

*Underground Injection Wells as an Option for Disposal of Shale Gas Wastewaters:
Policies & Practicality.*

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**(Answers provide below by Karen Johnson afterwards to questions that there was
not enough time to answer during webinar)**

1. How do you test to make sure the brine/drinking line is not rising?

I'm not sure I understand the question, but I believe you are concerned about salt water moving up to the surface...so let me try to explain.

If we lived near the ocean and pumped fresh water out of shallow aquifers, the salt water from the coast could move in to replace it. This occurs in coastal communities because they basically use up the fresh water and pull in the salt water from the ocean. It is called salt water intrusion, and is possible because of the sandy, highly porous soils and underlying rock.

In most areas however, fresh water percolates down from the surface, by gravity flow, and fills the pores in the soil and rock. Where it is saturated, is the water table. The underlying rocks are like layers of a cake. Those layers were deposited over millions of years and compressed into dense rocks. Depending on their origin, they contain different minerals. Some were deposited in marine environments and are very salty, like the Marcellus shale and other oil and gas formations underlying the area. The only way for these fluids to get to the surface or move upward, is through drilling a well. Putting salt water back into one of these formations will not change the depth of an underground source of drinking water, like it can near the ocean, because there are many layers of rock between the fresh water and injection zones. This is the main reason for the area of review provisions in the UIC program. We need to make sure there are no open pathways for fluids from deep formations to move under pressure to upper underground sources of drinking water (USDW's).

2. What is the amount of the bonding required for a disposal well, and does this normally cover the plugging with inflationary factors considered?

The Financial Responsibility has to cover the plugging costs of the individual well or all the wells on a facility, it is not a set fee per well. The costs are re-evaluated for inflation every couple years.

3. What formations are new Class IID wells being proposed for the Marcellus Shale produced water?

EPA evaluates permits that are received for injection. We recently received a new permit in VA, but it is for disposal of coalbed methane produced fluids. We have not received any PA permits in the last several years.

4. Are there any pending applications for Class I disposal wells in PA? If not, do you agree with the conventional wisdom that PA's geology is not suitable for Class I wells?

We have not received any Class I permit applications. The only pre-requisite is that the fluids be disposed of below the lowermost USDW, and have an adequate confining zone and insure that the fluids don't migrate out of the injection zone.

There may be formations suitable, but we have not received any applications. Class I wells can be any kind of municipal or industrial waste, including treatment residuals. Some states have Class I wells for disposal of treated municipal waste or treatment residuals from the treatment of drinking water.

5. Could disposal fluids be injected into a depleted well at a depth of 3-5 thousand feet?

I believe all of the existing brine disposal wells in PA are less than 5,000 feet deep. The issue is to protect underground sources of drinking water (USDW's). In order to do that all of the wells historically drilled into the same formation as the proposed injection well are properly plugged. Many old wells have had to be re-plugged in order to insure they can't be a potential pathway for migration.

6. RE: Mechanical integrity monitoring. What info is avail to concerned citizens - groups or individuals, to reassure ourselves that it IS indeed being done properly? If we cannot 'audit', how can we trust the alleged safety?

The Annual reports and monitoring results are documents that must be submitted to EPA. If there is a concern the public can request copies of these documents under the Freedom of Information Act. Most of the mechanical integrity tests, for all types of Class II wells, are witnessed by EPA to verify that the proper pressure is maintained to show the casing is sound. Also when an operating well has a failure, they must shut the well in immediately and report to us within 24 hours of the failure. They also have to notify us when they intend to re-work the well to fix the failure and re-test mechanical integrity to give us the opportunity to witness.

7. Was the Greene County UIC well plugged because its permit was revoked or was it voluntary by the operator?

I need to correct a mistake in the response to Question #8 during the Webinar. The Greene County well is not currently active, but has not been plugged. An older well in

Indiana County was the one plugged. Regarding the well in Greene county- the company has voluntarily stopped injecting into the well. We have an active enforcement action open against the operator.

8. Is all the data you collect on injection wells public information and easily retrievable?

All the monitoring, inspection and reporting data is in hard copy, not electronic, but copies of documents are available under the Freedom of Information Act.

9. Can old underground mine workings be used for injection wells since the water in the mine is not potable? It seems that this would be a good use of the brine because the mine water is typically acidic, and the brine would raise the pH of the water in the mine.

Many mines would still qualify as underground sources of drinking water and must be protected as potential sources of drinking water, so they could not be used for brine disposal unless they were exempted as aquifers. We wouldn't be inclined to do that since they might be useable aquifers with treatment in the future. Many times injection is used (Class V wells) to remediate acid mine drainage issues. In those cases, lime slurry is injected to fill in mine voids and the lime increases the pH to cause the metals to precipitate out and improve the water quality.

I'm also not sure the brine would have as beneficial effect on the pH as you believe and the total dissolved solids may be higher or lower than the existing mine, potentially further degrading the water quality depending on the source of the brine.

10. Is there a minimum depth for an injection horizon?

There is no minimum depth, just generally below USDW's in this part of the country, for Class II wells.

11. What is the amount of the bonding required for a disposal well, and does this normally cover the plugging with inflationary factors considered?

This is a duplicate of question #2

12. Will the fracing involved in Marcellus allow for conduits into drinking water?

The hydraulic fracturing of the Marcellus shale is being done at depths of between 4,000-9,000 feet below the surface. The process is to attempt to fracture the thickness of the gas bearing shale formation. Fractures generally only travel for several feet, or tens of feet, and are propped open by the fine sand, otherwise they would seal once pressure is released. There are many overlying formations between the Marcellus and the USDW's that would have to be fractured and the pressures are not adequate to attempt that.

The most likely conduit would be surface spills, or improperly plugged wells in the area. There aren't too many existing or historic wells that go to the depth of the Marcellus.

If an injection well was proposed into the Marcellus, the "Area of Review" process would be applied to the permit and any un-plugged well would have to be plugged.

13. Do you have any statistics on motor vehicle accidents with trucks containing drilling waste fluids to an injection well site? Recently a proposal in Pulteney NY would have had 30-45 trucks per day for 10 years travel small town and county roads, hauling fracking waste from PA to NY.

We don't regulate trucking. Department of Transportation may be able to provide statistics of how often the truckers are in an accident. Most types of wastes are hauled by truck, including sewage, industrial waste of all kinds... The shorter the distance the better, I would imagine.... Some states require a brine disposal well onsite for wastes produced to eliminate hauling, but PA and NY do not, so oil field brines have been trucked to publicly owned treatment (Waste water treatment) systems and industrial treatment systems for a long time. Hopefully revised State regulations will eliminate discharge of high TDS fluids like brines to surface waters that are often also used for drinking water sources.