§ 98.122 GHGs to report.

(a) You must report CO_2, CH_4, and N_2O combustion emissions from each stationary combustion unit. You must calculate and report these emissions under subpart C of this part (General Stationary Fuel Combustion Sources) by following the requirements of subpart C.

(b) You must report under subpart O of this part (HCFC–22 Production and HFC–23 Destruction) the emissions of HFC–23 from HCFC–22 production processes and HFC–23 destruction processes. Do not report the generation and emissions of HFC–23 from HCFC–22 production under this subpart.

(c) You must report the total mass of each fluorinated GHG emitted from:

(1) Each fluorinated gas production process and all fluorinated gas production processes combined.

(2) Each fluorinated gas transformation process that is not part of a fluorinated gas production process and all such fluorinated gas transformation processes combined, except report separately fluorinated GHG emissions from transformation processes where a fluorinated GHG reactant is produced at another facility.

(3) Each fluorinated gas destruction process that is not part of a fluorinated gas production process or a fluorinated gas transformation process and all such fluorinated gas destruction processes combined.

(4) Venting of residual fluorinated GHGs from containers returned from the field.

§ 98.123 Calculating GHG emissions.

For fluorinated gas production and transformation processes, you must calculate the fluorinated GHG emissions from each process using either the mass balance method specified in paragraph (b) of this section or the emission factor or emission calculation factor method specified in paragraphs (c), (d), and (e) of this section, as appropriate. For destruction processes that destroy fluorinated GHGs that were previously "produced" as defined at § 98.410(b), you must calculate emissions using the procedures in paragraph (f) of this section. For venting of residual gas from containers (e.g., cylinder heels), you must calculate emissions using the procedures in paragraph (g) of this section.

(a) *Default GWP value.* In paragraphs (b)(1) and (c)(1) of this section and in § 98.124(b)(8) and (c)(2), use a GWP of 2,000 for fluorinated GHGs that do not have GWPs listed in Table A–1 to subpart A of this part, except as provided in paragraph § 98.123(c)(1)(vi). Do not report CO_2e emissions under § 98.3(c)(4) for fluorinated GHGs that do not have GWPs listed in Table A–1 to subpart A of this part.

(b) *Mass balance method.* Before using the mass balance approach to estimate your fluorinated GHG emissions from a process, you must ensure that the process and the equipment and methods used to measure it meet either the error limits described in this paragraph and calculated under paragraph (b)(1) of this section or the requirements specified in paragraph § 98.124(b)(8). If you choose to calculate the error limits, you must estimate the absolute and relative errors associated with using the mass balance approach on that process using Equations L–1 through L–4 of this section in conjunction with Equations L–5 through L–10 of this section. You may use the mass-balance approach to estimate emissions from the process if this calculation results in an absolute error of less than or equal to 3,000 metric tons CO_2e per year or a relative error of less than or equal to 30 percent of the estimated CO_2e fluorinated GHG emissions. If you do not meet either of the error limits or the requirements of paragraph § 98.124(b)(8), you must use the emission factor approach detailed in paragraphs (c), (d), and (e) of this section to estimate emissions from the process.

(1) *Error calculation.* To perform the calculation, you must first calculate the absolute and relative errors associated with the quantities calculated using either Equations L–7 through L–10 of this section or Equation L–17 of this section. Alternatively, you may estimate these errors based on the variability of previous process measurements (e.g., the variability of measurements of stream concentrations), provided these measurements are representative of the current process and

current measurement devices and techniques. Once errors have been calculated for the quantities in these equations, those errors must be used to calculate the errors in Equations L–6 and L–5 of this section. You may ignore the errors associated with Equations L–11, L–12, and L–13 of this section.

(i) Where the measured quantity is a mass, the error in the mass must be equated to the accuracy or precision (whichever is larger) of the flowmeter, scale, or combination of volumetric and density measurements at the flow rate or mass measured.

(ii) Where the measured quantity is a concentration of a stream component, the error of the concentration must be equated to the accuracy or precision (whichever is larger) with which you estimate the mean concentration of that stream component, accounting for the variability of the process, the fre-quency of the measurements, and the accuracy or precision (whichever is larger) of the analytical technique used to measure the concentration at the concentration measured. If the varia-bility of process measurements is used to estimate the error, this variability shall be assumed to account both for the variability of the process and the precision of the analytical technique. Use standard statistical techniques such as the student's t distribution to estimate the error of the mean of the concentration measurements as a func-tion of process variability and fre-quency of measurement.

(iii) Equation L–1 of this section pro-vides the general formula for calcu-lating the absolute errors of sums and differences where the sum, S, is the summation of variables measured, a, b, c, etc. (e.g., S = a + b + c):

$$e_{SA} = [(a*e_a)^2 + (b*e_b)^2 + (c*e_c)^2]^{1/2} \quad (Eq. \ L-1)$$

Where:

e_{SA} = Absolute error of the sum, expressed as one half of a 95 percent confidence inter-val.
e_a = Relative error of a, expressed as one half of a 95 percent confidence interval.
e_b = Relative error of b, expressed as one half of a 95 percent confidence interval.

e_c = Relative error of c, expressed as one half of a 95 percent confidence interval.

(iv) Equation L–2 of this section pro-vides the general formula for calcu-lating the relative errors of sums and differences:

$$e_{SR} = \frac{e_{sA}}{(a+b+c)} \quad (Eq. \ L-2)$$

Where:

e_{SR} = Relative error of the sum, expressed as one half of a 95 percent confidence inter-val.
e_{SA} = Absolute error of the sum, expressed as one half of a 95 percent confidence inter-val.
a+b+c = Sum of the variables measured.

(v) Equation L–3 of this section pro-vides the general formula for calcu-lating the absolute errors of products (e.g., flow rates of GHGs calculated as the product of the flow rate of the stream and the concentration of the GHG in the stream), where the product, P, is the result of multiplying the vari-ables measured, a, b, c, etc. (e.g., P = a*b*c):

$$e_{PA} = (a*b*c)(e_a^2 + e_b^2 + e_c^2)^{1/2} \quad (Eq. \ L-3)$$

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Where:

e_{PA} = Absolute error of the product, expressed as one half of a 95 percent confidence interval.

e_a = Relative error of a, expressed as one half of a 95 percent confidence interval.

e_b = Relative error of b, expressed as one half of a 95 percent confidence interval.

e_c = Relative error of c, expressed as one half of a 95 percent confidence interval.

(vi) Equation L–4 of this section provides the general formula for calculating the relative errors of products:

$$e_{PR} = \frac{e_{PA}}{(a*b*c)} \quad (\text{Eq. L-4})$$

Where:

e_{PR} = Relative error of the product, expressed as one half of a 95 percent confidence interval.

e_{PA} = Absolute error of the product, expressed as one half of a 95 percent confidence interval.

a*b*c = Product of the variables measured.

(vii) Calculate the absolute error of the emissions estimate in terms of CO_2e by performing a preliminary estimate of the annual CO_2e emissions of the process using the method in paragraph (b)(1)(viii) of this section. Multiply this result by the relative error calculated for the mass of fluorine emitted from the process in Equation L–6 of this section.

(viii) To estimate the annual CO_2e emissions of the process for use in the error estimate, apply the methods set forth in paragraphs (b)(2) through (b)(7) and (b)(9) through (b)(16) of this section to representative process measurements. If these process measurements represent less than one year of typical process activity, adjust the estimated emissions to account for one year of typical process activity. To estimate the terms FER_d, FEP, and FEB_k for use in the error estimate for Equations L–11, L–12, and L–13 of this section, you must either use emission testing, monitoring of emitted streams, and/or engineering calculations or assessments, or in the alternative assume that all fluorine is emitted in the form of the fluorinated GHG that has the highest GWP among the fluorinated GHGs that occur in more than trace concentrations in the process. To convert the fluorinated GHG emissions to CO_2e, use Equation A–1 of § 98.2. For fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A of this part, use a default GWP of 2,000.

(2) The total mass of each fluorinated GHG emitted annually from each fluorinated gas production and each fluorinated GHG transformation process must be estimated by using Equation L–5 of this section.

$$E_{FGHGf} = \sum_{p=1}^{n} (E_{Rp-FGHGf} + E_{Pp-FGHGf} + E_{Bp-FGHGf}) \quad (\text{Eq. L-5})$$

Where:

E_{FGHGf} = Total mass of each fluorinated GHG f emitted annually from production or transformation process i (metric tons).

$E_{Rp-FGHGf}$ = Total mass of fluorinated GHG reactant f emitted from production process i over the period p (metric tons, calculated in Equation L–11 of this section).

$E_{Pp-FGHGf}$ = Total mass of the fluorinated GHG product f emitted from production process i over the period p (metric tons, calculated in Equation L–12 of this section).

$E_{Bp-FGHGf}$ = Total mass of fluorinated GHG by-product f emitted from production process i over the period p (metric tons, calculated in Equation L–13 of this section).

n = Number of concentration and flow measurement periods for the year.

(3) The total mass of fluorine emitted from process i over the period p must be estimated at least monthly by calculating the difference between the total mass of fluorine in the

reactant(s) (or inputs, for processes that do not involve a chemical reaction) and the total mass of fluorine in the product (or outputs, for processes that do not involve a chemical reaction), accounting for the total mass of fluorine in any destroyed or recaptured streams that contain reactants, products, or by-products (or inputs or outputs). This calculation must be performed using Equation L–6 of this section. An element other than fluorine may be used in the mass-balance equation, provided the element occurs in all of the fluorinated GHGs fed into or generated by the process. In this case, the mass fractions of the element in the reactants, products, and by-products must be calculated as appropriate for that element.

$$E_F = \sum_{1}^{v} (R_d * MFF_{Rd}) - P * MFF_P - F_D \qquad \text{(Eq. L-6)}$$

Where:

E_F = Total mass of fluorine emitted from process i over the period p (metric tons).

R_d = Total mass of the fluorine-containing reactant d that is fed into process i over the period p (metric tons).

P = Total mass of the fluorine-containing product produced by process i over the period p (metric tons).

MFF_{Rd} = Mass fraction of fluorine in reactant d, calculated in Equation L–14 of this section.

MFF_P = Mass fraction of fluorine in the product, calculated in Equation L–15 of this section.

F_D = Total mass of fluorine in destroyed or recaptured streams from process i containing fluorine-containing reactants, products, and by-products over the period p, calculated in Equation L–7 of this section.

v = Number of fluorine-containing reactants fed into process i.

(4) The mass of total fluorine in destroyed or recaptured streams containing fluorine-containing reactants, products, and by-products must be estimated at least monthly using Equation L–7 of this section unless you use the alternative approach provided in paragraph (b)(15) of this section.

$$F_D = \sum_{j=1}^{q} P_j * MFF_P + \sum_{k=1}^{u} \left[\left(\sum_{j=1}^{q} B_{kj} + \sum_{l=1}^{x} B_{kl} \right) * MFF_{Bk} \right] + \sum_{d=1}^{v} \left(\sum_{j=1}^{q} R_{dj} * MFF_{Rd} \right) \qquad \text{(Eq. L-7)}$$

Where:

F_D = Total mass of fluorine in destroyed or recaptured streams from process i containing fluorine-containing reactants, products, and by-products over the period p.

P_j = Mass of the fluorine-containing product removed from process i in stream j and destroyed over the period p (calculated in Equation L–8 or L–9 of this section).

B_{kj} = Mass of fluorine-containing by-product k removed from process i in stream j and destroyed over the period p (calculated in Equation L–8 or L–9 of this section).

B_{kl} = Mass of fluorine-containing by-product k removed from process i in stream l and recaptured over the period p.

R_{dj} = Mass of fluorine-containing reactant d removed from process i in stream j and destroyed over the period p (calculated in Equation L–8 or L–9 of this section).

MFF_{Rd} = Mass fraction of fluorine in reactant d, calculated in Equation L–14 of this section.

MFF_P = Mass fraction of fluorine in the product, calculated in Equation L–15 of this section.

MFF_{Bk} = Mass fraction of fluorine in by-product k, calculated in Equation L–16 of this section.

q = Number of streams destroyed in process i.

x = Number of streams recaptured in process i.

u = Number of fluorine-containing by-products generated in process i.

v = Number of fluorine-containing reactants fed into process i.

(5) The mass of each fluorinated GHG removed from process i in stream j and destroyed over the period p (i.e., P_j, B_{kj},

or R_{dj}, as applicable) must be estimated by applying the destruction efficiency of the device that has been demonstrated for the fluorinated GHG f to fluorinated GHG f using Equation L–8 of this section:

$$M_{FGHGfj} = DE_{FGHGf} * c_{FGHGfj} * S_j \quad \text{(Eq. L-8)}$$

Where:

M_{FGHGfj} = Mass of fluorinated GHG f removed from process i in stream j and destroyed over the period p. (This may be P_j, B_{kj}, or R_{dj}, as applicable.)

DE_{FGHGf} = Destruction efficiency of the device that has been demonstrated for fluorinated GHG f in stream j (fraction).

C_{FGHGfj} = Concentration (mass fraction) of fluorinated GHG f in stream j removed from process i and fed into the destruction device over the period p. If this con-centration is only a trace concentration, $c_{F–GHGfj}$ is equal to zero.

S_j = Mass removed in stream j from process i and fed into the destruction device over the period p (metric tons).

(6) The mass of each fluorine-con-taining compound that is not a fluorinated GHG and that is removed from process i in stream j and de-stroyed over the period p (i.e., P_j, B_{kj}, or R_{dj}, as applicable) must be estimated using Equation L–9 of this section.

$$M_{FCgj} = c_{FCgj} * S_j \quad \text{(Eq. L-9)}$$

Where:

M_{FCgj} = Mass of non-GHG fluorine-containing compound g removed from process i in stream j and destroyed over the period p. (This may be P_j, B_{kj}, or R_{dj}, as applicable).

c_{FCgj} = Concentration (mass fraction) of non-GHG fluorine-containing compound g in stream j removed from process i and fed into the destruction device over the pe-riod p. If this concentration is only a trace concentration, c_{FCgj} is equal to zero.

S_j = Mass removed in stream j from process i and fed into the destruction device over the period p (metric tons).

(7) The mass of fluorine-containing by-product k removed from process i in stream l and recaptured over the period p must be estimated using Equation L–10 of this section:

$$B_{kl} = c_{Bkl} * S_l \quad \text{(Eq. L-10)}$$

Where:

B_{kl} = Mass of fluorine-containing by-product k removed from process i in stream l and recaptured over the period p (metric tons).

c_{Bkl} = Concentration (mass fraction) of fluo-rine-containing by-product k in stream l removed from process i and recaptured over the period p. If this concentration is only a trace concentration, c_{Bkl} is equal to zero.

S_l = Mass removed in stream l from process i and recaptured over the period p (met-ric tons).

(8) To estimate the terms FER_d, FEP, and FEB_k for Equations L–11, L–12, and L–13 of this section, you must assume that the total mass of fluorine emitted, E_F, estimated in Equation L–6 of this section, occurs in the form of the fluorinated GHG that has the highest GWP among the fluorinated GHGs that occur in more than trace concentra-tions in the process unless you possess emission characterization measure-ments showing otherwise. These emis-sion characterization measurements must meet the requirements in para-graph (8)(i), (ii), or (iii) of this section, as appropriate. The sum of the terms must equal 1. You must document the data and calculations that are used to speciate individual compounds and to

estimate FER_d, FEP, and FEB_k. Exclude from your calculations the fluorine included in F_D. For example, exclude fluorine-containing compounds that are not fluorinated GHGs and that result from the destruction of fluorinated GHGs by any destruction devices (e.g., the mass of HF created by combustion of an HFC). However, include emissions of fluorinated GHGs that survive the destruction process.

(i) If the calculations under paragraph (b)(1)(viii) of this section, or any subsequent measurements and calculations under this subpart, indicate that the process emits 25,000 metric tons CO_2e or more, estimate the emissions from each process vent, considering controls, using the methods in § 98.123(c)(1). You must characterize the emissions of any process vent that emits 25,000 metric tons CO_2e or more as specified in § 98.124(b)(4).

(ii) For other vents, including vents from processes that emit less than 25,000 metric tons CO_2e, you must characterize emissions as specified in § 98.124(b)(5).

(iii) For fluorine emissions that are not accounted for by vent estimates, you must characterize emissions as specified in § 98.124(b)(6).

(9) The total mass of fluorine-containing reactant d emitted must be estimated at least monthly based on the total fluorine emitted and the fraction that consists of fluorine-containing reactants using Equation L–11 of this section. If the fluorine-containing reactant d is a non-GHG, you may assume that FER_d is zero.

$$E_{R-ip} = \frac{FER_d * E_F}{\left(\sum_{d=1}^{v} FER_d * MFF_{Rd} + FEP * MFF_P + \sum_{k=1}^{u} FEB_k * MFF_{Bk} \right)} \quad \text{(Eq. L-11)}$$

Where:

$E_{R\text{-}ip}$ = Total mass of fluorine-containing reactant d that is emitted from process i over the period p (metric tons).

FER_d = The fraction of the mass emitted that consists of the fluorine-containing reactant d.

E_F = Total mass of fluorine emissions from process i over the period p (metric tons), calculated in Equation L–6 of this section.

FEP = The fraction of the mass emitted that consists of the fluorine-containing product.

FEB_k = The fraction of the mass emitted that consists of fluorine-containing by-product k.

MFF_{Rd} = Mass fraction of fluorine in reactant d, calculated in Equation L–14 of this section.

MFF_P = Mass fraction of fluorine in the product, calculated in Equation L–15 of this section.

MFF_{Bk} = Mass fraction of fluorine in by-product k, calculation in Equation L–16 of this section.

u = Number of fluorine-containing by-products generated in process i.

v = Number of fluorine-containing reactants fed into process i.

(10) The total mass of fluorine-containing product emitted must be estimated at least monthly based on the total fluorine emitted and the fraction that consists of fluorine-containing products using Equation L–12 of this section. If the fluorine-containing product is a non-GHG, you may assume that FEP is zero.

$$E_{P-ip} = \frac{FEP * E_F}{\left(\sum_{d=1}^{v} FER_d * MFF_{Rd} + FEP * MFF_P + \sum_{k=1}^{u} FEB_k * MFF_{Bk} \right)} \quad \text{(Eq. L-12)}$$

Where:

E_{P-ip} = Total mass of fluorine-containing product emitted from process i over the period p (metric tons).

FEP = The fraction of the mass emitted that consists of the fluorine-containing product.

E_F = Total mass of fluorine emissions from process i over the period p (metric tons), calculated in Equation L–6 of this section.

FER_d = The fraction of the mass emitted that consists of fluorine-containing reactant d.

FEB_k = The fraction of the mass emitted that consists of fluorine-containing by-product k.

MFF_{Rd} = Mass fraction of fluorine in reactant d, calculated in Equation L–14 of this section.

MFF_P = Mass fraction of fluorine in the product, calculated in Equation L–15 of this section.

MFF_{Bk} = Mass fraction of fluorine in by-product k, calculation in Equation L–16 of this section.

u = Number of fluorine-containing by-products generated in process i.

v = Number of fluorine-containing reactants fed into process i.

(11) The total mass of fluorine-containing by-product k emitted must be estimated at least monthly based on the total fluorine emitted and the fraction that consists of fluorine-containing by-products using Equation L–13 of this section. If fluorine-containing by-product k is a non-GHG, you may assume that FEB_k is zero.

$$E_{Bk-ip} = \frac{FEB_k * E_F}{\left(\sum_1^v FER_d * MFF_{Rd} + FEP * MFF_P + \sum_{k=1}^u FEB_k * MFF_{Bk} \right)} \quad \text{(Eq. L-13)}$$

Where:

E_{Bk-ip} = Total mass of fluorine-containing by-product k emitted from process i over the period p (metric tons).

FEB_k = The fraction of the mass emitted that consists of fluorine-containing by-product k.

FER_d = The fraction of the mass emitted that consists of fluorine-containing reactant d.

FEP = The fraction of the mass emitted that consists of the fluorine-containing product.

E_F = Total mass of fluorine emissions from process i over the period p (metric tons), calculated in Equation L–6 of this section.

MFF_{Rd} = Mass fraction of fluorine in reactant d, calculated in Equation L–14 of this section.

MFF_P = Mass fraction of fluorine in the product, calculated in Equation L–15 of this section.

MFF_{Bk} = Mass fraction of fluorine in by-product k, calculation in Equation L–16 of this section.

u = Number of fluorine-containing by-products generated in process i.

v = Number of fluorine-containing reactants fed into process i.

(12) The mass fraction of fluorine in reactant d must be estimated using Equation L–14 of this section:

$$MFF_{Rd} = MF_{Rd} * \frac{AW_F}{MW_{Rd}} \quad \text{(Eq. L-14)}$$

Where:

MFF_{Rd} = Mass fraction of fluorine in reactant d (fraction).

MF_{Rd} = Moles fluorine per mole of reactant d.

AW_F = Atomic weight of fluorine.

MW_{Rd} = Molecular weight of reactant d.

(13) The mass fraction of fluorine in the product must be estimated using Equation L–15 of this section:

$$MFF_P = MF_P * \frac{AW_F}{MW_P} \quad \text{(Eq. L-15)}$$

Where:

MFF_P = Mass fraction of fluorine in the product (fraction).

MF_P = Moles fluorine per mole of product.

AW_F = Atomic weight of fluorine.

MW_P = Molecular weight of the product produced.

(14) The mass fraction of fluorine in by-product k must be estimated using Equation L–16 of this section:

$$MFF_{Bk} = MF_{Bk} * \frac{AW_F}{MW_{Bk}} \quad \text{(Eq. L-16)}$$

Where:

MFF_{Bk} = Mass fraction of fluorine in the product (fraction).

MF_{Bk} = Moles fluorine per mole of by-product k.

AW_F = Atomic weight of fluorine.

MW_{Bk} = Molecular weight of by-product k.

(15) *Alternative for determining the mass of fluorine destroyed or recaptured.* As an alternative to using Equation L–7 of this section as provided in paragraph (b)(4) of this section, you may estimate at least monthly the total mass of fluorine in destroyed or recaptured streams containing fluorine-containing compounds (including all fluorine-containing reactants, products, and by-products) using Equation L–17 of this section.

$$F_D = \sum_{j=1}^{q} DE_{avgj} * c_{TFj} * S_j + \sum_{l=1}^{x} c_{TFl} * S_l \quad \text{(Eq. L-17)}$$

Where:

F_D = Total mass of fluorine in destroyed or recaptured streams from process i containing fluorine-containing reactants, products, and by-products over the period p.

DE_{avgj} = Weighted average destruction efficiency of the destruction device for the fluorine-containing compounds identified in destroyed stream j under §98.124(b)(4)(ii) and (5)(ii) (calculated in Equation L–18 of this section)(fraction).

c_{TFj} = Concentration (mass fraction) of total fluorine in stream j removed from process i and fed into the destruction device over the period p. If this concentration is only a trace concentration, c_{TFj} is equal to zero.

S_j = Mass removed in stream j from process i and fed into the destruction device over the period p (metric tons).

c_{TFl} = Concentration (mass fraction) of total fluorine in stream l removed from process i and recaptured over the period p. If this concentration is only a trace concentration, c_{Bkl} is equal to zero.

S_l = Mass removed in stream l from process i and recaptured over the period p.

q = Number of streams destroyed in process i.

x = Number of streams recaptured in process i.

(16) *Weighted average destruction efficiency.* For purposes of Equation L–17 of this section, calculate the weighted average destruction efficiency applicable to a destroyed stream using Equation L–18 of this section.

$$DE_{avgj} = \frac{\sum_{f=1}^{w} DE_{FGHGf} * c_{FGHGf} * S_j * MFF_{FGHGf} + \sum_{g=1}^{y} c_{FCg} * S_j * MFF_g}{\sum_{f=1}^{w} c_{FGHGf} * S_j * MFF_{FGHGf} + \sum_{g=1}^{y} c_{FCg} * S_j * MFF_g}$$ (Eq. L-18)

Where:

DE_{avgj} = Weighted average destruction efficiency of the destruction device for the fluorine-containing compounds identified in destroyed stream j under 98.124(b)(4)(ii) or (b)(5)(ii), as appropriate.

DE_{FGHGf} = Destruction efficiency of the device that has been demonstrated for fluorinated GHG f in stream j (fraction).

c_{FGHGfj} = Concentration (mass fraction) of fluorinated GHG f in stream j removed from process i and fed into the destruction device over the period p. If this concentration is only a trace concentration, $c_{F-GHGfj}$ is equal to zero.

c_{FCgj} = Concentration (mass fraction) of non-GHG fluorine-containing compound g in stream j removed from process i and fed into the destruction device over the period p. If this concentration is only a trace concentration, c_{FCgj} is equal to zero.

S_j = Mass removed in stream j from process i and fed into the destruction device over the period p (metric tons).

MFF_{FGHGf} = Mass fraction of fluorine in fluorinated GHG f, calculated in Equation L–14, L–15, or L–16 of this section, as appropriate.

MFF_{FCg} = Mass fraction of fluorine in non-GHG fluorine-containing compound g, calculated in Equation L–14, L–15, or L–16 of this section, as appropriate.

w = Number of fluorinated GHGs in destroyed stream j.

y = Number of non-GHG fluorine-containing compounds in destroyed stream j.

(c) *Emission factor and emission calculation factor methods.* To use the method in this paragraph for batch processes, you must comply with either paragraph (c)(3) of this section (Emission Factor approach) or paragraph (c)(4) of this section (Emission Calculation Factor approach). To use the method in this paragraph for continuous processes, you must first make a preliminary estimate of the emissions from each individual continuous process vent under paragraph (c)(1) of this section. If your continuous process operates under different conditions as part of normal operations, you must also define the different operating scenarios and make a preliminary esti-

mate of the emissions from the vent for each operating scenario. Then, compare the preliminary estimate for each continuous process vent (summed across operating scenarios) to the criteria in paragraph (c)(2) of this section to determine whether the process vent meets the criteria for using the emission factor method described in paragraph (c)(3) of this section or whether the process vent meets the criteria for using the emission calculation factor method described in paragraph (c)(4) of this section. For continuous process vents that meet the criteria for using the emission factor method described in paragraph (c)(3) of this section and that have more than one operating scenario, compare the preliminary estimate for each operating scenario to the criteria in (c)(3)(ii) to determine whether an emission factor must be developed for that operating scenario.

(1) *Preliminary estimate of emissions by process vent.* You must estimate the annual CO_2e emissions of fluorinated GHGs for each process vent within each operating scenario of a continuous process using the approaches specified in paragraph (c)(1)(i) or (c)(1)(ii) of this section, accounting for any destruction as specified in paragraph (c)(1)(iii) of this section. You must determine emissions of fluorinated GHGs by process vent by using measurements, by using calculations based on chemical engineering principles and chemical property data, or by conducting an engineering assessment. You may use previous measurements, calculations, and assessments if they represent current process operating conditions or process operating conditions that would result in higher fluorinated GHG emissions than the current operating conditions and if they were performed in accordance with paragraphs (c)(1)(i), (c)(1)(ii), and (c)(1)(iii) of this section, as applicable. You must document all data, assumptions, and procedures used in the calculations or engineering assessment

and keep a record of the emissions determination as required by § 98.127(a).

(i) *Engineering calculations.* For process vent emission calculations, you may use any of paragraphs (c)(1)(i)(A), (c)(1)(i)(B), or (c)(1)(i)(C) of this section.

(A) U.S. Environmental Protection Agency, Emission Inventory Improvement Program, Volume II: Chapter 16, Methods for Estimating Air Emissions from Chemical Manufacturing Facilities, August 2007, Final (incorporated by reference, see § 98.7).

(B) You may determine the fluorinated GHG emissions from any process vent within the process using the procedures specified in § 63.1257(d)(2)(i) and (d)(3)(i)(B) of this chapter, except as specified in paragraphs (c)(1)(i)(B)(*1*) through (c)(1)(i)(B)(*4*) of this section. For the purposes of this subpart, use of the term ''HAP'' in § 63.1257(d)(2)(i) and (d)(3)(i)(B) of this chapter means ''fluorinated GHG''.

(*1*) To calculate emissions caused by the heating of a vessel without a process condenser to a temperature lower than the boiling point, you must use the procedures in § 63.1257(d)(2)(i)(C)(*3*) of this chapter.

(*2*) To calculate emissions from depressurization of a vessel without a process condenser, you must use the procedures in § 63.1257(d)(2)(i)(D)(*10*) of this chapter.

(*3*) To calculate emissions from vacuum systems, the terms used in Equation 33 to § 63.1257(d)(2)(i)(E) of this chapter are defined as follows:

(*i*) P_{system} = Absolute pressure of the receiving vessel.

(*ii*) P_i= Partial pressure of the fluorinated GHG determined at the exit temperature and exit pressure conditions of the condenser or at the conditions of the dedicated receiver.

(*iii*) P_j= Partial pressure of condensables (including fluorinated GHG) determined at the exit temperature and exit pressure conditions of the condenser or at the conditions of the dedicated receiver.

(*iv*) $MW_{Fluorinated\ GHG}$= Molecular weight of the fluorinated GHG determined at the exit temperature and exit pressure conditions of the condenser or at the conditions of the dedicated receiver.

(*4*) To calculate emissions when a vessel is equipped with a process condenser or a control condenser, you must use the procedures in § 63.1257(d)(3)(i)(B) of this chapter, except as follows:

(*i*) You must determine the flowrate of gas (or volume of gas), partial pressures of condensables, temperature (T), and fluorinated GHG molecular weight ($MW_{Fluorinated\ GHG}$) at the exit temperature and exit pressure conditions of the condenser or at the conditions of the dedicated receiver.

(*ii*) You must assume that all of the components contained in the condenser exit vent stream are in equilibrium with the same components in the exit condensate stream (except for noncondensables).

(*iii*) You must perform a material balance for each component, if the condensate receiver composition is not known.

(*iv*) For the emissions from gas evolution, the term for time, t, must be used in Equation 12 to § 63.1257(d)(2)(i)(B) of this chapter.

(*v*) Emissions from empty vessel purging must be calculated using Equation 36 to § 63.1257(d)(2)(i)(H) of this chapter and the exit temperature and exit pressure conditions of the condenser or the conditions of the dedicated receiver.

(C) Commercial software products that follow chemical engineering principles (e.g., including the calculation methodologies in paragraphs (c)(1)(i)(A) and (c)(1)(i)(B) of this section).

(ii) *Engineering assessments.* For process vent emissions determinations, you may conduct an engineering assessment to calculate uncontrolled emissions. An engineering assessment includes, but is not limited to, the following:

(A) Previous test results, provided the tests are representative of current operating practices of the process.

(B) Bench-scale or pilot-scale test data representative of the process operating conditions.

(C) Maximum flow rate, fluorinated GHG emission rate, concentration, or other relevant parameters specified or implied within a permit limit applicable to the process vent.

(D) Design analysis based on chemical engineering principles, measureable process parameters, or physical or chemical laws or properties.

(iii) *Impact of destruction for the preliminary estimate.* If the process vent is vented to a destruction device, you may reflect the impact of the destruction device on emissions. In your emissions estimate, account for the following:

(A) The destruction efficiencies of the device that have been demonstrated for the fluorinated GHGs in the vent stream for periods when the process vent is vented to the destruction device.

(B) Any periods when the process vent is not vented to the destruction device.

(iv) *Use of typical recent values.* In the calculations in paragraphs (c)(1)(i), (c)(1)(ii), and (c)(1)(iii) of this section, the values used for the expected process activity and for the expected fraction of that activity whose emissions will be vented to the properly functioning destruction device must be based on either typical recent values for the process or values that would overestimate emissions from the process, unless there is a compelling reason to adopt a different value (e.g., installation of a destruction device for a previously uncontrolled process). If there is such a reason, it must be documented in the GHG Monitoring Plan.

(v) *GWPs.* To convert the fluorinated GHG emissions to CO_2e, use Equation A–1 of § 98.2. For fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A of this part, use a default GWP of 2,000 unless you submit a request to use other GWPs for those fluorinated GHGs in that process under paragraph (c)(1)(vi) of this section and we approve that request.

(vi) *Request to use a GWP other than 2,000 for fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A of this part.* If your process vent emits one or more fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A of this part, that are emitted in quantities that, with a default GWP of 2,000, result in total calculated annual emissions equal to or greater than 10,000 metric tons CO_2e for the vent, and that

you believe have GWPs that would result in total calculated annual emissions less than 10,000 metric tons CO_2e for the vent, you may submit a request to use provisional GWPs for these fluorinated GHGs for purposes of the calculations in paragraph (c)(1) of this section. The request must be submitted by February 28, 2011 for a completeness determination and review by EPA.

(A) *Contents of the request.* You must include the following information in the request for each fluorinated GHG that does not have a GWP listed in Table A–1 to subpart A of this part and that constitutes more than one percent by mass of the stream emitted from the vent:

(*1*) The identity of the fluorinated GHG, including its chemical formula and, if available, CAS number.

(*2*) The estimated GWP of the fluorinated GHG.

(*3*) The data and analysis that supports your estimate of the GWP of the fluorinated GHG, including:

(*i*) Data and analysis related to the low-pressure gas phase infrared absorption spectrum of the fluorinated GHG.

(*ii*) Data and analysis related to the estimated atmospheric lifetime of the fluorinated GHG (reaction mechanisms and rates, including e.g., photolysis and reaction with atmospheric components such as OH, O_3, CO, and water).

(*iii*) The radiative transfer analysis that integrates the lifetime and infrared absorption spectrum data to calculate the GWP.

(*iv*) Any published or unpublished studies of the GWP of the gas.

(*4*) The engineering calculations or assessments and underlying data that demonstrate that the process vent is calculated to emit less than 10,000 metric tons CO_2e of this and other fluorinated GHGs only when the proposed provisional GWPs, not the default GWP of 2,000, are used for fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A of this part.

(B) *Review and completeness determination by EPA.* If EPA makes a preliminary determination that the request is complete, that it substantiates each of the provisional GWPs, and that it demonstrates that the process vent is calculated to emit less than 10,000 metric

tons CO_2e of this and other fluorinated GHGs only when the provisional GWPs, not the default GWP of 2,000, are used for fluorinated GHGs whose GWPs are not listed in Table A–1 to subpart A of this part, then EPA will publish a notice including the data and analysis submitted under paragraphs (c)(1)(vi)(A)(1) through (c)(1)(vi)(A)(3) of this section. If, after review of public comment on the notice, EPA finalizes its preliminary determination, then EPA will permit the facility to use the provisional GWPs for the calculations in paragraph (c)(1) of this section unless and until EPA determines that one or more of the provisional GWPs is in error and provides reasonable notice to the facility.

(2) *Method selection for continuous process vents.*

(i) If the calculations under paragraph (c)(1) of this section, as well as any subsequent measurements and calculations under this subpart, indicate that the continuous process vent has fluorinated GHG emissions of less than 10,000 metric ton CO_2e per year, summed across all operating scenarios, then you may comply with either paragraph (c)(3) of this section (Emission Factor approach) or paragraph (c)(4) of this section (Emission Calculation Factor approach).

(ii) If the continuous process vent does not meet the criteria in paragraph (c)(2)(i) of this section, then you must comply with the emission factor method specified in paragraph (c)(3) (Emission Factor approach) of this section.

(A) You must conduct emission testing for process-vent-specific emission factor development before the destruction device unless the calculations you performed under paragraph (c)(1)(iii) of this section indicate that the uncontrolled fluorinated GHG emissions that occur during periods when the process vent is not vented to the properly functioning destruction device are less than 10,000 metric tons CO_2e per year. In this case, you may conduct emission testing after the destruction device to develop a process-vent-specific emission factor. If you do so, you must develop and apply an emission calculation factor under paragraph (c)(4) to estimate emissions during any periods when the

process vent is not vented to the properly functioning destruction device.

(B) Regardless of the level of uncontrolled emissions, the emission testing for process-vent-specific emission factor development may be conducted on the outlet side of a wet scrubber in place for acid gas reduction, if one is in place, as long as there is no appreciable reduction in the fluorinated GHG.

(3) *Process-vent-specific emission factor method.* For each process vent, conduct an emission test and measure fluorinated GHG emissions from the process and measure the process activity, such as the feed rate, production rate, or other process activity rate, during the test as described in this paragraph (c)(3). Conduct the emission test according to the procedures in §98.124. All emissions test data and procedures used in developing emission factors must be documented according to §98.127. If more than one operating scenario applies to the process that contains the subject process vent, you must comply with either paragraph (3)(i) or paragraph (3)(ii) of this section.

(i) Conduct a separate emissions test for operation under each operating scenario.

(ii) Conduct an emissions test for the operating scenario that is expected to have the largest emissions in terms of CO_2e (considering both activity levels and emission calculation factors) on an annual basis. Also conduct an emissions test for each additional operating scenario that is estimated to emit 10,000 metric tons CO_2e or more annually from the vent and whose emission calculation factor differs by 15 percent or more from the emission calculation factor of the operating scenario that is expected to have the largest emissions (or of another operating scenario for which emission testing is performed), unless the difference between the operating scenarios is solely due to the application of a destruction device to emissions under one of the operating scenarios. For any other operating scenarios, adjust the process-vent specific emission factor developed for the operating scenario that is expected to have the largest emissions (or for another operating scenario for which emission

testing is performed) using the approach in paragraph (c)(3)(viii) of this section.

(iii) You must measure the process activity, such as the process feed rate, process production rate, or other process activity rate, as applicable, during the emission test and calculate the rate for the test period, in kg (or another appropriate metric) per hour.

(iv) For continuous processes, you must calculate the hourly emission rate of each fluorinated GHG using Equation L–19 of this section and determine the hourly emission rate of each fluorinated GHG per process vent (and per operating scenario, as applicable) for the test run.

$$E_{ContPV} = \frac{C_{PV}}{10^6} * MW * Q_{PV} * \frac{1}{SV} * \frac{1}{10^3} * \frac{60}{1} \qquad \text{(Eq. L-19)}$$

Where:

E_{ContPV} = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, during the emission test during test run r (kg/hr).

C_{PV} = Concentration of fluorinated GHG f during test run r of the emission test (ppmv).

MW = Molecular weight of fluorinated GHG f (g/g-mole).

Q_{PV} = Flow rate of the process vent stream during test run r of the emission test (m³/min).

SV = Standard molar volume of gas (0.0240 m³/g-mole at 68 °F and 1 atm).

$1/10^3$ = Conversion factor (1 kilogram/1,000 grams).

60/1 = Conversion factor (60 minutes/1 hour).

(v) You must calculate a site-specific, process-vent-specific emission factor for each fluorinated GHG for each process vent and each operating scenario, in kg of fluorinated GHG per process activity rate (e.g., kg of feed or production), as applicable, using Equation L–20 of this section. For continuous processes, divide the hourly fluorinated GHG emission rate during the test by the hourly process activity rate during the test runs.

$$EF_{PV} = \frac{\sum_{1}^{r} \left(\frac{E_{PV}}{Activity_{EmissionTest}} \right)}{r} \qquad \text{(Eq. L-20)}$$

Where:

EF_{PV} = Emission factor for fluorinated GHG f emitted from process vent v during process i, operating scenario j (e.g., kg emitted/kg activity).

E_{PV} = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, during the emission test during test run r, for either continuous or batch (kg emitted/hr for continuous, kg emitted/batch for batch).

$Activity_{EmissionTest}$ = Process feed, process production, or other process activity rate for process i, operating scenario j, during the emission test during test run r (e.g., kg product/hr).

r = Number of test runs performed during the emission test.

(vi) If you conducted emissions testing after the destruction device, you must calculate the emissions of each fluorinated GHG for the process vent (and operating scenario, as applicable) using Equation L–21 of this section. You must also develop a process-vent-specific emission calculation factor based on paragraph (c)(4) of this section for the periods when the process vent is not venting to the destruction device.

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$$E_{PV} = EF_{PV-C} * Activity_C + ECF_{PV-U} * Activity_U \quad \text{(Eq. L-21)}$$

Where:

E_{PV} = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, for the year (kg).

EF_{PV-C} = Emission factor for fluorinated GHG f emitted from process vent v during process i, operating scenario j, based on testing after the destruction device (kg emitted/activity) (e.g., kg emitted/kg product).

$Activity_C$ = Total process feed, process production, or other process activity for process i, operating scenario j, during the year for which emissions are vented to the properly functioning destruction device (i.e., controlled).

ECF_{PV-U} = Emission calculation factor for fluorinated GHG f emitted from process vent v during process i, operating scenario j during periods when the process vent is not vented to the properly functioning destruction device (kg emitted/activity) (e.g., kg emitted/kg product).

$Activity_U$ = Total process feed, process production, or other process activity during the year for which the process vent is not vented to the properly functioning destruction device (e.g., kg product).

(vii) If you conducted emissions testing before the destruction device, apply the destruction efficiencies of the device that have been demonstrated for the fluorinated GHGs in the vent stream to the fluorinated GHG emissions for the process vent (and operating scenario, as applicable), using Equation L–22 of this section. You may apply the destruction efficiency only to the portion of the process activity during which emissions are vented to the properly functioning destruction device (i.e., controlled).

$$E_{PV} = EF_{PV-U} * \left(Activity_U + Activity_C * (1 - DE) \right) \quad \text{(Eq. L-22)}$$

Where:

E_{PV} = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, for the year, considering destruction efficiency (kg).

EF_{PV-U} = Emission factor (uncontrolled) for fluorinated GHG f emitted from process vent v during process i, operating scenario j (kg emitted/kg product).

$Activity_U$ = Total process feed, process production, or other process activity for process i, operating scenario j, during the year for which the process vent is not vented to the properly functioning destruction device (e.g., kg product).

$Activity_C$ = Total process feed, process production, or other process activity for process i, operating scenario j, during the year for which the process vent is vented to the properly functioning destruction device (e.g., kg product).

DE = Demonstrated destruction efficiency of the destruction device (weight fraction).

(viii) *Adjusted process-vent-specific emission factors for other operating scenarios.* For process vents from processes with multiple operating scenarios, use Equation L–23 of this section to develop an adjusted process-vent-specific emission factor for each operating scenario from which the vent is estimated to emit less than 10,000 metric tons CO_2e annually or whose emission calculation factor differs by less than 15 percent from the emission calculation factor of the operating scenario that is expected to have the largest emissions (or of another operating scenario for which emission testing is performed).

$$EF_{PVadj} = \frac{ECF_{UT}}{ECF_T} * EF_{PV} \quad \text{(Eq. L-23)}$$

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Where:

EF$_{PVadj}$ = Adjusted process-vent-specific emission factor for an untested operating scenario.

ECF$_{UT}$ = Emission calculation factor for the untested operating scenario developed under paragraph (c)(4) of this section.

ECF$_T$ = Emission calculation for the tested operating scenario developed under paragraph (c)(4) of this section.

EF$_{PV}$ = Process vent specific emission factor for the tested operating scenario.

(ix) Sum the emissions of each fluorinated GHG from all process vents in each operating scenario and all operating scenarios in the process for the year to estimate the total process vent emissions of each fluorinated GHG from the process, using Equation L–24 of this section.

$$E_{Pfi} = \sum_1^o \; \sum_1^v E_{PV} \quad (\text{Eq. L-24})$$

Where:

E$_{Pfi}$ = Mass of fluorinated GHG f emitted from process vents for process i for the year (kg).

E$_{PV}$ = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, for the year, considering destruction efficiency (kg).

v = Number of process vents in process i, operating scenario j.

o = Number of operating scenarios for process i.

(4) *Process-vent-specific emission calculation factor method.* For each process vent within an operating scenario, determine fluorinated GHG emissions by calculations and determine the process activity rate, such as the feed rate, production rate, or other process activity rate, associated with the emission rate.

(i) You must calculate uncontrolled emissions of fluorinated GHG by individual process vent, E$_{PV}$, by using measurements, by using calculations based on chemical engineering principles and chemical property data, or by conducting an engineering assessment. Use the procedures in paragraphs (c)(1)(i) or (ii) of this section, except

paragraph (c)(1)(ii)(C) of this section. The procedures in paragraphs (c)(1)(i) and (ii) of this section may be applied either to batch process vents or to continuous process vents. The uncontrolled emissions must be based on a typical batch or production rate under a defined operating scenario. The process activity rate associated with the uncontrolled emissions must be determined. The methods, data, and assumptions used to estimate emissions for each operating scenario must be selected to yield a best estimate (expected value) of emissions rather than an over- or underestimate of emissions for that operating scenario. All data, assumptions, and procedures used in the calculations or engineering assessment must be documented according to § 98.127.

(ii) You must calculate a site-specific, process-vent-specific emission calculation factor for each process vent, each operating scenario, and each fluorinated GHG, in kg of fluorinated GHG per activity rate (e.g., kg of feed or production) as applicable, using Equation L–25 of this section.

$$ECF_{PV} = \frac{E_{PV}}{Activity_{\text{Re} \, presentative}} \quad (\text{Eq. L-25})$$

Where:

ECF$_{PV}$ = Emission calculation factor for fluorinated GHG f emitted from process

vent v during process i, operating scenario j, (e.g., kg emitted/kg product).

E$_{PV}$ = Average mass of fluorinated GHG f emitted, based on calculations, from

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process vent v from process i, operating scenario j, during the period or batch for which emissions were calculated, for either continuous or batch (kg emitted/hr for continuous, kg emitted/batch for batch).

Activity$_{Representative}$ = Process feed, process production, or other process activity rate corresponding to average mass of emissions based on calculations (e.g., kg prod-

uct/hr for continuous, kg product/batch for batch).

(iii) You must calculate emissions of each fluorinated GHG for the process vent (and operating scenario, as applicable) for the year by multiplying the process-vent-specific emission calculation factor by the total process activity, as applicable, for the year, using Equation L–26 of this section.

$$E_{PV} = ECF_{PV} * Activity \quad \text{(Eq. L-26)}$$

Where:

E$_{PV}$ = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, for the year (kg).

ECF$_{PV}$ = Emission calculation factor for fluorinated GHG f emitted from process vent v during process i, operating scenario j, (kg emitted/activity) (e.g., kg emitted/kg product).

Activity = Process feed, process production, or other process activity for process i, operating scenario j, during the year.

(iv) If the process vent is vented to a destruction device, apply the demonstrated destruction efficiency of the device to the fluorinated GHG emissions for the process vent (and operating scenario, as applicable), using Equation L–27 of this section. Apply the destruction efficiency only to the portion of the process activity that is vented to the properly functioning destruction device (i.e., controlled).

$$E_{PV} = ECF_{PV} * \left(Activity_U + Activity_C * (1 - DE) \right) \quad \text{(Eq. L-27)}$$

Where:

E$_{PV}$ = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, for the year considering destruction efficiency (kg).

ECF$_{PV}$ = Emission calculation factor for fluorinated GHG f emitted from process vent v during process i, operating scenario j, (e.g., kg emitted/kg product).

Activity$_U$ = Total process feed, process production, or other process activity for process i, operating scenario j, during the year for which the process vent is not vented to the properly functioning destruction device (e.g., kg product).

Activity$_C$ = Total process feed, process production, or other process activity for

process i, operating scenario j, during the year for which the process vent is vented to the properly functioning destruction device (e.g., kg product).

DE = Demonstrated destruction efficiency of the destruction device (weight fraction).

(v) Sum the emissions of each fluorinated GHG from all process vents in each operating scenario and all operating scenarios in the process for the year to estimate the total process vent emissions of each fluorinated GHG from the process, using Equation L–28 of this section.

$$E_{Pfi} = \sum_{1}^{o} \sum_{1}^{v} E_{PV} \quad \text{(Eq. L-28)}$$

Where:

E$_{Pfi}$ = Mass of fluorinated GHG f emitted from process vents for process i for the year (kg).

E_{PV} = Mass of fluorinated GHG f emitted from process vent v from process i, operating scenario j, for the year, considering destruction efficiency (kg).

v = Number of process vents in process i, operating scenario j.

o = Number of operating scenarios in process i.

(d) *Calculate fluorinated GHG emissions for equipment leaks (EL).* If you comply with paragraph (c) of this section, you must calculate the fluorinated GHG emissions from pieces of equipment associated with processes covered under this subpart and in fluorinated GHG service. If you conduct monitoring of equipment in fluorinated GHG service, monitoring must be conducted for those in light liquid and in gas and vapor service. If you conduct monitoring of equipment in fluorinated GHG service, you may exclude from monitoring each piece of equipment that is difficult-to-monitor, that is unsafe-to-monitor, that is insulated, or that is in heavy liquid service; you may exclude from monitoring each pump with dual mechanical seals, agitator with dual mechanical seals, pump with no external shaft, agitator with no external shaft; you may exclude from monitoring each pressure relief device in gas and vapor service with upstream rupture disk, each sampling connection system with closed-loop or closed-purge systems, and any pieces of equipment where leaks are routed through a closed vent system to a destruction device. You must estimate emissions using another approach for those pieces of equipment excluded from monitoring. Equipment that is in fluorinated GHG service for less than 300 hr/yr; equipment that is in vacuum service; pressure relief devices that are in light liquid service; and instrumentation systems are exempted from these requirements.

(1) The emissions from equipment leaks must be calculated using any of the procedures in paragraphs (d)(1)(i), (d)(1)(ii), (d)(1)(iii), or (d)(1)(iv) of this section.

(i) *Use of Average Emission Factor Approach in EPA Protocol for Equipment Leak Emission Estimates.* The emissions from equipment leaks may be calculated using the default Average Emission Factor Approach in EPA–453/

R–95–017 (incorporated by reference, see § 98.7).

(ii) *Use of Other Approaches in EPA Protocol for Equipment Leak Emission Estimates in conjunction with EPA Method 21 at 40 CFR part 60, appendix A–7.* The emissions from equipment leaks may be calculated using one of the following methods in EPA–453/R–95–017 (incorporated by reference, see § 98.7): The Screening Ranges Approach; the EPA Correlation Approach; or the Unit-Specific Correlation Approach. If you determine that EPA Method 21 at 40 CFR part 60, appendix A–7 is appropriate for monitoring a fluorinated GHG, and if you calibrate your instrument with a compound different from one or more of the fluorinated GHGs or surrogates to be measured, you must develop response factors for each fluorinated GHG or for each surrogate to be measured using EPA Method 21 at 40 CFR part 60, appendix A–7. For each fluorinated GHG or surrogate measured, the response factor must be less than 10. The response factor is the ratio of the known concentration of a fluorinated GHG or surrogate to the observed meter reading when measured using an instrument calibrated with the reference compound.

(iii) *Use of Other Approaches in EPA Protocol for Equipment Leak Emission Estimates in conjunction with site-specific leak monitoring methods.* The emissions from equipment leaks may be calculated using one of the following methods in EPA–453/R–95–017 (incorporated by reference, see § 98.7): The Screening Ranges Approach; the EPA Correlation Approach; or the Unit-Specific Correlation Approach. You may develop a site-specific leak monitoring method appropriate for monitoring fluorinated GHGs or surrogates to use along with these three approaches. The site-specific leak monitoring method must meet the requirements in § 98.124(f)(1).

(iv) *Use of site-specific leak monitoring methods.* The emissions from equipment leaks may be calculated using a site-specific leak monitoring method. The site-specific leak monitoring method must meet the requirements in § 98.124(f)(1).

(2) You must collect information on the number of each type of equipment;

the service of each piece of equipment (gas, light liquid, heavy liquid); the concentration of each fluorinated GHG in the stream; and the time period each piece of equipment was in service. Depending on which approach you follow, you may be required to collect information for equipment on the associated screening data concentrations for greater than or equal to 10,000 ppmv and associated screening data concentrations for less than 10,000 ppmv; associated actual screening data concentrations; or associated screening data and leak rate data (i.e., bagging) used to develop a unit-specific correlation.

(3) Calculate and sum the emissions of each fluorinated GHG in metric tons per year for equipment pieces for each process, E_{ELf}, annually. You must include and estimate emissions for types of equipment that are excluded from monitoring, including difficult-to-monitor, unsafe-to-monitor and insulated pieces of equipment, pieces of equipment in heavy liquid service, pumps with dual mechanical seals, agitators with dual mechanical seals, pumps with no external shaft, agitators with no external shaft, pressure relief devices in gas and vapor service with upstream rupture disk, sampling connection systems with closed-loop or closed purge systems, and pieces of equipment where leaks are routed through a closed vent system to a destruction device.

(e) *Calculate total fluorinated GHG emissions for each process and for production or transformation processes at the facility.*

(i) Estimate annually the total mass of each fluorinated GHG emitted from each process, including emissions from process vents in paragraphs (c)(3) and (c)(4) of this section, as appropriate, and from equipment leaks in paragraph (d), using Equation L–29 of this section.

$$E_i = E_{Pfi} + E_{ELfi} \quad (\text{Eq. L-29})$$

Where:

E_i = Total mass of each fluorinated GHG f emitted from process i, annual basis (kg/year).

E_{Pfi} = Mass of fluorinated GHG f emitted from all process vents and all operating scenarios in process i, annually (kg/year, calculated in Equation L–24 or L–28 of this section, as appropriate).

E_{ELfi} = Mass of fluorinated GHG f emitted from equipment leaks for pieces of equipment for process i, annually (kg/year, calculated in paragraph (d)(3) of this section).

(ii) Estimate annually the total mass of each fluorinated GHG emitted from each type of production or transformation process at the facility using Equation L–30 of this section. Develop separate totals for fluorinated gas production processes, transformation processes that transform fluorinated gases produced at the facility, and transformation processes that transform fluorinated gases produced at another facility.

$$E = \sum_{i=1}^{z} E_i * 0.001 \quad (\text{Eq. L-30})$$

Where:

E = Total mass of each fluorinated GHG f emitted from all fluorinated gas production processes, all transformation processes that transform fluorinated gases produced at the facility, or all transformation processes that transform fluorinated gases produced at another facility, as appropriate (metric tons).

E_i = Total mass of each fluorinated GHG f emitted from each production or transformation process, annual basis (kg/year, calculated in Equation L–29 of this section).

0.001 = Conversion factor from kg to metric tons.

z = Total number of fluorinated gas production processes, fluorinated gas transformation processes that transform fluorinated gases produced at the facility, or transformation processes that transform fluorinated gases produced at another facility, as appropriate.

(f) *Calculate fluorinated GHG emissions from destruction of fluorinated GHGs that were previously ''produced''.* Estimate annually the total mass of fluorinated GHGs emitted from destruction of fluorinated GHGs that were previously ''produced'' as defined at § 98.410(b) using Equation L–31 of this section:

$$E_D = RE_D * (1 - DE) \quad \text{(Eq. L-31)}$$

Where:

E_D = The mass of fluorinated GHGs emitted annually from destruction of fluorinated GHGs that were previously ''produced'' as defined at § 98.410(b) (metric tons).
RE_D = The mass of fluorinated GHGs that were previously ''produced'' as defined at § 98.410(b) and that are fed annually into the destruction device (metric tons).
DE = Destruction efficiency of the destruction device (fraction).

(g) *Emissions from venting of residual fluorinated GHGs in containers.* If you vent residual fluorinated GHGs from containers, you must either measure the residual fluorinated GHGs vented from each container or develop a heel factor for each combination of fluorinated GHG, container size, and container type that you vent. You do not need to estimate de minimis emissions associated with good-faith attempts to recycle or recover residual fluorinated GHGs in or from containers.

(1) *Measuring contents of each container.* If you weigh or otherwise measure the contents of each container before venting the residual fluorinated GHGs, use Equation L–32 of this section to calculate annual emissions of each fluorinated GHG from venting of residual fluorinated GHG from containers. Convert pressures to masses as directed in paragraph (g)(2)(ii) of this section.

$$E_{Cf} = \sum_1^n H_{Bfj} - \sum_1^n H_{Efj} \quad \text{(Eq. L-32)}$$

Where:

E_{Cf} = Total mass of each fluorinated GHG f emitted from the facility through venting of residual fluorinated GHG from containers, annual basis (kg/year).
H_{Bfj} = Mass of residual fluorinated GHG f in container j when received by facility.
H_{Efj} = Mass of residual fluorinated GHG f in container j after evacuation by facility. (Facility may equate to zero.)
n = Number of vented containers for each fluorinated GHG f.

(2) *Developing and applying heel factors.* If you use heel factors to estimate emissions of residual fluorinated GHGs vented from containers, you must annually develop these factors based on representative samples of the containers received by your facility from fluorinated GHG users.

(i) *Sample size.* For each combination of fluorinated GHG, container size, and container type that you vent, select a representative sample of containers that reflects the full range of quantities of residual gas returned in that container size and type. This sample must reflect the full range of the industries and a broad range of the customers that use and return the fluorinated GHG, container size, and container type. The minimum sample size for each combination of fluorinated GHG, container size, and container type must be 30, unless this

is greater than the number of containers returned within that combination annually, in which case the contents of every container returned must be measured.

(ii) *Measurement of residual gas.* The residual weight or pressure you use for paragraph (g)(1) of this section must be

determined by monitoring the mass or the pressure of your cylinders/containers according to §98.124(k). If you monitor the pressure, convert the pressure to mass using the ideal gas law, as displayed in Equation L–33 of this section, with an appropriately selected Z value.

$$pV = ZnRT \quad \text{(Eq. L-33)}$$

Where:

p = Absolute pressure of the gas (Pa)
V = Volume of the gas (m^3)
Z = Compressibility factor
n = Amount of substance of the gas (moles)
R = Gas constant (8.314 Joule/Kelvin mole)
T = Absolute temperature (K)

(iii) *Heel factor calculation.* To determine the heel factor h_{fj} for each combination of fluorinated GHG, container size, and container type, use paragraph (g)(1) of this section to calculate the total heel emissions for each sample selected under paragraph (g)(2)(i) of

this section. Divide this total by the number of containers in the sample. Divide the result by the full capacity (the mass of the contents of a full container) of that combination of fluorinated GHG, container size, and container type. The heel factor is expressed as a fraction of the full capacity.

(iv) Calculate annual emissions of each fluorinated GHG from venting of residual fluorinated GHG from containers using Equation L–34 of this section.

$$E_{Cf} = \sum_{j=1}^{n} h_{fj} * N_{fj} * F_{fj} \quad \text{(Eq. L-34)}$$

Where:

E_{Cf} = Total mass of each fluorinated GHG f emitted from the facility through venting of residual fluorinated GHG from containers, annual basis (kg/year).
h_{fj} = Facility-wide gas-specific heel factor for fluorinated GHG f (fraction) and container size and type j, as determined in paragraph (g)(2)(iii) of this section.
N_{fj} = Number of containers of size and type j returned to the fluorinated gas production facility.
F_{fj} = Full capacity of containers of size and type j containing fluorinated GHG f (kg).
n = Number of combinations of container sizes and types for fluorinated GHG f.

§ 98.124 Monitoring and QA/QC requirements.

(a) *Initial scoping speciation to identify fluorinated GHGs.* You must conduct an initial scoping speciation to identify all fluorinated GHGs that may be generated from processes that are subject to this subpart and that have at least

one process vent with uncontrolled emissions of 1.0 metric ton or more of fluorinated GHGs per year based on the preliminary estimate of emissions in §98.123(c)(1). You are not required to quantify emissions under this initial scoping speciation. Only fluorinated GHG products and by-products that occur in greater than trace concentrations in at least one stream must be identified under this paragraph.

(1) *Procedure.* To conduct the scoping speciation, select the stream(s) (including process streams or destroyed streams) or process vent(s) that would be expected to individually or collectively contain all of the fluorinated GHG by-products of the process at their maximum concentrations and sample and analyze the contents of these selected streams or process vents. For example, if fluorinated GHG by-products are separated into one low-