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Self-potential monitoring in Aneth test field, USA

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An appropriate monitoring program is indispensable for an individual geological carbon sequestration project to detecting subsurface changes within the reservoir, to provide for potential risk such as CO₂ leakage through the caprock, and to improve the predictive capability of reservoir simulation. AIST has studied various geophysical monitoring method and numerical simulation approach to combine with reservoir simulation technique. Self-potential (SP) monitoring is one of these monitoring method, which could detect subsurface fluid flow including CO₂ movement through electrical potential generated by electrokinetic effect, and REDOX potential change detected through geobattery mechanism.

To refine our monitoring technique in advance of domestic CO₂ injection test, we have carried out small-scale self-potential monitoring for the large-scale CO₂ injection test in Aneth oil field, Utah, USA. Aneth oil field is located in the southeastern part of Utah and found in 1956. Peak oil production rate was c.100,000 BOPD, and current production rate is around 10,000 BOPD. Waterflood for EOR commenced in 1962, and this water has switched to supercritical CO₂ fluid in the Section 13 of this oil field from early 2008 for carbon sequestration experiment of SWP (Southwest Regional Partnership for carbon sequestration), which is one of the seven regional carbon sequestration partnerships in USA.

To monitor self-potential in Aneth field, we installed 16 Ag-AgCl non-polarizing electrodes in the test field. To detect SP changes due to electrokinetic effect caused by subsurface flow change, electrodes are installed at eight sites, and three electrodes are installed around wells C313, C313 SE and C413, to detect REDOX potential change caused by chemical change in the deeper part of well casing. To use as reference point, three electrodes are installed at C124 abandoned well. The first installation of this SP monitoring system was in November, 2007, just before the onset of CO₂ injection in the Section 13, and we have finished our installation in May 2008. Monitoring data is stored in a memory card in the data logger, and one sample per 6 hours is transmitted to Japan using Argos satellite to monitor the system.

At the beginning of CO₂ injection, we detected gradual increase in SP at C313 injection well, possibly due to change in REDOX condition at the reservoir depth due to the injected supercritical CO₂ fluid. Except this SP change, there is no significant SP change clearly due to reservoir fluid flow at present.

Keywords: CCS, geosequestration, monitoring, self-potential, SP, Aneth