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Research on Oil and Gas-Related Induced Seismicity at Natural Resources Canada

Honn Kao (1), Maurice Lamontagne (2), Denis Lavoie (3), and John F. Cassidy (1)

(1) Geological Survey of Canada, Sidney, BC, Canada, (2) Geological Survey of Canada, 601 Booth Street, Ottawa, ON, Canada, (3) Geological Survey of Canada, Quebec, QC, Canada

The development of unconventional oil and gas in North America has caused a significant increase of seismicity in areas of intense hydraulic fracturing and wastewater injection operations. Since 2012, Natural Resources Canada (NRCan) has been investigating the possible relationship between hydraulic fracturing (HF) done for the exploration and the production of shale gas and the changing pattern of local seismicity. In 2015, the research project was expanded to include studies of all injection-related seismic events.

The project developed three main research axes: 1) improve real-time earthquake-monitoring capability in major shale gas basins where current seismic coverage was sparse; 2) establish the baseline (pre-development) regional seismicity pattern for basins with unconventional oil and gas potential; and 3)conduct targeted studies on significant induced events to understand the relationship between their seismogenesis and man-made operations.

Working closely with provincial and territorial governments, new real-time broadband seismograph stations have been installed in British Columbia (BC), Alberta (AB), New Brunswick (NB), Northwest Territories (NT), Quebec (QC), and Yukon Territory (YT). Studies of seismicity before, during, and after HF operations have been completed for the Horn River Basin in northeast BC, the Moncton and Sussex areas in southern NB, and the Norman Wells area of the central MacKenzie Valley, NT. Similar studies, with the addition of an InSAR component, are planned for the Montney play of BC and the Fox Creek area of AB.

Detailed studies into recent M>4 events in BC and AB are currently underway (including the Mw4.6 Montney earthquake of August 17, 2015) examining source processes and ground motions to better understand the causes of induced seismicity and potential hazards.