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Encana Pavillion news media conference call – Technical briefing
December 20, 2011

Doug Hock, Team Lead, Community and Public Relations

- I'd like to welcome everyone to our discussion regarding Encana's response to the preliminary findings of the Environmental Protection Agency's (EPA) groundwater investigation in Pavillion, Wyoming.
- As we all know, the matters raised by the issues in Pavillion are scientific, highly detailed and very complex. Because of that, we are holding this call today to underscore the technical foundation for our statements in the news release issued December 12. We are not holding this call in the expectation that you will necessarily write additional stories. Rather, we wanted to provide a more detailed awareness of the scientific work we have devoted to understanding naturally occurring groundwater conditions in Pavillion and, given that work, why natural gas development has not impacted drinking water.
- Our call will begin with remarks from the Vice-President for our Wyoming business unit, John Schopp, to be followed by remarks from our technical lead on this issue, David Stewart. We'll then open the call for your questions.
- I'll now turn the call over to John.

John Schopp, Vice-President, North Rockies Business Unit & New Ventures

- Thanks, Doug. Before I turn the call over to our technical lead, I just wanted to take a moment to share a few thoughts about our work in the Pavillion area.
- First, I would like to say that as a matter of principle, Encana is very concerned about the impacts of energy development on the environment everywhere that we operate, and we are deeply committed to working to ensure our operations do not impact groundwater.
- At the same time, the protection of domestic water wells and underground sources of drinking water is also a necessity and required by law. That's really a good thing. As is standard across the industry, we follow rigourous procedures that provide several degrees of protection for domestic water sources. If our operation is causing a problem, we want to know immediately, so it can be rectified. In the case of Pavillion, when a landowner complained about the taste and odour of his water, Encana conducted multiple rounds of tests and sought the expertise of both independent laboratories and the Wyoming Department of Environmental Quality. None of these tests indicated impacts due to our operations. We expect the odour comes from bacteria in the well and naturally occurring compounds, such as sulfates which occur at high levels in some of the water wells in this area. Nevertheless, we have continued to work with the state and later, the EPA, to address citizens' concerns.
- Besides the issues of odour and taste that I just mentioned, water well owners at Pavillion, over the Pavillion gas field, have one more challenge courtesy of Mother Nature. The Pavillion gas field was developed in a location where methane, also known as natural gas, is present at very shallow depths. This happens naturally in many sedimentary basins, and is a natural occurrence in Pavillion. Water well depths in this field tend to be restricted to about 300 feet because drilling below that depth is dangerous due to the amount of methane. Most water wells in the area have the potential for some minor naturally occurring methane with their water production.
- To understand the EPA results, you need to contrast the shallow methane with the gas from depths where we commercially produce oil and gas in this field, below 1,100 feet; at these depths there is much more methane present plus the gas contains other constituents commonly found in gas fields, including constituents like benzene and other hydrocarbons. We are pleased that these deep gas constituents have not appeared in either our studies or the EPA's drinking water well test results on any domestic wells. We were not surprised, however, when these constituents did appear in the EPA's well drilled to just under 1,000 feet in depth.
- Given the technical advancements in natural gas development in the industry, particularly horizontal shale gas drilling in other parts of the country, coupled with hydraulic fracturing, there is enhanced interest in the industry and its practices, and this EPA study in Pavillion is now playing a central role in this public dialogue.

- As we've stated in our December 12 news release on this matter, Encana strongly disagrees with the EPA's draft conclusions that talk of a possible link between the Pavillion groundwater chemistry and hydraulic fracturing operations. We believe the test methodology contained flaws and we disagree respectfully with the interpretation of the results.

- The EPA's draft report is being widely read and will be formally peer reviewed over the next few weeks and months. It is in the best interest of everyone that the peer review be truly unbiased and independent, and that it provides the public with an accurate assessment of this matter. In order to be unbiased and independent, it is of paramount importance that this review be conducted by parties outside of the EPA.

- During that public comment period, Encana will be providing a detailed review to the EPA and our reviews will be public. Also, I invite you to visit our website where we will provide further information and discussion on groundwater protection.

- I would like to now turn the call over to David Stewart, our Environment, Health & Safety Lead for the North Rockies business unit.

David Stewart, Group Lead, Environment, Health & Safety, North Rockies

- Thank you, John and welcome everyone. As John said, my name is David Stewart, and my team at Encana has been working directly with the EPA and the Wyoming regulators with regard to this situation for quite some time.

- Our Pavillion environmental science team includes specialists with advanced degrees in geology, hydrogeology, chemistry, geophysics, petroleum engineering, environmental engineering, drilling construction, engineering, reservoir and production engineering. It is important to note that these skill sets are necessary because this is a unique investigation and they represent expertise that we feel needs to be brought to bear to understand the science correctly.

- As John mentioned, Encana strongly disagrees with the conclusions in the EPA's draft report related to the groundwater study in the Pavillion field of Wyoming. In fact, it is our belief that the EPA made critical mistakes and misjudgments at almost every step in the process – from the way it designed the study, to the way it drilled and completed its wells, to the way it collected and interpreted the data, to its decision to release a preliminary draft report without independent, third-party peer review.

- To understand the situation, and set the stage, I want to remind you of the two core elements at play in the Pavillion investigation.

- The EPA tested water in two places, and the test results from those two places are distinctly different:

  – First, domestic drinking water from residents' wells were tested. In these drinking water wells, the EPA's tests found no indication of oil and gas impacts and no connection to hydraulic fracturing. The EPA's tests are consistent with all previous tests both published and conducted over the past 50 years, well prior to natural gas development in the area.

  – Second, the EPA tested water from its recently drilled deep wells, as John mentioned, at nearly 1,000 feet deep. These tapped far deeper into the formation at depths where components of natural gas are commonly found. It is expected that they would get results indicating compounds that are found naturally with gas. It is important to remember, these are not drinking water wells, they are deep test wells.

- Of most concern, many of the EPA's findings from its recent deep wells, including those related to any potential connection between hydraulic fracturing and Pavillion groundwater quality, are conjecture, not factual, and only serve to trigger undue alarm.

- We are especially disappointed that the EPA released its draft report, outlining preliminary findings, before subjecting it to qualified, third-party, scientific verification.

- As John mentioned, given our concerns about the report – as well as the concerns expressed by the state, Bureau of Land Management and others – we believe a truly third-party peer review, outside of the EPA, is required to understand the data.

I will spend the next few minutes reviewing the conclusions in the draft EPA report and our disagreements with those conclusions. I will go into some level of detail here, because we think it is important for everyone to understand precisely why we have such concerns about the preliminary EPA study.

The EPA supports its overall conclusion that – quote, "constituents associated with hydraulic fracturing have been released into the Wind River drinking water aquifers at depths above the current production zone", unquote – based upon what it characterizes as "lines of reasoning" approach. I will address those lines of reasoning and our disagreements with each.

1. High pH Values

One of the first things that the EPA points to is high pH values. They state that there is high pH value in the deep wells versus what is found in the Wind River formation naturally and they base this claim, or state the reason for this claim, is the use of potassium hydroxide used in hydraulic fracturing.

- Upon examination of the chemicals the EPA used to develop these wells, it was found that the EPA used dense soda ash with a reported pH similar to that noted in deep wells. So, that is another possible source or explanation for the elevation of the pH that they observed.
- A second possible source is the use of cement that the EPA used in construction of its wells. The time frame that they used to sample the wells was very near when they completed the wells, and the cement may not have been completely cured, leading to the higher pH.
- A third point to bring up on pH is the model the EPA used to simulate the reaction did not mimic reality. Potassium hydroxide was a small component used in an overall mixture of some hydraulic fractures with an overall pH between 6.5 and 7.0; that's nearly neutral, it hardly explains the elevated pH that the EPA claims is caused by the use of potassium hydroxide.
- A last point that is new to our understanding is that potassium hydroxide use was very limited in the Pavillion field and, in fact, current data has been analyzed and we have typically pumped very low volumes of CO_2 fracs that do not contain potassium hydroxide. So, as we develop our understanding of what was actually pumped into each of these wells and close proximity to the monitoring wells, we'll be developing that argument further.

So, therefore, the evidence indicates that the EPA itself put at least two constituents in its deep wells that match the pH levels that it is suggesting may have come from natural gas well completions. In our opinion, it is much more likely that high pH values stem from chemicals known to be in the EPA wells than from speculation that residual products in neighbouring natural gas wells traveled through low porosity rocks, and especially under the understanding that there is no pressure to cause such travel.

2. Elevated potassium and chloride

A second conclusion by the EPA that I would like to address is that there is elevated potassium and chloride observed in the deep well samples. They attribute this difference to the use of potassium chloride in hydraulic fracturing.

- The potassium readings don't establish the presence of potassium chloride. In fact, USGS (United States Geological Survey) studies note variable concentrations in both potassium and chloride and in certain cases high concentrations of naturally occurring potassium and chloride in the Pavillion field area groundwater. Furthermore, the potassium levels detected in the EPA's deep well number 1 declined by more than 50 percent from October 2010 sampling to April 2011, while the potassium level in the EPA's deep well number 2 increased during that same period. This lends credence to the evidence provided that USGS states potassium as widely variable in the Pavillion field.
- The EPA states that chloride concentrations don't have a tendency to increase with depth. That is incorrect and contrary to what the USGS has reported. Increased chloride concentration with depth is a function of basin geochemistry and well-documented facts. The chloride concentrations measured by the EPA are consistent with expectations for that depth of well.
- Given the natural variability of both potassium and chloride in the geology and the wide variance in the EPA's limited sampling data, it's not logical to Encana to attribute this to hydraulic fracturing. It's much more attributable to the natural variation of both potassium and chloride in the formation.

3. Detection of synthetic organic compounds

The third line of reasoning the EPA uses in its reports relates to the detection of synthetic and organic compounds. They detected synthetic organic compounds and I will switch the name to man-made compounds in the deep wells. These included tert-butyl alcohol, various glycols, ketones and 2-BE. So, I am going to discuss each one of these one by one to give you an idea of our opinions on these.

- Tert-butyl alcohol was found in one deep well by one lab. The presence of Tert-butyl alcohol in the EPA deep wells is attributed to the use of a peroxide breaker in hydraulic fracturing or MTBE in gasoline, according to the EPA report. However, we have never used a peroxide breaker nor gasoline in hydraulic fracturing or drilling in the Pavillion field. So, the presence of Tert-butyl alcohol indicates either quality control problems or EPA wellbore construction material contamination. The fact that this chemical is not used in the field and was found in the deep wells is indicative of quality assurance problems.

- Glycol was reported sporadically in the results but the data should have been excluded by the principle investigator for two reasons.
  - First, glycol was found in the blank quality assurance samples, indicating that its presence is likely due to either sample contamination or EPA wellbore construction material contamination.
  - The detections reported were based on an unapproved laboratory method and when identical samples were analyzed by a different EPA lab, glycol was not detected; so, very inconsistent detections of glycol, which lead one to question whether its presence was there at all.
- Let's discuss ketones now. First of all they are not used in hydraulic fracturing, period. So, the presence of these compounds in the deep well samples indicates either sample contamination or EPA wellbore construction material contamination. Please note that ketones are common components of coatings, degreasers and some cleaning agents. I can't emphasize enough these were not used in hydraulic fracturing, they are not used in drilling and they are not used in surface operations either, so the presence that it is there is very interesting to Encana as well.
- Another point, the EPA routinely references a list of the Material Safety Data Sheets that were provided to them by Encana. These represent a broad range of chemicals that could have been used by Encana or its predecessors. Upon more in-depth analysis, there is strong evidence that the correlations between the MSDSs and chemicals found in the wells are not correct, because they are not spatially specific. In other words, their "lines of reasoning" are based on chemicals not specifically tied to the Pavillion field. So, an example of this is the Tert-butyl alcohol explanation for the peroxide breaker. Peroxide breaker was never used in the field yet we did record it in the MSDSs, because it is possibly used in hydraulic fracturing. Yet they chose to make that claim despite knowing that the peroxide breaker was not used.
- Another compound the EPA reported finding is 2-BE, and this is a chemical used in hydraulic fracturing in the Pavillion field. Upon review of the data, identical samples analyzed by two different EPA labs indicate that this was not present. Additionally, it was not found in Phase 3 or any other previous phases of sampling. Furthermore, the gas chromatogram indicating this one single detection out of eight attempts to detect it didn't provide a clear chemical signature and mass spectrometry results, which could be used to further diagnose the signature, have not been provided by the EPA for review.
- In summary, the majority of man-made organic compounds detected by the EPA are not used in hydraulic fracturing and were introduced by the EPA in the process of sampling or construction of the deep wells. Those that are used consisted of a single detection that can't be duplicated and has not been spatially tied to natural gas wells in the vicinity of the EPA's deep wells.

4. Detection of petroleum hydrocarbons

The next major conclusion that I would like to address is the detection of petroleum hydrocarbons. The EPA wells were drilled into gas-bearing sand pockets so the presence of naturally occurring methane is not surprising.

While these wells were drilled to 783 feet and 981 feet respectively, most domestic water wells in the area are typically less than 300 feet. This accounts for the very different results. There were no natural gas impacts in domestic wells versus high levels of hydrocarbons in the EPA's deep wells. As we've stated previously, the EPA drilled its deep wells into a gas reservoir and found hydrocarbons put there by nature, not by Encana.

5. Breakdown products of organic compounds

The fifth major topic discussed in the EPA's report talks about the breakdown products of organic compounds. The EPA next cites the presence of what it terms "breakdown" products in the shallower of its two wells. In other words, the compounds found in the deeper of its two wells have broken down to these other products and they used benzoic acid and acetate as examples.

- Neither acetate nor benzoic acid are used in hydraulic fracturing. The EPA reports these as breakdown products and references artesian conditions as pushing from deep to shallow. There are several issues with this argument:
- First of all, benzoic acid was also found in EPA's blank samples, just like glycol.
  - Benzoic acid is also naturally occurring, as well as a common component of many other products including sample preservatives.
  - Toluene would break down to benzoic acid in nature, but toluene is also naturally occurring in this hydrocarbon-bearing zone and presence of breakdown products may also be a function of natural reactions. Note that shallower wells by the EPA monitoring well 02, if I have the depth right, is shallower and there may be are more aerobic activity accounting for this breakdown, which was not seen in the monitoring well 01. Also a last very strong point in regards to their conceptual model is that the USGS documents that there is no widespread artesian condition, so there is no known pressure gradients that would force fluids from deeper zones into shallower zones. So, it doesn't support the theory of migration.

This is another example of EPA trying to establish lines of reasoning that have pathways to many other potential answers.

6. Sporadic bonding outside production casing directly above intervals of hydraulic fracturing

Another point that EPA brings up in its report is sporadic bonding outside production casings directly above intervals of hydraulic fracturing. It cites sporadic bonding as a possible pathway between oil and gas production and domestic wells. The EPA cites what it believes are issues with natural gas well construction and cementing. This is all about well integrity. Specifically, the report cites "sporadic bonding outside production casing." I want you to take into consideration that Encana has been working as part of a voluntary working group process, with the EPA, Wyoming Oil & Gas (Conservation Commission (WOGCC)), Bureau of Land Management, Wyoming Geological survey, the Wind River Tribe and others for over two years. As part of this working group, it says well integrity was evaluated by the Pavillion field. The Wyoming Oil & Gas Conservation Commission initially did not note any problems with the well integrity. But they did decide to request the EPA look at a few wells to ensure that we don't have any integrity issues as part of the working group process. One of the issues the EPA points to in its analysis is this statement that cement yields were not great enough to provide enough cement to secure wellbore integrity. But the EPA based this judgment off of an analysis completed by an EPA-hired consultant who, when reviewing Encana's well records, underestimated the cement yields and therefore made inaccurate remarks and conclusions regarding the top of cement.

- Also we have done Bradenhead testing, a well-established procedure to test to determine the integrity of the wellbore. We are in the midst of that Bradenhead testing and will continue to Bradenhead test with the consent of the regulator Wyoming Oil & Gas Conservation Commission and we view it as a critical test of well construction and cementing. To date, the Pavillion Bradenhead tests do not indicate any widespread wellbore integrity issues. However, there are three wells noted with slightly elevated Bradenhead pressure that are being further examined and evaluated by the Wyoming Oil & Gas Commission and Encana.

- Finally, and most importantly, if there were issues with the construction of a natural gas well, the level of methane near the surface would be magnitudes higher than anything found in sampling.

Therefore, despite the EPA's assertions about well construction, rigourous testing of these wells, coupled with the lack of the conditions in the field that would be present if a cement bond were to fail, leads to the conclusion that there is no issue with the structural integrity of these natural gas wells.

7. Hydraulic fracturing into thin, discontinuous sandstone units

Another point the EPA brings up is they theorize that drilling activity has somehow enhanced the natural migration of gas toward the surface in the Pavillion field.

- At Pavillion, residential water well permits, granted by the state, tended to be limited to 300 feet in depth due to the long understood risks of drilling deeper and encountering gas flows. The specifics are documented as far back by the USGS as the 1950s, by the United States Geological Survey well before oil and gas development commenced.

- Oil and gas surface casing depths in the field are generally between 320 feet and 690 feet, depending upon the depth the regulator believed was necessary to protect potable water sources, and presumably an extra cushion of depth added at the operator's discretion to allow extra protection. Wells drilled by Encana have surface casings depths to between 510 feet and 660 feet.

- The EPA has identified that residential water wells at Pavillion actually range from about 40 feet to as deep as 800 feet, based on interviews with landowners. We are still learning the background on this, but it appears that several landowners chose to drill water wells deeper than recommended depths, or chose to drill with no permit at all. This becomes clear when you compare the state records with what was reported by the EPA.

- Encana's intent is to set surface casings significantly below the maximum depth for potable water. Despite these conditions, it is important to remember that oil and gas-related compounds have not been identified in the domestic drinking water wells. This suggests that protection offered by other factors has been adequate to protect even the deepest domestic water wells.

- Those protection factors include production casing cement that is a barrier preventing completion fluids from finding a pathway to water wells, and the natural limitation of Pavillion's discontinuous sand bodies to allow gas or water migration in this area.

Therefore, given the sampling results from the domestic wells versus the very different results from the deep wells drilled into a hydrocarbon zone, the EPA has failed to demonstrate enhanced migration of natural gas or for that matter, a potential pathway between natural gas production and domestic wells.

Just to reiterate a couple of primary points, I really want to point out that there is a great deal of blank hits in the EPA's samples that I touched on throughout my discussion and that is going to be one on the areas that we focus on learning to better understand. We have requested additional information from the EPA in regards to the wellbore construction materials used and reasoning for why materials used and water used were not sampled until one year after the testing occurred. So, therefore, we have serious disagreements with the results in this report and plan on analyzing each and every one of these further as we continue to work with our in-house experts and external experts on this issue.

That concludes my review of the EPA conclusions. Thank you for listening.