geoconvention
Calgary • Canada • May 15-19 2017

# Ethics of Geomechanics: A Thriving Discipline and Its Growing Responsibility

*Mehrdad Soltanzadeh*
*PetroGem Inc.*

### Summary

The fast-growing role of geomechanics in risk assessment and safety evaluation of underground operations comes along with serious responsibilities towards the society and environment. Handling these responsibilities requires a well-established structure that, at the very least, includes a geoethical framework, proper evaluation of technical uncertainty, clear regulations, an efficient educational system, support for scientific freedom, high levels of transparency and clear communication with the public and media. Specialised and focused independent institutions seem to be necessary to develop and support such a framework.

### Introduction

During the last two decades, reservoir geomechanics has been showered with attention from petroleum industry, academia and regulatory institutions mainly because modern technologies, new perspectives and economic opportunities have led to exponential growth of aggressive underground operations such as massive hydraulic fracturing, waste disposal, underground storage of greenhouse gases and in-situ thermal projects, all calling for geomechanics not just to help them with increasing their efficiency but also to answer some crucial questions on their safety and potential risks such as excessive ground deformation, fluid leakage, air, soil and water contamination and induced seismicity. In fact, none of these concerns are quite new but they have never been operated in a scale as large as today's. In the current sensitive social platform, the economic, sociopolitical and environmental importance of these risks can hardly be overlooked. The overwhelming popularity has come along with a heavy load of professional and ethical responsibility for geomechanics as a discipline that is primarily responsible for assessment of these risks.

### The Need for a Geoethical Structure

When it comes to the application of geosciences, relevant ethical issues fall under the umbrella of 'geoethics' (e.g., Peppoloni and Di Capua, 2012, Wyss and Peppoloni, 2015), a developing branch of ethics that is younger and less famous than its celebrity cousin, bioethics. While growing towards adolescence, theoretical and practical aspects of geoethics seem to receive less attention from the technical community (including geomechanics experts) in comparison to the environmental activists, ethics philosophers, politicians and business leaders. Nevertheless, with its crucial role in assessment of risks and concerns, joining the discourse of geoethics is an excellent opportunity for geomechanics

(a) (b)

**Figure 1. Two infamous cases of in-situ thermal operations in Alberta, Canada leading to (a) surficial spill of bitumen and (b) explosive release of steam. Sources for the photos: Pullman (2013) and ERCB (2010), respectively.**

community to its commitment to the welfare of the society and environment. To accomplish this task, geomechanics community (including regulatory institutes, academia, and industry) along with other parties need to start thinking of establishing a comprehensive structure that, at minimum, will include the following elements:

- **Ethical Platform:** Developing or adopting an ethical platform on how to treat problems that are imposing risks on the environment and society and how to define a balance between economic development, preservation, and socioeconomic prosperity will be the first step. Professional integrity and scientific honesty are obviously inseparable parts of such a platform but it will need to be much more comprehensive than a general code of ethics for a specific profession.

- **Acknowledging Uncertainty:** Open and clear recognition of the existing uncertainties in different processes of data acquisition, modeling, design, operation and monitoring is critical. Almost all the decisions made by geomechanics experts involve a (remarkable) level of uncertainty and, consequently, all the relevant risks must be assessed by bringing all the uncertainties into account. Any analysis needs to clearly acknowledge and address all different potential scenarios that may put the society and environment at risk and provide the best possible estimation of their probability to the decision makers and public. Different obstacles that may make this process difficult include scientific prejudice and overconfidence, technical ignorance, communication inefficiency, and the lack of professional integrity.

- **Regulations:** Standard design, operational, and monitoring codes are required to be developed by regulatory institutes in collaboration with the scientific community and industry to ensure that the minimum requirements for both safety and preservation are fulfilled. Similar to other disciplines (take the field of 'construction' as an example), coming up with such regulatory guidelines needs investment from all the stakeholders especially the governments and intergovernmental agencies. These investments are used to form specialized and independent research institutes with the duty of developing best-practice guidelines. Enforcing ultraconservative advices backed up with justifications such as ‘the lack of knowledge’ or ‘immaturity of science’ usually is not the best long-term strategies from regulatory institutes. With such excuses in effect, several of the currently existing developments in the world would never have had a chance to happen. The main role of regulatory institutes is taking the lead on developing knowledge, science and technology whenever necessary.

- **Education:** Training on environmental, social and economic aspects of relevant risks and their potential impacts is crucial. Such training should be a part of a systemic education in academia and industry for geomechanics practitioners. Different elements of ethics, especially geoethics must be a part of such educational system. It is important to ensure that all the practitioners are familiar with the codes of conduct through proper education. In addition, professional associations regulating the practice of the discipline need to show more profession-specific attention to education and qualification assessment of their members.

- **Scientific Freedom:** Importance of freedom of research and science cannot be emphasized enough. All the involved sectors need to ensure the circulation of knowledge is not bottlenecked for any unnecessary reason such as politics or profit. Practitioners need to feel ‘free’ in expressing their opinions on the matters concerning the society and environment regardless of the outcomes. It is important that proper whistleblower policies will be in effect in all the industries with potential georisks.

- **Transparency:** Without a minimum level of transparency in providing details on different processes of design, execution, monitoring and observation, preventing undesired situations will be extremely difficult. Along with respecting the interests of the investors, industry needs to ensure that confidentiality does not act as a barrier for sharing crucial information with the public and authorities.

- **Public Communication:** Communicating with the society and media can be quite a challenge for the technical communities including reservoir geomechanics due to the complex physical nature of their work. Nevertheless, this cannot be used as an excuse for not providing understandable explanation for the issues related to the welfare of the environment and society. Geomechanics needs to come up with creative methods to adequately explain itself to the general audience with minimum technical knowledge.

Some of the points addressed here may already be in place and practiced to some extent but it is still hard to overlook the urgent need for their development and improvement in addition to putting them in a well-defined structure. Fortunately, several other disciplines have been wrestling with similar issues for a long time and their experiences may be efficiently used to ensure the practice of geomechanics is aligned with the ethical and professional integrity and the welfare of the society and environment.

## Conclusions

The pivotal role of geomechanics in identifying risks and safe operational criteria for aggressive underground operations has led to fast growing of ethical responsibilities for this discipline. Therefore, estabilishing a well-defined structure seems to be required to handle these responsibilities. At the very least, the components of this structure are a solid ethical platform, acknowledging the existing uncertainty, proper regulations, ethical and technical eductation, scientific freedom, transparency and efficient public communication. Developing such a structure will need independent institutions that can properly coordinate the collaboration between the governments, academia and industry.

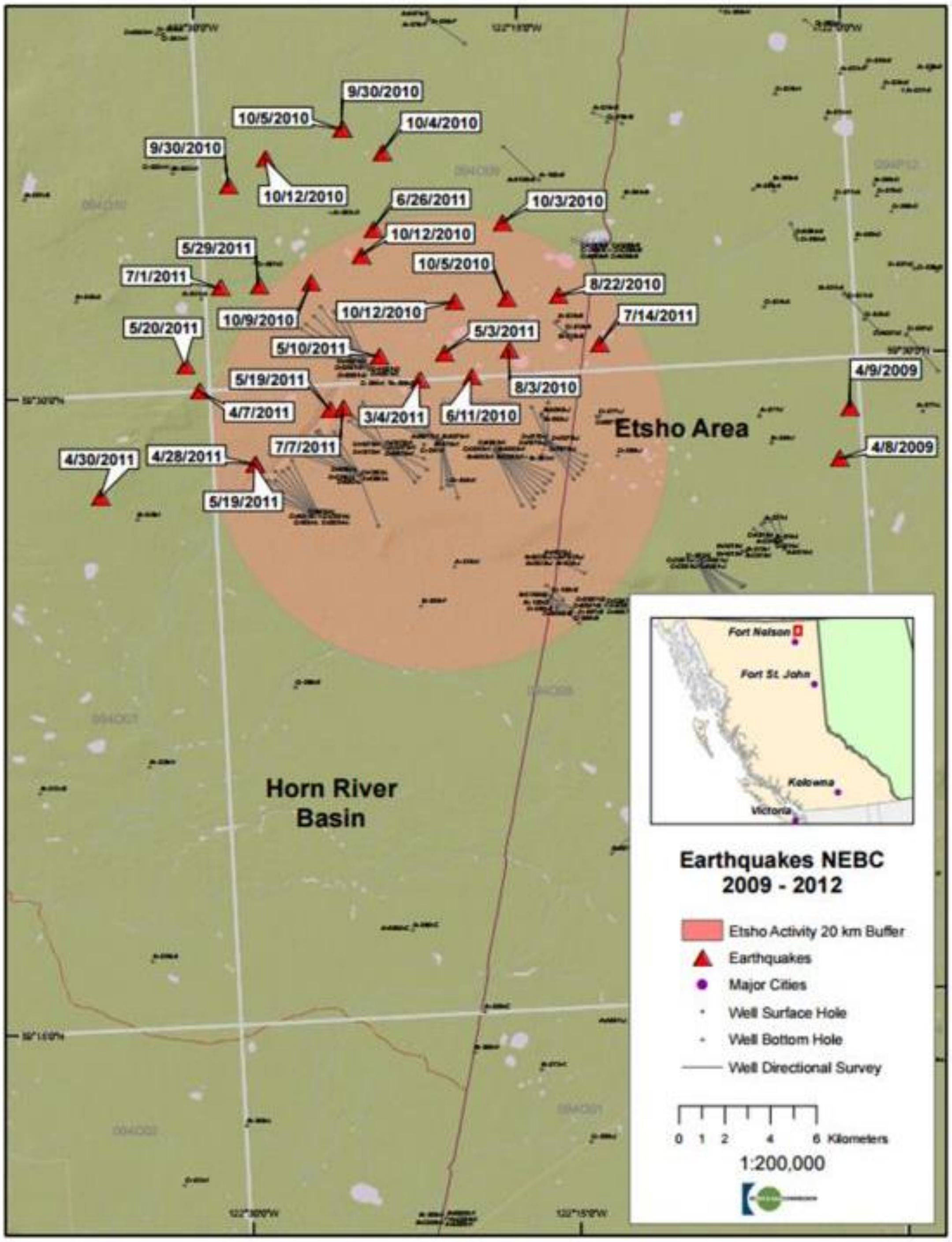


**Figure 2. Major seismic events recorded near hydraulic fracturing operation sites in British Coulombia, Canada, event locations and drilling pad locations within 10 km radius shaed circle (source: BCOGC, 2012).**

**References**

BCOGC (BC Oil and Gas Commission), 2012. Investigation of Observed Seismicity in the Horn River Basin, https://www.bcogc.ca/node/8046/download.

ERCB, 2010, *The photo published in:* Surface Steam Release of May 18, 2006 Joslyn Creek SAGD Thermal Operation ERCB Staff Review and Analysis, February 11.

Peppoloni, S., and Di Capua, G., 2012. Geoethics and Geological Culture: Awarness, Responsibility and Challenges, Analysis of Geophusics, 55(3), pp. 335-341.

Pullman, E., 2013, *The photo published in:* Oil continues to leak from Canadian Natural Resources Ltd.'s Primrose site, month after the first bitumen release by Francoeur, R. Northern Journal., August 12.

Wyss, M., and Peppoloni, S., 2015. Geoethics: Ethical Challenges and Case Studies in Earth Sciences, Elsevier, Amsterdam.