

Study Links Methane In Water To Gas Extraction

May 13, 2011

text size **A A A**

Robert B. Jackson, professor, Environmental Science, Duke University, Durham, N.C.

Reporting in the journal PNAS, researchers say drinking water containing potentially hazardous methane levels has been found near natural gas wells in Pennsylvania and New York. Ira Flatow and guests discuss the study, and its implications for "fracking" for natural gas.

John Conrad, president, Conrad Geoscience Corp., Poughkeepsie, N.Y.

Copyright © 2011 National Public Radio®. For personal, noncommercial use only. See Terms of Use. For other uses, prior permission required.

IRA FLATOW, host:

This is SCIENCE FRIDAY. Im Ira Flatow.

Up next this hour, the debate over natural gas fracking is on the front burner again. Fracking, to remind you, is a relatively new way of getting natural gas out of the ground, in which a well is drilled deep into rock, and then a mixture of water, sand and chemicals is ejected into the rock at high pressure so any natural gas that's trapped there is forced out and it is collected.

Congress held hearings this week on fracking and its potential effect on the environment. Proponents of drilling and fracking say it can be done safely. Some critics of the technology say the chemicals used to do it could contaminate drinking water and streams.

And a new film, "Gasland," showed a sink catching on fire from the methane-laden water coming from the tap. So as you can see, this is a very - no pun intended - explosive issue among people who live in areas where fracking is happening and where gas drilling is occurring in more and more places across the study - across the land.

And then there's a new study published this week in the Proceedings of the National Academy of Sciences that is adding some fuel to this gas-drilling debate.

A team from Duke University looking at water wells in Pennsylvania and New York found the methane gas levels were much higher in water wells closer to drilling sites. And some concentrations, the researchers reported, were dangerously high, high enough to explode.

Joining me now to talk more about it are my guests. Robert B. Jackson is professor of environmental science at Duke in Durham, North Carolina. He joins us from a studio there. Welcome to SCIENCE FRIDAY, Dr. JACKSON.

Dr. ROBERT B. JACKSON (Duke University): Thank you, Ira.

FLATOW: You're welcome. We were looking for a gas industry group, for a representative to come on SCIENCE FRIDAY and give us their side of the story. And they said, you know, you should talk to the folks at the Conrad Geoscience Corporation. And John Conrad, the president, is here. And he joins us from

Poughkeepsie. Welcome to SCIENCE FRIDAY, Mr. Conrad.

Mr. JOHN CONRAD (Conrad Geoscience Corporation): Glad to be here.

FLATOW: Let's talk a bit, Robert Jackson, about your study. You looked at water wells in Pennsylvania. How many wells did you look at?

Dr. JACKSON: We looked at 68 wells overall.

FLATOW: Sixty-eight. And how deep do these wells go?

Dr. JACKSON: Well, the drinking-water wells range from about 100 to about 500 feet underground. And it's important to remember or realize that the gas that we're talking about is many thousands of feet underground five, six or seven thousand feet, for instance. So there's a large separation between the two.

FLATOW: And in a nutshell, what did you find?

Dr. JACKSON: Well, we asked two simple question. The first question was: If you're living near a gas well, are you more likely to have problems or contamination of your drinking water? The answer to that question was yes for methane. You had much higher concentrations, 17 times higher, if you were within a kilometer. And the answer was no for evidence of fracking fluids and the chemicals in those fluids.

The second question was asked was: Of the methane that we found, did it look more like naturally occurring methane in shallow layers or deeper methane coming from far underground? And based on the chemical signature of the methane's isotopes, it looked much more like deep methane.

FLATOW: And that 17, average 17 times more methane of water near the natural gas well, is that high enough to explode like it did in the movie, where we see the sink exploding when the guy lit a match when his water was coming out?

Dr. JACKSON: Well, the highest values we observed were over 60 milligrams of methane per liter, and that is high enough to be a flammability, an explosion hazard. And we in fact saw a homeowner light his water, as you see in the movie "Gasland."

FLATOW: John Conrad, what do you think of this study?

Mr. CONRAD: Well, I have a couple of concerns about it and a few questions, and one quick correction on what was just said. I think - at least I would hope Dr. Jackson would agree that the famous scene in the film "Gasland" of the flaming sink was not caused by methane being there because of drilling or hydrofracking. It was investigated by the state of Colorado and determined to be biogenic methane that had nothing to do with gas extraction.

But the couple of questions and criticisms I have of this paper from the Duke team is that, number one, the conclusion that they've drawn would have you believe that the methane, or at least a contribution of methane, came from the recent drilling of Marcellus Shale Wells and from hydrofracking.

And in order for that - if that's true, then they're saying that the methane arrived there sometime after those new gas wells were drilled. But because they did not include baseline sampling or before and after sampling, that's really impossible to determine based on the dataset we have in front of us. So no baseline sampling is one problem.

The other is that this historically and according to the paper, has been an area of oil and gas exploration possibly dating back to the 1800s. And so as the paper does suggest, the legacy oil and gas wells that

really were drilled using the earlier crude technologies, sometimes uncased and uncemented, could represent conduits that might explain why you have the appearance of thermogenic gas in the shallow drinking-water aquifer.

FLATOW: Dr. Jackson, a reaction?

Dr. JACKSON: Well, sure, John's right that in an ideal world we would have pre and post-drilling data for all of our samples. And let me use an analogy for what we did.

If you went back in time and looked at the relationship between smoking and lung cancer, the original studies that people would have loved to have done would have been to follow people through their lives. You study people before they start smoking and then afterwards.

But for many reasons, that's not what was done first. People instead just asked a simple question: If you smoke, are you more likely to get lung cancer? It doesn't prove that lung cancer is caused by smoking, but it's not a bad first step.

And that's exactly what we did. We asked a simple question: If you're near a gas well, are you more likely to have high concentrations of methane? The answer is yes, and I believe it's a good first step.

FLATOW: And if you have that 17 times more methane in the water near a natural gas well, it could - your sink could explode if you lit it, even if it didn't happen that way in the movie?

Dr. JACKSON: I haven't seen "Gasland," and I won't actually watch "Gasland." It could it could if the gas builds up in a confined space, that's correct.

FLATOW: 1-800-989-8255 is our number, if you'd like to talk about fracking and this study. John Conrad, this is - fracking is going to become - and it is moving toward being the method of choice around the country, is it not, for extracting gas from the shale down there?

Mr. CONRAD: That's right. These are large deposits, and the technology required to release that gas is horizontal drilling and high-volume hydrofracking. So we will be seeing a lot of this across the Marcellus plate(ph) and other black shale plates in the U.S. and around the world.

FLATOW: Robert Jackson, do you think we should know more about this as we continue to drill more?

Dr. JACKSON: Well, I certainly think we do, we should. And the first thing to ask, obviously, is: What's the mechanism, or what's the cause of the relationship we saw? So we would love to have more data. We'll be taking samples this summer and in the coming years and hope to collaborate both with industry and other groups, other research labs.

But more data is always good. The most simple explanation, I believe, for what we saw involves leaky gas well casings. And that may have nothing to do with hydraulic fracturing. It could be, though, that the high pressures involved in hydrofracking are more likely to cause leaks in the gas well casings that protect the piping, the tubing, near the surface.

So we really don't know the mechanism yet, and that's a definite area of future research.

FLATOW: And what would be the best way to do this type of study, to take samples before and after a well is drilled?

Dr. JACKSON: That would exactly be the best way to do it. We would - we have some of the sites that we've already drilled. That - I'm sorry, pardon me. We have sites that we've already sampled that weren't

within our active extraction zones last year that are now being drilled or are about to be drilled.

So we'll have the opportunity to go back to those sites and look at how things have changed. Since the paper has come out, we've had many homeowners who've contacted us with pre-drilling data at certified laboratories, and they've asked us to come back and sample.

And finally, today I guess I'd like to propose a joint experiment with industry and homeowners and many groups. Industry in Pennsylvania alone has hundreds, if not thousands, of pre-drilling data points across the region.

It would be wonderful to be able to go back to 100 or more of those homes that have - are pre-drilling sampling data, contact the homeowners, get permission to sample them again since they've been drilled, and look and see if anything's changed. So I would love to do that jointly with industry.

FLATOW: John, would you sign on for that?

Mr. CONRAD: I think I would. I think there will be a lot of data generated. Right now most of the operators who are drilling wells in the Marcellus Shale Region are, in fact, doing pre-sampling baseline sampling of the residential wells surrounding the well pad.

Many of them are going to be doing follow-up sampling during the life of the drilling project and then after that. So there should be - we should be accumulating a large body of groundwater data to help with this type of assessment.

And I do agree with Dr. Jackson that industry has long known that methane migration can occur along improperly sealed or incompletely sealed gas wells. And so in fact industry goes to great lengths, and regulatory agencies put in place procedures to make sure that when the wells are drilled and cased that they're also properly cemented to prevent that.

But nevertheless, it is possible for vertical migration of methane to occur along those wellbores.

FLATOW: I guess, you know, you're then sort of admitting that it is possible for this methane to be leaking out.

Mr. CONRAD: Sure. It is possible and of considerable concern to the gas companies themselves and to the regulatory agencies. And so it is the focus of a lot of attention. But I will say that the modern drilling practices have really refined the practice of casing and cementing and what the - nothing is 100 percent sure and nothing is 100 percent perfect. But the technology is such that, most of the time, we believe we're getting a good seal when we drill and install these wells.

FLATOW: Mm-hmm. 1-800-989-8255. Let's go to Bruce in White County, Arkansas. Hi, Bruce.

BRUCE (Caller): Yes. I want to thank you for this program today because we have thousands of wells here in Arkansas in the Fayetteville Shale place that have been recently - been drilled since 2008. I think 7,000 is the number. It's been a nightmare for us. And no one's talking about the air pollution. We have compressor stations. We have - they must - they are flaring and venting at night. My neighbors have asthma. The kids are sick all the time. This is new. This is very new.

Also, we had a terrible drought last year. The - a lot of the - the drillers take water from our streams and it's put a terrible burden on our streams and rivers. I think each well uses from one to four million gallons of water per frack. And then, recently, we've had these terrible rains. And most of the drill sites have these holding ponds where fracked water is stored when it's pumped out. Well, a lot of these ponds have overflowed and flowed into our streams, flowed into our rivers. We have red streams now in Arkansas.

And there aren't enough inspectors to cover all of this. There are very few reporters reporting on this, so thank you so much. Something's - we need help here.

FLATOW: OK. Thank you, Bruce, for telling what's going on in your neighborhood. John, any, John or Robert, any comment on that?

Mr. CONRAD: Well, a little bit outside of today's subject I think. If - but -and I guess I don't have too much comment on that.

Dr. JACKSON: Well, I...

FLATOW: Go ahead, Robert.

Dr. JACKSON: Sure. I'll drop in just briefly. I think - and again, I believe John is right that we need a lot more information to be able to comment on that. But thank you - the caller. I would like to say one thing in addition to future search getting more pre-imposed drilling data and expanding our geographic coverage.

One of the things that we're trying to do this summer and in the coming year or two is to look for fugitive methane emissions. How much of methane that might be coming up into the groundwater could actually be reaching the atmosphere? Methane is a potent greenhouse gas, far more potent than carbon dioxide is. And so we hope to look for this by sampling the air in different locations and really try to get an answer to that question that's also been very controversial.

FLATOW: Mm-hmm. We're talking about drilling for gas this hour on SCIENCE FRIDAY from NPR. I'm Ira Flatow talking with Robert Jackson and John Conrad.

John, it is a very water-intensive drilling method, is it not, millions of gallons?

Mr. CONRAD: It is. Right.

FLATOW: And isn't that one of the problems and what to do that, well, the stuff that comes back out of the well?

Mr. CONRAD: Yeah. And in fact, it's one of the differences or one of the new elements of this technology. The hydrofracking has been done for a lot of years in New York, in Pennsylvania, in different parts of the country. And what's different here is exactly what you just said. These are longer wells, because by definition they have to be. They're drilled down, to the Marcellus Shale in this case, and then horizontally for a mile or more.

And so you have a very long wellbore that requires a large volume of water to fill. And the fracking process is to exert pressure on that column of water inside that new wellbore and then fracture of the surrounding rock. And so you have to obtain the - enough quantity of water to fill that wellbore and that does have a potential impact on streams. But at least in New York and in most regions, there are restrictions placed on water withdrawals from surface water.

And it's true. You do have to dispose of the water, the brine that comes back out of the well. Some of that is being recycled now. In fact, more and more of that initial flow back is being recycled and reused in the next hydrofracking job. But, ultimately, there will be - the capacity needed to take care of the salt water is produced along with the gas during the life of the well.

And so there are technologies available to do that. And that the deployment of those technologies is going to keep pace with the development of the Marcellus Shale.

FLATOW: Robert Jackson, any comment?

Dr. JACKSON: I think the water issue is equally important. A lot of things use a lot of water, agriculture and many other approaches. But there are parts of the country, I think, where the issues that John pointed to are especially important.

If you look at development, for instance, in the Eagle Ford in South Texas, that's a case where - at least as my understanding goes - most of the water, or much of the water, used for fracking is actually pumped out from groundwater. So there are places around the country where it's not just in drought conditions where it's an issue, but where groundwater depletion and the millions of gallons that are required are very much on people's minds. That's independent of the water quality.

FLATOW: Mm-hmm. Where do you go now with your research? What's your next step? What would you like to know?

Dr. JACKSON: Well, our next steps are to expand the number of samples, more data points are always better. The pre and post drilling that John referred to is absolutely correct. You want to see how the quality of water changes through time after drilling. The fugitive gas emission is another thing. And then finally focusing more on the water side, we'd like to have better information on what's included in fracking fluids and we have some samples to analyze. That would allow us to do a better job of tracking the fracking fluids, should they happen to migrate. And as I said earlier on, we did not find evidence for that in the study. And just thinking about disposal issues of water as well, as you alluded to.

FLATOW: Did you come across any of the leakage or the methane or the air pollution that our caller was talking about?

Dr. JACKSON: We did not measure methane leaking into the air, so I can't really comment on that.

FLATOW: Mm-hmm. Or the flaring of the gas as it came out.

Dr. JACKSON: No, we did not.

FLATOW: All right. Different issue, different topic. It's a big issue and will have a large impact on our energy future in this country as more and more - as fracking gets to be done in more and more places around the country, and especially in sensitive areas where there's no water. He was talking about Arkansas, talking about Texas. There are classic droughts happening in many parts of this - of the country. And the - these techniques use a lot of water.

I want to thank both of you for taking time to be with us today.

Mr. CONRAD: Thank you.

Dr. JACKSON: Thank you, Ira.

FLATOW: You're welcome. John Conrad, president of Conrad Geoscience in Poughkeepsie. And Robert J. - Robert P. Jackson is professor of environmental science at Duke University in Durham, North Carolina.

We're going to take a break and when we come back, we're going to talk about that weird picture, the top secret military technology used in the raid on bin Laden's compound. What was that helicopter? What was that stuff on it? Is it -well, we'll try to parse the pictures with us - with an expert who certainly knows more than I do. So stay with us. We'll be right back after this break.

I'm Ira Flatow. This is SCIENCE FRIDAY from NPR.

Copyright © 2011 National Public Radio®. All rights reserved. No quotes from the materials contained herein may be used in any media without attribution to National Public Radio. This transcript is provided for personal, noncommercial use only, pursuant to our Terms of Use. Any other use requires NPR's prior permission. Visit our permissions page for further information.

NPR transcripts are created on a rush deadline by a contractor for NPR, and accuracy and availability may vary. This text may not be in its final form and may be updated or revised in the future. Please be aware that the authoritative record of NPR's programming is the audio.

Related NPR Stories

France Moves To Ban Shale Gas Drilling May 12, 2011

New Film Investigates 'Fracking' For Natural Gas June 18, 2010

Dispute Over 'Fracking' For Natural Gas Jan. 8, 2010