

THE USE OF SEISMIC TECHNOLOGIES IN REDUCING UNCERTAINTY IN THE ESTIMATION OF RESERVES AND RESOURCES; APPLICATIONS OF 3D, 4D SEISMIC AND MICROSEISMIC TO THE SEC, NI-51-101 AND PRMS EVALUATIONS

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Summary

Use of seismic technology for estimating reserve volumes has been a continually evolving path which has not progressed at an even pace. Currently the United States Securities and Exchange Commission (SEC) guidance, Canadian NI-51-101 rules and the 2018 Petroleum Resources Management System Guidelines (PRMS) specify, to differing degrees, uses of seismic technology to estimate in-place hydrocarbon volumes. 2D and 3D seismic data, including various attribute analyses, are common forms of seismic technology widely used over large areas in both conventional and unconventional fields. Microseismic and multiple 3D seismic acquisitions (4D seismic) are additional technologies that are often applied to reduce uncertainty of specific factors.

Accepted practices and workflows for inclusion of seismic technologies in reserve and resource evaluations are demonstrated in this paper yet there are important differences depending on the standard under which the evaluation is being made. Guidelines and standards for determining the use in helping to define proven, probable and possible reserves as well as resource categories are not straightforward and are subject to misapplications. Some similarities and differences between the SEC, NI-51-101, and PRMS standards are documented and the applications of the best practices in the seismic workflow are detailed.

PRMS allows for the reporting of both resources and reserves based on seismic information. Chapter 3 of the PRMS Guidelines defines uses of seismic geophysical data. 2D seismic data can be used to estimate area, depth and sometimes thickness, depending on the quality, coverage and resolution of the seismic sections. 3D can be used to estimate area, depth, thickness, gross rock volume, as well as the petrophysical properties of porosity, lithology, pressure and saturation. 4D can be used to monitor temperature, pressure, fluid flow and fluid contact elevations.

SEC does not allow for the reporting of resources at all. SEC only allows the reporting of proved reserves. These proved reserves can be partially defined by seismic if it can aid in defining the economically producible quantity of oil or gas along with other engineering and geoscience information with reasonable certainty. It's critical to understand what constitutes reliable technology as well as reasonable certainty as it is defined by the SEC.

The Canadian NI-51-101 specifically refers to the COGEH Handbook for guidance in the use of technology in determining reserves and resources which in turn has specific recommendations of the use for both conventional and unconventional fields that was updated in the 2018 edition.

Theory / Method / Workflow

Definitions and guidance from the three major governing systems for oil and gas reserves are documented and contrasted with respect to the use of seismic technologies. Once the theoretical guidelines are established several case studies are used to demonstrate the importance of the rules and guidelines in using seismic technologies in reducing uncertainty.

Results, Observations, Conclusions

Seismic data in various forms, from 2D data, 3D data and 4D to microseismic data can be an important technology utilized to reduce uncertainty for both resource and reserve evaluations when correctly applied and applied under the proper guidelines.