



# Two Subsea Wells Successfully Completed During Phase I of a Full-Scale Offshore CCS Project

## HALLIBURTON SUCCESSFULLY COMPLETES TWO SUBSEA WELLS DURING PHASE I OF A FULL-SCALE OFFSHORE CCS PROJECT

NORTH SEA

### CHALLENGES

- » Completing the first two wells for a commercial CCS project in the North Sea, which can store 1.5 million metric tons of liquid CO<sub>2</sub> annually
- » Delivering safe and cost-efficient wells for permanent CO<sub>2</sub> sequestration with a focus on well integrity
- » Enabling cross-border transportation and sequestration of industrial CO<sub>2</sub>

### SOLUTIONS

- » XtremeGrip® low ECD and Quick Lock liner hangers
- » Versa-Trieve® packer
- » X-Trieve™ XHHC retrievable production packer
- » FS2 fluid loss control valve
- » Hydrostatic-set Perma-Series® HNT packer
- » Opsis® gauges
- » SP™ tubing-retrievable safety valve

### RESULTS

- » Successfully delivered full well completion solution for open-source offshore commercial cross-border CO<sub>2</sub> transport and storage facility
- » Delivered two wells using completion technology that enabled the safe and controlled conveyance of CO<sub>2</sub> from surface to geological formation for sequestration

### OVERVIEW

Halliburton successfully delivered a top-to-bottom completion solution for a cross-border CO<sub>2</sub> transport and storage facility. Phase I of this project includes the capacity to transport, inject, and permanently store up to 1.5 million metric tons of CO<sub>2</sub> per year. CO<sub>2</sub> storage will be possible through one injection well, which was sidetracked and completed from the original exploration well and a new contingency well. With these two wells in place, the customer is motivated to drill and complete three additional injection wells to expand capacity by an additional 3.5 million metric tons to a total of 5 million metric tons annually. The expanded capacity will help the customer accelerate industrial decarbonization and provide future CO<sub>2</sub> storage options for Europe.



Well completion solution creates first open-source opportunity for customer to provide safe and **successful industrial transport, storage and decarbonization** as a commercial service.

### CHALLENGE

The safe and successful design and operation of carbon capture and storage (CCS) wells requires careful consideration of a range of technical challenges. The primary objective is to ensure the permanent sequestration of CO<sub>2</sub> underground, which is dependent on the integrity of the well. One challenge is helping prevent leakage of CO<sub>2</sub> to the atmosphere, which could occur if materials used during well construction are not selected carefully. For example, the formation of carbonic acid (H<sub>2</sub>CO<sub>3</sub>) due to the mixing of dry CO<sub>2</sub> and saline formation water can lead to corrosion of carbon steel, potentially having negative impact on well integrity. To help prevent such issues, operators must select materials suitable for the well environment and compatible with the operator's objectives.



## SOLUTION

To help ensure the safe and permanent storage of CO<sub>2</sub> during well construction, several factors were considered, including injection CO<sub>2</sub> composition, anticipated reservoir pressure evolution, well temperature variations during injection and shut-in, formation fluids composition, and previous knowledge gained from other CO<sub>2</sub> injector wells. Laboratory corrosion testing determined that tubulars and completion equipment installed at the bottom of the well should be 25% chrome alloy or superior materials to allow a 25-year well lifetime.

During well construction of the primary injection well, a 14-inch XtremeGrip® low equivalent circulating density (ECD) and 9 5/8-inch XtremeGrip Quick Lock liner hanger were installed and sand control was achieved using standalone sand screens (SAS) in the openhole section. For the lower completion of the well, the Halliburton Versa-Trieve® retrievable sand control packer and FS2 fluid loss control valve were used. The upper completion was finalized using the Halliburton hydrostatic-set Perma-Series® HNT packer, 4 1/2- and 7-inch Opsis® gauges and the SPT™ tubing-retrievable safety valve (TRSV) to ensure safety.

The contingency injector was completed in a similar manner. A 14-inch Low ECD liner hanger was installed during well construction and sand control was achieved by gravel packing the openhole section. A Versa-Trieve retrievable sand control packer and FS2 fluid loss control valve were used for the lower completion, and the upper completion consisted of the X-Trieve™ XHHC retrievable production packer, two 7-inch Opsis gauges and the SP TRSV.

## RESULTS

Halliburton delivered a full well completion solution for the open-source offshore commercial cross-border CO<sub>2</sub> transport and storage demonstration project, which will accelerate industrial decarbonization and provide future CO<sub>2</sub> storage options for Europe.

Once Phase I of the project is completed, the operator will have the capacity to capture and store 1.5 million metric tons of liquid CO<sub>2</sub> annually. Based on customer demand, the operator can drill and complete additional wells to increase the storage volume annually.

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