Geologic Considerations in Carbon Sequestration: Rocky Mountain Insights and Beyond

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Abstract

Carbon Capture and Sequestration (CCS) initiatives in the United States have surged, fueled by government incentives such as the 45Q tax credit established 2008 and the U.S. Department of Energy's Carbon Storage Assurance Facility Enterprise (CarbonSAFE) initiative launched in 2016. Permit applications under the Environmental Protection Agency (EPA) Underground Injection Control (UIC) Class VI program have grown from merely 3 projects in 2021 to 43 projects spread across 12 states, encompassing 128 individual injection well applications. Notably, projects in Wyoming, North Dakota, and Louisiana are not included in the EPA reported figures, as these states have been granted primacy by the EPA, empowering them to review and approve applications independently. A comprehensive geologic characterization program, mandated by EPA regulations, is essential for a successful Class VI application. The complexity of the characterization is compounded by project-specific design and risks, necessitating a tailored approach. Evaluation steps encompass a spectrum of activities, ranging from large-scale regional mapping of existing data to site-specific seismic interpretation and stratigraphic test wells. Robust geologic and injection simulation models are required to predict the long-term impact of the project, while comprehensive monitoring and verification plans extend through the project life and beyond. The integration of data is key to quantifying storage resource and assessing the long-term viability of the sequestration site. The objective of this presentation is to outline the timeline of CCS growth, the geologic factors essential for a successful storage project and the requisite elements for permit submission. Additionally, specific case studies in the Rocky Mountain Region will be highlighted.