

Question: What is industry's experience with large-scale sequestration of CO<sub>2</sub>?

Answer: An industry project conducted in the Sleipner Gas Field located in the North Sea is the world's first commercial-scale initiative for the storage of CO<sub>2</sub> for mitigation of climate change. A fact sheet on the Sleipner activities is provided below.

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## Sleipner

### *World's First Commercial-Scale CO<sub>2</sub> Capture and Storage Operation*

Unwanted carbon dioxide (CO<sub>2</sub>) from Statoil's Sleipner West field in the Norwegian North Sea is stored 1,000 meters beneath the seabed in a saline aquifer reservoir. Standard industry practices would release this CO<sub>2</sub> into the atmosphere; but, as a result of this CO<sub>2</sub> storage operation, Norway's CO<sub>2</sub> emissions are reduced by about 3 percent each year. Since the project's inception in October 1996, 1 million tonne of CO<sub>2</sub> have been stored per year [2,800 tonne each day, an amount equal to the CO<sub>2</sub> emissions of a typical 150 MW coal-fired power plant located in the United States.

**Rationale:** The Sleipner field is one of the world's largest producers of natural gas, but the produced gas, at 9 percent CO<sub>2</sub>, does not meet end use or pipeline specifications. To reduce the CO<sub>2</sub> content to the 2.5 percent product specification level, while meeting national CO<sub>2</sub> emissions targets, a sequestration aquifer storage strategy was adopted in October of 1996.

**Research at Sleipner:** The goal is to permanently store the CO<sub>2</sub>, and a large-scale monitoring effort (The Saline Aquifer CO<sub>2</sub> Storage, SACS) project was initiated in 1997 to monitor and verify the fate of injected CO<sub>2</sub> at Sleipner. The first phase of monitoring was completed in 2000, and researchers confirmed there was no leakage from the Utsira formation. The spread of CO<sub>2</sub> through the reservoir aquifer is recorded by seismic surveys. SACS researchers are now developing methods and documentation to verify the reliability, environmental acceptability, and safety of CO<sub>2</sub> storage.

**Method:** Two towers, each about 20 meters high, are located on the platform. In the first tower, the CO<sub>2</sub> is captured (amine absorption) and compressed. Energy freed during the amine process is used to run two 3 MW generators, thereby, providing power for the platform. Next, the CO<sub>2</sub> is stripped from the amine, resulting in injection-ready CO<sub>2</sub>. A separate injection well is used to inject the CO<sub>2</sub> into the Utsira aquifer, a massive sandstone formation with a shale cap rock 1,000 meters under the seabed. The well itself reaches about 4 kilometers horizontally into the formation. The hydrocarbon reservoir used for natural gas production lies below Utsira at 3,500 meters.

**Capacity:** It is estimated that the Utsira formation can store up to 600 billion tonne of CO<sub>2</sub>. The entire CO<sub>2</sub> emissions from all of Europe's power plants could be stored in this structure for the next 600 years. While permanent storage cannot be assured, it's estimated that the injected CO<sub>2</sub> will remain in the structure for at least the next several hundred years.

**Cost:** Carbon capture and storage is technically feasible for many applications, including stationary power plants, but it is not yet cost-effective. The Statoil operation was undertaken largely because of the existing Norwegian CO<sub>2</sub> tax that was instituted in 1995.

**Partners:** Research at Sleipner is coordinated by the International Energy Agency's Greenhouse Gas R&D Programme, and managed by Statoil. Other contributing partners include BP Amoco, Mobil, Norsk Hydro, Saga, and Vattenfall. International government and industry organizations are providing research and technology

**DOE Participation:** The U.S. DOE is a member of the IEA Greenhouse Gas R&D Programme that oversees the Sleipner SACS project. DOE regularly participates in project workshops on SACS, and funds several complementary research projects in the Carbon Sequestration Program.

**Additional Information:** Additional information on Sleipner can be found at the following weblinks:

1. <http://www.ieagreen.org.uk/sacshome.htm>
2. [http://www.statoil.com/STATOILCOM/SVG00990.NSF/web/sleipner\\_main.html](http://www.statoil.com/STATOILCOM/SVG00990.NSF/web/sleipner_main.html)