CASE STUDY

HALLIBURTON

North Sea

Two subsea wells successfully completed during Phase I of a full-scale offshore CCUS project

Halliburton successfully completes two subsea wells during Phase I of a full-scale offshore CCUS project

CHALLENGE

- Complete first two wells for a commercial CCUS project in the North Sea, which can store
- 1.5 million metric tons of liquid CO_2 annually
- Deliver safe and cost-efficient wells for permanent CO_2 sequestration with a focus on well integrity
- Enable cross-border transportation and sequestration of industrial CO_2

SOLUTION

- 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
- NeoStar™ tubing-retrievable
- safety valve

RESULT

- Successfully delivered full
- well completion solution for open-source offshore commercial cross-border CO_2 transport and storage facility
- Delivered two wells using completion technology that enabled the safe and controlled conveyance of CO_2 from surface to geological formation for sequestrations

Overveiw

Halliburton successfully delivered a top-to-bottom completion solution for a cross-border CO_2 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_2 per year. CO_2 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 operator 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 operator accelerate industrial decarbonization and provide future CO_2 storage options for Europe.

The IsoRite® multilateral intervention system, first installed in the Middle East in 1997, addressed the need to complete through-completion intervention operations on both new and existing wells. The intervention system had to be compatible with the

Level 4 cemented multilateral junctions installed in the region and with coiled tubing, wireline, and slickline as intervention methods. To date, multilateral intervention systems have primarily been used to enable intervention access to Level 4 cemented junctions. This system can now provide the same value and versatility to Level 2 noncemented junctions.

Well completion solution creates first open-source opportunity for operator 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, utilization and storage (CCUS) wells requires careful consideration of a range of technical challenges. The primary objective is to ensure the permanent sequestration of CO_2 underground, which is dependent on the well integrity. One challenge is to prevent the leakage of CO_2 into the atmosphere, which could occur if materials used during well construction are not carefully selected carefully. For example, the formation of carbonic acid (H_2CO_3)

caused by mixing dry CO_2 and saline formation water can lead to corrosion of carbon steel, which can potentially negatively impact 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_2 during well construction, several factors were considered, including injection CO_2 composition, anticipated reservoir pressure evolution, well temperature variations during injection and shut-in, formation fluid-composition, and previous knowledge gained from other CO_2 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-in. XtremeGrip® low equivalent circulating density (ECD) and 9 5/8-in. 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-in. Opsis® gauges and the NeoStar™ tubing-retrievable safety valve (TRSV) to ensure safety.

The contingency injector was completed in a similar manner. A 14-in. 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-in. Opsis gauges and the NeoStar TRSV.

Result

Halliburton delivered a full well completion solution for the open-source offshore commercial cross-border CO_2 transport and storage demonstration project, which will accelerate industrial decarbonization and provide future CO_2 storage options for Europe.

Once Phase I of the project is complete, the operator will have the capacity to capture and store 1.5 million metric tons of liquid CO_2 annually. Based on operator demand, the operator can drill and complete additional wells to increase the storage volume annually.

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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