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Assessment of Pressure Interference in Alberta's Proposed Carbon Storage Hubs

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Abstract

Objectives and Scope: Twenty-four pore space evaluation permits were accepted by the Government of Alberta and the project proponents have entered into evaluation agreements with the province to further explore the project areas' suitability for safely storing carbon dioxide (CO_2). If the evaluation demonstrates that a proposed project can provide permanent storage, companies will be able to apply for the right to inject captured CO_2. The Basal Cambrian Sand has multiple hubs being evaluated with Sequestration Lease Areas (SLAs) that will share common borders. Projects will be designed to contain the CO_2 plumes within the SLA, but the area of elevated pressure will commonly be larger. The resulting pressure interference creates uncertainty on injectivity and storage capacity for each SLA as the various hubs compete to utilize the pore space within the regional aquifer.

Methods, Procedures, Process: This presentation assesses the magnitude and distance of elevated pressure that an injection site can impose on neighbouring projects resulting in potential for competitive injection. The results of initial 1D isothermal single-phase and multi-phase numerical simulation models are compared. Regional geologic and hydrogeologic mapping was completed and used as the basis to construct a regional-scale numerical model that was calibrated to replicate actual field pressure response at the Quest CCS site, a Shell operated site that began injecting CO_2 in 2015.

Results, Observations, Conclusions: Theoretical areas of elevated pressure are calculated to increase over distances far greater than the SLAs for the current purposed hubs. Pressure interference may impact the injectivity potential of some of the proposed hubs and pressure interference should be considered when designing MMV plans. The numerical simulations conclude that single phase water modeling is appropriate for regional assessment of pressure interference.

Significance/Novelty: An understanding of the magnitude and lateral extent of elevated pressure from hub SLAs and their relative impacts on CO_2 injectivity and storage capacity are not only crucial for successful deployment of CCS projects but also will have a wider application when modeling nearby resource production operations (oil and/or mineral).

Keywords: Pressure interference; Alberta Carbon Hubs; Sequestration Lease Areas (SLAs); Carbon Storage Hubs; Numerical Modeling; Pressure Plumes

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