Effects of shale gas exploration and development on groundwater and seismicity

Context

The exploration and development of shale gas raises questions about potential environmental and public health risks. Geoscience studies provide basic geological context and monitoring data that make it possible to assess potential effects on groundwater and induced seismicity. The fundamental questions that scientists will attempt to answer are:

- Can hydrocarbons and fracturing fluids migrate from hydraulically fractured shale toward shallow aquifers (research activity in southern Quebec and New Brunswick)?
- Can hydraulic fracturing and deep-well reinjection of post-hydraulic fracturing fluids cause earthquakes?

We know little about the geologic unit that is thought to protect groundwater from activities carried out at depth. This unit is located under the units used for water supply and above the units targeted by the industry. Indirect data is therefore used for assessments of groundwater vulnerability. This project is based on multi-source geoscience data, including data in geology, hydrogeology, geophysics, geomechanics and geochemistry.

The risk of seismic activity associated with shale gas development is evaluated with the help of detailed monitoring data. The data is on natural seismic activity in sectors considered for potential development or on variations in seismic patterns in places subjected to hydraulic fracturing. In both cases, a dense network of field seismographs is needed to detect very weak seismic shocks.

Expected outcome

The groundwater project is intended to develop a methodology for assessing groundwater vulnerability associated with the potential migration of fracturing fluids and hydrocarbons across natural or fracturing-induced fractures.
This vulnerability assessment protocol could be used in the future by regulatory bodies in the oil and gas industry when asking developers to provide different information and data before, during and after development.

The project on induced seismicity has two main objectives. The first objective is for the sectors that have the potential for future development. The project will establish a reference line for natural seismicity and for anomalous patterns in regional and local seismicity, which could be linked to future shale gas development.

The second objective is for areas where development is already underway. The project will define long-term effects on regional seismicity and determine potential causes of induced seismicity. The purpose of this research is to provide scientific advice to regulatory bodies that govern the oil and gas industry to better control the risks of significant induced earthquakes.

Partners

The shale gas project led by the Environmental Geoscience Program involves Canada-wide research. Researchers from the Earth Sciences Sector collaborate with scientists and professionals from other Natural Resources Canada sectors, with provincial departments of natural resources, and with federal and provincial departments of environment. The project also collaborates with Canadian universities, research consortiums and provincial regulatory bodies that govern the oil and gas industry.

Contact

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