Contribution ID: **541** Type: **Oral Presentation**

Monitoring of Brine Leakage form Carbon Storage in Deep Saline Formations: Method Validation Using Intermediate-Scale Testing

Wednesday, 1 June 2022 12:00 (15 minutes)

Injecting CO2 for storage into deep saline formations is a promising technology for minimizing the amount of released greenhouse gas released into the atmosphere, contributing to global warming. The pressure build-up in the storage formation during an injection can affect the caprock integrity, leading to pressure-driven leakage of native brine or CO2, posing a contamination risk in shallow aquifers. Hence, developing strategies for monitoring such leakage events and possible remediation action should be a part of selecting and implementing carbon capture and storage (CCS) operations. Regulatory constraints are in place to protect the aquifer water used for drinking. The complexities associated with deep geological settings and flow and transport in multiple heterogeneous layers of the storge, intermediate and shallow aquifers preclude the direct adaptation of the monitoring methods and approaches that have been developed and validated for traditional problems in shallow aquifers. Hence to address problems associated with brine leakage, new approaches have to be developed and validated before field implementation of CCS. As field CCS systems are at pilot testing stages and no field data exists on leakage events, the only currently available option for validation is the use of numerically generated synthetic data. This approach has a significant shortcoming as the available models are not validated for their ability to capture complex processes. This paper presents a method where an intermediate scale test system was used to generate data to validate a model that is used to develop a monitoring approach. A framework for designing monitoring systems that optimally use relatively readily available shallow zone data and hard-to-make deep zone observations was developed and validated. Basic to this framework is calibrating a transport model using monitoring data to determine leakage source conditions and then predicting brine plume contaminating the shallow aquifer. As it is expected that cost considerations limit monitoring the deep zone, the framework is developed to minimize the deep zone observations (e.g., using sensors). The best placement locations selected from a predefined number of observation points to provide the most worthful monitoring data that reduces predictive uncertainty is determined by integrating linear uncertainty analysis with the Genetic Algorithm. The framework was tested in an intermediate-scale soil tank, where monitoring data on brine leakage plume development from the storage zone to the shallow aquifer was collected. Predictions using a transport model using the data were then compared with experimental observations to evaluate the informativity of the monitoring locations. The results demonstrated the ability of the framework to select the most informative deep monitoring locations. It was also found that the deep observations and shallow zone data are worthful to determining source conditions. The results showed the possibility of identifying the likely areas of impact of shallow aquifer using early-stage monitoring data.

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References

Time Block Preference

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Participation

In person

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