

USGS Carbon Dioxide Storage Resource Assessment—Application in the Rocky Mountain Basins of Wyoming

Merrill, Matthew D.^{*1}; Blondes, Madalyn S.¹; Brennan, Sean T.¹; Buursink, Marc L.¹; Craddock, William H.¹; Covault, Jacob A.¹; DeVera, Christina A.¹; Drake II, Ronald M.²; Freeman, Philip A.¹; Gosai, Mayur A.¹; Lohr, Celeste D.¹; Mars, John C.¹; Slucher, Ernie R.¹; Warwick, Peter D.¹ (1) U.S. Geological Survey, Reston, VA. (2) U.S. Geological Survey, Lakewood, CO.

The 2007 Energy Independence and Security Act directs the U.S. Geological Survey (USGS) to conduct a national assessment of potential geologic storage resources for carbon dioxide (CO₂). Brennan and others (2010) published the USGS CO₂ storage assessment methodology following internal and external peer reviews and a public comment period. The methodology is non-economic and intended to be used at regional to subbasinal scales with storage assessment units (SAUs) based on common geologic characteristics. SAUs have an upper depth limit of 3,000 feet to ensure CO₂ is in a supercritical state, and a lower limit of 13,000 feet below surface, a depth accessible with average injection pipeline pressures. An additional deep SAU is created if a reservoir formation has potential storage at depths below 13,000 feet.

Assessment inputs and SAU boundaries are assembled with data obtained from proprietary commercial databases, published literature, and cooperation with various State geological surveys and the NETL Regional Carbon Sequestration Partnerships. National USGS CO₂ storage resource assessment results are scheduled to be released in 2013.

The three-year national assessment began in September 2010; as of December 2010, CO₂ storage assessments have been completed in 5 major Rocky Mountain basins within Wyoming: the Bighorn Basin (12 SAUs), Hanna-Laramie-Shirley Composite Basins (12 SAUs), Powder River Basin (10 SAUs), Southwest Wyoming Composite Basins (14 SAUs), and the Wind River Basin (13 SAUs). These 61 SAUs, each representing an individual reservoir-seal pair, were evaluated for CO₂ storage in discussion with an internal assessment panel.

Across the five assessed basins, a generally consistent list of target formations were identified with six to ten individual reservoir-seal pairs selected for assessment. Depth to the target formation in many SAUs exceeded the 13,000 foot threshold resulting in the creation of separate deep SAUs.

Paleozoic strata in these basins included few effective seals, therefore often one large composite SAU or a single Tensleep SAU sealed by the Permian Phosphoria Formation was assessed. Triassic and Jurassic formations, particularly the Nugget Sandstone and the units of the upper Chugwater Group, were assessed across four basins; however the areal extent of the Gypsum Springs Evaporite seal restricted the area assessed. Cretaceous formations represent approximately three quarters of all SAU reservoir-seal pairs including the Cloverly-Thermopolis, Muddy-Mowry, Frontier-Niobrara, numerous sands within the Steele/Cody/Pierre/Baxter shales, and Mesaverde Group sands sealed by the Lewis Shale.