

# Potential Injection-Induced Seismicity Associated With Oil & Gas Development

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*A primer on technical & regulatory considerations informing risk management & mitigation*



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**Carl Michael Smith**  
Executive Director  
Interstate Oil and Gas Compact Commission

# Induced Seismicity in the News

The New York Times

U.S.

**Oklahoma Acts to Limit Earthquake Risk at Oil and Gas Wells**

The Wichita Eagle 

Kansas oil drilling rules credited with limiting quakes set to expire (+video)

TIME

**Geologists: Fracking Likely Cause of Ohio Earthquakes**

NEWSOK

**Record 5.6 magnitude earthquake shakes Oklahoma**

The Saturday night earthquake had a magnitude of 5.6, and its epicenter was four miles east of Sparks in Lincoln County, according to the Oklahoma Geological Survey. The quake hit at 10:53 p.m., and it was reportedly felt as far away as Illinois, Kansas, Arkansas, Tennessee and Texas.

The Washington Post

**Study links fracking to dozens of small Ohio earthquakes**

# Introduction

- ▶ StatesFirst: Collaborative partnership between the Ground Water Protection Council and the Interstate Oil & Gas Compact Commission
- ▶ StatesFirst *Induced Seismicity Work Group* (“ISWG”) chartered in 2014 and led by States
- ▶ The ISWG is focused on addressing public concerns associated with induced seismicity
- ▶ Work Group deliverable: a “Primer” document to summarize and share knowledge



# StatesFirst Induced Seismicity Work Group

- ▶ ISWG Co-Chairs
  - ❖ Rick Simmers, Chief, Ohio Department of Natural Resources
  - ❖ Rex Buchanan, Interim Director, Kansas Geological Survey
- ▶ ISWG is comprised of representatives from state agencies
  - ❖ 24 volunteers from 13 states including:
    - ❖ Alaska
    - ❖ Arkansas
    - ❖ California
    - ❖ Colorado
    - ❖ Kansas
    - ❖ Illinois
    - ❖ Indiana
    - ❖ Ohio
    - ❖ Oklahoma
    - ❖ Texas
    - ❖ Utah
    - ❖ West Virginia
    - ❖ Wyoming

# StatesFirst Induced Seismicity Work Group

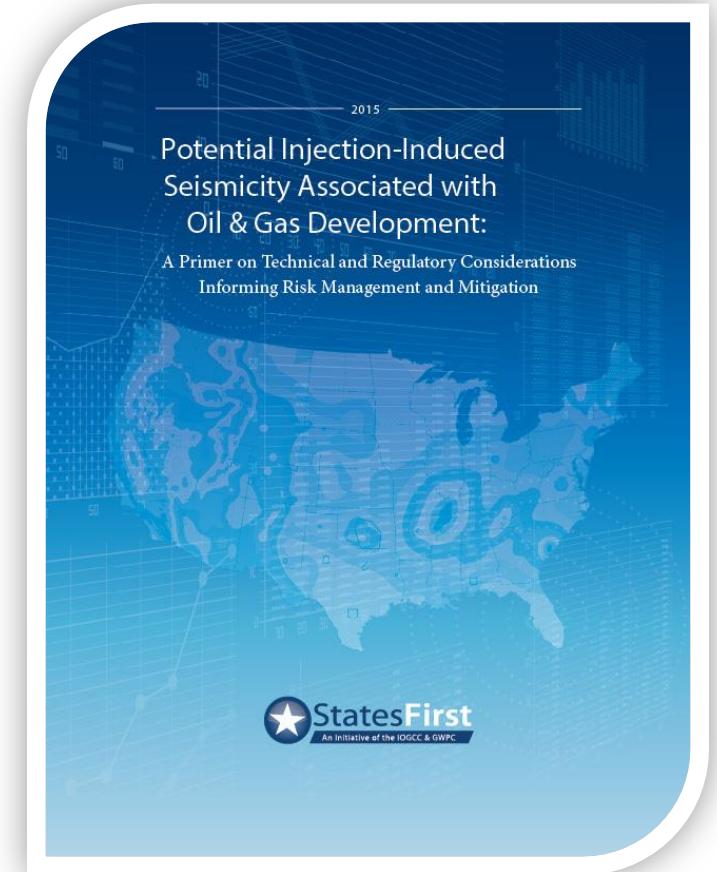
- ▶ ISWG supported by technical advisors (subject matter experts)
  - ❖ Over 60+ volunteers - academia, research entities, federal agencies, industry, consultants, and NGOs
- ▶ ISWG Primer developed via broad stakeholder engagement
- ▶ ISWG Primer vetted with Independent Technical Review Panel

## ISWG Objectives

- ▶ Share science, research, technical understanding and experience
- ▶ Provide forum for stakeholder discussion and communication
- ▶ Identify potential approaches and decision making tools to manage and mitigate risks
- ▶ Develop a “*Primer*” document that summarizes current knowledge and potential approaches for managing / mitigating risk and responding to anomalous seismicity

# Primer Overview

- ▶ Primary emphasis on potential induced seismicity associated with Class II disposal wells
- ▶ Document is solely informational and is not intended to offer recommended rules or regulations



# Primer Content

## ► 4 Chapters

- ❖ Understanding induced seismicity
- ❖ Assessing potentially induced seismicity
- ❖ Risk management & mitigation strategies
- ❖ External engagement & communication

## ► 9 Technical Appendices

- ❖ Relevant earthquake science
- ❖ Class II injection wells
- ❖ Induced seismicity case studies
- ❖ Design & installation of seismic monitoring networks
- ❖ NRC Report on induced seismicity potential in energy technologies
- ❖ Methods for estimating reservoir pressures changes associated with injection
- ❖ Tools for risk management and mitigation
- ❖ Data collection & interpretation
- ❖ Considerations for hydraulic fracturing

## Primer Key Messages

- ▶ The Primer provides regulatory agencies with a guide for evaluating risks associated with induced seismicity. It is designed to help those agencies develop strategies for managing and mitigating risks and provide information in a transparent and effective manner.
- ▶ This Primer does not recommend specific policies. It does emphasize that a one-size fits all regulatory scheme would be inappropriate, as it would not be flexible enough to account for area-specific risks and concerns.

## Primer Key Messages

- ▶ States are best equipped to manage the risk from induced seismicity, due to an in-depth knowledge of industry operations and local geology.
- ▶ Injection wells are currently regulated under the federal Safe Drinking Water Act, specifically the Underground Injection Control program (UIC). The UIC program, through primacy delegation, is administered by the states.
- ▶ Induced seismicity from injection can result from special subsurface conditions associated with faults that are already near failure and prone to slip.

## Primer Key Messages

- ▶ Only a small fraction of the 40,000 disposal wells associated with energy production in the United States have been potentially linked to induced earthquakes.
- ▶ Most induced seismic events are too small to be felt.
- ▶ The oil and gas industry has actively partnered with regulators, academia, NGOs and other experts to address induced seismicity, including sharing geologic data, helping to identify best practices, and supporting appropriate regulatory oversight at the state level.
- ▶ Underground wastewater injection is a critical component of continued U.S. oil and gas production.

# In Conclusion

- ▶ Induced seismicity is a very complex issue where the base of knowledge is changing rapidly.
- ▶ State regulatory agencies that deal with potential injection induced seismicity should be prepared to use tools, knowledge, and expertise, many of which are offered in this document, to prepare for and respond to occurrences of induced seismicity.
- ▶ Risk management, risk mitigation, and response strategies are most effective when developed considering specific local conditions and situations.



To learn more about the Primer through our webinar or to read the full publication, visit:

[www.statesfirstinitiative.org](http://www.statesfirstinitiative.org)

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