CALIFORNIA
AIR RESOURCES BOARD

Verifier Accreditation Training for Mandatory GHG Reporting

Transactions Specialty – Course 2.4

Suppliers of Carbon Dioxide (CO_2)

MRR Verifier Accreditation: Course Content

- Course 2: Transactions Specialty
  - 2.1 Electric Power Entities
  - 2.2 Suppliers of Transportation Fuels
  - 2.3 Suppliers of Natural Gas, Natural Gas Liquids, Liquefied Petroleum Gas, CNG and LNG
  - 2.4 Suppliers of Carbon Dioxide (CO_2)

Suppliers of Carbon Dioxide (CO_2) (§95123)

1. Applicability
2. Types of CO_2 Emissions Reported
3. Emissions Calculation
4. Verification
5. Case Study

Applicability

- All producers of (supplied) carbon dioxide without regard to quantity produced, and
- California importers and exporters of ≥ 10,000 MT CO_2 (§95101(c)(9))
- CO_2 suppliers can combine with other reports (unlike other suppliers who report separately)

On-site use of the CO_2 recovered from a process is not covered by § 95123.

Types of CO_2 Emissions Reported

- Mass of CO_2 captured from production process units
- Mass of CO_2 extracted from CO_2 production wells
- Mass of CO_2 imported and exported
  - Exports for purposes of geologic sequestration must be reported separately from exports for other purposes

Calculation of CO_2 Emissions

- Emissions calculated using equations in 40 CFR 98.423 subpart PP using meters that measure either:
  - Mass
    - At least quarterly CO_2 (wt %) composition data
  - Volume
    - At least quarterly CO_2 (wt % or vol%) composition data
    - At least quarterly density measurement
      - $MTCO_2$/scm for wt%
      - MT/scm for vol%

Calculation of CO_2 Emissions (mass meter)

- Mass meters measure the mass of CO_2. Calculation depends on mass of flow gas, and measured concentration of CO_2.
- To calculate emissions from supplied CO_2 measured by a mass flow meter, use subpart PP 40 CFR 98.423(a)(1)

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

$C_{CO2,p,u}$ = Quarterly CO_2 concentration measurement (wt. %CO_2)

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

- Mass of CO_2 is calculated by quarter, then summed

Calculation of CO_2 Emissions (volume meter)

- Volume meters measure the volume of CO_2. Calculation depends on volume of flowed gas, DENSITY and measured concentration of CO_2.
- Emissions calculated using equations in subpart PP 40 CFR 98.423(a)(2)

$$\sum_{p=1}^{4} Q_p * D_p * C_{CO_{2,p}} \qquad \text{(Eq. PP-2)}$$

Q_p = volumetric flow rate measurement in standard cubic meters

D_p = Density of CO_2 in MT of CO_2/scm if $C_{CO2,p}$ is measured in vol% or density of the whole CO_2 stream in MT/scm if $C_{CO2,p}$ is measured as wt% CO_2

$C_{CO2,p}$ = CO_2 concentration measurement as either vol% CO_2 or wt% CO_2

- Mass of CO_2 is calculated by quarter, then summed

Verification of CO_2 Emissions

- Verification
  - Ensure completeness of data
  - Ensure data are accurately measured, compiled and entered
  - Ask about meter location and concentration measurement location to ensure reported data matches actual CO_2 supplied
  - May be able to do quick review of sales records
  - If CO_2 is captured from H_2 production process, these emissions must be subtracted from Subpart P emissions (§95114(i), covered in more detail in Course 3)

Case Study
CO_2 Reported Under Subpart P and PP

- Calculate the CO_2 reported under Subparts P and PP for a CO_2 supplier given the following information:
- The hydrogen production unit at a refinery produces 85,000 $MTCO_2$
  - The refinery captures some CO_2 generated from hydrogen production and provides the following annual data: 20,000,000 scm capture, 0.00183 MT/scm, 97% CO_2 concentration by weight
- What is the amount of CO_2 reported under Subpart PP as CO_2 supplied and what are the emissions reported under subpart P as hydrogen production unit emissions?

Case Study - Solution
CO_2 Reported Under Subpart P and PP

- Calculate the CO_2 reported under Subpart PP for a CO_2 supplier:
  - Answer: $\sum_{p=1}^{4} Q_p * D_p * C_{CO_{2,p}}$ (Eq. PP-2)

    20,000,000 scm * .00183 $MTCO_2$/scm * 97% CO_2 = 35,502 $MTCO_2$ reported under PP
  - 85,000 $MTCO_2$ - 35,502 $MTCO_2$ = <u>49,498 MT CO_2</u> reported under subpart P

Course 2: Transactions

Complete:

- Course 2.1: Electric Power Entities (EPE)
- Course 2.2: Suppliers of Transportation Fuels
- Course 2.3: Suppliers of Natural Gas, Natural Gas Liquids & Liquefied Petroleum Gas
- Course 2.4: Suppliers of CO_2