CCS Safety and Environmental Impacts

Global Efforts

Since 2006, there have been many field experiments across the globe simulating a CO_2 leak in order to understand potential environmental impacts.

Click/Scan QR code for more info.

25 years of lab and field research and deployment show that CCS sites are unlikely to leak, but if they did, we have to understand and consider potential risks. Here is an overview.

Human Health

Potential CO_2 impacts include contamination of drinking water, displacement of oxygen in low-lying areas, and threats to ecosystem health. While CO_2 is not explosive or toxic, it can displace oxygen, posing a risk to health via oxygen deprivation. However, the overall risk is lower than everyday risks such as driving a car or being struck by lightning.

Potential Groundwater Impacts

CO_2 can potentially impact groundwater by causing the mobilization of heavy metals due to mineral dissolution or detachment from the grain surface, leading to contamination. Additionally, brine, which is difficult to clean up, can render water undrinkable due to its salt content.

Metal Mobilization

Research in both lab and in field experiments show that while CO_2 can mobilize metals in groundwater, the effect is often minimal and transient. The mobilized metals usually fall back out once the CO_2 or the groundwater moves away, and the amount is typically not enough to affect drinking water standards. Therefore, metal mobilization is no longer a major concern.

Brine Migration Potential

The main concern is brine contamination in groundwater, which is difficult to remedy. This risk is associated with closure and boundary conditions, and abandoned wells. It's crucial to manage injection pressure and ensure abandoned wells are properly plugged to prevent brine from being pushed into the aquifer.

Terrestrial Ecosystem

Ecosystem impacts of CO_2 are spatially limited and ecosystems have existing uptake mechanisms for CO_2, as it is not a toxic contaminant but a natural ecosystem component has been encountered before. Certain plants can tolerate high levels of CO_2. Over time there may be a shift to more acid-tolerant species.

Marine Ecosystem

Marine Ecosystems exhibit resilience to CO_2 leaks, with most organisms able to tolerate or escape the effects. The main damage is to organisms with calcium shells, particularly in their larval stage. However, the ecosystem's familiarity with CO_2 reduces the overall impact.

Did you Know?

There have been no instances of carbon dioxide leakage from a deep storage formation to the groundwater or to the surface.

Controlled release experiments around the world have shown that CO_2 leakage would not be as disastrous as once thought, with impacts being short-lived and spatially small.

Controlled Release Projects

Read: *What have we learnt about CO_2 leakage from CO_2 release field experiments, and what are the gaps for the future?*

J. Roberts and L. Stalker (2020)

Secure storage - why CO_2 doesn't leak

CO_2 is stored in liquid-like form at least 800 meters (2600 ft) deep. It is trapped in the pores of the rock like a stain is trapped in your clothing.

The main avenue for leakage is wells, often referred to as artificial penetrations, which provide a path for migration.

Source: Dr. Katherine Romanak

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