

# Petrochemical Production

## Subpart X, Greenhouse Gas Reporting Program

### OVERVIEW

Subpart X of the Greenhouse Gas Reporting Program (GHGRP) (40 CFR 98.240 – 98.248) applies to any facility that contains a petrochemical process and meets the Subpart X source category definition. Some subparts have thresholds that determine applicability for reporting, and some do not. To decide whether your facility must report under this subpart, please refer to 40 CFR 98.241 and the GHGRP [Applicability Tool](#).

This Information Sheet is intended to help facilities reporting under Subpart X understand how the source category is defined, what greenhouse gases (GHGs) must be reported, how GHG emissions must be calculated and shared with EPA, and where to find more information.



## How is This Source Category Defined?

Petrochemical production consists of all processes that produce the following as either an intermediate in the on-site production of other chemicals or as an end-product for sale or shipment offsite:

- Acrylonitrile (CH<sub>2</sub>CHCN)
- Carbon (C) Black
- Ethylene (C<sub>2</sub>H<sub>4</sub>)
- Ethylene Dichloride (EDC or C<sub>2</sub>H<sub>4</sub>Cl<sub>2</sub>)
- Ethylene Oxide (C<sub>2</sub>H<sub>4</sub>O)
- Methanol (CH<sub>3</sub>OH)

The following are excluded from the petrochemical production source category:

- Processes that produce a petrochemical as a by-product.
- A direct chlorination process that is operated independently of an oxychlorination process to produce EDC.
- A facility that makes CH<sub>3</sub>OH, hydrogen (H<sub>2</sub>), and/or ammonia (NH<sub>3</sub>) from synthesis gas if the annual mass production of CH<sub>3</sub>OH is less than either the individual annual mass production level of H<sub>2</sub> recovered as product or NH<sub>3</sub>.
- A process that produces bone black.
- A process that processes a petrochemical from biobased feedstock.
- A process that solely distills or recycles waste solvent that contains a petrochemical.



## What GHGs Must Be Reported?

Petrochemical production facilities must report the following gases:

- Carbon dioxide (CO<sub>2</sub>) process emissions from each petrochemical unit. Process emissions include CO<sub>2</sub> generated by reaction in the process, and CO<sub>2</sub>, methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) generated by combustion of process off-gas in stationary combustion units and flares.
- CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions from burning supplemental fuel in stationary combustion units that also burn process off-gas.
- CO<sub>2</sub> captured and reported under Subpart PP (Suppliers of CO<sub>2</sub>), found at 40 CFR 98.420 – 98.428, by following the requirements of Subpart PP.

If multiple Greenhouse Gas Reporting Program (GHGRP) source categories are co-located at a facility, the facility may need to report greenhouse gas (GHG) emissions under a different subpart. Please refer to the relevant information sheet for a summary of the rule requirements for any other source categories located at the facility.



## How Must GHG Emissions Be Calculated?

Owners or operators must estimate the GHG emissions from each petrochemical process unit. Process emissions include CO<sub>2</sub> emissions generated by chemical reactions in the process and combustion emissions of process off-gas and liquid wastes. In addition, process emissions also include CH<sub>4</sub> and N<sub>2</sub>O generated by combustion of process off-gas in stationary combustion units and flares when emissions are calculated using either the continuous emission monitoring system (CEMS) methodology or the C<sub>2</sub>H<sub>4</sub> processes methodology described below. Within a process unit, only one of the following three approaches may be used:

- **CEMS.** If all process vent emissions and emissions from combustion of process off-gas are routed to one or more stacks, and CEMS are used on each stack to measure CO<sub>2</sub> emissions (except for flare stacks), then the owner must report by following the Tier 4 Calculation Methodology of Subpart C (General Stationary Sources), found at 40 CFR 98.30 – 98.38. For each stack (excluding flare stacks) that includes emissions from combustion of petrochemical process off-gas, calculate CH<sub>4</sub> and N<sub>2</sub>O emissions using emission factors in Table C-2 in Subpart C and the Tier 3 Calculation Methodology in Subpart C. For each flare stack, calculate CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions using the methodology specified in 40 CFR 98.253 of Subpart Y (Petroleum Refineries).
- **Mass Balance.** Except as allowed below for C<sub>2</sub>H<sub>4</sub> processes, process units without applicable CEMS must use a mass balance approach for each petrochemical process unit to estimate process emissions of CO<sub>2</sub> for each calendar month. (Separate estimates for CH<sub>4</sub> and N<sub>2</sub>O emissions are not required.) To complete the mass balance, measure:
  - Volume or mass of each gaseous and liquid feedstock and product for each calendar month.
  - Mass rate of each solid feedstock and product for each calendar month.
  - C content of each feedstock and product based on monthly samples.
- **C<sub>2</sub>H<sub>4</sub> Processes.** For C<sub>2</sub>H<sub>4</sub> processes only, because nearly all process emissions from this process are from the combustion of process off-gas, the final rule allows calculation of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions from all stationary combustion units that burn process off-gas (with or without supplemental fuel) in accordance with procedures in Subpart C. Typically, either the Tier 3 or Tier 4 Calculation Methodology must be used. However, Equation C-1 or Equation C-2a may be used if the annual average flow rate of fuel gas to the combustion unit is less than 345 standard cubic feet per minute (scf/min) and a flow meter is not installed in the fuel line, or the combustion unit has a maximum rated heat input capacity of less than 30 million British thermal units per hour (mmBtu/hr) and a flow meter is not installed in the fuel line. In addition, this option requires CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions from each flare to be estimated using the procedures in 40 CFR 98.253(b) of Subpart Y (Petroleum Refineries).

A checklist for data that must be monitored is available here: [Subpart X Monitoring Checklist](#).



## What Information Must Be Reported?

In addition to the information required by the General Provisions in Subpart A, found at 40 CFR 98.3(c), the following must be reported under the circumstances indicated:

- If the CEMS methodology is used to measure CO<sub>2</sub> emissions, then owners and operators must report the information required by 40 CFR 98.246(b), which includes relevant information required by 40 CFR 98.36 of Subpart C (as specified below):
  - The petrochemical process unit ID or other appropriate descriptor and the type of petrochemical produced.
  - Information listed in 40 CFR 98.256(e) of Subpart Y for each flare that burns process off-gas. Additionally, provide estimates based on engineering judgment of the fractions of the total CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions that are attributable to combustion of off-gas from the petrochemical process unit(s) served by the flare.
  - Annual quantity of each type of petrochemical produced from each process unit (metric tons)
  - The name and annual quantity (in metric tons) of each C-containing feedstock and product.
  - For CEMS used on stacks that *include* emissions from stationary combustion units that burn any amount of off-gas from the petrochemical process, report:
    - The relevant information required under Subpart C, 40 CFR 98.36(c)(2) and (e)(2)(vi) for the Tier 4 Calculation Methodology (note, section 98.36(c)(2)(ii), (ix), and (x) do not apply to this subpart);
    - An estimate based on engineering judgment of the fraction of the total CO<sub>2</sub> emissions that results from CO<sub>2</sub> directly emitted by the petrochemical process unit plus, if applicable, the CO<sub>2</sub> generated by the combustion of off-gas from the petrochemical process unit; and
    - The CH<sub>4</sub> and N<sub>2</sub>O emissions expressed in metric tons of each gas. For each CEMS monitoring location, provide an estimate based on engineering judgment of the fraction of the total CH<sub>4</sub> and N<sub>2</sub>O emissions that is attributable to combustion of off-gas from the petrochemical process unit.
  - For CEMS used on stacks that *do not include* emissions from stationary combustion units, report an estimate based on engineering judgment of the fraction of the total CO<sub>2</sub> emissions that results from CO<sub>2</sub> directly emitted by the process unit and the information required under Subpart C, 40 CFR 98.36(b)(6) and (7), (b)(9)(i) and (ii), and (e)(2)(vi).
- For processes that use the mass balance methodology, owners and operators must report the following for each petrochemical process unit and each type of petrochemical product:
  - The petrochemical process unit ID number or other appropriate descriptor.
  - The type of petrochemical produced.
  - Annual CO<sub>2</sub> emissions calculated.
  - The name of each method listed in 40 CFR 98.244 used to determine C content or molecular weight.
  - Description of each type of device used to determine volume or mass.
  - Identification of each method used to determine volume or mass.
  - The temperature in degrees Fahrenheit (°F) at which gaseous feedstock and product volumes were determined.

- Annual quantity of each type of petrochemical produced from each process unit (metric tons). If you are electing to consider the petrochemical process unit to be the entire integrated ethylene dichloride/vinyl chloride monomer (EDC/VCM) process, the portion of the total amount of EDC produced that is used in VCM production may be a measured quantity or an estimate that is based on process knowledge and best available data. The portion of the total amount of EDC produced that is not utilized in VCM production must be measured in accordance with 40 CFR 98.244(b)(2) or (3). Sum the amount of EDC used in the production of VCM plus the amount of separate EDC product to report as the total quantity of EDC petrochemical from an integrated EDC/VCM petrochemical process unit.
- Identification of each combustion unit that burned both process off-gas and supplemental fuel.
- If you comply with the alternative to sampling and analysis specified in 40 CFR 98.243(c)(4) for a product, the number of days during which off-specification product was produced. If applicable, when complying with this alternative for either a product or feedstock, the date of any process change that reduced the composition to less than 99.5%.
- If you determine C content or composition of a feedstock or product using an alternative to methods listed in 40 CFR 98.244(b)(4)(i) through (xiv), the name of the alternative method, a copy of the method, and an explanation of why the alternative is needed (i.e., none of the listed methods can detect a relevant compound, the quality control (QC) methods of listed methods are not technically feasible, or use of listed methods would be unsafe).
- Annual average of the measurements or determinations of the C content of each feedstock and product.
- For each gaseous feedstock or product for which the volume was used in Equation X-1, report the annual average molecular weight of the measurements or determinations (in kilogram per kilogram mole (kg/kg-mole)).
- Name and annual quantity of each C-containing feedstock (metric tons).
- Name and annual quantity of each product (both the petrochemical and by-products) produced from each process unit (metric tons). Alternatively, if you elect to consider the petrochemical process unit to be the entire integrated EDC/VCM process, the reported quantity of EDC product should include only that which was not used in the VCM process.
- For the combustion methodology specified in 40 CFR 98.243(d), owners and operators must report the following information:
  - The C<sub>2</sub>H<sub>4</sub> process unit ID or other appropriate descriptor.
  - For each stationary combustion unit that burns C<sub>2</sub>H<sub>4</sub> process off-gas (or group of stationary sources with a common pipe), except flares, the relevant information listed in 40 CFR 98.36 for the applicable Tier Calculation Methodology. For each stationary combustion unit or group of units (as applicable) that burns C<sub>2</sub>H<sub>4</sub> process off-gas, estimate based on engineering judgment of the fraction of the total emissions that is attributable to each C<sub>2</sub>H<sub>4</sub> process unit.
  - Information listed in 40 CFR 98.256(e) of Subpart Y for each flare that burns C<sub>2</sub>H<sub>4</sub> process off-gas. Additionally, provide estimates based on engineering judgment of the fractions of the total CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions that are attributable to combustion of off-gas from the C<sub>2</sub>H<sub>4</sub> process unit(s) served by the flare.
  - Name and annual quantity of each C-containing feedstock (metric tons).
  - Annual quantity of C<sub>2</sub>H<sub>4</sub> produced from each process unit (metric tons).
  - Name and annual quantity (metric tons) of each product produced in each process unit.



## What Records Must Be Maintained?

Reporters are required to retain records that pertain to their annual GHGRP report for at least three years after the date the report is submitted. Please see the [Subpart A Information Sheet](#) and 40 CFR 98.3(g) for general recordkeeping requirements. Specific recordkeeping requirements for Subpart X are listed at 40 CFR 98.247.



## When and How Must Reports be Submitted?

Reporters must submit their annual GHGRP reports for the previous calendar year to the EPA by March 31<sup>st</sup>, unless the 31<sup>st</sup> falls on a Saturday, Sunday, or federal holiday, in which case reports are due on the next business day. Annual reports must be submitted electronically using the [electronic Greenhouse Gas Reporting Tool \(e-GGRT\)](#), the GHGRP's online reporting system.

Additional information on setting up user accounts, registering a facility, and submitting annual reports is available on the [GHGRP Help webpage](#).



## When Can a Facility Stop Reporting?

A facility may discontinue reporting under several scenarios, which are summarized in Subpart A (found at 40 CFR 98.2(i)) and the [Subpart A Information Sheet](#).



## For More Information

For additional information on Subpart X, please visit the [Subpart X webpage](#). For additional information on the GHGRP, please visit the [GHGRP website](#), which includes additional information sheets, [data](#) previously reported to the GHGRP, [training materials](#), and links to Frequently Asked Questions ([FAQs](#)). For questions that cannot be answered through the GHGRP website, please contact us at: [GHGreporting@epa.gov](mailto:GHGreporting@epa.gov).

*This Information Sheet is provided solely for informational purposes. It does not replace the need to read and comply with the regulatory text contained in the rule. Rather, it is intended to help reporting facilities and suppliers understand key provisions of the GHGRP. It does not provide legal advice; have a legally binding effect; or expressly or implicitly create, expand, or limit any legal rights, obligations, responsibilities, expectations, or benefits with regard to any person or entity.*