World first experiment will provide confidence in sub-seabed carbon dioxide storage .

If we are going to store large volumes of carbon dioxide (CO2) in depleted oil and gas reservoirs beneath the seabed we need to be sure that in the unlikely event of a leak, we can detect it. A world-first experiment, designed to develop methods for the detection and monitoring of leaks, however unlikely they are to occur, sets out this week to drill into the seabed of the North Sea. Here scientists will simulate a CO2 leak to test an array of sensors designed to detect even small leaks.

Climate change, driven by increasing carbon dioxide levels in the atmosphere, is now a well-stablished phenomenon that is having profound effects on the Earth's natural systems. While efforts are being made to reduce sources of human-related CO2 production, such as from industry and transport, there is a parallel need to prevent CO2 emissions from entering the atmosphere. One such strategy is carbon dioxide capture and storage (CCS), whereby CO2 is contained at source, transported and ultimately stored away from the atmosphere. Researchers and industry are investigating depleted, or near-depleted, oil and gas reservoirs as suitable storage sites for this anthropogenic CO2.

Putting the CO2 back into some of the reservoirs from whence it came as hydrocarbons seems a logical solution, but there are challenges. One of these is ensuring that once stored deep underground beneath the seabed, the gas remains locked away. To generate confidence in this approach a priority is to be able to detect any leak, should it occur, to measure its strength and duration and predict any effects it may have.

The Strategies for Environmental Monitoring of Marine Carbon Capture and Storage (STEMM-CCS) project is an EU Horizons 2020-funded project charged with doing exactly that. The project brings together researchers from Germany, Norway, Austria and the UK, and industry partner Shell, to develop the techniques and technology to pick up traces of any gas release if it occurs, to observe how the gas behaves in sediments and the water column above, and predict how far it may spread and what impacts this might have.

This week a research cruise sets sail from the Southampton's National Oceanography Centre aboard the Natural Environment Research Council's RRS *James Cook*. In a world-first experiment, a pipe is being inserted into the seabed 120 metres down in the open sea. The curved steel pipe will be positioned so that its exit will be two-three metres beneath the seabed surface. Sounds simple, but in order to achieve this, a special drill rig has had to be developed and built by Cellula Robotics. Once in place the pipe will be connected by a remotely operated vehicle (ROV) to a CO2 supply on the seabed, allowing gas to flow through the pipe into the sediments. Again, this sounds simple but specially designed gas cylinders, housed in a second rig, had to be designed to withstand the rigours of the salt-water environment. The CO2 is expected to eventually bubble out at the seafloor, so surrounding the escape point on the seafloor, is a range of sensors. Acoustic and visual instruments aim to detect the sound made by streams of bubbles or to spot them with cameras, while chemical sensors aim to 'sniff out' the CO2 and the minute amounts of chemical tracers it contains, which will enable scientists to differentiate this signal from any naturally occurring CO2. ROVs and autonomous underwater vehicles (AUVs) bearing other sensors, complete the arsenal of technology being deployed.

While the two-week controlled release of CO2 takes place, samples from around the simulated 'leak' will be taken to establish, how gas passing through sediment behaves and affects the sediment and the life it contains. The ultimate aim of the experiment and the STEMM-CCS project as a whole is to develop sensors and methods for detecting and monitoring gas seepage in a real-world situation.

Professor Douglas Connelly, the NOC scientist leading the project, will be on board overseeing the project: "Many months of hard work and innovative thinking have brought us to this exciting point in the STEMM-CCS project. This experiment is as near to a real leak as we can get and is the first time, anywhere in the world, it has been attempted. The North Sea can be a harsh environment and getting the pipe into the seabed, connected to a CO2 supply and producing a stream of gas is going to be no mean feat, but is essential if we are to test the sensors that have been developed to give peace of mind in the future, that if a leak should occur, we can detect it quickly and precisely."

NOTES:

The cruise: This world-first cruise embarks from NOC Southampton on the morning of 25th April, returning to Southampton at the end of May.

Funding: The Strategies for Environmental Monitoring of Marine Carbon Capture and Storage (STEMM-CCS) project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 654462.

Contacts: Professor Douglas Connelly, the NOC-based project coordinator will be on board and may be available for interview directly from the ship, weather, work-load and transmission signals pending. He will also be available for interview on the 24th April, as the RRS *James Cook* is being loaded with equipment for the research cruise.

Kelvin Boot will be land-based throughout the 4 week cruise and should be your first point of contact to arrange for interviews, images, video etc. kelvinboot@yahoo.co.uk or kelota@pml.ac.uk. Mobile – 07792 385158

Materials: On board the RRS *James Cook* will be a dedicated news gatherer who will be taking still and video imagery and conducting short interviews as the different activities take place. A daily blog (stemmccs.blog) and twitter feed (@STEMM_CCS_EU) will be produced when appropriate. Additionally the ROV will be obtaining underwater footage of the installation and aerial drones will be employed to gain footage of operations also. We are arranging for video etc to be transmitted from the ship on a regular basis, this can be made available to press and media, and will also be available on the STEMM-CCS website – www.stemm-ccs.eu

The German research vessel, RV *Poseidon* will also be in the area collecting baseline and other data as part of the same project, it is hoped that we can arrange a rendezvous between the two ships and capture the meeting on drone video.

Further information: from website or from Kelvin Boot