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W. Neal Smith[1], Sinisha A. Jikich[1], Grant Bromhal[2], Duane H. Smith[3], Turgay Ertekin[4], Olufemi Odusote[4]
(1) National Energy Technology Laboratory/EG&G, Morgantown, WV (2) National Energy Technology Laboratory/Parsons Technologies, Morgantown, WV (3) National Energy Technology Laboratory/U.S. Department of Energy, Morgantown, (4) Penn State University, University Park, PA

The Use of Reservoir Simulation for the Design of a Pilot Project for Sequestration of Carbon Dioxide and Enhanced Coalbed Methane Production

The possible contribution to global warming by anthropogenic carbon dioxide has received considerable attention in recent years. Geological sequestration of carbon dioxide has been proposed as one means of reducing these contributions. Unmineable coalseams are good candidates for such sequestration projects because they have served as excellent storage reservoirs for sorbed gases for geological time periods. Additionally, the enhanced methane production from these reservoirs makes a favorable contribution to the economics of the projects.

This study examines the design considerations for a proposed carbon dioxide sequestration/enhanced coalbed methane pilot project. The project consists of an isolated 3000 ft square pattern. The pattern is formed by four 3000 ft long horizontal wellbores on the exterior of the square that serve as production wells. At the center of the pattern are four horizontal wellbores that serve as either producers or injectors. The central wellbores are oriented perpendicular to the exterior wellbores. Methane production occurs through all wellbores until the reservoir pressure is reduced to given value, at which time the central wellbores are converted to carbon dioxide injectors while the exterior wellbores continue methane production. In this work we consider the effects of various injector lengths and operating pressures on the performance of the project.

On the bases of the ultimate amount of carbon dioxide sequestered, central injectors of approximately 600 feet are found to be optimum. However, this length for the injectors does not represent the highest injection rate of carbon dioxide, nor does it correspond to the largest amount of methane recovered. This paper examines the trade offs involved for injector lengths between 300 ft and 1000 ft and injection pressures from approximately 50% to 100% of the initial reservoir pressure. The effects of sweep efficiency and concentration profiles are analyzed for their contribution to project performance.