Certification framework based on effective trapping for geologic carbon sequestration

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Abstract:

We have developed a certification framework (CF) for certifying the safety and effectiveness of geologic carbon sequestration (GCS) sites. Safety and effectiveness are achieved if CO_2 and displaced brine have no significant impact on humans, other living things, resources, or the environment. In the CF, we relate effective trapping to CO_2 leakage risk which takes into account both the impact and probability of leakage. We achieve simplicity in the CF by using (1) wells and faults as the potential leakage pathways, (2) compartments to represent environmental resources that may be impacted by leakage, (3) CO_2 fluxes and concentrations in the compartments as proxies for impact to vulnerable entities, (4) broad ranges of storage formation properties to generate a catalog of simulated plume movements, and (5) probabilities of intersection of the CO_2 plume with the conduits and compartments. We demonstrate the approach on a hypothetical GCS site in a Texas Gulf Coast saline formation. Through its generality and flexibility, the CF can contribute to the assessment of risk of CO_2 and brine leakage as part of the certification process for licensing and permitting of GCS sites around the world regardless of the specific regulations in place in any given country.

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