History matching using public information and reservoir evaluation

*Yuuki Shigeoka[1], Haruki Nishiyama[1], Hiroshi Kinoto[1], Takaomi Tobase[2], Takahiro Nakajima[3], Ziqiu Xue[3]

1. J-POWER Business Survice Corporation, 2. Electric Power Development Co., Ltd., 3. Research Institute of Innovative Technology for the Earth

The Japanese government plans to reduce greenhouse gas (GHG) emission by 80% by 2050 compared to 2013. More than 90% of the Japan’ s GHG emission is carbon dioxide (CO2) and approximately 40% of them is accounted for by electric power sector. In the electric power sector, it is required to achieve both stable energy supply and decarbonization, so that CCS is essential to thermal power generation using fossil fuels. Therefore J-POWER Group Company has researching on geological storage of CO2.

One of the issues of CCS is reservoir evaluation. There are two points to consider for the reservoir evaluation. One is the evaluation of injection performance and the other is the evaluation of storage capacity of underground storage. In this research, a large-scale geological virtual model is made referring to the Quest CCS project in Alberta, Canada. Then, history matching using public information from Alberta government is conducted. (Note that this study is based on public information and is different from the evaluation of business-related companies.)

The research was conducted in the following two steps;

I) Production of basic analysis model
For the first step, an analysis model of virtual site referring to Quest CCS project was created. The physical parameter, like sedimentation environment and ground physical properties, were opened to the public on the Alberta website, and we utilized these data. Then the analysis model was revised with history matching between the monitoring data obtained in the Quest project and the prediction simulation. As a result, the base analysis model for assessments of storage capacity was created.

II) Storage capacity evaluations
As the second step, storage capacity was evaluated by numerical studies using the base analysis model created in the first step. Maximum injection amounts (storage capacity) under a certain reservoir pressure increment were calculated by the case studies about arrangement of injection wells. We analyzed the factors affecting storage capacity and obtained the knowledges about geological properties how they influence the evaluation. These knowledges will be beneficial for predicting both pressure elevation in the reservoir layer and distribution of CO2 plume. They will be also helpful for decision making on "reservoir management", such as arrangement of injection wells, number of wells, injection rate and time, and installation of pressure relief wells.

Keywords: Carbon dioxide Capture and Storage, Reservoir Simulation, Storage capacity evaluations

