

Aluminum Production



Final Rule: Mandatory Reporting of Greenhouse Gases

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 or operators are required to collect emission data; calculate GHG emissions; and follow the specified procedures for quality assurance, missing data, recordkeeping, and reporting.

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 GHGs 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 GHG 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:

<http://www.epa.gov/climatechange/emissions/downloads/checklists/aluminumproduction.pdf>.

When Must Reports be Submitted?

The submission date for the annual GHG report can vary in the first 3 years of the program.

- Reporting Year 2010. The report was required to be submitted by September 30, 2011.

- Reporting Year 2011. The due date depends on which source categories are included in the report. If the report includes one or more of the source categories listed below, then the report must be submitted by September 28, 2012. This reporting deadline applies to all subparts being reported by the facility. In addition, if the facility contains one or more of these source categories and the facility submitted a GHG annual report for reporting year 2010 under another subpart (e.g., subpart C for general stationary fuel combustion), then by April 2, 2012 you must notify EPA through e-GGRT that you are not required to submit the second annual report until September 28, 2012 (the notification deadline according to 4 CFR 98.3(b) is March 31, 2012, however, because this date falls on a Saturday in 2012, the notification is due on the next business day).
 - Electronics Manufacturing (subpart I)
 - Fluorinated Gas Production (subpart L)
 - Magnesium Production (subpart T)
 - Petroleum and Natural Gas Systems (subpart W)
 - Use of Electric Transmission and Distribution Equipment (subpart DD)
 - Underground Coal Mines (subpart FF)
 - Industrial Wastewater Treatment (subpart II)
 - Geologic Sequestration of Carbon Dioxide (subpart RR)
 - Manufacture of Electric Transmission and Distribution (subpart SS)
 - Industrial Waste Landfills (subpart TT)
 - Injection of Carbon Dioxide (subpart UU)
 - Imports and Exports of Equipment Pre-charged with Fluorinated GHGs or Containing Fluorinated GHGs in Closed-cell Foams (subpart QQ)

If the report contains none of the source categories listed above, then the report must be submitted by April 2, 2012 (the deadline is March 31, 2012, however, because this date falls on a Saturday, the annual report is due on the next business day).

- Reporting Year 2012. Starting in 2013 and each year thereafter, the report 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.

What Information Must Be Reported?

In addition to the information required by the General Provisions at 40 CFR 98.3(c), the rule requires each facility to report the following information at the facility level:

- Annual aluminum production in metric tons.
- 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.
 - 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.
 - CO₂ emissions from the smelter.
- The following CO₂-specific information for Söderberg cells on an annual basis:
 - Paste consumption.
 - 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.

EPA has temporarily deferred the requirement to report data elements in the above list that are used as inputs to emission equations (76 FR 53057, August 25, 2011). For the current status of reporting requirements, including the list of data elements that are considered to be inputs to emissions equations, consult the following link: <http://www.epa.gov/climatechange/emissions/CBI.html>

For More Information

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 final rule.

Visit EPA's Web site (www.epa.gov/climatechange/emissions/ghgrulemaking.html) for more information, including the final preamble and rule, additional information sheets on specific industries, the schedule for training sessions, and other documents and tools. For questions that cannot be answered through the Web site, please contact us at: GHGreporting@epa.gov.