Covered Emissions

A cement plant operator uses CEMS to calculate CO_2 process and combustion emissions from the production of clinker in the kiln. The total CO_2 emissions are calculated to be 1,500,000 MT for the calendar year and are deemed accurate by the verification team.

Question #1 - Based on the data below, calculate "covered" CO_2 emissions.
[Hint: Determine which fuels can be accurately subtracted from the total covered emissions.]

Table 1 - Fuel Measurement Accuracy for Biogenic Fraction of CO_2

	Name of Fuel	Quantity of Fuel Combusted	CO_2 Emissions (MT)	Evidence of +/- 5% Fuel Measurement Accuracy	Exempt Biogenic CO_2 Emissions (MT)
1	Coal	100,000 short tons	~260,000	No	0
2	Coke	50,000 short tons	~130,000	No	0
3	Natural gas	987,021 MMBtu	52,332	Yes	0
4	Tires	8,000 short tons	~18,000	No	0
5	Orchard prunings - field crop residues	5,000 short tons (unknown moisture content)	5,000	No	0
6	Rice hulls (ag. waste exempt)	23,075 bone-dry short tons	22,496	Yes	22,496
7	Sawmill residue (urban waste exempt)	10,439 bone-dry short tons	15,060	Yes	15,060
	Totals		502,888		37,556

Solution to Question 1

Rows #1-3: Fossil fuels represent most of the CO_2 combustion emissions being measured by the CEMS.

Row #4: The quantity of tires is not accurate, so the operator decides not to report biogenic emissions from tires using the 20% default biogenic factor. If the quantity of tires was accurately known, either a default of 20% or a measured biogenic fraction can be reported.

Row #5: Orchard prunings are measured with accurate weigh scales, but because the moisture content is not known, the value does not meet the requirement to accurately measure bone-dry short tons. Therefore the operator reports the associated emissions as covered emissions.

Rows #6-7: Quantities of combusted rice hulls and sawmill residue are confirmed by the verifier as exempt biogenic fuels. The verifier confirmed these fuels were purchased and combusted during the data year, and the quantities purchased are deemed accurate because the weight and moisture content data meet the financial transaction criteria. Therefore, biogenic CO_2 emissions from these fuels can be accurately reported by the operator and subtracted from the total covered emissions.

Total CEMS CO_2 - biogenic CO_2 (rice hulls and sawmill residue) = covered CO_2 1,500,000 - 37,556 = 1,462,444 MT covered CO_2 emissions

Note the verifier assesses material misstatement based on the total covered emissions. (CH_4, N_2O, and covered $CO_2 \rightarrow$ covered MT CO_2e)

Question #2 - The operator of this cement plant analyzes the flue gas going to the CEMS using radiocarbon analysis data from ASTM D6866-08 and calculates a biogenic fraction of 35%. What questions should the verification team ask the operator to review for accuracy and possible errors?

Solution to Question 2

(1) Cross-check the biogenic content measured in the flue gas with a fuel-based estimate using a Tier 1 calculation method. Ask for the hourly kiln feed rates for every fuel for the days when testing occurred and compare to other records, as available. Note there is a discrepancy between the flue gas result (35%) and a fuel-based cross-check (5,000 + 22,496 + 15,060 = 42,556 short tons; 42,556/1,500,000 = 2.8%). The operator would need to demonstrate that the sampling was representative considering relative fuel quantities combusted during the year, as required by §98.34(d)-(e).

(2) Ask for a written procedure describing how the sample was selected and collected. Review the analytical lab procedures and chain-of-custody documentation. Ask to witness the next test during that quarterly period. Ask if that data has been audited and if the operator has been trained on how to collect a sample from the flue gas.

<u>Covered Product Data</u>

For illustrative purposes, assume a cement plant operator sells cement that contains 5% gypsum and 95% clinker by weight and the sampling and analysis meets MRR accuracy requirements. For simplification of this exercise, assume no limestone was added for blending. Note that clinker consumed is the quantity of clinker mixed with additives to make the cement product.

The operator calculates the quantities of clinker consumed and gypsum blended during the data year based on the analyzed proportion above applied to cement produced during the data year. The operator calculates cement produced using (1) sales data, which is determined to meet the financial transaction criteria for accuracy and (2) an inventory adjustment, which is also determined to meet MRR accuracy requirements. Note that a data acquisition and handling system (DAHS) records the annual mass of clinker consumed and gypsum used to make cement to be approximately 1,439,000 short tons. Because of the uncertainty associated with these internal DAHS measurements, the operator uses this data as a cross-check only.

The amount of clinker produced is 1,600,000 short tons and is measured over weigh scales that meet MRR accuracy requirements.

Question #3: Calculate covered product data for this cement plant. *[Hint: First calculate how much cement was sold via trucks in Table 2. Use the data in Table 3 to adjust the sales to reflect the amount of cement that came from inventory (and therefore was not produced in the reporting year). Remember to include 1,600,000 short tons of clinker produced when assessing material misstatement.]*

Table 2 - Sales Data (short tons)

	Cement Sold (A)	Clinker in Cement Sold (B)=0.95(A)	Gypsum Blended in Cement Sold (C)=0.05(A)
January[1]	126,320	120,004	6,316
February	126,320	120,004	6,316
March	125,580	119,301	6,279
April	118,420	112,499	5,921
May	118,420	112,499	5,921
June	126,320	120,004	6,316
July	131,580	125,001	6,579
August	131,580	125,001	6,579
September	121,050	114,998	6,053
October	121,050	114,998	6,053
November	121,050	114,998	6,053
December[1]	121,050	114,998	6,053
Total[2]	1,488,740	1,414,303	74,437

[1]Check sales records are consistent with the inventory, e.g., sales do not include shipments made prior to or following the data year.
[2]Values may not sum due to rounding.

Table 3 - Cement Storage Data (short tons)			
Inventory of Cement Storage	**Cement in Storage (D)**	**Clinker Consumed (E)=0.95(D)**	**Gypsum Blended (F)=0.05(D)**
December 31, 2013	150,000	142,500	7,500
December 31, 2014	100,000	95,000	5,000
Inventory change	-50,000	-47,500	-2,500

Solution to Question 3

Some of the sold cement was produced during the previous year, as can be seen by the reduction in stored cement volume from the beginning to the end of the year. This quantity must be subtracted from the cement sales to accurately reflect only the cement produced in the reporting year.

<u>Cement Produced During the Reporting Year</u>
1,488,740 tons cement sold - 50,000 tons taken from cement storage =
1,438,740 short tons cement produced
<u>Clinker Consumed During the Reporting Year to Produce Cement</u>
1,438,740 tons cement produced x 0.95 clinker =
1,366,803 short tons of clinker consumed

<u>Gypsum Consumed During the Reporting Year to Produce Cement</u>
1,438,740 tons cement produced x 0.05 gypsum =
71,937 short tons of gypsum consumed
<u>Cross-check with DAHS value</u>
1,366,803 + 71,937 = 1,438,740 short tons ≈ the DAHS value of 1,439,000 short tons

<u>Consider cross-check with clinker inventory</u>
Note the amount of clinker produced is larger than the amount consumed.

<u>Consider cross-check with gypsum purchases and inventory</u>

Table 4 – Covered Product Data (short tons)			
Covered Product	**Short tons**	**Measurement accuracy conformance with §95103(k)**	**Conformance with §95103(l) and §95103(m)**
Clinker produced	1,600,000	Y	Y
Clinker consumed	1,366,803	Y	Y
Gypsum blended	71,937	Y	Y
SUM = Material mis-statement basis	3,038,740		