

From: Paul Younger
Sent: 12 November 2014 09:56
To: [REDACTED]
Cc: Robert Westaway
Subject: RE: Fracking
Attachments: QAPsubmissionforwebsite.pdf; Westaway & Younger 2014 Fracking seismicity QJEGH.pdf

Dear [REDACTED]

Thank you for taking the time to write to me. I can understand that you are anxious about 'fracking' and all that goes with it, not least because of the steady diet of uninformed comment and misinformation – on both sides of the argument - which has dominated the debate so far.

Let me preface my response with two caveats:

1. I was interviewed for about 5 mins, but as I do not live in NW England I have no idea how much (and which bits) of what I said was cut out in what they actually broadcast. Hence what you think my message was might well not be the same as what I intended. This is a perennial danger with doing pre-recorded pieces for TV news, but due to University and family duties I could not appear live at the time they desired, so I had to run that risk.
2. I have spent my career in protecting the environment from pollution, subsidence and other impacts arising from the extractive industries – in particular the mining industry, which routinely causes seismic events way beyond anything fracking could ever achieve. In all of that work, I took a preferential option to work "on the side" of affected communities, but ALWAYS with this proviso: if the evidence supported the community's grievances I would not hesitate to say so. However, if it did not, I would in no way make unsubstantiated statements just to help the community campaign. This used to infuriate activists at times, but as a professional scientist and engineer, and as someone aspiring to be a Christian, it is clear to me that my principal duty is to honesty, objective facts (insofar as these can be ascertained) and fairness – which includes being fair to others with whom I might not otherwise agree (e.g. mining companies being secretive and careless). I have done such work all over the world, most recently on behalf of Caritas International (in Honduras) and Amnesty International (in Guatemala), and it received the accolade of award of the Queen's Anniversary Prize for Higher Education in 2006 (see attached document). It is in the same spirit – siding with the disadvantaged insofar as the facts allow – that I approached my duties on the UK joint Royal Academies' panel on shale gas (2012; see <http://eprints.gla.ac.uk/69554/>) and the Scottish counterpart (which reported in June 2014; see <http://eprints.gla.ac.uk/95518/>). It was in the line of that work that I realised nonsense was being talked about seismic risks, by people who could have taken the time to inform themselves better. (The comments of Cuadrilla and iGas yesterday – which you will note were at odds with our own – would suggest that they still do not grasp the basic physics behind impacts from induced seismicity, which is depressing given all the time they have had to learn ...).

Now to what the key message from our paper (attached) actually is. All of the detailed argument and mathematical modelling simply support the following conclusion: it is illogical to regulate fracking-induced seismicity on the basis of the magnitude of the induced event at the point it occurs. Rather, as for quarry blasting, coal mining, RAF over-flights and other nuisances, the thing that should be regulated is the vibration affecting property. The physics of this is very well known, and the correlations between local event magnitude and distance to a sensitive receptor (e.g. somebody's house) are readily calculable and unequivocal. Therefore, while I must take your word for it that you have friends with damaged properties, in all honesty I have to state that this cannot reasonably be attributed to events of the magnitude you specify, which occurred 2.5 km below ground at Preese Hall. Don't take my word for it – the necessary equations and parameter values are in our paper, so you can calculate this yourself.

There are many things that can cause cracking in properties. In coastal Lancashire (whence part of my family hails) a common cause is, for instance, differential swelling or shrinking of lacustrine clays in the shallow subsurface – some

of which may be caused by local land drainage practices. I cannot say whether this applies at Weaton St Michael's. Any good engineering geologist or geotechnical engineer could make such an assessment, and I would advise your friends to seek such professional guidance if they are considering making a claim for damages against the local drainage board or some other organisation. What I would NOT advise them to do is to presume that any problems they are experiencing are attributable to those modest events at Preese Hall. This is simply not consistent with the laws of physics, and they would lose badly in any court case based on such an assertion.

Now to your point about a magnitude 3.6 event. If such an event occurred in the shallow subsurface, it could cause significant damage. If, however, it occurred at a depth of 2.5 km or so, nothing more than cosmetic damage would be predicted. There are mountains of data to substantiate this from all over the world – much of it cited in our paper – and it is well-established in the UK coalfields, where major first-breaks on longwall faces often generate events of such magnitude, typically within a few hundred metres of surface. But the key point of our paper, and what I told the BBC, is this: to regulate by magnitude is meaningless unless you also include depth and distance to properties – in other words, unless you regulate according to the long-established principles by which we regulate quarry blasting to avoid damaging vibrations (i.e. excessive peak ground velocities (PGV)) at people's properties. Let me spell this out further: we are NOT recommending increasing the threshold to M_L 3.6 – rather we are saying you shouldn't use M_L at all, but regulate according to the resultant PGV at people's properties (in most cases, the nearest building to the fracking operation, though making allowance for local geological nuances).

So did I make a false statement on TV? No. As I explained above, my first commitment is to truth, my second to helping the disadvantaged. I suspect from your comments that the BBC did not broadcast the part of the interview where they asked me whether my research is funded by shale gas fracking companies – the answer is “absolutely not”. I have no vested interest to protect other than honesty and public good. And with regard to the latter, the priority for me is those in fuel poverty. In Scotland, 82% of the population rely on gas for their heating and hot water. Those who have access to the gas grid still have a 1-in-4 chance of being in fuel poverty, whereas those who don't have a more than 2-in-3 chance. It is therefore clear that availability of reasonably-priced gas is a front-line defence against fuel poverty. As the UK is importing more and more gas each year, the price will go up and fuel poverty will worsen. Furthermore, we are already starting to see Russian gas supplementing Norwegian gas in our imports, and the long-term political consequences of depending on Russia for our heating do not bear thinking about. So I am of clear conscience that (i) I did not lie, and (ii) I have remained true to my long-standing principles.

Did Cuadrilla make false statements back in 2011? I can profess no detailed knowledge of their every public pronouncement, but I have the impression they at first denied causing the recorded seismic events to which you refer, but later admitted it when the British Geological Survey (BGS) made public their monitoring data. My view is that Cuadrilla were genuinely taken by surprise, though that is not a very good excuse for poor public communications. So it was the BGS, not Cuadrilla, that identified the earthquake magnitudes (1.5 and 2.3) and focal point depths etc back in 2011. This means that those statements were made by an independent scientific body, not by Cuadrilla. The data have since been pored over by so many people – including ourselves – that I think there is no doubt that the largest recorded event had a M_L of 2.3. So again, I do not think there were any lies told about the magnitude of the 2011 events. What I do think – and what we can demonstrate conclusively using the formulae in our paper – is that any damage to your friends' properties in Weaton St Michael's was not caused by those events. Again, as I said, please don't take my word for it: the relevant equations are there in our paper, and you can calculate this for yourself.

Thanks again for writing to me, and I hope this email has gone some way to dispelling the confusion you felt.

Best wishes

Paul Younger

Professor Paul L Younger FEng
Rankine Chair of Engineering, and
Professor of Energy Engineering
School of Engineering
James Watt Building (South)
University of Glasgow

GLASGOW G12 8QQ, Scotland

Tel. 0141 330 5042

Mob. 07711 391 066

Email: paul.younger@glasgow.ac.uk

Web: <http://www.gla.ac.uk/schools/engineering/staff/paulyounger/>

From: [REDACTED] [mailto:[REDACTED]@hotmail.com]

Sent: 11 November 2014 19:38

To: Paul Younger

Subject: Fracking

Mr Younger,

Having just watched the interview you gave tonight on BBC North West Tonight relating to Fracking, I am left confused by your answers.

You inferred that the seismic regulations currently in place for fracking are set too high and that they should be relaxed in line with quarry regulations. That 3.6 on the richter scale would cause practically unnoticeable cracks in residents properties.

So please could you explain to me why a number of my friends living in the Weaton St Micheals area where earth tremors, measuring only 1-2.5 on the richter scale, caused by fracking in 2011 left considerable damage e.g. highly visible cracks the entire height of their house ?

I can think of only two explanations for this, either;

- the recorded level reported by Cuadrilla at the time was false ? or
- the statements that you have just made on TV are false ?

Could you please confirm that the professional opinions you gave on TV tonight are indeed accurate and that an earth quake measuring 3.6 would cause practically unnoticeable damage.

Sincerely

[REDACTED]