

Managing the Growing Risk of Human-Made Earthquakes

A variety of oil and natural gas activities cause earthquakes, and mitigating the risks will require new tools and new openness from industry.

Nathan Collins, Pacific Standard, 2-20-15

There were more earthquakes in Oklahoma last year than in disaster-prone California, largely the result of new oil and natural gas extraction. That's cause for concern, but according to a new report, smart management could help ease the risk.

Human-induced earthquakes are by no means new, but they have been on the rise since 2001, particularly in Midwest states such as Oklahoma. While hydraulic fracturing, better known as fracking, has taken much of the blame in the public sphere, the issue is in fact broader than that. Indeed, the land in states like Oklahoma is often dry enough that companies drilling for oil and gas don't even need to employ fracking techniques, says United States Geological Survey senior scientist and study co-author William Ellsworth. It's actually industrial wastewater injection, carbon sequestration and storage, and the replenishment of underground reservoirs—things we'd think of as good for the environment—that can cause earthquakes.

While many of those induced earthquakes are small, "there are so many disposal wells that this contributes significantly to the total seismic hazard, at least in the mid-continent," the study's authors write in *Science*.

Determining exactly what the risks are, however, is a challenge. That's in part because any one human-induced earthquake is tough to distinguish from natural ones, making it harder to separate out the effects of natural and induced temblors. Plus, patterns of induced earthquake activity don't always follow a regular pattern. For instance, the authors write, "there may be a lengthy delay between the start of injection and the first detected earthquakes or an offset of many kilometers between the injection site and earthquakes."

Still, there are some steps that can be taken to reduce the earthquake hazard, the authors say. Among those is simply moving injection sites away from population centers or critical infrastructure, where rare but large earthquakes are the biggest concern.

Meanwhile, "the importance of seismic monitoring cannot be overstated," the authors write. "A seismic network capable of precise locations of small earthquakes could reveal the presence of a large, possibly dangerous, fault being reactivated due to fluid injection," allowing officials time to take action before being hit by a damaging earthquake. Most current systems aren't up to the task, they argue, but a recent study in Colorado showed what's possible: After researchers at the University of Colorado deployed a new detection network last year, their findings led regulators to require that one operator adjust how much and how deep they injected wastewater.

It's important that injection-well operators make data on their activities public, the authors argue. "Open sharing of data can benefit all stakeholders, including industry," they write, "by enabling the research needed to develop more effective techniques for reducing the seismic hazard."