Improving monitoring protocols for CO_2 geological storage with technical advances in CO_2 attribution monitoring

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Abstract

Existing monitoring protocols for the storage of carbon dioxide (CO_2) in geologic formations are provided by carbon dioxide capture and geological storage (CCS)-specific regulations and bodies including the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories, the European Union (EU) CCS and Emission Trading Scheme (ETS) Directives, United States Environmental Protection Agency (US EPA) Final Rules, and the United Nations Framework Convention on Climate Change (UNFCCC) Clean Development Mechanism (CDM) Modalities and Procedures (for developing countries). These protocols have varying levels of detail but similar principles and requirements for monitoring, and all include the need to quantify emissions and measure environmental impacts in the event of leakage to the surface. What they do not all include is the clarification that quantification monitoring should only be undertaken in cases where CO_2 has been attributed to leakage and not when leakage is only suspected. Quantifying suspected emissions is a significant monitoring challenge and undertaking, and may rely on acquiring large data sets over long time periods. This level of effort in monitoring would be unnecessary if the source of CO_2 detected at the surface is attributed to natural sources rather than from leakage, but a step to attribute CO_2 source is either missing from these protocols or is outdated in technical scope. Regulatory bodies call for protocols to be updated based on technical advances, and ongoing technical advances into leakage monitoring have now benefited from a first-ever public claim of leakage over a geologic CO_2 storage site in Saskatchewan, Canada, bringing more emphasis on the role of attribution monitoring. We present a brief update of some of the newest technical advances in attribution and suggest that CO_2 'attribution monitoring' could now be included in monitoring protocols to avoid unnecessary and costly quantification monitoring unless it is fully warranted. In this context, this paper describes an option to improve the existing protocols for monitoring CO_2 at geological storage sites made possible because of recent developments in near-surface attribution monitoring techniques.