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Wastewater injection is culprit for most earthquakes in southern Colorado and northern New Mexico

SAN FRANCISCO – The deep injection of wastewater underground is responsible for the dramatic rise in the number of earthquakes in Colorado and New Mexico since 2001, according to a study published by the *Bulletin of the Seismological Society of America (BSSA)*.

The Raton Basin, which stretches from southern Colorado into northern New Mexico, was seismically quiet until shortly after major fluid injection began in 1999. Since 2001, there have been 16 magnitude ≥ 3.8 earthquakes (including M 5.0 and 5.3), compared to only one (M 4.0) the previous 30 years. The increase in earthquakes is limited to the area of industrial activity and within 5 kilometers (3.1 miles) of wastewater injection wells.

In 1994, energy companies began producing coal-bed methane in Colorado and expanded production to New Mexico in 1999. Along with the production of methane, there is the production of wastewater, which is injected underground in disposal wells and can raise the pore pressure in the surrounding area, inducing earthquakes. Several lines of evidence suggest the earthquakes in the area are directly related to the disposal of wastewater, a by-product of extracting methane, and not to hydraulic fracturing occurring in the area.

Beginning in 2001, the production of methane expanded, with the number of high-volume wastewater disposal wells increasing (21 presently in Colorado and 7 in New Mexico) along with the injection rate. Since mid-2000, the total injection rate across the basin has ranged from 1.5 to 3.6 million barrels per month.



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The authors, all scientists with the U.S. Geological Survey, detail several lines of evidence directly linking the injection wells to the seismicity. The timing and location of seismicity correspond to the documented pattern of injected wastewater. Detailed investigations of two seismic sequences (2001 and 2011) places them in proximity to high-volume, high-injection-rate wells, and both sequences occurred after a nearby increase in the rate of injection. A comparison between seismicity and wastewater injection in Colorado and New Mexico reveals similar patterns, suggesting seismicity is initiated shortly after an increase in injection rates.

The study, “The 2001-Present Induced Earthquake Sequence in the Raton Basin of Northern New Mexico and Southern Colorado,” is co-authored by Justin Rubinstein, William Ellsworth, Arthur McGarr and Harley Benz of the U.S. Geological Survey. The study will be published online by *BSSA* on September 16 and in the October print edition.

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For a copy of the paper, please contact press@seismosoc.org.

Reporters who would like to interview any of the authors are asked to contact Leslie Gordon (USGS-Menlo Park) at lgordon@usgs.gov, or Heidi Koontz (USGS-Denver) at hkoontz@usgs.gov.