(h) * * *

(2) *Registration.* Active Duty sponsors must register potential ECHO-eligible beneficiaries through the Director, TRICARE Management Activity, or designee prior to receiving ECHO benefits. The Director, TRICARE Management Activity, or designee will determine ECHO eligibility and update the Defense Enrollment Eligibility Reporting System (DEERS) accordingly. Unless waived by the Director, TRICARE Management Activity or designee, sponsors must provide evidence of enrollment in the Exceptional Family Member Program provided by their branch of Service at the time they register their family member(s) for the ECHO.

(3) * * *

(v) *Public facility use.* (A) An ECHO beneficiary residing within a state must demonstrate that a public facility is not available and adequate to meet the needs of their qualifying condition. Such requirements shall apply to beneficiaries who request authorization for training, rehabilitation, special education, assistive technology, and institutional care in private nonprofit, public, and state institutions and facilities, and if appropriate for beneficiaries receiving institutional care, transportation to and from such institutions and facilities. The maximum Government cost-share for services that require demonstration of public facility non-availability or inadequacy is limited to $36,000 per fiscal year per beneficiary. State-administered plans for medical assistance under Title XIX of the Social Security Act (Medicaid) are not considered available and adequate facilities for the purpose of this section.

* * * * *

(j) *Effective date.* All changes to this section are effective as of October 14, 2008, and claims for ECHO benefits provided on or after that date will be reprocessed retroactively to that date as necessary.

* * * * *

Dated: August 21, 2009.

Patricia Toppings,

OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. E9–20685 Filed 8–28–09; 8:45 am]

BILLING CODE 5001–06–P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 146

[EPA–HQ–OW–2008–0390; FRL–8951–3]

RIN 2040–AE98

Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells; Notice of Data Availability and Request for Comment

AGENCY: Environmental Protection Agency (EPA).

ACTION: Data availability; request for comment.

SUMMARY: Today's Notice supplements the proposed ''Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells'' of July 25, 2008, presents new data and information, and requests public comment on related issues that have evolved in response to comments on the original proposal. This Notice contains preliminary field data from the Department of Energy-sponsored Regional Carbon Sequestration Partnership projects, the results of GS-related studies conducted by the Lawrence Berkeley National Laboratory, and additional GS-related research. Today's Notice also discusses comments and presents an alternative the Agency is considering related to the proposed injection depth requirements for Class VI wells.

DATES: Comments on the contents of this NODA must be received on or before October 15, 2009. EPA does not plan to extend the comment period for this Notice. EPA will hold a public hearing from 9 a.m. to 12 p.m. and 1 p.m. to 4 p.m., CDT, September 17, 2009 in Chicago, IL.

ADDRESSES: The public hearing will be held at the Ralph H. Metcalfe Federal Building, 77 W. Jackson Boulevard, Chicago, IL 60604. Due to capacity limitations, we encourage you to indicate your intent to participate through pre-registration. To pre-register, for directions, and for site specific information, please visit the following Web site: *http://gshearing.cadmusweb.com/.*

Submit your comments, identified by Docket ID No. EPA–HQ–OW–2008–0390, by one of the following methods:

- *http://www.regulations.gov:* Follow the on-line instructions for submitting comments.
- *Mail:* Water Docket, Environmental Protection Agency, Mailcode: 4101T, 1200 Pennsylvania Ave., NW., Washington, DC 20460.
- *Hand Delivery:* Water Docket, EPA Docket Center (EPA/DC), Public Reading Room, Room 3334, EPA West, 1301 Constitution Ave., NW., Washington, DC. Such deliveries are only accepted during the Docket's normal hours of operation which are 8:30 a.m. to 4:30 p.m., and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OW–2008–0390. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov,* including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or e-mail. Contact EPA directly (see the **FOR FURTHER INFORMATION CONTACT** section) prior to submitting CBI. The *http://www.regulations.gov* Web site is an ''anonymous access'' system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through *http://www.regulations.gov* your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses.

Docket: All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.*, CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the Water Docket, EPA Docket Center (EPA/DC), Public Reading Room, Room 3334, EPA West, 1301 Constitution Ave., NW., Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744, and the telephone number for the EPA Docket Center is (202) 566–2426.

FOR FURTHER INFORMATION CONTACT: Mary Rose Bayer, Underground Injection Control Program, Drinking Water Protection Division, Office of Ground Water and Drinking Water (MC–4606M), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; *telephone number:* (202) 564–1981; *e-mail address: bayer.maryrose@epa.gov.* For general information, contact the Safe Drinking Water Hotline, *telephone number:* (800) 426–4791. The Safe Drinking Water Hotline is open Monday through Friday, excluding legal holidays, from 10 a.m. to 4 p.m. Eastern time. For general information about the public hearing, please contact Sean Porse by phone (202) 564–5990, by e-mail at *porse.sean@epa.gov*, or by mail at: US Environmental Protection Agency, Mail Code 4606M, 1200 Pennsylvania Ave., NW., Washington, DC 20460.

SUPPLEMENTARY INFORMATION:

I. General Information

This Notice of Data Availability (NODA) presents new information and data related to geologic sequestration (GS) of CO_2 obtained after publication of the July 25, 2008, proposed rule, ''Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells'' (73 FR 43492). The proposal is available online at *http://www.epa.gov/fedrgstr/EPA-WATER/2008/July/Day-25/w16626.htm*. Availability of this new information could change EPA's approach to the final rulemaking.

The purpose of this NODA is to request public comment on new data and on related issues that have evolved in response to comments on the original proposal. This Notice provides additional information and data on the topic of injection depth as described in the July 25, 2008, proposal (73 FR 43492) and presents an alternative that responds to comments received on this issue. Therefore, EPA is providing the opportunity for notice and comment on the information provided in this Notice as a supplement to the proposed rule. The Agency seeks further public comment on any and all aspects of the specific data and alternatives it has identified in this Notice. EPA continues to review the comments received on the proposed rule and will address those comments and the comments submitted in response to this Notice in the final action.

Persons interested in recent research related to GS and proposed injection depth requirements are encouraged to read and respond to this NODA. Additionally, owners and operators, States, Tribes, and State co-regulators involved in GS activities may wish to comment on this publication.

Abbreviations and Acronyms

AL: Action Level
AoR: Area of Review
CBI: Confidential Business Information
CFR: Code of Federal Regulations
CCS: Carbon Capture and Storage
CO_2: Carbon Dioxide
DOE: Department of Energy
EGR: Enhanced Gas Recovery
EPA: Environmental Protection Agency
EOR: Enhanced Oil Recovery
GS: Geologic Sequestration
GHG: Greenhouse Gas
IPCC: Intergovernmental Panel on Climate Change
km: kilometer
LBNL: Lawrence Berkeley National Lab
m: meter
mg/l: milligrams per liter
Mt: Megaton
MCL: Maximum Contaminant Level
NETL: National Energy Technology Laboratory
NWIS: National Water Information System
NODA: Notice of Data Availability
ORD: Office of Research and Development
PWS: Public Water System
PWSS: Public Water Supply Supervision
RCSPs: Regional Carbon Sequestration Partnerships
SDWA: Safe Drinking Water Act
SECARB: Southeast Regional Carbon Sequestration Partnership
STAR: Science to Achieve Results
SWP: Southwest Regional Partnership on Carbon Sequestration
TDS: Total Dissolved Solids
UIC: Underground Injection Control
US: United States
USDW: Underground Source of Drinking Water
USGS: United States Geological Survey

Definitions

Action Level (AL): The concentration of lead or copper in water specified in 40 CFR 141.80(c) which determines, in some cases, the treatment requirements contained in subpart I of this part that a water system is required to complete.

Area of review (AoR): The region surrounding the geologic sequestration project that may be impacted by the injection activity. The area of review is based on computational modeling that accounts for the physical and chemical properties of all phases of the injected carbon dioxide stream.

Buoyancy: Upward force on one phase (*e.g.*, a fluid) produced by the surrounding fluid (*e.g.*, a liquid or a gas) in which it is fully or partially immersed, caused by differences in pressure or density.

Capillary force: Adhesive force that holds a fluid in a capillary or a pore space. Capillary force is a function of the properties of the fluid, and surface and dimensions of the space. If the attraction between the fluid and surface is greater than the interaction of fluid molecules, the fluid will be held in place.

Carbon Capture and Storage (CCS): The process of capturing CO_2 from an emission source, (typically) converting it to a supercritical state, transporting it to an injection site, and injecting it into deep subsurface rock formations for long-term storage.

Carbon dioxide plume: The extent underground, in three dimensions, of an injected carbon dioxide stream.

Carbon dioxide (CO_2) stream: Carbon dioxide that has been captured from an emission source (*e.g.*, a power plant), plus incidental associated substances derived from the source materials and the capture process, and any substances added to the stream to enable or improve the injection process. This subpart does not apply to any carbon dioxide stream that meets the definition of a hazardous waste under 40 CFR part 261.

Class VI wells: Wells used for geologic sequestration of carbon dioxide beneath the lowermost formation containing a USDW.

Confining zone: A geologic formation, group of formations, or part of a formation stratigraphically overlying the injection zone that acts as a barrier to fluid movement.

Corrective action: The use of Director approved methods to assure that wells within the area of review do not serve as conduits for the movement of fluids into underground sources of drinking water (USDWs).

Director: The person responsible for permitting, implementation, and compliance of the UIC program. For UIC programs administered by EPA, the Director is the EPA Regional Administrator; for UIC programs in Primacy States, the Director is the person responsible for permitting, implementation, and compliance of the State, Territorial, or Tribal UIC program.

Enhanced Oil or Gas Recovery (EOR/EGR): Typically, the process of injecting a fluid (*e.g.*, water, brine, or CO_2) into an oil or gas bearing formation to recover residual oil or natural gas. The injected fluid thins (decreases the viscosity) or displaces small amounts of extractable oil and gas, which is then available for recovery. This is also known as secondary or tertiary recovery.

Formation or geological formation: A layer of rock that is made up of a certain type of rock or a combination of types.

Geologic sequestration (GS): The long-term containment of a gaseous, liquid or supercritical carbon dioxide stream in subsurface geologic formations. This term does not apply to its capture or transport.

Geologic sequestration project: An injection well or wells used to emplace a CO_2 stream beneath the lowermost formation containing a USDW. It includes the subsurface three-dimensional extent of the carbon dioxide plume, associated pressure front, and displaced brine, as well as the surface area above that delineated region.

Injectate: The fluids injected. For the purposes of this rule, this is also known as the CO_2 stream.

Injection zone: A geologic formation, group of formations, or part of a formation that is of sufficient areal extent, thickness, porosity, and permeability to receive carbon dioxide through a well or wells associated with a geologic sequestration project.

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

Model: A representation or simulation of a phenomenon or process that is difficult to observe directly or that occurs over long time frames. Models that support GS can predict the flow of CO_2 within the subsurface, accounting for the properties and fluid content of the subsurface formations and the effects of injection parameters.

Pore space: Open spaces in rock or soil. These are filled with water or other fluids such as brine (*i.e.*, salty fluid). CO_2 injected into the subsurface can displace pre-existing fluids to occupy some of the pore spaces of the rocks in the injection zone.

Public Water System (PWS): A system for the provision to the public of water for human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year. Such term includes: any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system; and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. Such term does not include any ''special irrigation district.'' A public water system is either a ''community water system'' or a ''noncommunity water system.''

Pressure front: The zone of elevated pressure that is created by the injection of carbon dioxide into the subsurface. For GS projects, the pressure front of a CO_2 plume refers to the zone where there is a pressure differential sufficient to cause the movement of injected fluids or formation fluids into a USDW.

Saline formations: Deep and geographically extensive sedimentary rock layers saturated with waters or brines that have a high total dissolved solids (TDS) content (*i.e.*, over 10,000 mg/l TDS). Saline formations offer great potential for CO_2 storage capacity.

Stratigraphic zone (unit): A layer of rock (or stratum) that is recognized as a unit based on lithology, fossil content, age or other properties.

Total Dissolved Solids (TDS): The measurement, usually in mg/l, for the amount of all inorganic and organic substances suspended in liquid as molecules, ions, or granules. For injection operations, TDS typically refers to the saline (*i.e.*, salt) content of water-saturated underground formations.

Transmissive fault or fracture: A fault or fracture that has sufficient permeability and vertical extent to allow fluids to move between formations.

Trapping: The physical and geochemical processes by which injected CO_2 is sequestered in the subsurface. Physical trapping occurs when buoyant CO_2 rises in the formation until it reaches a layer that inhibits further upward migration or is immobilized in pore spaces due to capillary forces. Geochemical trapping occurs when chemical reactions between dissolved CO_2 and minerals in the formation lead to the precipitation of solid carbonate minerals.

Underground Source of Drinking Water (USDW): as defined under 40 CFR part 144.3, an aquifer or portion of an aquifer that supplies any public water system or that contains a sufficient quantity of ground water to supply a public water system, and currently supplies drinking water for human consumption, or that contains fewer than 10,000 mg/l total dissolved solids and is not an exempted aquifer.

Special Accommodations: For information on access or accommodations for individuals with disabilities, please contact Sean Porse at (202) 564–5990 or by e-mail at *porse.sean@epa.gov*. Please allow at least 10 days prior to the meeting, to give EPA time to process your request.

II. What Did EPA Propose?

On July 25, 2008, EPA published the proposed ''Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells.'' (73 FR 43492) The Agency proposed a new class of injection well (Class VI) along with technical criteria for permitting GS wells, including criteria for geologic site characterization, area of review (AoR) and corrective action, well construction, operation, mechanical integrity testing, monitoring, well plugging, post-injection site care, and site closure. These standards, if finalized, would protect underground sources of drinking water (USDWs) under the Safe Drinking Water Act (SDWA). The technical criteria in the proposed rule are based on the existing UIC regulatory framework under the SDWA for deep injection wells, with modifications to address the unique nature of CO_2 injection for GS.

Existing GS project experience, natural and industrial analogs, research, and current regulatory experience with underground injection were considered in the development of the proposed rule. Ongoing research builds upon the existing foundation of substantial literature on CO_2 injection and storage, some of which is available in the docket for this rulemaking. While CO_2 injection to extract oil and gas has taken place for many years, the use of UIC wells to inject large quantities of CO_2 for long-term storage is a relatively new practice. There are current projects and research underway that examine and demonstrate the effectiveness of underground injection as a tool for sequestering CO_2.

For example, there are four commercial projects in operation today:

- Sleipner (Norwegian North Sea)—1 Mt CO_2/yr injected since 1996;
- Weyburn (Canada)—1 Mt CO_2/yr injected since 2000;
- In Salah (Algeria)—1.2 Mt CO_2/yr injected since 2004;
- Snohvit (Norway)—0.7 Mt CO_2/yr injected since 2008.

Many additional large-scale projects are funded and under development worldwide.

The purpose of this NODA is to provide an update on newly available information and data related to research focused specifically on GS for long-term storage—with particular emphasis on data, research, and information that has become available since the July proposal publication.

In addition, the proposed rule contains a discussion of injection depth. In the July 2008 FR Notice, EPA proposed that the injection of CO_2 be confined to areas below the lowermost USDW (in the absence of an aquifer exemption). This approach is consistent with the approach used for other deep UIC wells; however, circumstances in a few States may warrant an alternative approach. Today's Notice provides additional discussion on an alternative the Agency is considering related to injection depth for GS wells.

EPA received a number of comments indicating that the Agency should further explore environmental and regulatory issues beyond the scope of the proposed SDWA requirements for underground injection of CO_2 for GS. EPA recognizes that a more comprehensive framework may be needed and that some stakeholders remain uncertain with respect to the potential applicability of other Federal environmental statutes such as the Clean Air Act, the Resource Conservation and Recovery Act, and the Comprehensive Environmental Response, Compensation, and Liability Act to various aspects of geologic sequestration of CO_2. The Agency is currently evaluating the need for a more comprehensive regulatory framework to provide legal guidance regarding this emerging technology. If the Agency chooses to pursue a more comprehensive regulatory approach to this subject, it will seek public comment on any proposal it develops for this framework and will also endeavor to issue a more comprehensive rule in the same time frame as it has planned for the stand-alone UIC GS rulemaking.

III. Research, Data Analysis, and Findings

A. Content of NODA and Summary of Comments

In this Notice, EPA is providing a short summary of several ongoing GS studies and interim information on current GS projects relevant to topics within the proposed GS regulation. This information and data were provided or made available after publication of the proposal in July 2008. More detailed information on the GS research and projects discussed below is available for review online as part of the docket for this rulemaking. EPA is providing this data and associated project summaries because the Agency expects that there may be additional studies and data on other GS projects, the use of existing technologies, and GS-related research that may inform the Agency's regulatory development process for GS. Such data could contribute to the Agency's understanding of site characterization, well construction, operation, and monitoring requirements. The Agency requests comment on data and research discussed in today's Notice and how the Agency might use this data and research in developing the final rule. The Agency also requests submission of additional GS studies related to the data and research discussed in this Notice to inform the GS rulemaking.

In the preamble of the proposed rule, EPA described an adaptive approach to developing regulations for GS. This approach would allow the Agency to establish regulations to protect USDWs and enable the Agency to make changes to regulations over time as information from demonstration projects and other studies becomes available. EPA received comments from stakeholders requesting that additional data be made available to the public before a final rulemaking (particularly related to specific areas of GS) and indicating that more research is needed to support GS in general. Many commenters suggested that supplementary research on GS is necessary prior to rule promulgation and that EPA should wait until the Department of Energy (DOE)-sponsored Phase II and Phase III pilot projects are complete before finalizing the GS rule. Others believed that a final rulemaking should proceed and that new information and data from ongoing GS research should be considered and incorporated over time as part of an adaptive rulemaking process. Comments on the proposal encouraged additional research and investigations on areas including (but not limited to): Confining zone characterization; modeling; CO_2 plume movement; geochemistry; impacts of GS on saline formations; leakage from abandoned wells caused by material and cement degradation; potential pathways for contamination of USDWs; leak mitigation and remediation; and criteria for determining that the CO_2 plume has stabilized.

The Agency is actively tracking the progress of the Regional Carbon Sequestration Partnership (RCSP) GS and carbon capture and storage projects. The RCSPs have been compiling information related to their pilot and demonstration projects and have been developing research projects related to these efforts. A summary of several of these projects is available in today's Notice.

In addition, EPA's Office of Research and Development is conducting intramural and extramural research activities to develop modeling and monitoring tools for protecting underground sources of drinking water. Laboratory, modeling, and field investigations are focusing on a variety of injection and storage scenarios and candidate injection sites. Analytic and semi-analytic models are being developed and evaluated for determining the area of review based on geologic and hydrologic conditions. Comprehensive laboratory tests are being applied to the development and field-testing of monitoring strategies that can detect migration of fluids into shallow aquifers and assess potential geochemical impacts. The ultimate goal of these research activities is to provide more robust tools for permitting, monitoring, and evaluating GS sites from injection through post-injection site care and site closure to prevent endangerment of USDWs. EPA is also funding six projects for the study of ground water and human health impacts of GS through the Science To Achieve Results (STAR) grant program. The awards will be announced this fall on EPA's Web site (*http://es.epa.gov/ncer/*).

Furthermore, EPA and DOE have jointly supported GS-related studies at Lawrence Berkeley National Lab (LBNL), described in Section II.B. These studies use modeling to predict the potential impacts on ground water from GS activities.

B. DOE-Sponsored Regional Carbon Sequestration Partnership Projects

Currently, DOE's National Energy Technology Laboratory (NETL) is developing and/or operating approximately 30 GS projects, a number of which have either completed injection or are in the process of injecting CO_2. The purpose of these projects is to ''help determine the best approaches for capturing and permanently storing gases that can contribute to global climate change'' and to determine ''the most suitable technologies, regulations, and infrastructure needs for carbon capture, storage, and sequestration in different parts of the country'' (*http://www.netl.doe.gov/technologies/carbon_seq/partnerships/partnerships.html*). Through cooperation with DOE, EPA has obtained pilot project data from several of these GS projects. RCSPs are conducting pilot and demonstration projects to study: site characterization (including injection and confining formation information, core data and site selection information); well construction (well depth, construction materials, and proximity to USDWs); frequency and types of tests and monitoring conducted (on the well and on the project site); modeling and monitoring results; and injection operation (injection rates, pressures, and volumes, CO_2 source and co-injectates). In addition to information available in the docket for this NODA, information on some of these projects is available at *http://www.netl.doe.gov/publications/proceedings/08/rcsp/*. The following is a short summary of select project activities and data generated.

Escatawpa, Mississippi (MS); Southeast Regional Carbon Sequestration Partnership (SECARB)

SECARB is conducting a CO_2 injection test in Jackson County, MS into a deep saline reservoir along the Gulf Coast that had not previously been characterized for oil and gas exploration. The injection zone, 9,500 feet (2,896 meters) deep in the Lower Tuscaloosa Massive Sand Unit, is overlain by two confining layers. The site is near the Victor J. Daniel Power Plant, the source of the CO_2, which was delivered to the injection site via truck.

Characterization of the site is based on a wealth of geophysical and core-derived information, including well core samples, open-hole and cased-hole well logging, baseline vertical seismic profiling, and pressure transient testing. Baseline sampling and analysis of formation fluids and soil flux sampling were also performed. The SECARB team performed a 3-dimensional simulation to estimate injectivity, storage capacity, and long-term fate of the injected CO_2. The model estimated that the plume would extend up to 350 feet (106.7 meters) at the end of the injection test.

An injection well and a monitoring well were drilled at the site. The injection well is permitted by the Mississippi Department of Environmental Quality as a UIC Class V experimental well. Both the injection and monitoring well were constructed with surface and long-string casing that was cemented from the injection zone to the surface. Pre-injection mechanical integrity tests of the injection and monitoring well (annulus pressure test, radioactive tracer survey, differential temperature survey, and pressure fall-off tests) met UIC Class I requirements.

In October of 2008, 3,027 tons (2,746 tonnes) of CO_2 were injected into the well; injection rates averaged 170 to 180 tons/day (154 to 163 tonnes/day). Continuous monitoring devices were used to record (at 30 second intervals): Injection pressure, annular pressure, temperature, and rate. The injection was complete on October 28, 2008.

SECARB is continuing to monitor activities at the site through surface or near-surface monitoring for upward CO_2 seepage via groundwater sampling, soil flux sampling and tracer detection. The purpose of this monitoring and sampling is to determine whether CO_2 is migrating upward from the injection zone. To date, there has been no indication of the return of the injected CO_2 in the shallow subsurface. SECARB also plans to employ time-lapse seismic and geophysical tools to determine the deep subsurface fate of the injectate.

This SECARB project employs, demonstrates, and validates the EPA's proposed Class VI well construction, operational, and monitoring requirements. The use of surface and near-surface monitoring techniques provides the EPA with preliminary information regarding the efficacy and appropriateness of these technologies at certain sites; and supports the need for a site-specific monitoring plan that will allow use of a range of monitoring technologies suitable for each unique GS site. This information and public comments on this research will be used to inform the Agency's final rulemaking.

For additional information about the Escatawpa Project, see the full report in the docket for today's publication.

Aneth Field, Paradox Basin, Southeast Utah (UT); Southwest Regional Partnership on Carbon Sequestration (SWP)

The Aneth Field is the site of an experimental combined EOR–GS test by the Southwest Partnership. The primary CO_2 injection target is the carbonate Paradox Formation, which is approximately 5,600 to 5,800 feet (1,707 to 1,768 meters) deep, and is overlain by the low-permeability Gothic Shale. Petrographic, geochemical and mechanical analyses of the Gothic Shale are underway or planned.

CO_2 injection began in August 2007, and approximately 150,000 tons (136,077 tonnes) of CO_2 have been injected to date. Extensive monitoring of the site is complete or underway. Monitoring activities at the site include time-lapse vertical seismic profiling, microseismic monitoring, geochemical and tracer tests, CO_2 soil flux measurements, a surface fracture and banding study, and self-potential monitoring.

Monitoring data are being used to establish parameters for state-of-the-art mathematical reservoir models, which include coupling of multiphase CO_2-ground water flow, rock deformation, and chemical reactions to evaluate residence times, migration patterns and rates, and effects of CO_2 injection on fluid pressures and rock strain.

The Aneth Field project confirms the need for a project design with a robust monitoring plan, and tests the importance of monitoring and modeling agreement in GS projects. In addition, the project demonstrates the utility of various monitoring technologies that may be used by owners and operators of Class VI wells. This information and public comments on this research will be used to inform the Agency's final rulemaking.

Pump Canyon Site, Near Archuleta, New Mexico (NM); Southwest Regional Partnership on Carbon Sequestration (SWP)

The SWP is conducting a Phase II project of CO_2 injection into deep, unmineable coal seams at the Pump Canyon Site near Archuleta, NM. To support characterization of the site, the SWP is performing a ''seal analysis'' of the ability of the Kirtland Formation to act as a barrier to the movement of CO_2 or other reservoir fluids. The Kirtland Formation is a major, regional aquitard and reservoir seal that directly overlies the geologic formation containing the coal seams.

To characterize the Kirtland Formation, detailed studies of geological core samples, downhole geophysical logs, and outcrop studies were conducted. Complete and in-progress laboratory analyses include electron microscopic studies of petrographic and petrophysical properties; capillary pressure measurements; multiscale fracture characterization using well logs and core analysis; descriptions of stratigraphic columns and sedimentary structures based on cores; pore size distributions analysis using BET (Brunauer-Emmett-Teller), and geomechanical analyses of the caprock and overlying aquifer.

Operators are actively monitoring potential surface deformation from injection through the use of tilt meters and radar-based Interferrometric Synthetic Aperture Radar (InSAR) in addition to monitoring the site's injection pressure. They are also tracking the CO_2 plume through continuous sampling of immediate offset production wells and through perfluorocarbon gas tracers (PFT) and naphthalene sulfonate water tracers (NST) introduced into the CO_2 injection stream. These tracers are used for identification in the unlikely event of reservoir leakage.

The Agency sought comment on using unmineable coal seams for GS in the proposed rule. The investigation at Pump Canyon will inform a determination on whether CO_2 can be effectively and safely sequestered in coal seams.

For further information on aspects of the Pump Canyon project, please refer to data available in the NODA docket.

C. Lawrence Berkeley National Laboratory (LBNL) Studies

An improperly managed GS project has the potential to endanger USDWs. The factors that increase the risk of USDW contamination are complex and can include improper siting, construction, operation and monitoring of GS projects. The proposed GS requirements address endangerment to USDWs by establishing new Federal requirements for the proper management of CO_2 injection and storage. Risks to USDWs from improperly managed GS projects can include CO_2 migration into USDWs, causing the leaching and mobilization of contaminants (*e.g.*, arsenic, lead, and organic compounds), changes in regional groundwater flow, and the movement of greater salinity formation fluids into USDWs, causing degradation of water quality. As mentioned in Section II of this Notice and in the proposal, CO_2 has been injected on large scales at four sites: at Sleipner in the North Sea, at In Salah in Algeria, at Snohvit in Norway, and in the Weyburn Field in Alberta, Canada. There have been no documented cases of leakage from these projects. Additionally, for decades, the oil and gas industry has been safely injecting CO_2 for the purpose of enhanced oil and gas recovery.

LBNL is studying the potential effects of CO_2 injection on ground water and surrounding formations to determine the potential for impacts on USDWs and human health in the event that a GS project is not properly sited, operated, or managed. Specifically, LBNL is evaluating the potential for GS to cause changes in ground water quality as a result of CO_2 leakage and subsequent mobilization of trace elements such as arsenic, barium, cadmium, mercury, lead, antimony, selenium, zinc, and uranium. In addition, LBNL is evaluating basin-scale hydrological impacts of large-volume injection of CO_2 on groundwater aquifers and in particular, the pressure front impacts caused by GS. Summaries of the interim results for these research areas are discussed below. The full publications are available in the docket and on LBNL's Web site at *http://esd.lbl.gov/GCS/projects/CO2/index_CO2.html.*

1. Ground Water Quality Changes Related to the Mobilization of Trace Elements

Summary

LBNL used a comprehensive computational model to evaluate the potential impact of CO_2 leaking from deep geologic sequestration sites on the concentrations of trace elements in potable ground waters (Birkholzer *et al.*, 2008a). LBNL estimated the amount of trace elements from native mineral species that could potentially be mobilized by the intrusion of CO_2, and the potential ground water concentrations that could result. LBNL then compared these estimates to EPA's Maximum Contaminant Levels (MCLs) and Action Levels (ALs) for drinking water to determine the potential for drinking water standards to be exceeded. It is important to note that model results were dependent on several assumptions and parameter values with a large degree of uncertainty, such as dissolution and dissociation constants. LBNL recommended that further studies should be conducted, including laboratory or field experiments and evaluation of natural analogues.

LBNL conducted multiple model runs to assess a variety of scenarios and aquifer conditions and, as discussed below, found that if injected CO_2 comes into contact with shallow USDWs, some trace element concentrations such as arsenic could increase.

Identification of Trace Elements of Concern

An important step in developing the model used to assess the different scenarios was the identification of naturally occurring minerals that could act as a source of trace elements in ground water if they were to come into contact with CO_2. This identification was accomplished through an extensive review of the scientific literature, through which potential minerals of concern were identified. The presence of these minerals in aquifer rocks was indirectly substantiated through an evaluation of more than 38,000 water-quality analyses from potable aquifers reported in the United States Geological Survey's (USGS) National Water Information System (NWIS). While the abundances of these host minerals are typically very small, all trace elements targeted for study occur frequently in soils, sediments, and aquifer rocks.

A preliminary assessment of CO_2-related water quality changes, including pH, was conducted by calculating the expected equilibrium concentrations of trace elements as a function of the amount of CO_2 in a representative potable groundwater. Results of this modeling obtained for typical aquifers under reducing conditions indicate that arsenic could potentially exceed Federal drinking water standards at elevated CO_2 concentrations (40 CFR 141.62 (b)(16)). Other trace elements, such as barium, cadmium, lead, antimony, and zinc, may also be mobilized in certain circumstances, but the majority of results did not show mobilization at levels exceeding the MCL or AL.

LBNL used reactive-transport modeling to further study the fate and transport of arsenic and lead in a representative potable aquifer as influenced by leakage of CO_2. This study is described as follows:

Prediction of the Fate and Transport of Trace Elements

LBNL used the reactive-transport model TOUGHREACT to 1) study and predict the transport of CO_2 within a shallow aquifer, 2) estimate potential geochemical changes caused by the presence of CO_2, and 3) estimate the fate and transport of mobilized trace elements. LBNL conducted sensitivity studies to account for a range of conditions found in potable aquifers throughout the US and to evaluate the uncertainty associated with geochemical processes and model parameters. Starting with a representative ground water under equilibrium conditions, the model was used to estimate the impact of CO_2 leakage into the aquifer for 100 years. For this analysis, the investigators assumed a hypothetical release scenario based on CO_2 escape from a deep geologic sequestration site via a preferential pathway, such as a fault zone, entering the shallow aquifer at a constant rate.

Results from this model simulation suggest that if CO_2 were to leak into a shallow aquifer, the potential for mobilization of lead and arsenic could be enhanced, causing increases in the concentration of these trace elements in ground water. While LBNL studies did suggest that CO_2 interaction could cause significant concentration increases compared to the initial water composition, the MCL for arsenic was exceeded in only a few simulation scenarios, while the lead concentrations remained below the AL under all scenarios. It is important to emphasize that these studies looked at potential consequences of CO_2 leakage into the USDW, not the likelihood of such leakage occurring. The goal of the UIC program and these regulations is to ensure that injectate does not contaminate USDWs in the first place.

The Agency will use these preliminary results and public comments on this research as well as potential site-specific analyses, to refine and inform site characterization, monitoring, and remediation requirements and guidance, if necessary, in the Agency's final rulemaking. The Agency seeks comment on this research and any additional studies related to a) mobilization of constituents and b) the likelihood or frequency of such leakage/risks.

2. Basin-Scale Hydrologic Impacts of CO_2 Storage

Summary

Pressure build-up from large volume CO_2 sequestration has been researched since the early 1990s. Recent studies have focused on better understanding large-scale pressure responses for future geologic sequestration projects (Zhou *et al.*, 2008; Van der Meer and Yavuz, 2008; Nicot, 2008; Birkholzer *et al.*, 2009). LBNL studied a hypothetical, future scenario of GS in a sedimentary basin as an illustrative example to demonstrate the potential for basin-scale hydrologic impacts of CO_2 storage (Birkholzer *et al.*, 2008b).

Sedimentary Basin Case Study

The example basin considered in this case study contains deep saline formations that are potential targets for large-scale CO_2 storage projects because they are geologically favorable for permanent CO_2 storage and the region has many large stationary sources of CO_2. The basin contains a thick, extensive, high porosity, high permeability sandstone that is the primary target for CO_2 storage. A superior confining shale layer is also present, making it an ideal site for geologic sequestration projects.

LBNL used a preliminary computational hydrogeologic model of the basin to simulate regional ground water flow patterns as influenced by large-scale deployment of GS in the region. The model assumed a scenario where 20 independent GS projects spaced throughout the center of a 570 kilometers (km) by 550 km (354 miles by 342 miles) model domain each injected 5 million tonnes (5.51 million tons) of CO_2 per year over 50 years. (The largest injection today is on the order of a million/tons/per year). Modeling results for this simulation indicated that the maximum size of each CO_2 plume was 6–8 km (3.7–5 miles) with lateral separation between each GS project of about 30 km (18.6 miles). These model results suggest that the basin is favorable for effective trapping of CO_2.

In addition, simulation runs indicated that injection pressures did not exceed fracture pressure or the maximum value used in the model for this basin. However, results also indicated that far-field pressure changes could propagate as far away as 200 km (124 miles) from the core injection area where the geologic sequestration projects are located. After CO_2 injection ended in the simulation, pressure buildup in the injection zone began to dissipate while the far-field pressure response continued to increase and expand. For this simulation example, a pressure increase of 0.5 bar existed at an areal extent of nearly 400 km by 400 km (249 miles by 249 miles) after 50 years. These model results indicate that basin-wide pressure influences can be large and may have intersecting pressure perturbations in a multiple-site scenario. While simulated changes in salinity within the storage formation were relatively small, the predicted pressure changes could push saline water upward into overlying aquifers if localized pathways such as conductive faults existed. As these large scale simulations indicated, limitations on injection volumes related to basin-scale pressure build-up should be considered during CO_2 capacity estimation.

EPA believes that the example studied by LBNL illustrates the importance of basin-scale evaluation of reservoir pressures and far-field pressures resulting from CO_2 injection. EPA requests comment on this study and welcomes additional studies that provide information on the need for basin-scale evaluations for GS injection.

D. Additional GS Research

There are international, consensus-based and peer-reviewed reports on CCS, including the Intergovernmental Panel on Climate Change (IPCC) Special Report on Carbon Dioxide Capture and Storage (IPCC, 2005), which specifically includes a chapter on GS drawn from published literature and research studies. Comprehensive reviews of the results from GS research are also available (*e.g.*, Holloway, 2001; Friedman, 2007; Tsang *et al.*, 2008). EPA will continue to track research project development and literature published by DOE and international governments and organizations including the International Energy Agency (IEA), IEA Greenhouse Gas Programme, and other major international CCS initiatives.

With respect to geologic and reservoir modeling, EPA has conducted one such synthesis and analysis of GS research to inform the rulemaking efforts. Schnaar and Digiulio (2009) present a research review of over forty GS modeling studies spanning from 1993–2008. This review found that GS models are based on pre-existing codes that have been developed for predicting the movement of water and solutes in soil, the behavior of groundwater contaminants at hazardous waste sites, and the recovery of oil and gas from petroleum-bearing formations. However, modeling the injection and sequestration of CO_2 poses unique challenges, such as the need to properly characterize CO_2 transport properties across a large range of temperatures and pressures, and the need to couple multiphase flow, reactive transport, and geomechanical processes. The authors reviewed studies that demonstrated the use of modeling in project design, site characterization, assessments of leakage, and site monitoring.

The complete modeling review is available in the online public docket at *http://www.regulations.gov*. A list of recent publications addressing potential environmental risks and risk management approaches for GS sites is also available in the docket. The Agency may use information generated from these studies to identify implementation guidance needs and refine the proposed requirements. EPA seeks comment on these studies and requests other research on geologic and reservoir modeling as well as research associated with potential environmental risks and risk management approaches for GS.

IV. Injection Depth for GS Projects

A. What did EPA propose for Class VI well injection depth relative to the location of USDWs?

In the proposed rule, EPA defined Class VI injection wells as wells used for GS (injection) of CO_2 beneath the lowermost formation containing a USDW. In Section III.A.4 of the preamble, EPA discussed *Injection Depth in Relation to USDWs* to further clarify the Agency's expectations regarding injection depth for Class VI wells. The proposed requirements would preclude injection of CO_2 into zones in between and above USDWs. EPA is aware that confining Class VI CO_2 injection to below the lowermost USDW may restrict the use of sequestration in areas of the country with deep USDWs where well construction would be technically impractical or infeasible. As proposed, the definition would also preclude injection of CO_2 into shallow formations such as coal seams and basalts. The Agency requested comment on alternative approaches that would allow injection between and/or above the lowermost USDW and thus potentially allow for more areas to be available for GS while continuing to prevent endangerment of USDWs.

Approaches on which the Agency sought comment in the preamble, as alternatives to the proposed injection depth requirements included:

- Allowing Class VI CO_2 injection above the lowermost USDW when the Director determines that geologic conditions exist that will prevent fluid movement into adjacent USDWs;
- Allowing the use of an aquifer exemption process for Class VI injection; and,
- Establishing, by regulation, a minimum injection depth for GS of CO_2.

B. Why did EPA propose that Class VI wells inject below the lowermost USDW?

EPA initiated the regulatory development process for GS and proposed new, tailored Federal requirements appropriate for the unique nature of injecting large volumes of CO_2 for long-term storage to ensure that USDWs are not endangered. The proposed injection depth requirements for Class VI wells are consistent with the siting and operational requirements for deep, technically sophisticated Class I wells and are an important component of the UIC program.

The basis of these requirements is the principle that placing distance between the injection formation and USDWs decreases risks to USDWs. In these deep-well injection scenarios, the added depth and distance between the injection zone and overlying formations serve both as a buffer allowing for pressure dissipation and as a zone for monitoring that may detect any excursions (of the injectate) out of the injection zone. Additional distance also allows trapping mechanisms, including dissolution of CO_2 in native fluids and mineralization, to occur over time—thereby reducing risks that CO_2 may migrate from the injection zone and endanger USDWs. Additionally, the depth and distance below the lowermost USDW allow the potential for the presence of additional confining layers (between the injection zone and overlying formations/USDWs).

C. Injection Depth Comments, Data, and Research

EPA received a range of comments both in support of, and opposed to, the proposed injection depth requirements for Class VI wells.

Comments Supporting the Proposed Injection Depth Requirements

Comments that supported the proposed requirements indicated that injection should be constrained to below the lowermost USDW (should not be allowed above and/or between USDWs) because:

- SDWA requires the UIC program to promulgate regulations (including injection depth requirements) that maximize USDW protection;
- Injection below the lowermost USDW is a long-standing principle of UIC deep well injection;
- In many cases, injection below the lowermost USDW ensures a greater distance between the injection zone and USDWs;
- GS is a new/unproven technology (at large scale) and, in the early years of deployment, injection depth limitations are prudent. These requirements could be relaxed in the future as information is learned about GS injection;
- Keeping injection below the lowermost USDW will reduce the likelihood of wells (*e.g.*, water, mineral, and/or hydrocarbon production) being drilled through a CO_2 plume in the future.

These comments and concerns about injection depth are further supported by ongoing research, data, and activities related to water use, availability, and planning; some of this research and data were submitted to the proposed rule docket (*e.g.*, EPA–HQ–OW–2008–0390–0181.1). Water availability research in the United States indicates that water treatment of higher salinity waters (in excess of the USDW protectiveness threshold of 10,000 ppm TDS) may be more cost effective than the cost of obtaining water rights or surface water elsewhere in the area (Sengebush, 2008). Additionally, as technologies advance, treatment of increasingly deeper and/or higher salinity waters may become a common practice employed in many communities throughout the US. Other studies support the need to consider long-term drinking water protection and the confluence of population growth and constrained water resources in parts of the US when developing injection depth requirements (US Government Accountability Office, 2003; Davidson, *et al.*, 2008).

Comments Opposed to the Proposed Injection Depth Requirements

Those opposed to the proposed requirements supported allowing injection above and between USDWs. These commenters indicated that such injection should be allowed under the following conditions and based on the following arguments:

- At any depth without limitations;
- Based on site-specific information and in certain geologic settings, where there are adequate confining systems above and below the injection zone;
- Where formations have been exempted (for other injection purposes) and/or where the formations are greater than 10,000 ppm TDS;
- Based on geographically delineated exemptions (*e.g.*, specifically delineated formations, basins, or regions where injection could occur at depths above/between USDW);
- Because many parts of the country will be excluded from GS activities and as a result CCS deployment may be restricted (if this requirement is maintained as written);
- Because Class II, Class III, and Class V operations are already injecting above the lowermost USDW without any potential for threats to underlying (or overlying) USDWs; and,
- Because there should not be a blanket prohibition for Class VI GS wells.

Research, information, and comments that support allowing injection above and between USDWs have focused on climate change mitigation, CO_2 geologic storage capacity assessments, and current UIC injection practices. Commenters interested in climate change mitigation emphasized the role that GS will play in reducing greenhouse gas (GHG) emissions while national GS capacity estimates focus on formations irrespective of depth (above/below the lowermost USDW). Furthermore, some specific research on CO_2 injection for GS into various formations including shallow, volcanic rocks such as flood basalts (McGrail, *et al.*, 2006) and coal seam injection (Dooley, *et al.*, 2006; IPCC, 2005; MIT 2007; White *et al.*, 2005) illustrates the potential for GS in these formations, but only if there is depth requirement flexibility. Certain States have indicated that where USDWs are very deep (*e.g.*, 15,000 ft/4,572 meters and deeper) and layered (stratified) these regions would become unavailable for large-scale GS projects because injectors would not be able to comply with the current injection depth (and well construction) requirements. These States suggest that GS should be allowed in certain areas if a site-specific demonstration can be made that USDWs will be protected.

Some comments support the suggestion that current Class II, Class III, and Class V injection activities occurring above and between USDWs may serve as a viable analogue for GS injection depth requirements. Class II and Class III owners and operators of sites where injection is taking place above and between USDWs must identify and demonstrate upper and lower impermeable confining units.

These confining units serve as barriers to fluid movement and pressure and must ensure continuous injectate isolation, confinement, and USDW protection. Identification of such units is conducted through analysis of sonic and resistivity logs, drill stem tests, and wire line tests.

D. Evaluation of Concerns About Injection Depth for Class VI GS Wells

Discussion

Under Section 1421 of the Safe Drinking Water Act (SDWA), UIC regulations must prevent underground injection that endangers USDWs. While EPA has met this statutory requirement in the past by requiring injection below the lowermost USDW, for some of the injection activities that may pose increased risks, the Act allows other approaches as well (Kobelski, *et al.*, 2005).

In today's NODA, EPA is providing additional information on an alternative for addressing injection depth in limited circumstances where there are deep USDWs. EPA believes that a waiver process may respond to the range of comments, both for and against the proposed requirement that Class VI wells inject below the lowermost USDW. The goals of this approach are to: (1) Provide flexibility to UIC Program Directors and owner/operators that will undertake CO_2 injection for GS; (2) respond to concerns about local and regional geologic storage capacity limitations imposed by the proposed injection depth requirements; (3) allow for a more site-specific assessment; (4) accommodate injection into different formation types; and, (5) consider the concept that CO_2 injection for GS above and/or between USDWs could be as safe and effective as injection below the lowermost USDW as evidenced by past experiences with some Class II, III and V injection wells. EPA believes this approach may additionally accommodate requests for geographic flexibility while placing such determinations at the State or Regional level. Lastly, the approach is designed to acknowledge and accommodate comments and concerns about drinking water resource availability and the potential/known future needs, and to afford such water resources protection.

EPA is considering a number of topics and the implications of the various commenters' concerns related to this potential alternative as follows:

There have been a number of national GS capacity estimates developed (*e.g.*, by DOE's National laboratories, USGS, *etc.*). Some of these assessments have broadly identified porous, permeable formations that may receive and store CO_2 at a range of depths beneath the ground surface (Burruss, R.C., *et al*, 2009; DOE, 2007; Davidson *et al.*, 2008; MIT, 2007; Dooley, 2006). In developing injection depth requirements, EPA acknowledges that these capacity estimates do not directly address specific site suitability attributes that would be identified through the UIC permitting site-characterization process. Additionally, these formations (identified through capacity estimates) may be stratified, stacked, or layered and in combination, their cumulative capacity could be limited (*i.e.*, less than assessed). In the absence of such site-specific information, it is currently difficult to identify what percentage of assessed national capacity is actually suitable for GS. In addition, very small geologic storage sites, even when aggregated within a given area, may not be conducive to/appropriate for large-scale, commercial GS projects. However, the approach described in this Notice allows for such a determination to be made on a site-specific basis.

Second, the alternative under consideration does not prohibit injection into any specific formation types (*e.g.*, basalts and/or coal seams). It affords all formations equal treatment and allows specific regions of the country the regulatory flexibility to determine if any injection at a particular site and depth is the appropriate approach. It will also help to manage injection in areas where there may be multiple, stratified formations with significant assessed cumulative capacity.

Third, because the Agency believes that it is necessary to address the specific, unique characteristics of Class VI injection (*e.g.*, large injection volumes, viscosity, and buoyancy) and the Agency does not have information or data indicating that Class II operations are entirely analogous to Class VI, large-scale injection, this alternative allows Class VI injection depth considerations to be tailored for GS. A number of dominant differences between Class II and Class VI operations indicate that these well classes warrant different treatment. EPA received comment during the public comment period supporting the need for such a distinction. These differences include: the risk profiles for these operations; the greater total injection volumes (of CO_2) for Class VI GS; and, differences in formation pressures (potentially higher for GS), greater opportunities for mobilization of constituents, and injection rates and operating conditions.

The alternative EPA is considering relies on the principle of site-suitability for GS: injection zones/formations that have suitable upper and lower confining units, appropriate lateral and vertical extent to receive and contain the injected CO_2, and an appropriate management scheme to ensure that the water and other resources contained within the injection zone will not be needed in the future. The management scheme will also ensure that there is a strategy developed to address future needs to access formations below the injection zone.

This approach would allow regulators and communities (*e.g.*, States, *etc.*) to assess the most appropriate injection depth for a given project, in a given geographic or geologic area. It may also allow communities, local, and State authorities to plan resource use appropriately and, if necessary, circumvent the need to drill through a CO_2 filled zone/formation/plume to exploit resources (both water and hydrocarbon) in or below the injection zone.

Conversely, EPA is weighing the fact that this alternative would be a divergence from the existing UIC deep-well injection requirements for industrial and hazardous waste injection. It will result in greater injection depth variability throughout the United States and may result in emplacement of fluids by injection in closer proximity to USDWs than would occur under the proposed requirements. Additionally, adoption of this alternative could potentially add a new administrative burden to UIC programs pursuing the waiver approach.

Consideration of New Approach

Based on new information and data from comments received on the proposed rule, the Agency is considering a waiver process to allow GS injection above and between USDWs under specific conditions in lieu of a blanket prohibition on injection above and between USDWs. The proposed Class VI GS injection depth requirements would remain unchanged but would allow an owner or operator seeking to inject above and/or between USDWs to apply for a waiver from the proposed injection depth requirements. The owner or operator would be required to demonstrate to regulatory authorities that such injection can be undertaken and completed in a manner that prevents fluid movement into overlying (and underlying) USDWs, thereby preventing the endangerment of public health from USDW contamination. This process would be separate from aquifer exemptions and has no effect on 40 CFR parts 144.7 and 146.4.

Under this alternative, an owner or operator applying for an injection depth waiver would need to consider and submit additional, specific information to the UIC Program Director and the Public Water Supply Supervision (PWSS) Program Director for review prior to completing a Class VI permit application. EPA is considering that such information would likely include:

- *Site characterization:* Site characterization data will be critical in determining appropriateness of a given formation and depth for GS injection. The waiver application would need to demonstrate: (1) Laterally continuous, impermeable confining units above and below the injection zone adequate to prevent fluid movement and pressure buildup; (2) A laterally continuous injection zone/formation with adequate injectability, including sufficient porosity and permeability, and appropriate soil-rock chemistry (so as to ensure that the injection matrix is not dissolved as a result of injection); (3) An injection zone and confining formations free of transmissive fractures and faults; and, (4) A characterization of regional fracture properties and a demonstration that such fractures will not interfere with injection, serve as conduits, or endanger USDWs.
- *AoR and corrective action:* Due to the potential risk that artificial penetrations pose as fluid/injectate conduits, the owner/operator would need to map and identify all artificial penetrations in the AoR that penetrate the injection zone, the upper and lower confining zones, and all USDWs in the area. The purpose of this demonstration would be to ensure that public water supplies, private wells, and potential future water resources are identified and the location of artificial penetrations into such formations are known and these artificial penetrations can be appropriately plugged during the permitting phase.
- *Emergency and remedial response and financial responsibility:* The owner or operator would need to supplement the emergency and remedial response plan (submitted as part of the waiver application process *and* as part of the UIC Class VI permit) to ensure protection of USDWs above and below the injection zone. The purpose of this plan would be to explain that the owner or operator has considered regional water resource issues and has explored alternative water supplies or water treatment options to address unanticipated movement of the injectate or formation fluids (*e.g.*, CO_2, brine, or other fluids) into any overlying or underlying USDWs. The owner/operator would also demonstrate sufficient, additional financial responsibility to address any potential contamination of USDWs above or below the injection zone.

Upon compliance with the waiver process requirements, the owner/operator would need to submit the information jointly to the UIC Program Director and the PWSS Program Director. These Directors would consider factors such as:

- The integrity of the upper and lower confining units (certified by a Professional Geologist or a Professional Engineer);
- The suitability of the injection zone (*e.g.*, lateral continuity; lack of transmissive faults and fractures; knowledge of current or planned artificial penetrations into it or formations below the injection zone);
- The potential capacity of the geologic formation to sequester CO_2, accounting for the availability of alternative injection sites;
- All other site characterization data, the proposed emergency and remedial response plan, and a demonstration of financial responsibility;
- Community needs, demands, and supply from drinking water resources;
- Planned needs, potential and/or future use of USDWs and non-USDWs in the area;
- Planned (or permitted) water, hydrocarbon, or mineral resource exploitation potential of the proposed injection formation and other formations both above and below the injection zone—to determine if there are any plans to drill through the formation to access resources in or beneath the proposed injection zone/formation;
- The proposed plan for securing alternative resources or treating USDW formation waters in the event of contamination related to the Class VI injection activity; and,
- Any other locally applicable considerations.

The waiver may also be subject to local notice and public hearing. Following a public hearing and waiver approval by both Program Directors, the owner/operator may complete and submit the Class VI permit application. The owner/operator may be required to comply with additional requirements that apply as a result of receipt of the waiver, designed to ensure the protection of USDWs both above and below the injection zone. These requirements could include: more specific construction and pre-operational testing requirements to reduce the chances of upward fluid movement or inter-formational flow; enhanced operating requirements such as more stringent injection pressure limitations; a site-specific monitoring regime that includes increased formation fluid and ground water sampling and monitoring above and below the injection zone in concert with local water suppliers; seismic plume tracking and monitoring of pressure changes above and below the injection zone; supplemented financial responsibility and emergency and remedial response requirements (consistent with those in the waiver); and identification of the location of PWS and private drinking water wells in developing and executing the post-injection site care and site closure plan at the GS site.

Adoption of the Waiver Requirements

Due to the range of concerns and comments related to the injection depth requirements and the nature of the suggested waiver approval procedure, EPA believes that adoption of any such injection depth waiver process, as previously described, should be at the discretion of the UIC Program Director. Because deep USDWs do not exist in every State, EPA expects that not all States would choose to adopt the waiver process. UIC Programs in such States may instead adopt and enforce the proposed requirement that injection for GS be below the lowermost USDW.

EPA also recognizes that States and UIC Directors have the discretion to be more stringent in writing regulations for GS and/or adopting Federal UIC requirements. As a result, States could include a minimum injection depth requirement in their regulations or a Director may impose such requirements on a site-specific basis.

The Agency is requesting comment on the merits and possible disadvantages of the injection depth waiver process. Specifically, should an approach such as the one described in this Notice be considered and if so, should there be additional, fewer, or different elements? Some stakeholders are concerned about the risks associated with the use of formations other than deep saline and depleted reservoirs (*e.g.*, coal seams, basalts, *etc.*). EPA is seeking comment on whether the waiver process should apply to formations other than these.

Additionally, the Agency is interested in:

(1) Information on specific areas of the United States where injection depth and USDW depth are of concern (including formation depth, location, and assessed capacity; demonstrated confinement and GS suitability; and, formation salinity/TDS) as determined by well-log analyses, cross sections, and formation fluid analyses;

(2) Data, information, and evidence from owners and operators constructing and operating injection wells through existing CO_2 plumes to access resources (*e.g.*, water, hydrocarbon, *etc.*) below the injection zone and whether or not such operations are safe and do not endanger USDWs; and,

(3) Strategies that States, Tribes, and regions are considering to manage competing GS and resource issues.

V. State Statutes, Regulations, and Activities Related to Geologic Sequestration

Throughout the regulatory development process for the Class VI proposal, EPA has made it a priority to engage States and State organizations. The EPA has honored a commitment to working with State co-regulators to address regulatory issues related to GS through a series of stakeholder and technical workshops, public hearings, and EPA participation with national organizations including the Ground Water Protection Council, the Interstate Oil and Gas Compact Commission, and the American Association of State Geologists. EPA values coordination with States and State co-regulators and will continue an open dialogue as the Agency moves forward in the regulatory development process.

EPA recognizes the complexity and importance of the States' approaches to managing GS and does not want to unduly hinder State activities as indicated in an April 2008 EPA letter to the States (available in the docket for this regulatory action). The Agency is aware that States are currently in various stages of developing statutory frameworks, regulations, workgroups, technical guidance, and strategies for addressing CCS and GS. Much of the expertise and infrastructure currently exists within State UIC Programs. These programs will form the foundation for managing GS wells. Additionally, States can use multiple authorities beyond those afforded under the SDWA and UIC regulations including surface access and land rights, unitization of fields, pore space ownership, mineral rights, worker safety and emergency preparedness, and maximization of State oil and gas resource exploitation.

At present, several States have published GS regulations, while a number of other States are investigating and developing strategies to address dual purpose injection wells (EOR/EGR and GS simultaneously). Some States are using natural gas storage regulations as a platform for developing these regulations. Additionally, as States develop regulations and statutes, they are examining which State Agency can most appropriately manage implementation for GS wells. EPA is continuing to collaborate with States and will consider this information as EPA develops guidance on the primacy application and approval process for Class VI wells. Information about these State activities may be found in the Docket for today's publication. EPA also seeks comment on current State activities addressing GS. This information will assist EPA in developing guidance for UIC program implementers.

VI. Conclusions

In conclusion, today's Notice supplements the proposed ''Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells'' of July 25, 2008 (73 FR 43492), presents new data and information, and requests public comment on related issues that have evolved in response to comments on the original proposal. This Notice contains preliminary field data from Department of Energy-sponsored Regional Carbon Sequestration Partnership projects, the results of GS-related studies conducted by the Lawrence Berkeley National Laboratory, and additional GS related research. Today's Notice also discusses comments and presents an alternative the Agency is considering related to the proposed injection depth requirements.

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