

Subpart F, Greenhouse Gas Reporting Program

Under the Mandatory Reporting of Greenhouse Gases (GHGs) rule, owners or operators of aluminum production facilities (as defined below) must report emissions from processes that produce primary aluminum and any other source categories located at the facility for which methods are defined in the rule. Owners and operators are required to collect emission data; calculate GHG emissions; and follow the specified procedures for quality assurance, missing data, recordkeeping, and reporting per the requirements of 40 CFR Part 98 Subpart F – Aluminum Production.

How Is This Source Category Defined?

The aluminum production source category consists of facilities that manufacture primary aluminum using the Hall-Héroult manufacturing process. The primary aluminum manufacturing process consists of the following operations:

- Electrolysis in prebake and Søderberg cells
- Anode baking for prebake cells

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

What Greenhouse Gases Must Be Reported?

Each aluminum production facility must report:

- Perfluoromethane (CF₄) and perfluoroethane (C₂F₆) emissions from anode effects in all prebake and Søderberg electrolysis cells combined.
- Carbon dioxide (CO₂) emissions from anode consumption during electrolysis in all prebake and Søderberg cells.
- All CO₂ emissions from onsite anode baking.

In addition, each facility must report GHG emissions for other source categories for which calculation methods are provided in the rule. For example, facilities must report CO₂, nitrous oxide (N₂O), and methane (CH₄) emissions from each stationary combustion unit on site by following the requirements of 40 CFR part 98, subpart C (General Stationary Fuel Combustion Sources). Please refer to the relevant information sheet for a summary of the rule requirements for calculating and reporting emissions from any other source categories at the facility.

How Must Greenhouse Gas Emissions Be Calculated?

Facilities must calculate GHG process emissions using the following methods:

- **CF₄ from anode effects.** Calculate annual CF₄ emissions based on the frequency and duration of anode effects in the aluminum electrolytic reduction process for each prebake and Søderberg electrolysis cell using the following parameters:
 - Anode effect minutes (AEM) per cell-day calculated monthly.
 - Aluminum metal production calculated monthly.
 - A slope coefficient relating CF₄ emissions to anode effect minutes per cell-day and aluminum production. The slope coefficient is specific to each smelter. Smelters that have never measured the slope coefficient must measure it within one year of rule publication. Smelters that have measured it must re-measure it

- within three years of rule publication. Thereafter, all smelters must measure it at least once every 10 years, or whenever there is a major technological or process change. The slope coefficient must be measured in accordance with the protocol specified in the rule. Under certain conditions, high-efficiency smelters may use a default slope coefficient from Table F-1 in the rule.
- **C₂F₆ from anode effects.** Estimate annual C₂F₆ emissions from anode effects from each prebake and Søderberg electrolysis cell using the estimated CF₄ emissions and the mass ratio of C₂F₆ to CF₄ emissions, as determined during the same test during which the slope coefficient is determined.
 - **Process CO₂ emissions.** Reporters can elect to calculate and report process CO₂ emissions from anode consumption during electrolysis and from anode baking by using one of two methods:
 - Installing and operating a continuous emission monitoring system (CEMS) and following the Tier 4 methodology (in 40 CFR part 98, subpart C).
 - Using the calculation procedures specified below.
 - **CO₂ emissions from anode consumption in prebake cells.** Estimate annual CO₂ emissions at the facility level using a mass balance equation based on measurements of the following parameters:
 - Net prebaked anode consumption rate per metric ton of aluminum metal produced.
 - Ash and sulfur contents of the anodes.
 - Total mass of aluminum metal produced per year for all prebake cells.
 - **CO₂ emissions from Søderberg cells.** Estimate CO₂ emissions from paste consumption in Søderberg cells using a mass balance equation at the facility level based on the following parameters:
 - Paste consumption rate per metric ton of aluminum metal produced and the annual mass of aluminum metal produced for all Søderberg cells.
 - Emissions of cyclohexane-soluble matter per metric ton of aluminum produced.
 - Binder content of the anode paste.
 - Sulfur, ash, and hydrogen contents of the coal tar pitch used as the binder in the anode paste.
 - Sulfur and ash contents of the calcined coke used in the anode paste.
 - Carbon in the skimmed dust from the cell, per metric ton of aluminum produced.
 - **CO₂ emissions from anode baking of prebake cells.** Estimate CO₂ emissions at the facility level separately from pitch volatiles and from bake furnace packing material.
 - To estimate CO₂ emissions from the pitch volatiles, use a mass balance equation based on the following parameters:
 - Initial weight of the green anodes.
 - Mass of hydrogen in the green anodes.
 - Mass of the baked anodes.
 - Mass of waste tar collected.
 - To estimate CO₂ emissions from bake furnace packing material, use a mass balance equation based on the following parameters:
 - Packing coke consumption rate per ton of baked anode production
 - Sulfur and ash contents of the packing coke.

Measure the smelter-specific values used to estimate CO₂ emissions from anode and paste consumption (e.g., sulfur, ash, and hydrogen contents), or use default values listed in the rule.

If process CO₂ emissions from anode consumption during electrolysis or anode baking are emitted through the same stack as a combustion unit or process equipment that uses a CEMS and follows the Tier 4 methodology in the rule to report CO₂ emissions, then the CEMS must be used to measure and report combined CO₂ emissions from that stack, instead of using the calculation procedures specified above.

A checklist for data that must be monitored is available at: <https://www.epa.gov/ghgreporting/subpart-f-checklist>.

What Information Must Be Reported?

In addition to the information required by the General Provisions at 40 CFR 98.3(c) each aluminum production facility must report the following information at the facility level:

- Type of smelter technology used.
- The following PFC-specific information on an annual basis:
 - CF₄ and C₂F₆ emissions from anode effects in all prebake and Søderberg electrolysis cells combined.
 - Anode effect minutes per cell-day, anode effect frequency, anode effect duration, if estimating CF₄ emissions from anode effect duration.
 - Anode effect overvoltage factor, potline overvoltage, and current efficiency, if estimating CF₄ from overvoltage.
 - Smelter-specific slope coefficients (or overvoltage emission factors) and the last date when the smelter-specific-slope coefficients (or overvoltage emission factors) were measured, if estimating CF₄ emissions from overvoltage.
- Method used to measure the frequency and duration of anode effects (or overvoltage).
- The following CO₂-specific information for prebake cells on an annual basis:
 - Anode consumption if using the method is 98.63(g).
 - CO₂ emissions from the smelter.
- The following CO₂-specific information for Søderberg cells on an annual basis:
 - Paste consumption if using the method in 98.63(g).
 - CO₂ emissions from the smelter.
- Smelter-specific inputs to the CO₂ process equations (e.g., levels of sulfur and ash) that were used in the calculation.

Facilities must enter required data into the electronic Greenhouse Gas Reporting Tool (e-GGRT) to be reported in the annual report, and must also enter into e-GGRT's *Inputs Verifier Tool* (IVT) the inputs to emission equations for which reporting is not required. IVT uses these entered data to calculate the equation results.

When and How Must Reports Be Submitted?

Annual reports must be submitted by March 31 of each year, unless the 31st is a Saturday, Sunday, or federal holiday, in which case the reports are due on the next business day. Annual reports must be submitted electronically using [e-GGRT](#), the GHGRP's online reporting system. Additional information on setting up user accounts, registering a facility and submitting annual reports is available at <https://ccdsupport.com/confluence/>.

When Can a Facility Stop Reporting?

There are several scenarios under which a facility may discontinue reporting. These scenarios are summarized in the [Subpart A Information Sheet](#) as well as in an [FAQ](#).

For More Information

For additional information on Subpart F, visit the [Subpart F Resources](#) webpage. For additional information on the Greenhouse Gas Reporting Program, visit the [Greenhouse Gas Reporting Program Website](#), which includes information sheets on other rule subparts, [data](#) previously reported to the Greenhouse Gas Reporting Program, [training materials](#), and links to [frequently asked questions](#).

This document is provided solely for informational purposes. It does not provide legal advice, have legally binding effect, or expressly or implicitly create, expand, or limit any legal rights, obligations, responsibilities, expectations, or benefits in regard to any person. The series of information sheets is intended to assist reporting facilities/owners in understanding key provisions of the Greenhouse Gas Reporting Program.