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40 CFR Part 98

Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 98

[EPA–HQ–OAR–2009–0926; FRL–9131–2]

RIN 2060–AP88

Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: EPA is proposing a rule to require reporting on carbon dioxide (CO_2) injection and geologic sequestration (GS). The proposed rulemaking does not require control of greenhouse gases (GHGs), rather it requires only monitoring and reporting of CO_2 injection and geologic sequestration. EPA first proposed that suppliers of CO_2 be subject to mandatory GHG reporting requirements in April 2009 and finalized the rule for suppliers of CO_2 on October 30, 2009.

DATES: *Comments.* Comments must be received on or before June 11, 2010.

Public hearings. There will be one public hearing. The hearing date and location is: April 19, 2010 from 9 a.m. to 1 p.m. at One Potomac Yard, 2777 S. Crystal Drive, Arlington, VA 22202.

To obtain information about the public hearing or to register to speak at the hearing, please go to *http://www.epa.gov/climatechange/emissions/ghgrulemaking.html.*

ADDRESSES: Submit your comments, identified by Docket ID No. EPA–HQ–OAR–2009–0926, by one of the following methods:

Federal eRulemaking Portal: http://www.regulations.gov. Follow the online instructions for submitting comments.

E-mail: GHGReportingRR@epa.gov.

Fax: (202) 566–1741.

Mail: EPA Docket Center, Attention Docket OAR–2009–0926, Mailcode 2822T, 1200 Pennsylvania Ave., NW., Washington, DC 20460.

Hand/Courier Delivery: EPA Docket Center Public Reading Room, Room 3334, EPA West Building, Attention Docket OAR–2009–0926, 1301 Constitution Ave., NW., Washington, DC 20004. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OAR–2009–0926. 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. 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 EPA's Docket Center, Public Reading Room, EPA West Building, Room 3334, 1301 Constitution Ave., NW., Washington, DC. This Docket Facility 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 Air Docket is (202) 566–1742.

FOR FURTHER INFORMATION CONTACT: For technical information, e-mail the Greenhouse Gas Reporting Rule Hotline at *ghgmrr@epa.gov* with the name of this action in the e-mail subject line, or contact Barbora Master, Climate Change Division, Office of Atmospheric Programs (MC–6207J), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; *telephone number:* (202) 343–9899; *fax number:* (202) 343–2359. To obtain information about the public hearings or to register to speak at the hearings, please go to *http://www.epa.gov/climatechange/emissions/ghgrulemaking.html.*

SUPPLEMENTARY INFORMATION:

Additional Information on Submitting Comments: To expedite review of your comments by Agency staff, you are encouraged to send a separate copy of your comments, in addition to the copy you submit to the official docket, to Carole Cook, Climate Change Division, Office of Atmospheric Programs (MC–6207J), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460; *e-mail address: GHGReportingRule@epa.gov.*

In drafting this proposed rulemaking, EPA reviewed and considered comments submitted on the proposed subpart PP. However, as this is a new proposal, EPA will not be responding to comments received on the April 2009 proposed subpart PP in this rulemaking. To ensure that their comments are considered, stakeholders should submit comments relevant to this rulemaking as instructed in this document.

Regulated Entities. The Administrator has determined that this action is subject to the provisions of Clean Air Act (CAA) section 307(d). See CAA section 307(d)(1)(V) (the provisions of CAA section 307(d) apply to "such other actions as the Administrator may determine"). This is a proposed regulation. If finalized, these regulations would affect owners or operators of CO_2 injection wells. Regulated categories and entities include those listed in Table 1 of this preamble:

TABLE 1—EXAMPLES OF AFFECTED ENTITIES BY CATEGORY

Category	NAICS	Examples of affected facilities
CO_2 Enhanced Oil and Gas Recovery Projects	211	Oil and gas extraction projects using CO_2 enhanced oil and gas recovery.
GS Sites	N/A	CO_2 geologic sequestration projects.

Table 1 of this preamble is not intended to be exhaustive, but rather provides a guide for readers regarding facilities likely to be affected by this action. Table 1 of this preamble lists the types of facilities that EPA is now aware could be potentially affected by the reporting requirements. Other types of facilities not listed in the table could also be subject to reporting requirements. To determine whether you are affected by this action, you should carefully examine the applicability criteria found in proposed 40 CFR part 98, subpart A or the relevant criteria in the sections related to the injection and GS of CO_2. If you have questions regarding the applicability of this action to a particular facility, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Some facilities that are affected by today's proposed rule have GHG emissions from multiple source categories. Table 2 of this preamble has been developed as a guide to help potential CO_2 injection and GS reporters subject to the proposed rule identify the source categories (by subpart) that they may need to (1) consider in their facility applicability determination, and/or (2) include in their reporting. The table should only be seen as a guide. Additional subparts in 40 CFR part 98 may be relevant for a given reporter. Similarly, not all listed subparts are relevant for all reporters.

TABLE 2—SOURCE CATEGORIES AND RELEVANT SUBPARTS

Source category (and main applicable subpart)	Other subparts recommended for review to determine applicability
Injection and Geologic Sequestration of Carbon Dioxide	40 CFR part 98, subpart C. 40 CFR part 98, subpart W (proposed). 40 CFR part 98, subpart PP.

Acronyms and Abbreviations. The following acronyms and abbreviations are used in this document.

3–D three-dimensional
CAA Clean Air Act
CBI confidential business information
CCS carbon dioxide capture and geologic sequestration
CDM Clean Development Mechanism
CFR Code of Federal Regulations
CH_4 methane
CO_2 carbon dioxide
DOE Department of Energy
EC European Commission
ECBM enhanced coalbed methane
EIA Economic Impact Analysis
EPA Environmental Protection Agency
EO Executive Order
ER enhanced oil and gas recovery
GHG greenhouse gas
GPG Good Practice Guidance
GS geologic sequestration
HFC hydrofluorocarbon
HFE hydrofluoroether
ICR Information Collection Request
IMO International Maritime Organization
IPCC Intergovernmental Panel on Climate Change
IRS Internal Revenue Service
MRR Mandatory Reporting of Greenhouse Gases Rule
MRV monitoring, reporting, and verification
N_2O nitrous oxide
NAICS North American Industry Classification System
NTTAA National Technology Transfer and Advancement Act
O&GJ Oil and Gas Journal
OAR Office of Air and Radiation
OMB Office of Management and Budget
OW Office of Water
PFC perfluorocarbon
QA/QC quality assurance/quality control
R&D research and development
RFA Regulatory Flexibility Act
SBREFA Small Business Regulatory Enforcement Fairness Act
SDWA Safe Drinking Water Act
SF_6 sulfur hexafluoride
TSD technical support document
UIC Underground Injection Control
UNFCCC United Nations Framework Convention on Climate Change
US United States
UMRA Unfunded Mandates Reform Act of 1995
USDA United States Department of Agriculture
USDW underground source of drinking water
VEF Vulnerability Evaluation Framework

Table of Contents

I. Background

A. Organization of This Preamble

This preamble is broken into several large sections, as detailed in the Table of Contents. The following paragraphs describe the layout of the preamble and provide a brief summary of each section.

Section I of this preamble contains the basic background information about the origin of this proposed rulemaking, including a discussion of how it relates to the finalized requirements for Suppliers of CO_2 (under 40 CFR, part 98, subpart PP) and to the Underground Injection Control (UIC) program. This section also discusses EPA's legal authority under the Clean Air Act (CAA) to collect the proposed data, and the benefits of collecting the data.

Section II of this preamble summarizes the general provisions of this proposed rulemaking for reporting CO_2 injection and GS. This section also provides a brief summary of, and rationale for, the selection of key design elements. Specifically, this section describes EPA's rationale for the proposed (i) definition of reporting facilities, (ii) applicability thresholds, (iii) data reporting requirements, (iv) monitoring, reporting and verification (MRV) plan requirements and process, (v) schedule and process for reporting, (vi) procedures for estimating missing data, and (vii) recordkeeping requirements. Thus, for example, there is a specific discussion regarding appropriate applicability thresholds, monitoring methodologies and reporting and recordkeeping requirements for all CO_2 injection facilities, and additional requirements for facilities that conduct GS. EPA describes the proposed options for each design element as well as the other options considered. Throughout this discussion, EPA highlights specific issues on which the Agency solicits comment.

Section III of this preamble provides the summary of the cost impacts, economic impacts, and benefits of this proposed rule from the Economic Impact Analysis (EIA). Finally, Section IV of this preamble discusses the various statutory and executive order requirements applicable to this proposed rulemaking.

B. Background on the Proposed Rule

On December 26, 2007, President Bush signed the fiscal year 2008 Consolidated Appropriations Act authorizing funding for EPA to issue a rule requiring the mandatory reporting of greenhouse gas (GHG) emissions (Consolidated Appropriations Act, 2008, Pub. L. 110–161, 121 Stat. 1844, 2128 (2008)). An accompanying joint explanatory statement directed EPA to "use its existing authority under the Clean Air Act" to develop a mandatory GHG reporting rule.

The proposed Mandatory Reporting of Greenhouse Gases Rule (MRR) was signed on March 10, 2009, by Administrator Lisa Jackson and was published a month later (74 FR 16448, April 10, 2009). After a 60-day comment period, two public hearings, and meeting with over 4,000 additional people in over 150 groups via Webinars, conferences, individual meetings, and other forms of outreach, EPA issued a final rule on October 30, 2009 (74 FR 56260). The MRR requires reporting of GHG emissions and supply from all sectors of the economy, including fossil fuel suppliers, industrial gas suppliers, and direct emitters of GHGs. The rule does not require the control of GHGs; rather the rule requires only that sources above certain threshold levels monitor and report those GHGs.

The final MRR covers the major GHGs that are directly emitted by anthropogenic activities. These include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and other specified fluorinated compounds (*e.g.,* hydrofluoroethers (HFEs)) used in boutique applications such as electronics and anesthetics.[1]

The final rule contains 31 subparts, each requiring reporting from a defined source category. In order to meet the reporting time, quality assurance, and verification requirements of the rule, EPA is establishing a facility-to-EPA electronic reporting system to facilitate collection of data under this rule. All facilities that are covered under this rule as reporters will use this data system to submit required data.

Subpart PP requires the reporting of CO_2 supplied to the economy. Subpart PP applies to all facilities with CO_2 production wells, facilities with production process units that capture and supply CO_2 for commercial applications or that capture and maintain custody of a CO_2 stream to sequester or otherwise inject it underground, and to importers and exporters of bulk CO_2. During the public comment period on the rule, EPA received many comments on subpart PP that CO_2 injected underground should be considered when estimating emissions from the CO_2 supply industry. Some commenters specified that some of the CO_2 supplied for the purposes of enhanced oil and gas recovery (ER) is additionally sequestered rather than emitted and characterized ER operations as "closed systems" rather than emissive. Other commenters stated that including reporting requirements for geologically sequestered CO_2 would fill a critical gap in the reporting system. EPA agrees that ER is a potentially non-emissive end use and that GS data reporting from ER sites can assist EPA in quantifying the amount of CO_2 that is permanently and securely geologically sequestered. In addition, EPA agrees that GS reporting requirements would provide information and transparency on the amount of CO_2 injected and geologically sequestered in the United States.

Although CCS is occurring now on a relatively small scale, it could play a larger role in mitigating GHG emissions from a wide variety of stationary sources. According to the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2007, stationary sources contributed 67 percent of the total CO_2 emissions from fossil fuel combustion in 2007.[2] These sources represent a wide variety of sectors amenable to CO_2 capture: electric power plants (existing and new), natural gas processing facilities, petroleum refineries, iron & steel foundries, ethylene plants, hydrogen production facilities, ammonia refineries, ethanol production facilities, ethylene oxide plants, and cement kilns. Furthermore, 95 percent of the 500 largest stationary sources are within 50 miles of a candidate GS reservoir.[3] Estimated GS capacity in the United States is over 3,500 Gigatons CO_2 ($GtCO_2$) (13,000 Gigatons CO_2 at the high end),[4] although the actual capacity may be lower once site-specific technical and economic considerations are addressed. Even if only a fraction of that geologic capacity is used, CCS is poised to play a sizeable role in mitigating U.S. GHG emissions.

Many of the injection and monitoring technologies that may be applicable for

[1] These gases influence the climate system by trapping in the atmosphere heat that would otherwise escape to space. Additional information about GHGs, climate change, climate science, and other related issues, can be found at EPA's climate change Web site at *http://www.epa.gov/climatechange/*.

[2] U.S. EPA Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990–2007, Draft Report, EPA 430–R–09–004. Available at: *http://epa.gov/climatechange/emissions/usinventoryreport.html.*

[3] Dooley, JJ, CL Davidson, RT Dahowski, MA Wise, N Gupta, SH Kim, EL Malone. 2006. "Carbon Dioxide Capture and Geologic Storage: A Key Component of a Global Energy Technology Strategy to Address Climate Change." Joint Global Change Research Institute, Battelle Pacific Northwest Division. PNWD–3602.

[4] DOE. 2008. Carbon Sequestration Atlas of the United States and Canada (Atlas II). Available at: *http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasII/.*

GS are commercially available today and will be more widely demonstrated over the next 10 to 15 years.[5] The oil and natural gas industry in the United States has over 35 years of experience of injection and monitoring of CO_2 in the deep subsurface for the purposes of enhancing oil and natural gas production. This experience provides a strong foundation for the injection and monitoring technologies that will be needed for commercial-scale CCS. U.S. experience with ER combined with the experience of four end-to-end commercial CCS projects[6] and ongoing research, demonstration, and deployment programs throughout the world, are building confidence that geologic sequestration of large amounts of CO_2 can be achieved.

C. Overview of the Proposal

Today, EPA is proposing to amend the Mandatory Reporting of Greenhouse Gases Program at 40 CFR part 98 to add reporting requirements covering facilities that conduct injection and geologic sequestration of CO_2.

EPA is proposing a tiered approach for reporting requirements under this subpart. The first tier of proposed regulations would establish a set of reporting requirements that would cover all facilities that inject CO_2 underground. As described in Section II.C of this preamble, all facilities would be required to report CO_2 transferred onsite from offsite sources, the source of the CO_2 (if known), and CO_2 injected underground.

The second tier of reporting requirements would apply to GS facilities. As described in Section II.C of this preamble, GS facilities would be required to calculate CO_2 sequestered by subtracting total CO_2 emissions from the CO_2 injected in the reporting year. The emitted quantity would include the injected CO_2 that leaked from the subsurface to the surface (if any), CO_2 produced with oil or natural gas where ER operations are conducted at the GS facility, fugitive or vented CO_2 emissions from surface equipment, and emissions from combustion sources located within the facility boundary, such as compressors.

EPA considered several options for monitoring, reporting and verification (MRV) of potential CO_2 leakage[7] at GS sites: do not require a MRV plan, require a universal MRV plan that applies to all GS sites, or require a site-specific MRV plan. EPA is proposing to require monitoring according to a site-specific MRV plan, but is seeking comment on all of the options considered. While the risk of leakage at a well-selected and well-managed GS site is expected to be low, the Agency considers it important for all facilities conducting GS to demonstrate that they have met MRV standards. The options described above are discussed in more detail in Section II.D of this preamble.

Data on CO_2 injection and GS are critical to informing CAA GHG policies. This data would provide information and transparency on the amount of CO_2 injected and geologically sequestered in the United States and, in combination with other subparts of the MRR, would enable EPA to track the flow of CO_2 across a CCS system. In addition, this information would enable EPA to monitor the growth and efficacy of GS (and therefore CCS) as a GHG mitigation technology over time and to evaluate relevant policy options. For example, EPA would be able to track whether incentives or regulations are needed to encourage faster or further GS project development. EPA would also be able to track whether ER sites are reporting GS and consider whether incentives or regulations are needed. Where ER facilities are reporting GS, EPA would be able to evaluate ER as a potentially non-emissive end use. In combination with subpart PP, EPA would be able to reconcile this data with CO_2 supplied in order to better understand the quantity of CO_2 supplied to emissive and non-emissive end uses. Furthermore, this data would inform Agency policy decisions under CAA sections 111 and 112 related to the use of CCS for mitigating GHG emissions.

In developing this proposal, EPA considered overlap between this program and other programs. In July 2008, EPA proposed to amend its UIC program to establish a new class of injection well for GS projects (73 FR 43492 (July 25, 2008)). Today's proposal provides a pathway for CO_2 injection facilities to report to EPA as GS facilities under the CAA, regardless of their UIC permit classification. Under this proposal, any facility sequestering CO_2 underground can choose to qualify and report as a GS facility for purposes of this proposed rule.

Since subpart RR is an amendment to the MRR, the general provisions of the MRR (40 CFR part 98, subpart A) apply to today's proposed subpart RR unless a provision is superseded by this subpart that applies uniquely to facilities that inject CO_2 or that conduct GS. The general provisions address the following topics: The purpose and scope (40 CFR 98.1); who must report (40 CFR 98.2); the general monitoring, reporting, recordkeeping and verification requirement (40 CFR 98.3); the authorization and responsibilities of the designated authority (40 CFR 98.4); how a report is submitted (40 CFR 98.5); definitions (40 CFR 98.6); the standardized methods incorporated by reference (40 CFR 98.7); the compliance and enforcement provisions (40 CFR 98.8); and the mailing addresses (40 CFR 98.9).

Amendments to the General Provisions. In a separate rulemaking, package that was recently published (March 16, 2010), EPA issued minor harmonizing changes to the general provisions for the GHG reporting rule (40 CFR part 98, subpart A) to accommodate the addition of source categories not included in the 2009 final rule (*e.g.,* subparts proposed in April 2009 but not finalized in 2009, any new subparts that may be proposed in the future). The changes update 98.2(a) on rule applicability and 98.3 regarding the reporting schedule to accommodate any additional subparts and the schedule for their reporting obligations (*e.g.,* source categories finalized in 2010 would not begin data collection until 2011 and reporting in 2012).

In particular, we restructured 40 CFR 98.2(a) to move the lists of source categories from the text into tables. A table format improves clarity and facilitates the addition of source categories that were not included in calendar year 2010 reporting and would begin reporting in future years. A table, versus list, approach allows other sections of the rule to be updated automatically when the table is updated; a list approach requires separate updates to the various list references each time the list is changed. In addition to reformatting the 98.2(a)(1)–(2) lists into tables, other sections of subpart A were reworded to refer to the source category tables because the tables make it clear which source categories are to be considered for determining the applicability threshold and reporting requirements for calendar years 2010, 2011, and future years.

[5] Dooley, JJ, CL Davidson, RT Dahowski. 2009. "An Assessment of the Commercial Availability of Carbon Dioxide Capture and Storage Technologies as of June 2009." Joint Global Change Research Institute. Pacific Northwest National Laboratory. PNNL–18520.

[6] These projects are: 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; and Snohvite (Norwegian Barents Sea)—0.7 Mt CO_2/yr injected since 2008.

[7] Leakage in this proposed rule is defined as the movement of CO_2 from the injection zone to the surface (for example to the atmosphere, indoor air, oceans or surface water).

As part of today's proposed rule, EPA is proposing changes to subpart A to accommodate subpart RR. Because all CO_2 injection and geologic sequestration facilities (as defined in proposed 40 CFR part 98, subpart RR) would be subject to proposed subpart RR, EPA is proposing that this source category be added to the table of "all-in" source categories referenced from 40 CFR 98.2(a)(1).[8] For facilities that become subject to the MRR due to CO_2 injection or geologic sequestration, the first annual GHG report would cover calendar year 2011 rather than 2010.

EPA is proposing to amend 40 CFR 98.2(a) so that the MRR applies to facilities located on or under the Outer Continental Shelf. These revisions are necessary to ensure that any CO_2 injection or GS facilities located on or under the Outer Continental Shelf of the United States would be required to report. In addition, EPA is proposing revisions to the definition of United States to clarify that the United States includes the territorial seas. Other facilities located offshore of the United States covered by the MRR program at 40 CFR part 98 would also be affected by this change in the definition of United States. For example, EPA is proposing in a separate rule to revise the MRR requirements to add a new subpart, subpart W, to address petroleum and natural gas systems. Any comments specific to that issue should be directed to the Agency in that rulemaking, not this one. Finally, in addition to the change to the definition of United States, EPA is adding a definition of "Outer Continental Shelf." This definition is drawn from the definition in the U.S. Code. Together, these changes make clear that the MRR applies to facilities on land, in the territorial seas, or on or under the Outer Continental Shelf of the United States, and that otherwise meet the applicability criteria of the MRR.

EPA also is proposing to amend 40 CFR 98.7 (incorporation by reference) to include standard methods used in proposed subpart RR.

D. Legal Authority

EPA is proposing subpart RR under the existing authority provided in CAA section 114. As noted in the MRR, CAA section 114 provides EPA with broad authority to require information mandated by this rule because such data will inform and are relevant to EPA's carrying out a wide variety of CAA provisions (74 FR 66264). Under CAA section 114(a)(1), the Administrator may require emissions sources, persons subject to the CAA, or persons whom the Administrator believes may have necessary information to monitor and report emissions and provide such other information as the Administrator requests for the purposes of carrying out the provisions in the CAA (except for a provision of title II with respect to motor vehicles).

As discussed in greater detail in the response to comments for the final MRR, the CAA provides EPA with broad authority to require the comprehensive and accurate information mandated in this rule because such data will inform, and are relevant to, EPA's analyses of various CAA provisions (Mandatory Reporting of Greenhouse Gases, EPA's Response to Public Comment's Section 3–Legal Issues). EPA may gather information for a variety of purposes, including for the purpose of assisting in the development of implementation plans or of emissions standards under CAA section 111, determining compliance with implementation plans or such standards, or more broadly for "carrying out any provision" of the CAA. In addition, CAA section 103 authorizes EPA to establish a national research and development program, including non-regulatory approaches and technologies for the prevention and control of air pollution as it relates to GHGs and climate change.

The information from CO_2 injection and GS facilities will allow EPA to make well-informed decisions about whether and how to use the CAA to regulate these facilities and encourage voluntary reductions.

E. Relationship to the Proposed UIC Class VI Rulemaking Under the Safe Water Drinking Act

The Agency maintains a high-level of coordination across EPA offices and regions on GS activities and regulatory development. EPA's Office of Air and Radiation (OAR) and Office of Water (OW) work closely to promote safe and effective implementation of GS technologies while ensuring protection of human health and the environment. All Agency efforts related to GS, including the UIC Class VI proposal which is discussed in more detail below, and this MRR proposal, are closely coordinated.

EPA's UIC program was established in the 1970s to prevent endangerment of underground sources of drinking water (USDWs) from injection of various fluids, including CO_2 for ER, oil field fluids, water stored for drinking water supplies, and municipal and industrial waste. The UIC program, which is authorized by Part C of the Safe Drinking Water Act (SDWA) (42 U.S.C. 300h *et seq.*), is designed to prevent the movement of such fluid into USDWs by addressing the potential pathways through which injected fluids can migrate and potentially endanger USDWs.

When EPA initially promulgated its UIC program regulations, the Agency defined five classes of injection wells at 40 CFR 144.6, based on similarities in the fluids injected, construction, injection depth, design, and operating techniques. Wells injecting industrial non-hazardous liquids, municipal wastewaters or hazardous wastes beneath the lowermost USDW are categorized as Class I. Those injecting fluids in connection with conventional oil or natural gas production, enhanced oil and gas production, and the storage of hydrocarbons which are liquid at standard temperature and pressure are categorized as Class II. Class III wells inject fluids associated with the extraction of minerals, and those categorized as Class IV inject hazardous or radioactive wastes into or above USDWs. Class IV injection wells are banned unless authorized under an approved Federal or State ground water remediation project. Class V includes all injection wells that are not included in Classes I–IV. This well class provides for Class V experimental technology wells including those permitted as GS pilot projects.[9]

In 2008, EPA proposed to amend the UIC program to establish a new class of injection well—Class VI—to cover the underground injection of CO_2 for the purpose of GS, or long-term storage of CO_2 (73 FR 43492, July 25, 2008). The proposed requirements would tailor existing components of the UIC program to address the unique nature of GS projects so as to ensure that the injection of large volumes of CO_2 in a variety of geologic formations for the purposes of long term storage would not endanger USDWs. The UIC Class VI proposal does not require any facilities to capture and/or sequester CO_2; rather the proposed requirements, if finalized, would protect USDWs under the SDWA. The SDWA does not provide authority to develop regulations for all areas related to GS such as capture or transport. As outlined in the UIC Class VI proposal, injection wells used for injecting CO_2 for the purposes of ER would continue to be regulated and permitted as Class II as long as any

[8] Since we changed the list of covered subcategories to tables, we are not providing regulatory text in this proposal because the preamble is clear.

[9] *See* EPA UIC Guidance #83. Available at: *http://www.epa.gov/safewater/uic/wells_sequestration.html.*

production is occurring. EPA received significant comments on this proposed approach and is currently evaluating these comments for the final rulemaking.

Facilities regulated under the UIC program are required to collect and report data, with minimum requirements for the collection and reporting of data established at the Federal level. Where States are given primacy over the UIC program, the data collected under the UIC program varies. Data currently collected under a State-issued UIC permit is submitted to States while, under today's subpart RR proposal, reporters will be submitting data directly to EPA. The Agency believes that State, local, and tribal input is valuable in ensuring that the subpart RR reporting requirements appropriately build on the UIC program requirements. EPA is seeking comment on a number of topics and will look for opportunities to conduct outreach with State, local and tribal organizations between proposal and finalization.

Today's proposal builds on the UIC program requirements for monitoring with the additional goals of verifying the amount of CO_2 sequestered and collecting data on CO_2 surface emissions from GS facilities. As described in Section II.D of this preamble, EPA is proposing that a facility's UIC permit may be used to demonstrate that certain MRV plan requirements have been fulfilled.

In the Agency's August 2009 Notice of Data Availability supplementing the UIC Class VI proposal, EPA noted that it was evaluating the need for a more comprehensive regulatory framework for GS. The Agency acknowledges that regulatory clarity is essential for enabling GS to move forward in a manner that protects human health and the environment. It is EPA's intention to coordinate GS requirements across relevant statutory or other programs in order to minimize any redundancies and increase clarity for stakeholders. The Agency seeks comment on whether this is appropriate.

The proposed UIC Class VI rule is a separate rulemaking action; the comment period for that rulemaking closed on December 24, 2008. EPA will not be accepting or responding to comments on the proposed UIC Class VI rule through today's proposal unless related to a specific issue raised by this action.

F. Relationship to Other CO_2 Injection Information Collection and Reporting Efforts

In considering how to design this proposal, EPA reviewed and took into account other domestic and international reporting and monitoring programs. Key programs are summarized in this section.

The Department of Energy (DOE) Energy Information Administration implements a voluntary GHG reporting program under section 1605(b) of the Energy Policy Act of 1992, which directed DOE to issue guidelines establishing a voluntary greenhouse gas reporting program (42 U.S.C. 13385(b)). Under the Energy Information Administration's "1605(b) program," reporters can choose to prepare an entity-wide GHG inventory and identify specific GHG reductions made by the entity.[10] Reporting tools were revised and published in 2009 to assist entities in preparing a preliminary estimate of emissions. The 2007 updated 1605(b) guidance outlines a voluntary process to report data on CO_2 sequestration. Currently, no CO_2 injection or sequestration entity has reported under the 1605(b) program per the 2007 guidelines. According to the Energy Information Administration Web site, the first reporting cycle under the revised Voluntary Reporting of Greenhouse Gases Program has not been completed as of January 15, 2010. The Energy Information Administration anticipates issuing an annual report and public use database for data reported through 2008 by early 2010.[11] The 1605(b) guidance requires the implementation of a site-specific monitoring plan, but this plan is not evaluated by DOE to determine whether the plan will provide for appropriate monitoring. Four prescriptive monitoring scenarios are offered with grades ranging from "A" to "C", any of which would be acceptable for compliance with the 1605(b) program. Furthermore, although the 1605(b) guidance cites the importance of reporting CO_2 leakage should it occur, the guidance does not include a discussion of, procedures for, or methodologies for using monitoring technologies and techniques to quantify the leakage. As a result of this, and the fact that reporting is voluntary, the 1605(b) program would not meet the data needs of this proposed rule.

The Internal Revenue Service (IRS) made public IRS Notice 2009–83 Credit for Carbon Dioxide Sequestration under section 45Q on its Web site on October 8, 2009.[12] The notice provides procedures for the allocation of credits for CO_2 sequestration under section 45Q of the Internal Revenue Code. Section 45Q was enacted by section 115 of the Energy Improvement and Extension Act of 2008, (October 3, 2008) and was amended by section 1131 of the American Recovery and Reinvestment Act of 2009 (February 17, 2009). To claim this credit, a taxpayer must follow general monitoring and verification principles, calculate CO_2 sequestered in the fiscal year using a mass-balance equation, and report to IRS the amount of qualified CO_2 sequestered in the fiscal year. Seventy-five million metric tons of qualified CO_2 can be taken into account for this credit. The IRS included a provision in the notice to supersede its monitoring and verification procedures and requirements with procedures and requirements finalized by EPA in future GS rulemaking such as the UIC Class VI proposal and this proposed rule.

EPA has concluded for a number of reasons that the IRS data would not meet the needs outlined in this proposed rule. First, the IRS reporting requirement will expire after 75 million metric tons of CO_2 is reported as sequestered to IRS, at which point the data collection will end. Second, the level of reporting and transparency would not meet the verification needs of this proposed rule. GS facilities only report the quantity of CO_2 sequestered to IRS. The data used to calculate sequestration and the specific monitoring procedures followed will only be reviewed by IRS staff in the case of an audit. Given the variability in geology and other conditions at GS facilities, EPA believes that the monitoring approach at each GS facility must be reviewed on a case-by-case basis to ensure that it is appropriate for the site-specific geologic and operational conditions. Third, the IRS does not outline procedures or provide a mechanism for quantifying and reporting any CO_2 leakage that may occur as is necessary for this proposed rule.

EPA notes that the United States submits an inventory of GHG emissions that accounts for CCS to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) each year. The UNFCCC, ratified by the United States in 1992, establishes an overall framework for intergovernmental efforts to tackle the

[10] Under the 1605(b) program an "entity" is defined as "the whole or part of any business, institution, organization or household that is recognized as an entity under any U.S. Federal, State or local law that applies to it; is located, at least in part, in the U.S.; and whose operations affect U.S. greenhouse gas emissions." Available at: *http://www.pi.energy.gov/enhancingGHGregistry.*

[11] Available at: *http://www.eia.doe.gov/oiaf/1605/data_reports.html.*

[12] Available at: *http://www.irs.gov/irb/2009-44_IRB/ar11.html.*

challenge posed by climate change. The United States has submitted the Inventory of U.S. Greenhouse Gas Emissions and Sinks (Inventory) to the United Nations every year since 1993. The annual Inventory is consistent with national inventory data submitted by other UNFCCC parties, and uses internationally accepted methods for its emission estimates. For more information about the Inventory, please refer to the following Web site: *http://www.epa.gov/climatechange/emissions/usinventoryreport.htm.*

The United States currently follows the 1996 [13] Intergovernmental Panel of Climate Change (IPCC) guidelines in preparing its Inventory, as supplemented by IPCC Good Practice Guidance (GPG) from 2000 [14] and 2003 [15]. Since these guidelines do not provide information on the accounting of GS, EPA addressed CO_2 usage in the 2007 Inventory by accepting some general, top-down assumptions about the end-use of supplied CO_2. First, EPA collected CO_2 production data for natural CO_2 domes and estimated for each dome the amount of CO_2 used for ER operations and the amount of CO_2 used for non-ER operations. EPA assumed that the percentage of naturally produced CO_2 used for non-ER operations (*e.g.*, food processing, chemical production) was all emitted to the atmosphere. The percentage used for ER operations was assumed to be sequestered. Second, EPA collected data from industry on anthropogenic CO_2 emitted from natural gas processing and ammonia plants and accounted it as emitted, regardless of whether the CO_2 was captured or not.

The IPCC published new inventory guidelines in 2006 [16], which directly address accounting for GS and include methodologies for the estimation of emissions from capture, transport, injection, and GS of CO_2. The guidelines are based on the principle that the CCS system should be accounted for in a complete and consistent manner across the entire Inventory. The approach accounts for CO_2 produced from natural CO_2 domes and captured at industrial facilities as well as emissions from capture, transport, and use. For GS specifically, the IPCC guidelines outline a Tier 3 methodology [17] for estimating and reporting emissions based on site-specific evaluations of each storage site. EPA believes that the GS monitoring, reporting, and verification requirements of this proposed rule are consistent with the 2006 IPCC guidelines.

In considering how to design this proposal, EPA also took into account the monitoring requirements adopted in other countries, in particular other UNFCCC member countries that have already taken steps towards collecting information for CCS to meet the 2006 IPCC guidelines. The Directive of the European Parliament and of the Council on the geological storage of carbon dioxide (Commission decision 2007/589/EC) establishes a legal framework for the environmentally safe geological storage of CO_2. It requires European Council (EC) member States to ensure that each GS site operator will carry out monitoring of the injection facilities, the storage complex (including the CO_2 plume), and, where appropriate, the surrounding environment for detection of any significant migration or leakage of CO_2 or any significant adverse effect on the surrounding environment.

The directive requires that monitoring frequency be determined by the competent authority, and should be at least once a year. A monitoring report should be developed that describes the quantities and properties of the CO_2 streams delivered and injected, including concentration of the CO_2 streams, in the reporting period. The parameters to be monitored include:

- Fugitive emissions of CO_2 at the injection facility;
- CO_2 volumetric flow at injection wellheads;
- CO_2 pressure and temperature at injection wellheads (to determine mass flow);
- Chemical analysis of the injected material; and
- Reservoir temperature and pressure (to determine CO_2 phase behavior and state).

Per the directive, each GS site should choose monitoring technology based on best practices available at the time the monitoring plan is designed. The following options should be considered and used when appropriate:

- Technologies that can detect the presence, location, and migration paths of CO_2 in the subsurface and at the surface;
- Technologies that provide information about pressure-volume behavior and aerial/vertical distribution of CO_2-plume to refine numerical 3–D-simulation to the 3–D-geological models of the storage formation; and
- Technologies that can provide a wide aerial spread in order to capture information on any previously undetected potential leakage pathways across the aerial dimensions of the complete storage complex and beyond, in the event of significant irregularities or migration of CO_2 out of the storage complex.

In Australia, the Proposed Greenhouse Gas Geological Sequestration Regulations 2009 were proposed to support the implementation and administration of the Greenhouse Gas Geological Sequestration Act 2008 and to address several CCS related issues, including monitoring requirements for GS. These regulations require that each GS site develop a monitoring and verification plan which includes the following:

- Characteristics of the geological formation into which the GHG substance is to be injected and any geological or other conditions that may influence containment of a stored GHG;
- A description of the existing environment above, on and below the surface of the ground; and any resource above, on and below the surface of the ground that a person is entitled to extract or use under a resource authority;
- Details of the equipment proposed to be used to monitor the behavior of stored greenhouse gas substances, and where it is to be located;
- Details of the techniques to be used to monitor, the length of time that each technique is to be used, and how often each monitoring technique is to be carried out; and
- The regulation also specifies that a report on the outcome of all monitoring and verification activities carried out should be completed quarterly.

Other international efforts have also been useful to EPA in developing the requirements of this proposed rule. The International Maritime Organization (IMO) has published under the London Protocol [18] two documents to provide guidelines to parties for the assessment of and implementation of disposal of CO_2 in sub-seabed geologic formations:

[13] IPCC, 1996. "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories." National Greenhouse Gas Inventories Programme. Available: *http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.html.*

[14] IPCC. 2000. "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories." National Greehouse Gas Inventories Programme. Available at: *http://www.ipcc-nggip.iges.or.jp/public/gp/english/.*

[15] IPCC. 2003. "Good Practice Guidance for Land Use, Land-Use Change, and Forestry." National Greenhouse Gas Inventories Programme. Available at: *http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html.*

[16] 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2—Energy. Chapter 5 Carbon Dioxide Transport, Injection, and Geological Storage. Available at: *http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm.*

[17] Tier 3 methods include either detailed emission models or measurements and data at individual plant level where appropriate.

[18] Available at: *http://www.imo.org/includes/blastData.asp/doc_id=10531/9%20%20CO2%20Sequestration%20English.pdf.*

Specific Guidelines for Assessment of Carbon Dioxide Streams for Disposal into Sub-Seabed Geological Formations (2009) and Risk Assessment and Management Framework for CO_2 Sequestration in Sub-Seabed Geological Structures (2007). These guidelines focus on several aspects of CCS including:

- CO_2 stream characterization (chemical and physical properties);
- Waste prevention audit;
- Consideration of waste management options;
- Action lists;
- Identification and characterization of sub-seabed geological formation;
- Assessment of potential impacts;
- Monitoring and risk management; and
- Permitting and permit condition.

Under the Kyoto Protocol, the Clean Development Mechanism (CDM) is a market-based mechanism that aids countries in meeting their emission limitation and reduction goals through emission reduction (or removal) projects in developing nations. These projects allow companies in industrialized countries to receive credits that can either be put towards their emission limitation or reduction, traded, or sold. Two new proposed CDM methodologies (NM0167 and NM0168) address CCS activities.[19] These new baseline and monitoring methodologies have not yet been approved by the CDM Executive Board, but EPA continues to follow their progress and to monitor for other GS methodology proposals.

II. Rationale for Reporting, Recordkeeping, and Verification Requirements

A. Definition of Reporting Facilities

1. CO_2 Injection Facility

EPA is proposing that the CO_2 injection facility be defined broadly to cover wells or a group of wells that inject CO_2 into the subsurface or sub-seabed geologic formations. This definition would encompass both onshore and offshore facilities.

EPA is proposing a broad definition of CO_2 injection facility to ensure complete reporting of basic information regarding the CO_2 transferred onsite, the source of the CO_2 if known, and the CO_2 injected. The broad definition also provides reporters with flexibility either to report this basic information on a well by well basis or to group wells in an area for reporting purposes. Given the proposed threshold and applicability for CO_2 injection facilities, a more specific definition addressing the aggregation of groups of wells in an area is not necessary. As discussed in more detail in Section II.B of this preamble, however, EPA is soliciting comment on the question of how to define the source category if a more precise definition is necessary.

2. GS Facility

EPA is proposing facilities injecting CO_2 for the long-term containment in subsurface geologic formations would meet the definition of GS in this proposed rule and would report additional information. EPA is proposing that facilities that inject CO_2 for ER would not be GS facilities unless they inject CO_2 for the long-term containment in subsurface geologic formations and submit and gain EPA approval of an MRV plan.

To comply with the specific reporting requirements discussed in Section II.C of this preamble, the reporter would need to identify the sources and surface equipment making up the GS facility. However, EPA recognizes that defining the extent of a GS facility source may be difficult. For example, there may be a number of injection wells in an oilfield under common ownership or common control of which only a subset would be considered GS facilities. In that example, the question of whether and how to aggregate various wells arises. In addition, the CO_2 plume and pressure front associated with a GS facility may extend for a distance beyond the injection point, and widely separated wells may be injecting into the same pore space. Because EPA is seeking data on the amount of CO_2 sequestered by these facilities and because EPA is proposing an all-in threshold for these facilities, EPA is proposing a narrow definition of GS source to simplify the reporting requirements associated with emissions from combustion and surface equipment. For purposes of this reporting rule, EPA is proposing to define a GS facility to include all structures associated with the injection of CO_2 located between the points of CO_2 transfer onsite from offsite and the injection well (or wells). A GS facility that injects CO_2 to enhance the recovery of oil or natural gas will also include all structures associated with production located between the production wells and the separators.

Although EPA is proposing a narrow definition of GS facility, the proposed rule would require GS facilities to monitor over a spatial area that will almost certainly extend beyond the boundaries of the facility, as defined here. Given that a main focus of this proposal is to obtain information regarding the efficacy of GS, EPA anticipates that the MRV plans for GS facilities will need to require monitoring over a broad area. This is discussed in Section II.D of this preamble.

EPA seeks comment on its approach to defining the boundary of the GS facility. In particular, EPA seeks comment on the question of whether EPA should require the aggregation of wells located in an area, and if so, what rules should be applied for determining what equipment comprises the source. EPA seeks comment on whether the GS facility should be defined to include the spatial area of monitoring proposed in Section II.D of this preamble. EPA also seeks comment on whether it should follow the approach for onshore facilities in the proposed subpart W regulations, which requires the aggregation of equipment to the geographic boundary of a single hydrocarbon basin as defined by the American Association of Petroleum Geologists.

EPA is proposing to exempt research and development (R&D) as defined at 40 CFR Part 98.6 from subpart RR, consistent with the approach taken in subparts C through QQ of the MRR. EPA is also proposing that, for the purposes of GS facility requirements under subpart RR, research and development means those projects receiving Federal funding to research practices and monitoring techniques that will enable safe and effective long-term containment of a gaseous, liquid, or supercritical CO_2 stream in subsurface geologic formations. R&D projects would not be required to submit an MRV plan under subpart RR. EPA seeks comment on how R&D projects are defined and treated in this proposal.

3. Other CO_2 End-Users

In developing this proposed rule, EPA considered requiring reporting from various other end-users of the CO_2 that is produced and supplied to the economy, including both emissive and potentially non-emissive applications. EPA considered but is not proposing requiring reporting from these other end-users; EPA has concluded that collecting information pursuant to subpart PP on CO_2 supplied to the economy will provide EPA with the necessary data on emissive volumes while minimizing the number of facilities impacted by this rule. EPA seeks comment on this conclusion. The Agency also seeks comment on whether applications, such as precipitated calcium carbonate and some cement production, permanently sequester CO_2 and if so, which industries this would include; how many facilities operate in

[19] Available at: *http://cdm.unfccc.int/about/ccs/index.html.*

each of these industries; how much of the CO_2 consumed in each industry would be sequestered; whether a sequestration factor would be reasonable in any case; and what methodologies could be used to verify this sequestration.

B. Selection of Reporting Thresholds

To determine the appropriate threshold for reporting under subpart RR, EPA considered both a threshold based on the amount of CO_2 emitted and a threshold based on the amount of CO_2 injected underground. EPA concluded that an emissions-based threshold would be problematic because of the lack of data on the incidence and scale of surface emissions and leakage from injection and GS of facilities. EPA seeks comment on how the Agency could determine an emissions-based threshold and detailed data underlying such an approach. EPA accordingly analyzed injection facilities based on the quantity of CO_2 injected underground and considered whether an injection threshold should apply. EPA evaluated a no threshold option (*i.e.,* all facilities that inject CO_2 would be required to report), 1,000 metric tons per year, 10,000 metric tons per year, 25,000 metric tons per year, and 100,000 metric tons per year per facility of CO_2 injected.

To establish a count of CO_2 injection facilities, EPA relied on data reported in the Oil and Gas Journal (O&GJ) Enhanced Oil Recovery Survey published in April 2008 (Volume 106, Issue 15). EPA compiled all the projects listed for miscible and immiscible CO_2 floods [20] reported in the O&GJ survey. A total of 105 active ER projects were reported. In some cases multiple projects were conducted by the same company in an oil field. For the purposes of this analysis, EPA grouped these reported projects by field and by owner or operator to align with typical industry practices for reporting project information to State oil and gas commissions. This computation results in eighty facilities for the facility count.

The O&GJ survey does not provide the specific volume of CO_2 used in each of the active ER projects. To calculate the estimated volume of CO_2 injected at each ER project, EPA took the total amount of CO_2 used daily for ER, as reported by the U.S. EPA in the Draft 1990–2007 Inventory of U.S. Greenhouse Gas Emissions and Sinks,[21] apportioned it to each ER project according to an average value for the fractional production of oil attributed to ER using CO_2 as presented in the O&GJ survey, and normalized the amount of CO_2 injection on an annual basis. EPA recognizes that this is likely an oversimplification of the actual injection volumes used at each facility and is seeking comment on whether it is reasonable to rely on the principle that higher production is a function of higher CO_2 injection volumes. If a different analytical approach would be more appropriate, EPA seeks detailed recommendations on the alternative approach as well as additional data that would enable EPA to conduct a more comprehensive analysis.

The results of the threshold analysis are presented in Table 3 of this preamble. For further information on the assumptions underlying the threshold analysis, please refer to the general technical support document (TSD) for this proposal.[22]

TABLE 3—CO_2 INJECTION FACILITIES: EFFECT OF INJECTION THRESHOLD ON REPORTED AMOUNT OF CO_2 INJECTED AND NUMBER OF FACILITIES REQUIRED TO REPORT

Threshold level (metric tons/yr of CO_2 injected)	Total estimated national (metric tons/yr of CO_2 injected)	Total number of U.S. facilities	Reported amount of CO_2 injected		Number of facilities required to report	
			Metric tons/yr of CO_2 injected	Percent covered	Number	Percent covered
All In	40,111,639	80	40,111,639	100.0	80	100.0
1,000	40,111,639	80	40,111,115	100.0	74	92.5
10,000	40,111,639	80	40,099,065	100.0	71	88.8
25,000	40,111,639	80	40,005,238	100.0	65	81.3
100,000	40,111,639	80	39,065,039	97.4	48	60.0

The analysis shown in Table 3 of this preamble suggests that nearly all injection data can be collected from roughly half of operating facilities at an injection threshold of 100,000 metric tons/yr of CO_2 injected. EPA considered establishing an injection threshold of 100,000 metric tons/yr of CO_2 injected. However, a low CO_2 injection or production quantity in one year is not a reliable prediction of the quantity that may be injected in the following year or in a year of full-scale operation. For example, six of the eighty facilities reported zero or near zero production and therefore did not exceed the 1,000 metric tons threshold as shown in Table 3 of this preamble. However, these six facilities may inject over this threshold in the following year. In addition, more than 40 of the 105 projects in this analysis were described in the OG&J survey as "just started" or pilot projects, indicating that they may not be at fully operational levels of CO_2 injection. Given the variability of CO_2 injection rates, EPA is proposing that all facilities report irrespective of injection or production quantities in the reporting year.

EPA is proposing that all CO_2 injection facilities would be required to report the minimum information in subpart RR (quantity of CO_2 injected, quantity of CO_2 transferred onsite from offsite, and source of the CO_2 if known) at no threshold. An all-in reporting threshold would allow the Agency to comprehensively track all CO_2 supply (as reported in Suppliers of CO_2, subpart PP) that is injected underground. This approach is consistent with the all-in requirements in the MRR for suppliers of petroleum, natural gas, and coal-to-liquid products (subparts LL, MM, and NN), producers of industrial gases (subpart OO), and suppliers of CO_2 (subpart PP). It was reasonable to require all of the facilities in these source categories to report because it would result in the most comprehensive accounting possible, simplify the rule, and permit facilities to quickly determine whether or not they must

[20] A miscible CO_2 flood injects CO_2 as a liquid at high pressure to completely mix with oil and make it flow more easily. An immiscible CO_2 flood uses lower pressures of CO_2 to swell the oil and provide additional gas pressure to move the oil.

[21] U.S. EPA Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990–2007, Draft Report, EPA 430–R–09–004. Available at: *http://epa.gov/climatechange/emissions/usinventoryreport.html.*

[22] Subpart RR General TSD (*see* docket ID No. EPA–HQ–OAR–2009–0926).

report; the same rationale applies for this source category proposed today. Furthermore, it would create a uniform burden for all covered facilities, ensuring a level playing field in, and preventing fragmentation of, the ER sector. EPA has estimated the cost for CO_2 injection facilities to comply with the minimum reporting requirements in this proposed rule and has determined that the burden would be small, given the equipment and data collection efforts already in place at ER projects.

EPA seeks comment on whether an all-in reporting threshold for injection facilities is appropriate or if a 100,000 metric tons/yr of CO_2 injected or other threshold on quantity injected (*e.g.,* 1 million metric tons/yr of CO_2 injected) should be applied, leveraging information collected through the UIC program. To apply a reporting threshold to injection facilities, EPA would need to more specifically define which wells should be grouped together to delineate an injection facility. One option would be to group wells together by field as EPA did with the OG&J data in this threshold analysis. This definition would not be appropriate for injection facilities that are not producing oil or gas, however, such as those injecting into saline formations or coal seams. A second option would be to group wells together by basin. This definition would not be appropriate for injection facilities that are not producing oil or gas, however, such as those injecting into saline formations or coal seams. A third option would be to group wells by UIC permit; an injection well would be delineated by individual well if permitted by UIC as such and by a group of wells if permitted by UIC as a group. This definition would not be appropriate for sub-seabed injection wells outside the jurisdiction of SDWA. A fourth option would be to define injection facility as one individual well. This definition could be impractical for injection facilities that operate hundreds of wells, however, such as some ER projects. EPA seeks comment on which of these options for delineating an injection facility, or any options not discussed, would be most appropriate in the case that a reporting threshold based on injection quantity is appropriate.

2. GS Facilities

Under this action, EPA is proposing that the subset of CO_2 injection facilities that are conducting GS (*i.e.,* a GS facility) must report to EPA a second tier of data. EPA considered whether a threshold should apply to this second tier of data given that it would place a reporting burden on GS facilities. However, EPA could not perform an analysis on GS facilities based on emissions without data on actual or expected GS facility emissions. EPA also could not perform a threshold analysis based on injection due to the uncertainty around predictions of injection quantities for potential GS facilities. In addition, it is difficult to predict how many injection facilities would choose to report GS. Therefore, EPA is proposing to exempt GS R&D projects but otherwise require all GS facilities to comply with the GS monitoring, reporting, and verification requirements of subpart RR, and that they report fugitive, vented, and combustion emissions from surface equipment (under subpart W, RR, or C, as applicable). An all-in threshold will allow EPA to work with the early-movers of this nascent industry and to strengthen EPA's understanding of GS.

EPA is seeking comment on the proposed injection-based threshold analysis approach and how the Agency might use an alternative threshold approach, such as an emissions-based threshold or risk-based threshold. The Agency is also seeking comment on whether the threshold analysis conducted for CO_2 injection facilities could also be applied to GS and, if so, whether a 100,000 metric tons/yr of CO_2 injected or other threshold (*e.g.,* 1 million metric tons/yr of CO_2 injected) should be applied. The Agency requests supporting data which could be used to establish a threshold.

C. Selection of Data To Be Reported

This section describes the data that injection facilities and GS facilities must report under subpart RR. The first tier of reporting requirements described is for all facilities that inject CO_2 underground. The second tier of reporting requirements described is for GS facilities only.

The first tier has three proposed reporting requirements. First, EPA is proposing that all CO_2 injection facilities report the mass of CO_2 injected. This would be determined by the mass flow or volumetric flow and CO_2 concentration of the CO_2 stream injected. Facilities must use mass flow meters to accurately measure the mass of the CO_2 injected or volumetric flow meters to accurately measure the volumetric flow of the CO_2 injected. To minimize the purchase and installation of new equipment, facilities subject to the UIC program would be allowed to measure the mass or volume of CO_2 injected with the flow meters installed for purposes of compliance with their UIC permits. EPA accordingly is proposing two methodologies for making these calculations, depending on whether the facility is using a volumetric or a mass flow meter. EPA is proposing this approach so that facilities can comply with these reporting requirements regardless of the type of flow meter already installed. In the case of a facility using a volumetric flow meter, EPA assumes that the facility can determine operating temperature and pressure, which would allow for the volumetric flow of CO_2 to be converted from operating conditions to standard conditions and, using a density value for CO_2 at standard conditions and the measured concentration of CO_2 in the flow, determine the mass of CO_2. EPA seeks comment on the assumption that facilities can determine operating temperature and pressure, and alternative approaches for determining the mass of CO_2 using a volumetric flow meter where operating temperature and pressure cannot be determined.

Facilities would measure the CO_2 concentration by sampling and testing the injected stream at the flow meter. With this approach, the flow and the concentration would be measured at the same point in the system for maximized data accuracy. Accordingly, if the flow meter were installed at the compressor(s), then the concentration would be measured at the compressor(s). If the flow meter were installed at the well(s), then the concentration would be measured at the well(s). EPA recognizes that a facility with tens or hundreds of injection wells, all of which have flow meters already installed at the wellheads, may face a significant burden in testing concentration at each of those flow meters. EPA seeks comment on alternative locations other than the flow meter(s) where concentration of the CO_2 injected could be measured at decreased burden without decreasing accuracy. EPA also seeks comment on potential methodologies to estimate concentration of the flow injected if flow is measured elsewhere, such as apportioning the concentration of CO_2 transferred onsite and the concentration of recycled CO_2 to the quantities from each source.

Second, EPA is proposing that all CO_2 injection facilities report the mass of the flow transferred onsite from offsite to verify the mass of CO_2 reported as injected. This would be determined by the mass flow or volumetric flow and CO_2 concentration of the flow transferred onsite from offsite. A subset of CO_2 injection facilities—facilities conducting ER—inject a combination of new CO_2 transferred onsite from offsite and old CO_2 recycled from the operation. Therefore, EPA would use reported data on CO_2 transferred onsite

from offsite to estimate the amount of CO_2 recycled from ER operations.

EPA is proposing that all CO_2 injection facilities monitor the CO_2 concentrations and mass flow or volumetric flow quarterly. The purpose of these measurements is to account for fluctuations in the CO_2 concentration over the reporting year. EPA seeks comment on this proposal and on the level of burden this frequency of reporting requires for facilities following different frequency parameters for their UIC permit.

Third, EPA is proposing that all CO_2 injection facilities would report the source contracted to supply the CO_2, if known. EPA would seek information on whether the CO_2 was contracted from a natural source (*i.e.,* produced from a natural CO_2 dome) or an industrial source. If an industrial source, EPA would seek information on the type of source if known (captured at a power plant, pulp and paper mill, ethanol plant, natural gas processing facility, or other type of industrial source). This would allow EPA to track the movement of CO_2 through a CCS system and any shift toward anthropogenic CO_2 supply sources. Pipelines that carry CO_2 to the CO_2 injection facility may contain a mix of CO_2 from various sources. EPA recognizes that facilities may not know the source of CO_2 that they purchase. Accordingly, EPA would require the data to be reported only if known. EPA seeks comment on the proposed approach for reporting the source contracted to supply the CO_2 if known.

EPA recognizes that at this time the source of CO_2 injected underground is predominantly CO_2 produced from natural CO_2 domes. It is possible that GS using naturally sourced CO_2 may not qualify as a GHG mitigation action because the purpose of GS is to isolate CO_2 that would otherwise have been emitted to the atmosphere. Under this proposed rule, however, GS facilities must report annual CO_2 sequestered regardless of the source.

EPA seeks comment on whether the three reporting requirements described above are sufficient or if there are additional reporting requirements that should apply to all CO_2 injection facilities. EPA is proposing that the best available monitoring methods (BAMM) provision outlined in § 98.3(d) of the MRR would apply in 2011 to injection facilities for the first tier of reporting requirements. EPA seeks comment on this proposal.

For this proposed rule, EPA also considered, but is not proposing, that a CO_2 injection facility be required to report only the CO_2 injection data it collects under its current UIC permit (under any class) or relevant permit in the case of a facility that is outside SDWA jurisdiction. Although this would impose the lowest burden on the reporter since no new data would need to be collected, EPA would not receive complete data on the mass of CO_2 injected. While collection of injection volume is a minimum monitoring requirement for all UIC well classes, CO_2 concentration data are not. Furthermore, facilities are not required to report CO_2 transferred onsite from offsite sources or the source of CO_2 under any UIC permit class.

EPA is proposing that GS facilities would be required to report a second tier of data in subpart RR. These reporting requirements include the amount of leakage of CO_2 to the surface (if any), the amount of CO_2 in produced oil or gas (for GS facilities conducting active ER operations), the amount of fugitive and vented CO_2 emissions from surface equipment, and the total annual amount of CO_2 sequestered using a mass balance equation. In this equation, the sum of the CO_2 emissions listed above would be subtracted from the amount of CO_2 injected to equal the amount of CO_2 sequestered. These four reporting requirements are described in more detail below.

GS facilities must report CO_2 leakage, if any occurs from the subsurface geologic formation to the surface. EPA is not proposing specific procedures or methodologies for detecting or quantifying CO_2 leakage. However, each GS facility would be required to develop and implement a site-specific approach to monitoring, detecting, and quantifying CO_2 leakage based on five requirements that are described in Section II.D of this preamble.

Second, EPA is proposing that GS facilities that are actively producing oil or gas would be required to report the quantity of CO_2 produced out of the subsurface with produced oil or natural gas. This would be done by measuring at each separator the volumetric flow or mass flow and the concentration of a CO_2 stream. These GS facilities would also report CO_2 that remains in the oil or gas after separation.

Third, unless already reported in the petroleum and natural gas system subpart, subpart W, EPA is proposing that all GS facilities would be required to report fugitive and vented CO_2 emissions from surface components located within the facility for which procedures and methodologies are provided in subpart W. This could include pump blow-downs and fugitive emissions from valves, flanges, and compressors. EPA seeks these data to better understand the volume of fugitive and vented GHG emissions at GS facilities as compared to the volume of CO_2 sequestered. This information is an important indicator of the effectiveness of GS as a GHG mitigation technology. In addition, fugitive and vented CO_2 emissions will need to be included in the mass balance calculation of GS if they occur downstream of the CO_2 injection flow meter or (if applicable for ER projects) upstream of the production flow meter. This is further discussed in Section II.D.3 of this preamble. This proposed rule does not impose a general requirement for all CO_2 injection facilities to report fugitive and vented CO_2 emissions from surface components since facilities that are not sequestering CO_2 would not report GS. EPA seeks comment on this approach.

Lastly, EPA is proposing that GS facilities use a mass balance equation to calculate and report CO_2 sequestered in the subsurface geologic formation in the reporting year. This reported data point would be valuable for EPA as the Agency tracks CO_2 across a CCS system and will provide EPA with information on the performance of GS projects over time. EPA seeks comment on this approach.

Alternatively, EPA could approximate CO_2 sequestered in the subsurface without proposing additional reporting requirements for GS facilities, by using data already reported on CO_2 transferred from offsite and CO_2 injected. EPA considered but did not propose this approach because it does not account for potential leakage from the subsurface and does not properly account for CO_2 fugitive or vented emissions from surface equipment during post-production, processing, transport, or compression. Given the importance of GS as a GHG mitigation technology, EPA seeks to achieve an accurate reporting of GS. EPA seeks comment on the proposed requirements for GS facilities.

EPA recommends that CO_2 injection and GS facilities review subparts C and PP and proposed subpart W. Subpart C provides GHG calculation procedures and reporting requirements for stationary fuel combustion devices that combust solid, liquid, or gaseous fuel. CO_2 injection and GS facilities should pay close attention to compressors and pumps located within the facility boundary. Subpart PP provides procedures for calculating and reporting quantities of CO_2 supplied to the economy. The subpart W proposal covers petroleum and natural gas systems by defining eight types of facilities and providing calculation procedures and reporting requirements for the GHG emissions of specific

equipment that may be located in those facilities. CO_2 injection and GS facilities should review in particular the definitions of onshore and offshore petroleum and natural gas production facilities.

EPA is proposing that if an injection facility is not conducting GS, it would determine applicability to other subparts of the rule separately from applicability to subpart RR (*see* Table 4 of this preamble). This is similar to the approach taken by reporters of upstream petroleum products supply, natural gas supply, natural gas liquids supply, and carbon dioxide supply (reporters in subparts MM, NN, and PP). For example, an injection facility not characterized as a GS facility would not automatically trigger reporting under subpart C by this proposal, but would make a separate applicability determination under subpart C. A GS facility would automatically trigger applicability under other subparts of the rule. This is similar to the approach taken by reporters of downstream emissions in the rest of the MRR. For example, the GS facility would report under subpart C the emissions from combustion sources located within the facility boundary, such as compressors.

TABLE 4—REPORTING REQUIREMENTS IN MRR FOR CO_2 INJECTION AND GS FACILITIES (IN SUBPART RR, SUBPART C, AND PROPOSED SUBPART W)

Data to report	Injection facilities (no GS)		GS facilities	
	ER	Other	With ER	Other
Quantity of CO_2 transferred onsite.	subpart RR	subpart RR	subpart RR	subpart RR.
Source of CO_2 if known	subpart RR	subpart RR	subpart RR	subpart RR.
Quantity of CO_2 injected	subpart RR	subpart RR	subpart RR	subpart RR.
Fugitive and vented CO_2 emissions from surface equipment.	subpart W	Not Applicable	subpart W or subpart RR[1]	subpart RR.
Emissions from combustion sources.	Separate applicability determination.	Separate applicability determination.	subpart C[2]	subpart C[2].
Quantity of CO_2 produced with oil or natural gas.	Not Required	Not Required	subpart RR	subpart RR.
Percent of CO_2 estimated to remain with the oil and gas.	Not required	Not required	subpart RR	Not applicable.
Quantity of CO_2 emitted from the subsurface.	Not Required	Not Required	subpart RR	subpart RR.
Quantity of CO_2 sequestered	Not Applicable	Not Applicable	subpart RR	subpart RR.

[1] Subpart W if the facility meets the subpart W threshold; if not then report in subpart RR.
[2] All GS facilities will be required to report combustion emissions according to subpart C.

In selecting data to be reported under today's proposal, EPA compared reporting requirements under today's subpart RR proposal with reporting under the UIC Class VI proposal (*see* Table 5 of this preamble). EPA found two data elements with potential overlap. The first area of potential overlap is the reporting of the amount (flow rate) of injected CO_2. The UIC Class VI and subpart RR proposals differ in the measurement unit and collection/reporting frequency. EPA determined that reporting of the amount (flow rate) of injected CO_2 was necessary in order to harmonize the data with other subparts of the MRR. To ensure that data needs are harmonized between the MRR and the UIC program requirements and to reduce burden, and because this data under a State-issued UIC permit is currently submitted to States while, under today's subpart RR proposal, reporters will be submitting data directly to EPA. EPA will look for ways to integrate data management between the UIC and MRR programs and the Agency is seeking comment on reporting the amount (flow rate) of CO_2 injected for purposes of this proposal.

TABLE 5—DATA ELEMENTS REPORTED UNDER UIC CLASS VI PROPOSAL AND SUBPART RR PROPOSAL

Data element	UIC class VI proposal	Subpart RR proposal	
		CO_2 injection facilities (no GS)	GS facilities
Quantity of CO_2 transferred onsite	No	Yes	Yes.
Quantity (flow rate) of CO_2 injected	Yes	Yes	Yes.
Fugitive and vented emissions from surface equipment	No	No	Yes.
Quantity of CO_2 produced with oil or natural gas (ER)	No	No	Yes.
Percent of CO_2 estimated to remain with the oil and gas (ER).	No	No	Yes.
Quantity of CO_2 emitted from the subsurface	No	No	Yes.
Quantity of CO_2 sequestered in the subsurface	No	No	Yes.
Cumulative mass of CO_2 sequestered in the subsurface	No	No	Yes.
Monitoring plan	Yes	No	Yes.

The second area of potential overlap relates to monitoring plans. Although both the UIC Class VI proposal and today's subpart RR proposal have monitoring plan requirements, the UIC Class VI proposal is focused on protection of USDWs, while today's subpart RR proposal is focused on air emissions. Potential differences include

baseline data and detection and measurement of CO_2 leakage to the surface. Recognizing that air monitoring under the UIC Class VI proposal is at the discretion of the UIC director, EPA notes that a UIC Class VI permit may fulfill requirements under today's proposal.

EPA considered whether a GS facility should also report methane (CH_4) leakage emissions from the subsurface. CH_4 emissions from the subsurface may occur at oil and natural gas reservoirs or ECBM sites. The cases in which leakage of CH_4 could occur at these sites may be similar to the potential for CO_2 leakage. CH_4 leakage could potentially occur through improperly sealed wells, open faults, and other pathways that have also been identified as potential CO_2 leakage pathways. However, CH_4 is present as a gas, and thus may be more upwardly mobile than CO_2 which is injected as a supercritical fluid. Therefore, the potential for leakage of methane at depleted oil and gas or ECBM sites may be greater than for CO_2.

EPA is proposing to focus on CO_2 emissions. EPA recognizes the potential for CH_4 leakage from the subsurface at facilities conducting GS in oil and gas reservoirs or coal seams and therefore seeks comment on whether to require reporting on CH_4 leakage. If the potential for CH_4 leakage exists, the GS reporter could include in the MRV plan a monitoring strategy to detect and quantify potential CH_4 leakage. CH_4 fugitive and vented emissions from surface equipment are covered under the proposed oil and gas subpart, subpart W.

Under subparts C through QQ of the MRR, adjacent or contiguous equipment in actual physical contact under common ownership or common control constitute a facility (*see* Section 98.6 of the MRR). In the case of petroleum and natural gas systems and GS, equipment are not necessarily in physical contact with one another in the conventional sense of the term. Subparts W and RR are each proposing interpretations of what would constitute a facility. As a result, a GS facility conducting ER may apply one facility boundary for reporting under subpart W and a different facility boundary for reporting under subpart RR. EPA acknowledges that this may present a challenge for submitting annual reports, depending on how the data system is designed. A CO_2 injection or GS operation would submit an annual report to EPA according to the proposed definition of facility discussed in Section II.A of this preamble. EPA seeks comment on a resolution that would reduce reporting burden while still meeting the data needs of both proposed subparts W and RR.

EPA also recognizes that, in the case of an ER operation conducting GS, the combustion emissions from equipment within the GS facility would be included in both annual reports. Though this approach results in duplicative reporting, EPA has concluded that to analyze the efficacy of GS as a GHG mitigation tool, EPA needs to collect information on combustion emissions from GS facility equipment at only the GS facility level rather than aggregated with emissions from additional equipment. EPA seeks comment on this approach for reporting combustion emissions from GS facilities.

D. Selection of Monitoring, Reporting, and Verification (MRV) Plan Requirements and Approval Process

1. Selection of MRV Plan Option

EPA considered three alternatives for monitoring, reporting and verification of potential CO_2 leakage at GS sites: do not require an MRV plan, require a universal MRV plan that applies to all GS sites, or require a site-specific MRV plan. The three alternatives vary in stringency and specificity as described below. EPA outlines the advantages and disadvantages of each alternative and seeks comment on each alternative, as well as any alternatives not discussed.

Under the first alternative, EPA would allow GS facilities to report the amount of CO_2 sequestered without requiring an MRV plan. Under this alternative, the Agency would rely on published information and existing studies to assume that injected CO_2 remains sequestered and would assume these results can be generalized to all GS projects. This alternative would impose the least burden on reporters. EPA notes that international guidelines on information collection and reporting efforts outlined in Section I.E of this preamble do not support this approach. Furthermore, EPA did not propose this approach because of the limited empirical data and the variability in geology and other conditions among GS facilities.

The second alternative that EPA considered was a one-size-fits-all MRV plan approach under which the Agency would prescribe specific monitoring technologies and quantification methods for GS facilities. The advantage of this approach is that all GS facilities would use the same monitoring technologies and methods. The disadvantage of this approach is that the geology and other conditions at potential GS facilities will vary from site to site and a one-size-fits all approach may not provide the most effective monitoring strategy for all facilities. EPA notes that international guidelines on information collection and reporting efforts outlined in Section I.E of this preamble do not support this approach. In addition, since the monitoring and testing plans implemented under the UIC program are necessarily site-specific in nature, it would be difficult to prescribe a one-size-fits-all MRV plan that would complement and build upon the UIC program. This alternative would likely be the least cost effective and most burdensome approach for reporters.

The third alternative, and the alternative that EPA is proposing, is that GS facilities be required to develop a site-specific MRV plan and submit it to EPA for approval. Facilities would report CO_2 injection until the final MRV plan has been approved. Once a final MRV plan has been approved by EPA, GS facilities would implement the plan, including the reporting of the amount of CO_2 that has been sequestered. The advantage of this approach is that it provides a flexible and cost-effective option for reporters and complements monitoring requirements under the proposed UIC Class VI rule. EPA recognizes that the rigorous proposed UIC Class VI requirements will provide the foundation for the safe sequestration of CO_2 and should serve to reduce the risk of CO_2 leakage to the atmosphere when finalized. An adequate MRV plan would be tailored to site-specific conditions and be designed for each stage of the GS project. In addition, the MRV plan would allow for modification or adaptation of the plan based on monitoring results. Although the risk of leakage at an appropriately selected and managed GS facility may be low, the MRV plan would ensure that if leakage occurs, the GS reporter would have an approved methodology for measuring the emitted CO_2. If leakage occurs, the MRV plan would also provide a process for revising the MRV plan, if necessary, as described in section II.E of this preamble.

It is important to recognize that this proposed rule is a data collection and monitoring proposal which does not directly address the potential human health and welfare, ground or surface water, ecosystem or geosphere impacts of GS. Therefore, the proposed rule does not address these potential impacts from CO_2 leakage (*e.g.,* requiring remediation or mitigation) as this is outside the scope of this proposal.

2. Background on MRV Approaches

EPA has identified published studies and/or guidelines on monitoring programs that identify and quantify CO_2 leakage from GS facilities.[23] While the science of quantifying CO_2 leakage from GS facilities is evolving, it is generally recognized that, when properly planned and implemented, monitoring methods will be effective at detecting leakages.[24, 25]

Though the methodologies for detecting and quantifying leakage of CO_2 from GS facilities have not been standardized, EPA has concluded that a GS facility would be able to propose a site-specific plan for leak detection and quantification under this rule based on the current availability of monitoring technologies. A wide range of techniques for monitoring sequestration of CO_2 have been used for a number of years in other applications, including oil and natural gas production, natural gas storage, disposal of liquid and hazardous waste in deep geologic formations, groundwater monitoring, and ecosystem research.[26] Some monitoring techniques such as seismic monitoring can detect the presence and location of CO_2 in the subsurface, including both vertical and lateral spread, although the accuracy of seismic monitoring for quantifying the amount of CO_2 may be more limited than other approaches. Other techniques, such as soil gas monitors or eddy covariance techniques, can detect, within a certain limit, leakage of CO_2 from the confining system. Many of these technologies have excellent sensitivity, and have been shown to be able to detect relatively low concentrations of CO_2 above background levels. The minimum leakage rate detectable is a function of parameters such as the volume of CO_2 making its way to the surface, the size of the leak area, and the sensitivity of the monitoring device.

Descriptions of the various monitoring technologies that could be deployed at a GS facility can be found in the general TSD to this proposal.[27] EPA seeks comment on the general TSD and seeks additional data and information on monitoring technologies for leak detection and quantification. Additional information on GS monitoring technologies can also be found in the IPCC Guidelines for National Greenhouse Gas Inventories (2006), the API/IPECA Inventory Guidelines for CCS (2007), Department of Energy MVA Best Practices Manual (2009), and the International Energy Agency GHG R&D Programme monitoring tool Web site (*www.co2captureandstorage.info/co2monitoringtool*).

3. MRV Plan Requirements

EPA is proposing that each submitted MRV plan must include at a minimum the four requirements described below:

- Step 1—Assessment of Risk of Leakage: All potential pathways that may result in CO_2 leakage have been identified and characterized and the risk of CO_2 leakage at each pathway has been evaluated;
- Step 2—Strategy for Detecting and Quantifying CO_2 Leakage to Surface: Potential pathways will be monitored according to the risk of CO_2 leakage to ensure that any leakage to the surface will be detected and that leakage to the surface, should it occur, will be quantified according to a specified methodology;
- Step 3—Strategy for Establishing Pre-Injection Environmental Baselines: Environmental baselines against which the monitoring results will be evaluated have been established at potential leakage pathways; and
- Step 4—Tailor Mass Balance Equation: Site-specific variables have been considered and developed for the mass balance equation provided in the regulatory text to calculate the amount of CO_2 sequestered.

These requirements are consistent with the IPCC Guidelines for National Greenhouse Gas Inventories (2006), as well as the other information collection and reporting efforts outlined in Section I.F of this preamble.

EPA developed a monitoring plan TSD that describes characteristics of a robust monitoring plan, and provides descriptions of potential GS geologic settings, potential leakage pathways, and the goals of monitoring.[28] The monitoring plan TSD uses EPA's Vulnerability Evaluation Framework (VEF) to describe potential vulnerabilities that may influence the risk for CO_2 leakage from a GS project and is not intended to be used as a step by step guide to develop an MRV plan. The VEF includes a holistic discussion of the potential impacts of GS. The VEF is also provided in the docket.[29] EPA seeks comment on the monitoring plan TSD.

In developing the proposed MRV plan requirements, EPA compared monitoring requirements under the UIC Class VI proposal with those under today's MRR proposal, as shown in Table 6 of this preamble. Monitoring requirements under the UIC Class VI proposal are focused on demonstrating that USDWs are not endangered as a result of CO_2 injection into the subsurface. As proposed, a UIC Class VI permit would require a site characterization and assessment of leakage pathways for the purpose of protection of USDWs. Therefore, EPA is proposing that a UIC Class VI permit may be used to demonstrate to EPA that the assessment of risk of leakage step of the MRV plan has been satisfied. The UIC Class VI proposal indicates that UIC Class VI permits may include surface monitoring at the UIC Director's discretion. To the extent that the UIC Class VI permit includes these surface monitoring and related environmental baseline components, it may be used to demonstrate to EPA that the strategy for detection and measurement of leakage to the surface and the strategy for establishing pre-injection environmental baselines have been satisfied. EPA seeks comment on allowing the use of a UIC Class VI permit to fulfill certain MRV plan requirements, whether there are situations where EPA's proposal to rely on a UIC Class VI permit would not be sufficient.

[23] Arts, R, O Eiken, A Chadwick, P Zweigel, L van der Meer, B Zinszner. 2004. "Monitoring of CO_2 injected at Sleipner using time-lapse seismic data." Energy 29: 1383–1392; Wilson, M. and M. Monea (Eds.). 2004. "IEA GHG Weyburn CO_2 Monitoring and Storage Project," Seventh International Conference on Greenhouse Gas Control Technologies, Vol. 3; Klusman, RW. 2003. "Rate Measurements and Detection of Gas Microseepage to the Atmosphere from an Enhanced Recovery Sequestration Project, Rangely, Colorado, USA," Applied Geochemistry, 18, 1825–1838; 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2—Energy. Chapter 5 Carbon Dioxide Transport, Injection, and Geological Storage. Available at: *http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm.;* DOE/NETL. 2009. "Best Practices for Monitoring, Verification, and Accounting for CO_2 Stored in Deep Geologic Formations." U.S. Department of Energy, National Energy Technology Laboratory.

[24] Benson, SM. 2006. "Monitoring Carbon Dioxide Sequestration in Deep Geological Formations for Inventory Verification and Carbon Credits." Society of Petroleum Engineers Paper 102833.

[25] FutureGen Alliance. 2006. "Mattoon Site Environmental Information Volume." December 2006.

[26] Benson, S and L Myer. 2002. "Monitoring to Ensure Safe and Effective Geological Sequestration of Carbon Dioxide." Lawrence Berkeley Laboratory, Berkeley, California; Benson, SM. 2002. "Geologic Sequestration of Carbon Dioxide." The Carbon Dioxide Dilemma, Promising Technologies and Policies, Proceedings of a Symposium, National Academy of Engineering, April 23–24, 2002, Washington, DC, pp. 29–39.

[27] Subpart RR General TSD (*see* docket ID No. EPA–HQ–OAR–2009–0926).

[28] Monitoring Plans for Geologic Sequestration TSD (see docket ID No. EPA–HQ–OAR–2009–0926).

[29] Vulnerability Evaluation Framework for Geologic Sequestration of Carbon Dioxide (*see* docket ID No. EPA–HQ–OAR–2009–0926).

TABLE 6—PROPOSED MRV PLAN ELEMENTS UNDER UIC CLASS VI PROPOSAL AND SUBPART RR PROPOSAL

Proposed MRV plan element	Required under UIC Class VI proposal	Required under subpart RR proposal
Assessment of Risk of Leakage	to USDWs	to surface.
Strategy for Detecting and Quantifying CO_2 Leakage to Surface	No	Yes.
Strategy for Establishing Pre-Injection Environmental Baselines at Surface.	No	Yes.
Tailor Mass Balance Equation	No	Yes.

Reporters that do not hold UIC Class VI permits would be required to provide the MRV plan element information outlined in this section.

Assessment of Risk of Leakage to the Surface. EPA is proposing that the GS facility reporter must provide sufficient information in the MRV plan to demonstrate to EPA that the potential risk for CO_2 leakage to the surface has been evaluated. This evidence must be "a combination of site characterization and realistic models that predict the movement of CO_2 over time and locations where emissions might occur".[30] EPA seeks this information to evaluate the leak detection strategy put forth by the reporter in the MRV plan. EPA believes this information is reasonable to request because it determines the boundaries of the area which will be monitored for potential CO_2 leakage. The risk assessment for CO_2 leakage allows the reporter to target monitoring in specific areas within these boundaries.

EPA is proposing that to demonstrate to the Agency that the risk of leakage to the surface has been evaluated over the appropriate spatial area,[31] the GS facility must determine through site characterization and computational modeling the spatial area that may be impacted by the CO_2 injection activity over the lifetime of the project, accounting for the physical and chemical properties of all phases of the injected CO_2 stream. This spatial area must be determined to account for all potential leakage pathways, including wells. If the GS facility is producing oil or gas, the spatial area would also need to contain the production wells associated with CO_2 injection.

EPA is proposing that the GS facility would be required to re-evaluate and re-model the spatial area of evaluation at least every ten years or to describe the rationale for a different frequency in its MRV plan and, once approved, apply that frequency. Requiring re-evaluation of the spatial area of monitoring through updating simulation models with new monitoring data will provide the most accurate representation of subsurface CO_2 movement.

EPA seeks comment on the proposed re-evaluation frequency and whether the spatial area required for site characterization is adequate to detect and quantify potential leakage to the surface. Specifically, EPA seeks comment on whether there will be cases in which the spatial area should be larger to detect unexpected leakage to the surface beyond the pressure front boundary. Alternatively, EPA seeks comment on whether the spatial area should be larger than the lateral extent of the CO_2 plume, but smaller than the area defined by the pressure front. EPA also seeks comment on whether the spatial area should be defined by the lateral extent of the CO_2 plume.

The MRV plan should include a description of the site characterization that confirms that the geology and the local and regional hydrogeology of the GS facility have been evaluated and that explains how the spatial area was established. This should include a narrative description of the geologic formation(s) along with simple stratigraphic depictions showing formation depths and locations, information on the presence of an effective confining system [32] overlying the injection zone,[33] and a map showing the modeled spatial area of evaluation over the lifetime of the project.

The MRV plan should also demonstrate to EPA that all potential leakage pathways for CO_2 escape to the surface from the injection zone in the spatial area have been identified and characterized. Wells (and other artificial penetrations such as boreholes) are one of the most probable conduits for the escape of CO_2 from the injection zone.[34] If a well penetrates the confining system, the site characterization should include an assessment of supporting documentation such as well construction and plugging. Faults and fractures that are natural or that may be induced by pressure changes may also serve as pathways for CO_2 leakage out of the confining zone and to the surface. Additionally, geologic heterogeneities, such as high permeability zones in the confining system or an insufficient lateral extent of the confining system, may be potential leakage pathways for CO_2. The MRV plan should include the location and depth of all potential leakage pathways along with a qualitative description of their condition. For more information on leakage pathways, see the monitoring plan TSD.[35] The MRV plan should include an overview of the methods used to characterize the site; actual data can but does not need to be initially submitted.

Finally, the risk assessment component of the MRV plan should

[30] 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Volume 2—Energy. Chapter 5 Carbon Dioxide Transport, Injection, and Geological Storage. Available at: *http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm; see* also UIC Class VI proposal, 73 FR 43492 (July 25, 2008).

[31] EPA recognizes that surface rights access to the entire spatial area required for site characterization and monitoring may not conveniently rest with the owner or operator of the CO_2 injection wells (*i.e.,* the GS facility reporter in subpart RR). Issues associated with surface and pore space ownership are outside the scope of this proposed rule. However, the Agency recognizes that the MRV plan will need to take into account the relevant ownership rights and property access.

[32] A confining system is a geological formation, group of formations, or part of a formation that is comprised of impermeable or distinctly less permeable material stratigraphically overlying the injection zone that acts as a barrier to CO_2 movement. (73 FR 43492).

[33] The injection zone is 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 GS project. (73 FR 43492).

[34] Gasda, SE, S Bachu and MA Celia. 2004. "The potential for CO_2 leakage from storage sites in geological media: Analysis of well distribution in mature sedimentary basins," Environmental Geology 46 (6–7), pp. 707–720; Benson, SM. 2005. "Monitoring to Ensure Safe and Effective Geologic Sequestration of Carbon Dioxide," IPCC Workshop on Carbon Dioxide Capture and Storage; IPCC. 2005. "IPCC Special Report on Carbon Dioxide Capture and Storage," by Working Group III of the Intergovernmental Panel on Climate Change. Available at: *http://www1.ipcc.ch/ipccreports/srccs.htm;* Carey, J, M Wigand, SJ Chipera, G WoldeGabriel, R Pawar, PC Lichtner, SC Wehner, MA Raines, GD Guthrie, Jr. 2007. "Analysis and performance of oil well cement with 30 years of CO_2 exposure from the SACROC Unit, West Texas, USA." 8th International Conference on Greenhouse Gas Control Technologies, International Journal of Greenhouse Gas Control Volume 1, Issue 1, April 2007, Pages 75–85.

[35] Monitoring Plans for Geologic Sequestration TSD (*see* docket ID No. EPA–HQ–OAR–2009–0926).

include an overview of the methods used to model the subsurface behavior of CO_2 and the modeling results that estimate the timing, location, route and flux of potential leakage to the surface. It should include a brief overview of the input data quantity and the level of uncertainty associated with the models, as well as sensitivity analysis to assess the range of potential CO_2 leakage emissions.

Strategy for Detecting and Quantifying CO_2 Leakage to the Surface. EPA is proposing that the MRV plan must provide a strategy for leak detection. The MRV plan would include the methodology for, rationale for, and frequency of monitoring that will be conducted to detect potential leakage of CO_2 to the surface. The strategy for leak detection should be based on the risk assessment required in this Section II.D.3 of this preamble and be targeted to where and when leakage to the surface is most likely to occur. Therefore, the MRV plan should also describe the methodology for, rationale for, and frequency of evaluation of the entire spatial area of the GS facility to detect any CO_2 emissions from unexpected leakage pathways. The MRV plan should describe the monitoring technologies that will be employed at the facility, the assumed detection limits of the technologies, the monitoring locations, spatial array, and frequency of sampling. The MRV plan should provide the rationale and justification for each of these choices. A leak detection strategy that adequately meets this proposed rule's requirements may include a combination of subsurface, vadose zone, soil zone, ocean, surface water, and/or atmospheric monitoring and modeling. For the purposes of this proposed rule, CO_2 leakage to the surface includes CO_2 emitted to the atmosphere, CO_2 emitted to the ocean from the sub-seabed, CO_2 emitted to surface water, and CO_2 emitted to indoor air environments. The Agency notes that continuous air monitoring or mitigation is not required by this proposal.

Even though only the CO_2 that leaks to the surface must be quantified for this proposed rule, information about the movement of CO_2 in the subsurface and near-surface can serve as an early warning of a potential leak at the surface. This information will lead to a better understanding of the GS facility and the anticipated movement of the CO_2 plume, and it will help to pinpoint the area and the timing in which a potential leak to the surface may occur. This in turn will inform where monitoring for leak detection at the surface must be deployed.

For example, sampling at a deep monitoring well may indicate migration of the CO_2 out of the confining system. Though this monitoring result does not necessarily mean that CO_2 will eventually leak to the surface, the GS reporter would use this information on the sub-surface movement of CO_2 to deploy monitoring equipment according to the strategy outlined in the MRV plan in case detection and quantification of CO_2 leakage to the surface is necessary.

Generally, an iterative process should be in place to update the predictive models by applying results of ongoing monitoring. The GS reporter needs to consider how the monitoring results will change the leak detection and quantification strategies in the MRV plan approved by EPA. Adjustments to the MRV plan may result from updates to the models that were used to identify the leakage pathways, assess the risk of leakage, and predict the scope of potential leakage scenarios. If the MRV plan is adjusted in these circumstances, the reporter must submit an addendum to EPA that describes how the leak detection and quantification strategy was adjusted (*see* Section II.E of this preamble for more detail).

EPA is proposing that the MRV plan would not need to include methods for monitoring fugitive and vented CO_2 emissions from surface equipment (*e.g.,* CO_2 compression systems) at GS facilities because, in EPA's view, those methods need not vary from site to site in order to estimate emissions effectively. Universal methods are proposed in subpart W, and those methods would be used to quantify fugitive and vented CO_2 emissions from surface equipment and to report those emissions under subpart W or subpart RR as appropriate (*see* Section II.C of this preamble).

If a CO_2 leak is detected at the surface, the GS reporter must quantify the amount of CO_2 leaked. EPA considered three alternatives for reporting CO_2 leakage: assuming that all injected CO_2 remains sequestered, assuming that a proportion of injected CO_2 remains sequestered, and reporting of CO_2 leakage based on site-specific monitoring. EPA outlines the advantages and disadvantages of each alternative and seeks comment and data on each alternative, as well as any alternatives not discussed.

Under the first alternative, EPA would rely on published information and existing studies to assume that all injected CO_2 remains sequestered. EPA would assume these results can be generalized to all GS projects. EPA notes that international guidelines on information collection and reporting efforts outlined in Section I.E of this preamble do not support this approach. Furthermore, EPA did not propose this approach because of the limited empirical data and the variability in geology, site management and/or business practices, and other conditions among GS facilities. In addition, assuming that all injected CO_2 remains sequestered would not take into account potential fugitive or vented emissions from surface equipment or CO_2 produced from oil or gas production wells, during or after operations.

Under the second alternative, EPA would assume that a proportion of injected CO_2 remains sequestered. EPA would assume that this proportion can be generalized to all GS projects. International guidelines on information collection and reporting efforts outlined in Section I.E of this preamble do not support this approach. Furthermore, EPA did not propose this approach because of the limited empirical data and the variability in geology, site management and/or business practices, and other conditions among GS facilities. EPA also seeks comment and data on whether a sequestration factor could be applied to ER operations in cases where CO_2 injection and site operations are not specifically designed with GS in mind.

The third approach, and the approach EPA is proposing today, is that the MRV plan describe the approaches that the GS reporter will take to quantify CO_2 emissions if leakage is detected. The approach should be specific to the type of potential leak. For example, for point sources of CO_2 (*e.g.,* leakage from wells), bagging or tenting methods could be used. EPA recognizes that quantifying CO_2 emissions and distinguishing CO_2 leakage from background emissions is challenging, but necessary for the purposes of determining the total amount of CO_2 that is sequestered at a GS facility. EPA is proposing that a leak could be quantified through estimation or by direct measurement and seeks comment on allowing either estimation or direct measurement for quantifying a leak.

In cases where a leak is not quantified by estimation, EPA is proposing that if a leak is detected, the reporter must assume that the duration of the leak is equal to the duration between demonstrated null monitoring results unless subsurface monitoring can be used to provide a better indication on the timing of the leak. EPA finds this conservative approach reasonable because the estimate of the duration of the leak directly influences the estimate of the amount of CO_2 emitted to the surface. The Agency recognizes that this

approach could overestimate emissions of CO_2. EPA considered requiring that the MRV plan include a site-specific strategy for determining duration of any leakage detected in cases where a leak is not determined by estimation, but EPA concluded that this approach would allow too much variation in reporting on CO_2 leakage (if any occurs) and would make the quantities of CO_2 reported as sequestered less comparable. EPA seeks comment on the selected approach for determining the duration of the leak event and the alternatives. EPA is proposing that if multiple CO_2 leaks to the surface occur in a reporting year, the mass of each leak should be quantified and the totals then aggregated for reporting.

An approach for an uncertainty assessment of the leakage estimates and measurements derived from the proposed modeling and monitoring at the GS facility should also be included in this component of the MRV plan.

As further outlined in Section II.E of this preamble, EPA is proposing that if leakage is detected during a given reporting year, the GS reporter must submit an annual report addendum to coincide with submission of the next annual report (March 31 of a following year).

Strategy for Establishing Pre-Injection Environmental Baselines. EPA is proposing that the MRV plan describe when and how pre-injection environmental baselines would be established based on the strategy for leak detection described in this section of the preamble. The GS reporter is required to establish baselines at potential leakage pathways (based on the risk of leakage from these pathways), and over the entire spatial area of evaluation for periodic evaluation of unidentified leakage pathways. Pre-injection baselines will be used to evaluate the performance of the site and are essential to detect CO_2 leakage from the site.

CO_2 is ubiquitous in the environment and concentrations may vary over space and time (*e.g.,* diurnally, seasonally, annually). Therefore, determining background levels of CO_2 and understanding natural fluctuations is necessary to discern whether detected CO_2 is attributable to leakage or to preexisting sources. It is also important to establish baselines before injection because many of the instruments used to monitor CO_2 at the surface do not measure fluxes of CO_2 directly; rather, the instruments are useful for tracking the injected CO_2 because one can compare parameters before and after injection and over time.[36] Environmental baselines at the facility before injection must reflect diurnal, seasonal, and annual changes in not only the levels of CO_2 but also in other relevant surface and/or near-surface conditions (*e.g.,* wind speed). Baseline monitoring could also include gas composition and isotopic analysis of any background fluxes of CO_2, which may be useful for distinguishing between natural (biogenic or thermogenic) and anthropogenic CO_2.[37]

There may be cases in which CO_2 injection has taken place for some time (potentially years, as in the case of currently operating ER projects) and the baseline was not evaluated pre-injection. EPA is proposing that a facility in this situation would outline in this component of the MRV plan alternatives to establishing pre-injection baselines. In such situations, alternatives to characterizing baseline conditions could include identification of proximal locations where diurnal, seasonal, and annual measurements that are assumed to be similar to pre-injection conditions at the site can be taken. This technique was used by a site that detected annual CO_2 emissions of about 3,800 tonnes/year (0.01 percent of total injected CO_2) from surface monitoring but could not compare the flux to a pre-injection baseline to determine what percentage was attributable to injected CO_2.[38] Other approaches could include permanent continuous monitor networks with upwind and downwind correlation or mobile monitoring capable of determining local ambient background levels. EPA recognizes the challenge in establishing a baseline in these cases and seeks comment on this proposed case-by-case approach and on whether real-time determination of environmental baseline upwind of potential leakage is preferred.

Tailor Mass Balance Equation for Sequestration. As explained in Section II.C of this preamble, a GS reporter would be required to report the annual amount of CO_2 sequestered at a facility using a mass balance equation, in which the sum of CO_2 emissions would be subtracted from the amount of CO_2 injected to equal the amount of CO_2 sequestered. A specific mass balance equation is provided in the regulatory text, to which the facility must apply site-specific variables based on operational conditions. Accordingly, EPA is proposing that a GS reporter must consider whether any fugitive or vented CO_2 surface emissions were measured downstream of the injection flow meters (*i.e.,* between the injection flow meter and the injection well). If so, these quantities should not be accounted as stored and should be subtracted from the mass balance equation as a variable. A GS facility with ER operations must additionally consider whether any fugitive or vented CO_2 emissions were measured upstream of the production flow meters (*i.e.,* between the production well and the separator) and how much produced CO_2 is not successfully measured by the production flow meter because it remains dissolved in the produced oil or gas. For ER operations, these quantities should not be accounted as stored and should also be subtracted from the mass balance equation as variables.

EPA is proposing that GS reporters be required to include a written summary of these considerations, including any assumptions made and methodologies used to calculate these site-specific variables over the reporting year.

4. MRV Plan Approval Process

EPA is proposing to evaluate each MRV plan to ensure that the GS facility has an appropriate strategy in place to effectively quantify geologically sequestered CO_2. EPA will evaluate the adequacy of the methodologies proposed to detect and quantify leakage, including whether the chosen monitoring technologies are suitable for the type of leakage pathway and for the type of risk evaluated at that pathway.

This proposal is being conducted under CAA section 114. As such, it does not require control measures, remediation, or any other actions that would alter operations at a facility. In order to develop, gain approval of, and implement its MRV plan, a GS facility would not be expected to shut down or delay its operations. EPA developed the proposed reporting requirements with

[36] Benson, S, E Gasperikova, and M Hoversten. 2004. "Overview of Monitoring Techniques and Protocols for Geologic Storage Projects." Prepared for the IEA GHG Programme. PH4–29; Johnson, J. 2009. "Integrated modeling, monitoring, and site characterization to assess the isolation performance of geologic CO_2 storage: Requirements, challenges, and methodology." Energy Procedia 1:1855–1861; Forbes, S, P Verma, T Curry, J Friedman, S Wade. 2008. "Guidelines for carbon dioxide capture, transport, and storage." World Resources Institute. Available at: *http://pdf.wri.org/ccs_guidelines.pdf.*

[37] American Petroleum Institute and International Petroleum Industry Environmental Conservation Association. 2007. "Oil and Natural Gas Industry Guidelines for Greenhouse Gas Reduction Projects Part II: Carbon Capture and Geological Storage Emission Reduction Family," June, 2007.

[38] Klusman, RW. 2003. "Rate measurements and detection of gas microseepage to the atmosphere from an enhanced oil recovery/sequestration project, Rangely, Colorado, USA." Applied Geochemistry, volume 18, issue 12.

consideration for business-as-usual operations in order to minimize burden.

Although MRV plan approval would be an inherently EPA function, the Agency is considering approaches and processes to streamline and facilitate external technical input in the development of specific evaluation criteria or guidelines, particularly at the outset of the program. EPA recognizes that an adaptive approach to the GS portion of this proposal will be necessary to take advantage of the experience gained in developing and implementing MRV plans and in complying with the proposed UIC Class VI requirements. EPA expects to update the guidelines and requirements of an MRV plan over time as technologies, methodologies, and scientific understanding of GS evolve; and the Agency believes that the site-specific nature of the MRV plan enables the proposed approach to adapt and improve over time.

E. Selection of Schedule and Process for Reporting

1. First Tier Reporting Requirements for Injection Facilities

All injection facilities that meet the definitions in subpart RR and that are in active operation when this proposed rule is finalized would begin collecting data on CO_2 injected, CO_2 transferred from offsite, and source of CO_2, if known, on January 1, 2011, covering a period between January 1 to December 31. Data would be submitted to EPA by operating facilities in an annual report on each March 31 of each calendar year, beginning with March 31, 2012, for data collected in the previous calendar year.

The Agency plans to issue the final rule in sufficient time for existing injection facilities to prepare for monitoring and reporting before January 1, 2011, and to begin monitoring CO_2 injection and CO_2 transferred from offsite on January 1, 2011. Preparation would include studying the final rule, determining whether it applies to the facility, identifying the requirements with which the facility must comply, and preparing to monitor and collect the required data needed to calculate and report GHG emissions. However, EPA recognizes that meeting that goal may be challenging and seek comments on alternative effective dates.

The date on which a new facility begins injecting CO_2 is the date on which a new facility must begin monitoring the first tier of requirements for subpart RR. The annual report submitted by the new facility on March 31 of the year following start-up therefore may include data for only part of the year.

2. Second Tier Reporting Requirements for GS Facilities—Submission, Approval, and Reporting

EPA is proposing that all GS facilities and any injection facilities that opt-in to the GS monitoring and reporting requirements would submit MRV plans to EPA and seek EPA approval. Where the GS facility would be relying on a new UIC Class VI permit for MRV plan requirements, EPA anticipates that the MRV plan review would be conducted concurrently with the UIC Class VI permit review. EPA would require the unique identification number associated with the permit application and notification of approval of the UIC Class VI permit. Once an MRV plan is approved by EPA, the GS facility would implement it and then begin collecting data on CO_2 emitted and CO_2 sequestered. Finally, the reporter would include this additional quantitative data in the first annual report submitted to EPA after the approved MRV plan has been implemented and in all subsequent annual reports. An annual report addendum would also be required to be submitted if the GS facility triggered any of the addendum submission requirements outlined in this proposal.

The Agency seeks to establish an MRV plan submission and approval schedule that allows the GS facility reporter to implement its plan without delay. Therefore, EPA is proposing a rolling schedule for submission of the MRV plan to EPA whereby the reporter could submit the plan to EPA on any calendar date. From the date submitted, EPA would determine if the application is complete, review the plan, work with each reporter to ensure that the MRV plan appropriately addresses the requirements, and revise the plan accordingly. This interactive process would be limited to a reasonable time period, after which EPA would approve a revised MRV plan.

EPA is proposing to provide for an appeal process in situations where the GS facility does not agree with the Agency's approved plan. One option would be for a reporter to request a formal administrative review (and if appropriate, an evidentiary hearing) with the Environmental Appeals Board using the appeal procedures provided in 40 CFR Part 78. Under this approach, filing an appeal and exhausting all administrative remedies would be a prerequisite to seeking judicial review. Another option would allow the reporter to appeal directly with the appropriate court, pursuant to CAA section 307(b)(1). EPA seeks comment on both options for resolving disputes regarding MRV plans, or whether any alternative, expedited process is more appropriate.

EPA is proposing that the GS facility must begin implementing the MRV plan within thirty days of EPA approval. Because implementation may require more than thirty days (*e.g.*, in order to establish environmental baselines), it is possible that implementation would not be completed within 30 days of EPA approval, depending on the MRV plan; the facility would follow implementation as set forth in the facility's MRV plan. If the MRV plan is appealed, EPA is proposing to require the GS facility to begin implementation of the approved plan until such a time that the MRV plan appeal process is complete. EPA seeks comment on whether the implementation of the MRV plan should be delayed until the appeal is resolved.

Every annual report submitted by the GS facility after MRV plan implementation begins would include both the first tier of data required of all CO_2 injection facilities and the second tier of data related to GS. In the first year following initial MRV plan implementation, it is possible that the GS-related data collected and reported may only cover part of the year.

EPA is proposing that an injection facility opting in to the GS portion of this proposed rule may submit an MRV plan at any time. All other GS facilities will be required to submit an MRV plan to EPA (A) within six months from the time that their UIC permitting authority confirms the area of review or (B) by December 31 of the year that the UIC permitting authority confirms the area of review, whichever date is later. If such facilities already have a UIC permit as of the date of publication of the final subpart RR in the **Federal Register**, they must submit the MRV plan to EPA within six months of the date of publication of this subpart. This submission deadline would allow the facility to implement all monitoring required by EPA as quickly and seamlessly as possible, and in parallel with a facility's UIC permit requirements. All facilities that are required to submit an MRV plan to EPA will be allowed to request an extension of up to an additional six months. In the case of a facility that is not under the jurisdiction of the SDWA, the MRV plan submission schedule would be based on the facility's relevant permit, rather than a UIC permit. EPA seeks comment on this approach for MRV plan submissions and on whether an alternative deadline, such as a submission deadline based on when a

GS facility's UIC permit is issued, would be more appropriate and efficient.

EPA seeks comment on the proposed rolling submission process and whether an alternative would be more appropriate. For example, GS facilities (both required and opt-in facilities) could be required to submit an MRV plan by a specific date or within a specific window of time each calendar year if they plan to begin operating in the subsequent calendar year.

3. Second Tier Reporting Requirements for GS Facilities—Post Implementation

Once a reporter begins implementing an EPA-approved MRV plan, it may be required to submit additional information to EPA, either through an annual report addendum, or through re-submitting a revised MRV plan for EPA approval.

When a reporter initially develops an MRV plan, it does so based on its existing understanding of the GS facility site characterization and in some cases previous experience with CO_2 injection, modeling, and monitoring. When EPA reviews the plan, it evaluates whether the procedures proposed will result in the most effective collection of data possible and practical, given this existing understanding. However, EPA recognizes that a reporter's understanding of the GS facility may evolve because of new information or altered site conditions. Under these circumstances, the site should continue to prioritize the most effective collection of data possible and practical, even if it requires an adjustment in the monitoring procedures used. The site would implement these adjustments as needed and would inform EPA about them via an annual report addendum, submitted at the same time as the next annual report (March 31 of the subsequent calendar year). An annual report addendum should also describe changes to the spatial area of monitoring. Data reporting should not be disrupted as a result. EPA is proposing that the annual report addendum will not require EPA approval.

A reporter would also be required to submit an annual report addendum if leakage is detected. The addendum should outline the procedures or equipment that detected the leakage, what assumptions were made to quantify the detected leakage to the surface, including assumptions about when the leak began and the duration of the leak, and any adjustment made to the MRV plan. If the number reported for leakage represents more than one leakage event, the addendum should describe how each leak was detected and quantified.

In general, the MRV plan should be revised as experience is gained over the course of the project (for example, as monitoring results are used to validate and update model predictions) and should keep pace with the development of monitoring instruments and methods. These revisions will be shared with EPA through annual report addenda.

EPA seeks comment on whether the GS facility should resubmit an MRV plan at a minimum frequency that compiles all revisions over the previous years into one updated document and that undergoes an EPA approval process. EPA seeks comment on whether such a routine resubmission is appropriate, and if so how the minimum frequency for re-submittal should be established. This minimum frequency could be a fixed number for all facilities, such as every ten years. Alternatively, it could be established on a site-by-site basis based on the reporter's technical justification or on the minimum frequency associated with the re-evaluation of the facility's spatial area of evaluation.

EPA is proposing that the MRV plan must be revised and re-submitted to EPA for approval if the reporter is out of compliance with its UIC permit (or relevant permit in the case of a facility that is not under the jurisdiction of the SDWA), or if EPA deems a resubmission necessary as the result of an annual report addendum received or an EPA on-site audit conducted as part of the MRR verification provisions. EPA seeks comment on whether any other events or conditions should require resubmission of the MRV plan. In addition, EPA is proposing that the GS facility under its own volition could submit a revised MRV plan in any reporting year. Resubmitted MRV plans would be accepted on a rolling basis just as initial MRV plans.

4. Annual Reports

For this proposed rule, EPA seeks quantitative data from all facilities in a consistent format and at a consistent level, in a timely fashion at the beginning of every reporting year (covering the previous year's data) in order to electronically verify the data, publish it as authorized by the CAA, and use the collected information for the purposes described in this proposal. Therefore, EPA is proposing that, as with the other data reported in the MRR, CO_2 injection and sequestration data would be reported directly to EPA electronically via an annual report. EPA is also proposing that MRV plans and annual report addenda developed by GS facilities would be submitted electronically to EPA. To minimize redundancy and burden on industry, EPA has considered the procedures, methodologies, units, quality assurance and quality control (QA/QC) requirements, and formats required under the UIC permit classes when developing the requirements of this proposed rule. EPA's intention is that reporters use the same data to meet the reporting requirements of both programs to the greatest extent possible.

All injection facilities would submit reports with quantitative data annually on an ongoing basis. The snapshot of information provided by a one-time information collection request would not provide the type of ongoing information which could inform the variety of potential policy options being evaluated for addressing climate change. Due to the comprehensive reporting and monitoring requirements in this proposal, the Agency has concluded that it is not appropriate to require reporting of historical emissions data. EPA proposed and evaluated comments on this reporting provision under the MRR. The historical data provision of the MRR also applies to today's proposed rule.

Most voluntary and mandatory GHG reporting programs include provisions for operators to revise previously submitted data. Under the final MRR, EPA requires the reporter to submit a revised report within 45 days of discovering or being notified by EPA of errors in an annual GHG report. The revised report must correct all identified errors. The reporter must retain documentation for three years to support any revisions made to an annual GHG report. EPA proposed and evaluated comments on this reporting provision under the MRR. As a final provision of that rule, the requirement to submit a correct report within 45 days and retention of documentation for three years applies to today's rule.

The final MRR provides a mechanism for facilities to exit the reporting program when they are below a reporting threshold for five or three consecutive years, depending on the exact emissions levels. Because of the unique nature of CO_2 injection and GS activities as noted in the threshold analysis discussion in Section II.B of this preamble, EPA is proposing that this provision would not apply to GS facilities. Instead, EPA is proposing that all CO_2 injection facilities would be allowed to cease reporting CO_2 injection upon the plugging of the injection well or wells that constitute the facility. GS facilities will be allowed to cease all other reporting requirements under this

subpart once the CO_2 plume and pressure front have stabilized. EPA will accept demonstrations made to fulfill UIC Class VI permit requirements in order to meet requirements for ceasing GS reporting under this proposal. EPA seeks comment on this approach for allowing facilities to cease reporting. EPA recognizes that there are other possible approaches. For example, the Agency could conform the mechanism that other facilities use for exiting the MRR to subpart RR, allowing CO_2 injection facilities that are not GS facilities to cease reporting if they are below an injection threshold for five or three consecutive years, depending on the exact injection levels. EPA did not propose this alternative because of a lack of data on the incidence and scale of surface emissions and leakage. Another approach would be to provide a "no exit" approach for GS facilities, which would allow EPA to obtain valuable data on the long-term efficacy of GS. EPA is not proposing a "no exit" approach because the Agency wanted to provide an opportunity for reporters to cease reporting. However, EPA seeks comment on these alternative approaches for allowing facilities to cease reporting.

Each annual report developed under this proposed rule would contain a signed certification by a Designated Representative of the facility. On behalf of the reporter, the Designated Representative would certify under penalty of law that the report has been prepared in accordance with the requirements of 40 CFR part 98 and that the information contained in the report is true and accurate, based on a reasonable inquiry of individuals responsible for obtaining the information. EPA proposed and evaluated comments on these reporting provisions under the MRR. As final provisions of the MRR, they apply to today's proposal.

5. Data Verification

In the MRR, EPA will verify emissions data electronically using numerous approaches such as: Executing equations and comparing the results to reported data; comparing reported data to a realistic data range; comparing trends in reported data across years; comparing data from one year across reporters; conducting a pass/fail check on binary data; collecting secondary data that can proxy emissions; and conducting statistical analysis to identify outliers. EPA may conduct selective audits on facilities whose data raises questions during the verification process. In addition, all reporting entities will select a Designated Representative to certify that the data reported is accurate to the best of his/her knowledge.

For this proposed rule, EPA is proposing that the data submitted by GS facilities may be evaluated and verified manually by EPA along with the qualitative contents of the MRV plan (*see* Section II.D of this preamble). It may be that electronic verification of GS data would not be adequate to verify whether the EPA-approved MRV plan was followed and whether any leakage was detected in the reporting year at a particular facility. EPA seeks comment on manual evaluation of data and qualitative elements of an MRV plan.

6. Confidential Business Information (CBI)

EPA's public information regulations contain a definition of "emissions data" at 40 CFR 2.301, and EPA has discussed in an earlier **Federal Register** notice what data elements constitute emissions data that cannot be withheld as CBI (56 FR 7042–7043, February 21, 1991). While determinations about whether information claimed as CBI and whether the information meets the definition of emissions data are usually made on a case-by-case basis, EPA recognizes that such an approach would be cumbersome given the scope of the MRR and the compelling need to make data that are not CBI, or are emissions data, available to the public. For this reason, EPA will be initiating a separate notice and comment process to make CBI and emissions data determinations for the categories of data collected under the MRR.

As stated in the MRR, EPA will protect any information claimed as CBI in accordance with regulations in 40 CFR part 2, subpart B. However, in general, emissions data collected under CAA section 114 shall be available to the public and cannot be withheld as CBI.

F. Selection of Procedures for Estimating Missing Data

EPA has concluded that it is important to have missing data procedures in order to ensure a complete report of amounts of CO_2 and emissions from a particular facility. In this rule, EPA is proposing missing data procedures for the quarterly values of mass or volume and concentration of these streams, and CO_2 transferred from offsite. EPA is proposing that these procedures can be used by all injection facilities, including GS facilities. EPA is also proposing procedures for missing data on CO_2 production from GS facilities. EPA seeks comment on these procedures and on whether it is appropriate to provide missing data procedures for GS facilities.

EPA is not proposing missing data procedures for leakage quantification. EPA is proposing that the MRV plan include quantification methods and assumptions for all potential leakage scenarios. If leakage is detected for which a quantification approach is not outlined in the plan, this information must be included in the addendum.

G. Selection of Records To Retain

EPA is proposing that, in addition to the records required by § 98.3(g), each facility must retain quarterly records of injected CO_2 and CO_2 transferred from offsite sources, including mass flow or volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams. EPA is proposing that GS facilities would also retain quarterly records of produced CO_2, if applicable, including mass flow or volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams; annual records of the emitted CO_2 from subsurface geologic formation leakage pathways; and any other records as outlined for retention in your MRV plan. EPA seeks comment on these record retention requirements.

III. Economic Impacts of the Proposed Rule

This section of the preamble examines the costs and economic impacts of the proposed rulemaking for CO_2 injection and GS and the estimated economic impacts of the rule on affected entities, including estimated impacts on small entities. Complete detail of the economic impacts of the proposed rule can be found in the text of the economic impact analysis (EIA) (EPA–HQ–OAR–2009–0926). EPA seeks comment on the methodology and data used for the analysis.

A. How were compliance costs estimated?

1. Summary of Method Used To Estimate Compliance Costs

EPA estimated costs of complying with this proposed rule and the total incremental annual cost of compliance. A base case is created assuming relevant monitoring costs required under UIC requirements (including the UIC Class VI proposal). Then incremental reporting from geologic storage sites were evaluated in terms required technologies, practices, and costs.

The estimated costs include capital and operating and maintenance (O&M)

including labor costs. The cost of drilling and equipping wells represents a large component of sequestration costs. Examples of other costs include seismic data acquisition, periodic sampling and testing of the injected CO_2.

The estimated costs are based on hypothetical or pro-forma sites for various types of projects such as R&D GS projects, commercial saline formation projects, and ER GS projects. The geologic and engineering assumptions for these pro-forma projects are the same as those used by the EPA Office of Water in the proposed UIC Class VI rule for CO_2 injection wells. The costs are presented in 2008 dollars.

The capital costs are annualized using an interest rate of 7% with projects lasting 7 years or 20 years. Next, annual O&M costs are added to the annualized capital costs to determine total annual direct costs. Finally, a 20 percent overhead and general and administrative cost factor is added to obtain total annual costs. These are then divided by the amount assumed to be injected each year in the pro-forma project to arrive at total costs per metric ton of CO_2 injected. These per-ton costs are then used to estimate total annual costs for the level of injection expected in the activity baseline.

B. What are the costs of the proposed rule?

1. Summary of Costs

The total annualized costs incurred under the rule by these entities would be approximately $714,000 ($2008 dollars), as illustrated in Table 7 of this preamble. The public sector burden estimate is $344,000 for program implementation and verification activities. This may underestimate the total public sector burden depending on the extent to which DOE R&D projects funded with public dollars transition to demonstration or commercial GS, and consequently incur costs associated with monitoring, reporting and verification. Given uncertainties related to project adoption and the costs of the reporting program, EPA considered two other private cost scenarios (one higher and one lower than the reference cost scenario) in order to assess a range of economic impacts on affected entities, as illustrated in table 8 of this preamble.

TABLE 7—NATIONAL ANNUALIZED MANDATORY REPORTING COSTS ESTIMATES (2008$): SUBPART RR

Type	Number of projects	Metric tons CO_2 injected per year	Total annual cost (thousand, 2008$)
R&D	9	5,320,000	37
CO_2 Injection Facilities (no GS) [1]	80	36,815,442	332
Private Sector, Total All Projects	89	45,435,442	369
Private Sector, Average ($/ton)			0.01
Public Sector, Total			344
National Total			714

[1] Includes Class II ER Facilities.

TABLE 8—ANNUALIZED REPORTING COSTS PER PROJECT (2008$): SUBPART RR

Type	Average		
		Alternative cost scenarios	
	Reference ($1,000)	Low ($1,000)	High ($1,000)
GS Facilities (commercial saline) [1]	289	7	470
GS Facilities (ER opt in)	1,679	1,485	1,804
CO_2 Injection Facilities [1]	4	4	4

[1] Includes Class II ER Facilities.

C. What are the economic impacts of the proposed rule?

1. Summary of Economic Impacts

EPA assessed how the regulatory program may influence the profitability of companies by comparing the monitoring program costs to total sales (*i.e.,* a "sales" test). Given limited data on commercial GS operations, EPA restricted the analysis to ER operations (approximately 90 percent of the fields). To do this, EPA divided the average annualized mandatory reporting costs per field by the estimated revenue for a representative field. Sales test ratios are between 3.1 to 3.3 percent for GS facilities (ER opt in). In contrast, ER CO_2 injection facilities (no GS) sales test ratios are below 0.01 percent, as illustrated in Table 9 of this preamble.

TABLE 9—ESTIMATED ANNUAL REVENUE FOR A REPRESENTATIVE COMMERCIAL ER FIELD OPERATION (2008$)

	Cost-to-Sales Ratios (CSRs)		
		Alternative cost scenarios	
	Reference (percent)	Low (percent)	High (percent)
GS Facilities (ER opt in)	3.1	2.7	3.3
CO_2 Injection Facilities (no GS) [1]	<0.01	<0.01	<0.01

[1] Includes Class II ER Facilities.

D. What are the impacts of the proposed rule on small businesses?

1. Summary of Impacts on Small Businesses

As required by the RFA and SBREFA, EPA assessed the potential impacts of the rule on small entities (small businesses, governments, and non-profit organizations). (*See* Section IV.C of this preamble for definitions of small entities.)

After considering the economic impact of the rule on small entities, EPA has concluded that this action will not have a significant economic impact on a substantial number of small entities. Currently EPA believes small ER operations will most likely be UIC Class II ER projects. As shown in Table 9 of this preamble, the average ratio of annualized reporting program costs to revenues of a typical ER operation likely owned by a representative small enterprise was less than 0.1%.

Although this rule will not have a significant economic impact on a substantial number of small entities, EPA nonetheless took several steps to reduce the impact of this rule on small entities. For example, EPA is proposing monitoring and reporting requirements that build off of the UIC program. In addition, EPA is proposing equipment and methods that may already be in use by a facility for compliance with its UIC permit. Also, EPA is requiring annual reporting instead of more frequent reporting.

In addition to the public hearing that EPA plans to hold, EPA has an open door policy, similar to the outreach conducted during the development of the proposed and final MRR. Details of these meetings are available in the docket (EPA–HQ–OAR–2009–0926).

E. What are the benefits of the proposed rule for society?

EPA examined the potential benefits of this proposed rule. EPA's previous analysis of the MRR discussed the benefits of a reporting system with respect to policy making relevance, transparency issues, market efficiency. Instead of a quantitative analysis of the benefits, EPA conducted a systematic literature review of existing studies including government, consulting, and scholarly reports.

The greatest benefit of mandatory reporting of industry GHG emissions to government will be realized in developing future GHG policies. For example, in the EU's Emissions Trading System, a lack of accurate monitoring at the facility level before establishing CO_2 allowance permits resulted in allocation of permits for emissions levels an average of 15 percent above actual levels in every country except the United Kingdom.

Benefits to industry of GHG emissions monitoring include the value of having independent, verifiable data to present to the public to demonstrate appropriate environmental stewardship, and a better understanding of their emission levels and sources to identify opportunities to reduce emissions. Such monitoring allows for inclusion of standardized GHG data into environmental management systems, providing the necessary information to achieve and disseminate their environmental achievements.

Standardization will also be a benefit to industry, once facilities invest in the institutional knowledge and systems to report emissions, the cost of monitoring should fall and the accuracy of the accounting should improve. A standardized reporting program will also allow for facilities to benchmark themselves against similar facilities to understand better their relative standing within their industry.

IV. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under Section 3(f)(1) of Executive Order 12866 (58 FR 51735, October 4, 1993), this proposed action is not by itself an "economically significant regulatory action" because it is unlikely to have an annual economic effect of less than $100 million. EPA's cost analysis, presented in Section 4 of the EIA, estimates that for the minimum reporting under the recommended regulatory option, the total annualized cost of the rule will be approximately $713,000 (in 2008$) during the first year of the program and $713,000 in subsequent years (including $0.3 million of programmatic costs to the Agency). This proposed action adds subpart RR to the MRR, which was a significant regulatory action. Thus, EPA has chosen to analyze the impacts of subpart RR as if it were significant. EPA submitted this proposed action to the Office of Management and Budget (OMB) for review under Executive Order 12866, and any changes made in response to OMB recommendations have been documented in the docket for this proposed action.

In addition, EPA prepared an analysis of the potential costs associated with this proposed action. This analysis is contained in the "Economic Impact Analysis for the Mandatory Reporting of Greenhouse Gas Emissions Subpart RR" (EPA–HQ–OAR–2009–0926). A copy of the analysis is available in the docket for this action and the analysis is briefly summarized here. In this report, EPA has identified the regulatory options considered, their costs, the emissions that would likely be reported under each option, and explained the selection of the option chosen for the rule. Overall, EPA has concluded that the costs of this proposed rule are outweighed by the potential benefits of more comprehensive information about GHGs.

B. Paperwork Reduction Act

The information collection requirements in this proposed rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number 2372.01.

EPA has identified the following goals of the mandatory reporting system, including:

- Obtain data that is of sufficient quality that it can be used to analyze and inform the development of a range of future climate change policies and potential regulations.
- Balance the rule's coverage to maximize the amount of emissions reported while excluding small emitters.
- Create reporting requirements that are, to the extent possible and appropriate, consistent with existing GHG reporting programs in order to reduce reporting burden for all parties involved.

The information from CO_2 injection and GS facilities will allow EPA to make well-informed decisions about whether and how to use the CAA to regulate these facilities and encourage voluntary reductions. Because EPA does not yet know the specific policies that will be adopted, the data reported through the mandatory reporting system should be of sufficient quality to inform policy and program development. Also, consistent with the Appropriations Act, the reporting rule covers a broad range of sectors of the economy.

This information collection is mandatory and will be carried out under CAA section 114. Information identified and marked as Confidential Business Information (CBI) will not be disclosed except in accordance with procedures set forth in 40 CFR Part 2. However, emissions information collected under CAA section 114 generally cannot be claimed as CBI and will be made public.[39]

[39] Although CBI determinations are usually made on a case-by-case basis, EPA has issued guidance

Continued

The projected ICR cost and respondent burden is $0.8 million and 4,510 hours per year. The estimated average burden per response is 6.8 hours; the frequency of response is annual for all respondents that must comply with the rule's reporting requirements, except for electricity-generating units that are already required to report quarterly under 40 CFR Part 75 (acid rain program); and the estimated average number of likely respondents per year is 89. The cost burden to respondents resulting from the collection of information includes the total capital and start-up cost annualized over the equipment's expected useful life (averaging $0.1 million per year) a total operation and maintenance component (averaging $0.3 million per year), and a labor cost component (averaging $0.3 million per year). Burden is defined at 5 CFR 1320.3(b).

These cost numbers differ from those shown elsewhere in the EIA because ICR costs represent the average cost over the first three years of the rule, but costs are reported elsewhere in the EIA for the first year of the rule. Also, the total cost estimate of the rule in the EIA includes the cost to the Agency to administer the program. The ICR differentiates between respondent burden and cost to the Agency.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR Part 9. When this ICR is approved by OMB, the Agency will publish a technical amendment to 40 CFR part 9 in the **Federal Register** to display the OMB control number for the approved information collection requirements contained in the final rule.

To comment on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, EPA has established a public docket for this proposed rule, which includes this ICR, under Docket ID number EPA–HQ–OAR–2009–0926. Submit any comments related to the ICR to EPA and OMB. *See* **ADDRESSES** section at the beginning of this notice for where to submit comments to EPA. Send comments to OMB at the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW., Washington, DC 20503, *Attention:* Desk Office for EPA. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after [date of publication], a comment to OMB is best assured of having its full effect if OMB receives it by [publication plus 30]. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

C. Regulatory Flexibility Act (RFA)

The RFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) A small business as defined by the Small Business Administration's regulations at 13 CFR 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. Currently EPA believes small ER operations will most likely be CO_2 injection facilities, including Class II ER projects. The average ratio of annualized reporting program costs to revenues of a typical ER operation likely owned by representative small enterprises is less than 1%

After considering the economic impacts of today's proposed rule on small entities, I therefore certify that this proposed rule will not have a significant economic impact on a substantial number of small entities.

Although this rule will not have a significant economic impact on a substantial number of small entities, EPA nonetheless took several steps to reduce the impact of this rule on small entities. For example, EPA is proposing monitoring and reporting requirements that build off of the UIC program. In addition, EPA is proposing equipment and methods that may already be in use by a facility for compliance with its UIC permit. Also, EPA is requiring annual reporting instead of more frequent reporting. In addition to the public hearing that EPA plans to hold, EPA has an open door policy, similar to the outreach conducted during the development of the proposed and final MRR. Details of these meetings are available in the docket (EPA–HQ–OAR–2009–0926).

D. Unfunded Mandates Reform Act (UMRA)

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Pub. L. 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under Section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for final rules with "Federal mandates" that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year.

This proposed rule does not contain a Federal mandate that may result in expenditures of $100 million or more for State, local, and tribal governments, in the aggregate, or the private sector in any one year. Overall, EPA estimates that the total annualized costs of this proposed rule are approximately $713,000 per year. Thus, this proposed rule is not subject to the requirements of sections 202 or 205 of UMRA.

This proposed rule is also not subject to the requirements of section 203 of UMRA because it contains no regulatory requirements that might significantly or uniquely affect small governments. Facilities subject to the proposed rule include facilities that inject CO_2 for enhanced recovery of crude oil, and those intending to sequester CO_2. None of the facilities currently known to undertake these activities are owned by small governments.

E. Executive Order 13132: Federalism

This action does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. This regulation applies directly to facilities that inject CO_2 underground. Few, if any, State or local government facilities would be affected. This regulation also does not limit the power of States or localities to collect GHG data and/or regulate GHG emissions. Thus, Executive Order 13132 does not apply to this action.

in an earlier **Federal Register** notice on what constitutes emissions data that cannot be considered CBI (956 FR 7042–7043, February 21, 1991). As discussed in Section II.R of the Final MRR preamble, EPA will be initiating a separate notice and comment process to make CBI determinations for the data collected under this proposed rulemaking.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed action from State and local officials.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments" (59 FR 22951, November 6, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications."

This proposed rule is not expected to have tribal implications, as specified in Executive Order 13175. This regulation applies to facilities that inject CO_2 underground. Few facilities expected to be affected by the rule are likely to be owned by tribal governments. Thus, Executive Order 13175 does not apply to this proposed rule.

Although Executive Order 13175 does not apply to this proposed rule, EPA sought opportunities to provide information to tribal governments and representatives during development of the MRR. In consultation with EPA's American Indian Environment Office, EPA's outreach plan included tribes. During the proposal phase, EPA staff provided information to tribes through conference calls with multiple Indian working groups and organizations at EPA that interact with tribes and through individual calls with two tribal board members of TCR. In addition, EPA prepared a short article on the GHG reporting rule that appeared on the front page of a tribal newsletter—*Tribal Air News*—that was distributed to EPA/Office of Air Quality Planning & Standards' network of tribal organizations. EPA gave a presentation on various climate efforts, including the MRR, at the National Tribal Conference on Environmental Management in June, 2008. In addition, EPA had copies of a short information sheet distributed at a meeting of the National Tribal Caucus. EPA participated in a conference call with tribal air coordinators in April 2009 and prepared a guidance sheet for Tribal governments on the proposed rule. It was posted on the MRR Web site and published in the Tribal Air Newsletter. For a complete list of tribal contacts, see the "Summary of EPA Outreach Activities for Developing the Greenhouse Gas Reporting Rule," in the MRR Docket (EPA–HQ–OAR–2008–0508–055). In addition to the consultation activities supporting the MRR, EPA continues to provide requested information to tribal governments and representatives during development of MRR source categories that have not been finalized (Track II rules) such as this proposed rulemaking. EPA specifically solicits additional comment on this proposed action from tribal officials.

G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

EPA interprets EO 13045 (62 FR 19885, April 23, 1997) as applying only to those regulatory actions that concern health or safety risks, such that the analysis required under section 5–501 of the EO has the potential to influence the regulation. This proposed action is not subject to EO 13045 because it does not establish an environmental standard intended to mitigate health or safety risks.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This proposed rule is not a "significant energy action" as defined in EO 13211 (66 FR 28355, May 22, 2001) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Further, EPA has concluded that this proposed rule is not likely to have any adverse energy effects. This proposed rule relates to monitoring, reporting and recordkeeping at facilities that inject CO_2 underground and does not impact energy supply, distribution or use. Therefore, EPA concludes that this proposed rule is not likely to have any adverse effects on energy supply, distribution, or use.

I. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (NTTAA), Public Law 104–113 (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (*e.g.,* materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rulemaking involves technical standards. EPA will use voluntary consensus standards from at least seven different voluntary consensus standards bodies, including the following: American Society for Testing and Materials (ASTM), American Society of Mechanical Engineers (ASME), International Standards Organization (ISO), Gas Processors Association, American Gas Association, American Petroleum Institute, and National Lime Association. These voluntary consensus standards will help facilities monitor, report, and keep records of CO_2 injections or geologic sequestration, and any associated GHG emissions. No new test methods were developed for this proposed rule. Instead, from existing rules for source categories and voluntary greenhouse gas programs, EPA identified existing means of monitoring, reporting, and keeping records of greenhouse gas emissions. The existing methods (voluntary consensus standards) include a broad range of measurement techniques, such as methods to measure gas or liquid flow; and methods to gauge and measure petroleum and petroleum products. The test methods are incorporated by reference into the proposed rule and are available as specified in 40 CFR 98.7.

By incorporating voluntary consensus standards into this proposed rule, EPA is both meeting the requirements of the NTTAA and presenting multiple options and flexibility in complying with the proposed rule. EPA welcomes comments on this aspect of the proposed rulemaking and, specifically, invites the public to identify potentially-applicable voluntary consensus standards and to explain why such standards should be used in this proposed regulation.

J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

EO 12898 (59 FR 7629, February 16, 1994) establishes Federal executive policy on environmental justice. Its main provision directs Federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations in the United States.

EPA has determined that this proposed rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations

because it does not affect the level of protection provided to human health or the environment. This proposed rule does not affect the level of protection provided to human health or the environment because it is a rule addressing information collection and reporting procedures.

List of Subjects in 40 CFR Part 98

Environmental protection, Administrative practice and procedure, Greenhouse gases, Incorporation by reference, Air pollution control, Reporting and recordkeeping requirements.

Dated: March 22, 2010.

Lisa P. Jackson,

Administrator.

For the reasons stated in the preamble, title 40, chapter I, of the Code of Federal Regulations is proposed to be amended as follows:

PART 98—[AMENDED]

1. The authority citation for part 98 continues to read as follows:

Authority: 42 U.S.C. 7401, *et seq.*

Subpart A—[Amended]

2. Section 98.2 is amended by revising paragraph (a) introductory text to read as follows:

§ 98.2 Who must report?

(a) The GHG reporting requirements and related monitoring, recordkeeping, and reporting requirements of this part apply to the owners and operators of any facility that is located in the United States or under or attached to the Outer Continental Shelf (as defined in 43 U.S.C. 1331) and that meets the requirements of either paragraph (a)(1), (a)(2), or (a)(3) of this section; and any supplier that meets the requirements of paragraph (a)(4) of this section:

* * * * *

3. Section 98.6 is amended by adding the following definitions in alphabetical order to read as follows:

§ 98.6 Definitions.

* * * * *

Outer Continental Shelf means all submerged lands lying seaward and outside of the area of lands beneath navigable waters as defined in 43 U.S.C. 1301, and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control.

* * * * *

United States means the 50 States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the Virgin Islands, Guam, and any other Commonwealth, territory or possession of the United States, as well as the territorial sea as defined by Presidential Proclamation No. 5928.

* * * * *

4. Section 98.7 is amended by revising paragraph (e)(39) to read as follows:

§ 98.7 What standardized methods are incorporated by reference into this part?

* * * * *

(e) * * *

(39) ASTM E1747–95 (Reapproved 2005) Standard Guide for Purity of Carbon Dioxide Used in Supercritical Fluid Applications, IBR approved for § 98.424(b) and § 98.444(a).

* * * * *

5. Part 98 is amended by adding subpart RR to read as follows:

Sec.

98.440 Definition of the source category.
98.441 Reporting threshold.
98.442 GHGs to report.
98.443 Calculating CO_2 Injection and Sequestration.
98.444 Monitoring and QA/QC requirements.
98.445 Procedures for estimating missing data.
98.446 Data reporting requirements.
98.447 Records that must be retained.
98.448 Geologic Sequestration Monitoring, Reporting, and Verification (MRV) Plan.
98.449 Definitions.

Subpart RR—Injection and Geologic Sequestration of Carbon Dioxide

§ 98.440 Definition of the source category.

(a) The injection and geologic sequestration of carbon dioxide (CO_2) source category comprises any well or group of wells that inject CO_2 into the subsurface, which includes under a seabed offshore. The source category consists of all wells that inject CO_2 into the subsurface, including wells for geologic sequestration (GS) or for any other purpose.

(b) A facility that is subject to this rule only because of CO_2 injection wells that do not meet the definition of geologic sequestration facility in paragraph (c) of this section is not required to report emissions under any other subpart of part 98.

(c) Geologic sequestration (GS) facility.

(1) For the purposes of this source category, a geologic sequestration facility is a facility that injects CO_2 for the long-term containment of a gaseous, liquid, or supercritical CO_2 stream in subsurface geologic formations. A facility that injects CO_2 to enhance the recovery of oil or natural gas is not a geologic sequestration facility for the purposes of this source category unless the facility also injects the CO_2 in subsurface geologic formations for long-term containment of a gaseous, liquid, or supercritical CO_2 stream and chooses to submit a monitoring, reporting, and verification (MRV) plan to EPA that is then approved by EPA.

(2) A facility that is not required to report for the purposes of this source category as a geologic sequestration facility, injects CO_2 for the long-term containment of a gaseous, liquid, or supercritical CO_2 stream in subsurface geologic formations, and chooses to submit an MRV plan to EPA that is then approved by EPA, is a geologic sequestration facility.

(3) A geologic sequestration facility includes all structures associated with injection located between the points of CO_2 transfer onsite and the injection wells.

(4) A geologic sequestration facility that injects CO_2 to enhance the recovery of oil or natural gas includes all structures associated with production located between the production wells and the separators.

(d) This source category does not include the following:

(1) Storage of CO_2 above ground.

(2) Temporary storage of CO_2 below ground.

(3) Transportation or distribution of CO_2.

(4) Purification, compression, or processing of CO_2 at the surface.

(5) Capture of CO_2.

(6) CO_2 in cement, precipitated calcium carbonate (PCC), or any other technique that does not involve injection of CO_2 into the subsurface.

§ 98.441 Reporting threshold.

(a) You must report under this subpart if your facility is an injection facility that injects CO_2 into the subsurface and the facility meets requirements of either § 98.2(a)(1) or (a)(2).

(b) The requirements of § 98.2(i) do not apply to this subpart. Once a facility is subject to the requirements of this subpart, the owner or operator must continue for each year thereafter to comply with all requirements of this subpart, including the requirement to submit annual GHG reports, even if the facility does not meet the applicability requirements in paragraph (a) of § 98.2(a) of this part in a future year, unless paragraphs (b)(1) or (b)(2) of this section apply.

(1) If the injection well or wells constituting the facility are plugged in compliance with the facility's Underground Injection Control permit requirements (or relevant permit requirements, if any, in the case of a facility that is not under the jurisdiction

of the Safe Drinking Water Act), a facility conducting geologic sequestration subject to the requirements of this subpart may discontinue complying with § 98.442(a) and § 98.442(b) and all other facilities subject to the requirements of this subpart may discontinue complying with this subpart. The owner or operator of the facility must notify EPA that the injection well or wells constituting the facility have been plugged in compliance with the facility's Underground Injection Control permit requirements (or relevant permit requirements, if any, in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act), and such notification must be certified as accurate by the owner or operator of the facility. The owner or operator must resume reporting for any future calendar year during which any activities that are source categories of this subpart resume operation.

(2) If the CO_2 plume and pressure front have stabilized and the GS facility has been closed in compliance with the facility's Underground Injection Control permit requirements (or relevant permit requirements, if any, in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act), a facility conducting geologic sequestration may discontinue complying with the remainder of this subpart. The owner or operator of the facility must notify EPA that the CO_2 plume and pressure front have stabilized and the GS facility has been closed in compliance with the facility's Underground Injection Control permit requirements (or relevant permit requirements, if any, in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act), and such notification must be certified as accurate by the owner or operator of the facility. The owner or operator must resume reporting for any future calendar year during which any activities that are source categories of this subpart resume operation.

§ 98.442 GHGs to report.

You must report:

(a) Mass of CO_2 received onsite.

(b) Mass of CO_2 injected into the subsurface.

(c) Facilities conducting geologic sequestration also report:

(1) Mass of CO_2 produced, if any.

(2) Mass of CO_2 sequestered in the subsurface geologic formation.

(3) Mass of CO_2 emitted from subsurface leaks.

(4) Mass of fugitive and vented CO_2 emissions from surface equipment at the facility if not reported under subpart W of this part.

§ 98.443 Calculating CO_2 Injection and Sequestration.

(a) A facility must calculate and report the annual mass of CO_2 transferred to the facility from offsite sources using the procedures in paragraphs (a)(1), (a)(2), and (a)(3) of this section.

(1) For each transfer point for which flow is measured using a mass flow meter, you must calculate the total annual mass of CO_2 in a CO_2 stream transferred onsite from offsite sources in metric tons by multiplying the mass flow by the CO_2 concentration in the flow, according to Equation RR–1 of this section. You must collect these data quarterly. Mass flow and concentration data measurements must be made in accordance with § 98.444.

$$CO_{2,v} = \sum_{p=1}^{4} Q_{p,v} * C_{CO_{2},p,v} \qquad \text{(Eq. RR-1)}$$

Where:

$CO_{2,v}$ = Annual CO_2 mass transferred onsite from offsite sources (metric tons) through transfer point v.

$Q_{p,v}$ = Quarterly mass flow rate measurement for transfer point v in quarter p (metric tons per quarter).

$C_{CO2,p,v}$ = Quarterly CO_2 concentration measurement in flow for transfer point v in quarter p (wt. $\%CO_2/100$).

p = quarter.

v = transfer point.

(2) For each transfer point for which flow is measured using a volumetric flow meter, you must calculate the total annual mass of CO_2 in a CO_2 stream transferred onsite from offsite sources in metric tons by multiplying the volumetric flow at standard conditions by the CO_2 concentration in the flow and the density of CO_2 at standard conditions, according to Equation RR–2 of this section. You must collect these data quarterly. Volumetric flow and concentration data measurements must be made in accordance with § 98.444.

$$CO_{2,v} = \sum_{p=1}^{4} Q_{p,v} * D_{p,v} * C_{CO_{2},p,v} \qquad \text{(Eq. RR-2)}$$

Where:

$CO_{2,v}$ = Annual CO_2 mass transferred onsite from offsite sources (metric tons) through transfer point v.

$Q_{p,v}$ = Quarterly volumetric flow rate measurement for transfer point v in quarter p at standard conditions (standard cubic meters per quarter).

$D_{p,v}$ = Density of CO_2 at standard conditions (metric tons per standard cubic meter): 0.0018704.

$C_{CO2,p,v}$ = Quarterly CO_2 concentration measurement in flow for transfer point v in quarter p (wt. $\%CO_2/100$).

p = quarter.

v = transfer point.

(3) To aggregate transfer data at the facility level, you must sum the mass of all CO_2 transferred onsite from offsite sources through all facility transfer points in accordance with the procedure specified in Equation RR–3 of this section.

$$CO_{2T} = \sum_{v=1}^{V} CO_{2,v} \qquad \text{(Eq. RR-3)}$$

Where:

CO_{2T} = Total annual CO_2 mass transferred onsite from offsite sources (metric tons) through all transfer points at the facility.

$CO_{2,v}$ = Annual CO_2 mass transferred (metric tons) through transfer point v.

v = transfer point.

(b) A facility must report annually the mass of CO_2 injected in accordance with the procedures specified in paragraphs (b)(1) through (b)(3) of this section.

(1) For each point at which the flow of an injected CO_2 stream is measured using a mass flow meter, you must calculate annually the total mass of CO_2 in the CO_2 stream injected in metric

tons by multiplying the mass flow by the CO_2 concentration in the flow, according to Equation RR–4 of this section. You must collect these data quarterly. Mass flow and concentration data measurements must be made in accordance with § 98.444.

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * C_{CO_{2,p,u}} \qquad \text{(Eq. RR-4)}$$

Where:

$CO_{2,u}$ = Annual CO_2 mass injected (metric tons) as measured by flow meter u.

$Q_{p,u}$ = Quarterly mass flow rate measurement for flow meter u in quarter p (metric tons per quarter).

$C_{CO2,p,u}$ = Quarterly CO_2 concentration measurement in flow in quarter p (wt. $\%CO_2/100$).

p = quarter.

u = flow meter.

(2) For each point at which the flow of an injected CO_2 stream is measured using a volumetric flow meter, you must calculate annually the total mass of CO_2 in the CO_2 stream injected in metric tons by multiplying the volumetric flow at standard conditions by the CO_2 concentration in the flow and the density of CO_2 at standard conditions, according to Equation RR–5 of this section. You must collect these data quarterly. Volumetric flow and concentration data measurements must be made in accordance with § 98.444.

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * D_{p,u} * C_{CO_{2,p,u}} \qquad \text{(Eq. RR-5)}$$

Where:

$CO_{2,u}$ = Annual CO_2 mass injected (metric tons) as measured by flow meter u.

$Q_{p,u}$ = Quarterly volumetric flow rate measurement for flow meter u in quarter p at standard conditions (standard cubic meters per quarter).

$D_{p,u}$ = Density of CO_2 at standard conditions (metric tons per standard cubic meter): 0.0018704.

$C_{CO2,p,u}$ = CO_2 concentration measurement in flow for transfer point u in quarter p (wt. $\%CO_2/100$).

p = quarter.

u = flow meter.

(3) To aggregate injection data at the facility level, you must sum the mass of all CO_2 injected through all injection wells at the facility in accordance with the procedure specified in Equation RR–6 of this section.

$$CO_{2I} = \sum_{u=1}^{U} CO_{2,u} \qquad \text{(Eq. RR-6)}$$

Where:

CO_{2I} = Total annual CO_2 mass injected (metric tons) through all injection wells.

$CO_{2,u}$ = Annual CO_2 mass injected (metric tons) as measured by flow meter u.

u = flow meter.

(c) All GS facilities must also report the mass of CO_2 emitted as fugitive or vented emissions from surface equipment (if this information is not required to be reported under subpart W of this part), the mass of CO_2 produced (if applicable), the mass of CO_2 emitted from subsurface leakage, and the mass of CO_2 geologically sequestered in accordance with the procedures as specified in paragraphs (c)(1) through (c)(4) of this section.

(1) If you do not report CO_2 emitted as fugitive or vented emissions from surface equipment at your facility in the reporting year under subpart W of this part, you must report them under subpart RR of this part in accordance with the procedures specified in subpart W of this part for each type of surface equipment. If you report these emissions under subpart W of this part, you do not need to report these emissions under subpart RR of this part.

(2) You must calculate the annual mass of CO_2 produced from oil or gas production wells (if applicable) at the facility for each separator that sends a stream of gas into a recycle or end use system in accordance with the procedures specified in paragraphs (c)(2)(i) through (c)(2)(iii) of this section.

(i) For each gas-liquid separator for which flow is measured using a mass flow meter, you must calculate annually the total mass of CO_2 produced from an oil or gas stream in metric tons by multiplying the mass flow by the CO_2 concentration in the flow, according to Equation RR–7 of this section. You must collect these data quarterly. Mass flow and concentration data measurements must be made in accordance with § 98.444.

$$CO_{2,w} = \sum_{p=1}^{4} Q_{p,w} * C_{CO_{2,p,w}} \qquad \text{(Eq. RR-7)}$$

Where:

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through separator w.

$Q_{p,w}$ = Quarterly mass flow rate measurement for separator w in quarter p (metric tons per quarter).

$C_{CO2,p,w}$ = Quarterly CO_2 concentration measurement in flow for separator w in quarter p (wt. % $CO_2/100$).

p = quarter.

w = separator.

(ii) For each gas-liquid separator for which flow is measured using a volumetric flow meter, you must calculate annually the total mass of CO_2 produced from an oil or gas stream in metric tons by multiplying the volumetric flow at standard conditions by the CO_2 concentration in the flow and the density of CO_2 at standard conditions, according to Equation RR–8 of this section. You must collect these data quarterly. Volumetric flow and concentration data measurements must be made in accordance with § 98.444.

$$CO_{2,w} = \sum_{p=1}^{4} Q_{p,w} * D_{p,w} * C_{CO_{2,p,w}} \qquad \text{(Eq. RR-8)}$$

Where:

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through separator w.

$Q_{p,w}$ = Volumetric flow rate measurement for separator w in quarter p at standard conditions (standard cubic meters per quarter).

$D_{p,w}$ = Density of CO_2 at standard conditions (metric tons per standard cubic meter): 0.0018704.

$C_{CO2,p,w}$ = CO_2 concentration measurement in flow for separator w in quarter p (wt. % CO_2/100).

p = quarter.

w = separator.

(iii) To aggregate production data at the facility level, you must sum the mass of all of the CO_2 separated at each gas-liquid separator at the facility in accordance with the procedure specified in Equation RR–9 of this section. You must assume that the total CO_2 measured at the separator(s) represents (100–X)% of the total CO_2 produced. In order to account for the X% of CO_2 produced that is estimated to remain with the produced oil and gas, you must multiply the quarterly mass of CO_2 measured at the separator(s) by (100+X)%. The value of X must be estimated using a methodology approved by EPA per your MRV plan.

$$CO_{2P} = (100 + X)\% * \sum_{w=1}^{W} CO_{2,w} \qquad \text{(Eq. RR-9)}$$

Where:

CO_{2P} = Total annual CO_2 mass produced (metric tons) through all separators in the reporting year.

$CO_{2,w}$ = Annual CO_2 mass produced (metric tons) through separator w in the reporting year.

X = Percent of CO_2 that is estimated to remain with the produced oil and gas.

w = separator.

(3) You must report the annual mass of CO_2 that is emitted from each leakage pathway identified in your MRV plan. You must calculate the total annual mass of CO_2 emitted from all leakage pathways at the facility in accordance with the procedure specified in Equation RR–10 of this section.

$$CO_{2E} = \sum_{x=1}^{X} CO_{2,x} \qquad \text{(Eq. RR-10)}$$

Where:

CO_{2E} = Total annual CO_2 mass emitted from the subsurface geologic formation (metric tons) at the facility in the reporting year.

$CO_{2,x}$ = Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year.

x = leakage pathway.

(4) You must report the annual mass of CO_2 that is sequestered in the subsurface geologic formation in the reporting year in accordance with the procedures specified in paragraphs (c)(4)(i) and (c)(4)(ii) of this section.

(i) GS facilities that are conducting enhanced recovery operations and that are actively producing oil or natural gas must calculate the annual mass of CO_2 that is sequestered in the underground subsurface formation in the reporting year in accordance with the procedure specified in Equation RR–11 of this section.

$$CO_2 = CO_{2I} - CO_{2P} - CO_{2E} - CO_{2FI} - CO_{2FP} \qquad \text{(Eq. RR-11)}$$

Where:

CO_2 = Total annual CO_2 mass sequestered in the subsurface geologic formation (metric tons) at the facility in the reporting year.

CO_{2I} = Total annual CO_2 mass injected (metric tons) at the facility in the reporting year.

CO_{2P} = Total annual CO_2 mass produced (metric tons) at the facility in the reporting year.

CO_{2E} = Total annual CO_2 mass emitted (metric tons) from the subsurface geologic formation in the reporting year.

CO_{2FI} = Total annual CO_2 mass emitted (metric tons) as fugitive or vented emissions from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead.

CO_{2FP} = Total annual CO_2 mass emitted (metric tons) as fugitive or vented emissions from equipment located on the surface between the production wellhead and of the flow meter used to measure production quantity.

(ii) GS facilities that are not actively producing oil or natural gas must calculate the annual mass of CO_2 that is sequestered in the subsurface geologic formation in the reporting year in accordance with the procedures specified in Equation RR–12 of this section.

$$CO_2 = CO_{2I} - CO_{2E} - CO_{2FI} \qquad \text{(Eq. RR-12)}$$

Where:

CO_2 = Total annual CO_2 mass sequestered in the subsurface geologic formation (metric tons) at the facility in the reporting year.

CO_{2I} = Total annual CO_2 mass injected (metric tons) at the facility in the reporting year.

CO_{2E} = Total annual CO_2 mass emitted (metric tons) from the subsurface geologic formation in the reporting year.

CO_{2FI} = Total annual CO_2 mass emitted (metric tons) as fugitive or vented emissions from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead.

§ 98.444 Monitoring and QA/QC requirements.

(a) All reporters must adhere to the requirements and procedures in paragraph (a) in this section if there has been no EPA direction or order specifying a preferred method of measurement.

(1) You must determine the quantity transferred by following the most appropriate of the following procedures:

(i) A reporter can measure quantity at the custody transfer meter installed at the facility boundary prior to any subsequent processing operations at the facility.

(ii) If you took ownership of the CO_2 in a commercial transaction, you can use the quantity data from the sales contract if it is a one-time transaction or from invoices or manifests if it is an ongoing commercial transaction with discrete shipments.

(2) The point of measurement for the quantity injected is specified in paragraphs (a)(2)(i) and (a)(2)(ii) of this section.

(i) For facilities regulated by the Underground Injection Control program, the point of measurement is the flow meter installed at the facility you already use to comply with the flow monitoring and reporting provisions of your Underground Injection Control permit.

(ii) For facilities not regulated by the Underground Injection Control program because they are outside of Safe Drinking Water Act jurisdiction, the point of measurement is the flow meter installed at the facility you already use to comply with the flow monitoring and reporting provisions of your relevant permit. If no such requirement exists, the point of measurement is the flow meter installed closest to the point of injection at your facility.

(3) You must determine the quantity injected by using a flow meter or meters.

(4) You must operate and calibrate all flow meters used to measure quantities reported in § 98.443 according to the following procedure:

(i) You must use an appropriate standard method published by a consensus-based standards organization if such a method exists. Consensus-based standards organizations include, but are not limited to, the following: ASTM International, the American National Standards Institute (ANSI), the American Gas Association (AGA), the American Society of Mechanical Engineers (ASME), the American Petroleum Institute (API), and the North American Energy Standards Board (NAESB).

(ii) Where no appropriate standard method developed by a consensus-based standards organization exists, you must follow industry standard practices.

(iii) You must ensure that any flow meter calibrations performed are NIST traceable.

(5) You must determine concentration of the transferred CO_2 stream by following the most appropriate of the following procedures:

(i) A reporter can sample the CO_2 stream at the point of transfer and measure its concentration.

(ii) If you took ownership of the CO_2 in a commercial transaction for which the sales contract was contingent on CO_2 concentration, and if the supplier of the CO_2 sampled the CO_2 stream and measured its concentration per the sales contract terms, you can use the CO_2 concentration data from the sales contract.

(6) You must determine the CO_2 concentration of the injected CO_2 stream by measuring immediately downstream of the flow meter as specified in paragraph (a)(2)(i) or (a)(2)(ii) of this section.

(7) If you measure the concentration of any CO_2 quantity for reporting, you must use methods that conform to applicable chemical analytical standards. Acceptable methods include U.S. Food and Drug Administration food-grade specifications for CO_2 (*see* 21 CFR 184.1240) and ASTM standard E1747–95 (Reapproved 2005) Standard Guide for Purity of Carbon Dioxide Used in Supercritical Fluid Applications (incorporated by reference, *see* § 98.7).

(8) You must determine the transferred CO_2 concentration and flow quarterly.

(9) You must sample the injected CO_2 concentration and calculate the flow quarterly.

(10) You must use the same calculation methodology throughout a reporting period unless you provide a written explanation of why a change in methodology was required.

(11) If you measure the flow of the CO_2 transferred or injected with a volumetric flow meter, you shall convert all measured volumes of carbon dioxide to the following standard industry temperature and pressure conditions for use in equations RR–2 and RR–5: Standard cubic meters at a temperature of 60 degrees Fahrenheit and at an absolute pressure of 1 atmosphere.

(b) GS facilities must additionally submit an MRV plan to EPA, receive approval from EPA, and adhere to the requirements and procedures in paragraph (b) of this section.

(1) You must adhere to paragraphs (a)(1) through (a)(11) of this section.

(2) For reporters who are not required to report the quantity of CO_2 emitted as fugitive or vented emissions from surface equipment at the injection site under subpart W of this part, and are thereby required to report fugitive and vented emissions from surface equipment under this subpart, monitoring and QA/QC requirements for these data should be followed in accordance with procedures specified in subpart W of this part.

(3) The point of measurement for the quantity of CO_2 produced from oil or natural gas production wells at the GS facility is a flow meter directly downstream of each separator that sends a stream of gas into a recycle or end use system.

(4) The point of measurement for the concentration of the stream of CO_2 produced is directly downstream of each separator that sends a stream of gas into a recycle or end use system.

(5) You must sample the produced CO_2 concentration and flow quarterly.

(6) A reporter must follow the procedures outlined in the most recent MRV plan submitted to and approved by EPA to determine the quantity of CO_2 emitted from the subsurface geologic formation and the percent of CO_2 that is estimated to remain with the produced oil and natural gas.

(c) For 2011, a facility that is subject to this rule only because of a CO_2 injection well(s) that does not meet the definition of GS facility in § 98.440(c) may follow the provisions of § 98.3(d)(1) through (3) for best available monitoring methods rather than follow the monitoring requirements of this section. For purposes of this subpart, any reference to the year 2010 in § 98.3(d)(1) through (3) shall mean 2011.

(d) All flow meters must be operated continuously.

(e) If you measure the flow of the CO_2 produced with a volumetric flow meter, you shall convert all measured volumes of carbon dioxide to the following standard industry temperature and pressure conditions for use in equation RR–8: Standard cubic meters at a temperature of 60 degrees Fahrenheit and at an absolute pressure of 1 atmosphere.

§ 98.445 Procedures for estimating missing data.

(a) A complete record of all measured parameters used in the GHG quantities calculations is required. Whenever the quality assurance procedures for all facilities covered under this subpart cannot be followed to measure flow and concentration, the most appropriate of the following missing data procedures must be followed if EPA has not specified a preferred procedure:

(1) A quarterly quantity of CO_2 injected that is missing must be estimated using the quantity of CO_2 injected from the nearest previous period of time at a similar injection pressure.

(2) A quarterly quantity of new CO_2 transferred onto the facility from offsite that is missing must be estimated using the quantity of new CO_2 flow based on supplier data or supplier-operated flow meters.

(3) A quarterly concentration value that is missing must be estimated using a concentration value from the nearest previous time period.

(b) A complete record of all measured parameters used in the GHG quantities calculations is required. Whenever the quality assurance procedures for facilities conducting GS cannot be followed, the most appropriate of the following missing data procedures must be followed:

(1) For any values associated with fugitive or vented CO_2 emissions from surface equipment at the facility that are reported in this supbart, missing data estimation procedures should be followed in accordance with those specified in subpart W of this part.

(2) The annual quantity of CO_2 produced from the subsurface geologic formation that is missing must be estimated according to the following:

(i) If an applicable procedure was included in the reporter's MRV plan submitted to EPA, that procedure must be applied.

(ii) If the procedure included in the reporter's MRV plan is not applicable, or if the reporter did not include a procedure in the MRV plan, the reporter must estimate annual quantity of CO_2 produced by subtracting the annual quantity of CO_2 transferred onsite from offsite from the annual quantity of CO_2 injected.

(3) The annual quantity of CO_2 emitted from the subsurface geologic formation must be estimated following the procedure included in the reporter's MRV plan submitted to EPA.

(4) All other missing data procedures as outlined in your approved MRV plan must be followed.

§ 98.446 Data reporting requirements.

In addition to the information required by § 98.3(c), report the information listed in this section. Facilities that are subject to this rule only because of CO_2 injection wells and that do not meet the definition of GS facility in § 98.440(c) do not report the information in § 98.3(c)(4).

(a) For each transfer point flow meter (mass or volumetric), report:

(1) CO_2 quantity transferred onsite (metric tons or standard cubic meters, as appropriate) in each quarter.

(2) CO_2 concentration in flow (volume or wt. % CO_2/100) in each quarter.

(3) If a volumetric flow meter is used, volumetric flow rate at standard conditions (standard cubic meters) in each quarter.

(4) If a mass flow meter is used, mass flow rate (metric tons) in each quarter.

(5) The standard used to calculate each value in paragraphs (a)(1) through (a)(4) of this section.

(6) The number of times in the reporting year for which substitute data procedures were used to calculate values reported in paragraphs (a)(1) through (a)(4) of this section.

(b) For each injection flow meter (mass or volumetric), report:

(1) CO_2 quantity injected (metric tons or standard cubic meters) in each quarter.

(2) CO_2 concentration in flow (volume or wt. % CO_2/100) in each quarter.

(3) If a volumetric flow meter is used, volumetric flow rate at standard conditions (standard cubic meters) in each quarter.

(4) If a mass flow meter is used, mass flow rate (metric tons) in each quarter.

(5) The standard used to calculate each value in paragraphs (b)(1) through (b)(4) of this section.

(6) The number of times in the reporting year for which substitute data procedures were used to calculate values reported in paragraphs (b)(1) through (b)(4) of this section.

(c) The source of the supplied CO_2, if known, according to the following categories:

(1) CO_2 production wells.

(2) Electric generating unit.

(3) Ethanol plant.

(4) Pulp and paper mill.

(5) Natural gas processing.

(6) Other anthropogenic source.

(7) Unknown.

(d) The total CO_2 received onsite (metric tons) in the reporting year as calculated in Equation RR–3.

(e) The total CO_2 injected (metric tons) in the reporting year as calculated in Equation RR–6.

(f) GS facilities must also report the following information:

(1) If you do not report under subpart W of this part, report the annual fugitive and vented CO_2 emissions from surface equipment (metric tons) located in the GS facility under this subpart.

(2) Annual CO_2 mass emitted (metric tons) as fugitive or vented emissions from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead.

(3) Annual CO_2 mass emitted (metric tons) as fugitive or vented emissions from equipment located on the surface between the production wellhead and of the flow meter used to measure production quantity.

(4) For each separator flow meter (mass or volumetric), report:

(i) CO_2 quantity produced (metric tons or standard cubic meters) in each quarter.

(ii) CO_2 concentration in flow (volume or wt. % CO_2/100) in each quarter.

(5) For each separator volumetric flow meter, volumetric flow rate at standard conditions (standard cubic meters) in each quarter.

(6) For each separator mass flow meter, mass flow rate (metric tons) in each quarter.

(7) The standard used to calculate each value in paragraphs (f)(4) through (f)(6) of this section.

(8) The number of times in the reporting year for which substitute data procedures were used to calculate values reported in paragraphs (f)(4) through (f)(6) of this section.

(9) The value for X (%) used in Equation RR–9 and as determined in your MRV plan.

(10) Annual CO_2 produced in the reporting year as calculated in Equation RR–9.

(11) For each leakage pathway, report the CO_2 (metric tons) emitted through that pathway in the reporting year.

(12) Annual CO_2 mass emitted (metric tons) from the subsurface geologic formation at the facility in the reporting year as calculated by Equation RR–10.

(13) Annual CO_2 (metric tons) sequestered in the subsurface geologic formation in the reporting year as calculated by Equation RR–11 or RR–12.

(14) Cumulative mass of CO_2 reported as sequestered in the subsurface geologic formation in all years since you began reporting.

(15) Date that the most recent MRV plan was approved and the MRV plan approval number that was issued by EPA.

(16) Whether any of the MRV plan resubmissions scenarios were triggered in the reporting year such that you must submit a new MRV plan in the following year.

(17) If the well is permitted by an Underground Injection Control permitting authority, for each injection well, report:

(i) The well ID number used for the Underground Injection Control permit.

(ii) The Underground Injection Control permit class.

(18) Any other reporting requirement that is specified in your MRV plan.

§ 98.447 Records that must be retained.

In addition to the records required by § 98.3(g), you must retain the records specified in paragraphs (a) through (c) of this section, as applicable.

(a) You must retain quarterly records of injected CO_2 and CO_2 transferred onto the facility from offsite sources,

including mass flow or volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.

(b) GS facilities must retain:

(1) Quarterly records of produced CO_2, if applicable, including mass flow or volumetric flow at standard conditions and operating conditions, operating temperature and pressure, and concentration of these streams.

(2) Annual records of the emitted CO_2 from subsurface geologic formation leakage pathways.

(3) Any other records as outlined for retention in your MRV plan.

§ 98.448 Geologic Sequestration Monitoring, Reporting, and Verification (MRV) Plan.

(a) A GS facility as defined in § 98.440(c) of this subpart must follow the procedures outlined in this section to develop a monitoring, reporting, and verification (MRV) plan, submit it to EPA, receive approval from EPA on the plan, implement the plan, and submit annual report addenda.

(1) You must develop an MRV plan that contains the following components.

(i) An assessment of the risk of leakage of CO_2 to the surface.

(ii) A strategy for detecting and quantifying any CO_2 leakage to the surface.

(iii) A strategy for establishing pre-injection environmental baselines.

(iv) Summary of considerations made to calculate site-specific variables for the mass balance equation.

(2) A facility that injects CO_2 to enhance the recovery of oil or natural gas or a facility that is not required to report as a GS facility can voluntarily submit the MRV plan to EPA at any time.

(3) A GS facility that does not inject CO_2 to enhance the recovery of oil or natural gas must submit the MRV plan on the following schedule.

(i) A GS facility must submit the MRV plan to EPA (A) within six months from the time the facility's Underground Injection Control permitting authority (or relevant permitting authority in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act) confirms the area of review or (B) by December 31 of the year that that the Underground Injection Control permitting authority (or relevant permitting authority in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act) confirms the area of review, whichever date is later. A facility will be allowed to request one extension of up to an additional six months.

(ii) If the GS facility holds an Underground Injection Control permit (or relevant permit in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act) as of the date of publication of this subpart or if the Underground Injection Control permitting authority (or relevant permitting authority in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act) has confirmed the area of review as of the date of publication of this subpart, such facility must submit the MRV plan to EPA within six months of the date of publication of this subpart. A facility will be allowed to request one extension of up to an additional six months.

(4) If you are using an Underground Injection Control Class VI permit to demonstrate that MRV plan requirements have been satisfied and the Underground Injection Control Class VI permit has not been approved, you must submit the identification number associated with the Underground Injection Control Class VI permit application and notify EPA when the Underground Injection Control Class VI permit has been approved.

(5) Upon MRV plan submission, the following approval process will apply.

(i) On a case-by-case basis, EPA will determine if the submitted MRV plan is complete, and evaluate the MRV plan to ensure that the facility has an appropriate strategy in place to effectively quantify geologically sequestered CO_2.

(ii) You must implement the EPA-approved MRV plan once the plan is final, regardless of the point in the reporting year.

(6) If adjustments to the MRV plan are made due to new information or altered site conditions or if a leak is detected in a calendar year, you must submit an addendum at the same time as the next annual report (March 31 of the subsequent calendar year) that includes the following components.

(i) A description of the leak including all assumptions, methodology, and technologies involved in leakage detection and quantification, if a leak was detected.

(ii) A description of how the monitoring strategy was adjusted, if adjustments were made.

(7) The MRV plan must be revised and resubmitted to EPA by March 31 of the calendar year following any of the following events.

(i) The reporter is out of compliance with its Underground Injection Control permit (or relevant permit in the case of a facility that is not under the jurisdiction of the Safe Drinking Water Act).

(ii) An EPA audit conducted under the verification procedures of this part determines it to be necessary.

(8) An MRV plan may be resubmitted in any reporting year on a reporter's own volition.

(9) Each MRV plan and annual report addendum must be submitted electronically in a format specified by the Administrator.

(b) [Reserved]

§ 98.449 Definitions.

All terms used in this subpart have the same meaning given in the Clean Air Act and subpart A of this part.

Leakage means the movement of CO_2 from the injection zone to the surface, including to the atmosphere, indoor air, oceans or surface water.

Research and development means, for the purposes of geologic sequestration facility requirements in this subpart, those projects receiving Federal funding to research practices and monitoring techniques that will enable safe and effective long-term containment of a gaseous, liquid, or supercritical CO_2 stream in subsurface geologic formations that are neither demonstration nor commercial projects.

Separator means a vessel in which streams of multiple phases are gravity separated into individual streams of single phase.

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