

NORTHWEST MCGREGOR FIELD CO₂ HUFF ‘N’ PUFF: A CASE STUDY OF THE APPLICATION OF SELECTED GEOPHYSICAL TECHNIQUES FOR CO₂ MONITORING IN A DEEP CARBONATE RESERVOIR

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ABSTRACT

As part of Phase II of the U.S. Department of Energy’s Regional Carbon Sequestration Partnership Program, the Plains CO₂ Reduction Partnership has conducted field activities to determine the effects of injecting carbon dioxide (CO₂) into an oil field in the U.S. portion of the Williston Basin. The purpose of the activities was to evaluate the potential dual purpose of CO₂ storage and enhanced oil recovery in carbonate rocks deeper than 2440 m. One of the goals of the project was to evaluate the ability of two geophysical technologies, specifically Schlumberger’s Reservoir Saturation Tool (RST) and Vertical Seismic Profiling (VSP), to detect a small-volume CO₂ plume in deep carbonate reservoirs. Specifically, a CO₂ huff ‘n’ puff test was conducted on an oil-producing well in the Mission Canyon Formation at a depth of approximately 2454 m in the Northwest McGregor oil field in Williams County, North Dakota. During the test, 440 tons of CO₂ was injected into a single well and allowed to “soak” for 2 weeks, after which the well was put back into production. The RST and VSP technologies were applied before and after the injection in an effort to observe the disposition of the injected CO₂ within the reservoir. The results of the RST and VSP indicated that the CO₂ penetrated approximately 300 feet horizontally and 50 feet vertically into the reservoir and suggest that the RST and VSP technologies may be effective monitoring, verification, and accounting tools for deep carbonate oil reservoirs.