On the geoelectric monitoring at the CO2 sequestration into an aquifer (2)

Toshiyuki Tosha[1]; Tsuneo Ishido[2]; Shinichi Takakura[2]; Mituhiko Sugihara[3]; Akinobu Miyakoshi[4]

[1] AIST; [2] GSJ/AIST; [3] GSJ; [4] GSJ,AIST

1. Introduction

The Kyoto Protocol came into effect on February 16 this year. The radical action is needed to attain 6% of curtailment target to the reference year during the first commitment period from 2008 to 2013. The geological sequestration to a saline aquifer is one of the most feasible methods. We have carried out geophysical measurements during the CO2 injection into a shallow saline aquifer to find out feasible monitoring methods.

2. Outline of the experiments

At the results of the air injection, the increase of the resisitivity was observed at the aquifer layers close to the injection well. The decrease of the resisitivity was also found at the further area from the well. The increase of SP was apparent starting after the injection and was larger close to the injection well. The increase was possibly caused by the oxidation-reduction change at the aquifer.

Although the aquifer will be oxidized by pressing air, it is unclear whether the geological formation will be oxidized or de-oxidized by the CO2 injection. The CO2 was injected in a gaseous state as the well is so shallow. The groundwater level was deeper than anticipation around the wells, GSK-1 and -2 at the last experiments. For this reason, the wells GSK-1 and -2 as well as the well SCW-1 were used where the groundwater is going up to near the surface.

3. Results of the logging

Temperature, conductivity, and oxidization-reduction potential were measured using simple logging tools at SCW-1. Water level change was also monitored and water was sampled at several depths for the geochemical analysis. SCW-1 is a vertical well with a digging depth of 114.6m, and a casing pipe is set at 43.6m depth. Measurements were conducted before and during the CO2 injection and at one week after the experiment end. Lost circulations were reported at the depths of 58.6m, 68m, 95m, and 108m during the digging well.

The largest temperature changes were observed at the depth of 40m during and after the injection. The temperature increased probably due to the heating of the groundwater in the formation. No significant temperature changes were observed at the depth deeper than 56.8m Temperature change at one week after the experiment end was falling to the almost same temperature level as experiment started.

The conductivity increased at the shallow formations. The change was not significant below the lost circulation of 56.8m. The conductivity was kept at higher level at one week after the injection. The influence of CO2 injection appeared also in oxidization-reduction potential change. The rise of the potential was observed during the injection test and lasted at one week after the test.

4. Results of the surveys

A survey line for electric prospecting was set up to pass the well SCW-1. Although the decrease of the regisitivity was observed at the injection well, the change had been continued. As there were rainfalls during the survey period, the regisitivity change was influenced by the rain. The separation of the signal from the rainfall noise seemed to be impossible since the amplitude of rainfall noise had come out greatly.

The increase of the gravity was, on the other hand, observed at the near survey points around the injection well, suggesting the movement of the shallow groundwater. The change of self-potential was also recorded. As the rise of the oxidization-reduction potential was observed by logging, the CO2 injection increased oxygen partial pressure at the aquifer. This made the SP change at the surface.

5. Conclusive remarks

The gaseous CO2 injection test was conducted with geophysical surveys and the logging from a viewpoint of the monitoring technique development in the geological sequestration. Gravity and SP changes were observed during the injection but no significant change was recorded in regisitivity measurement due to the rainfall.