Oilfield wastewater may trigger earthquakes for 'decades'

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Wastewater from oilfields is generally discarded by pumping it into deep geologic formations via salt water disposal wells

Wastewater from oil and gas production injected deep into wells could cause earthquakes strong enough to be felt on the surface for years to

come, according to new research published Tuesday.

The United States is undergoing a boom in oil and gas production as well as fracking, the process of shooting water mixed with sand and chemicals deep into the earth to bring up hydrocarbons trapped inside rock.

Wastewater from fossil fuel production has long been associated with tremors, as producers dispose of it by injecting jets into separate wells dug below ground.

The United States Geological Survey says that wastewater disposal from oil and gas production is the number one cause of human-induced earthquakes in the central and eastern US.

A team of experts from Virginia Polytechnic and State University now believe that the wastewater, due to its higher density, can pose an earthquake risk for years to come, since it displaces existing groundwater stocks that keep the ground stable.

They developed a model based on the wastewater flows in two fracking -heavy states, Kansas and Oklahoma.

The team found that the wastewater altered the subterranean fluid pressure to such an extent that it posed a quake risk for decades.

"That has some very interesting and I think important consequences for how we understand the hazard posed by oilfield wastewater disposal," said Ryan Pollyea, lead author of the study, published in *Nature Communications*.

Tremors of magnitude 3 or greater used to be relatively rare in the central United States. But in the wake of vast fossil fuel exploration,

their numbers have skyrocketed from around 20 a year in 2008 to more than 400 annually.

One particularly strong quake struck Oklahoma in September 2016, measuring 5.6 magnitude—large enough to be felt in seven states, from Texas to Iowa.

A peer-reviewed study a few months later suggested that four of the most five powerful Los Angeles Basin quakes of the early 20th-century oil boom may have been caused by oil and gas production.

Pollyea and the team found that the earthquakes were also getting stronger: in the two states analysed the number of magnitude 4 quakes increased 150 percent since 2016, while the number of 2.5-magnitude tremors went down by over a third.

They are also getting deeper.

"We have found a new mechanism to explain how fluid pressure causes and increases earthquakes deep under ground," Pollyea said.

"Our study can be used to improve hazard models for injection-induced earthquakes by accounting for fluid pressure variations that occur after injection operations are reduced or stopped," he told AFP.

More information: Ryan M. Pollyea et al. High density oilfield wastewater disposal causes deeper, stronger, and more persistent earthquakes, *Nature Communications* (2019). DOI: 10.1038/s41467-019-11029-8