Greenhouse Gas Reporting Program

XML Reporting Instructions for Subpart Y - Petroleum Refineries

United States Environmental Protection Agency
Climate Change Division
Washington, DC

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These instructions explain how to report 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 reported.

EPA has finalized a rule that defers the deadline for reporting data elements used as inputs to emission equations for direct emitters. (See http://www.epa.gov/climatechange/emissions/notices.html for a pre-publication version of the rule). In accordance with the rule, e-GGRT is not currently collecting data used as inputs to emission equations.

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1.0 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 2010 data collection year. The schema defines expected data elements and attributes, allowable data types for each element, and the hierarchy and order in which elements must appear. 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.

The e-GGRT XML schema is made up of a root element, complex elements, and simple 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 element is the base of the XML schema.

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. If a complex element is dependent on a parent complex element, the child complex element cannot be included in the XML file unless the appropriate parent complex element is also included.

The XML upload method may be used only for submitting the annual GHG report. User and facility or supplier registration, and the Certificate of Representation, must be entered on-line using e-GGRT.

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

An XML submission must only contain GHG data for a single facility or supplier. All data for a facility or supplier must be submitted in a single file as a complete report and must include all of the relevant subparts. It is not possible to submit a subset of any portion of a facility's data to add, delete, correct, or update. The entire report must be resubmitted to make any modification at all. Each subsequent submission for the same facility replaces all of the previously submitted data.

The e-GGRT XML schema contains enumerated lists of the units of measures for some data elements and allowable values for some data elements. Enumerations are case sensitive. Values must be entered exactly as they are displayed in order to be accepted by schema validation. For rules regarding the unit of measure or allowable values for a specific data element, please refer to the appropriate Data Elements table.

The e-GGRT XML Reporting Schema is available for download at the GHGRP web site here: http://www.epa.gov/climatechange/emissions/e-ggrt_xml.html.

This document provides a step-by-step description of how to report emissions data from petroleum refineries as required by Subpart Y of the Greenhouse Gas Reporting Program (GHGRP) using the XML schema. Please note the following:

- **Not all data elements included in the schema must be reported.** Required or relevant data components and data elements are boxed in red in the schema diagrams and listed in the tables. If a data element is not listed, it does not need to be reported (e.g., IsConfidentialBusinessInformationIndicator). Some data elements are conditional and only need to be reported if they are relevant to the reporting facility.

- **Enumerations are case sensitive.** Values must be entered exactly as they are displayed in order to be accepted by schema validation.

- **Data elements must be reported in a specific order.** The figures and tables in this document depict the specific order in which data elements must be reported in order to produce a well-formed XML report.

- **Data elements for calculated and measured values are not displayed in the schema diagrams.** The parent elements for calculated and measured values are displayed in the schema diagrams in this document, but the specific data elements to be reported are not displayed. The descriptions in the XML data elements tables include the specific data elements to report, which are commonly the calculated or measured value and the unit of measure. For some values, the number of times substitute data procedures were used may also be required. See Figure 1 for the expanded view of a sample data element which is a calculated value and Figure 2 for the expanded view of a sample data element which is a measured value.

Figure 1
Sample Calculated Value Schema Diagram

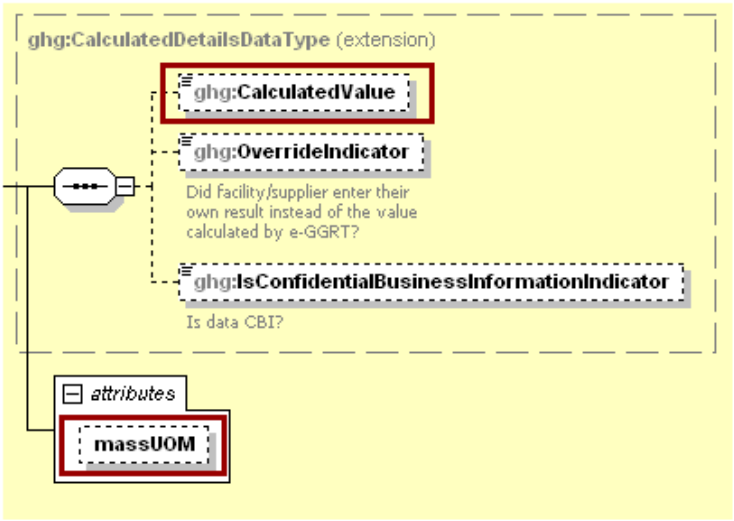
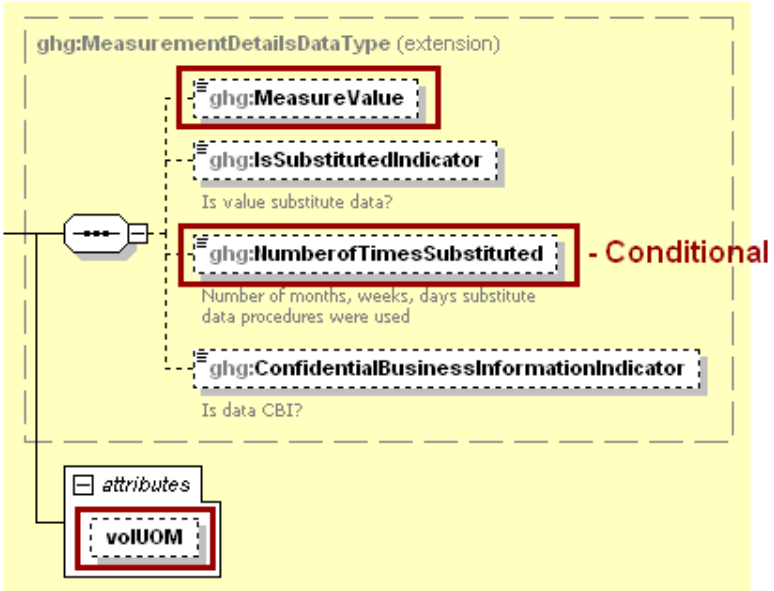


Figure 2
Sample Measured Value Schema Diagram



- Rounded results from calculated values should be reported in the XML schema. Please use the following rounding rules:

    1) CO_2e and CO_2 emissions data expressed in metric tons should be rounded to one decimal place. This should be done regardless of the level of data collection (e.g., unit-level, facility-level). Quantities less than 0.05 metric tons would round to 0.0 and be reported as such. Quantities greater than or equal to 0.05 metric tons would round up to 0.1 and be reported as such.

    2) CH_4 emissions data expressed in metric tons should be rounded to two decimal places.

    3) N_2O emissions data expressed in metric tons should be rounded to three decimal places.

    4) Other (non-emissions) quantitative data reported by the user (e.g., a monthly HHV sample result, an annual production quantity) will not need to be rounded.

    5) In the case of aggregation/roll-ups, those calculations should be performed on the rounded values.

The following terminology is used throughout this document:

- **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. An XML schema defines the set of rules to which the XML document must conform in order to be considered "valid". An instance of an XML schema is an XML schema document and is a file with the extension .xsd.
- **XML Document:** An XML document is a file containing data organized into a structured document using XML markup.
- **XML Element:** An XML element is a unit of the XML document that is expressed as tags in the form "<tagname>." XML elements must have either a start and end tag as in <ghg:GHGasInfoDetails> </ghg:GHGasInfoDetails> or a single empty tag name as in <ghg:GHGasInfoDetails/>. XML elements may be nested within one another in a structured hierarchy and sequence specified in an XML schema.
- **XML Attribute:** An XML attribute contains additional information about an XML element placed at the start tag of the XML element. XML attributes have the form attributeName = "attributeValue," as in <ghg:GHGasQuantity massUOM="Metric Tons">. XML attributes are used to report identifying information or to help e-GGRT process the data being reported within the data elements.

A petroleum refinery is any facility engaged in producing gasoline, gasoline blending stocks, naphtha, kerosene, distillate fuel oils, residual fuel oils, lubricants, or asphalt (bitumen) by the distillation of petroleum or the redistillation, cracking, or reforming of unfinished petroleum derivatives.

Reporters of the affected facilities are required to report greenhouse gas (GHG) emissions from the following sources: flares, catalytic cracking units, traditional fluid coking units, fluid coking units with flexicoking design, delayed coking units, catalytic reforming units, sulfur recovery units, coke calcining units, asphalt blowing, equipment leaks, storage tanks, uncontrolled blowdown systems, loading operations, process vents, and non-merchant hydrogen plants.

The XML schema includes the following areas for reporting for Subpart Y, as is diagramed in Figure 3:

2.0 Subpart-Level Emissions Summary Data: includes information on how to report the total annual GHG emissions from all applicable Subpart Y sources and the required emissions summary data, including CO_2 emissions from sour gas sent off site for sulfur recovery operations and CH_4 emissions from the other sources listed below.

- 2.1. Subpart Y Total Emissions
- 2.2. Sour Gas Details
- 2.3. Delayed Coking Emissions Summary
- 2.4. Uncontrolled Blowdown Details
- 2.5. Equipment Leaks Details
- 2.6. Storage Tanks Details
- 2.7. Loading Operations Details

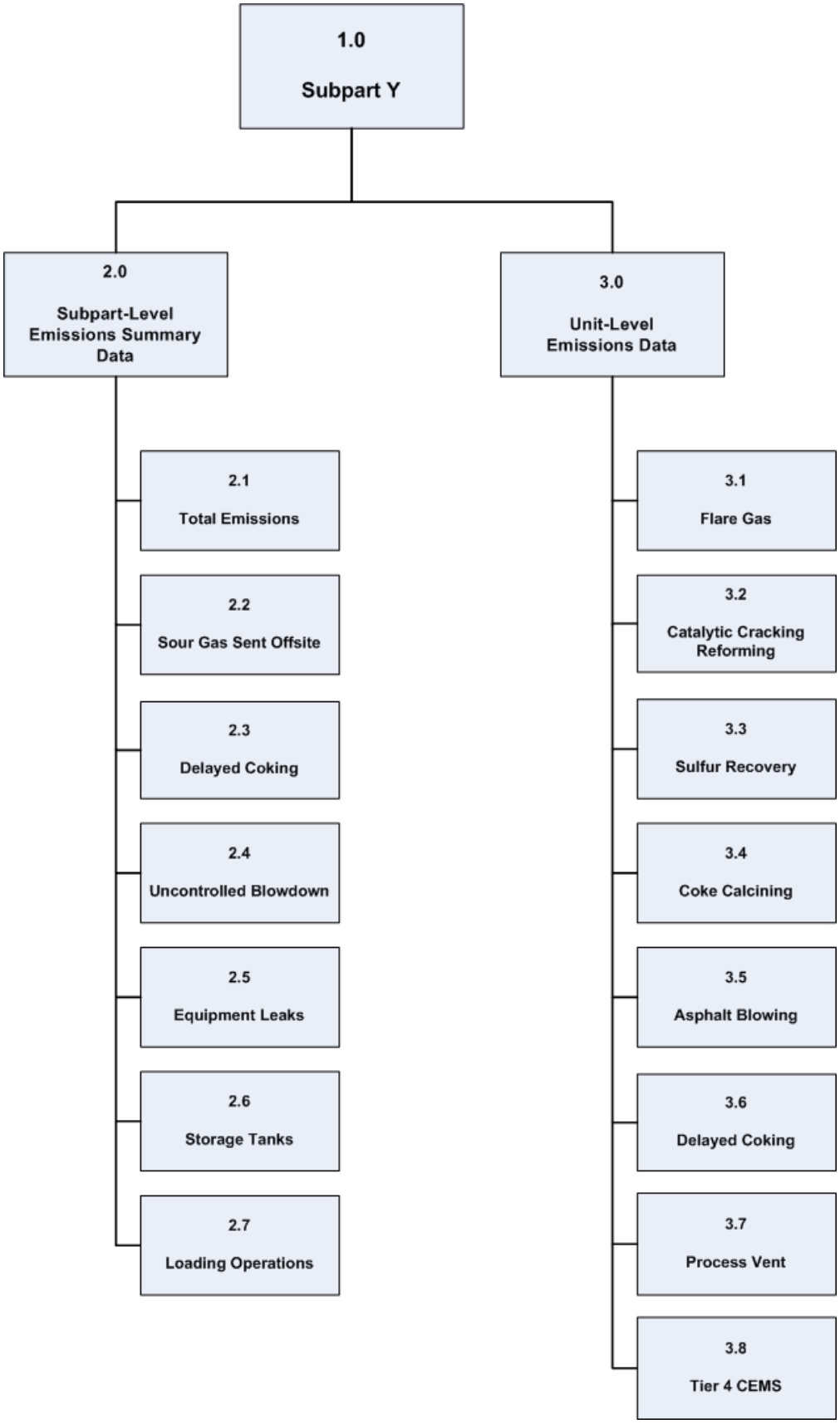
3.0 Unit-Level Emissions Data: includes information on how to report GHG data for each unit (subject to Subpart Y) within the facility.

- 3.1. Flare Gas Details
- 3.2. Catalytic, Cracking, Reforming Details
- 3.3. Sulfur Recovery Details
- 3.4. Coke Calcining Details
- 3.5. Asphalt Blowing Details
- 3.6. Delayed Coking Unit Details
- 3.7. Process Vent Details
- 3.8. Subpart Y Tier 4 CEMS Details

4.0 Facility-Level Roll-up Emissions Data: includes information on how to report total emissions for CO_2e (excluding biogenic CO_2) and biogenic CO_2. These are aggregated across all source category subparts associated with the facility.

Note: If you are using a Best Available Monitoring Method (BAMM) in accordance with the rule in place of a method in Subpart Y, you should report the "Other" option for the method data element and report "BAMM" or "Best Available Monitoring Method" for the corresponding “Other” data element. Details regarding BAMM methods used should be included in Subpart A.

Figure 3
Subpart Y Reporting Diagram

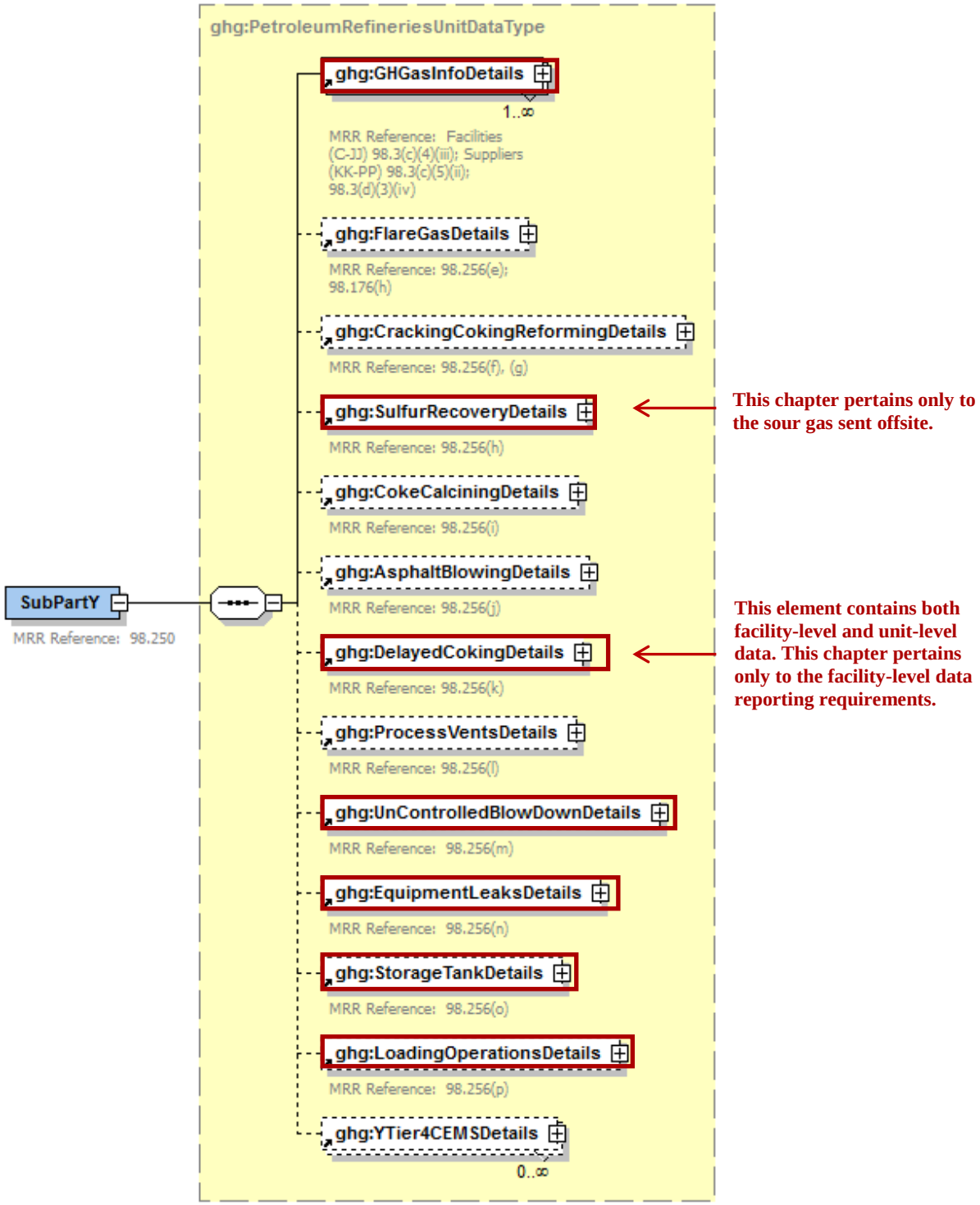


2.0 Subpart-Level Emissions Summary Data

For Petroleum refinery facilities required to report under Subpart Y, you must report the following:

- Total annual GHG emissions aggregated across all Subpart Y sources.
- Emissions summary data for each applicable source highlighted in red in Figure 4.

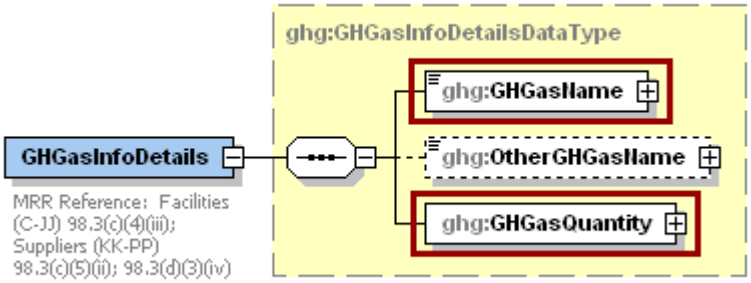
Figure 4
Subpart Y Emissions Summary Schema Diagram



2.1 Subpart Y Total Emissions

Greenhouse gas information details comprise a collection of data elements to report the total annual emissions of each greenhouse gas (GHG) listed in Table A-1 of the Mandatory Reporting of GHG, part 98, reported under subpart Y, expressed in metric tons.

Figure 5
Greenhouse Gas Information Details



The GHGasInfoDetails parent element is for reporting emissions rolled up to the Subpart level. For Subpart Y, report total emissions for carbon dioxide (excluding biogenic CO_2), biogenic CO_2, methane (CH_4) and nitrous oxide (N_2O) using the following guidelines:

1) **Total CO_2 emissions (excluding biogenic CO_2)**:
   - Add the total annual CO_2 mass emissions measured by the CEMS for each CEMS monitoring location (CML) in metric tons rounded to one decimal place. Then subtract the total annual biogenic CO_2 emissions for each CML in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from sour gas sent off-site in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from each asphalt blowing unit in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from each coke calcining unit in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from each coking/cracking/reforming unit in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from each flare in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from each process vent in metric tons rounded to one decimal place.
   - Add the annual CO_2 emissions from each sulfur recovery plant in metric tons rounded to one decimal place.

2) **Total biogenic CO_2 emissions:** Add the total annual biogenic CO_2 mass emissions in metric tons rounded to one decimal place for each CML.

3) **Total CH_4 emissions**:
   - Add the total CH_4 emissions measured by the CEMS for each CML in metric tons rounded to two decimal places.
   - Add the total CH_4 emissions from each uncontrolled blowdown system, each stabilized/unstabilized crude storage tank, all equipment leaks, all loading operations, and each delayed coking unit in metric tons rounded to two decimal places.

- Add the annual CH_4 emissions from each asphalt blowing unit in metric tons rounded to two decimal places.
- Add the annual CH_4 emissions from each coke calcining unit in metric tons rounded to two decimal places.
- Add the annual CH_4 emissions from each coking/cracking/reforming unit in metric tons rounded to two decimal places.
- Add the annual CH_4 emissions from each flare in metric tons rounded to two decimal places.
- Add the annual CH_4 emissions from each process vent in metric tons rounded to two decimal places.
- Add the total annual CH_4 emissions measured by the CEMS for each coke calcining unit in metric tons rounded to two decimal places.
- Add the total annual CH_4 emissions measured by the CEMS for each coking/cracking/reforming unit in metric tons rounded to two decimal places.

4) **Total N_2O emissions**:
   - Add the total annual N_2O emissions measured by the CEMS for each CML in metric tons rounded to three decimal places.
   - Add the annual N_2O emissions from each coke calcining unit in metric tons rounded to three decimal places.
   - Add the annual N_2O emissions from each coking/cracking/reforming unit in metric tons rounded to three decimal places.
   - Add the annual N_2O emissions from each flare in metric tons rounded to three decimal places.
   - Add the annual N_2O emissions from each process vent in metric tons rounded to three decimal places.
   - Add the total annual N_2O emissions measured by the CEMS for each coke calcining unit in metric tons rounded to three decimal places.
   - Add the total annual N_2O emissions measured by the CEMS for each coking/cracking/reforming unit in metric tons rounded to three decimal places.

For greenhouse gas quantity, report the calculated value and mass unit of measure (Metric Tons) only.

Table 1
GHGasInfoDetails XML Data Elements

Data Element Name	Description
GHGasInfoDetails	A collection of data elements containing the total annual emissions of each greenhouse gas (GHG) listed in Table A-1 of the Mandatory Reporting of GHGs, part 98, or other GHGs reported under this subpart, expressed in metric tons.
GHGasName	Specify the name of the GHG. See list of allowable values: Carbon Dioxide Biogenic Carbon dioxide Methane Nitrous Oxide
OtherGHGasName	The name of each F-GHG for which you are reporting annual emissions if you reported "Other".
GHGasQuantity	A collection of data elements that quantify the annual emissions from this source category. Report the calculated value only.
GHGasQuantity.massUOM	Set as equal to “Metric Tons”.

Figure 6
Sample XML Snippet for GHGasInfoDetails

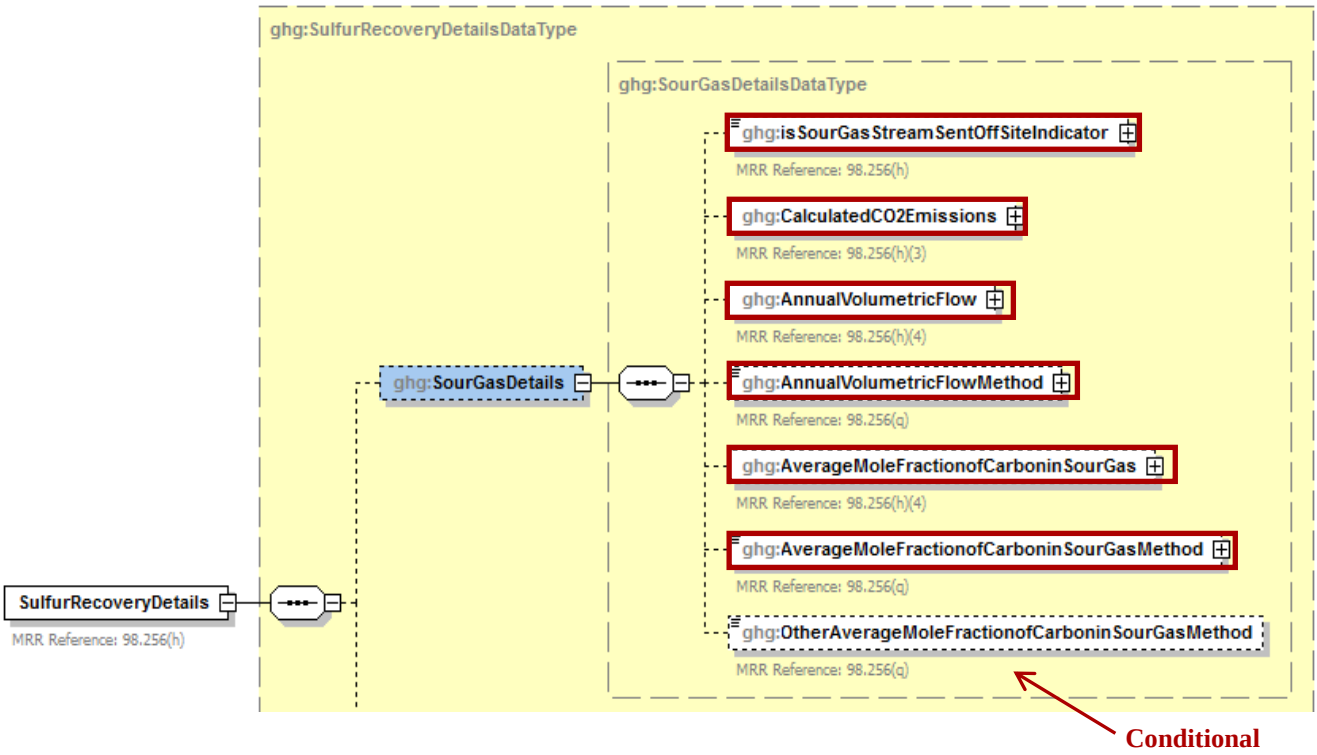
```
<ghg:GHGasInfoDetails>
    <ghg:GHGasName>Biogenic Carbon dioxide</ghg:GHGasName>
    <ghg:GHGasQuantity massUOM="Metric Tons">
        <ghg:CalculatedValue>3234.0</ghg:CalculatedValue>
    </ghg:GHGasQuantity>
</ghg:GHGasInfoDetails>
<ghg:GHGasInfoDetails>
    <ghg:GHGasName>Methane</ghg:GHGasName>
    <ghg:GHGasQuantity massUOM="Metric Tons">
        <ghg:CalculatedValue>89536.00</ghg:CalculatedValue>
    </ghg:GHGasQuantity>
</ghg:GHGasInfoDetails>
<ghg:GHGasInfoDetails>
    <ghg:GHGasName>Nitrous Oxide</ghg:GHGasName>
    <ghg:GHGasQuantity massUOM="Metric Tons">
        <ghg:CalculatedValue>156042.000</ghg:CalculatedValue>
    </ghg:GHGasQuantity>
</ghg:GHGasInfoDetails>
<ghg:GHGasInfoDetails>
    <ghg:GHGasName>Carbon Dioxide</ghg:GHGasName>
    <ghg:GHGasQuantity massUOM="Metric Tons">
        <ghg:CalculatedValue>298375.0</ghg:CalculatedValue>
    </ghg:GHGasQuantity>
</ghg:GHGasInfoDetails>
```

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

2.2 Sour Gas Sent Offsite

For petroleum refinery sources required to report under subpart Y, you are required to report the annual CO_2 emissions from sour gas sent offsite for sulfur recovery. You must also report information about the annual volume of sour gas fed to the sulfur recovery plant and the annual average mole fraction of carbon in the sour gas.

Figure 7
Sour Gas Sent Offsite Schema Diagram



Equation Y-12
If you use Equation Y-12 to calculate the cumulative CH_4 emissions from sour gas sent offsite, you can download the Y-12 spreadsheet from the e-GGRT help site or use the following information:

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

Where:

CO_2	=	Annual CO_2 emissions (metric tons/year).
F_{SG}	=	Volumetric flow rate of sour gas feed (including sour water stripper gas) to the sulfur recovery plant (scf/year).
44	=	Molecular weight of CO_2 (kg/kg-mole).
MVC	=	Molar volume conversion factor (849.5 scf/kg-mole at 68 ºF and 14.7 psia or 836.6 scf/kg-mole at 60 ºF and 14.7 psia).
MF_C	=	Mole fraction of carbon in the sour gas to the sulfur recovery plant (kg-mole

C/kg-mole gas); default = 0.20.

0.001 = Conversion factor, kg to metric tons

Table 2
Sour Gas Sent Offsite XML Data Elements

Data Element Name	Description or Value to Report
SourGasDetails	
isSourGasStreamSentOffSiteIndicator	An indication (Y/N) of whether the facility has a sour gas stream sent off-site for sulfur recovery. [MRR Reference: 98.256(h)]
CalculatedCO2Emissions	The calculated annual CO_2 emissions from sour gas sent offsite for sulfur recovery, expressed in metric tons. Report the calculated value and unit of measure only. [MRR Reference: 98.256(h)(3)]
CalculatedCO2Emissions.massUOM	Set as equal to "Metric Tons".
AnnualVolumetricFlow.NumberofTimesSubstituted	The number of hours that missing data procedures were used to determine the annual volume of sour gas fed. [MRR Reference: 98.256(h)(4)]
AnnualVolumetricFlow.rateUOM	Set as equal to "dscf/hour". **Note:** Although the value of the annual volume of sour gas fed to the sulfur recovery plant is deferred for reporting year 2010, the rateUOM (unit of measure) is required by the schema and must be reported.
AnnualVolumetricFlowMethod	The specific consensus-based standard method or description of the procedure specified by the flow meter manufacturer to measure annual volume of sour gas fed. [MRR Reference: 98.256(q)]
AverageMoleFractionofCarboninSourGas. NumberofTimesSubstituted	The number of hours that missing data procedures were used to determine the annual average mole fraction of carbon in the sour gas. [MRR Reference: 98.256(q)]
AverageMoleFractionofCarboninSourGas.fractionUOM	Set as equal to "kg-moleCF4/kg-molegas". **Note:** Although the value of the average mole fraction of carbon in sour gas is deferred for reporting year 2010, the fractionUOM is required by the schema and must be reported.

Data Element Name	Description or Value to Report
AverageMoleFractionofCarboninSourGasMethod	Method used to measure the annual average mole fraction of carbon in the sour gas. Below is the list of allowable values. Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAverageMoleFractionofCarboninSourGasMethod	Method used to measure the annual average mole fraction of carbon in the sour gas if not listed above.

Figure 8
Sample XML Snippet for Sour Gas Sent Offsite

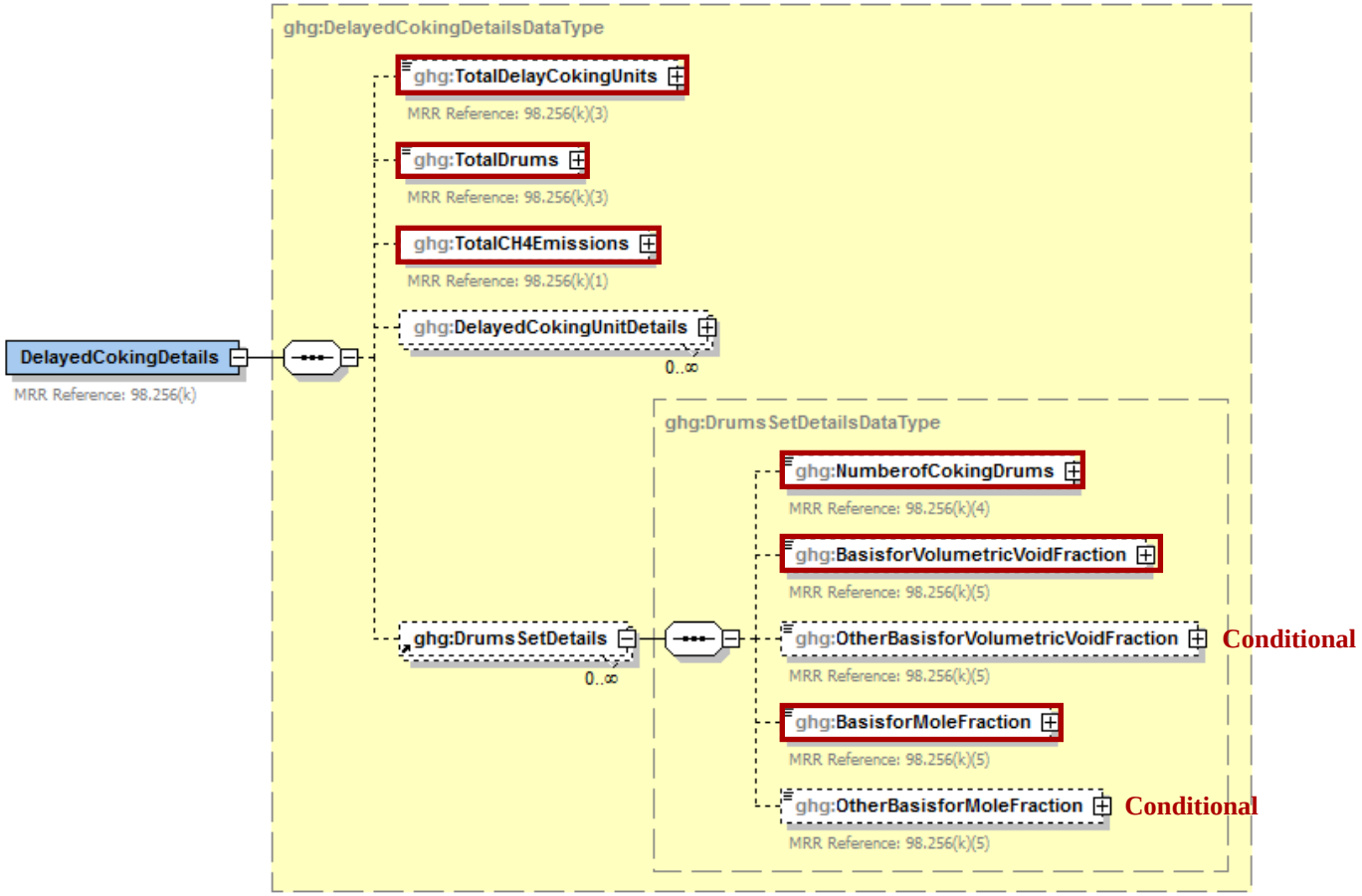
```
<ghg:SourGasDetails>
    <ghg:isSourGasStreamSentOffSiteIndicator>Y</ghg:isSourGasStreamSentOffSiteIndicator>
    <ghg:CalculatedCO2Emissions massUOM ="Metric Tons">
        <ghg:CalculatedValue>250.0</ghg:CalculatedValue>
    </ghg:CalculatedCO2Emissions>
    <ghg:AnnualVolumetricFlow rateUOM ="dscf/hour">
        <ghg:NumberofTimesSubstituted>1</ghg:NumberofTimesSubstituted>
    </ghg:AnnualVolumetricFlow>
    <ghg:AnnualVolumetricFlowMethod>Standard sour gas fed to plant</ghg:AnnualVolumetricFlowMethod>
    <ghg:AverageMoleFractionofCarboninSourGas fractionUOM="fraction (number between 0 and 1)">
        <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
    </ghg:AverageMoleFractionofCarboninSourGas>
    <ghg:AverageMoleFractionofCarboninSourGasMethod> ASTM D1946-90 (Reapproved 2006)</ghg:AverageMole…>
</ghg:SourGasDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting sour gas information. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

2.3 Delayed Coking Emissions Summary

For petroleum refinery sources required to report under subpart Y, you are required to report the cumulative methane (CH4) emissions for all delayed coking units at the facility. You must also report the total number of delayed coking units and the total number of delayed coking drums at the facility, and details about each coking drum set at the facility, including the number of coking drums in the set, the basis for the volumetric void fraction of the coke vessel prior to steaming, and the basis for the mole fraction of CH_4 in the coking gas.

Figure 9
Delayed Coking Details (Subpart-Level) Schema Diagram



Note: DelayedCokingDetails is a collection of data elements containing both facility-level and unit-level data. The instructions provided in this section of the document are for reporting the required facility-level data for delayed coking units. For information regarding unit-level emissions reporting, please see section 3.0 of this document.

Table 3
Delayed Coking Details (Subpart-Level) XML Data Elements

Data Element Name	Description
DelayedCokingDetails	
TotalDelayCokingUnits	The total number of delayed coking units at the facility (integer) [MRR Reference: 98.256(k)(3)]
TotalDrums	The total number of delayed coking drums at the facility (integer) [MRR Reference: 98.256(k)(3)]
TotalCH4Emissions	The cumulative annual CH_4 emissions (in metric tons) for all delayed coking units at the facility. Report only the measured value and unit of measure. [MRR Reference: 98.256(k)(1)]
TotalCH4Emissions.massUOM	Set as equal to "Metric Tons".
DelayedCokingUnitDetails	See the instructions for reporting unit-level delayed coking unit emissions in section 3.0 of this document.
DrumsSetDetails	
NumberofCokingDrums	For each set of coking drums that are the same dimensions: the number of coking drums in the set. [MRR Reference: 98.256(k)(4)] **Note:** Although the name/ID of each coking drum set is reported in e-GGRT (web forms), there is no corresponding data element in the schema to report this information.
BasisforVolumetricVoidFraction	For each set of coking drum dimensions, specify the basis for the volumetric void fraction of the coke vessel prior to steaming. [MRR Reference: 98.256(k)(5)] Below is the list of allowable values. Measurement data Engineering calculation Default value Other (specify)
OtherBasisforVolumetricVoidFraction	Specify the basis for the volumetric void fraction of the coke vessel prior to steaming if not listed above.
BasisforMoleFraction	For each set of coking drum dimensions, specify the basis for the mole fraction of methane in the coking gas. [MRR Reference: 98.256(k)(5)] Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Engineering calculation Default value Other (specify)
OtherBasisforMoleFraction	Specify the basis for the mole fraction of methane in the coking gas if not listed above.

Figure 10
Sample XML Snippet for Delayed Coking Details (Subpart-Level)

```
<ghg:DelayedCokingDetails>
    <ghg:TotalDelayCokingUnits>10</ghg:TotalDelayCokingUnits>
    <ghg:TotalDrums>8</ghg:TotalDrums>
    <ghg:TotalCH4Emissions massUOM="Metric Tons">
        <ghg:MeasureValue>234.0</ghg:MeasureValue>
    </ghg:TotalCH4Emissions>

    <ghg:DrumsSetDetails>
        <ghg:NumberofCokingDrums>16</ghg:NumberofCokingDrums>
        <ghg:BasisforVolumetricVoidFraction>Measurement data</ghg:BasisforVolumetricVoidFractio>
        <ghg:BasisforMoleFraction>Average of multiple source tests</ghg:BasisforMoleFraction>
    </ghg:DrumsSetDetails>

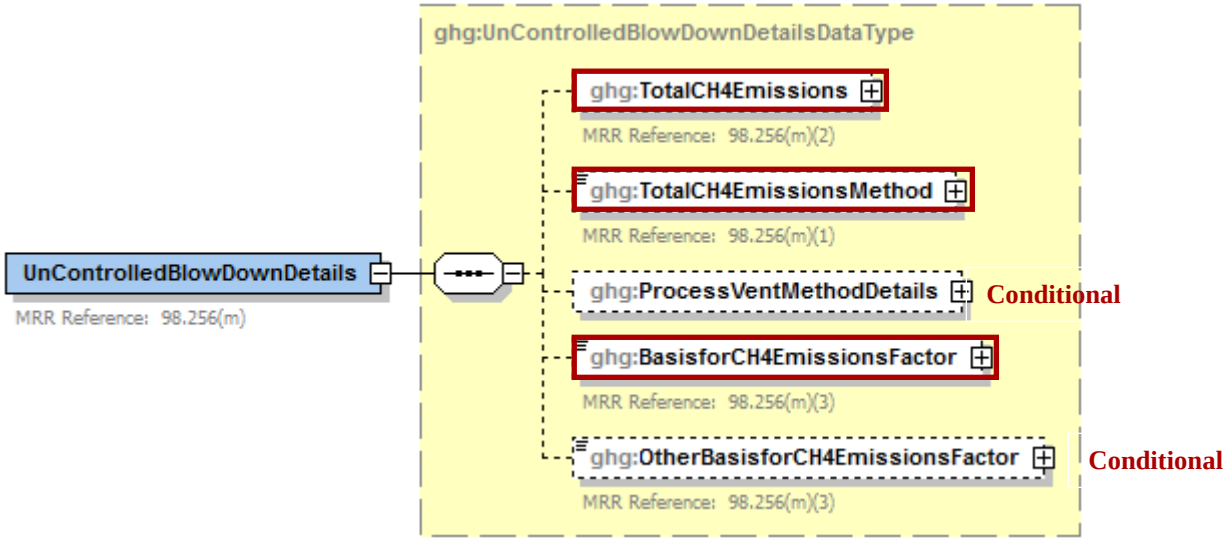
    <ghg:DrumsSetDetails>
        <ghg:NumberofCokingDrums>12</ghg:NumberofCokingDrums>
        <ghg:BasisforVolumetricVoidFraction>Other (specify</ghg:BasisforVolumetricVoidFraction>
        <ghg:OtherBasisforVolumetricVoidFraction>Bi-monthly</ghg:OtherBasisforVolumetricVoidFraction>
        <ghg:BasisforMoleFraction>Default value</ghg:BasisforMoleFraction>
    </ghg:DrumsSetDetails>
</ghg:DelayedCokingDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the cumulative CH_4 emissions for all delayed coking units at the facility. In the above example, there are two drum sets reported.

2.4 Uncontrolled Blowdown Systems

For petroleum refinery sources required to report under subpart Y, you are required to report the cumulative annual methane (CH4) emissions, expressed in metric tons, from uncontrolled blowdown systems and the method used, if any, to calculate the CH_4 emissions.

Figure 11
Uncontrolled Blowdown Details



Note: Blowdown systems in which the uncondensed gas stream is routed to a flare or similar control device are considered to be controlled.

Table 4
UnControlledBlowDownDetails XML Data Elements

Data Element Name	Description
UnControlledBlowDownDetails	A collection of data elements containing the cumulative annual methane (CH4) emissions, expressed in metric tons, from uncontrolled blowdown systems and the method used, if any, to calculate the CH_4 emissions.
TotalCH4Emissions	The cumulative annual CH_4 emissions (in metric tons of CH4) for uncontrolled blowdown systems. Report the calculated value and unit of measure only. [MRR Reference: 98.256(m)(2)]
TotalCH4Emissions.massUOM	Set as equal to "Metric Tons".
TotalCH4EmissionsMethod	The method used for calculating CH_4 emissions from uncontrolled blowdown systems [MRR Reference: 98.256(m)(1)]. Below is the list of allowable values. Reported under 98.256(k) Reported under 98.256(j) No uncontrolled blowdown systems

Data Element Name	Description
ProcessVentMethodDetails	See details in the next section.
BasisforCH4EmissionsFactor	For uncontrolled blowdown systems reporting under §98.253(k), the basis for the CH_4 emission factor value. Below is the list of allowable values. Company records Measurement data Process knowledge/engineering calculation Used default emission factor Other (specify)
OtherBasisforCH4EmissionsFactor	Specify the basis used for determining the CH_4 emissions factor if not listed in the set of allowable values above.

Specify the CH_4 Estimation Method
Subpart Y requires you to specify the appropriate option regarding the facility's uncontrolled blowdown system:

- You used equation Y-20 to estimate CH_4 emissions. [MRR: §98.253(K)]
- You used a process vents method to estimate CH_4 emissions. [MRR: §98.253 (J)]
- The facility does not have any uncontrolled blowdown systems.

If the facility does not have any uncontrolled blowdown systems then no further data is collected for uncontrolled blowdown systems.

Equation Y-20 Summary and Result
To calculate the annual CH_4 emissions from blowdown systems, you can download the Y-20 spreadsheet from the e-GGRT help site or use the following information:

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

Where:

CH4	=	Methane emission rate from blowdown systems (Metric Tons CH4/year).
QRef	=	Quantity of crude oil plus the quantity of intermediate products received from off site that are processed at the facility (MMbbl/year).
EFBD	=	Methane emission factor for uncontrolled blown systems (scf CH4/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 ºF and 14.7 psia or 836.6 scf/kg-mole at 60 ºF and 14.7 psia).
0.001	=	Conversion factor (metric ton/kg).

You must also indicate the basis for the methane emission factor value you used in equation Y-20.

- Company records
- Measurement data
- Process Knowledge/Engineering calculation

- Used default emission factor
- Other

Figure 12
Sample XML Snippet for Uncontrolled Blowdown System Details - A

```
<ghg:UnControlledBlowDownDetails>
    <ghg:TotalCH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>4878.00<ghg:/CalculatedValue>
     <ghg:/TotalCH4Emissions>
    <ghg:TotalCH4EmissionsMethod>Reported under 98.256(j)<ghg:/TotalCH4EmissionsMethod>
    <ghg:ProcessVentMethodDetails>
       <ghg:CumulativeAnnualVolumeFlowDischarged volUOM="scf">
         <ghg:MeasureValue>23</ghg:MeasureValue>
       </ghg:CumulativeAnnualVolumeFlowDischarged>
       <ghg:CumulativeAnnualVolumeFlowDischargedMethod>Engineering calculation</ghg:CumulativeAnnual…Method>
       <ghg:CumulativeNumberVentingEvents>
         <ghg:MeasureValue>3</ghg:MeasureValue>
       </ghg:CumulativeNumberVentingEvents>
       <ghg:CumulativeVentingTime>5</ghg:CumulativeVentingTime>
     </ghg:ProcessVentMethodDetails>
</ghg:UnControlledBlowDownDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting uncontrolled blowdown systems details if you used the Process Vent method to calculate CH_4 emissions. In some cases, an ellipse (…) was used to shorten the tag name. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Process Vent Method for Uncontrolled Blowdown Systems

Report the following data if you use a process vent method to calculate the CH_4 emissions from uncontrolled blowdown systems:

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

Figure 13
Process Vent Method Details

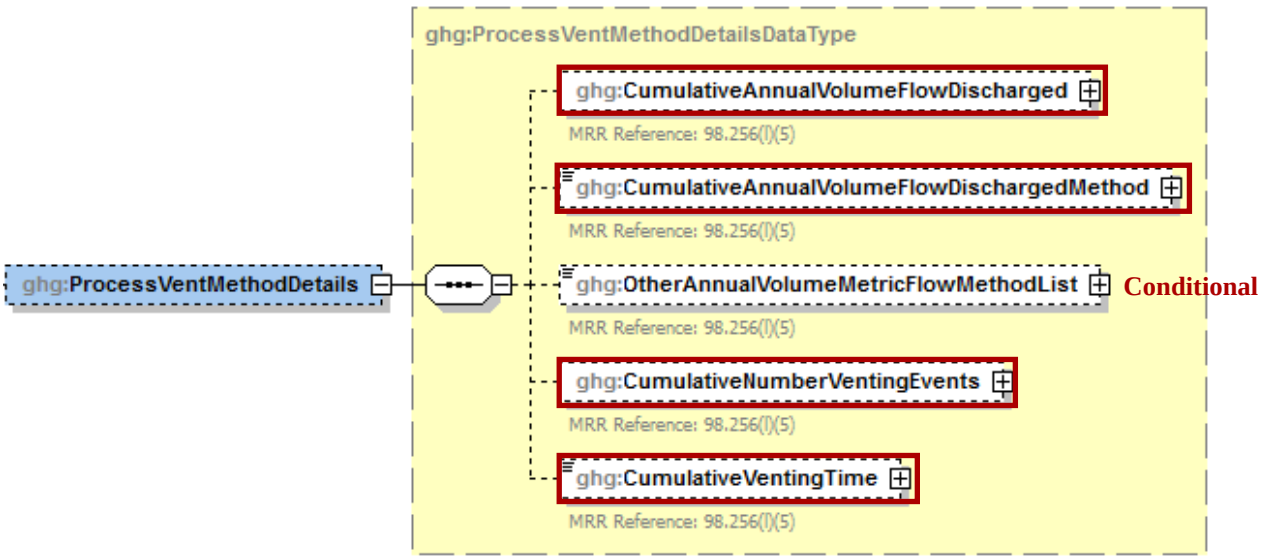


Table 5
Process Vent Method Details XML Data Elements

Data Element Name	Description
ProcessVentMethodDetails	A collection of data elements containing the cumulative annual methane (CH4) emissions, expressed in metric tons, from uncontrolled blowdown systems and the method used, if any, to calculate the CH_4 emissions.
CumulativeAnnualVolumeFlowDischarged	The cumulative annual volumetric flow discharged to the atmosphere. Report only the measured value and unit of measure.
CumulativeAnnualVolumeFlowDischarged.volUOM	scf
CumulativeAnnualVolumeFlowDischargedMethod	The method used to measure the volumetric flow discharged to the atmosphere. Below is the list of allowable values. Continuous or at least hourly measurements Routine (less frequent than hourly but at least weekly) measurements Periodic (less frequent than weekly) measurements Process knowledge Engineering calculation Other (specify)
OtherAnnualVolumeMetricFlowMethodList	The name of the method used to measure the volumetric flow discharged to the atmosphere if not found in the list of allowable methods.
CumulativeNumberVentingEvent	The number of venting events (for intermittent vents). **Note:** Report this value (integer) using the MeasureValue data element.
CumulativeVentingTime	The cumulative venting time. **Note:** Report this value in terms of hours.

Figure 14
Sample XML Snippet for Uncontrolled Blowdown System Details - B

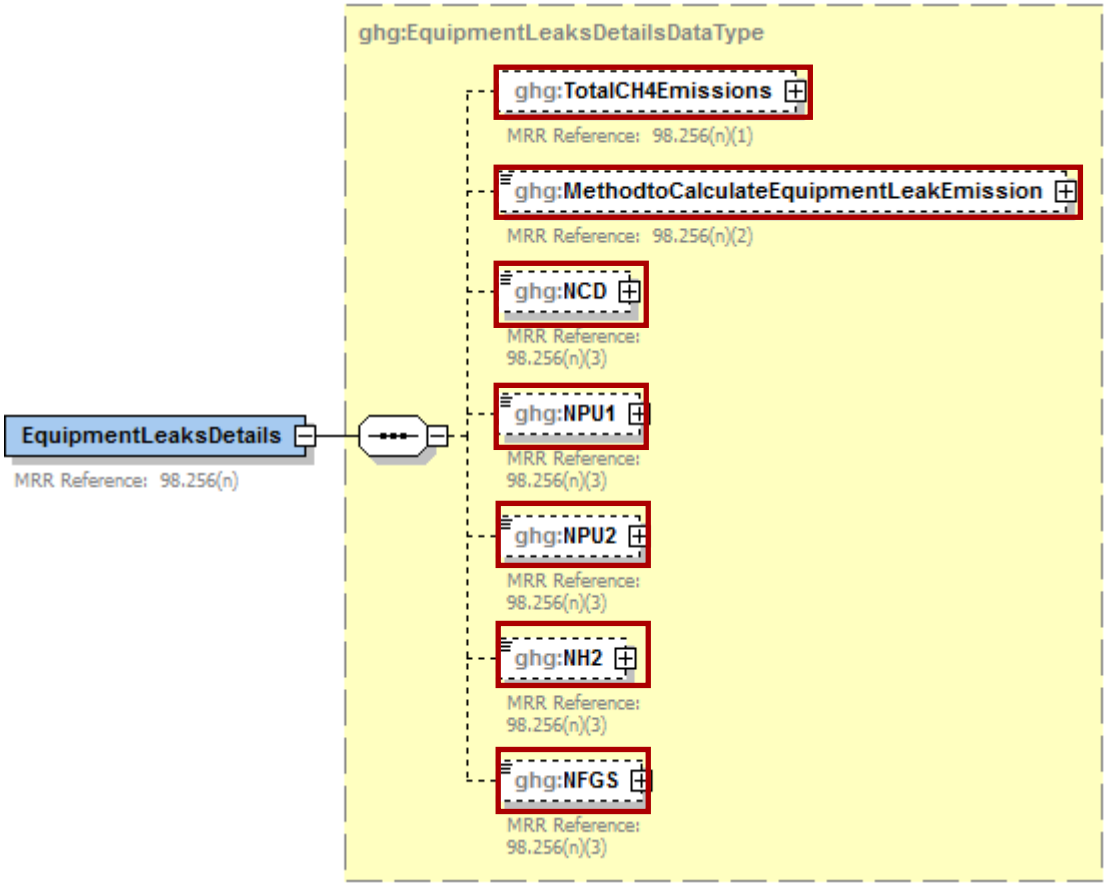
```
<ghg:UnControlledBlowDownDetails>
    <ghg:TotalCH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>233.0</ghg:CalculatedValue>
    </ghg:TotalCH4Emissions>
    <ghg:TotalCH4EmissionsMethod>Reported under 98.253(J)</ghg:TotalCH4EmissionsMethod>
        <ghg:ProcessVentMethodDetails>
        <ghg:CumulativeAnnualVolumeFlowDischarged volUOM="scf">
            <ghg:MeasureValue>212.0</ghg:MeasureValue>
            <ghg:ConfidentialBusinessInformationIndicator>Y</ghg:ConfidentialBusinessInformationIndicator>
        </ghg:CumulativeAnnualVolumeFlowDischarged>
        <ghg:CumulativeAnnualVolumeFlowDischargedMethod>Process knowledge</ghg:CumulativeAnnualVol…>
        <ghg:CumulativeNumberVentingEvents>
            <ghg:MeasureValue>23.0</ghg:MeasureValue>
        </ghg:CumulativeNumberVentingEvents>
        <ghg:CumulativeVentingTime timeUOM="Hours">54</ghg:CumulativeVentingTime>
    </ghg:ProcessVentMethodDetails>
</ghg:UnControlledBlowDownDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting uncontrolled blowdown systems details if you used a process vent method to calculate CH_4 emissions. In some cases, an ellipse (…) was used to shorten the tag name. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

2.5 Equipment Leaks

For petroleum refinery sources required to report under subpart Y, you are required to report the report cumulative CH_4 emissions from all equipment leaks. You must also specify the method used to calculate the reported equipment leak emissions.

Figure 15
Equipment Leaks Details



Method Used to Calculate CH_4 Emissions
You must specify the method used, if any, to calculate the CH_4 emissions from the facility's equipment leaks:

- Use process-specific methane composition data and any of the emission estimation procedures provided in the Protocol for Equipment Leak Emissions Estimates (EPA-453/R-95-017, NTIS PB96-175401) [MRR: §98.253(L)(1)]
- Use Equation Y-21 [MRR: §98.253(L)(2)]

Process-specific Methane Composition Data Method Summary and Result
If you use the process-specific methane composition data method to determine the cumulative CH_4 emissions from equipment leaks, then you must also report the following information:

- Cumulative CH_4 emissions for all equipment leak sources (metric tons)

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

Equation Y-21
If you use Equation Y-21 to calculate the cumulative CH_4 emissions from equipment leaks, you can download the Y-21 spreadsheet from the e-GGRT help site or use the following information:

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

Where:

CH4	=	Annual methane emissions from equipment leaks (metric tons/year)
N_{CD}	=	Number of atmospheric crude oil distillation columns at the facility.
N_{PU1}	=	Cumulative number of catalytic cracking units, coking units (delayed or fluid), hydrocracking, and full-range distillation columns (including depropanizer and debutanizer distillation columns) at the facility.
N_{PU2}	=	Cumulative number of hydrotreating/hydrorefining units, catalytic reforming units, and visbreaking units at the facility.
N_{H2}	=	Total number of hydrogen plants at the facility.
N_{FGS}	=	Total number of fuel gas systems at the facility.

Table 6
Equipment Leaks Details XML Data Elements

Data Element Name	Description
EquipmentLeaksDetails	
TotalCH4Emissions	The cumulative annual CH_4 emissions (in metric tons) from equipment leaks. Report the calculated value and unit of measure only.
TotalCH4Emissions.massUOM	Set as equal to "Metric Tons".
MethodtoCalculateEquipmentLeakEmission	The method used to calculate the reported equipment leak emissions as either that described in 98.253(L)(1) and (2). Below is the list of allowable values. 98.253(l)(1) method 98.253(l)(2) method
NCD	The number of atmospheric crude oil distillation columns at the facility (integer). Report if electing to use the 98.253(l)(1) method.

NPU1	The cumulative number of catalytic cracking units, coking units (delayed or fluid), hydrocracking, and full-range distillation columns (including depropanizer and debutanizer distillation columns) at the facility (integer). Report if electing to use the 98.253(l)(1) method.
NPU2	The cumulative number of hydrotreating/hydrorefining units, catalytic reforming units, and visbreaking units at the facility (integer). Report if electing to use the 98.253(l)(1) method.
NH2	The total number of hydrogen plants at the facility (integer). Report if electing to use the 98.253(l)(1) method.
NFGS	The total number of fuel gas systems at the facility (integer). Report if electing to use the 98.253(l)(1) method.

Figure 16
Sample XML Snippet for Equipment Leaks

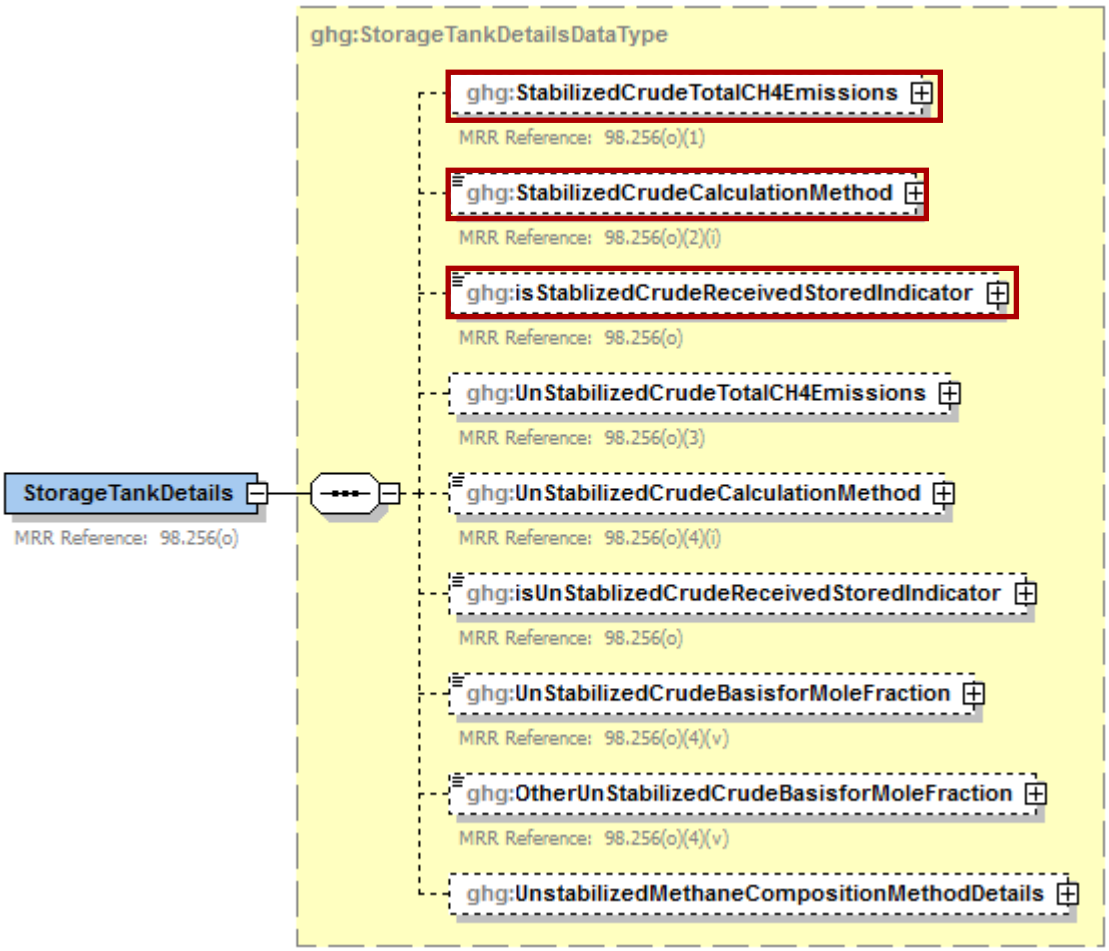
```
<ghg:EquipmentLeaksDetails>
   <ghg:TotalCH4Emissions massUOM="Metric Tons">
      <ghg:CalculatedValue>213.00</ ghg:CalculatedValue>
   </ ghg:TotalCH4Emissions>
   <ghg:MethodtoCalculateEquipmentLeakEmission>98.253(l)(1) method</ghg:MethodtoCalculateEquipmentLeakEmission>
   <ghg:NCD>55</ghg:NCD>
   <ghg:NPU1>11</ghg:NPU1>
   <ghg:NPU2>22</ghg:NPU2>
   <ghg:NH2>33</ghg:NH2>
   <ghg:NFGS>44</ghg:NFGS>
</ghg:EquipmentLeaksDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the cumulative CH_4 emissions from equipment leaks.

2.6 Storage Tanks

For petroleum refinery sources required to report under subpart Y, you are required to report the cumulative annual CH_4 emissions (in metric tons) for all storage tanks and the methods used to calculate the reported storage tank emissions. The cumulative annual CH_4 emissions and calculation methods used must be reported separately based on whether or not the storage tank was used to process unstabilized crude oil.

Figure 17
Storage Tanks (Stabilized Crude) Schema Diagram



Method Used to Calculate CH_4 Emissions
You must specify the method used, if any, to calculate the CH_4 emissions from storage tanks other than those processing unstabilized crude oil [MRR: §98.256(o)(2)(i)]:

- AP-42 - Section 7.1 of the AP-42: "Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources" (incorporated by reference, see MRR 98.7)
- Use Equation Y-22

Equation Y-22

If you use Equation Y-22 to calculate the cumulative CH_4 emissions from all storage tanks other than those processing unstabilized crude oil, you can download the Y-22 spreadsheet from the e-GGRT help site or use the following information:

$$CH_4 = (0.1 \times Q_{Ref})$$

Where:

CH4	=	Annual methane emissions from storage tanks (metric tons/year).
0.1	=	Default emission factor for storage tanks (metric ton CH4/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).

Table 7
Storage Tanks (Stabilized Crude) XML Data Elements

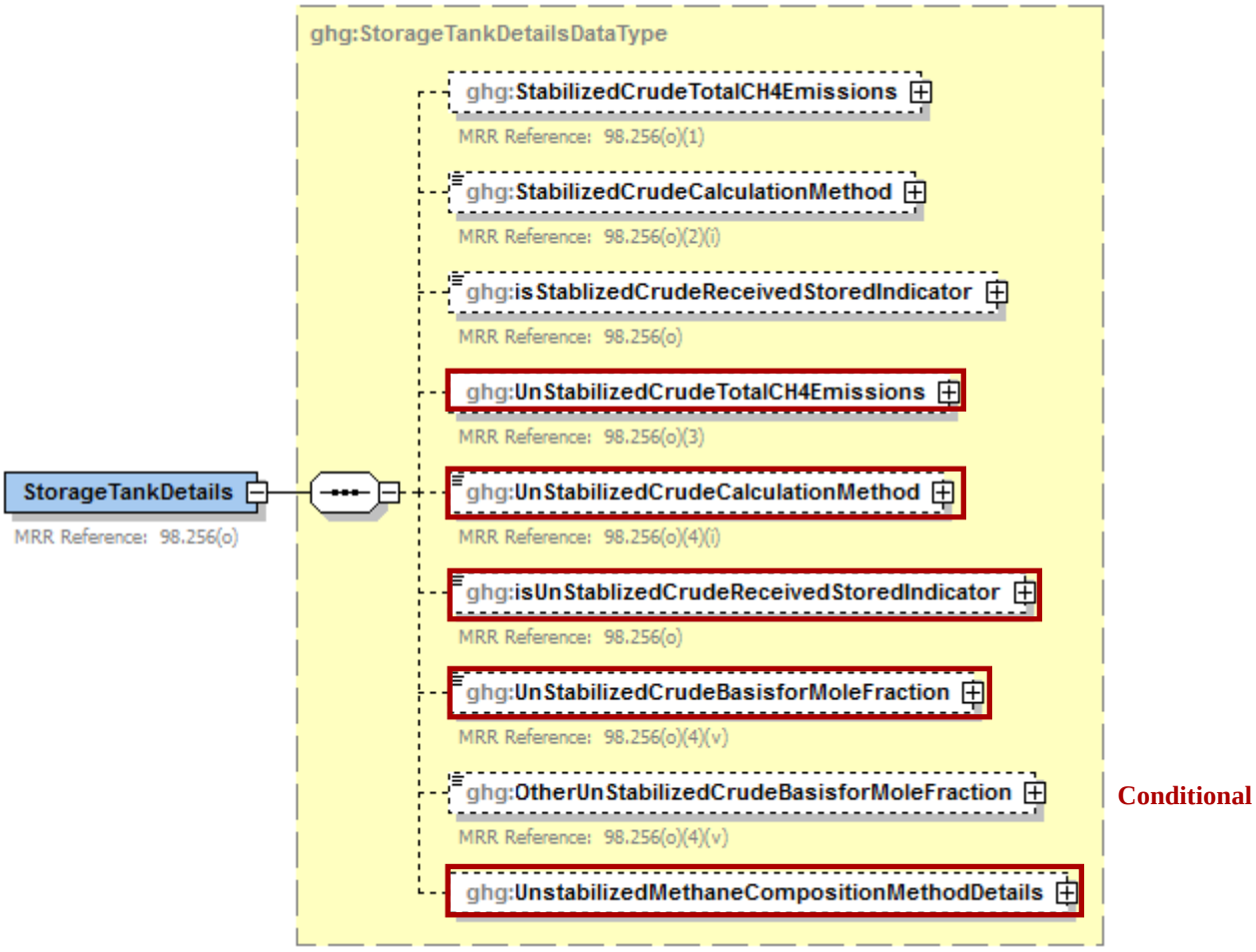
Data Element Name	Description
StorageTanksDetails	
StabilizedCrudeTotalCH4Emissions	The cumulative annual CH_4 emissions from all storage tanks (stored liquids), except for those used to process unstabilized crude oil. Report the calculated value and unit of measure only. [MRR Reference: 98.256(o)(1)]
StabilizedCrudeTotalCH4Emissions.massUOM	Set as equal to "Metric Tons".
StabilizedCrudeCalculationMethod	The method used to calculate the reported storage tank emissions for storage tanks other than those processing unstabilized crude. Below is the list of allowable values.[MRR Reference: 98.256(o)(2)(i)] AP-42 Equation Y-22
isStablizedCrudeReceivedStoredIndicator	An indication (Y/N) of whether the facility received stored liquids other than unstabilized crude oil during the reporting year. [MRR Reference: 98.256(o)]

Figure 18
Sample XML Snippet for Storage Tanks (Stabilized Crude)

```
<ghg:StorageTankDetails>
    <ghg:StabilizedCrudeTotalCH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>235.0</ghg:CalculatedValue>
    </ghg:StabilizedCrudeTotalCH4Emissions>
    <ghg:StabilizedCrudeCalculationMethod>Equation Y-22</ghg:StabilizedCrudeCalculationMethod>
    <ghg:isStablizedCrudeReceivedStoredIndicator>Y</ghg:isStablizedCrudeReceivedStoredIndicator>
    <ghg:isUnStablizedCrudeReceivedStoredIndicator>N</ghg:isUnStablizedCrudeReceivedStoredIndicator>
    </ghg:UnstabilizedMethaneCompositionMethodDetails>
</ghg:StorageTankDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting emissions data for storage tanks other than those processing unstabilized crude oil.

Figure 19
Storage Tanks (Unstabilized Crude) Schema Diagram



Note: You do not need to calculate CH_4 emissions from storage tanks that meet any of the following descriptions:

- Units permanently attached to conveyances such as trucks, trailers, rail cars, barges, or ships;
- Pressure vessels designed to operate in excess of 204.9 kilopascals and without emissions to the atmosphere;
- Bottoms receivers or sumps;
- Vessels storing wastewater; or
- Reactor vessels associated with a manufacturing process unit.

Method Used to Calculate CH_4 Emissions
If you are reporting emissions for storage tanks that process unstabilized crude oil, you must specify the method used, if any, to calculate the CH_4 emissions [MRR: §98.256(o)(4)(i)]:

- Tank-specific methane composition data and direct measurement of gas generation rate
- Use Equation Y-23

Tank-Specific Methane Composition Data Method Summary and Result
If you use the tank-specific methane composition data method to determine the cumulative CH_4 emissions from storage tanks processing unstabilized crude oil, then you must also report the following information:

- Cumulative CH_4 emissions from unstabilized crude oil storage (metric tons)
- Method used to measure tank-specific methane composition in the vapor
- If measured, the number of hours missing that data procedures were used to measure tank-specific methane composition
- Method used to measure the gas generation rate
- Specification of the procedures or method used to measure the gas generation rate if Equation Y-23 is not used.
- If measured, the number of hours that missing data procedures were used to measure the gas generation rate

Equation Y-23
If you use Equation Y-23 to calculate the annual CH_4 emissions from the storage of unstabilized crude oil, you can download the Y-23 spreadsheet from the e-GGRT help site or use the following information:

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

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 ºF and 14.7 psia or 836.6 scf/kg-mole at 60 ºF and 14.7 psia).
0.001	=	Conversion factor (metric ton/kg).

Mole Fraction Basis
Regardless of the method used to calculate CH_4 emissions, you are required to report the basis for the average mole fraction of CH_4 in the vent gas from the unstabilized crude oil storage tank. [MRR 98.256(o)(4)(v)]:

- Equation Y-23 default
- Measurement data
- Product knowledge
- Other (specify)

Table 8
Storage Tanks (Stabilized Crude) XML Data Elements

Data Element Name	Description
StorageTanksDetails	
UnStabilizedCrudeTotalCH4Emissions	The cumulative annual CH_4 emissions from storage tanks used to process unstabilized crude oil storage. Report the calculated value and unit of measure only. [MRR Reference: 98.256(o)(3)]
UnStabilizedCrudeTotalCH4Emissions.massUOM	Set as equal to "Metric Tons".
UnStabilizedCrudeCalculationMethod	The method used to calculate the reported unstabilized crude oil storage tank emissions. [MRR Reference: 98.256(o)(4)(i)] Below is the list of allowable values. Tank-specific methane composition data and direct measurement of gas generation rate Equation Y-23
isUnStablizedCrudeReceivedStoredIndicator	An indication (Y/N) of whether the facility received unstabilized crude oil during the reporting year. [MRR Reference: 98.256(o)]
UnStabilizedCrudeBasisforMoleFraction	Basis for the average mole fraction of CH_4 in vent gas from all unstabilized crude oil storage tanks. [MRR Reference: 98.256(o)(4)(v)] Below is the list of allowable values. Equation Y-23 default Measurement data Product knowledge Other (specify)
OtherUnStabilizedCrudeBasisforMoleFraction	Specify the basis for the mole fraction if not listed above.
UnstabilizedMethaneCompositionMethodDetails	A collection of data elements to capture CH_4 vapor data. Report this data if the tank-specific methane composition data method was used to determine the cumulative CH_4 emissions from storage tanks processing unstabilized crude oil.
CH4VaporCompositionData.NumberofTimesSubstituted	If measured, the number of hours that missing data procedures were used to measure tank-specific CH_4 composition. [MRR Reference: 98.256(o)(4)(vi)]

Data Element Name	Description
CH4VaporCompositionDataMethod	Specify the method used to measure tank-specific CH_4 composition in the vapor. [MRR Reference: 98.256(q)] Below is the list of allowable values. Measurement data Product knowledge Other (specify)
OtherCH4VaporCompositionDataMethod	Specify the method used to measure tank-specific CH_4 composition in the vapor if not listed above.
GasGenerationRateData.NumberofTimesSubstituted	If measured, the number of hours that missing data procedures were used to measure the gas generation rate. [MRR Reference: 98.256(o)(4)(vi)]
GasGenerationRateDataMethod	The method used to calculate the reported storage tank emissions if the facility indicates use of stabilized crude oil storage tanks. [MRR Reference: 98.256(q)] Below is the list of allowable values. Procedures specified by flow meter manufacturer (prompt to specify procedures) Method published by a consensus-based standards organization (prompt to specify the method) **Note:** The enumerated values listed above contain extraneous information (e.g., prompt to specify…) but until the XML schema is updated with the correct values, you must specify each value as it is currently defined.

Figure 20
Sample XML Snippet for Storage Tanks (Unstabilized Crude)

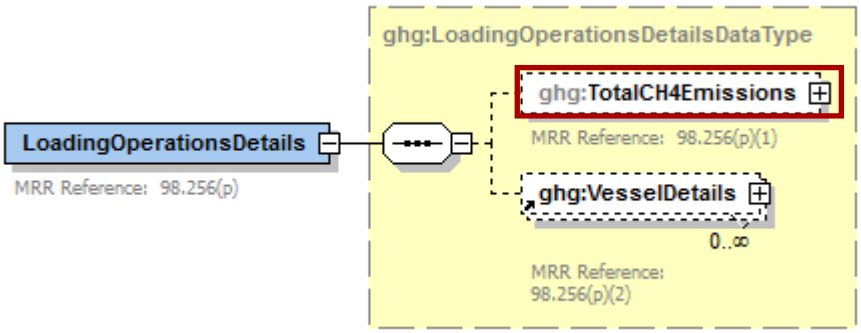
```
<ghg:StorageTankDetails>
    <ghg:isStablizedCrudeReceivedStoredIndicator>N</ghg:isStablizedCrudeReceivedStoredIndicator>
    <ghg:UnStabilizedCrudeTotalCH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>190.0</ghg:CalculatedValue>
    </ghg:UnStabilizedCrudeTotalCH4Emissions>
    <ghg:UnStabilizedCrudeCalculationMethod>Tank-specific methane composition data and direct measurement of
gas generation rate</ghg:UnStabilizedCrudeCalculationMethod>
    <ghg:isUnStablizedCrudeReceivedStoredIndicator>Y</ghg:isUnStablizedCrudeReceivedStoredIndicator>
    <ghg:UnStabilizedCrudeBasisforMoleFraction>Product knowledge</ghg:UnStabilizedCrudeBasisforMoleFraction>
    <ghg:UnstabilizedMethaneCompositionMethodDetails>
        <ghg:GasGenerationRateDataMethod>Procedures specified by flow meter manufacturer</ghg:GasGen…>
    </ghg:UnstabilizedMethaneCompositionMethodDetails>
</ghg:StorageTankDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting emissions data for storage tanks that process unstabilized crude oil calculated using a tank-specific methane composition data and direct measurement of gas generation rate. In some cases, an ellipse (…) was used to shorten the tag name. This was done merely to prevent the snippet data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

2.7 Loading Operations

For petroleum refinery sources required to report under subpart Y, you are required to report the cumulative methane (CH4) emissions for all loading operations.

Figure 21
Loading Operations Details Schema Diagram



You must also specify the types of materials, if any, that have a vapor-phase methane concentration of 0.5 volume percent or greater.

Figure 22
Vessel Details Schema Diagram

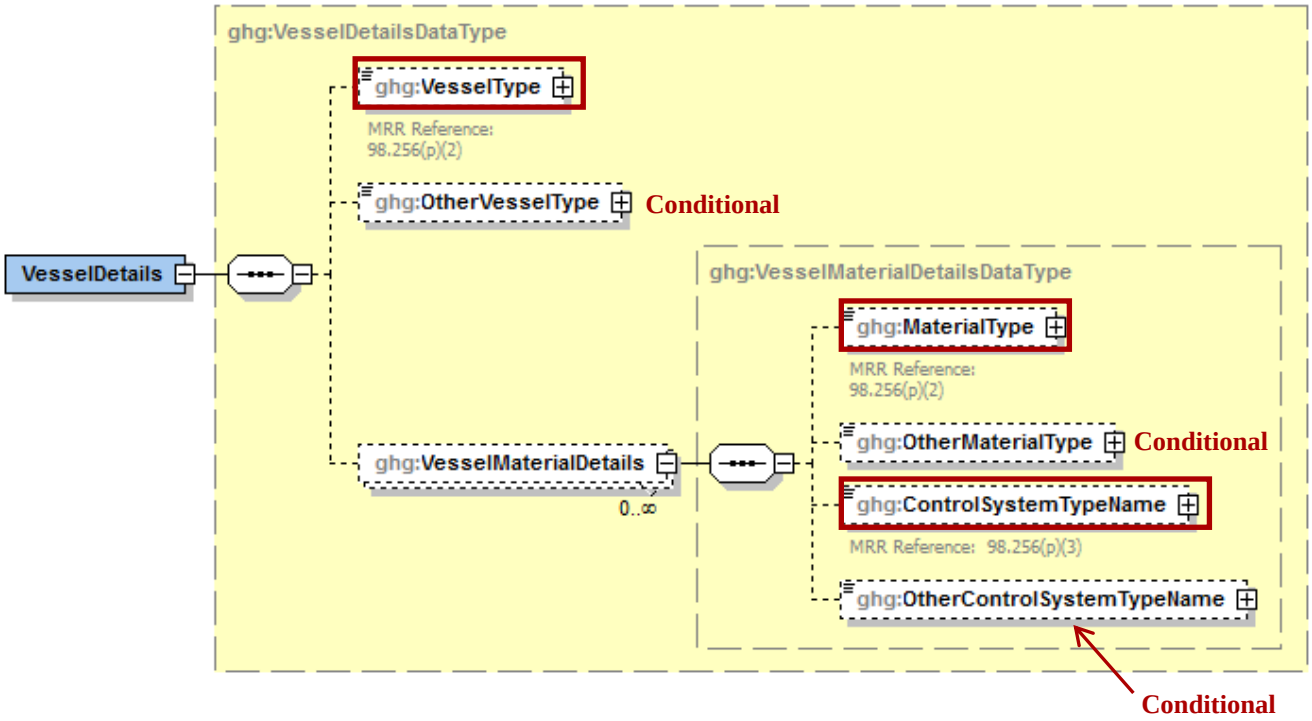


Table 9
Loading Operations XML Data Elements

Data Element Name	Description
LoadingOperationsDetails	
TotalCH4Emissions	The cumulative annual CH_4 emissions (in metric tons of CH4) for loading operations. Report the calculated value only. [MRR Reference: 98.256(p)(1)]
TotalCH4Emissions.massUOM	Set as equal to "Metric Tons".
VesselDetails	
VesselType	The type of each vessel used to transport material containing a vapor-phase concentration of 0.5 volume percent or greater. Below is the list of allowable values. Ship or ocean-going vessel Barge Railcar Tank truck Container (e.g., 55-gallon drum) Other (specify)
OtherVesselType	Specify each type of vessel not listed above that was used to transport material containing a vapor-phase concentration of 0.5 volume percent or greater.
VesselMaterialDetails	A collection of data element containing details about the materials loaded. Report a separate **VesselMaterialsDetails** record for each type of material loaded.
MaterialType	The type of each vessel material containing a vapor-phase CH_4 concentration of 0.5 volume percent or greater. Below is the list of allowable values. Unstabilized crude oil Stabilized crude oil Still gas or refinery fuel gas LPG (propane/butane) Ethylene Oxygenates Naphtha Gasoline or gasoline blending stocks other than oxygenates Other (specify)
OtherMaterialType	Specify each type of material not listed above that contained a vapor-phase concentration of CH_4 of 0.5 volume percent or greater.
ControlSystemTypeName	The type of control system used to reduce emissions from the loading of the material. Below is the list of allowable values. Submerged loading or bottom filling only; no other control system Vapor balancing Thermal or catalytic incinerator/oxidizer Flare Carbon adsorber Condenser Oil scrubber None Other (specify)
OtherControlSystemTypeName	Specify each type of control system used not listed above that was used to reduce emissions from the loading of the material.

Figure 23
Sample XML Snippet for Loading Operations

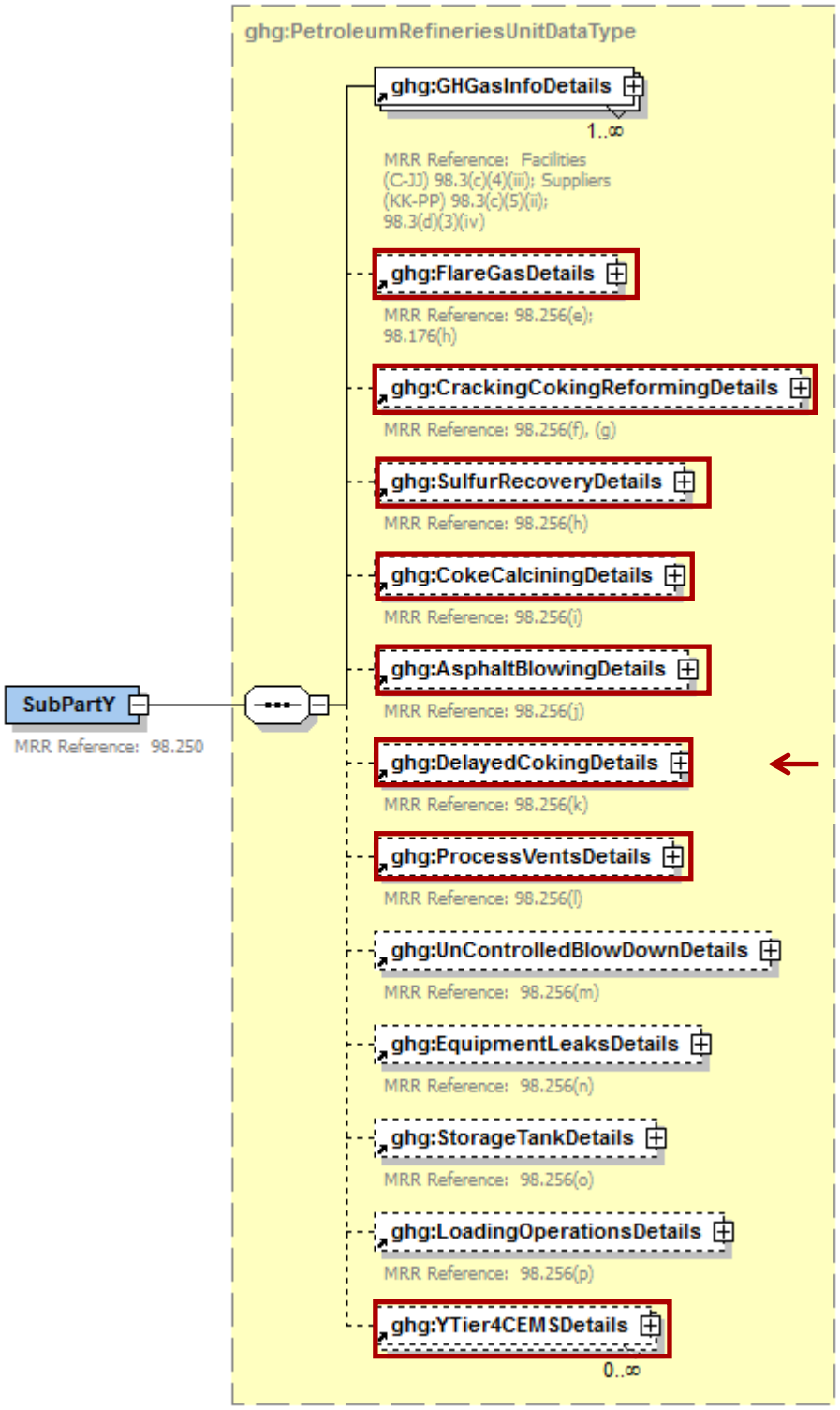
```
<ghg:LoadingOperationsDetails>
    <ghg:TotalCH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>123.0</ghg:CalculatedValue>
    </ghg:TotalCH4Emissions>
    <ghg:VesselDetails>
        <ghg:VesselType>Barge</ghg:VesselType>
        <ghg:VesselMaterialDetails>
            <ghg:MaterialType>Still gas or refinery fuel gas</ghg:MaterialType>
            <ghg:ControlSystemTypeName>Thermal or catalytic incinerator/oxidizer</ghg:Control…>
        </ghg:VesselMaterialDetails>
        <ghg:VesselMaterialDetails>
            <ghg:MaterialType>Oxygenates</ghg:MaterialType>
            <ghg:ControlSystemTypeName>Condenser</ghg:VesselMaterialDetails>
        </ghg:VesselDetails>
    <ghg:VesselDetails>
        <ghg:VesselType>Railcar</ghg:VesselType>
        <ghg:VesselMaterialDetails>
            <ghg:MaterialType>Ethylene</ghg:MaterialType>
            <ghg:ControlSystemTypeName>Oil scrubber</ghg:ControlSystemTypeName>
        </ghg:VesselMaterialDetails>
    </ghg:VesselDetails>
</ghg:LoadingOperationsDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the cumulative CH_4 emissions from equipment leaks. In the example above, there are two vessels, a barge and a railcar. The barge transported two types of material containing a vapor-phase CH_4 concentration of at least 0.5 percent and the railcar contained a single type.

3.0 Unit-Level Emissions – Subpart Y

For Petroleum refinery facilities required to report under subpart Y, you must provide unit-level emissions data for the applicable sources highlighted in red in the schema diagram below.

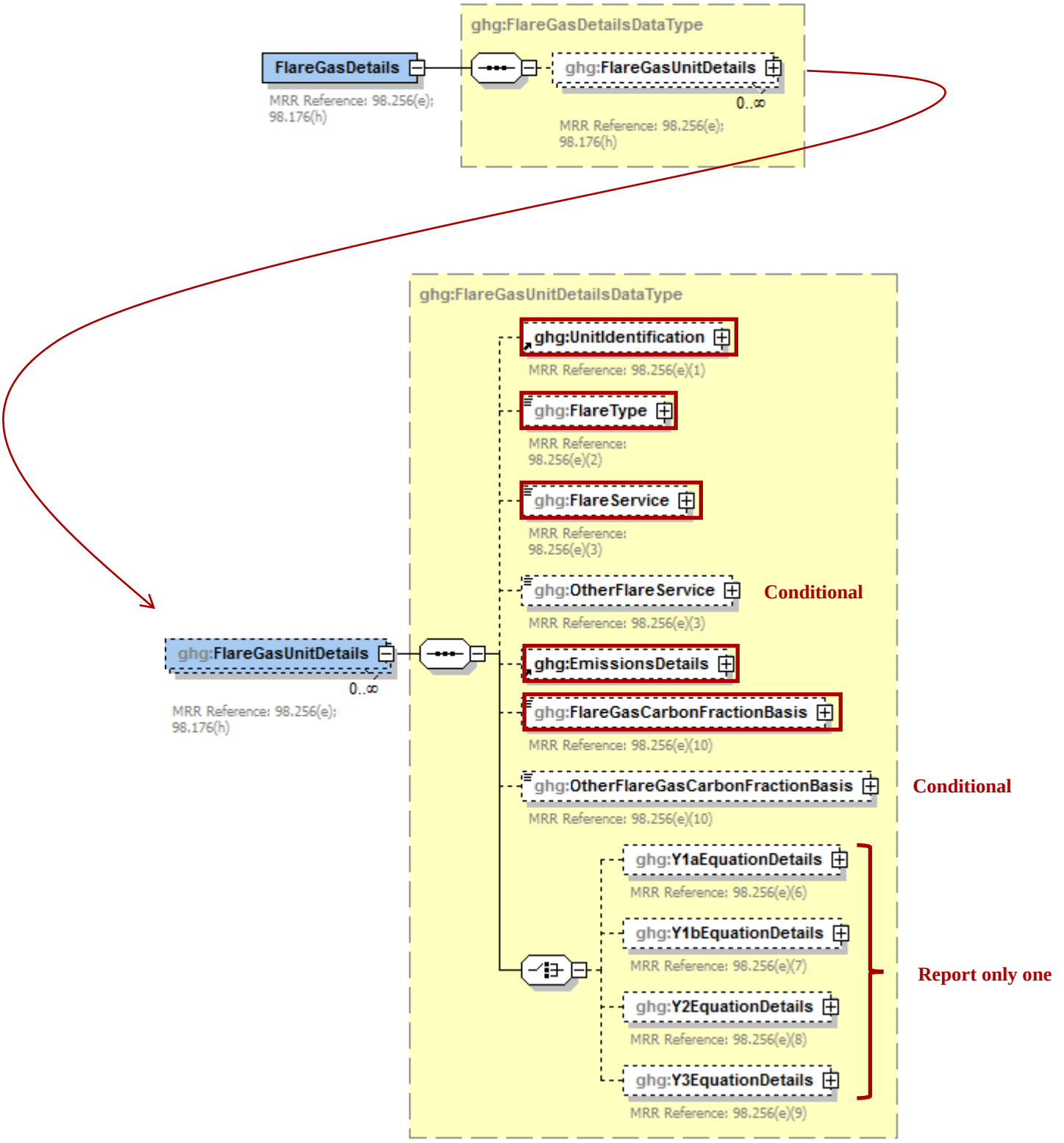
Figure 24
Unit-Level Emissions Schema Diagram



3.1 Flares Unit Information

This topic provides a step-by-step description of how to report Subpart Y Flares unit information for a facility. You must report CO_2, CH_4, and N_2O combustion emissions from each flare.

Figure 25
Flare Gas Details Schema Diagram



Subpart Y collects the following data about your flare unit:

- A unique name or identifier, plus optional description for this flare unit.
- Type of flare.
- Flare service type.
- The CO_2, CH_4, and N_2O annual emissions for each flare. For more information, see Table 11, "Emissions Details for Flare Gas Units XML Data Elements".
- The basis for the fraction of carbon in the flare gas contributed by methane used in Equation Y-4, if applicable.
- Details about the methods used to calculate the CO_2 emissions. For more information, see the applicable section:
    - Y1aEquationDetails
    - Y1bEquationDetails
    - Y2EquationDetails
    - Y3EquationDetails

Table 10
Flare Gas Unit Details XML Data Elements

Data Element Name	Description
FlareGasDetails	
UnitIdentification	A collection of data elements containing the identity of each Flare Gas unit. It includes the unit ID, an optional description, and a code representing the type of unit. Report the following unit type code: Flare
FlareType	Type of flare. Below is the list of allowable values. Steam assisted Air-assisted Unassisted Other (specify)
FlareService	Type of flare service. Below is the list of allowable values. General facility flare Unit flare Emergency only flare Back-up flare Other (specify)
OtherFlareService	Specify the type of flare service if not listed above.
EmissionsDetails	See Table 11, Emissions Details for Flare Gas Units XML Data Elements.

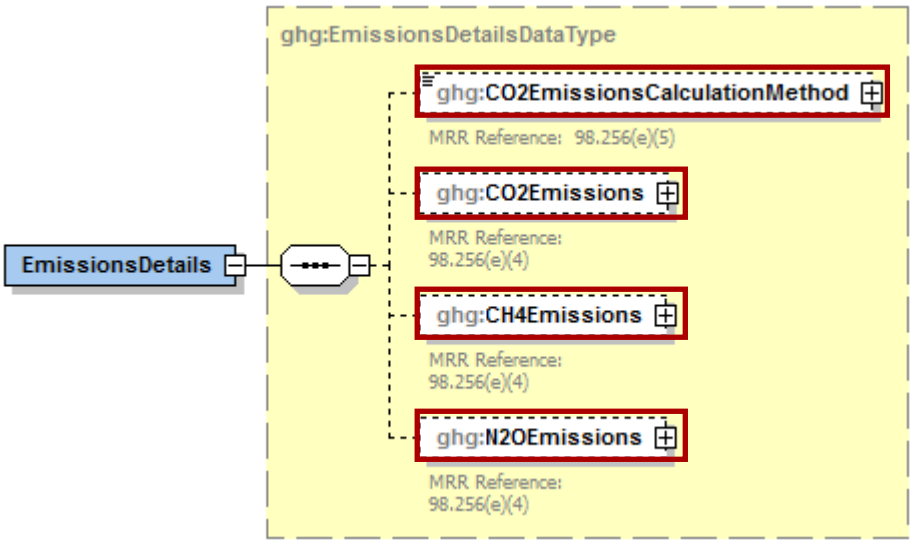
Data Element Name	Description
FlareGasCarbonFractionBasis	The basis for the fraction of carbon in the flare gas contributed by CH_4 value. Below is the list of allowable values. Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Engineering calculations Other (specify)
OtherFlareGasCarbonFractionBasis	Specify the basis for the fraction of carbon in the flare gas contributed by CH_4 value if not listed above.
Y1aEquationDetails	See section 3.1.1, Equation Y-1a Details, Gas Composition Monitored.
Y1bEquationDetails	See section 3.1.2, Equation Y-1b Details, Gas Composition Monitored.
Y2EquationDetails	See section 3.1.3, Equation Y-2 Details, Heat Content Monitored.
Y3EquationDetails	See section 3.1.4, Equation Y-3 Details, Start up, Shutdown, Malfunction.

Figure 26
Sample XML Snippet for Flare Details

```
<ghg:FlareGasDetails>
        <ghg:FlareGasUnitDetails>
        <ghg:UnitIdentification>
            <ghg:UnitName>FLARE-001</ghg:UnitName>
            <ghg:UnitDescription>Unit altered to increase the flow.</ghg:UnitDescription>
            <ghg:UnitType>Flare</ghg:UnitType>
        </ghg:UnitIdentification>
        <ghg:FlareType>Steam assisted</ghg:FlareType>
        <ghg:FlareService>General facility flare</ghg:FlareService>
        <ghg:EmissionsDetails>
            <ghg:CO2EmissionsCalculationMethod>98.253(b)(1) ...</ghg:CO2EmissionsCalculationMethod>
            <ghg:CO2Emissions massUOM="Metric Tons">
                <ghg:CalculatedValue>23400</ghg:CalculatedValue>
            </ghg:CO2Emissions>
            <ghg:CH4Emissions massUOM="Metric Tons">
                <ghg:CalculatedValue>3880</ghg:CalculatedValue>
            </ghg:CH4Emissions>
            <ghg:N2OEmissions massUOM="Metric Tons">
                <ghg:CalculatedValue>2035</ghg:CalculatedValue>
            </ghg:N2OEmissions>
        </ghg:EmissionsDetails>
        <ghg:FlareGasCarbonFractionBasis>Method 18 at 40 CFR part 60, ...</ghg:FlareGasCarbonFractionBasis>
        <ghg:Y1aEquationDetails>
            <ghg:MeasurementPeriod>Daily</ghg:MeasurementPeriod>
            <ghg:AnnualVolumeofFlareGas volUOM="Barrels of Liquid Fuel">
                <ghg:MeasureValue>2332</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
            </ghg:AnnualVolumeofFlareGas>
            <ghg:AnnualVolumeofFlareGasMethod>Method 123</ghg:AnnualVolumeofFlareGasMethod>
            <ghg:AnnualAverageMolecularWeight molewtUOM="kg/kg-mole">
                <ghg:MeasureValue>235</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>5</ghg:NumberofTimesSubstituted>
            </ghg:AnnualAverageMolecularWeight>
            <ghg:AnnualAverageMolecularWeightMethod>GPA 2261-00</ghg:AnnualAverageMolecularWeightMethod>
            <ghg:AnnualAverageCarbonContent carboncontentUOM="kgC/kg">
                <ghg:MeasureValue>12</ghg:MeasureValue>
            </ghg:AnnualAverageCarbonContent>
            <ghg:AnnualAverageCarbonContentMethod>ASTM D1945-03</ghg:AnnualAverageCarbonContentMethod>
        </ghg:Y1aEquationDetails>
    </ghg:FlareGasUnitDetails>
</ghg:FlareGasDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details about a flare gas unit. A **...** indicates that the reported value has been truncated merely for display purposes in order to prevent the line from wrapping.

Figure 27
Flare Gas Emissions Details Schema Diagram



Subpart Y collects the following data about your flare unit emissions:

- Method used to calculate the CO_2 emissions.
    - 98.253(b)(1)(ii)(A) - Equation Y-1a Gas Composition Monitored
      (Equation Y-1a or Y-1b must be used if you have a continuous gas composition monitor on the flare or if you measure it at least weekly.)
    - 98.253(b)(1)(ii)(A) - Equation Y-1b Gas Composition Monitored
      (Equation Y-1a or Y-1b must be used if you have a continuous gas composition monitor on the flare or if you measure it at least weekly.)
    - 98.253(b)(1)(ii)(B) - Equation Y-2 Heat Content Monitored
      (Equation Y-2 must be used if you have a continuous higher heating value monitor or measure it at least weekly and the heating value monitor or measurement is not based on compositional analyses; if compositional analyses are used, you must use Equations 1a or 1b.)
    - 98.253(b)(1)(ii) - Equation Y-3 Start-up, Shutdown, Malfunction
      (Equation Y-3 must be used if you do not measure gas composition or heating value at least weekly.)
- The calculated CO_2, CH_4, and N_2O annual emissions for each flare, expressed in metric tons of each GHG emitted. To report annual CO_2 emissions, follow the instructions that correspond to the calculation method reported. (See applicable section in this document: Equation Y-1a Details, Equation Y-1b Details, Equation Y-2 Details, or Equation Y-3 Details).

Table 11
Emissions Details for Flare Gas Units XML Data Elements

Data Element Name	Description

Data Element Name	Description
EmissionsDetails	The calculated CO2, CH4, and N_2O annual emissions for each flare.
CO2EmissionsCalculationMethod	The method used to calculate the CO_2 emissions for each flare (e.g., reference section and equation number). Below is the list of allowable values. 98.253(b)(1)(ii)(A) – Equation Y-1a – Gas Composition Monitored 98.253(b)(1)(ii)(A) – Equation Y-1b – Gas Composition Monitored 98.253(b)(1)(ii)(B) – Equation Y-2 – Heat Content Monitored 98.253(b)(1)(iii) – Equation Y-3 – Start-up, Shutdown, Malfunction
CO2Emissions	Annual CO_2 emissions for each flare (CalculatedValue).
CO2Emissions.massUOM	Set as equal to "Metric Tons".
CH4Emissions	Annual CH_4 emissions for each flare (CalculatedValue).
CH4Emissions.massUOM	Set as equal to "Metric Tons".
N2OEmissions	Annual N_2O emissions for each flare (CalculatedValue).
N2OEmissions.massUOM	Set as equal to "Metric Tons".

Figure 28
Sample XML Snippet for Flare Gas Emissions

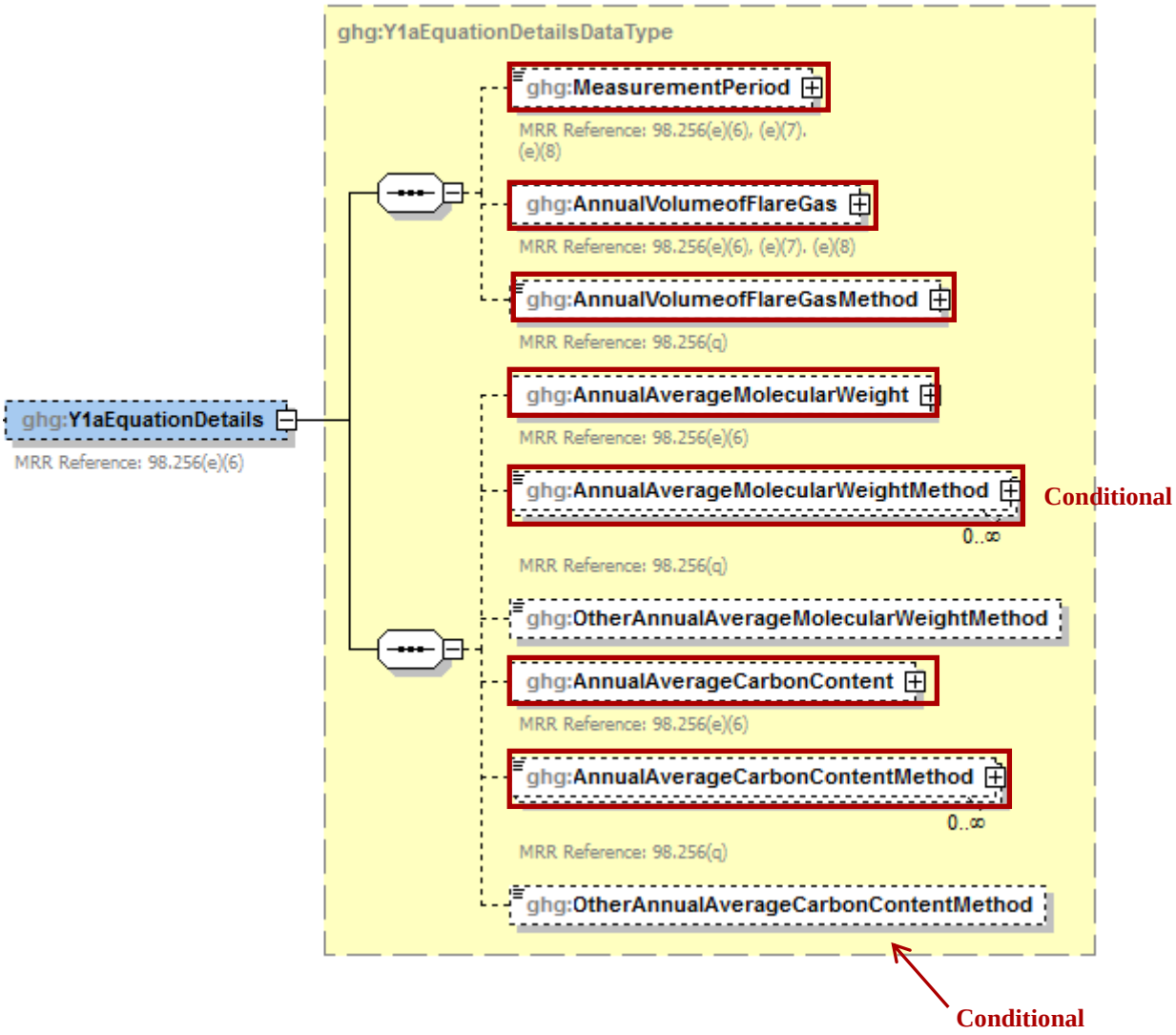
```
<ghg:EmissionsDetails>
    <ghg:CO2EmissionsCalculationMethod>98.253(b)(1)(ii)(A) – Equation Y-1a – Gas Composition
Monitored</ghg:CO2Emissions…>
    <ghg:CO2Emissions massUOM="Metric Tons">
<ghg:CalculatedValue>23400</ghg:CalculatedValue>
    </ghg:CO2Emissions>
    <ghg:CH4Emissions massUOM="Metric Tons">
<ghg:CalculatedValue>3880</ghg:CalculatedValue>
    </ghg:CH4Emissions>
    <ghg:N2OEmissions massUOM="Metric Tons">
<ghg:CalculatedValue>2035</ghg:CalculatedValue>
    </ghg:N2OEmissions>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting CO2, CH4, and N_2O emissions for each flare gas unit. In some cases, an ellipse (…) was used to shorten the tag name. This was done merely to prevent the snippet data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

3.1.1 Equation Y-1a Details, Gas Composition Monitored

This topic provides a step-by-step description of how to report details about Equation Y-1a. This equation is for calculating CO_2 emissions if you monitor gas composition and measure the molecular weight and carbon content of the flare gas combusted.

Figure 29
Y-1a Equation Details Schema Diagram



To calculate the annual CO_2 emissions from flare units using Equation Y-1a, you can download the Y-1a spreadsheet from the e-GGRT help site or use the following information:

$$CO_2 = 0.98 \times 0.001 \times \left(\sum_{p=1}^{n} \left[\frac{44}{12} \times Flare_p \times \frac{MW_p}{MVC} \times CC_p \right] \right)$$

Where:

CO2	=	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).
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.
44	=	Molecular weight of CO_2 (kg/kg-mole).
12	=	Atomic weight of C (kg/kg-mole).
(Flare)p	=	Volume of flare gas combusted during measurement period (standard cubic feet per period, scf/period). If a mass flow meter is used, measure flare gas flow rate in kg/period and replace the term "(MW)p/MVC" with "1".
(MW)p	=	Average molecular weight of the flare gas combusted during measurement period (kg/kg-mole). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.
MVC	=	Molar volume conversion factor (849.5 scf/kg-mole at 68 ºF and 14.7 psia or 836.6 scf/kg-mole at 60 ºF and 14.7 psia).
(CC)p	=	Average carbon content of the flare gas combusted during measurement period (kg C per kg flare gas). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.

You must also report the following data if you used Equation Y-1a to calculate CO_2 emissions:

- An indication of whether daily or weekly measurement periods are used [98.256(e)(6)]
- The annual volume of flare gas combusted (in scf) [98.256(e)(6)]
- The specific consensus-based standard method number or description of the procedure specified by the flow meter manufacturer [98.256(q)]
- The number of days during the reporting year missing data procedures were used to determine the volume of flare gas combusted
- The annual average molecular weight (in kg/kg-mole) [98.256(e)(6)]
- The method used to measure molecular weight [98.256(q)]
- The number of days during the reporting year missing data procedures were used to determine molecular weight
- The annual average carbon content of the flare gas (kg carbon/kg flare gas) [98.256(e)(6)]
- The method used to measure carbon content [98.256(q)]
- The number of days during the reporting year missing data procedures were used to determine carbon content

Table 12
Y1aEquationDetails XML Data Elements

Data Element Name	Description
Y1aEquationDetails	
MeasurementPeriod	An indication of whether daily or weekly measurement periods are used. [MRR Reference: 98.256(e)(6), (e)(7), and (e)(8)] Below is a list of the allowable values: Daily Weekly
AnnualVolumeofFlareGas	The annual volume of flare gas combusted (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual volume of flare gas combusted (NumberofTimeSubstituted). [MRR Reference: 98.256(e)(6), (e)(7), and (e)(8)]
AnnualVolumeofFlareGas.volUOM	Set as equal to "scf".
AnnualVolumeofFlareGasMethod	The specific consensus-based standard method or description of the procedure specified by the flow meter manufacturer. [MRR Reference: 98.256(q)]
AnnualAverageMolecularWeight	The annual average molecular weight (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual average molecular weight (NumberofTimeSubstituted). [MRR Reference: 98.256(e)(6)]
AnnualAverageMolecularWeight.molewtUOM	Set as equal to "kg/kg-mole".
AnnualAverageMolecularWeightMethod	The method used to determine the annual average molecular weight of the flare gas. [MRR Reference: 98.256(q)] Below is the list of allowable values. Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAnnualAverageMolecularWeightMethod	Specify the method used to determine the annual average molecular weight of the flare gas if not listed above.
AnnualAverageCarbonContent	The annual average carbon content of the flare gas (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual average carbon content of the flare gas (NumberofTimeSubstituted). [MRR Reference: 98.256(e)(6)]

Data Element Name	Description
AnnualAverageCarbonContent.carboncontentUOM	Set as equal to "decimal fraction; kg carbon/kg flare gas".
AnnualAverageCarbonContentMethod	The method used to determine the annual average carbon content of the flare gas. Below is the list of allowable values. [MRR Reference: 98.256(q)] Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAnnualAverageCarbonContentMethod	Specify the method used to determine the annual average carbon content of the flare gas if not listed above.

Figure 30
Sample XML Snippet for Equation Y-1a

```
<ghg:Y1aEquationDetails>
    <ghg:MeasurementPeriod>Daily</ghg:MeasurementPeriod>
    <ghg:AnnualVolumeofFlareGas volUOM="scf">
                <ghg:MeasureValue>2332</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
    </ghg:AnnualVolumeofFlareGas>
    <ghg:AnnualVolumeofFlareGasMethod>Method 123</ghg:AnnualVolumeofFlareGasMethod>
    <ghg:AnnualAverageMolecularWeight molewtUOM="kg/kg-mole">
                <ghg:MeasureValue>4</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>5</ghg:NumberofTimesSubstituted>
    </ghg:AnnualAverageMolecularWeight>
    <ghg:AnnualAverageMolecularWeightMethod>GPA 2261-00</ghg:AnnualAverageMolecularWeightMethod>
    <ghg:AnnualAverageCarbonContent carboncontentUOM="kgC/kg">
                <ghg:MeasureValue>0.6</ghg:MeasureValue>
    </ghg:AnnualAverageCarbonContent>
    <ghg:AnnualAverageCarbonContentMethod>ASTM D1945-03</ghg:AnnualAverageCarbonContentMethod>
</ghg:Y1aEquationDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the details for Equation Y-1a.

3.1.2 Equation Y-1b Details, Gas Composition Monitored

This topic provides a step-by-step description of how to report details about Equation Y-1b. This method is used for calculating CO_2 emissions if you monitor gas composition and measure both the mole percentage of CO_2 concentration and the number of carbon compounds, other than CO2, in the flare gas stream.

Figure 31
Equation Y-1b Details Schema Diagram

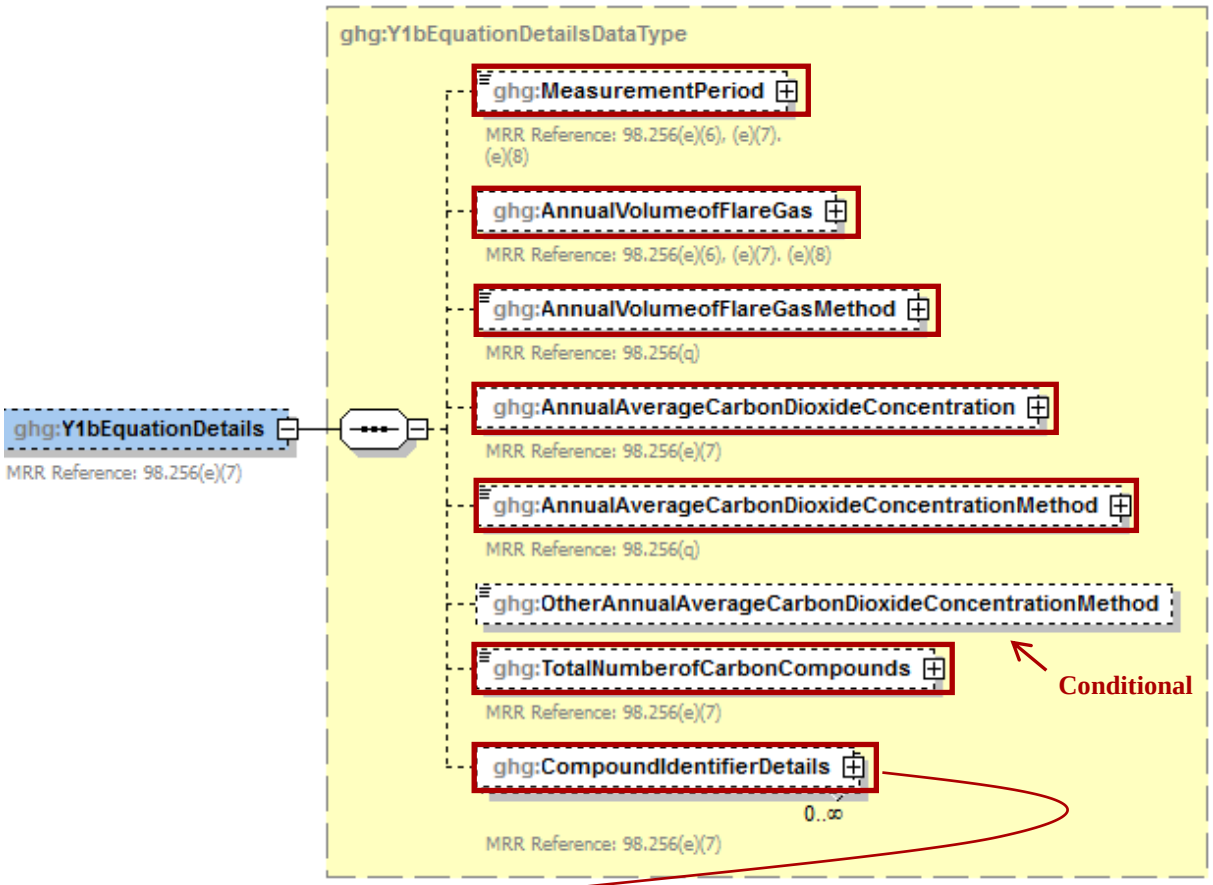
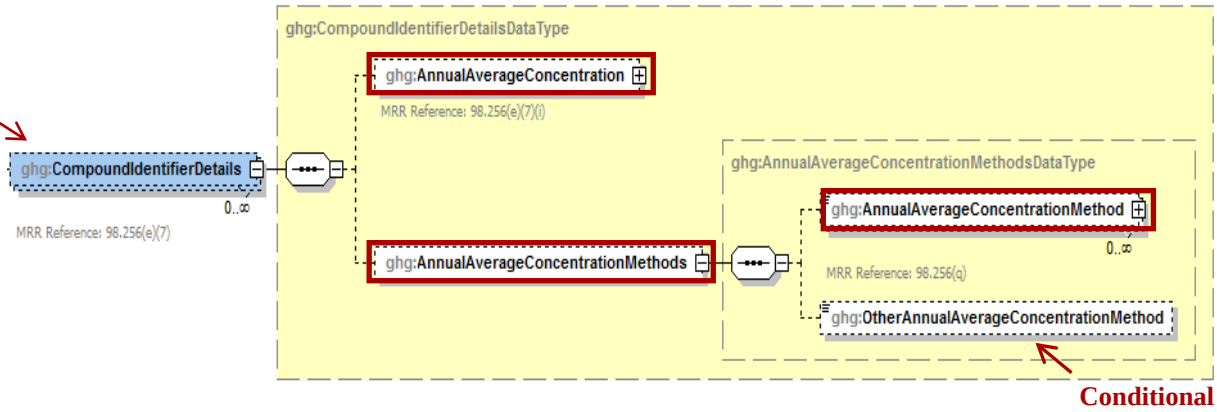


Figure 32
Compound Identifier Details Schema Diagram



To calculate the annual CO_2 emissions from flare units, you can download the Y-1b spreadsheet from the e-GGRT help site or use the following information:

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

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 68ºF and 14.7 psia or 836.6 scf/kg-mole at 60ºF and 14.7 psia).
0.001	=	Unit conversion factor (metric tons per kilogram, mt/kg).
(%CO2)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).
(%Cx)p	=	Mole percent concentration of compound "x" in the flare gas stream during the measurement period (mole percent = percent by volume)
CMNx	=	Carbon mole number of compound "x" in the flare gas stream (mole carbon atoms per mole compound). E.g., CMN for ethane (C2H6) is 2; CMN for propane (C3H8) is 3.

Table 13
Y1bEquationDetails XML Data Elements

Data Element Name	Description
Y1bEquationDetails	
MeasurementPeriod	An indication of whether daily or weekly measurement periods are used. [MRR Reference: 98.256(e)(6), (e)(7), and (e)(8)] Below is a list of the allowable values: Daily Weekly
AnnualVolumeofFlareGas	The annual volume of flare gas combusted (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual volume of flare gas combusted (NumberofTimesSubstituted). [MRR Reference: 98.256(e)(6), (e)(7), and (e)(8)]
AnnualVolumeofFlareGas.volUOM	Set as equal to "scf".
AnnualVolumeofFlareGasMethod	The specific consensus-based standard method or description of the procedure specified by the flow meter manufacturer. [MRR Reference: 98.256(q)]
AnnualAverageCarbonDioxideConcentration	The annual average CO_2 concentration in the flare gas stream (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual average CO_2 concentration in the flare gas stream (NumberofTimesSubstituted). [MRR Reference: 98.256(e)(7)].
AnnualAverageCarbonDioxideConcentration. concentrationUOM	Set as equal to "percent by volume or mole".
AnnualAverageCarbonDioxideConcentration Method	The method used to determine the annual average CO_2 concentration in the flare gas. Below is the list of allowable values. Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAnnualAverageCarbonDioxideConcentration Method	Specify the method used to determine the annual average CO_2 concentration in the flare gas if not listed above.
TotalNumberofCarbonCompounds	The number of carbon containing compounds other than CO_2 in the flare gas stream (integer).

Data Element Name	Description
CompoundIdentifierDetails	A collection of data elements containing details about the carbon containing compounds, other than CO_2, in the flare gas stream.
AnnualAverageConcentration	The annual average concentration of the compound for each carbon containing compound, other than CO2, in the flare gas stream (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual average concentration of the compound (NumberofTimesSubstituted). [MRR Reference: 98.256(q)]
AnnualAverageConcentration•concentrationUOM	Set as equal to "percent by volume or mole".
AnnualAverageConcentrationMethods	
AnnualAverageConcentrationMethod	The method used to determine the annual average concentration of the carbon containing compound in the flare gas stream. [MRR Reference: 98.256(q)] Below is the list of allowable values. Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAnnualAverageConcentrationMethod	Specify the method used to determine the annual average concentration of the carbon containing compound in the flare gas stream if not listed above.

Figure 33
Sample XML Snippet for Equation Y-1b

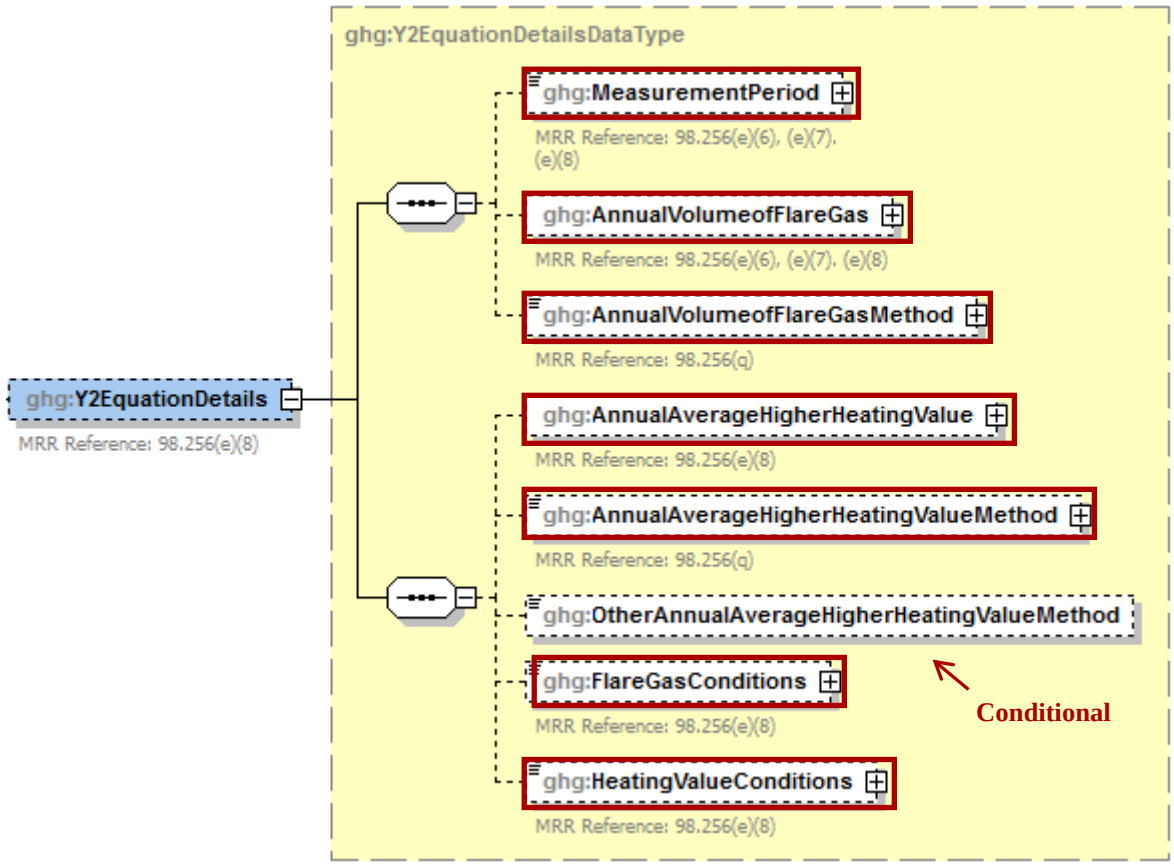
```
<ghg:Y1bEquationDetails>
        <ghg:MeasurementPeriod>Weekly</ghg:MeasurementPeriod>
        <ghg:AnnualVolumeofFlareGas volUOM="scf">
                <ghg:MeasureValue>2332</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
        </ghg:AnnualVolumeofFlareGas>
        <ghg:AnnualVolumeofFlareGasMethod>Method 123</ghg:AnnualVolumeofFlareGasMethod>
        <ghg:AnnualAverageCarbonDioxideConcentration concentrationUOM="percent by volume or mole">
                <ghg:MeasureValue>23</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>5</ghg:NumberofTimesSubstituted>
        </ghg:AnnualAverageCarbonDioxideConcentration>
        <ghg:AnnualAverageCarbonDioxideConcentration Method>UOP539-97</ghg:AnnualAverageCarbonDioxide ...Method>
        <ghg:TotalNumberofCarbonCompounds >12</ ghg:TotalNumberofCarbonCompounds>
        <ghg:CompoundIdentifierDetails>
                <ghg:AnnualAverageConcentration concentrationUOM="percent by volume or mole">
                        <ghg:MeasureValue>99</ghg:MeasureValue>
                        <ghg:NumberofTimesSubstituted>0</ghg:NumberofTimesSubstituted>
                          </ghg:AnnualAverageConcentration>
                <ghg:AnnualAverageConcentrationMethods>
                        <ghg:AnnualAverageConcentrationMethod>UOP539-97</ghg:AnnualAverageConcentrationMethod>
                          </ghg:AnnualAverageConcentrationMethods>
    </ghg:CompoundIdentifierDetails>
</ghg:Y1bEquationDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the details for Equation Y-1b. In some cases, an ellipse (…) was used to shorten the tag name in the sample data above. This was done merely to prevent the data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

3.1.3 Equation Y-2 Details, Heat Content Monitored

This topic provides a step-by-step description of how to report details about Equation Y-2. This method is used for calculating CO_2 emissions if you monitor heat content but do not monitor gas composition.

Figure 34
Equation Y-2 Details Schema Diagram



To calculate the annual CO_2 emissions from flare units, you can download the Y-1b spreadsheet from the e-GGRT help site or use the following information:

$$CO_2 = 0.98 \times 0.001 \times \sum_{p=1}^{n} \left[Flare_p \times HHV_p \times EmF \right]$$

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).
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 (million (MM) scf/period). If a mass flow meter is used, you must also measure molecular weight and convert the mass flow to a volumetric flow as follows: Flare[MMscf] = 0.000001 × Flare[kg] × MVC/(MW)p, where MVC is the molar volume conversion factor [849.5 scf/kg-mole at 68 ºF and 14.7 psia or 836.6 scf/kg-mole at 60 ºF and 14.7 psia depending on the standard conditions used when determining (HHV)p] and (MW)p is the average molecular weight of the flare gas combusted during measurement period (kg/kg-mole).

(HHV)p = Higher heating value for the flare gas combusted during measurement period (British thermal units per scf, Btu/scf = MMBtu/MMscf). If measurements are taken more frequently than daily, use the arithmetic average of measurement values within the day to calculate a daily average.

EmF = Default CO_2 emission factor of 60 kilograms CO_2/MMBtu (HHV basis).

Table 14
Y2EquationDetails XML Data Elements

Data Element Name	Description
Y2EquationDetails	
MeasurementPeriod	An indication of whether daily or weekly measurement periods are used. [MRR Reference: 98.256(e)(6), (e)(7), and (e)(8)] Below is a list of the allowable values. Daily Weekly
AnnualVolumeofFlareGas	The annual volume of flare gas combusted (MeasureValue). Also report the number of days that missing data procedures were used in measuring the annual volume of flare gas combusted (NumberofTimesSubstituted). [MRR Reference: 98.256(e)(6), (e)(7), and (e)(8)]
AnnualVolumeofFlareGas.volUOM	Set as equal to "MMscf".
AnnualVolumeofFlareGasMethod	The specific consensus-based standard method or description of the procedure specified by the flow meter manufacturer. [MRR Reference: 98.256(q)]

Data Element Name	Description
AnnualAverageHigherHeatingValue	The annual average higher heating value of the flare gas combusted (MeasureValue). Also report the number of days that missing data procedures were used (NumberofTimesSubstituted). [MRR Reference: 98.256(e)(8)]
AnnualAverageHigherHeatingValue.heatUOM	Set as equal to "MMBtu/MMscf".
AnnualAverageHigherHeatingValueMethod	The method used to determine the annual average higher heating value of the flare gas. Below is a list of allowable values. MRR Reference: 98.256(q). ASTM D4809-06 ASTM D240-02 (Reapproved 2007) ASTM D1826-94 (Reapproved 2003) ASTM D3588-98 (Reapproved 2003) ASTM D4891-89 (Reapproved 2006) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAnnualAverageHigherHeatingValueMethod	Specify the method used to determine the annual average higher heating value of the flare gas if not listed above.
FlareGasConditions	The conditions on which the annual volume of flare gas combusted was determined. [MRR Reference: 98.256(e)(8)] Below is the list of allowable values. 68 °F and 14.7 psia 60 ºF and 14.7 psia
HeatingValueConditions	The conditions on which the annual average higher heating value of the flare gas stream was determined. [MRR Reference: 98.256(e)(8)] Below is the list of allowable values. 68 °F and 14.7 psia 60 ºF and 14.7 psia

Figure 35
Sample XML Snippet for Equation Y-2

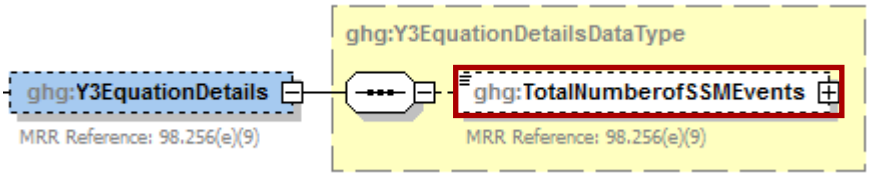
```
<ghg:Y2EquationDetails>
    <ghg:MeasurementPeriod>Daily</ghg:MeasurementPeriod>
    <ghg:AnnualVolumeofFlareGas volUOM="MMscf">
                <ghg:MeasureValue>2332</ghg:MeasureValue>
                <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
    </ghg:AnnualVolumeofFlareGas>
    <ghg:AnnualVolumeofFlareGasMethod>specific consensus-based method 123</ghg:AnnualVolumeofFlareGasMethod>
    <ghg:AnnualAverageHigherHeatingValue heatUOM="MMBtu/MMscf">
                 <ghg:MeasureValue>25</ghg:MeasureValue>
                 <ghg:NumberofTimesSubstituted>24</ghg:NumberofTimesSubstituted>
    </ghg:AnnualAverageHigherHeatingValue>
    <ghg: AnnualAverageHigherHeatingValueMethod>ASTM D4809-06</ghg:AnnualAverageHigherHeatingValueMethod>
    <ghg:FlareGasConditions >68 °F and 14.7 psia</ghg:FlareGasConditions >
    <ghg:HeatingValueConditions >60 ºF and 14.7 psia</ghg:HeatingValueConditions>
</ghg:Y2EquationDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the details for Equation Y2.

3.1.4 Equation Y-3 Details, Start-up, Shutdown, Malfunction

This topic provides a step-by-step description of how to report details about Equation Y-3. This method is used for calculating CO_2 emissions if you do not monitor gas composition nor measure the higher heating value or carbon content of the flare gas at least weekly.

Figure 36
Equation Y-3 Summary and Result



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

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).
FlareNorm=		Annual volume of flare gas combusted during normal operations from company records, (million (MM) standard cubic feet per year, MMscf/year).
HHV	=	Higher heating value for fuel gas or flare gas from company records (British thermal units per scf, Btu/scf = MMBtu/MMscf).
EmF	=	Default CO_2 emission factor for flare gas of 60 kilograms CO2/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).
(FlareSSM)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 ºF and 14.7 psia or 836.6 scf/kg-mole at 60 ºF 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).

Table 15
Y3EquationDetails XML Data Elements

Y3EquationDetails	
TotalNumberofSSMEvents	The total number of start-up, shutdown, or malfunction (SSM) events exceeding 500,000 scf/day (integer). MRR Reference: 98.256(e)(9).

Figure 37
Sample XML Snippet for Equation Y-3

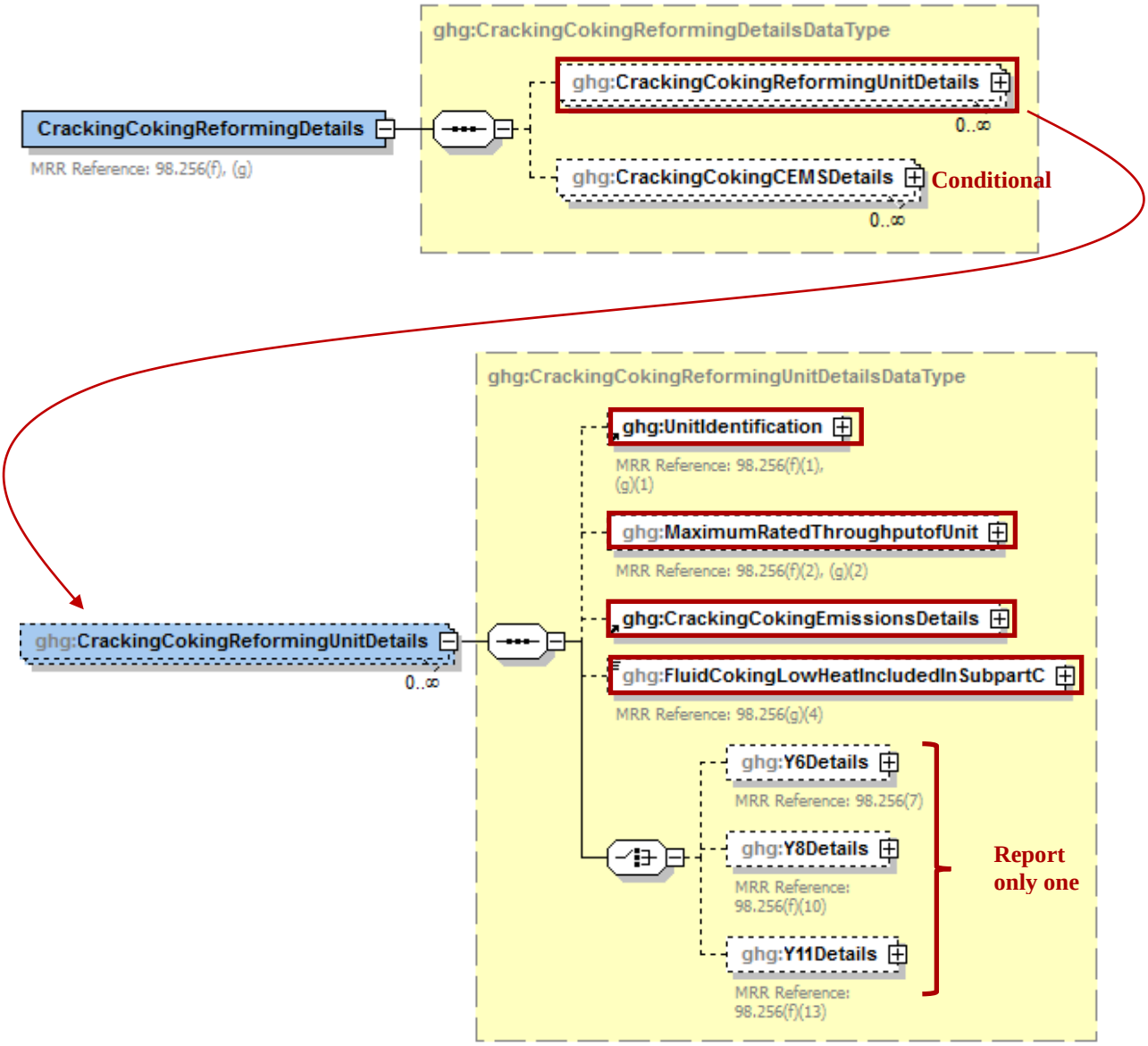
```
<ghg:Y3EquationDetails>
        <ghg:TotalNumberofSSMEvents>15</ghg:TotalNumberofSSMEvents>
</ghg:Y3EquationDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the details for Equation Y-3.

3.2 Catalytic Cracking, Fluid Coking, and Catalytic Reforming Unit Information

This topic provides a step-by-step description of how to report Catalytic Cracking, Fluid Coking, or Catalytic Reforming unit information for each facility. You must report CO2, CH4, and N_2O coke burn-off emissions from each catalytic cracking unit, fluid coking unit, and catalytic reforming unit under this subpart.

Figure 38
Cracking Coking Reforming (Non-CEMS) Unit Details Schema Diagram



You are required to report the following data about your Catalytic Cracking, Fluid Coking, or Catalytic Reforming (non-CEMS) unit:

- A unique name or identifier, plus an optional description for this unit (see also About Unique Unit Names).

- The type of unit.
  - Fluid Catalytic Cracking Unit
  - Thermal Catalytic Cracking Unit
  - Traditional Fluid Coking Unit
  - Catalytic Reforming Unit
  - Fluid Coking Unit with Flexicoking Design

- The maximum rated throughput of the fluid catalytic cracking unit (bbl per stream day).

  The calculated CO_2, CH_4, and N_2O annual emissions for each unit. For more information, see Figure 40, "Cracking Coking Emissions Details Schema Diagram".

- The methods used to calculate CO_2, CH_4, and N_2O annual emissions for each unit. **Note:** These methods do not apply to Fluid Coking Units with flexicoking design having GHG emissions accounted for in Subpart C.

- The basis of the unit-specific emission factors used for CH_4 or N_2O (if applicable).

- An indication of whether the GHG emissions from the low heat value gas are accounted for in data element "**YTier4CEMSDetails"** (Subpart C) of this subpart.

- Details about the methods used to calculate the CO_2 emissions. For more information, see the applicable section:
  - Y6Details
  - Y8Details
  - Y11Details

Table 16
Cracking Coking Reforming Unit XML Data Elements

Data Element Name	Description
CrackingCokingReformingUnitDetails	
UnitIdentification	A collection of data elements containing the identity of each non-CEMS cracking coking or reforming unit. It includes the unit name, an optional description, and a code representing the type of unit. [MRR Reference: 98.256(f)(1) & (2)] Report one of the following unit types: Fluid Catalytic Cracking Unit Thermal Catalytic Cracking Unit Traditional Fluid Coking Unit Catalytic Reforming Unit Fluid Coking Unit with Flexicoking Design
MaximumRatedThroughputofUnit	The maximum rated throughput of the unit (MeasureValue). [MRR Reference: 98.256(f)(3) & (g)(3)] **Note**: Report the measured value in terms of bbl per stream day.

(cont.)

Table 16
Cracking Coking Reforming XML Data Elements (cont.)

Data Element Name	Description
CrackingCokingEmissionsDetails	See Figure 40, Cracking Coking Emissions Details Schema Diagram.
FluidCokingLowHeatIncludedInSubpartC	An indication (Y/N) of whether the GHG emissions from the low heat value gas are accounted for in data element YTier4CEMSDetails of this subpart or §98.253(c) for each fluid coking unit of the flexicoking type. Report "Y" for yes or "N" for no.
Y6Details	See Table 18, Equation Y-6 Details XML Data Elements.
Y8Details	See Table 21, Equation Y-8 Details XML Data Elements.
Y11Details	See Table 22, Equation Y-11 Details XML Data Elements.

Figure 39
Sample XML Snippet for Cracking Coking Reforming Unit Details

```
<ghg:CrackingCokingReformingUnitDetails>
    <ghg:UnitIdentification>
        <ghg:UnitName>CCU-001</ghg:UnitName>
        <ghg:UnitDescription>Unit located in building 2.</ghg:UnitDescription>
        <ghg:UnitType>Fluid Coking Unit with Flexicoking Design</ghg:UnitType>
    </ghg:UnitIdentification>
    <ghg:MaximumRatedThroughputofUnit volUOM="bbl/streamday">
        <ghg:MeasureValue>446</ghg:MeasureValue>
    </ghg:MaximumRatedThroughputofUnit>
    <ghg:CrackingCokingEmissionsDetails>

        (see snippet for "Cracking Coking Reforming Emissions")

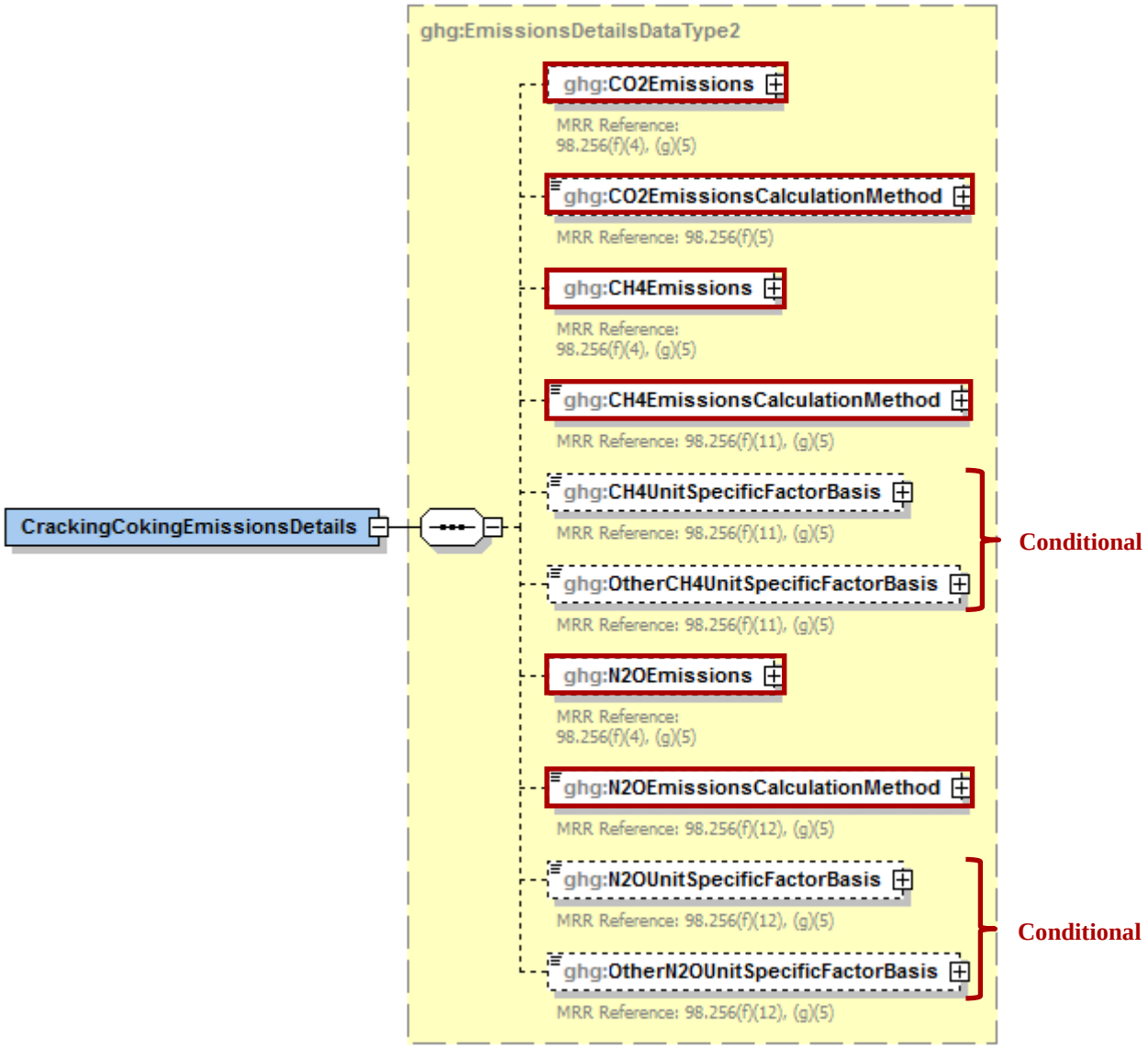
    </ghg:CrackingCokingEmissionsDetails>
    <ghg:FluidCokingLowHeatIncludedInSubpartC>N</ghg:FluidCokingLowHeatIncludedInSubpartC>

        (see snippets for "Equation Y-6 Details", "Equation Y-8 Details", and "Equation Y-11 Details")

</ghg:CrackingCokingReformingUnitDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for catalytic cracking, or fluid coking, or catalytic reforming units.

Figure 40
Cracking Coking Emissions Details Schema Diagram



Subpart Y collects the following data about your catalytic cracking, or fluid coking, and catalytic reforming unit emissions:

- The calculated CO_2, CH_4, and N_2O annual emissions for each flare, expressed in metric tons of each GHG emitted. To report annual CO_2 emissions, follow the instructions that correspond to the calculation method reported. (See applicable section in this document: Equation Y-1a Details, Equation Y-1b Details, Equation Y-2 Details, or Equation Y-3 Details).

- Method used to calculate the CO_2 emissions.

    - 98.253(c)(2) - Equation Y-6 and continuous monitor for flow (but not meeting the CEMS monitoring requirements of 98.253(c)(1); e.g., not meeting the full CEMS quality assurance requirements)

    - 98.253(c)(2) - Equation Y-6 and Y-7a

- 98.253(c)(2) - Equation Y-6 and Y-7b
- 98.253(c)(3) - Equation Y-8 [Option appears only for Catalytic Cracking or Coking units; available only for catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day (bbls/streamday) or less that do not use a continuous CO_2 CEMS for the final exhaust stack)]
- 98.253(e)(3) - Equation Y-11 [Option appears only for Catalytic Reforming units]

- Method used to calculate CH_4 emissions.
  - Unit-specific measurement data
  - Unit-specific emissions factor based on a source test of the unit
  - Equation Y-9 with a default emission factor
  - Equation Y-10 with a default emission factor

- Method used to calculate N_2O emissions.
  - Unit-specific measurement data
  - Unit-specific emissions factor based on a source test of the unit
  - Equation Y-9 with a default emission factor
  - Equation Y-10 with a default emission factor

- The basis for each unit-specific emissions factor based on a source test of the unit that is used to calculate CH_4 and N_2O emissions, if reported.
  - Weekly or more frequent measurements
  - Periodic (less frequent than weekly) measurements
  - Average of multiple source tests
  - One-time source test
  - Other (specify)

Table 17
Cracking Coking Reforming Emissions XML Data Elements

Data Element Name	Description
CrackingCokingEmissionsDetails	.
CO2Emissions	Calculated CO_2 annual emissions for each unit.
CO2Emissions.massUOM	Set as equal to "Metric Tons".
CO2EmissionsCalculationMethod	The method used to calculate the CO_2 emissions for each flare (e.g., reference section and equation number). Below is the list of allowable values. CEMS - 98.253(c)(1) Equation Y-6 and Y-7a - 98.253(c)(2) Equation Y-6 and Y-7b - 98.253(c)(2) Equation Y-6 and continuous monitor for flow - 98.253(c)(2) Equation Y-8 - 98.253(c)(3) Equation Y-11 - 98.253(e)(3)
CH4Emissions	Calculated CH_4 annual emissions for each unit.

(cont.)

Table 17
Cracking Coking Reforming Emissions XML Data Elements (cont.)

Data Element Name	Description
CH4Emissions.massUOM	Set as equal to "Metric Tons".
CH4EmissionsCalculationMethod	The method used to calculate the CO_2 emissions for each flare (e.g., reference section and equation number). Below is the list of allowable values. Unit-specific measurement data Unit-specific emissions factor based on a source test of the unit Equation Y-9 with a default emission factor Equation Y-10 with a default emission factor
CH4UnitSpecificFactorBasis	The basis for the unit-specific emission factor used to determine CH_4 annual emissions if the emission factor was based on a source test of the unit. Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify)
OtherN2OUnitSpecificFactorBasis	The basis for the unit-specific emission factor used to determine CH_4 emissions if not referenced in the list of allowable basis values.
N2OEmissions	Annual N_2O emissions for each flare.
N2OEmissions.massUOM	Set as equal to "Metric Tons".
N2OEmissionsCalculationMethod	The method used to calculate the N_2O emissions for each flare (e.g., reference section and equation number). Below is the list of allowable values. Unit-specific measurement data Unit-specific emissions factor based on a source test of the unit Equation Y-9 with a default emission factor Equation Y-10 with a default emission factor
N2OUnitSpecificFactorBasis	The basis for the unit-specific emission factor used to determine N_2O annual emissions if the emission factor was based on a source test of the unit. Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify)
OtherN2OUnitSpecificFactorBasis	The basis for the unit-specific emission factor used to determine N_2O emissions if not referenced in the list of allowable basis values.

Figure 41
Sample XML Snippet for Cracking Coking Emissions

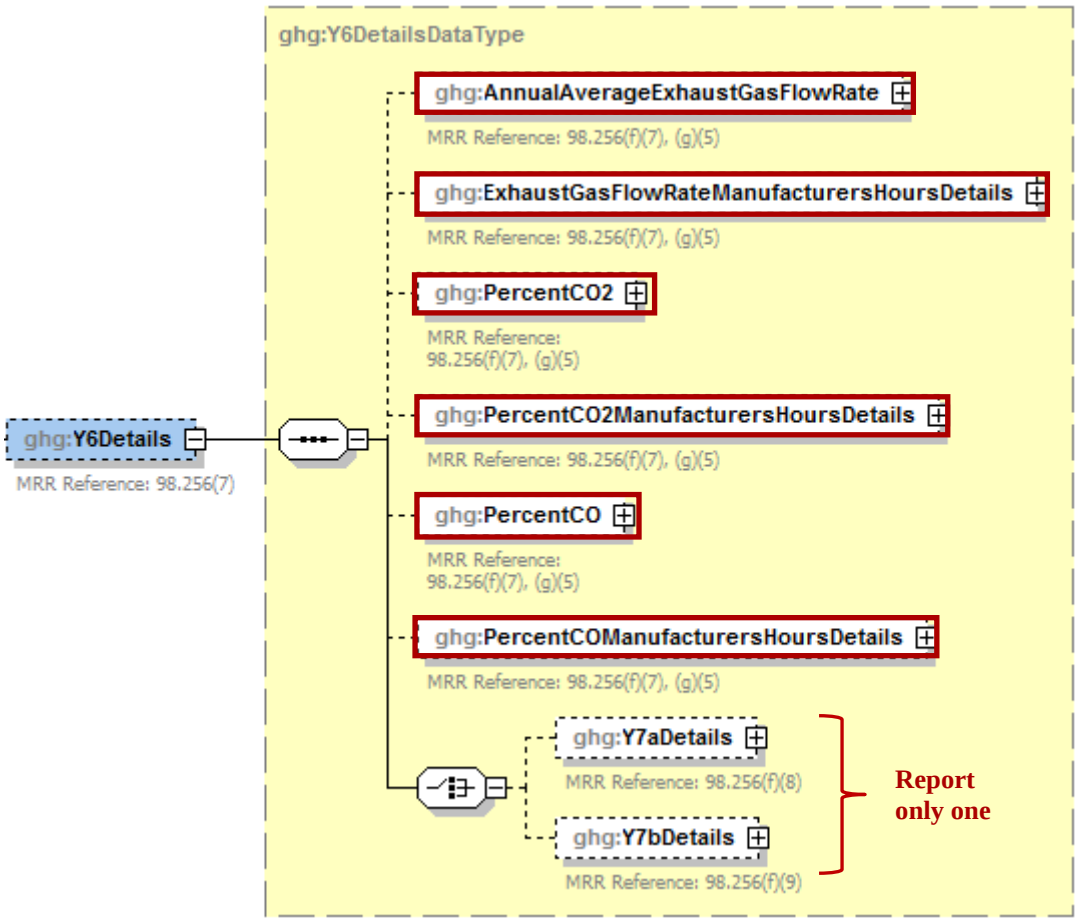
```
<ghg:CrackingCokingEmissionsDetails>
    <ghg:CO2Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>4322.6</ghg:CalculatedValue>
    </ghg:CO2Emissions>
    <ghg:CO2EmissionsCalculationMethod> Equation Y-6 and Y-7a - 98.253(c)(2)</ghg:CO2EmissionsCalculationMethod>
    <ghg:CH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>2342.88</ghg:CalculatedValue>
    </ghg:CH4Emissions>
    <ghg:CH4EmissionsCalculationMethod>Equation Y-9 with a default emission factor</ghg:CH4EmissionsCalculationMethod>
    <ghg:N2OEmissions massUOM="Metric Tons">
        <ghg:CalculatedValue>2221.234</ghg:CalculatedValue>
    </ghg:N2OEmissions>
    <ghg:N2OEmissionsCalculationMethod>Unit-specific emission factor based on a source test of the unit</ghg:N2OEmissions…>
    <ghg:N2OUnitSpecificFactorBasis>Other (specify)</ghg:N2OUnitSpecificFactorBasis>
    <ghg:OtherN2OUnitSpecificFactorBasis>Bi-weekly</ghg:OtherN2OUnitSpecificFactorBasis>
</ghg:CrackingCokingEmissionsDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting CO2, CH4, and N_2O emissions for a fluid coking unit with flexicoking design. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

3.2.1 Equation Y-6 Details

This topic provides a step-by-step description of how to report details about the method used to calculate CO_2 emissions from catalytic cracking units and fluid coking units with rated capacities greater than 10,000 barrels per stream day that do not use a continuous CO_2 CEMS for the final exhaust stack. This topic also applies to reporting CO_2 emissions from catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day or less that do not use a continuous CO_2 CEMS for the final exhaust stack, but that monitor at least daily the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack from the catalytic cracking unit regenerator or fluid coking unit burner prior to the combustion of other fossil fuels.

Figure 42
Equation Y-6 Details Schema Diagram



Method 1: 98.253(c)(2) - Equation Y-6 and continuous monitor for flow

If you continuously monitored the volumetric flow rate of exhaust gas from the fluid catalytic cracking unit regenerator or fluid coking unit burner prior to the combustion of other fossil fuels, you are required to report the following:

- Annual average volumetric flow rate of exhaust gas from the unit prior to the combustion of other fossil fuels (dscf/hour), and the number of hours that missing data procedures were used, if any. (If using Equation Y-7a or Y-7b, replace this value with the result of the equation.)

- A description of the manufacturer's recommended methods used to determine the following:
  - Annual average volumetric flow rate of exhaust gas
  - Hourly average percentage of CO_2 concentration in the exhaust gas stream
  - Hourly average percentage of CO concentration in the exhaust gas stream, if applicable.
- Hourly average percentage of CO_2 concentration (and CO, if applicable) in the exhaust gas stream from the unit (percent by volume – dry basis). Also report the number of hours that missing data procedures were used, if any.

Table 18
Equation Y-6 Details XML Data Elements

Data Element Name	Description
Y6Details	
AnnualAverageExhaustGasFlowRate	The annual average volumetric flow rate of exhaust gas from the fluid catalytic cracking unit prior to the combustion of other fossil fuels. Also report the number of hours that missing data procedures were used for the annual average volumetric flow rate of exhaust gas. [MRR Reference: 98.256(f)(7), (g)(5)]
AnnualAverageExhaustGasFlowRate.rateUOM	Set as equal to "dscf/hour".
ExhaustGasFlowRateManufacturersHoursDetails	
ManufacturersMethod	Specify the manufacturer's recommended method that was used to determine the annual average volumetric flow rate of exhaust gas. MRR Reference: 98.256(q).
PercentCO2	The annual average percent of CO_2 in the exhaust gas stream. MRR Reference: 98.256(f)(7), (g)(5)
PercentCO2ManufacturersHoursDetails	
ManufacturersMethod	Specify the manufacturer's recommended method that was used to determine the annual average percent of CO_2 in the exhaust gas stream. MRR Reference: 98.256(q).
PercentCO	The annual average percent of CO in the exhaust gas stream. MRR Reference: 98.256(f)(7), (g)(5)
PercentCOManufacturersHoursDetails	
ManufacturersMethod	Specify the manufacturer's recommended method that was used to determine the annual average percent of CO in the exhaust gas stream. MRR Reference: 98.256(q).
Y7aDetails	See Table 19, "Equation Y-7a Details XML Data Elements"
Y7bDetails	See Table 20, "Equation Y-7b Details XML Data Elements"

Figure 43
Sample XML Snippet for Equation Y-6

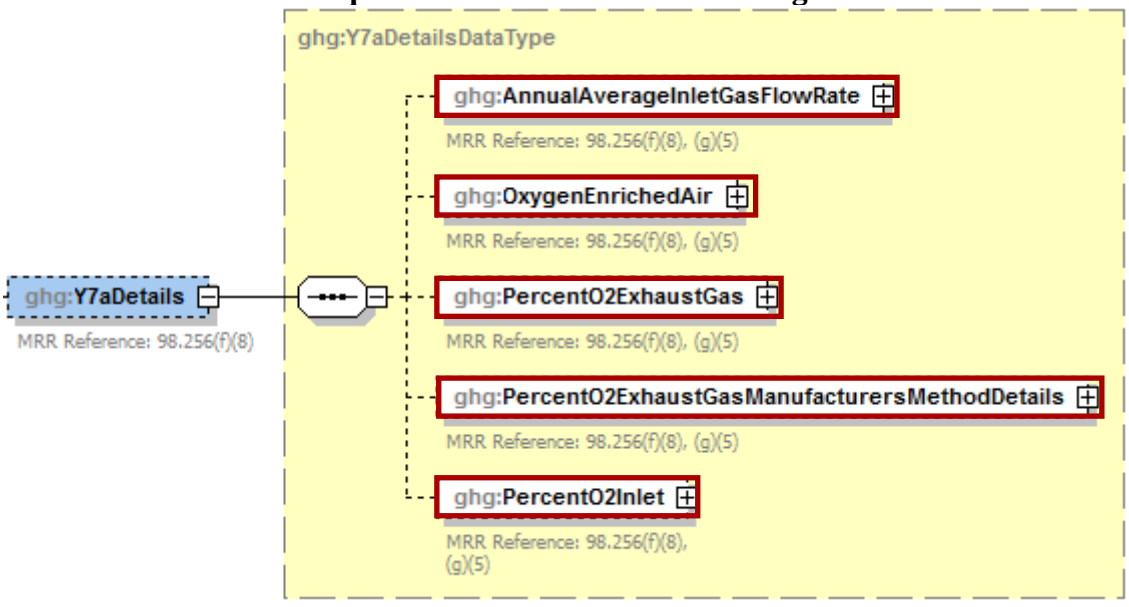
```
<ghg:Y6Details>
    <ghg:AnnualAverageExhaustGasFlowRate rateUOM="dscf/hour">
        <ghg:MeasureValue>232</ghg:MeasureValue>
        <ghg:NumberofTimesSubstituted>65</ghg:NumberofTimesSubstituted>
    </ghg:AnnualAverageExhaustGasFlowRate>
    <ghg:ExhaustGasFlowRateManufacturersHoursDetails>
        <ghg:ManufacturersMethod>Manufacturer's test method 1</ghg:ManufacturersMethod>
    </ghg:ExhaustGasFlowRateManufacturersHoursDetails>

    <ghg:PercentCO2 percentUOM="Number (between 0 and 100)">
        <ghg:MeasureValue>67</ghg:MeasureValue>
        <ghg:NumberofTimesSubstituted>67</ghg:NumberofTimesSubstituted>
    </ghg:PercentCO2>
    <ghg:PercentCO2ManufacturersHoursDetails>
        <ghg:ManufacturersMethod> Manufacturer's test method 2</ghg:ManufacturersMethod>
    </ghg:PercentCO2ManufacturersHoursDetails>

    <ghg:PercentCO percentUOM="Number (between 0 and 100)">
        <ghg:MeasureValue>2</ghg:MeasureValue>
        <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
    </ghg:PercentCO>
    <ghg:PercentCOManufacturersHoursDetails>
        <ghg:ManufacturersMethod> Manufacturer's test method 3</ghg:ManufacturersMethod>
    </ghg:PercentCOManufacturersHoursDetails>
</ghg:Y6Details>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for Equation Y-6.

Figure 44
Equation Y-7a Details Schema Diagram



Method 2: 98.253(c)(2) - Equation Y-6 and Equation Y-7a

If you calculated the volumetric flow rate of exhaust gas from the fluid catalytic cracking unit regenerator or fluid coking unit burner using Equation Y-7a, then report the following information, in addition to the items referenced under Method 1:

- Annual average volumetric flow rate of exhaust gas from the unit prior to the combustion of other fossil fuels (dscf/hour), including the number of hours that missing data procedures were used, if any. Report the output of Equation Y-7a in lieu of the value measured using a continuous monitor, as described in Equation Y-6.

- Annual average volumetric flow rate of air and oxygen-enriched air inlet to the unit, as determined from control room instrumentation (dscf/hour).

- Hourly average percentage of O_2 concentration in the oxygen-enriched gas stream inlet to the unit based on oxygen purity specifications of the oxygen supply used for enrichment (percent by volume – dry basis).

- Description of the manufacturer's recommended method used to determine the hourly average percentage of O_2 concentration in the exhaust gas stream, if applicable.

- O_2 concentration in the oxygen-enriched gas stream inlet to the unit based on oxygen purity specifications of the oxygen supply used for enrichment (percent by volume – dry basis).

Table 19
Equation Y-7a Details XML Data Elements

Data Element Name	Description
Y7aDetails	
AnnualAverageInletGasFlowRate	The annual average flow rate of inlet air. MRR Reference: 98.256(f)(8), (g)(5)
AnnualAverageInletGasFlowRate.rateUOM	Set as equal to "dscf/hour".
OxygenEnrichedAir	The annual average flow rate of oxygen-enriched air. MRR Reference: 98.256(f)(8), (g)(5)
OxygenEnrichedAir.rateUOM	Set as equal to "dscf/hour".
PercentO2ExhaustGas	The annual average percent of CO_2 in the exhaust gas stream. MRR Reference: 98.256(f)(8), (g)(5)
PercentO2ExhaustGas.percentUOM	Set as equal to "Number (between 0 and 100)".
PercentO2ExhaustGasManufacturersMethodDetails	
ManufacturersMethod	Specify the manufacturer's recommended method that was used to determine the annual average percent of O_2 in the oxygen-enriched gas stream inlet. MRR Reference: 98.256(q).
PercentO2Inlet	The annual average percent of O_2 in the oxygen-enriched gas stream inlet. MRR Reference: 98.256(f)(8), (g)(5)
PercentO2Inlet.percentUOM	Set as equal to "Number (between 0 and 100)".

Figure 45
Sample XML Snippet for Equation Y-7a

```
<ghg:Y7aDetails>
    <ghg:AnnualAverageInletGasFlowRate rateUOM="dscf/hour">
        <ghg:MeasureValue>45</ghg:MeasureValue>
    </ghg:AnnualAverageInletGasFlowRate>

    <ghg:OxygenEnrichedAir rateUOM="dscf/hour">
        <ghg:MeasureValue>35</ghg:MeasureValue>
    </ghg:OxygenEnrichedAir>

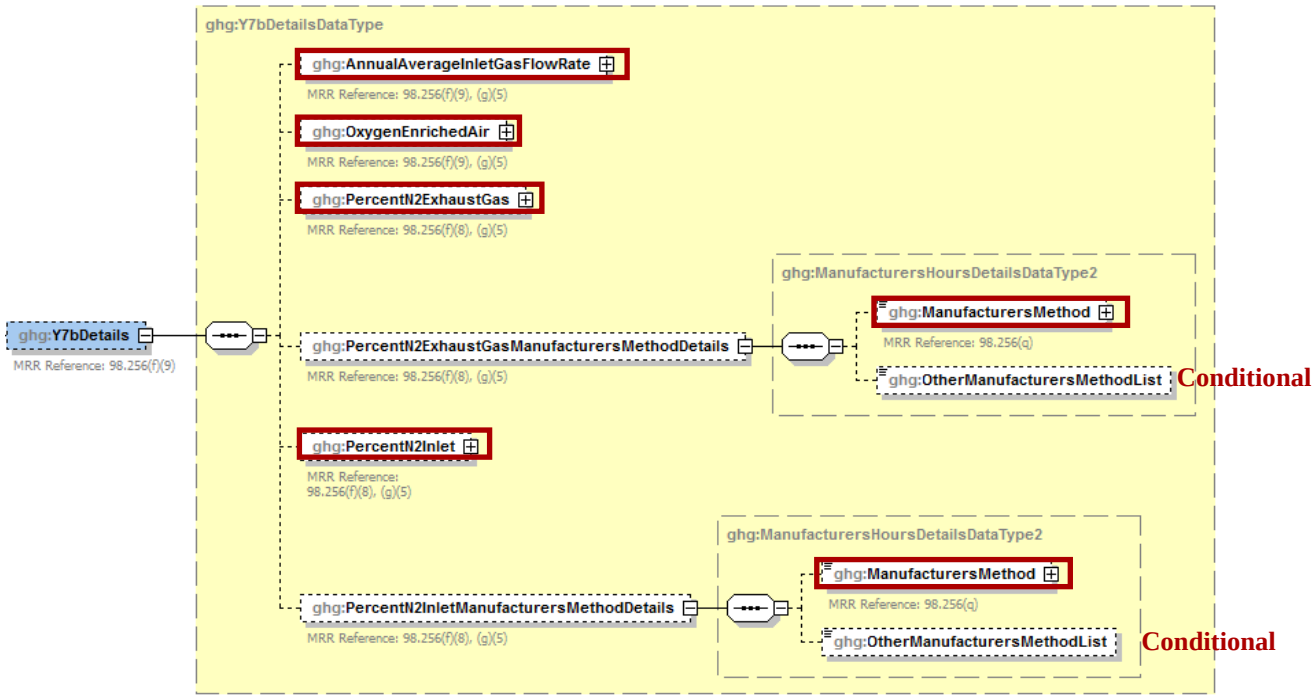
    <ghg:PercentO2ExhaustGas percentUOM="Number (between 0 and 100)">
        <ghg:MeasureValue>75</ghg:MeasureValue>
        <ghg:NumberofTimesSubstituted>0</ghg:NumberofTimesSubstituted>
    </ghg:PercentO2ExhaustGas>

    <ghg:PercentO2ExhaustGasManufacturersMethodDetails>
        <ghg:ManufacturersMethod>Test Method 3</ghg:ManufacturersMethod>
    </ghg:PercentO2ExhaustGasManufacturersMethodDetails>

    <ghg:PercentO2Inlet percentUOM="Number (between 0 and 100)">
        <ghg:MeasureValue>66</ghg:MeasureValue>
    </ghg:PercentO2Inlet>
</ghg:Y7aDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for Equation Y-7a. Extra lines were added for demonstration purposes only.

Figure 46
Equation Y-7b Details Schema Diagram



Method 3: 98.253(c)(2) - Equation Y-6 and Equation Y-7b

If you calculated the volumetric flow rate of exhaust gas from the fluid catalytic cracking unit regenerator or fluid coking unit burner using Equation Y-7b, then report the following information, in addition to the items referenced under Method 1 :

- Annual average volumetric flow rate of exhaust gas from the unit prior to the combustion of other fossil fuels (dscf/hour), including the number of hours that missing data procedures were used, if any. Report the output of Equation Y-7b in lieu of the value measured using a continuous monitor, as described in Equation Y-6.

- Annual average volumetric flow rate of air inlet to the unit, as determined from control room instrumentation (dscf/hour).

- Annual average volumetric flow rate of oxygen-enriched air inlet to the unit, as determined from control room instrumentation (dscf/hour).

- Hourly average percentage of N_2 concentration in the exhaust gas stream from the fluid catalytic cracking unit regenerator or fluid coking unit burner (percent by volume – dry basis).

- Description of the manufacturer's recommended method used to determine the hourly average percentage of N_2 concentration in the exhaust gas stream, if applicable.
    - Method 18 at 40 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90-Reapproved 2006
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92-Reapproved 2007
    - Chromatographic analysis: manufacturer's instructions
    - Maximum N2 impurity specification
    - Other (specify)

- N_2 concentration in the oxygen-enriched gas stream inlet to the unit based on oxygen purity specifications of the oxygen supply used for enrichment (percent by volume – dry basis).

- Description of the manufacturer's recommended method used to determine the N_2 concentration in the oxygen-enriched gas stream inlet to the unit, if applicable.
    - Method 18 at 40 CFR part 60, appendix A-6
    - ASTM D1945-03
    - ASTM D1946-90-Reapproved 2006
    - GPA 2261-00
    - UOP539-97
    - ASTM D2503-92-Reapproved 2007
    - Chromatographic analysis: manufacturer's instructions
    - Maximum N_2 impurity specification
    - Other (specify)

Table 20
Equation Y-7b Details XML Data Elements

Data Element Name	Description
Y7bDetails	
AnnualAverageInletGasFlowRate	The annual average flow rate of inlet air. MRR Reference: 98.256(f)(9), (g)(5)
AnnualAverageInletGasFlowRate.rateUOM	Set as equal to "dscf/hour".
OxygenEnrichedAir	The annual average flow rate of oxygen-enriched air. MRR Reference: 98.256(f)(9), (g)(5)
OxygenEnrichedAir.rateUOM	Set as equal to "dscf/hour".
PercentN2ExhaustGas	The annual average percent of N2 in the exhaust gas stream. MRR Reference: 98.256(f)(9), (g)(5)
PercentN2ExhaustGas.percentUOM	Set as equal to "Number (between 0 and 100)".
PercentN2ExhaustGasManufacturersMethodDetails	
ManufacturersMethod	Specify the method that was used to determine the annual average percent of N_2 in the exhaust gas stream. Below is the list of allowable values. MRR Reference: 98.256(q). Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Maximum N2 impurity specification Other (specify)
PercentN2Inlet	The annual average percent of N_2 in the oxygen-enriched gas stream inlet. MRR Reference: 98.256(f)(9), (g)(5)
PercentO2Inlet.percentUOM	Set as equal to "Number (between 0 and 100)".
PercentN2InletGasManufacturersMethodDetails	
ManufacturersMethod	Specify the method that was used to determine the annual average percent of N_2 in the oxygen-enriched gas stream inlet. Below is the list of allowable values. MRR Reference: 98.256(q). Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Maximum N2 impurity specification Other (specify)

Figure 47
Sample XML Snippet for Equation Y-7b

```
<ghg:Y7bDetails>
    <ghg:AnnualAverageInletGasFlowRate rateUOM="dscf/hour">
        <ghg:MeasureValue>564</ghg:MeasureValue>
    </ghg:AnnualAverageInletGasFlowRate>

    <ghg:OxygenEnrichedAir rateUOM="dscf/hour">
        <ghg:MeasureValue>345</ghg:MeasureValue>
    </ghg:OxygenEnrichedAir>

    <ghg:PercentN2ExhaustGas percentUOM="Number (between 0 and 100)">
        <ghg:MeasureValue>45</ghg:MeasureValue>
        <ghg:NumberofTimesSubstituted>3</ghg:NumberofTimesSubstituted>
    </ghg:PercentN2ExhaustGas>

    <ghg:PercentN2ExhaustGasManufacturersMethodDetails>
        <ghg:ManufacturersMethod>Method 18 at 40 CFR part 60, appendix A-6</ghg:ManufacturersMethod>
    </ghg:PercentN2ExhaustGasManufacturersMethodDetails>

    <ghg:PercentN2Inlet percentUOM="Number (between 0 and 100)">
        <ghg:MeasureValue>3</ghg:MeasureValue>
        <ghg:NumberofTimesSubstituted>70</ghg:NumberofTimesSubstituted>
    </ghg:PercentN2Inlet>

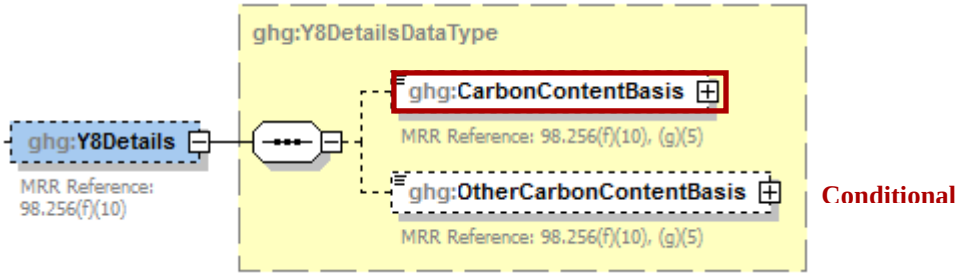
    <ghg:PercentN2InletManufacturersMethodDetails>
        <ghg:ManufacturersMethod>UOP539-97</ghg:ManufacturersMethod>
    </ghg:PercentN2InletManufacturersMethodDetails>
</ghg:Y7bDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for Equation Y-7b. Extra lines were added for demonstration purposes only.

3.2.2 Equation Y-8 Details

This topic provides a step-by-step description of how to report details about the method used to calculate CO_2 emissions from catalytic cracking units and fluid coking units with rated capacities of 10,000 barrels per stream day or less that do not use a continuous CO_2 CEMS for the final exhaust stack.

Figure 48
Equation Y-8 Details Schema Diagram



If you do not monitor at least daily the O_2, CO_2, and (if necessary) CO concentrations in the exhaust stack from the catalytic cracking unit regenerator or fluid coking unit burner prior to the combustion of other fossil fuels, calculate the CO_2 emissions from each catalytic cracking unit and fluid coking unit, use Equation Y-8.

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

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

Table 21
Equation Y-8 Details XML Data Elements

Data Element Name	Description
Y8Details	
CarbonContentBasis	The basis for the carbon content value. MRR Reference: 98.256(f)(10), (g)(5) Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly but at least quarterly) measurements Semi-annual or annual measurements Historical measurement value Engineering estimate Default value Other (specify)
OtherCarbonContentBasis	Specify the basis for the carbon content value if not referenced above. MRR Reference: 98.256(f)(10), (g)(5)

Figure 49
Sample XML Snippet for Equation Y-8

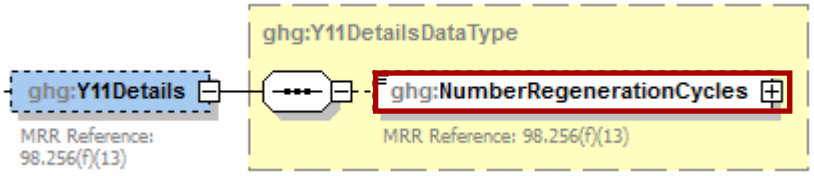
```
<ghg:Y8Details>
  <ghg:CarbonContentBasis>Other (specify)</ghg:CarbonContentBasis>
  <ghg:OtherCarbonContentBasis>Bi-weekly</ghg:OtherCarbonContentBasis>
</ghg:Y8Details>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for Equation Y-8.

3.2.3 Equation Y-11 Details

This topic provides a step-by-step description of how to report details about the method used to calculate CO_2 emissions from catalytic reforming catalyst regenerator units.

Figure 50
Equation Y-11 Details Schema Diagram



For this method you are required to report the total number of regeneration cycles and the average coke burn-off quantity per cycle or measurement period.

Table 22
Equation Y-11 XML Data Elements

Data Element Name	Description
Y11Details	
NumberRegenerationCycles	The total number of regeneration cycles or measurement periods in the calendar year. MRR Reference: 98.256(f)(13)
UnitIdentification	
UnitDescription (CrackingCokingReformingUnitDetails)	**Note:** The schema does not currently have a specific data element for reporting the average coke burn-off quantity. As a temporary workaround, please report your average coke burn-off quantity (kg coke / cycle or kg coke / measurement period) using the UnitDescription data element. This is required information. MRR Reference: 98.256(f)(13)

Figure 51
Sample XML Snippet for Equation Y-11

```
<ghg:CrackingCokingReformingUnitDetails>
      <ghg:UnitIdentification>
         <ghg:UnitName>cc-08</ghg:UnitName>
         <ghg:UnitDescription>average coke burn-off qty = 123 kg coke weekly</ghg:UnitDescription>
         <ghg:UnitType>Catalytic Reforming Unit</ghg:UnitType>
      </ghg:UnitIdentification>
                  ...

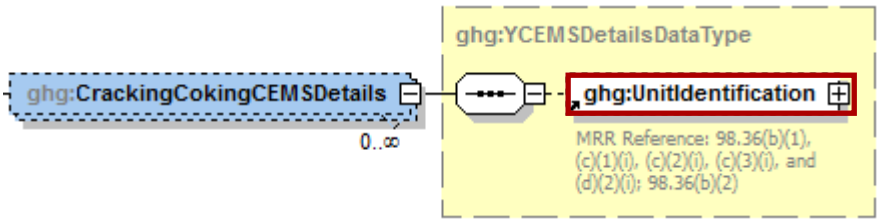
         <ghg:Y11Details>
         <ghg:NumberRegenerationCycles>3</ghg:NumberRegenerationCycles>
      </ghg:Y11Details>
</ghg:CrackingCokingReformingUnitDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for Equation Y-11 (Catalytic Reforming unit) including the average coke burn-off quantity.

3.2.4 Cracking Coking CEMS Details

For each catalytic cracking, fluid coking, and catalytic reforming unit that is monitored with a CEMS to measure CO_2 emissions, according to the guidelines specified in Subpart C, report the unit's identification information.

Figure 52
Cracking Coking CEMS Details Schema Diagram



In addition to reporting the identification of each catalytic reforming unit that is monitored with a CEMS, you must report the relevant information required under §98.36 for the Tier 4 Calculation Methodology. See instructions for reporting "YTier4CEMSDetails" in this document.

Table 23
Cracking Coking CEMS Details XML Data Elements

Data Element Name	Description
CrackingCokingCEMSDetails	
UnitIdentification	A collection of data elements containing the identity of each CEMS cracking coking or reforming unit. It includes the unit name, an optional description, and the type of unit. Report one of the following unit types: Fluid Catalytic Cracking Unit Thermal Catalytic Cracking Unit Traditional Fluid Coking Unit Catalytic Reforming Unit Fluid Coking Unit with Flexicoking Design

Figure 53
Sample XML Snippet for Cracking Coking CEMS Details

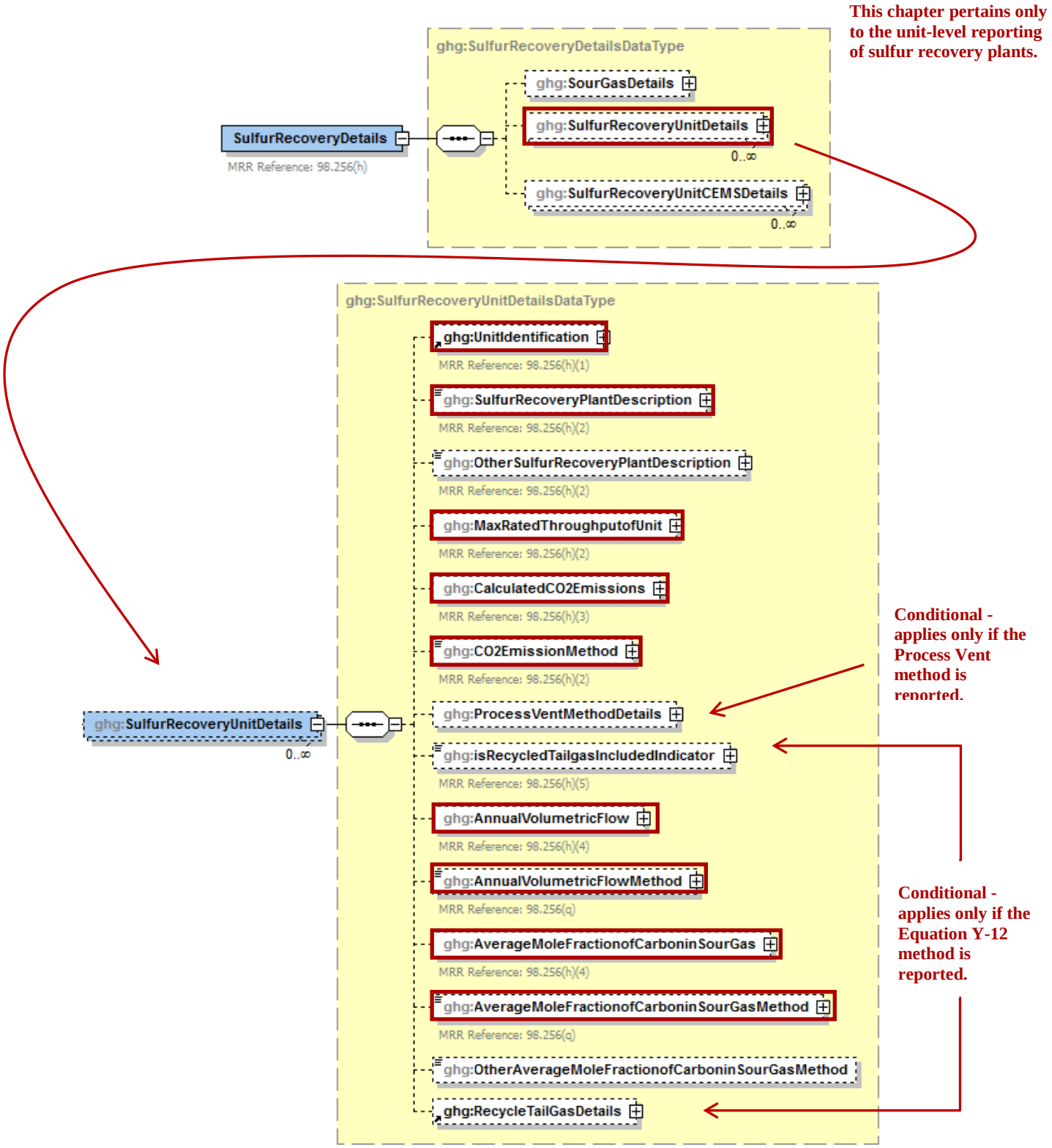
```
<CrackingCokingCEMSDetails>
      <UnitIdentification>
          <UnitName>CC-CEMS-001</UnitName>
          <UnitType>Fluid Catalytic Cracking Unit</UnitType>
      </UnitIdentification>
</CrackingCokingCEMSDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the identification of each catalytic reforming unit that is monitored with a CEMS.

3.3 Sulfur Recovery Plant Information

This topic provides a step-by-step description of how to report Sulfur Recovery Plant unit information for your facility. You are required to report CO_2 process emissions from each on-site sulfur recovery plant subject to this subpart.

Figure 54
Sulfur Recovery Details Schema Diagram



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

- A unique name or identifier, plus optional description for this sulfur recovery plant
- Type (description) of sulfur recovery plant:
    - Caustic scrubber
    - Claus
    - Lo-cat
    - Sulfuric acid plant
    - Other (specify)
- Maximum rated throughput of the sulfur recovery plant (metric tons sulfur per stream day)
- The calculated CO_2 annual emissions for each sulfur recovery plant, expressed in metric tons.
- Method used to calculate the CO_2 emissions. Specify either Equation Y-12 or Process Vent Method. For Claus Plants (that do not use a CEMS according to Subpart C,) Equation Y-12 must be used. For non-Claus plants (that do not use a CEMS according to Subpart C), either Equation Y-12 or the Process Vent Method may be used.
- Details about the Process Vent if that method is reported. (For more details, see Figure 13, "Process Vent Method Details".)
- An indication of whether the recycled flow rate and carbon content of recycled tail gas is included in the measured volumetric flow and carbon mole fraction data. If you do not recycle tail gas, please report 'N'. This only applies to reporters who use Equation Y-12 to calculate CO_2 emissions.
- An indication (Y/N) od whether a correction for CO_2 emissions in the tail gas is used. Note that per Section 98.253(f)(5), if tail gas is recycled to the front of the sulfur recovery plant and the recycled flow rate and carbon content is included in the measured data, then the annual CO_2 emissions must be corrected to avoid double counting these emissions. For more information, see Figure 58, **"**Recycle Tail Gas (Equation Y-12 Method) Details Schema Diagram".

Table 24
Sulfur Recovery Unit Details XML Data Elements

Data Element Name	Description
SulphurRecoveryUnitDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each non-CEMS sulfur recovery plant unit. It includes the unit name (UnitName), an optional description (UnitDescription), and the type of unit (UnitType). [MRR Reference: 98.256(h)(1)] Report the following unit type: Sulfur Recovery Plant
SulfurRecoveryPlantDescription	The type of sulfur recovery plant. Below is the list of allowable values. [MRR Reference: 98.256(h)(2)] Caustic scrubber Claus Lo-cat Sulfuric acid plant Other (specify)

Data Element Name	Description
OtherSulfurRecoveryPlantDescription	Specify the type of sulfur recovery plant you are reporting if your type is not listed above.
MaxRatedThroughputofUnit	Maximum rated throughput of each independent sulfur recovery plant. Report the measured value and unit of measure only. [MRR Reference: 98.256(h)(2)]
MaxRatedThroughputofUnit.rateUOM	Set as equal to "metric tons/streamday".
CalculatedCO2Emissions	The calculated CO_2 annual emissions for each sulfur recovery plant, expressed in metric tons. [MRR Reference: 98.256(h)(3)]
CalculatedCO2Emissions.massUOM	Set as equal to "Metric Tons"
CO2EmissionMethod	The method used to calculate CO_2 annual emissions for the sulfur recovery plant. Below is the list of allowable values. [MRR Reference: 98.256(h)(2)] CO2 CEMS Equation Y-12 Process Vent Method
ProcessVentMethodDetails	See Table 25, **"**Process Vent Method Details XML Data Elements**".**
isRecycledTailgasIncludedIndicator	If you recycle tail gas to the front of the sulfur recovery plant, specify (Y/N) whether the recycled flow rate and carbon content of recycled tail gas are included in the measured volumetric flow and carbon mole fraction data. (If you do not recycle tail gas, please report 'N'.) [MRR Reference: 98.256(h)(5)]
AnnualVolumetricFlow.NumberofTimesSubstituted	If you are using Equation Y-12, report the number of hours that missing data procedures were used to determine the annual volume of sour gas fed. [MRR Reference: 98.256(h)(4)]
AnnualVolumetricFlow.rateUOM	Set as equal to "dscf/hour". Note: Although the value of the annual volume of sour gas fed to the sulfur recovery plant is deferred for reporting year 2010, the rateUOM is required by the schema and must be reported.
AnnualVolumetricFlowMethod	If you are using Equation Y-12, report the specific consensus-based standard method or description of the procedure specified by the flow meter manufacturer to measure annual volume of sour gas fed. [MRR Reference: 98.256(q)]
AverageMoleFractionofCarboninSourGas. NumberofTimesSubstituted	If you are using Equation Y-12, report the number of hours that missing data procedures were used to determine the annual average mole fraction of carbon in the sour gas. [MRR Reference: 98.256(q)]

Data Element Name	Description
AverageMoleFractionofCarboninSourGas.fractionUOM	Set as equal to "kg-moleCF4/kg-molegas". Note: Although the value of the average mole fraction of carbon in sour gas is deferred for reporting year 2010, the fractionUOM is required by the schema and must be reported.
AverageMoleFractionofCarboninSourGasMethod	If you are using Equation Y-12, report the method used to measure the annual average mole fraction of carbon in the sour gas. Below is the list of allowable values. [MRR Reference: 98.256(q)] Method 18 at 40 CFR part 60, appendix A-6 ASTM D1945-03 ASTM D1946-90 (Reapproved 2006) GPA 2261-00 UOP539-97 ASTM D2503-92 (Reapproved 2007) Chromatographic analysis: manufacturer's instructions Other (specify)
OtherAverageMoleFractionofCarboninSourGasMethod	Method used to measure the annual average mole fraction of carbon in the sour gas if not listed above.
RecycleTailGasDetails	See Figure 58, **"**Recycle Tail Gas (Equation Y-12 Method) Details Schema Diagram**".**

Figure 55
Sample XML Snippet for Sulfur Recovery Units

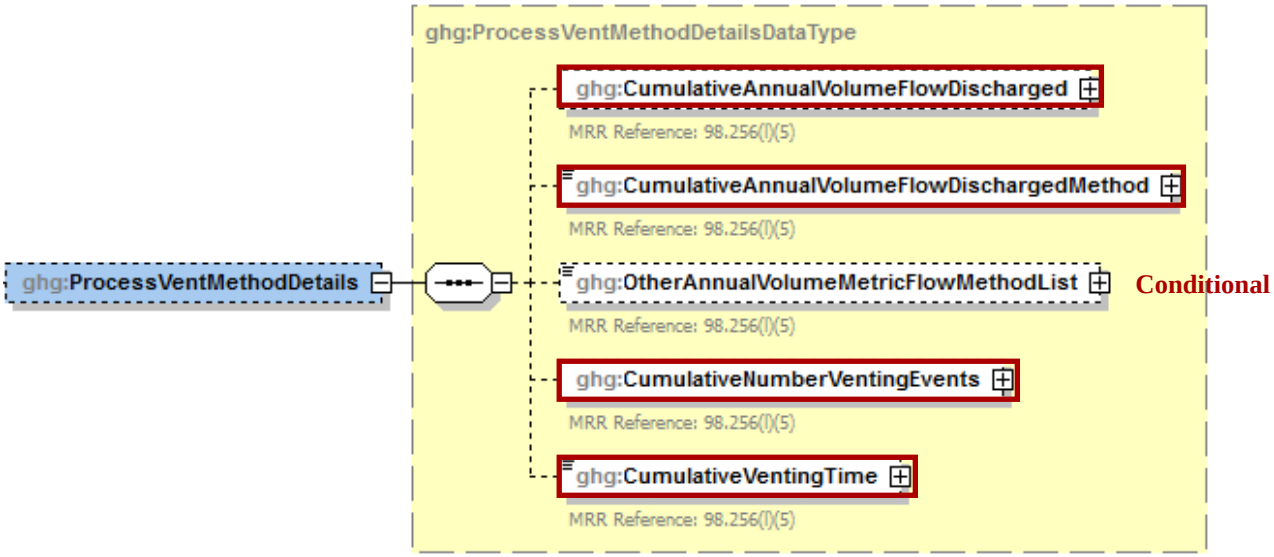
```
<ghg:SulfurRecoveryUnitDetails>
    <ghg:UnitIdentification>
        <ghg:UnitName>SR-NC-001</ghg:UnitName>
        <ghg:UnitDescription>Eastman Factory</ghg:UnitDescription>
        <ghg:UnitType>Sulfur Recovery Plant</ghg:UnitType>
    </ghg:UnitIdentification>
    <ghg:SulfurRecoveryPlantDescription>Caustic scrubber</ghg:SulfurRecoveryPlantDescription>
    <ghg:MaxRatedThroughputofUnit rateUOM="metric tons/streamday">
        <ghg:MeasureValue>23444</ghg:MeasureValue>
    </ghg:MaxRatedThroughputofUnit>
    <ghg:CalculatedCO2Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>45343</ghg:CalculatedValue>
    </ghg:CalculatedCO2Emissions>
    <ghg:CO2EmissionMethod>Equation Y-12</ghg:CO2EmissionMethod>
    <ghg:isRecycledTailgasIncludedIndicator>Y</ghg:isRecycledTailgasIncludedIndicator>
        <ghg:AnnualVolumetricFlow rateUOM="dscf/hour">
        <ghg:NumberofTimesSubstituted>51</ghg:NumberofTimesSubstituted>
    </ghg:AnnualVolumetricFlow>
    <ghg:AnnualVolumetricFlowMethod>Method A</ghg:AnnualVolumetricFlowMethod>
    <ghg:AverageMoleFractionofCarboninSourGas fractionUOM="kg-moleCF4/kg-molegas">
        <ghg:NumberofTimesSubstituted>15</ghg:NumberofTimesSubstituted>
    </ghg:AverageMoleFractionofCarboninSourGas>
    <ghg:AverageMoleFractionofCarboninSourGasMethod>ASTM D1946-90 (Reapproved 2006</ghg:AverageMole…>

                    … (See snippets for RecycleTailGasDetails and Process Vent Method Details)

</ghg:SulfurRecoveryUnitDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for sulfur recovery plant units. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Figure 56
Process Vent Method Details Schema Diagram



Subpart Y collects the following data regarding the Process Vent method:

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

Table 25
Process Vent Method Details XML Data Elements

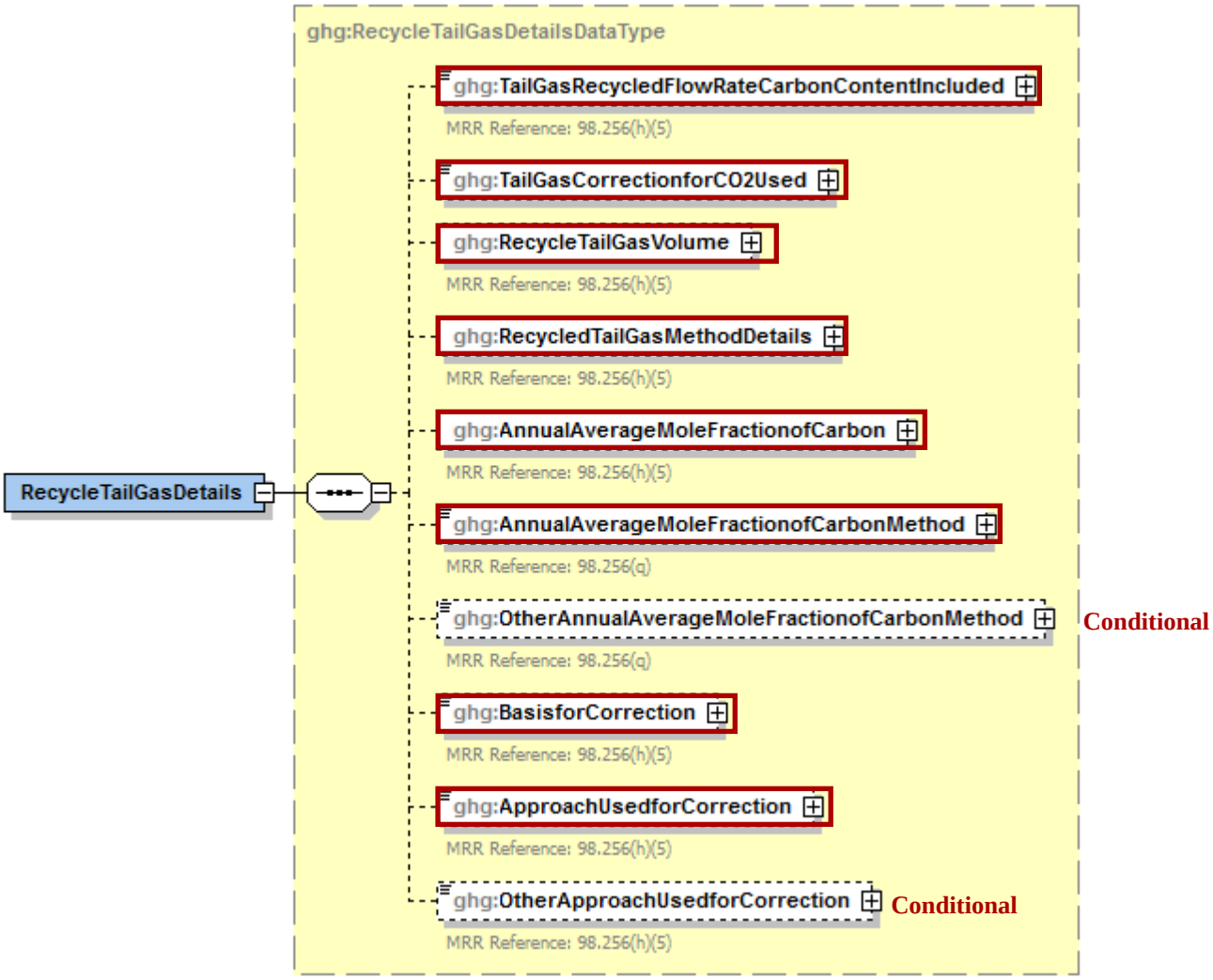
Data Element Name	Description
ProcessVentMethodDetails	
CumulativeAnnualVolumeFlowDischarged	The cumulative annual volumetric flow discharged to the atmosphere Report the measured value and unit of measure only. [MRR Reference: 98.256(l)(5)]
CumulativeAnnualVolumeFlowDischarged.volUOM	Set as equal to "scf".
CumulativeAnnualVolumeFlowDischargedMethod	The method used to measure or estimate the annual volumetric flow discharged to the atmosphere. Below is the list of allowable values. [MRR Reference: 98.256(l)(5)] Continuous or at least hourly measurements Routine (less frequent than hourly but at least weekly) measurements Periodic (less frequent than weekly) measurements Process knowledge Engineering calculation Other (specify)
OtherAnnualVolumeMetricFlowMethodList	Specify the method used to measure or estimate the annual volumetric flow discharged to the atmosphere if not listed above. [MRR Reference: 98.256(l)(5)]
CumulativeNumberVentingEvents	The number of cumulative venting events for all relevant vents, if vents are intermittent (not applicable for continuous venting). [MRR Reference: 98.256(l)(5)] **Note:** Specify only a count in the MeasureValue data element.
CumulativeVentingTime	The cumulative venting time for all relevant vents. [MRR Reference: 98.256(l)(5)]
CumulativeVentingTime.timeUOM	Set as equal to "Hours".

Figure 57
Sample XML Snippet for Process Vent Method Details

```
<ghg:ProcessVentMethodDetails>
    <ghg:CumulativeAnnualVolumeFlowDischarged volUOM="scf">
        <ghg:MeasureValue>123</ghg:MeasureValue>
    </ghg:CumulativeAnnualVolumeFlowDischarged>
    <ghg:CumulativeAnnualVolumeFlowDischargedMethod>Process knowledge</ghg:CumulativeAnnualVolumeFlowDischarg... >
    <ghg:OtherAnnualVolumeMetricFlowMethodList>ABC</ghg:OtherAnnualVolumeMetricFlowMethodList>
    <ghg:CumulativeNumberVentingEvents>
        <ghg:MeasureValue>25</ghg:MeasureValue>
    </ghg:CumulativeNumberVentingEvents>
    <ghg:CumulativeVentingTime timeUOM="Hours">187</ghg:CumulativeVentingTime>
</ghg:ProcessVentMethodDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for the process vent method if used to calculate CO_2 emissions for the sulfur recovery plant. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Figure 58
Recycle Tail Gas (Equation Y-12 Method) Details Schema Diagram



You are required to report the following details about the Recycled Tail Gas:

- Annual volume of recycled tail gas (report only if this value was not used to calculate the correction factor, in scf)
- If measured, method used to measure the annual volume of recycled tail gas
- If measured, number of hours missing data procedures were used for annual volume of recycled tail gas
- Annual average mole fraction of carbon in the tail gas (report only if this value was not used to calculate the correction factor, in kg-mole C/kg-mole gas)
- If measured, method used to measure the annual average mole fraction of carbon in the tail gas
- If measured, number of hours missing data procedures were used for annual average mole fraction of carbon in the sour gas

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

Table 26
Recycle Tail Gas Details XML Data Elements

Data Element Name	Description
RecycleTailGasDetails	
TailGasRecycledFlowRateCarbonContentIncluded	If you recycle tail gas to the front of the sulfur recovery plant, specify (Y/N) whether the recycled flow rate and carbon content of recycled tail gas are included in the measured volumetric flow and carbon mole fraction data. (If you do not recycle tail gas, please report 'N'.) [MRR Reference: 98.256(h)(5)]
TailGasCorrectionforCO2Used	An indication (Y/N) of whether a correction was used for CO_2 emissions is in the tail gas.
RecycleTailGasVolume	The annual volume of recycled tail gas (report only if this value was not used to calculate the correction factor.) [MRR Reference: 98.256(h)(5)]
RecycleTailGasVolume.volUOM	Set as equal to "scf".
RecycledTailGasMethodDetails	
RecycledTailGasMethod	If measured, the method used to measure the annual volume of recycled tail gas. Below is the list of allowable values. [MRR Reference: 98.256(h)(5)] Consensus based standard method Procedures specified by manufacturer Engineering estimates Company records Other (specify)
OtherRecycledTailGasMethod	Specify the method used to measure the annual average mole fraction of carbon in the tail gas if not listed above.

Data Element Name	Description
AnnualAverageMoleFractionofCarbon	The annual average mole fraction of carbon in the tail gas (report only if this value was not used to calculate the correction factor). Also report the number of hours that missing data procedures were used in determining the annual average mole fraction of carbon in the tail gas. [MRR Reference: 98.256(h)(5)]
AnnualAverageMoleFractionofCarbon.fractionUOM	Set as equal to "kg-moleCF4/kg-molegas". **Note:** The unit of measure value listed above contains a typo. The correct unit of measure is 'kg-mole C/kg-mole gas' but until this is corrected in the schema, please report as indicated above.
AnnualAverageMoleFractionofCarbonMethod	If measured, method used to measure the annual average mole fraction of carbon in the tail gas. Below is the list of allowable values. [MRR Reference: 98.256(h)(5)] Continuous composition monitor Routine (daily, weekly, or monthly) measurements Limited measurement data Engineering calculations Default value Other (specify)
OtherAnnualAverageMoleFractionofCarbonMethod	Specify the method used to measure the annual average mole fraction of carbon in the tail gas if not listed above.
BasisforCorrection	Correction factor used to calculated CO_2 emissions. Below is the list of allowable values. [MRR Reference: 98.256(q)] Default correction factor (95%) Unit-specific correction factor
ApproachUsedforCorrection	The approach used to determine the correction factor used to calculate the CO_2 emissions. Below is the list of allowable values. [MRR Reference: 98.256(h)(5)] Used measurement data for the annual volume of recycled tail gas and annual average mole fraction of carbon in the tail gas Used measurement data for the annual volume of recycled tail gas and engineering calculations for mole fraction of carbon in the tail gas Used measurement data for the mole fraction of carbon in the tail gas and engineering calculations for the annual volume of recycled tail gas Used engineering calculations for both the annual volume of recycled tail gas and annual average mole fraction of carbon in the tail gas Other (specify)
OtherApproachUsedforCorrection	Specify the approach used to determine correction factor used to calculate the CO_2 emissions if not listed above.

Figure 59
Sample XML Snippet for Recycled Tail Gas Details

```
<ghg:RecycleTailGasDetails>
      <ghg:TailGasRecycledFlowRateCarbonContentIncluded>Y</ghg:TailGasRecycledFlowRateCarbonContentIncluded>
      <ghg:TailGasCorrectionforCO2Used>Y</ghg:TailGasCorrectionforCO2Used>
      <ghg:RecycleTailGasVolume volUOM="scf">
         <ghg:MeasureValue>342</ghg:MeasureValue>
          <ghg:NumberofTimesSubstituted>132</ghg:NumberofTimesSubstituted>
      </ghg:RecycleTailGasVolume>
      <ghg:RecycledTailGasMethodDetails>
          <ghg:RecycledTailGasMethod>Engineering estimates</ghg:RecycledTailGasMethod>
      </ghg:RecycledTailGasMethodDetails>
      <ghg:AnnualAverageMoleFractionofCarbon fractionUOM="fraction (number between 0 and 1)">
          <ghg:MeasureValue>0.454</ghg:MeasureValue>
          <ghg:NumberofTimesSubstituted>123</ghg:NumberofTimesSubstituted>
      </ghg:AnnualAverageMoleFractionofCarbon>
      <ghg:AnnualAverageMoleFractionofCarbonMethod>Engineering calculations</ghg:AnnualAverageMoleFractionofCarbonMet...>
      <ghg:BasisforCorrection>Unit-specific correction factor</ghg:BasisforCorrection>
      <ghg:ApproachUsedforCorrection>Used measurement data for the annual volume of recycled tail gas and annual average
      mole fraction of carbon in the tail gas</ghg:ApproachUsedforCorrection>
</ghg:RecycleTailGasDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for the recycled tail gas if equation Y-12 is used to calculate CO_2 emissions for the sulfur recovery plant. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Sulfur Recovery CEMS Details

For each sulfur recovery unit that is monitored with a CEMS to measure CO_2 emissions, according to the guidelines specified in Subpart C, report the unit's identification information, and the relevant information required under §98.36 for the Tier 4 Calculation Methodology. See instructions for reporting data element "YTier4CEMSDetails."

Figure 60
Sulfur Recovery Unit CEMS Details Schema Diagram

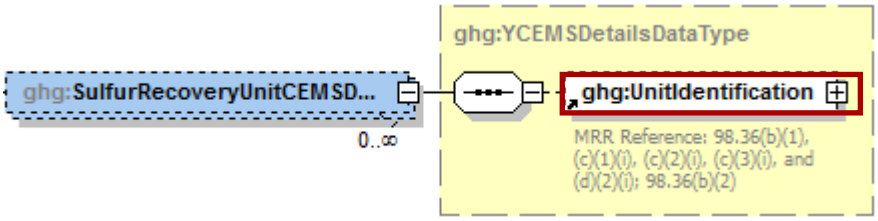


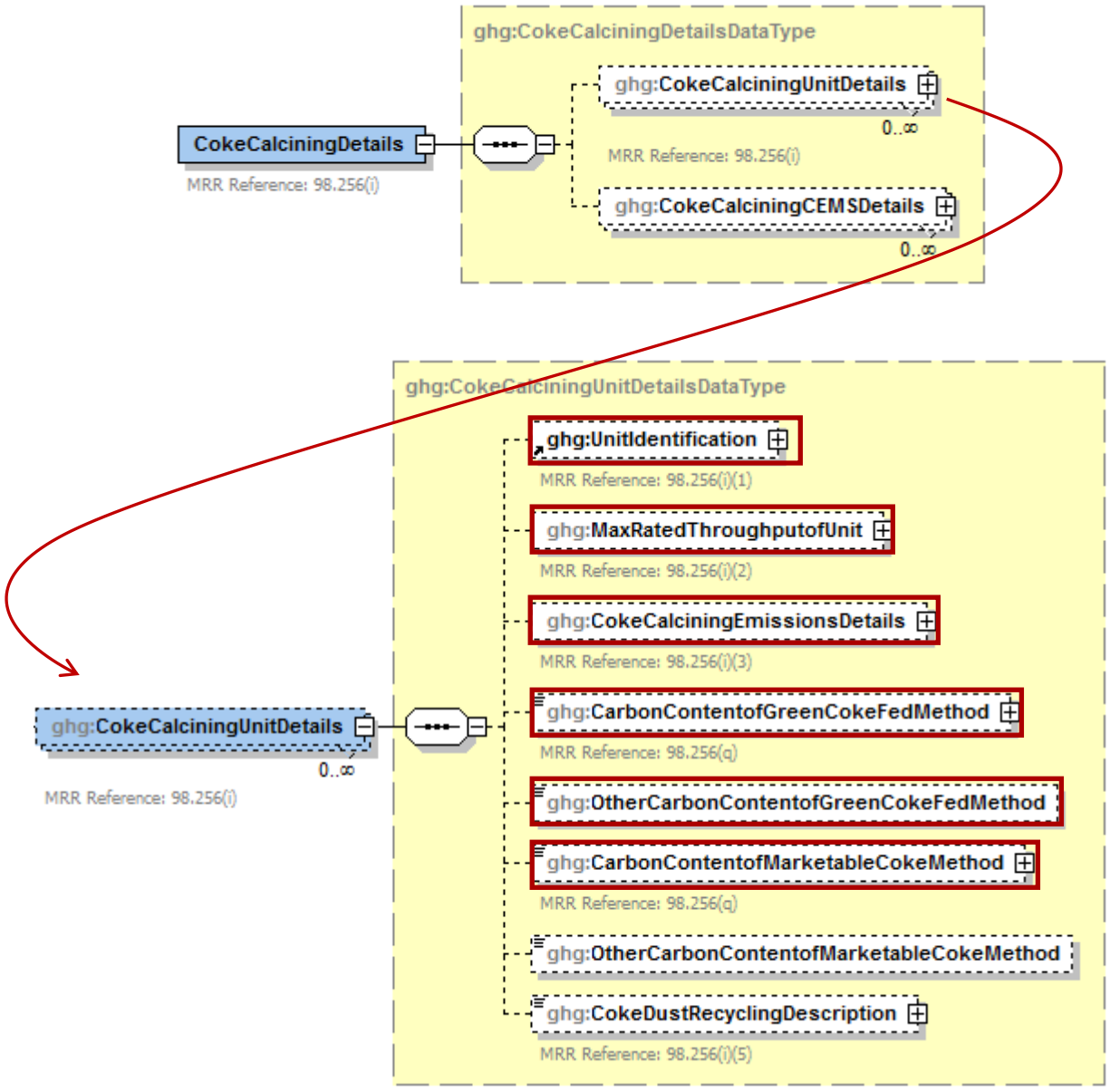
Table 27
Sulfur Recovery Unit CEMS Details XML Data Elements

Data Element Name	Description
SulfurRecoveryUnitCEMSDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each CEMS sulfur recovery plant unit. It includes the unit name (UnitName), an optional description (UnitDescription), and the type of unit (UnitType). Report the following unit type: Sulfur Recovery Plant

3.4 Coke Calcining Unit Information

This topic provides a step-by-step description of how to report Subpart Y Coke Calcining unit information for your facility. You are required to report CO_2, CH_4, and N_2O emissions from each coke calcining unit under this subpart.

Figure 61
Coke Calcining Details Schema Diagram



If you are reporting emissions for a unit that does not use a CEMS, you are required to report the following data about your coke calcining unit:

- A unique name or identifier, plus optional description for this coke calcining unit. See also About Unique Unit Names.
- Maximum rated throughput of the coke calcining unit (metric tons coke calcined per stream day)

- Method used to calculate the CH_4 emissions.
- Method used to calculate the N_2O emissions.

Table 28
Coke Calcining Unit Details XML Data Elements

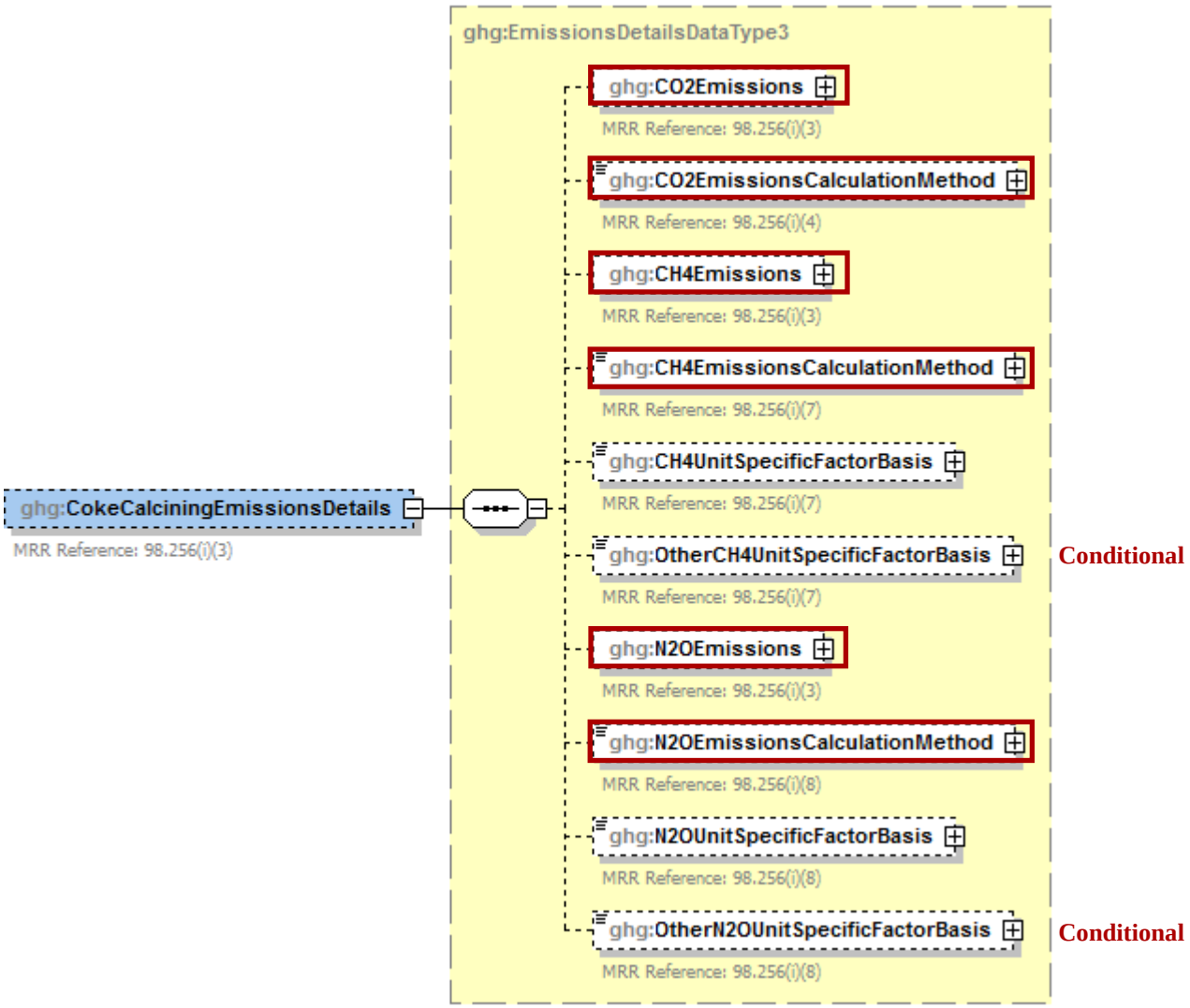
Data Element Name	Description
CokeCalciningUnitDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each **non-CEMS** sulfur recovery plant unit. It includes the unit name (UnitName), an optional description (UnitDescription), and type of unit (UnitType). MRR Reference: 98.256(i)(1) Report the following unit type: Coke Calcining Unit
MaxRatedThroughputofUnit	Maximum rated throughput of each independent sulfur recovery plant (Metric tons sulfur per stream day). MRR Reference: 98.256(i)(2)
MaxRatedThroughputofUnit.rateUOM	Set as equal to "metric tons/streamday".
CokeCalciningEmissionsDetails	See section "CokeCalciningEmissionsDetails"
CarbonContentofGreenCokeFedMethod	The method used to calculate CO_2 annual emissions for the sulfur recovery plant. Below is the list of allowable values. ASTM D3176-89 (Reapproved 2002) ASTM D5291-02 (Reapproved 2007 ASTM D5373-08
CarbonContentofMarketableCokeMethod	The method used to calculate CO_2 annual emissions for the sulfur recovery plant. Below is the list of allowable values. ASTM D3176-89 (Reapproved 2002) ASTM D5291-02 (Reapproved 2007) ASTM D5373-08
CokeDustRecyclingDescription	The type of coke dust recycling plant. Below is the list of allowable values. All dust is recycled A portion of the dust is recycled None of the dust is recycled

Figure 62
Sample XML Snippets for Coke Calcining Unit Details

```
<ghg:CokeCalciningUnitDetails>
        <ghg:UnitIdentification>
                <ghg:UnitName>CC-001</ghg:UnitName>
                <ghg:UnitType>Coke Calcining Unit</ghg:UnitType>
        </ghg:UnitIdentification>
        <ghg:MaxRatedThroughputofUnit rateUOM="metric tons/streamday">
                <ghg:MeasureValue>232</ghg:MeasureValue>
        </ghg:MaxRatedThroughputofUnit>
        <ghg:CokeCalciningEmissionsDetails>
                        ... (See snippets for section "Coke Calcining Emissions Details")
        </ghg:CokeCalciningEmissionsDetails>
        <ghg:CarbonContentofGreenCokeFedMethod>ASTM D5373-08</ghg:CarbonContentofGreenCokeFedMethod>
        <ghg:CarbonContentofMarketableCokeMethod> ASTM D5373-08</ghg:CarbonContentofMarketableCokeMethod>
        <ghg:CokeDustRecyclingDescription>All dust is recycled</ghg:CokeDustRecyclingDescription>
</ghg:CokeCalciningUnitDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details for coke calcining units.

Figure 63
Coke Calcining Emissions Details Schema Diagram



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

- The calculated CO_2, CH_4, and N_2O annual emissions for each unit, expressed in metric tons of each GHG emitted. To calculate the annual CO_2 emissions rate, use Equation Y-13 to calculate.

- Method used to measure the annual carbon content of green coke fed to the unit.
  - ASTM D3176-89-Reapproved 2002
  - ASTM D5291-02-Reapproved 2007
  - ASTM D5373-08

- Method used to measure the annual carbon content of marketable coke produced.
  - ASTM D3176-89-Reapproved 2002
  - ASTM D5291-02-Reapproved 2007
  - ASTM D5373-08

- Description of coke dust recycling for the unit.
  - All dust is recycled
  - A portion of the dust is recycled
  - None of the dust is recycled

Depending on the method reported to calculate the CH_4 and N_2O emission rates for coke calcining units, you may be required to report additional information.

- Basis for the emission factor. (Report this value only if you used a unit-specific emission factor based on a source test result.)
  - Weekly or more frequent measurements
  - Periodic (less frequent than weekly) measurements
  - Average of multiple source tests
  - One-time source test
  - Other

Table 29
Coke Calcining Emissions Details XML Data Elements

Data Element Name	Description
CokeCalciningEmissionsDetails	
CO2Emissions	The calculated CO_2 annual emissions for each coke calcining unit. MRR Reference: 98.256(i)(3)
CO2Emissions.massUOM	Set as equal to "Metric Tons".
CO2EmissionsCalculationMethod	The method used to calculate the CO_2 emissions for each coke calcining unit. MRR Reference: 98.256(i)(4) Below is the list of allowable values. CO2 CEMS Equation Y-13
CH4Emissions	The calculated CH_4 annual emissions for each coke calcining unit. MRR Reference: 98.256(i)(3)
CH4Emissions.massUOM	Set as equal to "Metric Tons".

Data Element Name	Description
CH4EmissionsCalculationMethod	The method used to calculate the CO_2 emissions for each flare (e.g., reference section and equation number). MRR Reference: 98.256(i)(7). Below is the list of allowable values. Unit-specific measurement data Unit-specific emissions factor based on a source test of the unit Equation Y-9 with a default emission factor Equation Y-10 with a default emission factor
CH4UnitSpecificFactorBasis	The basis for the unit-specific emission factor used to determine CH_4 annual emissions if the emission factor was based on a source test of the unit. MRR Reference: 98.256(i)(7). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify)
OtherN2OUnitSpecificFactorBasis	Specify the basis for the unit-specific emission factor used to determine CH_4 emissions if not referenced in the list of allowable basis values. MRR Reference: 98.256(i)(7).
N2OEmissions	The calculated N_2O annual emissions for each coke calcining unit. MRR Reference: 98.256(i)(3)
N2OEmissions.massUOM	Set as equal to "Metric Tons".
N2OEmissionsCalculationMethod	The method used to calculate the N_2O emissions for each flare (e.g., reference section and equation number). MRR Reference: 98.256(i)(8). Below is the list of allowable values. Unit-specific measurement data Unit-specific emissions factor based on a source test of the unit Equation Y-9 with a default emission factor Equation Y-10 with a default emission factor
N2OUnitSpecificFactorBasis	The basis for the unit-specific emission factor used to determine N_2O annual emissions if the emission factor was based on a source test of the unit. MRR Reference: 98.256(i)(8). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify)
OtherN2OUnitSpecificFactorBasis	Specify the basis for the unit-specific emission factor used to determine N_2O emissions if not referenced in the list of allowable basis values. MRR Reference: 98.256(i)(8).

Figure 64
Sample XML Snippets for Coke Calcining Emissions Details

```
<ghg:CokeCalciningEmissionsDetails>
    <ghg:CO2Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>22230.8</ghg:CalculatedValue>
    </ghg:CO2Emissions>
    <ghg:CO2EmissionsCalculationMethod>Equation Y-13</ghg:CO2EmissionsCalculationMethod>
    <ghg:CH4Emissions massUOM="Metric Tons">
        <ghg:CalculatedValue>4562.12</ghg:CalculatedValue>
    </ghg:CH4Emissions>
    <ghg:CH4EmissionsCalculationMethod>Equation Y-9 with a default emission factor</ghg:CH4EmissionsCalculationMethod>
    <ghg:N2OEmissions massUOM="Metric Tons">
        <ghg:CalculatedValue>8765.123</ghg:CalculatedValue>
    </ghg:N2OEmissions>
    <ghg:N2OEmissionsCalculationMethod> Unit-specific emission factor based on a source test of the unit</ghg:N2OEmi...>
    <ghg:N2OUnitSpecificFactorBasis>One-time source test</ghg:N2OUnitSpecificFactorBasis>
</ghg:CokeCalciningEmissionsDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting emissions details for coke calcining units. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Coke Calcining CEMS Details

For each coke calcining unit that is monitored with a CEMS to measure CO_2 emissions, according to the guidelines specified in Subpart C, report the unit's identification information, and the relevant information required under §98.36 for the Tier 4 Calculation Methodology. See instructions for reporting data element "YTier4CEMSDetails."

Figure 65
Coke Calcining CEMS Details Schema Diagram

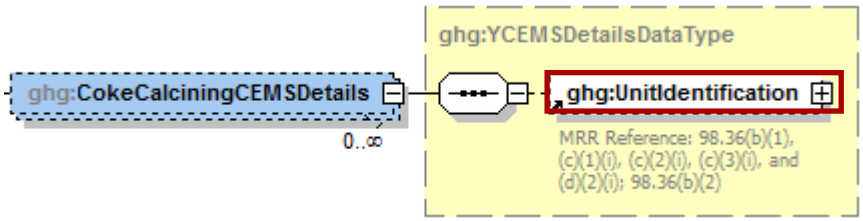


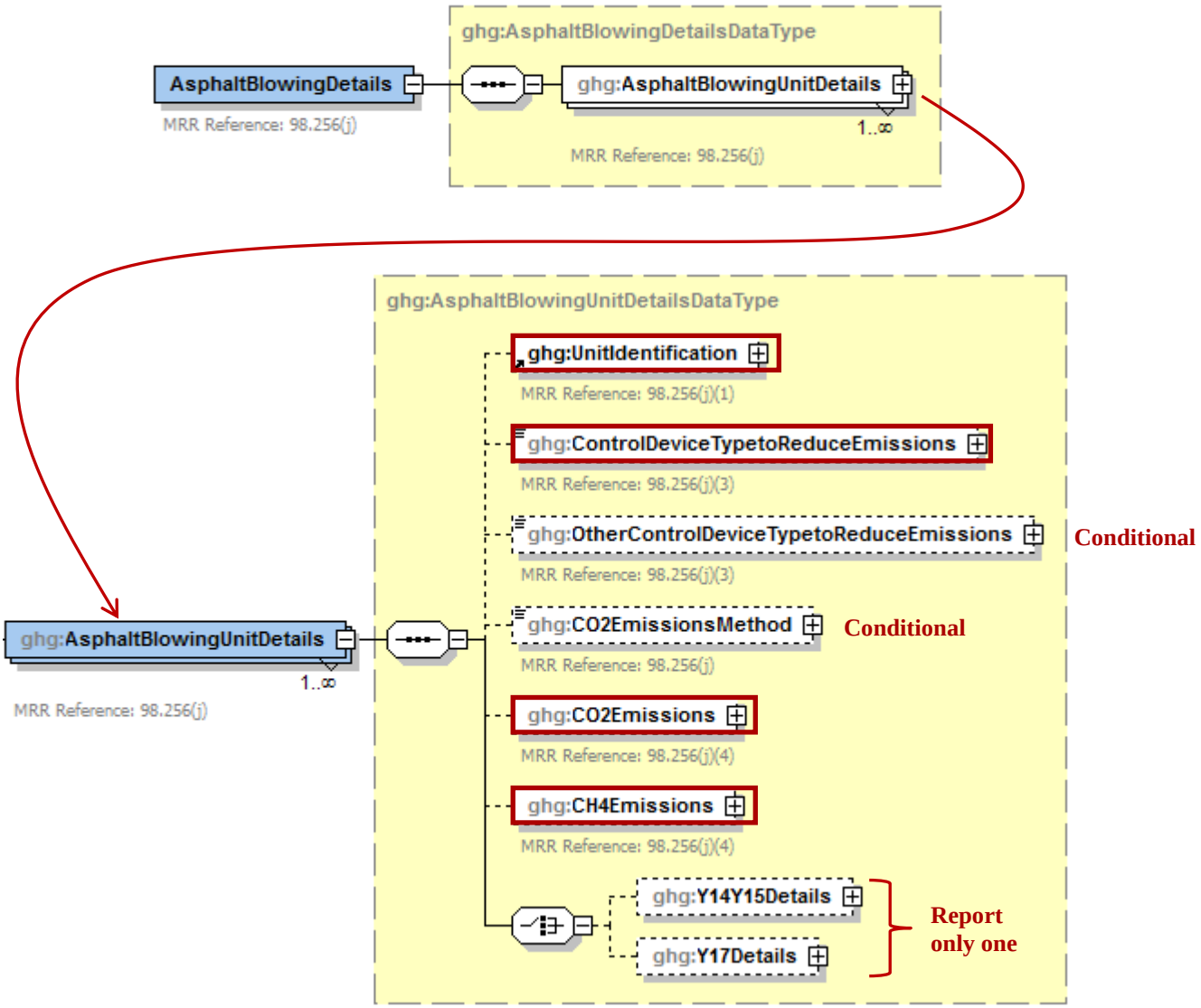
Table 30
Coke Calcining CEMS Details XML Data Elements

Data Element Name	Description
CokeCalciningCEMSDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each CEMS coke calcining unit. It includes the unit name (UnitName), an optional description (UnitDescription), and the type of unit (UnitType). Report the following unit type: Coke Calcining Unit

3.5 Asphalt Blowing Operations

This topic provides a step-by-step description of how to report Subpart Y asphalt blowing operations information for your facility. You are required to report CO_2 and CH_4 emissions from each asphalt blowing operations unit that is subject to this subpart.

Figure 66
Asphalt Blowing Unit Details Schema Diagram



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

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

- The method used to calculate the CO_2 emissions for your asphalt blowing operations.
  - Equations Y-14 and Y-15
  - Equations Y-16a and Y-17
  - Equations Y-16b and Y-17

  Note 1: For uncontrolled asphalt blowing operations or for asphalt blowing operations controlled by vapor scrubbing, calculate CO_2 and CH_4 emissions using Equations Y-14 and Y-15, respectively. For asphalt blowing operations controlled by thermal oxidizer or flare, calculate CH_4 emissions using Equation Y-17 and calculate CO_2 emissions using either Equations Y-16 or Equation Y-16b, provided these emissions are not already included in the flare emissions calculated elsewhere in the annual report.

  Note 2: If you use the process vent method, select the appropriate set of equations based on the type of control device as detailed in Note 1, enter "Other (specify)" for the basis for the emission factor, and enter "Process Vent Method" as the specification of the other basis.

- The calculated CO_2 and CH_4 annual emissions for each asphalt blower unit, expressed in metric tons.
- The basis for CO_2 and CH_4 emissions factors used. (See Table 32, "Equations Y-14 and Y-15 Details XML Data Elements" and Table 33, "Equation Y-17 Details XML Data Elements".)

Table 31
Asphalt Blowing Unit Details XML Data Elements

Data Element Name	Description
AsphaltBlowingUnitDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each asphalt blowing operations unit. It includes the unit name (UnitName), an optional description (UnitDescription), and the type of unit (UnitType). MRR Reference: 98.256(j)(1). Report the following unit type: Asphalt Blowing Unit
ControlDeviceTypetoReduceEmissions	The type of control device used to reduce methane (and other organic) emissions from the unit. Below is the list of allowable values. MRR Reference: 98.256(j)(3). Vapor scrubber Thermal oxidizer Flare Other (specify) None
OtherControlDeviceTypetoReduceEmissions	Specify the type of control device used if not listed above. MRR Reference: 98.256(j)(3).
CO2EmissionsMethod	Do not report value as it is redundant. The CO_2 Emissions method is indicated based on the data elements containing values, e.g. Y14Y15Details or Y17Details.
CO2Emissions	The calculated CO_2 annual emissions for each coke calcining unit. MRR Reference: 98.256(j)(4)
CO2Emissions.massUOM	Set as equal to "Metric Tons".

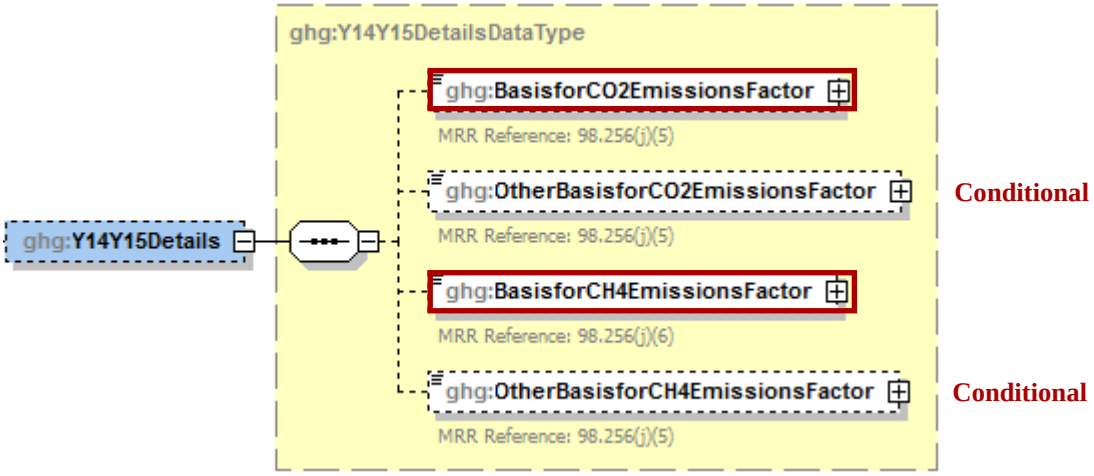
Data Element Name	Description
CH4Emissions	The calculated CH_4 annual emissions for each coke calcining unit. MRR Reference: 98.256(j)(4)
CH4Emissions.massUOM	Set as equal to "Metric Tons".
Y14Y15Details	See Table 32, "Equations Y-14 and Y-15 Details XML Data Elements".
Y17Details	See Table 33, "Equation Y-17 Details XML Data Elements".

Figure 67
Sample XML Snippets for Asphalt Blowing Unit Details

```
<ghg:AsphaltBlowingDetails>
    <ghg:AsphaltBlowingUnitDetails>
        <ghg:UnitIdentification>
            <ghg:UnitName>ABO-001</ghg:UnitName>
            <ghg:UnitDescription>Bitumen blowing unit</ghg:UnitDescription>
            <ghg:UnitType>Asphalt Blowing Unit</ghg:UnitType>
        </ghg:UnitIdentification>
        <ghg:ControlDeviceTypetoReduceEmissions>Vapor scrubber</ghg:ControlDeviceTypetoReduceEmissions>
        <ghg:CO2EmissionsMethod>[Equation Y-14 and Y-15]</ghg:CO2EmissionsMethod>
        <ghg:CO2Emissions massUOM="Metric Tons">
            <ghg:CalculatedValue>3443</ghg:CalculatedValue>
        </ghg:CO2Emissions>
        <ghg:CH4Emissions massUOM="Metric Tons">
            <ghg:CalculatedValue>786</ghg:CalculatedValue>
        </ghg:CH4Emissions>
        <ghg:Y14Y15Details>
            <ghg:BasisforCO2EmissionsFactor>Weekly or more frequent measurements</ghg:BasisforCO2EmissionsF...>
            <ghg:BasisforCH4EmissionsFactor>Used default emission factor</ghg:BasisforCH4EmissionsFactor>
        </ghg:Y14Y15Details>
    </ghg:AsphaltBlowingUnitDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting emissions details for asphalt blowing units. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Figure 68
Equations Y-14 and Y-15 Details Schema Diagram



If you used Equation Y-14 and Y-15 to calculate CO_2 and CH_4 annual emissions for your asphalt blowing operation, then you must also report the basis for CO_2 and CH_4 emissions factors.

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

Table 32
Equations Y-14 and Y-15 Details XML Data Elements

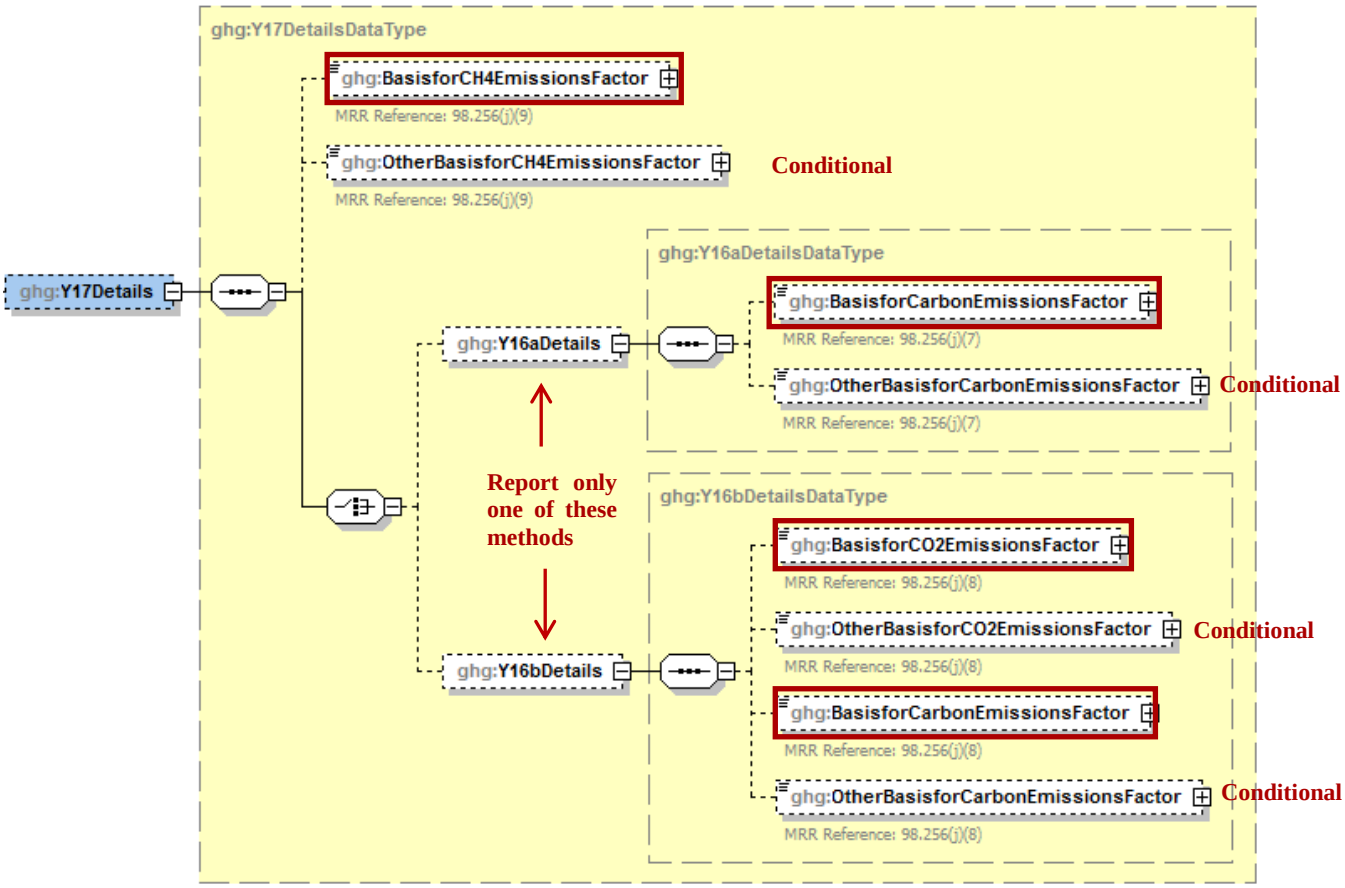
Data Element Name	Description
Y14Y15Details	
BasisforCO2EmissionsFactor	The basis for the CO_2 emission factor used in Equation Y-14. MRR Reference: 98.256(j)(5). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify) Used default emission factor
OtherBasisforCO2EmissionsFactor	Specify the basis for the CO_2 emission factor used in Equation Y-14 if not referenced above. MRR Reference: 98.256(j)(5).
BasisforCH4EmissionsFactor	The basis for the CH_4 emission factor used in Equation Y-14. MRR Reference: 98.256(j)(6). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify) Used default emission factor
OtherBasisforCH4EmissionsFactor	Specify the basis for the CH_4 emission factor used in Equation Y-14 if not referenced above. MRR Reference: 98.256(j)(5).

Figure 69
Sample XML Snippets for Equations Y-14 and Y-15 Details

```
<ghg:Y14Y15Details>
    <ghg:BasisforCO2EmissionsFactor>One-time source test</ghg:BasisforCO2EmissionsFactor>
    <ghg:BasisforCH4EmissionsFactor>Other (specify)</ghg:BasisforCH4EmissionsFactor>
    <ghg:OtherBasisforCH4EmissionsFactor> Daily measurements </ghg:OtherBasisforCH4EmissionsFactor>
</ghg:Y14Y15Details>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the basis for CO_2 and CH_4 emission factors used in Equations Y-14 and Y-15.

Figure 70
Equation Y-17 Details Schema Diagram



If you used Equation Y-16a or Y-16b or Y-17 to calculate the CO_2 annual emissions for your asphalt blowing operation, then you must also report the basis for the emissions factors used.

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

Table 33
Equation Y-17 Details XML Data Elements

Data Element Name	Description
Y17Details	
BasisforCH4EmissionsFactor	The basis for the CH_4 emissions factor used in Equation Y-17. MRR Reference: 98.256(j)(9). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify) Used default emission factor
OtherBasisforCH4EmissionsFactor	Specify the basis for the CH_4 emissions factor used in Equation Y-17 if not referenced above. MRR Reference: 98.256(j)(9).
Y16aDetails	
BasisforCarbonEmissionsFactor	The basis for the carbon emissions factor used in Equation Y-16a. MRR Reference: 98.256(j)(7). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify) Used default emission factor
OtherBasisforCarbonEmissionsFactor	Specify the basis for the carbon emissions factor used in Equation Y-16a if not referenced above. MRR Reference: 98.256(j)(7).
Y16bDetails	
BasisforCO2EmissionsFactor	The basis for the CO_2 emissions factor used in Equation Y-16b. MRR Reference: 98.256(j)(8). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify) Used default emission factor
OtherBasisforCO2EmissionsFactor	Specify the basis for the CO_2 emissions factor used in Equation Y-16b if not referenced above. MRR Reference: 98.256(j)(8).

Data Element Name	Description
BasisforCarbonEmissionsFactor	The basis for the carbon emission factor used in Equation Y-16b. MRR Reference: 98.256(j)(8). Below is the list of allowable values. Weekly or more frequent measurements Periodic (less frequent than weekly) measurements Average of multiple source tests One-time source test Other (specify) Used default emission factor
OtherBasisforCarbonEmissionsFactor	Specify the basis for the carbon emissions factor used in Equation Y-16b if not referenced above. MRR Reference: 98.256(j)(8).

Figure 71
Sample XML Snippets for Equation Y-17 Details

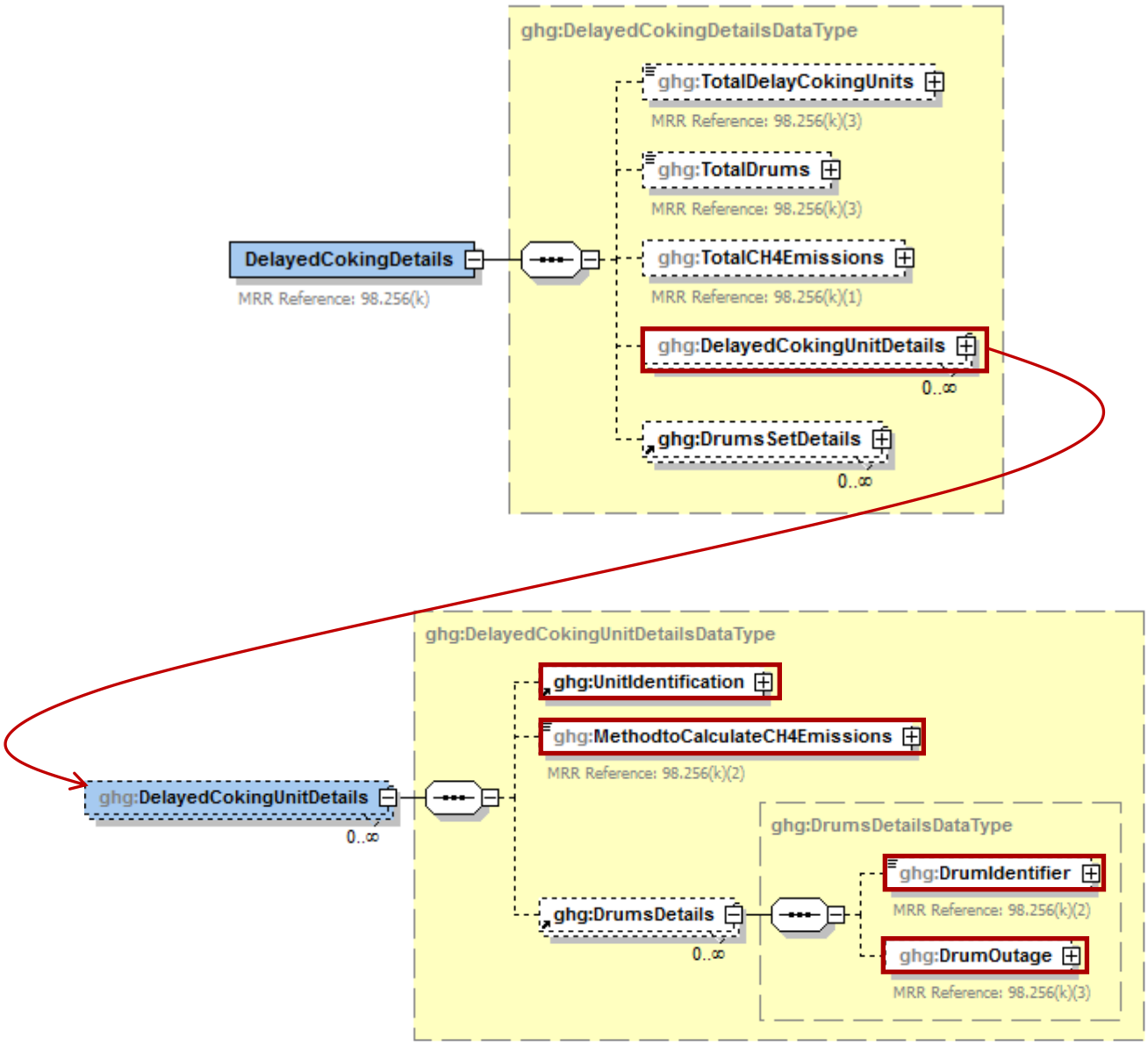
```
<ghg:Y17Details>
    <ghg:BasisforCH4EmissionsFactor>Periodic (less frequent than weekly) measurements</ghg:BasisforCH4Emissions…>
  <ghg:Y16aDetails>
      <ghg:BasisforCarbonEmissionsFactor>Other (specify)</ghg:BasisforCarbonEmissionsFactor>
        <ghg:OtherBasisforCarbonEmissionsFactor>Bi-weekly measurements </ghg:OtherBasisforCarbonEmissionsFactor>
  </ghg:Y16aDetails>
  <ghg:Y16bDetails>
      <ghg:BasisforCO2EmissionsFactor>Average or multiple source tests</ghg:BasisforCO2EmissionsFactor>
      <ghg:BasisforCarbonEmissionsFactor>Weekly or more frequent measurements</ghg:BasisforCarbonEmissionsFactor>
  </ghg:Y16bDetails>
</ghg:Y17Details>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the basis for CO2, CH4, and carbon emission factors used in Equations Y-16a, Y-16b, and Y-17. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

3.6 Delayed Coking Unit Details

The "DelayedCokingDetails" component is a collection of data elements containing both facility-level and unit-level data. The instructions provided below are for unit-level data reporting. For information regarding facility-level emissions reporting, please see section 2.0 of this document.

Figure 72
Delayed Coking Details (Unit-Level) Schema Diagram



Subpart Y requires you to report the following data about your delayed coking unit:

- A unique name or identifier, plus an optional description for delayed coking unit.
- The method used to calculate the CH_4 annual emissions for your delayed coking unit.
- Details about the drums used for each delayed coking unit.

Table 34
Delayed Coking Unit Details XML Data Elements

Data Element Name	Description
DelayedCokingUnitDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each delayed coking unit. It includes the unit name (UnitName), an optional description (UnitDescription), and the type of unit (UnitType). MRR Reference: 98.256(k)(1) Report the following unit type: Delayed Coking Unit
MethodtoCalculateCH4Emissions	Method used to calculate the CH_4 annual emissions for each delayed coking unit. MRR Reference: 98.256(k)(2). Below is the list of allowable values. Equation Y-18 and Y-19 - 98.253(i)(1) Equation Y-18 - 98.253(i)(2)
DrumDetails	
DrumIdentifier	A unique identifier/description of each coking drum. MRR Reference: 98.256(k)(2)
DrumOutage	The typical drum outage (i.e. the unfilled distance from the top of the drum). MRR Reference: 98.256(k)(3)
DrumOutage.heightUOM	Set as equal to “Feet”.

Figure 73
Sample XML Snippets for Delayed Coking Unit Details

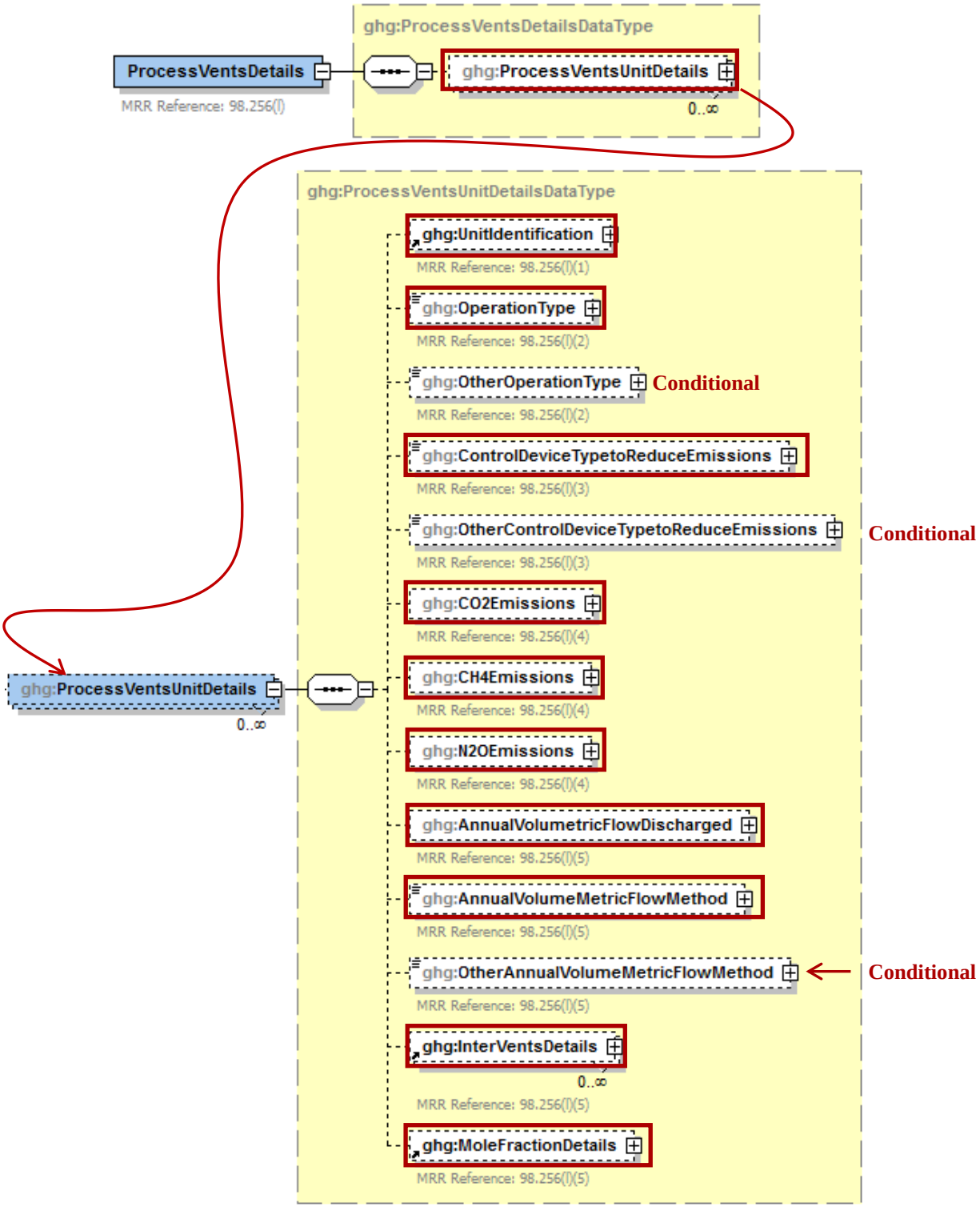
```
<DelayedCokingUnitDetails>
    <UnitIdentification>
        <UnitName>DC-001</UnitName>
        <UnitDescription>This is a test unit.</UnitDescription>
        <UnitType>Delayed Coking Unit</UnitType>
    </UnitIdentification>
    <MethodtoCalculateCH4Emissions> Equation Y-18 and Y-19) - 98.253(i)(1</MethodtoCalculateCH4Emissions>
    <DrumsDetails>
        <DrumIdentifier>DRUM-001</DrumIdentifier>
        <DrumOutage heightUOM="Feet">
            <MeasureValue>35</MeasureValue>
        </DrumOutage>
    </DrumsDetails>
</DelayedCokingUnitDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting details about the delayed coking unit.

3.7 Process Vents Unit Information

This topic provides a step-by-step description of how to enter Subpart Y Process Vents unit information about your facility. You must report CO2, CH4, and N_2O emissions from each process vent not specifically included in sections 98.252 (a) through 98.252 (g).

Figure 74
Process Vents Details (Unit-Level) Schema Diagram



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

- A unique name or identifier, plus optional description for this process vent unit. See also About Unique Unit Names
- Operation type associated with this process vent. See Table 35, "Process Vents Unit Details XML Data Elements" for a list of allowable values.
- Control device used to reduce methane (and other organic) emissions from the unit.
  - Thermal or catalytic incinerator/oxidizer
  - Carbon adsorber
  - Condenser
  - Oil scrubber
  - None
  - Other (specify)
- The calculated annual CO_2, CH_4, and N_2O emissions for each vent, expressed in metric tons of each pollutant emitted. Use Equation Y-19 to calculate values for each of these GHGs. CO_2 emissions must be reported if the process vent contains greater than 2 percent by volume CO_2 or greater. CH_4 emissions must be reported if the process vent contains 0.5 percent by volume of CH_4 or greater. N_2O emissions must be reported if the process vent contains 0.01 percent by volume of N_2O or greater.
- Annual volumetric flow discharged to the atmosphere (scf).
- Method used to measure or estimate the annual volumetric flow rate. Select from:
  - Continuous or at least hourly measurements
  - Routine (less frequent than hourly but at least weekly) measurements
  - Periodic (less frequent than weekly) measurements
  - Process knowledge
  - Engineering calculation
  - Other (specify)
- Inter Vent details (see Figure 75, "Inter Vents Details Schema Diagram")
- Mole Fraction Details (see Figure 77, "Mole Fraction Details Schema Diagram")

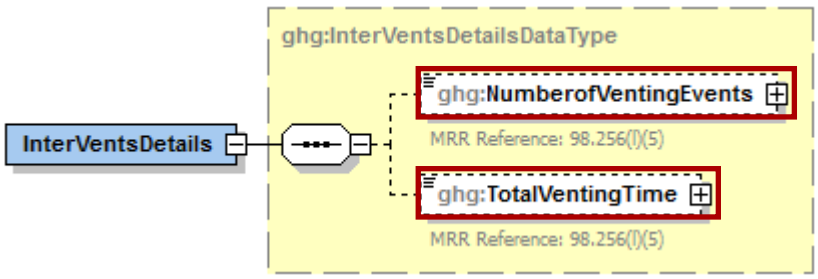
Table 35
Process Vents Unit Details XML Data Elements

Data Element Name	Description
ProcessVentsUnitDetails	
UnitIdentification	A collection of data elements (in parenthesis) containing the identity of each non-CEMS sulfur recovery plant unit. It includes the unit name (UnitName), an optional description (UnitDescription), and a the type of unit (UnitType). MRR Reference: 98.256(l)(1) Report the following unit type: ProcessVent

Data Element Name	Description
OperationType	The type of operation associated with the process vent's emissions. MRR Reference: 98.256(l)(2). Below is the list of allowable values. Atmospheric crude distillation Vacuum distillation Delayed coking Fluid coking (traditional) Flexicoking Visbreaking, other thermal cracking Fluid catalytic cracking unit Non-fluid catalytic cracking unit Catalytic hydrocracking Catalytic reforming unit - continuous regeneration Catalytic reforming unit - cyclic regeneration Catalytic reforming unit - semi-regenerative Fuels solvent deasphalting Desulfurization/ hydrotreat - naphtha/reformer feed Desulfurization/ hydrotreat - gasoline Desulfurization/ hydrotreat - kerosene/jet fuel Desulfurization/ hydrotreat - diesel Desulfurization/ hydrotreat - other distillate Desulfurization/ hydrotreat - residual Desulfurization/ hydrotreat - heavy gas oil Desulfurization/ hydrotreat - other HF alkylation H2SO4 alkylation Aromatics production Asphalt production Isomerization - Isobutane Isomerization - Iso C5,C6 Lubricants production Petroleum coke storage Sulfur plant Gas plant (LPG production unit) Oxygenate plant - MTBE Oxygenate plant - ETBE Oxygenate plant - TAME Oxygenate plant - other (specify) Marine vessel loading/unloading Truck/tank truck loading/unloading Rail car loading/unloading Blow down system Knock-out pot Analyzer Vacuum jet exhaust Wastewater treatment unit Wastewater collection system (drain, junction box, etc.) Soil remediation Other
OtherOperationType	Specify the type of operation associated with the emissions if not referenced above. MRR Reference: 98.256(l)(2).
ControlDeviceTypetoReduceEmissions	The type of control device used to reduce methane (and other organic) emissions from the unit, if applicable. MRR Reference: 98.256(l)(3). Below is the list of allowable values. Thermal or catalytic incinerator/oxidizer Carbon adsorber Condenser Oil scrubber None Other (specify)
OtherControlDeviceTypetoReduceEmissions	Specify the type of control device used to reduce methane (and other organic) emissions from the unit if not referenced above. MRR Reference: 98.256(l)(3).

Data Element Name	Description
CO2Emissions	The calculated annual CO_2 emissions for each vent, if applicable. MRR Reference: 98.256(l)(4).
CO2Emissions.massUOM	Set as equal to "Metric Tons".
CH4Emissions	The calculated annual CH_4 emissions for each vent, if applicable. MRR Reference: 98.256(l)(4).
CH4Emissions.massUOM	Set as equal to "Metric Tons".
N2OEmissions	The calculated annual N_2O emissions for each vent, if applicable. MRR Reference: 98.256(l)(4).
N2OEmissions.massUOM	Set as equal to "Metric Tons".
AnnualVolumetricFlowDischarged	The annual volumetric flow discharged to the atmosphere. MRR Reference: 98.256(l)(5).
AnnualVolumetricFlowDischarged.rateUOM	Set as equal to "scf".
AnnualVolumeMetricFlowMethod	The method used to measure or estimate the annual volumetric flow rate. MRR Reference: 98.256(l)(5). Below is the list of allowable values. Continuous or at least hourly measurements Routine (less frequent than hourly but at least weekly) measurements Periodic (less frequent than weekly) measurements Process knowledge Engineering calculation Other (specify)
OtherAnnualVolumeMetricFlowMethod	Specify the method used to measure or estimate the annual volumetric flow rate if not referenced above. MRR Reference: 98.256(l)(5).
InterVentsDetails	See Figure 75, "Inter Vents Details Schema Diagram".
MoleFractionDetails	See Figure 77, "Mole Fraction Details Schema Diagram"

Figure 75
Inter Vents Details Schema Diagram



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

- Number of venting events, if vent is intermittent
- Cumulative venting time (hours)

Table 36
Inter Vents Details XML Data Elements

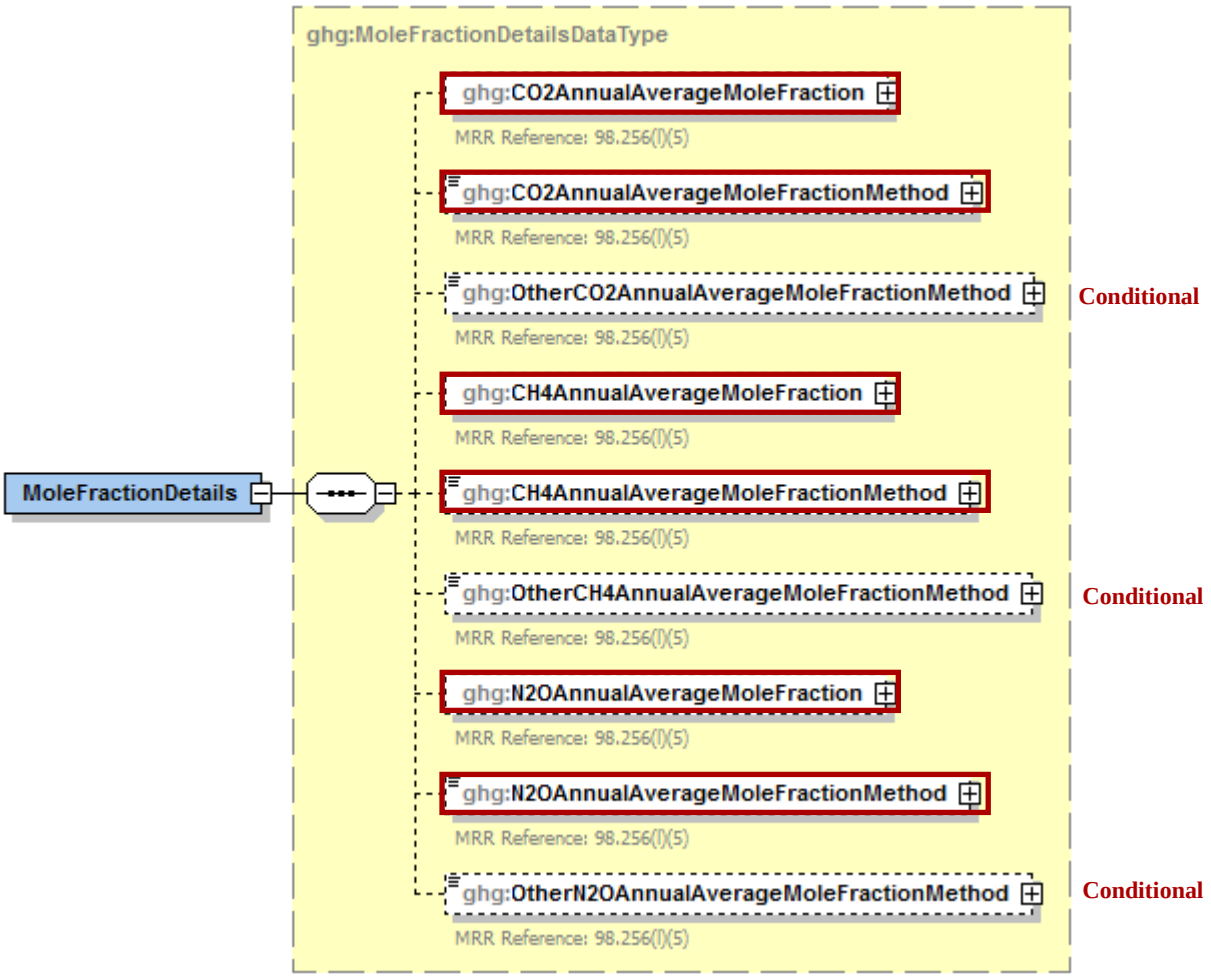
Data Element Name	Description
InterVentsDetails	
NumberofVentingEvents	The number of venting events for intermittent vents (integer). MRR Reference: 98.256(l)(5).
TotalVentingTime	The cumulative venting time. MRR Reference: 98.256(l)(5).
TotalVentingTime.timeUOM	Set as equal to "Hours".

Figure 76
Sample XML Snippets for Inter Vents Details

```
<ghg:InterVentsDetails>
      <ghg:NumberofVentingEvents>3</ghg:NumberofVentingEvents>
      <ghg:TotalVentingTime timeUOM="Hours">40</ghg:TotalVentingTime>
</ghg:InterVentsDetails>
```

Note: The code snippet above is presented here to demonstrate the concept of reporting the details of the intermittent vents.

Figure 77
Mole Fraction Details Schema Diagram



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

- Annual average mole fraction of CO_2.
- Method used to measure or estimate the annual average mole fraction of CO_2.
    - Engineering estimates/process knowledge
    - Direct measurement
    - Other (specify)
- Annual average mole fraction of CH_4.
- Method used to measure or estimate the annual average mole fraction of CH_4.
    - Engineering estimates/process knowledge
    - Direct measurement
    - Other (specify)
- Annual average mole fraction of N_2O.
- Method used to measure or estimate the annual average mole fraction of N_2O.
    - Engineering estimates/process knowledge
    - Direct measurement
    - Other (specify)

Table 37
Mole Fraction Details XML Data Elements

Data Element Name	Description
MoleFractionDetails	
CO2AnnualAverageMoleFraction	The annual average mole fraction of CO2. MRR Reference: 98.256(l)(5)
CO2AnnualAverageMoleFraction.fractionUOM	Set as equal to "fraction (number between 0 and 1)".
CO2AnnualAverageMoleFractionMethod	The method used to measure or estimate the CO_2 mole fraction. MRR Reference: 98.256(l)(5). Below is the list of allowable values. Engineering estimates/process knowledge Direct measurement Other (specify)
OtherCO2AnnualAverageMoleFractionMethod	Specify the method used to measure or estimate the CO_2 mole fraction if not referenced above MRR Reference: 98.256(l)(5).
CH4AnnualAverageMoleFraction	The annual average mole fraction of CH4. MRR Reference: 98.256(l)(5)
CH4AnnualAverageMoleFraction.fractionUOM	Set as equal to "fraction (number between 0 and 1)".
CH4AnnualAverageMoleFractionMethod	The method used to measure or estimate the CH_4 mole fraction. MRR Reference: 98.256(l)(5). Below is the list of allowable values. Engineering estimates/process knowledge Direct measurement Other (specify)
OtherCH4AnnualAverageMoleFractionMethod	Specify the method used to measure or estimate the CH_4 mole fraction if not referenced above. MRR Reference: 98.256(l)(5).
N2OAnnualAverageMoleFraction	The annual average mole fraction of N_2O. MRR Reference: 98.256(l)(5)
N2OAnnualAverageMoleFraction.fractionUOM	Set as equal to "fraction (number between 0 and 1)".
N2OAnnualAverageMoleFractionMethod	The method used to measure or estimate the N_2O mole fraction. MRR Reference: 98.256(l)(5). Below is the list of allowable values. Engineering estimates/process knowledge Direct measurement Other (specify)
OtherN2OAnnualAverageMoleFractionMethod	Specify the method used to measure or estimate the N_2O mole fraction if not referenced above MRR Reference: 98.256(l)(5).

Figure 78
Sample XML Snippets for Mole Fraction Details

```
<<ghg:MoleFractionDetails>
    <ghg:CO2AnnualAverageMoleFraction fractionUOM="fraction (number between 0 and 1)">
        <ghg:MeasureValue>0.5</ghg:MeasureValue>
    </ghg:CO2AnnualAverageMoleFraction>
    <ghg:CO2AnnualAverageMoleFractionMethod>Direct measurement</ghg:CO2AnnualAverageMoleFractionMethod>

    <ghg:CH4AnnualAverageMoleFraction fractionUOM="fraction (number between 0 and 1)">
        <ghg:MeasureValue>0.33</ghg:MeasureValue>
    </ghg:CH4AnnualAverageMoleFraction>
    <ghg:CH4AnnualAverageMoleFractionMethod> Direct measurement</ghg:CH4AnnualAverageMoleFractionMethod>

    <ghg:N2OAnnualAverageMoleFraction fractionUOM="fraction (number between 0 and 1)">
        <ghg:MeasureValue>0.75</ghg:MeasureValue>
    </ghg:N2OAnnualAverageMoleFraction>
    <ghg:N2OAnnualAverageMoleFractionMethod>Other (specify)</ghg:N2OAnnualAverageMoleFractionMethod>
    <ghg:OtherN2OAnnualAverageMoleFractionMethod>test method 2</ghg:OtherN2OAnnualAverageMoleFractionMethod>
</ghg:MoleFractionDetails>
```

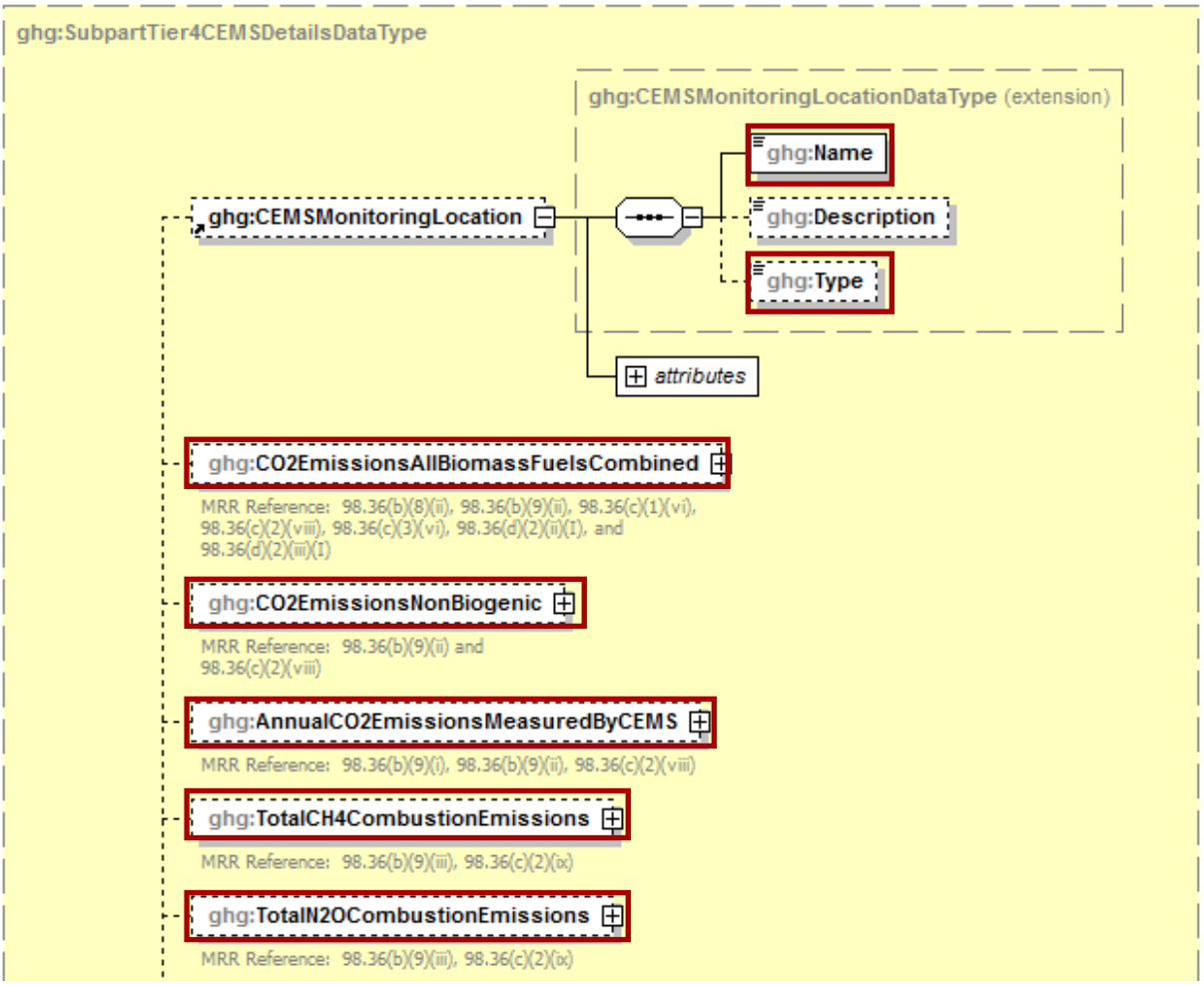
Note: The code snippet above is presented here to demonstrate the concept of reporting the CO2, CH4, and N_2O mole fraction details. Extra lines were added for demonstration purposes only.

3.8 Tier 4 CEMS Information

This section describes the emissions information that must be reported if the following types of process units were monitored by a continuous emissions monitoring system (CEMS) during the reporting year: Coke calcining units, Catalytic cracking units, Traditional fluid coking units, Fluid coking units with flexicoking design, Catalytic reforming units, or Sulfur recovery plants.

Figure 79
Tier 4 CEMS Details

Figure 80
Tier 4 CEMS Location and Emissions Details Schema Diagram



For subpart Y, information on each CEMS monitoring location (CML) is required including the name, an optional description and the configuration type. For each CML identified by the facility, the facility must specify the configuration type from the following list:

- Single industrial process or process unit that exhausts to a dedicated stack.
- Multiple industrial processes or process units share a common stack.
- Industrial process or process unit shares a common stack with a Tier 4 stationary fuel combustion unit.

For each CEMS monitoring location identified, the following emissions data must be reported:

- The total annual biogenic CO_2 mass emissions from combustion of all biomass fuels combined [98.36(b)(8)(ii)]
- The total annual non-biogenic CO_2 mass emissions (i.e. CO_2 mass emissions from fossil fuels, sorbent use, and process emissions) [98.36(b)(9)(ii)]
- The total annual CO_2 mass emissions measured by the CEMS [98.36(b)(9)(i)-(ii)]
- The total annual CH_4 mass emissions derived from Equation C-10, in metric tons CH_4 [98.36(b)(9)(iii), 98.36(c)(2)(ix)]
- The total annual N_2O mass emissions derived from Equation C-10, in metric tons N_2O [98.36(b)(9)(iii), 98.36(c)(2)(ix)]

Table 38
Tier 4 CEMS Location and Emissions Details XML Data Elements

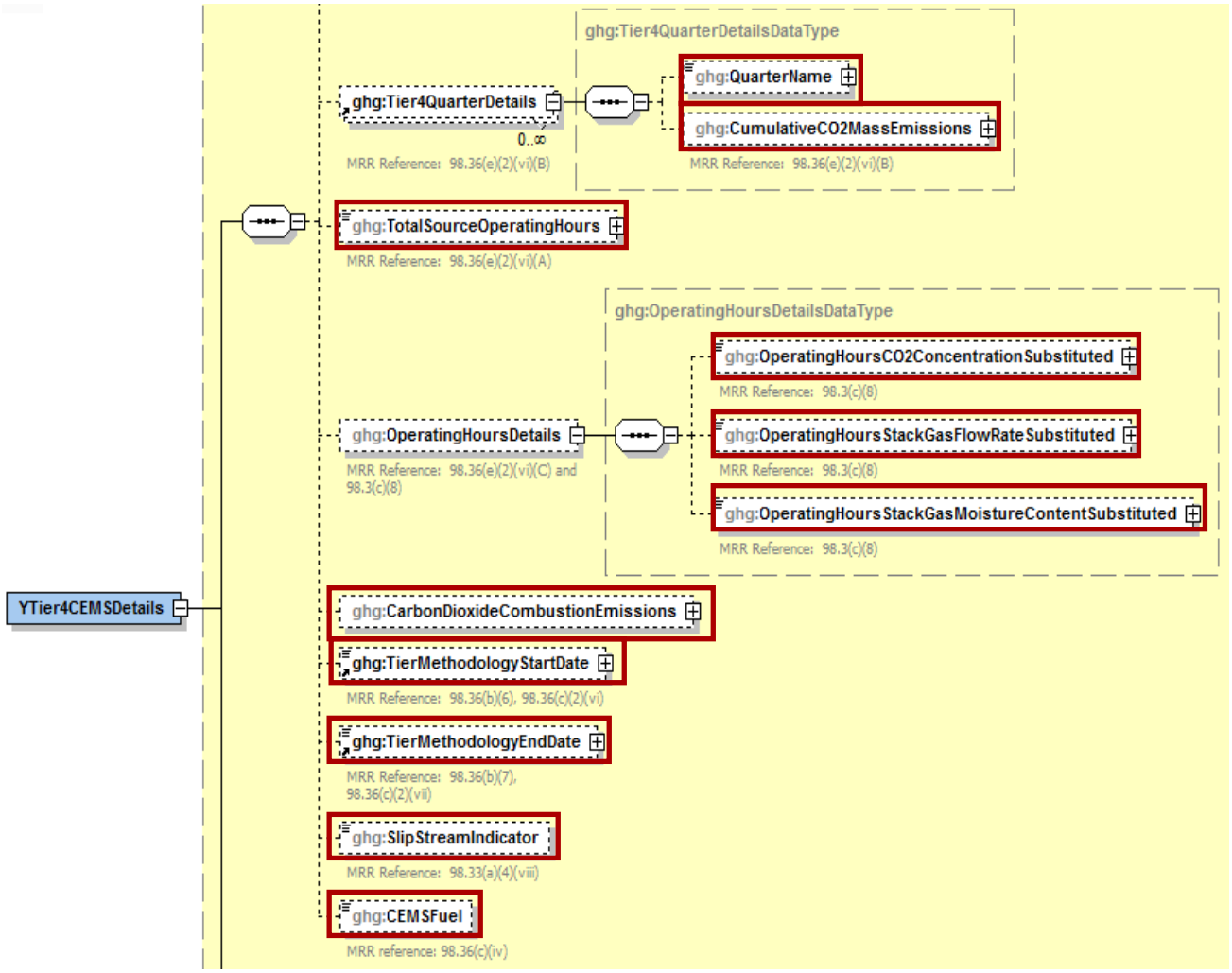
Data Element Name	Description
YTier4CEMSDetails	A collection of data elements containing information about a CEMS monitoring location.
CEMSMonitoringLocation	A collection of data elements containing the identity of each CEMS monitoring location. It includes the location's name, an optional description and configuration type. Below is the list of allowable configuration types. Single process/process unit exhausts to dedicated stack Multiple processes/process units share common stack Process/stationary combustion units share common stack
CO2EmissionsAllBiomassFuelsCombined	Total annual biogenic CO_2 mass emissions for the specified CEMS monitoring location. Report the calculated value only.
CO2EmissionsAllBiomassFuelsCombined.massUOM	Set as equal to "Metric Tons".
CO2EmissionsNonBiogenic	The total annual non-biogenic CO_2 mass emissions for the specified CEMS monitoring location. Report the calculated value only.
CO2EmissionsNonBiogenic.massUOM	Set as equal to "Metric Tons".
AnnualCO2EmissionsMeasuredByCEMS	The total annual CO_2 mass emissions measured by the CEMS at the specified CEMS monitoring location. Report the calculated value only.
AnnualCO2EmissionsMeasuredByCEMS.massUOM	Set as equal to "Metric Tons".
TotalCH4CombustionEmissions	The annual CH_4 mass emissions measured at the specified CEMS monitoring location during the reporting year calculated using Equation C-10 expressed in mass of CH_4. Report the calculated value only.
TotalCH4CombustionEmissions.massUOM	Set as equal to "Metric Tons".
TotalN2OCombustionEmissions	The annual N_2O mass emissions at the specified CEMS monitoring location during the reporting year calculated using Equation C-10 expressed in mass of N_2O. Report the calculated value only.
TotalN2OCombustionEmissions.massUOM	Set as equal to "Metric Tons".

Figure 81
Sample XML Excerpt for Tier 4 CEMS Location and Emissions Details

```
ghg:YTier4CEMSDetails>
        <ghg:CEMSMonitoringLocation>
                <ghg:Name>CS- Location 1</ghg:Name>
                <ghg:Description>Northwest</ghg:Description>
                <ghg:Type>Single process/process unit exhausts to dedicated stack</ghg:Type>
        </ghg:CEMSMonitoringLocation>
        <ghg:CO2EmissionsAllBiomassFuelsCombined massUOM="Metric Tons">
                <ghg:CalculatedValue>150</ghg:CalculatedValue>
        </ghg:CO2EmissionsAllBiomassFuelsCombined>
        <ghg:CO2EmissionsNonBiogenic massUOM="Metric Tons">
                <ghg:CalculatedValue>1400</ghg:CalculatedValue>
        </ghg:CO2EmissionsNonBiogenic>
        <ghg:AnnualCO2EmissionsMeasuredByCEMS massUOM="Metric Tons">
                <ghg:CalculatedValue>1500</ghg:CalculatedValue>
        </ghg:AnnualCO2EmissionsMeasuredByCEMS>
        <ghg:TotalCH4CombustionEmissions massUOM="Metric Tons">
                <ghg:CalculatedValue>250</ghg:CalculatedValue>
        </ghg:TotalCH4CombustionEmissions>
        <ghg:TotalN2OCombustionEmissions massUOM="Metric Tons">
                <ghg:CalculatedValue>350</ghg:CalculatedValue>
        </ghg:TotalN2OCombustionEmissions>
```

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

Figure 82
Tier 4 CEMS Quarter and Additional Details Schema Diagram



For each quarter of the reporting year, the facility must provide the cumulative CO_2 mass emissions for each CML [98.36(e)(2)(vi)(B)].

The facility must provide the following additional information for each CML:

- The total number of source operating hours in the reporting year [98.36(e)(2)(vi)(A)]
- The total operating hours in which a substitute data value was used in the emissions calculations for the CO_2 concentration parameter [98.36(e)(2)(vi)(C) and 98.3(c)(8)]
- The total operating hours in which a substitute data value was used in the emissions calculations for the stack gas flow rate parameter [98.36(e)(2)(vi)(C) and 98.3(c)(8)]
- If moisture correction is required and a continuous moisture monitor is used, the total operating hours in which a substitute data value was used in the emissions calculations for the stack gas moisture content parameter [98.36(e)(2)(vi)(C) and 98.3(c)(8)]
- The CO_2 emissions from the total annual CO_2 mass emissions (biogenic and non-biogenic) measured by the CEMS at the specified CML that are attributable to combustion
- The Tier 4 methodology start date [98.36(b)(6), 98.36(c)(2)(vi)]
- The Tier 4 methodology end date [98.36(b)(7), 98.36(c)(2)(vii)]
- Specify if emissions reported for the CEMS include emissions calculated according to 98.33(a)(4)(viii) for a slipstream that bypassed the CEMS [98.33(a)(4)(viii)]
- Each type of fuel combusted in the group of units during the reporting year [98.36(c)(1)(v)]

Table 39
Tier 4 CEMS Quarter and Additional Details XML Data Elements

Data Element Name	Description
Tier4QuarterDetails	
QuarterName	The name of the quarter. Below is the list of allowable values. First Quarter Second Quarter Third Quarter Fourth Quarter
CumulativeCO2MassEmissions	The cumulative CO_2 mass emissions for the specified CEMS monitoring location for the specified quarter of the reporting year. Report the calculated value only.
CumulativeCO2MassEmissions.massUOM	Set as equal to "Metric Tons".
TotalSourceOperatingHours	The total number of source operating hours in the reporting year for the specified CEMS monitoring location.
OperatingHoursDetails	
OperatingHoursCO2ConcentrationSubstituted	The total operating hours in which a substitute data value was used in the emissions calculations for the CO_2 concentration parameter at the specified CEMS monitoring location.
OperatingHoursStackGasFlowRateSubstituted	The total operating hours in which a substitute data value was used in the emissions calculations for the stack gas flow rate parameter at the specified CEMS monitoring location.

(cont.)

Table 39
Tier 4 CEMS Quarter and Additional Details XML Data Elements (cont.)

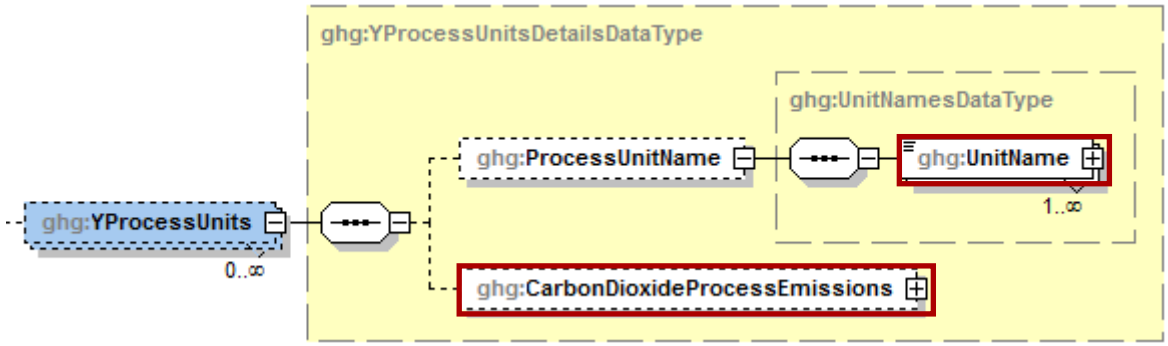
Data Element Name	Description
OperatingHoursStackGasMoistureContentSubstituted	If moisture correction is required and a continuous moisture monitor is used, the total operating hours in which a substitute data value was used in the emissions calculations for the stack gas moisture content parameter at the specified CEMS monitoring location.
CarbonDioxideCombustionEmissions	CO_2 emissions from the total annual CO_2 mass emissions (biogenic and non-biogenic) measured by the CEMS at the specified CML that are attributable to combustion. Report the measured value only.
CarbonDioxideCombustionEmissions.massUOM	Set as equal to "Metric Tons".
TierMethodologyStartDate	The tier methodology start date for the specified CEMS monitoring location.
TierMethodologyEndDate	The tier methodology end date for the specified CEMS monitoring location.
SlipStreamIndicator	An indication (Y/N) that the emissions reported for the CEMS include emissions calculated according to 98.33(a)(4)(viii) for a slipstream that bypassed the CEMS.
CEMSFuel	Each type of fuel combusted in the group of units during the reporting year.

Figure 83
Sample XML Excerpt for Y Tier 4 CEMS Quarter and Additional Details

```
<ghg:Tier4QuarterDetails>
        <ghg:QuarterName>First Quarter</ghg:QuarterName>
        <ghg:CumulativeCO2MassEmissions massUOM="Metric Tons">
            <ghg:CalculatedValue>600</ghg:CalculatedValue>
        </ghg:CumulativeCO2MassEmissions>
</ghg:Tier4QuarterDetails>
<ghg:Tier4QuarterDetails>
        <ghg:QuarterName>Second Quarter</ghg:QuarterName>
        <ghg:CumulativeCO2MassEmissions massUOM="Metric Tons">
            <ghg:CalculatedValue>700</ghg:CalculatedValue>
        </ghg:CumulativeCO2MassEmissions>
</ghg:Tier4QuarterDetails>
<ghg:Tier4QuarterDetails>
        <ghg:QuarterName>Third Quarter</ghg:QuarterName>
        <ghg:CumulativeCO2MassEmissions massUOM="Metric Tons">
            <ghg:CalculatedValue>800</ghg:CalculatedValue>
        </ghg:CumulativeCO2MassEmissions>
</ghg:Tier4QuarterDetails>
<ghg:Tier4QuarterDetails>
        <ghg:QuarterName>Fourth Quarter</ghg:QuarterName>
        <ghg:CumulativeCO2MassEmissions massUOM="Metric Tons">
            <ghg:CalculatedValue>900</ghg:CalculatedValue>
        </ghg:CumulativeCO2MassEmissions>
</ghg:Tier4QuarterDetails>
<ghg:TotalSourceOperatingHours>8400</ghg:TotalSourceOperatingHours>
<ghg:OperatingHoursDetails>
        <ghg:OperatingHoursCO2ConcentrationSubstituted>450</ghg:OperatingHoursCO2ConcentrationSubstituted>
        <ghg:OperatingHoursStackGasFlowRateSubstituted>550</ghg:OperatingHoursStackGasFlowRateSubstituted>
        <ghg:OperatingHoursStackGasMoistureContentSubstituted>650</ghg:OperatingHoursStackGasMoistureContent…>
</ghg:OperatingHoursDetails>
<ghg:CarbonDioxideCombustionEmissions massUOM="Metric Tons">
      <ghg:MeasureValue>3452</ghg:MeasureValue>
</ghg:CarbonDioxideCombustionEmissions>
<ghg:TierMethodologyStartDate>2010-01-01-00:05</ghg:TierMethodologyStartDate>
<ghg:TierMethodologyEndDate>2010-12-31-00:05</ghg:TierMethodologyEndDate>
<ghg:SlipStreamIndicator>Y</ghg:SlipStreamIndicator>
<ghg:CEMSFuel>coal, coke, natural gas</ghg:CEMSFuel>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting Tier 4 CEMS quarterly data. In some cases, an ellipse (…) was used to shorten the tag name in the sample data displayed above. This was done merely to prevent the sample data from wrapping to the next line. Please note that your XML report must contain the full tag names for every data element reported.

Figure 84
Tier 4 CEMS Quarter and Additional Details Schema Diagram



For each CML that is monitoring a Subpart Y petroleum refinery process unit, report the following for each process unit:

- The name/ID of each process unit monitored at the CML.
- The total annual CO_2 emissions from the CEMS monitoring location that are attributable to process CO_2 emissions from each process unit.

Table 40
Tier 4 CEMS Process Units Details XML Data Elements

Data Element Name	Description
YProcessUnits	A collection of data elements for process units monitored at the specified CEMS monitoring location.
ProcessUnitName	A collection of data elements for each process unit monitored at the specified CEMS monitoring location.
UnitName	The name of each unit that is monitored at the specified CEMS Monitoring Location. Use the exact unit name(s) as for "UnitIdentification". Report each unit separately.
CarbonDioxideProcessEmissions	CO_2 emissions from the CEMS monitoring location that are attributable to process CO_2 emissions from each process unit.
CarbonDioxideProcessEmissions.massUOM	Set as equal to “Metric Tons”.

Figure 85
Sample XML Excerpt for Tier 4 CEMS Process Units Details

```
<ghg:YProcessUnits>
      <ghg:ProcessUnitName>
            <ghg:UnitName>CEMS-001<ghg:/ProcessUnitName>
            <ghg:UnitName>CEMS-002<ghg:/ProcessUnitName>
            <ghg:UnitName>CEMS-003<ghg:/ProcessUnitName>
      <ghg:/ProcessUnitName>
      <ghg:CarbonDioxideProcessEmissions massUOM="Metric Tons">
            <ghg:ghg:MeasureValue>3452/ghg:MeasureValue>
      <ghg:/CarbonDioxideProcessEmissions >
<ghg:/YProcessUnits>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting Tier 4 CEMS process unit data.

4.0 Facility-Level Roll-up Emissions

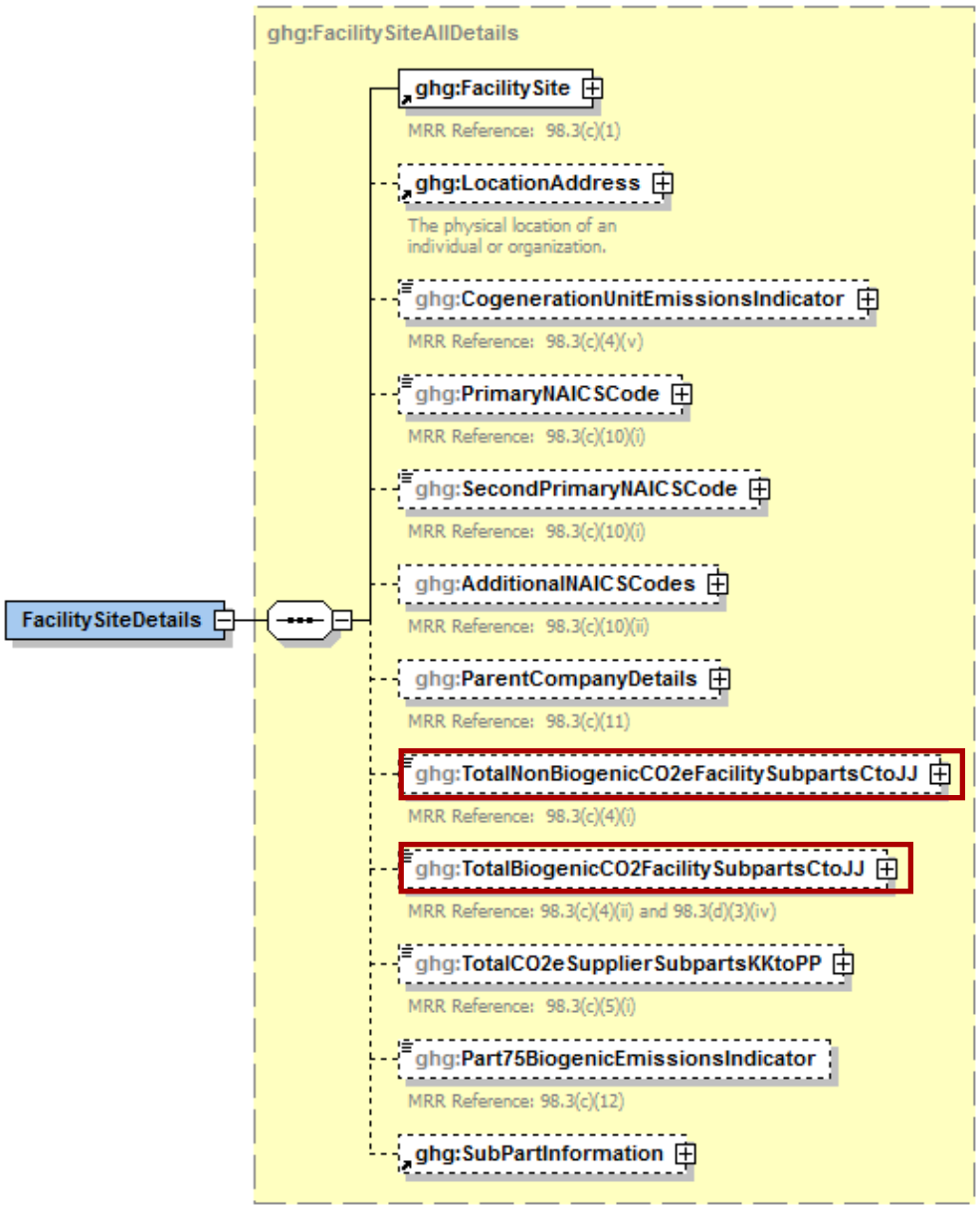
Each facility must report the following facility-level emission totals:

- Total CO_2 equivalent (CO_2e) emissions (excluding biogenic CO_2) aggregated across all direct emitter source categories (subparts C-HH) associated with the facility.
- Total biogenic CO_2 emissions aggregated across all direct emitter source categories (subparts C-HH) associated with the facility.

Each supplier must report the following supplier totals:

- Total CO_2e associated with products supplied aggregated across subparts NN, OO and PP (as applicable). Do not include subpart LL and MM totals in this data element as these values are not being collected in e-GGRT.

Figure 86
Facility-Level Roll-up Emissions Schema Diagram



1) Add the total CO_2e value for Subpart Y in metric tons to the total CO_2e emissions (excluding biogenic CO_2) aggregated across all source category subparts associated with the facility according to the following guidelines:

   - Add the value reported for Carbon Dioxide at the subpart level.
   - Multiply the value reported for CH_4 at the subpart level by the Global Warming Potential for CH_4 of 21, and add the resulting value rounded to one decimal place.
   - Multiply the value reported for N_2O at the subpart level by the Global Warming Potential for N_2O of 310, and add the resulting value rounded to one decimal place.

2) Add the total annual biogenic CO_2 mass emissions in metric tons rounded to one decimal place for each CML to the total biogenic CO_2 aggregated across all source category subparts associated with the facility.

Table 41
Facility Level Roll-up Emissions XML Data Elements

Data Element Name	Description
TotalNonBiogenicCO2eFacilitySubpartsCtoJJ	Add the total CO_2e value for Subpart Y in metric tons to the total CO_2e emissions (excluding biogenic CO_2) aggregated across all source category subparts associated with the facility according to the guidelines above.
TotalNonBiogenicCO2eFacilitySubpartsCtoJJ.massUOM	Set as equal to "Metric Tons".
TotalBiogenicCO2eFacilitySubpartsCtoJJ	Add the total annual biogenic CO_2 value for Subpart Y in metric tons to the total biogenic CO_2 emissions aggregated across all source category subparts associated with the facility according to the guideline above.
TotalBiogenicCO2FacilitySubpartsCtoJJ.massUOM	Set as equal to "Metric Tons".

Figure 87
Sample XML Excerpt for Facility Level Roll-up Emissions

```
<ghg:TotalNonBiogenicCO2eFacilitySubpartsCtoJJ massUOM="Metric Tons">117600.0</ghg:TotalNonBiogenicCO2eFacilitySubpartsCto    JJ>
<ghg:TotalBiogenicCO2eFacilitySubpartsCtoJJ massUOM="Metric Tons">150.0</ghg:TotalBiogenicCO2eFacilitySubpartsCtoJJ>
```

Note: The code excerpt above is presented here to demonstrate the concept of reporting facility level roll-up greenhouse gas emissions data.

Appendix A

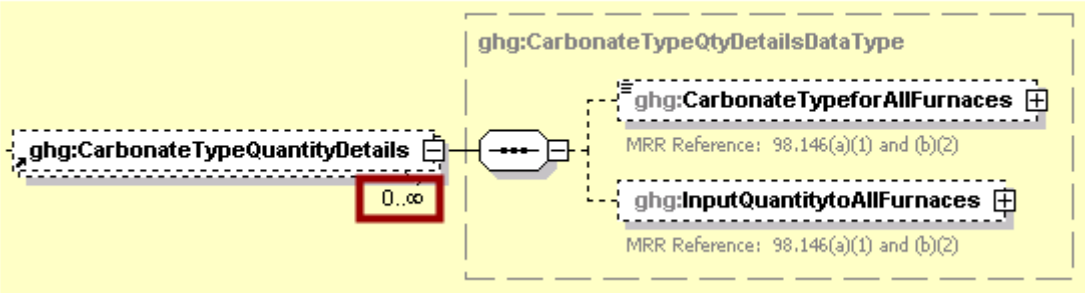
Legend for Tables

Blue = parent element

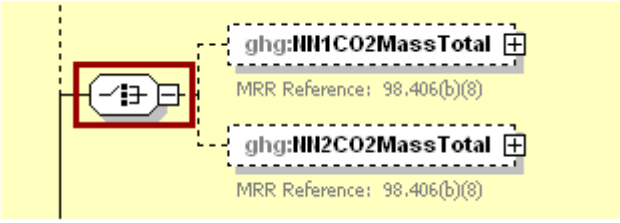
Legend for XML Schema Diagrams

Red box = relevant for reporting

The following XML symbol "0..∞" means that multiple occurrences for the parent element can be reported:



The following XML symbol for "or" means that only one of the data elements following the sign can be reported for the current instance of the parent element:



Appendix B

Sample XML Document for Subpart Y

(Note: Data values do not reflect an actual facility's emissions.)

```
<?xml version="1.0" encoding="UTF-8"?>
<ghg:GHG xsi:schemaLocation="http://www.exchangenetwork.net/schema/ghg/1 file:///L:/XML_Schema/GHG_Final_05062011/GHG_Final_v1.12.xsd"
xmlns:ghg="http://www.exchangenetwork.net/schema/ghg/1" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <ghg:SubmittalComment>Submitted by D. Rawler, Kenniston Enterprises</ghg:SubmittalComment>
    <ghg:FacilitySiteInformation>
        <ghg:ReportingYear>2010</ghg:ReportingYear>
        <ghg:FacilitySiteDetails>
            <ghg:FacilitySite>
                <ghg:FacilitySiteIdentifier>522948</ghg:FacilitySiteIdentifier>
                <ghg:FacilitySiteName>TEST Facility</ghg:FacilitySiteName>
            </ghg:FacilitySite>
            <ghg:LocationAddress>
                <ghg:LocationAddressText>12600 S. ANY STREET</ghg:LocationAddressText>
                <ghg:LocalityName>Houston</ghg:LocalityName>
                <ghg:StateIdentity>
                    <ghg:StateCode>TX</ghg:StateCode>
                </ghg:StateIdentity>
                <ghg:AddressPostalCode>77004</ghg:AddressPostalCode>
            </ghg:LocationAddress>
            <ghg:CogenerationUnitEmissionsIndicator>N</ghg:CogenerationUnitEmissionsIndicator>
            <ghg:PrimaryNAICSCode>111110</ghg:PrimaryNAICSCode>
            <ghg:TotalNonBiogenicCO2eFacilitySubpartsCtoJJ>51109696</ghg:TotalNonBiogenicCO2eFacilitySubpartsCtoJJ>
            <ghg:TotalBiogenicCO2eFacilitySubpartsCtoJJ>6479</ghg:TotalBiogenicCO2eFacilitySubpartsCtoJJ>
            <ghg:TotalCO2eSupplierSubpartsKKtoPP>0</ghg:TotalCO2eSupplierSubpartsKKtoPP>
            <ghg:SubPartInformation>
                <ghg:SubPartY>
                    <ghg:GHGasInfoDetails>
                        <ghg:GHGasName>Biogenic Carbon dioxide</ghg:GHGasName>
                        <ghg:GHGasQuantity massUOM="Metric Tons">
                            <ghg:CalculatedValue>3234</ghg:CalculatedValue>
                        </ghg:GHGasQuantity>
                    </ghg:GHGasInfoDetails>
                    <ghg:GHGasInfoDetails>
                        <ghg:GHGasName>Methane</ghg:GHGasName>
                        <ghg:GHGasQuantity massUOM="Metric Tons">
                            <ghg:CalculatedValue>89536</ghg:CalculatedValue>
                        </ghg:GHGasQuantity>
                    </ghg:GHGasInfoDetails>
                    <ghg:GHGasInfoDetails>
                        <ghg:GHGasName>Nitrous Oxide</ghg:GHGasName>
                        <ghg:GHGasQuantity massUOM="Metric Tons">
                            <ghg:CalculatedValue>156042</ghg:CalculatedValue>
                        </ghg:GHGasQuantity>
                    </ghg:GHGasInfoDetails>
                    <ghg:GHGasInfoDetails>
                        <ghg:GHGasName>Carbon Dioxide</ghg:GHGasName>
                        <ghg:GHGasQuantity massUOM="Metric Tons">
                            <ghg:CalculatedValue>298375</ghg:CalculatedValue>
                        </ghg:GHGasQuantity>
                    </ghg:GHGasInfoDetails>
                    <ghg:FlareGasDetails>
                        <ghg:FlareGasUnitDetails>
                            <ghg:UnitIdentification>
                                <ghg:UnitName>FL-003</ghg:UnitName>
                                <ghg:UnitDescription>description text</ghg:UnitDescription>
                                <ghg:UnitType>Flare</ghg:UnitType>
                            </ghg:UnitIdentification>
                            <ghg:FlareType>Unassisted</ghg:FlareType>
                            <ghg:FlareService>Emergency only flare</ghg:FlareService>
                            <ghg:EmissionsDetails>
                                <ghg:CO2EmissionsCalculationMethod>98.253(b)(1)(ii)(A) – Equation Y-1a – Gas Composition
Monitored</ghg:CO2EmissionsCalculationMethod>
                                <ghg:CO2Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>67989</ghg:CalculatedValue>
                                </ghg:CO2Emissions>
                                <ghg:CH4Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>55</ghg:CalculatedValue>
                                </ghg:CH4Emissions>
                                <ghg:N2OEmissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>22</ghg:CalculatedValue>
                                </ghg:N2OEmissions>
                            </ghg:EmissionsDetails>
                            <ghg:FlareGasCarbonFractionBasis>Method 18 at 40 CFR part 60, appendix A-6</ghg:FlareGasCarbonFractionBasis>
```

```
                    <ghg:Y2EquationDetails>
                        <ghg:MeasurementPeriod>Daily</ghg:MeasurementPeriod>
                        <ghg:AnnualVolumeofFlareGas volUOM="MMscf">
                            <ghg:MeasureValue>3423</ghg:MeasureValue>
                            <ghg:NumberofTimesSubstituted>60</ghg:NumberofTimesSubstituted>
                        </ghg:AnnualVolumeofFlareGas>
                        <ghg:AnnualVolumeofFlareGasMethod>ASTM - D</ghg:AnnualVolumeofFlareGasMethod>
                        <ghg:AnnualAverageHigherHeatingValue heatUOM="MMBtu/MMscf">
                            <ghg:MeasureValue>230</ghg:MeasureValue>
                            <ghg:NumberofTimesSubstituted>55</ghg:NumberofTimesSubstituted>
                        </ghg:AnnualAverageHigherHeatingValue>
                        <ghg:AnnualAverageHigherHeatingValueMethod>ASTM D240-02 (Reapproved 2007)</ghg:AnnualAverage...
Method>
                        <ghg:FlareGasConditions>68 degrees F and 14.7 psia</ghg:FlareGasConditions>
                        <ghg:HeatingValueConditions>60 degrees F and 14.7 psia</ghg:HeatingValueConditions>
                    </ghg:Y2EquationDetails>
                </ghg:FlareGasUnitDetails>
                <ghg:FlareGasUnitDetails>
                    <ghg:UnitIdentification>
                        <ghg:UnitName>FL-002</ghg:UnitName>
                        <ghg:UnitType>Flare</ghg:UnitType>
                    </ghg:UnitIdentification>
                    <ghg:FlareType>Air-assisted</ghg:FlareType>
                    <ghg:FlareService>Unit flare</ghg:FlareService>
                    <ghg:EmissionsDetails>
                        <ghg:CO2Emissions massUOM="Metric Tons">
                            <ghg:CalculatedValue>93673</ghg:CalculatedValue>
                        </ghg:CO2Emissions>
                        <ghg:CH4Emissions massUOM="Metric Tons">
                            <ghg:CalculatedValue>7888</ghg:CalculatedValue>
                        </ghg:CH4Emissions>
                        <ghg:N2OEmissions massUOM="Metric Tons">
                            <ghg:CalculatedValue>4567</ghg:CalculatedValue>
                        </ghg:N2OEmissions>
                    </ghg:EmissionsDetails>
                    <ghg:FlareGasCarbonFractionBasis>ASTM D1946-90 (Reapproved 2006)</ghg:FlareGasCarbonFractionBasis>
                    <ghg:Y1bEquationDetails>
                        <ghg:MeasurementPeriod>Weekly</ghg:MeasurementPeriod>
                        <ghg:AnnualVolumeofFlareGas volUOM="scf">
                            <ghg:MeasureValue>11</ghg:MeasureValue>
                            <ghg:NumberofTimesSubstituted>30</ghg:NumberofTimesSubstituted>
                        </ghg:AnnualVolumeofFlareGas>
                        <ghg:AnnualVolumeofFlareGasMethod>ASTM - C</ghg:AnnualVolumeofFlareGasMethod>
                        <ghg:AnnualAverageCarbonDioxideConcentration concentrationUOM="percent by volume or mole">
                            <ghg:MeasureValue>0.75</ghg:MeasureValue>
                            <ghg:NumberofTimesSubstituted>1</ghg:NumberofTimesSubstituted>
                        </ghg:AnnualAverageCarbonDioxideConcentration>
                        <ghg:AnnualAverageCarbonDioxideConcentrationMethod>UOP539-97</ghg:AnnualAverageCarbon... Method>
                        <ghg:TotalNumberofCarbonCompounds>2</ghg:TotalNumberofCarbonCompounds>
                        <ghg:CompoundIdentifierDetails>
                            <ghg:AnnualAverageConcentration concentrationUOM="percent by volume or mole">
                                <ghg:MeasureValue>39</ghg:MeasureValue>
                                <ghg:NumberofTimesSubstituted>30</ghg:NumberofTimesSubstituted>
                            </ghg:AnnualAverageConcentration>
                            <ghg:AnnualAverageConcentrationMethods>
                                <ghg:AnnualAverageConcentrationMethod>Method 18 at 40 CFR part 60, appendix A-6</ghg:Annual...
Method>
                                <ghg:AnnualAverageConcentrationMethod>UOP539-97</ghg:AnnualAverageConcentrationMethod>
                            </ghg:AnnualAverageConcentrationMethods>
                        </ghg:CompoundIdentifierDetails>
                        <ghg:CompoundIdentifierDetails>
                            <ghg:AnnualAverageConcentration concentrationUOM="percent by volume or mole">
                                <ghg:MeasureValue>35</ghg:MeasureValue>
                                <ghg:NumberofTimesSubstituted>20</ghg:NumberofTimesSubstituted>
                            </ghg:AnnualAverageConcentration>
                            <ghg:AnnualAverageConcentrationMethods>
                                <ghg:AnnualAverageConcentrationMethod>ASTM D1945-
03</ghg:AnnualAverageConcentrationMethod>
                                <ghg:AnnualAverageConcentrationMethod>ASTM D2503-92 (Reapproved 2007)</ghg:Annual...
Method>
                            </ghg:AnnualAverageConcentrationMethods>
                        </ghg:CompoundIdentifierDetails>
                    </ghg:Y1bEquationDetails>
                </ghg:FlareGasUnitDetails>
                <ghg:FlareGasUnitDetails>
                    <ghg:UnitIdentification>
                        <ghg:UnitName>FL-004</ghg:UnitName>
                        <ghg:UnitDescription>flar test unit</ghg:UnitDescription>
                        <ghg:UnitType>Flare</ghg:UnitType>
                    </ghg:UnitIdentification>
                    <ghg:FlareType>Other</ghg:FlareType>
                    <ghg:FlareService>Back-up flare</ghg:FlareService>
```

```
                        <ghg:EmissionsDetails>
                            <ghg:CO2Emissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>333</ghg:CalculatedValue>
                            </ghg:CO2Emissions>
                            <ghg:CH4Emissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>2342</ghg:CalculatedValue>
                            </ghg:CH4Emissions>
                            <ghg:N2OEmissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>434</ghg:CalculatedValue>
                            </ghg:N2OEmissions>
                        </ghg:EmissionsDetails>
                        <ghg:FlareGasCarbonFractionBasis>GPA 2261-00</ghg:FlareGasCarbonFractionBasis>
                        <ghg:Y3EquationDetails>
                            <ghg:TotalNumberofSSMEvents>43</ghg:TotalNumberofSSMEvents>
                        </ghg:Y3EquationDetails>
                    </ghg:FlareGasUnitDetails>
                    <ghg:FlareGasUnitDetails>
                        <ghg:UnitIdentification>
                            <ghg:UnitName>FL-001</ghg:UnitName>
                            <ghg:UnitDescription>Test Flare</ghg:UnitDescription>
                            <ghg:UnitType>Flare</ghg:UnitType>
                        </ghg:UnitIdentification>
                        <ghg:FlareType>Steam assisted</ghg:FlareType>
                        <ghg:FlareService>Unit flare</ghg:FlareService>
                        <ghg:EmissionsDetails>
                            <ghg:CO2Emissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>47879</ghg:CalculatedValue>
                            </ghg:CO2Emissions>
                            <ghg:CH4Emissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>2345</ghg:CalculatedValue>
                            </ghg:CH4Emissions>
                            <ghg:N2OEmissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>3214</ghg:CalculatedValue>
                            </ghg:N2OEmissions>
                        </ghg:EmissionsDetails>
                        <ghg:FlareGasCarbonFractionBasis>Engineering calculations</ghg:FlareGasCarbonFractionBasis>
                        <ghg:Y1aEquationDetails>
                            <ghg:MeasurementPeriod>Daily</ghg:MeasurementPeriod>
                            <ghg:AnnualVolumeofFlareGas volUOM="scf">
                                <ghg:MeasureValue>234</ghg:MeasureValue>
                                <ghg:NumberofTimesSubstituted>5</ghg:NumberofTimesSubstituted>
                            </ghg:AnnualVolumeofFlareGas>
                            <ghg:AnnualVolumeofFlareGasMethod>ASTM - A</ghg:AnnualVolumeofFlareGasMethod>
                            <ghg:AnnualAverageMolecularWeight molewtUOM="kg/kg-mole">
                                <ghg:MeasureValue>345</ghg:MeasureValue>
                                <ghg:NumberofTimesSubstituted>109</ghg:NumberofTimesSubstituted>
                            </ghg:AnnualAverageMolecularWeight>
                            <ghg:AnnualAverageMolecularWeightMethod>ASTM D1945-03</ghg:AnnualAverageMolecularWeightMethod>
                            <ghg:AnnualAverageMolecularWeightMethod>GPA 2261-00</ghg:AnnualAverageMolecularWeightMethod>
                            <ghg:AnnualAverageMolecularWeightMethod>ASTM D2503-92 (Reapproved 2007)</ghg:AnnualAverage...
Method>
                            <ghg:AnnualAverageCarbonContent carboncontentUOM="decimal fraction; kg carbon/kg flare gas">
                                <ghg:MeasureValue>0.65</ghg:MeasureValue>
                                <ghg:NumberofTimesSubstituted>3</ghg:NumberofTimesSubstituted>
                            </ghg:AnnualAverageCarbonContent>
                            <ghg:AnnualAverageCarbonContentMethod>ASTM D1945-03</ghg:AnnualAverageCarbonContentMethod>
                            <ghg:AnnualAverageCarbonContentMethod>ASTM D1946-90 (Reapproved 2006)</ghg:AnnualAverageCarbon...
Method>
                            <ghg:AnnualAverageCarbonContentMethod>Chromatographic analysis: manufacturer's
instructions</ghg:AnnualAverageCarbonContentMethod>
                        </ghg:Y1aEquationDetails>
                    </ghg:FlareGasUnitDetails>
                </ghg:FlareGasDetails>
                <ghg:CrackingCokingReformingDetails>
                    <ghg:CrackingCokingReformingUnitDetails>
                        <ghg:UnitIdentification>
                            <ghg:UnitName>CC-CEMS-001</ghg:UnitName>
                            <ghg:UnitType>Fluid Catalytic Cracking Unit</ghg:UnitType>
                        </ghg:UnitIdentification>
                        <ghg:MaximumRatedThroughputofUnit>
                            <ghg:MeasureValue>12</ghg:MeasureValue>
                        </ghg:MaximumRatedThroughputofUnit>
                        <ghg:CrackingCokingEmissionsDetails>
                            <ghg:CH4Emissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>12312</ghg:CalculatedValue>
                            </ghg:CH4Emissions>
                            <ghg:CH4EmissionsCalculationMethod>Equation Y-9 with a default emission factor</ghg:CH4Emissions...
Method>
                            <ghg:N2OEmissions massUOM="Metric Tons">
                                <ghg:CalculatedValue>122121</ghg:CalculatedValue>
                            </ghg:N2OEmissions>
```

```
                                <ghg:N2OEmissionsCalculationMethod>Equation Y-10 with a default emission factor</ghg:N2OEmissions...
Method>
                            </ghg:CrackingCokingEmissionsDetails>
                        </ghg:CrackingCokingReformingUnitDetails>
                        <ghg:CrackingCokingReformingUnitDetails>
                            <ghg:UnitIdentification>
                                <ghg:UnitName>FCCU-Y6Y7b-001</ghg:UnitName>
                                <ghg:UnitType>Fluid Catalytic Cracking Unit</ghg:UnitType>
                            </ghg:UnitIdentification>
                            <ghg:MaximumRatedThroughputofUnit>
                                <ghg:MeasureValue>655</ghg:MeasureValue>
                            </ghg:MaximumRatedThroughputofUnit>
                            <ghg:CrackingCokingEmissionsDetails>
                                <ghg:CO2Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>6544</ghg:CalculatedValue>
                                </ghg:CO2Emissions>
                                <ghg:CO2EmissionsCalculationMethod>Equation Y-6 and Y-7b -
98.253(c)(2)</ghg:CO2EmissionsCalculationMethod>
                                <ghg:CH4Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>4456</ghg:CalculatedValue>
                                </ghg:CH4Emissions>
                                <ghg:CH4EmissionsCalculationMethod>Equation Y-9 with a default emission factor</ghg:CH4Emissions...
Method>
                                <ghg:N2OEmissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>896</ghg:CalculatedValue>
                                </ghg:N2OEmissions>
                                <ghg:N2OEmissionsCalculationMethod>Equation Y-10 with a default emission factor</ghg:N2OEmissions...
Method>
                            </ghg:CrackingCokingEmissionsDetails>
                            <ghg:Y6Details>
                                <ghg:AnnualAverageExhaustGasFlowRate rateUOM="dscf/hour">
                                    <ghg:MeasureValue>345</ghg:MeasureValue>
                                </ghg:AnnualAverageExhaustGasFlowRate>
                                <ghg:PercentCO2 percentUOM="Number (between 0 and 100)">
                                    <ghg:MeasureValue>25</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>98</ghg:NumberofTimesSubstituted>
                                </ghg:PercentCO2>
                                <ghg:PercentCO2ManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test Method 1</ghg:ManufacturersMethod>
                                </ghg:PercentCO2ManufacturersHoursDetails>
                                <ghg:PercentCO percentUOM="Number (between 0 and 100)">
                                    <ghg:MeasureValue>3</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>200</ghg:NumberofTimesSubstituted>
                                </ghg:PercentCO>
                                <ghg:PercentCOManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test Method 2</ghg:ManufacturersMethod>
                                </ghg:PercentCOManufacturersHoursDetails>
                                <ghg:Y7bDetails>
                                    <ghg:AnnualAverageInletGasFlowRate rateUOM="dscf/hour">
                                        <ghg:MeasureValue>564</ghg:MeasureValue>
                                    </ghg:AnnualAverageInletGasFlowRate>
                                    <ghg:OxygenEnrichedAir rateUOM="dscf/hour">
                                        <ghg:MeasureValue>345</ghg:MeasureValue>
                                    </ghg:OxygenEnrichedAir>
                                    <ghg:PercentN2ExhaustGas percentUOM="Number (between 0 and 100)">
                                        <ghg:MeasureValue>45</ghg:MeasureValue>
                                        <ghg:NumberofTimesSubstituted>3</ghg:NumberofTimesSubstituted>
                                    </ghg:PercentN2ExhaustGas>
                                    <ghg:PercentN2ExhaustGasManufacturersMethodDetails>
                                        <ghg:ManufacturersMethod>Method 18 at 40 CFR part 60, appendix A-6</ghg:ManufacturersMethod>
                                    </ghg:PercentN2ExhaustGasManufacturersMethodDetails>
                                    <ghg:PercentN2Inlet percentUOM="Number (between 0 and 100)">
                                        <ghg:MeasureValue>3</ghg:MeasureValue>
                                        <ghg:NumberofTimesSubstituted>70</ghg:NumberofTimesSubstituted>
                                    </ghg:PercentN2Inlet>
                                    <ghg:PercentN2InletManufacturersMethodDetails>
                                        <ghg:ManufacturersMethod>UOP539-97</ghg:ManufacturersMethod>
                                    </ghg:PercentN2InletManufacturersMethodDetails>
                                </ghg:Y7bDetails>
                            </ghg:Y6Details>
                        </ghg:CrackingCokingReformingUnitDetails>
                        <ghg:CrackingCokingReformingUnitDetails>
                            <ghg:UnitIdentification>
                                <ghg:UnitName>FCCU-Y6CM-001</ghg:UnitName>
                                <ghg:UnitDescription>test unit</ghg:UnitDescription>
                                <ghg:UnitType>Fluid Catalytic Cracking Unit</ghg:UnitType>
                            </ghg:UnitIdentification>
                            <ghg:MaximumRatedThroughputofUnit>
                                <ghg:MeasureValue>123</ghg:MeasureValue>
                            </ghg:MaximumRatedThroughputofUnit>
                            <ghg:CrackingCokingEmissionsDetails>
                                <ghg:CO2Emissions massUOM="Metric Tons">
```

```
                                    <ghg:CalculatedValue>1111</ghg:CalculatedValue>
                                </ghg:CO2Emissions>
                                <ghg:CO2EmissionsCalculationMethod>Equation Y-6 and continuous monitor for flow -
98.253(c)(2)</ghg:CO2EmissionsCalculationMethod>
                                <ghg:CH4Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>1540</ghg:CalculatedValue>
                                </ghg:CH4Emissions>
                                <ghg:CH4EmissionsCalculationMethod>Equation Y-9 with a default emission factor</ghg:CH4Emissions...
Method>
                                <ghg:N2OEmissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>2222</ghg:CalculatedValue>
                                </ghg:N2OEmissions>
                                <ghg:N2OEmissionsCalculationMethod>Equation Y-10 with a default emission factor</ghg:N2OEmissions...
Method>
                            </ghg:CrackingCokingEmissionsDetails>
                            <ghg:Y6Details>
                                <ghg:AnnualAverageExhaustGasFlowRate rateUOM="dscf/hour">
                                    <ghg:MeasureValue>232</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>65</ghg:NumberofTimesSubstituted>
                                </ghg:AnnualAverageExhaustGasFlowRate>
                                <ghg:ExhaustGasFlowRateManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test method 1</ghg:ManufacturersMethod>
                                </ghg:ExhaustGasFlowRateManufacturersHoursDetails>
                                <ghg:PercentCO2 percentUOM="Number (between 0 and 100)">
                                    <ghg:MeasureValue>50</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>67</ghg:NumberofTimesSubstituted>
                                </ghg:PercentCO2>
                                <ghg:PercentCO2ManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test method 2</ghg:ManufacturersMethod>
                                </ghg:PercentCO2ManufacturersHoursDetails>
                                <ghg:PercentCO percentUOM="Number (between 0 and 100)">
                                    <ghg:MeasureValue>0.54</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>2</ghg:NumberofTimesSubstituted>
                                </ghg:PercentCO>
                                <ghg:PercentCOManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test method 3</ghg:ManufacturersMethod>
                                </ghg:PercentCOManufacturersHoursDetails>
                            </ghg:Y6Details>
                        </ghg:CrackingCokingReformingUnitDetails>
                        <ghg:CrackingCokingReformingUnitDetails>
                            <ghg:UnitIdentification>
                                <ghg:UnitName>FCCU-Y6Y7a-001</ghg:UnitName>
                                <ghg:UnitType>Fluid Catalytic Cracking Unit</ghg:UnitType>
                            </ghg:UnitIdentification>
                            <ghg:MaximumRatedThroughputofUnit>
                                <ghg:MeasureValue>1111</ghg:MeasureValue>
                            </ghg:MaximumRatedThroughputofUnit>
                            <ghg:CrackingCokingEmissionsDetails>
                                <ghg:CO2Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>6543</ghg:CalculatedValue>
                                </ghg:CO2Emissions>
                                <ghg:CO2EmissionsCalculationMethod>Equation Y-6 and Y-7a -
98.253(c)(2)</ghg:CO2EmissionsCalculationMethod>
                                <ghg:CH4Emissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>4542</ghg:CalculatedValue>
                                </ghg:CH4Emissions>
                                <ghg:CH4EmissionsCalculationMethod>Equation Y-9 with a default emission factor</ghg:CH4Emissions...
Method>
                                <ghg:N2OEmissions massUOM="Metric Tons">
                                    <ghg:CalculatedValue>765</ghg:CalculatedValue>
                                </ghg:N2OEmissions>
                                <ghg:N2OEmissionsCalculationMethod>Equation Y-10 with a default emission factor</ghg:N2OEmissions...
Method>
                            </ghg:CrackingCokingEmissionsDetails>
                            <ghg:Y6Details>
                                <ghg:AnnualAverageExhaustGasFlowRate rateUOM="dscf/hour">
                                    <ghg:MeasureValue>344</ghg:MeasureValue>
                                </ghg:AnnualAverageExhaustGasFlowRate>
                                <ghg:PercentCO2 percentUOM="Number (between 0 and 100)">
                                    <ghg:MeasureValue>34</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>16</ghg:NumberofTimesSubstituted>
                                </ghg:PercentCO2>
                                <ghg:PercentCO2ManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test Method 1</ghg:ManufacturersMethod>
                                </ghg:PercentCO2ManufacturersHoursDetails>
                                <ghg:PercentCO percentUOM="Number (between 0 and 100)">
                                    <ghg:MeasureValue>60</ghg:MeasureValue>
                                    <ghg:NumberofTimesSubstituted>23</ghg:NumberofTimesSubstituted>
                                </ghg:PercentCO>
                                <ghg:PercentCOManufacturersHoursDetails>
                                    <ghg:ManufacturersMethod>Test Method 1</ghg:ManufacturersMethod>
                                </ghg:PercentCOManufacturersHoursDetails>
```

```
                    <ghg:Y7aDetails>
                        <ghg:AnnualAverageInletGasFlowRate rateUOM="dscf/hour">
                            <ghg:MeasureValue>45</ghg:MeasureValue>
                        </ghg:AnnualAverageInletGasFlowRate>
                        <ghg:OxygenEnrichedAir rateUOM="dscf/hour">
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