



West Virginia's  
**Surface Owners' Rights Organization**

1500 Dixie Street, Charleston, West Virginia 25311  
Voice/VoiceMail 304-346-5891 · Fax 304-346-8981

September 27, 2010

Environmental Protection Agency  
200 Pennsylvania Ave. NW  
Mailcode 4606M  
Washington, D.C. 20460.  
E-mailed to hydraulic.fracturing@epa.gov

Attn: Jill Dean

Re: Comments on Hydraulic Fracture Study

Dear Sirs or Madams,

The oil and gas industry's position is that hydraulic fracturing cannot impair groundwater because the fracturing fluid passes through the groundwater formations through steel pipe casing that is cemented into the boreholes. This industry points out that the casing and cementing process is already regulated by state government.

We should first review other threats to groundwater from the oil and gas exploration and production.

**ORPHANED, UNPLUGGED WELLS.**

In West Virginia, before 1929, no government kept records of where gas wells were drilled. West Virginia state government began keeping records in 1929, probably at the behest of the coal companies. Even after 1929 there was inadequate government records kept of who owned wells; there were inadequate requirements for transferring wells; there was little or no oversight or requirements for casing and cementing wells; and there was little or no oversight or requirements for plugging the wells at the end of their useful life. There have been improvements lately, but there are still enormous problems with the bonding structure such that the bond for wells under a blanket bond for large company can be as little as \$12 per well.

The result of all this is documented in a State Review of Oil and Natural Gas Environmental Regulations (STRONGER) review of West Virginia's oil and gas regulatory programs that was funded by the EPA after the passage of the 1980 Amendments to the Resource Conservation and Recovery Act. The study can be found at

<http://www.strongerinc.org/reviews/reviews.asp>. According to the 2003 “Follow-Up and Supplemental Review”, on page 58, there were 9,000 *pre*-1929 wells sitting there un-plugged with no responsible owner to plug them.

The lack of adequate tracking and oversight continued after 1929. At time of the STRONGER study there were 10,000 *post*-1929 wells on the State’s list of wells that need to be plugged. (Since the State does little to oversee the "bona fide future use" declarations that keep wells off of the list of wells that need to be plugged, there are certainly thousands more than the 10,000 actually on the list that should be plugged.) Of those 10,000 that are on the list, 4000 had no operator left around to plug them! Another 6000 did have a responsible operator and the State had not gotten the operators to plug them.

The State has taken little action to get these wells plugged or otherwise remedy the situation. The State only has funding to plug a handful each year of the 9000 *pre*-1929 and 4000 *post*-1929 orphaned wells with no responsible operator. If some government agency does not do better at getting the 6000 wells that have responsible operators plugged by those operators, then those responsible operators will disappear leaving more orphaned wells.

These wells are an undeniable threat to groundwater. Their casings *will* go bad. Not every well with a bad casing will cause groundwater pollution, but many will. The pollution of the fresh water aquifers caused by these unplugged wells can come from the gas pressures from below, from brine and sulphur water aquifers below the fresh water aquifers, from bacteria etc. that seeps down from pastures and other surface uses.

## ACTIVE WELLS

The West Virginia State website says there are 55,000 active oil and gas wells in West Virginia. Those wells should be inspected regularly to make sure that they and their access roads are not causing groundwater pollution, soil erosion and sediment control or other problems. West Virginia has 17 to 20 oil and gas inspectors depending on yearly funding. If the inspectors were to visit each active well once a year, that would be 2,700 wells per inspector. With about 250 working days a year that is 11 wells a day. Not nearly possible if that is all they did. It would be lucky to locate and drive to two or three a day in West Virginia’s terrain and roads – if that is all they did.

## OVERSIGHT OF FRACING.

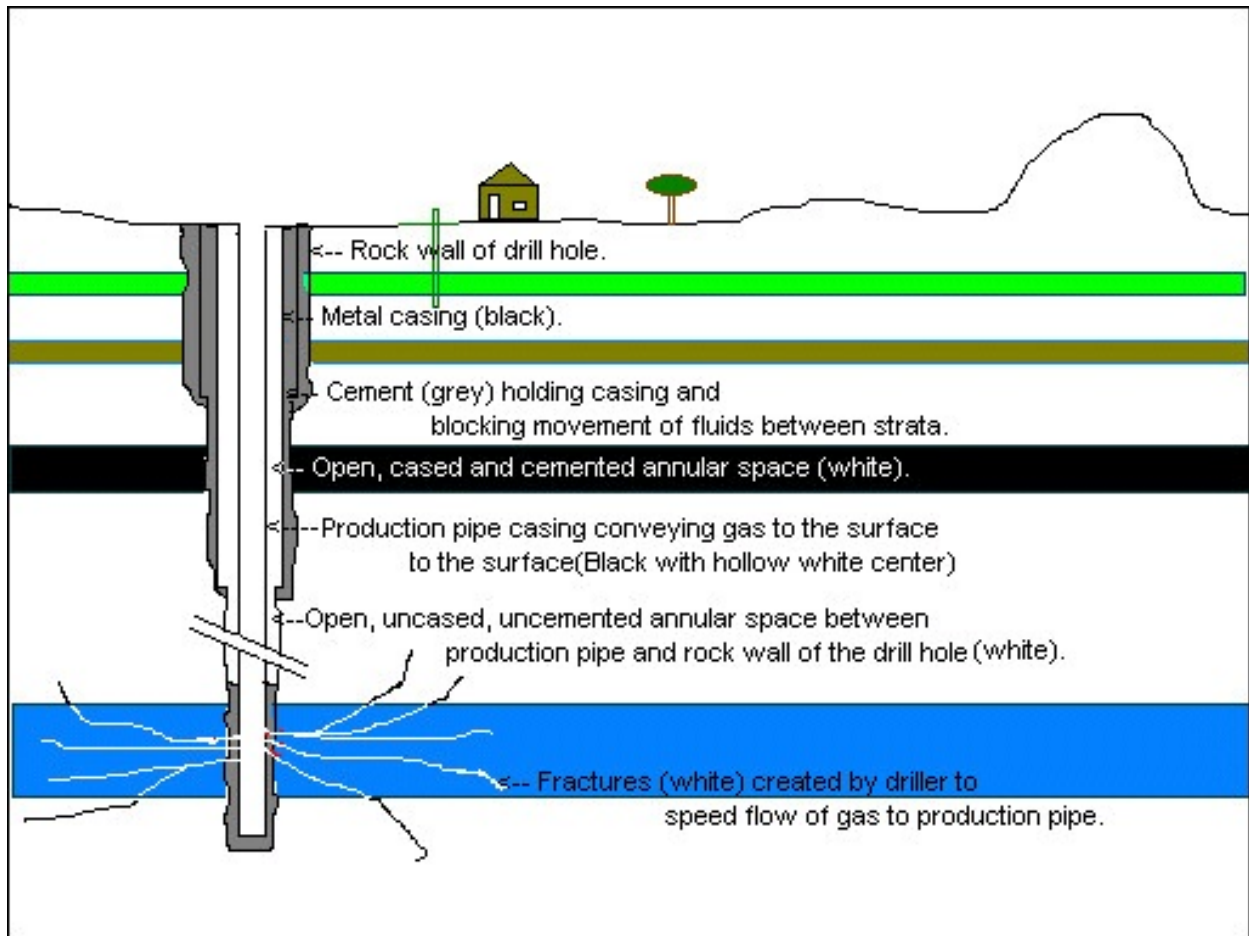
Again, the oil and gas industry’s position is that hydraulic fracturing cannot impair groundwater because the frac’ing fluid passes through the groundwater formations through steel pipe casing that is cemented into the boreholes. They point out that this casing and cementing process is regulated by state government.

West Virginia issues from 900 to 3000 “well work” permits a year. Not all of those are for new wells, and not all new well permits get drilled. But for the new wells that are drilled, the inspector should be there 6 times. Some of those visits, like checking that the cement "returns to the surface" and that the driller waits for the cement to cure before resuming drilling, are vital to protection of groundwater.

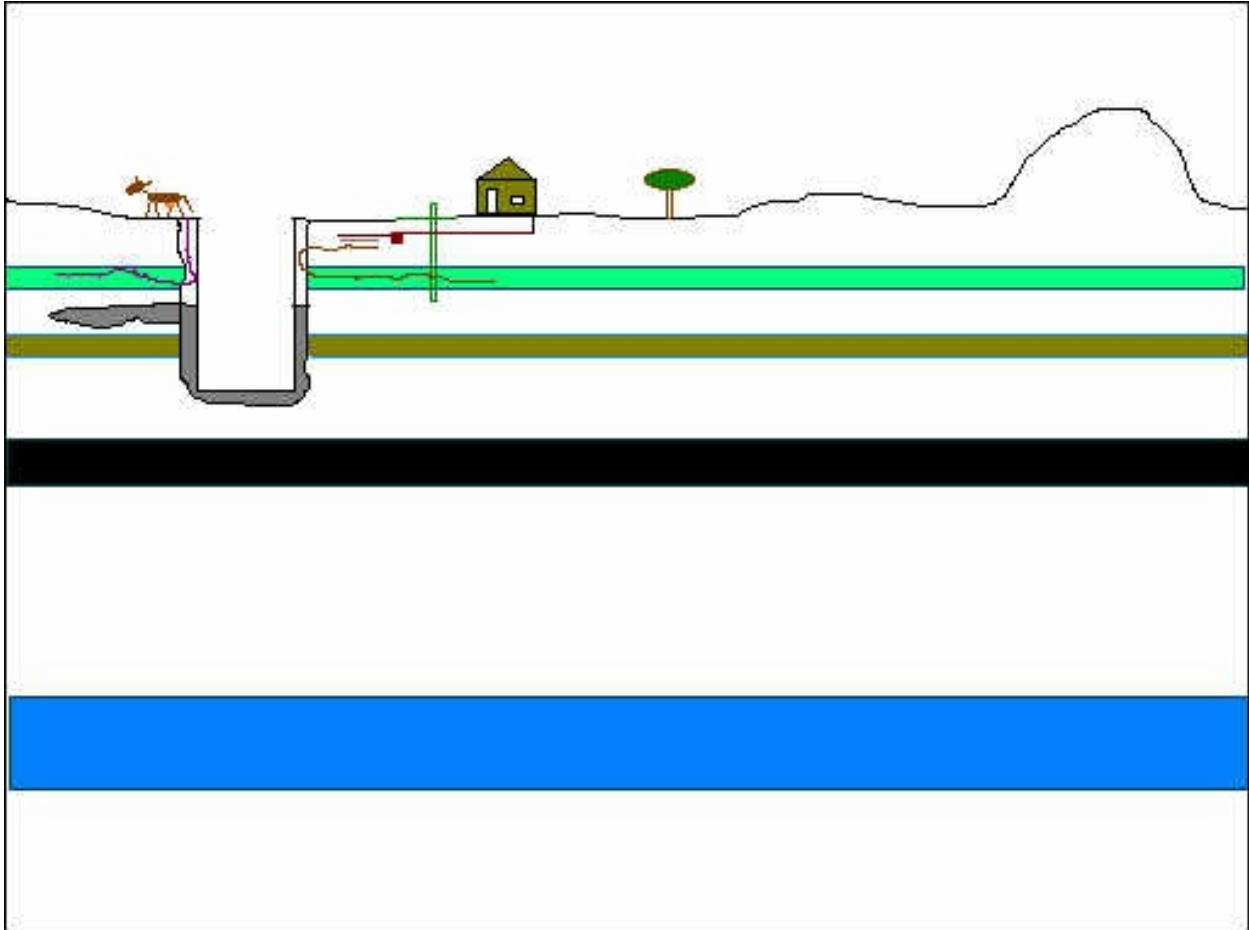
It is preposterous to suppose that West Virginia’s inspectors offer proper oversight of the casing and cementing process that is supposed to protect groundwater. Above we have recited some of their responsibilities the State has that it has failed at or cannot possibly do considering the small numbers of inspectors.

Casing and cementing of gas wells only works if it is done right and there are no problems.

The first illustration below explains the features of the illustrations of casing and cementing problems that follow. A more complete slide show on the subject can be found at [http://wvsoro.org/resources/how\\_a\\_well\\_is\\_drilled/index.html](http://wvsoro.org/resources/how_a_well_is_drilled/index.html).

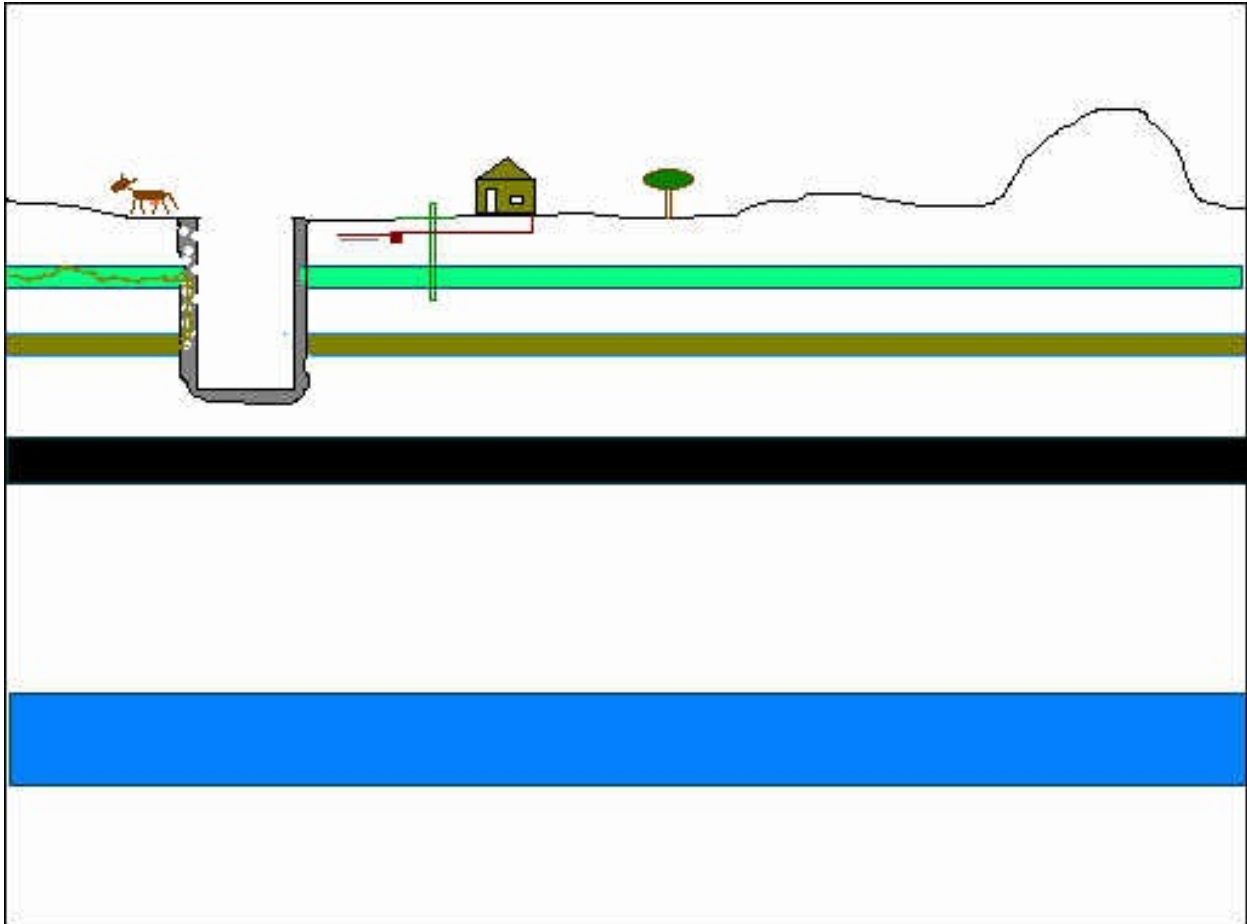


If the well was drilled through a void, as in the illustration below, the cement can go into the void, and not “return to the surface”. Fixing that problem by inserting cement from the top is unreliable. Groundwater is at risk.

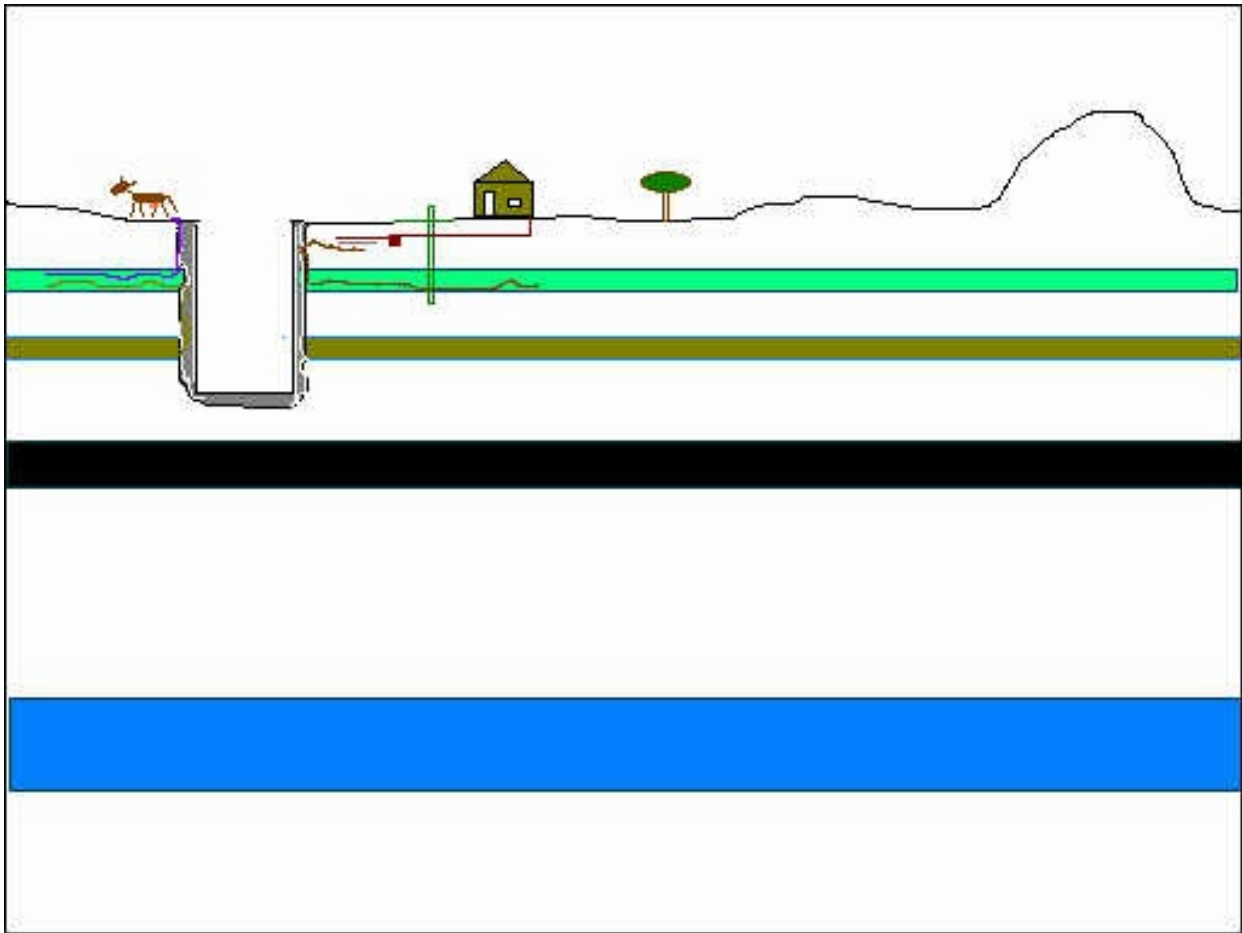


If the well was drilled through a high pressure groundwater seam, the cement job can become honeycombed with the water. See the illustrating below.

Or if the driller uses a bad cement formulation, that can cause similar problems.



Most commonly, if the driller does not wait a sufficient time for the cement to cure and begins drilling again, micro-annuluses can form.



It is also important to note that only the surface and “intermediate” casings are cemented all the way to the surface. The production string casing is only cemented at the bottom of the hole to just above the production formation. So the annulus between the outside of the production pipe and the inside of the bore hole is open for thousands of vertical feet.

The first image in this comment illustrates the final casing and cementing. Note the arrow pointing to the “Open, un-cased, un-cemented annular space between the production pipe and the rock wall of the drill hole” in the illustration.

What the illustration does not show is how far up and down this open space goes. Between the \\’s are thousands of feet of un-cemented casing that can serve as a conduit between any down hole problem and the bottom of the surface and intermediate casing. And if that surface and intermediate casing is not done well . . .

A bad surface casing cement job can allow surface pollution from septic drain fields, from pastures and other surface uses to get down into groundwater. It can allow the un-potable water that lies below freshwater aquifers to mix upward with the good water in freshwater aquifers.

## HYDRAULIC FRACTURING RISKS.

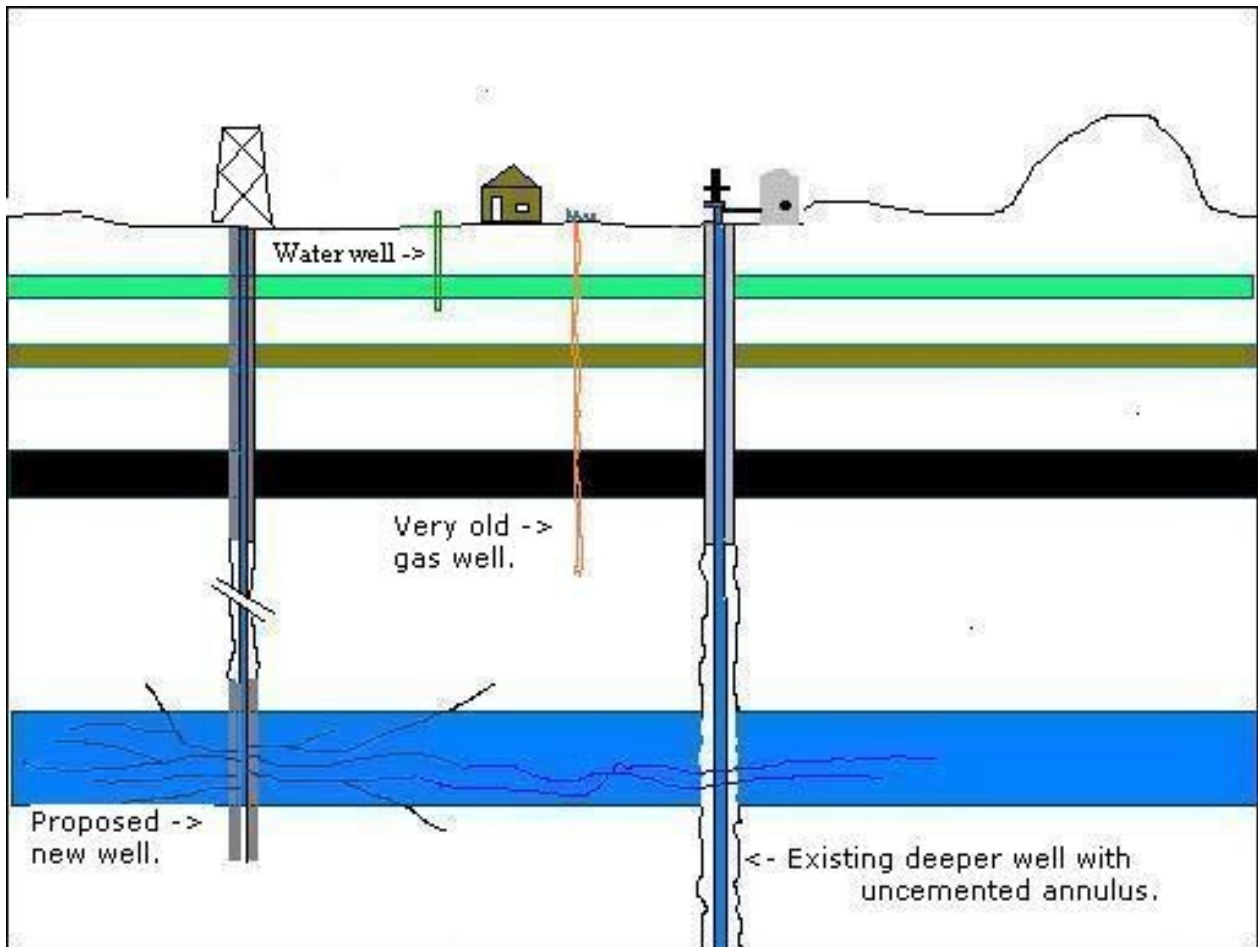
How do problems with casing and old unplugged wells relate to dangers to groundwater from hydraulic frac'ing?

If there are existing gas wells close to where they are proposing to drill the new gas well, especially if the new well is a horizontal gas well, then there is one way in which the frac fluid could work its way out of the target formation being fraced for the new well and into ground water. It will not be a common thing, maybe even rare, but it could happen.

If there is an existing gas well near the proposed well, and if the existing nearby well is deeper than the purposed new gas well, then there is a chance that the pipe of the existing nearby gas well is not "cemented" as it passes through the target formation that will be fraced by the new gas well. Almost always the existing wells are not as deep as the proposed wells, but if the existing wells are deeper, and if the frac fluid makes it through the rock of the target formation as far as the well bore of the existing nearby gas well, then the frac fluid can move up the un-cemented "annular" space between the outside of the production pipe and the inside of the bore hole. How far will it go up? It will go up until it reaches the bottom of the cement job of the intermediate and surface well casings. (To understand this better, view the more complete slide show on "How a Well is Drilled Down Into the Ground, and what can go wrong." at the link set out above.)

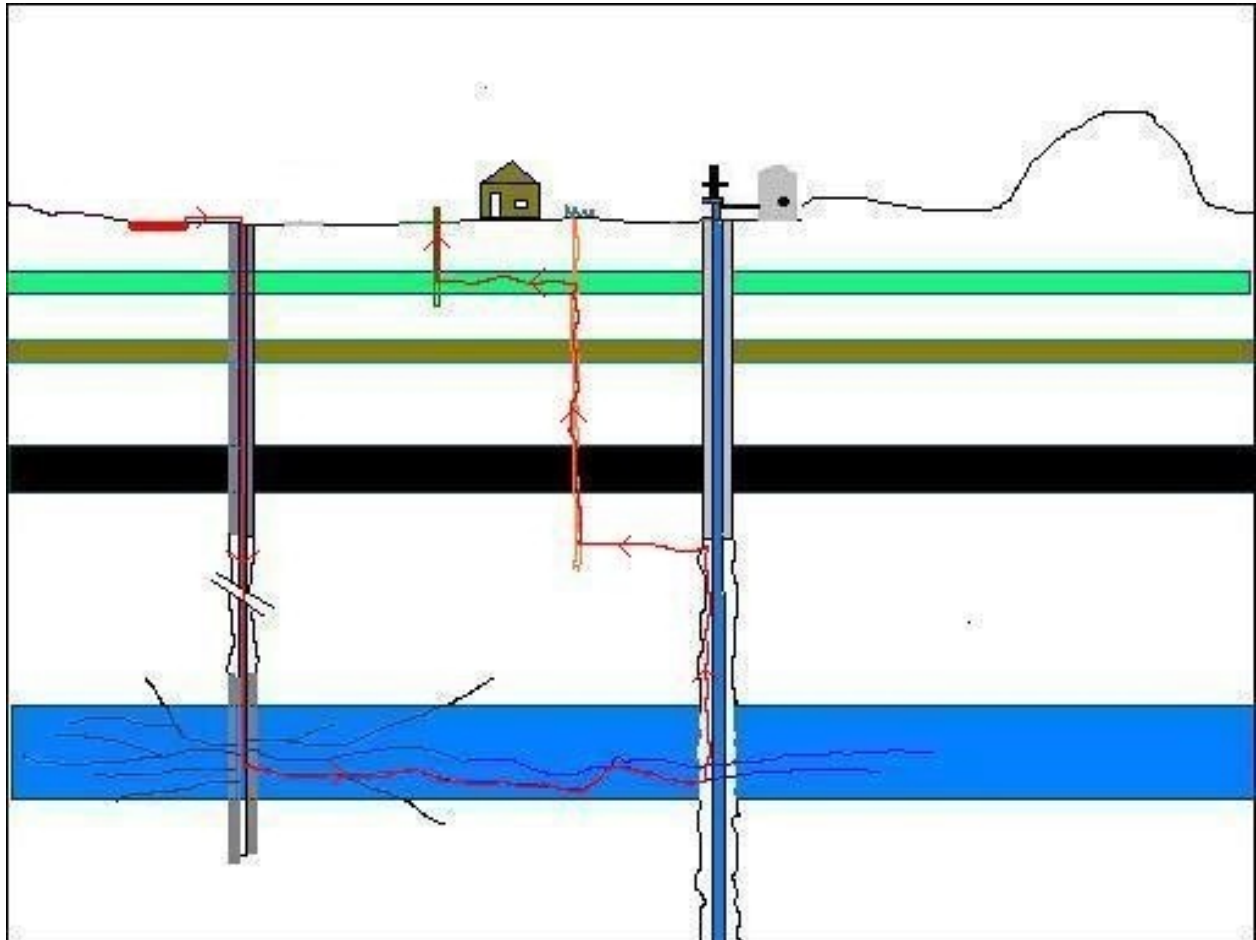
This bottom of the intermediate and surface cement jobs will still probably be hundreds or more feet deeper than the freshwater aquifer. However, if there also is a very, very old shallow well in the area, there is a possibility that those wells were not properly cased and/or are not plugged or improperly plugged.

The image immediately below is what the situation would look like for a proposed new vertical well. (The gray cementing of the steel pipe casing is simplified.) (If the proposed new well was a horizontal well, the well bore would turn sideways when it got to the target formation (usually the Marcellus Shale these days) and go 3000 feet or more horizontally making it even more likely it will pass near a nearby existing gas well.):





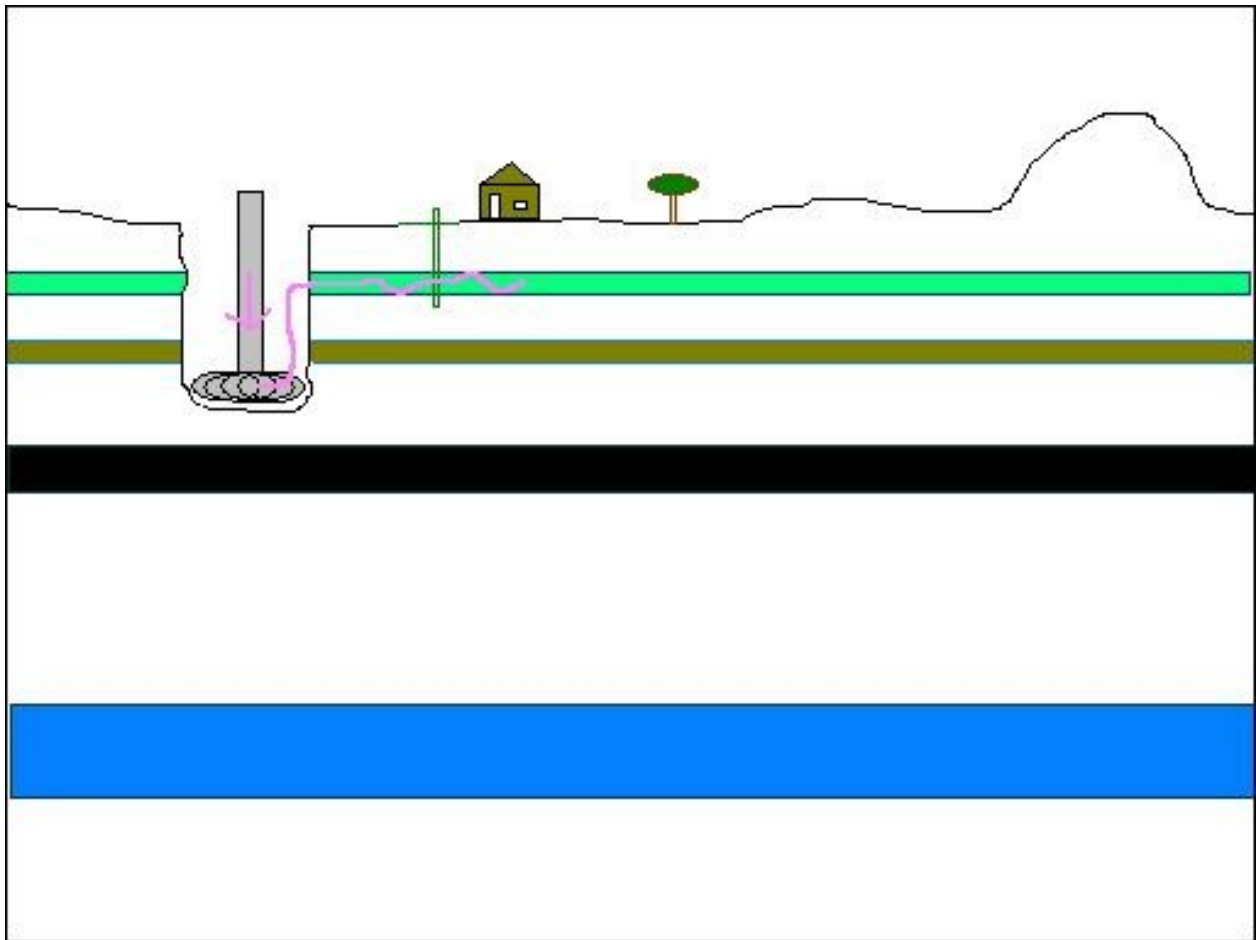
Although it is unlikely, the red line with arrows below shows how it is possible that the frac fluid could travel to the water table.



## ANOTHER WAY DRILLING CAN AFFECT GROUNDWATER

-- EVEN BEFORE CASING IS SET AND CEMENTED.

While the initial drilling is being done, before the "freshwater" casing is even set, chemicals are often added to the air or mud that is used in drilling the hole. And these can leak directly into groundwater. And that is more likely if the driller is careless with pressures and practices and chemicals, and does not make special allowances for karst etc. formations that can be encountered.



## CONCLUSION

To be sure drilling and casing and cementing are done properly, there should be adequate government oversight not just of the frac'ing process, but of the casing and cementing of wells and the plugging of played out wells.

There is not.

We should learn from history. The State has failed utterly regarding the thousands and thousands of gas wells that should have been plugged long ago and is failing now at those that should be plugged now. It fails at inspecting current wells. It could not possibly be expected, despite the good will of many of its few employees, to make sure that drilling and casing are done properly to protect groundwater – before during or after fracing.

The federal government through the EPA needs to take over this process and give the State large amounts of money, if they are granted primacy, to carry out these responsibilities.

Sincerely,

*/s/ David McMahon (intended as signature)*

David McMahon, J.D.  
Co-Founder