

## Development of Gas-Flux Monitor to Measure Soil CO<sub>2</sub> Emission from Ground Surface into Atmosphere at CO<sub>2</sub> Geological Storage Site

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**Abstract:** Today, the reduction of greenhouse gases such as CO<sub>2</sub> is emerging as a key issue that must be tackled through global cooperation. At the 2015 United Nations Climate Change Conference (COP21) held in Paris, France, in December 2015, 190 participant countries discussed and agreed upon a framework for global warming countermeasures from 2020 onward. Carbon Capture Utilization & Storage (CCUS) and Carbon Capture & Geological Storage (CCS) systems combine separation and capture of CO<sub>2</sub> from large-scale CO<sub>2</sub> emission sources, such as coal-fired power plants, with their sequestration and storage underground where those carbons were originally stored for a long period of time. In order to carry large scale of CCUS and CCS projects, the safety against gas leakage from the storage to surface is the critical issue for local communities around the sites. However, the criterion for the leakage CO<sub>2</sub> gas, that flux could be over natural soil CO<sub>2</sub> gas-flux, has not been regulated for a decision making to stop injecting CO<sub>2</sub>.

In this study, the gas-flux monitor and measurement methodology have been developed to measure soil CO<sub>2</sub> emission from ground surface into atmosphere. The automatic operating system to control gas chamber ventilation was developed. At the Ito Natural Analogue Test (INAS), Kyushu University, a series of soil CO<sub>2</sub> gas-flux monitoring was carried out using with the monitor for three months. Sensitivities of the environmental factor such as soil surface temperature and precipitation for soil CO<sub>2</sub> gas flux were investigated. Furthermore, a criterion or a threshold value has been presented for a warning alarm on CO<sub>2</sub> gas leakage at CCS sites based on those long-term measurement results.

**Keywords:** CO<sub>2</sub> Emission, CCS, CCUS, Soil Gas-Flux, Monitor, Leakage Monitoring

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