

PROGRAM facts

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NATIONAL ENERGY TECHNOLOGY LABORATORY

Sequestration

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GEOSEQUESTRATION FIELD EXPERIMENTS

As the concept of carbon sequestration has moved forward, the U.S. DOE has supported field experiments to test the storage of carbon dioxide (CO₂) in underground formations. Acquiring regulatory approval was an important part of these experiments and provides valuable insights for future deployments. Compliance and permitting efforts are highlighted below.

Mountaineer Project, American Electric Power (AEP)

AEP is interested in the possibility of capturing CO₂ from its Mountaineer Power Plant in New Haven, WV and injecting it into a saline formation that underlies the facility. The project is currently in the assessment phase, and no CO₂ has yet been injected. AEP has performed preliminary designs of CO₂ capture and onsite pipeline transport to ensure they do not violate any of the facility's existing permits. Seismic tests of the region have been conducted and a 10,000 foot test well was drilled. These activities were granted a categorical exclusion under NEPA on the basis that they were needed to obtain the data necessary to perform an Environmental Assessment. The West Virginia State Oil and Gas Division granted the well a test well variance (or Class V permit) under the UIC Program. AEP has undertaken a significant community outreach and education effort in preparation for possible future CO₂ injection.

West Pearl Queen, Strata Production

In this experiment, 2,100 tons of CO₂ was injected into a depleted oil reservoir in Lost Hills, NM, 4,000 feet below the surface. The experiment utilized two existing wells, one for CO₂ injection and another for monitoring. The activities received a categorical exclusion under NEPA based on the fact that the test involved a smallscale and unsustainable injection deep underground. The experiment was conducted on federal lands and the Bureau of Land Management required the operators to conduct archeological and biological surveys of the area before seismic surveys were allowed. These surveys entailed walking the property to ensure there were no Indian artifacts, endangered species, or sensitive ecosystems that could be compromised by the heavy off-road trucks employed for a seismic survey.

Frio, University of Texas Bureau of Economic Geology

A small amount of CO₂, 3,000 tons, was injected into a deep saline formation. The investigators performed an Environmental Assessment under NEPA and received a Finding of No Significant Impacts (FONSI). As a part of a request of the Texas Commission on Environmental Quality for Class V permit under the UIC program, the project developers prepared a high-quality 100-page document describing the geology and hydrology of the injection zone, plans for construction and operation of the injection well, and results from a reservoir modeling effort. The basis for the Class V request was that the Frio area is primarily a depleted oil field, and that the current experiment was to be conducted in a saline zone for the purposes of using an undisturbed geology that would provide clearer data and enhanced learning. The Class V permit was granted.

Central Appalachian Basin, Consol Energy

This field test is being coordinated with a primary coal bed methane (CBM) recovery project. Roughly 26,000 tons of CO₂ will be injected into a coal seam at the end of primary CBM recovery in late 2005. The well employs slant hole technology and has the potential to be highly effective in enhanced CBM recovery. The operators performed an Environmental Assessment under NEPA and received a Finding of No Significant Impacts (FONSI). The primary CBM recovery project required permits for gas recovery wells and produced water.

Tiffany, Burlington Resources

This experiment had minimal permitting requirements. It was conducted in an established natural gas production area, the San Juan Basin in New Mexico, and utilized existing infrastructure including a pipeline and injection wells. Research was conducted by Advanced Resources International following the 6-year commercial injection of 280,000 tons of CO₂ for CBM recovery.

Weyburn, Alta Energy

This field test is affiliated with the commercial scale EOR operation at Weyburn. The injection wells were permitted as a part of the ongoing oil production operations at the Weyburn field. The major permitting activity required for the field test was for the 140 mile pipeline needed to transport CO₂ from Dakota Gasification to the Weyburn field. The segments on the U.S. and Canadian side were of course under different jurisdictions. After a public hearing, Canada's National Energy Board approved the application from Souris Valley Pipeline in October 1998. In the United States, the pipeline was approved by the Federal Energy Regulatory Commission. On the U.S. side the pipeline travels west from Dakota Gasification and then north following oil reservoirs. This path creates strategic possibilities but also takes the pipeline through North Dakota's cherished bad lands, raising concerns about the pipeline's disturbance of the land. Basin Electric employees and others have worked proactively, in concert with the U.S. Department of Transportation rules, to restore the land disturbed by the buried pipeline. They have focused on reseeding steep slopes. Also, Haines Construction Company, the contractor that built the pipeline, used backhoes instead of conventional trencher, a practice that enabled topsoil to be separated and replaced on top. Six years later, in many places, the pipeline route is difficult to discern during aerial surveys.

Taken as a whole, these examples show that sensible project selection and proactive compliance with environmental regulations can provide a clear path for geosequestration as a greenhouse gas mitigation option.

U.S. Regulations Applicable to CO₂ Geologic Sequestration Field Tests

The National Energy Policy Act (NEPA). The goal of NEPA is to ensure the actions of the Federal Government protect the environment. NEPA is a procedural law that compels the Federal government to study the environmental impacts of any action it proposes to take and to communicate the impacts to the public, specifically the public in the vicinity of the proposed action. The process compels the Federal government to look at ways to avoid any adverse environmental impacts and also to explore alternatives to the proposed action in general. NEPA requirements are sequential. A less-stringent Environmental Assessment (EA) is conducted first, and based on the EA a decision is made whether a more stringent Environmental Impact Statement (EIS) is merited. Exploratory wells can receive a categorical exclusion under NEPA.

Underground Injection Control (UIC) Program.

The goal of the UIC program is to ensure that drinking water resources are not rendered unfit for use by underground injection of contaminants. UIC considers five classes of underground injection wells. Class I includes hazardous wastes and requires the most stringent assessment and monitoring. This includes a proof of no migration. Class II includes wells to re-inject produced water from oil and gas production operations and also fluids injected to enhance the recovery of oil and gas. Wells used to inject CO₂ for enhanced oil recovery and enhanced coal bed methane recovery would be categorized as Class II. Class V wells are wells that do not fit into categories I-IV. Class V wells do not require a permit, but an operator must apply for Class V categorization. Small-scale, experimental CO₂ injection wells into saline formations can and have received Class V status.