

Software estimates likelihood of 'man-made earthquakes'

July 7 2016, by Robert Crowe

Southwest Research Institute (SwRI) is announcing at the AAPG Annual Convention & Exhibition in Alberta, Canada, that version 5.0 of its 3DStress software offers new, improved capabilities for oil and gas industry clients. Attendees can visit Booth No. 1813 to learn more.

Nuclear regulators, oil and gas companies, and geothermal energy producers have used the interactive program for more than 20 years to investigate geologic stress states and effects on developing and reactivating faults and fractures. Thanks to a new suite of tools, 3DStress users can now determine the potential for induced seismicity and man-made earthquakes caused by fault slip associated with fluid injection into wastewater [disposal wells](#) or for enhanced geothermal systems.

"If you plan to inject a large volume of water at a certain rate in an area that has known faults, 3DStress can assess the potential for generating an earthquake and predict the associated magnitude," said Alan Morris, a SwRI geoscientist who led the current software upgrades.

Most petroleum wells produce a substantial amount of water along with the oil and gas. Managing this so-called "produced water" is an important issue when that water is reinjected into producing reservoirs to enhance oil and gas recovery or into deep wells for disposal. It is the disposal wells that seem to increase seismic activity, Morris said.

Earthquakes happen when an underground geologic fault slips. During injection, as fluid pressure increases, a previously stable fault can

become unstable and slip, producing an earthquake. Man-made earthquakes are not a new phenomenon. Numerous documented examples have occurred since the 1930s from dam construction, reservoir filling, and underground fluid injection.

As the industry prepares for a return to higher oil and gas prices, regulators across the country are exploring legislation that will require operators to evaluate and mitigate seismic risks with disposal wells. At the same time, predicting and mitigating induced seismicity near producing oil wells is vital to ensure productivity, especially in a difficult market.

"Induced earthquakes can damage property and impact communities, while also unintentionally altering productivity of reservoirs and even production in neighboring leases," added Morris. "We designed 3DStress to help the industry mitigate a variety of risks by providing tools that can quickly evaluate fault reactivation and induced seismicity."

3DStress provides a user-friendly and interactive tool to investigate geologic stress states and effects on developing and reactivating faults and fractures. Components include Mohr circle plots with Hoek-Brown failure criteria, stress-ratio plots, stereonet and 3-D visualization tools to enable the user to illustrate hypothetical situations or complex real-world fault and fracture systems, and a patented stress inversion algorithm that does not require slip direction information.

More information: For more information, see www.3dstress.swri.org

Provided by Southwest Research Institute

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