

BELL CREEK FIELD PROJECT

Bell Creek Oilfield in the Powder River Basin, Southeast Montana
Plains CO₂ Reduction Partnership



NETL

NATIONAL ENERGY TECHNOLOGY LABORATORY

BACKGROUND

The Plains CO₂ Reduction Partnership, (PCOR), led by the Energy and Environmental Research Center (EERC), is working with Denbury Onshore LLC to study CO₂ storage associated with a large-scale commercial enhanced oil recovery project at the Denbury-operated Bell Creek Field Oilfield. The lessons learned from the study are providing stakeholders with information necessary to move CCS technology development and deployment into broader commercial implementation.

A variety of modeling activities are conducted at the Bell Creek site including geologic models at multiple scales, predictive multiphase fluid flow simulations, geomechanical modeling and geochemical simulations. The models interpret and analyze the geologic, reservoir, and fluid data for predictive simulations—work that identifies data gaps and guides researchers in predicting and addressing challenges associated with long-term CO₂ storage.

PROJECT OVERVIEW

Beginning in 2010, characterization efforts began to better understand the associated CO₂ storage at the Bell Creek Field. The target injection horizon in the Field is an oil-bearing sandstone reservoir in the Muddy Formation at a depth of about 4,500 feet. One of the project goals was to demonstrate that CO₂ storage can be safely and permanently achieved on a commercial scale in association with an enhanced oil recovery operation and that oil-bearing sandstone formations are viable regional storage formations for CO₂. Another goal of the project was to show that monitoring, verification, accounting (MVA) and assessment methods can be used to effectively monitor CO₂ storage in association with commercial-scale CO₂/EOR projects.

The Bell Creek project began CO₂ injection in May 2013. The CO₂ is transported to the site via pipeline from the Lost Cabin and Shute Creek gas processing plants in Wyoming, where it is separated from the process stream during natural gas refinement. The CO₂ is delivered at a target rate of more than 50 million cubic feet per day to the Bell Creek oil field and injected into the oil-bearing zone of the Muddy Formation. Injection is occurring in a staged approach with nine planned developmental phases, injection is currently underway in phases 1-4. The reservoir is suitable for miscible flooding conditions and is expected to meet the incremental oil production target of 40 to 50 million barrels.

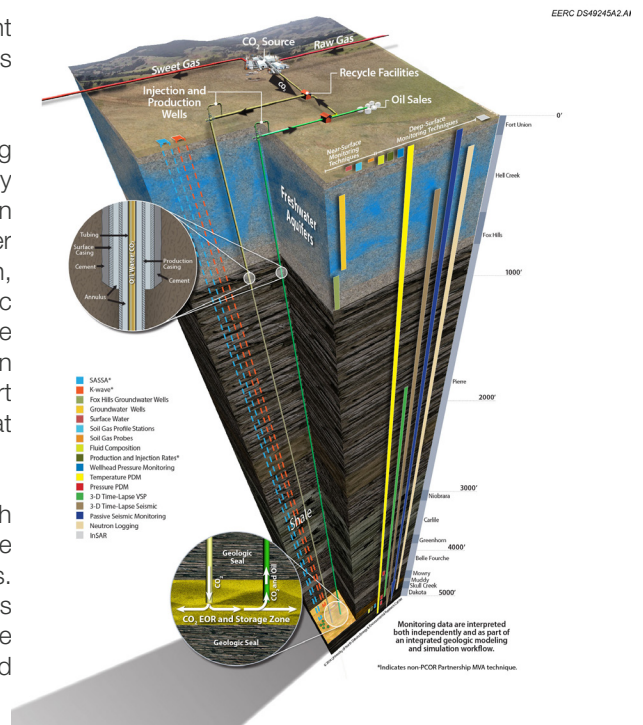
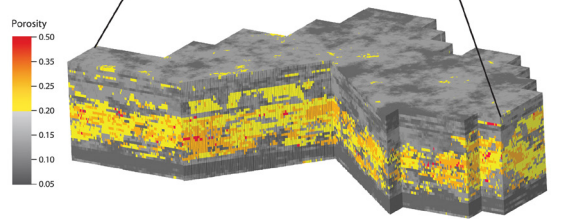
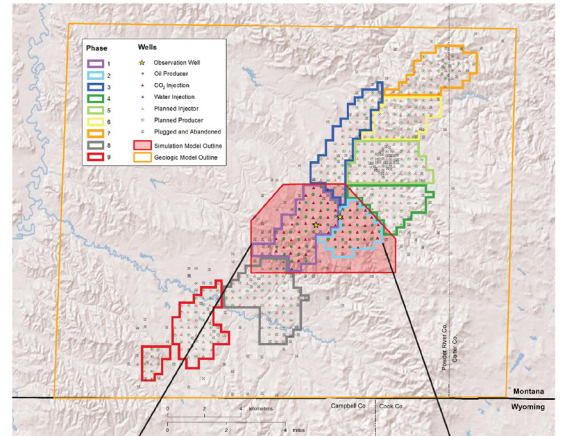
A robust and iterative site characterization program was initiated in 2010 to provide data necessary to establish baseline reservoir characteristics and modeling and simulation activities. Characterization activities continue to provide a solid foundation for other critical elements of the Bell Creek project like risk assessment, modeling and simulation and MVA that create an increased confidence in predicting and tracking CO₂ movement.

PROJECT SUCCESSES

The Bell Creek Field Project is successfully demonstrating regionally significant large-scale storage in a commercial EOR setting. These accomplishments could yield economic benefits to the region.

The project is improving the cost-effectiveness of forecasting and tracking CO₂ movement. A site characterization program provides data necessary to establish baseline reservoir characteristics and modeling and simulation activities. Characterization activities provide a solid foundation for other critical elements of the project like risk assessment, modeling and simulation, and MVA. Research data produced after injecting more than 1 million metric tons of CO₂ between May 2013 and July 2014 provided relevant baseline MVA data that aided in evaluating the site security, accounting, and location of the lateral and vertical extent of CO₂ in the Bell Creek oilfield. As part of this effort, an adaptive management approach was implemented that integrates operations and monitoring in to a single process.

The PCOR Partnership Program is producing several high-impact outreach products. Five award-winning public television documentaries were produced, with another two due to be completed in the next two years. In addition, a 20-minute technical video was also produced that acquaints technical audiences with the basics of casing-conveyed permanent downhole monitoring systems, as well as the unique field installation practices required by these systems.



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