

## Optimum Designing of Geophysical Monitoring for Geological Storage of Carbon Dioxide using Reservoir Simulation Techniques

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Reliable and cost-effective monitoring for the storage of carbon dioxide(CO<sub>2</sub>) is of great importance to ensure safe and effective geologic sequestration. Time-lapse 3D seismic imaging has been used successfully at Sleipner CO<sub>2</sub> storage in Europe and the high-resolution cross-well seismic tomography has been adapted to monitor CO<sub>2</sub> behavior in EOR projects as seismic survey method is one of the most common geophysical tools in the petroleum field. The seismic monitoring methods are, however, less economical and other geophysical survey should be worthy of consideration to design the cost-effective monitoring.

The numerical simulation has been developed in this decade to predict the future of the geological reservoir at oil fields and has also been utilized to conduct for the production control at geothermal fields. As the simulator has been able to calculate a multi-phase and multi-component of gas and fluid owing to the innovation of the technology and the increase of the computer ability, modeling of the process for underground injection and dilution of CO<sub>2</sub> at the reservoir can be made using the numerical simulation techniques with equations of various state of CO<sub>2</sub>.

The postprocessors for the various geophysical surveys have recently been developed which calculate the geophysical properties such as gravity, electric potential and resistivity distribution based on the output of the reservoir simulation. Geophysical change due to the underground injection of CO<sub>2</sub> and associated change of the physical property of the geological reservoir can be predicted by the numerical simulation and postprocessors. Based on the above concept, a feasibility study on designing of the optimum monitoring programs for geological sequestration of CO<sub>2</sub> started in 2002 under the funding of new pre-feasibility study program in NEDO. Three objectives were selected for the feasibility study as follows;

- (1) Study on a numerical simulator
- (2) Study on appropriate postprocessors
- (3) Field experiment for evaluation of the monitoring methods

In this paper we will present the basic concept of the study and preliminary results of the objectives.