

# Greenhouse Gas Reporting Program

**Subpart RR: Geologic Sequestration of Carbon Dioxide**

**Subpart UU: Injection of Carbon Dioxide**



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For a copy of the presentation slides, visit:

<http://www.epa.gov/ghgreporting/reporters/training/index.html>

# Overview of Subparts RR and UU



- EPA has finalized greenhouse gas (GHG) reporting mechanisms for facilities that conduct geologic sequestration (subpart RR) and all other facilities that inject carbon dioxide (CO<sub>2</sub>) underground for enhanced oil and gas recovery or any other purpose (subpart UU).
  - Proposal signed on March 22, 2010.
  - Final rule signed on November 22, 2010.
- This rule is complementary to and builds on EPA's Underground Injection Control (UIC) permit requirements
- On November 9, 2011 EPA finalized Technical Corrections, Clarifying and Other Amendments to seven subparts, including RR and UU.

# Subparts RR/UU Rule Topics



- I. Applicability – Who is Subject to Subparts RR and UU?
- II. Subpart RR/UU Reporting, Calculation, and Monitoring Requirements
- III. Estimating Missing Data
- IV. Data Reporting and Recordkeeping
- V. Subpart RR Monitoring, Reporting, and Verification (MRV) Plans



# **I. Applicability: Who is Subject to Subparts RR and UU?**

# What Facilities Must Report Under Subparts RR and UU?



## Subpart RR

- Subpart RR source category includes:
  - Any well or group of wells that inject a CO<sub>2</sub> stream for long-term containment in subsurface geologic formations
  - All wells permitted as UIC Class VI wells
  - Facilities that conduct enhanced oil and gas recovery are not required to report geologic sequestration under subpart RR unless
    - (1) the owner or operator chooses to opt-in to subpart RR or,
    - (2) the facility holds a UIC Class VI permit for the well or group of wells used to enhance oil and gas recovery

## Subpart UU

- Subpart UU source category includes:
  - Any well or group of wells that inject a CO<sub>2</sub> stream into the subsurface that does not report under Subpart RR

**Facilities that report under subpart RR are not required to report under subpart UU**

# Subpart RR Exemption for R&D Projects



- R&D projects will be granted an exemption from subpart RR provided they meet the eligibility requirements
- A project is eligible for the exemption if it meets the subpart RR definition of R&D project:
  - *a project for the purpose of investigating practices, monitoring techniques, or injection verification, or engaging in other applied research, that will enable safe and effective long-term containment of a CO<sub>2</sub> stream in subsurface geologic formations, including research and short duration CO<sub>2</sub> injection tests conducted as a precursor to long-term storage*
- Projects receiving a subpart RR R&D exemption report under subpart UU.

# Subpart RR R&D Exemption - Request



- A submission in support of an exemption as an R&D project must contain the following information:
  - The planned duration of CO<sub>2</sub> injection for the project
  - The planned annual CO<sub>2</sub> injection volumes during this time period
  - The research purposes of the project
  - The source and type of funding for the project
  - The class and duration of UIC permit or, for an offshore facility not subject to the Safe Drinking Water Act, a description of the legal instrument authorizing geologic sequestration

# Subpart RR R&D Exemption - Process



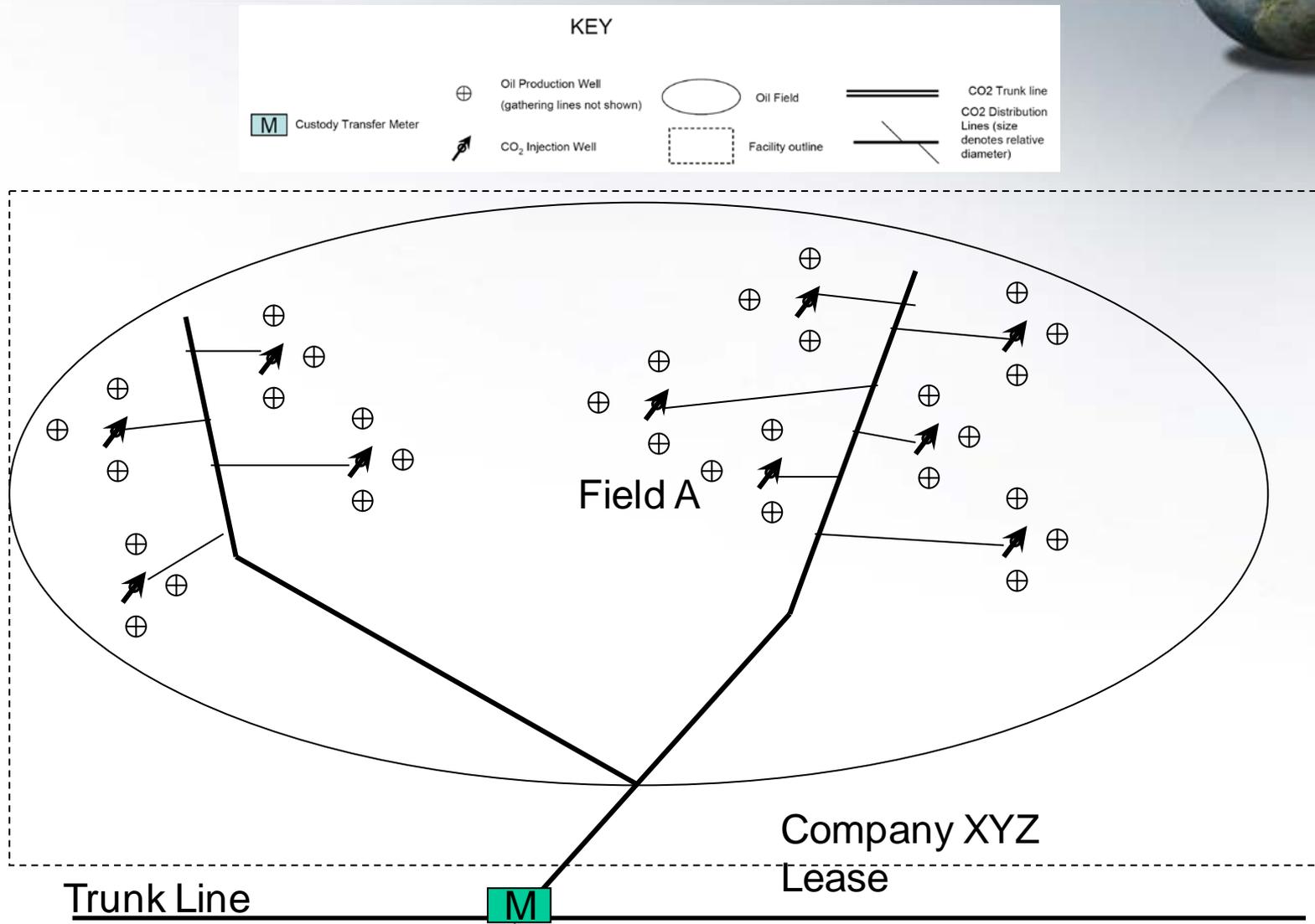
- EPA will determine if a project meets the definition of R&D project within 60 days of receipt of the submission of a request for exemption.
  - Appeals are subject to 40 CFR part 78
- An R&D project that the Administrator determines is not eligible for the exemption must submit a proposed MRV plan to EPA within 180 days of the determination
  - A 180 day extension may be requested

# How is a Facility Delineated?

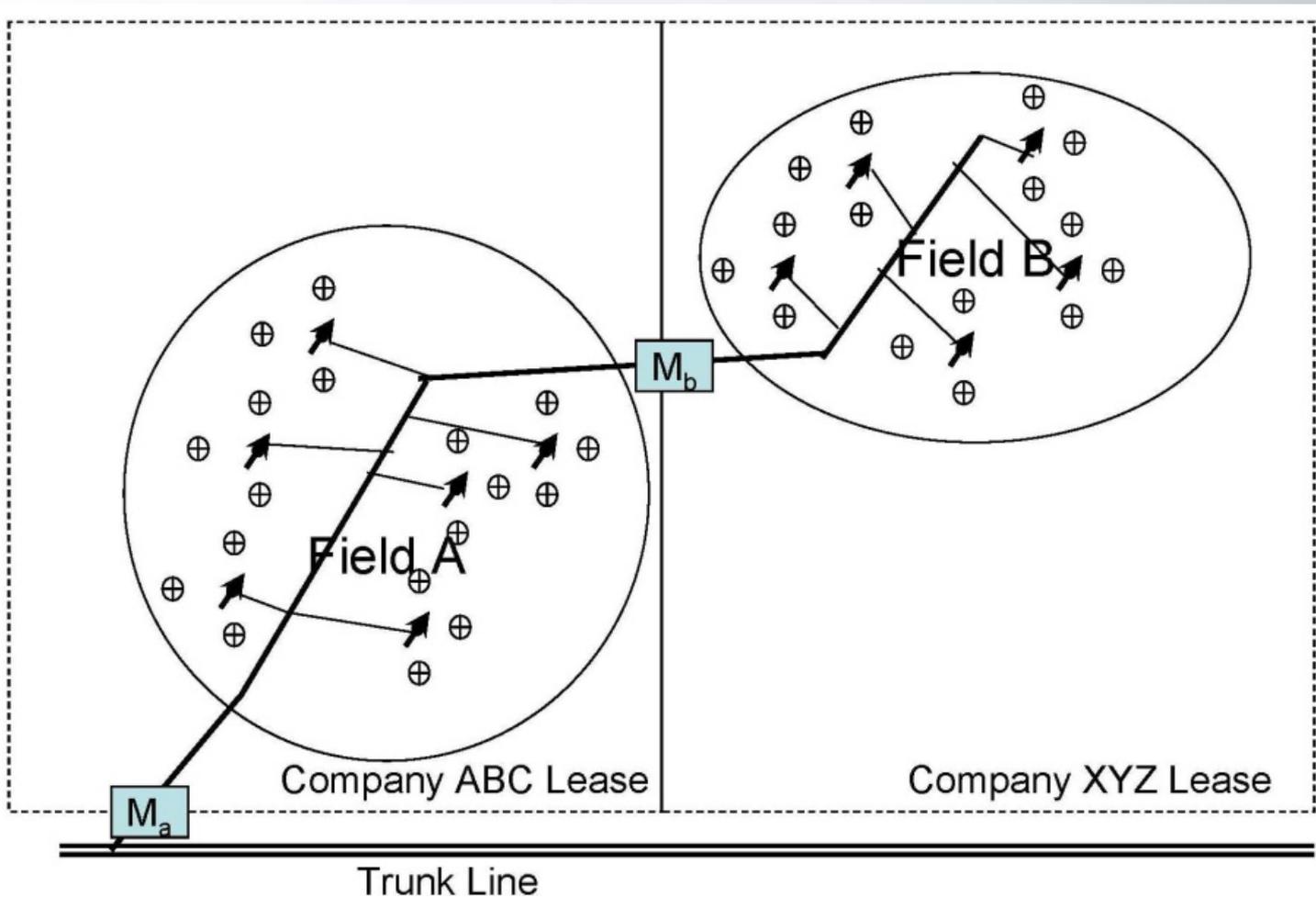
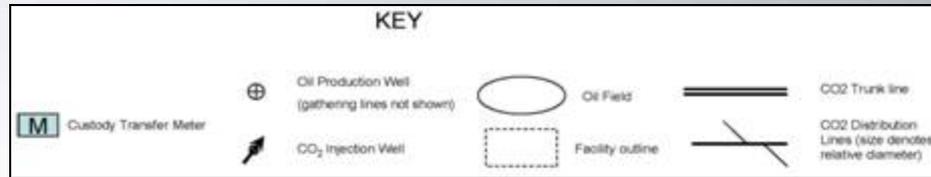


- Subparts RR/UU rely on the definition of facility in the general provisions of the GHG Reporting Program (subpart A)
- A facility is defined as...
  - Physical property, plant, building, structure, source, or stationary equipment;
  - on contiguous or adjacent properties;
  - in actual physical contact or separated solely by public roadway or other public right of way; and
  - under common ownership or common control

# Example Facilities



# Example Facilities Cont'd



# Reporting Threshold



- There is no reporting threshold for subparts RR/UU - both subparts are all-in source categories

# Provisions to Cease Reporting



## Subpart RR

In order to cease reporting, a facility must:

1. Plug and abandon all well(s), **AND**
2. Submit a request that must contain either:
  - a. For Class VI wells - a copy of the applicable UIC Director's authorization of site closure
  - b. For non-Class VI wells and as an alternative for Class VI wells - a demonstration that current monitoring and model(s) show that the injected CO<sub>2</sub> stream is not expected to migrate in the future in a manner likely to result in surface leakage

## Subpart UU

A facility must continue to report unless either:

1. Mass of CO<sub>2</sub> received for injection is <25,000 metric tons/yr for 5 consecutive years
2. Mass of CO<sub>2</sub> received for injection is <15,000 metric tons/yr for 3 consecutive years



## **II. Subpart RR/UU Reporting, Calculation, and Monitoring Requirements**

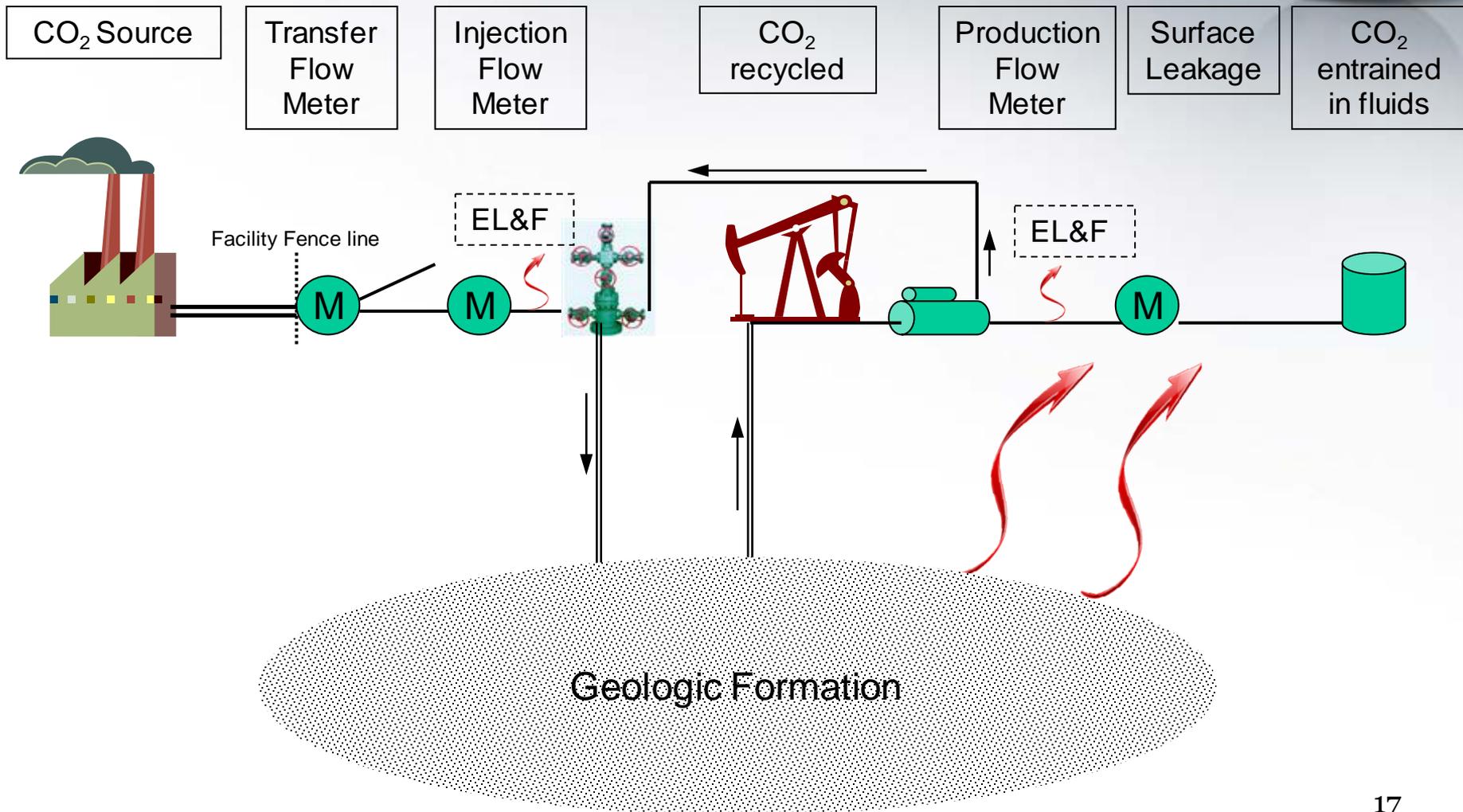
# GHGs to be Reported



*X denotes if a GHG must be reported under either subpart UU, RR, or both*

	<b>GHGs to be Reported</b>	<b>Subpart RR</b>	<b>Subpart UU</b>
1	Mass of CO <sub>2</sub> received	X	X
2	Mass of CO <sub>2</sub> injected into the subsurface	X	
3	Mass of CO <sub>2</sub> produced	X	
4	Mass of CO <sub>2</sub> emitted by surface leakage	X	
5	Mass of CO <sub>2</sub> equipment leakage and vented CO <sub>2</sub> emissions from surface equipment located between the injection flow meter and the injection wellhead	X	
6	Mass of CO <sub>2</sub> equipment leakage and vented CO <sub>2</sub> emissions from surface equipment located between the production flow meter and the production wellhead	X	
7	Mass of CO <sub>2</sub> sequestered in subsurface geologic formations	X	
8	Cumulative mass of CO <sub>2</sub> reported as sequestered in subsurface geologic formations in all years since the facility became subject to reporting requirements under subpart RR	X	

# Illustrative Example of GHGs to be Reported



# Calculating CO<sub>2</sub> Received (Subparts RR and UU)



Depending on the measurement instrumentation at the facility and on the method in which CO<sub>2</sub> is received, Reporters may use any of these measurement options

- For CO<sub>2</sub> received in pipelines
  - A mass flow meter
  - A volumetric flow meter
- If a facility has more than one flow meter, the mass of CO<sub>2</sub> received must be summed over each flow meter
- For CO<sub>2</sub> received in containers
  - A mass measurement of the container contents
  - A volume measurement of the container contents

# Calculating CO<sub>2</sub> Received (Subparts RR and UU)



Mass flow meter  $CO_{2T,r} = \sum_{p=1}^4 (Q_{r,p} - S_{r,p}) * C_{CO_{2,p,r}}$  Eq. RR-1/UU-1

Volumetric flow meter  $CO_{2T,r} = \sum_{p=1}^4 (Q_{r,p} - S_{r,p}) * D * C_{CO_{2,p,r}}$  Eq. RR-2/UU-2

CO <sub>2T,r</sub>	Net annual mass of CO <sub>2</sub> received through flow meter r (metric tons)
Q <sub>r,p</sub>	Quarterly mass flow through a receiving flow meter r in quarter p (metric tons)
S <sub>r,p</sub>	Quarterly mass flow through a receiving flow meter r that is redelivered to another facility without being injected into your well in quarter p (metric tons)
D	Density of CO <sub>2</sub> at standard conditions (metric tons per standard cubic meter): 0.0018682
CCO <sub>2,p,r</sub>	Quarterly CO <sub>2</sub> concentration measurement in flow for flow meter r in quarter p (wt. percent CO <sub>2</sub> , expressed as a decimal fraction).
p	Quarter of the year
r	Receiving flow meter

\*For calculating CO<sub>2</sub> received in containers please refer to the subpart RR/UU regulation and TSD

# CO<sub>2</sub> Received – Monitoring Requirements (Subparts RR and UU)



- **At the point of receipt:**
  - **Flow:** Measure flow rates at the receiving custody transfer meter prior to any subsequent processing operations at the facility and collect the flow rate quarterly
  - **Concentration:** Sample the CO<sub>2</sub> stream at a minimum of one time per quarter at the point of receipt and measure its CO<sub>2</sub> concentration
- **If ownership of the CO<sub>2</sub> was taken in a commercial transaction:**
  - **Flow:** Use the quarterly flow rate 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
  - **Concentration** (if sales contract was contingent on CO<sub>2</sub> concentration): use the CO<sub>2</sub> concentration data from the sales contract for that quarter if the supplier of the CO<sub>2</sub> sampled the CO<sub>2</sub> stream in a quarter and measured its concentration per the sales contract terms

# CO<sub>2</sub> Received – Monitoring Requirements (Subparts RR and UU)



- **If CO<sub>2</sub> is injected from a production process unit that is part of the facility:**
  - **Flow:** Use the quarterly CO<sub>2</sub> flow rate that was measured at the equivalent of a custody transfer meter following procedures provided in subpart PP
  - **Concentration:** use the quarterly CO<sub>2</sub> concentration that was measured and reported in accordance with subpart PP

\*For monitoring requirements for CO<sub>2</sub> received in containers please refer to the subpart RR/UU regulatory text and TSD.

# CO<sub>2</sub> Received – Source (Subparts RR and UU)



- For all CO<sub>2</sub> received facilities must monitor and record the source of the CO<sub>2</sub> by category, if known
- Categories include:
  - (1) CO<sub>2</sub> production wells
  - (2) Electric generating unit
  - (3) Ethanol plant
  - (4) Pulp and paper mill
  - (5) Natural gas processing
  - (6) Gasification operations
  - (7) Other anthropogenic source
  - (8) Discontinued enhanced oil and gas recovery project
  - (9) Unknown

# Calculating CO<sub>2</sub> Injected (Subpart RR)



Mass flow meter 
$$CO_{2,u} = \sum_{p=1}^4 Q_{p,u} * C_{CO_{2,p,u}} \quad \text{Eq. RR-4}$$

Volumetric flow meter 
$$CO_{2,u} = \sum_{p=1}^4 Q_{p,u} * D * C_{CO_{2,p,u}} \quad \text{Eq. RR-5}$$

CO <sub>2,u</sub>	Annual CO <sub>2</sub> mass injected (metric tons) as measured by flow meter u
Q <sub>p,u</sub>	Quarterly mass flow rate measurement for flow meter u in quarter p (metric tons per quarter)
D	Density of CO <sub>2</sub> at standard conditions (metric tons per standard cubic meter): 0.0018682
C <sub>CO<sub>2</sub>,p,u</sub>	Quarterly CO <sub>2</sub> concentration measurement in flow for flow meter u in quarter p (wt. percent CO <sub>2</sub> , expressed as a decimal fraction)
p	Quarter of the year
u	Flow meter

# CO<sub>2</sub> Injected – Monitoring Requirements (Subpart RR)



- Point of flow measurement must be:
  - Where the CO<sub>2</sub> stream(s) is representative of the CO<sub>2</sub> stream(s) being injected; or
  - The measurement location used to comply with the UIC permit for the well(s) at the facility
- Point of concentration measurement must be immediately upstream or downstream of the flow meter used to measure flow rate of that CO<sub>2</sub> stream and measure the CO<sub>2</sub> concentration of the sample

# Calculating CO<sub>2</sub> Produced (Subpart RR)



Mass flow meter  $CO_{2,w} = \sum_{p=1}^4 Q_{p,w} * C_{CO_{2,p,w}}$  Eq. RR-7

Volumetric flow meter  $CO_{2,w} = \sum_{p=1}^4 Q_{p,w} * D * C_{CO_{2,p,w}}$  Eq. RR-8

CO <sub>2,u</sub>	Annual CO <sub>2</sub> mass produced (metric tons) through separator w
Q <sub>p,u</sub>	Quarterly mass flow rate measurement for separator w in quarter p (metric tons per quarter)
D	Density of CO <sub>2</sub> at standard conditions (metric tons per standard cubic meter): 0.0018682
C <sub>CO<sub>2</sub>,p,u</sub>	Quarterly CO <sub>2</sub> concentration measurement in flow for separator w in quarter p (wt. percent CO <sub>2</sub> , expressed as a decimal fraction)
p	Quarter of the year
w	Separator

# Calculating CO<sub>2</sub> Produced (Subpart RR)



- The amount of CO<sub>2</sub> produced must be summed over all flow meters at the facility used to measure CO<sub>2</sub> production
- The total CO<sub>2</sub> measured at the separator(s) represents a percentage of the total CO<sub>2</sub> produced

$$\text{CO}_{2\text{P}} = (1+\text{X}) * \sum_{w=1}^W \text{CO}_{2,w} \quad \text{Eq. RR-9}$$

CO <sub>2</sub> p	Total annual CO <sub>2</sub> mass produced (metric tons) through all separators in the reporting year
X	Entrained CO <sub>2</sub> in produced oil or other fluid divided by the CO <sub>2</sub> separated through all separators in the reporting year (weight percent CO <sub>2</sub> , expressed as a decimal fraction)
CO <sub>2</sub> w	Annual CO <sub>2</sub> mass produced (metric tons) through separator w in the reporting year
w	Separator

- X would be determined using a method specified in the Reporter's EPA approved site-specific MRV plan (to be discussed in more detail)

# CO<sub>2</sub> Produced – Monitoring Requirements (Subpart RR)



- Point of measurement of flow of CO<sub>2</sub> produced must be a flow meter directly downstream of each separator that sends a stream of gas into a recycle or end use system
- Point of concentration measurement must be immediately upstream or downstream of the flow meter used to measure flow rate of that CO<sub>2</sub> stream and measure the CO<sub>2</sub> concentration of the sample

# Calculating CO<sub>2</sub> Emitted by Surface Leakage (Subpart RR)



$$\text{CO}_{2\text{E}} = \sum_{x=1}^X \text{CO}_{2,x} \quad \text{Eq. RR-10}$$

CO <sub>2E</sub>	Total annual CO <sub>2</sub> mass emitted by surface leakage (metric tons) in the reporting year
CO <sub>2,x</sub>	Annual CO <sub>2</sub> mass emitted (metric tons) at leakage pathway x in the reporting year
X	Leakage pathway

- Surface leakage is the movement of the injected CO<sub>2</sub> stream from the injection zone to the surface, and into the atmosphere, indoor air, oceans, or surface water
- The mass of CO<sub>2</sub> emitted through each leakage pathway (x) will be determined in accordance with the Reporter's EPA approved site-specific MRV plan (to be discussed in more detail)

# Equipment Leaks and Vented Emissions



- For equipment leaks and vented emissions, follow the monitoring and QA/QC requirements specified in subpart W (Oil and Natural Gas Systems) for the equipment located on the surface, either:
  - Between the flow meter used to measure injection quantity and the injection wellhead, or
  - Between the flow meter used to measure production quantity and the production wellhead

# Calculating CO<sub>2</sub> Sequestered (Subpart RR)



**Facilities actively producing oil or other fluids**

$$CO_2 = CO_{2I} - CO_{2P} - CO_{2E} - CO_{2FI} - CO_{2FP}$$

***Eq. RR-11***

**Facilities NOT actively producing oil or other fluids**

$$CO_2 = CO_{2I} - CO_{2E} - CO_{2FI}$$

***Eq. RR-12***

CO <sub>2</sub>	Total annual CO <sub>2</sub> mass sequestered in subsurface geologic formations (metric tons) at the facility in the reporting year
CO <sub>2I</sub>	Total annual CO <sub>2</sub> mass injected (metric tons) in the well or group of wells covered by this source category in the reporting year
CO <sub>2P</sub>	Total annual CO <sub>2</sub> mass produced (metric tons) in the reporting year
CO <sub>2E</sub>	Total annual CO <sub>2</sub> mass emitted (metric tons) by surface leakage in the reporting year
CO <sub>2FI</sub>	Total annual CO <sub>2</sub> mass emitted (metric tons) as equipment leakage or vented emissions from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead, for which a calculation procedure is provided in subpart W
CO <sub>2FP</sub>	Total annual CO <sub>2</sub> mass emitted (metric tons) as equipment leakage or vented emissions from equipment located on the surface between the production wellhead and the flow meter used to measure production quantity, for which a calculation procedure is provided in subpart W

# Subparts RR/UU Measurement Device Monitoring Requirements



- Operate all flow meters continuously - except as necessary for maintenance and calibration.
- Flow meters must be calibrated according to requirements in the general provisions (subpart A)
- Flow meters must be operated using one of the following:
  - An appropriate standard method published by a consensus-based standards organization, if such a method exists; or
  - An industry standard practice
- All flow meter calibrations performed must be National Institute of Standards and Technology (NIST) traceable

# Subparts RR/UU General Monitoring Requirements



- The concentration of any CO<sub>2</sub> quantity must be measured according to one of the following:
  - An appropriate standard method published by a consensus-based standards organization, if such a method exists, such as:
    - Gas Processors Association (GPA) Standard 2261-00. Analysis for Natural Gas and Similar Gaseous Mixtures by Gas Chromatography
    - GPA Standard 2177-03. Analysis of Natural Gas Liquid Mixtures Containing Nitrogen and Carbon Dioxide by Gas Chromatography
    - ASTM E1747-95 (re-approved 2005). Purity of Carbon Dioxide Used in Supercritical Fluid Applications
  - An industry standard practice
- All measured volumes of CO<sub>2</sub> must be converted to standard conditions, where the standard temperature and pressure conditions are a temperature of **60 degrees Fahrenheit** and an absolute pressure of **1 atmosphere**



# **III. Estimating Missing Data**

# Available Missing Data Procedures



<b>Measured Parameter</b>	<b>Missing Data Procedure</b>	<b>Applicable Subpart(s)</b>
Quarterly flow rate	If none of the provided methods for obtaining this parameter are feasible, use a representative flow rate value from the nearest previous time period	Subpart RR Subpart UU
Quarterly mass of volume of CO <sub>2</sub> container contents	If none of the provided methods for obtaining this parameter are feasible, use a a representative mass or volume value from the nearest previous time period	Subpart RR Subpart UU
Quarterly CO <sub>2</sub> concentration	If none of the provided methods for obtaining this parameter are feasible, use a representative concentration value from the nearest previous time period	Subpart RR Subpart UU
Quarterly quantity of CO <sub>2</sub> injected	Use a representative quantity of CO <sub>2</sub> injected from the nearest previous period of time at a similar injection pressure	Subpart RR
CO <sub>2</sub> equipment leakage and vented CO <sub>2</sub> emissions	Follow subpart W missing data procedures	Subpart RR

# Available Missing Data Procedures

## Cont'd



<b>Measured Parameter</b>	<b>Missing Data Procedure</b>	<b>Applicable Subpart(s)</b>
Quarterly quantity of CO <sub>2</sub> produced	Use a representative quantity of CO <sub>2</sub> produced from the nearest previous period of time	Subpart RR
Mass of CO <sub>2</sub> emitted by surface leakage	Use procedures in the EPA approved site-specific MRV plan	Subpart RR
Other missing data	Use procedures in the EPA approved site-specific MRV plan	Subpart RR



# **IV. Data Reporting and Recordkeeping**

# Subpart UU Reporting Requirements



- Information required by 98.3(c)(1)-(3), and 98.3(c)(5)-(9) of subpart A
- All inputs and results of calculations required for subpart UU
- All standards or methods used to measure parameters for calculations in subpart UU
- The number of times missing data procedures were used for any parameters for which missing data procedures are provided
- The types of flow meters used for measurements at the facility
- The source of the CO<sub>2</sub> received

# Subpart RR Reporting Requirements



- Information required by 98.3(c)
- All inputs and results of calculations required for subpart RR
- All standards or methods used to measure parameters for calculations in subpart RR
- The number of times missing data procedures were used for any parameters for which missing data procedures are provided
- The source of the CO<sub>2</sub> received
- For flow meters
  - The types of flow meters used for measurements at the facility
  - Flow meter numerical identifications
  - CO<sub>2</sub> injection flow meter locations

# Subpart RR Reporting Requirements Cont'd



- Date the most recent MRV plan was approved by EPA, and the approval number
- For UIC permitted wells
  - The well ID number used for the UIC permit
  - The UIC permit class
- For offshore wells
  - Any well ID number
  - Any ID number used for the legal instrument authorizing geologic sequestration
- Numerical identifiers for all leakage pathways in the event of surface leakage
- Annual Monitoring Reports, including:
  - Narrative history of monitoring efforts
  - Non-material changes to the MRV Plan
  - Narrative history of monitoring anomalies
  - Description of surface leakage of CO<sub>2</sub>, if any

# Recordkeeping Requirements (Subparts RR and UU)



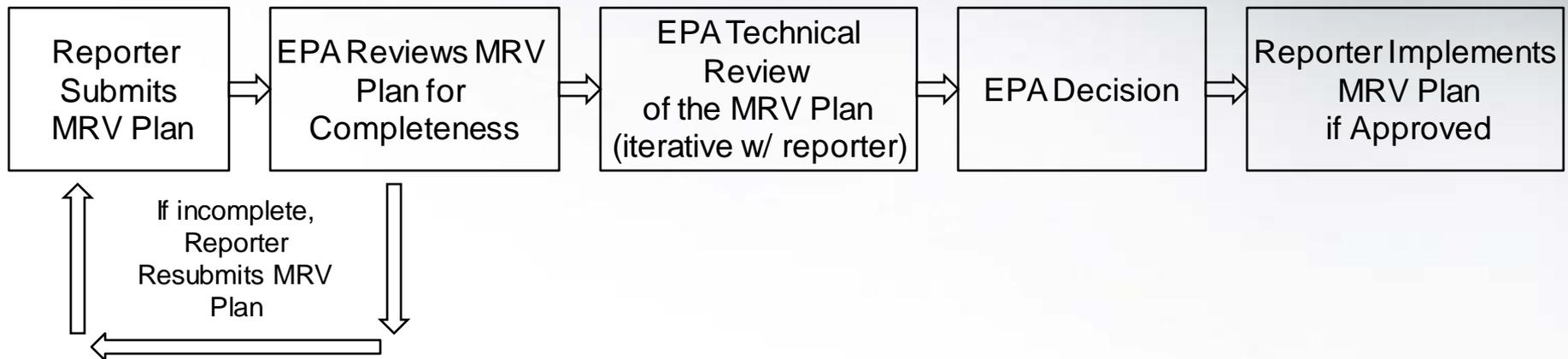
- You must retain all required records for at least 3 years.

<b>Recordkeeping Element</b>	<b>Subpart RR</b>	<b>Subpart UU</b>
Information required by 98.3(g) of subpart A	<b>X</b>	<b>X</b>
Quarterly records of CO <sub>2</sub> received, including all parameters measured to calculate CO <sub>2</sub> received	<b>X</b>	<b>X</b>
Quarterly records of CO <sub>2</sub> injected, including all parameters measured to calculate CO <sub>2</sub> injected	<b>X</b>	
Quarterly records of CO <sub>2</sub> produced, including all parameters measured to calculate CO <sub>2</sub> produced	<b>X</b>	
Information used to calculate the CO <sub>2</sub> emitted by surface leakage from leakage pathways	<b>X</b>	
Information used to calculate CO <sub>2</sub> emitted as equipment leakage or vented emissions	<b>X</b>	
Other records specified in EPA approved site-specific MRV plans	<b>X</b>	



# **V. Subpart RR Geologic Sequestration Monitoring, Reporting, and Verification (MRV) Plan**

# MRV Plan Review



*Note: MRV plan resubmittals follow the same process*

# Contents of MRV Plan



- Delineation of the maximum monitoring area (MMA) and active monitoring areas (AMAs)
- Identification of potential surface leakage for pathways in the MMA
- A strategy for detecting and quantifying surface leakage of CO<sub>2</sub>
- A strategy for establishing the expected baseline for monitoring CO<sub>2</sub> surface leakage
- Site-specific variables for the mass balance equation
- Well ID number(s)
  - For UIC permit holders and permit applicants – well ID number(s)
  - For offshore wells not subject to SDWA - any well(s) ID number(s) and any ID(s) used for the legal instrument authorizing geologic sequestration
- Proposed date to begin collecting data for calculating total amount sequestered (Eqs RR-11 and RR-12)
  - Date must be after expected baselines are established and the leakage detection and quantification strategy is implemented in the initial AMA

# Maximum Monitoring Area (MMA)



- **Maximum monitoring area** is the area expected to contain the free phase CO<sub>2</sub> plume until the CO<sub>2</sub> plume has stabilized plus an all-around buffer zone of at least one-half mile
  - Additional buffer area may be needed depending on subsurface features
  - Initially determined from predictive models

# Active Monitoring Area (AMA)



- **Active monitoring area** is the area that will be monitored over a specific time interval from the first year of the period (n) to the last year in the period (t).
  - This allows operators to phase in monitoring so that during any given time interval, only that part of the MMA in which leakage might occur needs to be monitored.
- The boundary of the active monitoring area is established by superimposing two areas:
  1. The area projected to contain the free phase CO<sub>2</sub> plume at the end of year t, plus an all around buffer zone of one-half mile or greater if known leakage pathways extend laterally more than one-half mile.
  2. The area projected to contain the free phase CO<sub>2</sub> plume at the end of year t+5.

# Potential Leakage Pathways



- MRV plan must identify the likelihood, magnitude, and timing of potential leakage from each pathway
- Example pathways:
  - Wells
    - Injection well(s)
    - Monitoring wells
    - Active/abandoned oil and gas wells
  - Faults, fractures, and bedding plane partings
  - Confining zone competency, extent and dip

# Leakage Detection Strategy



- Leakage detection systems may include
  - Continuous measurements (e.g., injection well, IZ/ACZ pressure in monitoring wells) or,
  - Regular periodic surveys (water chemistry, airborne surveys, MIT)
- Detection capability should be described in the MRV plan
- Considerations could include:
  - Resolution, accuracy, precision, areal coverage, and time for leak to reach measurement point
  - The ability for the monitoring method to discriminate expected conditions from potential leaks

# Leakage Verification Strategy



- Leakage verification allows reporter to confirm the location and source of leakage that has been detected
- MRV plan may describe the methods and criteria for determining how an anomalous reading or condition will be evaluated to determine if it represents a leak, and to verify the location and source of the leak
- Examples:
  - Taking a second measurement with a redundant device or a different device of higher accuracy or precision,
  - Using a denser sample grid or taking more frequent measurements

# Leakage Quantification Strategy



- MRV plan must include a discussion of how leaks will be quantified once they are detected and verified
- Multiple monitoring technologies and quantification techniques can address different leakage pathways and leakage calculation methods
- Description of strategy should include:
  - The methods and expected accuracy of the quantification techniques
  - Distinguishing leakage from expected baseline

# Strategy for establishing the expected baseline



- Expected baselines allow the reporter to discern whether the results of monitoring are attributable to leakage of injected CO<sub>2</sub>
- Parameters may be environmental such as subsurface pressure, soil flux rates, etc., or operational, such as the injection pressure and the annular pressure in the well
- The MRV plan should describe how the baselines will be determined and how they could be used to detect monitoring anomalies

# Entrained CO<sub>2</sub> in produced fluids



- Fluids produced at GS facilities may contain CO<sub>2</sub> that is not captured in the gas phase CO<sub>2</sub> measurement downstream of the gas-liquid separator
  - Dissolved gas in the oil or water phase of the produced fluids
  - Dissolved in water extracted from the IZ
- Equation RR-9 describes the mass balance of CO<sub>2</sub> at the gas-liquid separator including amount of CO<sub>2</sub> in the produced oil and water
  - In the MRV plan, the reporter should estimate the percentage of entrained CO<sub>2</sub> in produced oil or other fluid
  - For example, this can be determined using industry standard laboratory analyses

# When Does Reporting Begin?



- Subpart RR
  - Submit annual reports to EPA by September 28, 2012 reporting basic information on CO<sub>2</sub> received in 2011.
  - Once EPA-approved MRV plan is implemented, add data to annual reports on the amount of CO<sub>2</sub> that is geologically sequestered based on mass balance approach and annual monitoring activities.
- Subpart UU
  - Submit annual reports to EPA by September 28, 2012 reporting basic information on CO<sub>2</sub> received in 2011.

# Subpart RR Schedule



- Facilities that are subject to Subpart RR must submit a proposed MRV plan, MRV plan submission extension request, or R&D exemption request according to the following schedule:

<b>Date that the well or group of wells were issued final UIC permit:</b>	<b>e-GGRT Certificate of Representation (COR) submittal due:</b>	<b>Proposed MRV plan, MRV plan submission extension request, R&amp;D exemption request due to EPA:</b>
On or before December 31, 2010	By May 1, 2011	By June 30, 2011 (180 day extension allowed)
On or after January 1, 2011	60 days prior to submission of proposed MRV plan, MRV plan extension request, or R&D exemption request (whichever is earliest)	Within 180 days of receiving UIC permit

- See Slide 6 for determining applicability to Subpart RR



# More Information

# Website



- For more information, visit EPA's website at:  
<http://www.epa.gov/ghgreporting/reporters/index.html>
  - Implementation information for each subpart
  - FAQs
  - Preamble and rule
  - Technical background documents on source categories
  - Comment response documents
  - Training and Webinar schedule
  - Other technical assistance materials
  - Hotline
- For a copy of these slides, visit:  
<http://www.epa.gov/ghgreporting/reporters/training/index.html>