| Plenary 1 - Monitoring plans & tech selection | | | | |
|---|---|---|---|---|
| **Question directed to** | **Question** | **Question posed by** | **Submission Time** | |
| Helen, Spirit | What's the average sandwaves migration rate at the Morecambe site? | Tommaso Ciccarone | 09:04:10 | Around 1m/yr broadly Eastwards |
| Helen, Spirit | Did you consider costs in your measurements selection? | Saad Kisra | 09:11:35 | We have based our initial screening on accuracy, precision, resolution, detection limits, measurement uncertainty and repeatability. Post screening we have a list of possible technologies ranked according to confidence in them meeting objectives/acting as risk mitigations. Cost is then brought into the equation to select between technologies. |
| Helen, Spirit | Will you acquire seismic to have as a baseline for potential later corrective monitoring? | Anonymous | 09:12:07 | We acquired a 3DHR Seismic survey in 2024 which we have avalable as a baseline for potential later corrective monitoring. |
| Helen, Spirit | Has MNZ reached FID and if so who is funding it? Is it part of the government Track 1 or 2 schedule? | Anonymous | 09:12:55 | MNZ is a post track project. FID will be late 2020's |
| Helen, Spirit | How do you define the baseline with active gas production in the field? | Tony Bourne | 09:13:53 | Baseline gravity will be aquired prior to CCS injection. Gas production and CCS injection will not occur simultaneously. |
| Helen, Spirit | Your technology concept selection methodology will work well, however with an evolving landscape of TRL's how do you keep updated? | Colin Black, SPE | 09:32:54 | We will make updates at set intervals, likely around input to key milestones (eg preliminary monitoring plan, monitoring plan, monitoringing plan updates). |
| | | | | |
| | | | | |
| SLB, Saad | The monitoring dashboard is an interesting concept. Have you explored this as a reporting tool with Regulators in different jurisdictions? | Ian Barron | 09:56:54 | We are exploring how the integrated monitoring dashboard could be positioned as a reporting tool for regulators across different jurisdictions. At this stage, our focus is on ensuring the framework is flexible enough to accommodate varying regulatory requirements and reporting standards. We are also working with a partner to extend it to credit issuance and validation.<br><br>There is strong potential for this to evolve into a more formalised reporting interface, particularly as expectations around transparency and monitoring in CCS projects continue to increase. We recently received a similar request from another regulator regarding the sharing of microseismic events above a certain threshold, which we are actively assessing. We would be keen to align this development with emerging regulatory needs. |
| Helen, Spirit | Have you already started permitting phase for the gravity survey? | Anonymous | 09:58:22 | We have not yet started that permitting step. Interestingly we will need to place CP's outside of the area of our Carbon storage licence as well as within it. |

| Plenary 2 - well & reservoir monitoring | | | | |
|---|---|---|---|---|
| **Question directed to** | **Question** | **Question posed by** | **Submission Time** | |
| Weatherford, Terry | Thank you for the presentation. How many fibers the interrogator manage at the same time? | Alice Pozzoli | 11:13:49 | In the case study, four fibres were deployed throughout the well and connected to a pressure/temperature (PT) interrogator. The capacity of the interrogator is not typically constrained by the number of fibres, but rather by the data write speed of the server-side storage systems.<br><br>We currently have long term installations where a single interrogator is successfully managing more than 45 individual fibres, supporting over 130 addressable discrete measurement points. These measurements include pressure, temperature, and multiphase flow, demonstrating the scalability of the system architecture.<br><br>It should be noted that Weatherford did not supply the DFOS interrogator for this particular application. DFOS systems introduce significantly higher data demands, often generating terabytes of data per day, which places even greater emphasis on high-performance data handling and storage solutions. |

| | | | | |
|---|---|---|---|---|
| Weatherford, Terry | What are the challenges with getting the fibre through the packer and across the entire length of the well. | Anonymous | 11:16:16 | The primary challenge of routing fibre through the packer lies in achieving continuous light transmission with acceptable signal loss, while simultaneously maintaining a reliable pressure barrier.<br><br>A key limitation is the available space for creating a pressure-testable Drymate (DMC) connection. Due to these constraints, we are typically limited to running three fibres through the packer. However, this configuration has become a standard appplication and is sufficient to support three zones, incorporating dual annulus and tubing pressure/temperature gauges in each zone, alongside Distributed Acoustic Sensing (DAS) across the entire well in O+G space.<br><br>In the case study referenced, the main challenge arose from the client selecting a different vendor for cable supply, driven by the requirement for engineered fibre suitable for Distributed Fibre Optic Sensing (DFOS). This cable did not include the aluminium buffer necessary for our standard welding process. As a result, we implemented an alternative solution involving a fusion splice combined with a mechanical gas-tight splice version of our DMC (GT DMC) in place of the conventional DMC approach.<br><br>It is worth noting that Weatherford has a partnership with the engineered cable supplier, and the cable specified for this CCUS case study is available in a weld-ready format when sourced through this arrangement.<br><br>We have developed engineering solutions for the majority of feed-through applications, drawing on extensive experience across a wide range of completion designs in the oil and gas sector. Early engagement in system design, along with a clear and realistic understanding of requirements, is essential to ensure that the appropriate hardware is specified to meet your data acquisition needs. |

| **Plenary 3 - environmental** | | | | |
|---|---|---|---|---|
| **Question directed to** | **Question** | **Question posed by** | **Submission Time** | |
| Allison, NOC | Have you considered including other types of sensors in your landers? E.g. seismic | Anonymous | 13:49:01 | We could add other sensors, yes, or equally could put our sensors on someone else's platform. The lander is really just functioning as a frame. |
| Reach Subsea | How do you get data back off your CPs? | Anonymous | 13:57:38 | A Concrete Pad itself is just a passive concrete construction placed on the seabed to be a fixed and leveled position for the gWatch (gravity and pressure measurements) we in turn want to perform.<br><br>The gWatch measurements is carried out by a sensor package which is carried by a Work Class ROV. The sensor package consists of three gravimeters and three pressure sensors. These instruments are directly connected to the ROV which is then connected to the vessel carrying the ROV. All measurements are transferred in real time to shore, and our team on-shore is then performing quality control of the data to ensure that the measurements are correct to avoid having to return to perform more surveys. |
| Allison, NOC | Do the NOC landers require ROV for deployment/recovery? | Anonymous | 13:58:05 | The landers are designed to be deployed and recovered on a line without an ROV. |
| Sentinel | What is the GHG warming value (GWP) of your tracer pleaae? | Owain Tucker - shell | 14:23:44 | For every 1kg of stored $CO_2$, the tracer is equivalent to the warming potential of 0.015g of $CO_2$. |
| Sentinel | Is the battery of the beacon tested to survive 20 years in water? | Tommaso | 14:30:03 | Our batteries have been specifically designed for this application by SAFT with a draw down analysis conducted on a specific duty cycle. Subsequent analysis on recovered beacons shows draw down tracking the predicted trend. |

| | | | | |
|---|---|---|---|---|
| Sentinel | How do you know your tracer does not partition into another phase? | Owain Tucker - shell | 14:30:53 | Literature Data: Our trcaers have a sufficiently high Log pow<br>Internal Data : We have conducted several partioning tests at reservoir T and P and with a range of Gas-to-Oil ratios<br>Field Tests: Tracerco have been using these tracers in reservoir applications for nearly 40 years |
| Sentinel | For 10Mt injection, how many tonnes of tracer do you need? | Owain Tucker - shell | 14:32:11 | The amount is dependent upon how much of a leak you want/need to detect or characterise<br>Typically for a well of volume of 10,000,000,000 kg<br>- To determine a a 0.1% leak we typically mark at c.3 ppb ( w/w )<br>- Total amount of tracer required is 30kg<br>-Additional tracer would be required to determine smaller leaks |
| Sentinel | Is there any limitation to tracers detectability in water? | Tommaso | 14:33:16 | While the tracer have very low solubility in water, Tracerco's proven pre-concentration analytical method enables highly sensitive detection, achieving parts-per-trillion ( ppt) detection limits within the concentrate. |