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A CO_2-PENS model of methods and costs for treatment of water extracted during geologic carbon sequestration

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ABSTRACT

Extraction of water during subsurface carbon sequestration may be useful for the control of CO_2 placement, reducing pressure risks, and mitigating environmental risks. Desalination of this water may be possible if costs are kept low, in order to minimize the quantity that must be reinjected or otherwise disposed. Added value may be recovered in the form of treated water that can be reused by carbon capture, sequestration, and other industrial processes. Total dissolved solids will range from 10,000 mg/L up to over 100,000 mg/L, and temperatures may range up to 120°C, once the water is brought to the surface. We have developed a system-level, mesoscale analysis module for the CO_2-Predicting engineered natural system model to analyze the feasibility of treatment, the costs of treatment, the value of energy recovery, and the costs of concentrate disposal. Costs are derived from a database of reported literature values. The model allows the user to select the most economic options for treatment, to compare costs, and to understand the trade-off of risks and costs. Results of preliminary modeling indicate that while reverse osmosis is feasible within certain temperature and salinity ranges, nanofiltration and thermal methods may be more cost-effective or otherwise feasible.

Keywords: Carbon sequestration; Reverse osmosis; Nanofiltration; Multiple-effect distillation; Multistage flash distillation; Thermal distillation; Brine concentrate disposal

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