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*Unofficial electronic compilation of the
U.S. EPA Final Rule on Mandatory Reporting of Greenhouse Gases
incorporated by reference in California's Regulation for the
Mandatory Reporting of Greenhouse Gas Emissions*

Unofficial Electronic Compilation

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ARB's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (title 17, California Code of Regulations (CCR), sections 95100-95157) incorporated by reference certain requirements promulgated by the United States Environmental Protection Agency (U.S. EPA) in its Final Rule on Mandatory Reporting of Greenhouse Gases (Title 40, Code of Federal Regulations (CFR), Part 98). Specifically, section 95100(c) of ARB's regulation incorporated those requirements promulgated by U.S. EPA as published in the Federal Register on October 30, 2009, July 12, 2010, September 22, 2010, October 28, 2010, November 30, 2010, December 17, 2010, and April 25, 2011.

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**40 CFR Part 98
Subpart H**

Mandatory Reporting of Greenhouse Gases

PART 98—MANDATORY GREENHOUSE GAS REPORTING

Subpart H—Cement Production

§98.80 Definition of the source category.

§98.81 Reporting threshold.

§98.82 GHGs to report.

§98.83 Calculating GHG emissions.

§98.84 Monitoring and QA/QC requirements.

§98.85 Procedures for estimating missing data.

§98.86 Data reporting requirements.

§98.87 Records that must be retained.

§98.88 Definitions.

§98.80 Definition of the source category.

The cement production source category consists of each kiln and each in-line kiln/raw mill at any portland cement manufacturing facility including alkali bypasses, and includes kilns and in-line kiln/raw mills that burn hazardous waste.

§98.81 Reporting threshold.

You must report GHG emissions under this subpart if your facility contains a cement production process and the facility meets the requirements of either §98.2(a)(1) or (2).

§98.82 GHGs to report.

You must report:

(a) CO₂ process emissions from calcination in each kiln.

(b) CO₂ combustion emissions from each kiln.

(c) CH₄ and N₂O combustion emissions from each kiln. You must calculate and report these emissions under subpart C of this part (General Stationary Fuel Combustion Sources) by following the requirements of subpart C.

(d) CO₂, CH₄, and N₂O emissions from each stationary combustion unit other than kilns. You must report these emissions under subpart C of this part (General Stationary Fuel Combustion Sources) by following the requirements of subpart C.

§98.83 Calculating GHG emissions.

You must calculate and report the annual process CO₂ emissions from each kiln using the procedure in paragraphs (a) and (b) of this section.

(a) For each cement kiln that meets the conditions specified in §98.33(b)(4)(ii) or (b)(4)(iii), you must calculate and report under this subpart the combined process and combustion CO₂ emissions by operating and maintaining a CEMS to measure CO₂ emissions according to the Tier 4 Calculation Methodology specified in §98.33(a)(4) and all associated requirements for Tier 4 in subpart C of this part (General Stationary Fuel Combustion Sources).

(b) For each kiln that is not subject to the requirements in paragraph (a) of this section, calculate and report the process and combustion CO₂ emissions from the kiln by using the procedure in either paragraph (c) or (d) of this section.

(c) Calculate and report under this subpart the combined process and combustion CO₂ emissions by operating and maintaining a CEMS to measure CO₂ emissions according to the Tier 4 Calculation Methodology specified in §98.33(a)(4) and all associated requirements for Tier 4 in subpart C of this part (General Stationary Fuel Combustion Sources).

(d) Calculate and report process and combustion CO₂ emissions separately using the procedures specified in paragraphs (d)(1) through (d)(4) of this section.

(1) Calculate CO₂ process emissions from all kilns at the facility using Equation H-1 of this section:

$$CO_{2CMF} = \sum_{m=1}^k CO_{2Cli,m} + CO_{2rm} \quad (\text{Eq. H-1})$$

Where:

CO_{2CMF} = Annual process emissions of CO₂ from cement manufacturing, metric tons.

CO_{2 Cli,m} = Total annual emissions of CO₂ from clinker production from kiln m, metric tons.

CO_{2 rm} = Total annual emissions of CO₂ from raw materials, metric tons.

k = Total number of kilns at a cement manufacturing facility.

(2) CO₂ emissions from clinker production. Calculate CO₂ emissions from each kiln using Equations H-2 through H-5 of this section.

$$CO_{2 Cli,m} = \sum_{j=1}^p \left[(Cli, j) * (EF_{Cli, j}) * \frac{2000}{2205} \right] + \sum_{i=1}^r \left[(CKD, i) * (EF_{CKD, i}) * \frac{2000}{2205} \right] \quad (\text{Eq. H-2})$$

Where:

Cli_j = Quantity of clinker produced in month j from kiln m, tons.

EF_{Cli,j} = Kiln specific clinker emission factor for month j for kiln m, metric tons CO₂/metric ton clinker computed as specified in Equation H-3 of this section.

CKD_i = Cement kiln dust (CKD) not recycled to the kiln in quarter i from kiln m, tons.

EF_{CKD,i} = Kiln specific CKD emission factor for quarter i from kiln m, metric tons CO₂/metric ton CKD computed as specified in Equation H-4 of this section.

p = Number of months for clinker calculation, 12.

r = Number of quarters for CKD calculation, 4.

2000/2205 = Conversion factor to convert tons to metric tons.

(i) Kiln-Specific Clinker Emission Factor. Calculate the kiln-specific clinker emission factor using Equation H-3 of this section.

$$EF_{\text{Chi}} = (Cl_{\text{CaO}} - Cl_{\text{ncCaO}}) * MR_{\text{CaO}} + (Cl_{\text{MgO}} - Cl_{\text{ncMgO}}) * MR_{\text{MgO}} \quad (\text{Eq. H-3})$$

Where:

- Cl_{CaO} = Monthly total CaO content of Clinker, wt-fraction.
- Cl_{ncCaO} = Monthly non-calcined CaO content of Clinker, wt-fraction.
- MR_{CaO} = Molecular-weight Ratio of $\text{CO}_2/\text{CaO} = 0.785$.
- Cl_{MgO} = Monthly total MgO content of Clinker, wt-fraction.
- Cl_{ncMgO} = Monthly non-calcined MgO content of Clinker, wt-fraction.
- MR_{MgO} = Molecular-weight Ratio of $\text{CO}_2/\text{MgO} = 1.092$.

Non-calcined CaO is CaO that remains in the clinker in the form of CaCO_3 and CaO in the clinker that entered the kiln as a non-carbonate species. Non-calcined MgO is MgO that remains in the clinker in the form of MgCO_3 and MgO in the clinker that entered the kiln as a non-carbonate species.

(ii) Kiln-Specific CKD Emission Factor. Calculate the kiln-specific CKD emission factor for CKD not recycled to the kiln using Equation H-4 of this section.

$$EF_{\text{CKD}} = (CKD_{\text{CaO}} - CKD_{\text{ncCaO}}) * MR_{\text{CaO}} + (CKD_{\text{MgO}} - CKD_{\text{ncMgO}}) * MR_{\text{MgO}} \quad (\text{Eq. H-4})$$

Where:

- CKD_{CaO} = Quarterly total CaO content of CKD not recycled to the kiln, wt-fraction.
- CKD_{ncCaO} = Quarterly non-calcined CaO content of CKD not recycled to the kiln, wt-fraction.
- MR_{CaO} = Molecular-weight Ratio of $\text{CO}_2/\text{CaO} = 0.785$.
- CKD_{MgO} = Quarterly total MgO content of CKD not recycled to the kiln, wt-fraction.
- CKD_{ncMgO} = Quarterly non-calcined MgO content of CKD not recycled to the kiln, wt-fraction.
- MR_{MgO} = Molecular-weight Ratio of $\text{CO}_2/\text{MgO} = 1.092$.

Non-calcined CaO is CaO that remains in the CKD in the form of CaCO_3 and CaO in the CKD that entered the kiln as a non-carbonate species. Non-calcined MgO is MgO that remains in the CKD in the form of MgCO_3 and MgO in the CKD that entered the kiln as a non-carbonate species.

(3) CO_2 emissions from raw materials. Calculate CO_2 emissions from raw materials using Equation H-5 of this section:

$$CO_{2,rm} = \sum_{i=1}^m rm * TOCr_{m} * \frac{44}{12} * \frac{2000}{2205} \quad (\text{Eq. H-5})$$

Where:

- rm = The amount of raw material i consumed annually, tons/yr (dry basis) or the amount of raw kiln feed consumed annually, tons/yr (dry basis).
- $CO_{2,rm}$ = Annual CO_2 emissions from raw materials.

- TOCr_m = Organic carbon content of raw material i or organic carbon content of combined raw kiln feed(dry basis), as determined in §98.84(c) or using a default factor of 0.2 percent of total raw material weight.
- M = Number of raw materials or 1 if calculating emissions based on combined raw kiln feed.
- 44/12 = Ratio of molecular weights, CO₂ to carbon .
- 2000/2205 = Conversion factor to convert tons to metric tons.

(4) Calculate and report under subpart C of this part (General Stationary Fuel Combustion Sources) the combustion CO₂ emissions from the kiln according to the applicable requirements in subpart C.

§98.84 Monitoring and QA/QC requirements.

(a) You must determine the weight fraction of total CaO and total MgO in CKD not recycled to the kiln from each kiln using ASTM C114-09, Standard Test Methods for Chemical Analysis of Hydraulic Cement (incorporated by reference, see §98.7). The monitoring must be conducted quarterly for each kiln from a CKD sample drawn either as CKD is exiting the kiln or from bulk CKD storage.

(b) You must determine the weight fraction of total CaO and total MgO in clinker from each kiln using ASTM C114-09 Standard Test Methods for Chemical Analysis of Hydraulic Cement (incorporated by reference, see §98.7). The monitoring must be conducted monthly for each kiln from a clinker sample drawn from bulk clinker storage if storage is dedicated to the specific kiln, or from a monthly arithmetic average of daily clinker samples drawn from the clinker conveying systems exiting each kiln.

(c) The total organic carbon contents (dry basis) of each raw material must be determined annually using ASTM C114-09 Standard Test Methods for Chemical Analysis of Hydraulic Cement (incorporated by reference, see §98.7) or a similar industry standard practice or method approved for total organic carbon determination in raw mineral materials. The analysis must be conducted either on sample material drawn from bulk raw kiln feed storage or on sample material drawn from bulk raw material storage for each category of raw material (i.e., limestone, sand, shale, iron oxide, and alumina). Facilities that opt to use the default total organic carbon factor provided in §98.83(d)(3), are not required to monitor for TOC.

(d) The quantity of clinker produced monthly by each kiln must be determined by direct weight measurement of clinker using the same plant techniques used for accounting purposes, such as weigh hoppers or belt weigh feeders measurements against inventory measurements. As an alternative, facilities may also determine clinker production by direct measurement of raw kiln feed and application of a kilnspecific feed-to-clinker factor. Facilities that opt to use a feed-to-clinker factor must verify the accuracy of this factor on a monthly basis.

(e) The quantity of CKD not recycled to the kiln generated by each kiln must be determined quarterly using the same plant techniques used for accounting purposes, such as direct weight measurements, weigh hoppers, truck weigh scales, or belt weigh feeders.

(f) The annual quantity of raw kiln feed or annual quantity of each category of raw materials consumed annually by the facility (e.g., limestone, sand, shale, iron oxide, and alumina) must be determined monthly by direct weight measurement using the same plant instruments used for accounting purposes, such as weigh hoppers, truck weigh scales, or belt weigh feeders.

(g) The monthly non-calcined CaO and MgO that remains in the clinker in the form of CaCO₃ or that enters the kiln as a non-carbonate species may be assumed to be a default value of 0.0 or may be determined monthly by careful chemical analysis of feed material and clinker material from each kiln using well documented analytical and calculational methods or the appropriate industry standard practice.

(h) The quarterly non-calcined CaO and MgO that remains in the CKD in the form of CaCO₃ or that enters the kiln as a non-carbonate species may be assumed to be a default value of 0.0 or may be determined quarterly by careful chemical analysis of feed material and CKD material from each kiln using well documented analytical and calculational methods or the appropriate industry standard practice.

§98.85 Procedures for estimating missing data.

A complete record of all measured parameters used in the GHG emissions calculations in §98.83 is required. Therefore, whenever a quality-assured value of a required parameter is unavailable, a substitute data value for the missing parameter shall be used in the calculations. The owner or operator must document and keep records of the procedures used for all such estimates.

(a) If the CEMS approach is used to determine combined process and combustion CO₂ emissions, the missing data procedures in §98.35 apply.

(b) For CO₂ process emissions from cement manufacturing facilities calculated according to §98.83(d), if data on the carbonate content (of clinker or CKD), noncalcined content (of clinker or CKD) or the annual organic carbon content of raw materials are missing, facilities must undertake a new analysis.

(c) For each missing value of monthly clinker production the substitute data value must be the best available estimate of the monthly clinker production based on information used for accounting purposes, or use the maximum tons per day capacity of the system and the number of days per month.

(d) For each missing value of monthly raw material consumption the substitute data value must be the best available estimate of the monthly raw material consumption based on information used for accounting purposes (such as purchase records), or use the maximum tons per day raw material throughput of the kiln and the number of days per month.

§98.86 Data reporting requirements.

In addition to the information required by §98.3(c), each annual report must contain the information specified in paragraphs (a) and (b) of this section, as appropriate.

(a) If a CEMS is used to measure CO₂ emissions, then you must report under this subpart the relevant information required by §98.36(e)(2)(vi) and the information listed in this paragraph(a):

- (1) Monthly clinker production from each kiln at the facility.
- (2) Monthly cement production from each kiln at the facility.
- (3) Number of kilns and number of operating kilns.

(b) If a CEMS is not used to measure CO₂ emissions, then you must report the information listed in this paragraph (b) for each kiln:

- (1) Kiln identification number.
- (2) Monthly clinker production from each kiln.
- (3) Annual cement production at the facility.
- (4) Number of kilns and number of operating kilns.
- (5) Quarterly quantity of CKD not recycled to the kiln for each kiln at the facility.
- (6) Monthly fraction of total CaO, total MgO, non-calcined CaO and non-calcined MgO in clinker for each kiln (as wt-fractions).
- (7) Method used to determine non-calcined CaO and non-calcined MgO in clinker.
- (8) Quarterly fraction of total CaO, total MgO, non-calcined CaO and non-calcined MgO in CKD not recycled to the kiln for each kiln (as wt-fractions).
- (9) Method used to determine non-calcined CaO and non-calcined MgO in CKD.

- (10) Monthly kiln-specific clinker CO₂ emission factors for each kiln (metric tons CO₂/metric ton clinker produced).
- (11) Quarterly kiln-specific CKD CO₂ emission factors for each kiln (metric tons CO₂/metric ton CKD produced).
- (12) Annual organic carbon content of raw kiln feed or annual organic carbon content of each raw material (wt-fraction, dry basis).
- (13) Annual consumption of raw kiln feed or annual consumption of each raw material (dry basis).
- (14) Number of times missing data procedures were used to determine the following information:
 - (i) Clinker production (number of months).
 - (ii) Carbonate contents of clinker (number of months).
 - (iii) Non-calcined content of clinker (number of months).
 - (iv) CKD not recycled to kiln (number of quarters).
 - (v) Non-calcined content of CKD (number of quarters)
 - (vi) Organic carbon contents of raw materials (number of times).
 - (vii) Raw material consumption (number of months).
- (15) Method used to determine the monthly clinker production from each kiln reported under (b)(2) of this section, including monthly kiln-specific clinker factors, if used.

§98.87 Records that must be retained.

- (a) If a CEMS is used to measure CO₂ emissions, then in addition to the records required in §98.3(g), you must retain under this subpart the records required for the Tier 4 Calculation Methodology in §98.37.
- (b) If a CEMS is not used to measure CO₂ emissions, then in addition to the records required by §98.3(g), you must retain the records specified in this paragraph (b) for each Portland cement manufacturing facility.
 - (1) Documentation of monthly calculated kiln-specific clinker CO₂ emission factor.
 - (2) Documentation of quarterly calculated kiln-specific CKD CO₂ emission factor.
 - (3) Measurements, records and calculations used to determine reported parameters.

§98.88 Definitions.

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