



# EPA Proposes New Requirements for Geologic Sequestration of Carbon Dioxide

The United States Environmental Protection Agency (EPA) is proposing new federal requirements under the Safe Drinking Water Act (SDWA) for the underground injection of carbon dioxide (CO<sub>2</sub>) for the purpose of long-term underground storage, or geologic sequestration (GS). The regulation is proposed under the authority of SDWA to ensure protection of underground sources of drinking water from injection related activities. The Agency is seeking comments on the proposed rule for 120 days.

## **Why is the Proposed GS Rule Needed?**

The capture and injection of CO<sub>2</sub> produced by human activities for long-term storage is one of a portfolio of options that can reduce CO<sub>2</sub> emissions to the atmosphere and help to mitigate climate change.

While the elements of today's proposal are based on the existing regulatory framework of EPA's Underground Injection Control (UIC) Program, modifications address the unique nature of CO<sub>2</sub> injection for GS. The relative buoyancy of CO<sub>2</sub>, its corrosivity in the presence of water, the potential presence of impurities in captured CO<sub>2</sub>, its mobility within subsurface formations, and large injection volumes anticipated at full scale deployment warrant specific requirements tailored to this new practice.

## **What is Geologic Sequestration?**

GS is the process of injecting CO<sub>2</sub> captured from an emission source (e.g., a power plant or industrial facility) into deep subsurface rock formations for long-term storage. It is part of a process known as "carbon capture and storage," or CCS.

CO<sub>2</sub> is captured from flue gas produced by fossil-fueled power plants or industrial facilities, typically compressed to convert it from a gaseous state to a supercritical fluid, and transported to the sequestration site, usually by pipeline. The CO<sub>2</sub> is then injected into deep subsurface rock formations through one or more wells, using technologies that have been developed and refined over the past several decades. To store the CO<sub>2</sub> as a supercritical fluid, it would likely be injected at depths greater than approximately 800 meters (2,625 feet), where the pressure and temperature below the earth's surface are sufficient to keep the CO<sub>2</sub> in a supercritical state.

When injected in an appropriate receiving formation, CO<sub>2</sub> is sequestered by a combination of physical and geochemical trapping processes. Physical trapping occurs when the relatively buoyant CO<sub>2</sub> rises in the formation until it reaches a low-permeability layer that inhibits further upward migration, or when residual CO<sub>2</sub> is immobilized in

formation pore spaces. Geochemical trapping occurs when chemical reactions between the dissolved CO<sub>2</sub> and minerals in the formation lead to the precipitation of solid carbonate minerals. Similarly, naturally-occurring CO<sub>2</sub> deposits have been physically and geochemically trapped in geologic formations for millions of years.

The United States has abundant CO<sub>2</sub> storage potential in onshore and offshore deep saline formations, depleted oil and gas fields, and deep, unmineable coal seams. These formations are present across the country and 95 percent of the largest stationary sources in the nation that emit CO<sub>2</sub> are within 50 miles of a candidate CO<sub>2</sub> storage reservoir.

### **Who will be Affected by the Proposed Rule?**

EPA's proposal applies to owners or operators of wells that will be used to inject CO<sub>2</sub> into the subsurface for the purpose of long-term storage. It will also affect state agencies that choose to administer the program in the future. The proposed rule is the proposed framework for permitting GS wells, but does not require any facilities to capture and/or sequester CO<sub>2</sub>.

### **What is EPA's Proposal?**

EPA's proposed rule would establish a new class of injection well—Class VI—and technical criteria for geologic site characterization; area of review and corrective action; well construction and operation; mechanical integrity testing and monitoring; well plugging; post-injection site care; and site closure for the purposes of protecting underground sources of drinking water.

The elements of today's proposal build upon the existing UIC regulatory framework, with modifications based on the unique nature of CO<sub>2</sub> injection for GS, including:

- Geologic site characterization to ensure that GS wells are appropriately sited;
- Requirements to construct wells with injectate-compatible materials and in a manner that prevents fluid movement into unintended zones;
- Periodic re-evaluation of the area of review around the injection well to incorporate monitoring and operational data and verify that the CO<sub>2</sub> is moving as predicted within the subsurface;
- Testing of the mechanical integrity of the injection well, ground water monitoring, and tracking of the location of the injected CO<sub>2</sub> to ensure protection of underground sources of drinking water;
- Extended post-injection monitoring and site care to track the location of the injected CO<sub>2</sub> and monitor subsurface pressures; and
- Financial responsibility requirements to assure that funds will be available for well plugging, site care, closure, and emergency and remedial response.

The proposal discusses long term liability for GS operations and seeks comment on this issue as part of the proposed rulemaking. The proposal also includes public participation requirements that would be associated with the issuance of permits for GS wells.

When finalized, the GS rule will provide certainty to industry and the public about requirements that would apply to GS by providing consistency in requirements across the nation, and transparency regarding the requirements that apply to owners and operators. Many components of the proposed rule provide flexibility by allowing the permitting authority discretion to set certain permit criteria that are appropriate to local geologic settings.

### **How Much Will the Rule Cost?**

EPA estimates the total incremental annual cost associated with the implementation of the rule as proposed to be \$15.0 million and \$15.6 million using 3 percent and 7 percent discount rates, respectively. The details of EPA's cost estimate are presented in the cost analysis for the proposed GS Rule. The costs attributed to the proposed rulemaking (costs associated with the sequestration but not the capture or transport of CO<sub>2</sub>) represent less than 10 percent of the total cost of carbon capture and storage.

### **How Did EPA Consult with Stakeholders in Evaluating GS and Developing the Proposal?**

Over the past several years, EPA has coordinated with the Department of Energy, the lead U.S. agency conducting GS field research, to monitor the progress of pilot GS projects. The Agency has convened seven workshops since 2005 to discuss various technical issues associated with GS and convened two public stakeholder meetings in December 2007 and February 2008 to identify and discuss questions relevant to the effective management of CO<sub>2</sub> GS. Each stakeholder workshop was attended by more than 200 stakeholders representing a broad range of interests including government, industry, public interest groups, and the general public. EPA also worked closely with four state co-regulators affiliated with the Ground Water Protection Council and the Interstate Oil and Gas Compact Commission. Additionally, the proposal is open for public comment for 120 days.

### **How Can I Get More Information?**

The proposed rule, supporting information, and information on how to comment on the proposal are available on EPA's Web site at [http://www.epa.gov/safewater/uic/wells\\_sequestration.html](http://www.epa.gov/safewater/uic/wells_sequestration.html). For additional information, contact the Safe Drinking Water Hotline toll free Monday through Friday, 10:00 am to 4:00 pm eastern time (except federal holidays) at 1-800-426-4791.