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Changing geophysical priorities for CCS projects – balancing technical rigour with cost effective solutions

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Summary

As global commitments to reduce CO_2 emissions start to drive increased interest and investment in commercial CCS projects, there is a compelling need to deliver cost effective and efficient geophysical solutions that assist integrated project teams with key decisions related to all phases of a CCS project (IEA, 2020). This starts with initial site screening and project concept design, and continues through to storage complex selection, regulatory applications, subsurface characterization, on to project execution and, eventually, to site closure. Developing a fit for purpose, risk based, Measurement, Monitoring and Verification (MMV) Plan is just one area where integrated geoscientists are challenged to apply best in class techniques while minimizing execution costs (Couёslan et. al., 2021).

Theory

Numerous demonstration and pilot CCS projects have published extensively about geophysical tools and methodologies to monitor CO_2 injection and verify subsurface plume behaviour, both in Canada and the United States (PCOR, 2018). These projects have been supported and benefited from substantial research funding to explore and validate existing or new technologies with the goal of providing assurance to regulators and the general public regarding the feasibility and security of carbon storage operations (Alberta Energy, 2023). As we move towards commercial operations and gigatons of storage capacity, there is a continued need to ensure robust and accurate monitoring that meets the requirements of regulators and community partners and also aims to reduce capital expense so projects can progress successfully through final investment decision (FID) and on to operational phases. Due to the way CCS projects are funded the necessity to manage the trifecta of time, cost, and quality is greater than ever and requires careful consideration of trade-offs involved and use of emerging techniques.

Results

Using several recent case studies, the authors will demonstrate the application and adaptation of classic geophysical and geological exploration tools to the rapidly growing CCS landscape. This will include a discussion of the similarities and differences between conventional exploration and CCS project development and the challenge of finding the “right” solution that meets the needs of the workflow shown in Figure 1. The ongoing need for effective integration across subsurface disciplines is highlighted by the requirement to quickly and effectively develop comprehensive plans for storage solutions that consider multiple factors of reservoir management. These plans must be cost effective, test for real world conformance with project models, and be adaptive in the case of discrepancy.

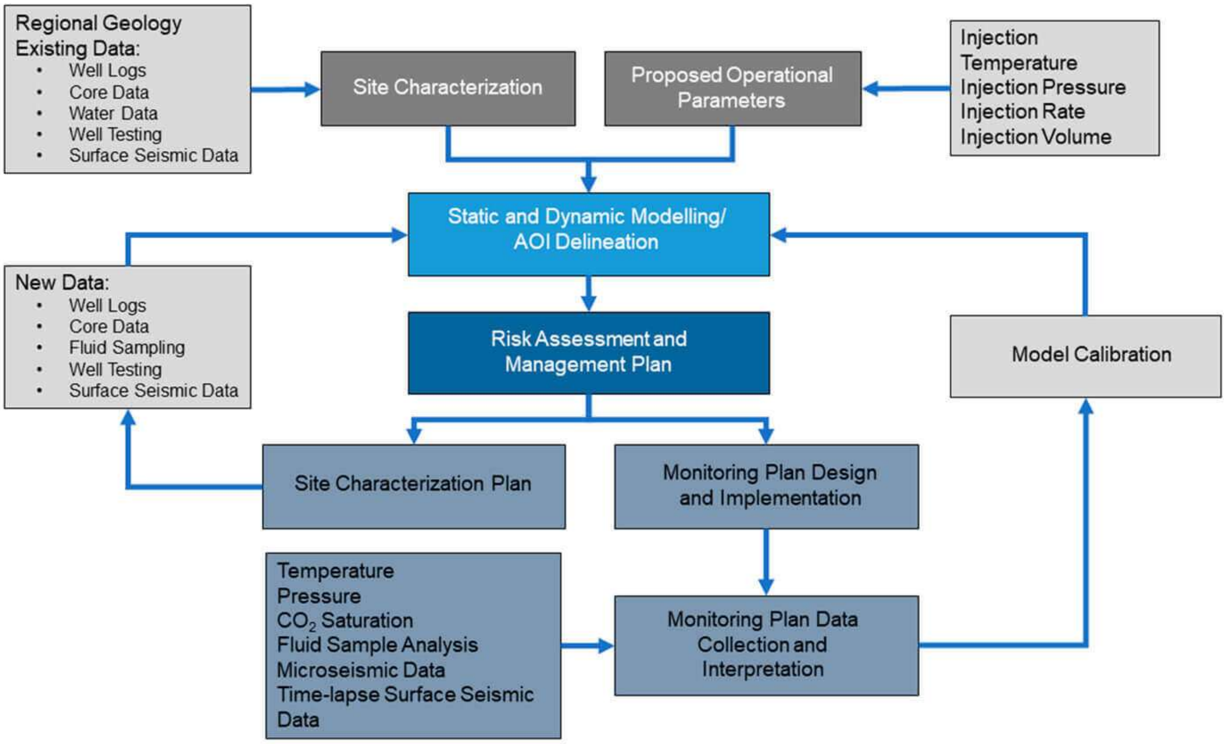

Figure 1. Workflow from initial site characterization for a project through to MMV plan design

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