Could Fracking Cause a Major Earthquake?

Patrick J. Kiger, Discovery News, 1-16-15

Shortly before midnight on Aug. 23, 2011, residents of Trinidad, Colo. and surrounding communities were startled when the ground started shaking beneath them, knocking bricks and stones loose from buildings. Fortunately, no one was injured. As far as earthquakes go, the 5.3 event and the aftershocks that followed were relatively mild.

Nevertheless, the Trinidad quake raised anxiety for another reason. The U.S. Geological Survey eventually concluded that it probably was a man-made quake, caused by the disposal of waste water produced by the oil and gas industry.

Similarly, scientists have linked disposal of oil-gas industry waste water to increased seismic activity in states ranging from Texas to Ohio. That's raised additional worries about one of the sources of that waste water -- fracking, the controversial process in which water, sand and chemicals are injected into the earth at high pressure to crack rock formations and reach deposits of natural gas and oil.

While the fracking boom in recent years has provided an economic boost to the United States and increased its energy independence, some worry that there's a potentially catastrophic downside, if the process adds to the waste water that's lubricating earthquake faults.

And while most of the quakes linked to waste water injection wells have been small to moderate in intensity, some worry that one eventually could trigger a major quake that might seriously damage buildings and important infrastructure, and endanger people as well.

In oil-and-gas-rich Oklahoma, for example, where the rate of quakes increased by 50 percent between 2013 and 2014, the U.S. Geological Survey and state officials issued a May 2014 alert to residents that the state had an increased risk of a 5.5 magnitude quake or greater, and pointed to waste water injection wells as a likely explanation for the heightened seismic risk. (From Michigan Technological University, here's a chart explaining what risks are posed by various magnitudes.)

It's been known for a long time that humans could induce earthquakes by pumping fluids underground. Back in 1962, the U.S Army injected toxic waste fluids into a deep well at the Rocky Mountain Arsenal northwest of Denver, but then stopped after the area was rattled over five years by more than 1,500 quakes, including one that shook chandeliers at the state Capitol and forced legislators to take cover.

But those worries have risen because of fracking. Seismologists' big concern is not the fracking process itself, but what what operators do with the enormous quantities of waste water that flows back out of the well afterward. Some of that water, which is salty and contaminated with chemicals used in the fracking process, is treated and reused in fracking. But much of it is too contaminated for reuse and has to be trucked or piped to other sites, where it is injected into storage wells that are drilled thousands of feet deep into the Earth.

There are about 30,000 such waste water injection wells across the nation. USGS research geophysicist Justin Rubinstein, who worked on the study of the 2011 Colorado quake, explains that injection wells have a potentially much greater seismic impact than the fracking process itself, because fracking wells tend to be short-lived. Injection wells, in contrast, may last for years and receive a far greater quantity of water, and not just from fracking.