerns actually stem from possible contamination of USDWs near our private water wells and major public water supplies. Recent articles have cited one well integrity violation was issued for every six deep injection wells examined in the nation (Propublica, *680,000 wells hold waste across US without unknown risks*).

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Respectfully we request you provide adequate time for this community to research this proposed disposal injection well site and based on current input from Elk County Commissioners strongly consider denying the application due to all the concerns listed with our underground sources of water (USDWs). Thank you for your consideration of my testimony.

Sincerely,

Darlene Marshall

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Brockway, PA 15824

December 14, 2012

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

RE: Proposed Zelman #1 Injection Well
Brady Township, Clearfield County

Dear Mr. Platt,

I object to issue of this, or any, injection well permit for disposal of Marcellus flowback and production wastewaters in the Commonwealth of Pennsylvania. My reasons for this objection are as follows.

1. Injection wells in Ohio, Colorado, and Texas have been determined to be the likely source of numerous earthquakes in these three states. It is reported that ground faults are in the area of the proposed well and thus injection of fluids may trigger earthquakes in the surrounding residential area. As you are aware, water is not compressible and injection of fluids underground will result in earth movement of some kind. For example, 1 million gallons of water has a volume of 133,690 cu ft, which is a substantial amount of something that has to be displaced.

2. The general area of the proposed well has been extensively deep coal mined in the past and also has several abandoned gas wells reported to be into the same formation that wastewater will be injected into. It is quite likely that the abandoned wells were never properly sealed and so it is very likely that injected wastewater would have a means to migrate into aquifers and even into the old mine workings, which do discharge to surface waters. Due to the features of the proposed site, it is likely that both subsurface contamination of aquifers and surface waters will be caused by operation of the well.

3. As shown on the attached data table, all Marcellus production waters contain a significant amount of toxic barium chloride. Is this site going to be permitted as a TSD facility for disposal of "Hazardous Wastes"? The levels of barium shown in the table all exceed the USEPA TCLP limit of 100 mg/l for barium which determines if a waste is hazardous or not. If there is any processing of this wastewater prior to injection, I believe that the Oil and Gas exemption for hazardous waste does not apply.

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Injection well objection letter 12.12.doc

AWT ASSOCIATION OF WATER TECHNOLOGIES

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4. Technically, as shown in the attached IWC paper, there is a viable, environmentally superior means to dispose of Marcellus wastewaters that does not result in potential future environmental problems.

5. As shown on the attached new clipping, your Agency has not been properly regulating use of injection wells in other states; we do not need these types of problems in Pennsylvania.

Thank you for your attention. Please feel free to contact me directly if you have any questions or comments.

Sincerely,

Timothy Keister

Timothy Keister, CWT
Chief Chemist/President

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EPA allowed waste injection that polluted at least 100 aquifers (Pittsburgh Post-Gazette): A view of the dry bed of the E.V. Spence Reservoir in Robert Lee, Texas, in October 2011. Records show that environmental officials have granted more than 50 aquifer exemptions for waste disposal and uranium mining in the drought-stricken state. Federal officials have given energy and mining companies permission to pollute aquifers in more than 1,500 places across the country, releasing toxic material into underground reservoirs that help supply more than half of the nation's drinking water. In many cases, the Environmental Protection Agency has granted these so-called aquifer exemptions in Western states now stricken by drought and increasingly desperate for water. EPA records show that portions of at least 100 drinking water aquifers have been written off because exemptions have allowed them to be used as dumping grounds. "You are sacrificing these aquifers," said Mark Williams, a hydrologist at the University of Colorado and a member of a National Science Foundation team studying the effects of energy development on the environment. "By definition, you are putting pollution into them. If you are looking 50 to 100 years down the road, this is not a good way to go." As part of an investigation into the threat to water supplies from underground injection of waste, ProPublica set out to identify which aquifers have been polluted. We found the EPA has not even kept track of exactly how many exemptions it has issued, where they are, or whom they might affect. What records the agency was able to supply under the Freedom of Information Act show that exemptions are often issued in apparent conflict with the EPA's mandate to protect waters that may be used for drinking...

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Aquifer Pollution 1212.doc

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November 30, 2012
Marcellus and Utica production wastewaters

Parameter	Frac 15	Frac 16	Frac 17	Frac 18	Frac 19	Frac 20	Frac 21
location	Tioga	SW PA	Boone Mt.	Tioga	Bky	Utica OH	Utica OH
barium mg/l	6,000	325	760	7,700	560	384	332
calcium mg/l	17,500	19,600	36,000	30,400	27,200	23,000	35,500
iron mg/l	100	83.5	44.5	167	110	230	129
magnesium mg/l	1,800	1,945	2,930	2,100	2,000	2,050	2,450
manganese mg/l	3.5	10.8	13.0	13.0	19.0	9.0	43.0
strontium mg/l	3,600	2,360	1,400	3,720	5,000	3,560	3,460
pH		5.8	4.98	5.3	5.4	5.5	5.9
sodium mg/l	80,000	41,000	42,200	52,000	62,000	50,000	47,000
chloride mg/l	180,000	108,230	157,400	180,000	178,800	103,800	137,100
lithium mg/l	189	93	200	234	220	78	55
bromide mg/l	812	2,660	2,340	1,070	1,912	1,240	1,770
ammonia mg/l	132						
oil/grease mg/l						38	834
specific gravity	1.124	1.125	1.17	1.42			
Radium 226 pCi/l		117.32	290.11	118.29	24.09	0.58	49.86
Radium 228 pCi/l		308.86	458.68	52.10	49.94	8.3	707.19

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Frac production wastewaters as received 11.12.doc

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Parameter	Frac 22	Frac 23	Frac 24	Frac 25	Frac 26	Frac 27	
location	King	Vannoy	Meas	Sharer	Hunt 1	Hunt 2	
barium mg/l	8,800	434	14,000	25,400	4,400	4,950	
calcium mg/l	11,000	3,410	22,500	16,800	35,000	34,000	
iron mg/l	66.1	92.0	121	208	148	181	
magnesium mg/l	800	1,600	1,100	1,150	2,220	2,220	
manganese mg/l	2.1	6.0	7.4	8.1	27.5	25.5	
strontium mg/l	3,390	400	5,850	5,720	6,220	6,160	
pH	5.8	6.0	5.5	5.4	4.6	4.7	
sodium mg/l	31,500	7,000	47,500	49,500	64,000	64,000	
chloride mg/l	77,900	15,200	116,800	121,900	177,400	175,500	
lithium mg/l	150	19	279	260	220	210	
bromide mg/l	578	103	854	961	1,407	1,434	
COD mg/l			1,664	19,688	2,473	1,789	
oil/grease mg/l				3,236			
specific gravity							
Radium 226 pCi/l	20.53	1.36	18.94	7.16	25.06	32.51	
Radium 228 pCi/l	16.59	4.17	44.05	68.99	62.93	40.55	

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Sequential Precipitation - Fractional Crystallization Treatment of Marcellus Shale Flowback and Production Wastewaters

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Keywords: Marcellus, shale, flowback, production wastewater, treatment, resource recovery, sequential, precipitation, fractional, crystallization

ABSTRACT

By 2016 development of the Marcellus shale gas play in the Northeast will generate an estimated 60 million gallons per day of hydrofracture flowback and production wastewater. This wastewater is close to saturation with sodium, calcium, magnesium, strontium, and barium chlorides as major constituents. Discharge of such wastewater has been outlawed in Pennsylvania, leaving deep well injection and treatment for recycle/reuse as current disposal options. Resource recovery by sequential precipitation and fractional crystallization, which produces salable products from the wastewater, has been developed as an economic disposal method for Marcellus wastewaters.

BACKGROUND

The Marcellus gas shale deposit, which underlies most of northern Appalachia, is estimated to contain 168+ trillion cubic feet of natural gas. Due to the depth and compact nature of this formation, horizontal drilling with follow-up hydrofracture of the formation using a mixture of high pressure water and sand is required to obtain economic gas production.

From 2 to 8 million gallons of water, mixed with sand and various additives, is required to completion fracture each horizontal deep well. Following hydrofracture, free water must be removed from the well, generally 10 to 20% is recovered, and is commonly referred to as "flowback" wastewater. Recent developments permit recycle of flowback, with minimal treatment, as hydrofracture makeup water.

Once a Marcellus gas well has been drilled and hydrofractured, "production" wastewater is produced for the 15 to 20 year life of the well at rates from 400 to 4,000 gpd. By 2016, with 30,000 wells expected to be in production, it is estimated that 60 million gallons per day of production wastewater will be generated and require proper management. Production wastewater is "dispersed"; the wells producing it are geographically spread over wide areas with low daily flows. Management of this wastewater will require well site tankage and tank truck based collection to convey it to either transshipping locations for transport to injection wells, out of state treatment; or to central resource recovery facilities.

In contrast to production wastewaters from other gas shale plays, Marcellus production wastewater has a very high level of dissolved solids with large amounts of barium, calcium, magnesium, sodium, and strontium chlorides; with many other constituents, such as bromine and lithium, present in lesser quantities. Table 1 is a typical analysis of a Marcellus Production Wastewater.

Table 1, Marcellus Production Wastewater

Parameter as mg/l	Result
aluminum	3.0
barium	6,500
bromide	800
calcium	18,000
chemical oxygen demand	8,000
chloride	116,900
iron	60
lithium	150
magnesium	1,300
sodium	48,00
strontium	4,000

Note that chemical analysis of Marcellus production wastewaters presents a challenge to analytical laboratories due to the high dissolved solids content.

PAST AND CURRENT TECHNOLOGY

Past and current practice for disposal of flowback and production wastewaters has included use as a roadway deicer in winter and dust control agent in the summer, discharge to surface waters via publicly owned treatment works (POTW), treatment with direct discharge to stream, and treatment with recycle as hydrofracture makeup water.

ROADWAY DEICER/ DUST CONTROL- Gas well production wastewaters have been generated and disposed of in Pennsylvania for over 100 years. In the past, the majority of these wastewaters were either dumped around the producing well or used for roadway deicing and dust control. The advent of environmental regulation has correctly eliminated these disposal practices.

DISCHARGE VIA POTW (Publicly Owned Treatment Plants) - Prior to the Marcellus shale development, a substantial amount of gas well production wastewater was

disposed of via POTW with subsequent discharge to surface waters. This did not result in any major problems as non-Marcellus gas well production wastewaters are low volume and contain much lower amounts of barium and strontium than Marcellus wastewaters. In 2008, the rapid increase in Marcellus wastewater production and disposal via POTW that the Monongahela River was severely impacted, dissolved solids levels increasing by a factor of more than two. This prompted the PA Department of Environmental Protection (PADEP) to ban disposal of Marcellus wastewaters by almost all POTW. Currently less than ten (10) POTW are permitted for gas well wastewater disposal and continue to accept limited amounts of gas well wastewaters. Some specific problems noted by POTW accepting Marcellus gas well wastewaters include increased sludge generation, increased barium content in produced sludge leading to concerns as to a potential hazardous waste designation, and flotation of sludge in final clarifiers.

TREATMENT WITH DISCHARGE- Prior to development of the Marcellus shale, several facilities existed for chemical treatment of gas well wastewaters with direct discharge to stream. These facilities use chemical precipitation with calcium hydroxide to remove suspended solids and some dissolved metals.

The PADEP has prohibited discharge of additional, or new, high dissolved solids (over 500 mg/l) wastewaters into waters of the Commonwealth. This prohibition has restricted these facilities to treat no more than historical flows, estimated at 1.5 mgd, and dissolved solids loading, which existed prior to the regulation change.

These facilities face an additional challenge if Marcellus wastewaters are to be treated in that as their discharge permits are renewed, or modified, they must comply with an effluent limitation of 10 mg/l maximum for both barium and strontium.

TREATMENT WITH RECYCLE AS HYDROFRACTURE MAKEUP WATER- Since start of Marcellus development, several facilities have been constructed which treat gas well wastewaters by precipitation using sulfate to lock up barium and strontium followed by calcium hydroxide for general metals removal.

The resulting clear brine is then returned to gas well drillers for use as hydrofracture makeup water. There is a substantial debate as to what standards are needed for reuse of treated water as hydrofracture makeup water. The following Table 2, Recycle Criteria, summaries some generally accepted recycle criteria.

Table 2, Recycle Criteria

Parameter	Criteria
pH	6.0 to 8.0
maximum total hardness	2,5000 mg/l as $CaCO_3$
maximum calcium hardness	350 mg/l as $CaCO_3$
maximum total iron	2 to 20 mg/l
maximum sulfate	100 mg/l
maximum dissolved solids	40,000 to 150,000 mg/l

Note that these criteria are usually achieved by precipitation treatment of the Marcellus wastewater followed by a high rate of dilution with fresh water.

Major problems with this approach include a large volume of mixed sludge to be landfilled and the potential to become water logged as Marcellus hydrofracture activity is replaced by production operations.

TOTAL EVAPORATION- Various promoters have advanced use of total evaporation with production of a condensate as a viable means to dispose of Marcellus wastewater. Evaporation has two major problems.

Evaporation of Marcellus wastewaters produces a solid material for disposal which, if the barium content is not removed or

chemically rendered insoluble, will often test out as a USEPA Toxic Characteristic Leach Procedure (TCLP) test hazardous waste due to soluble barium content. This specific problem has been demonstrated by operation of a total evaporation pilot facility where the produced solids were determined to be a TCLP hazardous waste due to soluble barium content.

The other problem with total evaporation is the amount and chemical composition of the solid material produced and how to manage it. Based on the typical Marcellus wastewater, pretreated for barium removal, evaporation of 250,000 gallons would produce 397,823 pounds (approximately 200 tons) of a mixture of residual salts. Some of these salts, such as calcium chloride, are deliquescent; all are very soluble in water as shown in the following Table 3, Residual Salts Solubility.

Table 3, Residual Salts Solubility

Residual Salt	Solubility
barium chloride	37.5 g/100 ml
calcium chloride	74.5 g/100 ml
lithium chloride	63.7 g/100 ml
magnesium chloride	54.3 g/100 ml
sodium chloride	35.7 g/100 ml
strontium chloride	53.8 g/100 ml

Based on the solubility of these salts, disposal of the residual salt mixture from total evaporation treatment in a landfill of any kind would appear to be impractical due to their ready formation of liquid salt solutions on contact with water or moisture. While use of the residual salts for roadway deicing has been proposed, this appears to be ruled out by the regulation of strontium in aqueous effluent at a maximum of 10 mg/l and would also present substantial logistics problems.

CHEMICAL PRECIPITATION TO SALT BRINE- Chemical precipitation of barium, calcium, magnesium, and strontium from Marcellus wastewater results in production of a sodium chloride brine, which could be utilized for roadway deicing if other toxic constituents were at suitable levels. This brine could also be evaporated to produce a solid sodium chloride that may be suitable for other uses. Drawbacks include generation of very large amounts of mixed sludge requiring landfill disposal and a substantial logistics problem.

DEEP WELL INJECTION- Currently, a substantial amount of Marcellus wastewater is disposed of by deep well injection, most of the injection wells being located in Ohio. This disposal method has two problems, the first being simply that the wastewater has to be transported considerable distances by tank truck or rail tank car to the injection well site. Transportation costs on the order of $0.05 to $0.25/gallon have been reported.

A second problem has been recently noted around Youngstown, OH, with several deep well injection sites being linked to earthquakes. The Ohio EPA has responded by shutting several injection wells down and restricting both the amount of wastewater that can be injected and development of additional wells.

SEQUENTIAL PRECIPITATION FRACTIONAL CRYSTALLIZATION

We have developed the Sequential Precipitation Fractional Crystallization Process (SPFCP) to address economic disposal of Marcellus wastewater by resource recovery. This patent pending technology disposes of the wastewater by processing it into salable commodity chemical products with no landfill disposal of residual material or discharge of liquids. Cost of process operation is generally less than the revenue produced by product sales.

The SPFCP must first address the high content of barium found in Marcellus wastewater. As barium is a USEPA hazardous heavy metal, it is desired to remove it to low levels from the wastewater as a salable product.

BARIUM RECOVERY- The first precipitation step in the SPFCP is to chemically remove the barium as insoluble barium sulfate under closely defined conditions where precipitation of calcium, magnesium, and strontium are minimized. The concentration of barium and strontium in the wastewater is first determined, then sulfate ion (as sulfuric acid) is added in an amount of 40% over the calculated stoichiometric amount to remove the barium as the sulfate to low levels. In this first mix tank, potassium permanganate is also added in an amount to obtain a faint pink color, indicating excess permanganate, which oxidizes the majority of the organics present in the wastewater and to oxidize any ferrous iron present. Sodium hydroxide is also added to this mix tank to maintain the pH in the range of 2.5 to 3.5.

In a second mix tank, the wastewater pH is adjusted to 3.5 to 4.0 by addition of sodium hydroxide to complete the barium sulfate precipitation. Under these process conditions, a fine barium sulfate precipitate is formed which is then flocculated in a third mix tank, equipped with a VFD slow speed mixer, by addition of a low anionic charge, high molecular weight polyacrylamide polymer . The flocculated barium sulfate is removed from the wastewater using an inclined plate clarifier, dewatered and washed with distilled water for retained soluble salt removal in a plate and frame filter press, discharged, and dried. The recovered barium sulfate at this point is a commercial product, "barite" with barium stripped brine remaining.

STRONTIUM RECOVERY- Dependent upon its concentration and economics involved, strontium can be removed from the barium stripped wastewater as the sulfate in a process similar to that for barium and recovered for sale.

SODIUM CHLORIDE RECOVERY- We have discovered that sodium chloride can be removed from the barium stripped wastewater by fractional crystallization to produce a very high purity sodium chloride crystal and a commercial grade solution of calcium chloride.

Evaporation of the stripped wastewater results in concentration of the various salts present. As shown in the following Table 4, Three Phase Solubility, as the concentration of calcium and magnesium salts increase, the solubility of sodium chloride decreases, resulting in fractional crystallization of sodium chloride from the concentrating wastewater.

Table 4, Three Phase Solubility

Calcium Chloride	Magnesium chloride	Sodium chloride
33.8	8.4	2.3
52.9	8.2	0.9
60.1	0	0
60.2	0	0

as grams/100 ml @ 95 C

We have also discovered that sodium chloride crystal size and potential scaling of the evaporator are controlled by equipping the evaporator with a high energy mechanical mixer.

Sodium chloride crystals are removed by sidestream filtration of the condensed wastewater from the evaporator on a continuous basis using a linear vacuum belt filter. Filtered crystals are washed with saturated sodium chloride brine, to remove the more soluble salts, and dried. The sodium chloride crystal at this point is a commercial product.

CALCIUM CHLORIDE RECOVERY- By controlling the concentration of calcium chloride in the evaporator to remove sodium chloride to below 2.5%, the resulting calcium chloride solution is a salable commercial product.

After removal of the sodium chloride crystals by sidestream filtration, the filtered calcium chloride solution passes through a specific gravity measurement device and if the specific gravity is above 1.44, routed to the

calcium chloride solution storage tank. Calcium chloride solution below this specific gravity is returned to the evaporator for further concentration.
Calcium chloride solution at a specific gravity of 1.44 will have to be diluted with distilled water to a specific gravity between 1.275 and 1.310 to make a commercial grade product at 28 to 31% calcium chloride content.
DISTILLED WATER- Evaporator water vapor will be condensed to recover energy by preheating incoming barium stripped wastewater in a heat exchanger. This distilled water will provide the facility with barite rinse water, water for sodium chloride brine preparation, calcium chloride solution concentration adjustment, and cooling tower and boiler makeup.
Any excess water could be sold for use as hydrofracture makeup water or even discharged to stream with an appropriate permit.

LABORATORY RESULTS

The SPFCP has been tested in laboratory scale experiments to ascertain process operating parameters on a variety of actual Marcellus flowback and production wastewaters.
The following Table 5, FRAC 15 Test Results, shows typical results obtained on one test of a Marcellus production wastewater from Tioga County, PA, where first the barium is precipitated (Ba ↓) followed by fractional crystallization removal of sodium (Na ↓).

Table 5, FRAC 15 Test Results - as mg/l

Parameter	untreated	Ba ↓	Na ↓
barium	6,000	43	50
bromide	812	1,020	9,632
calcium	17,500	19,300	182,000
lithium	189	220	2,050
magnesium	1,800	1,540	14,750
sodium	80,000	55,500	2,600
strontium	3,600	1,280	10,100

The sodium chloride crystal recovered from this test run was analyzed with the following results obtained, Table 6, Sodium Chloride Results.

Table 6, Sodium Chloride Results

Parameter	Result - mg/kg
sodium	410,000
calcium	1,535
magnesium	107
barium	60

A sample of produced barite was tested using the USEPA TCLP to determine if the product could be classified as USEPA hazardous waste. As shown in the following Table 7, Barite TCLP Results, the product is not a hazardous waste.

Table 7, Barite TCLP Results

Parameter	Result - mg/l
arsenic	0.016
barium	0.465
cadmium	<0.005
chromium	0.0236
lead	<0.02
mercury	<0.0002
selenium	0.402
silver	<0.01

To date, a total of fourteen (14) Marcellus flowback and thirteen (13) production wastewaters from across Pennsylvania have been tested to determine if the SPFCP was applicable to that specific wastewater. This testing has confirmed that the SPFCP can be used to treat all of the tested Marcellus wastewaters.

ECONOMICS

BARITE- An average value for barium in production water is 5,000 mg/l, so a 500,000 gpd SPFCP facility would produce 17.7 dry tons of barite per day or 6,469 tons per year. Annual world use of barite was estimated at 7,000,000 tons in 2010 with the product found in drilling mud, glass, brake linings,

paints, and mold release compounds. Annul US use of barite is estimated at 2,700,000 tons with about 80% imported. Good quality barite sells for up to $1.00/lb, with wholesale prices in the $0.15 to $0.25/lb range.
From this information it is evident that the barite product by resource recovery of Marcellus gas shale wastewaters can be easily absorbed into the existing market and that significant revenue can be generated by barite sales.
SODIUM CHLORIDE- An operating SPFCP facility will produce large amounts of sodium chloride. With a typical production water sodium level of 58,500 mg/l, a 500,000 gpd SPP facility will produce about 122 tons/day, annual output of 44,530 tons, of sodium chloride crystal.
Annual production of sodium chloride in the US is estimated at 45,000,000 tons with a bulk wholesale price of $30/ton. Bagged, good quality material can be sold at up to $160/ton.
As with the barite, the sodium chloride output of several SPFCP facilities can be readily absorbed into the existing market with significant revenue generated by salt sales.
CALCIUM CHLORIDE- Assuming typical production water content of 15,000 mg/l calcium, a 500,000 gpd SPFCP facility will produce 96.5 dry tons per day, 241 tons of 40% liquid calcium chloride product. This product is used in de-icing fluids and freeze proofing coal, coke, stone, and ore; production paper, fungicides, starch paste, concrete additive, fabric sizing, and electrolytic cells. Current wholesale price for 40% calcium chloride solution is $160/ton. When the annual output of one SPFCP facility of 35,223 dry tons is compared to 2002 annual worldwide use of 1,687,000 tons, it is evident that the output from several SPFCP facilities can be readily absorbed in the market. As with the barite and sodium chloride, significant revenue can be generated by sale of calcium chloride solution.

OPERATING ECONOMICS- Based on the chemical and energy use of a 250,000 gpd capacity SPFCP facility, market pricing of the various inputs, and labor costs; a daily operating cost of $22,000 has been calculated. Sale of produced commodities, at wholesale prices as noted, will return approximately $35,500/day, resulting in $13,500/day income to pay for construction of the facility.
FACILITY COST- Our Engineered Services Division recently estimated the cost to build a 250,000 gpd capacity SPFCP facility at $11,316,000, exclusive of site acquisition and development costs. With this cost and the $13,500/day operating cost credit, there is a simple payback of 2.3 years on a SPFCP facility of this capacity.

FUTURE RESEARCH

Both bromine and lithium are concentrated in the calcium chloride solution to levels which may be economical to consider recovery of one, or both, materials. Future research will be directed towards examination of methods for recovery of both materials.

CONCLUSION

Based on extensive laboratory research, the SPFCP has been determined to be an economical method for disposal of Marcellus wastewaters. Production of salable commodities from the wastewater provides a positive cash flow which will pay for construction of a facility in a reasonable amount of time.

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12-13-12

ection well inspectors? A sick joke

Curmudgeon's corner

Glenn Schuckers

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This is a one-family home and 95 percent of the time two people live here. It is located on 86 acres which we own, and the nearest neighbor is a quarter of a mile, uphill, from our home. Yet we had to have a soil scientist come out and inspect and then design a septic system to dispose of the little waste that we generate.

Before we moved in, we had to have another engineer come out and look at the whole place to make sure it met the "Code" that specifies that, among other things, there is a railing on the basement steps.

In short, we had to be inspected half a dozen or more times before we could build and then move into a house. Two people, one house. We didn't mind because it is just the law.

Contrast that with the law that permits a well that could poison or at least destroy the quality of life for hundreds or even thousands of people.

First, the state turns over that control to the federal government.

Why stop there? Why not have the federal government issue drivers' licenses? Why not have the feds issue hunting licenses? Diplomas? Why not have the feds come out and issue a permit for a septic system?

But as ridiculous as all that sounds, the state has determined to turn over jurisdiction of injection wells, not gas wells, to the feds. And, as I heard it, they have one inspector for all of north central Pennsylvania. One inspector to cover an area from Clearfield County up to the New York line, over to Ohio south half way down the state and back east some hundred miles to Clearfield. One inspector!

And it gets even better. In order for government to enforce the rules, they need someone to report violations. Why not have the companies do it themselves?

And why not invite restaurants to report any violations they have in the kitchen and invite an inspector to come out and close them down for a month?

"But," someone might ask, "what happened to the rules that govern the oil and gas industry?"

The answer is pretty simple: the Cheney Rule. Exceptions to the rules that control oil and gas operations, commonly referred to as the Cheney Rule since they were instituted under the suggestions of former vice-president Dick Cheney, formerly an executive in a major oil company.

One exception states, "Section 323 Provides an EXEMPTION (my emphasis) for oil and gas companies from the Federal Water Pollution Control Act for their construction activities surrounding oil and gas drilling." In other words, the rules that apply to all other activities that might contaminate water don't apply to oil and gas companies.

The EPA spokesperson stated that the EPA does not conduct any impact studies on the effect of an injection well. Coal companies have to do an impact study; timber companies have to do an impact study shopping centers and malls have to do impact studies.

But not oil and gas companies. For an injection well, they are exempt from impact studies.

This is a bad law. You don't have to be a tree hugger to know this is a bad law. It is bad by any standard that anyone could apply to it. My question is why no one has changed it. Why have lawmakers, the people who are supposed to protect the people, allowed it to stand for twelve years.

Oh, yeah, I forgot. The Supreme Court has said corporations, including oil and gas corporations, are people too, and we have to protect their profits, er rights.

❑❑❑

Glenn Schuckers was proprietor of Schuckers chard from 1970 -1992, was in education for 35 y as a teacher, administrator bus driver. He has also be bartender, steelworker, fa and school board mem He decided to retire in 2 and start another career and his wife Ann have in Brady Township, Clea County, since 1971. They two sons, Erik and Nathan opinions are strictly his Email: curmud1@yahoo.c

glenn-schuckers-12-2012.jpg

This well doesn't belong there or anywhere

Following Monday's federally-sponsored public hearing in Luthersburg, we are even more uncomfortable with the concept of using injection wells as disposal wells for gas-oil drilling liquids than we have been — and we were fairly uncomfortable even then.

With respect, we disagree with a comment made by state Rep. Matt Gabler, understandably desirous of protecting the residents of his legislative district. "There are better places for a well like this," Gabler was quoted as having said.

We think not.

"Hiding" is not "disposing."

Residents and other opponents of the well made a good case for concern about the likelihood of leakage, at the surface or below, now or in the future. The owner of the company wishing to construct and operate the well said he is convinced that the well can be operated safely. We don't doubt his sincerity, but we reach a different conclusion.

We think Pennsylvania should ban the use of deep injection wells as "disposal" methods for liquids, whether they come from oil-gas wells or from radioactive activities of nuclear power plants, or anywhere else. If federal law overrides, then Congress needs to do that.

Beneath the surface, Pennsylvania's geology is Swiss cheese in texture. Abandoned oil/gas wells, backfilled strip mines, surface-sealed but subterranean-open deep mine tunnels, and the gaps and upheavals occurring naturally clearly dictate that what is down there can be brought to the surface again, either by natural forces such as earthquakes or by human activities.

Indeed, the very fact that oil and gas can be recovered from the Marcellus Shale and other deep geological layers contradicts the implication by proponents that, once injected, those liquids will just lie there quiescently.

We support drilling for natural gas. We support drilling into the Marcellus and Utica layers and hydrofracturing those layers to release the gas and oil. We need both. And the drilling and extraction can be done safely enough, in our opinion.

But it makes no sense to hide material that can be treated at the surface, and the liquids intended for injections can be surface-treated and rendered reusable or inert, or disposed of at the surface where future problems, if any, can be confronted and controlled.

There are, in fact, no better places for a well like this, in our opinion.

— Denny Bonavita

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EPA allowed waste injection that polluted at least 100 aquifiers (Pittsburgh Post-Gazette) 12/12/12

Federal officials have given energy and mining companies permission to pollute aquifers in more than 1,500 places across the country, releasing toxic material into underground reservoirs that help supply more than half of the nation's drinking water.

In many cases, the Environmental Protection Agency has granted these so-called aquifer exemptions in Western states now stricken by drought and increasingly desperate for water.

EPA records show that portions of at least 100 drinking water aquifers have been written off because exemptions have allowed them to be used as dumping grounds.

"You are sacrificing these aquifers," said Mark Williams, a hydrologist at the University of Colorado and a member of a National Science Foundation team studying the effects of energy development on the environment. "By definition, you are putting pollution into them. ... If you are looking 50 to 100 years down the road, this is not a good way to go."

As part of an investigation into the threat to water supplies from underground injection of waste, ProPublica set out to identify which aquifers have been polluted.

We found the EPA has not even kept track of exactly how many exemptions it has issued, where they are, or whom they might affect.

What records the agency was able to supply under the Freedom of Information Act show that exemptions are often issued in apparent conflict with the EPA's mandate to protect waters that may be used for drinking.

Though hundreds of exemptions are for lower-quality water of questionable use, many allow grantees to contaminate water so pure it would barely need filtration, or that is treatable using modern technology.

The EPA is only supposed to issue exemptions if aquifers are too remote, too dirty, or too deep to supply affordable drinking water. Applicants must persuade the government that the water is not being used as drinking water and that it never will be.

Sometimes, however, the agency has issued permits for portions of reservoirs that are in use, assuming contaminants will stay within the finite area exempted.

In Wyoming, people are drawing on the same water source for drinking, irrigation and livestock that, about a mile away, is being fouled with federal permission. In Texas, EPA officials are evaluating an exemption for a uranium mine — already approved by the state — even though numerous homes draw water from just outside the underground boundaries outlined in the mining company's application.

The EPA declined repeated requests for interviews for this story, but sent a written response saying exemptions have been issued responsibly, under a process that ensures contaminants remain confined.

"Aquifer Exemptions identify those waters that do not currently serve as a source of drinking

water and will not serve as a source of drinking water in the future and, thus, do not need to be protected," an EPA spokesperson wrote in an email statement. "The process of exempting aquifers includes steps that minimize the possibility that future drinking water supplies are endangered."

Yet EPA officials say the agency has quietly assembled an unofficial internal task force to re-evaluate its aquifer exemption policies. The agency's spokesperson declined to give details on the group's work, but insiders say it is attempting to inventory exemptions and to determine whether aquifers should go unprotected in the future, with the value of water rising along with demand for exemptions closer to areas where people live.

Advances in geological sciences have deepened regulators' concerns about exemptions, challenging the notion that waste injected underground will stay inside the tightly drawn boundaries of the exempted areas.

"What they don't often consider is whether that waste will flow outside that zone of influence over time, and there is no doubt that it will," said Mike Wireman, a senior hydrologist with the EPA who has worked with the World Bank on global water supply issues. "Over decades, that water could discharge into a stream. It could seep into a well. If you are a rancher out there and you want to put a well in, it's difficult to find out if there is an exempted aquifer underneath your property."

Aquifer exemptions are a little-known aspect of the government's Underground Injection Control program, which is designed to protect water supplies from the underground disposal of waste.

The Safe Drinking Water Act explicitly prohibits injection into a source of drinking water, and requires precautions to ensure that oil and gas and disposal wells that run through them are carefully engineered not to leak.

Areas covered by exemptions are stripped of some of these protections, however. Waste can be discarded into them freely, and wells that run through them need not meet all standards used to prevent pollution. In many cases, no water monitoring or long-term study is required.

The recent surge in domestic drilling and rush for uranium has brought a spike in exemption applications, as well as political pressure not to block or delay them, EPA officials told ProPublica.

"The energy policy in the U.S is keeping this from happening because right now nobody — *nobody* — wants to interfere with the development of oil and gas or uranium," said a senior EPA employee who declined to be identified because of the sensitivity of the subject. "The political pressure is huge not to slow that down."

Many of the exemption permits, records show, have been issued in regions where water is needed most and where intense political debates are underway to decide how to fairly allocate limited water resources.

In drought-stricken Texas, communities are looking to treat brackish aquifers beneath the surface because they have run out of better options and several cities, including San Antonio and El Paso, are considering whether to build new desalinization plants for as much as $100 million

apiece.

And yet environmental officials have granted more than 50 exemptions for waste disposal and uranium mining in Texas, records show. The most recent was issued in September.

The Texas Railroad Commission, the state agency that regulates oil and gas drilling, said it issued additional exemptions, covering large swaths of aquifers underlying the state, when it brought its rules into compliance with the federal Safe Drinking Water Act in 1982. This was in large part because officials viewed them as oil reservoirs and thought they were already contaminated. But it is unclear where, and how extensive, those exemptions are.

EPA "Region VI received a road map — yes, the kind they used to give free at gas stations — with the aquifers delineated, with no detail on depth," said Mario Salazar, a former EPA project engineer who worked with the underground injection program for 25 years and oversaw the approval of Texas' program, in an email.

In California, where nearly half of the nation's fruits and vegetables are grown with water from as far away as the Colorado River, the perennially cash-strapped state's governor is proposing to spend $14 billion to divert more of the Sacramento River from the north to the south. Near Bakersfield, a private project is underway to build a water bank, essentially an artificial aquifer.

Still, more than 100 exemptions for natural aquifers have been granted in California, some to dispose of drilling and fracking waste in the state's driest parts. Though most date back to the 1980s, the most recent exemption was approved in 2009 in Kern County, an agricultural heartland that is the epicenter of some of the state's most volatile rivalries over water.

The balance is even more delicate in Colorado. Growth in the Denver metro area has been stubbornly restrained not by available land, but by the limits of aquifers that have been drawn down by as much as 300 vertical feet. Much of Eastern Colorado's water has long been piped underneath the Continental Divide and, until recently, the region was mulling a $3 billion plan to build a pipeline to bring water hundreds of miles from western Wyoming.

Along with Wyoming, Montana and Utah, however, Colorado has sacrificed more of its aquifer resources than any other part of the country.

More than 1,100 aquifer exemptions have been approved by the EPA's Rocky Mountain regional office, according to a list the agency provided to ProPublica. Many of them are relatively shallow and some are in the same geologic formations containing aquifers relied on by Denver metro residents, though the boundaries are several hundred miles away. More than a dozen exemptions are in waters that might not even need to be treated in order to drink.

"It's short-sighted," said Tom Curtis, the deputy executive director of the American Water Works Association, an international non-governmental drinking water organization. "It's something that future generations may question."

To the resource industries, aquifer exemptions are essential. Oil and gas drilling waste has to go somewhere and in certain parts of the country, there are few alternatives to injecting it into porous rock that also contains water, drilling companies say. In many places, the same layers of rock that contain oil or gas also contain water, and that water is likely to already contain

pollutants such as benzene from the natural hydrocarbons within it.

Similarly, the uranium mining industry works by prompting chemical reactions that separate out minerals within the aquifers themselves; the mining can't happen without the pollution.

When regulations governing waste injection were written in the 1980s to protect underground water reserves, industry sought the exemptions as a compromise. The intent was to acknowledge that many deep waters might not be worth protecting even though they technically met the definition of drinking water.

"The concept of aquifer exemptions was something that we 'invented' to address comments when the regulations were first proposed," Salazar, the former EPA official, said. "There was never the intention to exempt aquifers just because they could contain, or would obviate, the development of a resource. Water was the resource that would be protected above all."

Since then, however, approving exemptions has become the norm. In an email, the EPA said that some exemption applications had been denied, but provided no details about how many or which ones. State regulators in Texas and Wyoming could not recall a single application that had been turned down and industry representatives said they had come to expect swift approval.

"Historically they have been fairly routinely granting aquifer exemptions," said Richard Clement, the chief executive of Powertech Uranium, which is currently seeking permits for new mining in South Dakota. "There has never been a case that I'm aware of that it has not been done."

Aquifer Exemptions Granted

The aquifer exemptions approved by the EPA each year are according to a partial list of approvals provided to ProPublica by the agency in response to a FOIA request.

In 1981, shortly after the first exemption rules were set, the EPA lowered the bar for exemptions as part of settling a lawsuit filed by the American Petroleum Institute. Since then, the agency has issued permits for water not "reasonably expected" to be used for drinking. The original language allowed exemptions only for water that could never be used.

Oil companies have been the biggest users of aquifer exemptions by far. Most are held by smaller, independent companies, but Chevron, America's second-largest oil company, holds at least 28 aquifer exemptions. Exxon holds at least 14. In Wyoming, the Canadian oil giant EnCana, currently embroiled in an investigation of water contamination related to fracking in the town of Pavillion, has been allowed to inject into aquifers at 38 sites.

Once an exemption is issued, it's all but permanent; none have ever been reversed. Permits dictate how much material companies can inject and where, but impose little or no obligations to protect the surrounding water if it has been exempted. The EPA and state environmental agencies require applicants to assess the quality of reservoirs and to do some basic modeling to show where contaminants should end up. But in most cases there is no obligation, for example, to track what has been put into the earth or — except in the case of the uranium mines — to monitor where it does end up.

The biggest problem now, experts say, is that the EPA's criteria for evaluating applications are

outdated. The rules — last revised nearly three decades ago — haven't adapted to improving water treatment technology and don't reflect the changing value and scarcity of fresh water.

Aquifers once considered unusable can now be processed for drinking water at a reasonable price.

The law defines an underground source of drinking water as any water that has less than 10,000 parts per million of what are called Total Dissolved Solids, a standard measure of water quality, but historically, water with more than 3,000 TDS has been dismissed as too poor for drinking. It also has been taken for granted that, in most places, the deeper the aquifer — say, below about 2,000 feet — the higher the TDS and the less salvageable the water.

Yet today, Texas towns are treating water that has as high as 4,000 TDS and a Wyoming town is pumping from 8,500 feet deep, thousands of feet below aquifers that the EPA has determined were too far underground to ever produce useable water.

"You can just about treat anything nowadays," said Jorge Arroyo, an engineer and director of innovative water technologies at the Texas Water Development Board, which advises the state on groundwater management. Arroyo said he was unaware that so many Texas aquifers had been exempted, and that it would be feasible to treat many of them. Regarding the exemptions, he said, "With the advent of technology to treat some of this water, I think this is a prudent time to reconsider whether we allow them."

Now, as commercial crops wilt in the dry heat and winds rip the dust loose from American prairies, questions are mounting about whether the EPA should continue to grant exemptions going forward.

"Unless someone can build a clear case that this water cannot be used — we need to keep our groundwater clean," said Al Armendariz, a former regional administrator for the EPA's South Central region who now works with the Sierra Club. "We shouldn't be exempting aquifers unless we have no other choice. We should only exempt the aquifer if we are sure we are never going to use the water again."

Still, skeptics say fewer exemptions are unlikely, despite rising concern about them within the EPA, as the demand for space underground continues to grow. Long-term plans to slow climate change and clean up coal by sequestering carbon dioxide underground, for example, could further endanger aquifers, causing chemical reactions that lead to water contamination.

"Everyone wants clean water and everyone wants clean energy," said Richard Healy, a geologist with the U.S. Geological Survey whose work is focused on the nexus of energy production and water. "Energy development can occur very quickly because there is a lot of money involved. Environmental studies take longer."

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December 15, 2012

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,

This letter is to add to our testimony presented and submitted on December 10, 2012 at the EPA Public Hearing on the Zelman #1 Injection Well proposed for Brady Township, Clearfield County.

1 - Please extend the deadline for submitting comments since we need to submit the Casselberry report for the DuBois watershed and additional details on the coal mines that we received from the DEP. We also believe additional information is available from other community members and the medical field needs to weigh in on this testimony.

2 – Extending the deadline for public comments is also important because we have asked Brady Township supervisors to enact a local ordinance. They may or may not enact a local ordinance but the community would like to know what the EPA means when they state, "they will not override local ordinances." Knowing you were out on the road last week, I waited to call the EPA office till Friday and didn't receive a response yet to my call.

3 - Neighbors living behind us near the Carlson deep gas well, who are outside the 1/4 mile Area of Review, have had their water affected by a gas well being drilled less than a mile away. We believe residents on #2 Shaft Road and Route 219 could be directly affected if this deep gas well is improperly plugged and their water could become contaminated. Two water sources behind my house (Plyer & Michael) somehow were affected by this gas well drilled near Kennedy's so we assume that potential water contamination near our homes could have a direct affect on homes at the end of #2 Shaft Road or those on Route 219. It was stated when the gas well was drilled it affected their water for awhile. This well is a really great supply of water and supplies at least two homes endlessly. This gas well is probably within a mile from the Carlson deep gas well that is plugged and our water wells.

3 - We need to stress what Brady Township Supervisor, Mr. Muth, stated, "we know this area is already saturated in the Oriskany," this is from a person with drilling background. The gas well on Atkinson's property when in operation they had to daily take the brine off.

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4 – Brady Township Engineer, Wilson Fisher, believes an impact study for NEPA (National Environmental Policy Act) should be completed.

5 – Brady Township Engineer, Wilson Fisher, wants further research done on mineral rights in the area. The legal implications on our subsurface rights is a concern.

6 - Driller complacency is a concern as we saw on December 10, 2012. That this is just a "hole in the ground to pump waste" is not an accurate statement. A participant on December 10 talked to Mr. Hoover and asked about how Windfall would know the length of time able to pump waste, which Mr. Hoover responded that, "this is a dice game." Residents don't want anyone gambling with their water sources, homes and lives.

7 - We know drillers and stories that tell us we should be concerned. People with drilling experience spoke at the hearing and have supported us with our research. They have major concerns and some of them live in the affected area.

8 – The Pittsburgh Post Gazettee explained recently more studies need to be done on disposal injection wells, which is stated from an EPA hydrologist. (See the attached news article from December 12, 2012)

9 – Residents have received information on the PA DEP application this week from Windfall Oil & Gas. This information raises further questions and needs reviewed more in depth especially on the answers to questions on the coal mines in the area. We believe the coal mines are within 1000 feet.

All the above facts will take further time to study the effects on underground sources of water (USDWs). An impact study will take time and should be completed. We should have time to respond to the driller with local information and not be forced into a quick response that doesn't include all the facts.

Sincerely,

Duane & Darlene Marshall