§ 98.58 Definitions.

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

Subpart F—Aluminum Production

§ 98.60 Definition of the source category.

(a) A primary aluminum production facility manufactures primary aluminum using the Hall-Héroult manufacturing process. The primary aluminum manufacturing process comprises the following operations:
   (1) Electrolysis in prebake and Söderberg cells.
   (2) Anode baking for prebake cells.

(b) This source category does not include experimental cells or research and development process units.

§ 98.61 Reporting threshold.

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

§ 98.62 GHGs to report.

You must report:
   (a) Perfluoromethane (CF\(_4\)) and perfluoroethane (C\(_2\)F\(_6\)) emissions from anode effects in all prebake and Söderberg electrolysis cells.
   (b) \(\text{CO}_2\) emissions from anode consumption during electrolysis in all prebake and Söderberg electrolysis cells.
   (c) \(\text{CO}_2\) emissions from on-site anode baking.
   (d) You must report under subpart C of this part (General Stationary Fuel Combustion Sources) the emissions of \(\text{CO}_2\), \(\text{N}_2\text{O}\), and \(\text{CH}_4\) emissions from each stationary fuel combustion unit by following the requirements of subpart C.


§ 98.63 Calculating GHG emissions.

(a) The annual value of each PFC compound (\(\text{CF}_4\), \(\text{C}_2\text{F}_6\)) shall be estimated from the sum of monthly values using Equation F–1 of this section:

\[ E_{\text{PFC}} = \sum_{m=1}^{12} E_m \]  
(Eq. F-1)

Where:

\( E_{\text{PFC}} \) = Annual emissions of each PFC compound from aluminum production (metric tons PFC).
\( E_m \) = Emissions of the individual PFC compound from aluminum production for the month “m” (metric tons PFC).

(b) Use Equation F–2 of this section to estimate \(\text{CF}_4\) emissions from anode effect duration or Equation F–3 of this section to estimate \(\text{CF}_4\) emissions from overvoltage, and use Equation F–4 of this section to estimate \(\text{C}_2\text{F}_6\) emissions from anode effects from each prebake and Söderberg electrolysis cell.

\[ E_{\text{CF}_4} = S_{\text{CF}_4} \times \text{AEM} \times \text{MP} \times 0.001 \]  
(Eq. F-2)

Where:

\( E_{\text{CF}_4} \) = Monthly \(\text{CF}_4\) emissions from aluminum production (metric tons \(\text{CF}_4\)).
\( S_{\text{CF}_4} \) = The slope coefficient ((kg \(\text{CF}_4\)/metric ton Al)/(AE-Mins/cell-day)).
\( \text{AEM} \) = The anode effect minutes per cell-day (AE-Mins/cell-day).
\( \text{MP} \) = Metal production (metric tons Al), where AEM and MP are calculated monthly.

\[ E_{\text{CF}_4} = EF_{\text{CF}_4} \times \text{MP} \times 0.001 \]  
(Eq. F-3)

Where:

\( E_{\text{CF}_4} \) = Monthly \(\text{CF}_4\) emissions from aluminum production (metric tons \(\text{CF}_4\)).
\( EF_{\text{CF}_4} \) = The overvoltage emission factor (kg \(\text{CF}_4\)/metric ton Al).
\( \text{MP} \) = Metal production (metric tons Al), where MP is calculated monthly.
\[ E_{\text{C2F6}} = E_{\text{CF4}} \times F_{\text{C2F6/CF4}} \times 0.001 \quad \text{(Eq. F-4)} \]

Where:
- \( E_{\text{C2F6}} \) = Monthly \( \text{C}_2\text{F}_6 \) emissions from aluminum production (metric tons \( \text{C}_2\text{F}_6 \)).
- \( E_{\text{CF4}} \) = \( \text{CF}_4 \) emissions from aluminum production (kg \( \text{CF}_4 \)).
- \( F_{\text{C2F6/CF4}} \) = The weight fraction of \( \text{C}_2\text{F}_6/\text{CF}_4 \) (kg \( \text{C}_2\text{F}_6/\text{kg} \text{ CF}_4 \)).
- 0.001 = Conversion factor from kg to metric tons, where \( E_{\text{CF4}} \) is calculated monthly.

(c) You must calculate and report the annual process \( \text{CO}_2 \) emissions from anode consumption during electrolysis and anode baking of prebake cells using either the procedures in paragraph (d) of this section, the procedures in paragraphs (e) and (f) of this section, or the procedures in paragraph (g) of this section.

(d) Calculate and report under this subpart the process \( \text{CO}_2 \) emissions by operating and maintaining CEMS according to the Tier 4 Calculation Methodology in \$98.33(a)(4) and all associated requirements for Tier 4 in subpart C of this part (General Stationary Fuel Combustion Sources).

(e) Use the following procedures to calculate \( \text{CO}_2 \) emissions from anode consumption during electrolysis:

(1) For Prebake cells: you must calculate \( \text{CO}_2 \) emissions from anode consumption using Equation F-5 of this section:

\[ E_{\text{CO2}} = NAC \times MP \times \left[ \left( 100 - S_a - \text{Ash}_a \right)/100 \right] \times (44/12) \quad \text{(Eq. F-5)} \]

Where:
- \( E_{\text{CO2}} \) = Annual \( \text{CO}_2 \) emissions from prebaked anode consumption (metric tons \( \text{CO}_2 \)).
- \( NAC \) = Net annual prebaked anode consumption per metric ton \( \text{Al} \) (metric tons \( \text{C}/ \text{metric tons} \text{ Al} \)).
- \( MP \) = Annual metal production (metric tons \( \text{Al} \)).
- \( S_a \) = Sulfur content in baked anode (percent weight).
- \( \text{Ash}_a \) = Ash content in baked anode (percent weight).
- 44/12 = Ratio of molecular weights, \( \text{CO}_2 \) to carbon.

(2) For \( \text{S\ddot{a}}\text{derberg} \) cells you must calculate \( \text{CO}_2 \) emissions using Equation F-6 of this section:

\[ E_{\text{CO2}} = (PC \times MP - [\text{CSM} \times MP]/1000 - BC/100 \times PC \times MP \times \left[ S_p + \text{Ash}_p + H_p \right]/100 - [100 - BC]/100 \times PC \times MP \times \left[ S_c + \text{Ash}_c \right]/100 \times MP \times CD) \times (44/12) \quad \text{(Eq. F-6)} \]

Where:
- \( E_{\text{CO2}} \) = Annual \( \text{CO}_2 \) emissions from paste consumption (metric ton \( \text{CO}_2 \)).
- \( PC \) = Annual paste consumption (metric ton \( \text{C}/ \text{metric ton} \text{ Al} \)).
- \( MP \) = Annual metal production (metric tons \( \text{Al} \)).
- \( \text{CSM} \) = Annual emissions of cyclohexane soluble matter (kg/metric ton \( \text{Al} \)).
- \( BC \) = Binder content of paste (percent weight).
- \( S_p \) = Sulfur content of pitch (percent weight).
- \( \text{Ash}_p \) = Ash content of pitch (percent weight).
- \( H_p \) = Hydrogen content of pitch (percent weight).
- \( S_c \) = Sulfur content in calcined coke (percent weight).
- \( \text{Ash}_c \) = Ash content in calcined coke (percent weight).
- \( CD \) = Carbon in skimmed dust from \( \text{S\ddot{a}}\text{derberg} \) cells (metric ton \( \text{C}/ \text{metric ton} \text{ Al} \)).
- 44/12 = Ratio of molecular weights, \( \text{CO}_2 \) to carbon.
§ 98.64 Monitoring and QA/QC requirements.

(f) Use the following procedures to calculate CO₂ emissions from anode baking of prebake cells:

\[ E_{CO2PV} = (GA - H_w - BA - WT) \times (44/12) \]  
(\text{Eq. F-7})

Where:
- \( E_{CO2PV} \) = Annual CO₂ emissions from pitch volatiles combustion (metric tons CO₂).
- \( GA \) = Initial weight of green anodes (metric tons).
- \( H_w \) = Annual hydrogen content in green anodes (metric tons).
- \( BA \) = Annual baked anode production (metric tons).
- \( WT \) = Annual waste tar collected (metric tons).
- \( 44/12 \) = Ratio of molecular weights, CO₂ to carbon.

(1) Use Equation F-7 of this section to calculate emissions from pitch volatiles combustion.

(2) Use Equation F-8 of this section to calculate emissions from bake furnace packing material.

\[ E_{CO2PC} = PCC \times BA \times \left( \left[ 100 - S_{pc} - Ash_{pc} \right]/100 \right) \times (44/12) \]  
(\text{Eq. F-8})

Where:
- \( E_{CO2PC} \) = Annual CO₂ emissions from bake furnace packing material (metric tons CO₂).
- \( PCC \) = Annual packing coke consumption (metric tons/metric ton baked anode).
- \( BA \) = Annual baked anode production (metric tons).
- \( S_{pc} \) = Sulfur content in packing coke (percent weight).
- \( Ash_{pc} \) = Ash content in packing coke (percent weight).
- \( 44/12 \) = Ratio of molecular weights, CO₂ to carbon.

(g) If process CO₂ emissions from anode consumption during electrolysis or anode baking of prebake cells are vented through the same stack as any combustion unit or process equipment that reports CO₂ emissions using a CEMS that complies with the Tier 4 Calculation Methodology in subpart C of this part (General Stationary Fuel Combustion Sources), then the calculation methodology in paragraphs (d) and (e) of this section shall not be used to calculate those process emissions. The owner or operation shall report under this subpart the combined stack emissions according to the Tier 4 Calculation Methodology in §98.33(a)(4) and all associated requirements for Tier 4 in subpart C of this part (General Stationary Fuel Combustion Sources).