USC Viterbi School of Engineering

# ISC

USC University of Southern California

# The Induced Seismicity Consortium

## What is ISC?

The Induced Seismicity Consortium (ISC) aims to improve our understanding of induced seismicity and how it is influenced by subsurface fluid injection and production (SFIP). The ultimate goal is to develop science-based risk assessment tools and establish procedures to help minimize the potential for induced seismicity.

## Mission Statement

The mission is to bring science into the debate on hydraulic fracturing and induced seismicity. The ISC facilitates direct communication from the scientific community and industry to state and federal agencies, regulatory bodies, and environmental groups.

Through extensive data gathering, modeling, laboratory work, data analysis and general scientific investigations, the ISC helps to predict the geologic and surface impacts of SFIP processes (including hydraulic fracturing). The ISC expects to advance the required geoscience and engineering technologies to accomplish this objectives.

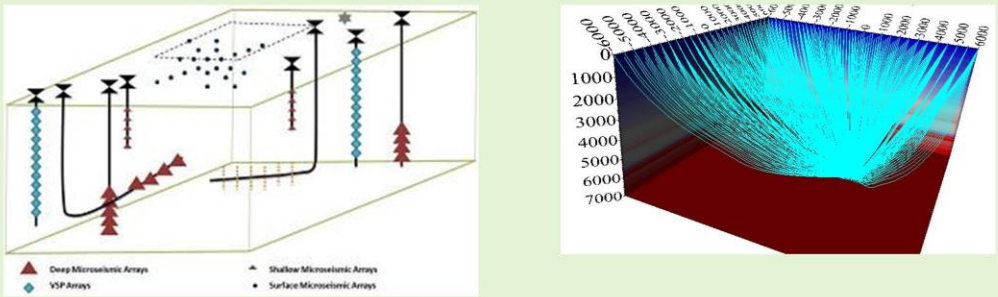
The work of the ISC will is used to develop "best practices," inform, and advise various regulatory, educational, and public entities regarding SFIP operations and impacts.

## ISC Project Plan

1. Characterizing fracture networks using MEQ data
2. Establish correlations between induced seismic events and micro-seismic attributes
3. Develop a hierarchical probabilistic model to relate operational parameters and seismicity
4. Design a system to mitigate the seismic hazards associated with SFIP
5. Provide a regional geologic framework for observed seismicity and predictive modeling
6. Create a science-based framework for input to regulatory and government entities
7. Informing the professional community and the general public on the scientific findings

## Multi-array micro-seismic survey design for hybrid arrays

Supported by GTI




Horizontal and vertical seismometer placement (left), Ray tracing to optimize coverage with the least number of phones (right)

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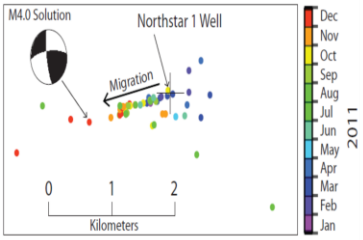
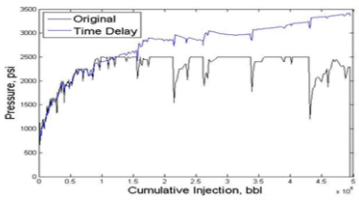
## Selected Accomplishments

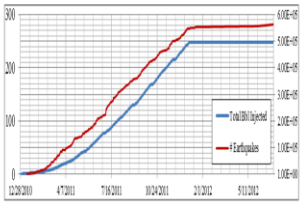
1. Youngstown, Ohio Induced Seismicity
   - ✓ Improved understanding of the subsurface through micro-earthquake imaging
   - ✓ Developed a predictive model based upon the geophysical data




Location map

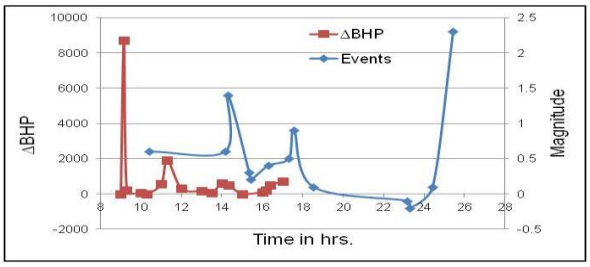



Prediction of Pressure from Production

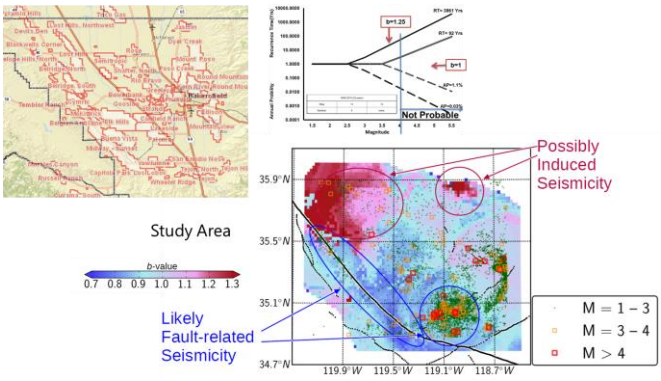


Correlation of injection/seismicity

2. Hydraulic Fracturing in Bowland Shale, Blackpool
   - ✓ Demonstrated a time lag between ΔBHP and magnitude of earthquakes




3. Seismicity in California Oil and Gas Fields
   - ✓ Designed seismic monitoring software for all the oil and gas fields in California
   - ✓ Correlated SFIP operations and hydraulic fracturing with seismic events




## ISC Membership

ISC membership includes many companies involved in the development of oil and gas (Aera Energy, British Gas, Occidental Petroleum, Sinopec, and SR2020). There are also have several companies and organizations with observer status (Environmental Defense Fund, Gas Technology Institute, Interstate Oil and Gas Commission, California State MRM, Ohio State DNR, KMS Technology, and AltaRock Energy).
As of October 1, 2013, we enter the second year of operation. We invite new members to join ISC.

AERA · British Gas · City of Long Beach Incorporated 1897 · OXY · Paulsson, · Sinopec · SR2020

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