

# Wastewater injection cracks open quake concerns

Oklahoma's largest recorded earthquake — magnitude 5.7 — might have been caused by the injection of wastewater from oil drilling in the region. That makes it the largest quake yet linked to the practice of wastewater injection.

Katie Keranan from the University of Oklahoma and colleagues looked at a sequence of quakes that shook Oklahoma in 2011. A magnitude 5 event was followed by a main shock of 5.7, along with thousands of aftershocks. They note that the starting rupture happened within 200 metres of fluid injection sites that serve nearby conventional oil and gas wells, and within the same sedimentary layer that wastewater was being injected into. They argue that 18 years of pumping has probably increased the pressure down below, leading to an increased quake risk (K. Keranan *et al.* *Geology* <http://doi.org/k68>; 2013).

The Oklahoma Geological Survey disagrees. A statement on their website argues that measurements hint that the region isn't over-pressured, and concludes that these earthquakes were probably natural.

Injection of water into porous rock is a common procedure, intended to dispose of fluid waste without contaminating drinking water supplies or rivers. But it has long been known that this practice can trigger earthquakes — starting in 1962, wastewater



© ISTOCKPHOTO / THINKSTOCK

injection in the Rocky Mountain Arsenal well, near Denver, triggered a series of quakes that brought the operation to a halt in 1966. The largest tremor was magnitude 4.8.

The US Geological Survey is investigating whether an increase in injection quantities

across the nation might be linked to an increase in the number of quakes: in 2011, the number of earthquakes that were magnitude 3 or greater east of the Rockies was six times the annual average for the twentieth century. The disposal of large quantities of fluid has also become more common, thanks in large part to a surge in hydraulic fracturing, whereby water is used to crack open tight shale rocks and allow gas to escape. Some areas — including France and the state of Vermont — have banned so-called 'fracking' because of environmental concerns. The wells in Oklahoma are not fracking operations, but still generate large quantities of wastewater.

Keranan and colleagues argue that the hazard of quakes linked to wastewater injection could be much greater than previously thought. They note that the possibility of delayed chain reactions, in which decades of pumping induces one quake that triggers another, might produce much larger earthquakes than currently anticipated. Keranan supports better monitoring of reservoir pressures, so that the cause of future quakes, in Oklahoma or elsewhere, can be more definitively determined. □

*Nicola Jones is a freelance journalist based in Pemberton, British Columbia, Canada.*

## The journalist's take

The possibility of mankind starting earthquakes makes for a compelling story: like climate change and the ozone hole, it tells of the unintended consequences of industrial development. Earthquakes can and have been triggered by everything from nuclear tests to the construction of giant reservoirs. But nothing gets press like the triggering of quakes by the oil and gas industry.

This is in part thanks to a campaign mounted by ProPublica, an independent, non-profit investigative journalism group, highlighting problems with hydraulic fracturing. Their stories — including a 2011 viral music video with the catchy chorus line "What the frack is going on?" — have focused on the possible pollution of groundwater by this gas extraction procedure, rather than on quake risks. But the result, alongside other productions such as the 2010 documentary *Gasland*, has been to make

'fracking' a term that people associate with danger.

Fracking itself rarely causes much seismic activity; it is the disposal of wastewater, which happens in both fracking operations and traditional oil and gas fields, that can cause potentially damaging tremors. But the link between fracking and 'bad things' is so strong now in some minds that several news reports about the new *Geology* paper incorrectly assumed it was about fracking — including those in *Wired* (<http://go.nature.com/3srkHu>) and the *BBC* (<http://go.nature.com/qqsGQM>).

Although the oil exploration under study here is not a fracking operation, hydraulic fracturing is clearly part of the story for journalists. These operations use much more water than traditional gas exploration. And fracking is ramping up quickly — it is expected to account for 49% of US natural gas production by 2035. New technologies

always get (and deserve) more media scrutiny than older ones. The inclusion of discussion about fracking in these stories is justified; the mix-up about what caused the Oklahoma quake is not. Getting the facts straight is the first step in a sober, sensible discussion about energy resources — all of which have pros and cons.

Journalists are keen to expose possible harm done by big business, especially when the money behind those businesses is sometimes used to bury or disguise bad news. Keranan says she has felt pressure from oil companies over her work, although that did not affect this paper. Surprisingly, she says none of the many dozens of journalists she spoke to about this story asked her about that. Chasing down the details about such pressures and their consequences is core to investigative journalism, but often beyond the scope of reporters trying to get out a quick story about a press-released journal article.