

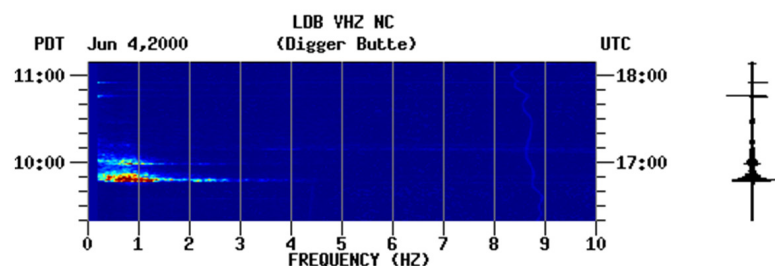
# Shale Gas Development Challenges – A Closer Look

## *Induced Seismic Events (Earthquakes)*

### Key Points:

- **Induced seismic events** are earthquakes attributable to human activity. The possibility of induced seismic activity related to energy development projects, including shale gas, has drawn some public attention.
- Although **hydraulic fracturing** releases energy deep beneath the surface to break rock, studies thus far indicate the energy released is generally not large enough to trigger a seismic event that could be felt on the surface.<sup>1</sup>
- However, **waste fluid disposal** through underground injection can “pose some risk for induced seismicity.”<sup>2</sup>
- According to the **National Academies of Sciences (NAS)**, accurately predicting seismic event magnitude or occurrence is not possible, in part because of a lack of comprehensive data on the natural rock systems at shale gas and other energy development sites.
- NAS said further **research** is required to “better understand and address the potential risks associated with induced seismicity.”

*Image shows a teleseism which is a record of an earthquake made by a seismograph at a great distance. Source: U.S. Geological Survey*



<sup>1</sup> Government Accountability Office, “Unconventional Oil and Gas Development: Key Environmental and Public Health Requirements,” September 2012, page 52.

<sup>2</sup> The National Academies of Sciences, “Induced Seismicity Potential in Energy Technologies,” 2012, Executive Summary, page 1.

Scientists have long understood that pumping fluids into or out of the Earth has the potential for inducing seismic events, including **earthquakes** that can be felt at the surface. A series of small seismic events in Arkansas, Ohio, Oklahoma and Texas over the past several years has drawn public attention to a possible link between earthquakes and deep wells used to dispose of hydraulic fracturing waste water. As presently implemented, scientists do not believe the process of **hydraulic fracturing** a well for shale gas production poses a significant risk for inducing felt seismic events.<sup>3</sup> Injection for disposal of **waste water** from the process, however, may pose some risk, although very few instances have ever been documented.

According to the **National Academies of Sciences (NAS)**, the factor that appears to have the most direct consequence for inducing seismicity is **net fluid balance** – the total balance of fluid introduced into or withdrawn from the subsurface. But additional factors may also influence the way fluids affect the subsurface. “Energy projects that are designed to maintain a balance between the amount of fluid being injected and withdrawn, such as most oil and gas development projects, appear to produce **fewer seismic events** than projects that do not maintain fluid balance,” an NAS report says. “Future research is required to better understand and address the potential risks associated with induced seismicity.”



*Scientists do not believe hydraulic fracturing activities are a significant cause of seismic events that can be felt at the surface. Waste fluid disposal, however, does pose some risk for induced seismicity. Future research is needed to better understand risks associated with induced seismicity, according to the National Academies of Sciences. Photo: Bill Cunningham, U.S. Geological Survey*

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<sup>3</sup> Ibid.