Ensuring the safety of offshore carbon storage

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Credit: AI-generated image (disclaimer)

Carbon dioxide is an essential part of our atmosphere, but industrial and commercial activities over the past 150 years have seen CO2 emissions rise to problematic levels. EU-funded research is examining how to capture the gas at source and safely store it deep beneath the sea.

Faced with increasing levels of carbon dioxide in our atmosphere and oceans, scientists are developing on- and offshore carbon capture and storage (CCS) systems as a potential solution to the problem. Further research is still needed, however, to ensure the safety of new technologies that capture and permanently store industrial emissions in the seabed.

This process is the subject of a multi-disciplinary EU-funded project, which looks at new approaches, methodologies and tools to ensure the safe operation of offshore CCS sites – often existing oil and gas reservoirs that are economically unviable. The STEMM-CCS project aims to develop approaches that will identify appropriate marine storage sites and monitor them effectively, increasing public confidence in CCS as a viable option for reducing CO2 in the atmosphere and seas.

The research team, led by scientists in the UK, have published a paper in the *Journal of Geophysical Research: Oceans*, in which they outline cost-effective ways of detecting the source of leaks from storage sites seeping through the ocean floor. Such leaks may be harmful to humans and the marine environment, but monitoring operations can be costly.

In his report, Guttorm Alendal from the University of Bergen combines Bayes' theorem and 'footprint predictions' to suggest three strategies for deciding the search paths of autonomous underwater vehicles carrying sensors.

Tracing leaks quickly, efficiently and autonomously

Tracing the source of a leak depends to a large extent on local oceanic and atmospheric conditions. Environmental shifts such as changes in fauna or elevated concentrations of dissolved gases can be used as indicators of marine gas releases, but variability in ocean dynamics – local topography and varying current directions caused by tidal

variations, for example – create challenges for autonomous vehicles.

Such vehicles are capable of making instant measurements to identify the source of gas leaks: each measurement updates the vessel's probability field and informs its decision about where in the designated search area to examine next. Creating a probability map based on Bayes' theorem can point the vehicle on the most cost-effective path to tracking down the origin of the leak.

STEMM-CCS (Strategies for Environmental Monitoring of Marine Carbon Capture and Storage) will carry out a number of research cruises at a potential CCS site in the North Sea, where researchers will release CO2 beneath the seabed and track its path to the seafloor and into the water column. Using a combination of existing technology and their own new sensors and techniques to examine baseline conditions, sub-seafloor structures and fluid pathways, the team aims to generate a substantial amount of knowledge to support recommendations for future best practice.

More information: Project website: cordis.europa.eu/project/rcn/200472_en.html

G. Alendal. Cost efficient environmental survey paths for detecting continuous tracer discharges, *Journal of Geophysical Research: Oceans* (2017). DOI: 10.1002/2016JC012655

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