

Managing the Hazard of Induced Earthquakes in a Changing World

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Humans can induce earthquakes to occur as an unintended consequence of a wide range of industrial activities. These include impoundment of water behind dams, creation of voids through mining, and the extraction or injection of fluids in the subsurface. They cause earthquakes by disrupting the balance between the natural forces that promote and resist fault slip.

Earthquake activity in the central U.S. increased dramatically since 2009 as a consequence of changing practices for the production of oil and gas from low permeability formations. Although hydraulic fracturing (“fracking”) has been widely discussed as a cause, it does not appear to be a significant contributor to the increased seismic activity. Rather, these induced earthquakes are caused by disposal of unprecedented volumes of wastewater by injection into deep, undepleted formations.

Unlike the hazard of natural earthquakes, the hazard of induced earthquakes and the risk they pose can be managed. A key challenge is to develop an operational earthquake forecasting capability that anticipates where activity may either initiate or shut-off in response to changing industrial drivers. This will require a deeper understanding of the physical processes and conditions that link human perturbations to the Earth system to its response in seismic events.

