Conversations That Matter

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Now that the Premiere of British Columbia has gone out of his way to accommodate the building of a massive LNG production facility in Kitimat we have to ask where will the gas come from?

The answer, of course, is it comes from under the ground in both B.C. and Alberta.

Natural gas is the byproduct of decayed plants and animal life that was compacted and pressurized under layers of sand and rock over millions of years.

Deep under the earth's crust in temperatures that exceeded 120 degrees Celsius the organic matter cooks and eventually the carbon bonds in the organic material break down and fossil fuels are formed. This is called primary gas. Now, secondary natural gas accompanies oil, which cooked for many, many millions of years more.

Getting that gas out of the ground means drilling. And it also means hydraulic fracture drilling, also known as fracking.

Well, what exactly is fracking? How is the operation carried out? And more importantly is it a process we want to be a byproduct of the LNG industry that we've invited to set up shop here in British Columbia?

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We invited Brad Hayes, the Director of the Canadian Society of Unconventional Resources. He's an adjunct professor at the University of Alberta and a respected expert on fracking to join us for a conversation that matters about fracking. What it is, how it's done, and most importantly, is it safe?

- [Narrator] Conversations That Matter is a partner program for the Center for Dialogue at Simon Fraser University. The production of this program is made possible thanks to the support of the following and viewers like you.

- Welcome to Conversations.

- Good afternoon. I'm pleased to be here.

- Unconventional resources, what exactly are unconventional resources?

- Well, they're unconventional, we're talking about oil and gas. The reason they're unconventional is because you have to do unconventional things to get them out of the ground.

- Such as?

- Such as drilling horizontal wells and doing hydraulic fracturing at a very large scale. Most of the history of the oil and gas industry we've drilled vertical wells. We might have fractured them. But it's been a pretty well established process.

- Up and down, that's it?

- Up and down and vertical. The last 10 years what we've had to do in order to access these unconventional resources is to drill our wells vertically and then turn them horizontally, a thousand, 2000, 3000-meters under the earth, and drill the moat into the formation containing the oil and gas.

- So what exactly is fracturing? We hear about it all the time. It's called fracking and fracturing. But what exactly is it?

- It's a process where you actually break the rock, the reservoir rock that's underground that two or 3000-meters deep and you break it by pumping a fluid down, usually water-based fluid, and just putting it down the hole under so much pressure that the rock is physically shattered and breaks apart along that horizontal well bore 2000-meters deep.

- So what happens then? I put all that pressure on water in there. It fractures the ground there and releases, when there's oil there, I guess it releases oil. How does it get back up if there's all that pressure pushing in? Are you extracting the water back out after you've, okay?

- Yeah, I mean, when you go that deep in the ground there's a lot of pressure already. All the pressure of the rock over top, 2000-meters of rock pushing down on that reservoir, so if I inject that water under very high pressure I break the rock and then I just quit injecting the actual pressure of the rock over top of the reservoir will push my water right back out. It'll flow the water back out of the hole, and once it's flowed all that water, that frac fluid out of the hole, then whatever else is in the reservoir, the oil or the gas, is gonna come out behind it, which is exactly the same process as when we drill a conventional well. You drill down there. You open up the reservoir to the well bore and there's so much pressure that the fluids just come up and out of the well bore.

- How long does that flow continue out of that bore that you've put down? You've gone horizontally and you've created this. So you've now got a channel. What happens? How much for how long is there gonna be a flow from there?

- As long as there's enough fluid, oil or gas, down there under pressure to come out and be produced from the well bore. So it depends if you've drilled a really long well bore and you've accessed a big area of reservoir, you could be flowing the oil and gas back for 10 years, 20 years, because you've actually stimulated that flow of a very big area and it comes up the little pipe. I mean, you know, the pipe's about that big that it comes up so it takes a long time to get all that out of there if you've done the job well.

- I'm gonna get you to hang on for a second while we take a quick commercial break. We'll be right back.

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- Once you've done it, out comes the machinery, and the water, what happens to the water when it comes out of the well?

- The water that we put down there, we get some of it back. Some of it just gets absorbed into the formation. But let's say we get 30% or 50% of the water back. It comes out the well bore. We have to recapture it because it's been down there. It's been contaminated. We put some chemicals in it to give it the properties we need it to have. So all of the water has to be captured. It's basically taken back to tanks, and in most Canadian operations now where we're doing a number of these wells, we recycle that water. At the end of the day when we finally end up with this remnant of water that's been up and down and up and down a whole bunch of times and is quite saline and perhaps not very usable anymore, then we'll have to dispose of it, and that'll be down at deep disposal well. We'll dispose of it, again, a thousand, 2000-meters underground into a formation that's way below anything that we would get drinking water out of, and that's already full of highly saline or toxic water already.

- This is a pretty big operation isn't it?

- Huge operations. They're very, and that's part of, I think it's part of the issue that people have with unconventional developments sometimes. I tell people about and say it's a very intensive operation. It happens over big areas, and even though it's very efficient in terms of doing a lot of things from one point on the surface, it's a big time industrial process that goes on for a period of time where we're drilling, and then when we're fracking. Once we're done, the fracking, and everything's flowing out and we've got our oil and gas coming out then we can move all the equipment off and put basically a wellhead cover on, the valves and so on that guide the flow into the pipeline, and we're pretty much done.

- When you go down go and turn in one direction, in the same hole do you turn and go another direction and another direction and so on because--

- Just about, it's not exactly the same vertical hole. So what you'll do, in the bigger operations they call them super pads, you might have four drilling rigs going at once in the same area and each one of them will drill its own vertical hole. It'll take it off in some direction. Then if the next well they want to drill, many of these rigs now, the modern ones are equipped, they can just basically shuffle them over a few meters and start a new vertical hole. So they don't go in all directions from one vertical hole. Each horizontal well has a vertical and then a horizontal. But they're all very closely spaced together at the surface.

- And at different depths as well?

- It depends on the reservoir that you're looking at. Most companies try to do a very systematic development at one particular level because they optimize the techniques they use in terms of how long they drill the wells and how they formulate their frac fluid and all this. If they want to go to the same spot and drill a horizontal well into a different formation or a different elevation underground, they probably need to change the procedure details a little bit so they'll probably come back and maybe do a round of horizontal drilling at that different level at a different time, just, again, for the purposes of efficiency.

- You're giving up pretty good yield from this. There's an awful lot of protests about this. And they talk about water contamination. Is that a legitimate concern?

- Any industrial process that you undertake like that has risks and accidents do happen. But to be very fair about hydraulic fracturing many of the mechanisms or the ways that people imagine that water can be contaminated, it doesn't really add up. When we drill the well it's lined with steel casing and with cement that prevents the fluids that are in the hole whether it's the salt water or whether it's the oil and

gas later, from leaking and getting in contact with drinking water. That's in an underground for water wells or at the surface.

- Is the placement of that sleeve, does it happen simultaneous with the drilling?

- It does, that's right. That sleeve or that casing is all in place well before you ever do the fracking operation.

- Okay, so you're sealing that off.

- It's all sealed off before the fracking happens.

- So even if you do happen to pass through an underground water aquifer that may have drinking water in it not all do, but--

- Some do and they're always very shallow.

- That you're gonna protect any flow that's coming out from contaminating that water?

- That's right. And the regulator in British Columbia, so BC Oil and Gas Commission, has its number of regulations that tell you exactly how you have to, what depths, what measurements you've got to make, how you've got to put that sleeve into place, procedures to make sure that it's done correctly. Now, it's again, it's an operation. People are doing it. There can be mistakes made. And sometimes well bore construction doesn't happen exactly properly. But it's like anything else. I mean, there's very odd exceptions, but almost every single well, the rules are in place, the wells are done properly. It's a highly efficient, highly effective way of protecting groundwater. There's really more risk of contaminating groundwater, contaminating water that we're worried about at the surface, a lake or something, by a truck driving along the highway and accidentally spilling its load, for example, into a lake or something like that. The risk of something like that happening, while it's quite small because trucks are built well too, but I mean, it's a greater risk than contamination from a well bore.

- This is our second break. We'll be back in a moment.

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- The fact that you say that accidents can happen, we live in a soundbite world where somebody's gonna go ah, see he admits accidents can happen. Does that make it very difficult to operate in that kind of environment where people are willing to jump on that kind of statement?

- You know, i think we have to be very honest about these things. I mean, I can say very honestly the regulations are very good. There are very few, if any, accidents. I'm not aware and I've certainly looked at a lot of the literature, out there being any instances in Canada of a well bore failures so that oil or gas or deep saline water contaminated drinking water.

- You're not aware of any incidences?

- I'm not, no. Not in Canada.

- Okay. Now, we hear reports out of the United States that this happens.

- We do and what's interesting if you look at a lot of the, I would call it advocacy pieces, where people are trying to make the case that these are dangerous procedures, you'll see that a lot of the examples that they use are from the United States and they're from back when the industry started these procedures 10 or more years ago. Basically back when it wasn't very well regulated in some jurisdictions and before we really understood all the risks. There is a very different regulatory mindset and climate between Canada and the United States in general in the industry. We tend to be much more cautious here about putting much firmer regulations in place. And so you'll see that most of the examples, people like to talk about the Marcellus Shale in Pennsylvania and some things happening in Colorado and things like that. They don't really come and talk to us about things that are happening in the Dufferin area and the Horn River Basin or in the Montney Fairway because quite frankly they don't have any examples to point at where there's been bad procedures followed where there's been contamination.

- We have heard of some seismic activity associated with fracking in Northeastern British Columbia. What is the risk there?

- Every hydraulic fracturing operation that you do puts energy into the ground and one of the ways that we actually monitor and control our hydraulic fracturing is to put out what we call micro-seismic array. We put out a bunch of geophones listening devices. And while we do the fractures the listening devices pick up all those little tiny events of the rock breaking underground. We can map out how things happen. What we know from looking at these micro-seismic data is that sometimes if you drill your horizontal well and you inject your fluids and you get close to a fault or a break that's already in existence underground that fluid, some of the energy, can actually go into that fault that's there already. Now, a lot of the faults in Western Canada, they're naturally stressed. If you go off of the west coast and you got the plate boundaries and that where the big earthquakes happen where there's a lot of stress on those faults because there's activity already going on even now, if you're talking about Northeastern B.C., the stress that's on those rocks is the stress that happened 60 million years ago when the mountains formed. There's still stress there. So if you put fluid in there, if you lubricate that fault, and it's got some stress on it, it may move. And that's what's happened. So as we monitor our frac jobs what

we'll see is there'll be some energy released and some faults will move. There'll be little seismic events. The vast majority of them are too small to detect. But some of the bigger ones are bigger and there have been a few up to magnitude 4.6, 4.8 that, if you're really nearby, yeah, you can feel that. And there's even the potential you could feel quite significantly if you were sitting right on top of that event. Now, most of these wells aren't drilled right underneath people. They're pretty remote in Northeastern B.C. And even though you feel it, you're talking about feeling things like a big truck going by or something like that. You're not talking about a movie earthquake. So I think what people worry about is if we can get a four maybe we can get a five, or maybe we can get a six.

- Or we're gonna trigger something.

- Or we're gonna trigger something bigger.

- It was ready to go and we've now provoked it into action.

- I think people have that concern. That seems to me quite a logical concern. Now, at CSUR we work with a number of academics on these seismicity issues. There are researchers at University of Calgary, Western University, places like that, and they're very careful being academics. They don't want to say anything with certainty. Anything in the academic world's possible, but quite frankly if you look at the stresses that exist in the Northeastern B.C. Or in Western Alberta where we've seen a couple of these seismic events too, we're not talking about being at the edge of the plate out in the Pacific Ocean in the ring of fire. We're talking about in the interior of the continent and quite frankly the stresses that exist there that could be released, that could be provoked, by our putting fluid into the ground, it's very unlikely. And again, I'm being an academic here now too. It's very unlikely that you're going to release anything of much bigger magnitude than we've seen already.

- Third and final break. We'll be right back.

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- Let's talk about you, your credentials and who CSUR is because there's gonna be somebody who's watching and going oh yeah, who's paying for that guy? So who is paying for you?

- CSUR is paying for me. CSUR is the Canadian Society For Unconventional Resources. Our members include all different organizations from, there's industry companies, there's regulators. For example, the Oil and Gas Commission is a member. The Alberta Energy Regulator is a member. The Provincial Government Geological Agencies are members. The universities are members because much of our really good technical material that gets presented at our luncheons and at our conventions and so on

comes from university research and the academics. Again, we're mostly this organization of engineers, geoscientists, business people, and that that really want to understand the science and how to make unconventional oil and gas extraction better. And CSUR is paying for me to come do this because basically they want to get out in front of more people that this good scientific work's being done that we've got some really very good understanding of the processes, of the regulations, of all the things that go on to do with hydraulic fracturing and water resources and that, and really just want that information out there.

- Who's the most important audience? It sounds to me like you want to be talking to people who are regulators and who are in the industry and sharing information that says here are best practices. Are you also active in working with students who are moving into the profession?

- Mm hmm, you're absolutely right. Most of our effort is focused at exchange of information amongst our membership between our industry people, our regulators, our academics and so on. We host all sorts of events and workshops where we get together and show what research is being done and so on and it's a very good symbiotic relationship. There's a lot of support from industry and from regulators, for academics who do the work and things like that. The work that I'm engaged in right now is we call our outreach program and so yes, we've modeled after some other outreach programs. Our first audiences have been in the universities, at the technical colleges talking to students. The people that we know quite frankly are geoscientists and engineers. I know geoscience professors and I'm an adjunct geoscience professor at University of Alberta myself. So we've got good contacts. We go talk to those people because we know those people are gonna be in industry and they're gonna be our colleagues at some point or our bosses or whatever some day. But we think it's important now too to get out to more broad audience.

- Why is it important? why do you feel that the general public needs to be more aware of topics like this?

- Simply because I think that the general public hears a lot of different things that aren't factually based. They get told many things, and you mentioned before about the potential contamination of groundwater and there are people out there that will simply say oh yes, groundwater gets contaminated. Oh yes, we're at high risk of damage from earthquakes. Well, oh no, we're not. Those aren't scientifically backed truths. So we would like to contribute to the discussion the science right from where it's being done. The science, the investigations into how injecting water into the earth affects seismicity or earthquakes, the science experiments are the wells that are being drilled. We're right on the edge of it and we're making the measurements. We, when I say we I mean all of the different members of CSUR, the operating companies, the regulators, the academics and so on. We feel it's an important thing to contribute more measured scientific facts. And as I've tried to do during the conversation here today is to realize that it's not perfect. I would never sit here, and I don't think any responsible person should sit here, and say there will never be groundwater contamination. There will

never be any problem with seismicity. We understand the processes. We regulate them. Industry tries its best to follow regulations. Will there be accidents? Will there be things happen that we don't want to happen? Yes, and I can certainly point to, there's been some incidences of things that have happened that, while they haven't really damaged the public, they've certainly caused a lot of financial damage to industry companies because they haven't done things well. But what always happens when we get involved with CSUR with things like that is we help people exchange information. We figure out what went wrong. How do you change the regulations or how do you change the best practices so that particular event might not happen again.

- Well, I appreciate you taking the time to explain a number of things that I kept going, okay, how exactly does this work? And I am guilty. I read the headlines and I go, it looks like it's got an awful lot of problems. So thank you ever so much for coming in and sharing this information.

- Thank you very much. My pleasure.