Greenhouse Gas Reporting Program

XML Reporting Instructions
Inputs Verification Tool (IVT)
For
Subpart Y - Petroleum Refineries

United States Environmental Protection Agency
Climate Change Division
Washington, DC

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These instructions explain how to upload the required data for the applicable regulations. Owners and operators of units should refer to the applicable regulations for information about what data are required to be uploaded.

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I. Introduction

The U.S. Environmental Protection Agency's (EPA's) electronic greenhouse gas reporting tool (e-GGRT) extensible markup language (XML) Reporting Schema contains all of the data elements needed to comply with the Greenhouse Gas Reporting Program (GHGRP) beginning with the reporting year (RY) 2010.

Beginning with RY 2014, e-GGRT uses two separate schemas: one schema defines requirements for reporting data elements through e-GGRT, and the other defines requirements for uploading certain equation inputs to the Inputs Verification Tool (IVT). These instructions specifically relate to the equation inputs uploaded to IVT. IVT will perform electronic verification on the entered inputs to emission equations and use the entered inputs to calculate the emission equation results. IVT will not retain the entered inputs (i.e., the inputs are not reporting requirements under Part 98); instead, IVT will conduct certain checks at the time of data entry and generate a verification summary. The EPA will not have access to the entered inputs either during the time of entry or any time thereafter.

The XML schemas define expected data elements and attributes, allowable data formats for each data element, and the hierarchical structure and sequence in which data elements must appear in the XML file. Similar to an architectural blueprint that describes the structural design of a house, an XML schema describes the structural design of an XML file. In some cases, it also defines which elements are optional and which are required and the maximum number of occurrences allowed for each element.

II. E-GGRT IVT XML Overview

The e-GGRT IVT XML schema is made up of a root data element and complex and simple data elements. A simple element is a single piece of data. A complex element is a group of simple elements which are logically grouped together. The root data element is the base of the XML schema.

The schema's structure can be thought of as a family tree. The elements are related to each other in parent-child relationships. The root element is the parent element of the entire schema. Complex elements are children of the root element, and complex elements can also be children of other complex elements.

All IVT XML files submitted to e-GGRT must be well formed and will be accepted only if they conform to the current version of the e-GGRT IVT XML schema.

An XML upload must only contain data for a single facility. All data for a facility must be uploaded in a single complete file and must include all required inputs for all of the relevant direct emitter subparts applicable to the facility. It is not possible to upload a subset of any portion of a facility's input data to add, delete, correct or update. The entire report must be re-uploaded to make any modification at all. Each subsequent upload for the same facility replaces all of the previously uploaded data.

The e-GGRT IVT XML schema includes information about the units of measure and allowable values for the data elements. For rules regarding the unit of measure or allowable values for a specific data element, please refer to the appropriate Schema Excerpts and Data Element Definitions tables in Part III of these instructions.

The e-GGRT IVT XML schema is available for download at the e-GGRT help website: http://www.ccdsupport.com/confluence/display/help/Inputs+Verifier+Tool+and+the+XML+Reporting+Method?src=search. By clicking the Inputs Verifier Tool XML Schema link, you can download a zip file containing subpart-specific IVT schemas and a schema with summary content that is relevant for all IVT XML files.

Table 1
Using Numbers in IVT XML Uploads

Number Format	Description
Rounding	Non-emissions quantitative data uploaded by the user (e.g., a monthly HHV sample result, a monthly feedstock quantity, etc.) will not need to be rounded.
Percentages	If a value must be expressed as a percentage, then the number should be within the range of 0 to 100 (percent), e.g., 85.5% should be expressed as 85.5.
Fractions	If a value must be expressed as a decimal fraction, then the number should be within the range of 0 to 1, e.g., 1/4 should be expressed as 0.25. Leading zeroes are optional.

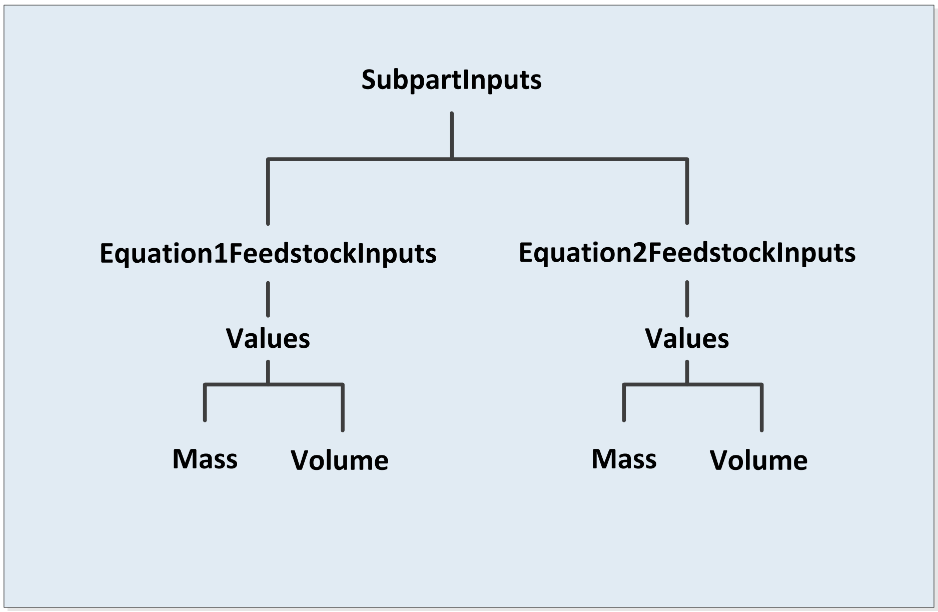
Key XML Terms

- XML: A markup language for documents containing structured information. The XML specification defines a standard way to add markup to documents. Its primary purpose is to facilitate the sharing of structured data across different information systems, particularly via the internet.
- XML Schema: An XML schema describes the structure of an XML document. The schema also defines the set of rules to which the XML document must conform in order to be considered "valid".
- XML file: A file containing data organized into a structured document using XML markup.
- Data Element: An XML data element is used for storing and classifying data in an XML file. Opening and closing tags represent the start and end of a data element. An opening tag looks like <elementName>, while a closing tag has a slash that is placed before the element's name </elementName>. The following example shows how to identify the facility's identification number: <FacilitySiteIdentifier>23222</FacilitySiteIdentifier>. The information shaded in blue represents the data element's value.

  If a data element does not contain a value, then a single empty tag name may be used. An empty tag has a slash placed after the element's name <FacilitySiteIdentifier/>. **Note:** If you do not intend to upload a value for a particular data element, then it is recommended that you do not include the data element in the XML file.
- **Attribute:** An XML attribute contains additional information about a specific data element. An attribute for a data element is placed within the opening tag. The syntax for including an attribute in an element is <elementName attributeName="value">. For example, <TotalCH4CombustionEmissionsmassUOM="Metric Tons">.
- **Root/Parent/Child Element:** The schema's structure can be thought of as a family tree. At the top of the tree is some early ancestor and at the bottom of the tree are the latest children. With a tree structure you can see which children belong to which parents and many other relationships.

  XML data elements are sometimes referenced in terms of how they relate to each other, e.g., parent-child relationships, within the schema's tree structure, also known are hierarchy. The top of the XML tree is considered the root – it is the parent to all data elements within the schema. In the example below, "Facility Identifier" is the root, and just like in many other family trees, there is more than one item with the same name (e.g., "Unit Name"). The easiest way to distinguish these items is by referencing them in terms of their parent-child relationships, e.g., Equation2FeedstockInputs/Values vs. Equation1FeedstockInputs/Values.

Figure 1
Example of an XML Tree



This document provides a step-by-step description of how to temporarily upload data into IVT using the XML schema. Please note the following:

- **Unit names submitted through the IVT XML file must match the corresponding unit names within the Annual Report exactly.** In most cases, units of measure do not need to be included in the IVT XML file, because they are associated automatically in e-GGRT. Details on units of measure are provided in the schema diagram excerpts and the data elements definition tables.

- **The Annual Report XML file must be uploaded before uploading the IVT XML file.** IVT XML data for multiple subparts may be combined in one file. Correction of inaccurate data within either the IVT XML or the Annual Report XML files will, in most cases, require reporters to re-upload both files.

- **The inputs data in the IVT XML file do not persist within e-GGRT if the user logs out, closes the browser, or if the user's session times out due to an extended period of inactivity; they must be saved on a local drive and must be re-uploaded each time the record is opened and viewed within e-GGRT.**

- **Non-applicable data elements should not be included in the facility's XML file.** The schema contains many data elements, some of which may not be applicable to XML reporters in general or to a particular situation. If a data element is not referenced in the instructions (definition tables), then **do not** include it in the facility's XML file.

- **Data elements must be ordered as defined by the schema.** The figures and tables in this document depict the specific sequence in which data elements must be arranged in the facility's IVT XML file in order to produce a well-formed XML file.

- **Enumerations are case sensitive.** Many data elements have a defined set of allowable values, also known as enumerations. Values for enumerations must be entered exactly as they are defined within the schema (including punctuation marks) in order to be accepted by schema validation. See the data definition tables for a complete list of enumerations.

- **Schema diagrams depict the hierarchy (or tree structure).** The primary purpose of the schema diagrams is to indicate the sequence in which data elements must appear within the facility's IVT XML file and to identify the data elements that are required (must be uploaded) and conditionally required (see last bullet). Required data elements are boxed in red and conditionally required data elements are noted.

- **Definition tables provide details for required and conditionally required data elements.** The tables are designed to provide unique instructions for reporting a given data element, including the list of enumerations and required units of measure, if defined.

- **Some data elements are conditionally required.** Data elements which are conditionally required are noted in the schema diagrams and the data element definitions tables. If your facility meets the condition specified for the data element, then the data element is required and you must include it in the facility's IVT XML file. If your facility does not meet the condition specified for the data element, then **do not** include the data element in the facility's IVT XML file. If a parent element is not required, then **do not** include any of its child data elements in the facility's IVT XML file.

The following sample schema diagram and data elements definition table depict the bulleted items discussed above.

Figure 2
Feedstock Inputs Type Schema Diagram

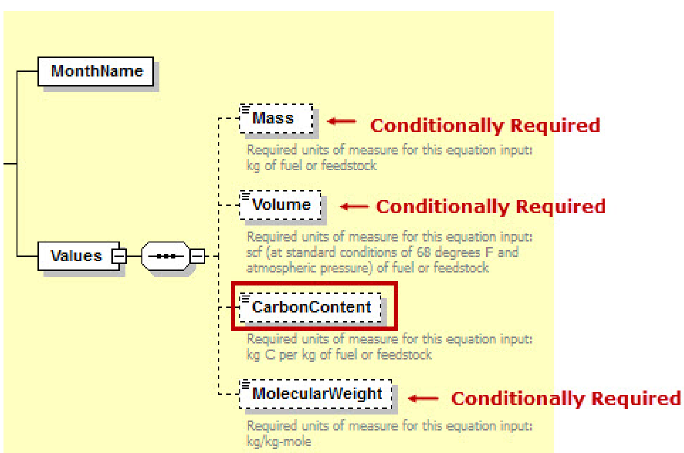


Table 2
Feedstock Inputs Type Data Element Definitions

Data Element Name	Description
FeedstockInputsType	
Mass	The quantity of the gaseous fuel or feedstock consumed during the month (kg). **Conditionally Required:** This data element is only required if the gaseous fuel or feedstock is measured in mass units of measure.
Volume	The quantity of the gaseous fuel or feedstock consumed during the month (scf). **Conditionally Required:** This data element is only required if the gaseous fuel or feedstock is measured in volumetric units of measure.
CarbonContent	The average carbon content of the gaseous fuel or feedstock for the specified month (kg carbon per kg fuel or feedstock).
MolecularWeight	The average molecular weight of the gaseous fuel or feedstock for the specified month (kg per kg-mole). **Conditionally Required:** This data element is only required if the gaseous fuel or feedstock is measured in volumetric units of measure.

Section III provides details on the XML schema and reporting requirements for Subpart Y feedstock and fuel usage data submitted through the IVT for petroleum refinery units using non-CEMS (mass balance) calculation methodology. The IVT does not apply to petroleum refinery units using the CEMS calculation methodology.

III. IVT Submittals for Subpart Y – Petroleum Refineries

This section provides a description of how to upload the inputs data for the Subpart Y IVT using the XML schema. In accordance with 40 CFR 98.253, petroleum refineries must calculate the annual CO_2, CH_4, and/or N_2O emissions from specific types of units, tanks and systems.

1.0 Facility Input

Prior to compiling the inputs data for each emission source, the general facility data should be defined. These data elements are described below in Table 3 and the XML file format is illustrated in Excerpt 1.

Table 3
Facility Input Details Data Element Definitions

Data Element Name	Description
Facility Inputs – name	Specify the registered name of the facility
Facility Inputs – id	Specify the 6-digit facility ID
Facility Inputs – Reporting Year	Specify the reporting year
Facility Inputs – Last Update Date	Specify the date associated with the most recent file update.

Excerpt 1 illustrates a portion of the XML file that can be used for the Facility Inputs data described above. See Appendix A for examples of complete XML files that can be submitted through the IVT.

XML Excerpt 1
Subpart Y Process Unit High Level

```
<FacilityInputs lastUpdateDate=”2014-08-11” reportingYear=”2014” id=”544770” name=”SY Industries”
            <SubpartInputs>
                    <SubpartYInputs>

            ---  insert XML for Subpart Y Unit data ---

                    </SubpartYInputs>
            </SubpartInputs>
</FacilityInputs>
```

2.0 Subpart Y Inputs (High-Level)

The schema is organized by Subpart Y unit type and then by Subpart Y equation. Separate equations are used, depending on the unit category.

Subpart Y Inputs (High-Level)

Inputs for Subpart Y are organized by Subpart Y unit type. The XML structure requires that all inputs determined by Subpart Y equations must follow the order shown in the schema structure. Figure 3 shows the high level structure of the Subpart Y IVT schema, and Table 4 provides detailed data element descriptions.

Figure 3
Subpart Y Inputs Type High-Level Schema Structure

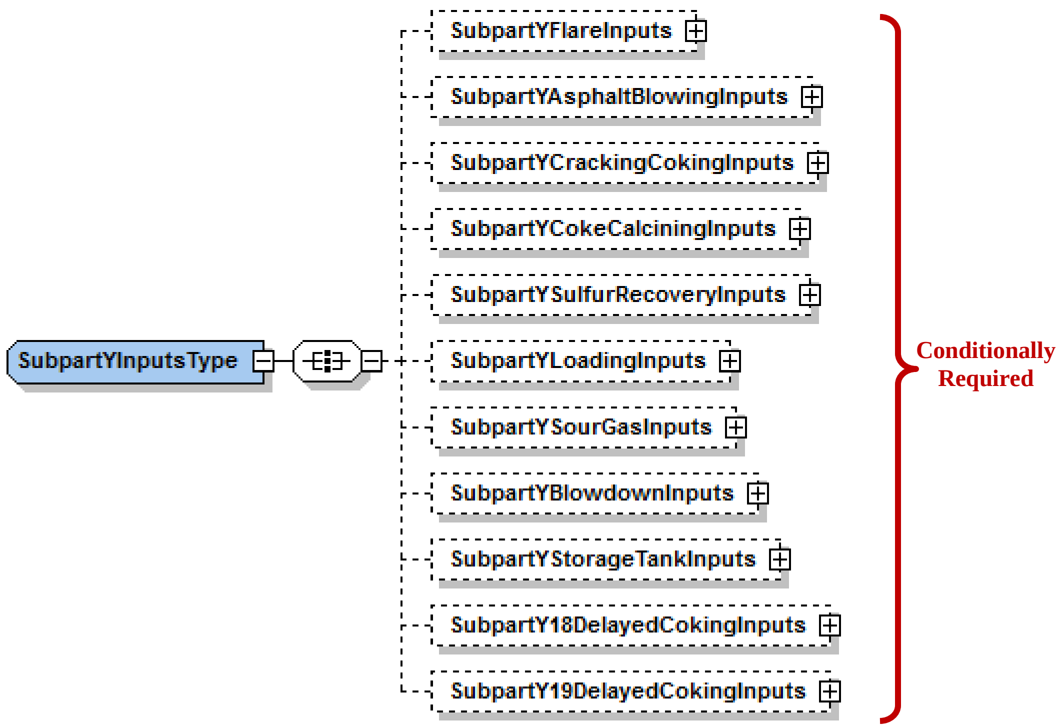


Table 4
Data Element Definitions for Subpart Y Inputs Type (High Level)

Data Element Name	Description
SubpartYInputsType	**Parent Element:** A collection of data elements containing the inputs for Subpart Y
SubpartYFlares	**Parent Element:** A collection of data elements containing the flare name and the emission calculation equation inputs. **Conditionally required:** These data elements are required only for flares.

SubpartYAsphaltBlowingUnits	**Parent Element:** A collection of data elements containing the asphalt blowing unit name and the emission calculation equation inputs. **Conditionally required:** These data elements are required only for asphalt blowing units.
SubpartYCrackingCokingUnits	**Parent Element:** A collection of data elements containing the catalytic cracking, fluid coking, or catalytic reforming unit name and the emission calculation equation inputs. **Conditionally required:** These data elements are required only for catalytic cracking, fluid coking, and catalytic reforming units.
SubpartYCokeCalciningUnits	**Parent Element:** A collection of data elements containing the coke calcining unit name and the emission calculation equation inputs. **Conditionally required:** These data elements are required only for coke calcining units.
SubpartYSulfurRecoveryUnits	**Parent Element:** A collection of data elements containing the sulfur recovery unit name and the emission calculation equation inputs. **Conditionally required:** These data elements are required only for sulfur recovery units.
SubpartYLoadingInputs	**Parent Element:** A collection of data elements containing the vessel inputs map, the vessel ID, the vessel inputs, the material inputs map, the material ID and the emission calculation equation inputs. **Conditionally required:** These data elements are required only for loading inputs.
SubpartYSourGasInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally required:** These data elements are required only for sour gas sent off-site for sulfur recovery.
SubpartYBlowdownInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally required:** These data elements are required only for uncontrolled blowdown systems.
SubpartYStorageTankInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally required:** These data elements are required only for storage tanks.
SubpartY18DelayedCokingInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally required:** These data elements are required only for delayed coking unit vessels.
SubpartY19DelayedCokingInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally required:** These data elements are required only for process vents, catalytic reforming unit depressurization and purge vents where methane is used as the purge gas.

Detailed instructions for preparing XML for each Subpart Y input type are provided in the sections below. The sections are presented in schema order; inputs by Subpart Y input type and equation are provided in Sections 2.1 to 2.10.

The inputs data for Subpart Y facilities can be submitted for one or more of the numerous emission equations outlined in §98.253. The required inputs data are unique to each equation. Table 5 shows the equations, the order in which the equation inputs are entered in the schema, the affiliated types of units, systems or equipment, the type(s) of GHG emissions calculated using the equation, and the regulatory citation.

Table 5
Subpart Y Equations, Type of Unit, Pollutant and Regulatory Citation

Equation	Type of Unit	Pollutant	Regulatory Citation
Y-1b	Flares	CO_2	§98.253(b)(1)
Y-4	Flares (that use Equation Y-1b to calculate CO_2)	CH_4	§98.253(b)(1)
Y-3	Flares	CO_2	§98.253(b)(2)
Y-4	Flares (that use Equation Y-3 to calculate CO_2)	CH_4	§98.253(b)(2)
Y-14	Asphalt Blowing (uncontrolled or controlled by vapor scrubbing)	CO_2	§98.253(h)(1)
Y-15	Asphalt Blowing (uncontrolled or controlled by vapor scrubbing)	CH_4	§98.253(h)(1)
Y-16a	Alphalt Blowing (controlled by thermal oxidizer or flare)	CO_2	§98.253(h)(2)
Y-16b	Alphalt Blowing (controlled by thermal oxidizer or flare)	CO_2	§98.253(h)(2)
Y-17	Alphalt Blowing (controlled by thermal oxidizer or flare)	CH_4	§98.253(h)(2)
Y-8	Catalytic Cracking & Fluid Coking Units	CO_2	§98.253(c)(3)
Y-9 (Alt)	Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units	CH_4	§98.253(c)(4)
Y-10 (Alt)	Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units	N_2O	§98.253(c)(5)
Y-11	Catalytic Reforming Units	CO_2	§98.253(e)(1)
Y-9 (Alt)	Coke Calcining Units	CH_4	§98.253(c)(4)
Y-10 (Alt)	Coke Calcining Units	N_2O	§98.253(c)(5)
Y-13	Coke Calcining Units	CO_2	§98.253(g)(2)
Y-12	On-Site Sulfur Recovery Plants	CO_2	§98.253(f)(4)
Y-LD	Crude Oil, Intermediate, or Product Loading Operations	CH_4	§98.253(n)
Y-12	Sour Gas Sent Off-site for Sulfur Recovery	CO_2	§98.253(f)(4)
Y-20	Uncontrolled Blowdown Systems	CH_4	§98.253(k)
Y-22	Storage Tanks Other than Those Processing Unstabilized Crude Oil	CH_4	§98.253(m)(1)
Y-23	Storage Tanks Processing Unstabilized Crude Oil	CH_4	§98.253(m)(2)
Y-18	Delayed Coking Units	CH_4	§98.253(i)(1)
Y-19	Delayed Coking Units	CH_4	§98.253(j)

2.1 Subpart Y Flares Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y flares are shown and defined.

Figure 4
Subpart Y Flares High-Level Schema Structure

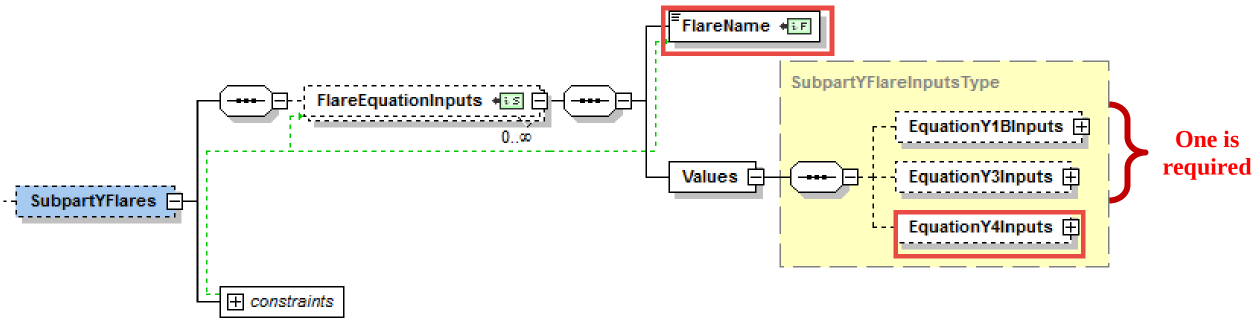


Table 6
Data Element Definitions for Subpart Y Flares (High Level)

Data Element Name	Description
SubpartYFlares	**Parent Element:** A collection of data elements containing the flare equation inputs. **Conditionally required:** These data elements are required only for flares.
FlareEquationInputs	**Parent Element:** A collection of data elements containing the flare name and the emission calculation equation inputs.
FlareName	The name of the flare for which inputs are being uploaded. **Important**: The flare name must match EXACTLY the flare name in the facility's annual emissions report to e-GGRT.
Values	**Parent Element:** A collection of data elements describing inputs for emissions calculation equations for flares.
EquationY1BInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs for Equation Y-1b. **Conditionally required:** These equation inputs are required only for flares that monitor gas composition.
EquationY3Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs for Equation Y-3. **Conditionally required:** These equation inputs are required only for flares that do not have monitors that measure the higher heating value or carbon content at least weekly.
EquationY4Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs for Equation Y-4. These equation inputs are required for all flares regardless of the equation used to calculate CO_2 emission.

Following from the high-level schema discussed above, the XML structure for each Subpart Y category and input values must follow the order shown in the schema structure. For flares that monitor gas composition, you should enter inputs for Equation Y-1b to calculate CO_2 emissions and inputs for Equation Y-4 to calculate CH_4 emissions. For flares that do not have monitors that measure the higher heating value or carbon content of the flare gas at least weekly, you must provide inputs to Equation Y-3 to calculate CO_2 emissions and inputs for Equation Y-4 to calculate CH_4 emissions. If Equation Y-1b is used, Equation Y-4 inputs for the flare must be included after any Equation Y-1b inputs are added; similarly, if Equation Y-3 is used, Equation Y-4 inputs for the flare must be included after any Equation Y-3 inputs are added.

XML Excerpt 2
Subpart Y Flares High Level

```
<SubpartYFlares>
 <FlareEquationInputs>
  <FlareName>2. Y Flare 2 (Eq Y-1b) - fl1</FlareName>
  <Values>
...
 <FlareEquationInputs>
</SubpartYFlares>
```

2.1.1 Flares (Gas Composition -CO_2 and CH_4): Equation Y-1b [§98.253(b)(1)] and Equation Y-4 [§98.253(b)(2)]

To determine CO_2 and CH_4 emissions for flares that monitor gas composition, you must provide inputs to Equation Y-1b and Equation Y-4. Following are the formulas for Equation Y-1b and Equation Y-4 and the list of variables. The corresponding XML schemas are illustrated in Figure 5 and Figure 6 and data elements are described in Table 7.

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

Where:

CO_2 = Annual CO_2 emissions for a specific fuel type (metric tons/year).
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).
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.
44 = Molecular weight of CO_2 (kg/kg-mole).
MVC = 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).
0.001 = Unit conversion factor (metric tons per kilogram, mt/kg).
$(\%CO_2)_p$ = Mole percent CO_2 concentration in the flare gas stream during the measurement period (mole percent = percent by volume).
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.
0.98 = Assumed combustion efficiency of a flare (mole CO_2 per mole carbon).
$(\%C_X)_p$ = Mole percent concentration of compound "x" in the flare gas stream during the measurement period (mole percent = percent by volume)
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.

$$CH_4 = \left(CO_2 \times \frac{EmF_{CH4}}{EmF}\right) + CO_2 \times \frac{0.02}{0.98} \times \frac{16}{44} \times f_{CH4} \quad \text{(Eq. Y-4)}$$

Where:

CH_4 = Annual methane emissions from flared gas (metric tons CH_4/year).
CO_2 = Emission rate of CO_2 from flared gas calculated in paragraph (b)(1) of this section (metric tons/year).
EmF_{CH4} = Default CH_4 emission factor for "Fuel Gas" from Table C-2 of subpart C of this part (General Stationary Fuel Combustion Sources) (kg CH_4/MMBtu).
EmF = Default CO_2 emission factor for flare gas of 60 kg CO_2/MMBtu (HHV basis).
0.02/0.98 = Correction factor for flare combustion efficiency.
16/44 = Correction factor ratio of the molecular weight of CH_4 to CO_2.
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.

Figure 5
Flare (Gas Composition: CO_2) Information Details Schema Diagrams (Equation Y-1b)

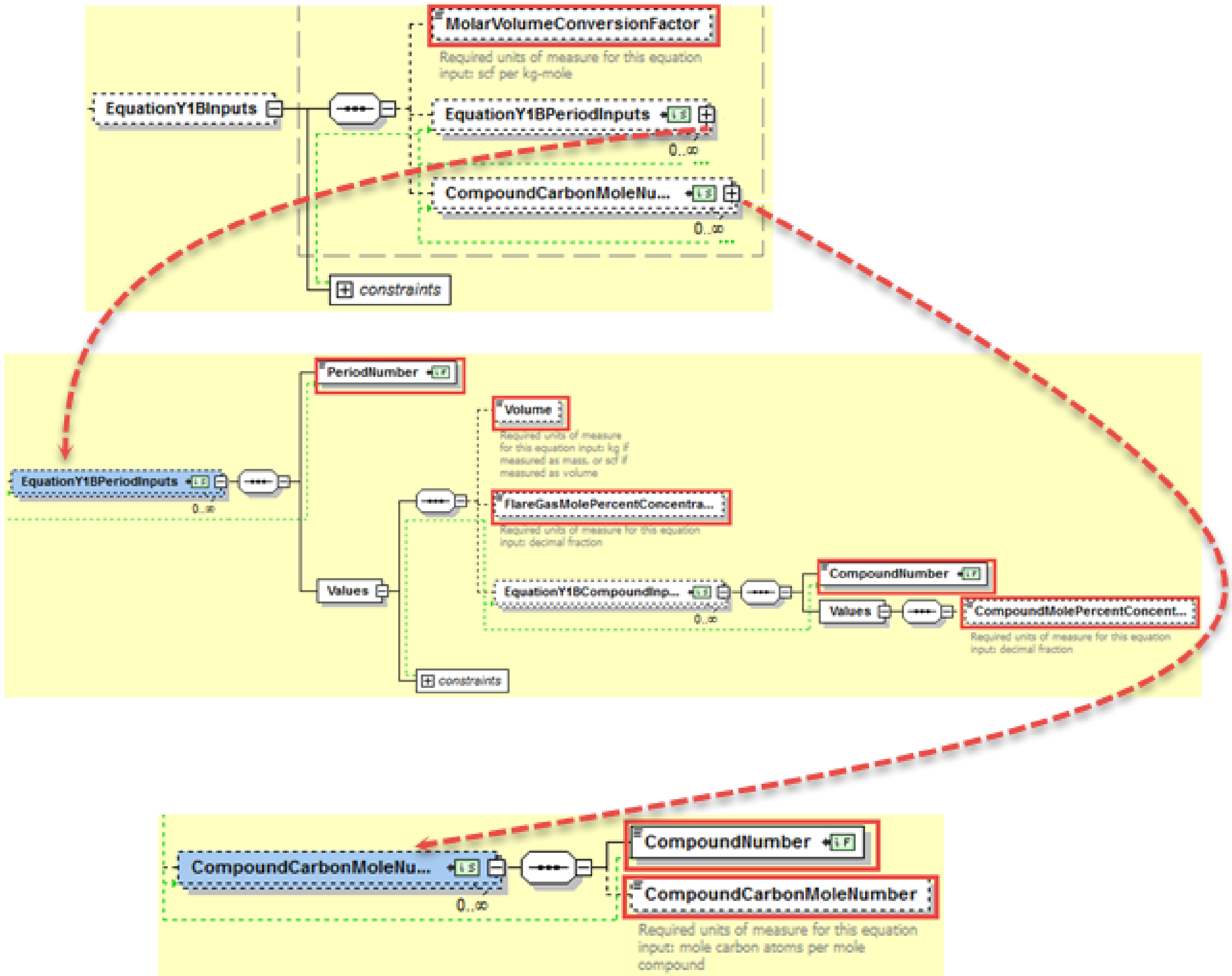


Figure 6
Flare (Gas Composition: CH_4) Information Details Schema Diagram (Equation Y-4)

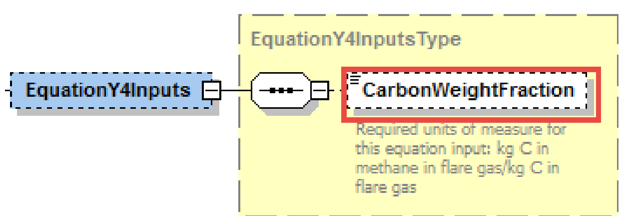


Table 7
Flare (Gas Composition: CO_2 and CH_4) Information Details Data Element Definitions – Equation Y-1b and Equation Y4

Data Element Name	Description
EquationY1BInputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs for Equation Y-1b. **Conditionally required:** These data elements are required only for flares that monitor gas composition.
MolarVolumeConversationFactor	Specify the molar volume conversation factor using 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. This is the variable specified as “MVC” in Equation Y-1b.
EquationY1BPeriodInputs	**Parent Element:** A collection of data elements containing the inputs required for each measurement period.
Period Number	Indicate the measurement period for which the inputs are being reported. The period number should range from 1 to 52 (for weekly measurements) and 1 to 365 or 366 (for daily measurements).
Values	**Parent Element:** A collection of data elements containing the inputs needed to calculate the emissions for each compound during the specified measurement period.
Volume	Specify the volume of flare gas combusted during the specified measurement 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 f low to a volumetric flow.
FlareGasMolePercentConcentration	Specify the mole percent CO_2 concentration in the flare gas stream during the specified measurement period (mole percent = percent by volume).
EquationY1BCompoundInputs	**Parent Element:** A collection of data elements containing the inputs for compounds other than CO_2 that are present in the flare gas stream during the specified measurement period.
CompoundNumber	Indicate a number to serve as an index for the compound other than CO_2 that is in the flare gas stream during the specified measurement period. Each compound for which there are inputs must have a unique compound number. The compound number in this data field must match the compound number in CompoundCarbonMoleNumbers. **Important:** The compound number must match EXACTLY the compound number in the facility’s annual emissions report to e-GGRT.
Values	**Parent Element:** Data element containing the mole percent concentration for compounds other than CO_2.

Data Element Name	Description
CompoundMolePercentConcentration	Specify the mole percent concentration in the flare gas stream during the measurement period for each unique compound (mole percent = percent by volume).
CompoundCarbonMoleNumbers	**Parent Element:** A collection of data elements containing the carbon mole number data for each compound other than CO_2 that is present in the flare gas stream.
CompoundNumber	Indicate a number to serve as an index for the compound other than CO_2 that is in the flare gas stream. Each compound for which there are inputs must have a unique compound number. The compound number in this data field must match the compound number under EquationY1BCompoundInputs. **Important:** The compound number must match EXACTLY the compound number in the facility's annual emissions report to e-GGRT.
CompoundCarbonMoleNumber	Specify the carbon mole number data for the specified compound other than CO_2 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.
EquationY4Inputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs for Equation Y-4.
CarbonWeightFraction	Specify the 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.

XML Excerpt 3 below illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-1b and Equation Y-4. See Appendix A for an example of a complete XML file that can be submitted through the IVT for flare (CO_2 and CH_4) inputs.

XML Excerpt 3
Example for Flare (Gas Composition: CO_2 and CH_4) – Equation Y-1b and Equation Y-4 Information Details

```xml
<FlareEquationInputs>
  <FlareName>2. Y Flare 2 (Eq Y-1b) - fl1</FlareName>
  <Values>
    <EquationY1BInputs>
      <MolarVolumeConversionFactor>836.6</MolarVolumeConversionFactor>
      <EquationY1BPeriodInputs>
        <PeriodNumber>1</PeriodNumber>
        <Values>
          <Volume>777</Volume>
          <FlareGasMolePercentConcentration>0.34</FlareGasMolePercentConcentration>
          <EquationY1BCompoundInputs>
            <CompoundNumber>1</CompoundNumber>
            <Values>
              <CompoundMolePercentConcentration>0.25</CompoundMolePercentConcentration>
            </Values>
          </EquationY1BCompoundInputs>
        </Values>
      </EquationY1BPeriodInputs>
      <CompoundCarbonMoleNumbers>
        <CompoundNumber>1</CompoundNumber>
        <CompoundCarbonMoleNumber>65</CompoundCarbonMoleNumber>
      </CompoundCarbonMoleNumbers>
    </EquationY1BInputs>
    <EquationY4Inputs>
      <CarbonWeightFraction>0.12</CarbonWeightFraction>
    </EquationY4Inputs>
  </Values>
</FlareEquationInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.1.2 Flares (Alternative to Heat Value/Carbon Content: CO_2 and CH_4)- Equation Y-3 [§98.253(b)(1] and Equation Y-4 [§98.253(b)(2)]

To determine emissions from flares that do not have monitors that measure the higher heating value or carbon content of the flare gas at least weekly, you must provide inputs to Equation Y-3 and Equation Y-4. For Equation Y-3, you must provide inputs data about the quantity of gas discharged to the flare separately for periods of routine flare operation and for periods of start-up, shutdown, or malfunction. Following are the formulas for Equation Y-3 and Equation Y-4 and the list of variables. The corresponding XML schema are illustrated in Figure 7 and Figure 8 and the data elements are described in Table 8.

$$CO_2 = 0.98 \times 0.001 \times \left(Flare_{Norm} \times HHV \times EmF + \sum_{p=1}^{n} \left[\frac{44}{12} \times (Flare_{SSM})_p \times \frac{(MW)_p}{MVC} \times (CC)_p \right] \right) \quad \text{(Eq. Y-3)}$$

Where:

CO_2 = Annual CO_2 emissions for a specific fuel type (metric tons/year).
0.98 = Assumed combustion efficiency of a flare.
0.001 = Unit conversion factor (metric tons per kilogram, mt/kg).
$Flare_{Norm}$ = 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 (Btu/scf, MMBtu/MMscf).
EmF = Default CO_2 emission factor for flare gas of 60 kilograms CO_2/MMBtu (HHV basis).
n = Number of start-up, shutdown, and malfunction events during the reporting year exceeding 500,000 scf/day.
p = Start-up, shutdown, and malfunction event index.
44 = Molecular weight of CO_2 (kg/kg-mole).
12 = Atomic weight of C (kg/kg-mole).
$(Flare_{SSM})_p$ = 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).
MVC = 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).
$(CC)_p$ = Average carbon content of the flare gas, from analysis results or engineering calculations for the event (kg C per kg flare gas).

$$CH_4 = \left(CO_2 \times \frac{EmF_{CH4}}{EmF} \right) + CO_2 \times \frac{0.02}{0.98} \times \frac{16}{44} \times f_{CH4} \quad \text{(Eq. Y-4)}$$

Where:

CH_4 = Annual methane emissions from flared gas (metric tons CH_4/year).
CO_2 = Emission rate of CO_2 from flared gas calculated in paragraph (b)(1) of this section (metric tons/year).
EmF_{CH4} = Default CH_4 emission factor for "Fuel Gas" from Table C-2 of subpart C of this part (General Stationary Fuel Combustion Sources) (kg CH_4/MMBtu).
EmF = Default CO_2 emission factor for flare gas of 60 kg CO_2/MMBtu (HHV basis).
0.02/0.98 = Correction factor for flare combustion efficiency.
16/44 = Correction factor ratio of the molecular weight of CH_4 to CO_2.
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.

Figure 7
Flare (Alternative to Heat Value/Carbon Content: CO_2) Information Details Schema Diagrams (Equation Y-3)

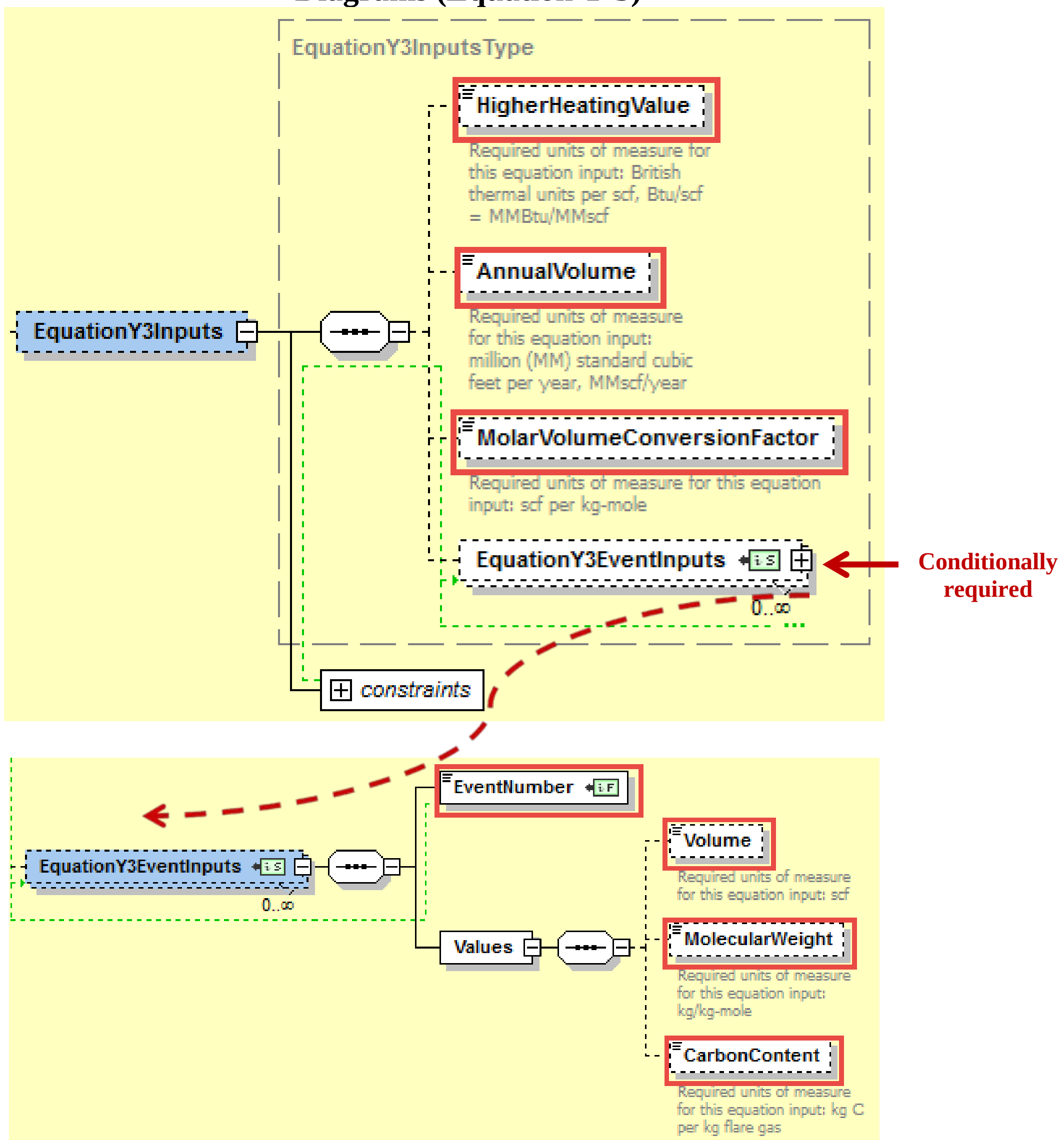


Figure 8
Flare (Alternative to Heat Value/Carbon Content: CH_4) Information Details Schema Diagram (Equation Y-4)

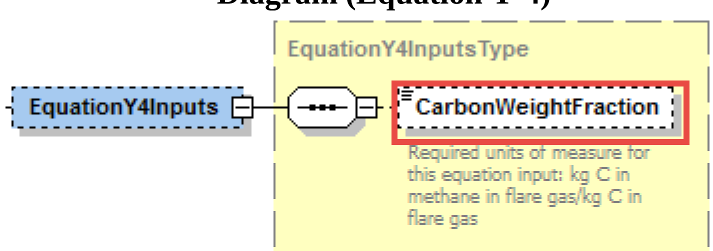


Table 8
Flare (Alternative to Heat Value/Carbon Content: CO_2 and CH_4) Information Details Data Element Definitions – Equation Y-3 and Equation Y-4

Data Element Name	Description
EquationY3Inputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs. **Conditionally required:** These data elements are required if the flare does not have monitors that measure gas composition.
HigherHeatingValue	Specific the higher heating value for fuel gas or flare gas from company records (Btu/scf, MMBtu/MMscf).
AnnualVolume	Specify the annual volume of flare gas combusted during normal operations from company records, (million (MM) standard cubic feet per year, MMscf/year).
MolarVolumeConversionFactor	Specify 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).
EquationY3EventInputs	**Parent Element:** A collection of data elements containing the inputs from each indexed start-up, shutdown, or malfunction (SSM) event. **Conditionally required:** These data elements are required onlyfor SSM events that exceed 500,000 scf/day.
EventNumber	The event number for which inputs are being uploaded. **Important:** The event number must match EXACTLY the event number in the facility's annual emissions report to e-GGRT.
Values	**Parent Element:** A collection of data elements containing the inputs needed to calculate the emissions for each SSM event.
Volume	Specify the volume of flare gas combusted during the specified SSM event from engineering calculations (scf/event).
MolecularWeight	Specify the average molecular weight of the flare gas, from the analysis results or engineering calculations for the specified SSM event (kg/kg-mole).
CarbonContent	Specify the average carbon content of the flare gas, from analysis results or engineering calculations for the specified SSM event (kg C per kg flare gas).
EquationY4Inputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs for Equation Y-4.
CarbonWeightFraction	Specify the 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.

XML Excerpt 4 below illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-3 and Equation Y-4. See Appendix A for an example of a complete XML file that can be submitted through the IVT for flare inputs.

XML Excerpt 4
Example for Flare (Alternative to Heat Value/Carbon Content: CO_2 and CH_4) – Equation Y-3 Information Details

```
<FlareEquationInputs>
  <FlareName>4. Y Flare 4 (Eq Y-3)</FlareName>
  <Values>
    <EquationY3Inputs>
      <HigherHeatingValue>66</HigherHeatingValue>
      <AnnualVolume>50</AnnualVolume>
      <MolarVolumeConversionFactor>836.6</MolarVolumeConversionFactor>
      <EquationY3EventInputs>
        <EventNumber>1</EventNumber>
        <Values>
          <Volume>10</Volume>
          <MolecularWeight>0.34</MolecularWeight>
          <CarbonContent>0.95</CarbonContent>
        </Values>
      </EquationY3EventInputs>
    </EquationY3Inputs>
    <EquationY4Inputs>
      <CarbonWeightFraction>0.12</CarbonWeightFraction>
    </EquationY4Inputs>
  </Values>
</FlareEquationInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.2 Subpart Y Asphalt Blowing Units Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y asphalt blowing units are shown and defined, provided these emissions are not already included in the flare emissions calculated in Section 2.1 of these instructions, or, in the stationary combustion unit emissions required under subpart C (General Stationary Fuel Combustion Sources).

Figure 9
Subpart Y Asphalt Blowing Units High-Level Schema Structure

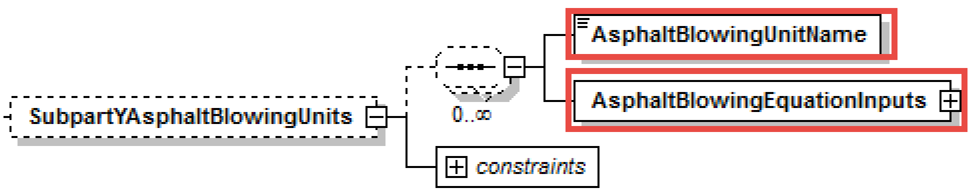


Table 9
Data Element Definitions for Subpart Y Asphalt Blowing Units (High Level)

Data Element Name	Description
SubpartYAsphaltBlowingUnits	**Parent Element:** A collection of data elements containing the asphalt blowing unit name and equation inputs. **Conditionally Required:** These data elements are required only if the unit is an asphalt blowing unit.
Values	**Parent Element:** A collection of data elements describing inputs for Subpart Y asphalt blowing units.
AsphaltBlowingUnitName	The name of the asphalt blowing unit for which inputs are being uploaded. **Important**: The asphalt blowing unit name must match EXACTLY the flare name in the facility's annual emissions report to e-GGRT.
AsphaltBlowingEquationInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs.

XML Excerpt 5
Subpart Y Asphalt Blowing Units High Level

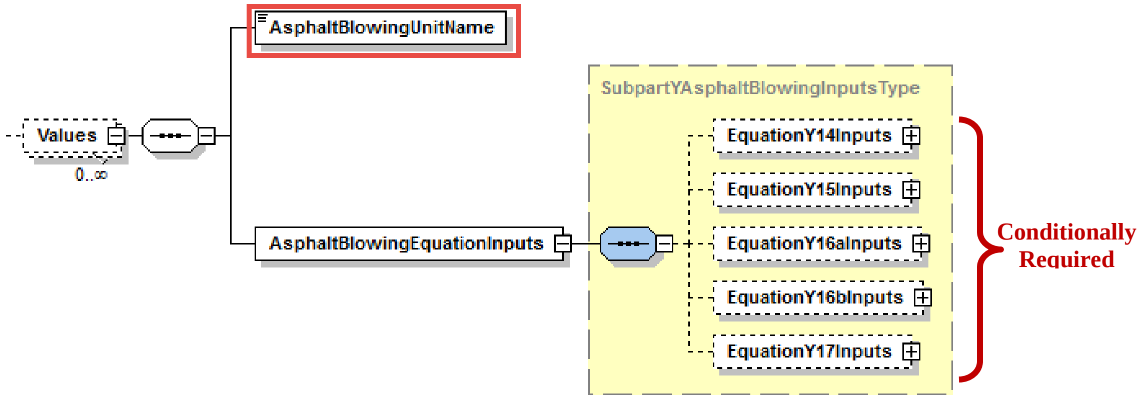
```
<SubpartYAsphaltBlowingUnits>
  <AsphaltBlowingUnitName>1. Asphalt Blowing (Vapor - Y14 &amp;Y15)</AsphaltBlowingUnitName>
  <AsphaltBlowingEquationInputs>

... insert equation-specific inputs

 </AsphaltBlowingEquationInputs>
 <AsphaltBlowingUnitName>1. Asphalt Blowing (Vapor - Y14 &amp;Y15)a</AsphaltBlowingUnitName>
 <AsphaltBlowingEquationInputs>
```

The order of Subpart Y asphalt blowing unit equations required by the schema is displayed as Figure 10.

Figure 10
Subpart Y Asphalt Blowing Unit Schema Structure Showing Required Equation Order



Following from the high-level schema discussed above, the XML structure for each Subpart Y category and input values must follow the order shown in the schema structure. For example, all Equation Y-14 inputs for the asphalt blowing unit (uncontrolled or controlled by vapor scrubbing) must be included before any Equation Y-15 inputs are added; similarly, all Equation Y-16a (or Equation Y-16b) inputs for the asphalt blowing unit (controlled by thermal oxidizer or flare) must be included before any Equation Y-17 inputs are added.

2.2.1 Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing): CO_2-Equation Y-14 [§98.253(h)(1)]

In order to determine CO_2 emissions for uncontrolled asphalt blowing operations or asphalt blowing operations controlled by vapor scrubbing, you must provide the quantity of asphalt blown and the CO_2 emission factor as inputs to Equation Y-14. Following is the formula for Equation Y-14 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 11 and the IVT data elements are described in Table 10.

$$CO_2 = (Q_{AB} \times EF_{AB,CO2}) \qquad \text{(Eq. Y-14)}$$

Where:

CO_2 = Annual CO_2 emissions from uncontrolled asphalt blowing (metric tons CO_2/year).
Q_{AB} = Quantity of asphalt blown (million barrels per year, MMbbl/year).
$EF_{AB,CO2}$ = Emission factor for CO_2 from uncontrolled asphalt blowing from facility-specific test data (metric tons CO_2/MMbbl asphalt blown); default = 1,100.

Figure 11
Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing) (CO_2)-Information Details Schema Diagram (Equation Y-14)

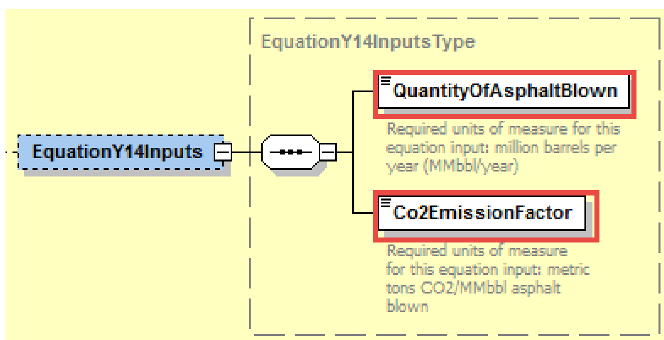


Table 10
Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing) (CO_2) Information Details Data Element Definitions – Equation Y-14

Data Element Name	Description
EquationY14Inputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is an asphalt blowing unit with uncontrolled asphalt blowing operations or asphalt blowing operations controlled by vapor scrubbing.
QuantityofAsphaltBlown	Specify the quantity of asphalt blown (million barrels per year, MMbbl/year).
Co2EmissionFactor	Specify the emission factor for CO_2 from uncontrolled asphalt blowing from facility-specific test data (metric tons CO_2/MMbbl asphalt blown); default = 1,100.

XML Excerpt 6 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-14. See Appendix A for an example of a complete XML file that can be submitted through the IVT for asphalt blowing inputs.

XML Excerpt 6
Example for Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing) (CO_2) – Equation Y-14 Information Details

```
<EquationY14Inputs>
  <QuantityOfAsphaltBlown>1</QuantityOfAsphaltBlown>
  <Co2EmissionFactor>0.34</Co2EmissionFactor>
</EquationY14Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.2.2 Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing): CH_4-Equation Y-15 [§98.253(h)(1)]

In order to determine CH_4 emissions for uncontrolled asphalt blowing operations or asphalt blowing operations controlled by vapor scrubbing, you must provide the CH_4 emissions factor as input to Equation Y-15 to calculate CH_4 emissions. Following is the formula for Equation Y-15 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 12 and the IVT data elements are described in Table 11.

$$CH_4 = \left(Q_{AB} \times EF_{AB,CH4}\right) \qquad \text{(Eq. Y-15)}$$

Where:

CH_4 = Annual methane emissions from uncontrolled asphalt blowing (metric tons CH_4/year).
Q_{AB} = Quantity of asphalt blown (million barrels per year, MMbbl/year).
$EF_{AB,CH4}$ = Emission factor for CH_4 from uncontrolled asphalt blowing from facility-specific test data (metric tons CH_4/MMbbl asphalt blown); default = 580.

Figure 12
Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing) (CH_4)-Information Details Schema Diagram (Equation Y-15)

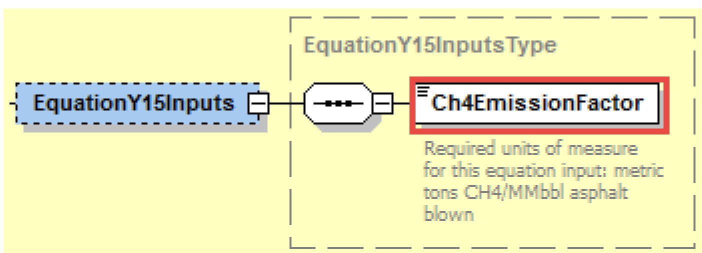


Table 11
Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing) (CH_4) Information Details Data Element Definitions – Equation Y-15

Data Element Name	Description
EquationY15Inputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is an asphalt blowing unit with uncontrolled asphalt blowing operations or asphalt blowing operations controlled by vapor scrubbing.
Ch4EmissionFactor	Specify the Emission factor for CH_4 from uncontrolled asphalt blowing from facility-specific test data (metric tons CH_4/MMbbl asphalt blown); default = 580.

XML Excerpt 7 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-15. See Appendix A for an example of a complete XML file that can be submitted through the IVT for asphalt blowing inputs.

XML Excerpt 7
Example for Asphalt Blowing Operations (Uncontrolled or Controlled by Vapor Scrubbing) (CH_4) – Equation Y-15 Information Details

```
<EquationY15Inputs>
 <Ch4EmissionFactor>0.12</Ch4EmissionFactor>
</EquationY15Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.2.3 Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare): CO_2- Equation Y-16a [§98.253(h)(2)]

To determine CO_2 emissions for asphalt blowing operations controlled by thermal oxidizer or flare, you must provide inputs to Equation Y-16a or Y-16b. If you are using Equation Y-16a, you must input quantity of asphalt blown and the carbon emission factor from asphalt blowing. Following is the formula for Y-16a and the list of variables. The corresponding IVT XML schema is illustrated in Figure 13 and the IVT data elements are described in Table 12.

$$CO_2 = 0.98 \times \left(Q_{AB} \times CEF_{AB} \times \frac{44}{12} \right) \qquad \text{(Eq. Y-16a)}$$

Where:

CO_2 = Annual CO_2 emissions from controlled asphalt blowing (metric tons CO_2/year).
0.98 = Assumed combustion efficiency of thermal oxidizer or flare.
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.
44 = Molecular weight of CO_2 (kg/kg-mole).
12 = Atomic weight of C (kg/kg-mole).

Figure 13
Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CO_2) Information Details Schema Diagram (Equation Y-16a)

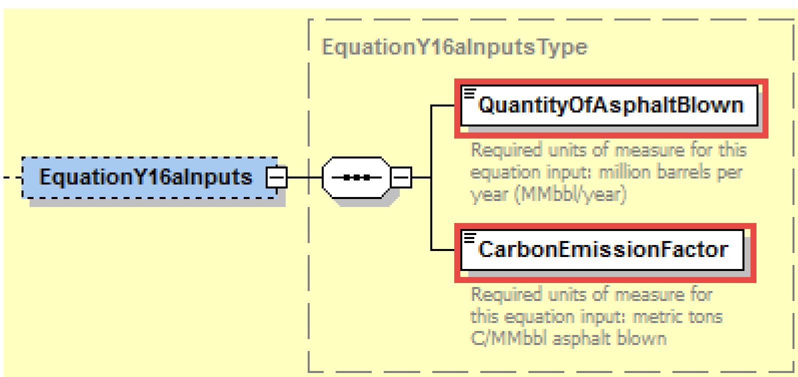


Table 12
Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CO_2) Information Details Data Element Definitions – Equation Y-16a

Data Element Name	Description
EquationY16aInputs	**Parent Element:** A collection of data elements containing the the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is an asphalt blowing unit controlled by thermal oxidizer or flare and Equation Y-16a is being used to calculate CO_2 emissions. .
QuantityOfAsphaltBlown	Specify the quantity of asphalt blown (MMbbl/year).

Data Element Name	Description
CarbonEmissionFactor	Specify the carbon emission factor from asphalt blowing from facility-specific test data (metric tons C/MMbbl asphalt blown); default = 2,750.

XML Excerpt 8 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-16a. See Appendix A for an example of a complete XML file that can be submitted through the IVT for asphalt blowing inputs.

XML Excerpt 8
Example for Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CO_2) – Equation Y-16a Information Details

```
<EquationY16aInputs>
  <QuantityOfAsphaltBlown>3</QuantityOfAsphaltBlown>
  <CarbonEmissionFactor>0.34</CarbonEmissionFactor>
</EquationY16aInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.2.4 Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare): CO_2- Equation Y-16b [§98.253(h)(2)]

In order to determine CO_2 emissions from asphalt blowing operations controlled by thermal oxidizer or flare, you must provide inputs to Equation Y-16a or Y-16b. If you are using Equation Y-16b, you must input quantity of asphalt blown, the CO_2 emission factor and the carbon emission factor from asphalt blowing. Following is the formula for Equation Y-16b and the list of variables. The corresponding IVT XML schema is illustrated in Figure 14 and the IVT data elements are described in Table 13.

$$CO_2 = Q_{AB} \times \left(EF_{AB,CO2} + 0.98 \times \left[\left(CEF_{AB} \times \frac{44}{12} \right) - EF_{AB,CO2} \right] \right) \quad \text{(Eq. Y-16b)}$$

Where:

CO_2 = Annual CO_2 emissions from controlled asphalt blowing (metric tons CO_2/year).
Q_{AB} = Quantity of asphalt blown (MMbbl/year).
0.98 = Assumed combustion efficiency of thermal oxidizer or flare.
$EF_{AB,CO2}$ = Emission factor for CO_2 from uncontrolled asphalt blowing from facility-specific test data (metric tons CO_2/MMbbl asphalt blown); default = 1,100.
CEF_{AB} = Carbon emission factor from asphalt blowing from facility-specific test data (metric tons C/MMbbl asphalt blown); default = 2,750.
44 = Molecular weight of CO_2 (kg/kg-mole).
12 = Atomic weight of C (kg/kg-mole).

Figure 14
Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CO_2) Information Details Schema Diagram (Equation Y-16b)

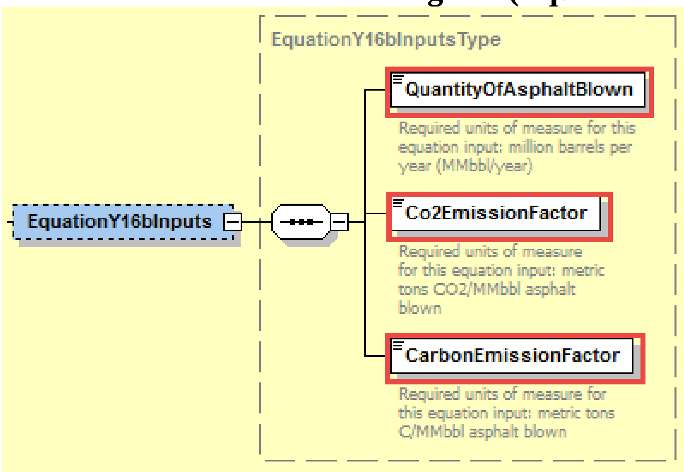


Table 13
Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CO_2) Information Details Data Element Definitions – Equation Y-16b

Data Element Name	Description
EquationY16bInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is an asphalt blowing unit controlled by thermal oxidizer or flare, and Equation Y-16b is being used to calculate CO_2 emissions.

Data Element Name	Description
QuantityOfAsphaltBlown	Specify the quantity of asphalt blown (MMbbl/year).
Co2EmissionFactor	Specify the emission factor for CO_2 from uncontrolled asphalt blowing from facility-specific test data (metric tons CO_2/MMbbl asphalt blown); default = 1,100.
CarbonEmissionFactor	Specify the carbon emission factor from asphalt blowing from facility-specific test data (metric tons C/MMbbl asphalt blown); default = 2,750.

XML Excerpt 9 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-16b. See Appendix A for an example of a complete XML file that can be submitted through the IVT for asphalt blowing inputs.

XML Excerpt 9
Example for Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CO_2) – Equation Y-16b Information Details

```
<EquationY16bInputs>
  <QuantityOfAsphaltBlown>4</QuantityOfAsphaltBlown>
  <Co2EmissionFactor>0.34</Co2EmissionFactor>
  <CarbonEmissionFactor>0.9</CarbonEmissionFactor>
</EquationY16bInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.2.5 Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare): CH_4- Equation Y-17 [§98.253(h)(2)]

In order to determine CH_4 emissions for asphalt blowing operations controlled by thermal oxidizer or flare, you must provide the CH_4 emission factor as input to Equation Y-17. Following is the formula for Equation Y-17 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 15 and the IVT data elements are described in Table 14.

$$CH_4 = 0.02 \times \left(Q_{AB} \times EF_{AB,CH4}\right) \qquad \text{(Eq. Y-17)}$$

Where:

CH_4 = Annual methane emissions from controlled asphalt blowing (metric tons CH_4/year).
0.02 = Fraction of methane uncombusted in thermal oxidizer or flare based on assumed 98% combustion efficiency.
Q_{AB} = Quantity of asphalt blown (million barrels per year, MMbbl/year).
$EF_{AB,CH4}$ = Emission factor for CH_4 from uncontrolled asphalt blowing from facility-specific test data (metric tons CH_4/MMbbl asphalt blown); default = 580.

Figure 15
Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CH_4)-Information Details Schema Diagram (Equation Y-17)

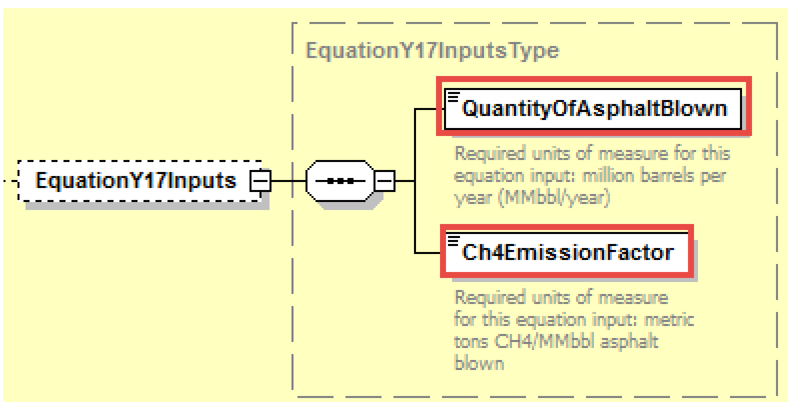


Table 14
Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CH_4) Information Details Data Element Definitions – Equation Y-17

Data Element Name	Description
EquationY17Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is an asphalt blowing unit controlled by thermal oxidizer or flare.
QuantityOfAsphaltBlown	Specify the quantity of asphalt blown (MMbbl/year).
Ch4EmissionFactor	Specify the Emission factor for CH_4 from uncontrolled asphalt blowing from facility-specific test data (metric tons CH_4/MMbbl asphalt blown); default = 580.

XML Excerpt 10 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-17. See Appendix A for an example of a complete XML file that can be submitted through the IVT for asphalt blowing inputs.

XML Excerpt 10
Example for Asphalt Blowing Operations (Controlled by Thermal Oxidizer or Flare) (CH_4) – Equation Y-17 Information Details

```
<EquationY17Inputs>
  <QuantityOfAsphaltBlown>3</QuantityOfAsphaltBlown>
  <Ch4EmissionFactor>0.12</Ch4EmissionFactor>
</EquationY17Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.3 Subpart Y Catalytic Cracking, Fluid Coking and Catalytic Reforming Unit Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y catalytic cracking, fluid coking, and catalytic reforming units are shown and defined.

Figure 16
Subpart Y Cracking Coking Reforming Units High-Level Schema Structure

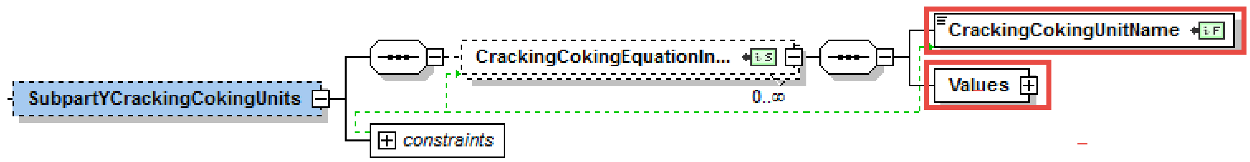


Table 15
Data Element Definitions for Subpart Y Cracking Coking Reforming Units (High Level)

Data Element Name	Description
SubpartYCrackingCokingUnits	**Parent Element:** A collection of data elements containing the catalytic cracking, fluid coking, or catalytic reforming unit inputs. **Conditionally Required:** These data elements are required only if the unit is a catalytic cracking, fluid coking, or catalytic reforming unit.
CrackingCokingEquationInputs	**Parent Element:** A collection of data elements containing the catalytic cracking, fluid coking, or catalytic reforming unit name and the emission calculation equation inputs.
CrackingCokingName	The name of the catalytic cracking, fluid coking, or catalytic reforming unit for which inputs are being uploaded. **Important**: The catalytic cracking, fluid coking, or catalytic reforming name must match EXACTLY the catalytic cracking, fluid coking, or catalytic reforming name in the facility's annual emissions report to e-GGRT.
Values	**Parent Element:** A collection of data elements describing inputs for Subpart Y catalytic cracking, fluid coking, or catalytic reforming units.

XML Excerpt 11
Subpart Y Cracking Coking Reforming High Level

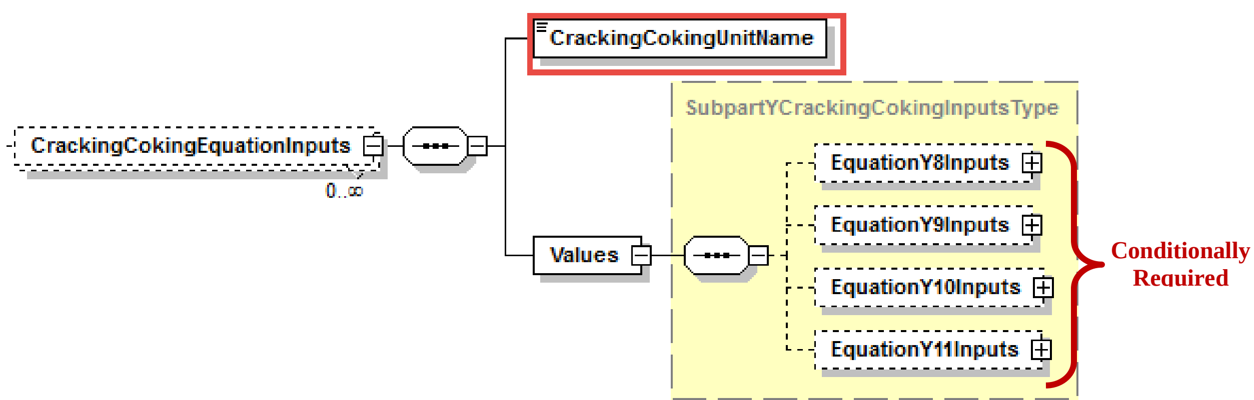
```
<SubpartYCrackingCokingUnits>
  <CrackingCokingEquationInputs>
    <CrackingCokingUnitName>4. Cat Craking (Cat Reforming Y-11)</CrackingCokingUnitName>
    <Values>

... insert equation-specific inputs

    </Values>
  </CrackingCokingEquationInputs>
</SubpartYCrackingCokingUnits>
```

The order of Subpart Y catalytic cracking, fluid coking, and catalytic reforming equations required by the schema is displayed as Figure 17.

Figure 17
Subpart Y Cracking Coking Reforming Equation Inputs Schema Structure Showing Required Equation Order



Following from the high-level schema discussed above, the XML structure for each Subpart Y category and input values must follow the order shown in the schema structure. For example, all Equation Y-8 inputs for the catalytic cracking and fluid coking unit must be included before any Equation Y-9 alternative inputs are added; similarly, all Equation Y-8 and Equation Y-9 alternative inputs must be included before any Equation Y-10 alternative and Y-11 inputs are added.

2.3.1 Catalytic Cracking and Fluid Coking Units: CO_2 - Equation Y-8 [§98.253(c)(3)]

In order to determine 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 use a continuous CO_2 CEMS for the final exhaust stack, you must provide inputs to Equation Y-8. You must input annual throughput of the unit, coke burnoff factor, and the carbon content of the coke. Following is the formula for Equation Y-8 and the list of variables. The corresponding IVT XML schema isillustrated in Figure 18 and the IVT data elements are described in Table 16.

$$CO_2 = Q_{unit} \times (CBF \times 0.001) \times CC \times \frac{44}{12} \qquad \text{(Eq. Y-8)}$$

Where:

CO_2 =	Annual CO_2 mass emissions (metric tons/year).
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.
0.001 =	Conversion factor (metric ton/kg).
CC =	Carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94.
44/12 =	Ratio of molecular weight of CO_2 to C (kg CO_2 per kg C).

Figure 18
Catalytic Cracking and Fluid Coking Units (CO_2) - Information Details Schema Diagram (Equation Y-8)

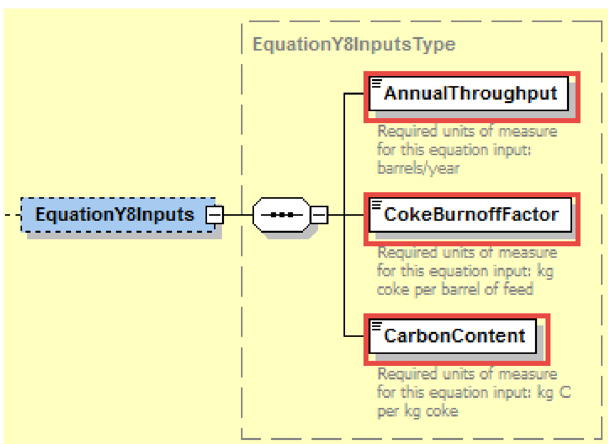


Table 16
Catalytic Cracking and Fluid Coking Units (CO_2) Information Details Data Element Definitions – Equation Y-8

Data Element Name	Description
EquationY8Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a catalytic cracking or fluid coking unit.

Data Element Name	Description
AnnualThroughput	Specify the annual throughput of unit from company records (barrels (bbls) per year, bbl/yr).
CokeBurnoffFactor	Specify the 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.
CarbonContent	Specify carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94.

XML Excerpt 12 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-8. See Appendix A for an example of a complete XML file that can be submitted through the IVT for catalytic cracking and fluid coking inputs.

XML Excerpt 12
Example for Catalytic Cracking and Fluid Coking Units (CO_2) – Equation Y-8 Information Details

```
<EquationY8Inputs>
 <AnnualThroughput>100</AnnualThroughput>
 <CokeBurnoffFactor>7.3</CokeBurnoffFactor>
 <CarbonContent>0.99</CarbonContent>
</EquationY8Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.3.2 Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units: CH_4- Equation Y-9 Unit-Specific CH_4 Emission Factor Alternative [§98.253(c)(4)]

In order to determine CH_4 emissions for catalytic cracking units, fluid coking units, and, catalytic reforming units, you must provide inputs to the Equation Y-9 alternative that uses a unit-specific CH_4 emission factor combined with activity data. The Equation Y-9 alternative simply multiplies activity data by a unit-specific emission factor (note that the UOM must be consistent between the activity data and emission factor). The corresponding XML IVT schema is illustrated in Figure 19 and the IVT data elements are described in Table 17.

Figure 19
Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units (CH_4) - Information Details Schema Diagram (Equation Y-9 Alternative)

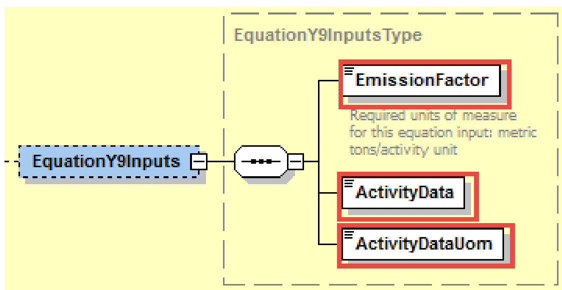


Table 17
Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units (CH_4) Information Details Data Element Definitions – Equation Y-9 Alternative

Data Element Name	Description
EquationY9Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a catalytic cracking, fluid coking, or catalytic reforming unit.
EmissionFactor	Specify the unit-specific CH_4 emission factor (metric tons/activity unit (e.g., metric tons/bbl)).
ActivityData	Specify the annual activity data (e.g., input or product rate)
ActivityDataUom	Indicate the unit of measure for the annual activity data (ensure consistent units of measure are used here and for the activity data (i.e., the denominator) used to calculate the emission factor. For example, if your emission factor is in metric tons/bbl then your annual activity data should be reported in units of bbl)

XML Excerpt 13 below illustrates a portion of the XML file that can be used to upload inputs data to the IVT for the Equation Y-9 alternative. See Appendix A for an example of a complete XML file that can be submitted through the IVT for catalytic cracking and fluid coking inputs.

XML Excerpt 13
Example for Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units (CH_4) – Equation Y-9 Alternative Information Details

```
<EquationY9Inputs>
  <EmissionFactor>3</EmissionFactor>
  <ActivityData ActivityDataUOM="bbl”>100</ActivityData>
</EquationY9Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.3.3 Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units: N_2O- Equation Y-10 Unit-Specific N_2O Emission Factor Alternative [§98.253(c)(5)]

In order to determine N_2O emissions for catalytic cracking units, fluid coking units, and catalytic reforming units, you must provide inputs to the Equation Y-10 alternative that uses a unit-specific N_2O emission factor combined with activity data. The Equation Y-10 alternative simply multiplies activity data by a unit-specific emission factor (note that the UOM must be consistent between the activity data and emission factor). The corresponding IVT XML schema is illustrated in Figure 20 and the IVT data elements are described in Table 18.

Figure 20
Catalytic Cracking, Fluid Coking and Catalytic Reforming Units (N_2O)- Information Details Schema Diagram (Equation Y-10 Alternative)

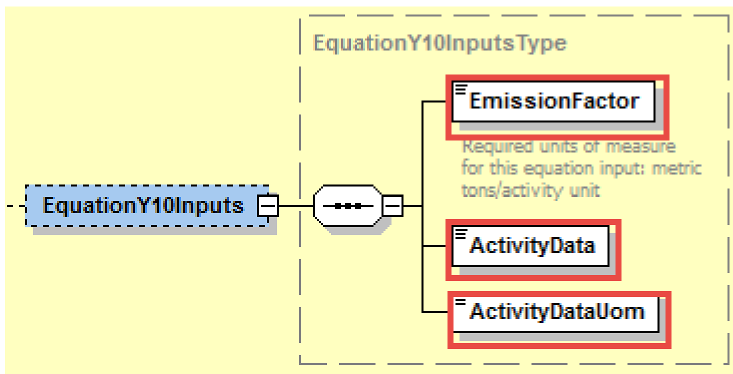


Table 18
Catalytic Cracking, Fluid Coking, and Catalytic Reforming Units (N_2O) Information Details Data Element Definitions – Equation Y-10 Alternative

Data Element Name	Description
EquationY10Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a catalytic cracking, fluid coking, or catalytic reforming unit.
Emission Factor	Specify the unit-specific N_2O emission factor (metric tons/activity unit (e.g., metric tons/bbl)).
ActivityData	Specify the annual activity data (e.g., input or product rate)
ActivityDataUom	Indicate the unit of measure for the annual activity data (ensure consistent units of measure are used here and for the activity data (i.e., the denominator) used to calculate the emission factor. For example, if your emission factor is in metric tons/bbl then your annual activity data should be reported in units of bbl)

XML Excerpt 14 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for the Equation Y-10 alternative. See Appendix A for an example of a complete XML file that can be submitted through the IVT for catalytic cracking, fluid coking and catalytic reforming inputs.

XML Excerpt 14
Example for Catalytic Cracking, Fluid Coking and Catalytic Reforming Units (N_2O) – Equation Y-10 Alternative Information Details

```
<EquationY10Inputs>
 <EmissionFactor>0.3</EmissionFactor>
 <ActivityData>100</ActivityData>
 <ActivityDataUom>bbl</ActivityDataUom>
</EquationY10Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.3.4 Catalytic Reforming Units: CO_2- Equation Y-11 [§98.253(e)(1)]

In order to determine CO_2 emissions for catalytic reforming units, you must provide inputs to Equation Y-11. Following is the formula for Equation Y-11and the list of variables. The corresponding IVT XML schema is illustrated in Figure 21 and the IVT data elements are described in Table 19.

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

Where:

CO_2 = Annual CO_2 emissions (metric tons/year).
CB_Q = Coke burn-off quantity per regeneration cycle or measurement period from engineering estimates (kg coke/cycle or kg coke/measurement period).
n = Number of regeneration cycles or measurement periods in the calendar year.
CC = Carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94.
44/12 = Ratio of molecular weight of CO_2 to C (kg CO_2 per kg C).
0.001 = Conversion factor (metric ton/kg).

Figure 21
Catalytic Reforming Units (CO_2) - Information Details Schema Diagram (Equation Y-11)

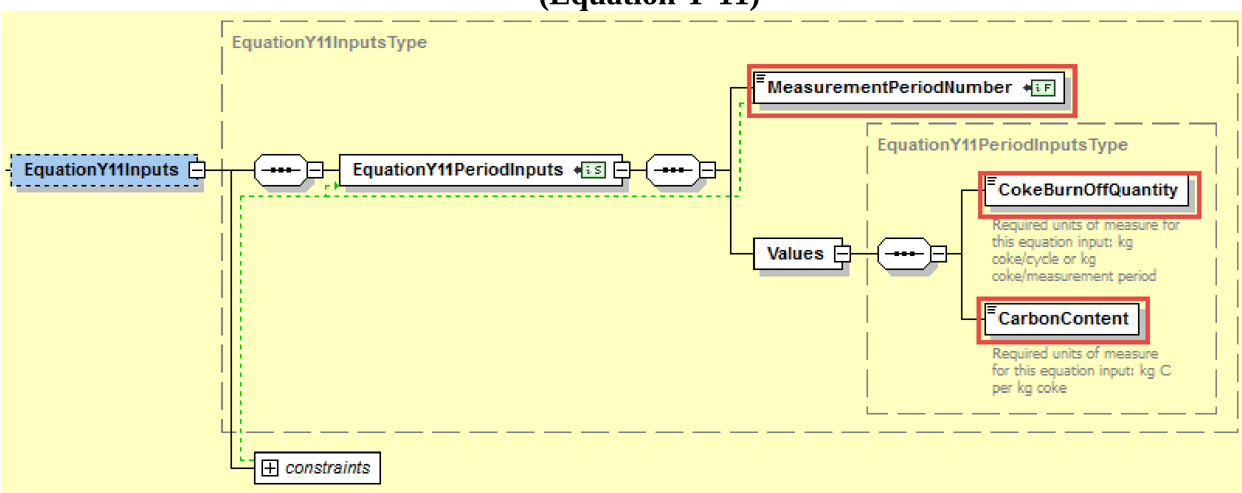


Table 19
Catalytic Reforming Units (CO_2) Information Details Data Element Definitions – Equation Y-11

Data Element Name	Description
EquationY11PeriodInputs	**Parent Element:** A collection of data elements describing inputs for each measurement period for Subpart Y catalytic reforming units. **Conditionally Required:** These data elements are required only if the unit is a catalytic reforming unit.
MeasurementPeriodNumber	Specify the measurement period number.

Data Element Name	Description
Values	**Parent Element:** A collection of data elements describing inputs for each measurement period for Subpart Y catalytic reforming units
CokeBurnOffQuantity	Specify the coke burn-off quantity per regeneration cycle or measurement period from engineering estimates (kg coke/cycle or kg coke/measurement period).
CarbonContent	Specify the carbon content of coke based on measurement or engineering estimate (kg C per kg coke); default = 0.94.

XML Excerpt 15 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-11. See Appendix A for an example of a complete XML file that can be submitted through the IVT for catalytic reforming unit inputs.

XML Excerpt 15
Example for Catalytic Reforming Units (CO_2) – Equation Y-11 Information Details

```
<EquationY11Inputs>
  <EquationY11PeriodInputs>
    <MeasurementPeriodNumber>1</MeasurementPeriodNumber>
    <Values>
      <CokeBurnOffQuantity>55</CokeBurnOffQuantity>
      <CarbonContent>0.94</CarbonContent>
    </Values>
  </EquationY11PeriodInputs>
</EquationY11Inputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.4 Subpart Y Coke Calcining Unit Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y coke calcining unit are shown and defined.

Figure 22
Subpart Y Coke Calcining Units High-Level Schema Structure

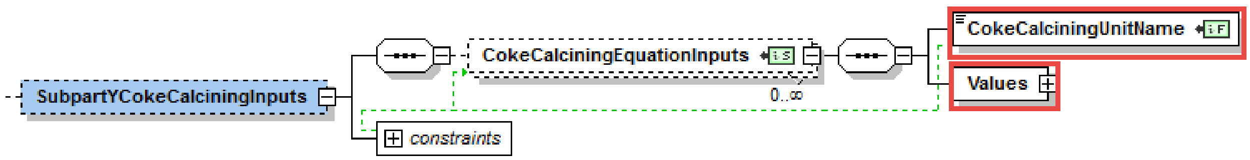


Table 20
Data Element Definitions for Subpart Y Coke Calcining Units (High Level)

Data Element Name	Description
SubpartYCokeCalciningUnits	**Parent Element:** A collection of data elements containing the coke calcining unit inputs. **Conditionally Required:** These data elements are required only if the unit is a coke calcining unit.
CokeCalciningEquationInputs	**Parent Element:** A collection of data elements containing the coke calcining name and the emission calculation equation inputs.
CokeCalciningUnitName	The name of the coke calcining unit for which inputs are being uploaded. **Important**: The coke calcining unit name must match EXACTLY the cracking coking name in the facility's annual emissions report to e-GGRT.
Values	**Parent Element:** A collection of data elements describing inputs for Subpart Y coke calcining units.

XML Excerpt 16
Subpart Y Coke Calcining Unit High Level

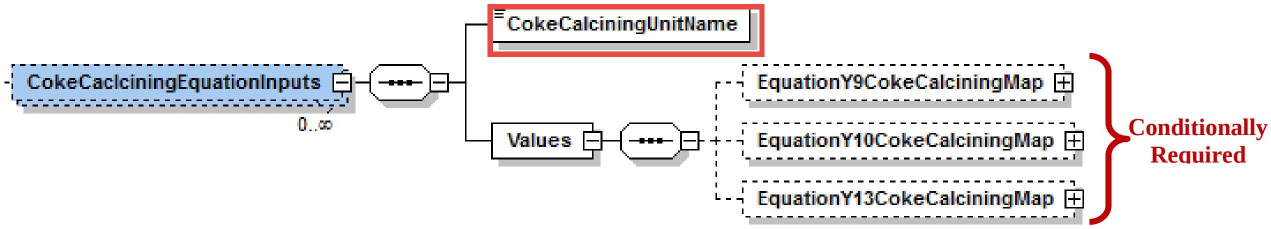
```
<SubpartYCokeCalciningUnits>
 <CokeCalciningEquationInputs>
  <CokeCalciningUnitName>Coke Calcining Unit Y-9 Y-10 and Y-13</CokeCalciningUnitName>
  <Values>

    …insert equation specific inputs

  </Values>
 </CokeCalciningEquationInputs>
</SubpartYCokeCalciningUnits>
```

The order of Subpart Y coke calcining unit equations required by the schema is displayed as Figure 23.

Figure 23
Subpart Y Coke Calcining Equation Inputs Schema Structure Showing Required Equation Order



Following from the high-level schema discussed above, the XML structure for each Subpart Y category and input values must follow the order shown in the schema structure. For example, all Equation Y-9 alternative inputs for the coke calcining unit must be included before any Equation Y-10 alternative inputs are added; similarly, all Equation Y-9 alternative and Equation Y-10 alternative inputs must be included before any Equation Y-13 inputs are added.

2.4.1 Coke Calcining Units: CH_4- Equation Y-9 Unit-Specific CH_4 Emission Factor Alternative [§98.253(c)(4)]

In order to determine CH_4 emissions for coke calcining units, you must provide inputs to the Equation Y-9 alternative that uses a unit-specific CH_4 emission factor combined with activity data. The Equation Y-9 alternative simply multiplies activity data by a unit-specific emission factor (note that the UOM must be consistent between the activity data and emission factor).The corresponding IVT XML schema is illustrated in Figure 24 and the IVT data elements are described in Table 21.

Figure 24
Coke Calcining Units (CH_4)- Information Details Schema Diagram (Equation Y-9 Alternative)

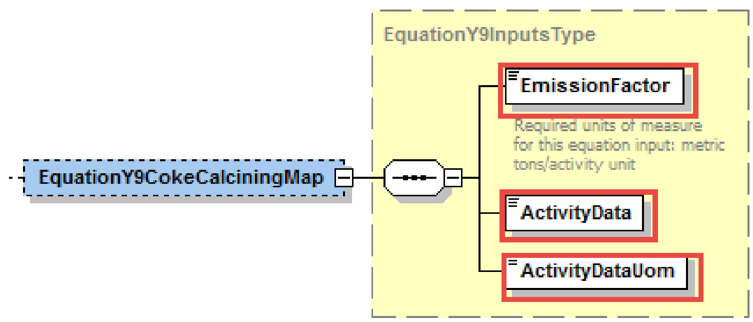


Table 21
Coke Calcining Units (CH_4) Information Details Data Element Definitions – Equation Y-9 Alternative

Data Element Name	Description
EquationY9CokeCalciningMap	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a coke calcining unit.
Emission Factor	Specify the unit-specific CH_4 emission factor (metric tons/activity unit (e.g., metric tons/bbl)).
ActivityData	Specify the annual activity data (e.g., input or product rate)
ActivityDataUom	Indicate the unit of measure for the annual activity data (ensure consistent units of measure are used here and for the activity data (i.e., the denominator) used to calculate the emission factor. For example, if your emission factor is in metric tons/bbl then your annual activity data should be reported in units of bbl)

XML Excerpt 17 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-9 alternative. See Appendix A for an example of a complete XML file that can be submitted through the IVT for coke calcining unit inputs.

XML Excerpt 17
Example for Coke Calcining Units (CH_4) – Equation Y-9 Alternative Information Details

```
<EquationY9CokeCalciningMap>
 <EmissionFactor>2</EmissionFactor>
 <ActivityData>0.5</ActivityData>
 <ActivityDataUom>bbl</ActivityDataUom>
</EquationY9CokeCalciningMap>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.4.2 Coke Calcining Units: N_2O- Equation Y-10 Unit-Specific N_2O Emission Factor Alternative [§98.253(c)(5)]

In order to determine N_2O emissions for coke calcining units, you must provide inputs to the Equation Y-10 alternative that uses a unit-specific N_2O emission factor combined with activity data. The Equation Y-10 alternative simply multiplies activity data by a unit-specific emission factor (note that the UOM must be consistent between the activity data and emission factor). The corresponding IVT XML schema is illustrated in Figure 25 and the IVT data elements are described in Table 22.

Figure 25
Coke Calcining Units (N_2O)- Information Details Schema Diagram (Equation Y-10 Alternative)

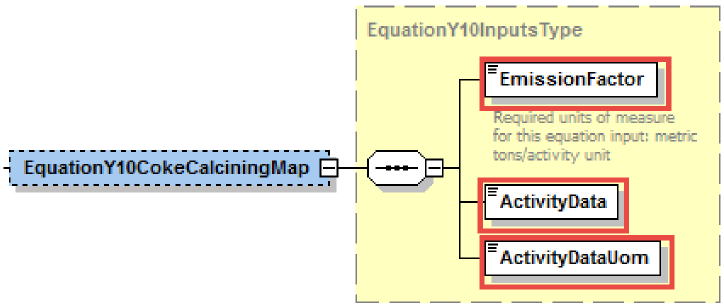


Table 22
Coke Calcining Units (N_2O) Information Details Data Element Definitions – Equation Y-10 Alternative

Data Element Name	Description
EquationY10CokeCalciningMap	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a coke calcining unit.
Emission Factor	Specify the unit-specific N_2O emission factor (metric tons/activity unit (e.g., metric tons/bbl)).
ActivityData	Specify the annual activity data (e.g., input or product rate)
ActivityDataUom	Indicate the unit of measure for the annual activity data (ensure consistent units of measure are used here and for the activity data (i.e., the denominator) used to calculate the emission factor. For example, if your emission factor is in metric tons/bbl then your annual activity data should be reported in units of bbl)

XML Excerpt 18 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-10 alternative. See Appendix A for an example of a complete XML file that can be submitted through the IVT for coke calcining unit inputs.

XML Excerpt 18
Example for Coke Calcining Units (N_2O) – Equation Y-10 Alternative Information Details

```
<EquationY10CokeCalciningMap>
 <EmissionFactor>1</EmissionFactor>
 <ActivityData>0.06</ActivityData>
 <ActivityDataUom>bbl</ActivityDataUom>
</EquationY10CokeCalciningMap>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.4.3 Coke Calcining Units: CO_2- Equation Y-13 [§98.253(g)(2)]

In order to determine CO_2 emissions for coke calcining units, you must provide inputs to Equation Y-12. Following is the formula for Equation Y-12and the list of variables. The corresponding IVT XML schema is illustrated in Figure 26 and the IVT data elements are described in Table 23.

$$CO_2 = \frac{44}{12} * \left(M_{in} * CC_{GC} - \left(M_{out} + M_{dust}\right) * CC_{MPC}\right) \qquad \text{(Eq. Y-13)}$$

Where:

CO_2 = Annual CO_2 emissions (metric tons/year).
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).
44 = Molecular weight of CO_2 (kg/kg-mole).
12 = Atomic weight of C (kg/kg-mole).

Figure 26
Coke Calcining Units (CO_2)- Information Details Schema Diagram (Equation Y-13)

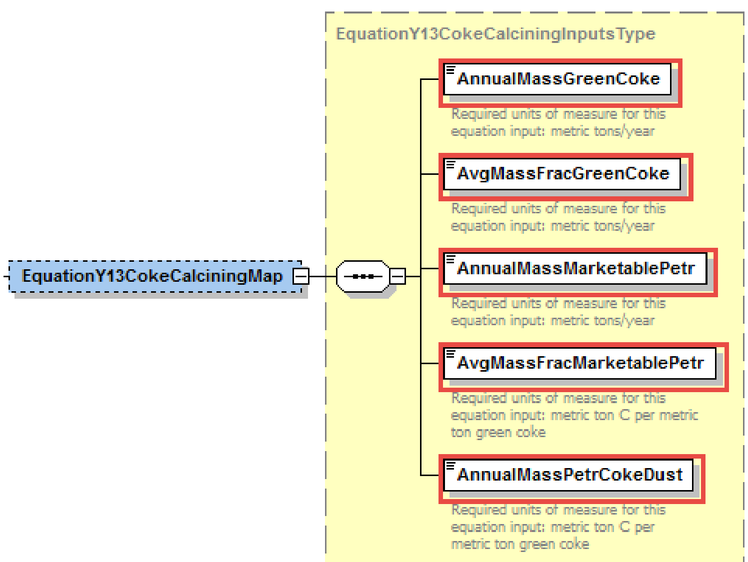


Table 23
Coke Calcining Units (CO_2) Information Details Data Element Definitions – Equation Y-13

Data Element Name	Description
EquationY13CokeCalciningMap	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a coke calcining unit.
AnnualMassGreenCoke	Specify the annual mass of green coke fed to the coke calcining unit from facility records (metric tons/year).
AvgMassFracGreenCoke	Specify the average mass fraction carbon content of green coke from facility measurement data (metric ton carbon/metric ton green coke).
AnnualMassMarketablePetr	Specify the annual mass of marketable petroleum coke produced by the coke calcining unit from facility records (metric tons petroleum coke/year).
AvgMassFracMarketablePetr	Specify the 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).
AnnualMassPetrCokeDust	Specify the 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.

XML Excerpt 19 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-13. See Appendix A for an example of a complete XML file that can be submitted through the IVT for coke calcining unit inputs.

XML Excerpt 19
Example for Coke Calcining Units (CO_2) – Equation Y-13 Information Details

```
<EquationY13CokeCalciningMap>
  <AnnualMassGreenCoke>145</AnnualMassGreenCoke>
  <AvgMassFracGreenCoke>0.8</AvgMassFracGreenCoke>
  <AnnualMassMarketablePetr>28</AnnualMassMarketablePetr>
  <AvgMassFracMarketablePetr>0.92</AvgMassFracMarketablePetr>
  <AnnualMassPetrCokeDust>14</AnnualMassPetrCokeDust>
</EquationY13CokeCalciningMap>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.5 Subpart Y Sulfur Recovery Unit Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y coke sulfur recovery unit are shown and defined.

Figure 27
Subpart Y Sulfur Recovery Units High-Level Schema Structure

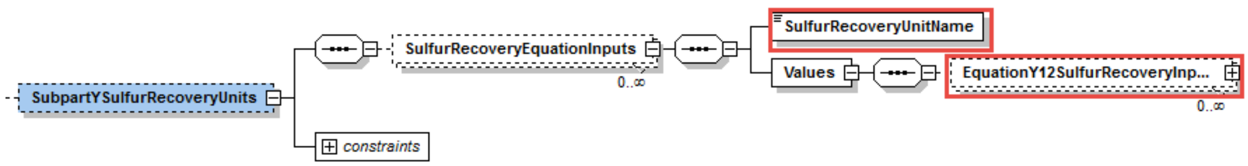


Table 24
Data Element Definitions for Subpart Y Sulfur Recovery Units (High Level)

Data Element Name	Description
SubpartYSulfurRecoveryUnits	**Parent Element:** A collection of data elements containing the sulfur recovery unit equation inputs. **Conditionally Required:** These data elements are required only if the unit is a sulfur recovery unit.
SulfurRecoveryEquationInputs	**Parent Element:** A collection of data elements containing the sulfur recovery unit name and the emission calculation equation inputs.
SulfurRecoveryUnitName	The name of the sulfur recovery unit name for which inputs are being uploaded. **Important:** The sulfur recovery unit name must match EXACTLY the sulfur recovery unit name in the facility's annual emissions report to e-GGRT.
Values	**Parent Element:** A collection of data elements describing inputs for Subpart Y sulfur recovery units.
EquationY12SulfurRecoveryInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs for sulfur recovery units.

XML Excerpt 20
Subpart Y Sulfur Recovery Unit High Level

```
<SubpartYSulfurRecoveryUnits>
  <SulfurRecoveryEquationInputs>
    <SulfurRecoveryUnitName>Sulfur Recovery Unit Y-12</SulfurRecoveryUnitName>
    <Values>
      <EquationY12SulfurRecoveryInputs>

... insert equation-specific inputs

      </EquationY12SulfurRecoveryInputs>
    </Values>
  </SulfurRecoveryEquationInputs>
</SubpartYSulfurRecoveryUnits>
```

2.5.1 On-Site Sulfur Recovery Plants: CO_2- Equation Y-12 [§98.253(f)(4)]

In order to determine CO_2 emissions for on-site sulfur recovery plants, you must provide inputs to Equation Y-12. If the tail gas is recycled, and a unit-specific CO_2 correction factor is being used, you must also provide the volumetric flow rate of tail gas and the mole fraction of carbon in the tail gas recycled to the front of the sulfur recovery plant. Following is the formula for Equation Y-12 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 28 and the IVT data elements are described in Table 25.

$$CO_2 = F_{SG} * \frac{44}{MVC} * MF_C * 0.001 \qquad \text{(Eq. Y-12)}$$

Where:

CO_2 = Annual CO_2 emissions (metric tons/year).
F_{SG} = Volumetric flow rate of sour gas (including sour water stripper gas) fed to the sulfur recovery plant or the sour gas feed sent off-site for sulfur recovery (scf/year).
44 = Molecular weight of CO_2 (kg/kg-mole).
MVC = 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).
MF_C = Mole fraction of carbon in the sour gas fed to the sulfur recovery plant or the sour gas feed sent off-site for sulfur recovery (kg-mole C/kg-mole gas); default = 0.20.
0.001 = Conversion factor, kg to metric tons.

Figure 28
On-Site Sulfur Recovery Plants (CO_2) - Information Details Schema Diagram (Equation Y-12)

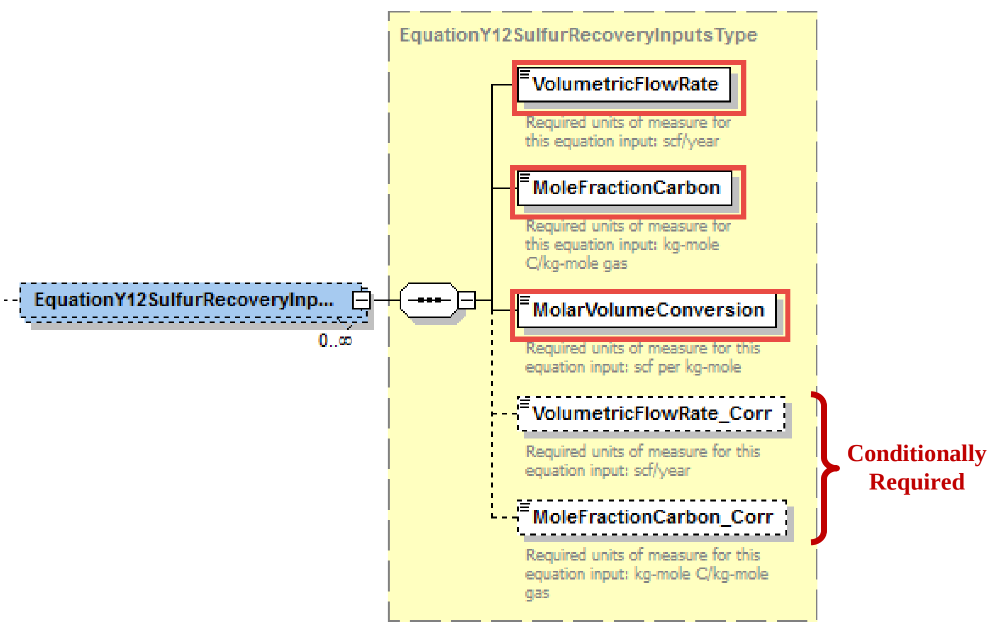


Table 25
On-Site Sulfur Recovery Plants (CO_2) Information Details Data Element Definitions – Equation Y-12

Data Element Name	Description
EquationY12SulfurRecoveryInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a sulfur recovery unit.
VolumetricFlowRate	Specify the volumetric flow rate of sour gas (including sour water stripper gas) fed to the sulfur recovery plant (scf/year).
MoleFractionCarbon	Specify the mole fraction of carbon in the sour gas fed to the sulfur recovery plant (kg-mole C/kg-mole gas); default = 0.20.
MolarVolumeConversion	Specify 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).
VolumetricFlowRate_Corr	Specify the volumetric flow rate of tail gas recycled to the front of the sulfur recovery plant (scf/yr) **Conditionally Required:** This data element is only required if a unit-specific CO_2 correction factor is being used.
MoleFractionCarbon_Corr	Specify the mole fraction of carbon in the tail gas recycled to the front of the sulfur recovery plant (kg-mol C/kg-mol gas)\ **Conditionally Required:** This data element is only required if a unit-specific CO_2 correction factor is being used.

XML Excerpt 21 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-12. See Appendix A for an example of a complete XML file that can be submitted through the IVT for on-site sulfur recovery plants unit inputs.

XML Excerpt 21
Example for On-Site Sulfur Recovery Plants (CO_2) – Equation Y-12 Information Details

```
<EquationY12SulfurRecoveryInputs>
  <VolumetricFlowRate>125</VolumetricFlowRate>
  <MoleFractionCarbon>0.2</MoleFractionCarbon>
  <MolarVolumeConversion>849.5</MolarVolumeConversion>
</EquationY12SulfurRecoveryInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.6 Subpart Y Loading Operations Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y loading operations are shown and defined.

Figure 29
Subpart Y Loading Operations Inputs High-Level Schema Structure

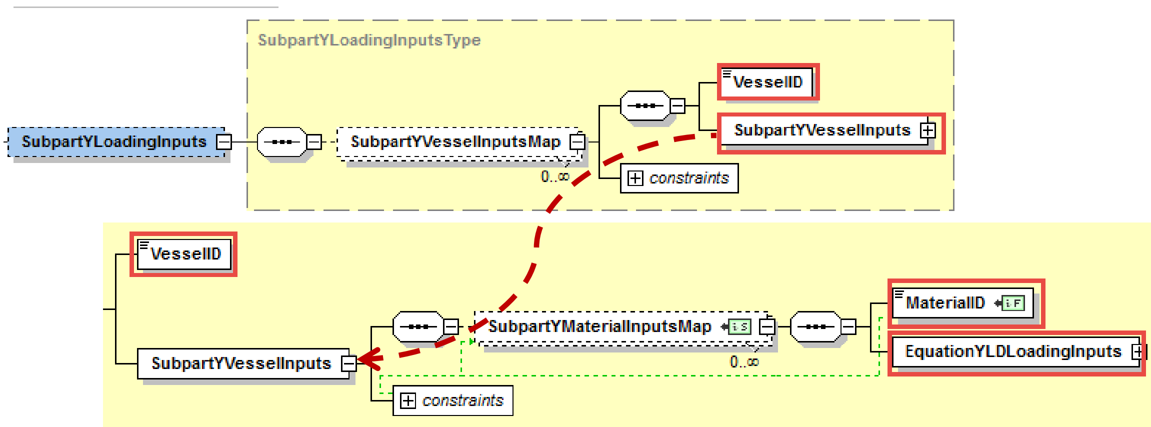


Table 26
Data Element Definitions for Subpart Y Loading Operations Inputs (High Level)

Data Element Name	Description
SubpartYLoadingInputs	**Parent Element:** A collection of data elements containing the loading operations inputs. **Conditionally Required:** These data elements are required only if the unit has crude oil, intermediate, or product loading operations for which the vapor-phase concentration of methane is 0.5 volume percent or more.
SubpartYVesselInputsMap	**Parent Element:** A collection of data elements containing the vessel ID, vessel inputs and the constraints.
VesselID	The vessel ID for which inputs are being uploaded. **Important**: The vessel ID must match EXACTLY the vessel ID in the facility's annual emissions report to e-GGRT.
SubpartYVesselInputs	**Parent Element:** A collection of data elements containing the material inputs and constraints for Subpart Y vessels.
SubpartYMaterialInputsMap	**Parent Element:** A collection of data elements containing the material ID and equation loading inputs for Subpart Y materials.
MaterialID	The material ID for which inputs are being uploaded. **Important**: The material ID must match EXACTLY the material ID in the facility's annual emissions report to e-GGRT.
EquationYLDLoadingInputs	**Parent Element:** A collection of data elements containing inputs for the equation YLD.

XML Excerpt 22
Subpart Y Loading Operations Inputs High Level

```xml
<SubpartYLoadingInputs>
  <SubpartYVesselInputsMap>
    <VesselID>Barge</VesselID>
    <SubpartYVesselInputs>
      <SubpartYMaterialInputsMap>
        <MaterialID>Still gas or refinery fuel gas:Condenser</MaterialID>
        <EquationYLDLoadingInputs>
      </SubpartYMaterialInputsMap>
    </SubpartYVesselInputs>
  </SubpartYVesselInputsMap>
  <SubpartYVesselInputsMap>
</SubpartYLoadingInputs>
```

2.6.1 Crude Oil, Intermediate, or Product Loading Operations: Equation Y-LD [§98.253(n)]

In order to determine the loading factor for crude oil, intermediate, or product loading operations for which the vapor-phase concentration of methane is 0.5 volume percent or more, you must provide inputs to Equation Y-LD for each material/vessel. Following is the formula for Equation Y-LD and the list of variables. The corresponding IVT XML schema is illustrated in Figure 30 and the IVT data elements are described in Table 27.

Equation Y-LD

$$L = 12.46SPM/(T+460) * (100\%\text{-efficiency})$$

Where:

L =	Loading factor
S =	Saturation factor
P =	True vapor pressure of liquid loaded (psia)
M =	Molecular weight of vapors (lb/lb-mole)
T =	Temperature of bulk liquid loaded (°R =°F+460)
Efficiency =	Overall emission control system reduction efficiency, including the vapor collection system efficiency and the vapor recovery or destruction efficiency (enter zero if no emission controls)

Figure 30
Crude Oil, Intermediate, or Product Loading Operations Inputs Information Details Schema Diagram (Equation Y-LD)

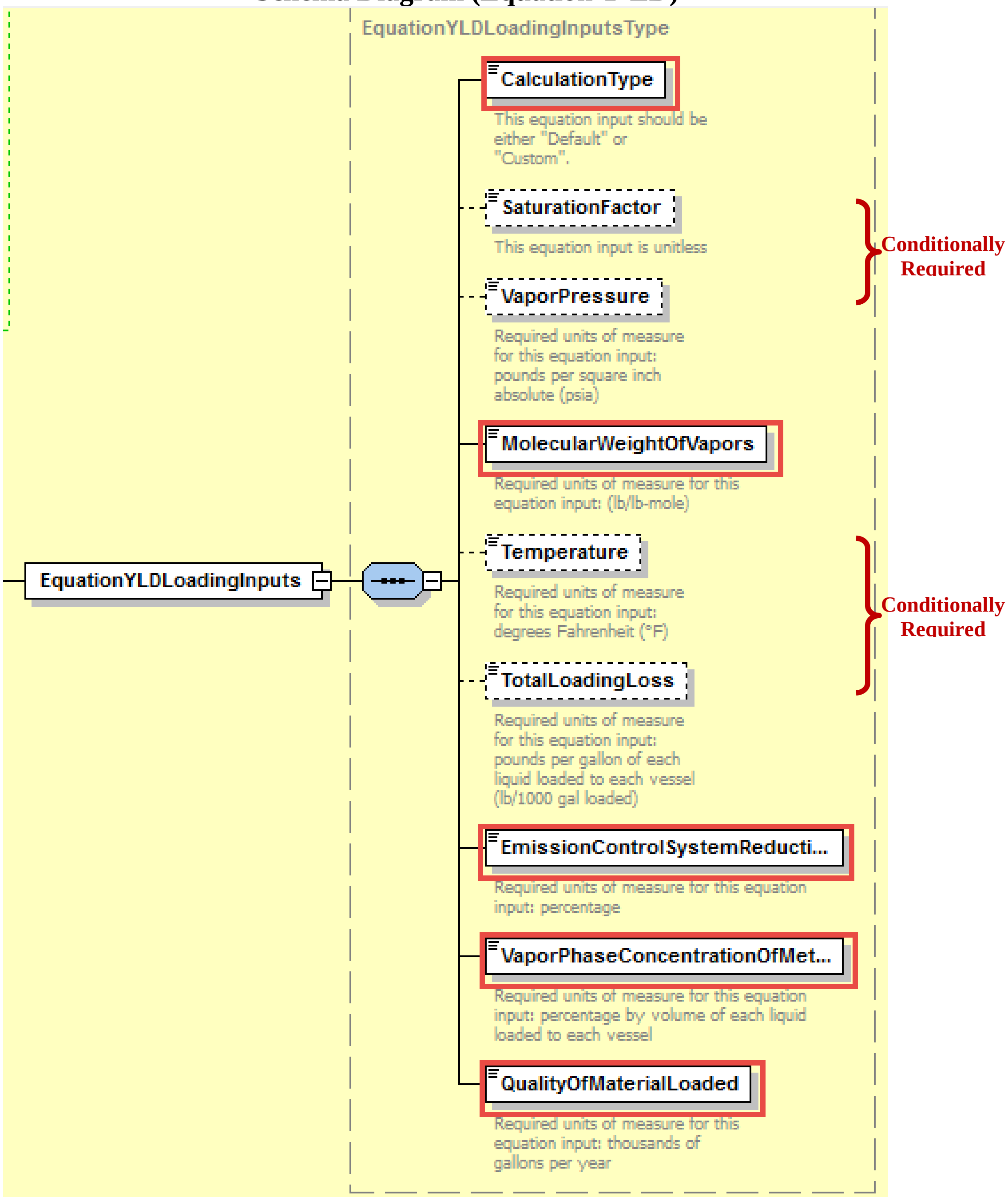


Table 27
Crude Oil, Intermediate, or Product Loading Operations Information Details Data Element Definitions – Equation Y-LD

Data Element Name	Description
EquationYLDLoadingInputs	**Parent Element:** A collection of data elements containing inputs for the equation YLD calculation. **Conditionally Required:** These data elements are required only if the unit has crude oil, intermediate or product loading operations.
CalculationType	Indicate "Custom" if loading factor L is calculated from AP-42 Section 5.2 equation 1, or "Default" if using the default specified in Tables 5.2-2, 5.2-5, or 5.2-6 of AP-42.
SaturationFactor	**Indicate the saturation factor from AP-42, Table 5.2-1 for each liquid loaded to each vessel.** **Conditionally required: This data element is only entered if "Custom" is selected.**
VaporPressure	**Indicate the true vapor pressure of liquid loaded (psia) for each liquid loaded to each vessel.** **Conditionally required: This data element is only entered if "Custom" is selected..**
MolecularWeightOfVapors	Indicate the molecular weight of vapors (lb/lb-mole) for each liquid loaded to each vessel.
Temperature	**Indicate the temperature of bulk liquid loaded.** **Conditionally required: This data element is only entered if "Custom" is selected.**
TotalLoadingLoss	**Indicate the total loading loss (without efficiency correction) in lb/1000 gal loaded for each liquid loaded to each vessel.** **Conditionally required: This data element is only entered if "Custom" is selected..**
EmissionControlSystemReduction	Indicate the overall emission control system reduction efficiency (%) including the vapor collection system efficiency and the vapor recovery or destruction efficiency (enter 0 if no emission controls).
VaporPhaseConcentrationofMeth…	Specify the vapor phase concentration (percent by volume) in the liquid loaded.
QualityofMaterialLoaded	Specify the quantity of material loaded in 1,000 gal/year.

XML Excerpt 23 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-LD. See Appendix A for an example of a complete XML file that can be submitted through the IVT for loading inputs.

XML Excerpt 23
Example for Crude Oil, Intermediate, or Product Loading Operations – Equation Y-LD Information Details

```
<EquationYLDLoadingInputs>
  <CalculationType>default</CalculationType>
  <MolecularWeightOfVapors>56</MolecularWeightOfVapors>
  <TotalLoadingLoss>10</TotalLoadingLoss>
  <EmissionControlSystemReductionEfficiency>67</EmissionControlSystemReductionEfficiency>
  <VaporPhaseConcentrationOfMethane>3</VaporPhaseConcentrationOfMethane>
  <QualityOfMaterialLoaded>365</QualityOfMaterialLoaded>
</EquationYLDLoadingInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.7 Subpart Y Sour Gas Sent Off-Site for Sulfur Recovery Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y sour gas sent off-site for sulfur recovery are shown and defined.

2.7.1 Sour Gas Sent Off-Site for Sulfur Recovery: CO_2- Equation Y-12 [§98.253(f)(4)]

In order to determine CO_2 emissions for sour gas sent off-site for sulfur recovery, you must provide inputs to Equation Y-12. Following is the formula for Equation Y-12 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 31 and the IVT data elements are described in Table 28.

$$CO_2 = F_{SG} * \frac{44}{MVC} * MF_C * 0.001 \qquad \text{(Eq. Y-12)}$$

Where:

CO_2 =	Annual CO_2 emissions (metric tons/year).
F_{SG} =	Volumetric flow rate of sour gas (including sour water stripper gas) fed to the sulfur recovery plant or the sour gas feed sent off-site for sulfur recovery (scf/year).
44 =	Molecular weight of CO_2 (kg/kg-mole).
MVC =	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).
MF_C =	Mole fraction of carbon in the sour gas fed to the sulfur recovery plant or the sour gas feed sent off-site for sulfur recovery (kg-mole C/kg-mole gas); default = 0.20.
0.001 =	Conversion factor, kg to metric tons.

Figure 31
Sour Gas Sent Off-Site for Sulfur Recovery (CO_2)- Information Details Schema Diagram (Equation Y-12)

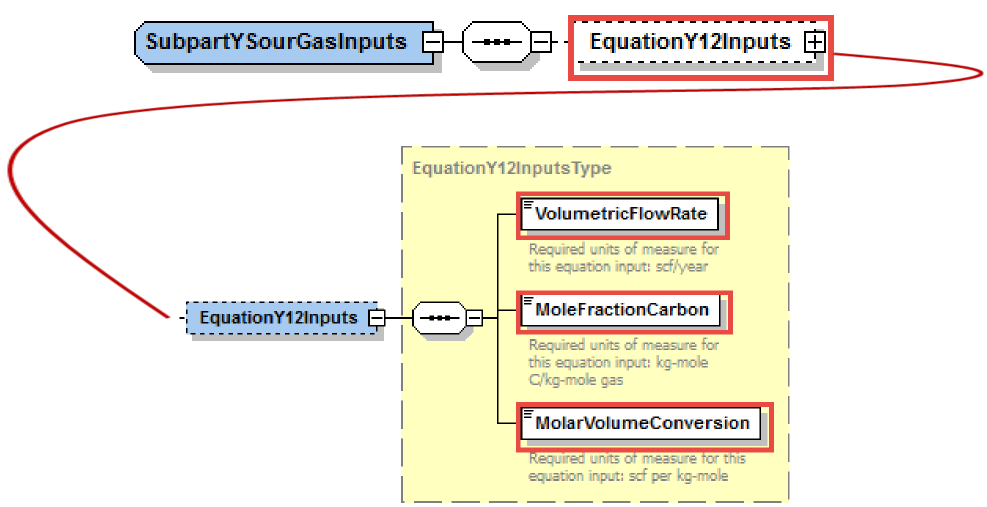


Table 28
Sour Gas Sent Off-Site for Sulfur Recovery (CO_2) Information Details Data Element Definitions – Equation Y-12

Data Element Name	Description
SubpartYSourGasInputs	**Parent Element:** A collection of data elements containing input for the emissions calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit has sour gas sent off-site for sulfur recovery.
EquationY12Inputs	**Parent Element:** A collection of data elements containing inputs for the equation Y-12 emission calculation.
VolumetricFlowRate	Specify the volumetric flow rate of the sour gas feed sent off-site for sulfur recovery (scf/year).
MoleFractionCarbon	Specify the mole fraction of carbon in the sour gas feed sent off-site for sulfur recovery (kg-mole C/kg-mole gas); default = 0.20.
MolarVolumeConversion	Specify 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).

XML Excerpt 24 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-12. See Appendix A for an example of a complete XML file that can be submitted through the IVT for on-site sulfur recovery plants unit inputs.

XML Excerpt 24
Example for Sour Gas Sent Off-Site for Sulfur Recovery (CO_2) – Equation Y-12 Information Details

```
<SubpartYSourGasInputs>
  <EquationY12Inputs>
    <VolumetricFlowRate>600</VolumetricFlowRate>
    <MoleFractionCarbon>0.2</MoleFractionCarbon>
    <MolarVolumeConversion>849.5</MolarVolumeConversion>
  </EquationY12Inputs>
</SubpartYSourGasInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.8 Subpart Y Blowdown Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y uncontrolled blowdown systems are shown and defined.

2.8.1 Uncontrolled Blowdown Systems: CH_4- Equation Y-20 [§98.253(k)]

In order to determine CH_4 emissions for uncontrolled blowdown systems, you must provide inputs to Equation Y-20. Blowdown systems where the uncondensed gas stream is routed to a flare or similar control device are considered to be controlled and are not required to estimate emissions with this equation. Following is the formula for Equation Y-20 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 32 and the IVT data elements are described in Table 29.

$$CH_4 = \left(Q_{Ref} \times EF_{BD} \times \frac{16}{MVC} \times 0.001 \right) \qquad \text{(Eq. Y-20)}$$

Where:

CH_4 = Methane emission rate from blowdown systems (mt CH_4/year).
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 CH_4/MMbbl); default is 137,000.
16 = Molecular weight of CH_4 (kg/kg-mole).
MVC = 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).
0.001 = Conversion factor (metric ton/kg).

Figure 32
Uncontrolled Blowdown Systems (CH_4)- Information Details Schema Diagram (Equation Y-20)

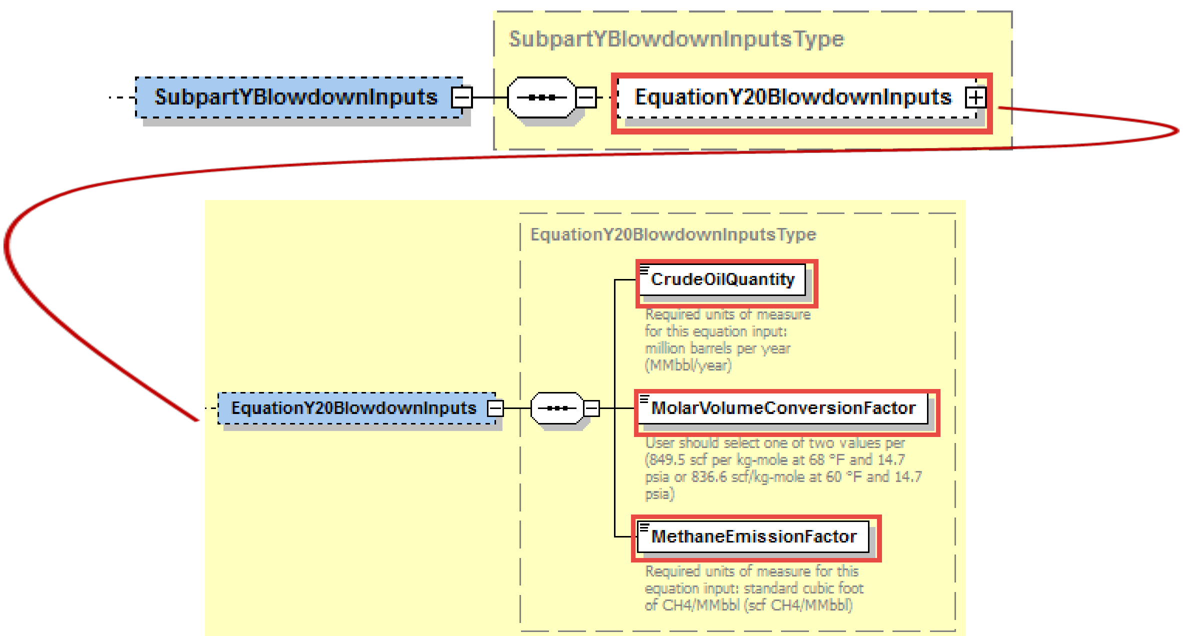


Table 29
Uncontrolled Blowdown Systems (CH_4) Information Details Data Element Definitions – Equation Y-20

Data Element Name	Description
SubpartYBlowdownInputs	**Parent Element:** A collection of data elements containing the emissions equation inputs for uncontrolled blowdown systems. **Conditionally Required:** These data elements are required only if the unit is an uncontrolled blowdown system.
EquationY20BlowdownInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs.
CrudeOilQuantity	Specify the quantity of crude oil plus the quantity of intermediate products received from off site that are processed at the facility (MMbbl/year).
MolarVolumeConversionFactor	Specify 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).
MethaneEmissionsFactor	Specify the methane emission factor for uncontrolled blown systems (scf CH_4/MMbbl); default is 137,000.

XML Excerpt 25 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-20. See Appendix A for an example of a complete XML file that can be submitted through the IVT for uncontrolled blowdown system inputs.

XML Excerpt 25
Example for Uncontrolled Blowdown Systems (CH_4) – Equation Y-20 Information Details

```xml
<SubpartYBlowdownInputs>
  <EquationY20BlowdownInputs>
    <CrudeOilQuantity>200</CrudeOilQuantity>
    <MolarVolumeConversionFactor>836.6</MolarVolumeConversionFactor>
    <MethaneEmissionFactor>0.99</MethaneEmissionFactor>
  </EquationY20BlowdownInputs>
</SubpartYBlowdownInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.9 Subpart Y Storage Tank Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y storage tanks are shown and defined.

For storage tanks other than those processing unstabilized crude oil, enter inputs for Equation Y-22 to calculate CH_4 emissions. For storage tanks that process unstabilized crude oil, you must provide inputs to Equation Y-23 to calculate CH_4 emissions.

Figure 33
Storage Tank Inputs - High Level Schema Structure

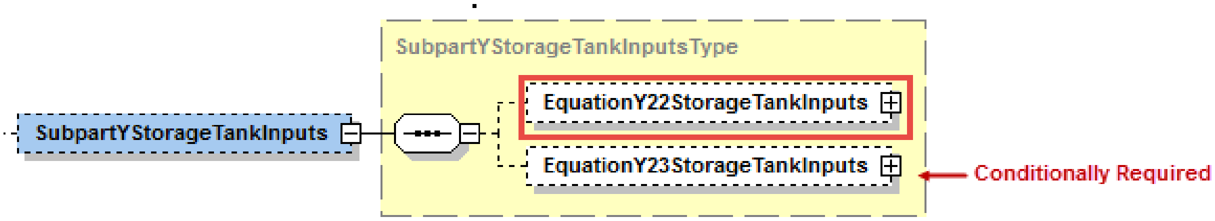


Table 30
Data Element Definitions for Subpart Y Storage Tanks (High Level)

Data Element Name	Description
SubpartYStorageTankInputs	**Parent Element:** A collection of data elements containing the storage tank equation inputs. **Conditionally Required:** These data elements are required only if the unit is a storage tank.
EquationY22StorageTankInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs.
EquationY23StorageTankInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a storage tank processing unstabilized crude oil.

XML Excerpt 26
Subpart Y Storage Tanks High Level

```
<SubpartYStorageTankInputs>

        …insert equation specific inputs

</SubpartYStorageTankInputs>
```

2.9.1 Storage Tanks Other Than Those Processing Unstabilized Crude Oil: CH_4- Equation Y-22 [§98.253(m)(1)]]

In order to determine CH_4 emissions for storage tanks other than those processing unstabilized crude oil, you must provide the quantity of crude oil plus the quantity of intermediate products received from off-site that are processed at the facility as inputs to Equation Y-22. Following is the formula for Equation Y-22 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 34 and the IVT data elements are described in Table 31.

$$CH_4 = \left(0.1 \times Q_{Ref}\right) \qquad \text{(Eq. Y-22)}$$

Where:

CH_4 = Annual methane emissions from storage tanks (metric tons/year).
0.1 = Default emission factor for storage tanks (metric ton CH_4/MMbbl).
Q_{Ref} = Quantity of crude oil plus the quantity of intermediate products received from off site that are processed at the facility (MMbbl/year).

Figure 34
Storage Tanks (CH_4) Information Details Schema Diagram (Equation Y-22)

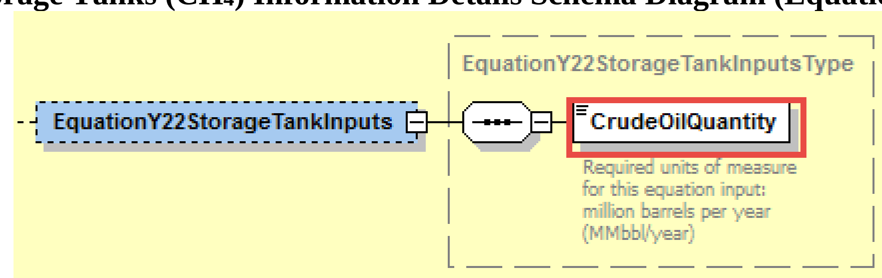


Table 31
Storage Tanks (CH_4) Information Details Data Element Definitions – Equation Y-22

Data Element Name	Description
EquationY22StorageTankInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs.
CrudeOilQuantity	Specify the quantity of crude oil plus the quantity of intermediate products received from off site that are processed at the facility (MMbbl/year).

XML Excerpt 27 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-22. See Appendix A for an example of a complete XML file that can be submitted through the IVT for storage tank inputs.

XML Excerpt 27
Example for Storage Tanks (CH_4) – Equations Y-22 Information Details

```
<EquationY22StorageTankInputs>
  <CrudeOilQuantity>4</CrudeOilQuantity>
</EquationY22StorageTankInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.9.2 Storage Tanks Processing Unstabilized Crude Oil: CH_4- Equation Y-23[§98.253(m)(2)]

In order to determine CH_4 emissions for storage tanks that process unstabilized crude oil, provide inputs to Equation Y-23. Following is the formula for Equation Y-23 and the list of variables. The corresponding XML schema is illustrated in Figure 35 and the data elements are described in Table 32.

$$CH_4 = (995{,}000 \times Q_{un} \times \Delta P) \times MF_{CH4} \times \frac{16}{MVC} \times 0.001 \qquad \text{(Eq. Y-23)}$$

Where:

CH_4 = Annual methane emissions from storage tanks (metric tons/year).
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} = Average mole fraction of CH_4 in vent gas from the unstabilized crude oil storage tanks from facility measurements (kg-mole CH_4/kg-mole gas); use 0.27 as a default if measurement data are not available.
995,000 = Correlation Equation factor (scf gas per MMbbl per psi).
16 = Molecular weight of CH_4 (kg/kg-mole).
MVC = 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).
0.001 = Conversion factor (metric ton/kg).

Figure 35
Storage Tanks (CH_4) Information Details Schema Diagram (Equation Y-23)

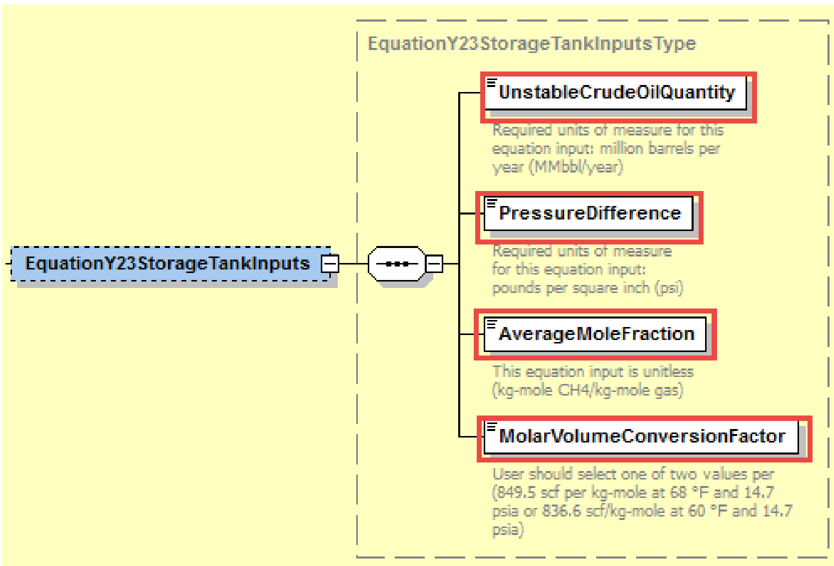


Table 32
Storage Tanks (CH_4) Information Details Data Element Definitions – Equation Y-23

Data Element Name	Description
EquationY23StorageTankInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a storage tank processing unstabilized crude oil.
UnstableCrudeOilQuantity	Specify the quantity of unstabilized crude oil received at the facility (MMbbl/year).
PressureDifference	Specify the pressure differential from the previous storage pressure to atmospheric pressure (pounds per square inch, psi).
AverageMoleFraction	Specify the average mole fraction of CH_4 in vent gas from the unstabilized crude oil storage tanks from facility measurements (kg-mole CH_4/kg-mole gas); use 0.27 as a default if measurement data are not available.
MolarVolumeConversionFactor	Specify 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).

XML Excerpt 28 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-22. See Appendix A for an example of a complete XML file that can be submitted through the IVT for storage tank inputs.

XML Excerpt 28
Example for Storage Tanks (CH_4) – Equations Y-23 Information Details

```
<EquationY23StorageTankInputs>
  <UnstableCrudeOilQuantity>6</UnstableCrudeOilQuantity>
  <PressureDifference>16</PressureDifference>
  <AverageMoleFraction>0.4</AverageMoleFraction>
  <MolarVolumeConversionFactor>849.5</MolarVolumeConversionFactor>
</EquationY23StorageTankInputs>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.10 Subpart Y Delayed Coking Units Vessel Inputs

In the following figures and tables, inputs for calculating emissions from Subpart Y delayed coking unit vessels are shown and defined.

Figure 36
Subpart Y Vessel Inputs (Delayed Coking Units) High-Level Schema Structure

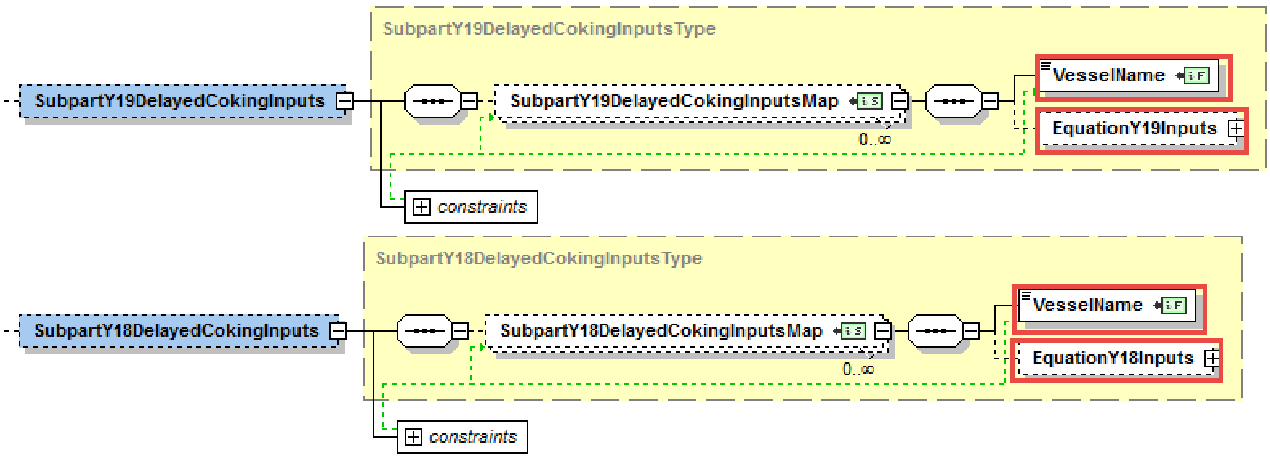


Table 33
Data Element Definitions for Subpart Y Delayed Coking Unit Vessels (High Level)

Data Element Name	Description
SubpartY18DelayedCokingInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a delayed coking unit vessel.
SubpartY18DelayedCokingInputsMap	**Parent Element:** A collection of data elements containing the vessel name and the emission calculation equation inputs for the Subpart Y delayed coking unit vessel.
VesselName	The name of the vessel for which inputs are being uploaded. **Important:** The vessel name must match EXACTLY the vessel name in the facility's annual emissions report to e-GGRT.
EquationY18Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs.

Table 34
Data Element Definitions for Subpart Y Delayed Coking Unit Vessels (High Level)

Data Element Name	Description

SubpartY19DelayedCokingInputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a delayed coking unit vessel.
SubpartY19DelayedCokingInputsMap	**Parent Element:** A collection of data elements containing the vessel name and the emission calculation equation inputs for the Subpart Y delayed coking unit vessel.
VesselName	The name of the vessel for which inputs are being uploaded. **Important:** The vessel name must match EXACTLY the vessel name in the facility's annual emissions report to e-GGRT.
EquationY19Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs.

XML Excerpt 29
Subpart Y Delayed Coking Unit Vessels High Level – Equation Y-18 Details

```
<SubpartY18DelayedCokingInputs>
  <SubpartY18DelayedCokingInputsMap>
  <VesselName>Coking Drum DCU XML Test</VesselName>
  <EquationY18Inputs>-----</EquationY18Inputs>
  <SubpartY18DelayedCokingInputs>
  </SubpartY18DelayedCokingInputsMap>
</SubpartY18DelayedCokingInputs>
```

XML Excerpt 30
Subpart Y Delayed Coking Unit Vessels High Level - Equation Y-19 Details

```
<SubpartY19DelayedCokingInputs>
  <SubpartY19DelayedCokingInputsMap>
  <VesselName>1-Coking Drum DCU XML Test</VesselName>
  <EquationY19Inputs>-----</EquationY19Inputs>
  <SubpartY19DelayedCokingInputs>
  </SubpartY19DelayedCokingInputsMap>
</SubpartY19DelayedCokingInputs>
```

2.10.1 Delayed Coking Units: CH_4- Equation Y-18 [§98.253(i)(1)]

In order to determine CH_4 emissions for delayed coking units following the criteria in §98.253(i), you must provide inputs toEquation Y-18. Following is the formula for Equation Y-18 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 37 and the IVT data elements are described in Table 35.

$$CH_4 = \left(N \times H \times \frac{(P_{CV} + 14.7)}{14.7} \times f_{void} \times \frac{\pi \times D^2}{4} \times \frac{16}{MVC} \times MF_{CH4} \times 0.001 \right) \qquad \text{(Eq. Y-18)}$$

Where:

CH_4 =	Annual methane emissions from the delayed coking unit vessel opening (metric ton/year).
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).
14.7 =	Assumed atmospheric pressure (pounds per square inch, psi).
f_{void} =	Volumetric void fraction of coking vessel prior to steaming (cf gas/cf of vessel); default = 0.6.
D =	Diameter of coking unit vessel (feet).
16 =	Molecular weight of CH_4 (kg/kg-mole).
MVC =	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).
MF_{CH4} =	Mole fraction of methane in coking vessel gas (kg-mole CH_4/kg-mole gas, wet basis); default value is 0.01.
0.001 =	Conversion factor (metric ton/kg).

Figure 37
Delayed Coking Units (CH_4)- Information Details Schema Diagram (Equation Y-18)

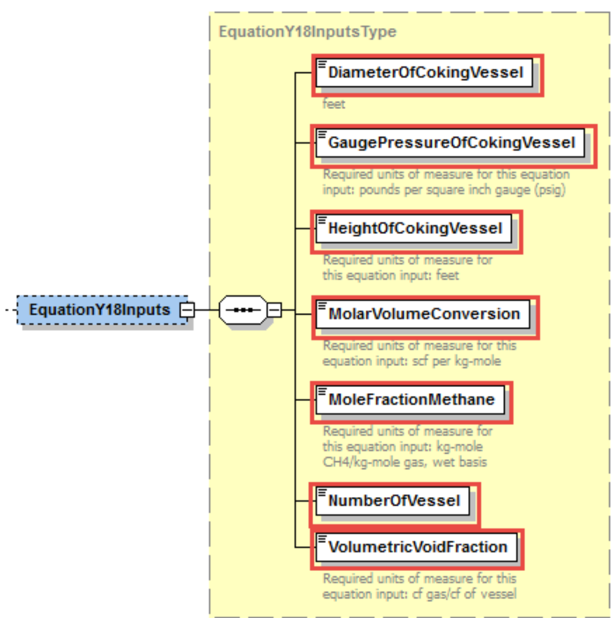


Table 35
Delayed Coking Units (CH_4) Information Details Data Element Definitions – Equation Y-18

Data Element Name	Description
EquationY18Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a delayed coking unit vessel.
DiameterOfCokingVessel	Specify the diameter of the coking unit vessel (feet).
GaugePressureOfCokingVessel	Specify the 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).
HeightOfCokingVessel	Specify the height of the coking unit vessel (feet).
MolarVolumeConversion	Specify 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).
MoleFractionMethane	Specify the mole fraction of methane in coking vessel gas (kg-mole CH_4/kg-mole gas, wet basis); default value is 0.01.
NumberOfVessel	Specify the cumulative number of vessel openings for all delayed coking unit vessels of the same dimensions during the year.
VolumetricVoidFraction	Specify the volumetric void fraction of coking vessel prior to steaming (cf gas/cf of vessel); default = 0.6.

XML Excerpt 31 below illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-18. See Appendix A for an example of a complete XML file that can be submitted through the IVT for delayed coking unit inputs.

XML Excerpt 31
Example for Delayed Coking Units (CH_4) – Equation Y-18 Information Details


```xml
<EquationY18Inputs>
  <DiameterOfCokingVessel>15</DiameterOfCokingVessel>
  <GaugePressureOfCokingVessel>25</GaugePressureOfCokingVessel>
  <HeightOfCokingVessel>75</HeightOfCokingVessel>
  <MolarVolumeConversion>849.5</MolarVolumeConversion>
  <MoleFractionMethane>0.09</MoleFractionMethane>
  <NumberOfVessel>150</NumberOfVessel>
  <VolumetricVoidFraction>0.05</VolumetricVoidFraction>
</EquationY18Inputs>
```


Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

2.10.2 Delayed Coking Units: CH_4- Equation Y-18 [§98.253(i)(1) and Equation Y-19 [§98.253(j)]]

In order to determine CH_4 emissions for delayed coking units using the combined Equation Y-18/19 methodology, you must provide inputs to Equation Y-18 and Y-19. Following are the formulas for Equation Y-18 and Equation Y-19 and the list of variables. The corresponding IVT XML schema is illustrated in Figure 38 and Figure 39 and the IVT data elements are described in Table 36 and Table 37.

$$CH_4 = \left(N \times H \times \frac{(P_{CV} + 14.7)}{14.7} \times f_{void} \times \frac{\pi \times D^2}{4} \times \frac{16}{MVC} \times MF_{CH4} \times 0.001 \right) \qquad \text{(Eq. Y-18)}$$

Where:

CH_4 =	Annual methane emissions from the delayed coking unit vessel opening (metric ton/year).
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).
14.7 =	Assumed atmospheric pressure (pounds per square inch, psi).
f_{void} =	Volumetric void fraction of coking vessel prior to steaming (cf gas/cf of vessel); default = 0.6.
D =	Diameter of coking unit vessel (feet).
16 =	Molecular weight of CH_4 (kg/kg-mole).
MVC =	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).
MF_{CH4} =	Mole fraction of methane in coking vessel gas (kg-mole CH_4/kg-mole gas, wet basis); default value is 0.01.
0.001 =	Conversion factor (metric ton/kg).

$$E_x = \sum_{p=1}^{N} \left((VR)_p \times (MF_x)_p \times \frac{MW_x}{MVC} \times (VT)_p \times 0.001 \right) \qquad \text{(Eq. Y-19)}$$

Where:

E_X =	Annual emissions of each GHG from process vent (metric ton/yr).
N =	Number of venting events per year.
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.
$(MF_X)_p$ =	Mole fraction of GHG x in process vent during the event (kg-mol of GHG x/kg-mol vent gas) from measurement data, process knowledge, or engineering estimates.
MW_X =	Molecular weight of GHG x (kg/kg-mole); use 44 for CO_2 or N_2O and 16 for CH_4.
MVC =	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).
$(VT)_p$ =	Venting time for the event, (hours).
0.001 =	Conversion factor (metric ton/kg).

Figure 38
Delayed Coking Units (CH_4)- Information Details Schema Diagram (Equation Y-18)

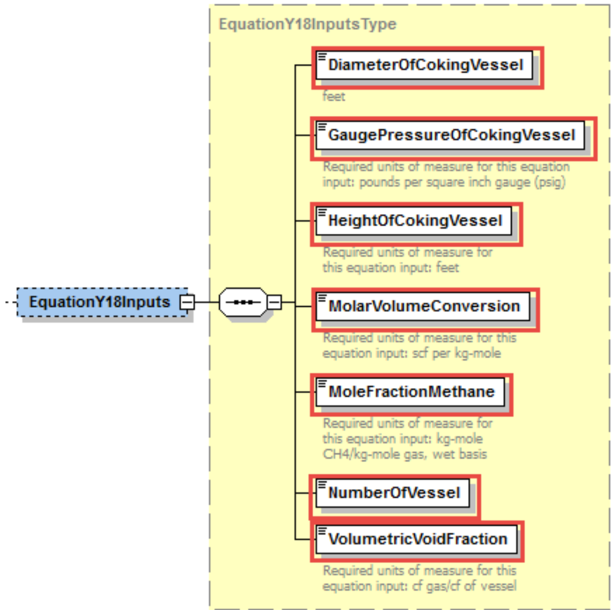


Figure 39
Delayed Coking Units (CH_4) - Information Details Schema Diagram (Equation Y-19)

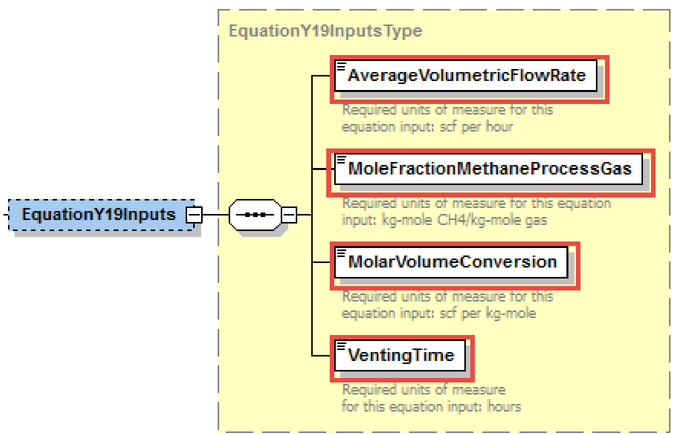


Table 36
Delayed Coking Units (CH_4) Information Details Data Element Definitions – Equation Y-18

Data Element Name	Description
EquationY18Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a delayed coking unit vessel.
DiameterOfCokingVessel	Specify the diameter of the coking unit vessel (feet).
GaugePressureOfCokingVessel	Specify the 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).
HeightOfCokingVessel	Specify the height of the coking unit vessel (feet).
MolarVolumeConversion	Specify 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).
MoleFractionMethane	Specify the mole fraction of methane in coking vessel gas (kg-mole CH_4/kg-mole gas, wet basis); default value is 0.01.
NumberOfVessel	Specify the cumulative number of vessel openings for all delayed coking unit vessels of the same dimensions during the year.
VolumetricVoidFraction	Specify the volumetric void fraction of coking vessel prior to steaming (cf gas/cf of vessel); default = 0.6.

Table 37
Delayed Coking Units (CH_4) Information Details Data Element Definitions – Equation Y-19

Data Element Name	Description
EquationY19Inputs	**Parent Element:** A collection of data elements containing the emission calculation equation inputs. **Conditionally Required:** These data elements are required only if the unit is a delayed coking unit using the combined Equation Y-18 and Y-19 methodology.
AverageVolumetricFlowRate	Specify the average volumetric flow rate of process gas during the event (scf per hour) from measurement data, process knowledge, or engineering estimates.
MoleFractionMethaneProcessGas	Specify the mole fraction of CH_4 in process gas during the event (kg-mol of GHG x/kg-mol vent gas) from measurement data, process knowledge, or engineering estimates.

Data Element Name	Description
MolarVolumeConversion	Specify 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).
VentingTime	Specify the venting time for the event, (hours).

XML Excerpt 32 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-18. XML Excerpt 33 illustrates a portion of the XML file that can be used to upload inputs data to the IVT for Equation Y-19. See Appendix A for an example of a complete XML file that can be submitted through the IVT for delayed coking unit vessel inputs.

XML Excerpt 32
Example for Delayed Coking Units (CH_4) – Equation Y-18 Information Details


```
<EquationY18Inputs>
  <DiameterOfCokingVessel>15</DiameterOfCokingVessel>
  <GaugePressureOfCokingVessel>25</GaugePressureOfCokingVessel>
  <HeightOfCokingVessel>75</HeightOfCokingVessel>
  <MolarVolumeConversion>849.5</MolarVolumeConversion>
  <MoleFractionMethane>0.09</MoleFractionMethane>
  <NumberOfVessel>150</NumberOfVessel>
  <VolumetricVoidFraction>0.05</VolumetricVoidFraction>
</EquationY18Inputs>
```


XML Excerpt 33
Example for Delayed Coking Units (CH_4) – Equation Y-19 Information Details


```
<EquationY19Inputs>
  <AverageVolumetricFlowRate>2500</AverageVolumetricFlowRate>
  <MoleFractionMethaneProcessGas>0.6</MoleFractionMethaneProcessGas>
  <MolarVolumeConversion>836.6</MolarVolumeConversion>
  <VentingTime>144</VentingTime>
</EquationY19Inputs>
```


Note: The code excerpt above is presented here to demonstrate the concept of reporting greenhouse gas quantity data.

IV. Appendix A - Sample XML Documents for Subpart Y IVT


```xml
<FacilityInputs name="Test Facility 90" id="516278" reportingYear="2017" lastUpdateDate="2018-11-24T16:10:40.322-05:00">
 <SubpartInputs>
  <SubpartYInputs>
   <SubpartYFlares>
    <FlareEquationInputs>
     <FlareName>Flare Equation Y-1b</FlareName>
     <Values>
      <EquationY1BInputs>
       <MolarVolumeConversionFactor>849.5</MolarVolumeConversionFactor>
       <EquationY1BPeriodInputs>
        <PeriodNumber>1</PeriodNumber>
        <Values>
         <Volume>2000001</Volume>
         <FlareGasMolePercentConcentration>52</FlareGasMolePercentConcentration>
         <EquationY1BCompoundInputs>
          <CompoundNumber>1</CompoundNumber>
          <Values>
           <CompoundMolePercentConcentration>76</CompoundMolePercentConcentration>
          </Values>
         </EquationY1BCompoundInputs>
        </Values>
       </EquationY1BPeriodInputs>
       <CompoundCarbonMoleNumbers>
        <CompoundNumber>1</CompoundNumber>
        <CompoundCarbonMoleNumber>4</CompoundCarbonMoleNumber>
       </CompoundCarbonMoleNumbers>
      </EquationY1BInputs>
      <EquationY4Inputs>
       <CarbonWeightFraction>0.99</CarbonWeightFraction>
      </EquationY4Inputs>
     </Values>
    </FlareEquationInputs>
    <FlareEquationInputs>
     <FlareName>Flare Y-3 Y-4 and Y-5</FlareName>
     <Values>
      <EquationY3Inputs>
       <HigherHeatingValue>256</HigherHeatingValue>
```

```xml
        <AnnualVolume>1000</AnnualVolume>
        <MolarVolumeConversionFactor>849.5</MolarVolumeConversionFactor>
        <EquationY3EventInputs>
          <EventNumber>1</EventNumber>
          <Values>
            <Volume>700000</Volume>
            <MolecularWeight>55</MolecularWeight>
            <CarbonContent>0.6</CarbonContent>
          </Values>
        </EquationY3EventInputs>
      </EquationY3Inputs>
      <EquationY4Inputs>
        <CarbonWeightFraction>0.43</CarbonWeightFraction>
      </EquationY4Inputs>
    </Values>
  </FlareEquationInputs>
</SubpartYFlares>
<SubpartYCrackingCokingUnits>
  <CrackingCokingEquationInputs>
    <CrackingCokingUnitName>Fluid Catalytic Cracking Unit XML Y-8</CrackingCokingUnitName>
    <Values>
      <EquationY8Inputs>
        <AnnualThroughput>100</AnnualThroughput>
        <CokeBurnoffFactor>7.3</CokeBurnoffFactor>
        <CarbonContent>0.99</CarbonContent>
      </EquationY8Inputs>
    </Values>
  </CrackingCokingEquationInputs>
  <CrackingCokingEquationInputs>
    <CrackingCokingUnitName>Catalytic Reforming Unit Y-11</CrackingCokingUnitName>
    <Values>
      <EquationY11Inputs>
        <EquationY11PeriodInputs>
          <MeasurementPeriodNumber>1</MeasurementPeriodNumber>
          <Values>
            <CokeBurnOffQuantity>2000</CokeBurnOffQuantity>
            <CarbonContent>0.94</CarbonContent>
          </Values>
        </EquationY11PeriodInputs>
      </EquationY11Inputs>
```

```
    </Values>
   </CrackingCokingEquationInputs>
  </SubpartYCrackingCokingUnits>
  <SubpartYCokeCalciningUnits>
   <CokeCaclciningEquationInputs>
    <CokeCalciningUnitName>Coke Calcining Unit Y-9 Y-10 and Y-13</CokeCalciningUnitName>
    <Values>
     <EquationY9CokeCalciningMap>
      <EmissionFactor>2</EmissionFactor>
      <ActivityData>0.5</ActivityData>
      <ActivityDataUom>bbl</ActivityDataUom>
     </EquationY9CokeCalciningMap>
     <EquationY10CokeCalciningMap>
      <EmissionFactor>1</EmissionFactor>
      <ActivityData>0.06</ActivityData>
      <ActivityDataUom>bbl</ActivityDataUom>
     </EquationY10CokeCalciningMap>
     <EquationY13CokeCalciningMap>
      <AnnualMassGreenCoke>145</AnnualMassGreenCoke>
      <AvgMassFracGreenCoke>0.8</AvgMassFracGreenCoke>
      <AnnualMassMarketablePetr>28</AnnualMassMarketablePetr>
      <AvgMassFracMarketablePetr>0.92</AvgMassFracMarketablePetr>
      <AnnualMassPetrCokeDust>14</AnnualMassPetrCokeDust>
     </EquationY13CokeCalciningMap>
    </Values>
   </CokeCaclciningEquationInputs>
  </SubpartYCokeCalciningUnits>
  <SubpartYSulfurRecoveryUnits>
   <SulfurRecoveryEquationInputs>
    <SulfurRecoveryUnitName>Sulfur Recovery Unit Y-12</SulfurRecoveryUnitName>
    <Values>
     <EquationY12SulfurRecoveryInputs>
      <VolumetricFlowRate>125</VolumetricFlowRate>
      <MoleFractionCarbon>0.2</MoleFractionCarbon>
      <MolarVolumeConversion>849.5</MolarVolumeConversion>
     </EquationY12SulfurRecoveryInputs>
    </Values>
   </SulfurRecoveryEquationInputs>
  </SubpartYSulfurRecoveryUnits>
  <SubpartYAsphaltBlowingUnits>
```

```
    <AsphaltBlowingUnitName>Asphalt 1 Y-14 and Y-15</AsphaltBlowingUnitName>
    <AsphaltBlowingEquationInputs>
      <EquationY14Inputs>
        <QuantityOfAsphaltBlown>23</QuantityOfAsphaltBlown>
        <Co2EmissionFactor>0.5</Co2EmissionFactor>
      </EquationY14Inputs>
      <EquationY15Inputs>
        <Ch4EmissionFactor>0.45</Ch4EmissionFactor>
      </EquationY15Inputs>
    </AsphaltBlowingEquationInputs>
  </SubpartYAsphaltBlowingUnits>
  <SubpartYSourGasInputs>
    <EquationY12Inputs>
      <VolumetricFlowRate>600</VolumetricFlowRate>
      <MoleFractionCarbon>0.2</MoleFractionCarbon>
      <MolarVolumeConversion>849.5</MolarVolumeConversion>
    </EquationY12Inputs>
  </SubpartYSourGasInputs>
  <SubpartYBlowdownInputs>
    <EquationY20BlowdownInputs>
      <CrudeOilQuantity>200</CrudeOilQuantity>
      <MolarVolumeConversionFactor>836.6</MolarVolumeConversionFactor>
      <MethaneEmissionFactor>0.99</MethaneEmissionFactor>
    </EquationY20BlowdownInputs>
  </SubpartYBlowdownInputs>
  <SubpartYStorageTankInputs>
    <EquationY22StorageTankInputs>
      <CrudeOilQuantity>4</CrudeOilQuantity>
    </EquationY22StorageTankInputs>
    <EquationY23StorageTankInputs>
      <UnstableCrudeOilQuantity>6</UnstableCrudeOilQuantity>
      <PressureDifference>16</PressureDifference>
      <AverageMoleFraction>0.4</AverageMoleFraction>
      <MolarVolumeConversionFactor>849.5</MolarVolumeConversionFactor>
    </EquationY23StorageTankInputs>
  </SubpartYStorageTankInputs>
  <SubpartYLoadingInputs>
    <SubpartYVesselInputsMap>
      <VesselID>Barge</VesselID>
      <SubpartYVesselInputs>
```

```
    <SubpartYMaterialInputsMap>
     <MaterialID>Still gas or refinery fuel gas:Condenser</MaterialID>
     <EquationYLDLoadingInputs>
      <CalculationType>default</CalculationType>
      <MolecularWeightOfVapors>56</MolecularWeightOfVapors>
      <TotalLoadingLoss>10</TotalLoadingLoss>
      <EmissionControlSystemReductionEfficiency>67</EmissionControlSystemReductionEfficiency>
      <VaporPhaseConcentrationOfMethane>3</VaporPhaseConcentrationOfMethane>
      <QualityOfMaterialLoaded>365</QualityOfMaterialLoaded>
     </EquationYLDLoadingInputs>
    </SubpartYMaterialInputsMap>
   </SubpartYVesselInputs>
  </SubpartYVesselInputsMap>
  <SubpartYVesselInputsMap>
   <VesselID>Container (e.g., 55-gallon drum)</VesselID>
   <SubpartYVesselInputs>
    <SubpartYMaterialInputsMap>
     <MaterialID>Naphtha:Oil scrubber</MaterialID>
     <EquationYLDLoadingInputs>
      <CalculationType>calculated</CalculationType>
      <SaturationFactor>0.2</SaturationFactor>
      <VaporPressure>52</VaporPressure>
      <MolecularWeightOfVapors>26</MolecularWeightOfVapors>
      <Temperature>68</Temperature>
      <EmissionControlSystemReductionEfficiency>42</EmissionControlSystemReductionEfficiency>
      <VaporPhaseConcentrationOfMethane>34</VaporPhaseConcentrationOfMethane>
      <QualityOfMaterialLoaded>42.56</QualityOfMaterialLoaded>
     </EquationYLDLoadingInputs>
    </SubpartYMaterialInputsMap>
   </SubpartYVesselInputs>
  </SubpartYVesselInputsMap>
 </SubpartYLoadingInputs>
 <SubpartY18VesselInputs>
  <SubpartY18VesselInputsMap>
   <VesselName>Coking Drum DCU XML Test</VesselName>
   <EquationY18Inputs>
    <DiameterOfCokingVessel>15</DiameterOfCokingVessel>
    <GaugePressureOfCokingVessel>25</GaugePressureOfCokingVessel>
    <HeightOfCokingVessel>75</HeightOfCokingVessel>
    <MolarVolumeConversion>849.5</MolarVolumeConversion>
```

```
        <MoleFractionMethane>0.09</MoleFractionMethane>
        <NumberOfVessel>150</NumberOfVessel>
        <VolumetricVoidFraction>0.05</VolumetricVoidFraction>
      </EquationY18Inputs>
    </SubpartY18VesselInputsMap>
  </SubpartY18VesselInputs>
  <SubpartY19VesselInputs>
    <SubpartY19VesselInputsMap>
      <VesselName>1-Coking Drum DCU XML Test</VesselName>
      <EquationY19Inputs>
        <AverageVolumetricFlowRate>2500</AverageVolumetricFlowRate>
        <MoleFractionMethaneProcessGas>0.6</MoleFractionMethaneProcessGas>
        <MolarVolumeConversion>836.6</MolarVolumeConversion>
        <VentingTime>144</VentingTime>
      </EquationY19Inputs>
    </SubpartY19VesselInputsMap>
  </SubpartY19VesselInputs>
 </SubpartYInputs>
</SubpartInputs>
</FacilityInputs>
```