the ENERGY lab

PROJECT FACTS

Carbon Sequestration

Argonne National Laboratory - Management of Water from Carbon Capture and Storage

Background

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) is helping to develop technologies to capture, separate, and store carbon dioxide (CO_2) to aid in reducing green-house gas (GHG) emissions without adversely influencing energy use or hindering economic growth. Carbon capture and sequestration (CCS) — the capture of CO_2 from large point sources and subsequent injection into deep geologic formations for permanent storage — is one option that is receiving considerable attention.

Argonne National Laboratory (ANL), one of DOE's oldest and largest national laboratories for science and engineering research, contends that by withdrawing water already residing in the receiving geological formations, the pressure caused by injection could be reduced and additional pore space freed up to sequester CO_2. However, the produced formation water is typically of low quality (typically due to elevated total dissolved solids [TDS] concentrations) and must be handled and disposed of with care to prevent adversely affecting surface and groundwater resources. Nevertheless, there is potential for beneficial use of produced water from CO_2 sequestration operations. NETL is providing funding to ANL to assess the available options for managing the water extracted from geologic formations receiving CO_2 for storage purposes, including applications for beneficial use of the water.

Figure 1: Typical CO_2 injection well at an oil field site.

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PARTNERS

None

PROJECT DURATION

Start Date	End Date
01/2010	06/2011

COST

Total Project Value
$150,000

DOE/Non-DOE Share
$150,000 / $0

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U.S. DEPARTMENT OF ENERGY

Project Description

ANL will evaluate formation water withdrawn in association with CCS in a manner similar to that of produced water from oil and gas wells and develop possible uses and applications. In oil and gas exploration, produced water includes saline water found in underground formations that is brought to the surface in association with oil and gas extraction. For the purpose of geologic sequestration of CO_2, production of water is not necessary in many cases, but may be withdrawn from formations receiving injected CO_2 in an attempt to increase available pore space and alleviate overall formation pressure. Examples of management options for produced water include reinjecting the water into another formation (with or without treatment), treating and discharging the water to a surface water body, evaporating the water, or treating and reusing the water for some other beneficial purpose. A large number of promising geologic sequestration formations identified in the United States and Canada are deep saline formations in which formation water, if withdrawn in association with CCS, is likely to be quite salty, thereby limiting the options that can be selected without first treating the water.

To determine if formation water can be used for additional applications, ANL will investigate industries or sectors that may be able to beneficially reuse water that is of lesser or different quality than drinking water. Each of the possible applications will be evaluated to determine the water quality required supporting them, the treatment options necessary, and the costs associated with each. ANL will also conduct a qualitative investigation into innovative ways of using some of the components contained in formation water, such as heat (geothermal energy) and chemical constituents (lithium or other uncommon elements).

Figure 2: Water storage tanks storing produced formation water from an oilfield enhanced oil recovery (EOR) operation injecting CO_2.

Goals/Objectives

The principle project focus is to gather information on the extraction and reuse of formation water produced from CCS operations. The project investigates options for managing water removed from geologic formations, the costs of those options, and the potential for beneficial use of the water. To meet this goal, ANL will obtain data from a variety of sources including the National Carbon Database (NATCARB), the Regional Partnerships, state geological surveys, the United States Geological Survey (USGS), and other sources to describe the chemical and physical characteristics of the water currently found in key receiving formations. This information will allow ANL to identify industries or sectors that can beneficially reuse water and provide a basis to evaluate the required water quality and level of treatment needed to support those uses.

Benefits

NETL and the entire CCS stakeholder community will benefit from coordinated and focused information on where the formation water should be extracted, at what point in the sequestration process the water should be extracted, and possible applications for the water withdrawn from the formation. Some industries and industrial processes may benefit from the availability of CCS produced water in their regions,. Produced water may also have applications for geothermal power generation, as recent technological advances have lowered the minimum required temperature of geothermal fluids. Agriculture and livestock production may also benefit from the availability of produced water (particularly in arid regions) as the water quality requirements for crops and livestock are typically less than those for human consumption.