

ps. I agree that it's wrong for the media to link Oklahoma wastewater disposal to shale gas development

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[if it's really urgent, don't use email]

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On Nov 14, 2013, at 2:08 PM, Holland, Austin A. wrote:

Bill,

I am sorry I had meant to send you our information poster on the earthquakes which occurred near Lake Arcadia (attached). I appreciate your concern and certainly welcome any advice. I am quite skeptical myself of the potential link between a very small subset of earthquakes in the OKC metro area and the lake levels at Lake Arcadia the correlation as stated in our poster is interesting and requires further investigation. The corporation commission mentioned this to reporters and I was asked to speak to it, so my hand was forced on this matter. One thing to remember is that we have had twice as much rainfall as normal so in addition to lake load you also have the additional subsurface aquifer loading, and the stress field has been modified by the previous earthquakes in the area. The correlation to lake levels for these few events is better than most of our earthquakes and disposal wells with the exception of the B. SMITH 31 well (April 2013) in Lincoln , County and the LCD #1 in Love, County.

While we clearly need to examine the potential links between earthquakes and disposal wells, I don't believe we are looking at a crisis and on the verge of disaster. Having said that the large number of upper magnitude 3 earthquakes in some areas have me concerned that we may be moving towards more significant earthquakes within Oklahoma. While Oklahoma has a lot of disposed of volume Texas far exceeds Oklahoma and has had much less seismic moment released than we have seen over the past few years. Kansas has a fair amount of disposal wells and almost no earthquakes. We clearly need to examine this issues and are actively working to understand them, but none of the discussion

that is occurring within the popular media is at all helpful to the discussion or the science. While there are regions where we see increased water disposal and increased earthquakes, such as the Mississippi Lime play, it is important to remember that there has been a lot of disposal and injection in Oklahoma for a long time. It is also important to note that most of the injected volume represents produced water and has nothing to do with shale gas development and as such hasn't seen the dramatic boom that shale gas development has seen over the recent past. Our hydrologist, Kyle Murray, has looked at the sources of water disposal and the vast majority of water disposal is from produced water which has been occurring for decades. It is likely there are many cases of induced seismicity from fluid disposal in Oklahoma. It is important to quantitatively demonstrate those connections and adequately characterize uncertainty of such conclusions, and move past reasonable hypothesis and arm waving and quantitatively document such cases. This will help to truly understanding things and move towards more effectively mitigating and managing the risk of induced seismicity.

Since early 2010 we have recognized the potential for the Jones earthquake swarm to be due to the Hunton dewatering, but until we can demonstrate that scientifically or not we were not going to discuss that publicly. Now we have no choice, because others are discussing this publicly. This is not helpful to our efforts because every hour I spend talking to reporters is another two hours I really can't be doing the research that needs to be done. There has been far too much hype about the recent earthquakes. I have had as many media requests as I did following the Prague earthquake.

On a somewhat unrelated note we are seeing a number of magnitude 2+ earthquakes just south of Lake Texhoma in Texas. We only report on earthquakes we observe in Oklahoma, but weren't sure who might be interested in receiving more information on these earthquakes.

Regards,

**Austin A. Holland**

*Research Seismologist*

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From: [Holland, Austin A.](#)  
To: [Keller, G. Randy](#); [Grillot, Larry R.](#)  
Bcc: [Holland, Austin A.](#)  
Subject: Summary of Meeting at OCC  
Date: Tuesday, October 29, 2013 8:14:22 AM

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Hi,

I wanted to make sure you guys were up to date on the meeting I had in Commissioner Douglas's office. So Jack Stark, Senior Vice President of Exploration with Continental Resources was there. **The basic jist of the meeting is that Continental does not feel induced seismicity is an issue and they are nervous about any dialog about the subject.** Both Continental and Commissioner Douglas were concerned about the recent energy wire story and the USGS press release. I explained that the press release was made better by our co-operation and that both Randy and Bill Leith felt that Soraghan had not done them justice in what he chose to write. So I was under the impression that Continental had a potential case of induced seismicity but rather they are in the denial phase that this is a possibility. It was almost like talking to New Dominion they have done some work with mapping faults in central Oklahoma using magnetics which is of course non-unique and could simply be a compositional change. When the commissioner asked them if they could release that of course they said it was proprietary. I did have a good conversation with Jack about potential cooperations. This would have been a better meeting for you two to attend than I. Commissioner Douglas did say that she wants decisions and actions to be data driven and is willing to push for any help we might need in addressing these issues. She also wants to of course protect the safety of Oklahomans but also balance that with industry in the state.

Commissioner Douglas really appreciated her hydraulic fracturing plexi-glass model you gave her Larry.

Regards,

Austin

**Date:** Monday, November 18, 2013 9:20 PM  
**To:** Austin Holland <[austin.holland@ou.edu](mailto:austin.holland@ou.edu)>  
**Subject:** RE: Odd call to me just now

Gosh. I guess that's better than having Kool Aid with them. . . I guess.

Will see you tomorrow if you're in! OK?

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**From:** Holland, Austin A.  
**Sent:** Monday, November 18, 2013 5:18 PM  
**To:** Smith, Connie G.  
**Subject:** Re: Odd call to me just now

I have been asked to have "coffee" with President Boren and Harold Hamm Wednesday.

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**From:** <Smith>, "Connie G." <[cgsmith@ou.edu](mailto:cgsmith@ou.edu)>  
**Date:** Monday, November 18, 2013 3:43 PM  
**To:** "Grillot, Larry R." <[lrgrillot@ou.edu](mailto:lrgrillot@ou.edu)>, "Keller, G. Randy" <[grkeller@ou.edu](mailto:grkeller@ou.edu)>, Austin Holland <[austin.holland@ou.edu](mailto:austin.holland@ou.edu)>  
**Subject:** Odd call to me just now

I just got a call from someone and I really didn't catch the company or organization she started out with, but then she said her group was affiliated (I think this was the word she used or something similar) with Continental Resources, then she started asking me a bunch of questions like: Are we part of the USGS, are we affiliated with the USGS, what does the OGS do, who do we work for, who pays us, are we state employees, who pays us (she said this several times), what do we do, do we do surveys, do we issue press releases and are they on our website, etc. etc. She really kept asking about who pays us.

I could kick myself for not getting her name, but it really caught me off guard. She kept asking who we work for and I kept saying "We are a state agency and are part of the MCEE at OU" and then she said "Do you work for OU?" and I said we are paid and under the administration of the University of Oklahoma.

She was talking very fast when I first answered and I thought she said something about Texas—but I could be wrong.

She sounded like a lawyer because she was very brusque and was really grilling me and asking the same things over and over, and I immediately wanted to put my hand on a Bible. . . or on OGS Bulletins 40 at least!

Just wanted to let you three know because it was a strange call so to alert you, please get her name and organization if she contacts you! Or if she has already, please let me know who she is!

Connie

Connie Smith

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