

**RULE 2011 PROTOCOL -  
CHAPTER 3**

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**PROCESS UNITS - PERIODIC REPORTING  
AND RULE 219 EQUIPMENT**



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Process units may share fuel meters if each equipment has the same emission factor. This chapter also includes the equations describing the methods used to calculate SO<sub>x</sub> process unit emissions and the reporting procedures. The interim reporting period does not apply to process units since existing fuel metering equipment or timers shall be used starting January 1, 1994 for Cycle 1 facilities and July 1, 1994 for Cycle 2 facilities.

#### **A. GENERAL REQUIREMENTS**

1. The equipment-specific or category-specific starting emission factor found in Table 2 of Rule 2002 - Allocations for Oxides of Nitrogen (NO<sub>x</sub>) and Oxides of Sulfur (SO<sub>x</sub>) shall be used for quantifying quarterly mass emissions for a SO<sub>x</sub> process unit.
2. Instead of using the equipment-specific or category-specific starting emission factor found in Table 2 of Rule 2002, the Facility Permit holder of a process unit may apply to the Executive Officer to use a representative emission factor or alternative emission factor for purposes of calculating SO<sub>x</sub> emissions. The alternative emission factor shall be established by the requirements provided in Chapter 6, Subdivision E.
3. The Facility Permit holder of a process unit shall use an emission factor or alternative emission factor to calculate the mass emission according to the methodology specified in Chapter 3, Subdivision B, Paragraph 2. (fuel totalizing meters) or Chapter 3, Subdivision B, Paragraph 3, Subparagraph a (timers).
4. The Facility Permit holder of each SO<sub>x</sub> process unit shall use a totalizing fuel meter or timer as applicable and specified in the Facility Permit for each affected equipment to measure and report the variables listed in Tables 3-A and 3-B, respectively, for each equipment.
5. The Facility Permit holder of each SO<sub>x</sub> process unit shall monitor, report and maintain the following records on a quarterly basis:
  - a. Type and quantity of fuel burned in units of million standard cubic feet per quarter (mmscf per quarter) for gaseous fuels or thousand gallons per quarter (mgal per quarter) for liquid fuels, expressed with three significant figures minimum; or
  - b. Total hours of operation.
6. The Facility Permit holder of each SO<sub>x</sub> process unit shall also provide any other data necessary for calculating the emission rates of oxides of sulfur as determined by the Executive Officer.
7. Fuel meters and/or timers must be non-resettable and tamper-proof. They shall have seals installed by the meter/timer manufacturer to prove the integrity of the measuring device.

Meters which are unsealed for maintenance or repairs shall be resealed by an authorized manufacturers representative.

**B. EMISSION CALCULATIONS FOR REPORTED DATA**

**1. Quarterly Mass Emissions for Interim Periods (January 1, 1994 thru December 31, 1994 for Cycle 1 facilities; and July 1, 1994 thru June 30, 1995 for Cycle 2 facilities)**

- a. Pursuant to Rules 2011(d)(3) and 2011(f)(2), starting January 1, 1994 for Cycle 1 facilities, and starting July 1, 1994 for Cycle 2 facilities, the quarterly emission of each process unit shall be calculated and recorded according to:

$$E_{ip} = \sum_{j=1}^r d_j \times EF_{sj} \quad (\text{Eq.15})$$

where:

$E_{ip}$  = The quarterly mass emission of sulfur oxides for interim period (lb/quarter).

$d_j$  = The quarterly fuel usage for each type of fuel recorded as mmscf/quarter or mgal/quarter.

$EF_{sj}$  = The starting emission factor used to calculate unit emissions in the initial allocation, as specified in Table 2 of Rule 2002 - Allocations for Oxides of Nitrogen ( $NO_x$ ) and Oxides of Sulfur ( $SO_x$ ) (lb/mmscf or lb/mgal, ).

$r$  = The number of different types of fuel.

Example calculation: IC engine burning natural gas

Starting Emission factor = 0.60 lb/mmscf  
 Quarterly fuel usage = 2 mmscf/quarter

$E_{ip} = (0.60) \times (2.0)$   
 $= 1.2 \text{ lb/quarter}$

**2. Totalizing Fuel Meter Based Calculations**

The Facility Permit holder of each equipment in a  $SO_x$  process unit when equipped with a totalizing fuel meter shall use emission factor listed in Table 2 of Rule 2002 or alternative emission factors established according to the methodology provided in Chapter 4 to obtain the quarterly mass emissions according to:

$$E_{EF} = \sum_{k=1}^n d_k \times EF_k \quad \text{Eq.15)}$$

where:

$E_{EF}$  = The quarterly emissions of  $SO_x$  obtained using emission factor (lb/quarter.)

$d_k$  = The quarterly fuel usage for each type of fuel (mmscf/quarter or mgal/quarter.)

$EF_k$  = The emission factor as specified in Table 2 of Rule 2002 - Allocations for Oxides of Nitrogen ( $NO_x$ ) and Oxides of Sulfur ( $SO_x$ ) (lb/mmscf, lb/mgal or lb/mdbl) or an alternative emission factor proposed by the Facility Permit holder as established from the source test requirement provided in Chapter 4

$k$  = Each type of gaseous or liquid fuel consumed by each process unit throughout the quarter.

$n$  = The total number of different types of fuel consumed by each process unit throughout the quarter

### 3. Timer-Based Emission Calculations

If the  $SO_x$  process unit is equipped with a timer, the Facility Permit holder shall quantify the quarterly fuel usage for each affected equipment according to Eq. 17 - Eq. 20 and calculate the quarterly mass emissions according to Eq. 16 - Eq. 20.

#### a. Quarterly Fuel Usage for Each Affected $SO_x$ Process Unit

If the  $SO_x$  process unit does not measure fuel usage with a fuel meter, the quarterly fuel usage for each affected equipment in a process unit shall be quantified according to:

$$d = d_{pu} \times (H/H_{pu}) \quad \text{(Eq.17)}$$

Where:

$d$  = The quarterly fuel usage of an affected  $SO_x$  process unit without a dedicated fuel meter (mmscf/quarter or mgal/quarter).

$d_{pu}$  = The quarterly fuel usage of all  $SO_x$  process units at the facility (mmscf/quarter or mgal/quarter).

H = The quarterly heat input of an affected SO<sub>x</sub> process unit without a dedicated fuel meter (mmBtu/quarter).

H<sub>pu</sub> = The quarterly heat input of all SO<sub>x</sub> process units at the facility (mmBtu/quarter).

Example Calculation:

$$d_{pu} = 1,587 \text{ mmscf/quarter}$$

$$H = 5,400 \text{ mmBtu/quarter}$$

$$H_{pu} = 27,000 \text{ mmBtu/quarter}$$

$$d = d_{pu} \times (H/H_{pu})$$

$$d = 1,587 \text{ mmscf/quarter} \times (5,400 \text{ mmBtu/quarter} / 27,000 \text{ mmBtu/quarter})$$

$$d = 317.4 \text{ mmscf/quarter}$$

The quarterly fuel usage for all SO<sub>x</sub> process units at the facility (d<sub>pu</sub>) shall be calculated according to the following equation:

$$d_{pu} = d_{fac} - d_{major} \tag{Eq.18}$$

where:

d<sub>fac</sub> = The quarterly fuel usage of all major sources and SO<sub>x</sub> process units at the facility (mmscf/quarter or mgal/quarter).

d<sub>major</sub> = The quarterly fuel usage of all major SO<sub>x</sub> sources at the facility (mmscf/quarter or mgal/quarter).

Example Calculation:

$$d_{fac} = 58 \text{ mmscf/quarter}$$

$$d_{major} = 42 \text{ mmscf/quarter}$$

$$d_{pu} = F_{fac} - F_{major}$$

$$d_{pu} = 58 - 42$$

$$d_{pu} = 16 \text{ mmscf/quarter}$$

The quarterly heat input of all SO<sub>x</sub> process units at the facility (H<sub>pu</sub>) shall be calculated according to:

$$H_{pu} = \sum_{i=1}^n (R_i \times T_i) \tag{Eq.19}$$

where:

$R_i$  = The maximum rated heat input capacity of a  $SO_x$  process unit (mmBtu/hr).

$T_i$  = The quarterly accumulated operation hours for a  $SO_x$  process unit (hr/quarter).

$i$  = Each process unit

$n$  = The total number of  $SO_x$  process units at the facility.

Example Calculation:

$$\begin{aligned} R_1 &= 3.5 \text{ mmBtu/hr} \\ R_2 &= 2.7 \text{ mmBtu/hr} \\ T_1 &= 480 \text{ hr/quarter} \\ T_2 &= 120 \text{ hr/quarter} \end{aligned}$$

$$H_{pu} = \sum_{i=1}^2 (R_i \times T_i)$$

$$\begin{aligned} H_{pu} &= (3.5 \times 480) + (2.7 \times 120) \\ H_{pu} &= 2004 \text{ mmBtu/quarter} \end{aligned}$$

The maximum rated heat input capacity of all  $SO_x$  process units shall be in units of mmBtu/hr. Since internal combustion engines are usually rated in units of brake horse power, the maximum rated heat input capacity of an engine shall be computed as follows.

$$R = 0.002545 \times \text{bhp} / \text{eff} \quad (\text{Eq.20})$$

where:

$R$  = The maximum rated heat input capacity

$\text{eff}$  = The manufacturer's rated efficiency @LHV x (LHV/HHV)

= 0.25, if not provided by the operator

$\text{bhp}$  = The manufacturer's rated shaft output in brake horse power

Example Calculation:

$$\begin{aligned} \text{eff} &= 0.25 \\ \text{bhp} &= 75 \text{ bhp} \\ R &= 0.002545 \times \text{bhp} / \text{eff} \\ R &= 0.002545 \times 75 / .25 \\ R &= 0.7635 \text{ mmBtu/hr} \end{aligned}$$

If gas turbines are rated in kilowatts, the rating shall be converted to mmBtu/hr by applying the manufacturer's heat rate (in mmBtu/kw-hr). If the manufacturer's heat rate is not available, a default value of 15,000 Btu/kw-hr shall be used.

**Example Calculation:**

Quarterly fuel usage for an ICE with maximum rated bhp of 90 bhp, 0.25 eff and a boiler rated at 4 mmBtu/hr being served by one fuel totalizer reading 10.5 mmscf. The boiler and ICE burn landfill gas.

I.C.E.= 90 bhp Boiler= 4 mmBtu/hr  $C_g = 80$  ppmv for landfill  
 Fuel meter reading =  $F_{pu} = 10.5$  mmscf gas

I.C.E.

$$R = 0.002545 \times 90 / .25 = 0.916 \text{ mmBtu/hr}$$

$$t = 3 \text{ hr/day} \times 7 \text{ days/wk.} \times 4 \text{ wk./mo.} \times 3 \text{ mo/qtr} = 252 \text{ hr/qtr}$$

$$H_{ice} = R \times t = 0.916 \times 252 = 230.8 \text{ mmBtu/qtr}$$

Boiler

$$H_{boiler} = 4 \text{ mmBtu/hr} \times 24 \text{ hr./day} \times 7 \text{ day/wk.} \times 4 \text{ wk./mo.} \times 3 \text{ mo/qtr}$$

$$H_{boiler} = 8064 \text{ mmBtu/qtr.}$$

$$H_{pu} = 230.8 + 8064 = 8294.8 \text{ mmBtu/qtr.}$$

$$d_{ice} = d_{pu} \times (H_{ice} / H_{pu})$$

$$= 10.5 \text{ mmscf/qtr.} \times (230.8 / 8294.8)$$

$$= .292 \text{ mmscf/qtr.}$$

$$d_{boiler} = d_{pu} \times (H_{boiler} / H_{pu})$$

$$= 10.5 \text{ mmscf/qtr.} \times (8064 / 8294.8)$$

$$= 10.2 \text{ mmscf/qtr.}$$

$$E_{ice} = d_{ice} \times C_g \times 0.166$$

$$E_{ice} = .292 \text{ mmscf/qtr} \times 80 \text{ ppmv} \times 0.166$$

$$E_{ice} = 3.88 \text{ lb/qtr.}$$

$$E_{boiler} = d_{boiler} \times C_g \times 0.166$$

$$E_{boiler} = 10.2 \text{ mmscf/qtr} \times 80 \text{ ppmv} \times 0.166$$

$$E_{boiler} = 135 \text{ lb/qtr.}$$

$$E = E_{ice} + E_{boiler} = 3.88 + 135 = 138.88 \text{ lb/qtr.}$$

**C. TOTAL QUARTERLY EMISSIONS CALCULATION FOR ALL SO<sub>x</sub> PROCESS UNITS AT THE FACILITY**

Quarterly SO<sub>x</sub> emissions of all SO<sub>x</sub> process units at the facility shall be quantified according to:

$$E = \sum_{i=1}^m E_{EF} \quad (\text{Eq.21})$$

where:

E = The quarterly total emissions of SO<sub>x</sub> for all SO<sub>x</sub> process units (lb/quarter).

E<sub>EF</sub> = The quarterly emissions of SO<sub>x</sub> obtained using emission factor (lb/quarter).

i = Each process unit

m = The number of process units at the facility.

**D. REPORTING PROCEDURES**

1. The Facility Permit holder of any SO<sub>x</sub> process unit that opts to monitor at the major source monitoring level shall meet the requirements set forth in Chapter 2 - "Major Sources - Continuous Emission Monitoring System."
2. The total recorded quarterly fuel usage data and SO<sub>x</sub> emissions in pounds per quarter for all SO<sub>x</sub> process units in any facility without RTU shall be recorded in a format approved by the Executive Officer and shall be submitted to the District as part of the Quarterly Certification of Emissions required by Rule 2004.
3. The Facility Permit holder of each SO<sub>x</sub> process unit shall maintain daily records of hours of operation or quarterly usage for each SO<sub>x</sub> process unit.
4. Any changes made in type of fuel used shall be recorded by the Facility Permit holder.

**E. FUEL METER SHARING**

1. A single totaling fuel meter shall be allowed to measure and record the fuel usage of more than one equipment in a process unit, provided that each piece of equipment elects for the same emission factor or alternative emission factor as specified in the Facility Permit.
2. Fuel meter sharing for the interim period shall be for those equipment in a process unit with the same emission factor.

**F. RULE 219 EQUIPMENT**

**1. Emission Determination and Reporting Requirements**

- a. The Facility Permit holder shall determine the emissions for one or more equipment exempt under Rule 219 and report the emissions on a quarterly

basis as part of the Quarterly Certified Emissions report required by Rule 2004. The Facility Permit holder shall be allowed to use the existing fuel totalizer, the monthly fuel billing statement, or any other equivalent methodology to quantify their fuel usage for a quarterly period.

- b. Quarterly reporting period shall start on January 1, 1994 for Cycle 1 facilities and July 1, 1994 for Cycle 2 facilities.
- c. The Facility Permit holder of each equipment shall maintain the quarterly fuel usage data for all equipment exempt under Rule 219 for three years. Such data shall be made available to District staff upon request.
- d. The fuel usage for equipment exempt under Rule 219 may be used in conjunction with process units provided that they have the same emission factor.

**2. Emission Calculations**

The Facility Permit holder shall determine SO<sub>x</sub> emissions for equipment exempt under Rule 219 as follows:

$$E_{EF} = \sum_{k=1}^n d_k \times EF_k \tag{Eq.22}$$

where:

$E_{EF}$  = The quarterly emissions of SO<sub>x</sub> obtained using emission factor (lb/quarter).

$d_k$  = The quarterly fuel usage for each type of fuel (mmscf/quarter or mgal/quarter).

$EF_k$  = The emission factor as specified in Table 2 of Rule 2002 - Allocations for Oxides of Nitrogen (NO<sub>x</sub>) and Oxides of Sulfur (SO<sub>x</sub>) (lb/mmscf, or lb/mgal or lb/mbbl or an alternative emission factor proposed by the Facility Permit holder as established from the source test requirement provided in chapter 4.

$k$  = Each type of gaseous or liquid fuel consumed by each process unit throughout the quarter.

$n$  = The total number of different types of fuel consumed by each process unit throughout the quarter.

**3. Missing Data Periods**

The Facility Permit holder shall determine SO<sub>x</sub> emissions for equipment exempt under Rule 219 using the substitute data procedures specified in Subdivision G of this Chapter for any quarter for which the Facility Permit holder did not obtain and record valid fuel consumption data as required by Subdivision F Paragraphs 1 and 2 of this Chapter.

**G. SUBSTITUTE DATA PROCEDURES**

1. For each process unit or process units using a common fuel meter, elapsed time meter, or equivalent monitoring device, the Facility Permit holder shall provide substitute data as described below whenever a valid quarter of usage data has not been obtained and recorded. Alternative data, based on a back-up fuel meter, elapsed time meter, or equivalent monitoring device, is acceptable for substitution if the Facility Permit holder can demonstrate to the Executive Officer that the alternative system is fully operational during meter down time and within + or - 2% accuracy. The substitute data procedures are retroactively applicable from the adoption date of the RECLAIM program.
2. Whenever data from the process monitor is not available or not recorded for the affected equipment or when the equipment is not operated within the parameter range specified in the Facility Permit, the Facility Permit holder shall calculate substitute data for each quarter, when valid data has not been obtained, according to the following procedures.
  - a. For a missing data period less than or equal to one quarter, substitute data shall be calculated using the process unit(s) average quarterly fuel usage for the previous four quarters. If four quarters of data are not available, substitute data shall be calculated as if the facility has no records.
  - b. For a missing data period greater than one quarter, substitute data shall be calculated using the process unit(s) highest quarterly fuel usage data for the previous four quarters. If four quarters of data are not available, substitute data shall be calculated as if the facility has no records.
  - c. If the facility has no records, substitute data shall be calculated using 100% uptime during the substitution period and the process unit(s) maximum rated capacity and uncontrolled emission factor for each quarter of missing data.

**TABLE 3-A**

**MEASURED VARIABLES FOR ALL SO<sub>x</sub> PROCESS UNITS**

EQUIPMENT	MEASURED VARIABLES
Any SO <sub>x</sub> unit that is not categorized as a major source	<ol style="list-style-type: none"> <li>1. Fuel usage; or Operating time;</li> <li>2. Production rate;</li> <li>3. Fuel sulfur content.</li> </ol>

**TABLE 3-B**

**REPORTED VARIABLES FOR ALL SO<sub>x</sub> PROCESS UNITS**

EQUIPMENT	REPORTED VARIABLES
Any SO <sub>x</sub> unit that is not categorized as a major source	Quarterly SO <sub>x</sub> emissions from each unit.