Greenhouse Gas Reporting Program

EMISSION CALCULATION METHODOLOGIES

The Greenhouse Gas Reporting Program (GHGRP) prescribes methodologies that must be used to determine greenhouse gas (GHG) emissions from each source category. Reporters generally have the flexibility to choose among several methods for computing GHG emissions. The decision of which method to use may be influenced by the existing environmental monitoring systems in place and other factors. Reporters can change emission calculation methods from year to year, as long as they meet the requirements for use of the method selected.

Direct-Emitting Facilities

Direct-emitting facilities report emissions from each source category (rule subpart) included in the GHGRP and these emissions can generally be categorized as either combustion or process emissions. Emissions from fuel combustion comprise carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) emitted from combustion of a fossil fuel (e.g., coal, natural gas, petroleum products) or biomass feedstock (e.g., wood, landfill gas). Process emissions generally include emissions from chemical transformation of raw materials and fugitive emissions. The chemical transformation of raw materials often releases greenhouse gases such as CO_2, CH_4, and N_2O. These processes include iron and steel production, cement production, petrochemical production, and nitric acid production, among others. Fugitive emissions refer to emissions of gases due to leaks or other unintended or irregular releases. Fugitive CH_4 releases occur from petroleum and natural gas systems and underground coal mines. Fugitive emissions of fluorinated gases occur from industrial gas production, electrical equipment production and use, electronics manufacturing, aluminum production, and magnesium production. These processes typically release hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).

- **Emissions from fuel combustion** are determined by facilities by using a continuous emission monitoring system (CEMS), measured fuel composition data, or default emission factors. A CEMS is a device that continually collects information on the quantity of a gas being emitted. CEMS are generally thought to be the most accurate way to determine emissions for heterogeneous fuels like municipal solid waste, and collect accurate information on emissions from standard fuels as well. Site-specific fuel composition data can also be used to calculate emissions. A facility using this methodology would measure for each fuel type the high heating value (HHV), carbon content, and (for gaseous fuels) molecular weight of a representative sample of the fuel they combust and determine their emissions by multiplying these parameters by the quantity of fuel consumed. Facilities using default emission factors use an emission factor supplied by the GHGRP that is a representative average emission factor based on many samples of the fuel that have been taken across the country. For homogeneous fuels such as pipeline quality natural gas, default emission factors often provide a very accurate emissions estimate.

- **Process emissions** are determined by facilities using a variety of methods including a CEMS, a mass balance approach, or site-specific or default emission factors. The methods specified in the rule vary by source category, and are the methods determined to be most appropriate for that source. For example, facilities with a large share of their emissions emanating from a single or small number of stacks (e.g., cement production) monitor and determine their emissions differently than those with numerous small emissions sources spread over a large spatial area (e.g., fugitive leaks from a natural gas distribution system). In cases where a facility has a CEMS-monitored stack through which both combustion and process CO2 are emitted, it may not be possible, based on GHGRP data, to determine the allocation of combustion and process emissions.

The mass balance approach generally measures the carbon exiting the process through products and entering the process through feedstocks, calculates the difference between these two values, and assumes that unaccounted for carbon is either directly released or oxidized and released as CO_2. Site-specific emission factors for process emissions are determined either by measuring the carbon content of feedstocks or by performing periodic (e.g., annual) stack tests. Default emission factors are provided by the GHGRP and are based on the average emissions that occur per unit of consumption of raw material (e.g., limestone feedstock) or per unit of output (e.g., glass produced).

Suppliers

Suppliers of certain fossil fuels and industrial gases report the emissions that would occur if the products that they place into the economy were fully released or oxidized. The emissions can be determined generally using mass balance methods based on either default emission factors (based on quantities produced, imported, or exported), reporter-specific emission factors derived from testing, or direct measurement of carbon quantities (flow and concentration). Reporters are generally allowed to determine quantities of product supplied by using standard industry practices for business transactions.

CO_2 Injection Facilities

Facilities that inject CO_2 underground for sequestration or other purposes are required to report the quantity of CO_2 that they receive for injection. Reporters are allowed to determine the mass of CO_2 received for injection by using standard industry practices for mass and volumetric flow calculations. Facilities that conduct geologic sequestration are required to report information on the CO_2 received for injection and must develop and implement an EPA-approved monitoring, reporting, and verification (MRV) plan for reporting the amount of CO_2 geologically sequestered using a mass balance approach.

Best Available Monitoring Methods (BAMM)

When the rule first became into effect, facilities and suppliers had the option to use BAMM to determine emissions from specific emissions sources for a limited amount of time. The use of BAMM was allowed because it was not always feasible for a facility to acquire, install, and operate all of the required monitoring equipment by the required date. EPA's BAMM provision provided time for facilities to install monitoring equipment in a way that could minimize impacts to normal business operations. Over time, facilities are expected to operate all monitoring equipment required by the GHGRP and determine emissions using the methods specified by the GHGRP. Learn more about Best Available Monitoring Methods (BAMM).