

# Demonstration Plant for CO<sub>2</sub> Injection into an Onshore Saline Aquifer

## 1. Introduction

In the Kyoto Protocol adopted in 1997, Japan promised to reduce 6% greenhouse gases emission compared to 1990 by 2008 to 2012. Nevertheless, the country's emission of greenhouse gases rose 7.6% in 2002. Therefore, implementing drastic measures to reduce greenhouse gases has become an urgent necessity.

Geological sequestration of carbon dioxide (CO<sub>2</sub>) is considered one of the most promising technologies for reducing CO<sub>2</sub> significantly. In Japan, the "CO<sub>2</sub> Geological Sequestration Project" has been carried out by the Research Institute of Innovative Technology for the Earth (RITE) in cooperation with the Engineering Advancement Association of Japan (ENAA) since 2000. For the purpose of this project, Nippon Steel Corporation (NSC) constructed Japan's first demonstration plant for CO<sub>2</sub> geological sequestration for the client RITE/ENAA. The plant was installed at the Iwanohara base (in Nagaoka City, Niigata) of Teikoku Oil Co., Ltd. and put into operation in July, 2003 and ended in January, 2005 with the total injected CO<sub>2</sub> amount of 10,400 tons. No damage was observed despite Niigata Chuetsu Earthquake in October, 2004. RITE is continuously monitoring injected CO<sub>2</sub> behavior.

## 2. Characteristics

In the ordinary CO<sub>2</sub> geological sequestration process, CO<sub>2</sub> is collected from concentrated emission sources and transported to the sequestration site by gas pipelines, tanker trucks, or vessels. However, in testing the demonstration plant, which is comparatively small in scale, commercially available liquefied CO<sub>2</sub> was used. The plant is designed so that liquefied CO<sub>2</sub> supplied from the storage tank is converted into CO<sub>2</sub> in a supercritical state by a booster pump and a heater (critical point of CO<sub>2</sub>: 31.1°C, 7.28 MPa) before being fed into an injection well. From the injection well, the CO<sub>2</sub> is injected into an aquifer below impervious bedrock called a cap rock and sequestered there. The aquifer is located some 1,100 m below the ground surface.

The plant is operated automatically either at a constant injection rate or with a constant injection pressure. Unattended operation of the plant with remote monitoring is also possible. The injection rate can be set freely by adjusting the stroke of the liquefied CO<sub>2</sub> pump or changing the speed of the inverter-controlled motor.

## 3. Future Activity

At present, NSC also participates in RITE's project entitled "Cost Saving CO<sub>2</sub> Capture System." Through the supply of its integrated engineering service, from separation and recovery of CO<sub>2</sub> to transportation of CO<sub>2</sub> by pipeline to injection of CO<sub>2</sub>, NSC hopes to continue contributing to the curbing of global warming.

( For further information, contact  
Energy Facilities, Civil Engineering & Marine  
Construction Division )

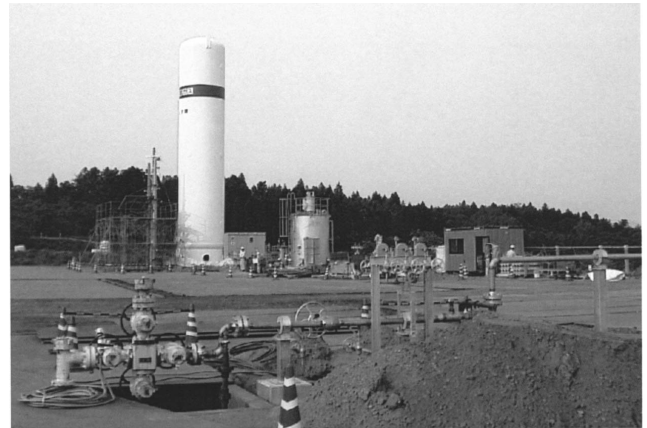


Fig. 1 Demonstration plant for CO<sub>2</sub> injection into an onshore saline aquifer

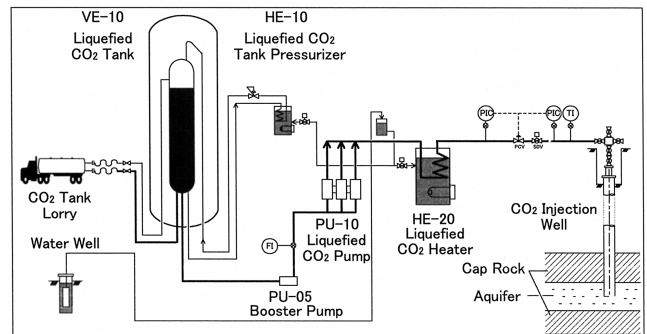


Fig. 2 Process flow sheet

Table 1 Plant specification

Injection temperature	32 °C
Injection pressure	12.9 MPa (maximum)
Injection rate	48 ton/day (maximum)

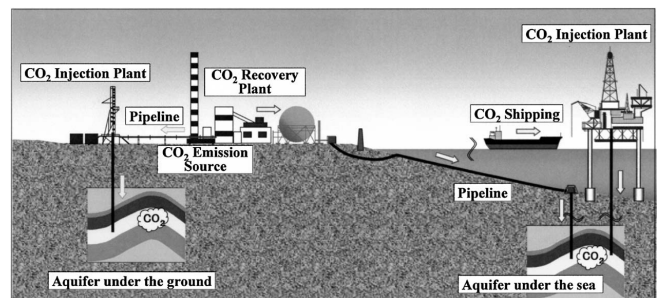


Fig. 3 Image of CO<sub>2</sub> storage system under the ground