Subpart Y - Petroleum Refineries

A printer-friendly version (pdf) (96 pp, 11,239K) of GHG reporting instructions for this subpart

Please select a help topic from the list below:

Additional Resources:

Using e-GGRT to Prepare Your Subpart Y Report

Subpart Y consists of facilities that produce gasoline, gasoline blending stocks, naphtha, kerosene, distillate fuel oils, residual fuel oils, lubricants, or asphalt (bitumen) by the distillation of petroleum or the redistillation, cracking, or reforming of unfinished petroleum derivatives.

This page provides an overview of subtopics that are central to Subpart Y reporting:

- Subpart Y Summary Information for this Facility
- Subpart Y Delayed Coking Unit Information
- Subpart Y Asphalt Blowing Unit Information
- Subpart Y Coke Calcining Unit Information
- Subpart Y Catalytic Cracking, Fluid Coking, and Catalytic Reforming Unit Information
- Subpart Y Flares Unit Information
- Subpart Y Process Vents Unit Information
- Subpart Y Sulfur Recovery Plant Information
- Subpart Y Emissions Information for Process Units Monitored by CEMS
- Subpart Y Validation Report

The end of the page contains links you can use for more information on these topics.

If you previously reported for Reporting Year (RY) 2011, the Agency has carried some of your RY2011 data forward and entered it in your RY2012 forms to reduce the reporting burden. It is still your responsibility to review and ensure that all of the information in your submission is correct, but the Agency believes that most of the data which is carried forward is unlikely to change significantly from year to year. For more information about carry forward data, please see the Carry forward of data from previous submissions into RY2012 forms help content.

If you are using a Best Available Monitoring Method (BAMM) in accordance with the rule in place of a method in Subpart Y, you should select the "Other" option in the method menu and write "BAMM" or "Best Available Monitoring Method" in the corresponding text box. Details regarding BAMM methods used should be included in Subpart A.

Subpart Y Summary Information for this Facility

Subpart Y requires you to report the following data about your facility:

- The annual CO_2 emissions from sour gas sent off-site for sulfur recovery
- The annual CH_4 emissions from the following sources:
  - Uncontrolled Blowdown Systems
  - Equipment Leaks
  - Loading Operations
  - Storage Tanks
  - Delayed Coking

Subpart Y Delayed Coking Unit Information

Subpart Y requires you to report the following data for each delayed coking unit at your facility:

- A unique name or identifier, plus optional description. See also About Unique Unit Names
- Method used to calculate the CH_4 emissions

Subpart Y requires you to report the following data for each coking drum at your facility:

- A unique name or identifier, plus optional description. See also About Unique Unit Names
- Typical drum outage in feet (i.e. unfilled distance from the top of the drum)

Subpart Y Asphalt Blowing Unit Information

Subpart Y requires you to report the following data about your asphalt blowing operations:

- A unique name or identifier, plus optional description for this asphalt blowing unit. See also About Unique Unit Names.
- Specify the control device used to reduce methane (and other organic) emissions from the unit. Select from Vapor scrubber, Thermal oxidizer, Flare, Other (specify), or None.

When you are finished, click SAVE.

If you selected Thermal oxidizer, Flare, or Other, an additional question will appear requiring you to select a CO_2 AND CH_4 EMISSIONS CALCULATION METHOD. The system requires you to select the method used to calculate the CO_2 and CH_4 emissions for your asphalt blowing operations from the following list:

- Equations Y-14 and Y-15 (appears only if Other was selected)
- Equations Y-16a and Y-17
- Equations Y-16b and Y-17
- Equation Y-19 (Process Vent)

Subpart Y Coke Calcining Unit Information

Subpart Y collects the following data about your coke calcining unit:

- Maximum rated throughput of the coke calcining unit (metric tons coke calcined per stream day)
- Method used to calculate the CH_4 emissions:
  - Equation Y-9
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit
- Method used to calculate the N_2O emissions:
  - Equation Y-10
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit

Subpart Y Catalytic Cracking, Fluid Coking, and Catalytic Reforming Unit Information

Subpart Y collects the following data about your Catalytic Cracking, Fluid Coking, or Catalytic Reforming unit:

- A unique name or identifier, plus optional description for this unit (see also About Unique Unit Names)
- Specify the type of unit:
  - Fluid Catalytic Cracking Unit
  - Thermal Catalytic Cracking Unit
  - Traditional Fluid Coking Unit
  - Catalytic Reforming Unit
  - Fluid Coking Unit with Flexicoking Design (see note below)
- An indication whether each unit is monitored by a CEMS

> ⚠ For **Fluid Coking Units with Flexicoking Design**, you will be asked if the GHG emissions from the low heat value gas are accounted for in Subpart C.
>
> - If your answer to this question is 'yes', you are only required to report maximum rated throughput of the fluid coking unit with flexicoking design
> - If your answer to this question is 'no', you are required to report maximum rated throughput of the fluid coking unit with flexicoking design and the methods used to calculate emissions per the sections below

For Catalytic Cracking or Coking units that are NOT monitored by CEMS, Subpart Y also collects the following data:

- Maximum rated throughput of the unit (bbl per stream day)
- Method used to calculate CO_2 emissions (only appears if you select No for using a CEMS):
  - 98.253(c)(2) - Equation Y-6 and continuous monitor for flow (but not meeting the CEMS monitoring requirements of 98.253(c)(1); e.g., not meeting the full CEMS quality assurance requirements)
  - 98.253(c)(2) - Equation Y-6 and Y-7a
  - 98.253(c)(2) - Equation Y-6 and Y-7b
  - 98.253(c)(3) - Equation Y-8 (option appears only for Catalytic Cracking or Coking units; available only for catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day (bbls/sd) or less that do not use a continuous CO_2 CEMS for the final exhaust stack)
  - 98.253(e)(3) - Equation Y-11 (option appears only for Catalytic Reforming units)
- Method used to calculate CH_4 emissions:
  - Equation Y-9
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit
- Method used to calculate N_2O emissions:
  - Equation Y-10
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit

For Catalytic Cracking or Coking units that are monitored by CEMS, Subpart Y also collects the following data:

- Maximum rated throughput of the unit (bbl per stream day)
- Method used to calculate CH_4 emissions:
  - Equation Y-9
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit
- Method used to calculate N_2O emissions:
  - Equation Y-10
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit

Subpart Y Flares Unit Information

Subpart Y collects the following data about your flare unit:

- A unique name or identifier, plus optional description for this flare unit (see also About Unique Unit Names)
- Type of flare:
  - Steam assisted
  - Air assisted
  - Unassisted
  - Other (specify)
- Flare service type:
  - General facility flare
  - Unit flare
  - Emergency only flare
  - Back-up flare
  - Other (specify)
- Method used to calculate the CO_2 emissions:
  - 98.253(b)(1)(ii)(A) – Equation Y-1a Gas Composition Monitored (Equation Y-1a or Y-1b must be used if you have a continuous gas composition monitor on the flare or if you measure it at least weekly)
  - 98.253(b)(1)(ii)(A) – Equation Y-1b Gas Composition Monitored (Equation Y-1a or Y-1b must be used if you have a continuous gas composition monitor on the flare or if you measure it at least weekly)
  - 98.253(b)(1)(ii)(B) – Equation Y-2 Heat Content Monitored (Equation Y-2 must be used if you have a continuous higher heating value monitor or measure it at least weekly and the heating value monitor or measurement is not based on compositional analyses; if compositional analyses are used, you must use Equation Y-1a or Y-1b)
  - 98.253(b)(1)(iii) – Equation Y-3 Start-up, Shutdown, Malfunction (Equation Y-3 must be used if you do not measure gas composition or heating value at least weekly.)

Subpart Y Process Vents Unit Information

Subpart Y collects the following data about your Process Vent unit:

- A unique name or identifier, plus optional description for this process vent unit (see also About Unique Unit Names):
- Operation type associated with this process vent:
- Control device used to reduce methane (and other organic) emissions from the unit:
- Annual volumetric flow discharged to the atmosphere (scf)
- Method used to measure or estimate the annual volumetric flow rate:
- Number of venting events, if vent is intermittent
- Cumulative venting time (hours)
- Greenhouse gases to report for this process vent. Select any combination of CO_2, CH_4 or N_2O. CO_2 emissions must be reported if the process vent contains greater than 2 percent by volume CO_2 or greater. CH_4 emissions must be reported if the process vent contains 0.5 percent by volume of CH_4 or greater. N_2O emissions must be reported if the process vent contains 0.01 percent by volume of N_2O or greater.

Subpart Y collects the following data if CO_2 is being reported for this Process Vent:

- Annual CO_2 emissions from this process vent (metric tons).
- Annual average mole fraction of CO_2
- Method used to measure or estimate the annual average mole fraction of CO_2

Subpart Y collects the following data if CH_4 is being reported for this Process Vent:

- Annual CH_4 emissions from this process vent (metric tons).
- Annual average mole fraction of CH_4
- Method used to measure or estimate the annual average mole fraction of CH_4

Subpart Y collects the following data if N_2O is being reported for this Process Vent:

- Annual N_2O emissions from this process vent (metric tons).
- Annual average mole fraction of N_2O
- Method used to measure or estimate the annual average mole fraction of N_2O

Subpart Y Sulfur Recovery Plant Information

Subpart Y collects the following data about your sulfur recovery plant:

- Maximum rated throughput of the sulfur recovery plant (metric tons sulfur per stream day)
- Type of sulfur recovery plant:
  - Caustic scrubber
  - Claus
  - Lo-cat
  - Sulfuric acid plant
  - Other (specify)
- Method used to calculate the CO_2 emissions. Specify either Equation Y-12 or Process Vent Method. [Only appears if No is selected for using a CEMS. For Claus Plants (that do not use a CEMS according to Subpart C), Equation Y-12 must be used. For non-Claus plants (that do not use a CEMS according to Subpart C), either Equation Y-12 or the Process Vent Method may be used.]
- Indicate whether, if you recycle tail gas, the recycled flow rate and carbon content of recycled tail gas is included in the measured volumetric flow and carbon mole fraction data. If you do not recycle tail gas, please select No. [This question appears only if Equation Y-12 is selected]. Click either Yes or No.
- Indicate if a correction for CO_2 emissions in the tail gas is used. [This question appears only if Yes is selected for previous question]. Click either Yes or No. Note that per Section 98.253(f)(5), if tail gas is recycled to the front of the sulfur recovery plant and the recycled flow rate and carbon content is included in the measured data, then the annual CO_2 emissions must be corrected to avoid double counting these emissions.

Subpart Y Emissions Information for Process Units Monitored by CEMS

For each CEMS Monitoring Location, provide the following information:

- A unique unit name or identifier for the CML (see also About Unique Unit Names)
- An optional description or label for the CML
- The configuration of processes or process units that are monitored by the CML:
  - Single industrial process or process unit that exhausts to a dedicated stack

    - Multiple industrial processes or process units share a common stack
    - Industrial process or process unit shares a common stack with one or more stationary fuel combustion units
- The name of each fuel combusted in the unit(s) monitored by the CEMS
- The Tier 4/CEMS methodology start and end dates
- The cumulative total of hourly CO_2 mass emissions for each quarter of the reporting year (in metric tons) (*Do not cumulate emissions data between quarters*)
- The total annual CO_2 mass emissions measured by the CEMS (in metric tons)
- An indication whether emissions reported for the CEMS include emissions calculated according to 98.33(a)(4)(viii) for a slipstream that bypassed the CEMS
- The total annual biogenic CO_2 emissions from the combustion of all biomass fuels combined (in metric tons) (*if applicable*)
- The total annual non-biogenic CO_2 emissions (includes fossil fuel, sorbent, and process CO_2 emissions, in metric tons)
- The total annual CH_4 and N_2O emissions associated with the combustion of all Table C-2 fuels combusted in all processes/process units monitored by the CEMS derived from application of Equation C-10 (in metric tons) (*if there are no combustion emissions in this CML, please enter zero*)
- The total number of source operating hours in the reporting year
- The total operating hours in which a substitute data value was used in the emissions calculations for the CO_2 concentration parameter
- The total operating hours in which a substitute data value was used in the emissions calculations for the stack gas flow rate parameter
- If moisture correction is required and a continuous moisture monitor is used, the total operating hours in which a substitute data value was used in the emissions calculations for the stack gas moisture content parameter
- An indication of the process units monitored by the CML
- The CO_2 emissions from this CEMS Monitoring Location that are attributable to process CO_2 emissions from this process unit (metric tons).

Subpart Y Validation Report

The Validation Report assists with the completeness and quality of your reporting data.

We strongly encourage you to use the Validation Report to check your work. The Validation Report performs two types of checks:

- Data Completeness: Data required for reporting that are missing or incomplete.
- Data Quality: Data that are outside of the expected range of values.

You may view the Validation Report at any time.

> Note that the Validation Report is intended to assist users in entering data, but it is not an indication that the reporter has entered all necessary information, nor is it an indication that the reporter is in compliance with part 98. Furthermore a negative finding on the validation report is not a guarantee that a data element was entered incorrectly.

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See Also

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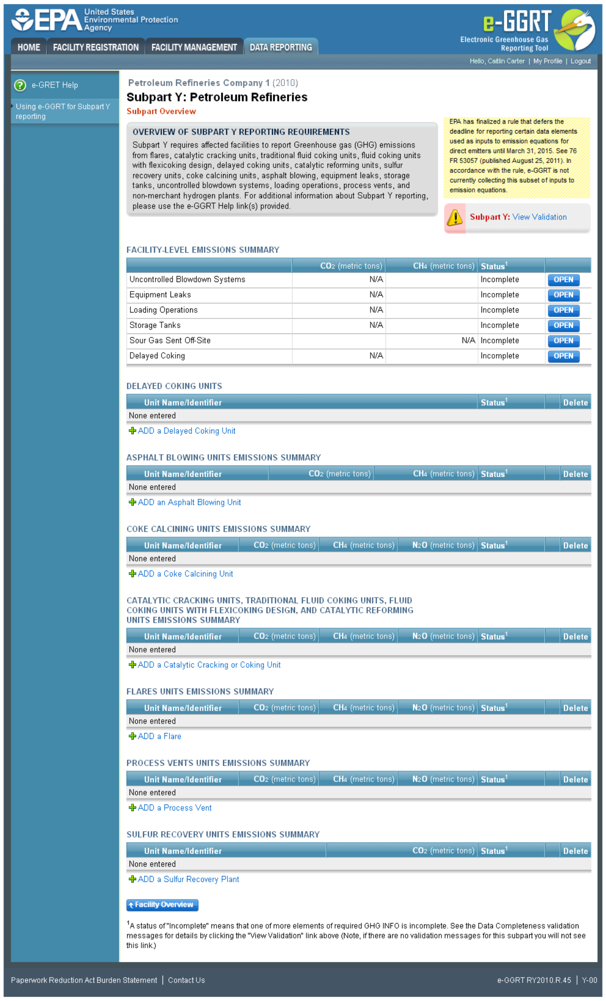
Subpart Y Summary Information for this Facility

This topic provides a step-by-step description of how to enter Subpart Y summary information about this facility.

Click image to expand



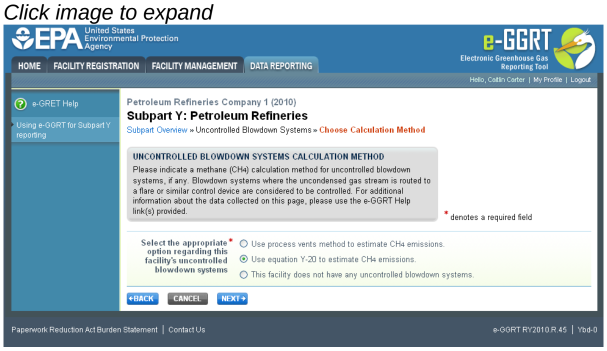
Updating Summary Information for this Facility

To update Subpart Y Summary Information for this Facility, locate the FACILITY-LEVEL EMISSIONS SUMMARY table on the Subpart Y Overview page, and click OPEN for the appropriate section.

Updating Uncontrolled Blowdown Systems

Petroleum Refineries must specify a CH_4 calculation method for uncontrolled blowdown systems, if any. Blowdown systems where the uncondensed gas stream is routed to a flare or similar control device is considered to be controlled.

Click image to expand



Step 1: Select Estimation Method

Subpart Y requires you to specify the appropriate option regarding this facility's uncontrolled blowdown systems. Select from:

- Use process vents method to estimate CH_4 emissions

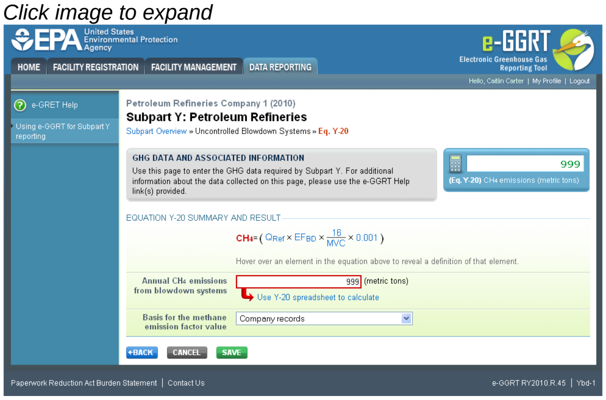
- Use equation Y-20 to estimate CH_4 emissions
- This facility does not have any uncontrolled blowdown systems

When you are finished, click NEXT.

If “This facility does not have any uncontrolled blowdown systems” is selected then no further data is collected for uncontrolled blowdown systems.

Depending on which methodology you choose, follow either Step 2a or Step 2b.

Click image to expand



Step 2a: Equation Y-20 Summary and Result

The annual CH_4 emissions from blowdown systems is required. The e-GGRT system provides links to optional worksheets that may be used to perform the calculations; use of the spreadsheet is entirely optional and is provided for your assistance. To calculate this value using the optional spreadsheet, download the spreadsheet by clicking the link titled “Use Y-20 spreadsheet to calculate”. Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CH_4 calculated by the spreadsheet to this page in the box next to “Annual CH_4 emissions from blowdown systems (metric tons)”.

The Equation Y-20 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

The basis for the methane emission factor value is required. Select from:

- Company records
- Measurement data
- Process Knowledge/Engineering calculation
- Used default emission factor
- Other (specify)

Step 2b: Process Vent Method for Uncontrolled Blowdown Systems

The annual CH4 emissions from blowdown systems is required. The e-GGRT system provides links to optional worksheets that may be used to perform the calculations; use of the spreadsheet is entirely optional and is provided for your assistance. To calculate this value using the optional spreadsheet, download the spreadsheet by clicking the link titled “Use Y-19 spreadsheet to calculate”. Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CH4 calculated by the spreadsheet to this page in the box next to “Annual CH4 emissions from blowdown systems (metric tons)”.

The Equation Y-19 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Subpart Y collects the following data:

- Annual volumetric flow discharged to the atmosphere (scf)
- Method used to measure or estimate the annual volumetric flow rate:
    - Continuous or at least hourly measurements
    - Routine (less frequent than hourly but at least weekly) measurements
    - Periodic (less frequent than weekly) measurements
    - Process knowledge
    - Engineering calculation
    - Other (specify)
- Number of venting events for all relevant vents, if vent is intermittent (see note below)
- Cumulative venting time (hours)
- Annual average mole fraction of CH4 (decimal between 0 and 1)
- Method used to measure or estimate the mole fraction of CH4:
    - Engineering estimates/process knowledge
    - Direct measurement
    - Other (specify)

Note that number of venting events is not applicable for continuous venting in which case you may leave this field blank

Step 3: Save Your Data

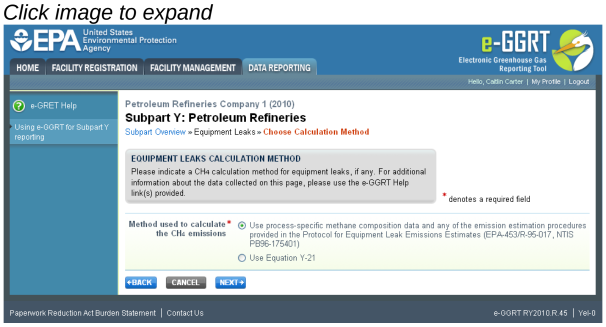
When you have finished entering Equation Y-20 results, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CH_4 emissions, rounded to the nearest 0.01 of a metric ton. The value displayed is for informational purposes only.

Updating Equipment Leaks

Petroleum Refineries must specify the method used to calculate the reported equipment leak emissions.

Click image to expand



Step 1: Select Estimation Method

Subpart Y requires you to specify the appropriate option regarding this facility's equipment leaks. Select from:

- Use process-specific methane composition data and any of the emission estimation procedures provided in the Protocol for Equipment Leak Emissions Estimates (EPA-453/R-95-017, NTIS PB96-175401)
- Use Equation Y-21

When you are finished, click NEXT.

Step 2a: Equation Y-21 Summary and Result

The annual CH_4 emissions from equipment leaks is required. The e-GGRT system provides links to optional worksheets that may be used to perform the calculations; use of the spreadsheet is entirely optional and is provided for your assistance. To calculate this value using the optional spreadsheet, download the spreadsheet by clicking the link titled “Use Y-21 spreadsheet to calculate”. Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CH_4 calculated by the spreadsheet to this page in the box next to “Annual CH_4 emissions from equipment leaks (metric tons).”

The Equation Y-21 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Step 2b: Process-specific Methane Composition Data Method Summary and Result

If the “Use process-specific methane composition data and any of the emission estimation procedures provided in the Protocol for Equipment Leak Emissions Estimates” option was selected then the following screen will display.

Click image to expand

Enter process-specific methane composition data (from measurement data or process knowledge) and any of the emission estimation procedures provided in the Protocol for Equipment Leak Emissions Estimates (EPA-453/R-95-017, NTIS PB96-175401).

Enter the following data:

- Cumulative CH_4 emissions for all equipment leak sources (metric tons)
- Cumulative number of catalytic cracking units, coking units (delayed or fluid), hydrocracking, and full-range distillation columns (including depropanizer and debutanizer distillation columns) at the facility
- Cumulative number of hydrotreating/hydrorefining units, catalytic reforming units, and visbreaking units at the facility
- Total number of hydrogen plants at the facility
- Total number of fuel gas systems at the facility
- Number of atmospheric crude oil distillation columns at the facility

Step 3: Save Your Data

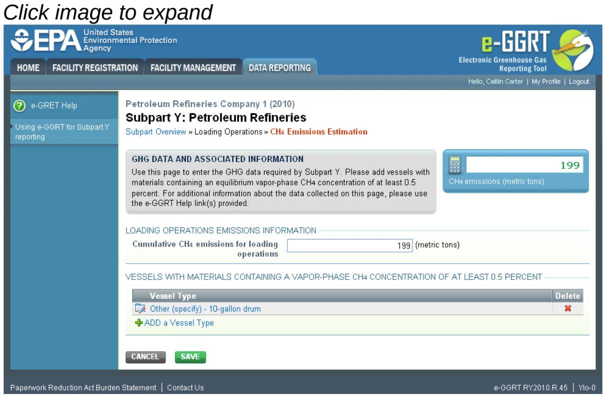
When you have finished entering the above data, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CH_4 emissions, rounded to the nearest 0.01 of a metric ton. The value displayed is for informational purposes only.

Updating Loading Operations

Petroleum Refineries must specify the cumulative annual methane emissions (in metric tons of each pollutant emitted) for loading operations.

Click image to expand



Step 1: Loading Operations Emissions Information

The cumulative CH_4 emissions for loading operations is required. Enter the value of CH_4 in the box next to “Cumulative CH_4 emissions for loading operations (metric tons)”.

Step 2: Vessels

Complete the applicable Vessels sections for vessels with materials containing a vapor-phase CH_4 concentration of at least 0.5 percent.

Click the link titled "ADD a Vessel Type".

Click image to expand

Specify the type of vessel:

- Ship or ocean-going vessel
- Railcar
- Tank truck
- Container
- Other (specify)

You may immediately enter materials containing a vapor-phase CH_4 concentration of at least 0.5 percent for this vessel now or whenever you edit an existing vessel (see Step 3: Materials). When you are finished, click SAVE.

Continue to add vessels until all vessel types with materials containing a vapor-phase CH_4 concentration of at least 0.5 percent are listed.

To edit an existing Vessel (e.g., to add, edit, or delete a material), click on the edit icon or the Name/ID link, which is the first column in the VESSELS SUMMARY table.

To delete an existing Vessel, click on the delete icon, which is the last column in the VESSELS SUMMARY table.

Step 3: Materials

Complete the applicable Materials section for each vessel.

Click the link titled "ADD a Material" while adding or editing a Vessel type.

Click image to expand

Specify the type of material:

- Unstabilized crude oil
- Stabilized crude oil
- Still gas or refinery fuel gas
- LPG (propane/butane)
- Ethylene
- Oxygenates
- Naphtha
- Gasoline or gasoline blending stocks other than oxygenates
- Other (specify)

Specify the control device used to reduce emissions from the loading of the material:

- Submerged loading or bottom filling only; no other control system
- Vapor balancing
- Thermal or catalytic incinerator/oxidizer
- Flare
- Carbon adsorber
- Condenser
- Oil scrubber
- None
- Other (specify)

When you are finished, click SAVE.

Continue to add materials for a specific vessel type until all materials containing a vapor-phase CH_4 concentration of at least 0.5 percent that are loaded in the specified vessel type are listed.

To edit an existing Material, click on the edit icon or the Name/ID link, which is the first column in the MATERIAL SUMMARY table.

To delete an existing Material, click on the delete icon, which is the last column in the MATERIAL SUMMARY table.
When you are finished, click SAVE.

Step 4: Save Your Data

When you have finished entering loading operations emissions and all vessel/material type combinations for materials containing a vapor-phase CH_4 concentration of at least 0.5 percent, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CH_4 emissions, rounded to the nearest 0.01 of a metric ton. The value displayed is for informational purposes only.

Updating Storage Tanks

Petroleum refineries must report annual CH_4 emissions from unstabilized crude oil storage and stored liquids other than unstabilized crude oil.

Step 1: Indicate receipt of unstabilized crude oil or stored liquids other than unstabilized crude oil

Subpart Y requires you to report whether or not your facility received and stored unstabilized crude oil during the reporting year by selecting one of the following two options:

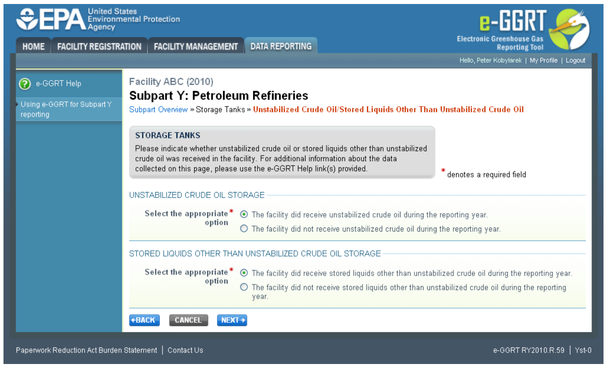
- “The facility did receive unstabilized crude oil during the reporting year.”
- “The facility did not receive any unstabilized crude oil during the reporting year.”

Subpart Y requires you to report whether or not your facility received and stored liquids other than unstabilized crude oil during the reporting year by selecting one of the following two options:

- “The facility did receive stored liquids other than unstabilized crude oil during the reporting year.”
- “The facility did not receive stored liquids other than unstabilized crude oil during the reporting year.”

When finished, click NEXT

Click image to expand



Step 2: Indicate emissions calculation methods (if applicable)

If the facility indicates use of “unstabilized crude oil” storage tanks, Subpart Y requires you to report:

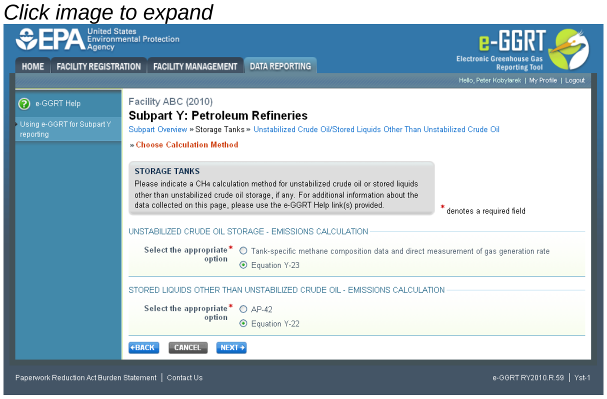
- The method used to calculate the reported storage tank emissions
  - Tank-specific methane composition data and direct measurement of gas generation rate
  - Equation Y-23

If the facility indicates use of “stored liquids other than unstabilized crude oil” storage tanks, Subpart Y requires you to report:

- The method used to calculate the reported storage tank emissions
  - AP-42
  - Equation Y-22

When finished, click NEXT

Click image to expand



Step 3: Enter emissions information and additional data

If the facility indicates use of “unstabilized crude oil” storage tanks, Subpart Y also requires you to report:

- The annual CH4 emissions from unstabilized crude oil storage (from tank-specific methane composition data and direct measurement of gas generation rate or the output of Equation Y-23, in metric tons)
- The basis for the average mole fraction of CH4 in vent gas
  - Equation Y-23 default
  - Measurement data
  - Product knowledge
  - Other (specify)
- If the facility indicates use of “unstabilized crude oil” storage tanks AND if the facility selected the ‘tank-specific methane composition data’ method, the system shall require the facility to report:
  - The method used to measure tank-specific methane composition in the vapor
    - Measurement data
    - Product knowledge
    - Other (specify)
    - If measured, the number of hours missing data procedures were used
  - The method used to measure the gas generation rate
    - Procedures specified by flow meter manufacturer
    - Method published by a consensus-based standards organization
  - If measured, number of hours missing data procedures were used to measure the gas generation rate

For assistance in calculating process CH4 emissions from unstabilized crude oil storage using Equation Y-23, access the optional calculation spreadsheet by clicking the link located below the red emissions entry box titled “Use Y-23 spreadsheet to calculate” and follow the provided instructions.

If the facility indicates use of “stored liquids other than unstabilized crude oil” storage tanks, Subpart Y also requires you to report:

- The annual CH_4 emissions from stored liquids other than unstabilized crude oil (the output of AP-42 or Equation Y-22, in metric tons)

For assistance in calculating process CH_4 emissions from stored liquids other than unstabilized crude oil using Equation Y-22, access the optional calculation spreadsheet by clicking the link located below the red emissions entry box titled “Use Y-22 spreadsheet to calculate” and follow the provided instructions.

Step 4: Save Your Data

When you have finished entering all storage tank emissions information and additional data, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CH_4 emissions for stored liquids other than unstabilized crude oil and unstabilized crude oil storage, rounded to the nearest 0.01 of a metric ton. The value displayed is for informational purposes only.

Click image to expand

Updating Sour Gas Sent Off-Site

Petroleum refineries must report annual CO_2 emissions from sour gas sent off-site.

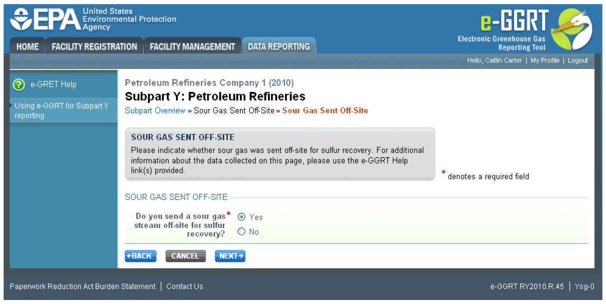
Step 1: Indicate if sour gas stream is off-site for sulfur recovery

Subpart Y requires you to report whether or not your facility sent a sour gas stream off-site for sulfur recovery during the reporting year by selecting one of the following two options:

- Yes
- No

When finished, click NEXT

Click image to expand



Step 2: Enter emissions information and additional data (if applicable)

If the facility indicates that a sour gas stream was sent off-site for sulfur recovery during the reporting year, Subpart Y requires you to report:

- The annual CO_2 emissions from sour gas sent off-site (the output of Equation Y-12, in metric tons)
- If measured, specific consensus-based standard method or describe the procedure specified by the flow meter manufacturer used to measure annual volume of sour gas fed (from the facility to the off-site sulfur recovery plant)
- If measured, the number of hours missing data procedures were used for annual volume of sour gas fed (from the facility to the off-site sulfur recovery plant)
- If measured, the method used to measure the annual average mole fraction of carbon in the sour gas:
  - Method 18 at 40 CFR part 60, appendix A-6
  - ASTM D1945-03
  - ASTM D1946-90 (Reapproved 2006)
  - GPA 2261-00
  - UOP539-97
  - ASTM D2503-92 (Reapproved 2007)
  - Chromatographic analysis: manufacturer's instructions
  - Other (specify)
- If measured, the number of hours missing data procedures were used for annual average mole fraction of carbon in the sour gas

For assistance in calculating process CH_4 emissions from sour gas sent off-site using Equation Y-12, access the optional calculation spreadsheet by clicking the link located below the red emissions entry box titled "Use Y-12 spreadsheet to calculate" and follow the provided instructions.

Step 3: Save Your Data

When you have finished entering all sour gas emissions information and additional data, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CO_2 emissions for sour gas sent off-site, rounded to the nearest 0.1 of a metric ton. The value displayed is for informational purposes only.

Click image to expand

Updating Delayed Coking

Petroleum refineries must report the cumulative CH_4 emissions from all delayed coking units at the facility.

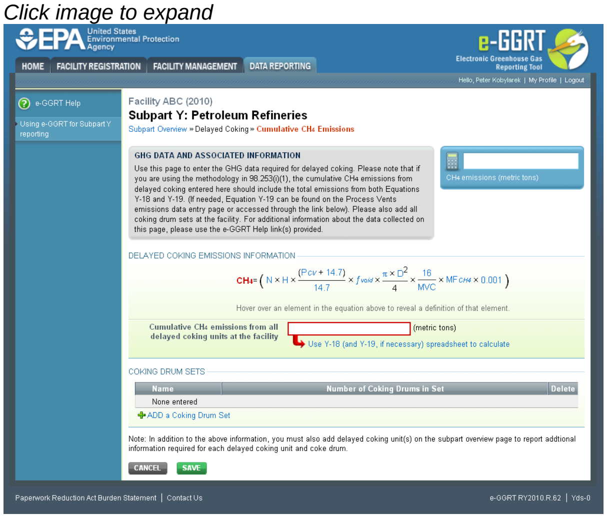
> Data reporting for delayed coking is not limited to this section. Data for delayed coking processes must be entered in BOTH the "Facility-Level Emissions Summary" section of Subpart Y and the "Delayed Coking Units" section of Subpart Y.

Step 1: Enter emission information and additional data

Subpart Y requires you to report:

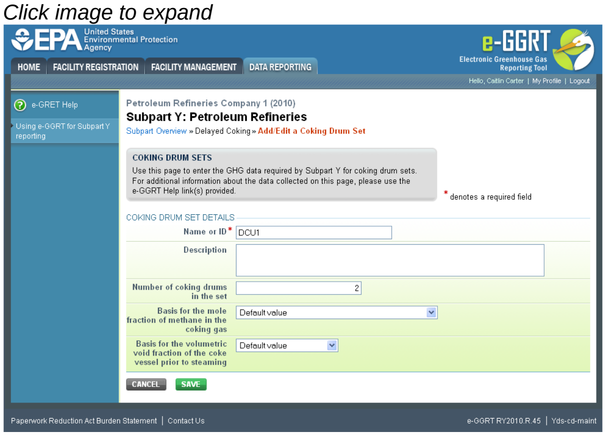
- The cumulative CH_4 emissions from all delayed coking units at the facility
- For each coking drum set at your facility, Subpart Y also requires you to report
  - A unique unit name or identifier and an optional description or label (see also About Unique Unit Names)
  - The number of coking drums in the set
  - The basis for the mole fraction of methane in the coking gas
  - The basis for the volumetric void fraction of the coke vessel prior to steaming

Click image to expand



To add a coking drum set, click the link titled "ADD a Coking Drum Set" below the COKING DRUM SETS table, enter the required information, then click SAVE. Repeat for each coking drum set at your facility.

Click image to expand

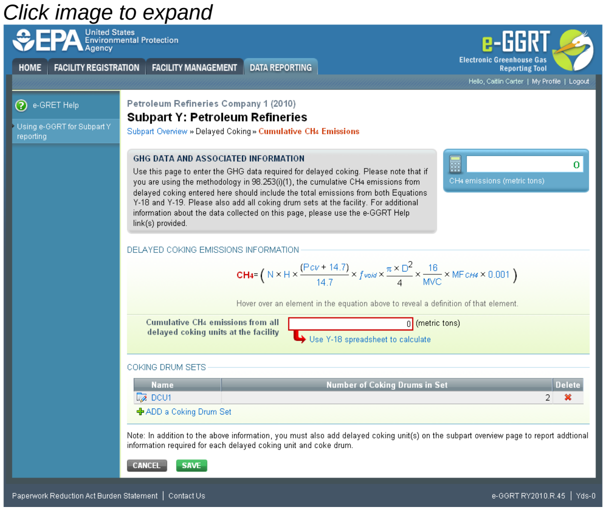


Step 2: Save Your Data

When you have finished entering all delayed coking unit emissions information and additional data, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the cumulative CH_4 emissions from all delayed coking units at the facility, rounded to the nearest 0.01 of a metric ton. The value displayed is for informational purposes only.

Click image to expand



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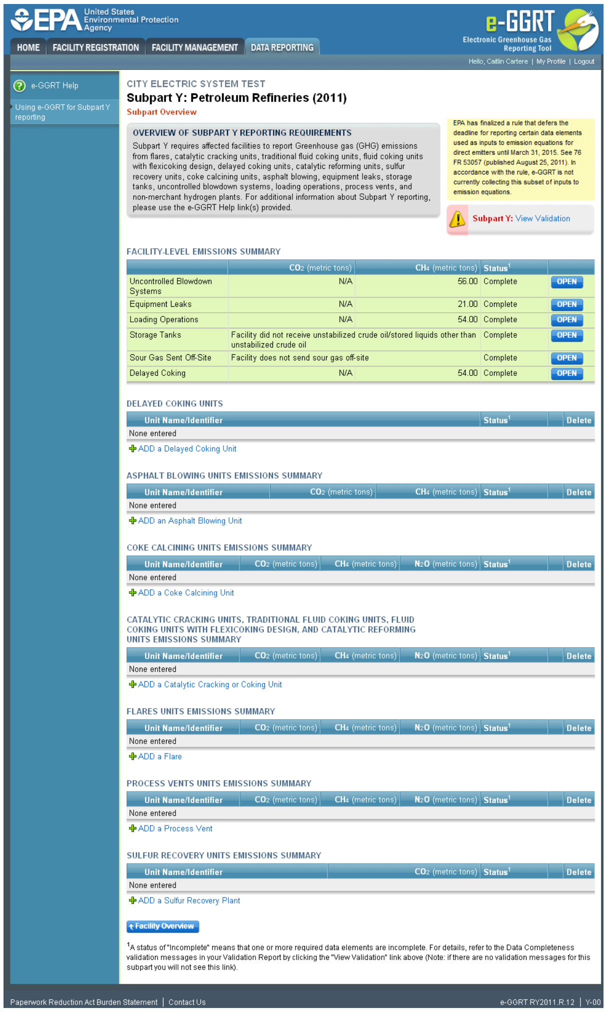
Subpart Y Delayed Coking Unit Information

This topic provides a step-by-step description of how to enter Subpart Y Delayed Coking unit information about this facility.

> Data reporting for delayed coking is not limited to this section. Data for delayed coking processes must be entered in BOTH the "Facility-Level Emissions Summary" section of Subpart Y and the "Delayed Coking Units" section of Subpart Y.

Click image to expand



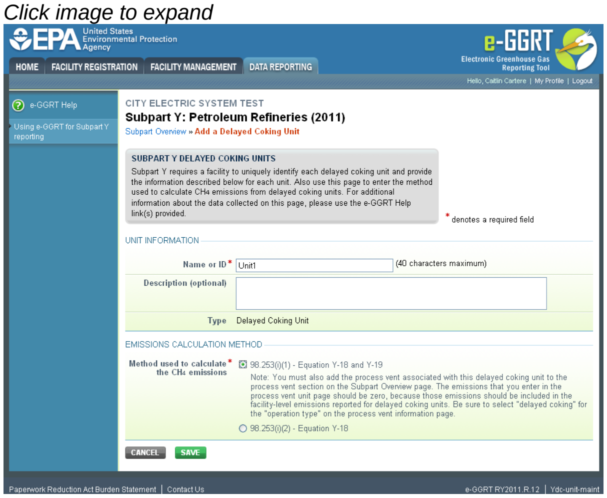
Adding or Updating Delayed Coking Unit Information

To add or update Subpart Y Delayed Coking Unit Information for this Facility, click the link titled "ADD a Delayed Coking Unit" below the DELAYED COKING UNITS table on the Subpart Y Overview page.

To edit an existing Delayed Coking Unit, click on the edit icon or the Name/ID link in the first column in the DELAYED COKING UNITS table.

To delete an existing Delayed Coking Unit, click on the delete icon in the last column in the DELAYED COKING UNITS table.

Click image to expand



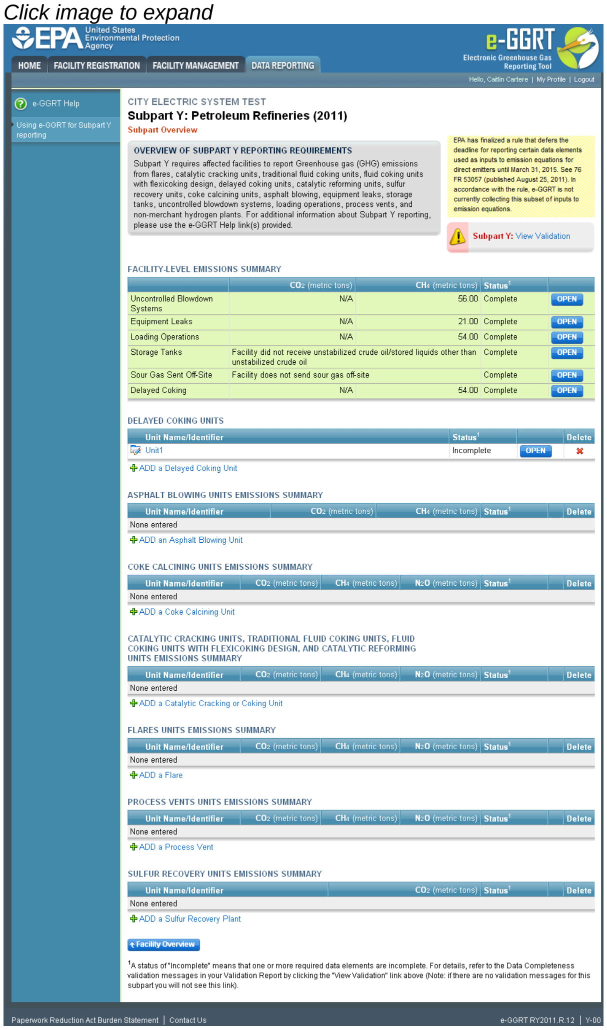
Subpart Y requires you to report the following data for each delayed coking unit at your facility:

- A unique name or identifier, plus optional description. See also About Unique Unit Names
- Method used to calculate the CH_4 emissions:
  - 98.253(i)(1) - Equation Y-18 and Y-19, or
  - 98.253(i)(2) - Equation Y-18

Note: If you select **98.253(i)(1) - Equation Y-18 and Y-19**, you must also add the process vent associated with this delayed coking unit to the process vent section on the Subpart Overview page. The emissions that you enter in the process vent unit page should be zero, because those emissions should be included in the facility-level emissions reported for delayed coking units. Be sure to select "delayed coking" for the "operation type" on the process vent information page. Click this link to access instructions for entering Subpart Y Process Vents Unit Information

When you are finished entering the required information, click SAVE.

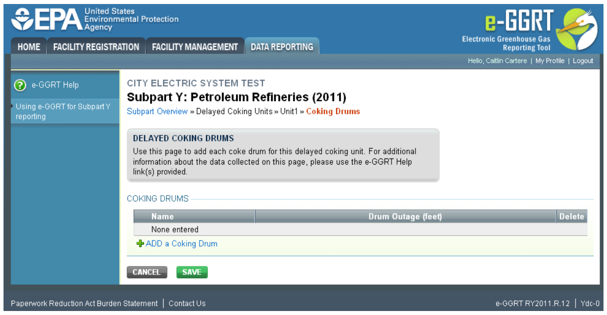
Click image to expand



Adding or Updating Coking Drum Information

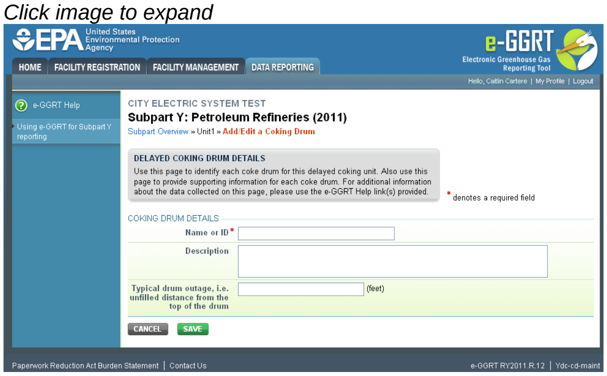
To add or update Coking Drum Information for a delayed coking unit, locate the unit in the DELAYED COKING UNITS table on the Subpart Y Overview page, and click OPEN.

Click image to expand



To add a Coking Drum for a delayed coking unit, click the link labeled "ADD a Coking Drum".

Click image to expand

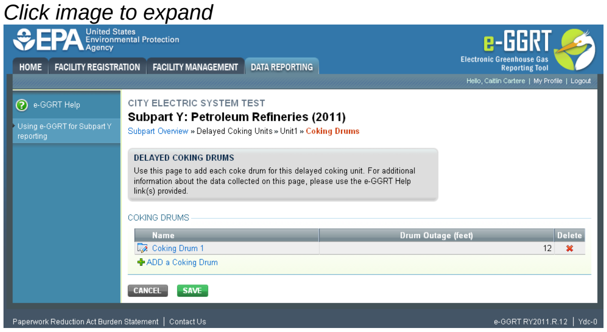


Subpart Y requires you to report the following data for each coking drum at your facility:

- A unique name or identifier, plus optional description. See also About Unique Unit Names
- Typical drum outage in feet (i.e. unfilled distance from the top of the drum)

When you are finished entering the required information, click SAVE.

Click image to expand



Repeat this step until you have entered information for all coking drums for this delayed coking unit.

When finished, click SAVE.

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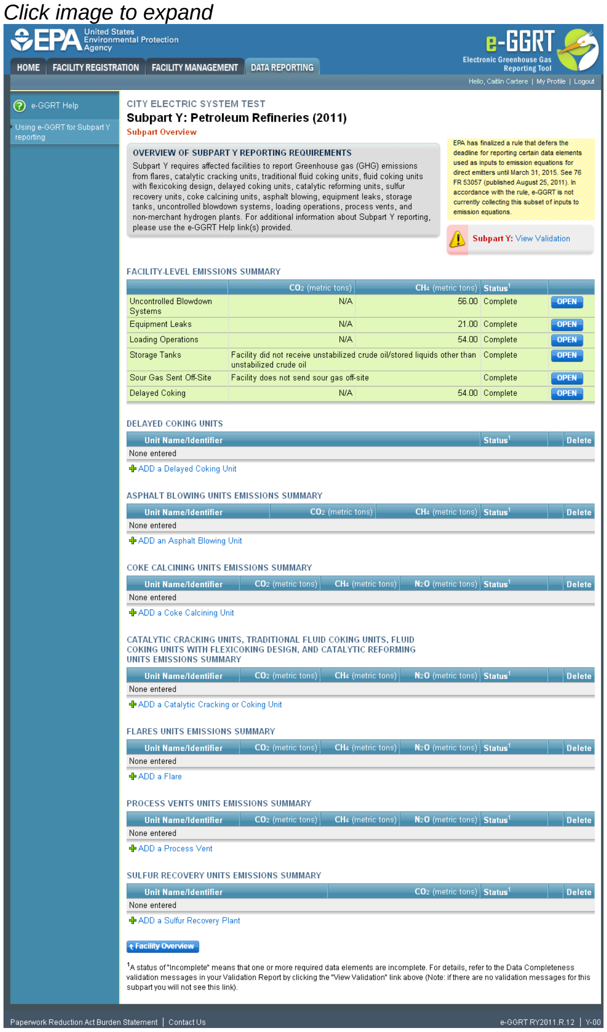
Subpart Y Asphalt Blowing Unit Information

This topic provides a step-by-step description of how to enter Subpart Y Asphalt Blowing unit information about this facility

Click image to expand



Adding or Updating Asphalt Blowing Information

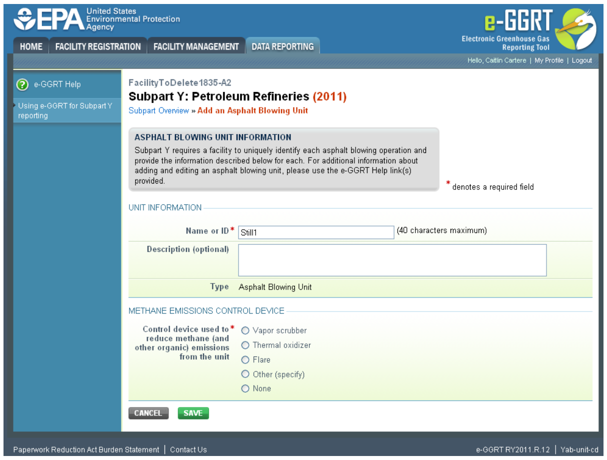
To add or update Subpart Y Asphalt Blowing Information for this Facility, locate the ASPHALT BLOWING UNIT-LEVEL EMISSIONS SUMMARY table on the Subpart Y Overview page.

Click the link titled "ADD an Asphalt Blowing Unit."

To edit an existing Asphalt Blowing Unit, click on the edit icon or the Name/ID link, which is the first column in the ASPHALT BLOWING UNIT-LEVEL EMISSIONS SUMMARY table.

To delete an existing Asphalt Blowing Unit, click on the delete icon, which is the last column in the ASPHALT BLOWING UNIT-LEVEL EMISSIONS SUMMARY table.

Click image to expand



Subpart Y requires you to report the following data about your asphalt blowing operations:

- A unique name or identifier, plus optional description for this asphalt blowing unit. See also About Unique Unit Names.
- Specify the control device used to reduce methane (and other organic) emissions from the unit. Select from Vapor scrubber, Thermal oxidizer, Flare, Other (specify), or None.

When you are finished, click SAVE.

If you selected Thermal oxidizer, Flare, or Other, an additional question will appear requiring you to select a CO_2 AND CH_4 EMISSIONS CALCULATION METHOD. The system requires you to select the method used to calculate the CO_2 and CH_4 emissions for your asphalt blowing operations from the following list:

- Equations Y-14 and Y-15 (appears only if Other was selected)
- Equations Y-16a and Y-17
- Equations Y-16b and Y-17
- Equation Y-19 (Process Vent)

When you are finished, click SAVE.

> Note: if you selected Vapor scrubber or None as the asphalt blowing operations control device, you must use Equations Y-14 and Y-15 or Y-19 (Process Vent).

The emissions entry screen presented will be dependent on the type of control device selected and, if necessary, the calculation method selected.

Adding or Updating Asphalt Blowing Emissions Information

Step 1: Asphalt Blowing Operations Emissions Summary and Result

If Equation Y-14 and Y-15 is required or chosen, then you will be prompted with the Equation Y-14/Y-15 Summary and Result page.

If Equation Y-16a is chosen then you will be prompted with the Equation Y-16a/Y-17 Summary and Result page.

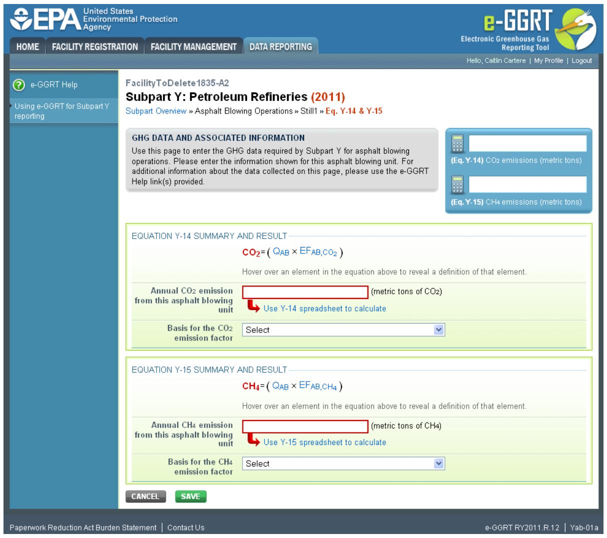
If Equation Y-16b is chosen then you will be prompted with the Equation Y-16b/Y-17 Summary and Result page.

If Equation Y-19 (Process Vent) is chosen then you will be prompted with the Equation Y-19 (Process Vent) Summary and Result page.

Data entry instructions for each of these pages follow:

Step 1a: Equation Y-14/Y-15 Summary and Result

Click image to expand



The annual CO_2 and CH_4 emissions from asphalt blowing operations are required. To calculate this value download the appropriate spreadsheet by clicking the link titled “Use Y-14 spreadsheet to calculate” for CO_2 or “Use Y-15 spreadsheet to calculate” for CH_4. Fill in the spreadsheet using the instructions in the spreadsheet. After completing each respective spreadsheet, copy the values of CO_2 and CH_4 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this asphalt blowing unit (metric tons)” or “Annual CH_4 emission from this asphalt blowing unit (metric tons),” as appropriate.

The Equation Y-14/Y-15 Summaries are presented on the page. You can hover over an element in the equation to reveal a definition of that element.

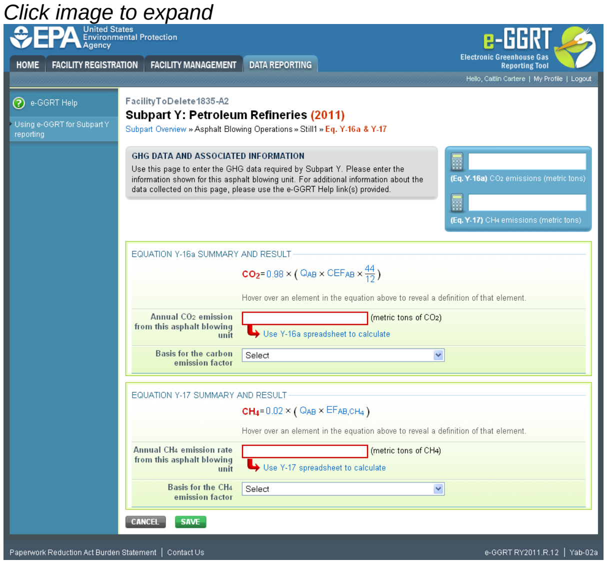
Both the CO_2 and CH_4 emission factors require a basis:

- Used default emission factor
- Weekly or more frequent measurements
- Periodic (less frequent than weekly) measurements
- Average of multiple source tests
- One-time source test
- Other (specify)

Note: if you selected Vapor scrubber or None as the asphalt blowing operations control device, you must use Equations Y-14 and Y-15 or Y-19 (Process Vent).

Step 1b: Equation Y-16a / Y-17 Summary and Result

Click image to expand



The annual CO_2 and CH_4 emissions from asphalt blowing operations are required. To calculate this value download the appropriate spreadsheet by clicking the link titled “Use Y-16a spreadsheet to calculate” for CO_2 or “Use Y-17 spreadsheet to calculate” for CH_4. Fill in the spreadsheet using the instructions in the spreadsheet. After completing each respective spreadsheet, copy the values of CO_2 and CH_4 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this asphalt blowing unit (metric tons)” or “Annual CH_4 emission from this asphalt blowing unit (metric tons),” as appropriate.

The Equation Y-16a/Y-17 Summaries are presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Both the CO_2 and CH_4 emission factors require a basis:

- Used default emission factor
- Weekly or more frequent measurements
- Periodic (less frequent than weekly) measurements
- Average of multiple source tests
- One-time source test
- Other (specify)

Step 1c: Equation Y-16b/Y-17 Summary and Result

Click image to expand

The annual CO_2 and CH_4 emissions from asphalt blowing operations are required. To calculate this value download the appropriate spreadsheet by clicking the link titled “Use Y-16b spreadsheet to calculate” for CO_2 or “Use Y-17 spreadsheet to calculate” for CH_4. Fill in the spreadsheet using the instructions in the spreadsheet. After completing each respective spreadsheet, copy the value of CO_2 and CH_4 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this asphalt blowing unit (metric tons)” or “Annual CH_4 emission from this asphalt blowing unit (metric tons),” as appropriate.

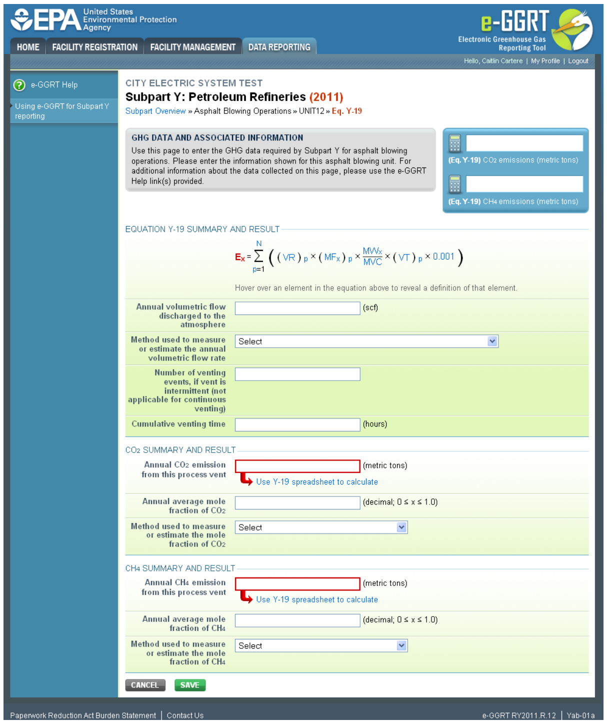
The Equation Y-16b/Y-17 Summaries are presented on the page. You can hover over an element in the equation to reveal a definition of that element.

The CO_2, carbon, and CH_4 emission factors require a basis:

- Used default emission factor
- Weekly or more frequent measurements
- Periodic (less frequent than weekly) measurements
- Average of multiple source tests
- One-time source test
- Other (specify)

Step 1d: Equation Y-19 (Process Vent) Summary and Result

Click image to expand



The annual CO_2 and CH_4 emissions from asphalt blowing operations are required. To calculate this value download the appropriate spreadsheet by clicking the link titled “Use Y-19 spreadsheet to calculate”. Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the values of CO_2 and CH_4 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this process vent (metric tons)" or “Annual CH_4 emission from this process vent (metric tons)" as appropriate.

The Equation Y-19 (Process Vent) Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Subpart Y collects the following data about your asphalt blowing unit process vent:

- Annual volumetric flow discharged to the atmosphere (scf)
- Method used to measure or estimate the annual volumetric flow rate:
  - Continuous or at least hourly measurements
  - Routine (less frequent than hourly but at least weekly) measurements
  - Periodic (less frequent than weekly) measurements
  - Process knowledge
  - Engineering calculation
  - Other (specify)
- Number of venting events, if vent is intermittent (see note below)
- Cumulative venting time (hours)
- Annual average mole fraction of CO2
- Method used to measure or estimate the annual average mole fraction of CO2:
  - Engineering estimates/process knowledge
  - Direct measurement
  - Other (specify)
- Annual average mole fraction of CH4
- Method used to measure or estimate the annual average mole fraction of CH4:
  - Engineering estimates/process knowledge
  - Direct measurement
  - Other (specify)

> Note that number of venting events is not applicable for continuous venting in which case you may leave this field blank.

Step 2: Save Your Data

When you have finished entering Asphalt Blowing Operations Emissions Summary and Result, click SAVE.

After you save the data on this page, the next time you open the page, the calculators on the top of the page will display the CO_2 and CH_4 emissions, rounded to the nearest 0.1 and 0.01 of a metric ton, respectively. The values displayed are for informational purposes only.

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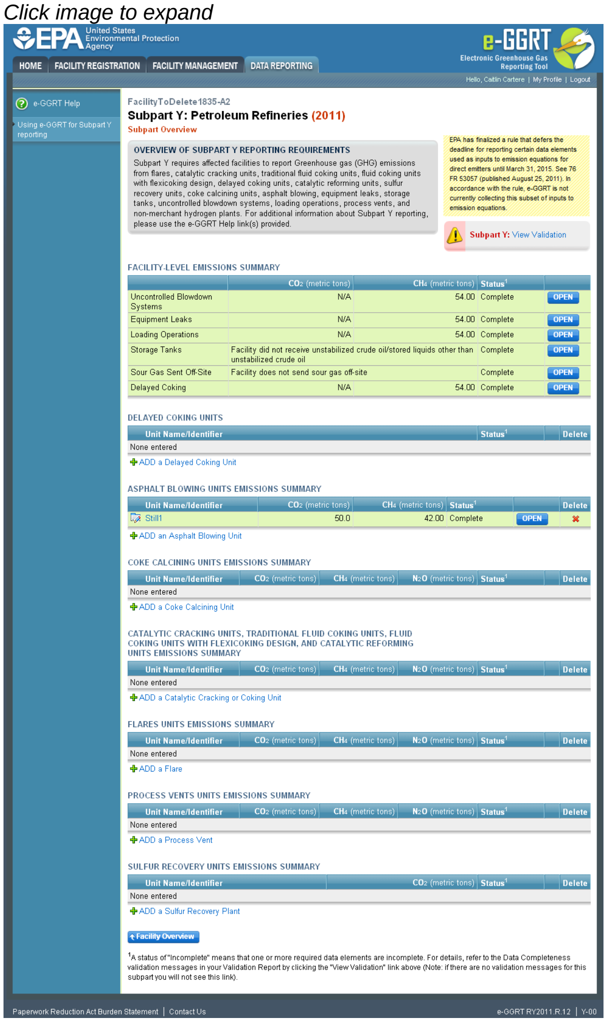
Subpart Y Coke Calcining Unit Information

This topic provides a step-by-step description of how to enter Subpart Y Coke Calcining unit information about this facility.

Click image to expand



Adding or Updating Coke Calcining Unit Information

To add or update Subpart Y Coke Calcining Unit Information for this Facility, locate the COKE CALCINING UNIT-LEVEL EMISSIONS SUMMARY table on the Subpart Y Overview page.

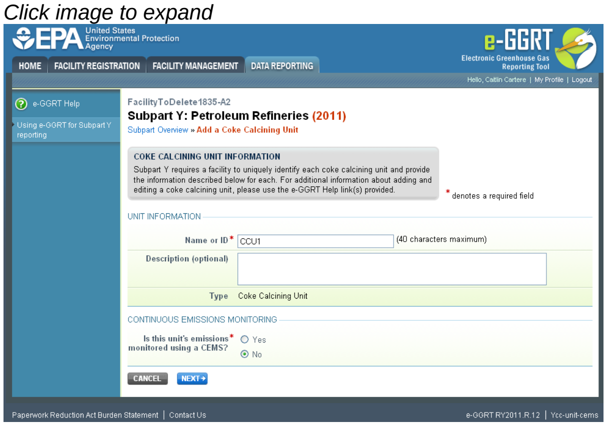
Click the link titled "ADD a Coke Calcining Unit."

To edit an existing Coke Calcining Unit, click on the edit icon or the Name/ID link, which is the first column in the COKE CALCINING UNIT-LEVEL

EMISSIONS SUMMARY table.

To delete an existing Coke Calcining Unit, click on the delete icon, which is the last column in the COKE CALCINING UNIT-LEVEL EMISSIONS SUMMARY table.

Click image to expand



Subpart Y requires you to report the following data about your coke calcining unit:

- A unique name or identifier, plus optional description for this coke calcining unit. See also About Unique Unit Names
- For each unit, answer the following question: “Do you operate and maintain a Continuous Emissions Monitoring System (CEMS) that measures CO_2 emissions according to subpart C? This means you have both a flow meter and a concentration monitor installed. If so, you must use the CEMS methodology. Click either Yes or No.

When you are finished, click NEXT.

If you selected Yes for using a CEMS, Subpart Y collects the maximum rated throughput of the coke calcining unit (metric tons coke calcined per stream day)

Click image to expand

If you select No for using a CEMS, Subpart Y collects the following data about your coke calcining unit:

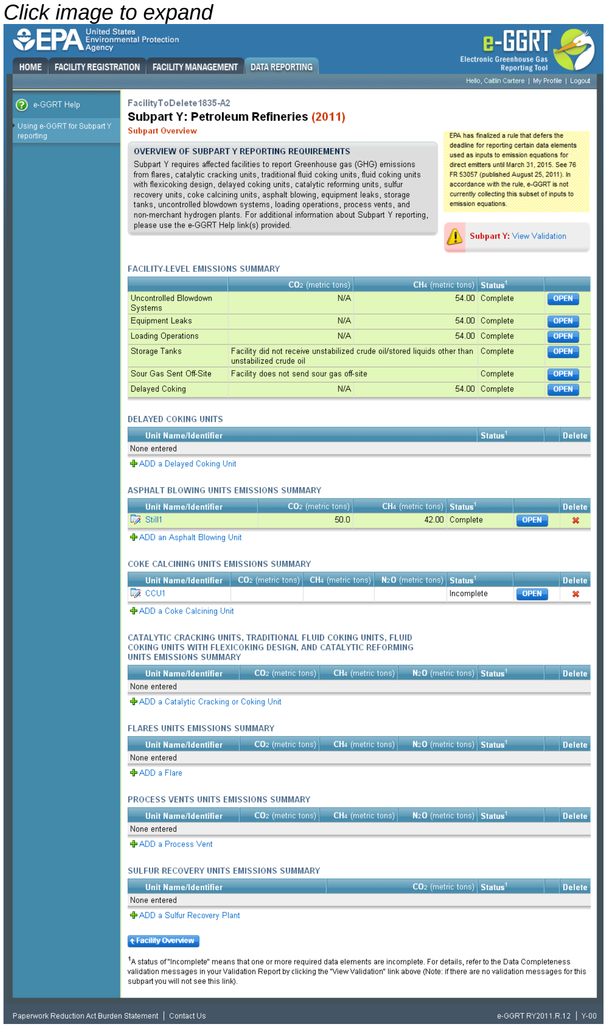
- Maximum rated throughput of the coke calcining unit (metric tons coke calcined per stream day)
- Method used to calculate the CH_4 emissions:
  - Equation Y-9
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit
- Method used to calculate the N_2O emissions:
  - Equation Y-10
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit

When you are finished, click SAVE.

Adding or Updating Coke Calcining Emissions Information

The following provides a step-by-step description of how to enter Subpart Y Coke Calcining emissions information.

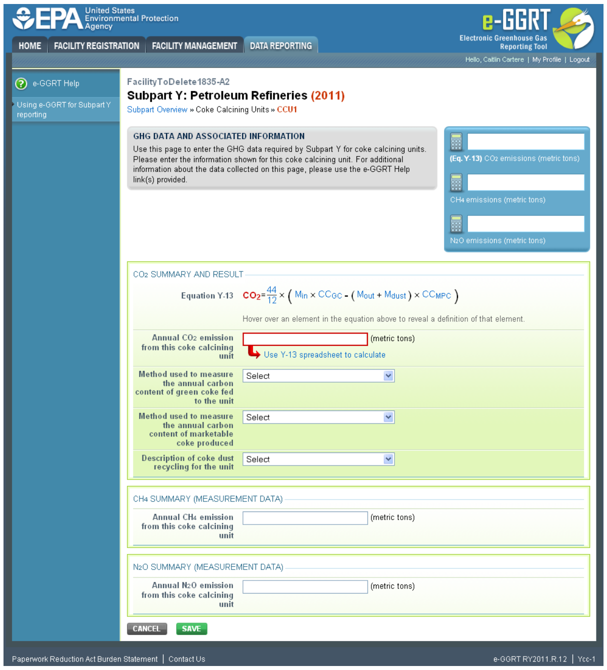
Click image to expand



To add or update CO_2 emissions information for a coke calcining unit that is monitored by CEMS, please refer to the Subpart Y Emissions Information for Process Units Monitored by CEMS help page (*CH_4 and N_2O emissions information for coke calcining units that are monitored by CEMS are reported separately per the instructions below*).

To add or update CO_2, CH_4, and N_2O emissions information for a coke calcining unit that is NOT monitored by CEMS **OR** CH_4 and N_2O emissions information for a coke calcining unit that is monitored by CEMS, locate the COKE CALCINING UNIT-LEVEL EMISSION SUMMARY table on the Subpart Y Overview page, and click OPEN.

Click image to expand



Step 1. CO_2 Emissions: Equation Y-13 Summary and Result (for Units NOT Monitored by CEMS)

Step 1 does not apply to units monitored by CEMS. If you are reporting for a unit monitored by CEMS, please skip to Step 2a.

The annual CO_2 emissions from coke calcining operations is required. To calculate this value download the spreadsheet by clicking the link titled "Use Y-13 spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing each respective spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to "Annual CO_2 emission from this coke calcining unit (metric tons)."

The Equation Y-13 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Subpart Y requires the following additional data:

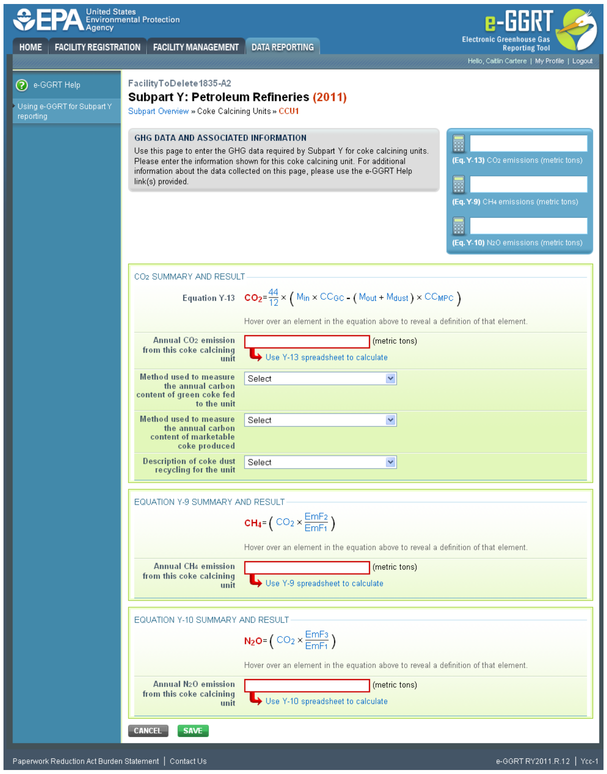
- Method used to measure the annual carbon content of green coke fed to the unit:
  - ASTM D3176-89-Reapproved 2002
  - ASTM D5291-02-Reapproved 2007
  - ASTM D5373-08
  - Other (specify)
- Method used to measure the annual carbon content of marketable coke produced:
  - ASTM D3176-89-Reapproved 2002
  - ASTM D5291-02-Reapproved 2007
  - ASTM D5373-08.
  - Other (specify)
- Description of coke dust recycling for the unit:
  - All dust is recycled
  - A portion of the dust is recycled
  - None of the dust is recycled

Step 2. CH_4 and N_2O Emissions

Depending on the method selected to calculate the CH_4 and N_2O emissions for coke calcining units, some combination of the screens presented below (Steps 2a, 2b and 2c) will collect CH_4 and N_2O emissions.

Step 2a: Equation Y-9/Y-10 Summary and Result

Click image to expand

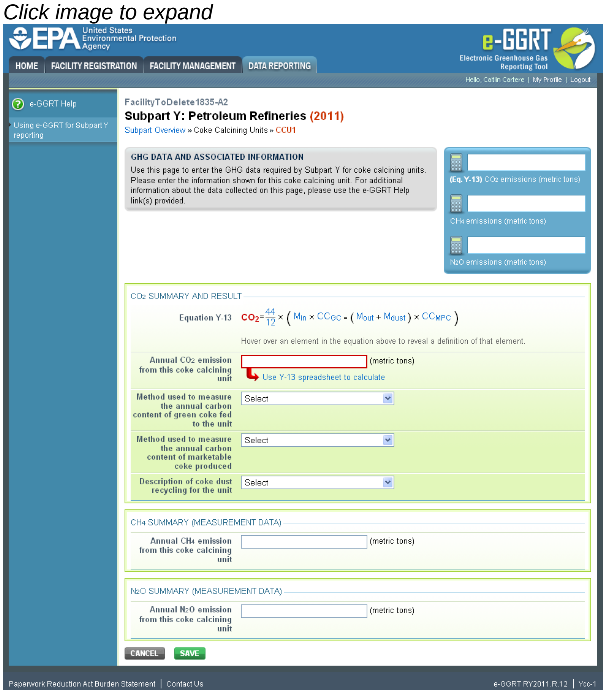


The annual CH_4 and N_2O emissions from coke calcining operations are required. To calculate these values download the appropriate spreadsheet by clicking the link titled “Use Y-9 spreadsheet to calculate” for CH_4 or “Use Y-10 spreadsheet to calculate” for N_2O. Fill in the spreadsheet using the instructions in the spreadsheet. After completing each respective spreadsheet, copy the value of CH_4 and N_2O calculated by the spreadsheet to this page in the box next to “Annual CH_4 emission from this coke calcining unit (metric tons)” or “Annual N_2O emission from this coke calcining unit (metric tons),” as appropriate.

The Equation Y-9/Y-10 Summaries are presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Step 2b: Unit-specific Measurement Result

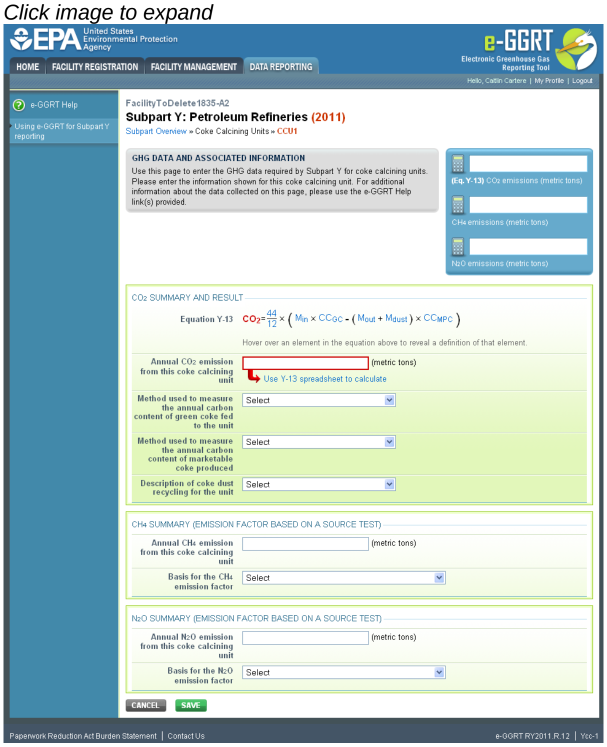
Click image to expand



The annual CH_4 and N_2O emissions from coke calcining operations are required. Enter the value of CH_4 and N_2O in this page in the box next to “Annual CH_4 emission from this coke calcining unit (metric tons)” or “Annual N_2O emission from this coke calcining unit (metric tons),” as appropriate.

Step 2c: Unit-specific Emission Factor Based on a Source Test Result

Click image to expand



The annual CH_4 and N_2O emissions from coke calcining operations are required. Enter the value of CH_4 and N_2O in this page in the box next to “Annual CH_4 emission from this coke calcining unit (metric tons)” or “Annual N_2O emission from this coke calcining unit (metric tons),” as appropriate.

Both CH_4 and N_2O emissions include the basis for the emission factor:

- Weekly or more frequent measurements
- Periodic (less frequent than weekly) measurements
- Average of multiple source tests
- One-time source test
- Other (specify)

Step 3: Save Your Data

When you have finished entering emission results, click SAVE.

After you save the data on this page, the next time you open the page, the calculators on the top of the page will display the CO_2, CH_4 and N_2O emissions, rounded to the nearest 0.1, 0.01, and 0.001 of a metric ton, respectively. The value displayed is for informational purposes only.

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See Also

Screen Errors
Using e-GGRT to Prepare Your Subpart Y Report
Subpart Y Summary Information for this Facility
Subpart Y Delayed Coking Unit Information
Subpart Y Asphalt Blowing Unit Information
Subpart Y Coke Calcining Unit Information
Subpart Y Catalytic Cracking, Fluid Coking, and Catalytic Reforming Unit Information
Subpart Y Flares Unit Information
Subpart Y Process Vents Unit Information

Subpart Y Catalytic Cracking, Fluid Coking, and Catalytic Reforming Unit Information

This page provides a step-by-step description of how to enter Subpart Y Catalytic Cracking, Fluid Coking, or Catalytic Reforming unit information about this facility.

Adding or Updating Catalytic Cracking, Fluid Coking, or Catalytic Reforming Unit Information

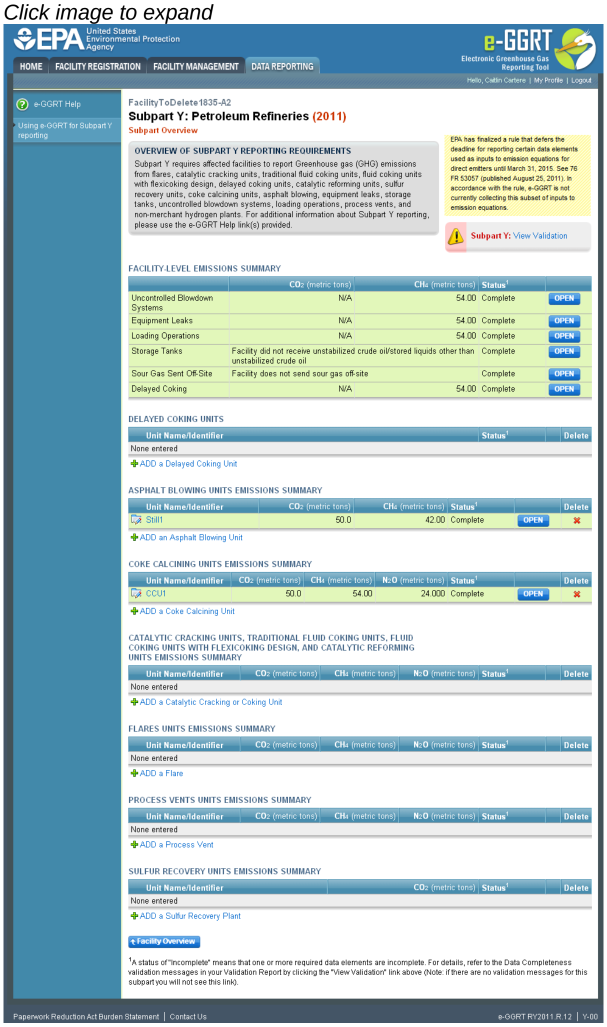
To add or update Subpart Y Catalytic Cracking, Fluid Coking, or Catalytic Reforming unit information for this Facility, locate the CATALYTIC CRACKING UNITS, TRADITIONAL FLUID COKING UNITS, FLUID COKING UNITS WITH FLEXICOKING DESIGN, AND CATALYTIC REFORMING UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page.

Click the link titled "ADD a Catalytic Cracking or Coking Unit."

To edit an existing Catalytic Cracking, Fluid Coking, or Catalytic Reforming Unit, click on the edit icon or the Name/ID link, which is the first column in the CATALYTIC CRACKING UNITS, TRADITIONAL FLUID COKING UNITS, FLUID COKING UNITS WITH FLEXICOKING DESIGN, AND CATALYTIC REFORMING UNITS EMISSIONS SUMMARY table.

To delete an existing Catalytic Cracking, Fluid Coking, or Catalytic Reforming Unit, click on the delete icon, which is the last column in the CATALYTIC CRACKING UNITS, TRADITIONAL FLUID COKING UNITS, FLUID COKING UNITS WITH FLEXICOKING DESIGN, AND CATALYTIC REFORMING UNITS EMISSIONS SUMMARY table.

Click image to expand



Subpart Y collects the following data about your Catalytic Cracking, Fluid Coking, or Catalytic Reforming unit:

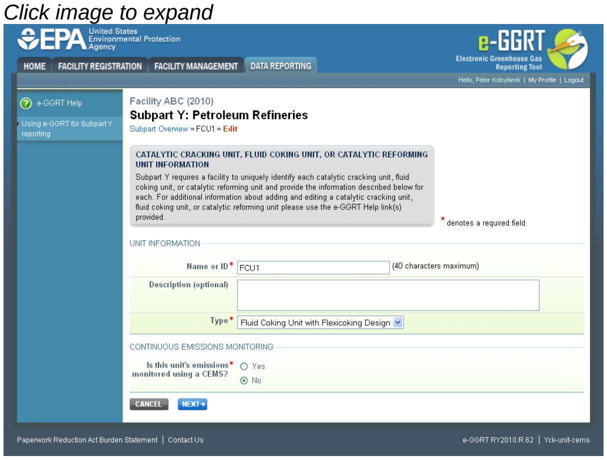
- A unique name or identifier, plus optional description for this unit (see also About Unique Unit Names)
- Specify the type of unit:
  - Fluid Catalytic Cracking Unit
  - Thermal Catalytic Cracking Unit
  - Traditional Fluid Coking Unit
  - Catalytic Reforming Unit
  - Fluid Coking Unit with Flexicoking Design (see note below)
- For each unit, answer the following question: Do you operate and maintain a CEMS that measures CO_2 emissions according to subpart C? This means that both a flow meter and a concentration monitor need to be installed. If so, you must use the CEMS methodology for measuring CO_2 emissions from this unit. Click either Yes or No.

For Fluid Coking Units with Flexicoking Design, you will be asked if the GHG emissions from the low heat value gas are accounted for in Subpart C.

- If your answer to this question is 'yes', you are only required to report maximum rated throughput of the fluid coking unit with flexicoking design
- If your answer to this question is 'no', you are required to report maximum rated throughput of the fluid coking unit with flexicoking design and the methods used to calculate emissions per the sections below

When you are finished entering the required information, click NEXT.

Click image to expand



For Catalytic Cracking or Coking units that are NOT monitored by CEMS, Subpart Y also collects the following data:

- Maximum rated throughput of the unit (bbl per stream day)
- Method used to calculate CO_2 emissions (only appears if you select No for using a CEMS):
  - 98.253(c)(2) - Equation Y-6 and continuous monitor for flow (but not meeting the CEMS monitoring requirements of 98.253(c)(1); e.g., not meeting the full CEMS quality assurance requirements)
  - 98.253(c)(2) - Equation Y-6 and Y-7a
  - 98.253(c)(2) - Equation Y-6 and Y-7b
  - 98.253(c)(3) - Equation Y-8 (option appears only for Catalytic Cracking or Coking units; available only for catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day (bbls/sd) or less that do not use a continuous CO_2 CEMS for the final exhaust stack)
  - 98.253(e)(3) - Equation Y-11 (option appears only for Catalytic Reforming units)
- Method used to calculate CH_4 emissions:
  - Equation Y-9
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit
- Method used to calculate N_2O emissions:
  - Equation Y-10
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit

When you are finished entering the required information, click SAVE.

Click image to expand

For Catalytic Cracking or Coking units that are monitored by CEMS, Subpart Y also collects the following data:

- Maximum rated throughput of the unit (bbl per stream day)
- Method used to calculate CH_4 emissions:
  - Equation Y-9
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit
- Method used to calculate N_2O emissions:
  - Equation Y-10
  - Unit-specific measurement data
  - A unit-specific emission factor based on a source test of the unit

When you are finished entering the required information, click SAVE.

Adding or Updating Catalytic Cracking or Coking Unit Emissions Information

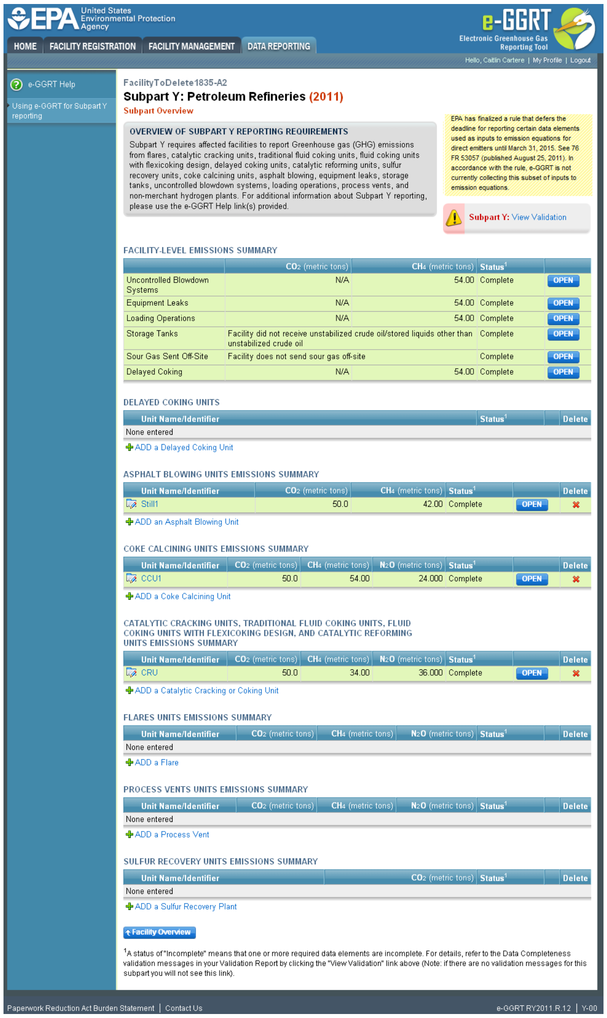
This section provides a step-by-step description of how to enter Subpart Y Catalytic Cracking or Coking unit emissions information.

To add or update **CO_2** emissions information for a catalytic cracking or coking unit that is monitored by CEMS, please refer to the Subpart Y Emissions Information for Process Units Monitored by CEMS help page. **CH_4 and N_2O** emissions information for catalytic cracking or coking units that are monitored by CEMS are reported separately per the instructions below.

To add or update CO_2, CH_4, and N_2O emissions information for a catalytic cracking or coking unit that is NOT monitored by CEMS **OR** CH_4 and N_2O emissions information for a catalytic cracking or coking unit that is monitored by CEMS, locate the CATALYTIC CRACKING UNITS, TRADITIONAL FLUID COKING UNITS, FLUID COKING UNITS WITH FLEXICOKING DESIGN, AND CATALYTIC REFORMING UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page, and click OPEN.

> Note that Fluid Coking Units with Flexicoking Design for which the GHG emissions from the low heat value gas are accounted for in Subpart C require no emissions or additional data under Subpart Y thus the OPEN button is black and has no function.

Click image to expand



> Depending on the methods selected to calculate CO_2, CH_4 and N_2O emissions (see previous section titled "Adding or Updating Catalytic Cracking, Fluid Coking, or Catalytic Reforming Unit Information"), you will be presented with screens to collect the respective CO_2, CH_4 and N_2O emission results and additional data. Each specific screen is discussed below.

CO_2 Emissions Calculation: 98.253(c)(2) – Equation Y-6 and Flow

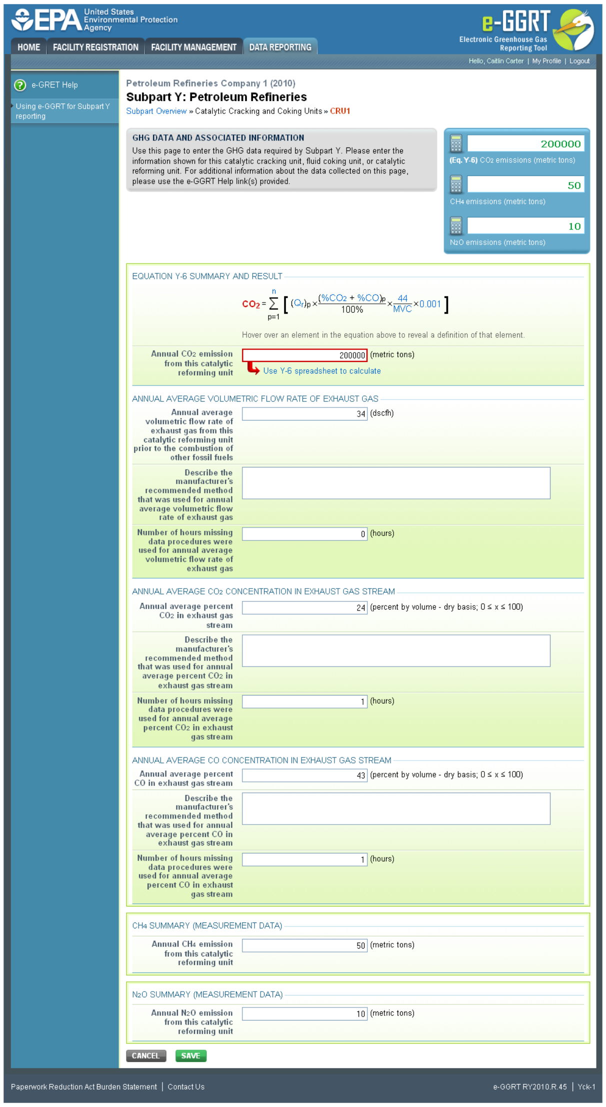
The annual CO_2 emission rate from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled "Use Y-6 spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to "Annual CO_2 emission from this *unit type* unit (metric tons)."

Subpart Y also collects the following CO_2 emission data:

- Annual average flow rate of exhaust gas (dscfh)
- Manufacturer's recommended method used for annual average flow rate of exhaust gas
- Number of hours missing data procedures were used for annual average flow rate of exhaust gas (hours)
- Annual average percent CO_2 in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Manufacturer's recommended method used for annual average percent CO_2 in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent CO_2 in exhaust gas stream (hours)
- Annual average percent CO in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Manufacturer's recommended method used for annual average percent CO in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent CO in exhaust gas stream (hours)

The Equation Y-6 Summary and monitored flow requirements are presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element.

Click image to expand



CO_2 Emissions Calculation: 98.253(c)(2) – Equation Y-6 and Y-7a

The annual CO_2 emissions from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled "Use Y-6 and Y-7a spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to "Annual CO_2 emission from this *unit type* unit (metric tons)."

The Equation Y-6 and Y-7a Summaries are presented on the page. You can hover over an element in the equation to reveal a definition of that element.

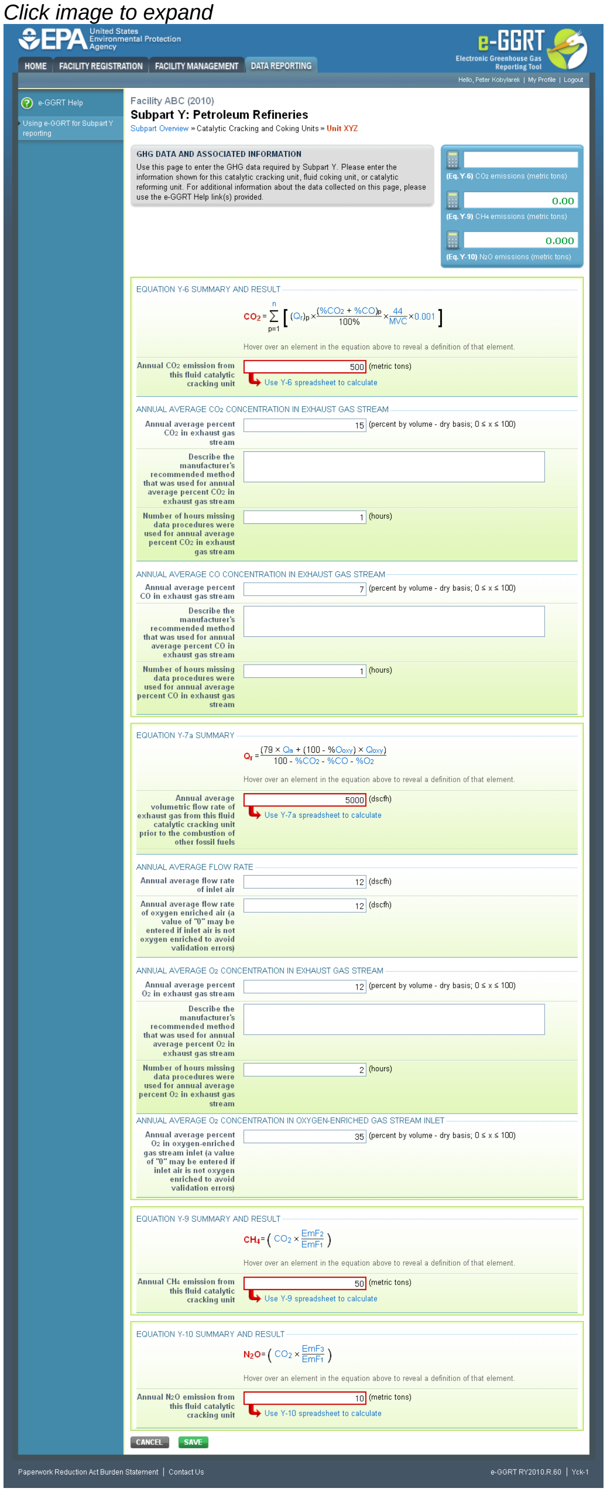
Subpart Y also collects the following CO_2 emission data:

- Annual CO_2 emission from this unit (metric tons)
- Annual average percent CO_2 in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Describe the manufacturer's recommended method that was used for annual average percent CO_2 in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent CO_2 in exhaust gas stream (hours)
- Annual average percent CO in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Describe the manufacturer's recommended method that was used for annual average percent CO in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent CO in exhaust gas stream (hours)
- Annual average volumetric flow rate of exhaust gas from this unit prior to the combustion of other fossil fuels (dscfh)
- Annual average flow rate of inlet air (dscfh)
- Annual average flow rate of oxygen enriched air (*a value of "0" may be entered if inlet air is not oxygen enriched to avoid validation errors*) (dscfh)
- Annual average percent O_2 in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Describe the manufacturer's recommended method that was used for annual average percent O_2 in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent O_2 in exhaust gas stream (hours)

- Annual average percent O_2 in oxygen-enriched gas stream inlet (*a value of "0" may be entered if inlet air is not oxygen enriched to avoid validation errors*) (percent by volume - dry basis; 0 ? x ? 100)

The Equation Y-6 and Y-7a Summaries are presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element.

Click image to expand



CO_2 Emissions Calculation: 98.253(c)(2) – Equation Y-6 and Y-7b

The annual CO_2 emissions from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled "Use Y-6 and Y-7b spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to "Annual CO_2 emission from this *unit type* unit (metric tons)."

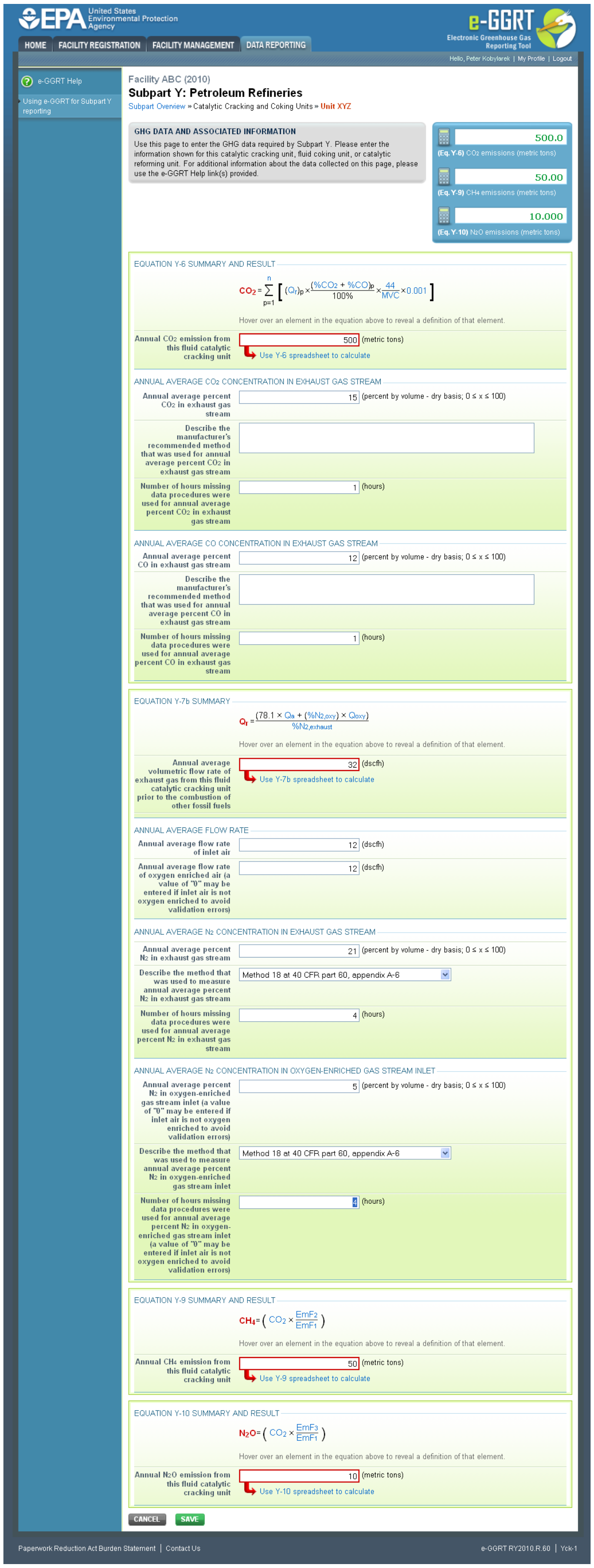
Subpart Y also collects the following CO_2 emission data:

- Annual CO_2 emission from this unit (metric tons)
- Annual average percent CO_2 in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Describe the manufacturer's recommended method that was used for annual average percent CO_2 in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent CO_2 in exhaust gas stream (hours)
- Annual average percent CO in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Describe the manufacturer's recommended method that was used for annual average percent CO in exhaust gas stream
- Number of hours missing data procedures were used for annual average percent CO in exhaust gas stream (hours)
- Annual average volumetric flow rate of exhaust gas from this unit prior to the combustion of other fossil fuels (dscfh)
- Annual average flow rate of inlet air (dscfh)
- Annual average flow rate of oxygen enriched air (*a value of "0" may be entered if inlet air is not oxygen enriched to avoid validation errors*) (dscfh)
- Annual average percent N_2 in exhaust gas stream (percent by volume - dry basis; 0 ? x ? 100)
- Describe the method that was used to measure annual average percent N_2 in exhaust gas stream:
    - Method 18 at 50 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90-Reapproved 2006
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92-Reapproved 2007
    - Chromatographic analysis: manufacturer's instructions
    - Maximum N_2 impurity specification
    - Other (specify)
- Number of hours missing data procedures were used for annual average percent N_2 in exhaust gas stream (hours)
- Annual average percent N_2 in oxygen-enriched gas stream inlet (*a value of "0" may be entered if inlet air is not oxygen enriched to avoid validation errors*) (percent by volume - dry basis; 0 ? x ? 100)
- Describe the method that was used to measure annual average percent N_2 in oxygen-enriched gas stream inlet:
    - Method 18 at 50 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90-Reapproved 2006
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92-Reapproved 2007
    - Chromatographic analysis: manufacturer's instructions
    - Maximum N_2 impurity specification
    - Other (specify)
- Number of hours missing data procedures were used for annual average percent N_2 in oxygen-enriched gas stream inlet (*a value of "0" may be entered if inlet air is not oxygen enriched to avoid validation errors*) (hours)

> If the gas stream in question does not contain any oxygen-enrichment, then a value of zero may be entered for questions related to oxygen-enrichment.

The Equation Y-6 and Y-7b Summaries are presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element.

Click image to expand



CO_2 Emissions Calculation: 98.253(c)(3) – Equation Y-8

The annual CO_2 emissions from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled “Use Y-8 spreadsheet to calculate.” Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this *unit type* unit (metric tons).”

For this method, Subpart Y also collects the basis for the carbon content value:

- Weekly or more frequent measurements
- Periodic (less frequent than weekly but at least quarterly) measurements
- Semi-annual or annual measurements
- Historical measurement value
- Engineering estimate
- Default value
- Other (specify)

The Equation Y-8 Summary is presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element

Click image to expand

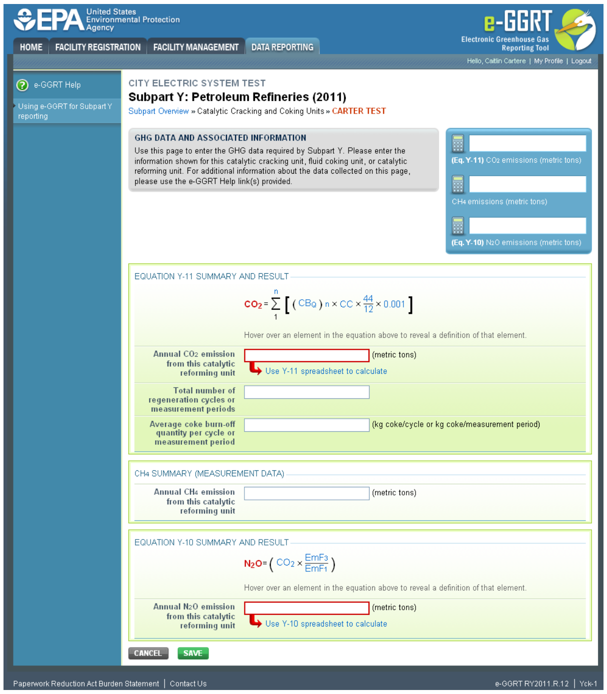
CO_2 Emissions Calculation: 98.253(c)(3) - Equation Y-11

The annual CO_2 emissions from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled “Use Y-11 spreadsheet to calculate.” Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this catalytic reforming unit (metric tons).”

For this method, Subpart Y also collects the total number of regeneration cycles or measurement periods, as well as the average coke burn-off quantity per cycle or measurement period.

The Equation Y-11 Summary is presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element.

Click image to expand



CH_4 Emissions Calculation: Equation Y-9

The annual CH_4 emissions from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled "Use Y-9 spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CH_4 calculated by the spreadsheet to this page in the box next to "Annual CH_4 emission from this *unit type* unit (metric tons)."

The Equation Y-9 Summary is presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element.

Click image to expand

CH_4 Emissions Calculation: Unit-Specific Measurement Data

For the unit-specific measurement data method, Subpart Y collects the annual CH_4 emission from this unit (metric tons).

The CH_4 Summary (Measurement Data) is presented in the screenshot below.

Click image to expand

CH_4 Emissions Calculation: A Unit-Specific Emission Factor Based on a Source Test of the Unit

For the unit-specific emission factor based on a source test of the unit method, Subpart Y collects annual CH_4 emission from this unit (metric tons).

For this method Subpart Y also collects the basis for the CH_4 emission factor:

- Weekly or more frequent measurements
- Periodic (less frequent than weekly) measurements
- Average of multiple source tests
- One-time source test
- Other (specify)

The CH_4 Summary (Emission Factor Based on a Source Test) is presented in the screenshot below.

Click image to expand

N_2O Emissions Calculation: Equation Y-10

The annual N_2O emissions from the unit operations is required. To calculate this value download the spreadsheet by clicking the link titled "Use Y-10 spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of N_2O calculated by the spreadsheet to this page in the box next to "Annual N_2O emission from this *unit type* unit (metric tons)."

The Equation Y-10 Summary is presented in the screenshot below. You can hover over an element in the equation to reveal a definition of that element.

Click image to expand

N_2O Emissions Calculation: Unit-Specific Measurement Data

For the unit-specific measurement data method, Subpart Y collects the annual N_2O emission from this unit (metric tons).

The N_2O Summary (Measurement Data) is presented in the screenshot below.

Click image to expand

N_2O Emissions Calculation: A Unit-Specific Emission Factor Based on a Source Test of the Unit

For the unit-specific emission factor based on a source test of the unit method, Subpart Y collects annual N_2O emission from this unit (metric tons).

For this method Subpart Y also collects the basis for the N_2O emission factor:

- Weekly or more frequent measurements
- Periodic (less frequent than weekly) measurements
- Average of multiple source tests
- One-time source test
- Other (specify)

The N_2O Summary (Emission Factor Based on a Source Test) is presented in the screenshot below.

Click image to expand

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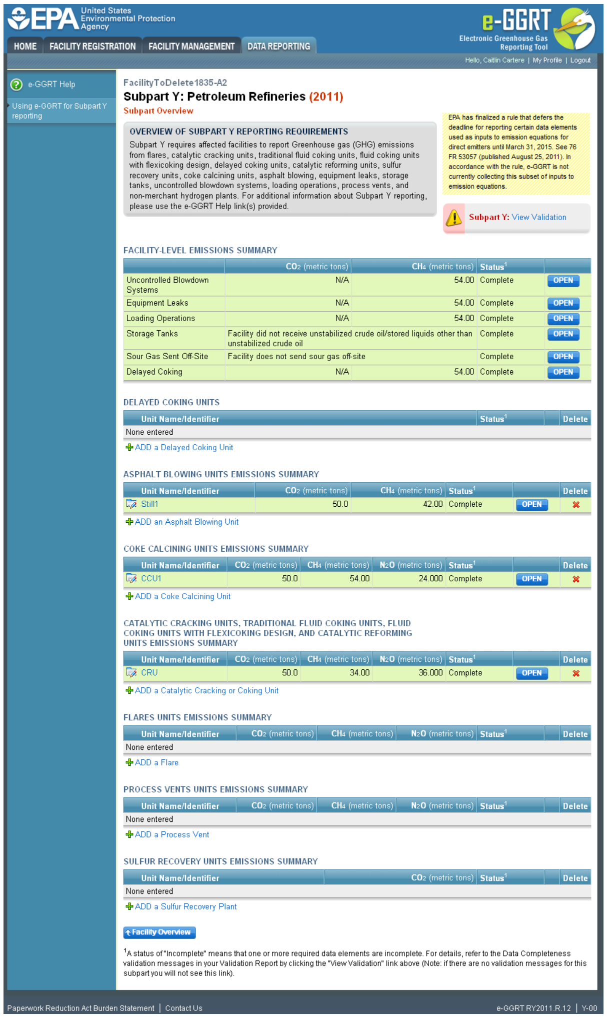
See Also

Screen Errors
Using e-GGRT to Prepare Your Subpart Y Report
Subpart Y Summary Information for this Facility
Subpart Y Delayed Coking Unit Information
Subpart Y Asphalt Blowing Unit Information
Subpart Y Coke Calcining Unit Information
Subpart Y Catalytic Cracking, Fluid Coking, and Catalytic Reforming Unit Information
Subpart Y Flares Unit Information
Subpart Y Process Vents Unit Information
Subpart Y Sulfur Recovery Plant Information
Subpart Y Emissions Information for Process Units Monitored by CEMS
Subpart Validation Report

Subpart Y Flares Unit Information

This topic provides a step-by-step description of how to enter Subpart Y Flares unit information about this facility.

Click image to expand



Step 1. Adding or Updating Flares Unit Information

To add or update Subpart Y Flares Unit Information for this Facility, locate the FLARES UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page, click the link titled "ADD a Flare."

To edit an existing Flare Unit, click on the edit icon or the Name/ID link, which is the first column in the FLARES UNITS EMISSIONS SUMMARY table.

To delete an existing Flare Unit, click on the delete icon, which is the last column in the FLARES UNITS EMISSIONS SUMMARY table.

Click image to expand

Subpart Y collects the following data about your flare unit:

- A unique name or identifier, plus optional description for this flare unit (see also About Unique Unit Names)
- Type of flare:
  - Steam assisted
  - Air assisted
  - Unassisted
  - Other (specify)
- Flare service type:
  - General facility flare
  - Unit flare
  - Emergency only flare
  - Back-up flare
  - Other (specify)
- Method used to calculate the CO_2 emissions:
  - 98.253(b)(1)(ii)(A) – Equation Y-1a Gas Composition Monitored (Equation Y-1a or Y-1b must be used if you have a continuous gas composition monitor on the flare or if you measure it at least weekly)
  - 98.253(b)(1)(ii)(A) – Equation Y-1b Gas Composition Monitored (Equation Y-1a or Y-1b must be used if you have a continuous gas composition monitor on the flare or if you measure it at least weekly)
  - 98.253(b)(1)(ii)(B) – Equation Y-2 Heat Content Monitored (Equation Y-2 must be used if you have a continuous higher heating value monitor or measure it at least weekly and the heating value monitor or measurement is not based on compositional analyses; if compositional analyses are used, you must use Equation Y-1a or Y-1b)
  - 98.253(b)(1)(iii) – Equation Y-3 Start-up, Shutdown, Malfunction (Equation Y-3 must be used if you do not measure gas composition or heating value at least weekly.)

When you are finished, click SAVE.

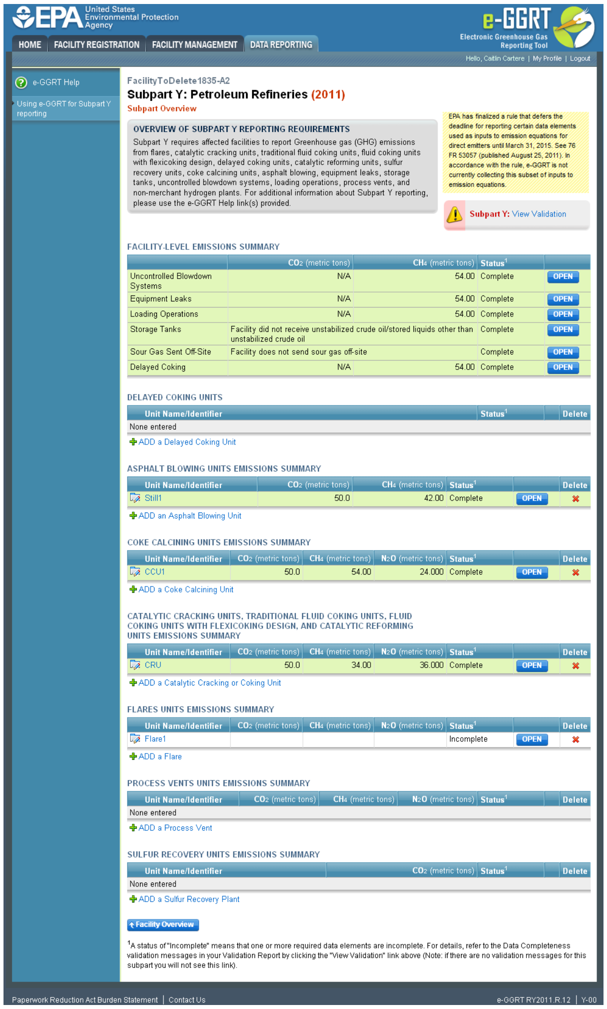
Step 2. Adding or Updating Flare Unit Emissions Information

This page provides a step-by-step description of how to enter Subpart Y Flares unit emissions information.

Step 2a: Select a flare

To add or update Subpart Y flare emissions information, locate the FLARES UNITS EMISSION SUMMARY table on the Subpart Y Overview page, and click OPEN.

Click image to expand



Step 2b: Equation Summary and Results

The Equation Summary is presented on this page. You can hover over an element in the equation to reveal a definition of that element.

For each flare at your facility, Subpart Y requires you to enter the following emissions information:

- The annual CO_2 emissions from flare unit operations (the output of Equation Y-1a, Y-1b, Y-2, or Y-3 depending on the calculation method used for this flare, in metric tons) [98.256(e)(4)]
- The annual CH_4 emissions from flare unit operations (the output of Equation Y-4, in metric tons) [98.256(e)(4)]
- The basis for the fraction of carbon in the flare gas contributed by methane value:
  - Method 18 at 40 CFR part 60, appendix A-6
  - ASTM D1945-03
  - ASTM D1946-90-Reapproved 2006
  - GPA 2261-00
  - UOP539-97
  - ASTM D2503-92-Reapproved 2007
  - Chromatographic analysis: manufacturer's instructions
  - Engineering calculations
  - Other (specify)
- The annual N_2O emissions from flare unit operations (the output of Equation Y-5, in metric tons) [98.256(e)(4)]

The e-GGRT system provides links to optional worksheets that may be used to perform the calculations; use of the spreadsheet is entirely optional and is provided for your assistance. To calculate annual CO_2 emissions using the optional spreadsheets, download the calculation spreadsheet by clicking the link titled "Use Y-x spreadsheet to calculate" (where 'x' represents 1a, 1b, 2, or 3 depending on the CO_2 calculation method used for this flare). Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the red box next to "Annual CO_2 emission from this flare (metric tons)."

To calculate annual CH_4 and N_2O emissions using the optional spreadsheets, download the calculation spreadsheets by clicking the links titled "Use Y-4 spreadsheet to calculate" and "Use Y-5 spreadsheet to calculate," respectively. Fill in the spreadsheets using the instructions in each spreadsheet. After completing the spreadsheets, copy the values of CH_4 and N_2O calculated by the spreadsheets to this page in the red box next to "Annual CH_4 emission from this flare (metric tons)" and "Annual N_2O emission from this flare (metric tons)," respectively.

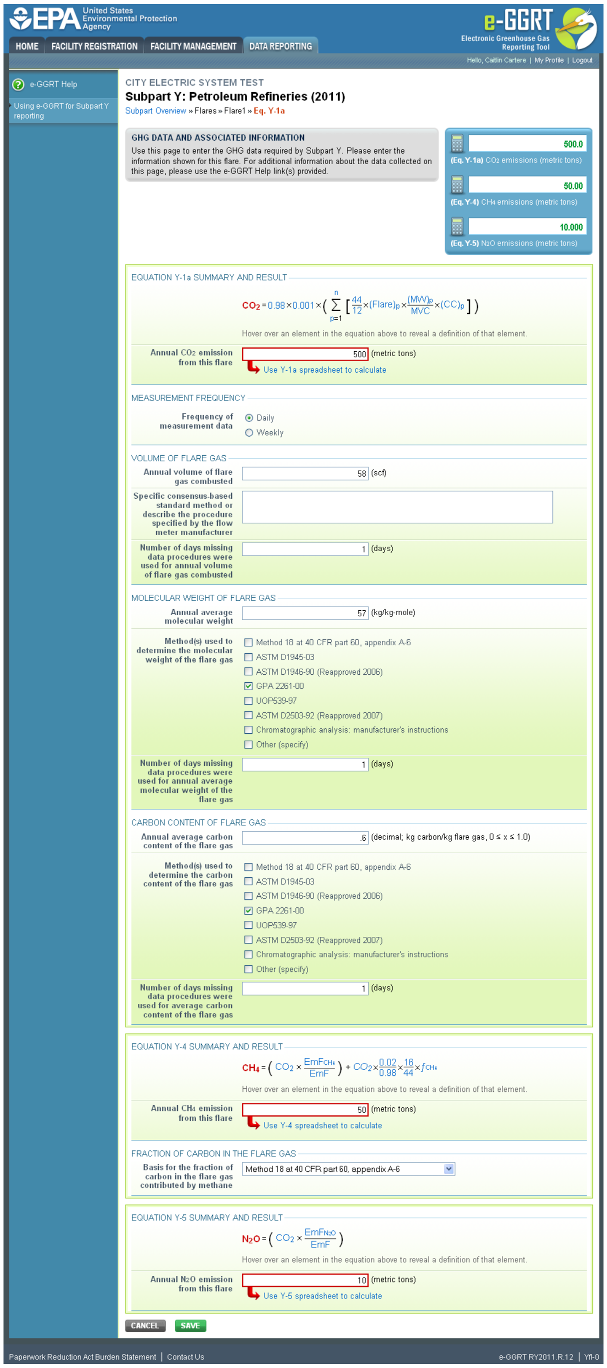
If using a mass flow meter to measure flow, molecular weights may be estimated instead of measured.

Step 2c: Enter supplemental emissions information

For each flare using the **Equation Y-1a** calculation method, Subpart Y requires you to enter the following supplemental emissions information:

- An indication of whether daily or weekly measurement periods are used [98.256(e)(6)]
- The annual volume of flare gas combusted (in scf) [98.256(e)(6)]
- The specific consensus-based standard method number or description of the procedure specified by the flow meter manufacturer [98.256(q)]
- The number of days during the reporting year missing data procedures were used to determine the volume of flare gas combusted
- The annual average molecular weight (in kg/kg-mole) [98.256(e)(6)]
- The method used to measure molecular weight [98.256(q)]
    - Method 18 at 40 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90 (Reapproved 2006)
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92 (Reapproved 2007)
    - Chromatographic analysis: manufacturer's instructions
    - Other (specify)
- The number of days during the reporting year missing data procedures were used to determine molecular weight
- The annual average carbon content of the flare gas (kg carbon/kg flare gas) [98.256(e)(6)]
- The method used to measure carbon content [98.256(q)]
    - Method 18 at 40 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90 (Reapproved 2006)
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92 (Reapproved 2007)
    - Chromatographic analysis: manufacturer's instructions
    - Other (specify)
- The number of days during the reporting year missing data procedures were used to determine carbon content

Click image to expand

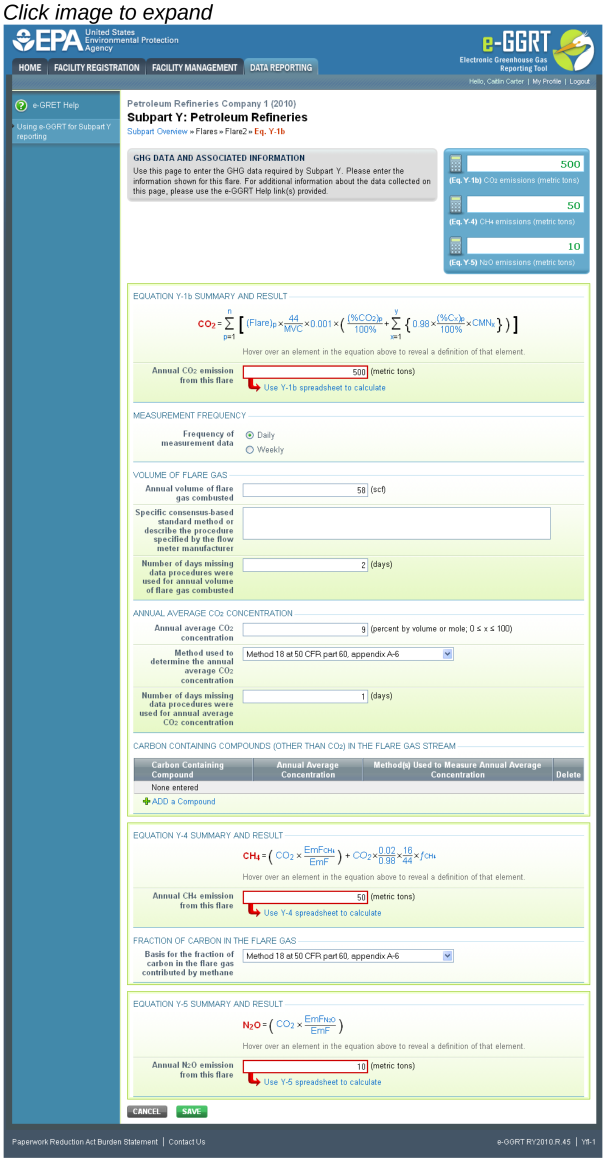


For each flare using the **Equation Y-1b** calculation method, Subpart Y requires you to enter the following supplemental emissions information:

- An indication of whether daily or weekly measurement periods are used [98.256(e)(7)]
- The annual volume of flare gas combusted (in scf) [98.256(e)(7)]
- The specific consensus-based standard method number or description of the procedure specified by the flow meter manufacturer [98.256(q)]
- The number of days during the reporting year missing data procedures were used to determine the volume of flare gas combusted
- The annual average CO_2 concentration (in percent by volume or mole) [98.256(e)(7)]
- The method used to measure CO_2 concentration [98.256(q)]
    - Method 18 at 40 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90 (Reapproved 2006)
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92 (Reapproved 2007)
    - Chromatographic analysis: manufacturer's instructions
    - Other (specify)
- The number of days during the reporting year missing data procedures were used to determine CO_2 concentration

- For each carbon containing compound other than CO_2 in the flare gas stream identified by the facility, and for each flare using Equation Y-1b, the system shall require the facility to identify:
- The annual average concentration of the compound (in percent by volume or mole) [98.256(e)(7)(i)]
- The method used to measure concentration of the compound [98.256(q)]
    - Method 18 at 40 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90 (Reapproved 2006)
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92 (Reapproved 2007)
    - Chromatographic analysis: manufacturer's instructions
    - Other (specify)
- The number of days during the reporting year missing data procedures were used to determine the concentration of the compound

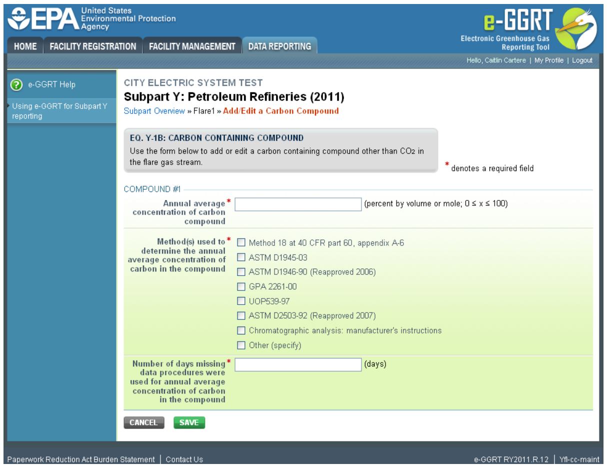
Click image to expand



To add a non-CO_2 carbon-contain compound for the flare, click the "ADD a Compound" link in the CARBON CONTAINING COMPOUNDS (OTHER THAN CO2) IN THE FLARE GAS STREAM section on the Equation Summary and Result page and enter the required information.

When finished entering the required compound information, click SAVE.

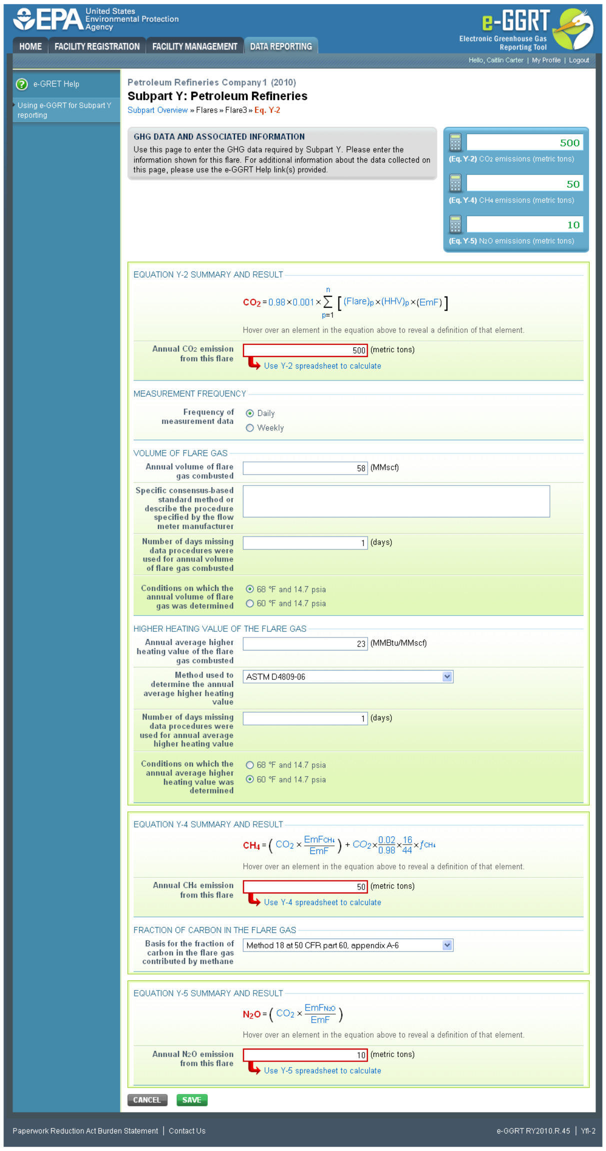
Click image to expand



For each flare using the **Equation Y-2** calculation method, Subpart Y requires you to enter the following supplemental emissions information:

- An indication of whether daily or weekly measurement periods are used [98.256(e)(8)]
- The annual volume of flare gas combusted (in MMscf) [98.256(e)(8)]
- The specific consensus-based standard method number or description of the procedure specified by the flow meter manufacturer [98.256(q)]
- The number of days during the reporting year missing data procedures were used to determine the volume of flare gas combusted
- The annual average higher heating value of the flare gas (MMBtu/MMscf) [98.256(e)(8)]
- The method used to measure higher heating value of the flare gas [98.256(q)]
  - ASTM D4809-06
  - ASTM D240-02 (Reapproved 2007)
  - ASTM D1826-94 (Reapproved 2003)
  - ASTM D3588-98 (Reapproved 2003)
  - ASTM D4891-89 (Reapproved 2006)
  - Chromatographic analysis: manufacturer's instructions
  - Other (specify)
- The number of days during the reporting year missing data procedures were used to determine the higher heating value of the flare gas
- An indication of whether the annual volume of flare gas combusted was determined using standard conditions of 68 ºF and 14.7 psia or 60 ºF and 14.7 psia [98.256(e)(8)]
- An indication of whether the annual average higher heating value of the flare gas was determined using standard conditions of 68 ºF and 14.7 psia or 60 ºF and 14.7 psia [98.256(e)(8)]

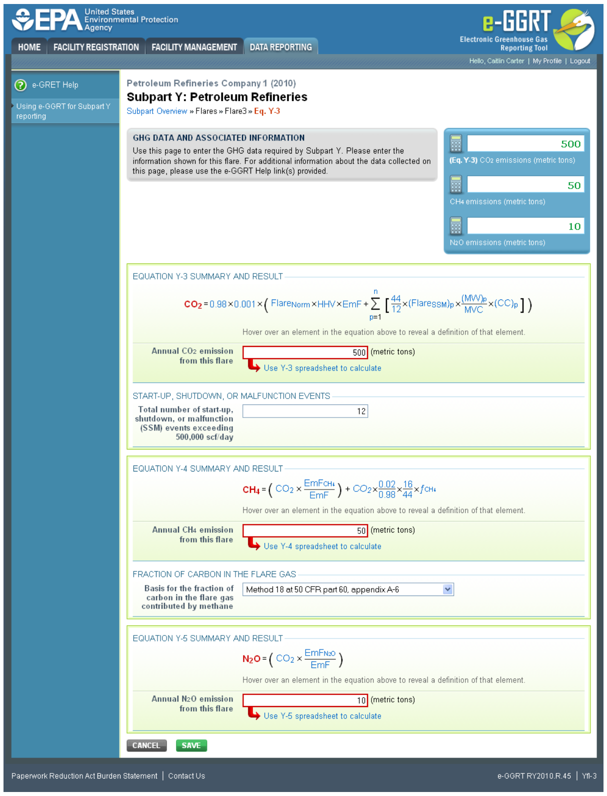
Click image to expand



For each flare using the **Equation Y-3** calculation method, Subpart Y requires you to enter the following supplemental emissions information:

- The total number of start-up, shutdown, or malfunction (SSM) events exceeding 500,000 scf/day [98.256(e)(9)]

Click image to expand



Step 2d: Save Your Data

When you have finished entering emission results, click SAVE.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CO_2, CH_4, and N_2O emissions, rounded to the nearest 0.1, 0.01, and 0.001 of a metric ton, respectively. The value displayed is for informational purposes only.

Step 3. Repeat Steps 1-2

Repeat Steps 1-2 until you have entered emissions information for all flares at your facility.

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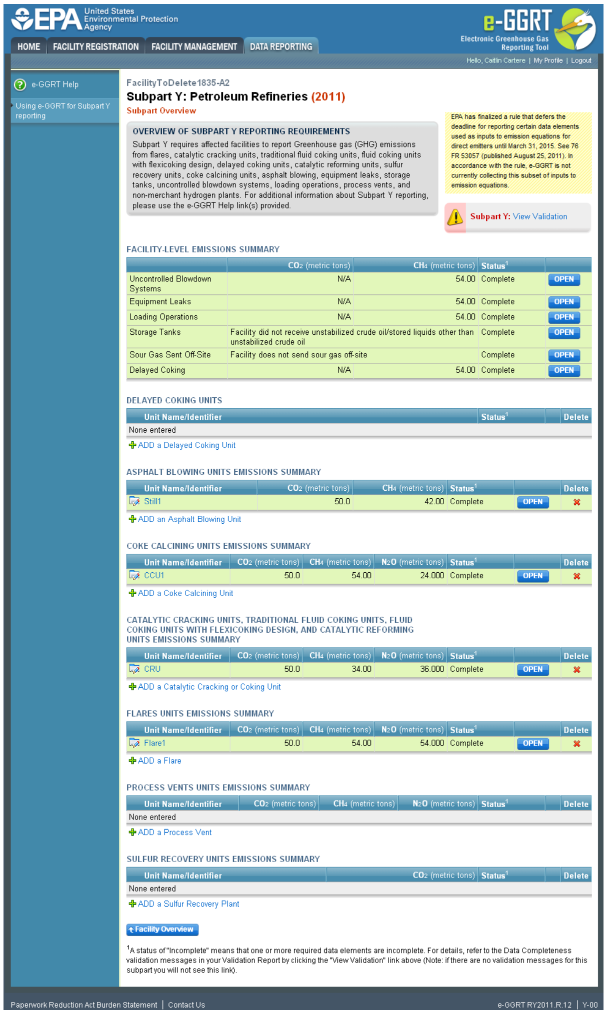
Subpart Y Process Vents Unit Information

This topic provides a step-by-step description of how to enter Subpart Y Process Vents unit information about this facility.

Adding or Updating Process Vents Unit Information

Click image to expand



To add or update Subpart Y Process Vents unit information for this Facility, locate the PROCESS VENTS UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page.

Click the link titled "ADD a Process Vent."

To edit an existing Process Vent unit, click on the edit icon or the Name/ID link, which is the first column in the PROCESS VENTS UNITS EMISSIONS SUMMARY table.

To delete an existing Process Vent unit, click on the delete icon, which is the last column in the PROCESS VENTS UNITS EMISSIONS SUMMARY table.

Click image to expand

Subpart Y collects the following data about your Process Vent unit:

- A unique name or identifier, plus optional description for this process vent unit (see also About Unique Unit Names):
- Operation type associated with this process vent:
    - Atmospheric crude distillation
    - Vacuum distillation
    - Delayed coking
    - Fluid coking (traditional)
    - Flexicoking
    - Visbreaking, other thermal cracking
    - Fluid catalytic cracking unit
    - Non-fluid catalytic cracking unit
    - Catalytic hydrocracking
    - Catalytic reforming unit – continuous regeneration
    - Catalytic reforming unit – cyclic regeneration
    - Catalytic reforming unit – semi-regenerative
    - Fuels solvent deasphalting
    - Desulfurization/ hydrotreat – naphtha/reformer feed
    - Desulfurization/ hydrotreat – gasoline
    - Desulfurization/ hydrotreat – kerosene/jet fuel
    - Desulfurization/ hydrotreat – diesel
    - Desulfurization/ hydrotreat – other distillate
    - Desulfurization/ hydrotreat – residual
    - Desulfurization/ hydrotreat – heavy gas oil
    - Desulfurization/ hydrotreat --other
    - HF alkylation
    - H2SO4 alkylation
    - Aromatics production
    - Asphalt production
    - Isomerization – Isobutane
    - Isomerization – Iso C5,C6
    - Lubricants production
    - Petroleum coke storage
    - Sulfur plant
    - Gas plant (LPG production unit)
    - Oxygenate plant – MTBE
    - Oxygenate plant – ETBE
    - Oxygenate plant – TAME
    - Oxygenate plant – other (specify)
    - Marine vessel loading/unloading
    - Truck/tank truck loading/unloading
    - Rail car loading/unloading
    - Blow down system
    - Knock-out pot
    - Analyzer
    - Vacuum jet exhaust
    - Wastewater treatment unit
    - Wastewater collection system (drain, junction box, etc.)
    - Soil remediation

- Other
- Control device used to reduce methane (and other organic) emissions from the unit:
  - Thermal or catalytic incinerator/oxidizer
  - Carbon adsorber
  - Condenser
  - Oil scrubber
  - None
  - Other (specify)
- Greenhouse gases to report for this process vent. Select any combination of CO_2, CH_4 or N_2O. CO_2 emissions must be reported if the process vent contains greater than 2 percent by volume CO_2 or greater. CH_4 emissions must be reported if the process vent contains 0.5 percent by volume of CH_4 or greater. N_2O emissions must be reported if the process vent contains 0.01 percent by volume of N_2O or greater. You must use Equation Y-19 for catalytic reforming unit depressurization and purge vents when methane is used as the purge gas.

When you are finished, click SAVE.

Adding or Updating Process Vents Unit Emissions Information

This page provides a step-by-step description of how to enter Subpart Y Process Vents unit GHG and associated data.

To add or update Subpart Y Process Vents unit emissions information, locate the PROCESS VENTS UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page, and click OPEN.

Click image to expand

Subpart Y collects the following data about your Process Vent unit:

- Annual volumetric flow discharged to the atmosphere (scf)
- Method used to measure or estimate the annual volumetric flow rate:
  - Continuous or at least hourly measurements
  - Routine (less frequent than hourly but at least weekly) measurements
  - Periodic (less frequent than weekly) measurements
  - Process knowledge
  - Engineering calculation
  - Other (specify)
- Number of venting events, if vent is intermittent (see note below)
- Cumulative venting time (hours)

Note that number of venting events is not applicable for continuous venting in which case you may leave this field blank

Subpart Y collects the following data if CO_2 is being reported for this Process Vent:

- Annual CO_2 emissions from this process vent (metric tons). To calculate this value download the spreadsheet by clicking the link titled “Use Y-19 spreadsheet to calculate.” Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this process vent (metric tons).”
- Annual average mole fraction of CO_2
- Method used to measure or estimate the annual average mole fraction of CO_2:
  - Engineering estimates/process knowledge
  - Direct measurement
  - Other (specify)

Subpart Y collects the following data if CH_4 is being reported for this Process Vent:

- Annual CH_4 emissions from this process vent (metric tons). To calculate this value download the spreadsheet by clicking the link titled “Use Y-19 spreadsheet to calculate.” Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CH_4 calculated by the spreadsheet to this page in the box next to “Annual CH_4 emission from this process vent (metric tons).”
- Annual average mole fraction of CH_4
- Method used to measure or estimate the annual average mole fraction of CH_4:
  - Engineering estimates/process knowledge
  - Direct measurement
  - Other (specify)

Subpart Y collects the following data if N_2O is being reported for this Process Vent:

- Annual N_2O emissions from this process vent (metric tons). To calculate this value download the spreadsheet by clicking the link titled “Use Y-19 spreadsheet to calculate.” Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of N_2O calculated by the spreadsheet to this page in the box next to “Annual N_2O emission from this process vent (metric tons).”
- Annual average mole fraction of N_2O
- Method used to measure or estimate the annual average mole fraction of N_2O:
  - Engineering estimates/process knowledge
  - Direct measurement
  - Other (specify)

The Equation Y-19 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

When you have finished entering emission results, click SAVE.

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Subpart Y Sulfur Recovery Plant Information

This page provides a step-by-step description of how to enter Subpart Y Sulfur Recovery Plant information about this facility.

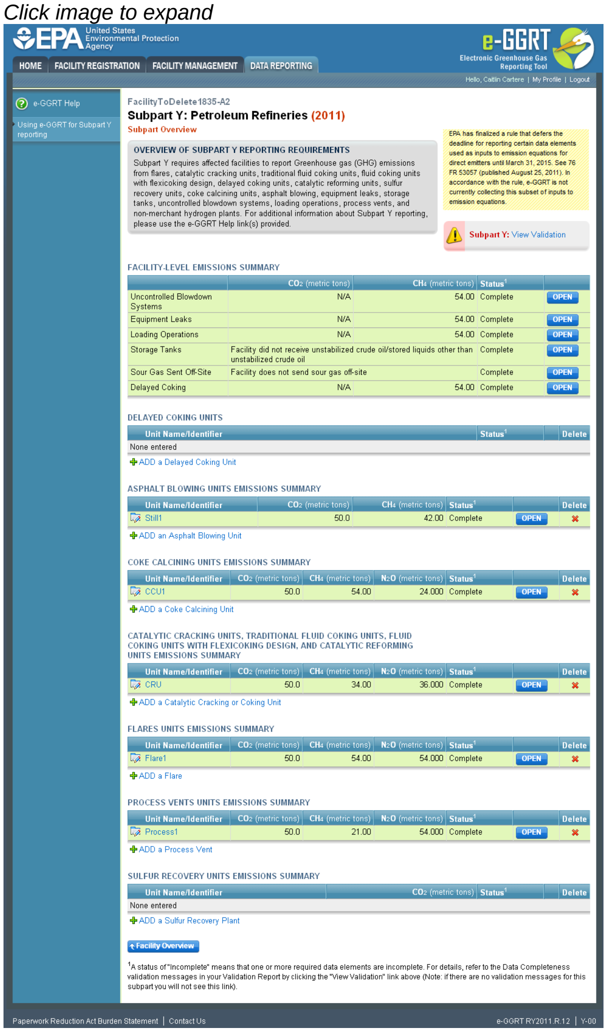
Adding or Updating Sulfur Recovery Plant Information

To add or update Subpart Y Sulfur Recovery Plant information for this Facility, locate the SULFUR RECOVERY UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page.

To edit an existing Sulfur Recovery Plant, click on the edit icon or the Unit Name/Identifier link, which is the first column in the SULFUR RECOVERY UNITS EMISSIONS SUMMARY table.

To delete an existing Sulfur Recovery Plant, click on the delete icon, which is the last column in the SULFUR RECOVERY UNITS EMISSIONS SUMMARY table.

Click image to expand

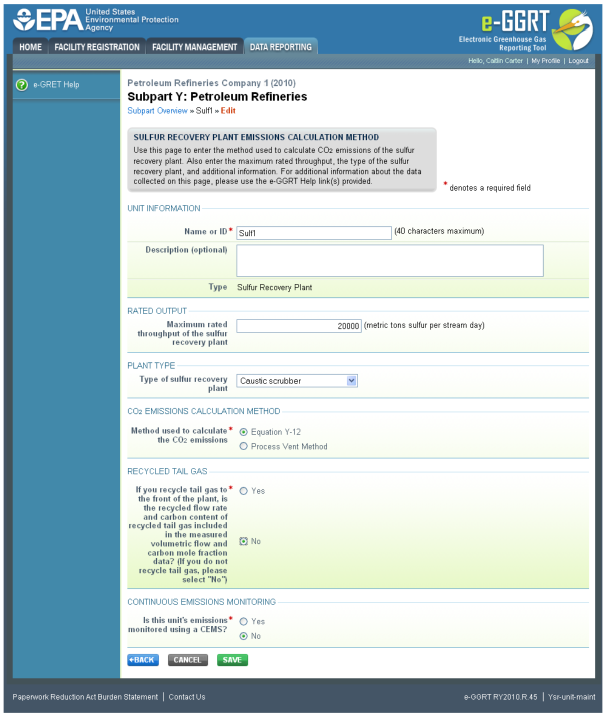


Subpart Y collects the following data about your sulfur recovery plant:

- A unique name or identifier, plus optional description for this sulfur recovery plant (see also About Unique Unit Names).
- For each plant, indicate a response of Yes or No answering the question: Do you operate and maintain a CEMS that measures CO_2 emissions according to subpart C? This means that both a flow meter and a concentration monitor need to be installed. If so, you must use the CEMS methodology for measuring CO_2 emissions from the sulfur recovery unit.

When you are finished, click NEXT.

Click image to expand



Subpart Y collects the following data about your sulfur recovery plant:

- Maximum rated throughput of the sulfur recovery plant (metric tons sulfur per stream day)
- Type of sulfur recovery plant:
  - Caustic scrubber
  - Claus
  - Lo-cat
  - Sulfuric acid plant
  - Other (specify)
- Method used to calculate the CO_2 emissions. Specify either Equation Y-12 or Process Vent Method. [Only appears if No is selected for using a CEMS. For Claus Plants (that do not use a CEMS according to Subpart C), Equation Y-12 must be used. For non-Claus plants (that do not use a CEMS according to Subpart C), either Equation Y-12 or the Process Vent Method may be used.]
- Indicate whether, if you recycle tail gas, the recycled flow rate and carbon content of recycled tail gas is included in the measured volumetric flow and carbon mole fraction data. If you do not recycle tail gas, please select No. [This question appears only if Equation Y-12 is selected]. Click either Yes or No.
- Indicate if a correction for CO_2 emissions in the tail gas is used. [This question appears only if Yes is selected for previous question]. Click either Yes or No. Note that per Section 98.253(f)(5), if tail gas is recycled to the front of the sulfur recovery plant and the recycled flow rate and carbon content is included in the measured data, then the annual CO_2 emissions must be corrected to avoid double counting these emissions.

When you are finished, click SAVE.

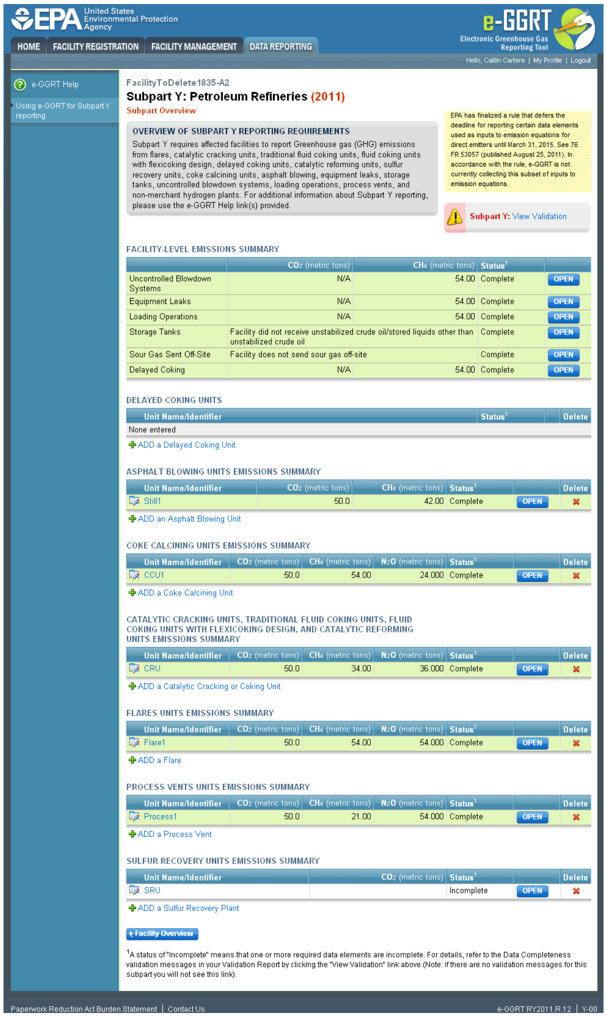
Adding or Updating Sulfur Recovery Plant Emissions Information

This section provides a step-by-step description of how to enter Subpart Y sulfur recovery plant emissions information.

To add or update emissions information for a sulfur recovery plant that is monitored by CEMS, please refer to the Subpart Y Emissions Information for Process Units Monitored by CEMS help page.

To add or update emissions information for a sulfur recovery plant that is NOT monitored by CEMS, locate the SULFUR RECOVERY UNITS EMISSIONS SUMMARY table on the Subpart Y Overview page, and click OPEN.

Click image to expand



Depending on the methods selected to calculate CO_2 emissions (see previous section titled "Adding or Updating Sulfur Recovery Plant Information"), you will be presented with screens to collect CO_2 emission results and additional data. Each specific screen is discussed below.

Equation Y-12 Summary and Result

The Equation Y-12 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

> ⚠ Data collection elements that contains the phrase "If measured" below are not required if you use a non-measurement option provided in the rule to report this data (i.e. engineering estimates).

Subpart Y collects the following data about your sulfur recovery plant:

- Annual CO_2 emissions from this sulfur recovery plant (metric tons). The e-GGRT system provides links to optional worksheets that may be used to perform the calculations; use of the spreadsheet is entirely optional and is provided for your assistance. To calculate this value using the optional spreadsheet, download the spreadsheet by clicking the link titled "Use Y-12 spreadsheet to calculate." Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to "Annual CO_2 emission from this sulfur recovery plant (metric tons)."
- If measured, specific consensus-based standard method or describe the procedure specified by the flow meter manufacturer used to measure annual volume of sour gas fed
- If measured, number of hours missing data procedures were used for annual volume of sour gas fed
- If measured, method used to measure the annual average mole fraction of carbon in the sour gas
- If measured, number of hours missing data procedures were used for annual average mole fraction of carbon in the sour gas
- Annual volume of recycled tail gas (report only if this value was not used to calculate the correction factor, in scf)
- If measured, method used to measure the annual volume of recycled tail gas
- If measured, number of hours missing data procedures were used for annual volume of recycled tail gas
- Annual average mole fraction of carbon in the tail gas (report only if this value was not used to calculate the correction factor, in kg-mole C/kg-mole gas)
- If measured, method used to measure the annual average mole fraction of carbon in the tail gas
- If measured, number of hours missing data procedures were used for annual average mole fraction of carbon in the sour gas

- Correction factor used to calculate CO_2 emissions
    - If unit specific correction factor is used, method used to determine correction factor used to calculate the CO_2 emissions
        - Used measurement data for the annual volume of recycled tail gas and annual average mole fraction of carbon in the tail gas
        - Used measurement data for the annual volume of recycled tail gas and engineering calculations for mole fraction of carbon in the tail gas
        - Used measurement data for the mole fraction of carbon in the tail gas and engineering calculations for the annual volume of recycled tail gas
        - Used engineering calculations for both the annual volume of recycled tail gas and annual average mole fraction of carbon in the tail gas
        - Other (specify)

When you have finished entering emission results, click SAVE.

Click image to expand

Process Vent Method (Equation Y-19) Summary and Result

The Equation Y-19 Summary is presented on the page. You can hover over an element in the equation to reveal a definition of that element.

Subpart Y collects the following data about your sulfur recover plant:

- Annual CO_2 emissions from this sulfur recovery plant (metric tons). The e-GGRT system provides links to optional worksheets that may be used to perform the calculations; use of the spreadsheet is entirely optional and is provided for your assistance. To calculate this value using the optional spreadsheet, download the spreadsheet by clicking the link titled “Use Y-19 spreadsheet to calculate.” Fill in the spreadsheet using the instructions in the spreadsheet. After completing the spreadsheet, copy the value of CO_2 calculated by the spreadsheet to this page in the box next to “Annual CO_2 emission from this sulfur recovery plant (metric tons).”
- Annual volumetric flow discharged to the atmosphere (scf)
- Method used to measure or estimate the annual volumetric flow rate:
    - Continuous or at least hourly measurements
    - Routine (less frequent than hourly but at least weekly) measurements
    - Periodic (less frequent than weekly) measurements
    - Process knowledge
    - Engineering calculation
    - Other (specify)
- Number of venting events, if vent is intermittent (see note below)
- Cumulative venting time (hours)
- Annual average mole fraction of CO_2
- Method used to measure or estimate the annual average mole fraction of CO_2:
    - Engineering estimates/process knowledge
    - Direct measurement
    - Other (specify)

Note that number of venting events is not applicable for continuous venting in which case you may leave this field blank

When you have finished entering emission results, click SAVE.

Click image to expand

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Subpart Y Emissions Information for Process Units Monitored by CEMS

This page provides step-by-step instructions on how to enter and edit Subpart Y Petroleum Refinery CO_2 emissions information for process units that are monitored by a Continuous Emissions Monitoring System (CEMS).

This page applies to the following types of process units that may be monitored by CEMS under Subpart Y:

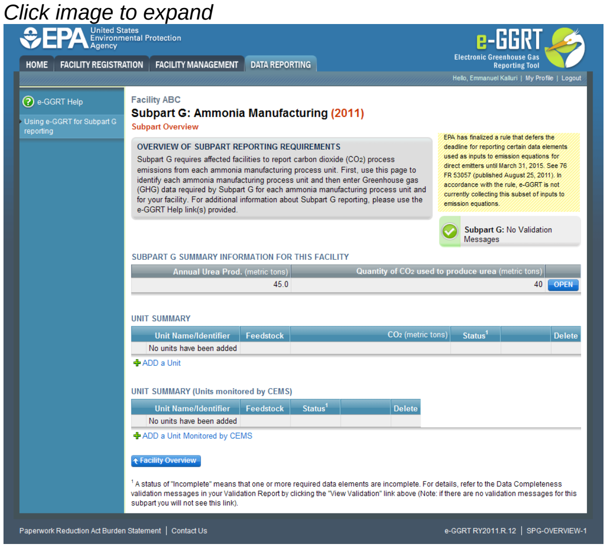
- Coke calcining units
- Catalytic cracking units
- Traditional fluid coking units
- Fluid coking units with flexicoking design
- Catalytic reforming units
- Sulfur recovery plants

Step 1: Add a CEMS Monitoring Location (CML)

To add a CML, click the “Add a CEMS Monitoring Location” link below the CEMS MONITORING LOCATION (CML) SUMMARY table on the Subpart Overview page

> ⚠ The screenshot below is from Subpart G and is displayed as an example. The screen for other subparts may differ slightly.

Click image to expand



Step 2: Define a CML and report emissions information

For each CEMS Monitoring Location, provide the following information:

- A unique unit name or identifier for the CML (see also About Unique Unit Names)
- An optional description or label for the CML
- The configuration of processes or process units that are monitored by the CML:
  - Single process or process unit that exhausts to a dedicated stack
  - Multiple processes or process units that share a common stack
  - Process or process unit that shares a common stack with one or more stationary fuel combustion units
- The types of fuel combusted in the unit(s) monitored by the CEMS
- The Tier 4/CEMS methodology start and end dates
- The quarter total of hourly CO_2 mass emissions for each quarter of the reporting year (metric tons) (*Do not cumulate emissions data between quarters*)
- The total annual CO_2 mass emissions measured by the CEMS (metric tons)
- An indication whether emissions reported for the CEMS include emissions calculated according to 98.33(a)(4)(viii) for a slipstream that bypassed the CEMS
- The total annual biogenic CO_2 emissions from the combustion of all biomass fuels combined (metric tons) (*if not applicable, enter '0'*)
- The total annual non-biogenic CO_2 emissions which includes fossil fuel, sorbent, and process CO_2 emissions (metric tons)
- The total annual CH_4 and N_2O emissions associated with the combustion of all Table C-2 fuels combusted in all processes/process units monitored by the CEMS derived from application of Equation C-10 (metric tons) (*if there are no combustion emissions in this CML, please enter '0'*)
- The total number of source operating hours in the reporting year
- The total operating hours in which a substitute data value was used in the emissions calculations for the CO_2 concentration parameter
- The total operating hours in which a substitute data value was used in the emissions calculations for the stack gas flow rate parameter
- If moisture correction is required and a continuous moisture monitor is used, the total operating hours in which a substitute data value was used in the emissions calculations for the stack gas moisture content parameter
- The total annual CO2 emissions from the CEMS Monitoring Location (CML) Summary attributable to combustion (metric tons)

Do not leave any of these fields blank. If, for example, your facility has no biogenic CO_2 emissions, enter '0'.

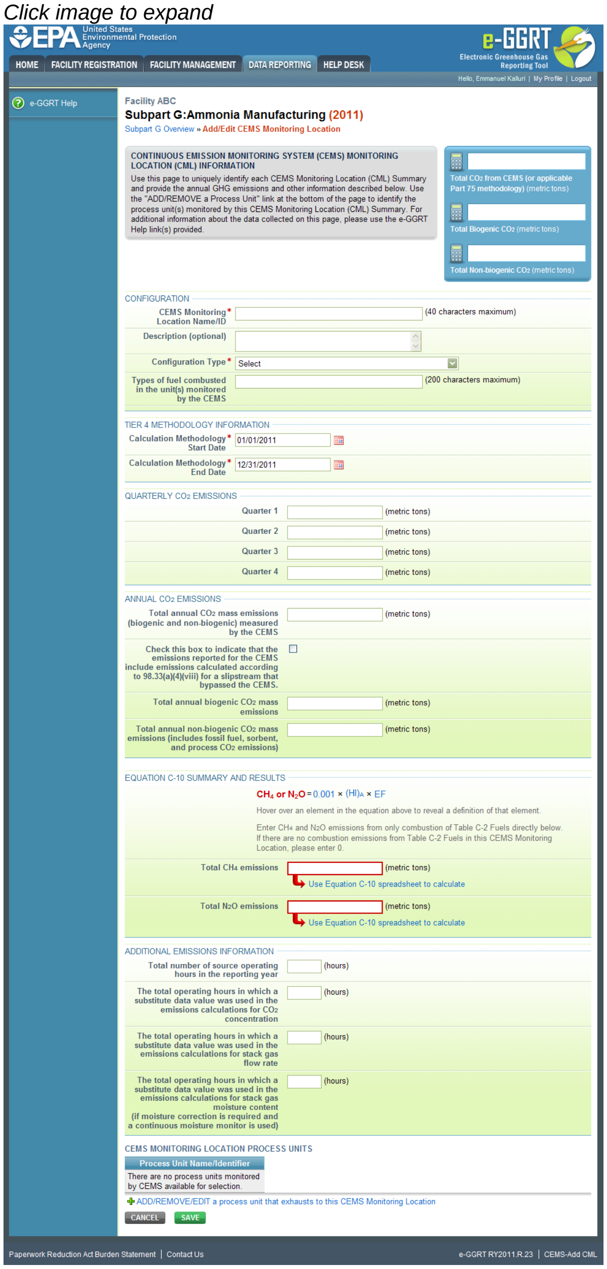
For assistance in calculating annual CH_4 and N_2O emissions using Equation C-10, access the optional calculation spreadsheet by clicking one of the links titled "Use Equation C-10 spreadsheet to calculate" located below each of the red emissions information data entry boxes and follow the provided instructions

Step 3: Identify process units monitored at a CML

To identify the process units monitored at a CML, first click the link titled "ADD/REMOVE a process unit that exhausts to this CEMS Monitoring Location" at the bottom of the page

The screenshot below is from Subpart G and is displayed as an example. The screen for other subparts may differ slightly.

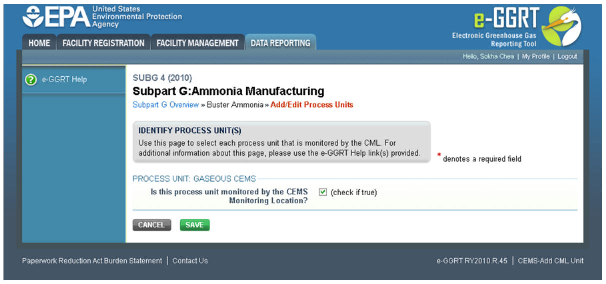
Click image to expand



On the CML Process Units Selection page, use the check boxes to select the process unit(s) monitored at this CML. This will indicate that the unit(s) selected vent emission through the stack monitored by this CML.

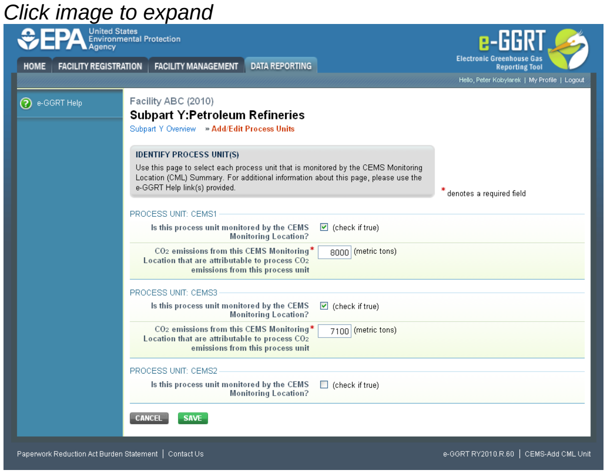
The screenshot below is from Subpart G and is displayed as an example. The screen for other will differ slightly depending on the number of units with emissions monitored by a single CML at your facility.

Click image to expand



Subpart Y also collects the CO_2 emissions from this CEMS Monitoring Location that are attributable to process CO_2 emissions from this process unit (metric tons).

Click image to expand



When finished selecting process unit for the CML and entering additional required information (if applicable), click SAVE. You should then be directed back to the Add/Edit a CML Location form and see the units you selected listed in the CEMS MONITORING LOCATION (CML) PROCESS UNITS table.

Step 4: Save entered data for a CML

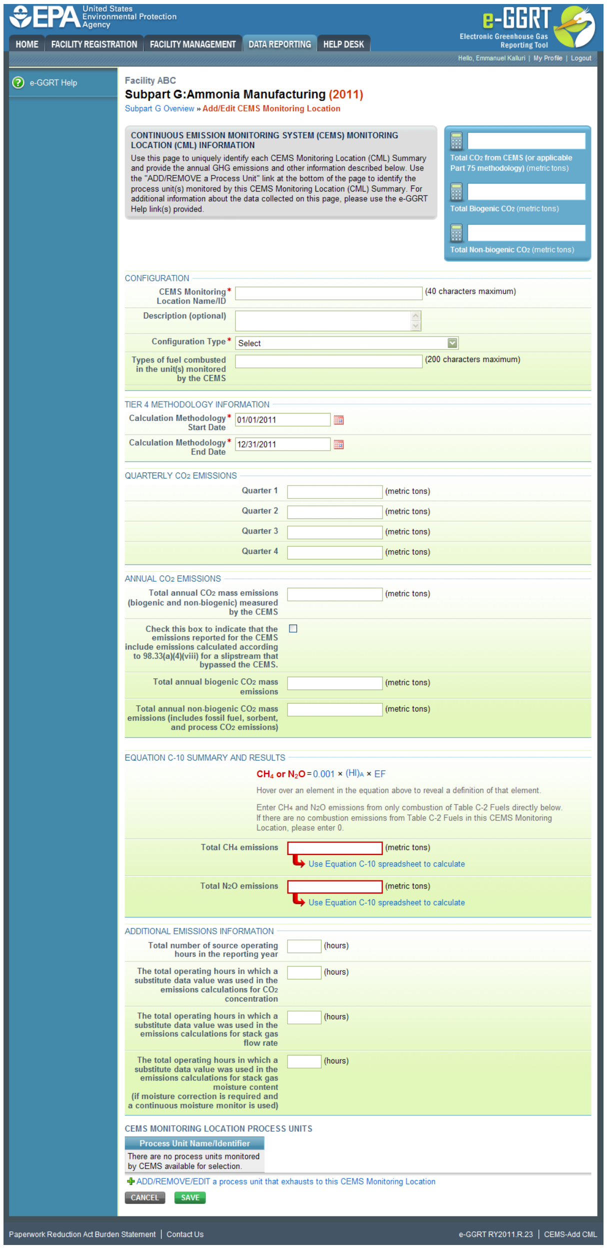
When you have finished entering data for a CML, click SAVE. You will then return to the Subpart Overview page. You will see the status of data entry for the CML updated to “Complete” in the Status column in the CEMS MONITORING LOCATION (CML) SUMMARY table.

If you don't have all the data, you can enter some now, save it, and finish later by clicking on the hyperlinked name of the CML in the CEMS MONITORING LOCATION (CML) SUMMARY table.

After you save the data on this page, the next time you open the page, the calculator on the top of the page will display the CO_2 process emissions for the CML, rounded to the nearest 0.1 of a metric ton. The value displayed is for informational purposes only.

> Note: the screenshot below is from Subpart G and is displayed as an example. The screen for other subparts will differ slightly.

Click image to expand



Step 5: Repeat Steps 1-4

Repeat Steps 1-4 until emissions information has been entered for all CMLs. If you have missed something, the validation report messages will help you identify any incomplete entries.

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Using Subpart Y Calculation Spreadsheets

These optional spreadsheets are provided to assist reporters in calculating emissions and in keeping records of these calculations.

Reporters are required to keep records of these calculations under 40 CFR 98.3(g) and additional subpart-specific provisions, but are not required to use these spreadsheets or to submit any spreadsheets to EPA.

Spreadsheets may include inputs to emission equations, reporting some of which EPA deferred until 2015.
(See 76 FR 53057, published August 25, 2011, http://www.gpo.gov/fdsys/pkg/FR-2011-08-25/pdf/2011-21727.pdf).

Overview

This help page provides guidance for working with the supplemental Subpart Y calculation spreadsheets. The guidance provides step-by-step instructions for the following tasks:

- Selecting the Appropriate Calculation Spreadsheet
- Downloading a Calculation Spreadsheet
- General Information on Using a Calculation Spreadsheet
- Using the Equation Y-1a Calculation Spreadsheet
- Using the Equation Y-1b Calculation Spreadsheet
- Using the Equation Y-2 Calculation Spreadsheet
- Using the Equation Y-3 Calculation Spreadsheet
- Using the Equation Y-4, Y-5 Calculation Spreadsheet
- Using the Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet
- Using the Equation Y-8 Calculation Spreadsheet
- Using the Equation Y-9, Y-10 Calculation Spreadsheet
- Using the Equation Y-11 Calculation Spreadsheet
- Using the Equation Y-12 Calculation Spreadsheet
- Using the Equation Y-13 Calculation Spreadsheet
- Using the Equation Y-14, Y-15 Calculation Spreadsheet
- Using the Equation Y-16a, Y-16b, Y-17 Calculation Spreadsheet
- Using the Equation Y-18 Calculation Spreadsheet
- Using the Equation Y-19 Calculation Spreadsheet
- Using the Equation Y-20 Calculation Spreadsheet
- Using the Equation Y-21 Calculation Spreadsheet
- Using the Equation Y-22 Calculation Spreadsheet
- Using the Equation Y-23 Calculation Spreadsheet

Specific information on each of the calculation spreadsheets is provided below:

Calculation Spreadsheet (click to download)	Selection Criteria: Emissions Source	Output(s)	Instructions (click to view)
Equation Y-1a Calculation Spreadsheet.xls	Flares	CO_2	Y-1a Help
Equation Y-1b Calculation Spreadsheet.xls	Flares	CO_2	Y-1b Help
Equation Y-2 Calculation Spreadsheet.xls	Flares	CO_2	Y-2 Help
Equation Y-3 Calculation Spreadsheet.xls	Flares	CO_2	Y-3 Help
Equation Y-4, Y-5 Calculation Spreadsheet.xls	Flares	CH_4, N_2O	Y-4, Y-5 Help
Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet.xls	Catalytic Cracking Units or Fluid Coking Units	CO_2	Y-6, Y-7a, 7b Help
Equation Y-8 Calculation Spreadsheet.xls	Catalytic Cracking Units or Fluid Coking Units	CO_2	Y-8 Help
Equation Y-9, Y-10 Calculation Spreadsheet.xls	Catalytic Cracking Units, Fluid Coking Units, Coke Calcining Units, Catalytic Reforming Units	CH_4, N_2O	Y-9, Y-10 Help

Equation Y-11 Calculation Spreadsheet.xls	Catalytic Reforming Units	CO_2	Y-11 Help
Equation Y-12 Calculation Spreadsheet.xls	On-Site Sulfur Recovery Plants, Sour Gas Sent Off-Site for Sulfur Recovery	CO_2	Y-12 Help
Equation Y-13 Calculation Spreadsheet.xls	Coke Calcining Units	CO_2	Y-13 Help
Equation Y-14, Y-15 Calculation Spreadsheet.xls	Uncontrolled Asphalt Blowing Operations, Asphalt Blowing Operations Controlled by vapor Scrubbing	CO_2, CH_4	Y-14, Y-15 Help
Equation Y-16a, Y-16b, Y-17 Calculation Spreadsheet.xls	Asphalt Blowing Operations Controlled by Thermal Oxidizer or Flare	CO_2, CH_4	Y-16a, Y-16b, Y-17 Help
Equation Y-18 Calculation Spreadsheet.xls	Delayed Coking Units	CH_4	Y-18 Help
Equation Y-19 Calculation Spreadsheet.xls	Process Vents Not Covered in Paragraphs (a) through (i) of Section 98.253	CO_2, CH_4, or N_2O	Y-19 Help
Equation Y-20 Calculation Spreadsheet.xls	Blowdown Systems	CH_4	Y-20 Help
Equation Y-21 Calculation Spreadsheet.xls	Equipment Leaks	CH_4	Y-21 Help
Equation Y-22 Calculation Spreadsheet.xls	Storage Tanks Other Than Those Processing Unstabilized Crude Oil	CH_4	Y-22 Help
Equation Y-23 Calculation Spreadsheet.xls	Storage Tanks That Process Unstabilized Crude Oil	CH_4	Y-23 Help

Selecting the Appropriate Calculation Spreadsheet

Subpart Y requires facilities to report annual carbon dioxide (CO_2), methane (CH_4), and/or nitrous oxide (N_2O) emissions from various types of equipment, systems, and operations at petroleum refineries including the following:

- CO_2, CH_4 and N_2O emissions from each flare
- CO_2, CH_4, and N_2O coke burn-off emissions from each catalytic cracking unit, fluid coking unit, and catalytic reforming unit
- CO_2 emissions from sour gas sent off site for sulfur recovery operations
- CO_2 process emissions from each on-site sulfur recovery plant
- CO_2, CH_4, and N_2O emissions from each coke calcining unit
- CO_2 and CH_4 emissions from asphalt blowing operations
- CH_4 emissions from equipment leaks, storage tanks, loading operations, delayed coking units, and uncontrolled blowdown systems
- CO_2, CH_4, and N_2O emissions from each process vent not specifically included in paragraphs (a) through (g) of §98.253
- CO_2 emissions from non-merchant hydrogen production process units (not including hydrogen produced from catalytic reforming units)

For certain emission sources, Subpart Y requires the use of CO_2 CEMS when one is in place that meets certain requirements. Specifically, Subpart Y requires the use of CO_2 CEMS if one is in place for the following sources: catalytic cracking units; traditional fluid coking units; catalytic reforming units; sulfur recovery plants; and coke calcining units. Refer to the help page for CEMS if you use a CO_2 CEMS for one of these units. The spreadsheets considered in this help page should only be used for these units when a qualified CO_2 CEMS is not used.

To determine which calculation spreadsheet(s) to use for your facility or company, consider the emission source and the GHG(s) emitted. For each emission source, use the corresponding calculation spreadsheet(s) to calculate emissions. Where reporting of multiple GHGs is required for a single emissions source, you may need to use multiple calculation spreadsheets for that emissions source. The calculation spreadsheet(s) appropriate for each emission source are detailed below.

Flares

Subpart Y requires affected facilities to report CO_2, CH_4, and N_2O from flares. Five calculation spreadsheets are available to calculate emissions from flares. To calculate CH_4 and N_2O emissions from flares, use the Equation Y-4, Y-5 Calculation Spreadsheet. To calculate CO_2 emissions from flares, select the appropriate calculation spreadsheet based on the follow criteria:

- If you monitor gas composition, calculate the CO_2 emissions from the flare using either the Equation Y-1a or Equation Y-1b Calculation Spreadsheet. You may elect to use either equation. Equation Y-1b is more data intensive, but is expected to be more accurate, particularly if there is a high level of CO_2 in the gas stream being sent to the flare.

- If you monitor heat content but do not monitor gas composition, calculate the CO_2 emissions from the flare using the Equation Y-2 Calculation Spreadsheet.
- If you do not measure the higher heating value or carbon content of the flare gas at least weekly, determine the quantity of gas discharged to the flare separately for periods of routine flare operation and for periods of start-up, shutdown, or malfunction, and calculate the CO_2 emissions using the Equation Y-3 Calculation Spreadsheet.

Catalytic Cracking Units and Fluid Coking Units

Subpart Y requires affected facilities to report CO_2, CH_4, and N_2O from each catalytic cracking unit, each traditional fluid coking unit, and each fluid coking unit of flexicoking design that does not account for GHG emissions resulting from the use of low value fuel gas using the methods described in subpart C (General Stationary Fuel Combustion Sources). Three calculation spreadsheets are available to calculate emissions from these units. To calculate CH_4 and N_2O emissions from catalytic cracking units and fluid coking units, use the Equation Y-9, Y-10 Calculation Spreadsheet. To calculate CO_2 emissions from catalytic cracking units and fluid coking units (that do not use a CO_2 CEMS), select the appropriate calculation spreadsheet based on the following criteria:

- For catalytic cracking units and fluid coking units with rated capacities greater than 10,000 barrels per stream day (bbls/sd), use the Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet to calculate the CO_2 emissions.
- For catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day (bbls/sd) or less that continuously or no less frequently than daily monitor the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack prior to combustion of other fossil fuels, use the Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet to calculate the CO_2 emissions.
- For catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day (bbls/sd) or less that do not monitor at least daily the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack prior to combustion of other fossil fuels, use the Equation Y-8 Calculation Spreadsheet to calculate the CO_2 emissions.

Catalytic Reforming Units

Subpart Y requires affected facilities to report CO_2, CH_4, and N_2O from each catalytic reforming unit. Three calculation spreadsheets are available to calculate emissions from these units. To calculate CH_4 and N_2O emissions from catalytic reforming units, use the Equation Y-9, Y-10 Calculation Spreadsheet. To calculate CO_2 emissions from catalytic reforming units (that do not use a CO_2 CEMS), select the appropriate calculation spreadsheet based on the following criteria:

- For catalytic reforming units that continuously or no less frequently than daily monitor the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack prior to combustion of other fossil fuels, use the Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet to calculate the CO_2 emissions.
- For reforming units that do not monitor at least daily the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack prior to combustion of other fossil fuels, use the Equation Y-11 Calculation Spreadsheet.

Sulfur Recovery

Subpart Y requires affected facilities to report CO_2 emissions from sour gas sent off site for sulfur recovery and CO_2 process emissions from each on-site sulfur recovery plant. For most of these sources, only one calculation spreadsheet is available to calculate emissions from these sources. To calculate CO_2 emissions from sour gas sent off site for sulfur recovery or from each on-site sulfur recovery plant (that does not use a CO_2 CEMS), use the Equation Y-12 Calculation Spreadsheet. Alternatively, for non-Claus sulfur recovery plants (that do not use a CO_2 CEMS), you may elect to use the process vent method, for which you would calculate CO_2 emissions using the Equation Y-19 Calculation Spreadsheet.

Coke Calcining Units

Subpart Y requires affected facilities to report CO_2, CH_4, and N_2O from each coke calcining unit. Two calculation spreadsheets are available to calculate emissions from these units. To calculate CO_2 emissions from coke calcining units (that do not use a CO_2 CEMS), use the Equation Y-13 Calculation Spreadsheet. To calculate CH_4 and N_2O emissions from coke calcining units, use the Equation Y-9, Y-10 Calculation Spreadsheet.

Asphalt Blowing Operations

Subpart Y requires affected facilities to report CO_2 and CH_4 from asphalt blowing operations. Two calculation spreadsheets are available to calculate emissions from asphalt blowing operations. To calculate CO_2 and CH_4 emissions from uncontrolled asphalt blowing operations or asphalt blowing operations controlled by vapor scrubbing, use the Equation Y-14, Y-15 Calculation Spreadsheet. To calculate CO_2 and CH_4 emissions from asphalt blowing operations controlled by thermal oxidizer or flare, use the Equation Y-16a, Y-16b, Y-17 Calculation Spreadsheet.

Delayed Coking Units

Subpart Y requires affected facilities to report CH_4 emissions from each delayed coking unit. One calculation spreadsheet is available to calculate emissions from these units. To calculate CH_4 emissions from delayed coking units, use the Equation Y-18 Calculation Spreadsheet. Alternatively, you may elect to use the process vent method for the depressurization cycle. If you elect this alternative, calculate CH_4 emissions during depressurization using the Equation Y-19 Calculation Spreadsheet and calculate the CH_4 emissions during vessel opening using the Equation Y-18 Calculation Spreadsheet. You will then need to add these emissions together to calculate the total CH_4 emissions from the delayed coking unit.

Process Vents

Subpart Y requires affected facilities to report CO_2, CH_4, and N_2O emissions from each process vent not covered in paragraphs (a) through (i) of §98.253 that can reasonably be expected to contain greater than 2 percent by volume CO_2 or greater than 0.5 percent by volume of CH_4 or greater than 0.01 percent by volume (100 parts per million) of N_2O. This "process vent method" can also be used as an alternative methodology for certain other emission sources. One calculation spreadsheet is available to calculate emissions from these vents. To calculate GHG emissions from process vents, use the Equation Y-19 Calculation Spreadsheet.

Blowdown Systems

Subpart Y requires affected facilities to report CH_4 emissions from blowdown systems. One calculation spreadsheet is available to calculate emissions from blowdown systems. To calculate CH_4 emissions from blowdown systems, use the Equation Y-20 Calculation Spreadsheet. Alternatively, the Equation Y-19 Calculation Spreadsheet may be used to calculate CH_4 emissions from uncontrolled blowdown systems.

Equipment Leaks

Subpart Y requires affected facilities to report CH_4 emissions from equipment leaks. One calculation spreadsheet is available to calculate emissions from equipment leaks. To calculate CH_4 emissions from equipment leaks, use the Equation Y-21 Calculation Spreadsheet. Alternatively, CH_4 emissions from equipment leaks may be calculated using process-specific methane composition data (from measurement data or process knowledge) and any of the emission estimation procedures provided in the Protocol for Equipment Leak Emissions Estimates (EPA-453/R-95-017, NTIS PB96-175401). There are no calculation spreadsheets available for this alternative.

Storage Tanks

Subpart Y requires affected facilities to report CH_4 from storage tanks. Two calculation spreadsheets are available to calculate emissions from storage tanks. To calculate CH_4 emissions from storage tanks other than those processing unstabilized crude oil, use the Equation Y-22 Calculation Spreadsheet. Alternatively, CH_4 emissions from storage tanks other than those processing unstabilized crude oil may be calculated using tank-specific methane composition data (from measurement data or process knowledge) and the emission estimation methods provided in AP-42, Section 7.1; there are no calculation spreadsheets available for this alternative. To calculate CH_4 emissions from Storage tanks that process unstabilized crude oil, use the Equation Y-23 Calculation Spreadsheet.

Downloading a Calculation Spreadsheet

The table below summarizes the applicability of Subpart Y calculation spreadsheets relative to the various emission sources for petroleum refineries. Addition details are provided for each type of emissions source below the table. Calculation spreadsheets for Subpart Y may be downloaded by clicking one of the links in the first column of the table below. Users may also jump to instructions for each calculation spreadsheet by clicking one of the links in the fourth column.

Calculation Spreadsheet (click to download)	Selection Criteria: Emissions Source	Output(s)	Instructions (click to view)
Equation Y-1a Calculation Spreadsheet.xls	Flares	CO_2	Y-1a Help
Equation Y-1b Calculation Spreadsheet.xls	Flares	CO_2	Y-1b Help
Equation Y-2 Calculation Spreadsheet.xls	Flares	CO_2	Y-2 Help
Equation Y-3 Calculation Spreadsheet.xls	Flares	CO_2	Y-3 Help
Equation Y-4, Y-5 Calculation Spreadsheet.xls	Flares	CH_4, N_2O	Y-4, Y-5 Help
Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet.xls	Catalytic Cracking Units or Fluid Coking Units	CO_2	Y-6, Y-7a, 7b Help
Equation Y-8 Calculation Spreadsheet.xls	Catalytic Cracking Units or Fluid Coking Units	CO_2	Y-8 Help

Equation Y-9, Y-10 Calculation Spreadsheet.xls	Catalytic Cracking Units, Fluid Coking Units, Coke Calcining Units, Catalytic Reforming Units	CH_4, N_2O	Y-9, Y-10 Help
Equation Y-11 Calculation Spreadsheet.xls	Catalytic Reforming Units	CO_2	Y-11 Help
Equation Y-12 Calculation Spreadsheet.xls	On-Site Sulfur Recovery Plants, Sour Gas Sent Off-Site for Sulfur Recovery	CO_2	Y-12 Help
Equation Y-13 Calculation Spreadsheet.xls	Coke Calcining Units	CO_2	Y-13 Help
Equation Y-14, Y-15 Calculation Spreadsheet.xls	Uncontrolled Asphalt Blowing Operations, Asphalt Blowing Operations Controlled by vapor Scrubbing	CO_2, CH_4	Y-14, Y-15 Help
Equation Y-16a, Y-16b, Y-17 Calculation Spreadsheet.xls	Asphalt Blowing Operations Controlled by Thermal Oxidizer or Flare	CO_2, CH_4	Y-16a, Y-16b, Y-17 Help
Equation Y-18 Calculation Spreadsheet.xls	Delayed Coking Units	CH_4	Y-18 Help
Equation Y-19 Calculation Spreadsheet.xls	Process Vents Not Covered in Paragraphs (a) through (i) of Section 98.253	CO_2, CH_4, or N_2O	Y-19 Help
Equation Y-20 Calculation Spreadsheet.xls	Blowdown Systems	CH_4	Y-20 Help
Equation Y-21 Calculation Spreadsheet.xls	Equipment Leaks	CH_4	Y-21 Help
Equation Y-22 Calculation Spreadsheet.xls	Storage Tanks Other Than Those Processing Unstabilized Crude Oil	CH_4	Y-22 Help
Equation Y-23 Calculation Spreadsheet.xls	Storage Tanks That Process Unstabilized Crude Oil	CH_4	Y-23 Help

Using a Calculation Spreadsheet to Make Calculations

The guidance provided in this section applies to each of the calculation spreadsheets for Subpart Y. Additional guidance is provided for each individual calculation spreadsheet in the sections below.

Color coding

The calculation spreadsheets contain green input cells, gray informational cells, and red-bordered results cells filled with yellow or white. Users should use green input cells to enter all data specific to their facility, unit, or process. Gray informational cells contain parameter names, column and row headings, equation constants and subtotals. Calculation results are displayed in red-bordered results cells filled with yellow or white. For red-bordered, yellow-filled results cells, the values in these cells should be entered in the appropriate and separate calculation spreadsheet (as directed below cell) where additional calculations will be made. For red-bordered, white filled results cells, the values in these cells should be entered in e-GGRT for the appropriate process units. All cells that are not green input cells are locked and cannot be modified.

	Green input cell (data entry)
	Gray informational cells (locked)
	Red-bordered, yellow-filled results cells (enter in appropriate and separate calculation spreadsheet)
	Red-bordered, white filled results cells (enter in e-GGRT)

Stop and Warning Messages

The calculation spreadsheets will display a stop message if the user enters a value that is invalid or a warning message if the user enters a value outside the EPA estimated range for a particular data element. For invalid data entries, the stop messages will not allow a user to proceed and the user must reenter valid data before moving forward. For data entries that are outside the EPA estimated range for a particular data element, the warning messages will allow a user to proceed if the user deems the entered value to be accurate.

Multiple Units

For emissions sources under Subpart Y that require emission data to be reported for each unit, use separate calculation spreadsheets for each unit. Do not aggregate data for multiple units when calculating emissions from these sources using these calculation spreadsheets.

Using the Equation Y-1a Calculation Spreadsheet

If you monitor gas composition, you may use the Equation Y-1a Calculation Spreadsheet to calculate annual CO_2 emissions for each fuel type combusted in each flare using the average carbon content of the flare gas combusted. A separate spreadsheet should be used for each flare and fuel type combination. In nearly all cases, gas sent to a flare will be a mixture of different process gases, which are collectively considered to be fuel gas. As such, Equation Y-1a would be applied once for this fuel type. If you monitor separately the fuel gas sent to the flare and natural gas added to the flare for the purposes of preventing oxygen infiltration or ensuring adequate heating value of the gas flared, you should calculate the CO_2 emissions separately for these fuels and sum the values for subsequent reporting. You do not need to separately calculate or report CO_2 emissions from natural gas used as pilot gas for the flare. Equation Y-1a is provided below.

(Equation Y-1a)

$$CO_2 = 0.98 \times 0.001 \times \left(\sum_{p=1}^{n} \left[\frac{44}{12} \times (Flare)_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right)$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	Flare

Next, enter the requested information in the green input cells in the first Input Data table. Based on your entries in the first Input Data table, a number of green input cells will be activated in the second Input data table. Enter the requested information in the green input cells in the second Input Data table.

Input Data

This calculation spreadsheet can be used for up to 366 measurement periods.

[n] = Number of measurement periods. The minimum value for n is 52 (for weekly measurements); the maximum value for n is 366 (for daily measurements during a leap year)	100.
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)	

[p] = Measurement period index	**[(Flare)$_p$]** = Volume of flare gas combusted during measurement period (standard cubic feet per period, scf/period). If a mass flow meter is used, measure flare gas flow rate in kg/period and replace the term "(MW)$_p$/MVC" with "1"	**[(MW)$_p$]** = Average molecular weight of the flare gas combusted during measurement period (kg/kg-mole). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average	**[(CC)$_p$]** = Average carbon content of the flare gas combusted during measurement period (kg C per kg flare gas). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average	Equation value for measurement period p
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

The calculation spreadsheet will calculate the annual CO_2 emissions for a fuel type combusted in a flare. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare. If different fuel types are separately monitored, add together the CO_2 emissions calculated for each fuel type for a given flare and use the resulting sum for entry in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare.

Annual CO_2 Emissions (metric tons/year) from Equation Y-1a

$[CO_2]$ = Annual CO_2 emissions for a specific fuel type (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-4 and Y-5

Using the Equation Y-1b Calculation Spreadsheet

If you monitor gas composition and elect not to use Equation Y-1a, use the Equation Y-1b Calculation Spreadsheet to calculate annual CO_2 emissions for one or more fuels combusted in a single flare using the mole percent concentration and carbon mole number of each compound in the flare gas stream. A separate spreadsheet should be used for each flare and fuel type combination. In nearly all cases, gas sent to a flare will be a mixture of different process gases, which are collectively considered to be fuel gas. As such, Equation Y-1b would be applied once for this fuel type. If you monitor separately the fuel gas sent to the flare and natural gas added to the flare for the purposes of preventing oxygen infiltration or ensuring adequate heating value of the gas flared, you should calculate the CO_2 emissions separately for these fuels and sum the values for subsequent reporting. You do not need to separately calculate or report CO_2 emissions from natural gas used as pilot gas for the flare. Equation Y-1b is provided below.

(Equation Y-1b)

$$CO_2 = \sum_{p=1}^{n}\left[(Flare)_p \times \frac{44}{MVC} \times 0.001 \times \left(\frac{(\%CO_2)_p}{100\%} + \sum_{x=1}^{y}\left\{0.98 \times \frac{(\%C_x)_p}{100\%} \times CMN_x\right\}\right)\right]$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	Flare

Next, enter the requested information in the green input cells in the first Input Data table. Based on your entries in the first Input Data table, a number of green input cells will be activated in the second Input data table. Enter the requested information in the green input cells in the second Input Data table. Space is provided for up to 20 carbon-containing compounds in the fuel stream.

Click image to expand

Input Data

This calculation spreadsheet can be used for up to 366 measurement periods.

This calculation spreadsheet can be used for up to 20 carbon-containing compounds other than CO2 in the flare gas stream.

[n] = Number of measurement periods. The minimum value for n is 52 (for weekly measurements); the maximum value for n is 366 (for daily measurements during a leap year)	
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)	
[y] = Number of carbon-containing compounds other than CO_2 in the flare gas stream	

[x] = Index for carbon-containing compounds other than CO_2	x=1	x=20
[(CMN$_x$] = Carbon mole number of compound "x" in the flare gas stream (mole carbon atoms per mole compound). E.g., CMN for ethane (C_2H_6) is 2; CMN for propane (C_3H_8) is 3		
Comment (optional)		

[p] = Measurement period index	**[(Flare)$_p$]** = Volume of flare gas combusted during measurement period (standard cubic feet per period, scf/period). If a mass flow meter is used, you must determine the average molecular weight of the flare gas during the measurement period and convert the mass flow to a volumetric flow	**[(%CO$_2$)$_p$]** = Mole percent CO_2 concentration in the flare gas stream during the measurement period (mole percent = percent by volume)	**[(%C$_x$)$_p$]** = Mole percent concentration of compound "x" in the flare gas stream during the measurement period (mole percent = percent by volume)	**[(%C$_x$)$_p$]** = Mole percent concentration of compound "x" in the flare gas stream during the measurement period (mole percent = percent by volume)	Intermediate equation value (second summation term)	Equation value for measurement period p
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

The calculation spreadsheet will calculate the annual CO_2 emissions for a fuel stream combusted in a flare. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare. If different fuel types are separately monitored, add together the CO_2 emissions calculated for each fuel type for a given flare and use the resulting sum for entry in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare.

Annual CO_2 Emissions (metric tons/year) from Equation Y-1b

[CO_2] = Annual CO_2 emissions for a specific fuel type (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-4 and Y-5

Using the Equation Y-2 Calculation Spreadsheet

If you monitor heat content but do not monitor gas composition or if reporting under subpart Q per §98.172(b), you may use the Equation Y-2 Calculation Spreadsheet to calculate annual CO_2 emissions for each fuel type combusted in each flare. A separate spreadsheet should be used for each flare and fuel type combination. In nearly all cases, gas sent to a flare will be a mixture of different process gases, which are collectively considered to be fuel gas. As such, Equation Y-2 would be applied once for this fuel type. If you monitor separately the fuel gas sent to the flare and natural gas added to the flare for the purposes of preventing oxygen infiltration or ensuring adequate heating value of the gas flared, you should calculate the CO_2 emissions separately for these fuels and sum the values for subsequent reporting. You do not need to separately calculate or report CO_2 emissions from natural gas used as pilot gas for the flare. Equation Y-2 is provided below.

(Equation Y-2)

$$CO_2 = 0.98 \times 0.001 \times \sum_{p=1}^{n} \left[(Flare)_p \times (HHV)_p \times EmF \right]$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	Flare

Next, enter the requested information in the green input cells in the first Input Data table. Based on your entries in the first Input Data table, a number of green input cells will be activated in the second Input data table. Enter the requested information in the green input cells in the second Input Data table.

If reporting under subpart Q per §98.172(b), you must report CO_2 emissions from flares that burn blast furnace gas or coke oven gas according to the procedures in §98.253(b)(1) of subpart Y (Petroleum Refineries). When using the alternatives set forth in §98.253(b)(1)(ii)(B) and §98.253(b)(1)(iii)(C), you must use the default CO_2 emission factors for coke oven gas (46.85 kg CO_2/MMBtu) and blast furnace gas (274.32 kg CO_2/MMBtu) from Table C-1 to subpart C in Equations Y-2 and Y-3 of subpart Y.

Input Data

This calculation spreadsheet can be used for up to 366 measurement periods.

[n] = Number of measurement periods. The minimum value for n is 52 (for weekly measurements); the maximum value for n is 366 (for daily measurements during a leap year)		Please enter value for [n] before trying to input values in the table below
[EmF] = Default CO_2 emission factor in kilograms CO_2/MMBtu (HHV basis).	60	The default value for **[EmF]** if reporting under subpart Y is 60 kg CO_2/MMBtu (HHV basis). As prescribed in §98.172(b), if you are reporting CO_2 emissions under subpart Q from flares that burn blast furnace gas or coke oven gas according to the procedures in §98.253(b)(1) and are using the alternatives set forth in §98.253(b)(1)(ii)(B) and §98.253(b)(1)(iii)(C), you must use the default CO_2 emission factors for coke oven gas (46.85 kg CO_2/MMBtu) and blast furnace gas (274.32 kg CO_2/MMBtu) from Table C–1 to subpart C in Equations Y–2 and Y–3 of subpart Y.

[p] = Measurement period index	**[(Flare)$_p$]** = Volume of flare gas combusted during measurement period (million (MM) scf/period). If a mass flow meter is used, you must also measure molecular weight and convert the mass flow to a volumetric flow as follows: Flare[MMscf] = 0.000001 × Flare[kg] × MVC/(MW)$_p$, where MVC is the molar volume conversion factor [(849.5 scf/kg-mole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia depending on the standard conditions used when determining (HHV)$_p$]) and (MW)$_p$ is the average molecular weight of the flare gas combusted during measurement period (kg/kg-mole)	**[(HHV)$_p$]** = Higher heating value for the flare gas combusted during measurement period (British thermal units per scf, Btu/scf = MMBtu/MMscf). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average	Equation value for measurement period p
1			0.000
2			0.000
3			0.000
4			0.000
5			0.000
6			0.000
7			0.000
8			0.000
9			0.000
10			0.000

The calculation spreadsheet will calculate the annual CO_2 emissions for a fuel type combusted in a flare. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare. If different fuel types are separately monitored, add together the CO_2 emissions calculated for each fuel type for a given flare and use the resulting sum for entry in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare.

Annual CO_2 Emissions (metric tons/year) from Equation Y-2

[CO_2] = Annual CO_2 emissions for a specific fuel type (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-4 and Y-5

Using the Equation Y-3 Calculation Spreadsheet

If you do not measure the higher heating value or carbon content of the flare gas at least weekly or if reporting under subpart Q per §98.172(b), you may use the Equation Y-3 Calculation Spreadsheet to calculate annual CO_2 emissions for each fuel type combusted in each flare using the average carbon content of the flare gas combusted. A separate spreadsheet should be used for each flare and fuel type combination. In nearly all cases, gas sent to a flare will be a mixture of different process gases, which are collectively considered to be fuel gas. As such, Equation Y-3 would be applied once for this fuel type. If you track separately the fuel gas sent to the flare and natural gas added to the flare for the purposes of preventing oxygen infiltration or ensuring adequate heating value of the gas flared, you should calculate the CO_2 emissions separately for these fuels and sum the values for subsequent reporting. You do not need to separately calculate or report CO_2 emissions from natural gas used as pilot gas for the flare. Equation Y-3 is provided below.

(Equation Y-3)

$$CO_2 = 0.98 \times 0.001 \times \left(Flare_{Norm} \times HHV \times EmF + \sum_{p=1}^{n} \left[\frac{44}{12} \times (Flare_{SSM})_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right)$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	Flare

Next, enter the requested information in the green input cells in the first Input Data table. Based on your entries in the first Input Data table, a number of green input cells will be activated in the second Input data table. Enter the requested information in the green input cells in the second Input Data table.

> If reporting under subpart Q per §98.172(b), you must report CO_2 emissions from flares that burn blast furnace gas or coke oven gas according to the procedures in §98.253(b)(1) of subpart Y (Petroleum Refineries). When using the alternatives set forth in §98.253(b)(1)(ii)(B) and §98.253(b)(1)(iii)(C), you must use the default CO_2 emission factors for coke oven gas (46.85 kg CO_2/MMBtu) and blast furnace gas (274.32 kg CO_2/MMBtu) from Table C-1 to subpart C in Equations Y-2 and Y-3 of subpart Y.

Input Data

This calculation spreadsheet can be used for up to 366 events.

[n] = Number of start-up, shutdown, and malfunction events during the reporting year exceeding 500,000 scf/day		Please enter value for [n] before trying to input values in the table below
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)		
[$Flare_{Norm}$] = Annual volume of flare gas combusted during normal operations from company records, (million (MM) standard cubic feet per year, MMscf/year)		
[HHV] = Higher heating value for fuel gas or flare gas from company records (British thermal units per scf, Btu/scf = MMBtu/MMscf)		
[EmF] = Default CO_2 emission factor for flare gas in kilograms CO_2/MMBtu (HHV basis).	60.	The default value for **[EmF]** if reporting under subpart Y is 60 kg CO_2/MMBtu (HHV basis). As prescribed in §98.172(b), if you are reporting CO_2 emissions under subpart Q from flares that burn blast furnace gas or coke oven gas according to the procedures in §98.253(b)(1) and are using the alternatives set forth in §98.253(b)(1)(ii)(B) and §98.253(b)(1)(iii)(C), you must use the default CO_2 emission factors for coke oven gas (46.85 kg CO_2/MMBtu) and blast furnace gas (274.32 kg CO_2/MMBtu) from Table C–1 to subpart C in Equations Y–2 and Y–3 of subpart Y.

[p] = Start-up, shutdown, and malfunction event index	**[$(Flare_{SSM})_p$]** = Volume of flare gas combusted during indexed start-up, shutdown, or malfunction event from engineering calculations, (scf/event)	**[$(MW)_p$]** = Average molecular weight of the flare gas, from the analysis results or engineering calculations for the event (kg/kg-mole)	**[$(CC)_p$]** = Average carbon content of the flare gas, from analysis results or engineering calculations for the event (kg C per kg flare gas)	Intermediate equation value (summation term)
1				0.000
2				0.000
3				0.000
4				0.000
5				0.000
6				0.000
7				0.000
8				0.000
9				0.000
10				0.000

The calculation spreadsheet will calculate the annual CO_2 emissions for a fuel type combusted in a flare. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare. If CO_2 emissions are estimated for different fuel types, add together the CO_2 emissions calculated for each fuel type for a given flare and use the resulting sum for entry in e-GGRT and the Equation Y-4, Y-5 Calculation Spreadsheet for this flare.

Annual CO_2 Emissions (metric tons/year) from Equation Y-3

[CO_2] = Annual CO_2 emissions for a specific fuel type (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-4 and Y-5

Using the Equation Y-4, Y-5 Calculation Spreadsheet

Use the Equation Y-4, Y-5 Calculation Spreadsheet to calculate annual CH_4 and N_2O emissions for each flare. A separate spreadsheet should be used for each flare. Equations Y-4 and Y-5 are provided below.

> Per §98.172(b), if you are reporting under subpart Q, you must report CH_4 and N_2O emissions from flares according to the requirements in §98.33(c)(2) which employ Equation C-9a (not Y-4 and Y-5) and the emission factors for coke oven gas and blast furnace gas in Table C--2 to subpart C.

(Equation Y-4)	$$CH_4 = \left(CO_2 \times \frac{EmF_{CH4}}{EmF}\right) + CO_2 \times \frac{0.02}{0.98} \times \frac{16}{44} \times f_{CH4}$$
(Equation Y-5)	$$N_2O = \left(CO_2 \times \frac{EmF_{N2O}}{EmF}\right)$$

Begin by entering the facility name, your name, the unit name or identifier, unit description, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Petroleum Refinery Flare

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[CO_2] = Emission rate of CO_2 from flared gas calculated in paragraph (b)(1) of this section (metric tons/ year)		
[f_{CH4}] = Weight fraction of carbon in the flare gas prior to combustion that is contributed by methane from measurement values or engineering calculations (kg C in methane in flare gas/kg C in flare gas); default is 0.4	0.4	The default value for f_{CH4} is 0.4

The calculation spreadsheet will calculate the annual CH_4 and N_2O emissions from this flare. The calculated values will be displayed in the red-bordered cells at the bottom of the spreadsheet. These values should be entered in e-GGRT for this flare.

Annual Methane Emissions from flared gas (metric tons CH_4/ year) from Equation Y-4

[CH_4] = Annual methane emissions from flared gas (metric tons CH_4/year)	0.00

Enter this value in e-GGRT

Annual N_2O Emissions from flared gas (metric tons N_2O/ year) from Equation Y-5

[N_2O] = Annual nitrous oxide emissions from flared gas (metric tons N_2O/year)	0.00

Enter this value in e-GGRT

Using the Equation Y-6, Y-7a, Y-7b Calculation Spreadsheet

For catalytic cracking units, fluid coking units, and catalytic reforming units that are required to use the methods provided in §98.253(c)(2)(i) through (iii), use the Equation Y-6, and potentially Y-7a or Y-7b Calculation Spreadsheet to calculate annual CO_2 emissions from each catalytic cracking unit and fluid coking unit. A separate spreadsheet should be used for each unit. If you do not continuously monitor the volumetric flow rate of exhaust gas prior to the combustion of other fossil fuels, Equation Y-7a (based on percent concentrations of O_2, CO_2, and CO in gas stream inlet and/or exhaust gas stream) or Y-7b (based on percent concentration of N_2 in gas stream inlet and exhaust gas stream) may be used to calculate the volumetric flow rate. Equations Y-6, Y-7a, and Y-7b are provided below.

(Equation Y-6)	$CO_2 = \sum_{p=1}^{n} \left[(Q_r)_p \times \frac{(\%CO_2 + \%CO)_p}{100\%} \times \frac{44}{MVC} \times 0.001 \right]$
(Equation Y-7a)	$Q_r = \frac{(79 * Q_a + (100 - \%O_{oxy}) * Q_{oxy})}{100 - \%CO_2 - \%CO - \%O_2}$
(Equation Y-7b)	$Q_r = \frac{(78.1 * Q_a + (\%N_{2,oxy}) * Q_{oxy})}{\%N_{2,exhaust}}$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, any additional comments, and the unit type in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	

Due to the extreme length of this spreadsheet, calculation results are displayed below the general information table near the top of the spreadsheet in addition to the bottom of the spreadsheet. Once the spreadsheet has been completely filled out, enter the results in the red-bordered cell in e-GGRT and in the Equation Y-9, Y-10 Calculation Spreadsheet.

Annual CO_2 Emissions (metric tons/year) from Equation Y-6

[CO_2] = Annual CO_2 mass emissions (metric tons/year)	FALSE

Enter this value in e-GGRT
and in Equations Y-9 and Y-10

Before transferring the data to e-GGRT and the Equation Y-9, Y-10 Calculation Spreadsheet, enter the requested information in the green input cells in the first Input Data table.

Input Data

This calculation spreadsheet can be used for up to 8784 hours per year.

[n] = Number of hours in calendar year	100.
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)	
Is Q_r calculated using Equation Y-7a, calculated using Equation Y-7b, or continuously monitored?	

Based on your entries in the first Input Data table, a number of green input cells will be activated in the subsequent Input data tables. Enter the requested information in the green input cells in the second Input Data table shown below regardless of how Q_r is determined.

Use these data inputs regardless of how Q_r is determined		
Measurement period index	**[%CO_2]** = Hourly average percent CO_2 concentration in the exhaust gas stream from the fluid catalytic cracking unit regenerator or fluid coking unit burner (percent by volume – dry basis)	**[%CO]** = Hourly average percent CO concentration in the exhaust gas stream from the fluid catalytic cracking unit regenerator or fluid coking unit burner (percent by volume – dry basis). When there is no post-combustion device, assume %CO to be zero. [For Equation Y-7a: When no auxiliary fuel is burned and a continuous CO monitor is not required under 40 CFR part 63 subpart UUU, assume %CO to be zero.]
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

If you continuously monitor the volumetric flow rate of exhaust gas prior to the combustion of other fossil fuels, enter the requested information in the green input cells in the third Input Data table shown below.

Use these data inputs if Q_r is **CONTINUOUSLY MONITORED**	
[Q_r] = Volumetric flow rate of exhaust gas from the fluid catalytic cracking unit regenerator or fluid coking unit burner prior to the combustion of other fossil fuels (dry standard cubic feet per hour, dscfh)	Equation Y-6 value for measurement period

If you do not continuously monitor the volumetric flow rate of exhaust gas prior to the combustion of other fossil fuels and calculated Q_r using Equation Y-7a (based on percent concentrations of O_2, CO_2, and CO in gas stream inlet and/or exhaust gas stream), enter the requested information in the green input cells in the forth Input Data table shown below.

Use these data inputs if Q_r is **CALCULATED USING EQUATION Y-7a**					
[Q_a] = Volumetric flow rate of air to the fluid catalytic cracking unit regenerator or fluid coking unit burner, as determined from control room instrumentation (dscfh)	**[Q_{oxy}]** = Volumetric flow rate of oxygen enriched air to the fluid catalytic cracking unit regenerator or fluid coking unit burner as determined from control room instrumentation (dscfh)	**[$\%O_{oxy}$]** = O_2 concentration in oxygen enriched gas stream inlet to the fluid catalytic cracking unit regenerator or fluid coking unit burner based on oxygen purity specifications of the oxygen supply used for enrichment (percent by volume – dry basis)	**[$\%O_2$]** = Hourly average percent oxygen concentration in exhaust gas stream from the fluid catalytic cracking unit regenerator or fluid coking unit burner (percent by volume – dry basis)	Equation Y-7a value for measurement period	Equation Y-6 value for measurement period

If you do not continuously monitor the volumetric flow rate of exhaust gas prior to the combustion of other fossil fuels and calculated Q_r using Equation Y-7b (based on percent concentration of N_2 in gas stream inlet and exhaust gas stream), enter the requested information in the green input cells in the fifth Input Data table shown below.

Use these data inputs if Q_r is **CALCULATED USING EQUATION Y-7b**					
[Q_a] = Volumetric flow rate of air to the fluid catalytic cracking unit regenerator or fluid coking unit burner, as determined from control room instrumentation (dscfh)	**[Q_{oxy}]** = Volumetric flow rate of oxygen enriched air to the fluid catalytic cracking unit regenerator or fluid coking unit burner as determined from control room instrumentation (dscfh)	**[$\%N_{2,oxy}$]** = N_2 concentration in oxygen enriched gas stream inlet to the fluid catalytic cracking unit regenerator or fluid coking unit burner based on measured value or maximum N_2 impurity specifications of the oxygen supply used for enrichment (percent by volume – dry basis)	**[$\%N_{2,exhaust}$]** = Hourly average percent N_2 concentration in the exhaust gas stream from the fluid catalytic cracking unit regenerator or fluid coking unit burner (percent by volume – dry basis)	Equation Y-7b value for measurement period	Equation value for measurement period

The calculation spreadsheet will calculate the annual CO_2 emissions from each catalytic cracking unit and fluid coking unit. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-9, Y-10 Calculation Spreadsheet for this unit.

Annual CO_2 Emissions (metric tons/year) from Equation Y-6

[CO_2] = Annual CO_2 mass emissions (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-9 and Y-10

Using the Equation Y-8 Calculation Spreadsheet

For catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day (bbls/sd) or less that do not monitor at least daily the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack prior to combustion of other fossil fuels, use the Equation Y-8 Calculation Spreadsheet to calculate annual CO_2 emissions for each catalytic cracking unit and fluid coking unit. A separate spreadsheet should be used for each unit. Equation Y-8 is provided below.

(Equation Y-8)

$$CO_2 = Q_{unit} \times (CBF \times 0.001) \times CC \times \frac{44}{12}$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, any additional comments, and the unit type in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	

Next, enter the requested information in the green input cells in the first Input Data table.

Input Data

[Q_{unit}] = Annual throughput of unit from company records (barrels (bbls) per year, bbl/yr)		
[CBF] = Coke burn-off factor from engineering calculations (kg coke per barrel of feed); default for catalytic cracking units = 7.3; default for fluid coking units = 11		The default value for CBF is 7.3 (for catalytic cracking units) or 11 (for coking units)
[CC] = Carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94	0.94	The default value for TCC is 0.94

The calculation spreadsheet will calculate the annual CO_2 emissions from each catalytic cracking unit and fluid coking unit. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-9, Y-10 Calculation Spreadsheet for this unit.

Annual CO_2 Mass Emissions (metric tons/year) from Equation Y-8

[CO_2] = Annual CO_2 mass emissions (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-9 and Y-10

Using the Equation Y-9, Y-10 Calculation Spreadsheet

Use the Equation Y-9, Y-10 Calculation Spreadsheet to calculate annual CH_4 and N_2O emissions for each catalytic cracking unit, fluid coking unit, coke calcining unit, and/or catalytic reforming unit when the default emission factors are used (no calculation spreadsheets are provided if measurement data or site-specific emission factors are used). A separate spreadsheet should be used for each unit. The Equation Y-9, Y-10 Calculation Spreadsheet performs the calculations using Equations Y-9 and Y-10 provided below.

(Equation Y-9)

$$CH_4 = \left(CO_2 * \frac{EmF_2}{EmF_1} \right)$$

(Equation Y-10)	$$N_2O = \left(CO_2 * \frac{EmF_3}{EmF_1} \right)$$

Begin by entering the facility name, your name, the unit name or identifier, unit description, any additional comments, and the unit type in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[CO_2] = Emission rate of CO_2 from coke burn-off calculated in paragraphs (c)(1), (c)(2), (e)(1), (e)(2), (g)(1), or (g)(2) of this section, as applicable (metric tons/ year)	

The calculation spreadsheet will calculate the annual CH_4 and N_2O emissions from this unit. The calculated values will be displayed in the red-bordered cells at the bottom of the spreadsheet. These values should be entered in e-GGRT for this unit.

Annual Methane Emissions from coke burn-off (metric tons CH_4/ year) from Equation Y-9

[CH_4] = Annual methane emissions from coke burn-off (metric tons CH_4/year)	0.00

Enter this value in e-GGRT

Annual N_2O Emissions from coke burn-off (metric tons N_2O/ year) from Equation Y-10

[N_2O] = Annual nitrous oxide emissions from coke burn-off (metric tons N_2O/year)	0.00

Enter this value in e-GGRT

Using the Equation Y-11 Calculation Spreadsheet

Use the Equation Y-11 Calculation Spreadsheet to calculate annual CO_2 emissions for each catalytic reforming unit that does not monitor at least daily the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack prior to combustion of other fossil fuels. A separate spreadsheet should be used for each unit. Equation Y-11 is provided below.

(Equation Y-11)	$$CO_2 = \sum_{1}^{n} \left[\left(CB_Q \right)_n \times CC \times \frac{44}{12} \times 0.001 \right]$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	Catalytic Reforming Unit

Next, enter the requested information in the green input cells in the first Input Data table. Based on your entries in the first Input Data table, a number of green input cells will be activated in the second Input data table. Enter the requested information in the green input cells in the second Input Data table.

Input Data

This calculation spreadsheet can be used for up to 366 regeneration cycles. Use additional spreadsheets for regeneration cycles greater than this.

[n] = Number of regeneration cycles or measurement periods in the calendar year	

Index for Measurement Period	[CB_Q] = Coke burn-off quantity per regeneration cycle or measurement period from engineering estimates (kg coke/cycle or kg coke/measurement period)	[CC] = Carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94	Equation value for measurement period
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

The calculation spreadsheet will calculate the annual CO_2 emissions from a catalytic reforming unit. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-9, Y-10 Calculation Spreadsheet for this unit.

Annual CO_2 Emissions (metric tons/year) from Equation Y-11

[CO_2] = Annual CO_2 emissions (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-9 and Y-10

Using the Equation Y-12 Calculation Spreadsheet

Except for non-Claus units electing to use the process vent method, use the Equation Y-12 Calculation Spreadsheet to calculate annual CO_2 emissions from sour gas sent off site for sulfur recovery and annual CO_2 process emissions from each on-site sulfur recovery plant. A separate spreadsheet should be used for sour gas sent off site for sulfur recovery and for each on-site sulfur recovery plant. The Equation Y-12 Calculation Spreadsheet performs the calculations using Equation Y-12 provided below.

(Equation Y-12)

$$CO_2 = F_{SG} * \frac{44}{MVC} * MF_C * 0.001$$

Begin by entering the facility name, your name, the unit name or identifier, unit description, any additional comments, and the unit type in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Petroleum Refinery Sulfur Recovery Plant

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[F_{SG}] = Volumetric flow rate of sour gas feed (including sour water stripper gas) to the sulfur recovery plant (scf/year)		
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)		
[MF_C] = Mole fraction of carbon in the sour gas to the sulfur recovery plant (kg-mole C/kg-mole gas); default = 0.20.	0.2	The default value for MF_C is 0.2

The calculation spreadsheet will calculate the annual CO_2 emissions from sour gas sent off site for sulfur recovery or annual CO_2 process emissions from each on-site sulfur recovery plant. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT.

Annual CO_2 Emissions (metric tons/year) from Equation Y-12

[CO_2] = Annual CO_2 emissions (metric tons/year)	

Enter this value in e-GGRT

Using the Equation Y-13 Calculation Spreadsheet

Use the Equation Y-13 Calculation Spreadsheet to calculate annual CO_2 emissions for each coke calcining unit. Use a separate spreadsheet for each unit. Equation Y-13 is provided below.

(Equation Y-13)

$$CO_2 = \frac{44}{12} * \left(M_{in} * CC_{GC} - (M_{out} + M_{dust}) * CC_{MPC}\right)$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Petroleum Refinery Coke Calcining Unit

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[M_{In}] = Annual mass of green coke fed to the coke calcining unit from facility records (metric tons/year)	
[CC_{GC}] = Average mass fraction carbon content of green coke from facility measurement data (metric ton carbon/metric ton green coke)	
[M_{out}] = Annual mass of marketable petroleum coke produced by the coke calcining unit from facility records (metric tons petroleum coke/year).	
[M_{dust}] = Annual mass of petroleum coke dust removed from the process through the dust collection system of the coke calcining unit from facility records (metric ton petroleum coke dust/year). For coke calcining units that recycle the collected dust, the mass of coke dust removed from the process is the mass of coke dust collected less the mass of coke dust recycled to the process.	
[CC_{MPC}] = Average mass fraction carbon content of marketable petroleum coke produced by the coke calcining unit from facility measurement data (metric ton carbon/metric ton petroleum coke)	

The calculation spreadsheet will calculate the annual CO_2 emissions from a coke calcining unit. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT and the Equation Y-9, Y-10 Calculation Spreadsheet for this unit.

Annual CO_2 Emissions (metric tons/year) from Equation Y-13

[CO_2] = Annual CO_2 emissions (metric tons/year)	

Enter this value in e-GGRT and in Equations Y-9 and Y-10

Using the Equation Y-14, Y-15 Calculation Spreadsheet

For uncontrolled asphalt blowing operations and asphalt blowing operations controlled by vapor scrubbing, use the Equation Y-14, Y-15 Calculation Spreadsheet to calculate annual CO_2 and CH_4 emissions for asphalt blowing operation. Equations Y-14 and Y-15 is provided below.

(Equation Y-14)	$CO_2 = (Q_{AB} \times EF_{AB,CO2})$
(Equation Y-15)	$CH_4 = (Q_{AB} \times EF_{AB,CH4})$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Asphalt Blowing Operations

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[Q_{AB}] = Quantity of asphalt blown (million barrels per year, MMbbl/year)		
[$EF_{AB, CO2}$] = Emission factor for CO2 from uncontrolled asphalt blowing from facility-specific test data (metric tons CO_2/MMbbl asphalt blown); default = 1,100		The default value for this parameter is 1,100
[$EF_{AB, CH4}$] = Emission factor for CH4 from uncontrolled asphalt blowing from facility-specific test data (metric tons CH_4/MMbbl asphalt blown); default = 580		The default value for this parameter is 580

The calculation spreadsheet will calculate the annual CO_2 and CH_4 emissions from asphalt blowing operations. The calculated values will be displayed in red-bordered cells at the bottom of the spreadsheet. These values should be entered in e-GGRT.

Annual Carbon Dioxide Emissions from Asphalt Blowing Operations (metric tons CO_2/ year) from Equation Y-14

[CO_2] = Annual CO_2 emissions from uncontrolled asphalt blowing (metric tons CO_2/ year)	

Enter this value in e-GGRT

Annual Methane Emissions from Asphalt Blowing Operations (metric tons CH_4/ year) from Equation Y-15

emissions from uncontrolled asphalt blowing (metric tons CH_4/year)	

Enter this value in e-GGRT

Using the Equation Y-16a, Y-16b, Y-17 Calculation Spreadsheet

For asphalt blowing operations controlled by thermal oxidizer or flare, use the Equation Y-16a, Y-16b, Y-17 Calculation Spreadsheet to calculate annual CO_2 and CH_4 emissions for asphalt blowing operation. Equations Y-16a, Y-16b, and Y-17 are provided below.

(Equation Y-16a)	$CO_2 = 0.98 \times \left(Q_{AB} \times CEF_{AB} \times \frac{44}{12}\right)$
(Equation Y-16b)	$CO_2 = Q_{AB} \times \left(EF_{AB,CO2} + 0.98 \times \left[\left(CEF_{AB} \times \frac{44}{12}\right) - EF_{AB,CO2}\right]\right)$
(Equation Y-17)	$CH_4 = 0.02 \times \left(Q_{AB} \times EF_{AB,CH4}\right)$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Asphalt Blowing Operations

Next, enter the requested information in the green input cells in the first Input Data table.

Input Data

[Q_{AB}] = Quantity of asphalt blown (MMbbl/year)		
[CEF_{AB}] = Carbon emission factor from asphalt blowing from facility-specific test data (metric tons C/MMbbl asphalt blown); default = 2,750	2,750.	The default value for CEF_{AB} is 2,750
[$EF_{AB,CH4}$] = Emission factor for CH4 from uncontrolled asphalt blowing from facility-specific test data (metric tons CH_4/MMbbl asphalt blown); default = 580	580.	The default value for $EF_{AB,CH4}$ is 580
[$EF_{AB,CO2}$] = Emission factor for CO2 from uncontrolled asphalt blowing from facility-specific test data (metric tons CO2/MMbbl asphalt blown); default = 1,100	1,100.	[$EF_{AB,CO2}$] is a required input for Equation Y-16b only; the default value is 1,100

The calculation spreadsheet will calculate the annual CO_2 and CH_4 emissions from asphalt blowing operations. The calculated values will be displayed in red-bordered cells at the bottom of the spreadsheet. If you used an emission factor for CO_2 from uncontrolled asphalt blowing from facility-specific test data enter the result from Equation Y-16b into e-GGRT, otherwise enter the result from Equation Y-16a into e-GGRT. The result for CH_4 should also be entered in e-GGRT.

Annual Carbon Dioxide Emissions from Asphalt Blowing Operations (metric tons CO_2/ year) from Equation Y-16a

[CO_2] = Annual CO_2 emissions from controlled asphalt blowing (metric tons CO_2/ year)	

Enter this value in e-GGRT

Annual Carbon Dioxide Emissions from Asphalt Blowing Operations (metric tons CO_2/ year) from Equation Y-16b

[CO_2] = Annual CO_2 emissions from controlled asphalt blowing (metric tons CO_2/ year)	

Enter this value in e-GGRT

Annual Methane Emissions from Asphalt Blowing Operations (metric tons CH_4/ year) from Equation Y-17

[CH_4] = Annual methane emissions from controlled asphalt blowing (metric tons CH_4/year)	

Enter this value in e-GGRT

Using the Equation Y-18 Calculation Spreadsheet

Use the Equation Y-18 Calculation Spreadsheet to calculate annual CH_4 emissions for each set of similar delayed coking vessels. A separate spreadsheet should be used for each set of different delayed coking vessels. Equation Y-18 is provided below.

(Equation Y-18)

$$CH_4 = \left(N \times H \times \frac{(P_{CV} + 14.7)}{14.7} \times f_{void} \times \frac{\pi \times D^2}{4} \times \frac{16}{MVC} \times MF_{CH4} \times 0.001 \right)$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Delayed Coking Unit

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[N] = Cumulative number of vessel openings for all delayed coking unit vessels of the same dimensions during the year		
[H] = Height of coking unit vessel (feet)		
[P_{CV}] = Gauge pressure of the coking vessel when opened to the atmosphere prior to coke cutting or, if the alternative method provided in paragraph (i)(2) of this section is used, gauge pressure of the coking vessel when depressurization gases are first routed to the atmosphere (pounds per square inch gauge, psig)		
[D] = Diameter of coking unit vessel (feet)		
[MF_{CH4}] = Mole fraction of methane in coking vessel gas (kg-mole CH_4/kg-mole gas, wet basis); default value is 0.01	0.01	The default value for MF_{CH4} is 0.01
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)		
[f_{void}] = Volumetric void fraction of coking vessel prior to steaming (cf gas/cf of vessel); default = 0.6	0.6	The default value for f_{void} is 0.6

The calculation spreadsheet will calculate the annual CH_4 emissions from a set of similar delayed coking vessels. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. If you elect to use the process vent method for the depressurization cycle, calculate CH_4 emissions during depressurization using the Equation Y-19 Calculation Spreadsheet and add that value to the CH_4 emissions calculated using the Equation Y-18 Calculation Spreadsheet for vessel openings. If you have multiple sets of delayed coking vessels, add together the CH_4 emissions from all delayed coking vessels and enter the sum total into e-GGRT for delayed coking units.

Annual CH_4 Mass Emissions (metric tons/year) from Equation Y-18

[CH4] = Annual methane emissions from the delayed coking unit vessel opening (metric tons/year)	

Enter this value in e-GGRT

Using the Equation Y-19 Calculation Spreadsheet

Use the Equation Y-19 Calculation Spreadsheet to calculate annual CO_2, CH_4, and N_2O emissions for each process vent not covered in paragraphs (a) through (i) of §98.253 or for other sources electing to use this method. A separate spreadsheet should be used for each process vent. Equation Y-19 is provided below.

(Equation Y-19)

$$E_x = \sum_{p=1}^{N} \left((VR)_p \times (MF_x)_p \times \frac{MW_x}{MVC} \times (VT)_p \times 0.001 \right)$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, any additional comments, and the unit types in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name/ ID:	
Reporting Period:	
Comments:	
Unit Type:	

Next, enter the requested information in the green input cells in the first Input Data table. Based on your entries in the first Input Data table, a number of green input cells will be activated in the second Input data table. Enter the requested information in the green input cells in the second Input Data table.

Click image to expand

Input Data

This calculation spreadsheet can be used for up to 366 venting events. Use additional spreadsheets for venting events greater than this,.

[N] = Number of venting events	
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)	

[P] = Index of venting events	[(VR)p] = Average volumetric flow rate of process gas during the event (scf per hour) from measurement data, process knowledge, or engineering estimates	[(VT)p] = Venting time for the event (hours)	[(MF CO2)p] = Mole fraction of GHG CO_2 in process vent during the event (kg-mol of GHG CO_2/kg-mol vent gas) from measurement data, process knowledge, or engineering estimates	[(MF CH4)p] = Mole fraction of GHG CH_4 in process vent during the event (kg-mol of GHG CH_4/kg-mol vent gas) from measurement data, process knowledge, or engineering estimates	[(MF N2O)p] = Mole fraction of GHG N_2O in process vent during the event (kg-mol of GHG N_2O/kg-mol vent gas) from measurement data, process knowledge, or engineering estimates	Equation value (CO_2) for venting event P	Equation value (CH_4) for venting event P	Equation value (N_2O) for venting event P
1								
2								
3								
4								
5								
6								
7								
8								

The calculation spreadsheet will calculate the annual CO_2, CH_4, and N_2O emissions from for a process vent. The calculated values will be displayed in the red-bordered cells at the bottom of the spreadsheet. These values should be entered in e-GGRT for this process vent (or for this process unit for units electing to use the process vent method).

Annual Greenhouse Gas Emissions (metric tons/year) from Equation Y-19

[E_{CO2}] = Annual emissions of CO_2 from process vent	
[E_{CH4}] = Annual emissions of CH_4 from process vent	
[E_{N2O}] = Annual emissions of N_2O from process vent	

Enter these values in e-GGRT

Using the Equation Y-20 Calculation Spreadsheet

Use the Equation Y-20 Calculation Spreadsheet to calculate annual CH_4 emissions for blowdown systems unless the process vent method is selected. Equation Y-20 is provided below.

(Equation Y-20)

$$CH_4 = \left(Q_{Ref} \times EF_{BD} \times \frac{16}{MVC} \times 0.001 \right)$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Blowdown System

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[Q_{ref}] = Quantity of crude oil plus the quantity of intermediate products received from off site that are processed at the facility (MMbbl/year)		
[EF_{BD}] = Methane emission factor for uncontrolled blown systems (scf CH4/MMbbl); default is 137,000	137,000.	The default value for EF_{BD} is 137,000
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)		

The calculation spreadsheet will calculate the annual CH_4 emissions from blowdown systems. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT for this unit.

Annual CH_4 Mass Emissions (metric tons/year) from Equation Y-20

[CH4] = Annual methane emissions from the delayed coking unit vessel opening (metric tons/year)	

Enter this value in e-GGRT

Using the Equation Y-21 Calculation Spreadsheet

Use the Equation Y-21 Calculation Spreadsheet to calculate annual CH_4 emissions for equipment leaks unless the alternative method is selected.

Equation Y-21 is provided below.

(Equation Y-21)	$$CH_4 = (0.4 \times N_{CD} + 0.2 \times N_{PU1} + 0.1 \times N_{PU2} + 4.3 \times N_{H2} + 6 \times N_{FGS})$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Equipment leaks

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[N_{CD}] = Number of atmospheric crude oil distillation columns at the facility	
[N_{PU1}] = Cumulative number of catalytic cracking units, coking units (delayed or fluid), hydrocracking, and full-range distillation columns (including depropanizer and debutanizer distillation columns) at	
[N_{PU2}] = Cumulative number of hydrotreating/ hydrorefining units, catalytic reforming units, and visbreaking units at the facility	
[N_{H2}] = Total number of hydrogen plants at the facility	
[N_{FGS}] = Total number of fuel gas systems at the facility	

The calculation spreadsheet will calculate the annual CH_4 emissions from equipment leaks. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT for this unit.

Annual CH_4 Mass Emissions (metric tons/year) from Equation Y-21

[CH4] = Annual methane emissions from equipment leaks (metric tons/year)	

Enter this value in e-GGRT

Using the Equation Y-22 Calculation Spreadsheet

Use the Equation Y-22 Calculation Spreadsheet to calculate annual CH_4 emissions for storage tanks other than those processing unstabilized crude oil unless the alternative method is selected. Equation Y-22 is provided below.

(Equation Y-22)	$$CH_4 = (0.1 \times Q_{Ref})$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Storage tanks other than those processing unstabilized crude oil

Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[Q_{ref}] = Quantity of crude oil plus the quantity of intermediate products received from off site that are processed at the facility (MMbbl/year)	

The calculation spreadsheet will calculate the annual CH_4 emissions from storage tanks other than those processing unstabilized crude oil. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT for this unit.

Annual CH_4 Mass Emissions (metric tons/year) from Equation Y-22

[CH4] = Annual methane emissions from storage tanks (metric tons/year)	

Enter this value in e-GGRT

Using the Equation Y-23 Calculation Spreadsheet

Use the Equation Y-23 Calculation Spreadsheet to calculate annual CH_4 emissions for storage tanks that process unstabilized crude oil. Equation Y-23 is provided below.

(Equation Y-23)

$$CH_4 = (995{,}000 \times Q_{un} \times \Delta P) \times MF_{CH4} \times \frac{16}{MVC} \times 0.001$$

Begin by entering the facility name, your name, the unit name or identifier, reporting period, and any additional comments in the green input cells of the general information table located immediately below the equation in the calculation spreadsheet. This is for your records.

Facility Name:	
Reporter Name:	
Unit Name or Identifier:	
Unit Description:	
Comments:	
Unit Type:	Storage tanks that process unstabilized crude oil

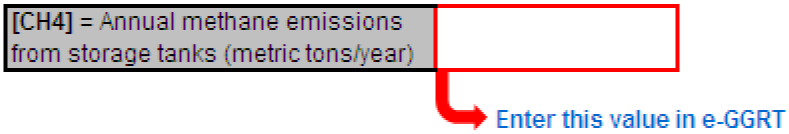
Next, enter the requested information in the green input cells in the Input Data table.

Input Data

[Q_{un}] = Quantity of unstabilized crude oil received at the facility (MMbbl/year)		
[ΔP] = Pressure differential from the previous storage pressure to atmospheric pressure (pounds per square inch, psi)		
[MF_{CH4}] = Mole fraction of CH_4 in vent gas from the unstabilized crude oil storage tank from facility measurements (kgmole CH_4/kg-mole gas); use 0.27 as a default if measurement data are not available	0.27	The default value for MF_{CH4} is 0.27
[MVC] = Molar volume conversion factor (849.5 scf/kgmole at 68 °F and 14.7 psia or 836.6 scf/kg-mole at 60 °F and 14.7 psia)	836.6	

The calculation spreadsheet will calculate the annual CH_4 emissions from storage tanks that process unstabilized crude oil. The calculated value will be displayed in the red-bordered cell at the bottom of the spreadsheet. This value should be entered in e-GGRT for this unit.

Annual CH_4 Mass Emissions (metric tons/year) from Equation Y-23



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