Geoscience BC Energy & Water Projects – 2021 Summary

As in previous years and in collaboration with Geoscience BC (GBC), this Technical Webinar was used to showcase some of the scholarship recipients for 2021. In keeping with GBC's strategic objectives, the projects and focus areas were divided into five (5) sections:

1. Identifying New Natural Resource Opportunities
2. Advancing Science and Innovative Geoscience Technologies
3. Facilitating Responsible Natural Resource Development
4. Enabling Clean Energy, and
5. Understanding Water

This webinar featured 6 presentations, incorporating 3 of the above-mentioned objectives (2, 3 & 5).

Opening comments were provided by Richard Truman, Vice President – External Relations at GBC. The six presentations were subdivided further into 2 categories: Induced Seismicity and Water. In addition to prompting further discussions, the key objective of the session was for the speakers to provide a high-level summary of each of the research projects.

Significant amount of research and study continues in Northeastern British Columbia to understand, predict, and mitigate seismic activity directly related to operations in the energy industry (mainly fracture stimulation and water disposal activities). Similar to work being done on the Alberta side of the border, integrated machine learning is being utilized, using data catalogued from various sources as input, for generating an induced seismicity geological susceptibility framework and map. Extensive research and work is also ongoing by looking at amplification of seismic ground motion mapping correlated to soil thickness (unconsolidated ground above bedrock) and topographical factors. With significantly more strategically placed monitoring stations now operating and active in the province, a comprehensive summary of all events is being catalogued (regardless of magnitude). This is being utilized, together with incorporating the key influencing elements (injection type, geological structure and stratigraphic setting) into the equation, to generate new methods in an attempt to predict future events in real-time.

The increased activity in the Montney over the past number of years has resulted in an even greater need for responsible management of flowback & wastewater removal strategies / options. There is significant societal pressure on operators to recycle and reuse the water, both to limit the amount of fresh water makeup and reduce the amount of disposal volumes. Detailed reservoir capacity work continues to identify safe and opportune zones for deep wastewater disposal. On the recycle and reuse part of the strategy, there is a growing market for and continuous need / introduction of novel technologies that can efficiently and responsibly manage this problem. Sufficient modular / portable type capability and deep reservoir disposal capacity will both be necessary to address the challenges being faced currently.

Important work is also underway to determine and identify fugitive gas in near-surface groundwater quality in the Peace River region. With focus on the methane content, there appears to be little or no influence from oil and gas development activities in the area. The existing low levels of methane in the groundwater appear to be naturally occurring and not from deeper zones (except in cases of leaky wells due to gas migration or natural pathways). Isotopic or fingerprinting analysis is being conducted to determine the origin of the methane in these wells.

For additional & more detailed information on these and other projects, please visit GBC's web portal at: geosciencebc.com/SummaryofActivities2021.

SUMMARY AND AGENDA

Geoscience BC's Summary of Activities 2021: Energy and Water, contains 10 papers from Geoscience BC–funded projects or scholarship recipients that are within Geoscience BC's strategic focus areas of energy (including oil and gas, and geothermal) and water.

The papers are divided into five sections, based on Geoscience BC's strategic objectives of:

1) Identifying New Natural Resource Opportunities
2) Advancing Science and Innovative Geoscience Technologies
3) Facilitating Responsible Natural Resource Development
4) Enabling Clean Energy
5) Understanding Water

During this webinar, we will hear from six of those researchers, covering three sections of Geoscience BC's Strategic Objectives:

- Within the 'Facilitating Responsible Natural Resource Development' section there will be three talks focused on Northeast BC. Erik Eberhardt's paper is on the development of an induced seismicity susceptibility framework and map using an integrated machine learning approach, Pat Monahan presents on the amplification of seismic ground motion hazard mapping and Honn Kao presents on a comprehensive investigation of injection-induced earthquakes.
- The 'Advancing Science and Innovative Geoscience Technologies' section is represented by two papers. Brad Hayes presents on wastewater disposal in the maturing Montney Play and Joshua Zoshi will provide an overview of the Saltworks AirBreather pilot project.
- Lastly, 'Understanding Water' section will be represented by Roger Beckie who will present on fugitive gas in near-surface groundwater of the Peace Region.

PRESENTERS

INDUCED SEISMICITY

2019-014: Development of an Induced Seismicity Susceptibility Framework and Map for NEBC using an Integrated Machine Learning and Mechanistic Validation Approach

Erik Eberhardt
University of British Columbia

Erik Eberhardt is a Professor of Rock Mechanics and Rock Engineering, and the Director of the Geological Engineering program at the University of British Columbia. His research focuses on understanding the underlying mechanisms responsible for complex rock mass responses to engineering activities related to mining and unconventional gas projects. Erik is a registered professional engineer in British Columbia and consults on international projects in North and South America, Europe and Asia. He recently served on the Scientific Review Panel on Hydraulic Fracturing in British Columbia, and has published over 200 technical papers. He was the 2013 recipient of the CGS John A. Franklin Award for outstanding technical contributions to rock mechanics and rock engineering, and 2017 recipient of the CGS Thomas Roy Award for outstanding contributions to the field of Engineering Geology in Canada.

2018-052: Amplification of Seismic Ground Motion Hazard Mapping for the Fort St. John – Dawson Creek Area

Pat Monahan
Monahan Petroleum Consulting

Dr. Monahan has 51 years of geological experience in western Canada and adjacent areas, primarily in petroleum and Quaternary geology. He has been working on earthquake –related studies since the mid-1990s, and has participated in several earthquake hazard mapping projects in southwest British Columbia, in Chilliwack, Victoria and Richmond. More recently he lead a preliminary assessment of the amplification susceptibility of the Montney play area of northeastern BC. In the petroleum industry he has worked in both technical and managerial roles for Aquitaine, Canterra, Enron and most recently, Penn West.
He received his BSc from UBC in 1974 and his PhD from the University of Victoria in 1999.

2019-007: Comprehensive Investigation of Injection-Induced Earthquakes in Northeastern British Columbia

Honn Kao, PhD
Research Scientist
Geological Survey of Canada, Natural Resources Canada
and Adjunct Professor at UVic

Honn Kao obtained his BSc in Geophysics from the National Central University, Taiwan, in 1985, MSc and Ph.D. in Geophysics from the University of Illinois at Urbana-Champaign in 1991 and 1993, respectively. He was recruited by the Institute of Earth Sciences (IES), Academia Sinica, Taiwan, as an Assistant Research Fellow immediately after finishing his Ph.D. During his initial years at IES, he was in charge of establishing the Broadband Array in Taiwan for Seismology (BATS). He was promoted to Associate Research Fellow in 1996 and then Research Fellow in 2000. He was awarded the Outstanding Research Award of the National Research Council of Taiwan twice (1999 and 2001). In 2001, he was awarded the Distinguished Youth Medal of the Republic of China. He joined the Geological Survey of Canada, Natural Resources Canada (NRCan) in 2002 as a research scientist working on earthquake source characteristics and seismogenic structures. In 2006, he was appointed by the School of Earth and Ocean Sciences, University of Victoria, as an Adjunct Professor. In 2019, he received NRCan's Departmental Achievement Award for impact and contributions to excellence in science. Currently, he is the leader of NRCan's Induced Seismicity Research Project.

WATER

2019-004: Wastewater Disposal in the Maturing Montney Play Fairway of NEBC

Brad Hayes
Outreach CSUR Director
President at Petrel Robertson Consultants Ltd.

Brad Hayes is President of Petrel Robertson Consulting Ltd., a geoscience consulting firm applying subsurface skills to energy technologies in conventional and unconventional oil and gas, non-petroleum resource exploration, energy storage and geothermal applications.

Brad earned a PhD in geology from the University of Alberta, and a BSc from the University of Toronto. He joined PRCL in 1996 after 15 years of exploration experience in the petroleum industry. Brad is a Director for the Canadian Society for Unconventional Resources (CSUR), and an active member and Past-President of the Canadian Society of Petroleum Geologists (CSPG). He recently completed a six-year term as Councillor for the Association of Professional Engineers and Geoscientists of Alberta (APEGA), and is also registered as a Professional Geoscientist in BC and Nova Scotia.

Brad is an active Adjunct Professor in the University of Alberta Department of Earth and Atmospheric Sciences, and a sessional lecturer at Mount Royal University. With CSUR, Brad manages the Outreach Program, sharing accurate, unbiased scientific information related to unconventional oil and gas development.

2017-002: Fugitive Gas in Near-Surface Groundwater of the Peace Region: Results from a Monitoring Network Study

Roger Beckie, P.Eng. FEC
University of British Columbia

Roger Beckie, P.Eng. FEC, is a professor in Earth, Ocean and Atmospheric Sciences at the University of British Columbia, where he was the Director of the Geological Engineering Program (2002-2011) and Department Head (2014 - 2019). He holds a B.A.Sc. from the University of Waterloo, and an M.A. and PhD from Princeton University. His principal research areas are groundwater hydrology and geochemistry, with emphasis on the impacts of fugitive natural gas on near-surface groundwater in the Peace Region of NE British Columbia, the hydrology and hydrogeochemistry of mine waste rock, and naturally occurring arsenic is aquifers in south Asia.

2020-001: Saltworks AirBreather Pilot

Joshua Zoshi **(UNABLE TO ATTEND)**
Co-Founder and COO
Saltworks Technologies

Joshua Zoshi is co-founder and Chief Operating Officer of Saltworks Technologies. He has helped grow Saltworks into a leading provider of advanced industrial water treatment solutions that help customers recycle wastewater, remove contaminants, extract valuable resources, and reduce disposal volumes. Josh's background spans semiconductors, energy, and enterprise software. He received his Bachelor of Applied Science in Electrical Engineering and his Master of Business Administration (Management of Technology) from Simon Fraser University. Josh lives with his wife in Vancouver and can usually be found snowboarding the local hills and taking every opportunity to scuba dive in exotic locations.

THIS PAPER WILL BE PRESENTED BY:

Pierce Maguire, Ph.D.
Technology Specialist
Saltworks Technologies

Pierce Maguire received his Ph.D. in physics in 2018 from Trinity College Dublin, before also completing a post-doc there in 2019. His research was focused on the defect engineering of laser devices and 2D materials using focused electron and ion beams, and the characterization of same using various microscopy and spectroscopy methods. His research output includes presentations at international conferences and authorship of 22 peer-reviewed scientific articles.

He moved to Canada in 2019 and joined Saltworks Technologies, Inc. in 2020. He is responsible for communicating the company's advanced water treatment solutions—helping clients to understand their options directly or via technical marketing collateral. He enjoys working between the technical, executive, and client teams.

He is passionate about science communication, water, and cleantech.

MODERATOR

Richard Truman, B.A., Dip. CIPR
Vice President, External Relations
Geoscience BC

Richard Truman is an external relations and communications professional with 15 years of community engagement and communications experience in Canada and Europe. Richard joined Geoscience BC in early 2017 and is responsible for creating and implementing communication strategies to engage the diverse audiences the organization is trying to reach, including Indigenous groups, the resource sector, universities, governments, and communities.

Prior to this role, Richard lead communications and engagement projects for CopperMoon Communications and The Castlemain Group. This included bringing together Indigenous leadership, community members, legal teams, negotiators, Provincial and Federal governments and the resource sectors on subjects such as Impact Benefit Agreements.